



**RAT.con VZW**

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# Evaluation Guideline:

*Product certification procedure for stationary, atmospheric, single and double walled, glass reinforced plastic (GRP), vertical or horizontal, cylindrical above ground process and storage tanks for the storage of liquids; with or without spill container*



**Evaluation Guideline TRA 05**

Valid from

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## Introduction

*The additional value of a voluntary quality label is the confidence it creates in the quality of the product the customer wants to use. The manufacturer of the product guarantees the continuity of the compliance of the product (or service) by continuous industrial or sectoral self-control. In addition, licensed manufacturers are periodically submitted to an external evaluation by the certification body who confirms its confidence in the manufacturer by means of assigning the quality label.*

*To establish its role as guardian of quality in the tank construction sector, being as such the sector operator, RAT.con vzw has surrounded itself with experts and functions also as a certification body for the BENOR quality label for tanks. The respect for the certification rules, the evaluation of the maintenance of self-control are tasks assigned to certification bodies, while the external product tests are executed by independent laboratories.*

*The quality of these services together with their objectivity and impartiality guarantees the authenticity of the quality label. These are the reasons why accreditation according to ISO 17065 is a requirement for the certification body.*

*This guideline describes the provisions of external control that must be respected by the collaborators and the subcontractors of RAT.con vzw in order to, with a sufficient level of confidence, confirm the compliance of the manufacturer to the requirements for continued qualification of the voluntarily BENOR-quality label.*

# Table of contents

<b>1. General</b> .....	5
1.1 Field of application.....	5
1.2 Acceptance of test reports .....	5
1.3 Product certificate.....	5
1.4 Modifications to an approved design .....	5
<b>2. Terms and definitions</b> .....	6
<b>3. Legal requirements</b> .....	7
<b>4. Normative references</b> .....	8
<b>5. Product certification procedure</b> .....	10
<b>6. Technical requirements</b> .....	11
6.1 Field of application.....	11
6.1.1 Single walled tanks with or without spill container .....	11
6.1.2 Double walled tanks .....	11
6.2 Documentation.....	12
6.2.1 constructor/customer information agreement.....	12
6.2.2 Design drawings .....	12
6.2.3 Calculations .....	12
6.2.4 Installation and user instructions.....	12
6.2.5 Marking of tank and/or spill container .....	12
6.3 Requirements and test methods of material properties .....	13
6.3.1 Raw material properties.....	13
6.3.2 Resistance to the stored medium .....	13
6.3.3 Design of double walled tanks with leak detection area.....	13
6.3.4 Resistance against UV-ageing.....	14
6.3.5 Electrical resistivity (if applicable).....	14
6.3.6 Fire retardants (if applicable) .....	14
6.3.7 Reaction to fire (if applicable).....	14
6.3.8 Laminating procedure .....	14
6.3.9 Laminator approval.....	14
6.3.10 laminator's record sheet .....	14
6.3.11 Welding procedure (for thermoplastic liners - if applicable) .....	15
6.3.12 welders approval (for thermoplastic liners – if applicable) .....	15
6.3.13 Repair procedure.....	15
6.3.14 Samples.....	15
6.4 Requirements and test methods for the tanks, spill container and double wall.....	15
6.4.1 Visual inspection.....	15
6.4.2 Wall thickness.....	15
6.4.3 Dimensional control .....	16
6.4.4 Capacity of the spill container.....	16
6.4.5 Leak detection system .....	16

6.4.6 Leak tightness (F.O.W.).....	16
6.4.7 Pressure resistance.....	16
6.4.8 Spark testing.....	16
6.4.9 Connections to the tank.....	16
6.4.10 Internal piping of the tank.....	17
6.4.11 Manhole and inspection openings.....	17
6.4.12 Elastomeric sealing elements.....	17
6.4.13 Barcol hardness.....	17
6.4.14 Short-term creep (advanced design).....	18
6.4.15 Inter laminar shear strength of laminates.....	18
6.4.16 Glass Content.....	18
6.4.17 Resistivity check (if applicable).....	18
<b>7. Quality system requirements.....</b>	<b>19</b>
7.1 General.....	19
7.2 Quality system.....	19
7.2.1 Identification of documents.....	19
7.2.2 Procedures and working instructions.....	19
7.2.3 Complaints, corrective- and preventive actions.....	19
7.2.4 Personnel.....	19
7.2.5 Calibration and maintenance.....	20
7.3 Design changes.....	20
7.4 Pre-certification conformity assessment.....	20
7.5 Product certification audits.....	20
7.6 External lab testing.....	20
7.7 Use of logo and certificates.....	20
7.8 Test and Inspection Plan.....	21
<b>Annex 1.....</b>	<b>23</b>
<b>Annex 2.....</b>	<b>24</b>
<b>Annex 3.....</b>	<b>25</b>
<b>Annex 4.....</b>	<b>26</b>
<b>Annex 5.....</b>	<b>27</b>
<b>Annex 6.....</b>	<b>29</b>

# 1. General

*The requirements in the product certification procedure (PCP) shall be taken into account by RAT.con vzw for both the evaluation of the initial request for certification and the continuance of a product certificate for stationary, atmospheric, single and double walled, glass reinforced plastic (GRP), vertical or horizontal, cylindrical above ground process and storage tanks for the storage of liquids.*

## 1.1 Field of application

*The tanks and spill containers are designed to be used for the atmospheric above ground storage of liquids. The storage tanks can be used both inside as outside.*

## 1.2 Acceptance of test reports

*When the manufacturer provides the certification body with test reports in order to demonstrate the compliance with the requirements of the PCP, the certification body or laboratory shall meet one of the applicable accreditation standards:*

*NBN EN ISO/IEC 17020:2012 Conformity assessment - Requirements for the operation of various types of bodies performing inspection*

*NBN EN ISO/IEC 17021:2015 Conformity assessment – Requirements for bodies providing audits and certification of management systems*

*NBN EN ISO/IEC 17024:2012 Conformity assessment – General requirements for bodies operating certification of persons*

*NBN EN ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories*

*NBN EN ISO/IEC 17065:2012 Conformity assessment – Requirements for bodies certifying products, processes and services.*

*The institution must always work with the latest version of the applicable standard.*

*The institution meets these criteria when a valid certificate of accreditation can be submitted. This certificate shall be relevant for the required testing.*

*When no certificate of accreditation can be submitted, the certification body can verify and decide whether the requirements of the accreditation standard are fulfilled, or retest the samples in an accredited laboratory. In case, there is no possibility of testing under accreditation, the certification body shall clearly indicate its acceptance of the test results in the process of the certification.*

## 1.3 Product certificate

*A model of the under this Evaluation Guideline BENOR product certificate issued has been included in Annex 3.*

## 1.4 Modifications to an approved design

*Any modification to an approved design shall be submitted to the certification body prior to taking effect. The certification body will decide whether the changes can be accepted or rejected under the active product certification.*

## 2. Terms and definitions

<i>Nominal capacity</i>	<i>the total calculated capacity. This capacity is the volume of the tank up to the connection with the roof in case of vertical tanks.</i>
<i>Reduced nominal capacity</i>	<i>the total calculated capacity up to the lower part of the overflow connection if provided or in case of double walled tanks, up to the volume of the double walled section of the tank.</i>
<i>Filling capacity</i>	<i>the filling capacity is limited to 95 % of the nominal capacity.</i>
<i>(Single walled) tank</i>	<i>tank constructed with a liner, structural laminate and a topcoat.</i>
<i>Double walled tank</i>	<i>tank constructed with a liner, structural laminate, interstitial space for leak detection, structural laminate and topcoat This type of tank can be installed without a spill container.</i>
<i>Liner</i>	<i>inner layer of the tank, consisting of either a single protective layer (SPL), chemical resistant layer (CRL) or thermoplastic resistant layer (TPL);</i>
<i>Structural laminate</i>	<i>Layered construction that contributes to the strength and stiffness properties of the tank;</i>
<i>Topcoat</i>	<i>outer protective layer</i>
<i>Spill container</i>	<i>container which is designed to enclose a tank to prevent leakage from the tank to the environment. The spill container is generally be made out of glass reinforced plastic (GRP);</i>
<i>Leak detection area</i>	<i>interstitial space between the single and double wall, which is equipped with a leak detection.</i>
<i>Stationary</i>	<i>permanent set-up filled on location.</i>
<i>Process tank</i>	<i>tank that is part of a process installation.</i>
<i>Storage tank</i>	<i>tank in which liquids are stored.</i>
<i>Conformity assessment</i>	<i>a number of tests and inspections to determine whether all the requirements of the Evaluation Guideline are met.</i>
<i>Product certification audit</i>	<i>tests and inspections carried out after the product certificate has been granted in order to determine whether the certified products continue to meet the requirements in the Evaluation Guide.</i>
<i>Liquid</i>	<i>an aggregation state in which substances can occur. In this state the substance or mixture is fluid.</i>
<i>Compliance certificate</i>	<i>document provided with a unique number, which is delivered by the certification body, for each BENOR tank, spill container or double wall.</i>

## 3. Legal requirements

The valid European standards for this Evaluation Guideline are:

- NBN EN 13121-1: GRP tanks and vessels for use above ground - Part 1: Raw materials - Specification conditions and acceptance conditions;
- NBN EN 13121-2: GRP tanks and vessels for use above ground - Part 2: Composite materials - Chemical resistance;
- NBN EN 13121-3: GRP tanks and vessels for use above ground - Part 3: Design and workmanship;
- NBN EN 13121-4: GRP tanks and vessels for use above ground - Part 4: Delivery, installation and maintenance.

The tanks must be made of material that is provided with a factory inspection report similar to the standard NBN EN 10204 type 2.2 or a test report according to the standard NBN EN 10204 type 3.1: Metallic products - Types of inspection documents, as is applicable in the steel industry.

The lamination must be carried out by certified laminators, in accordance to the standard NBN EN 13121-3 Annex E: approval testing of laminators.

If any welding is applicated it must be carried out by certified welders, in accordance to the standard NBN EN 13067: Plastics welding personnel - Qualification testing of welders - Thermoplastics welded assemblies.

The Evaluation Guideline will always follow the latest version of the proposed standards. As a result, the version number of the Evaluation Guideline (as well as a part of the content) may vary over time. Manufacturers will be notified when drastic changes are made in the Evaluation Guideline.

Note: receiving the BENOR-quality label shall not exempt the manufacturer of other legal requirements imposed by specific regional or national legislation.

Note: Equivalent standards can be accepted by the certification body. The manufacturer has to prove the equivalence of the standard.

## 4. Normative references

This list contains the normative references necessary for the correct application of this document. Reference is made to the most recent version of the standards listed at present.

Should any of the standards become obsolete or has been cancelled, the standard replacing it, is to be used.

<b><u>Standard number</u></b>	<b><u>Title</u></b>
NBN EN 13121-1	GRP tanks and vessels for use above ground - Part 1: Raw materials - Specification conditions and acceptance conditions
NBN EN 13121-2	GRP tanks and vessels for use above ground - Part 2: Composite materials - Chemical resistance
NBN EN 13121-3	GRP tanks and vessels for use above ground - Part 3: Design and workmanship
NBN EN 13121-4	GRP tanks and vessels for use above ground - Part 4: Delivery, installation and maintenance
NBN EN 10204	Metallic products - Types of inspection documents
NBN EN 13067	Plastics welding personnel - Qualification testing of welders - Thermoplastics welded assemblies
NBN EN 13501-1	Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests.
NPR-CLC-IEC/TR 60079-32-1	Explosive atmospheres - Part 32-1: Electrostatic hazards-guidance
NBN EN 1991-1-3+ ANB	Eurocode 1 - Actions on structures - Part 1-3: General actions - Snow loads
NBN EN 1991-1-4+ANB	Eurocode 1: Actions on structures - Part 1-4: General actions - Wind actions
NBN EN 1998-1	Eurocode 8: Design of structures for earthquake resistance - Part 1: General rules, seismic actions and rules for buildings
NBN-EN 681-1+AC	Elastomeric seals - Material requirements for pipe joint seals used in water and drainage applications - Part 1: Vulcanized rubber
NBN EN 59	Glass reinforced plastics - Determination of indentation hardness by means of a Barcol hardness tester
NBN EN ISO 1183	Plastics - Methods for determining the density of non-cellular plastics
NBN EN ISO 527-4	Plastics - Determination of tensile properties - Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites
NBN EN ISO 178	Plastics - Determination of flexural properties
NBN EN ISO 75-3	Plastics - Determination of temperature of deflection under load - Part 3: High-strength thermosetting laminates and long-fibre-reinforced plastics
NBN EN ISO 6721	Plastics - Determination of dynamic mechanical properties
NBN EN ISO 1172	Textile-glass-reinforced plastics - Prepregs, moulding compounds and laminates - Determination of the textile-glass and mineral-filler content - Calcination methods



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<i>BRL-K21011</i>	<i>Evaluation guideline for the Kiwa product certificate for Glass reinforced plastic (GRP) tanks, with or without spill containers, for the above ground storage of chemicals</i>
<i>NBN EN 59</i>	<i>Glass reinforced plastics - Determination of indentation hardness by means of a Barcol hardness tester</i>
<i>NBN EN ISO 899-1</i>	<i>Plastics – Determination of creep behaviour – Part 1: Tensile creep</i>
<i>NBN EN ISO 899-2</i>	<i>Plastics – Determination of creep behaviour – Part 2: Flexural creep by three-point loading</i>
<i>NBN EN ISO 14125</i>	<i>Fibre-reinforced plastic composites – Determination of flexural properties</i>
<i>NBN EN ISO 1172</i>	<i>Textile-glass-reinforced plastics - Prepregs, moulding compounds and laminates - Determination of the textile-glass and mineral-filler content - Calcination methods</i>
<i>NBN EN ISO 3915</i>	<i>Plastics – Measurement of resistivity of conductive plastics</i>

## 5. Product certification procedure

*When applying for certification under this Evaluation Guideline, the manufacturer has to read this document together with the product certification procedure regulation document (CR). The CR will always be available on the website of the certification body as well as the latest version of the Evaluation Guideline.*

*Upon his decision to proceed with the certification, the certificate applicant needs to send his application to the certification body in writing.*

*The certification body shall then provide the manufacturer with a number of documents to allow him to proceed and will provide a copy of the financial regulation (FR) for the certification.*

*The conformity assessment shall be carried out as described in the product and construction requirements in this Evaluation Guideline, including the test methods.*

*Depending on the type of product to be certified the conformity assessment shall pertain to the following inspections:*

- *sample testing for product requirements and performance requirements (ITT= initial type testing);*
- *evaluation of the production process;*
- *evaluation of the quality system and the factory production control (FPC);*
- *evaluation of the functionality of other required procedures.*

*Prior to the conformity assessment, the internal quality system has to be operational for at least three months.*

*On a mutually agreed date the conformity assessment will take place on the manufacturer's premises.*

*Upon conclusion of the conformity assessment by the auditor, an audit report will be issued by the auditor. In this report possible shortcomings will be listed.*

*This audit report shall be evaluated by a revisor. He/she shall evaluate the results of this.*

*Upon reception of the audit report, the manufacturer is to react on the comments made by the auditor within the time frame indicated under art. 8.4 of the CR, with a maximum duration of six months.*

*Once the comments have been reacted to and the proposed modification to the internal quality system have been agreed upon by the certification body, a product certification decision will be made by a person that has not been involved in the conformity assessment. The manufacturer will be notified in writing (with eventual reason of decline). If the certification is granted, the manufacturer will receive a Product Certificate to make the certification official (see annex 3).*

*The certification body will publish the certified companies on the website ([www.ratcon.be](http://www.ratcon.be)) including the date of the validity of the certification.*

*After having been granted the product certificate, the manufacturer may start the production of BENOR- labelled tanks.*

*The manufacturer (now certification holder) shall provide the (series of) tank number(s) produced under product certification to the certification body.*

*Each tank and/or spill container or double wall shall have a compliance certificate provided by the certification body with a unique BENOR number. The manufacturer shall label the BENOR tanks in accordance with the requirements of BENOR as indicated under Annex 4.*

*Once the product certification under this Evaluation Guideline is obtained, the certification holder will be subject to regular audits. The frequency of these product certification audits is determined under part 7 of this Evaluation Guideline.*

## 6. Technical requirements

The requirements in this section relate to both single walled process or storage tanks, with or without glass reinforced plastic spill containers as to double walled process or storage tanks.

If required there will be a specified split between single and double walled tanks.

The legal requirements (chapter 3) as well as the quality requirements (chapter 7) remain applicable for both types.

### 6.1 Field of application

#### 6.1.1 Single walled tanks with or without spill container

The single walled process or storage tanks are designed to be used for:

- storage or processing of fluids;
- with or without thermoplastic liner;
- horizontal cylindrical tanks with dished ends,
- vertical cylindrical tanks with a flat, conical or dished roof or bottom;
- above ground installation;
- indoor or outdoor installation;
- atmospheric pressure i.e. with a design pressure  $\leq 500$  mbar (50 kPa);
- construction at the manufacturer or on site;
- maximum filling capacity: 95 % of the nominal capacity;
- normal working temperature between  $- 40$  °C and  $+ 120$  °C.

The spill containers are designed for:

- secondary containment of fluids;
- above ground installation;
- construction at the manufacturer or on site;
- atmospheric pressure;
- normal working temperature between  $- 40$  °C and  $+ 120$  °C;
- at least 110 % of the nominal capacity of the tank.

Note: the tanks and spill containers are made from glass reinforced plastics.

Note: if scrubbers or water seals are present in the installation, a pressure relief valve will need to be foreseen in addition to the inclusion in the calculation of the possible over and under pressure that may occur.

All storage tanks must be installed with an amenity for collecting liquids. If there is no approved amenity, a spill container, made according to the requirements of this Evaluation Guideline must be applied.

If the manufacturer supplies both the tank and the spill container, he is responsible for the correct arrangement of the assembly in accordance with the installation regulations.

#### 6.1.2 Double walled tanks

The double walled process or storage tanks are designed to be used for:

- storage or processing of fluids;
- above ground installation;
- with or without thermoplastic liner;
- equipped with an interstitial space for leak detection;
- horizontal cylindrical tanks with dished ends,
- vertical cylindrical tanks with a flat, conical or dished roof or bottom;
- indoor or outdoor installation;
- atmospheric pressure i.e. with a design pressure  $\leq 500$  mbar (50 kPa);
- construction at the manufacturer or on site;
- normal working temperature between  $- 40$  °C and  $+ 120$  °C.
- maximum filling capacity: 95 % of the nominal capacity.

Note: if scrubbers or water seals are present in the installation, a pressure relief valve will need to be foreseen in addition to the inclusion in the calculation of the possible over and under pressure that may occur.

## 6.2 Documentation

### 6.2.1 Constructor/customer information agreement

The information agreement shall at a minimum comply with annex 6.

### 6.2.2 Design drawings

The manufacturer shall define and submit for approval all tank types for certification to the certification body.

The details of the design, materials to be used, the wall build-up (glass fiber types), the laminating details of the completely assembled tank and the tolerances on the height and diameter shall be specified in the technical drawings by the manufacturer.

The certification body shall evaluate the drawing and designs for approval.

### 6.2.3 Calculations

The design details and calculations of the structural laminate shall be according to the standard NBN EN 13121-3. The design is based on a life expectancy of at least 20 years for the tank and 5 years for the spill container, where the spill container has to be calculated as a storage tank and anchoring of the spill container must always be provided.

For outdoor installation the following parameters need to be taken into account:

- wind speed depending on the region of installation (according to the standard NBN EN 1991-1-4+A1);
- snow load depending on the region of installation (according to the standard NBN EN 1991-1-3+A1).

The manufacturer shall refer to the temperature, snow load and wind speed in the installation and user instructions.

For earthquake prone areas and when specified by the client, the calculations shall be in accordance with the standard NBN EN 1998-1.

The most recent version of the standard must always be used for the calculations.

The partial influence and design factors are applied according to table 8 of the standard NBN EN 13121-3.

Note: if vertical tanks are produced with a sloped bottom, the manufacturer will have to document and detail his code of good practice as this is not covered by the standard NBN EN 13121.

### 6.2.4 Installation and user instructions

The manufacturer shall provide proper written installation and user instructions as well as transport and maintenance instructions in Dutch, French and German.

For installations abroad, the instructions may also be written in English.

### 6.2.5 Marking of tank and/or spill container

Every storage or process tank and spill container be marked with the following:

- name and number of the certification body;
- manufacturer's name and/or trade mark;
- serial number of tank and/or spill container;
- month and year of construction;
- nominal capacity of the tank in liters or m<sup>3</sup>;
- filling capacity of the tank in liters or m<sup>3</sup>;
- stored medium (in case of chemicals CAS-number and corresponding concentration and CLP label);
- location of the tank: indoor or outdoor;
- spark test at XX kV (according to NBN EN 13121-3: D14);
- test pressure;
- maximum operating temperature ( $\leq$  design temperature);
- calculated life expectancy;
- construction standard;
- dimensions;
- material.

The identification plate is designed to permanently mark the data, and fitted in such a way it cannot be removed nor erased from the tank.

The identification plate mounted at eye level is located on both the tank and the spill container. If the spill container impedes the view of the identification plate of the tank, a second identification plate for the tank must be mounted next to the identification plate of the spill container or double wall.

### 6.3 Requirements and test methods of material properties

#### 6.3.1 Raw material properties

The construction materials to be used shall be in accordance with the requirements of the standard NBN EN 13121-1 (thermoplastic liner, thermosetting resins, curing agents, reinforcing materials, additives, fillers).

The material properties for the materials used for the tank and the spill container must correspond to the physical, chemical and mechanical properties used in the calculations. This can be demonstrated by means of inspection reports.

#### 6.3.2 Resistance to the stored medium

The tank and spill container shall be resistant to the liquid for a minimum period of 20 years and 6 months respectively.

The liner shall be in compliance with the standard NBN EN 13121-2.

Additionally, use may also be made of the DIBt Medienlisten 40. In those cases where the resistance to chemicals as indicated by the standard NBN EN 13121-2 differs from that given by the DIBt, the value given in the standard NBN EN 13121-2 shall be used.

In any case the most recent version of mentioned resistance lists are to be used.

The resistance can be demonstrated by means of a verification report.

In case the stored liquid cannot be found in the resistance lists, individual advise of the material suppliers can be used. The material advise needs to be presented in writing.

In case no suitable liner can be found for the minimum required life expectancy of 20 years, the structural laminate can be calculated for a shorter life span. This reduced life span must be documented and clearly stated on the identification plate (see 6.2.4)

The structural laminate of the tank and spill container or double wall must not be equally resistant to the stored liquids, but shall be in compliance to the standard NBN EN 13121-2 Annex A.

In case no suitable resin can be found for the minimum required life expectancy of 20 years, the structural laminate has to be calculated for a shorter life span. This reduced life span must be documented and clearly stated on the identification plate (see 6.2.4)

The resin used for the topcoat of the tank shall be suitable for a period of 3 months against the medium stored. Verification of period of resistance needs to be documented.

Note: all of the above is also applicable to the tank connections, manhole and inspection openings.

#### 6.3.3 Design of double walled tanks with leak detection area

The design of the structural laminate of double walled tanks shall be in accordance with the requirements of the standard NBN EN 13121-3.

To create the leak detection area, the manufacturer shall use one of the following materials:

- 3D spacer glass fabrics;
- conductive layer (separated from the stored conductive medium through a nonconductive lining).

The leak detection area required for leak detection purposes shall not contribute to the calculation of the structural laminate strength of the tank.

The leak detection area shall at least cover the bottom and the cylindrical section up to the nominal capacity of the tank.

In case of the use of 3D glass fabric, the interstitial space shall be designed to withstand an overpressure or under pressure dependent on the system used.

The system shall be in accordance to the requirements of the standard EN 13160-2.

If an under pressure system is used, the leak detection system shall have its measuring point at the lowest point of the interstitial space. This is not a requirement for overpressure systems.

In case a conductive layer is used as leak detection system, the following restriction applies: the liquid needs to have a minimum conductivity of 200  $\mu\text{S}$  (to be confirmed by the manufacturer).

#### 6.3.4 Resistance against UV-ageing

The tanks and spill containers for outdoor storage shall be UV resistant. In order to achieve this, ultra-violet absorbers shall be incorporated into the laminate or outer layers, in accordance with the supplier's recommendations (usually at a level of less than 0,5 % by mass), according to the standard EN 13121-1 §7.7.

The resin supplier or manufacturer shall supply a document confirming the suitability of the UV absorber.

#### 6.3.5 Electrical resistivity (if applicable)

Where the build-up of static electricity may cause problems, the surface conductivity has to be decreased by reducing the surface resistance to  $< 10^6 \text{ Ohm}$ . Depending on the local situation this will be applicable for the inner wall or outer wall or both.

In case of inner application, liquid earthing is necessary by means of a metallic or conductive plastic pipe.

The testing standard will be NBN EN ISO 3915 according to the standard NBN EN 13121-3 clause D12.

The manufacturer shall document the way static electricity build up will be avoided.

#### 6.3.6 Fire retardants (if applicable)

Fire retardants may be added to specified laminate layers to meet any requirements for fire resistance (NBN EN 13121-1 § 7.4).

The manufacturer shall provide documentation as to the suitability of the fire retardants used.

#### 6.3.7 Reaction to fire (if applicable)

When required or specified, the external surface layer(s) of the tank and/or spill container shall be modified to meet these requirements.

The material shall be tested and classified in accordance to the standard NBN EN 13501-1:2019.

#### 6.3.8 Laminating procedure

The manufacturer shall have an approved laminating procedure for each type of tank according to the standard NBN EN 13121-3.

The procedures will be kept up to date and valid procedures will need to be presented when applying for a laminator approval certificate.

#### 6.3.9 Laminator approval

All laminating shall be done by qualified personnel. The qualification must be carried out according to the standard NBN EN 13121-3 Annex E: approval testing of laminators by an external inspection authority. Equivalent certificates can be accepted by the certification body.

Laminator approval certificates will need to be kept up to date and presented for every laminator involved in the production of certified tanks.

#### 6.3.10 Laminator's record sheet

For every tank, the laminator will keep a record sheet during the production cycle.

The laminator sheet should contain at least the following information;

- Project/tank identification (nominal capacity, product to be stored, diameter...)
- The minimal required thickness of the laminate and the actual thickness measured (including overlaminates)
- Specification of the different glass types
- The resins to be used
- The total quantity of each glass type

- The laminate build-up
- The length of the total tank, the cylinder of the tank and the length of the overlaminates
- The results of the visual inspection (imperfections - see table 32 of NBN EN 13121-3)

The laminator sheet needs to be signed off for approval by the main laminator and verified by the quality system manager.

#### 6.3.11 Welding procedure (for thermoplastic liners – if applicable)

The manufacturer shall have an approved welding procedure for each type of weld according to the standard NBN EN 13067. The requirements in the standard EN 13121-3:2016 under article 17.4.2. need to be taken into account.

The procedures will be kept up to date and valid procedures will need to be presented when applying for a welder's certificate.

#### 6.3.12 Welders approval (for thermoplastic liners – if applicable)

If any welding is carried out it shall be done by qualified personnel. The qualification must be carried out according to the standard NBN EN 13067: Plastics welding personnel - Qualification testing of welders - Thermoplastics welded assemblies. Equivalent certificates can be accepted by the certification body.

Welder's certificates will need to be kept up to date and presented for every welder involved in the production of certified tanks.

#### 6.3.13 Repair procedure

When the thickness of the laminate is below the approved value on the drawings or the imperfections in the laminate are outside the limits given in Table 32 of the standard NBN EN 13121-3, the laminate can be repaired following an accepted specified repair procedure.

Repair procedures shall be technically endorsed, recorded in the manufacturing document and made available for inspection as required.

#### 6.3.14 Samples

Samples (if any) taken from cut-outs shall be made available for inspection and testing.

Alternatively, specimen laminates may be prepared (same time, same materials, same manner of laminating and curing as for the tank).

The representative samples and the results of the testing thereof will be kept with the tank databook.

### 6.4 Requirements and test methods for the tanks, spill container and double wall

The design of the tank, spill container or double wall shall be in accordance to the legal requirements as in chapter 3 of this Evaluation Guideline.

The manufacturer will issue a written registration of the test results for each of the inspections listed hereafter.

#### 6.4.1 Visual inspection

The visual inspection must include all aspects of table 32 – Permissible imperfections in laminates of the standard NBN EN 13121-3:2016.

If applicable the visual inspection of the welds (quality and thickness) must be carried out.

The manufacturer's quality system shall include clear procedures for approval and rejection.

#### 6.4.2 Wall thickness

The wall thickness and the wall build-up of the tank and spill container shall not be less than specified or on the manufacturer's approved drawings (according to the approved calculations).

The manufacturer's quality system shall include clear procedures for approval and rejection.

#### 6.4.3 Dimensional control

The measured sizes must be in accordance with the construction plan.

The cylindrical body of the tank, the spill container or double wall must be round. The out of roundness of the nominal diameter, as calculated in accordance with the standard NBN EN 13121-3, is determined by four measurements (angle of 45°) at three different measuring points equally spread over the cylinder. The permissible tolerance is in accordance with table 31 of the standard NBN EN 13121-3.

Details of dimensions, flat spots, straightness, the setting of the nozzles, squareness of flanges and flatness of faces shall be within the dimensional tolerances detailed in the figures 64 to 67 of the standard NBN EN 13121-3.:2016.

The manufacturer's quality system shall include clear procedures for approval and rejection.

#### 6.4.4 Capacity of the spill container

The spill container must have a capacity of at least 110 % of the nominal capacity of the tank.

A maximum of one tank can be placed in the spill container.

The actual capacity shall be recorded by the manufacturer.

#### 6.4.5 Leak detection system

A double walled tank shall be provided with a leak detection system as foreseen under 6.3.3.

The installation of the leak detection system shall be in accordance with the instructions of the manufacturer of the leak detection system.

After installation, the leak detection system shall be tested for proper functionality by the tank manufacturer

Note: when a conductive layer is used as leak detection system, this test of the leak detection system will be carried out at the same time as the leak tightness test (6.4.6) as the tank needs to be filled with water to be able to test the functionality.

The result of the functionality test shall be recorded by the manufacturer and included in the documentation presented to the end user.

#### 6.4.6 Leak tightness (F.O.W.)

All tanks, spill containers or double walls must be tested for leak tightness.

The tank must be filled with water for a minimum of 24 hours at the production site, under the responsibility and according to the instructions of the manufacturer. The customer can also choose to test the tank by filling it with the liquid to be stored at their own location.

No leaks or deformation may be detected. The results will be recorded by the manufacturer.

#### 6.4.7 Pressure resistance

An additional pressure resistance test may be required by use of an additional water column on the tank in accordance with the required operating pressure of the tank or as foreseen in the tank calculations.

No leaks or deformations may be detected. The results will be recorded by the manufacturer.

#### 6.4.8 Spark testing

When use is made of a thermoplastic liner, the welds shall be spark tested for discontinuities. Any discontinuity shall be repaired and the retesting shall be performed at the original test voltage.

The test shall be performed in accordance with the standard NBN EN 13121-3 (D14) and the results shall be recorded by the manufacturer.

#### 6.4.9 Connections to the tank

If the tank is equipped with the connections listed below, the following additional requirements must be taken into account



- *Filling pipe:*  
The filling pipe shall have a minimal diameter of DN 50 and shall be located opposite the vent (as far away as possible);
- *Suction pipe:*  
The suction pipe shall have a minimal diameter of DN 50;
- *Fluid level indicator:*  
The fluid level indicator shall have a minimal diameter of DN 40. This shall be located away from the filling pipe (unless in a tube);
- *Vent:*  
The minimal diameter of the vent is not specified, but shall be at least 1,5 times the size of the filling pipe or suction pipe (the largest value), to prevent either over pressure or under pressure in the tank. This shall be located at the highest point of the tank (above the liquid level);
- *Overfill protection:*  
The minimal diameter and location of the overfill protection is not specified.

Preferably all connections will be made above the maximum liquid level.

For tanks with a double wall, a connection below the maximum liquid level can be accepted only if it is provided with a double walled flange where the interstitial space is connected to a leak detection system. The flange should ideally be equipped with an automatic "normally closed" safety valve or a manual valve in the event of a power failure (or system that absorbs the power failure).

#### 6.4.10 Internal piping of the tank

The internal piping is an integral part of the tank.

The following connections are allowed to have internal piping in the tank:

- *Filling pipe:* if provided, this pipe shall have a minimal 3 mm diameter hole as high as possible;
- *Suction pipe:* distance of the lowest point of this pipe to the bottom of the tank shall be at least half of the diameter of the used pipe.

#### 6.4.11 Manhole and inspection openings

Tanks must be provided with a manhole with an internal diameter of at least DN 600. The manhole will be placed in the cylindrical body or on the roof.

Horizontal tanks with a cylindrical length longer than 10 m shall be equipped with two manholes (minimal one per compartment and a maximum distance of 5 m of any measuring point of the tank to the center of the manhole). The manhole flange shall not extend beyond 20 mm into the tank in order to ensure a free flow of the vapors of the stored chemical.

Vertical tanks with a cylindrical height higher than 10 m shall be equipped with a manhole in the lower cylindrical part of the tank. In case of a double walled tank, this manhole should be executed double walled as well.

If the tank has a nominal capacity < 3.000 l, an inspection opening can be used instead of a manhole.

This opening will have an internal diameter of at least DN 300.

Manholes and/or inspection openings must always be free of connections.

#### 6.4.12 Elastomeric sealing elements

The manufacturer shall provide information regarding the resistance of the seals to the stored medium. He can use the existing resistance list to support his choice.

If he cannot find the required information in resistance lists, he can request written advice from the seal manufacturer.

If no information can be found regarding the resistance, the resistance to the medium stored will need to be tested. Testing has to be in compliance with the requirements of the standard NBN EN 681-1+AC:2002 (or equal). The tests are to be carried out with the stored liquids. The seal cannot be damaged after the swelling test has been carried out.

The test results shall be inspected by the certification body.

#### 6.4.13 Barcol hardness

The Barcol hardness test is to be carried out on all parts of the tank (cylinder, roof and bottom(s)).

*It may also be carried out on the inner and outer surfaces on representative samples (bottoms, cylinder, etc.) to establish that the resin has reached the appropriate level of cure.*

*In the case of polyester type resins and vinyl ester resins the Barcol hardness of the cured resin shall be not less than 80 % of the value quoted by the resin manufacturer for the particular grade of resin used for the laminate.*

*The test shall be executed according to the standard NBN EN 59.*

*The results of the test are to be recorded.*

#### 6.4.14 Short-term creep (advanced design)

*The flexural short-term creep test shall be used to verify the factor  $A_5$  and will be executed according to NBN EN 13121-3 (D.10).*

#### 6.4.15 Inter laminar shear strength of laminates

*The test shall be executed according to test D.7 described in the standard NBN EN 13121-3.*

*The inter laminar shear strength shall not be less than the values given in table 4 of the standard NBN EN 13121-3. Where combinations of laminates are used, the lowest value shall be used.*

*The results of the test are to be recorded.*

#### 6.4.16 Glass Content

*The test shall be executed according to the standard NBN EN ISO 1172.*

*The glass content shall be between the limits specified in the laminating procedure.*

*The glass residue after the loss by ignition shall be examined to determine if the lay-up conforms to that specified in the laminating procedure.*

*The results of the test are to be recorded.*

#### 6.4.17 Resistivity check (if applicable)

*The test shall be executed according to the standard NBN EN ISO 3915.*

*The electrical resistivity shall be  $< 10^6$  Ohm.*

*The results of the test are to be recorded.*

# 7. Quality system requirements

## 7.1 General

*This chapter contains the requirements that have to be fulfilled by the manufacturer's quality system.*

## 7.2 Quality system

*The manufacturer shall appoint a quality system manager (internal or external).*

*The manufacturer has to implement an internal quality system.*

*Before the pre-certification conformity assessment can take place, the internal quality system has to be operational for at least three months.*

*This quality system has to include the following items:*

### 7.2.1 Identification of documents

*The manufacturer shall have a procedure for the identification of documents, which includes the following:*

- *How the identification of the documents is done;*
- *How changes to documents shall be done;*
- *Where documents are archived.*

*All documentation have to be archived for a minimum period of ten years and preferably the life of the tank.*

*The manufacturer shall have an overview list of all documents and their latest review.*

### 7.2.2 Procedures and working instructions

*The manufacturer shall identify all processes for the production and self-control and shall have procedures and working instructions for all the processes.*

*Which include at least the following:*

- *Procedure inspection incoming materials;*
- *Inspection during production;*
- *Inspection of final products;*
- *Registration of test results (internally and externally);*
- *Procedure for non-conforming products;*
- *Procedure for repairs.*

### 7.2.3 Complaints, corrective and preventive actions

*The manufacturer shall have a procedure and keep registrations for the handling of complaints, corrective and preventive actions, which include the following:*

- *Identification of the complaints;*
- *Registration of the complaints (and an overview list);*
- *How complaints are handled;*
- *Responsible person for handling the complaints.*

### 7.2.4 Personnel

*The manufacturer shall have a procedure and keep registrations for the qualification of personnel, which includes the following:*

- *Determine the criteria for the competence of personnel for each function;*
- *Identify training needs and provide, as necessary, training programs;*
- *Demonstrate that the personnel has the required competencies for each function.*

#### 7.2.5 Calibration and maintenance

The manufacturer shall have a procedure and keep registrations for the calibration and maintenance of equipment, which include the following:

- Identification of production equipment;
- Calibration/maintenance scheme;
- Overview of all equipment and status;
- Acceptance criteria after calibration/maintenance.

#### 7.3 Design changes

Design changes of the certified products shall always be reported to the certification body prior to the start of production.

The certification body shall evaluate the drawing and designs for approval.

#### 7.4 Pre-certification conformity assessment

The pre-certification conformity assessment covers all aspects of the Evaluation Guideline.

The maximum duration of this pre-certification conformity assessment period is set at six months.

Upon completion of the conformity assessment, the manufacturer will receive a product certificate from the certification body (see Annex 3).

Once the product certification is obtained, the manufacturer will be subjected to periodical product certification audits.

#### 7.5 Product certification audits

The product certification audits shall be conducted as summarized in the table in 7.8 (Test and Inspection Plan).

The auditor shall at random choose a tank, produced under this TRA. All the requirements for the tank under this TRA shall be checked.

The auditor also has the possibility to choose to visit the end user, where a BENOR-tank has been installed. The appointment at the clients premises will then be made in mutual consultation.

Depending on the availability of a tank at the manufacturer, the auditor can decide to perform control measurements to evaluate the measurements taken by the manufacturer.

Initially, three audits a year will be planned. The frequency can be reduced to two audits after the first year if all requirements are fulfilled and if production is limited to thirty tanks a year.

Whenever more tanks are produced, the frequency of the audits can stay at three audits a year.

#### 7.6 External lab testing

Periodically, the documents on the material properties shall be submitted to further testing by taking some samples. Testing (according to the table in 7.8) shall be executed by an external lab (every thirty tanks and at least once per year).

#### 7.7 Use of BENOR-logo and certificates

The correct use of the BENOR-logo (Annex 4) and use of issued certificates shall be examined.

7.8 *Test and Inspection Plan (TIP)*

Features	Article TRA	Internal control (*)	Control by external lab (**)	Visit Certification Body (***)
<b>General documentation</b>				
<i>Design drawings</i>	6.2.1	X		<i>Each visit</i>
<i>Calculations/parameters</i>	6.2.2	X		<i>Each visit</i>
<i>Installation and user instructions</i>	6.2.3	X		<i>Each visit</i>
<i>Marking of the tank and/or spill container</i>	6.2.4	X		<i>Each visit</i>
<b>Material properties</b>				
<i>Raw material properties</i>	6.3.1	X		<i>Each visit</i>
<i>Resistance to the stored medium</i>	6.3.2	X		<i>Each visit</i>
<i>Design of double walled tanks with leak detection area</i>	6.3.3	X		<i>Each visit</i>
<i>Resistance against UV-ageing</i>	6.3.4	X		<i>Each visit</i>
<i>Electrical resistivity (if applicable)</i>	6.3.5	X		<i>Each visit</i>
<i>Fire retardants (if applicable)</i>	6.3.6	X		<i>Each visit</i>
<i>Reaction to fire (if applicable)</i>	6.3.7	X		<i>Each visit</i>
<i>Laminating procedure</i>	6.3.8	X		<i>Each visit</i>
<i>Laminator approval</i>	6.3.9	X		<i>Each visit</i>
<i>Laminator's record sheet</i>	6.3.10	X		<i>Each visit</i>
<i>Welding procedure (for thermoplastic liners – if applicable)</i>	6.3.11	X		<i>Each visit</i>
<i>Welders approval (for thermoplastic liners – if applicable)</i>	6.3.12	X		<i>Each visit</i>
<i>Repair procedure samples</i>	6.3.13	X		<i>Each visit</i>
	6.3.14	X		<i>Each visit</i>
<b>Requirements of the tank and/or spill container</b>				
<i>Visual inspection</i>	6.4.1	X		<i>Each visit</i>
<i>Wall thickness</i>	6.4.2	X		<i>Each visit</i>
<i>Dimensional control</i>	6.4.3	X		<i>Each visit</i>
<i>Capacity of the spill container</i>	6.4.4	X		<i>Each visit</i>
<i>Leak detection system</i>	6.4.5	X		<i>Each visit</i>
<i>Leak tightness (F.O.W.)</i>	6.4.6	X		<i>Each visit</i>
<i>Pressure resistance</i>	6.4.7	X		<i>Each visit</i>
<i>Spark testing</i>	6.4.8	X		<i>Each visit</i>
<i>Connections to the tank</i>	6.4.9	X		<i>Each visit</i>
<i>Internal piping of the tank</i>	6.4.10	X		<i>Each visit</i>
<i>Manway and inspection openings</i>	6.4.11	X		<i>Each visit</i>
<i>Elastomeric sealing elements</i>	6.4.12	X		<i>Each visit</i>
<i>Barcol hardness</i>	6.4.13	X	X	<i>Each visit</i>
<i>Short-term creep (advanced design)</i>	6.4.14	X	X	<i>Each visit</i>
<i>Inter laminar shear strength of laminates</i>	6.4.15	X	X	<i>Each visit</i>
<i>Glass content</i>	6.4.16	X	X	<i>Each visit</i>
<i>Resistivity check (if applicable)</i>	6.4.17	X		<i>Each visit</i>
<b>Internal quality control</b>				
<i>Identification of documents</i>	7.2.1	X		<i>Each visit</i>
<i>Procedures and working instructions</i>	7.2.2	X		<i>Each visit</i>
<i>Complaints, corrective and preventive actions</i>	7.2.3	X		<i>Each visit</i>
<i>Personnel</i>	7.2.4	X		<i>Each visit</i>
<i>Calibration and maintenance</i>	7.2.5	X		<i>Each visit</i>
<i>Design changes</i>	7.3			<i>Each visit</i>
<i>External lab testing</i>	7.6			<i>1x/year</i>
<i>Use of logo and certificates</i>	7.7			<i>1x/year</i>

(\*) the internal control shall be conducted by the manufacturer for each tank. Except for the tank properties, most self-control is purely administrative.

(\*\*) external controls: frequency at least once a year.

(\*\*\*) once the product certification is obtained.

The audit report will contain three types of remarks (CR art. 8.5):

- A-remark: subparts that show deviations in a way that the quality of the product can no longer be guaranteed.
- B-remark: subparts that show deviations, but do not compromise the quality of the product immediately.
- C-remark: subparts that show deviations, but do not compromise the quality of the product in any way.

After the audit, the manufacturer will receive an audit report according to CR art. 8.4.1.

The certification regulations (art. 15) gives an overview of the penalties whenever remarks made during the audit are not resolved.

# Annex 1

*Whenever a BENOR-tank shall change owner, the certification body shall be notified of this change.*

*The seller of the tanks shall provide the new owner with the complete BENOR-file of the tank.*

## Annex 2

*When a BENOR-tank is designed, the intended liquid that will be stored is always taken into consideration.*

*Whenever a different liquid is going to be stored, the certification body needs to be notified prior to the product change.*

*The certification body will decide whether the product change can take place or not.*

*In any case documents like new calculations (according to article 6.2.2), resistance verification (according to 6.3.3) will need to be presented to the certification body. As a result of this product change, further inspection as under annex 1 may be required.*



## Annex 3: Product certificate

Certificate



**RAT.con VZW**  
Gentsesteenweg 45  
9300 Aalst  
Tel 051/703405  
Email: info@ratcon.be



**BENOR**  
TROUW AAN KWALITEIT  
LA QUALITÉ EN CONFIANCE



**BELAC**  
602-PROD

Certificate number:

Date of issue:

**Product certificate**

**stationary, atmospheric, single and double walled, glass reinforced plastic (GRP), vertical or horizontal, cylindrical above ground process and storage tanks for the storage of liquids, with or without spill container**

Based on the initial conformity assessment and periodical certification audits by RAT.con, the tanks produced under the submitted scope by xxx marked with the BENOR quality label, comply with the evaluation guideline TRA05 (revision xx) issued by RAT.con.

RAT.con vzw

Certified company :

Production site :

Valid until:





## Annex 4: BENOR label



### Use of the BENOR-label

If the BENOR label relates to a product, it should, if possible, be fixed to that product itself. If this is impossible, eg in the case of bulk goods, the BENOR label is at least used in the delivery note.

The BENOR label may also be used for all kinds of trade documents and publications of the certificate holder. The application of the BENOR label may never give rise to confusion with regard to the products, processes or services to which the certification applies and the manufacturer or supplier to whom the certificate was issued.

The application of the BENOR label on the product, on the delivery note or on other commercial documents and publications in no way prevents the marking or use of another individual or collective brand, insofar as any ambiguity is excluded here.

The dimensions of the BENOR label are at least in the order of magnitude of the other indications that appear on the product, on the delivery note or the commercial documents or publications.

### Marking the BENOR-label

The BENOR quality label on the product shall be supplemented by the standard and the identification number of the production unit.

The supplemental data should be placed as follows:

- Directly beside or underneath the logo
- Either in the following way:
  - o in the box to the left of the logo, the pointer of the standard or at least the serial number of the standard in the standard series;
  - o in the box to the right, the identification number of the production unit.

If necessary, the identification number may be replaced by the name of the license holder, provided that the production unit is uniquely identified below.

In principle, the BENOR label must be applied to every unit of the product itself. If this method is impossible or impractical, the logo is either fixed to each individual packaging or wrapping of the product or to a label attached to the product.

### Marking

The word BENOR appears in the midfield of the mark. The identification number of the certificate holder and the product, process or service can be indicated in the rounded end fields of the mark.

The font for the word BENOR and the identification number is Helvetica. The mark is monochrome. The color of any additional information to the mark is the same as the mark itself.

# Annex 5: requirements for a onetime BENOR certification

## 1. General

*In case a non-certified manufacturer needs to obtain a onetime BENOR certification on one tank (in the preparation towards a BENOR-certificate, or in case of a single project) a pre-certification conformity assessment can be carried out for that one particular case.*

*It is also possible for manufacturers that are already certified according to this TRA to obtain a BENOR certification on a tank that deviates in some extend from the present TRA.*

*The deviations shall be reported to the certification body prior to the start or production.*

*The certification body shall evaluate the deviations and decide whether or not these deviations can be accepted under this annex, or a new TRA need to be created.*

*In case of multiple tanks or orders a new TRA or annex to this TRA will have to be created.*

## 2. Technical requirements

*In case of the above, the tank and the manufacturer must comply with the following parts of the TRA:*

- 3. Legal requirements;
- 6. Technical requirements;
- Any additional requirements (for the deviation);
- 7. Quality system requirements

## 3. Product- and quality control

*The certification body will carry out an audit at the manufacturer's premises.*

*During this audit by the certification body, all points of the Test and Inspection Plan will be checked.*

Features	Article TRA
<b>General documentation</b>	
<b>Design drawings</b>	6.2.1
<b>Calculations/parameters</b>	6.2.2
<b>Installation and user instructions</b>	6.2.3
<b>Marking of the tank and/or spill container</b>	6.2.4
<b>Material properties</b>	
<b>Raw material properties</b>	6.3.1
<b>Resistance to the stored medium</b>	6.3.2
<b>Design of double walled tanks with leak detection area</b>	6.3.3
<b>Resistance against UV-ageing</b>	6.3.4
<b>Electrical resistivity (if applicable)</b>	6.3.5
<b>Fire retardants (if applicable)</b>	6.3.6
<b>Reaction to fire (if applicable)</b>	6.3.7
<b>Laminating procedure</b>	6.3.8
<b>Laminator approval</b>	6.3.9

<b>Laminator's record sheet</b>	6.3.10
<b>Welding procedure (for thermoplastic liners – if applicable)</b>	6.3.11
<b>Welders approval (for thermoplastic liners – if applicable)</b>	6.3.12
<b>Repair procedure</b>	6.3.13
<b>samples</b>	6.3.14
<b>Requirements of the tank and/or spill container</b>	
<b>Visual inspection</b>	6.4.1
<b>Wall thickness</b>	6.4.2
<b>Dimensional control</b>	6.4.3
<b>Capacity of the spill container</b>	6.4.4
<b>Leak detection system</b>	6.4.5
<b>Leak tightness (F.O.W.)</b>	6.4.6
<b>Pressure resistance</b>	6.4.7
<b>Spark testing</b>	6.4.8
<b>Connections to the tank</b>	6.4.9
<b>Internal piping of the tank</b>	6.4.10
<b>Manway and inspection openings</b>	6.4.11
<b>Elastomeric sealing elements</b>	6.4.12
<b>Barcol hardness</b>	6.4.13
<b>Short-term creep (advanced design)</b>	6.4.14
<b>Inter laminar shear strength of laminates</b>	6.4.15
<b>Glass content</b>	6.4.16
<b>Resistivity check (if applicable)</b>	6.4.17
<b>Internal quality control</b>	
<b>Identification of documents</b>	7.2.1
<b>Procedures and working instructions</b>	7.2.2
<b>Complaints, corrective- and preventive actions</b>	7.2.3
<b>Personnel</b>	7.2.4
<b>Calibration and maintenance</b>	7.2.5

In the context of the audit, there are three types of remarks:

- A-remark: subparts that show deviations in a way that the quality of the product cannot be guaranteed.
- B-remark: subparts that show deviations, but do not compromise the quality of the product immediately.
- C-remark: subparts that show deviations, but do not compromise the quality of the product in any way.

These remarks shall be sent in writing to the manufacturer.

All A and B remarks must be eliminated before the tank can be accepted as a BENOR tank and a BENOR compliance certificate will be granted.

For the C-remarks the manufacturer will need to advise the end-user of these remarks but the BENOR-compliance certificate will be granted.

Upon approval, a compliance certificate will be made by the certification body, provided with a unique BENOR number (for the specific tank and customer).

## Annex 6: Information agreed between the purchaser and the manufacturer

*The following information to be agreed between the purchaser and the manufacturer shall be documented:*

- *Lifetime;*
- *Liquid to be contained and any special properties;*
- *Maximum density;*
- *Design temperature (and operating);*
- *Design pressure and design negative pressure (and operating);*
- *Pressure valves, gas scrubbers, water lock, ...*
- *Indoor / outdoor (and location);*
- *Desired volume (nominal / useful);*
- *Type of liner;*
- *Slope of bottom;*
- *Type of roof and slope;*
- *Type of tank (SW, DW, ...);*
- *Manhole (s) (number, size, position and pressure class);*
- *Flange(s) (number, size, position and pressure class);*
- *Live loads, concentrated loads;*
- *Insulation thickness;*
- *Method of heating or cooling the liquid;*
- *F.O.W. or pressure test;*
- *Type of seals;*
- *Repair procedure for damaged parts;*
- *Seismic loads.*