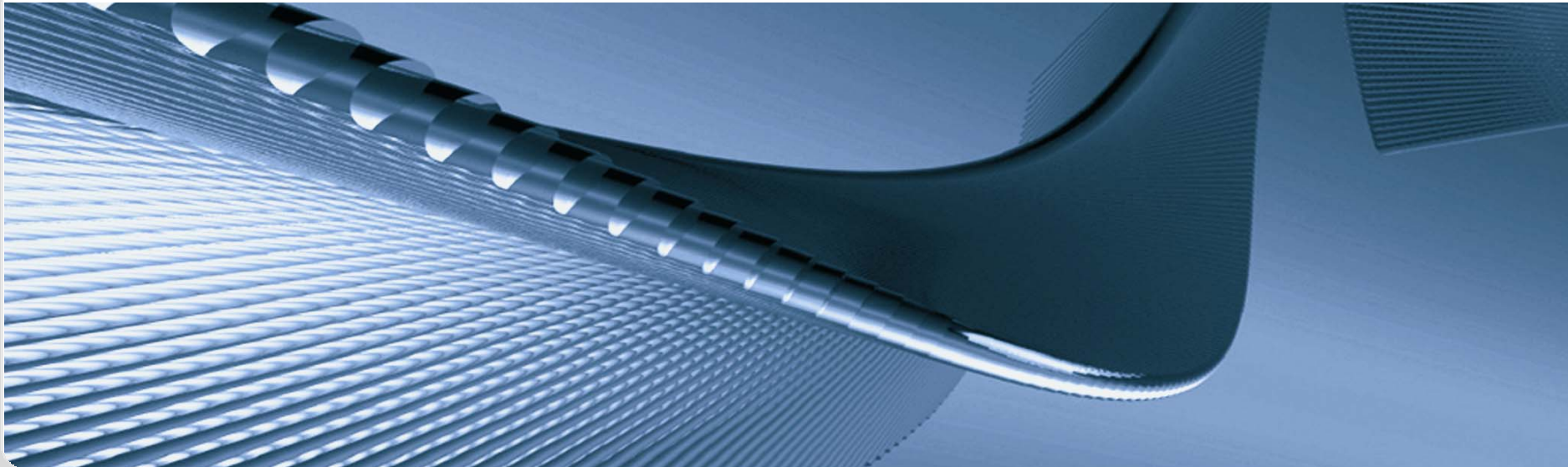


# EN 1090-1, -2




## General delivery conditions and technical requirements for the execution of steel structures

Versuchsanstalt für Stahl, Holz & Steine - Abt. Stahl- und Leichtmetallbau – Dr.-Ing. Michael Volz



# EN 1090

## Execution of steel structures and aluminium structures

- Part 1: Requirements for conformity assessment for structural components (CE)
  -  replaces „Übereinstimmungsnachweis“ Ü
- Part 2: Technical requirements for the execution of steel structures
  -  replaces DIN 18800 part 7
- Part 3: Technical requirements for the execution of aluminium structures
  -  replaces DINV 4113 part 3

# EN 1090

## Execution of steel structures and aluminium structures

- Part 1: Requirements for conformity assessment for structural components (CE)

 replaces „Übereinstimmungsnachweis“ Ü

- Part 2: Technical requirements for the execution of steel structures

 replaces DIN 18800 part 7

- Part 3: Technical requirements for the execution of aluminium structures

 replaces DINV 4113 part 3

# Normative Regulations

steel constructions

 DIN 18800-7

railway vehicles

 DIN 6700 / EN 15085 

road vehicles

no regulatory  
requirement

**ISO 3834, EN 1011, EN 287, ISO 14731, ISO 15609 ...**

pressure tanks

 EN 13445

 AD-Regulations

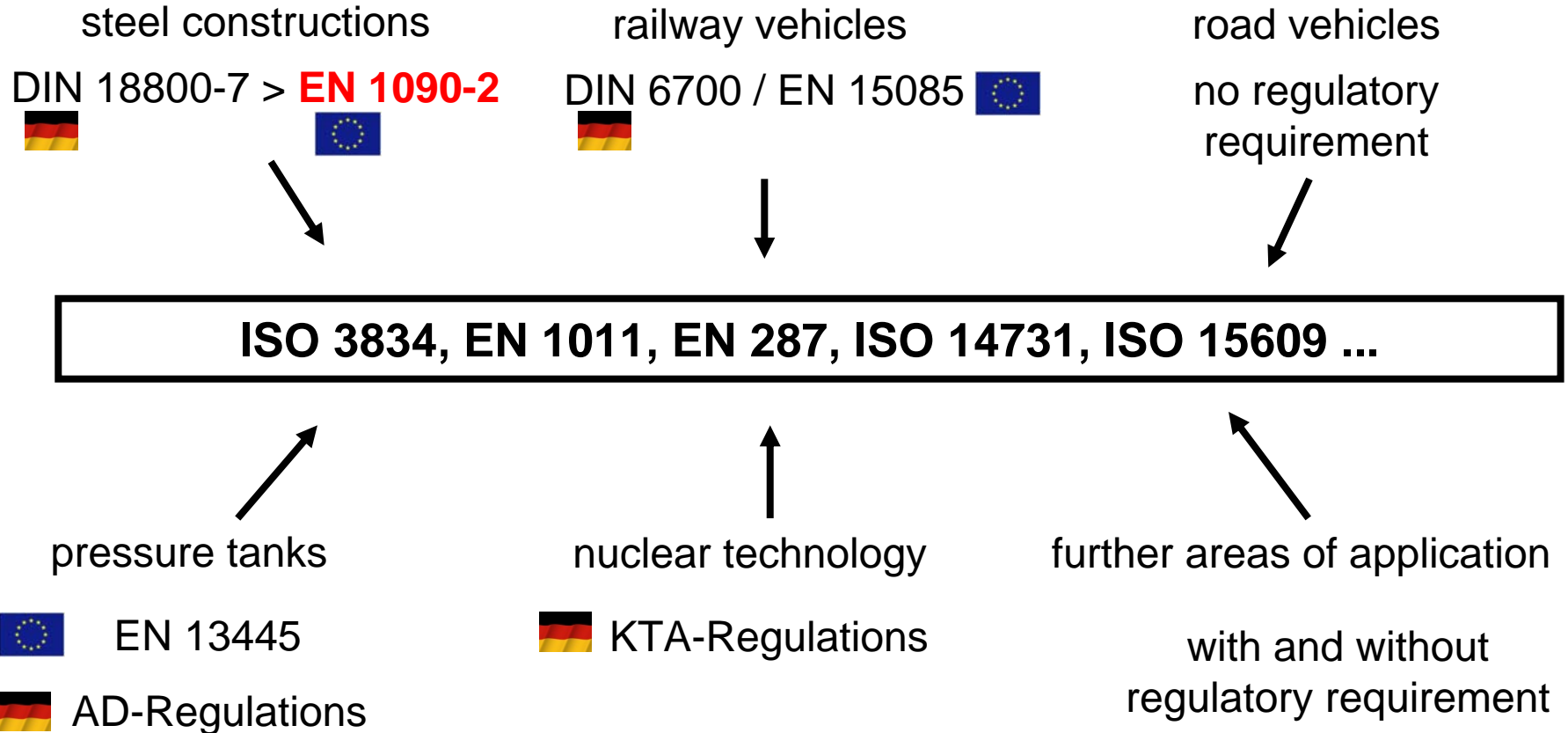
nuclear technology

 KTA-Regulations

further areas of application

with and without  
regulatory requirement

# Normative Regulations





DIN 18800 part 7



weldment classes

A – E

depend on

- material
- thickness of product
- welding process
- component
- loading



EN 1090 part 2



execution classes EXC

1 – 4

depend on

- consequence class CC
- service categorie SC
- production categorie PC

## Terms and definitions

### **execution**

all activities performed for the physical completion of the works, i.e. procurement, fabrication, welding, mechanical fastening, transportation, erection, surface treatment and the inspection and documentation thereof

### **execution class**

classified set of requirements specified for the execution of the works as a whole, of an individual component or of a detail of a component

### **service category**

category that characterises a component in terms of the circumstances of its use

### **production category**

category that characterises a component in terms of the methods used for its execution

### **Consequence classes**

EN 1990:2002 gives in its Annex B guidelines for the choice of consequence class for the purpose of reliability differentiation. Consequence classes for structural components are divided in three levels denoted C<sub>Ci</sub> (i = 1, 2 or 3).

# Consequence Classes CC

## EN 1990 Annex B

Schadens- folgeklassen	Merkmale	Beispiele im Hochbau oder bei sonstigen Ingenieurbauwerken
CC 3	Hohe Folgen für Menschenleben <u>oder</u> sehr große wirtschaftliche, soziale oder umweltbeeinträchtigende Folgen	Tribünen, öffentliche Gebäude mit hohen Versagensfolgen (z. B. eine Konzerthalle)
CC 2	Mittlere Folgen für Menschenleben, beeinträchtigte wirtschaftliche, soziale oder umweltbeeinträchtigende Folgen	Wohn- und Bürogebäude, öffentliche Gebäude mit mittleren Versagensfolgen (z. B. ein Bürogebäude)
CC 1	Niedrige Folgen für Menschenleben <u>und</u> kleine oder vernachlässigbare wirtschaftliche, soziale oder umweltbeeinträchtigende Folgen	Landwirtschaftliche Gebäude ohne regelmäßigen Personenverkehr (z. B. Scheunen, Gewächshäuser)

CC1 = low

CC2 = standard

CC3 = high



Versagens- folgeklasse	Beispiel für Zusammenhang von Gebäudetyp und -Nutzung
1	<p>Einfamilienhäuser mit bis zu 4 Stockwerken Landwirtschaftliche Gebäude, die nicht zu anderen Gebäuden oder Flächen mit häufiger Nutzung durch Personen mindestens das 1,5-fache der Gebäudehöhe beträgt.</p> <p style="text-align: center;"><b>CC1 = low</b></p>
2a Untere Risiko- Gruppe	<p>5-stöckige Gebäude mit einheitlicher Nutzung. Hotels mit bis 4 Stockwerken. Wohn- und Apartmentgebäude mit bis 4 Stockwerken. Bürogebäude mit bis 4 Stockwerken. Industriebauten mit bis 3 Stockwerken. Einzelhandelsgeschäfte mit bis 3 Stockwerken und bis 1 000 m<sup>2</sup> Geschosßfläche in jedem Geschosß. Einstöckige Schulgebäude Alle Gebäude mit Geschosßflächen bis 2 000 m<sup>2</sup> in jedem Geschosß</p> <p style="text-align: center;"><b>CC2 = standard</b></p>
2b Obere Risiko- Gruppe	<p>Hotels, Wohn- und Apartmentgebäude mit mehr als 4 und bis 15 Stockwerken. Schulgebäude mit mehr als einem und bis 15 Stockwerken. Einzelhandelsgeschäfte mit mehr als 3 und bis 15 Stockwerken. Krankenhäuser mit bis 3 Stockwerken. Bürogebäude mit mehr als 4 und bis zu 15 Stockwerken. Alle Gebäude mit Publikumsverkehr mit Geschosßflächen von mehr als 2 000 m<sup>2</sup> und über 20 m Höhe Parkhäuser mit mehr als 3 Stockwerken</p> <p style="text-align: center;"><b>extraordinary big buildings</b></p>
3	<p>Alle über 20 m hohen Gebäude Alle Stahlschalen Gebäude mit einer Spannweite über 100 m</p> <p style="text-align: center;"><b>CC3 = soccer arenas (railway bridges)</b></p>

## Consequence Classes **CC**

Further examples für CC3

Suggestion for Austria, source: Internet

- Hospitals
- Kindergartens, schools
- Buildings with a capacity  $>1000$  persons

## Service Kategorie SC

Categories	Criteria
SC1	<ul style="list-style-type: none"> <li>Structures and components designed for quasi static actions only (Example: Buildings)</li> <li>Structures and components with their connections designed for seismic actions in regions with low seismic activity and in DCL*</li> <li>Structures and components designed for fatigue actions from cranes (class <math>S_0</math>)**</li> </ul>
SC2	<ul style="list-style-type: none"> <li>Structures and components designed for fatigue actions according to EN 1993. (Examples: Road and railway bridges, cranes (class <math>S_1</math> to <math>S_9</math>)**, structures susceptible to vibrations induced by wind, crowd or rotating machinery)</li> <li>Structures and components with their connections designed for seismic actions in regions with medium or high seismic activity and in DCM* and DCH*</li> </ul>
<p>* DCL, DCM, DCH: ductility classes according to EN 1998-1</p> <p>** For classification of fatigue actions from cranes, see EN 1991-3 and EN 13001-1</p>	

SC1 = static

SC2 = fatigue

## Production Kategorie PC

Categories	Criteria
PC1	<ul style="list-style-type: none"> <li>• Non welded components manufactured from any steel grade products</li> <li>• Welded components manufactured from steel grade products below S355</li> </ul>
PC2	<ul style="list-style-type: none"> <li>• Welded components manufactured from steel grade products from S355 and above</li> <li>• Components essential for structural integrity that are assembled by welding on construction site</li> <li>• Components with hot forming manufacturing or receiving thermic treatment during manufacturing</li> <li>• Components of CHS lattice girders requiring end profile cuts</li> </ul>

PC1

S235 / S275

PC2

≥ S355 or building site

## Execution Classes **EXC**

Consequence classes		CC1		CC2		CC3	
Service categories		SC1	SC2	SC1	SC2	SC1	SC2
Production categories	PC1	EXC1	EXC2	EXC2	EXC3	EXC3 <sup>a</sup>	EXC3 <sup>a</sup>
	PC2	EXC2	EXC2	EXC2	EXC3	EXC3 <sup>a</sup>	EXC4

<sup>a</sup> EXC4 should be applied to special structures or structures with extreme consequences of a structural failure as required by national provisions.

## Execution Classes EXC

EXC 1   EXC 2   EXC 3   EXC 4



Consequence Class  
**CC**

Production Kategorie  
**PC**

Service Kategorie  
**SC**

- CC 1 – low

- CC 2 – standard

- CC 3 – high

- PC 1 < S355

- PC 2 -  $\geq$  S355

- building site

- SC 1 – static

- SC 2 – fatigue

## Execution Classes EXC

Execution Classes (workshop welded components)

Consequence Class (workshop)		CC1 low		CC2 standard		CC3 high	
		SC1 static	SC2 fatigue	SC1 static	SC2 fatigue	SC1 static	SC2 fatigue
Production Categorie	PC1 S235, S275	<b>EXC1</b>	<b>EXC2</b>	<b>EXC2</b>	<b>EXC3</b>	<b>EXC3</b>	<b>EXC3</b>
	PC2 ≥ S355	<b>EXC2</b>	<b>EXC2</b>	<b>EXC2</b>	<b>EXC3</b>	<b>EXC3</b>	<b>EXC4</b>

<sup>a</sup> EXC4 should be applied to special structures or structures with extreme consequences of a structural failure as required by national provisions

# welding supervisor

B = IWS    S = IWT    C = IWE

EXC	Steels (steel group)	Reference standards	Thickness (mm)		
			$t \leq 25^a$	$25 < t \leq 50^b$	$t > 50$
EXC2	S235 to S355 (1.1, 1.2, 1.4)	EN 10025-2, EN 10025-3, EN 10025-4 EN 10025-5, EN 10149-2, EN 10149-3 EN 10210-1, EN 10219-1	B	S	C <sup>c</sup>
	S420 to S700 (1.3, 2, 3)	EN 10025-3, EN 10025-4, EN 10025-6 EN 10149-2, EN 10149-3 EN 10210-1, EN 10219-1	S	C <sup>d</sup>	C
EXC3	S235 to S355 (1.1, 1.2, 1.4)	EN 10025-2, EN 10025-3, EN 10025-4 EN 10025-5, EN 10149-2, EN 10149-3 EN 10210-1, EN 10219-1	S	C	C
	S420 to S700 (1.3, 2, 3)	EN 10025-3, EN 10025-4, EN 10025-6 EN 10149-2, EN 10149-3 EN 10210-1, EN 10219-1	C	C	C
EXC4	All	All	C	C	C

<sup>a</sup> Column base plates and endplates  $\leq 50$  mm.

<sup>b</sup> Column base plates and endplates  $\leq 75$  mm.

<sup>c</sup> For steels up to and including S275, level S is sufficient.

<sup>d</sup> For steels N, NL, M and ML, level S is sufficient.



# Execution Classes EXC

Execution Classes (workshop welded components)

Consequence Class (workshop)		CC1 low		CC2 standard		CC3 high	
		SC1 static	SC2 fatigue	SC1 static	SC2 fatigue	SC1 static	SC2 fatigue
Production Categorie	PC1 S235, S275	<b>EXC1</b>	<b>EXC2</b>	<b>EXC2</b>	<b>EXC3</b>	<b>EXC3</b>	<b>EXC3</b>
	PC2 ≥ S355	<b>EXC2</b>	<b>EXC2</b>	<b>EXC2</b>	<b>EXC3</b>	<b>EXC3</b>	<b>EXC4</b>

<sup>a</sup> EXC4 should be applied to special structures or structures with extreme consequences of a structural failure as required by national provisions

## Execution Class and welding supervisor (workshop welded components)



Consequence Class		CC1 low		CC2 standard		CC3 high	
Service Categorie		SC1 static	SC2 fatigue	SC1 static	SC2 fatigue	SC1 static	SC2 fatigue
PC1 <u>&lt;S355</u>	$t \leq 25$ (50 <sup>1</sup> )	<b>EXC1</b> ---	<b>EXC2</b> IWS	<b>EXC2</b> IWS	<b>EXC3</b> IWT	<b>EXC3</b> IWT T	<b>EXC3</b> IWT
	$25 < t \leq 50$ (75 <sup>1</sup> )	<b>EXC1</b> ---	<b>EXC2</b> IWT	<b>EXC2</b> IWT	<b>EXC3</b> IWE	<b>EXC3</b> IWE	<b>EXC3</b> IWE
	$t > 50$	<b>EXC1</b> ---	<b>EXC2</b> IWT	<b>EXC2</b> IWT	<b>EXC3</b> IWE	<b>EXC3</b> IWE	<b>EXC3</b> IWE

<sup>a</sup> EXC4 should be applied to special structures or structures with extreme consequences of a structural failure as required by national provisions

<sup>1</sup>) column base plates and endplates

<sup>2</sup>) IWT adequate if grade N, NL, M, ML

# Execution Classes **EXC**

Execution Classes (workshop welded components)

Consequence Class (workshop)		CC1 low		CC2 standard		CC3 high	
		SC1 static	SC2 fatigue	SC1 static	SC2 fatigue	SC1 static	SC2 fatigue
Production Categorie	PC1 S235, S275	<b>EXC1</b>	<b>EXC2</b>	<b>EXC2</b>	<b>EXC3</b>	<b>EXC3</b>	<b>EXC3</b>
	PC2 ≥ S355	<b>EXC2</b>	<b>EXC2</b>	<b>EXC2</b>	<b>EXC3</b>	<b>EXC3</b>	<b>EXC4</b>

<sup>a</sup> EXC4 should be applied to special structures or structures with extreme consequences of a structural failure as required by national provisions

## Execution Class and welding supervisor (workshop welded components)



Consequence Class		CC1 low		CC2 standard		CC3 high	
		SC1 static	SC2 fatigue	SC1 static	SC2 fatigue	SC1 static	SC2 fatigue
<u>PC2</u> <u>S355</u>	$t \leq 25$ (50 <sup>1</sup> )	<b>EXC2</b> <b>IWS</b>	<b>EXC2</b> <b>IWS</b>	<b>EXC2</b> <b>IWS</b>	<b>EXC3</b> <b>IWT</b>	<b>EXC3</b> <b>IWT</b>	<b>EXC4</b> <b>IWE</b>
	$25 < t \leq 50$ (75 <sup>1</sup> )	<b>EXC2</b> <b>IWT</b>	<b>EXC2</b> <b>IWT</b>	<b>EXC2</b> <b>IWT</b>	<b>EXC3</b> <b>IWE</b>	<b>EXC3</b> <b>IWE</b>	<b>EXC4</b> <b>IWE</b>
	$t > 50$	<b>EXC2</b> <b>IWE</b>	<b>EXC2</b> <b>IWE</b>	<b>EXC2</b> <b>IWE</b>	<b>EXC3</b> <b>IWE</b>	<b>EXC3</b> <b>IWE</b>	<b>EXC4</b> <b>IWE</b>

<sup>a</sup> EXC4 should be applied to special structures or structures with extreme consequences of a structural failure as required by national provisions

1) column base plates and endplates

2) IWT adequate if grade N, NL, M, ML

# Execution Class and welding supervisor (workshop welded components)



Consequence Class		CC1		CC2		CC3	
		low		standard		high	
Service Categorie		SC1	SC2	SC1	SC2	SC1	SC2
		static	fatigue	static	fatigue	static	fatigue
PC2 > S355	$t \leq 25$ (50 <sup>1</sup> )	<b>EXC2</b> <b>IWT</b>	<b>EXC2</b> <b>IWT</b>	<b>EXC2</b> <b>IWT</b>	<b>EXC3</b> <b>IWE</b>	<b>EXC3</b> <b>IWE</b>	<b>EXC4</b> <b>IWE</b>
	$25 < t \leq 50$ (75 <sup>1</sup> )	<b>EXC2</b> <b>IWE<sup>2</sup></b>	<b>EXC2</b> <b>IWE<sup>2</sup></b>	<b>EXC2</b> <b>IWE<sup>2</sup></b>	<b>EXC3</b> <b>IWE</b>	<b>EXC3</b> <b>IWE</b>	<b>EXC4</b> <b>IWE</b>
	$t > 50$	<b>EXC2</b> <b>IWE</b>	<b>EXC2</b> <b>IWE</b>	<b>EXC2</b> <b>IWE</b>	<b>EXC3</b> <b>IWE</b>	<b>EXC3</b> <b>IWE</b>	<b>EXC4</b> <b>IWE</b>

<sup>a</sup> EXC4 should be applied to special structures or structures with extreme consequences of a structural failure as required by national provisions

<sup>1</sup>) column base plates and endplates

<sup>2</sup>) IWT adequate if grade N, NL, M, ML

# welding supervisor IWS - application limits

standard steel structures



CC2

DIN 18800 part 7

EN 1090 part 2

S235, S275

S235 - S355

$t \leq 22$  mm

$t \leq 25$  mm

$t \leq 30$  mm (endplates)

$t \leq 50$  mm (endplates)

span, height  $\leq 20$  m

span, height  $\rightarrow$  no limits

single-story

4 floors / 15 floors

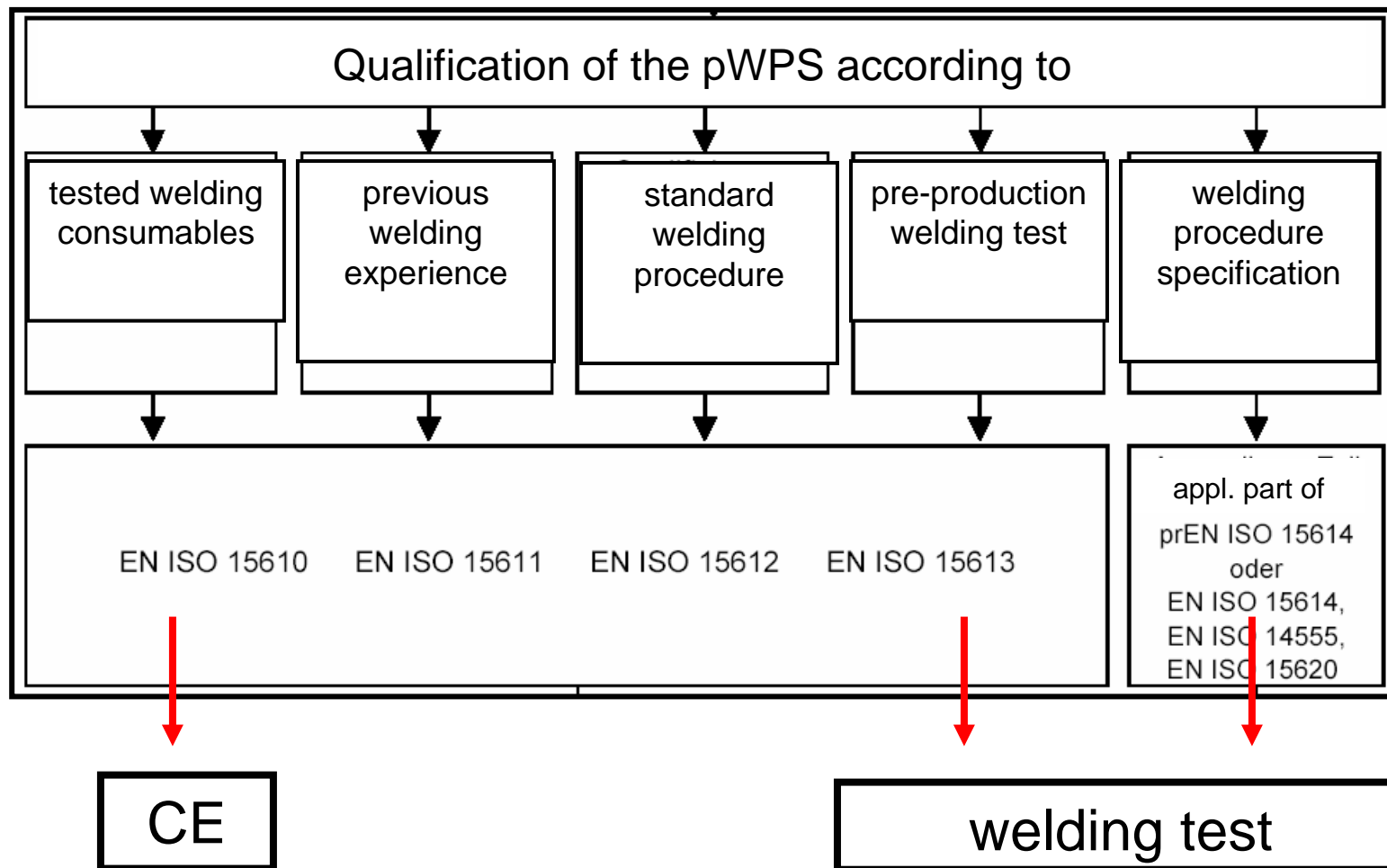
MAG, MIG, WIG, E

no limits

static actions

static actions

# welding according to qualified welding procedure specifications WPS



# welding according to qualified welding procedure specifications WPS

**Table 12 — Methods of qualification of welding procedures  
for the processes 111, 114, 12, 13 and 14**

Method of qualification		EXC 2	EXC 3	EXC 4
Welding procedure specification	EN ISO 15614-1	X	X	X
Pre-production welding test	EN ISO 15613	X	X	X
Standard welding procedure	EN ISO 15612	X <sup>a</sup>	-	-
Previous welding experience	EN ISO 15611	X <sup>b</sup>		
Tested welding consumables	EN ISO 15610			
X	Permitted			
-	Not permitted			
<sup>a</sup> Only for materials ≤ S 355 and only for manual or partly mechanized welding. <sup>b</sup> Only for materials ≤ S 275 and only for manual or partly mechanized welding.				



# Qualification of the WPS acc to ISO 15610



STALT  
& STEINE

## Schweißenweisung WPS Welding Procedure Specification

HSP Spengler

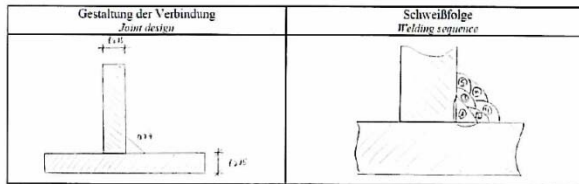
Ort / Place: Grünfeld  
Datum: 01.04.2007  
Schweißverfahren des Herstellers: 135 - MAG  
Welding process:  
Beleg-Nr.: WPS-HSP-001  
Reference No.:  
WPQR-Nr.:

Hersteller: HSP Spengler GmbH & Co. KG  
Manufacturer:  
Nahart: FW  
Joint type:  
Fügevorrichtung:  
Weld preparation:  
(Zeichnung)\*:  
(Drawing):

Art der Vorbereitung und Reinigung: trocken und sauber  
Method of preparation and cleaning:

Spezifikation des Grundwerkstoffes: 1.1, 1.2, 1.4  
Parent metal specification:

Werkstückdicke (mm): >15 mm  
Parent metal thickness (mm):  
Anwendungsdurchmesser (mm):  
Pipe outside diameter:  
Schweißposition: PB  
Welding position:



Einzelheiten für das Schweißen welding details

Schweißnaht Bm	Prozess Process	Durchmesser des Zusatzwerkstoffes Size of filler metal (mm)	Strom- stärke Current (A)	Spannung Voltage (V)	Stromart Polar. Current Pol.	Dreh- vorrichtung Wire feed (m/min)	Vorschubge- schwindigkeit *) Travel speed (cm/min)	Wärmeein- bringung *) Heat input (kJ/cm)
1	135	1,2	260 ± 30	28 ± 3	=+	9	40 - 50	7,8
2-a	135	1,2	260 ± 30	28 ± 3	=+	9	40 - 50	7,8

Zusatzwerkstoff  
Filler metal:  
- Einteilung und Markenname: G4Si1 - Carbofil1A  
- Typ and designation:  
Sondervorschriften für Trocknung:  
Low special baking or drying:  
Schutzgas: Schweißpulver  
Gas welding flux:  
- Schweißpulver:  
- welding flux:  
- Schutzgas:  
- gas: M21 (ArC-18, Igumix 18)  
- Wurzelschutz:  
- backing  
Bemerkungen/Remarks:

Letzte Aktualisierung last update 04.05.09

HSP Spengler GmbH & Co. KG  
Schweißfachingenieur  
) falls gefordert if necessary

Gasdurchflussmenge  
Gas flow rate:  
- Schutzgas: 15 l/min  
- Shield:  
- Wurzelschutz: 1 mm  
- Backing:  
Wellenablenkwinkel: Durchmesser: mm  
Tungston elektrode type size:  
Einzelheiten über Ausfügen / Schweißbaudsicherung:  
Details of back gouging backing:  
Vorwärmtemperatur:  
Preheat temperature:  
- S235  
1 < 30 mm: schweißwasserfrei vor-trocknen  
1 ≥ 30 mm: 50 - 80°C  
- S355  
1 < 25 mm: 50 - 80°C  
1 ≥ 25 mm: ≥ 100°C  
- S355NL  
1 < 25 mm: 50 - 80°C  
1 ≥ 25 mm: 120 - 150°C  
Zwischenabgerichteperatur: max 250 °C  
Interpass temperature:



Versuchsanstalt für Stahl, Holz und Steine  
(Amtliche Materialprüfungsanstalt)  
Universität Karlsruhe (TH)

Head: Univ.-Prof. Dr.-Ing. H. J. Blaß und Univ.-Prof. Dr.-Ing. T. Ummenhofer

## Welding Procedure Qualification Record (WPQR)

Qualification based on tested welding consumables (DIN EN ISO 15610)

Test-Certificate Nr. 092096-1

Manufacturer: HSP Spengler GmbH & Co. KG  
Address: Philipp-Holzmann-Straße 11  
97947 Grünfeld  
Reference number: --  
WPS number: WPS HSP-001 (s. Annex)  
Inspection scope: DIN EN ISO 15610/DIN 18800  
Welding process: 135 - MAG-welding  
Joint type: FW (s. WPS)  
Parent material group: 1.1, 1.2, 1.4  
Parent material thickness (mm): >15 (s. WPS)  
Weld metal thickness (mm): n.a.  
Filler metal thickness (mm): a>4 (s. WPS)  
Single/multi layer: s/ml  
Welding position: PB  
Preheat temperature: s. WPS  
Interpass temperature: s. WPS  
Designation of gas/flux: M21 (ArC-18, Igumix 18)

Test centre: Versuchsanstalt für Stahl, Holz und Steine,  
Universität Karlsruhe (TH)  
Dep: Stahl- und Leichtmetallbau, D-76128 Karlsruhe  
Tel.: +49 (0)721 608 2205, Fax: +49 (0)721 608 4078  
Regulation/testing standard: DIN EN ISO 15610/DIN 18800  
Date of welding: n.a.  
Name of welder/operator: n.a.  
Outside diameter (mm): n.a.  
Designation of filler material: G4Si1 - Carbofil1A  
Size of filler metal (mm): 1,2  
Heat input: s. WPS  
Heat treatment: n.a.  
Current/Polarisation: =/+  
Designation of backing gas: n.a.

Remarks:  
The approval for the Carbofil 1A as tested welding consumable is e.g.:

- "DB-Zulassungsnummer": 42.098.01
- "VdTUV-Kennblattnummer": 11042.00 03.08 and/or 00266.10 06.07

This WPQR confirms the qualification of the mentioned welding procedure specification (WPS) of the manufacturer based on the application of the described tested welding consumables.

Karlsruhe, 04.05.2009  
Official in charge  
Dr.-Ing. M. Volz, IWE

This test certificate may only be reproduced in an unabridged version. A publication in extracts needs our written approval.

## DIN 18800 part 7

### Limits of application

MAG, MIG, WIG, E

S235 - S275 (1.1) (+S355)

Stainless steels (8.1)

thickness 3 - 40 mm

fillet welds  $a \geq 3$  mm

tube diameters  $> 25$  mm

## EN 1090 part 2

### Limits of application

MAG, MIG, WIG, E

S235 - S275 (1.1) (~~+S355~~)

Stainless steels (8.1)

Thickness 3 - 40 mm

fillet welds  $a \geq 3$  mm

tube diameters  $> 25$  mm

## EN 1090 part 2

### Limits of application

MAG, MIG, WIG, E

**only EXC2 !**

S235 - S275 (1.1) (~~+S355~~)

Stainless steels (8.1)

**- changings for fatigue actions**

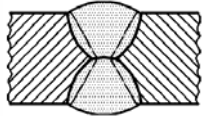
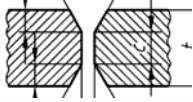
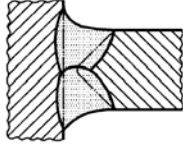
THICKNESS 5 - 40 mm

**- changings in CC3 (high)**

fillet welds  $a \geq 3$  mm

**- if welding supervisor IWS → similar to DIN 18800-7**

# supplementary non destructive testings

Type of weld	IWS	Shop and site welds		
		EXC2	EXC3	EXC4
<p>Transverse butt welds and partial penetration welds in butt joints subjected to tensile stress.</p> <p><math>U \geq 0,5</math></p>  <p><math>U &lt; 0,5</math></p> 		10 %	20 %	100 %
		0 %	10 %	50 %
<p>Transverse butt welds and partial penetration welds:</p> <p>in cruciform joints</p>  <p>in T joints</p>		10 %	20 %	100 %
		5 %	10 %	50 %
<p>Transverse fillet welds in tension or shear:</p> <p>With <math>a &gt; 12 \text{ mm}</math> or <math>t &gt; 20 \text{ mm}</math></p> <p>With <math>a \leq 12 \text{ mm}</math> and <math>t \leq 20 \text{ mm}</math></p>		5 %	10 %	20 %
		0 %	5 %	10 %
<p>Longitudinal welds and welds to stiffeners</p>		0 %	5 %	10 %
<p>NOTE 1 Longitudinal welds are those made parallel to the component axis. All the others are considered as transverse welds.</p> <p>NOTE 2 <math>U</math> = Utilization grade for welds for quasi-static actions. <math>U = E_d/R_d</math>, where <math>E_d</math> is the largest action effect of the weld and <math>R_d</math> is the resistance of the weld in the ultimate limit state.</p> <p>NOTE 3 Terms <math>a</math> and <math>t</math> refer respectively to the throat thickness and the thickest material being joined.</p>				

# EN 1090

## Execution of steel structures and aluminium structures

### -Part 1: Requirements for conformity assessment for structural components (CE)

 replaces „Übereinstimmungsnachweis“ Ü

### - Part 2: Technical requirements for the execution of steel structures

 replaces DIN 18800 part 7

### - Part 3: Technical requirements for the execution of aluminium structures

 replaces DINV 4113 part 3



The Construction Products Directive (CPD) shall guarantee the **free trade** with and the **unlimited use** of construction products in the single european market



CE - conformity assessment



EN 1090-1 Annex ZA

<p style="text-align: center;"><b>CE</b></p> <p style="text-align: center;">01234</p>	<p><i>CE conformity marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.</i></p> <p><i>Identification number of the notified body</i></p>
<p style="text-align: center;">AnyCo Ltd, PO Box 21, B-1050</p> <p style="text-align: center;"><b>08</b></p> <p style="text-align: center;">01234-CPD-00234</p>	<p><i>Name or identifying mark and registered address of the producer</i></p> <p><i>Last two digits of the year in which the marking was affixed</i></p> <p><i>Certificate number</i></p>
<p style="text-align: center;"><b>EN 1090-1</b></p> <p style="text-align: center;">Welded steel beam – M 346</p> <p><b>Tolerances on geometrical data: EN 1090-2.</b></p> <p><b>Weldability: Steel S235J0 according to EN 10025-2.</b></p> <p><b>Fracture toughness: 27 J at 0°C.</b></p> <p><b>Reaction to fire: Material classified: Class A1.</b></p> <p><b>Release of cadmium: NPD.</b></p> <p><b>Emission of radioactivity: NPD.</b></p> <p><b>Durability: Surface preparation according to EN 1090-2, preparation grade P3. Surface painted according to EN ISO 12944-5, S.1.09.</b></p> <p><b><u>Structural characteristics:</u></b>  <b><u>Design:</u></b> NPD.  <b><u>Manufacturing:</u></b> According to component specification CS-034/2006, and EN 1090-2, execution class EXC2.</p>	<p><i>No. of European standard</i></p> <p><i>Description of product</i></p> <p style="text-align: center;"><i>and</i></p> <p><i>information on regulated characteristics</i></p>

Figure ZA.1 – Example of CE marking information of product properties by material properties and geometrical data



Regulations for the CE-conformity assessment



conformity assessment procedure 2+

**Table ZA.2 System of attestation of conformity for steel and aluminium structural components**

Product	Intended use	Level(s) or class(s)	Attestation of conformity system
Steel and aluminium structural components	For structural use in all types of construction works		2+

System 2+: See CPD Annex III.2 (ii). First possibility, including certification of the factory production control by an approved body on the basis of initial inspection of factory and of factory production control as well as of continuous surveillance, assessment and approval of factory production control.

**Table ZA.3 Assignment of tasks for evaluation of conformity of structural steel and aluminium components**

Tasks		Content of the task	Evaluation of conformity Clauses to apply
Tasks under the responsibility of the manufacturer	Initial type testing	Relevant parameters related to the performance characteristics of Table ZA.1	6.2
	Factory Production Control (FPC)	Relevant parameters related to the performance characteristics of Table ZA.1	6.3
	Sampling, testing and inspection at the factory	Relevant characteristics of Table ZA.1	Table 2
Tasks for the certification body	Certification of FPC by a certified body on the basis of:	Initial inspection of factory and of FPC	6.3 and Annex B
		Continuous surveillance, assessment and approval of FPC	6.3 and Annex B

# Welding Certificate

The welding certificate should include the following information:

- scope and the applicable standards;
- execution class(es);
- welding process(es);
- parent material(s);
- responsible welding coordinator, see EN ISO 14731;
- remarks if any.

**Table B.3 — Routine surveillance intervals**

<b>Execution class</b>	<b>Intervals between inspections of manufacturer's FPC after the ITT (years)</b>
EXC1 and EXC2	1– 2 – 3 – 3
EXC3 and EXC4	1 – 1 – 2 – 3 – 3

# Quality control system

DIN 18800 part 7



conformity assessment (ÜH)

+

Certificate of manufacturers qualification



Initial Inspection

+

Continous Inspection

EN 1090 Teil 2



conformity assessment 2+  
(Welding Certificate)



Initial Inspection

+

Continous Inspection

# Ex: Factory Building

→ CC 2

- span 25 m
- max t = 16 mm
- end plates 40 mm
- S235
- shop welding
- Static loading

⇒ PC 1

→ SC 1

Consequence classes		CC1		<u>CC2</u>		CC3	
Service categories		SC1	SC2	<u>SC1</u>	SC2	SC1	SC2
Production categories	<u>PC1</u>	EXC1	EXC2	<b>EXC2</b>	EXC3	EXC3 <sup>a</sup>	EXC3 <sup>a</sup>
	PC2	EXC2	EXC2	EXC2	EXC3	EXC3 <sup>a</sup>	EXC4

<sup>a</sup> EXC4 should be applied to special structures or structures with extreme consequences of a structural failure as required by national provisions.

# Ex: Factory Building

CC2, SC1, PC1, EXC2

- max t = 16 mm
- end plates 40 mm
- S235

Execution Class and welding supervisor (workshop welded components)

Consequence Class		CC1 low		CC2 standard		CC3 high	
Service Kategorie		SC1 static	SC2 fatigue	SC1 static	SC2 fatigue	SC1 static	SC2 fatigue
PC1 <u>&lt;S355</u>	<u><math>t \leq 25 (50^1)</math></u>	EXC1 ---	EXC2 IWS	EXC2 IWS	EXC3 IWT	EXC3 IWT T	EXC3 IWT
	$25 < t \leq 50 (75^1)$	EXC1 ---	EXC2 IWT	EXC2 IWT	EXC3 IWE	EXC3 IWE	EXC3 IWE
	$t > 50$	EXC1 ---	EXC2 IWT	EXC2 IWT	EXC3 IWE	EXC3 IWE	EXC3 IWE

Ex: Factory Building

CC2, SC1, PC1, EXC2

- max t = 16 mm
- end plates 40 mm
- S235

## Qualification of the WPS

Table 12 — Methods of qualification of welding procedures for the processes 111, 114, 12, 13 and 14

Method of qualification		EXC 2	EXC 3	EXC 4
Welding procedure test	EN ISO 15614-1	X	X	X
Pre-production welding test	EN ISO 15613	X	X	X
Standard welding procedure	EN ISO 15612	X <sup>a</sup>	-	-
Previous welding experience	EN ISO 15611	X <sup>b</sup>	-	-
Tested welding consumables	EN ISO 15610			
X	Permitted			
-	Not permitted			
<sup>a</sup> Only for materials ≤ S 355 and only for manual or partly mechanized welding. <sup>b</sup> Only for materials ≤ S 275 and only for manual or partly mechanized welding.				

CE

X<sup>b</sup>

# Qualification of the WPS acc to ISO 15610



STALT  
& STEINE

## Schweißenweisung WPS Welding Procedure Specification

HSP Spengler

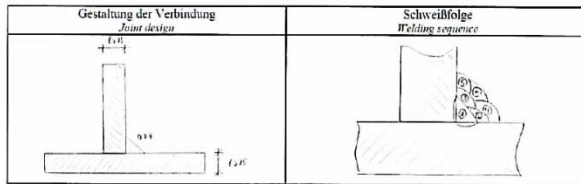
Ort / Place: Grünfeld  
Datum: 01.04.2007  
Schweißverfahren des Herstellers: 135 - MAG  
Welding process:  
Beleg-Nr.: WPS-HSP-001  
Referenz-Nr.:  
WPQR-Nr.:

Hersteller: HSP Spengler GmbH & Co. KG  
Manufacturer:  
Nahart: FW  
Joint type:  
Fügevorrichtung:  
Weld preparation:  
(Zeichnung)\*:  
(Drawing):

Art der Vorbereitung und Reinigung: trocken und sauber  
Method of preparation and cleaning:

Spezifikation des Grundwerkstoffes: 1.1, 1.2, 1.4  
Parent metal specification:

Werkstückdicke (mm):  $\geq 15$  mm  
Parent metal thickness (mm):  
Anwendungsdurchmesser (mm):  
Pipe outside diameter:  
Schweißposition: PB  
Welding position:



Einzelheiten für das Schweißen welding details

Schweißnaht Bm	Prozess Process	Durchmesser des Zusatzwerkstoffes Size of filler metal (mm)	Strom- stärke Current (A)	Spannung Voltage (V)	Stromart Polar. Current Pol.	Dreh- vorrichtung Wire feed (mm/min)	Vorschubge- schwindigkeit *) Travel speed (cm/min)	Wärmeein- bringung *) Heat input (kJ/cm)
1	135	1,2	260 ± 30	28 ± 3	=+	9	40 - 50	7,8
2-a	135	1,2	260 ± 30	28 ± 3	=+	9	40 - 50	7,8

Zusatzwerkstoff  
Filler metal  
- Einteilung und Markenname: G4Si1 - Carbofil1A  
- Typ und Bezeichnung:  
Sondervorschriften für Trocknung:  
dow special baking or drying:  
Schutzgas: Schweißpulver  
Gas welding flux  
- Schweißpulver:  
- welding flux:  
- Schutzgas:  
- gas: M21 (ArC-18, Igamix 18)  
- Wurzelschutz:  
- backing

Bemerkungen/Remarks:

Letzte Aktualisierung last update 04.05.09

HSP Spengler GmbH & Co. KG  
Schweißfachingenieur  
) falls gefordert if necessary

Gasdurchflussmenge  
Gas flow rate  
- Schutzgas: 15 l/min  
- Shield:  
- Wurzelschutz: 1 mm  
- Backing  
Wellenablenkwinkel: Durchmesser: mm  
Tungston elektrode type size  
Einzelheiten über Ausfügen / Schweißbaudsicherung:  
Details of back gouging backing  
Vorwärmtemperatur:  
Preheat temperature  
- S235  
- S355  
- S355NL  
Zwischenlagerungstemperatur: max 250 °C  
Interpass temperature:

Zwischenlagerungstemperatur: max 250 °C  
Interpass temperature:



Versuchsanstalt für Stahl, Holz und Steine  
(Amtliche Materialprüfungsanstalt)  
Universität Karlsruhe (TH)

Head: Univ.-Prof. Dr.-Ing. H. J. Blaß und Univ.-Prof. Dr.-Ing. T. Ummenhofer

## Welding Procedure Qualification Record (WPQR)

Qualification based on tested welding consumables (DIN EN ISO 15610)

Test-Certificate Nr. 092096-1

Manufacturer: HSP Spengler GmbH & Co. KG  
Address: Philipp-Holzmann-Straße 11  
97947 Grünfeld  
Reference number: --  
WPS number: WPS HSP-001 (s. Annex)  
Inspection scope: DIN EN ISO 15610/DIN 18800  
Welding process: 135 - MAG-welding  
Joint type: FW (s. WPS)  
Parent material group: 1.1, 1.2, 1.4  
Parent material thickness (mm):  $\geq 15$  (s. WPS)  
Weld metal thickness (mm): n.a.  
Fillet weld thickness (mm):  $\geq 4$  (s. WPS)  
Single/multi layer: s/ml  
Welding position: PB  
Preheat temperature: s. WPS  
Interpass temperature: s. WPS  
Designation of gas/flux: M21 (ArC-18, Igamix 18)

Test centre: Versuchsanstalt für Stahl, Holz und Steine,  
Universität Karlsruhe (TH)  
Dep: Stahl- und Leichtmetallbau, D-76128 Karlsruhe  
Tel.: +49 (0)721 608 2205, Fax: +49 (0)721 608 4078  
Regulation/testing standard: DINENISO 15610/DIN 18800  
Date of welding: n.a.  
Name of welder/operator: n.a.  
Outside diameter (mm): n.a.  
Designation of filler material: G4Si1 - Carbofil1A  
Size of filler metal (mm): 1,2  
Heat input: s. WPS  
Heat treatment: n.a.  
Current/Polarisation: =/+  
Designation of backing gas: n.a.

Remarks: The approval for the Carbofil 1A as tested welding consumable is e.g.:

- "DB-Zulassungsnummer": 42.098.01
- "VdTUV-Kennblattnummer": 11042.00 03.08 and/or 00266.10 06.07

This WPQR confirms the qualification of the mentioned welding procedure specification (WPS) of the manufacturer based on the application of the described tested welding consumables.

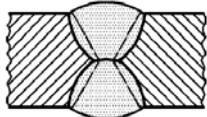
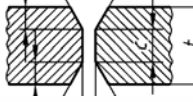
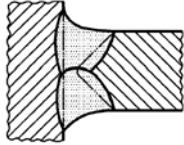
Karlsruhe, 04.05.2009  
Official in charge  
Dr.-Ing. M. Volz, IWE

This test certificate may only be reproduced in an unabridged version. A publication in extracts needs our written approval.



# supplementary non destructive testings

Table 24 — Extent of supplementary NDT

Type of weld	Shop and site welds		
	EXC2	EXC3	EXC4
<p>Transverse butt welds and partial penetration welds in butt joints subjected to tensile stress.</p> <p><math>U \geq 0,5</math></p>  <p><math>U &lt; 0,5</math></p> 	10 %	20 %	100 %
	0 %	10 %	50 %
<p>Transverse butt welds and partial penetration welds:</p> <p>in cruciform joints</p>  <p>in T joints</p>	10 %	20 %	100 %
	5 %	10 %	50 %
<p>Transverse fillet welds in tension or shear:</p> <p>With <math>a &gt; 12</math> mm or <math>t &gt; 20</math> mm</p> <p>With <math>a \leq 12</math> mm and <math>t \leq 20</math> mm</p>	5 %	10 %	20 %
	0 %	5 %	10 %
Longitudinal welds and welds to stiffeners	0 %	5 %	10 %
<p>NOTE 1 Longitudinal welds are those made parallel to the component axis. All the others are considered as transverse welds.</p> <p>NOTE 2 <math>U</math> = Utilization grade for welds for quasi-static actions. <math>U = E_d/R_d</math>, where <math>E_d</math> is the largest action effect of the weld and <math>R_d</math> is the resistance of the weld in the ultimate limit state.</p> <p>NOTE 3 Terms <math>a</math> and <math>t</math> refer respectively to the throat thickness and the thickest material being joined.</p>			

Ex: soccer arena

→ CC 3

- max t = 50 mm
- end plates 60 mm
- S355
- site weldings
- Static loading

→ PC 2

→ SC 1



Consequence classes		CC1		CC2		<u>CC3</u>	
Service categories		SC1	SC2	SC1	SC2	<u>SC1</u>	SC2
Production categories	PC1	EXC1	EXC2	EXC2	EXC3	EXC3 <sup>a</sup>	EXC3 <sup>a</sup>
	<u>PC2</u>	EXC2	EXC2	EXC2	EXC3	<b>EXC3<sup>a</sup></b>	EXC4

<sup>a</sup> EXC4 should be applied to special structures or structures with extreme consequences of a structural failure as required by national provisions.

# Ex: soccer arena

CC3, SC1, PC2, EXC3

- max t = 50 mm
- Stirnplatten 60 mm
- S355

Consequence Class		CC1 low		CC2 standard		CC3 <u>high</u>	
		SC1 static	SC2 fatigue	SC1 static	SC2 fatigue	<u>SC1 static</u>	SC2 fatigue
PC2 <u>S355</u>	$t \leq 25 (50^1)$	EXC2 IWS	EXC2 IWS	EXC2 IWS	EXC3 IWT	EXC3 IWT	EXC4 IWE
	<u><math>25 &lt; t \leq 50 (75^1)</math></u>	EXC2 IWT	EXC2 IWT	EXC2 IWT	EXC3 IWE	<b>EXC3 IWE</b>	EXC4 IWE
	$t > 50$	EXC2 IWE	EXC2 IWE	EXC2 IWE	EXC3 IWE	EXC3 IWE	EXC4 IWE

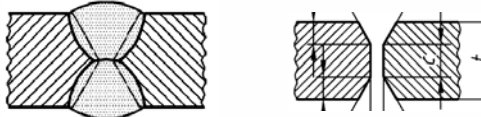
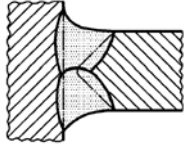
Qualification of the WPS

**Table 12 — Methods of qualification of welding procedures for the processes 111, 114, 12, 13 and 14**

Method of qualification		EXC 2	EXC 3	EXC 4
Welding procedure test	EN ISO 15614-1	X	X	X
Pre-production welding test	EN ISO 15613	X	X	X
Standard welding procedure	EN ISO 15612	X <sup>a</sup>	-	-
Previous welding experience	EN ISO 15611	X <sup>b</sup>	-	-
Tested welding consumables	EN ISO 15610			
X	Permitted			
-	Not permitted			
<sup>a</sup> Only for materials ≤ S 355 and only for manual or partly mechanized welding.				
<sup>b</sup> Only for materials ≤ S 275 and only for manual or partly mechanized welding.				

# supplementary non destroying testings

Table 24 — Extent of supplementary NDT

Type of weld	Shop and site welds		
	EXC2	EXC3	EXC4
<p>Transverse butt welds and partial penetration welds in butt joints subjected to tensile stress.</p> <p><math>U \geq 0,5</math></p> <p><math>U &lt; 0,5</math></p> 	10 %	20 %	100 %
	0 %	10 %	50 %
<p>Transverse butt welds and partial penetration welds:</p> <p>in cruciform joints</p> <p>in T joints</p> 	10 %	20 %	100 %
	5 %	10 %	50 %
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	0 %	5 %	10 %
<p>Longitudinal welds and welds to stiffeners</p>	0 %	5 %	10 %
<p>NOTE 1 Longitudinal welds are those made parallel to the component axis. All the others are considered as transverse welds.</p> <p>NOTE 2 <math>U</math> = Utilization grade for welds for quasi-static actions. <math>U = E_d/R_d</math>, where <math>E_d</math> is the largest action effect of the weld and <math>R_d</math> is the resistance of the weld in the ultimate limit state.</p> <p>NOTE 3 Terms <math>a</math> and <math>t</math> refer respectively to the throat thickness and the thickest material being joined.</p>			

# Ex: Bridges

railway bridge



EXC 4

road bridge



CC 2 / 3

SC 2    PC 1 / 2

EXC 3 / 4

pedestrian bridge



CC 2 / 3

SC 1 / 2    PC 1 / 2

EXC 2 / 3 / 4

Consequence classes		CC1		CC2		CC3	
Service categories		SC1	SC2	SC1	SC2	SC1	SC2
Production categories	PC1	EXC1	EXC2	EXC2	EXC3	EXC3 <sup>a</sup>	EXC3 <sup>a</sup>
	PC2	EXC2	EXC2	EXC2	EXC3	EXC3 <sup>a</sup>	EXC4

<sup>a</sup> EXC4 should be applied to special structures or structures with extreme consequences of a structural failure as required by national provisions.

# Summary

- EN 1090-2 replaces national regulations (DIN 18800 part 7)
- EN 1090-2 classifies Execution Classes EXC 1 – 4
- EN 1090-2 defines welding supervisors IWS / IWT / IWE with application limits
- EN 1090-2 defines supplementary non destructive testings
- EN 1090-2 defines test piece weldings
- EN 1090-1 defines regulations for the CE – conformity assessment
- EN 1090-1 requires a welding certificate

