# DIN EN ISO 15614-8:2016-11 (E)

## Specification and qualification of welding procedures for metallic materials - Welding proc edure test - Part 8: Welding of tubes to tube-plate joints (ISO 15614-8:2016)

## Contents

Page


European foreword ..... 4

Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC -- Pressure Equipment ..... 5

Foreword ..... 6

Introduction ..... 8

1 Scope ..... 9

2 Normative references ..... 9

3 Terms and definitions ..... 10

4 Symbols and abbreviated terms ..... 10

5 Preliminary welding procedure specification (pWPS) ..... 11
5.1 General ..... 11
5.2 Parameters for all welding process ..... 11
5.3 Parameters for particular welding processes ..... 12

6 Qualification of welding procedure ..... 13

7 Welding of test pieces ..... 13
7.1 General ..... 13
7.2 Type of test piece ..... 13
7.2.1 Joint preparation and joint construction ..... 13
7.2.2 Tube ends welded on triangular pitch ..... 13
7.2.3 Tube ends welded on square pitch ..... 14

8 Examination and testing ..... 15
8.1 Performance ..... 15
8.1.1 General ..... 15
8.1.2 Visual testing ..... 15
8.1.3 Penetrant testing ..... 16
8.1.4 Radiographic testing ..... 16
8.1.5 Macroscopic examination ..... 16
8.1.6 Hardness test ..... 16
8.1.7 Push-out or pull-out test ..... 16
8.2 Acceptance levels ..... 17
8.2.1 General ..... 17
8.2.2 Visual testing ..... 17
8.2.3 Penetrant testing ..... 17
8.2.4 Radiographic testing ..... 17
8.2.5 Macroscopic examination ..... 18
8.2.6 Hardness values ..... 18
8.2.7 Push-out or pull-out load ..... 18
8.3 Re-test ..... 18

9 Range of qualification ..... 19

9.1 General ..... 19
9.2 Related to the manufacturer ..... 19
9.3 Related to the material ..... 19
9.3.1 Parent metal ..... 19
9.3.2 Tube-plate and tube dimensions ..... 19
9.3.3 Tube pitch ..... 19
9.4 Common to all welding procedures ..... 19
9.4.1 Welding process ..... 19
9.4.2 Welding position of tube-plate ..... 19
9.4.3 Type of joint ..... 19
9.4.4 Filler metal, classification ..... 20
9.4.5 Filler metal, dimensions ..... 20
9.4.6 Type of current ..... 20
9.4.7 Arc energy (heat input) ..... 20
9.4.8 Pre-heat temperature ..... 20
9.4.9 Interpass temperature ..... 20
9.4.10 Post-weld heat treatment ..... 20
9.4.11 Shielding gas ..... 20

10 Welding procedure qualification record form (WPQR) ..... 20

Annex A (informative) Welding procedure qualification record form for tube to tube-plate joints (WPQR) ..... 22

Bibliography ..... 26