

Welding

Most offshore metallic structures, vessels, equipment packages, and pipework involve welding during fabrication and construction onshore or offshore.

Welding involves the following steps:

- Weld type specification.
- Welding Procedure Specification (WPS).
- Welding procedure qualification.
- Welder coding.
- Weld type specification

The engineer/designer specifies the type of weld on the fabrication drawing.

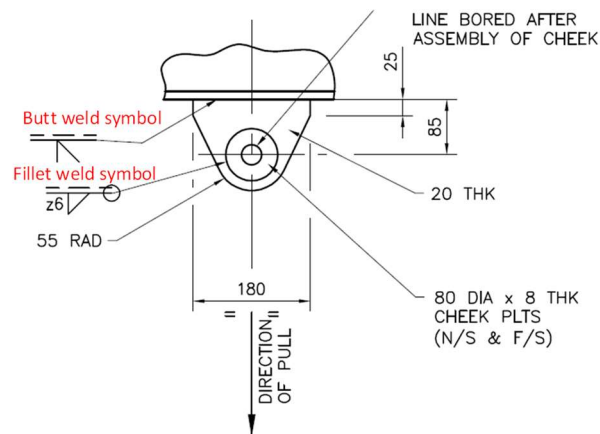


Fig Padeye fabrication drawing showing welding symbols.

Welding Procedure Specification (WPS)

The fabricator reviews the fabrication drawing and determines if suitable welding procedure specifications are available. A welding procedure specification is a document describing welding parameters with direction for the welder or welding equipment operators in making sound and quality production welds per code requirements. The document contains weld preparation details, filler material to be used,

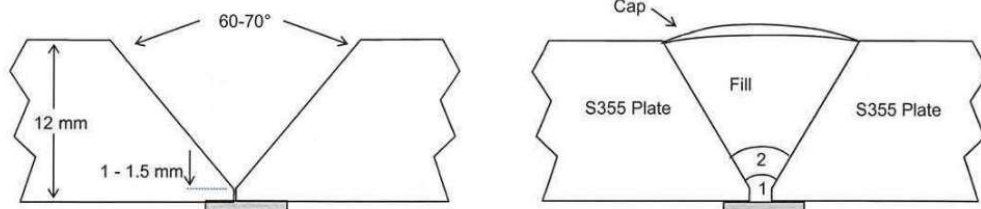
the current and voltage, travel speed and heat input ranges, number and types of passes, and preheat and post-heat temperatures. If the fabricator does not have a WPS, they will generate one for review and approval. The process to develop a WPS can take many weeks or months and may require adjustments and multiple iterations if qualification fails.

Weld Parameters:

Run No	Welding Process	Filler Make	Trade Name	Dia (mm)	Spec	Grade	AC/DC	Amps (A) (±10%)	Volts (V) (±10%)	ROL (mm) (±10%)	Heat Input (KJ/mm) ² (±25%)
1	111	Filarc	88S	2.5	AWS A5.5	E8016-G	DC-Ve	63-78	17-22	36-44	1.3-2.3
2	111	Filarc	88S	3.2	AWS A5.5	E8016-G	DC+Ve	86-106	22-28	79-97	0.9-1.6
Fill	111	Filarc	88S	3.2	AWS A5.5	E8016-G	DC+Ve	98-121	21-27	83-102	1.2-2.1
Fill	111	Filarc	88S	4.0	AWS A5.5	E8016-G	DC+Ve	137-168	20-26	151-185	1.1-2.0
Cap	111	Filarc	88S	3.2	AWS A5.5	E8016-G	DC+Ve	98-121	21-27	118-145	0.8-1.4

Weld Preparation for wrapper long seam:

Typical Weld Sequence:



Wrapper long seam weld does not come into contact with parent pipe.

- Notes:
1. Consumables to be clean/dry and stored as per manufacturer's instructions.
 2. Amps, Voltage and Heat input were recorded during qualification using AMV500 Arc Monitor.
 3. ROL calculated by distance recorded on Arc Monitor during qualification, divided by number of electrodes used per pass.
 4. A k factor of 0.8 has been applied to heat input in accordance with EN 1011-1:2009.
 5. Heat input parameters are based on actual min and max values recorded during qualification.

Fig. An example of a WPS.

Weld procedure qualification

A weld procedure qualification will be carried out if a suitable, previously qualified procedure is not available and rigorous destructive testing is needed to ensure that the weld meets the specification requirements.

Welder coding

Finally, the welders carrying out the qualified weld will be examined to demonstrate that they can perform this particular weld.

Once the procedure is completed, the fabrication weld can be carried out. Welders will be monitored to ensure the welding parameters stated on the previously qualified weld procedure are observed, ensuring that satisfactory mechanical properties are achieved in production welds.

Production welds are inspected by various techniques to confirm integrity and is used to the extent needed for the application and criticality.