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Reinforcing steel
Inspection

DIN 488 Part 6

Betonstahl; Überwachung (Güteüberwachung)

Supersedes August 1974 edition.

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.

See Explanatory notes for connection with EURONORM 80 published by the European Coal and Steel Community.

The DIN 488 series includes:

DIN 488 Part 1 Reinforcing steel; grades, properties, marking
DIN 488 Part 2 Reinforcing steel; reinforcing steel bars; dimensions and masses
DIN 488 Part 3 Reinforcing steel; reinforcing steel bars; testing
DIN 488 Part 4 Reinforcing steel; reinforcing steel fabric and wire; design, dimensions and masses
DIN 488 Part 5 Reinforcing steel; reinforcing steel fabric and wire; testing
DIN 488 Part 6 Reinforcing steel; inspection
DIN 488 Part 7 Reinforcing steel; verification of weldability of reinforcing steel bars; test procedure and evaluation

1 Field of application

This standard describes the inspection system (comprising internal control and third party inspection) that is to be used to check the requirements to be met by reinforcing steel bars, reinforcing steel fabric and wire as specified in DIN 488 Parts 1, 2 and 4 at the manufacturer's works.

The inspection procedure is based on DIN 18200 and on the additional provisions given in the present standard, the relevant test methods being described in DIN 488 Parts 3, 5 and 7.

2 Inspection

2.1 General

2.1.1 The inspection procedure consists of an initial inspection and routine inspections.

2.1.2 The object of the initial inspection (see clause 3) is to verify whether the requisite staffing and equipment for ensuring a continuous and trouble-free production and for undertaking appropriate internal control is available, and whether the products meet the requirements specified.

Following this, the quality level is determined by more frequent inspections limited to a specific period of time and covering a given minimum production quantity.

2.1.3 The routine inspections comprise internal control and third party inspection (see clauses 4 and 5).

2.2 Evaluation of tests

2.2.1 The production (population) shall be such as to meet the minimum requirements specified in DIN 488 Part 1, September 1984 edition, table 1 for the p quantile, the population being considered to comprise all subpopulations taken from current production (heats, daily tonnage) over a period of not more than 3 months, or all subpopulations from which a minimum of 200 test results has been obtained. The minimum requirements shall be deemed to be fulfilled if each p value is satisfied with a statistical probability $W = 1 - \alpha = 0{,}90$ (one-sided), meaning that current production is being maintained at the required quality level.

2.2.2 The inspection lot shall be taken as the unit for inspection purposes, inspection lot being understood to mean that quantity of material which, in respect of the properties to be investigated, can be classed as more or less homogeneous, for example a single heat in the case of reinforcing steel bars of the same nominal size, or a type of reinforcing steel fabric welded with a single machine setting.

2.3 Works symbol

After a manufacturing works has passed the works inspection and the verification of material properties has yielded positive results, the works is allocated a works symbol [1]). As a rule, the validity of the works symbol allocated is limited to one year and is extended on verification of the quality level.

3 Initial inspection

3.1 General

3.1.1 Procedure

Initial inspection shall be performed by an accredited testing agency [2]), the tests being carried out for each manufacturing process and each manufacturing works.

The manufacturing works shall be deemed to be the production facility in which the reinforcing steel is given its ultimate properties and the form in which it is supplied.

3.1.2 Inspection reports

Inspection reports shall be issued concerning verification of the manufacturing conditions as specified in subclause 3.2 and regarding verification of the material properties as specified in subclause 3.3.

After the quality level has been determined as described in subclause 3.4, a further report shall be issued giving the details mentioned there.

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[1]) The works symbol is allocated by the *Institut für Bautechnik* (Institute for Building Technology), Reichpietschufer 72–76, D-1000 Berlin 30, which also keeps a list of current works symbols.

[2]) The testing agency is to be determined by the *Institut für Bautechnik*.

3.2 Verification of manufacturing conditions (works inspection)

3.2.1 It has to be verified whether

- the production facility is suitable for the manufacture of reinforcing steel in compliance with the specifications,
- the requirements in terms of staffing and equipment are fulfilled,
- adequate testing equipment is available,
- internal control as practised in the manufacturing works is undertaken by a department that is independent of the production side,
- the in-house quality assurance system permits the production quality to be reliably controlled.

3.2.2 When starting material is bought from other suppliers, a check shall be made to see whether the material has been supplied on the basis of specific technical delivery conditions and whether the receiving inspection system is adequate for quality assurance purposes.

3.3 Verification of material properties

3.3.1 General

The sample material shall be produced on the plant intended for actual manufacture and the tests shall be carried out on products covering the complete range of nominal sizes envisaged for subsequent production.

The samples shall be taken by the testing agency as random samples from the minimum quantity required at the time of sampling (see subclause 3.3.2).

3.3.2 Scope of test

3.3.2.1 Reinforcing steel bars (see table 1)

If bars covering an entire range of nominal sizes as given in table 1 are produced, one bar each shall be tested from the lower, middle and upper range. In the case of 8 mm bars, the fatigue test shall be carried out on stirrup type samples.

If the complete range of sizes is not manufactured, one size from each of the respective ranges shall be tested.

If manufacture is confined to bars of the lower range, however, the smallest and largest nominal sizes covered shall be tested, and one bar shall be subjected to the fatigue test in the embedded condition.

Bars of the nominal sizes to be tested shall originate from not less than three heats. Of each such size not less than 50 t of reinforcing steel bars shall be produced at the time of sampling.

The type and scope of the tests to be performed can be seen from table 1.

3.3.2.2 Reinforcing steel fabric

If wire covering the complete range of nominal sizes is manufactured, the wire combinations listed in table 2 shall be tested.

If the complete range of wire sizes is not manufactured, the following procedure shall be adopted.

- Only those wire combinations shall be tested that lie within the range manufactured, the inclusion of the largest and smallest wire sizes being obligatory.
- When double-wire fabric is manufactured, not less than two of the wire combinations shall include double wires.
- In the fatigue test, not less than three wire combinations shall be tested; for this purpose, the smallest and largest wire sizes shall be included and the wires with the smallest size ratio envisaged for testing as per table 2 shall be welded.

Of each wire combination to be tested, not less than 30 sheets of reinforcing steel fabric with the usual dimensions shall be manufactured.

See table 3 for the type and scope of the individual tests.

Table 1. **Type and scope of tests for initial inspection of reinforcing steel bars**

	1	2	3	4	5	6	7	8	9	10
1	Size range (assigned nominal size)	Lower range 6 to 12 mm			Middle range 14 to 16 mm			Upper range 20 to 28 mm		
2	Nominal size to be tested	8 mm [1] (possibly 6 mm)			16 mm			28 mm		
3	Heat No.	1	2	3	1	2	3	1	2	3
	Number of samples									
4	Deviations in cross sectional dimensions	15	15	15	15	15	15	15	15	15
5	Surface configuration	4	4	4	4	4	4	4	4	4
6	Tensile test [2]	15	15	15	15	15	15	15	15	15
7	Rebend test [3]	≥ 10	≥ 10	≥ 10	≥ 10	≥ 10	≥ 10	≥ 10	≥ 10	≥ 10
8	Fatigue test	≥ 5 [4]	≥ 5 [4]	≥ 5 [4]	≥ 5	≥ 5	≥ 5	≥ 5	≥ 5	≥ 5
9	Weldability	See DIN 488 Part 7.								

[1] See subclause 3.3.2.1.

[2] For all heats the standard deviation for yield strength, tensile strength and elongation after fracture shall be determined.

[3] In the rebend test in the context of initial inspection it is necessary to determine the limiting bend mandrel size for which no fracture or incipient cracking on the side in tension occurs. The test shall be carried out on the lines of DIN 488 Part 3, June 1986 edition, subclause 4.3 (heating to 250 °C).

[4] Required when manufacture is confined to the lower range.

Table 2. **Wire combinations to be tested for initial inspection of reinforcing steel fabric (production covering the complete size range)**

	1	2	3	4
	Wire combinations for tests as given in table 3 (lines 1 to 7) For manufacture of reinforcing steel fabric from		Wire combinations for fatigue tests as given in table 3 (line 8) For manufacture of reinforcing steel fabric from	
	single and double wires	single wires only	single and double wires	single wires only
1	4,0 *d* × 4,0	4,0 × 4,0	–	–
2	6,0 *d* × 8,5	6,0 × 5,0	–	–
3	7,0 × 5,0	6,0 × 8,5	5,0 × 7,0	6,0 × 8,5
4	7,0 *d* × 6,0	7,0 × 6,0	–	–
5	8,5 *d* × 7,0	8,5 × 7,0	8,5 *d* × 7,0	8,5 × 7,0
6	10,0 × 7,0	10,0 × 7,0	7,0 × 10,0	7,0 × 10,0
7	12,0 × 8,5	12,0 × 8,5	–	–
8	12,0 *d* × 10,0	12,0 × 10,0	10,0 × 12,0 *d*	10,0 × 12,0

Table 3. **Number of tests for reinforcing steel fabric per wire combination or per size covered**

	1	2
	Type of test/ characteristics to be tested	Number and assignment of tests
1	Cross-sectional dimensions	15 per longitudinal and cross wire, per wire combination
2	Surface configuration	10 per size
3	Tensile test	15 per longitudinal and cross wire, per wire combination
4	Shear test	30 per wire combination
5	Rebend test	10 per size[1]
6	Execution of weld (bend test at weld)	15 per wire combination
7	Weldability	Determining the chemical composition on all wire sizes
8	Fatigue test	20 per size combination as in table 2[2]

[1] In the rebend test in the context of initial inspection it is necessary to determine the limiting bend mandrel size with which no fracture or incipient cracking on the side in tension occurs. The test shall be carried out on the lines of DIN 488 Part 3, subclause 4.3.

[2] 10 samples per combination shall be tested at a stress amplitude of 120 N/mm^2 and 10 samples at 240 N/mm^2.

3.3.2.3 Reinforcing wire

If both indented and plain reinforcing steel wire is being manufactured, only indented wire shall be tested in the context of initial inspection. In all other cases, the respective wire manufactured shall be tested.

For the purpose of testing, welded reinforcing elements shall be made from the wire combinations as specified in table 2 (column 2). The type and scope of the tests shall be as indicated in table 3 (lines 1 to 7).

3.3.3 Evaluation of tests

3.3.3.1 General

For materials testing in the context of initial inspection it is necessary, as a rule, for all individual values to comply at least with the respective nominal values.

The probability with which the specified p values of the quantile are complied with is to be estimated. For this purpose, the test results may either all be combined or they may be grouped according to size ranges, depending on which method gives a more reliable statement.

The test results shall be shown in a diagram in accordance with the chosen grouping.

The testing agency shall present the individual results, their evaluation and an overall appraisal of the test results in the form of an inspection report.

3.3.3.2 Inspection by variables

An inspection by variables which produces for each sample a measured value for the qualitative characteristic under investigation shall be undertaken for the evaluation of yield stress, R_e, tensile strength, R_m, elongation after fracture, A_{10}, shear force, S (in the case of reinforcing steel fabric and wire), deviations in cross section, relative rib area, f_R, and ratio R_m/R_e.

In the inspection by variables a check shall be made on the basis of the values found for the standard deviations (heat-related in the case of reinforcing steel bars, all tests in the case of reinforcing steel fabric) to determine whether the

specified increment can be used for internal control as described in clause 4.

3.3.3.3 Inspection by attributes

An inspection by attributes in which the result of testing the quality characteristic under investigation permits only a statement on the presence or absence of a qualitative characteristic to be made shall be undertaken when evaluating the

- rebend test,
- test for execution of weld on reinforcing steel fabric.

3.3.3.4 Verification of fatigue strength

a) Reinforcing steel bars

It is to be verified that at 2×10^6 load cycles a mean fatigue strength value of not less than 200 N/mm^2 is reached, with a 10% quantile of not less than 170 N/mm^2.

Each size shall be assessed separately.

b) Reinforcing steel fabric

In the case of welded reinforcing steel fabric, the stress amplitude is to be verified as having a mean value of not less than 120 N/mm^2 with a 10% quantile of not less than 100 N/mm^2 at 2×10^6 load cycles, and a mean value of not less than 240 N/mm^2, with a 10% quantile of not less than 200 N/mm^2 at 2×10^5 load cycles.

Each size combination shall be assessed separately.

3.4 Determining the quality level

For determining the quality level, the frequency of inspection shall be increased (see subclauses 4.1.5 and 5.2.2). This procedure shall generally extend over a period of one year, on the assumption that during this time at least 12000 t of reinforcing steel bars or 6000 t of reinforcing steel fabric are manufactured and inspected.

4 Internal control

4.1 General

4.1.1 Internal control shall be carried out as specified in DIN 18200, December 1986 edition, clause 3, taking account of the additional provisions made in subclauses 4.1.2 to 4.1.5 below.

4.1.2 Evaluation of the test results is to be made on a statistical basis normally involving verification of the p values of the quantile as specified in DIN 488 Part 1, table 1, using a specified increment (see subclauses 4.2 and 4.3).

4.1.3 If relevant data is already available, internal control may be carried out according to a sampling plan departing from the information given in subclause 4.1.2. Any such plan shall, however, ensure that the minimum requirements regarding the population are complied with (see subclause 5.4).

4.1.4 For the rebend test, the requirements given in subclause 2.2.1 shall also apply. However, if the test produces a result that is not in compliance with the specifications, then further investigations will be necessary (see subclause 4.2.4.3).

4.1.5 For determining the quality level as specified in subclause 3.4, the scope of test as given in table 4 (for reinforcing steel bars and reinforcing steel fabric) or as detailed in subclause 4.4 (for reinforcing steel wire) shall be doubled.

4.2 Internal control of reinforcing steel bar in conjunction with a specified increment

4.2.1 Inspection lot

A heat shall form the inspection lot.

4.2.2 Number of samples

The number of samples for internal control (random sampling) for heat-wise testing is given in table 4 (columns 1 to 4) as a function of heat size.

4.2.3 Sampling plan

In the inspection by variables, the distribution of the characteristic tested may be assumed to approximate to a normal distribution.

For each element j (with $j = 1$ to n) of the sample the value x_j of the characteristic to be tested shall be determined and from the values so obtained the sample mean, $\bar{x}$, and the smallest individual value, $x_{(1)}$, calculated, all the results being arranged in ascending order.

$z_1 = \bar{x}$ and $z_2 = x_{(1)}$ shall be taken as the test statistics.

The inspection lot shall count as accepted if the following conditions are satisfied: $z_1 \geq x_N + V$ and $z_2 \geq x_N - \delta$,

where

$\bar{x}$ is the mean value of the sample;

x_j is any individual value;

x_N is the nominal value of the quality characteristic;

V is the specified increment;

δ is a coefficient for an individual value.

4.2.4 Requirements

4.2.4.1 When testing as specified in subclauses 4.2.1 to 4.2.3, the requirements given in table 5 are to be satisfied.

4.2.4.2 Verification that the cross-sectional dimensions on average are not below the relevant nominal values shall be based on the population (see subclause 2.2.1).

4.2.4.3 When testing the bending behaviour by means of the rebend test each test shall yield results in compliance with the specifications.

Any inconsistent value shall be investigated.

If an outlier is not involved, an increased number of samples shall be used for determining the limiting bend mandrel diameter and for checking whether the deformability required in DIN 488 Part 1, subclause 5.2.3, exists.

4.2.4.4 For testing weldability, compliance with the specified chemical composition shall be verified by means of a cast analysis. If there is a departure from the specified contents in a particular case, weldability shall be verified for the heats concerned by testing.

4.2.4.5 The fatigue strength shall be verified in the context of third party inspection (see subclause 5.3.1).

4.3 Internal control of reinforcing steel fabric in conjunction with a specified increment

4.3.1 Inspection lot

The daily tonnage of a fabric type shall form the inspection lot.

4.3.2 Scope of test

The number of samples for internal control (samples taken at random) is given in table 4 (columns 5 to 8) as a function of average monthly tonnage.

Subclause 4.2.3 shall apply for inspection by variables.

Table 4. **Scope of internal control testing**

	Column No.		1	2	3	4	5	6	7	8	9	10
	Type of test		Number of samples per								Testing of	
			heat and size for a heat mass of				daily tonnage [1] given an average monthly tonnage of				reinforcing steel bars	welded reinforcing steel fabric
			up to 50 t	over 50 t up to 100 t	over 100 t up to 150 t	over 150 t	up to 1000 t	over 1000 t up to 2000 t	over 2000 t up to 3000 t	over 3000 t	as specified in DIN 488 Part 3*),	as specified in DIN 488 Part 5*),
			Minimum				Minimum					
1	Measurement of cross-sectional dimensions		2	3	4	5	15	20	25	30	clause 2	clause 2
2	Check of surface configuration	Indented [2]	2	3	4	5	Per size and per 25 t of daily tonnage: 1 sample				–	subclause 3.2
3		Ribbed [2]									clause 3	subclause 3.1
4	Tensile test		2	3	4	5	15	20	25	30	subclause 4.1	subclause 4.1
5	Shear test		–	–	–	–	15	20	25	30	–	subclause 4.2
6	Rebend test		2	3	4	5	–	–	–	–	subclause 4.3	–
7	Bend test as to execution of weld [3]		–	–	–	–	4	6	8	10	–	clause 5
8	Fatigue test		–	–	–	–	See subclause 4.3.3.4.				subclause 4.2	subclause 4.3

*) June 1986 edition.
[1]) Distributed proportionately among the manufactured products of the same nominal size.
[2]) It shall be assumed for this purpose that the surface configuration is subjected to routine checking in a suitable manner.
[3]) Assuming compliance with the cast analysis as specified in DIN 488 Part 1, table 1.

Table 5. **Requirements to be complied with in the internal control of reinforcing steel bars**

	1	2	3
	Property	Requirements [1]	
		x_i min.	$\bar{x}$ min.
1	Cross-sectional area, A_S	$0{,}96 \cdot A_{S,N}$	See subclause 4.2.4.2.
2	Relative rib area, f_R	$f_{R,N}$	
3	Yield stress, R_e	$R_{e,N}$	$R_{e,N} + 15\,N/mm^2$
4	Tensile strength, R_m	$R_{m,N}$ $1{,}05 \cdot R_{e,actual}$	
5	Elongation after fracture, A_{10}	$A_{10,N}$	$A_{10,N} + 1{,}5\,\%$
6	Bending behaviour	See subclause 4.2.4.3.	
7	Weldability	See subclause 4.2.4.4.	
8	Fatigue strength	See subclause 4.2.4.5.	

[1]) See subclause 4.2.4.

4.3.3 Requirements

4.3.3.1 When testing as described in subclauses 4.3.1 and 4.3.2, the requirements given in table 6 shall be fulfilled.

4.3.3.2 Verification that the cross-sectional dimensions on average are not below the nominal values shall be based on the population (see subclause 2.2.1).

4.3.3.3 Testing for execution of weld shall be carried out and evaluated as specified in DIN 488 Part 5, June 1986 edition, clause 5.

4.3.3.4 The tests serving to determine fatigue strength shall be carried out as specified in DIN 488 Part 5, subclause 4.3. For this purpose, if possible, the same wire combinations shall be tested as in the initial inspections specified in subclause 3.3.2.2. If this is not feasible, other wire combinations shall be chosen which are next to the least favourable size ratio manufactured. The samples shall be taken so that they are evenly distributed over a production period. Once a year, from each of five size combinations from the most frequently manufactured fabric types, four samples each of the thinner wire of the respective size combination shall be tested as specified in DIN 488 Part 5, subclause 4.3, applying a stress amplitude of 120 N/mm^2, and two further samples each applying a stress amplitude of 240 N/mm^2.

The tests shall be deemed to have been passed if, for each size combination, at least two samples do not fracture before attaining 2×10^6 load cycles for a stress amplitude of 120 N/mm^2, and none of the remaining samples fractures before attaining $0{,}5 \times 10^6$ load cycles, and for a stress amplitude of 240 N/mm^2 all the respective pairs of samples exceed $1{,}5 \times 10^5$ load cycles before fracture.

If these requirements are not fulfilled, the fatigue strength shall be verified as specified in subclause 3.3.3.4 b).

4.4 Internal control of reinforcing steel wire

4.4.1 The internal control of reinforcing steel wire is to be effected on the lines of subclause 4.3.

4.4.2 The scope of test for internal control is specified as follows, as a function of the quantity supplied:

- up to 5 t supplied, 2 tensile samples per nominal size;
- more than 5 t supplied, 1 tensile test per 5 t and nominal size;
- check of surface configuration: 1 test each per 25 t and size, subject to a minimum of one measurement per size and batch supplied.

4.4.3 The requirements specified in table 6, lines 1 to 5, shall be complied with.

4.4.4 Fatigue strength in the context of internal control and third party inspection shall be deemed to be verified if the tests carried out by the manufacturer on the welded fabric as specified in subclause 4.3.3.4 have been passed.

4.4.5 The test results obtained in the context of both internal control and third party inspection shall be recorded and evaluated separately from the results obtained for reinforcing steel fabric.

5 Third party inspection

5.1 General

5.1.1 Third party inspection shall be carried out as specified in DIN 18 200, taking account of the additional provisions made in subclauses 5.1.2 to 5.1.8 below.

5.1.2 The inspection tests shall be carried out at intervals of 4 to 8 weeks.

5.1.3 The properties to be verified by testing shall be those subject to internal control. The results shall be

Table 6. **Requirements to be complied with in the internal control of reinforcing steel fabric**

	1	2	3
	Property	Requirements[1] x_i min.	$\bar{x}$ min.
1	Cross-sectional area, A_S	$0{,}96 \cdot A_{S,N}$	See subclause 4.3.3.2.
2	Relative rib area, f_R	$f_{R,N}$	
3	Yield stress, R_e	$R_{e,N}$ ($R_{e,N}$ + 20 N/mm^2)[2]	$R_{e,N}$ + 40 N/mm^2 ($R_{e,N}$ + 60 N/mm^2)[2]
4	Tensile strength, R_m	$R_{m,N}$ $1{,}05 \cdot R_{e,actual}$[3] $1{,}03 \cdot R_{e,actual}$[4]	
5	Elongation after fracture, A_{10}	$A_{10,N}$	$A_{10,N}$ + 1,5 %
6	Shear strength at joints, S	$0{,}3 \cdot A_{S,N} \cdot R_{e,N}$	$0{,}4 \cdot A_{S,n} \cdot R_{e,N}$
7	Execution of weld	See subclause 4.2.4.4.	
8	Fatigue strength	See subclause 4.2.4.5.	

[1] See subclause 4.3.3.

[2] This requirement shall apply for $A_{S,actual}$ between $0{,}96 \times A_{S,N}$ and less than $1{,}0 \times A_{S,N}$.

[3] This requirement shall apply for $R_{e,actual}$ not exceeding $R_{e,N}$ + 50 N/mm^2.

[4] This requirement shall apply for $R_{e,actual}$ exceeding $R_{e,N}$ + 50 N/mm^2.

evaluated statistically and compared with the results of internal control.

5.1.4 In the context of third party inspection a check shall also be made of the internal control to discover any systematic errors in sampling, test procedure and evaluation.

5.1.5 Compliance with the guideline values given for the chemical composition in DIN 488 Part 1 shall be checked.

5.1.6 The number of samples shall be such as to suit the required production quality level and to enable a reliable statement to be made by aggregating the results of the inspection tests.

5.1.7 If the production subject to inspection as specified in this standard is suspended for more than 12 months, the inspection as specified in subclause 5.2 shall be repeated when production is resumed.

The same shall apply if within a 12-month period the tonnage does not attain a minimum of 12000 t in the case of reinforcing steel bars and 6000 t in the case of reinforcing steel fabric.

If production is suspended for longer than 3 years, the works symbol loses its validity.

5.1.8 Testing as specified in subclause 5.2 shall be performed if production facilities are substantially modified as compared with the conditions under which the initial inspection was undertaken.

5.2 Determination of quality level

5.2.1 The quality level shall be determined in order to check whether the requirements specified in DIN 488 Part 1 are complied with over a long-term period, and whether the quality level is consistent, the results being compared with the results of testing as specified in subclause 3.3. It has further to be checked whether the results of internal control and third party inspection agree with each other.

5.2.2 For determining the quality level as specified in subclause 3.4, not less than 50 % of the heats or of the total production of reinforcing steel fabric shall be tested. The time intervals for works inspections shall be matched to this requirement.

5.2.3 Inspection tests for verifying weldability as specified in DIN 488 Part 7 shall be carried out and the limit values for the chemical composition of reinforcing steel bars to be complied with by the manufacturer in routine production be determined.

5.2.4 Fatigue tests as specified in subclause 5.3 shall be carried out twice.

5.3 Verification of fatigue strength

5.3.1 Reinforcing steel bars

If the complete size range is produced, inspection tests shall be carried out annually on samples of the 16 and 28 mm size under the conditions mentioned below. If production covers only the lower range, the largest size of that range shall be tested.

Per size, three samples as specified in DIN 488 Part 3, subclause 4.2, shall be tested at a stress amplitude of 200 N/mm^2; of these, one sample each shall sustain not less than 2×10^6, $1{,}2 \times 10^6$ or $0{,}4 \times 10^6$ load cycles without failure.

If these requirements are not fulfilled, then, for each size of the samples that do not comply with the specifications, further tests shall be carried out using 5 samples each time. In this case, the following requirements shall be fulfilled:

two samples shall sustain not less than 2×10^6 load cycles,

one sample shall sustain not less than $0{,}6 \times 10^6$ load cycles,

and

two samples shall sustain not less than $0{,}3 \times 10^6$ load cycles,

without failure.

If the samples still fail to pass the test, the initial inspection procedure specified in subclause 3.3.3.4 shall be adopted.

5.3.2 Reinforcing steel fabric

Twenty inspection tests shall be carried out annually. The samples shall be distributed over not less than four size combinations, 15 tests being performed at a stress amplitude of 120 N/mm^2 and 5 tests at a stress amplitude of 240 N/mm^2. For the test procedure and evaluation, subclause 4.3.3.4 shall apply as appropriate.

5.4 Requirements for individual sampling plans

Individual sampling plans for internal control may be used provided that sufficient manufacturing data are available and the production level has stabilized. The sampling plan shall have been approved by the *Institut für Bautechnik* or by an agency appointed by the latter.

The parameters of the individual sampling plan are to be verified. The report to be prepared annually shall describe the sampling plan, and an appraisal of its usefulness be given.

5.5 Inspection report

5.5.1 Individual report

A report on each test conducted in the context of third party inspection shall be prepared and sent to the works. In this report the individual results shall be evaluated and an assessment made regarding the quality level of the production sector from which the samples originate.

The inspection report shall provide the details specified in DIN 18200.

5.5.2 Annual report

To allow an appraisal of the long-term quality level to be made, the results of third party inspection during a one year period shall be summarized in a report. In this report, a comparison shall be made with the results of internal control.

The report shall be submitted to the *Institut für Bautechnik* and shall give the following particulars:

- size ranges of current production;
- data on interruptions to production (duration, any extraordinary inspection);
- details of tonnage produced;
- number of works inspections (sampling);
- particulars regarding complaints.

These reports shall be kept at the manufacturer's premises and at the agency responsible for third party inspection for not less than 5 years.

5.6 Measures to be taken in the case of non-compliance with the requirements

5.6.1 Depending on the degree of non-compliance with the requirements specified in DIN 488 Part 1, table 1, the testing agency shall take appropriate measures. As a rule, these may comprise the following, ranked according to increasing stringency:

- increased frequency of inspections (internal control and third party inspection);
- repetition of the initial inspection following any modification of the technical parameters in the manufacturer's works;
- discontinuation of third party inspection.

5.6.2 In all cases involving the measures indicated in subclause 5.6.1 the *Institut für Bautechnik* shall be informed.

Standards referred to

DIN	488 Part 1	Reinforcing steel; grades, properties, marking
DIN	488 Part 2	Reinforcing steel; reinforcing steel bars; dimensions and masses
DIN	488 Part 3	Reinforcing steel; reinforcing steel bars; testing
DIN	488 Part 4	Reinforcing steel; reinforcing steel fabric and wire; design, dimensions and masses
DIN	488 Part 5	Reinforcing steel; reinforcing steel fabric and wire; testing
DIN	488 Part 7	Reinforcing steel; verification of weldability of reinforcing steel bars; test procedure and evaluation
DIN	18 200	Inspection of construction materials, structural members and types of construction; general principles

Previous editions

DIN 488 Part 6: 09.73, 08.74.

Amendments

Amendments have been made to the August 1974 edition with regard to the following items (see also Explanatory notes):

a) determination of quality level;
b) initial inspection;
c) internal control system;
d) initial inspection of reinforcing steel wire.

Explanatory notes

Revision of the August 1974 edition of this standard was necessary to take into account new steel grades and to implement new insights gained into the process of inspection and to incorporate new findings regarding the usefulness of sampling plans.

The following amendments have been made to the previous edition of this standard.

a) Determination of quality level

Taking into account the relevant safety regulations, the minimum requirements have been specified as p quantiles of the tonnage (population) of the manufacturer's works, as has already been specified in DIN 488 Part 1, table 1. It was decided not to include a maximum standard deviation as a further requirement, since the inclusion of this parameter would have substantially complicated the inspection procedure.

b) Initial inspection

In the initial inspection it was previously the practice to base the decision on the qualification of a manufacturer's works more or less exclusively on the results of materials testing on a very limited number of heats.

Advanced and often complex technologies made it necessary to carry out a detailed works inspection prior to starting the materials tests. Subject to the works inspection and the materials testing yielding positive results, the works is given permission to start production. For a period of roughly one year after the start of production, however, the frequency of inspections (covering both internal control and third party inspection) is to be increased.

The purpose of this, consistent with the requirements regarding the quantile of the long-term quality level, is to check whether the quality level is maintained in routine production.

For fatigue strength testing in the context of initial inspection, no evaluation has been given for verifying the 10% quantile. The manner in which this verification is to be carried out is optional, for example the up-and-down method or a delimiting method, or any other method may be used. The previous practice of specifying a sampling plan, for example a single-step test method, reduces the amount of information provided by this test.

c) Internal control system

The previous edition of this standard specified two sampling plans. One of these permitted relatively small numbers of samples and operated with specified increments.

The other sampling plan was a relatively complicated plan based on known data, for which there are no known instances of its practical application.

For the revision of this standard, the first mentioned sampling plan has been adopted as the standard sampling plan. Assuming that adequate data are available and that compliance with the specified quality level is verified, the manufacturer is however permitted to draw up an individual sampling plan.

The sampling plan that stipulated a higher number of samples has been dropped. The reason for this was that the acceptance characteristics included in the previous edition of this standard no longer formed the object of inspection. The inspection by attributes was dropped in its entirety, because the minimum requirements for the rebend test had to be reduced to a p value of 1% and the sampling plans given in the previous edition of this standard were statistically incorrect.

In cases in which no reliable statement on the quality of a lot can be obtained from testing with the number of samples specified in table 4, the number of samples may naturally be increased.

Assuming the one-sided statistical probability specified in this standard, the requisite number of samples can be taken, for example, from ISO 3207.

d) Reinforcing steel wire

As specified in subclause 3.3.2.3, the initial inspection of reinforcing wire is to be undertaken by testing welded reinforcing elements in order thus to provide proof of weldability.

e) Miscellaneous

The specifications regarding marking and delivery note until now covered in the present standard are now being dealt with in DIN 488 Part 1.

f) Connection with EURONORM 80

EURONORM 80, Reinforcing bars (not for prestressing); technological delivery conditions, gives in an appendix the internationally agreed specifications for continuous quality control. These specifications shall apply to suitability testing (initial inspection) and to internal control and third party inspection. The principles for evaluating these tests agree with those given in the present standard although there are greater or lesser differences in detail. The field of application of the EURONORM has been limited to include reinforcing steel bars only, i.e. reinforcing steel fabric and reinforcing steel wire are not covered.

International Patent Classification

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