Welding – Welding certification overview

Description

Diaphragm seal assemblies are all having specific welded parts. Welding makes leak free connection between the parts. With diaphragm seals the most common welds are the capillary weld to the transmitter and diaphragm seal and the diaphragm to its body. Badotherm has a long list of materials that are suitable to be used as diaphragm or body. This document gives a short overview on the material groups and types of construction that are certified either by the ASME IX or the ISO 15613 or both.

Welding documents

Certification is done by an external notified body. Mainly there are three different types of documents.

WPS

WPS is the Welding Procedure Specification. This document is carefully composed and includes the 'recipe' for the welders and give clear direction how to make the quality weld according to the specific standard. Information such as tools, parameters, and the process to follow are listed in that document.

PQR

PQR is the Procedure Qualification Records and is a record of the test and proves the welding process. It documents what ocured during welding of the test coupon and the results of the test coupon. The PQR does not contain specific welding variables and parameters such as the WPS.

WPQ

WPQ is the Welders Performance Qualification. This document is used to certify the actual welder if he or she is able to produce a sound weld according to the paramenters in the WPS. This document contains a continuation sheet as well that proves the skill level is still up to date. Depending on the material and standard the records are within the ASME IX and the ISO 9606.

Standards used

Certification Standards

Standard	Description
ASME IX	BPVC Section IX-Welding, Brazing, and Fusing Qualifications
EN ISO 15613	qualification of welding procedures for metallic materials
EN ISO 15614-1	Arc and gas welding of steels and arc welding of nickel and nickel alloys
EN ISO 9606-1	Arc and gas welding of steels and arc welding of nickel and nickel alloys
EN ISO 9606-5	Approval testing of welders — Fusion welding — Part 5: Titanium and titanium alloys, zirconium and zirconium alloys
EN ISO 3834	Quality requirements for fusion welding of metallic materials

Inspection Standards

Standard	Description
EN ISO 9712	Non-destructive testing - Qualification and certification of NDT personnel

Welding dossier

Welding certification is propriety knowledge and in principle not disclosed. On request, per order, a welding dossier can be prepared as part of the order. This contains an overview of the relevant PQR and WPQ for that order, related to the configurations and materials used. The WPS will not be disclosed, or essential elements will be removed. However, it will be clear from the welding dossier, that the welds are certified.

Welding Quality – ISO 3834

Badotherm is ISO 3834 certified. This means the competence of the fusion welding process is assesed independantly. The ISO 3834 is manditory in many pressure vessel standards. All parts of the process are audited, reviewed, and documented such as a yearly validation of the welding equipement according the IEC 60974-4 and the EN 50110. In process all performed welds are registered per machine and per welder for a clear traceability. These are just a grasp from the ISO 3834 requirements.

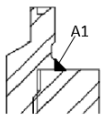
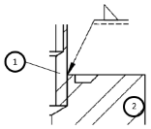
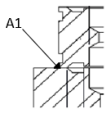
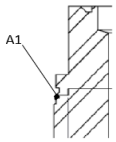
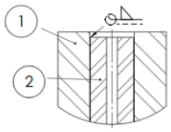
Materials

Numerous combinations and material groups can be certified. Badotherm has made a broad selection of materials that are certified within the ASME IX and ISO 15613. Most cases the materials are based on identical materials for both parts. In some occasions Badotherm selected materials from different groups in order to cover AISI 316L capillary in an exotic body material such as for example Alloy C276.

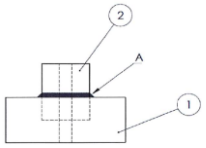
Material group numbers

Material			Material	
General name	UNS	Wst.	Number	Group
AISI 316L	S31603	1.4404	8	1
AISI 304L	S30400	1.4306	8	1
AISI 321	S32100	1.4541	8	1
AISI 316 UG	S31603	1.4435	8	1
Alloy C276	N27600	2.4810	43	-
AISI310MoLn	S31050	1.4466	8	2
AISI 904L	N08904	1.4539	45	-
Alloy 20	N08020	2.4660	45	-
Alloy 400	N04400	2.4360	42	-
Alloy 600	N06600	2.4816	43	-
Alloy 625	N06625	2.4856	43	-
Alloy 825	N08825	2.4858	45	-
Alloy B2	N10665	2.4617	44	-
Alloy C-22	N06022	2.4602	43	-
254 SMO (6Mo)	S31254	1.4547	8	4
Duplex 2205	S32205	1.4462	10H	1
Super Duplex 2507	S32750	1.4410	10H	1
Nickel 201	N02201	2.4068	41	-
Titanium Gr. 1	R50250	2.7025	51	-
Zirconium	R60702	-	61	-

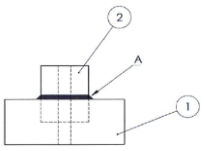
Welding procedure specification overview for specific welds for nipples

Weld ID	Part	Material	Welding procedure	Sketch
BDT001	M12 capillary adapter	P no: 8; Group no: 1 e.g.: AISI 316/AISI316L	GTAW (Pulse) Position 2F Without filler material	
	Low volume flange			
BDT002	capillary nipple		GTAW (Pulse) Position 2F Without filler material	
	Seal part / Welding nipple			
BDT003	Capillary adapter		GTAW (Pulse) Position 2F Without filler material	
	Flange/transmitter body			
BDT004	Full weld adapter		GTAW Position 2G Without filler material	
	Transmitter sensor body			
	Low volume flange			
BDT006	Capillary adapter		GTAW Position 2G Without filler material	
	Capillary tube			
BDT007	Capillary adapter	P no: 43; Group no: e.g.: Alloy 625	GTAW Position 2G Without filler material	
	Capillary tube			

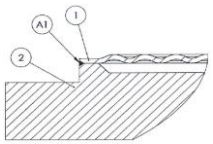
Welding procedure specification overview for socket welding (e.g. capillary and valves)

WPS No	Part	Material	Welding procedure	Sketch
BDT FW001	Tube part	P no: 8; Group no: 1 e.g.: AISI 316/AISI316L	GTAW Position 2F With filler material	
	Body part	P no: 8; Group no: 1 e.g.: AISI 316/AISI316L		
BDT FW002	Tube part	P no: 8; Group no: 1 e.g.: AISI 316/AISI316L		
	Body part	P no: 10H; Group no: 1 e.g.: Duplex F51, Super Duplex		
BDT FW003	Tube part	P no: 8; Group no: 1 e.g.: AISI 316/AISI316L		
	Body part	P no: 42; Group no: - e.g.: Alloy 400		
BDT FW004	Tube part	P no: 8; Group no: 1 e.g.: AISI 316/AISI316L		
	Body part	P no: 43; Group no: - e.g.: Alloy C276, Alloy 625, Alloy C22		
BDT FW005	Tube part	P no: 8; Group no: 1 e.g.: AISI 316/AISI316L		
	Body part	P no: 8; Group no: 4 e.g.: 254 SMO		
BDT FW009	Tube part	P no: 43; Group no: - e.g.: Alloy 625 (3 layers)		
	Body part	P no: 43; Group no: - e.g.: Alloy 625 (3 layers)		

Welding procedure specification overview for penetration weld (e.g. butt welded valves)

WPS No	Part	Material	Welding procedure	Sketch
BDT PW001	Tube part	P no: 8; Group no: 1 e.g.: AISI 316/AISI316L	GTAW Position 2F With filler material	
	Body part	P no: 8; Group no: 1 e.g.: AISI 316/AISI316L		
BDT PW002	Tube part	P no: 8; Group no: 43 e.g.: Alloy C276, Alloy 625		
	Body part	P no: 10H; Group no: 43 e.g.: Alloy C276, Alloy 625		

Welding procedure specification overview for Diaphragm welding

WPS No	Part	Material Group	Welding procedure	Sketch
BDT DP001	Diaphragm	P no: 8; Group no: 1 e.g.: AISI 316/AISI316L	GTAW Position 2F Without filler material	
	Body part	P no: 8; Group no: 1 e.g.: AISI 316/AISI316L		
BDT DP002	Diaphragm	P no: 43; Group no: - e.g.: Alloy C276, Alloy 625		
	Body part	P no: 43; Group no: e.g.: Alloy C276, Alloy 625		
BDT DP003	Diaphragm	P no: 42; Group no: - e.g.: Alloy 400		
	Body part	P no: 42; Group no: - e.g.: Alloy 400		
BDT DP004	Diaphragm	P no: 10H; Group no: 1 e.g.: Duplex 2205, Super Duplex		
	Body part	P no: 10H; Group no: 1 e.g.: Duplex F51, Super Duplex		
BDT DP006	Diaphragm	P no: 61; Group no: - e.g.: Zirconium 702		
	Body part	P no: 61; Group no: - e.g.: Zirconium 702		
BDT DP007	Diaphragm	P no: 8; Group no: 2 e.g.: 25-22-2 (UNS S31050)		
	Body part	P no: 8; Group no: 2 e.g.: AISI 310MoLn		

Change log

Date	Change
30-3-2020	