

DIN EN 15085-3:2010-01 (E)

Railway applications - Welding of railway vehicles and components - Part 3: Design requirements

Contents		Page
Foreword		5
Introduction		6
1	Scope	7
2	Normative references	7
3	Terms and definitions	8
4	Design requirements	8
4.1	General	8
4.2	Joint static dimensioning	8
4.3	Joint fatigue dimensioning	9
4.4	Stress categories and stress factors	9
4.5	Safety categories	10
4.6	Weld performance classes	10
4.7	Weld inspection classes	11
4.8	Relationship between stress category, safety category, weld performance class, quality levels for imperfections, inspection class and testing	12
5	Quality levels for imperfections	13
5.1	General	13
5.2	Quality levels for imperfections	13
6	Choice of parent metals and welding consumables	15
6.1	Choice of parent metals	15
6.2	Choice of welding consumables	15
7	Weld joint design	16
7.1	General	16
7.2	Welding in cold formed areas	16
7.3	Manufacturing provisions	17
7.4	Joint preparation	28
Annex A (informative) List of welded joints		29
Annex B (informative) Joint preparation of welds		30
Annex C (informative) Joint preparation for plug welds		38
Annex D (informative) Types of joints in relation to stresses and inspection classes		39
Annex E (informative) Welded joint validation chart		40
Annex F (normative) Resistance spot welding		41
F.1	General	41
F.2	Minimum shear pull forces	45
Annex G (informative) Determination of safety category for welded joints		47

Annex H (informative) Welding of 6000 series aluminium alloy extrusions - Recommendations from the Aljoin project for improved crashworthiness	48
Bibliography	49
Figures	
Figure 1 -- Example of box girder with high stress level in the tension flange	17
Figure 2 -- Butt joint on parts of dissimilar thickness	18
Figure 3 -- Weldability access for plug and slot welds	19
Figure 4 -- Dimensions for plug and slot welds	19
Figure 5 -- Minimum distance between molten areas	20
Figure 6 -- Stiffeners fitted perpendicularly to a longitudinal weld	20
Figure 7 -- Filler and drain ports	20
Figure 8 -- Design of gusset and stiffener ends	21
Figure 9 -- Gusset shape	21
Figure 10 -- Weld return	22
Figure 11 -- Edge distance for fillet welds	22
Figure 12 -- Minimum overlapping distance for overlapping welds	23
Figure 13 -- Example of run-on and run-off plates for butt welds	23
Figure 14 -- Clamped joints	24
Figure 15 -- Mixed assemblies	25
Figure 16 -- Corrosion locations	25
Figure 17 -- Weld toe improvement	26
Figure 18 -- Intermittent welds	28
Figure D.1 -- Types of joints in relation to stresses and inspection classes	39
Figure F.1 -- Resistance spot welding of angled profiles and plates	41
Figure F.2 -- Resistance spot welding of plates, single row	42
Figure F.3 -- Resistance spot welding of plates, double row	42
Figure F.4 -- Resistance spot welding of plates, double row, offset	42
Tables	
Table 1 -- Stress categories	10
Table 2 -- Weld performance classes	11
Table 3 -- Correspondence between weld performance classes and inspection classes	12
Table 4 -- Relationship between stress category, safety category, weld performance class, quality levels for imperfections, inspection class and testing	12
Table 5 -- Quality levels for imperfections for steel related to weld performance class	13

Table 6 -- Quality levels for imperfections for aluminium and its alloys related to weld performance class	14
Table 7 -- Quality levels for imperfections for laser and electron beam welding for steel related to the weld performance class	14
Table 8 -- Quality levels for imperfections for laser and electron beam welding for aluminium and its alloys related to the weld performance class	15
Table 9 -- Welding in cold formed areas (for steel)	17
Table B.1 -- Joint preparations and throat thicknesses of welds	30
Table C.1 -- Joint preparations and throat thicknesses of plug welds	38
Table F.1 -- Spot spacing, distance from edge	41
Table F.2 -- Quality requirements	43
Table F.3 -- Surface quality	45
Table F.4 -- Minimum shear pull forces for resistance spot welding joints of steel for weld performance classes CP C1, CP C2 and CP C3	46
Table F.5 -- Minimum shear pull force for resistance spot welding joints of aluminium and alloys for the weld performance classes CP C1, CP C2 and CP C3	46