Restraint System acc. to EN 1317

Linetech LT 103
(incl. modifications)

Installation instructions

Passive restraint system
as in situ concrete safety barrier
acc. to DIN EN 1317-2

Containment level  H2
Working width  W2
Impact severity  ASI C
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1 General

The LT 103 restraint system is intended to be installed in the public road network. It is designed to protect vehicle occupants when a vehicle veers off the carriageway, as well as to protect third parties and objects.

These installation instructions are therefore intended for all users (e.g. planners, construction supervisors, building contractors) and trained fitters who are installing the LT 103 restraint system on public roads and thoroughfares. The most recent revision of these installation instructions is always to be used. This revision replaces all superseding versions. All references to other documents relate, unless otherwise stated, to the latest revision.

The LT 103 restraint system has been tested in accordance with EN 1317. The test results were attained under the conditions described in the test report. However, the tests cannot cover every scenario that may arise in practice. For this reason, this installation manual describes peripheral conditions for the installation in accordance with current technical standards where a deployment can be expected to ensure that the safety barrier functions properly in practical situations.

The supplied system components are to be checked against the delivery notes for completeness and the absence of defects and damage. All the parts lists in these installation instructions are to be used for this purpose. Any damage, defects or incorrect deliveries must be reported to the supplier without delay.

The requirements laid down in these instructions are to be strictly adhered to when installing and assembling the system in order to achieve the declared performance for initial testing (TT). In the event of any deviation from these requirements during installation without consulting the manufacturer, liability for the construction product will be transferred to the manufacturing company.

NOTE: The in situ concrete safety barrier has been tested with a reinforcing steel reinforcement B500B. The joints must be filled if this reinforcing steel is being used. Maintenance-free durability cannot be guaranteed in this case.

Stainless steel B500B NR, grade 1.4482 (4486), must be used if maintenance-free durability for at least 30 years is required. Please refer to 4 - Approved modifications for details about modifying the reinforcement.
2 Description of the LT 103 vehicle restraint system

2.1 System description and data

The distinctive characteristic of the LT 103 double-sided concrete safety barrier (refer to the appendix for a drawing) is that it is fabricated as a free-standing in situ concrete construction using a slipform paver.

The tested LT 103 exhibits the following characteristic values:

<table>
<thead>
<tr>
<th>Containment level</th>
<th>H2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working width class</td>
<td>W2 (W ≤ 0.8 m)</td>
</tr>
<tr>
<td>Impact severity level</td>
<td>C</td>
</tr>
<tr>
<td>Test length = minimum installation length</td>
<td>60.7 m</td>
</tr>
<tr>
<td>Height</td>
<td>90 cm</td>
</tr>
<tr>
<td>Width (base)</td>
<td>54 cm</td>
</tr>
<tr>
<td>Width (head)</td>
<td>20 cm</td>
</tr>
<tr>
<td>Foundation</td>
<td>On asphalt</td>
</tr>
</tbody>
</table>

Material

- Steel reinforcement: B500B or B500B NR, grade 1.4482 (4486)
- Concrete: C30/37 (LP) XC4, XD3, XF4 WA pursuant to DIN EN 206-1
- Drainage duct (if present) steel DX 51vz Hot-dipping galvenized according DIN EN 1461

Durability

- min. 30 years (with use of B500B reinforcement joint-filling maintenance is required every 5 years)

Maintenance-free durability

- min. 30 years (with use of B500B NR stainless steel reinforcement)

2.2 Parts list

<table>
<thead>
<tr>
<th>Component</th>
<th>Material quality</th>
<th>Unit weight</th>
<th>Weight [kg/m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete pursuant to DIN EN 206-1</td>
<td>C30/37 (LP), XD3, XF4, XC4, WA</td>
<td></td>
<td>813</td>
</tr>
<tr>
<td>Reinforcement 6 x Ø 14 mm</td>
<td>B500B or B500B NR Grade 1.4482 (4486)</td>
<td>approx. à 1.2 kg/</td>
<td>7.2</td>
</tr>
<tr>
<td>Total weight LT 103</td>
<td></td>
<td></td>
<td>approx. 820</td>
</tr>
</tbody>
</table>
2.3 Building materials for the safety barrier

The utilised materials are assigned in the parts list to the respective components of the safety barrier.

2.3.1 Concrete

2.3.1.1 General

Composition, preparation and processing are subject to DIN EN 206-1.

2.3.1.2 Exposure classes and minimum compressive strength

The LT 103 is to be fabricated using minimum compressive strength class C 30/37 LP concrete which fulfils the requirements of exposure classes XC4, XD3 and XF4. To avoid any possible corrosion of the concrete due to an alkali-silica reaction, its composition is always to be based on moisture class WA. The use of cement CEM III/B is not permitted.

The composition of the concrete is to be determined following an initial test so that it will sustainably meet the demands made upon it. The concrete is to be prepared and processed in line with Supervision.

2.3.1.3 Consistency

When fabricating barriers using the slipform method, the consistency of the fresh concrete must be such that the fresh, compacted concrete remains dimensionally stable after the mould is slipped off. The consistency is always to be prepared beforehand at the concrete works and tested as appropriate with a trial stretch of concrete. As a guideline for constructing the LT 103, a consistency within a slump range of 330-360 mm (F1) or a compactability of between 1.28 and 1.32 (C1) is recommended.

To ensure a uniform consistency of the single delivery batches for the slipform construction method, the tolerance range of the slump is to be limited to half of the tolerance permitted pursuant to DIN EN 206-1, i.e. to ± 15 mm.
2.3.1.4 Air content and air void content

The air void content is to be monitored and logged every hour at the construction site.

2.3.1.5 Surface

The surface of the LT 103 must have a uniform closed structure. No holes, coarse unevenness, flaws, etc. may be present in the surface. The LT 103 features a uniformly applied brushed finish on the entire surface, vertically on the front and rear faces of the barrier, and transversally to the system axis on the barrier head.

2.3.2 Reinforcing steel

B500B NR, grade 1.4482 (4486), reinforcing stainless steel bars are to be used.

B500B NR may only be straightened, bent or cut to make ready-to-use reinforcement by manufacturing companies that have demonstrated their suitability for this work and are subject to monitoring. Suitability is to be proved by a certificate of conformity.

The use of B500B (formerly BSt 500 S (B)) reinforcing steel bars is only permitted with limitations. Refer to 1 – General for details.

Finite sized reinforcement as well as endless steel bars rolled up on a coil can also be used.

The steel is to be transported and stored so that it does not become dirty or warped.

2.3.3 Backfill

It is not allowed to backfill the LT 103.

2.3.4 Joint fillers

A joint filling is only required on the joint sections adjoining the concrete safety barriers and transition structures with standard steel reinforcement or for fabrication with reinforcing steel reinforcement.

A permanently resilient material that is capable of withstanding a total movement absorption of 25% expansion and compression movement is to be used as a joint filler.

Contraction joints in the vicinity of stainless steel reinforcements may not be filled.
2.4  Tolerances

In situ concrete safety barrier
- Ground plan of its intended location (distance to reference line) ± 5 cm
- Alignment (over length of 4 m) ± 2 cm
- Installation height ± 3 cm
- Width -1 and +5 cm

Safety barrier reinforcement
- Elevation ± 4 cm
- Distance from one another ± 4 cm
- Lateral position ± 3 cm

2.5  Durability

The information given in these installation instructions is to be heeded to attain the expected durability of at least 30 years. Furthermore, changes may occur that cannot be described at this time since as yet unforeseeable external factors might affect the in situ concrete safety barrier. To take this fact into account, it is recommended to periodically inspect the barrier elements for any changes. The manufacturer is to be informed about all changes to the system which are not described here.

In case of using B500B reinforcement
In particular, Sections 2.6 and 3.4.2.4 of these installation instructions must be heeded. The performance capability and durability of the barrier may be impaired if refurbishment and repair work is not carried out in a proper manner.

In case of using B500 B NR stainless-steel-reinforcement
Cracks can occur during the service life. Rampant cracks are to be assessed and repaired as required as described in Section 3.4.2.4 of these installation instructions. Grade 1.4482 (4486) stainless steel reinforcement is sufficiently resistant to corrosion so that its durability is assured even where it is exposed to the elements. Filling/sealing cracks and joints when using stainless steel reinforcement is not permitted as this may diminish its durability.

2.6  Inspection and maintenance

The LT 103 concrete safety barrier does not generally require any maintenance. Any existing joint fillings are to be maintained.
It is recommended to conduct an annual visual inspection for any recognisable damage caused by external factors (e.g. accidents) and to check the functional capability of the joint fillers on joint sections between concrete safety barriers with standard/reinforcing steel and stainless steel. These are to be treated as described in 3.4.2.4 Joints.
2.7 Disposal / recycling of the system

No toxic substances are used in the system. The LT 103 concrete safety barrier is made of concrete and steel. The materials are to be recycled in compliance with statutory and local recycling and waste disposal regulations.

3 Installing the LT 103 vehicle restraint system

3.1 Safety and health protection

National labour, safety and health regulations are to be observed when installing the LT 103 system. Traffic legislation regulations must likewise be complied with. The requisite personal protective equipment (PPE) is to be used by the installation personnel.

3.2 Personnel requirements

The personnel to be deployed for the installation must be adequately trained in the work that is to be performed (e.g. in the field of concrete construction or masonry craft) and be supervised by a squad leader with at least 2 years' experience in slipform construction in order to be able to carry out the work properly and to the appropriate high quality.

The installation squad is to be placed under the charge of a specialist (concrete safety barrier installation engineer) especially trained. He must be perfectly acquainted with the installation of safety barriers made of concrete and the contents of this manual.

The in situ concrete installation must additionally be supervised at the construction site by a specialist with advanced concrete technology expertise.

Sections of the reinforcement may only be welded together by qualified and approved personnel. The welding of reinforcing steel is subject to a welder's test certificate in accordance with DIN EN ISO 17660-1.

The squad personnel (first and foremost the machinery operators) must be adequately trained in setting up safety devices. The machine operators are to obtain and demonstrate their qualifications by attending an appropriate technical course.

All the personnel's qualifications and skills must be kept up to standard by attending regular training courses.
3.3 Required equipment

The following equipment is required to install the LT 103:

**Basic equipment**
- Bricklaying equipment such as trowels, smoothers, shovels, stonemason's hammers, etc.
- Concrete vibrators, converters, generator
- Spirit level, folding metre rule, string
- Drill or impact device, single-handed angle cutter
- Welding equipment and approved stainless/reinforcement steel welding electrodes
- General tools

An appropriate and adequately stocked machinery pool is required for a **professional installation** of the vehicle restraint system. All vehicles, machinery and equipment that are necessary for installing vehicle restraint systems must be operational and roadworthy and be technically capable of performing the task in hand.

The LT 103 is always to be fabricated using a **slipform paver**. The slipform paver must be equipped with an electronic directional and elevation control mechanism (stringline). The installation machinery must be equipped with adequate lighting for a high standard of work performed in the dark. This must illuminate all the working areas and be non-dazzling.

The **compaction units** (e.g. concrete vibrators) on the installation machinery are to be arranged so that uniform and full compaction is assured over the entire cross section of the in situ concrete safety barrier profile. Both the applied compaction energy as well as the position of the compaction units on the installation machinery must be adjustable to achieve this.

The formwork being used must fabricate the LT 103 accurate to size within the stipulated tolerances. It is to be ensured that the reinforcing steel bars are inserted straight and without tension in the correct position by means of a wire-threading device mounted on the front of the sliding formwork.

The LT 103 can be fabricated using a fixed formwork in exceptional cases (e.g. work on bridge piers, closing gaps and repairs). A system formwork is to be used with which the in situ concrete safety barrier can be fabricated accurately within the stipulated tolerances. It is important to make sure that the formwork is secured during the installation to prevent it from rising upwards.
3.4 Fabricating the LT 103 vehicle restraint system

3.4.1 Requirements for the subsurface

The subsurface underneath the in situ concrete safety barrier must be asphalt with a minimum thickness of 16 cm. The asphalt on the side of the concrete safety barrier facing away from the traffic must extend for at least 10 cm beyond the trailing edge of the barrier. The width of the subsurface must be dimensioned—depending on whether the concrete safety barrier is to be used as a single or double-sided restraint system—so that the effectiveness of the restraint system is not impaired. The foundation may have to be made wider dependent upon the installation conditions.

3.4.2 Concrete installation in five steps

3.4.2.1 Step 1: Preparation for the installation

- **Subsurface / foundation**
  The subsurface must be prepared in such a way that the dimensions and tolerances as specified in the system description are reliably achieved during installation. The subsurface may have to be cleaned and any loose material removed as required.

- **Concrete**
  The suitability of the concrete is to be verified and tested before starting work on the construction.

- **Reinforcement**
  The reinforcement is to be designed so that the overlap joints are offset to one another. They must be at least 0.5 m apart.
  The horizontal reinforcement of the concrete safety barrier has to be welded pursuant to DIN EN ISO 17660-1/2 with at least 10% of the reinforcement diameter as an overlap joint.
  *The welding requirements described under 3.4.2.1.1 must be observed, as does Appendix B – Construction of transition elements.*

- **Ensuring the reinforcement positioning**
  The reinforcement is to be fed into the slipform mould using a roll guide so that the positioning corresponds to the setpoint positioning shown in the drawing "Illustration of concrete safety barrier with minimum permissible cross-section and maximum permissible scoring" in Appendix A. The setpoint positioning is to be verified and documented in writing every time after starting concreting work (including after interruptions), again after 5 metres and 15 metres, and then every 100 metres.
• **Contact wire:**
  The contact wire is to be aligned with the installation location of the concrete safety barrier and has to be tensioned so as to prevent any undue deviation from the intended position.
  
  *Note: The location of the contact wire should be chosen so that its position does not change during the course of the construction work.*

• **Slipform paver:**
  It is necessary to ensure that the slipform is rigidly and securely mounted on the paver. The vibrators are to be checked to confirm that they are functioning properly prior to starting work on the installation. The paver has to be adjusted to accommodate the contact wire. It is to be driven without concrete to ensure that the paver calibration corresponds to the intended position of the concrete safety barrier.

• **Transporting the concrete:**
  It is only permitted to use concrete mixer trucks that are capable of unloading the concrete quickly and continuously. To ensure a high-quality finish, the concrete must be delivered continuously and a period of 90 minutes from the production of the concrete until it is unloaded must not be exceeded.

### 3.4.2.1.1 Welding reinforcing steel

Fundamentally, the reinforcement in the concrete safety barrier is joined to form a continuous tension bar.

This is done by applying a weld joint pursuant to DIN EN ISO 17660-1+2 with a requisite length of at least 10x the diameter.

The weld joint is made using the arc welding method. Electrodes suitable for the materials to be joined are to be used for this purpose.

This requirement applies for all welded joints: stainless steel to stainless steel, stainless steel to reinforcing steel, and reinforcing steel to reinforcing steel.

It must always be ensured that certified electrode types (e.g. FOX CN 22/9 N) are used when welding stainless steel to grade 1.4482 (4486) stainless steel. These electrode types are also to be used for welding reinforcing steel to stainless steel.

**The requirements laid down in Appendix B – Construction of transition elements are to be observed!**

### 3.4.2.2 Step 2: Concreting, fabrication

The reinforcement is to be inserted into the slipform mould. The reinforcement has to be secured to prevent it from being displaced. The reinforcement must be installed in the precise position detailed in the system description.
Factory-mixed, fresh concrete is to be used which is delivered to the construction site in concrete mixer trucks. The concrete is installed using a towed mould. The concrete slipform paver's control mechanism for the lateral and vertical positioning must be constantly checked to make sure that the dimensions of the concrete safety barrier always comply with the system specifications. The concrete must be uniformly and fully compacted over the entire cross section and it has to remain dimensionally stable after the mould has been slipped off.

Freshly effected repairs can be patched with the concrete being used to fabricate the in situ concrete safety barrier. In doing so, it is to be ensured that the repaired area has the same quality as the continuous in situ concrete safety barrier. Subsequent repair work must be carried out as described in Section 3.7.

The surface of the concrete on the side facing the carriageway must have a closed, uniform structure. This is produced using a trowel followed by a brushed finish.

The concrete is to be controlled at the construction site. The results of the proprietary controls must be documented and kept in accordance with the applicable deadlines.

**The temperature conditions as detailed in 3.5 Fabricating concrete at low or high temperatures must be adhered to.**

### 3.4.2.3 Step 3: Drainage (as required)

Drainage ducts can be incorporated in the base of the concrete safety barrier for proper draining of surface or melt water. It is recommended to plan the necessity and number of drainage ducts.

Required drainage ducts can be fabricated in the size 12 x 10 cm [WxH]. The spacing between the ducts is usually 5 m (but at least 3 m). LT 902 moulds are to be used for reliable fabrication of the ducts. The moulds are to be laid out at the specified intervals and nailed into the ground prior to concreting.

Any deviations from the distances and dimensions stated above must be approved by the manufacturer.

### 3.4.2.4 Step 4: Joints

- **Contraction joints**

  The LT 103 concrete safety barrier is to be divided into sections by contraction joints to allow the intentional formation of cracks and to compensate for changes in length.

  These contraction joints are fabricated by scoring the concrete with a small disk to a width of 2-3 mm, a depth of 40-50 mm on the front, head and back sides of the barrier.

  Equipment that enables straight and sharp-edged cutting is to be used for scoring. The scoring is cut by machine.

  The joints are to be made vertically and perpendicular to the longitudinal axis of the barrier.
The joints have to be cut early to avoid "rampant" cracks. The timing is to be chosen dependent upon the consistency of the concrete (to protect against chipping while cutting) and the effluent hydration heat (to prevent "rampant" cracking). To ensure that the joints are cut in good time, the concrete temperature and firmness are to be checked every hour. A sufficient quantity of cutting equipment must be kept available at the construction site.

**It is to be ensured that the reinforcement is integrated along the full length of the reinforcement and that it is not damaged during cutting.** Refer to the drawing "Illustration of concrete safety barrier with minimum permissible cross-section and maximum permissible scoring" in Appendix A for details.

**Stainless steel to stainless steel**
The contraction joints do not have to be widened and filled. Filling the joints can diminish the durability of the stainless steel reinforcement!

**Stainless steel to reinforcing steel (e.g. connection to existing systems)**
The area in the vicinity of the connection between the stainless steel and the reinforcing steel must have a filled joint. The scoring is opened with a second disc out to a width of 10 mm and a depth of 20 mm to form a joint cavity, which is filled with a permanently resilient filler. This area is to be constructed so that the joints are not superimposed on the weld joints. To ensure the corrosion resistance of the weld joint, it must be coated with zinc dust paint pursuant to EN ISO 1461 for 5 cm all around the joint.

**Reinforcing steel to reinforcing steel**
The area in the vicinity of the connection between the stainless steel and the reinforcing steel must have a filled joint. The scoring is opened with a second disc out to a width of 10 mm and a depth of 20 mm to form a joint cavity, which is filled with a permanently resilient filler.

- **Joint filling in the vicinity of stainless steel to reinforcing steel joins (existing barriers) or when using reinforcing steel**

How to select and install the joint fillers is described in Chapter 2.3.4. This joint filling is installed at the earliest when the concrete is 7 days. The joint gaps must be cleaned before they are filled. An appropriate primer for the joint filler is to be used.

- **Joint spacing**

The joints are usually spaced 5 m apart. This only needs to be reduced to 4 m at a very high fresh concrete temperature of > 28 °C when the air temperature is > 30 °C. Where drainage ducts are incorporated into the barrier, the contraction joints have to be positioned centrally above them. The manufacturer must be consulted if the structural conditions require a change in the spacing of the contraction joints.
• Cracks

When using stainless steel reinforcement
The occurrence of rampant cracks is not influenced by the use of stainless steel reinforcement. They are just as likely to inadvertently occur as with a reinforcing steel reinforcement. Filling cracks and joints are not allowed this can diminish the durability of the stainless steel reinforcement!

When using reinforcing steel reinforcement
All Cracks wider 0,9 mm must get closed. The crack is opened out to a width of 10 mm and a depth of 20 mm to form a joint cavity, which is filled with a permanently resilient filler.

• Compression joints / end of shift joints

Compression and end of shift joints are fabricated in the same manner as contraction joints.

3.4.2.5 Step 5: Curing

The concrete requires curing.
A curing agent is to be evenly applied to in situ concrete safety barriers when the finished surface has attained a slightly damp state. The appropriate quantity of the curing agent is to be applied dependent upon the type of agent being used and the surface texture with the aim of achieving a continuous film with sealing coefficient S.
Curing agents with a higher lightness coefficient (white level) VH-W or VM-W can be used if practicable in strong sunshine and summer temperatures. It is not practicable to post-treat in situ concrete safety barriers by covering them in sheeting.

3.5 Fabricating concrete at low or high temperatures

It is not permitted to cast concrete at an air temperature of -3 °C or below or when the temperature of the concrete lies below 5 °C or above 30 °C.
If concreting has to take place at air temperatures below +5 °C, appropriate measures are to taken when making the concrete.
Such measures can include increasing the cement content, using cements with a higher initial strength, or raising the temperature of the fresh concrete.
When using mixing water with a temperature higher than +70 °C, the water must first be mixed with the aggregates before the cement is added. It is important to make sure that the difference between the air temperature and the temperature of the building structure is not too great to prevent cracks from forming in the concrete safety barrier. It is not permissible to use frozen aggregate.
When concreting at air temperatures above +25 °C, appropriate measures are to be taken when making the concrete. Such measures can include placing the aggregates in the shade, or spraying the coarse aggregates with water. Additional apply the stipulations of DIN EN 13670.

### 3.6 Manufacturer markings

The LT 103 in situ concrete safety barrier must be clearly marked by every manufacturer with the following information:

<table>
<thead>
<tr>
<th>LT 103*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linetech GmbH &amp; Co. KG</td>
</tr>
<tr>
<td>Von-Hünefeld-Straße 99</td>
</tr>
<tr>
<td>50829 Köln</td>
</tr>
<tr>
<td>Safety Barrier Manufacturer Ltd.</td>
</tr>
<tr>
<td>Anywhere Road 1</td>
</tr>
<tr>
<td>12345 Anywhere State</td>
</tr>
<tr>
<td>Germany</td>
</tr>
<tr>
<td>Year of installation (p.e. 2015)</td>
</tr>
</tbody>
</table>

The markings on the concrete safety barrier are to be applied every 100 m, and at least at the beginning and end of the barrier, on the side facing the road traffic. Further details on applying the markings can be found in the appendix. The durability of the markings must be at least the same as the useful life of the product itself.

* Additional marking when using stainless steel reinforcement

If the concrete safety barrier is being fabricated with stainless steel reinforcement, "ME" must be added to the product name = LT 103 ME.

### 3.7 Repair conditions / information about carrying out repairs:

Repairs are required if at least one of the following conditions applies:

a) Surface damage in the form of scratches, grooves or similar with a depth of > 1.5 cm on the side of the barrier facing the carriageway.

b) Broken-off pieces > 2 kg of the cross sectional area of the concrete.

c) The provisions of Section 3.4.2.4 of these installation instructions are to be noted in the event of cracks.

d) Displacement of the safety barrier.

e) The reinforcement is cut through.

f) If a permanent plastic deformation of the in-situ concrete safety barrier has occurred.
Repair options:
For a) and b) Repair using concrete replacement systems in the case of broken-off pieces.
For c) Refer to 3.4.2.4 Joints
For d) to f) Replacement of the damaged section, but at minimum the length between two successive joints. Procedure: Break off the concrete, fabricate a connecting reinforcement using an approved system, set up the mould, pour in the concrete, remove the mould, cure the concrete, make the joints. The full procedure is described in Section 3.

• Documentation of repairs:
Proof that repairs have been carried out in compliance with these installation instructions is to be provided in the form of a protocol and a photographic documentation. The photographic documentation must include at least the following photographs:
- last intact markings on the barrier before the repair section
- first intact markings on the barrier after the repair section
- reinforcement joint at the beginning and end of the repair section
- repairs using a slipform mould or fixed formwork
- insertion of the reinforcement in the slipform mould or fixed formwork
- overall view of the repaired section, before/afterwards
The protocol must include at least the following in addition to the usual construction site documentation:
- protocol of all the control measurements for assessing the dimensional stability of the barrier
- air temperature
- concrete temperature (if relevant)
- precipitation (type, quantity)
- delivery notes for the concrete
- delivery notes for the reinforcing steel
- curing method
- curing agent

3.8 Disposal / recycling of the fabrication materials

The single components of the safety systems and the packaging or residual materials left over from the fabrication process are to be properly recycled or disposed of in compliance with statutory waste disposal regulations.
3.9 Non-conformance measures

The vehicle restraint system may not be installed if the conditions stipulated in the system description cannot be established when installing the system. The customer, the responsible construction supervisor and the manufacturer must be informed accordingly in due time and in writing. The next step is to look for ways to establish the requisite conditions for the fabrication as stipulated in the installation instructions (e.g. changes to the surrounding area). If this is not possible, the required modifications are to be coordinated with the manufacturer. Modifications may only be carried out by the manufacturer.

In the event of systematic or frequent problems with the product and/or the fabrication process, the manufacturer must be informed in order to be able to implement any improvements.

Any subsequently occurring inconsistencies in the vehicle restraint system or the surrounding area must be reported to the customer.

4 Approved changes (modifications)

Modifying the stainless steel reinforcement 1.4482 (4486)
The LT 103 in situ concrete safety barrier has been subjected to an impact test with a reinforcing steel reinforcement B500B. This may be replaced with a stainless steel reinforcement. The modification only involves the reinforcement material. The number, location and diameter of the reinforcement, as well as the type and length of the joint welds, remain the same as the construction used for the impact test.
Stainless steel of grade 1.4482 (4486) has been tested and approved for this modification.

5 Additional information about the installation

The subsurface underneath the in situ concrete safety barrier must be asphalt with a minimum thickness of 16 cm.

Surrounding area:
Maximum gradient of the subsurface behind the system:
An upward or downward slope leading from the rear of the system is safe outside the working width and is not regulated. Within the working width, an upward or downward slope can have a maximum gradient of 12%.

Maximum gradient of the subsurface in front of the system:
An upward or downward slope leading from the front of the system can have a maximum gradient of 12%.

Supporting surface:
The supporting surface is the area underneath the vehicle restraint system that is to be fabricated. This can have a maximum gradient of 6%. The supporting surface will have to be suitably prepared if the lateral gradient is greater than this.
Variations in the subsurface gradient:
Variations in the subsurface gradient are irrelevant because the system is always positioned perpendicular to the subsurface in the transverse direction and parallel to the subsurface in the longitudinal direction.

5.1 Installation limitations
The installation limitations are stated in the descriptions in these installation instructions. Installation situations not described here are not permitted.

5.1.1 Provision for barriers shorter than the test length
In some cases, the LT 103 system may have to be installed with a shorter length than the test length. In this case, the length of the system must be at least 20 m, whereby this applies only if an additional safety barrier with containment level H2 is connected on both sides to a transition element in line with the requirements of the release approval process. The test length of the connected safety barrier must not fall short of the stipulated minimum length.

The test length can only be interrupted by a bridging cover if a construction element from Linetech GmbH & Co. KG is used. When using the LT 1-3-1 bridging cover, at least 30 m of the concrete safety barrier must be connected on both sides.

5.1.2 Limitations for steps in front of the barrier
The height of the LT 103 concrete safety barrier is independent from position to roadway and possibly present kerb-caps. A height adaption is not required. The barrier is fabricated with an installation height of 0.90 m.

If the installation subsurface is higher than the road, the height is measured from the subsurface in front of the barrier.

If the installation surface of the concrete barriers is below the road level, its required to install an additional foundation to adapt to road subsurface height. The height of the barrier is measured from the roadway top edge.
5.1.3 Installations on embankments

The following principles apply to downward and upward sloping embankments:
The LT 103 system must be fabricated as detailed in the system drawings.

5.1.4 Construction on central reservations and hard shoulders

Safety barriers for use on both central reservations and hard shoulders are constructed as described in these installation instructions. The working width must always be kept unobstructed.

5.1.5 Execution of radii / minimum radii

The radii for slipform constructions are adapted to the respective local conditions.

5.1.6 Pivoting

Pivoting / distorting must be executed with a ratio of at least 1:20.

5.2 Additional fittings

Additional fittings must not affect the functional capabilities of the LT 103 system in any manner whatsoever. They must not endanger the occupants of impacting vehicles or other people.

5.2.1 Mounting of traffic signs

Traffic signs can only be mounted using the Linetech LT 901 holder. The LT 901 installation instructions must be observed.

5.2.2 Mounting of ladders

Only the Linetech LT 903 and LT 904 products may be used as ladders. They are mounted using the Linetech LT 901 holder. The respective installation instructions must be observed.

5.2.3 Top-mounted marker posts

The installation of top-mounted marker posts is permitted if they comply with national regulations. The installation instructions of the respective manufacturer must be observed.

5.3 Local adaptations

5.3.1 Interruptions

Interruptions in the LT 103 system are subject to the provisions of Section 5.1.1 of these installation instructions.

The use of constructions from other manufacturers is not permitted.

The durability of the LT 1-3-1 construction must correspond to the useful lifetime of the LT 103 system (minimum of 30 years).
5.3.2 Recesses
Single recesses (see diagram below) in the base of the LT 103 system are permitted without an additional construction up to a maximum depth of 10 cm in the alignment of the concrete safety barrier. Recesses may only be incorporated in places where there is no drainage duct in the base area.

5.3.3 Boreholes
Boreholes can be drilled in any position. The boreholes must not reduce the concrete cross section by more than 5%. The reinforcement must not be damaged by the borehole. The responsible road construction authorities and the manufacturer are to be informed if other boreholes are required.

5.3.4 Partitioning for repairs and alterations
The concrete safety barriers can be partitioned at any location using concrete cutting equipment. The system cross section is to be fully restored after partitioning. The reinforcement is to be restored with a force-fit connection as detailed in the system description. The reinforcement must be exposed for a minimum length of 25 cm and connected to the new reinforcement as a force fit. Exposed ends of the reinforcement are to be covered with a minimum layer of concrete.

6 Miscellaneous manufacturer information

6.1 Instructions for use

- The working width must always be kept unobstructed.
- It’s not allowed to backfill the LT 103.
- Subsequent installations in the working width, such as road sign gantries, are to be coordinated with the manufacturer. Adaptations to the safety barrier may be required.
- Linetech GmbH & Co.KG will not assume any liability for construction work that deviates from these technical specifications.
7 Regulations and standards

The LT 103 complies with the following European standards:

EN 1317-1 Road restraint systems; Part 1: Terminology and general criteria for test methods; current version
EN 1317-2 Road restraint systems; Part 2: Performance classes, impact test acceptance criteria and test methods for safety barriers and vehicle parapets; current version
DIN EN ISO 17660-1/2 Welding of reinforcing steel; current version
DIN EN ISO 1461 Hot-dip galvanising of steel construction components; current version
DIN EN ISO 10684 Hot-dip galvanising of bolts; current version
DIN EN 206-1 Concrete - Part 1: Specification, properties, production and conformity; current version
Appendix A - Drawings
9 Appendix B - Construction of transition elements

The following applies for all transition elements:

- There is a separate construction drawing for each transition element*. This is to be used supplementary to the installation instructions.
- Each transition element can be used regardless of the direction of traffic.
- The installation instructions for the connected concrete safety barriers are always to be referred to for fabricating the transition element.
- The dimensions of the connected in situ concrete safety barriers are to be taken from the drawings in the respective installation instructions.
- The concrete quality in the vicinity of the transition element is the same as that of the connected in situ concrete safety barrier.
- The quality of the material used for the subsurface corresponds to the requirements for the respectively connected in situ concrete safety barrier.
- The subsurface of the two connected barriers are each extended up to the middle of the transition element.
- Any profile adaptations are to be made on the transition element at a ratio of at least 1:20.
- The reinforcement joints must always overlap.
- The reinforcement is joined to form a continuous tension bar. The reinforcement elements are joined using the arc welding method.
- The horizontal reinforcement has to be welded pursuant to DIN EN ISO 17660-1/2 with at least 10 x the diameter of the reinforcement as overlap joints. Where reinforcements of differing diameters are being used, the smaller diameter is definitive.
- Electrodes suitable for the materials to be joined are to be used for the weld joint. It must always be ensured that the prescribed electrode types are used for welding stainless steel to stainless steel, stainless steel to standard steel, and reinforcing steel to reinforcing steel. Refer to the table below for details.
- No joints must be arranged in the vicinity of weld joints on transition elements.
- This requirement applies for all welded joints: stainless steel to stainless steel, stainless steel to reinforcing steel, and reinforcing steel to reinforcing steel.

**Note!**

- The following applies when welding stainless steel to standard steel: To ensure the corrosion resistance of the weld joint, it must be coated with zinc dust paint pursuant to EN ISO 1461 for 5 cm all around the joint.

### Table with overview of welded joints

<table>
<thead>
<tr>
<th>Welding method</th>
<th>Reinforcing steel to reinforcing steel</th>
<th>Reinforcing steel to stainless steel</th>
<th>Stainless steel to stainless steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding method pursuant to DIN EN ISO 4063</td>
<td>111 - arc welding</td>
<td>111 - arc welding</td>
<td>111 - arc welding</td>
</tr>
<tr>
<td>Weld seam length</td>
<td>10 x diameter</td>
<td>10 x diameter</td>
<td>10 x diameter</td>
</tr>
<tr>
<td>Approved electrodes [examples]</td>
<td>various</td>
<td>FOX CN 22/9 N (for 1.4482) Eurotrode E 8370 (for 1.4571)</td>
<td>FOX CN 22/9 N (for 1.4482) Eurotrode E 2580 (for 1.4571)</td>
</tr>
<tr>
<td>Corrosion protection measures on the weld seam</td>
<td>none</td>
<td>Coated with zinc dust paint</td>
<td>none</td>
</tr>
</tbody>
</table>

* The list of transition elements and the corresponding drawings are available from the manufacturer, Linetech GmbH & Co. KG.
9.1. Standard lowering LT 103
10 Appendix C - Mounting instructions for manufacturer markings

Manufacturer markings with reinforcing bars on the rear side are impressed into the fresh concrete.
Manufacturer markings without reinforcing bars are mounted on the hardened concrete using screws and plugs.

*The markings must be permanently mounted in both cases.*

- The manufacturer markings are to be mounted on the side facing the traffic approx. 5 cm below the top edge of the in situ concrete safety barrier.
- The manufacturer markings are to be mounted at the beginning and end of a newly fabricated in situ concrete safety barrier. This does not apply to the beginnings and ends of end-of-shift interruptions.
- The manufacturer markings are also to be mounted at intervals of 100 m on the in-situ concrete safety barrier.
- When switching to a different system (connection to another vehicle restraint system), the manufacturer markings must also be mounted at the beginning and end of the newly fabricated in-situ concrete safety barrier. This does not apply to: bridging covers, dilatations, bases of road sign gantries.

**Example: Concrete barrier without a system transition**

```plaintext
Anfang
100m 100m 100m 100m 100m 100m 100m 100m 80m
Ende
```

880m = 10 Herstellerkennzeichen

**Example: Concrete barrier with a system transition**

```plaintext
Anfang Ende Anfang 40m Ende Anfang 100m 100m 100m 100m 20m
270m Strecke 340m Bauwerk 320m Strecke
```

Strecke 270m = 4 Herstellerkennzeichen
Bauwerk 340m = 5 Herstellerkennzeichen
Strecke 320m = 5 Herstellerkennzeichen