IMPLEMENTATION RULES RÈGLEMENT D'APPLICATION TOEPASSINGSREGLEMENT	TRA	413
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IMPLEMENTATION RULES OF THE BENOR-MARK IN THE SECTOR OF CONCRETE REINFORCEMENTS - METHODS OF ASSESSMENT APPLICABLE TO THE "USERS OF THE MARK" – PRODUCERS OF LATTICE GIRDERS

REGLEMENT D'APPLICATION DE LA MARQUE BENOR DANS LE SECTEUR DES PRODUITS EN ACIER POUR BETON MODALITÉS DE CONTRÔLE APPLICABLES AUX USAGERS DE LA MARQUE - PRODUCTEURS DE POUTRES TREILLIS

TOEPASSINGSREGLEMENT VAN HET BENOR-MERK IN DE SECTOR VAN STALEN PRODUCTEN VOOR GEWAPEND BETON - CONTROLEMODALITEITEN TOEPASSELIJK OP DE GEBRUIKERS VAN HET MERK - PRODUCENTEN VAN TRALIELIGGERS

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FOREWORD

On 01.04.2024, the npo's PROBETON, BE-CERT, OCAB-OCBS and PROCERTUS merged in accordance with article 13 of the Code of Companies and Associations. On that date, PROBETON, BE-CERT and OCAB-OCBS were automatically dissolved, and all their rights and obligations were transferred to PROCERTUS, which alone continues their activities.

CONTENT

1 INTRODUCTION

These Implementation rules (TRA[1]) of PROCERTUS, sectoral organisation, were initially established by the Technical bureau 1 "Concrete reinforcing steels" of OCAB-OCBS, and are managed by PROCERTUS for the BENOR certification of concrete reinforcements.

According to the Rules of use and control of the BENOR-mark[2] and its article 9, these Implementation Rules constitute the reference certification scheme for 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[3].
- Règlement général pour la gestion de la marque BENOR / Algemeen reglement voor het beheer van het BENOR-merk[4].
- 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[5].

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 A 24-303, Produits sidérurgiques - Aciers pour béton armé - Fils écrouis à froid lisses et fils écrouis à froid à nervures / Staalproducten - Betonstaal - Gladde en geribde koudvervormde draad.
- 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.
- NBN EN ISO 15630-2, Aciers pour l'armature et la précontrainte du béton – Méthodes d'essai – Partie 2 : Treillis soudés et treillis raidisseurs / Staal voor de wapening en voorspanning van beton – Beproevingsmethoden, Deel 2: Gepuntlaste wapeningsnetten en tralieliggers.

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

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

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

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

[5] According to the last edition in force

- 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 303, Aciers pour béton armé, Fils écrouis à froid à nervures à basse ductilité / Gewapend betonstaal, Geribde koudvervormde draad met lage ductiliteit.
- PTV 305, Aciers pour béton armé, Poutres-treillis / Gewapend betonstaal, Tralieliggers.
- 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[6]). To be recognised as such, this laboratory must fulfil the following requirements:

- The tensile testing machines of this laboratory must be calibrated in accordance with standard NBN EN ISO 15630-1. They must be of class 1 or better; the last calibration carried out by a service independent of the laboratory, cannot be older than one year. Moreover, they are equipped with a system of measurement of total elongation under the maximum load.
- 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[7] according to the provisions of the preliminary examination.
- During the annual check by the certification body[8], 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[9].

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[6] 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.*

[7] See definition in 2.2.1.2

[8] PROCERTUS

[9] 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 conformity of the products to the prescriptions being the subject of standards NBN A 24-301, -302 and -303 and technical specifications PTV 302, 303 and 305[10] 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 four types of lattice girders, the lattice girders worked out according to different processes, the lattice girders manufactured starting from wires with different grades for the upper wires, for the diagonal wires as for the lower wires being able to intervene in the calculation of stability, are regarded as different products.

For a defined product, a model is an assembly made up of an upper wire for which the diameter and the grade are specified, of two lower wires for which the diameter and the grade are specified, and of two diagonal wires for which the diameter and the grade are specified.

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.

3.1.2 Preliminary examination

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].

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 the manufacturing of these products.

3.1.4 Requirements

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

[10] In the rest of the text, for simplification, the term “standard(s)” covers the most recent version of standards NBN A24-301, -302 and -303 including addendum, as well as PROCERTUS’ normative documents PTV 302, 303 and 305.

[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 wires with ribs (or indentations) bear rolling marks in conformity with standard NBN A24-301 or PTV 302 and 303, 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 burden of lattice girder (types 1-2-3-4) is provided with one or more labels carrying at least the following information (see also PTV 305 and chapter on *Designation*):

- the reference to "Lattice girder"
- the type (1, 2, 3 or 4)
- the grade of steel and the diameter for the upper wire, the lower wires and the diagonals, the height
- a reference number allowing to ensure the traceability of the autocontrol (see 4.1.4)
- the name of the producer and the place of manufacturing.

The labels must be indelible and sufficiently robust to support the handling of the lattice-girders. The labels must be submitted to the certification body for approval. After attribution of the BENOR-mark, the labels are provided with the BENOR logo together with the distinctive number of the user of the mark. The lattice girders must be provided with BENOR labels and be delivered with delivery sheets conform to the prescriptions of BRP 279 §6.

3.1.6 Presentation and sampling

3.1.6.1 Presentation

First certification

The producer declares for which products, which grades 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 presents to the certification body, per product for which the producer applies for the use of BENOR-mark, a quantity of product in the state such as they leave the factory according to the following indications:

- During the examination for the issue of a first authorisation of use of the BENOR-mark, the producer presents at least 20 tons of product. Out of those, the certification body chooses 2 models of lattice girders; the 2 models are characterised by a diameter different from the lower wire and upper wire and if possible, by a diameter different from the diagonal wire. In the case where the product includes several grades of steel corresponding to the high ductility, these various grades must be taken again in the models.
- **By model of lattice girder of type 1**, the certification body takes 15 sections. Each section is selected in a different lattice girder. Of these sections are taken -5 samples of upper wires, 2 * 15 samples of lower wires and sufficient points of welding for the shear test; for the checking of the diagonal wire, 5 samples divided between the two diagonal wires are taken before welding.
- **By model of lattice girder of type 2**, the certification body takes 5 sections. Each section is selected in a different lattice girder. Of these sections 5 samples of upper wires are taken, 2 * 5 samples of lower wires and sufficient points of welding for the shear test; for the checking of the diagonal wire, 5 samples divided between the 2 diagonal wires are taken before welding.
- **By model of lattice girder of type 3**, the certification body takes 30 sections. Each section is selected in a different lattice girder. Of these sections 30 samples of upper wires are taken, 5 samples of lower wires and sufficient points of welding for the shear test; for the checking of the diagonal wire, 5 samples divided between the two diagonal wires are taken before welding.
- **By model of lattice girder of type 4**, the certification body takes 30 sections. Each section is selected in a different lattice girder. Of these sections 30 samples of upper wires are taken, 2 * 15 samples of lower wires and sufficient points of welding for the shear test; for the checking of the diagonal wire, 5 samples divided between the two diagonal wires are taken before welding.

The samples mentioned above are suitable to undertake the measurements indicated in the following tables:

	Type 1				Type 2			
	LW	**D**	**UW**	**LG**	**LW**	**D**	**UW**	**LG**
Height				5x (A)				5x (A)
Width				5x (A)				5x (A)
Pitch		5x (A)				5x (A)		
Slope				5x (A)				5x (A)
SG	5/30x (A)[12]							
Section	30x (A)	5x (A)	5x (A)		5x (A)	5x (A)	5x (A)	
Rm	30x (S)	5x (A)	5x (A)		5x (A)	5x (A)	5x (A)	
OTP	30x (S)							
Bending	5x (A)							
CA	5x (A)							
SS	5x (A)		5x (A)		5x (A)		5x (A)	

	Type 3				Type 4			
	LW	**D**	**UW**	**LG**	**LW**	**D**	**UW**	**LG**
Height				5x (A)				5x (A)
Width				5x (A)				5x (A)
Pitch		5x (A)				5x (A)		
Slope				5x (A)				5x (A)
SG			5/30x (A)[13]		5/30x (A)[14]	5x (A)	5/30x (A)[15]	
Section	5x (A)	5x (A)	30x (A)		30x (A)	5x (A)	30x (A)	
Rm	5x (A)	5x (A)	30x (S)		30x (S)	5x (A)	30x (S)	
OTP			30x (S)		30x (S)	5x (A)	30x (S)	
Bending			5x (A)		5x (A)		5x (A)	
CA			5x (A)		5x (A)	5x (A)	5x (A)	
SS	5x (A)		5x (A)		5x (A)		5x (A)	

Legend:

- LW: Lower wire, D: diagonal, UW: Upper wire, LG: Lattice-girder, SG: Surface Geometry, CA: Chemical analysis, OTP: Other tensile properties, SS: Shear Strength, LG: Lattice Girder
- 5x, 30x: 5 measurements, 30 measurements
- A, S: control by attribute, statistical control by measurements (cf. respectively 3.2.2 and 3.2.1)

[12] 5x in case of measurement of the height and the spacing of the ribs, 30x in case of measurement of the relative rib or indentation area f_R (f_P)

[13] See previous note

[14] See previous note

[15] See previous note

Extension

When the producer applies for an extension of the authorisation of use of BENOR-mark, the producer presents at least 10 tons.

The numbers of samplings of sections are equivalent to those given to item 1, or reduced according to the tests to realise; the samples enable to undertake the measurements listed in the following tables:

Extension for the lower wires to another grade or range of diameters

	Type 1	**Type 2 and type 3**	**Type 4**	
	LW	**LW**	**LW**	**D**
SG	5/30x (A)[16]		5/30x (A)[17]	
Section	30x (A)	5x (A)	30x (A)	5x (A)
Rm	30x (S)	5x (A)	30x (S)	5x (A)
OTP	30x (S)		30x (S)	5x (A)
Bending	5x (A)		5x (A)	
CA	5x (A)		5x (A)	
SS	5x (A)	5x (A)	5x (A)	

Extension for the diagonals to another grade or range of diameters

	Type 1			**Type 2**		
	LW	**D**	**UW**	**LW**	**D**	**UW**
Section	30x (A)	5x (A)			5x (A)	
Rm	30x (S)	5x (A)			5x (A)	
OTP	30x (S)					
SS	5x (A)		5x (A)	5x (A)		5x (A)

	Type 3			**Type 4**		
	LW	**D**	**UW**	**LW**	**D**	**UW**
SG					5x (A)	
Section		5x (A)	30x (A)	30x (A)	5x (A)	30x (A)
Rm		5x (A)	30x (S)	30x (S)	5x (A)	30x (S)
OTP			30x (S)	30x (S)	5x (A)	30x (S)
CA					5x (A)	
SS	5x (A)		5x (A)	5x (A)		5x (A)

[16] See previous note

[17] See previous note

Extension for the upper wires to another grade or range of diameters

	Type 1 and type 2	Type 3	Type 4	
	UW	**UW**	**UW**	**D**
SG		5/30x (A)[18]	5/30x (A)[19]	
Section	5x (A)	30x (A)	30x (A)	5x (A)
Rm	5x (A)	30x (S)	30x (S)	5x (A)
OTP		30x (S)	30x (S)	5x (A)
Bending		5x (A)	5x (A)	
CA		5x (A)	5x (A)	
SS	5x (A)	5x (A)	5x (A)	

3.1.6.2 Sampling

During the examination for the first authorisation of use of the BENOR-mark, 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 the 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 all tests following the prescriptions above.

The producer carries out, for each lattice girder among the selected types, the above-mentioned tests in the presence of the certification body. The control laboratory indicated by the certification body proceeds in its turn with tensile tests on the 30 corresponding sections. The tests are carried out in accordance with the specifications of the standards.

In case of an extension, the tests are only carried out in factory.

In the case of products already having an authorisation of use of BENOR-mark, the tests by a control laboratory are in general carried out only once a year.

3.1.7 Equipment of the internal laboratory

The equipment of the internal laboratory must be in conformity with the requirements of ECU 606.

3.1.8 Chemical properties

The producer must have the certificates of analysis of the semi-finished products with which he manufactures the wire, unless this wire is a product delivered under the BENOR-mark. The results of this analysis must satisfy the criteria of "cast analysis" of the standard.

3.1.9 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.

[18] See previous note

[19] See previous note

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 issuing 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 where a control by measurements is required following § 3.1.6.1, the interpretation of the results of the tests is done using the statistical methods:

1. by adopting a reliable failure rate of 5 % [p = 0,95] at a probability of 90 % (risk of 10 %) for the yield and tensile strength (R'm, R'e) and for the the relative rib or indentation area (f_R or f_P)[20]
2. by adopting a reliable failure rate of 10 % [p = 0,90] at a probability of 90 % (risk of 10 %) for the other properties (ratio R'm/R'e and Agt).

One calculates, by diameter, the average "m", the estimate of the standard deviation "s" and the estimate of the characteristic value "m - k.s"[21].

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

3.2.2 Controls by attributes

The evaluation will be performed by attributes for the properties designated in § 3.1.6.1.

One compares each individual value with the values specified in the standards.

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 by the factory with those of the control laboratory by the method of 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 of 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 group of products of types 1, 3 and 4 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.

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

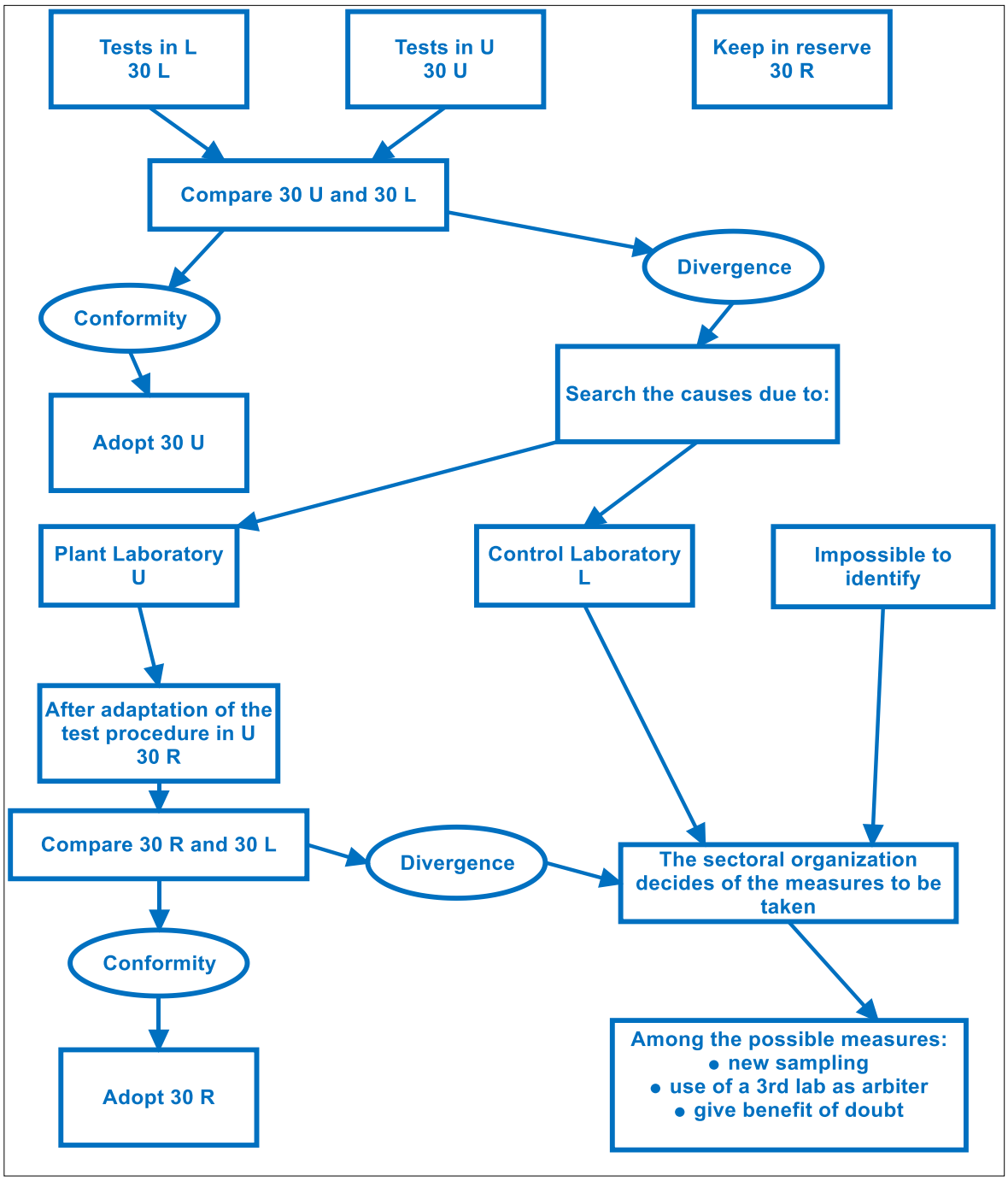
[21] The coefficient k for m = 30 is equal to 2,08 (reliable failure rate 5% - probability β risk 10%); and 1,66 (reliable failure rate 10% - probability β risk 10%) (see tables 4.2.2).

It is necessary that, for each group of lattice girders of type 2, selected according to the indications of paragraph 3.1, all criteria of the standard are satisfied, in particular:

- for the properties controlled by attributes, there can be no non-satisfactory specimen.

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)

In all cases, the statistical analysis (lower wires of lattice girders of type 1, upper wire of lattice girders of type 3 and all wires for lattice girders of type 4) requires having at least 30 test results, resulting from continuous or non-continuous productions of the same diameter during the last three months. This period may be extended to be able to present the last 30 successive results, however without exceeding twelve months.

The sampling and the tests cover all production teams and equipment.

Per 20 tons of products of same geometrical characteristics, the producer takes at least a sample intended for the controls foreseen by the standard on the wires composing the lattice girders, in particular:

- Lattice girder of type 1:
  - control of dimensions of the lattice girder
  - determination of the tensile properties of the lower wire
  - rebend test on the lower wire
  - determination of the geometry of surface of the lower wire
  - determination of Rm of the diagonal and upper wire
  - determination of the conventional section of all the wires
  - shear strength
- Lattice girder of type 2:
  - control of dimensions of the lattice girder
  - determination of Rm of all the wires
  - determination of the conventional section of all the wires
  - shear strength.
- Lattice girder of type 3:
  - control of dimensions of the lattice girder
  - determination of the tensile properties of the upper wire
  - rebend test on the upper wire
  - determination of the geometry of surface of the upper wire
  - determination of Rm of the diagonal and lower wire
  - determination of the conventional section of all the wires
  - shear strength
- Lattice girder of type 4:
  - control of dimensions of the lattice girder
  - determination of the tensile properties of the upper wire, diagonal and lower wires
  - rebend test on the upper and lower wires
  - determination of the geometry of surface of the upper wire, diagonal and lower wire
  - determination of the conventional section of all the wires
  - shear strength

The samples of diagonal wires can be taken before welding on the lattice girder.

The samplings are to be distributed in the monthly production bearing the approved marking at a rate of a maximum sampling per bundle of lattice girders.

For the lattice girders, it is necessary when machines of the different types are used:

- either to separately consider the reinforcements produced by the machines of the same type
- or to distribute the series of tests on the production of the various machines.

The tests are carried out in accordance with the standards.

4.1.3 Chemical analysis

4.1.3.1 Method and equipment of analysis

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

4.1.3.2 Chemical analysis on semi-finished product

For the semi-finished products from which the lower wires of the lattice girder of type 1, the upper wire of the lattice girder of type 3 and all wires of the lattice girder of type 4 are manufactured, the producer must have a certificate of analysis by cast, unless these semi-finished products are delivered under the BENOR-mark. Moreover, all semi-finished products are provided with an identification so that traceability of corresponding cast is possible.

4.1.3.3 Chemical analysis on end products

The producer is not obliged to carry out the chemical analysis 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, chemical analysis in an external laboratory can be required, at his expenses.

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 the 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 computerized system, the aforementioned register is not essential. This system of classification must offer all the guarantees and be approved by the certification body.

After classification, the results of the lower wire of the lattice girders of type 1, those of the upper wire of the lattice girders of type 3 and those of all wires of the lattice girders of type 4 are gathered by diameter. The results of all the other wires per type (lower wire, diagonal wire, upper wire) are also gathered by diameter.

For the shear strength of the welded node, the results are regarded as a result got on the lower wire or the upper wire.

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 the encountered problems and their solutions must be joined (see § 4.3.2).

4.2 Statistical control by measurements

This control applies to the lower wire of the lattice girders of type 1, to the upper wire of the lattice girders of type 3 and to all wires of the lattice girders of type 4 for the determination of:

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 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 the test results

The statistical interpretation of test results is to be carried out monthly by product coming from the production over the period defined in § 4.1.4 for each group.

However, the manufacturer 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 2.7.1. of the Particular Rules BRP 279.

4.3 Statistical control by attributes

This control applies to the following properties:

- the dimensions of the lattice girder (height and width, pitch and slope)
- the conventional section of all wires
- for
  - Lower wires for lattice girders of type 1,
  - Upper wire for lattice girders of type 3,
  - All wires for lattice girders of type 4.
    - the height of the ribs (depth of the indentations)[22]
    - spacing of the ribs (spacing of the indentations)[23]
    - rebend test (not for the diagonal wire)
    - chemical analysis of semi-finished product from which the wire is produced
- on
  - the other wires:
    - tensile strength
- shear strength.

[22] In case the determination of surface configuration is achieved through the height and the spacing of the ribs (depth and spacing of the indentations). 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 according to § 4.2.

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

4.3.1 Principle

The interpretation of 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 non-conforming result is accepted.

For the other examined properties, the interpretation of results of the tests 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 wires 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 additional tests, its probable cause as well as that 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.

Maximum admitted number of non-conforming 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 relating 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 the authorisation of use of the BENOR-mark (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 equipment of the internal laboratory is in conformity with the provisions of ECU 606,
- that the producer has certificates of cast analysis of all the semi-finished products used,
- 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,
- that all actions were taken so that the 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 initiative of the producer to the certification body.
- 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 the results of autocontrol according to § 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, wires, rod resulting from straightened coil, manufacturing processes, geometrical profile) and by diameter.

5.1.2 Periodicity of the surveillance visits

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 inspection, the certification body chooses at least 1 product.

If the scope of the producer contains several types, the certification body shall sample

- lattice girders of type 1 at least twice a year and
- lattice girders of types 3 and 4 at least once a year.

Per product, the certification body samples 8 pieces of type 1, or 3 of type 2 or 15 of type 3 and 4 of the same geometry of the end products (= same model).

If end products are not available, the certification body checks, by consultation of the registers of production and the delivery slips, that the theoretical stock is indeed null.

When usually the stock of the products is too small to carry out the sampling of the necessary specimens, the producer regularly transmits to the certification body the program of production by announcing the probable dates of forwarding.

These samples are the subject of tests according to the indications of the table below (the chemical analysis is optional).

The artificial ageing must be carried out immediately before the tensile test and in the presence of the certification body.

	Type 1				Type 2			
	LW	**D**	**UW**	**LG**	**LW**	**D**	**UW**	**LG**
Height				3x (A)				3x (A)
Width				3x (A)				3x (A)
Pitch		3x (A)				3x (A)		
Slope				3x (A)				3x (A)
SG	3x (A)							
Section	15x (A)	3x (A)	3x (A)		3x (A)	3x (A)	3x (A)	
Rm	15x (S)	3x (A)	3x (A)		3x (A)	3x (A)	3x (A)	
OTP	15x (S)							
Bending	3x (A)							
CA	3x (A)							
SS	3x (A)		3x (A)		3x (A)		3x (A)	

	Type 3				Type 4			
	LW	**D**	**UW**	**LG**	**LW**	**D**	**UW**	**LG**
Height				3x (A)				3x (A)
Width				3x (A)				3x (A)
Pitch		3x (A)				3x (A)		
Slope				3x (A)				3x (A)
SG			3x (A)		3x (A)	3x (A)	3x (A)	
Section	3x (A)	3x (A)	15x (A)		15x (A)	3x (A)	15x (A)	
Rm	3x (A)	3x (A)	15x (S)		15x (A)	3x (A)	15x (S)	
OTP			15x (S)		15x (S)	3x (A)	15x (S)	
Bending			3x (A)		3x (A)		3x (A)	
CA			3x (A)		3x (A)	3x (A)	3x (A)	
SS	3x (A)		3x (A)		3x (A)		3x (A)	

Legend:

- LW: Lower wire, D: diagonal, UW: Upper wire, LG: Lattice-girder, SG: Surface Geometry, CA: Chemical analysis, OTP: Other tensile properties, SS: Shear Strength, LG: Lattice Girder
- 3x, 15x: 3 measurements, 15 measurements
- A, S: control by attribute, statistical control by measurements (cf. respectively 3.2.2 and 3.2.1)

5.1.3.2 Annual controls

Once a year, at the time of one of its inspections, the certification body takes 8 samples of a lattice girder of the type 1, or 15 samples of a lattice girder of the type 3 and 4 of the same geometry of the end products (= same model); each sample comes from a different lattice girder; the certification body lets cutting out 15 samples of the lower wire for type 1, of the upper wire for type 3 and of all wires for type 4 has cut out in two equal parts. The first half is subjected to the tensile test at the internal laboratory within the framework of routine checking according to § 5.1.3.1, the second half is sent for the execution of the tensile test in a control laboratory, indicated by the certification body.

For the producers already having an authorisation of use of the BENOR-mark, one admits that the tests are carried out only once a year by a laboratory indicated by the certification body.

For the producers who dispose of 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 tests referred to in the tables of § 5.1.3.1.

The samples for the possible chemical analysis are controlled in the internal laboratory, otherwise in a laboratory selected by the producer and accepted by the certification body. 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 checking

For the lower wires of the lattice girders of type 1, the upper wires of the lattice girders of type 3 and all wires of lattice girders of type 4, the interpretation of 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 regulations
   - 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. to check that for the R'_m/R'_e ratio and total elongation A_{gt} each individual value is higher than the specified value.

For the conventional section, the rebend test, the geometry of ribs or indentations, the shear strength of the welded nodes and the possible chemical analyses, the results must meet the standard.

For the diagonal and upper wires of the lattice girders of the type 1, for the wires composing the lattice girders of the type 2, for the diagonal and lower wires of the lattice girders of the type 3, for the diagonal wires of the lattice girders of the type 4, for dimensions of the lattice girders, the interpretation of the test results of the characteristics searched according to the table of the 5.1.3.1 paragraph. consist in checking that all results meet 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 in 0.

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 is completed later on 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 are 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.

5.2.2 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 are 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 are 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 to execute them in a unilaterally way.

Users who consider themselves being 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 HISTORY OF REVISIONS

Revisions 0 to 3

- Creation, updates

Revision 4

- Implementation of lattice girders of type 4.
- Reference to asbl BENOR vzw.

Revision 5

- Reformatting of the whole document.
- Edition in the English language.

Revision 6

- Deletion of §3.1.10, §3.2.1 first paragraph, §3.2.2

Revision 7

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