IMPLEMENTATION RULES	TRA	270
	VERSION 12	2024/10

IMPLEMENTATION RULES OF THE BENOR-MARK IN THE SECTOR OF CONCRETE REINFORCEMENTS - METHODS OF ASSESSMENT APPLICABLE TO THE USERS OF THE MARK –

PRODUCERS OF BARS OR WIRES WITH RIBS OR INDENTATIONS AND HIGH DUCTILITY

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CONTENT

1 INTRODUCTION

These Implementation Rules (TRA[2]) of PROCERTUS, sectoral organisation, are established by the Sectoral Committee ST1 "Concrete reinforcing steels and prestressing steels" managed by PROCERTUS for the BENOR certification of concrete reinforcements.

According to the Rules for the use and control of the BENOR-mark[3] and its article 9, these Implementation Rules constitute the reference certification scheme to the BENOR-mark.

2 REFERENCE DOCUMENTS AND DEFINITIONS

2.1 Reference documents

The following certification rules apply:

- Règlement d'usage et de contrôle de la marque BENOR / Algemeen reglement voor het beheer van het Benor-merk[4].
- Règlement général pour la gestion de la marque BENOR / Algemeen reglement voor het beheer van het Benor-merk[5].
- Règlement particulier d'usage et de contrôle de la marque BENOR dans le secteur des produits en acier laminés à chaud et dans le secteur des aciers écrouis à froid pour béton, / Bijzonder reglement voor gebruik en controle van het BENOR-merk in de sector de warmgewalste staalproducten en in de sector van het koudvervormde staal voor gewapend beton, BRP 279[6].

The last edition of the standards and PTV applies. In the event of an incompatibility following the revision of one of the documents quoted hereafter, an addendum to the present Implementation Rules will be published if necessary.

- NBN A 24-301, Produits sidérurgiques - Aciers pour béton armé - Barres, fils et treillis soudés - Généralités et prescriptions communes / Staalproducten - Betonstaal - Staven, draden en gelaste wapeningsnetten - Algemeenheden en gemeenschappelijke voorschriften.
- NBN A 24-302, Produits sidérurgiques - Aciers pour béton armé - Barres lisses et barres à nervures - Fils machine lisses et fils machine à nervures / Staalproducten - Betonstaal - Gladde en geribde staven - Gladde en geribde walsdraad.
- NBN EN ISO 15630-1, Aciers pour l'armature et la précontrainte du béton – Méthodes d'essai – Partie 1 : Barres, fils machine et fils pour béton armé / Staal voor de wapening en voorspanning van beton – Beproevingsmethoden, Deel 1: Staven, draad en draad voor gewapend beton.
- PTV 302, Aciers pour béton armé, Barres à nervures ou à empreintes et fils à nervures ou à empreintes à haute ductilité / Gewapend betonstaal, Geribde of gedeukte staven en Geribde of gedeukte draad met hoge ductiliteit betonstaal.
- PTV 306, Aciers pour béton armé - Façonnage (dresser, couper, plier, positionner et souder) / Gewapend betonstaal - Bewerken van betonstaal (rechten, knippen, plooien, schikken en lassen).
- PTV 307, Aciers pour béton armé, Barres à nervures – Profil alternatif / Gewapend betonstaal, Geribde staven-alternatief profiel.
- PTV 310, Aciers pour béton armé, Barres et fils machine laminés à nervures et fils tréfilés à froid à nervures - Essai

[2] **TRA** : **T**oepassings**r**eglement – **R**èglement d'**A**pplication

[3] Reference asbl BENOR vzw : NBN/RVB.CA/RM2012-10-02 and following editions in force)

[4] Reference: NBN/RVB.CA/RM2012-10-02 and following editions in force

[5] Reference: NBN/RVB.CA/RG2012-10-02 and following editions in force

[6] According to the last edition in force

de traction après pliage-dépliage / Gewapend betonstaal, Geribde warmgewalste en geribde koudvervormde staven en draad - Trekproef na heen- en terugbuigen.

- NRN 418, Modalités de contrôle applicables aux Usagers de la Marque – Annexes statistiques / Controlemodaliteiten toepasselijk op de gebruikers van het Merk - Bijlage statistiek.

- ECU 606, Application of the BENOR-mark in the sector of concrete reinforcements - Methods of assessment applicable to the "Users of the mark, Processors and Distributors of BENOR products" - Equipment of control, determination of the "λ-value" for the computation of f_R or f_P, simplified procedure for the setting of a straightening machine

2.2 Basic definitions and requirements

2.2.1 Laboratories

2.2.1.1 Internal laboratory

It is the own internal laboratory (laboratory of the producer[7]). To be recognised as such, this laboratory must fulfil the following requirements:

- The tensile testing machines are equipped with a system of measurement of total elongation under the maximum load.
- The tensile testing machines of this laboratory must be calibrated in accordance with standard NBN EN ISO 15630-1. They must display the different levels of class defined by that standard regarding the loads and the elongations; the last calibration carried out by a service independent of the laboratory, cannot be older than one year.
- **All tensile testing machines used within the framework of BENOR certification** must be the subject of paired comparisons with the tensile testing machine of the control laboratory[8] according to the provisions of the **preliminary examination**.
- During the annual control by the certification body[9], the test results of at least one testing machine must be subjected to the ones of a control laboratory. Each tensile testing machine must be subjected to a paired comparison with a control laboratory at least once every three years. If the producer uses other tensile machines in the internal laboratory, those machines are annually compared with the machine for which the comparison with the control laboratory is carried out. If it is not possible to compare those other tensile machines with this machine (e.g. because of different capacity), an annual comparison with a control laboratory must be carried out for each machine concerned.
- All other measurement and testing devices must be calibrated at least once a year.

2.2.1.2 Control laboratory

Laboratory accredited according to ISO/IEC 17025 and listed in document 503a[10].

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[7] COUNCIL DIRECTIVE of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products (85/374/EEC), Article 3.1: '***Producer***' *means the manufacturer of a finished product, the producer of any raw material or the manufacturer of a component part and any person who, by putting his name, trademark or other distinguishing feature on the product presents himself as its producer.*

[8] See definition in 2.2.1.2

[9] PROCERTUS

[10] Document 503 a, "Lijst – Liste – List, Keuringsinstellingen, Laboratoria, Organismes d'inspection, Laboratoires, Inspection Bodies, Laboratories »

3 PRELIMINARY EXAMINATION PRIOR TO THE GRANTING OF THE AUTHORISATION OF USE OF THE BENOR-MARK

3.1 General information

3.1.1 Principle

The preliminary examination is based on the tests of current control carried out by the services of the producing factory and on additional tests carried out by an external laboratory on request of the certification body or its representative[11]. The purpose of this preliminary examination is to check that the producer can manufacture the products for which he applies for the authorisation of use of the mark, and can maintain a regularity for the properties of these products in current manufacturing.

The conformity of the products to the requirements of standards NBN A 24-301 and -302 and technical prescriptions PTV 302 and 307 is checked by a preliminary examination prior to the granting of the authorisation of use of the BENOR-mark.

The authorisation of use of the mark is granted by product. The products delivered in coils, the products delivered as straight bars (produced as such) and the products delivered out of rods resulting from straightened coils, as well as the products processed according to different manufacturing processes, or the products showing different geometrical profile are regarded as **different products**.

The complementary aptitude to bending and unbending according to PTV 310 is an optional characteristic. The producer must declare as a preliminary if he wishes or not to include this property in his certification. The requirements relative to this complementary certification are listed in chapter 6.

3.1.2 Technical file

Any producer applying for authorisation to use the BENOR-mark for a given product must first establish a technical file. This technical file describes the methods (processes) and means of production (machines) used in the manufacture of the products. In this case, the producer must describe the reinforcements that are part of the perimeter of certification. The initial technical file is sent to PROCERTUS. The technical file must be adapted for each change made to the administration (organisation, …) and production (other machine, other steel quality, diameters, etc...). The technical file, together with each of its amendments, shall be signed for approval by the representative of the certification body for granting authorisation to use the mark.

3.1.3 Random sampling

The certification body selects, as much as possible randomly, the applicable number of products for control among the available products (see §§ 3.1.6 and 3.1.8).

All these available products come from the installations intended for manufacturing these products.

3.1.4 Requirements

It is necessary to check that the specified properties fulfil the criteria defined in the - standards and technical prescriptions mentioned above and clarified in articles 4.2 and 4.3 of this document.

[11] In the rest of the text and for simplification reasons, the term "certification body" includes its representative as well as the inspection body and its representative.

3.1.5 Marking and identification

The bars and the wires with ribs (or indentations) bear rolling marks in conformity with standard NBN A24-301 or PTV 302 and 307, making it possible to identify the origin as well as the grade of steel. The producer indicates to the certification body the marking he has chosen; this marking is also reproduced on the various delivery slips.

Moreover, each coil or bundle of bars is provided with a label mentioning the name of the user, the number of the coil or the bundle, the nominal diameter, the quality of steel according to the Belgian denomination and an identification number ensuring the traceability of the autocontrol of the producer (see § 4.1.4). After attribution of the BENOR-mark, the labels are provided with the BENOR logo together with the identification number of the user of the mark.

3.1.6 Presentation and sampling

3.1.6.1 Necessary products to be presented

The producer declares for which products and which diameters in these products he applies for the authorisation of use of the BENOR-mark

For the control of the mechanical and geometrical properties, the producer submits to the certification body per type of product, in the state where it leaves the factory, a quantity of products according to the following indications:

1. during the examination for the issue of a first authorisation of use of the BENOR-mark,
   - if the product includes 4 diameters or more, the certification body indicates for the sampling 3 diameters distributed in the range of the diameters.
   - if the product includes only 3 diameters or less, all diameters are presented; the quantities presented are those described here before and as far as possible, coming from different casts.
2. if the producer applies for the granting of the mark for a product other than that benefitting from the initial authorisation of use, the certification body indicates for the sampling a diameter among the small ones and a diameter among the large ones.
3. when the producer applies for the granting of the mark for an extension of the range of the diameters of a product already recognised: in this case, the extreme diameter is controlled; if the extension relates at the same time to the small ones and the large diameters, the two extreme diameters are controlled; the quantities to be presented are those defined below.

In each diameter thus indicated, the producer presents:

- for the products in coils, at least 30 coils,
- for the products out of straight bars or rods, at least 20 tons.

The presented quantity comes from at least 3 different casts.

The certification body takes, in each thus indicated diameter, 30 samples regularly distributed between the casts. Each sample comes from a bar, a rod or a different coil. The samples taken in the products delivered in coil are straightened at the internal laboratory.

3.1.6.2 Examination for the first authorisation of use of the BENOR-mark

During the examination for the first authorisation of use of the BENOR-mark (case 1 above), each sample is divided into three thirds: the first third is intended for control by the internal laboratory, the second third of one of the series is sent to the control laboratory, the third and last third of all samples and the rest of the second thirds is to be kept in reserve. The length of each third of sample must make it possible to carry out control:

- of the conventional section
- of the surface configuration[12]
- of the tensile characteristics
- by a rebend test
- by possible chemical analyses (see § 3.1.8).

The factory proceeds, in the presence of the certification body, with the above-mentioned tests on the 30 samples of each selected diameter. The control laboratory proceeds in its turn on 30 samples of the corresponding series[13] dedicated to the determination of the tensile characteristics. The tests are carried out in accordance with the requirements of the standards.

For the producers who already dispose of an authorisation of use of the BENOR-mark, tests in a control laboratory take place only once a year.

3.1.6.3 Examination for granting the authorisation of use of the BENOR-mark to another product

During the examination for granting the authorisation of use of the mark to another product, each sample is subjected to the checking of its geometrical properties, that is to say:

- conventional section
- surface configuration

Moreover, the length of each sample must make it possible to control complementarily by:

- tensile characteristics
- rebend test
- possible chemical analyses (see § 3.1.8).

If the product is made from the same steel, by an identical manufacturing process, delivered in the same form and in the same diameters, but where only the geometry differs, these mechanical tests and of chemical analysis should be realised only for one of the indicated diameters.

The factory proceeds, in the presence of the certification body, with the above-mentioned tests.

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[12] The determination of the surface configuration can be made, at the choice of the producer:

1. either through the measurement of the height and the spacing of the ribs (depth and spacing of the indentations)
2. or through the measurement of the relative rib or indentation area f_R (f_P).

In case of option 2, the chapter *Determination of the "λ-value" for the computation of f_R or f_P* of ECU 606 is of full and mandatory application in case of reinforcements delivered into coils and thus liable to be straightened by a processor and controlled with regard to that straightening operation. The "λ-value" is then published in the BENOR certificate of the producer for each certified product grade and diameter of reinforcements delivered as coils.

[13] IMPORTANT NOTICE: It is to be recalled that each tensile machine of the internal laboratory concerned with the BENOR preliminary certification must be subjected to paired comparisons. Therefore, if the producer uses one tensile machine for the whole BENOR certification, only 30 samples are tensile tested in the control laboratory. In other cases where the producer uses several machines for the whole BENOR certification, each machine must be subjected to 30 tensile tests made in the control laboratory. The organisation of the series of triplicate 30 samples must therefore be made in accordance with the actual encountered conditions.

3.1.7 Tensile testing machines

The tensile testing machines of the two laboratories must be in conformity with the requirements of § 2.2.1.1 of these Implementation Rules.

3.1.8 Chemical properties

For the control of the chemical properties, the certification body indicates:

- for the tests on casts: coming from various casts, three samples of jets of cast representative of the quantity of products presented according to § 3.1.6.1.
- for the tests on products: three specimens coming from these same casts.

The analyses are carried out in a control laboratory.

In addition, when a producer rolls, starting from semi-finished products which do not come from his own production, he must be in possession of the certificates of concerned cast analysis.

3.1.9 Chemical methods of analysis

The contents of carbon "C" and carbon equivalent "CE" are determined by sufficiently fast methods so as to make it possible for the certification body to attend (spectrometry, combustion, …). For the content of CE, all elements necessary to its calculation must be clearly mentioned. The calibration of the equipment and the accuracy of the methods of analysis are controlled by the analysis of reference samples in accordance with ECU 606.

3.1.10 Authorisation of use of the BENOR-mark

The authorisation of use of the BENOR-mark cannot be granted before the preliminary examination has been completed.

3.2 Interpretation of results

The results of the factory must be in conformity with paragraphs 3.2.1, 3.2.2 and 3.2.4. In addition, in the case of the examination for the granting of the authorisation of use of the BENOR-mark, the statistical comparison must be in conformity with § 3.2.3.

3.2.1 Controls by measurements

For each property being checked by measurement, in particular:

1. yield strength
2. tensile strength
3. R'_m/R'_e ratio
4. total elongation under maximum load (A_{gt})
5. the relative rib or indentation area (f_R or f_P)[14]

one calculates, by diameter, the average "m", the estimate of the standard deviation "s" and the estimate of the characteristic value "m - k.s"[15].

One compares the estimates of the characteristic values with the values specified in the standards.

[14] In the case that the determination of surface configuration is achieved through the relative rib or indentation area f_R - f_P.

[15] The coefficient k for m = 30 is equal to 2,08 (reliable failure rate 5% - probability β risk 10%) for properties 1, 2 and 5; and 1,66 (reliable failure rate 10% - probability β risk 10%) for properties 3 and 4 (see tables 4.2.2).

3.2.2 Controls by attributes

For each property being checked by attributes, in particular:

- the conventional section
- the height of the ribs (depth of the indentations)[16]
- spacing of the ribs (spacing of the indentations)[17]
- rebend test
- chemical analysis on cast, semi-finished product or end product.

it is necessary to determine the number of specimens not satisfying the criteria of the standard.

3.2.3 Comparison between the results of the tests carried out in the factory and those of the control laboratory

For the tensile strength and the yield strength, one proceeds to the statistical comparison of the results of the tests carried out with the factory with those of the control laboratory by the method of the paired observations (see NRN 418).

The comparison must show that the series of tests are statistically identical.

If the comparison shows that the series of tests are statistically not identical, it is necessary to search the causes thereof:

- if it appears that the causes are due to control by the internal laboratory, this one adapts its test procedure and starts again the tests on the products kept in reserve,
- if it appears that the causes are due to the control laboratory or, if it is not possible to detect the cause of the divergences, the certification body considers measures to be taken.

The flow chart at the end of the present chapter 3 summarises the process to be followed.

3.2.4 Acceptance criteria

It is required that, for each diameter of the group of products chosen according to the indications of paragraphs 3.1.6 and 3.1.8, all criteria of the standard are satisfied, in particular:

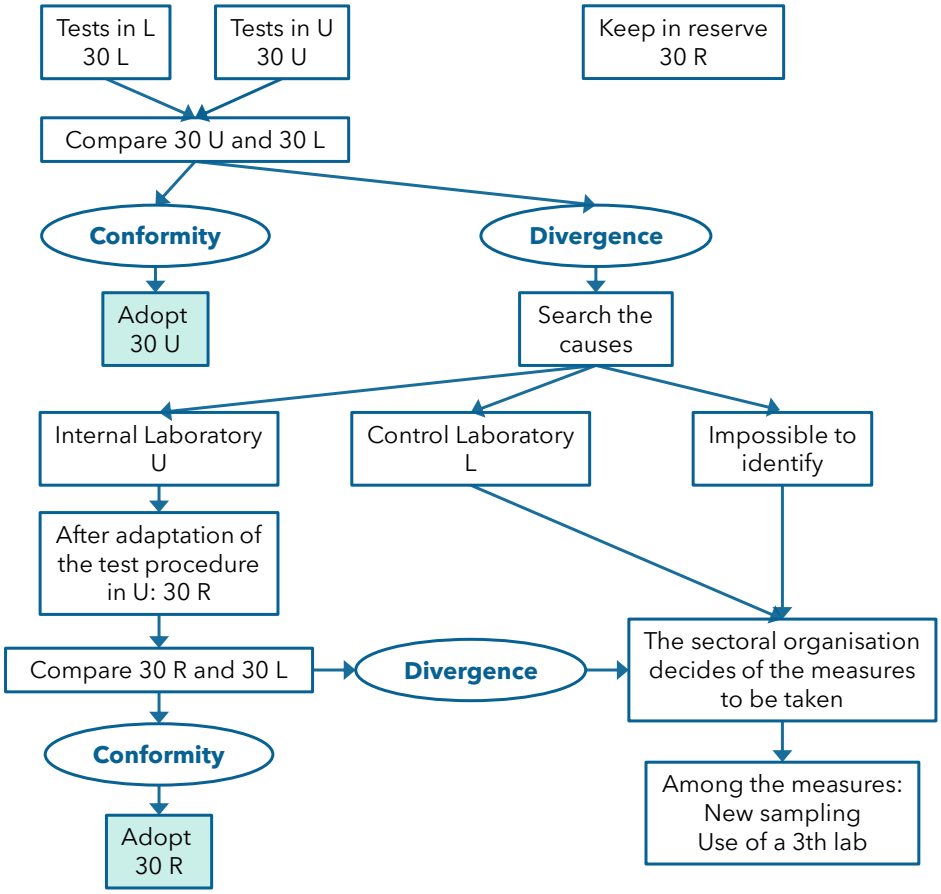
- for the properties controlled by measurements, values “m - k.s” must satisfy the criteria of the standard,
- for the properties controlled by attributes there can be no unsatisfactory specimen,
- the comparison of the tensile characteristics must show that they are statistically equivalent.

[16] In the case that the determination of surface configuration is achieved through the height and the spacing of the ribs (depth and spacing of the indentations).

[17] See footnote above about the determination of the surface configuration.

Flow chart for 1 diameter

L = control laboratory / U = internal laboratory / R = reserve



4 INDUSTRIAL AUTOCONTROL

4.1 General information

4.1.1 Methods of control

During the manufacturing of one or several product(s) for which he obtained the authorisation of use of the BENOR-mark, the producer must have the methods of control allowing to check the respect of the criteria fixed by the applicable standards, for the entirety of the production bearing the recorded rolling marks (see § 3.1.5).

4.1.2 Sampling and tests (by product)

For each product the producer shall take:

a) per maximum 40 tons of products of the same nominal diameter, at least one sample (and for the products delivered in coils, also a counterpart if the producer chooses to resort to the procedure of sampling on counterpart during routine checking: see further § 5.1.3.1) intended for the controls envisaged by the standard, in particular:
   - a determination of the relative rib or indentation area (f_R or f_P)[18]
   - a determination of the conventional section
   - a tensile test
     - the sampling is to be distributed in the production bearing the recorded marking at a rate of a maximum sampling per bar or coil.

b) per maximum 100 tons of products of the same nominal diameter, at least one sample intended for the control of the surface configuration (through the height of the ribs/depth of the indentations and spacing of the ribs/indentations)[19]

c) per maximum 200 tons of products of the same nominal diameter, at least one sample intended for a rebend test.

The tests are carried out in accordance with the standards.

The sampling, tests and the interpretation of those are done by product.

4.1.3 Chemical analysis

4.1.3.1 Method and device of analysis

The method and the devices used for the chemical analysis must give results representative of the product, whatever its structural heterogeneity is.

4.1.3.2 Chemical analysis on casts

For the determination of the chemical analysis of casts, at least a sample is taken by cast. The contents in C, Mn, Cu, Ni, Cr, Mo and V are determined by the internal laboratory. If necessary, when the sample on cast is unusable, the analysis can be made on a sample of product coming from the same cast. The samples on cast or, possibly, the sample of corresponding product are preserved until the next visit of the certification body.

4.1.3.3 Chemical analysis on semi-finished products

The rolling mill must have the certificate of analysis of all its semi-finished products per cast. Moreover, all the semi-

[18] In so far as the producer has chosen to measure the relative rib or indentation area.

[19] In so far as the producer has chosen to measure only the height of the ribs/depth of the indentations and spacing of the ribs/indentations instead of the relative rib or indentation area.

finished products must be located with the indication of corresponding cast.

4.1.3.4 Chemical analysis on end products

The producer is not obliged to carry out the chemical analyses on end products; however, checks can be carried out by the certification body at the time of the periodic visits at the same time as the calibration of the devices of chemical analysis. If the producer does not have the necessary equipment, the chemical analyses in external laboratory can be required, at the cost of the producer.

4.1.4 Recording and analysis of autocontrol results

All control results are numbered and recorded. The classification of the tests is done in particular in reference to the numbers of manufacturing and identification of the products (see § 3.1.5) so as to ensure traceability. One uses a register in pre-numbered and pre-signed pages by the certification body. The register can be made up of loose sheets. If the monitoring service of the factory uses a system of continuous classification of the test results, or a computerised system, the aforementioned register is not essential. This system of classification must offer all guarantees and be approved by the certification body.

The results are kept for a period of 10 years by the producer.

The results are analysed statistically by the producer using a calculation program approved by the certification body and the results of this statistical analysis are sent to the certification body within thirty days after the month concerned. The producer can eliminate from this statistical analysis the results coming from products withdrawn from the trade-circuit (see § 4.4), and certain too favourable aberrant results (see § 4.2.2). The attachments regarding encountered problems and their solutions must be joined (see § 4.3.2).

4.2 Statistical control by measurements

This control applies to:

1. yield strength
2. tensile strength
3. R'_m/R'_e ratio
4. total elongation under maximum load (A_{gt})
5. the relative rib or indentation area (f_R or f_P).

4.2.1 Principle

The interpretation of the results of the tests is done using the statistical methods:

- by adopting a reliable failure rate of 5 % [p = 0,95] at a probability of 90 % (risk of 10 %) for properties 1 and 2 (R'_m, R'_e) and 5 (f_R or f_P)
- by adopting a reliable failure rate of 10 % [p = 0,90] at a probability of 90 % (risk of 10 %) for properties 3 and 4 (ratio R'_m/R'_e and A_{gt}).

4.2.2 Statistical interpretation of test results

The statistical interpretation of the test results is to be carried out monthly for each product and for each diameter coming from the production over the period defined below.

This statistical analysis requires at least 30 test results of the same diameter per grade of steel coming from a production, continuous or not, over a period extending over the last three months. This period may be extended to be able to present at least the last 30 successive results, however without exceeding twelve months.

However, the producer is free to divide his production into several homogeneous batches. In this case, this division must appear clearly in the documents of statistical interpretation that he submits for control to the certification body.

For each examined property, one determines for n available results, the arithmetic mean "m" and the estimate of the standard deviation "s". One calculates the estimate of the characteristic value "m - k.s".

The tables hereafter give the constant of acceptance "k" according to the number of available results (according to NBN EN 10080: 2005).

Coefficient k as a function of the number (n) of test results for a reliable failure rate of 5 % (p = 0,95) at a probability of 90 %

n	k	n	k
5	3,40	30	2,08
6	3,09	40	2,01
7	2,89	50	1,97
8	2,75	60	1,93
9	2,65	70	1,90
10	2,57	80	1,89
11	2,50	90	1,87
12	2,45	100	1,86
13	2,40	150	1,82
14	2,36	200	1,79
15	2,33	250	1,78
16	2,30	300	1,77
17	2,27	400	1,75
18	2,25	500	1,74
19	2,23	1000	1,71
20	2,21	∞	1,64

Coefficient k as a function of the number (n) of test results for a reliable failure rate of 10 % (p = 0,90) at a probability of 90 %

n	k	n	k
5	2,74	30	1,66
6	2,49	40	1,60
7	2,33	50	1,56
8	2,22	60	1,53
9	2,13	70	1,51
10	2,07	80	1,49
11	2,01	90	1,48
12	1,97	100	1,47
13	1,93	150	1,43
14	1,90	200	1,41
15	1,87	250	1,40
16	1,84	300	1,39
17	1,82	400	1,37
18	1,80	500	1,36
19	1,78	1000	1,34
20	1,77	∞	1,28

If this value does not satisfy the specified value, the producer has the possibility to put aside no more than half of the values provided for control under consideration, but on the condition that doing it in the order of the values classified while starting with most favourable and to calculate: "m_i - k_i. s_i".

If these new values still do not satisfy the specified value, the whole of the products considered is to be sheared to scrap in accordance with Article 2.6.1. of the Particular Rules BRP 279.

4.3 Statistical control by attributes

This control applies to the following properties:

- chemical analysis
- conventional section
- rebend test
- height of the ribs (depth of the indentations)[20]
- spacing of the ribs (spacing of the indentations)[21].

4.3.1 Principle

The interpretation of the results of the tests is based on a simple sampling, by adopting a reliable failure rate of 10 % [p = 0,90] at a probability of 95 % (risk of 5 %).

4.3.2 Interpretation of test results

The interpretation of the chemical analysis applies to all casts of steel. This interpretation takes place, prior to production, on the basis of certificate of analysis of cast (see 4.1.3.2). No unsatisfactory result is accepted.

For the other examined properties, the interpretation of the test results is to be carried out monthly for the products coming from the production the last three months in the same diameter. One admits a maximum number of non-conforming results according to the number of results necessary to respect the criterion, as indicated in the table hereafter.

As soon as a non-conforming result arises and leads to exceeding the admitted number, either the producer shears to scrap the concerned unit of autocontrol in accordance with article 2.6.1 of the Particular Rules BRP 279, or he samples from this unit (40 tons, 100 tons or 200 tons according to the test – cf. § 4.1.2) a minimum of 5 samples including one in the same coil or the same bundle of bars and 4 others in a random way.

If all results are satisfactory, the unit of autocontrol is accepted and the first result is not taken any more into account. In the contrary case, the products are sheared to scrap.

The anomaly, the results of the complementary tests, its probable cause as well as the pursuant action taken (measurements taken to cure it or put to scrap) must always be recorded and be the subject of an attachment to the transmitted autocontrol results.

[20] The determination of the height and the spacing of the ribs (depth and spacing of the indentations) may, at the request of the producer, be replaced by the determination of the relative rib or indentation area f_R (f_P) and shall in this case be evaluated following § 4.2.

[21] See above footnote over the determination of the relative rib or indentation area (f_R, f_P).

Maximum admitted number of unsatisfactory results	Minimum number of results necessary to respect the criterion
0	29
1	46
2	63
3	78
4	92
5	106
6	119
7	132
8	145
9	158
10	170
11	182
12	195
13	207
14	219
15	231
16	243
17	255
18	267
19	279
20	291
21	303

4.4 Products not to bear the BENOR-mark

All precautions must be taken so that products that do not fulfil the requirements of the standard and cannot bear the BENOR-mark, cannot be confused with those which bear the BENOR-mark.

4.5 Register of complaints

All technical complaints related to the delivered products are gathered in a register.

They are transmitted to the persons responsible for their treatment.

On request, the register is made available to the certification body.

5 PERIODICAL CONTROLS BY THE CERTIFICATION BODY

5.1 Products being in the producing factory

5.1.1 General information

The requirements on which the authorisation of use of the BENOR-mark is based (regularity in the manufacturing of the products and conformity to the standards of the products bearing the BENOR-mark), are periodically controlled by the certification body.

These controls consist in making sure:

- that the tensile testing machines and their extensometer are in conformity and are calibrated in accordance with the requirements of § 2.2.1.1 and that their last calibration is not older than one year,
- that the producer disposes of all certificates of chemical analysis of semi-finished products he used,
- by means of representative samples, that the calibration of the devices used for the chemical analysis is correct,
- that the industrial autocontrol is carried out correctly,
- that the results of the industrial autocontrol are correctly interpreted.
  - hereto, the certification body carries out the checking of the statistical analysis of at least two series of results a year.
- that the results of the industrial autocontrol are satisfactory,
- that the results obtained and recorded during this industrial autocontrol are in line with reality, by carrying out control tests on products manufactured under the BENOR-mark and subjected to autocontrol, or on samples of casts or semi-finished products preserved to this end (see §§ 4.1.3.1 and 4.1.3.2),
- that all actions were taken so that products already bearing the BENOR-mark but that must be sheared, are stored separately from conform BENOR steels,
  - the proof of shearing must be presented at the initiative of the producer to the certification body.
- the technical file is kept up to date and corresponds effectively to the methods (processes) and means (machines) used.
- that when anomalies were noted, necessary corrective actions were taken to cure them.

The producer takes all measures to facilitate these controls; in particular, he informs the certification body about:

- the name of the person in charge of the quality control services of the factory,
- the date of starting any slightly modified production, i.e. products lying within the perimeter of the certification but comprising certain minor modifications.

He keeps at disposal all autocontrol results according to §§ 4.1.3 and 4.1.4.

He also sends to the certification body, for each monthly period starting from the date of delivery of the authorisation of use of the BENOR-mark, the quantity of products delivered under the BENOR-mark as well as the quantity of sheared products. The quantities are clearly subdivided by type of product (coil, bars, rod resulting from straightened coil, manufacturing processes, geometrical profile) and by diameter.

5.1.2 Periodicity of the control visits of surveillance

For the period following a decision of the first certification, the user of the mark is subjected to a one-year probationary period comprising six visits.

During this period, documentary audits or complementary visits can be applied based on the result of the initial inspection (in particular depending on the nonconformities) and of a decision of the Certification Committee.

The same principles are applicable in the event of extension during a one-year period, the number of basic visits being

in this case limited to 4.

The inspections conducted by the certification body during the duration of certification, are in theory carried out four times a year.

This periodicity is once a month in the following cases:

- on decision of the certification body, when the results obtained on the samples taken during a routine control and those obtained by the internal laboratory on the samples coming from the industrial autocontrol, present a statistically significant difference (see § 5.1.4.2) and that the producer could not satisfactorily justify this,
- on decision of the certification body, when other situations make it possible to question the level of product quality or its regularity.

5.1.3 Test sample selection

5.1.3.1 Routine controls

At the time of the visit, the certification body chooses at least a product in which it takes 15 samples belonging to one of the diameters of the end products; each sample comes from coils or different bars; these samples have a sufficient length to make it possible to carry out a tensile test, a rebend test, a determination of the conventional section, the measurement of the surface configuration and possibly the chemical analysis. The artificial ageing before tensile testing is obligatorily carried out immediately before the test and in the presence of the certification body (except for the rolled bars, where the choice - aged or not aged - is determined by the producer during his autocontrol).

The chemical analyses are limited to 3 per diameter.

The certification body takes care to distribute the choice of the products in which it samples, so that each product is controlled minimum once a year.

For the products delivered in coils, the producer may preserve counterparts. Their number is in accordance with paragraph § 4.1.2. The counterpart must have a sufficient length to possibly be able to undergo controls in a control laboratory (see § 5.1.3.2). However, at least once a year, control takes place on samples taken in the presence of the certification body on at least 20 production units except stock of the producer. The counterparts are preserved until the periodic visit.

If finished products do not remain in stock, the certification body checks, by consultation of the production registers and the delivery slips, that the theoretical stock is indeed null.

When the products are regularly in insufficient quantity to carry out the sampling of the 15 specimens, the producer transmits to the certification body the programme of production by announcing the probable dates of forwarding.

5.1.3.2 Annual controls

Once a year, at the time of one of its visits, the certification body takes the 15 samples and has them cut out in two equal parts. The first half is submitted to testing at the internal laboratory within the framework of routine controls according to § 5.1.3.1; the second half is sent for tensile test in a control laboratory.

For the producers who benefit from an authorisation of use of the BENOR-mark for several products, the tests in a control laboratory take place only once a year.

5.1.4 Tests and interpretation of results

5.1.4.1 Tests

The internal laboratory proceeds, in the presence of the certification body, with the tensile tests on the 15 specimens, and with the rebend tests and measurements of surface configuration on at least 5 of the 15 specimens.

The samples for the possible chemical analysis are controlled in the internal laboratory. The calibration of the devices used for this purpose is controlled via representative samples (see § 3.1.9).

5.1.4.2 Interpretation of results

Case of routine controls

The interpretation of the tensile test results consists in:

1. comparing the results of yield strength R'_e and tensile strength R'_m with those obtained during the autocontrol of the corresponding production. For this purpose, annex B of NRN 418 is used.
2. checking that the results of R'_e and R'_m satisfy the following requirements
   - each individual value is higher than the specified characteristic value
   - and the mean value of R'_e and R'_m is higher than the specified characteristic value increased by 10 N/mm²
3. checking that for the R'_m/R'_e ratio and total elongation A_{gt}, each individual value is higher than the specified value.

All results of the determination of the conventional section, the rebend test, the determination of the height of the ribs (depth of the indentations) and of the spacing of the ribs (or indentations) or the relative rib or indentation area and of the possible chemical analyses, must satisfy the standard. When the relative rib or indentation area is determined, this is performed by the formula chosen by the producer in his technical file and with the empirical formula with validated value of λ. Both results must satisfy the standard.

Case of the annual controls in a control laboratory

For the results of the yield and tensile strength obtained in the control laboratory, the interpretation consists in checking by the method of the paired observations (see Annex A of document NRN 418) that there is conformity between these results and those obtained by the internal laboratory on the specimens coming from the same samples.

For information, the results of R'_e, R'_m, R'_m/R'_e, A_{gt} and of the conventional section are interpreted as described above.

5.1.5 Official control report of surveillance

The results of the controls are recorded each visit in a report.

This report must include the following indications:

1. producer and factory
2. identification of the products
3. data on the test sample selection
4. results of the tests carried out in the presence of the certification body and corresponding results of the industrial autocontrol
5. overall evaluation
6. place and date
7. signatures.

If necessary, the report on completed is later with a copy of the official report of the tensile tests carried out in a control laboratory.

The report must be kept for a period of at least 10 years by the producer and by the certification body.

5.2 Products bearing the BENOR-mark and being outside the producing factory

5.2.1 Controls carried out on the initiative of the certification body

5.2.1.1 Principle

If the certification body judges it necessary, samples can be taken in the stores of the stockists-distributors, a processor-distributor or on a building site, in order to check that the products stored there and considered to bear the BENOR-mark, meet the applicable requirements of the Belgian standards.

According to the agreement taken beforehand and for the mechanical tests only, the tests are carried out in a control laboratory or, in the presence of the certification body, in the internal laboratory.

5.2.1.2 Conditions for implementation of control

The samples taken are numbered and cut in 3 equal parts. A series of tests is carried out in a control laboratory as described in 5.2.1.1. The two other series are preserved for possible additional tests in the internal laboratory or in a second control laboratory.

During the sampling, the certification body records markings and takes copies of all documents concerning the controlled products. It preserves the labels attached to find, if necessary, the autocontrol test results.

The test results are provided to the producer. In case anomalies or irregularities are found, the producer is invited to provide a justification within a fixed deadline.

The costs of the tests are charged to the producer when anomalies or irregularities have been found.

In the event of observing of a disrespect of the provisions of the rules of the BENOR-mark or Particular Rules (cf. chapter 2 of BRP 279), the corresponding procedures are applied by PROCERTUS to the users of the mark.

In the event of discovery of fraud, PROCERTUS reserves itself the right to prosecute the party responsible for the fraud.

5.2.2 Controls carried out by the certification body in case of an external complaint

One or more contradictory samplings are carried out by the certification body on the products being the subject of the litigation, the producer or his representative in Belgium and the distributor having been duly convened.

The tests are carried out on the first and second thirds of samples during normal periodic controls in the internal laboratory and a control laboratory. The third and last third of the samples is preserved for possible complementary tests.

The possible chemical analysis on products are carried out in a laboratory selected by mutual agreement. The methods and devices used must give results representative of the average of the product, whatever its structural heterogeneity is.

The test results are provided to the producer. In case anomalies or irregularities are found, the producer is invited to provide a justification within a fixed time frame.

After assessment of the results, the conclusions of the certification body are announced to the producer and to the plaintiff.

The costs of the tests are charged to the producer if anomalies or irregularities have been found.

In the event of observing a disrespect of the provisions of the rules of the BENOR-mark or Particular Rules (cf. chapter 2 of BRP 279), the corresponding procedures are applied by PROCERTUS to the users of the mark.

In the event of discovery of fraud, PROCERTUS reserves itself the right to prosecute the party responsible for the fraud.

5.2.3 Controls carried out on the initiative of a user

Whatever the results of the tests, their costs are at the exclusive charge of the user who took the initiative of executing them in a unilaterally way.

Users who consider themselves disadvantaged can address their substantiated complaint to PROCERTUS.

As soon as possible, PROCERTUS decides on the admissibility of the complaint and, if necessary, decides to carry out controls and tests. PROCERTUS then applies the procedure described in 5.2.2 if the products being the subject of the litigation are still available, or the procedure described in 5.2.1 in the contrary case.

6 COMPLEMENTARY APTITUDE TO BENDING AND UNBENDING ACCORDING TO PTV 310

The complementary aptitude to bending and unbending according to PTV 310 is evaluated by attributes.

For the tensile test after bending and unbending test according to PTV 310, the number of tests is equal to 5 per diameter.

During an initial certification of this aptitude, at least 3 diameters per product are tested in the presence of the certification body.

In the event of extension, the minimum or maximum diameter concerned with the product is tested in the presence of the certification body.

For the autocontrol, this property must be the subject of at least 5 tests per product on each diameter at least once a year.

For routine controls, the rebend tests are replaced by the control of this complementary aptitude. This one must be able to be checked at least once a year.

The tests carried out in the presence of the certification body can be taken into account within the framework of the autocontrol for this complementary aptitude.

7 VALIDATION OF THE "λ-VALUE" FOR THE COMPUTATION OF F_R OR F_P

This procedure detailing the methodology to determine a coefficient "λ" for one diameter of one product as defined by ISO 15630-1 in its chapter dealing with the *Empirical formula* is defined in ECU 606.

The procedure shall be repeated whenever there is a change in the geometry of the profile or if doubts should arise about the correctness of the "λ"value. The procedure may by repeated at any time at the initiative of the certification body.

In case the results would display a lower "λ"value than the one mentioned in the certificate, the producer may extend the assessment on more results to validate the certified value.

In other cases, the certification body may withdraw the publication of "λ" values on the certificate and impose to define surface configuration through the height of the ribs/depth of the indentations and spacing of the ribs/indentations.

8 HISTORY OF REVISIONS

Revisions 0 to 3

- Creation, updates

Revision 4

- The complete document was modified in order to lay down the possibility of steels with indentations.
- Minor administrative modifications made to various chapters.

Revision 5

- Reference to asbl BENOR vzw.
- Adaptation of the periodicity of the checks after the first certification.
- Old chapters A, B and C become 3, 4 and 5.

Revision 6

- Definition of the sampling for steels according to PTV 310 (chapter 6).

Revision 7

- Definition of the concept of laboratory internal and control laboratory.

Revision 8

- Corrections of form.

Revision 9

- Updating of requirements regarding surface configuration
- Edition in the English language.

Revision 10

- Implementation of formal requirements regarding the technical file of the manufacturer
- Editorial updates or corrections.

Revision 11

- Transfer from OCAB-OCBS to PROCERTUS
- Change of vocabulary, where relevant, from sectoral organisation to certification body
- Editorial and linguistical corrections

Revision 12

- Modification in §3.1.8 – control by the producer
- Modification in §5.1.3.1 – deleting the control at the processor
- Modification in §7 – validation frequency