

Quenched and tempered steel castings  
for general applications  
Technical delivery conditions

**DIN**  
17 205

Vergütungsstahlguß für allgemeine Verwendungszwecke; technische Lieferbedingungen

*In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.*

The symbol ● denotes items which shall, the symbol ●● denoting items which may, be agreed upon at the time of ordering.

### 1 Field of application

1.1 This standard specifies technical delivery conditions for quenched and tempered steel castings, made from the steel grades specified in table 1, having maximum section thicknesses of 50 to 400 mm.

1.2 The specifications given in DIN 17 182, DIN 17 245, *Stahl-Eisen-Werkstoffblätter* (Iron and steel materials sheets) (SEW) 520 and 685 shall also apply.

1.3 The specifications given in DIN 1690 Parts 1 and 2 shall be complied with unless otherwise stated here.

### 2 Concept

For the purposes of this standard, 'quenched and tempered' is hardening followed by tempering (cf. DIN 17 014 Part 1). Quenched and tempered steel castings are suitable for service temperatures up to 300 °C.

### 3 Designation

3.1 The material designations given in table 1 have been taken from the Explanatory notes to the 1983 edition of *DIN-Normenheft* (Standardization booklet) 3, and the material numbers, from DIN 17 007 Part 2.

3.2 The standard designation shall give the name of the product (steel casting), the DIN number (DIN 17 205), the material designation or number, the symbol denoting heat treatment condition and, if necessary, the strength class.

Example 1:

Designation of a steel casting complying with this standard, made of a material identified by material designation GS-30 Mn 5 (material number 1.1165), supplied in the air-hardened and tempered condition (LV):

Steel casting DIN 17 205 – GS-30 Mn 5 LV  
or

Steel casting DIN 17 205 – 1.1165 LV

Example 2:

Designation of a steel casting complying with this standard, made of a material identified by material designation GS-25 CrMo 4 (material number 1.7218), supplied in the liquid quenched and tempered condition (V), belonging to strength class II:

Steel casting  
DIN 17 205 – GS-25 CrMo 4 V II  
or

Steel casting DIN 17 205 – 1.7218 V II

### 4 Steel grades

The materials covered in this standard are classified according to their chemical composition and their mechanical properties at ambient temperature.

### 5 Requirements

#### 5.1 Steelmaking process

The steel shall be made in an electric furnace using the oxygen method or an equivalent method.

#### 5.2 Heat treatment condition

Steel castings shall be supplied in either the air-hardened and tempered or in the liquid quenched and tempered condition (cf. tables 3 and 4, respectively). As a function of the steel grade and ruling section, castings supplied in the latter condition are also to be assigned to strength class I or II.

● The heat treatment condition shall be agreed at the time of ordering.

Table 6 gives guideline values for heat treatment temperatures and those relevant for welding operations.

#### 5.3 Chemical composition

5.3.1 The chemical composition, as determined by cast analysis, shall be in compliance with table 1.

5.3.2 Where a product analysis of a cast-on test piece is to be carried out, the results may deviate from the values given in table 1 by the amounts listed in table 2.

5.3.3 ●● Subject to agreement, deviations from the specifications given in subclauses 5.3.1 and 5.3.2 are permitted, provided the mechanical properties, weldability, and the performance of the finished product are not adversely affected. Where relevant, limit deviations are to be agreed at the time of ordering.

#### 5.4 Mechanical properties

5.4.1 The values of mechanical properties specified in tables 3 and 4, as determined on a cast-on test piece or a separately cast test piece, shall be complied with.

The values of 0,2 % proof stress, tensile strength and impact energy specified in tables 3 and 4 shall apply for test pieces and products with a maximum ruling section thickness of 150 mm. Where this exceeds 150 mm, the values given shall be regarded as guideline values.

●● Where elongation at fracture is to be determined on test pieces taken from the product, the required value shall be the subject of agreement.

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**5.4.2** Impact energy shall be determined on three test pieces. The minimum values specified shall apply for the mean from these three, it being permitted for one single value to be lower than the specified minimum value, but not less than 70% of that value.

**5.4.3** Guideline values for impact transition temperature are given in table 5.

## 5.5 Surface quality

**5.5.1** The general surface quality requirements specified in DIN 1690 Part 1 shall be complied with.

**5.5.2** ●● Where special agreement has not been reached regarding internal or external imperfections, the products shall fulfil the requirements of severity level 5 as specified in DIN 1690 Part 2.

## 5.6 Welding

**5.6.1** The general welding requirements specified in DIN 1690 Part 1 shall be complied with. Fabrication welds are permitted, provided they are done with the necessary care and expertise. In cases of doubt, the fabricator should consult with the casting manufacturer.

**5.6.2** Filler metals shall be selected as a function of the steel grade, the product geometry, the stresses expected in service, and the postweld heat treatment.

**5.6.3** The preheat temperature and interpass temperature shall be selected as a function of the steel grade, the welding conditions, and the ruling section thickness and geometry of the product. As a rule, the preheat temperature should be higher as internal stresses increase. Where the maximum section thickness is between 30 and 80 mm, and where metal-arc welding with covered electrode is used as the welding process, the preheat and interpass temperatures should fall within the ranges specified in table 6.

For the purposes of this standard and as a departure from DIN 32 524, the interpass temperature is defined as the temperature of the middle of the weld bead before the next run is welded. Use of a thermocrayon to measure the interpass temperature is not permitted.

**5.6.4** After welding is complete, the annealing temperature shall be a minimum of 20 K and a maximum of 50 K below the tempering temperature, which shall be specified by the casting manufacturer.

Where suitable filler metals are used, the weld metal shall be quenched and tempered.

## 6 Testing and inspection documents

### 6.1 General

The general requirements for testing and for inspection documents specified in DIN 1690 Part 1 shall be complied with.

### 6.2 Inspection documents

**6.2.1** ● Castings complying with this standard shall be supplied with a DIN 50 049 inspection document, the type of document being the subject of agreement at the time of ordering.

In the case of third party inspection, the purchaser's representative or the testing agency shall be stated at the time of ordering and, where required, on the inspection document (e.g. DIN 50 049 - 3.1 C inspection certificate).

**6.2.2** Where it has been agreed to issue a DIN 50 049 inspection certificate or inspection report, this shall include the following particulars:

- a) the results of cast analysis for all elements specified in table 1 for the relevant steel grade;
- b) the results of the tests used to verify compliance with the values for mechanical properties specified in table 3 or 4;
- c) in the case of castings assigned to severity levels S 01 to S 3 or V 1 to V 3 as specified in DIN 1690 Part 2, the results of non-destructive testing used to verify the general casting quality and basis for assignment to a particular severity level;
- d) the results of any additional tests agreed upon;
- e) symbol denoting heat treatment condition and, where required, the strength class;
- f) marking (cf. clause 7);
- g) inspector's mark.

## 6.3 Tests on the castings supplied

### 6.3.1 General

In addition to the requirements given in subclauses 6.3.2 to 6.3.4, the castings supplied, or a batch therefrom, shall be tested in accordance with DIN 1690 Parts 1 and 2.

### 6.3.2 Properties to be tested

Castings shall be subjected to the tests referred to in subclause 6.2.2, items a) to d).

### 6.3.3 Scope of testing

**6.3.3.1** Where it has been agreed to test batches of castings for compliance with the requirements specified in table 3 or 4, the mass of a batch shall be a maximum of:

- a) 2500 kg where it consists of products made from the same material or originating from the same cast;
- b) 1500 kg where it consists of products from the same heat treatment batch.

Remainders with a total mass of not more than half the maximum amounts specified above may be distributed uniformly among the other batches.

**6.3.3.2** Testing of batches as delivered is not permitted.

**6.3.3.3** When testing product originating from the same cast, not more than four batches per cast need be tested.

### 6.3.4 Non-destructive testing

To determine the internal and external condition, test pieces shall be sampled and subjected to non-destructive testing in accordance with DIN 54 111 Part 2, *Stahl-Eisen-Prüfblätter* (Iron and steel test sheets) (SEP) 1922, 1935 and 1936.

## 6.4 Sampling

Sampling shall be carried out in accordance with DIN 1690 Part 1, the maximum section thickness of cast-on test pieces or those cast separately being 150 mm.

## 7 Marking

**7.1** Castings shall be marked with the material designation and the manufacturer's mark.

**7.2** The requirements specified in DIN 1690 Part 1, regarding the marking of castings supplied with an inspection certificate, also apply to castings supplied with an inspection report.

Table 1. Steel grades and their chemical composition as determined by cast analysis

Material		Percentage by mass										
designation	number	C	Si max.	Mn	P max.	S max.	Cr	Mo	Ni	V		
GS-30 Mn 5	1.1165	0,27 to 0,34	0,60	1,20 to 1,50	0,020	0,015						
GS-25 CrMo 4	1.7218	0,22 to 0,29	0,60	0,50 to 0,80	0,020	0,015	0,80 to 1,20	0,20 to 0,30				
GS-34 CrMo 4	1.7220	0,30 to 0,37	0,60	0,50 to 0,80	0,020	0,015	0,80 to 1,20	0,20 to 0,30				
GS-42 CrMo 4	1.7225	0,38 to 0,45	0,60	0,60 to 1,00	0,020	0,015	0,80 to 1,20	0,20 to 0,30				
GS-30 CrMoV 6 4	1.7725	0,27 to 0,34	0,60	0,60 to 1,00	0,020	0,015	1,30 to 1,70	0,30 to 0,50			0,05 to 0,15	
GS-35 CrMoV 10 4	1.7755	0,32 to 0,39	0,60	0,60 to 1,00	0,020	0,015	2,20 to 2,70	0,30 to 0,50			0,05 to 0,15	
GS-25 CrNiMo 4	1.6515	0,22 to 0,29	0,60	0,60 to 1,00	0,020	0,015	0,80 to 1,20	0,20 to 0,30	0,80 to 1,20			
GS-34 CrNiMo 6	1.6582	0,30 to 0,37	0,60	0,60 to 1,00	0,020	0,015	1,40 to 1,70	0,20 to 0,30	1,40 to 1,70			
GS-30 NiCrMo 8 5	1.6570	0,27 to 0,34	0,60	0,60 to 1,00	0,015	0,010	1,10 to 1,40	0,30 to 0,40	1,80 to 2,10			
GS-33 NiCrMo 7 4 4	1.6740	0,30 to 0,36	0,60	0,50 to 0,80	0,015	0,007	0,90 to 1,20	0,35 to 0,50	1,50 to 1,80			

Table 2. Amounts by which the chemical composition as determined by product analysis may deviate from the limiting values specified for cast analysis

Element	Limiting values as determined by cast analysis, as in table 1, as a percentage by mass	Limit deviations for product analysis <sup>1)</sup> , as a percentage by mass
C	$\geq 0,22 \leq 0,45$	$\pm 0,02$
Si	$\leq 0,60$	+ 0,05
Mn	$\leq 0,80$ $> 0,80 \leq 1,50$	$\pm 0,07$ $\pm 0,10$
P	$\leq 0,020$	+ 0,003
S	$\leq 0,015$	+ 0,003
Cr	$\leq 2,70$	$\pm 0,08$
Mo	$\leq 0,50$	$\pm 0,06$
Ni	$\leq 1,50$ $> 1,50 \leq 2,10$	$\pm 0,08$ $\pm 0,10$
V	$\leq 0,15$	$\pm 0,02$

<sup>1)</sup> If a number of product analyses are to be carried out, the deviations shown by an element within one cast shall lie either only above the upper limit or below the lower limit of the range specified for the cast analysis, but not both at the same time.

Table 3. Mechanical properties at ambient temperature of castings supplied in the air-hardened and tempered condition<sup>1)</sup>

Material designation	Material number	Ruling section thickness, in mm	Min. 0,2% proof stress, $R_{p0,2}^{2)}$ , in N/mm <sup>2</sup>	Tensile strength, $R_m^{2)}$ , in N/mm <sup>2</sup>	Min. elongation at fracture, $A_5$ , as a percentage	Min. impact energy (ISO-V), $A_v^{2), 3)}$ , in J
GS-30 Mn 5	1.1165	≤ 400	260	520 to 670	18	32
GS-25 CrMo 4	1.7218	≤ 250	300	550 to 700	16	27
GS-34 CrMo 4	1.7220	≤ 150	380	650 to 800	10	16
		> 150 ≤ 250	330	620 to 770		
		> 250 ≤ 400	300	620 to 770		
GS-42 CrMo 4	1.7225	≤ 150	400	700 to 850	10	12
		> 150 ≤ 250	350	650 to 800		
		> 250 ≤ 400	320	650 to 800		
GS-30 CrMoV 6 4	1.7725	≤ 150	400	650 to 800	12	20
		> 150 ≤ 250	350	650 to 800		
		> 250 ≤ 400	320	650 to 800		
GS-35 CrMoV 10 4	1.7755	≤ 150	650	800 to 950	10	20
		> 150 ≤ 250	600	750 to 900		
		> 250 ≤ 400	500	700 to 850		
GS-25 CrNiMo 4	1.6515	≤ 150	400	700 to 850	15	20
		> 150 ≤ 250	380	650 to 800		
		> 250 ≤ 400	350	650 to 800		
GS-34 CrNiMo 6	1.6582	≤ 150	550	800 to 950	12	32
		> 150 ≤ 400	500	750 to 900		
GS-30 NiCrMo 8 5	1.6570	≤ 150	600	800 to 950	12	32
GS-33 NiCrMo 7 4 4	1.6740	> 150 ≤ 400	550	750 to 900		

1) The values specified apply for cast-on test pieces or those cast separately.

2) The values specified apply for test pieces taken from the product, having or approaching the maximum section thickness specified, provided this is below 150 mm. Where it is higher than 150 mm, the values specified shall be regarded as guideline values.

3) Represents the mean from three test pieces.

Table 4. Mechanical properties at ambient temperature of castings supplied in the liquid quenched and tempered condition<sup>1)</sup>

Material designation	Material number	Ruling section thickness, in mm	Strength class	Min. 0,2% proof stress, $R_{p0,2}^{2)}$ , in N/mm <sup>2</sup>	Tensile strength, $R_m^{2)}$ , in N/mm <sup>2</sup>	Min. elongation at fracture, $A_5$ , as a percentage	Min. impact energy (ISO-V), $A_v^{2), 3)}$ , in J
GS-30 Mn 5	1.1165	$\leq 50$	I	400	520 to 670	14	50
			II	550	700 to 850	10	35
		$> 50 \leq 100$	I	360	500 to 650	12	35
			II	450	600 to 750	10	27
GS-25 CrMo 4	1.7218	$\leq 50$	I	450	600 to 750	18	50
			II	600	750 to 900	10	35
		$> 50 \leq 100$	I	450	600 to 750	14	40
			II	550	700 to 850	10	32
$> 100 \leq 150$	I	410	600 to 750	12	32		
	II	500	700 to 850	10	27		
GS-34 CrMo 4	1.7220	$\leq 50$	I	600	750 to 850	14	35
			II	700	850 to 1000	10	27
		$> 50 \leq 100$	I	540	700 to 850	12	30
			II	650	830 to 980	10	27
$> 100 \leq 150$	I	480	620 to 770	10	27		
	II	580	720 to 870	10	27		
GS-42 CrMo 4	1.7225	$\leq 50$	I	650	780 to 930	14	35
			II	800	900 to 1100	10	27
		$> 50 \leq 100$	I	600	800 to 950	12	30
			II	700	850 to 1000	10	27
$> 100 \leq 150$	I	550	700 to 850	10	27		
	II	650	750 to 900	10	27		
GS-30 CrMoV 6 4	1.7725	$\leq 100$	I	700	850 to 1000	14	45
			II	750	900 to 1100	12	32
		$> 100 \leq 250$	I	550	750 to 900	10	27
GS-35 CrMoV 10 4	1.7755	$\leq 100$	I	700	850 to 1000	15	45
			II	850	1050 to 1250	10	27
		$> 100 \leq 250$	I	650	800 to 950	12	32
			II	800	1000 to 1200	10	27
$> 250 \leq 400$	I	600	750 to 900	10	27		
GS-25 CrNiMo 4	1.6515	$\leq 100$	I	550	700 to 850	15	45
			II	650	800 to 950	10	27
		$> 100 \leq 250$	I	550	700 to 850	14	32
$> 250 \leq 400$	I	500	700 to 850	10	27		
GS-34 CrNiMo 6	1.6582	$\leq 100$	I	700	850 to 1000	12	45
			II	800	900 to 1100	10	35
		$> 100 \leq 250$	I	650	800 to 950	12	30
		$> 250 \leq 400$	I	600	800 to 950	10	27
GS-30 NiCrMo 8 5 GS-33 NiCrMo 7 4 4	1.6570 1.6740	$\leq 100$	I	700	850 to 1000	16	50
			II	950	1050 to 1250	10	35
		$> 100 \leq 250$	I	700	850 to 1000	14	35
$> 250 \leq 400$	I	650	800 to 950	10	27		

1) The values specified apply for cast-on test pieces or those cast separately.

2) The values specified apply for test pieces taken from the product, having or approaching the maximum section thickness specified, provided this is below 150 mm. Where it is higher than 150 mm, the values specified shall be regarded as guideline values.

3) Represents the mean from three test pieces.

Table 5. Guideline values for impact transition temperature

Material		Ruling section thickness, in mm	Strength class	Approx. impact transition temperature (for 27 J), in °C
designation	number			
GS-30 Mn 5	1.1165	$\leq 50$	I	-10
			II	0
		$> 50 \leq 100$	I	0
			II	20
GS-25 CrMo 4	1.7218	$\leq 50$	I	-30
			II	0
		$> 50 \leq 100$	I	-20
			II	0
$> 100 \leq 150$	I	0		
GS-34 CrMo 4	1.7220	$\leq 50$	I	0
			II	20
		$> 50 \leq 100$	I	0
			II	20
$> 100 \leq 150$	I	20		
GS-42 CrMo 4	1.7225	$\leq 50$	I	0
			II	20
		$> 50 \leq 100$	I	0
			II	20
$> 100 \leq 150$	I	20		
GS-30 CrMoV 6 4	1.7725	$\leq 100$	I	-20
			II	-15
		$> 100 \leq 250$	I	20
GS-35 CrMoV 10 4	1.7755	$\leq 100$	I	-20
			II	20
		$> 100 \leq 250$	I	0
			II	20
$> 250 \leq 400$	I	20		
GS-25 CrNiMo 4	1.6515	$\leq 100$	I	-20
			II	20
		$> 100 \leq 250$	I	-10
$> 250 \leq 400$	I	20		
GS-34 CrNiMo 6	1.6582	$\leq 100$	I	-30
			II	-20
		$> 100 \leq 250$	I	-10
		$> 250 \leq 400$	I	20
GS-30 NiCrMo 8 5 GS-33 NiCrMo 7 4 4	1.6570	$\leq 100$	I	-40
	1.6740		II	-20
		$> 100 \leq 250$	I	-30
	$> 250 \leq 400$	I	20	

Table 6. Guideline temperatures for heat treatment and preheating during welding<sup>1)</sup>

Material designation		Heat treatment condition <sup>2)</sup>	Hardening temperature, in °C	Tempering temperature, in °C	Temperature for stress-relieving and annealing after welding, in °C	Preheat and interpass temperature, in °C <sup>3)</sup>
number						
GS-30 Mn 5	1.1165	LV	880 to 950	580 to 630	4)	150 to 300
		VI		630 to 680		
		VII		580 to 630		
GS-25 CrMo 4	1.7218	LV		600 to 650		150 to 300
		VI		600 to 650		
		VII		550 to 600		
GS-34 CrMo 4	1.7220	LV		600 to 650		200 to 350
		VI		600 to 650		
		VII		550 to 600		
GS-42 CrMo 4	1.7225	LV		600 to 650		200 to 350
		VI		600 to 650		
		VII		550 to 600		
GS-30 CrMoV 6 4	1.7725	LV	600 to 650	200 to 350		
		VI	600 to 650			
		VII	530 to 580			
GS-35 CrMoV 10 4	1.7755	LV	600 to 650	250 to 350		
		VI	600 to 650			
		VII	510 to 560			
GS-25 CrNiMo 4	1.6515	LV	880 to 930	600 to 650	200 to 350	
		VI		600 to 650		
		VII		550 to 600		
GS-34 CrNiMo 6	1.6582	LV	880 to 920	600 to 650	200 to 350	
		VI		600 to 650		
		VII		510 to 560		
GS-30 NiCrMo 8 5	1.6570	LV		600 to 650	200 to 350	
		VI		600 to 650		
		VII		500 to 550		
GS-33 NiCrMo 7 4 4	1.6740	LV		600 to 650	200 to 350	
		VI		600 to 650		
		VII		500 to 550		

1) Cf. subclause 5.6.  
2) LV = air-hardened and tempered; VI and VII = liquid quenched and tempered, of strength class I and II, respectively.  
3) Cf. subclause 5.6.3.  
4) Cf. subclause 5.6.4.

### Standards and other documents referred to

- DIN 1690 Part 1 Technical delivery conditions for castings of metallic materials; general
- DIN 1690 Part 2 Technical delivery conditions for castings of metallic materials; steel castings; classification into severity levels on the basis of non-destructive testing
- DIN 17 007 Part 2 Material numbers; main group 1: steel
- DIN 17 014 Part 1 Heat treatment of ferrous materials; terminology
- DIN 17 182 Steel castings with improved weldability and toughness for general applications; technical delivery conditions
- DIN 17 245 High-temperature ferritic cast steel; technical delivery conditions
- DIN 32 524 Measurement of preheat temperature, interpass temperature and hold temperature during welding
- DIN 50 049 Inspection documents for the delivery of metallic materials
- DIN 54 111 Part 2 Non-destructive testing of metallic materials using X-rays or gamma rays; radiographs of castings made from ferrous materials
- Stahl-Eisen-Werkstoffblatt 520*<sup>1)</sup> *Hochfester Stahlguß mit guter Schweißbeignung* (High strength steel castings with good weldability)
- Stahl-Eisen-Werkstoffblatt 685*<sup>1)</sup> *Kaltzäher Stahlguß* (Steel castings with low temperature toughness)
- Stahl-Eisen-Prüfblatt 1922*<sup>1)</sup> *Ultraschallprüfung von Gußstücken aus ferritischem Stahl* (Ultrasonic testing of castings made from ferritic steel)
- Stahl-Eisen-Prüfblatt 1935*<sup>1)</sup> *Oberflächenrißprüfung von Gußstücken aus Stahl; Magnetpulverprüfung* (Crack detection on steel castings by means of magnetic powder inspection)
- Stahl-Eisen-Prüfblatt 1936*<sup>1)</sup> *Oberflächenrißprüfung von Gußstücken aus Stahl; Eindringprüfung* (Crack detection on steel castings by means of penetrant inspection)
- DIN-Normenheft 3-1983 Kurznamen und Werkstoffnummern der Eisenwerkstoffe in DIN-Normen und Stahl-Eisen-Werkstoffblättern* (Ferrous material designations and numbers as used in DIN Standards and Steel and iron materials sheets)

### Explanatory notes

This standard supersedes SEW 510 and SEW 515, issued by the *Verein Deutscher Eisenhüttenleute* (Society of German Ferrous Metallurgists). In comparison with those two documents, the following amendments have been made.

- a) DIN 1690 Parts 1 and 2 are the basic standards referred to.
- b) Steel grades GS-Ck 25, GS-34 CrMo 4 4, GS-40 NiCrMo 6 5 6, GS-19 CrMo 9 10 (now covered in SEW 520), GS-20 NiMoCr 3 7 (cf. SEW 685) and G-X 5 CrNi 13 4 (now covered in SEW 520) are no longer included.
- c) Steel grade GS-33 NiCrMo 7 4 4 is included for the first time.
- d) Some of the requirements for chemical composition have been amended.
- e) The amounts by which the chemical composition as determined on a cast-on test piece may deviate from the limiting values specified for cast analysis have been specified.
- f) It is now specified that one of the three values of impact energy may be lower, by not more than 30%, than the specified minimum value.
- g) It is now specified that the values for 0,2% proof stress, tensile strength and impact energy apply to a maximum section thickness of 150 mm.
- h) Specifications regarding welding have been made.
- i) Testing of batches as delivered is no longer permitted.
- j) The batch size has been defined.
- k) The number of test pieces per cast to be tested has been defined.
- l) Reference to relevant *Stahl-Eisen-Prüfblätter* has been made with regard to the sampling procedures to be followed for non-destructive testing.
- m) The types of inspection documents to be issued have been specified.
- n) Marking details have been specified.

### International Patent Classification

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<sup>1)</sup> Obtainable from *Verlag Stahleisen mbH*, Postfach 10 5145, D-4000 Düsseldorf 1.