**Sika CarboDur® S**

Pultruded carbon fiber plates for structural strengthening as part of a Sika CarboDur® system

**System Description**

Sika CarboDur® plates are pultruded carbon fibre reinforced polymer (CFRP) laminates, designed for strengthening concrete, timber, masonry, steel and fiber reinforced polymer structures.

Sika CarboDur® plates are bonded onto the structure as externally bonded reinforcement using Sikadur®-30 LP (IN) epoxy resin based adhesive during application and / or service.

Sika CarboDur® plates are bonded into slots as near surface mounted reinforcement using Sikadur®-30 LP (IN) or Sikadur®-330 epoxy resin based adhesives during application. Sikadur®-300 epoxy resin based adhesive is used for horizontal applications; additionally Sika AnchorFix®-3+ epoxy resin based adhesives supplied in cartridges can be used.

Please refer to the relevant Product Data Sheet for more detailed information about each of these adhesives.

**Uses**

Sika CarboDur® systems are used to improve, increase or repair the performance and resistance of structures for:

- **Increased Load Carrying Capacity**:
  - Increasing the load capacity of floor slabs, beams and bridge sections
  - For installation of heavier machinery
  - To stabilising vibrating structures
  - For changes in building use

- **Damage to structural element due to**:
  - Deterioration of original construction materials
  - Steel reinforcement corrosion
  - Accidents (Vehicle impact, earthquakes, fire)

- **Improvement of serviceability and durability**:
  - Reduced deflection and crack width
  - Stress reduction in steel reinforcement
  - Improved fatigue resistance

- **Change of the structural system**:
  - Removal of walls and /or columns
  - Removal of floor and wall sections to create access / openings

- **Resistance to possible events**:
  - Increased resistance to earthquakes, impact or explosion etc

- **To repair design or construction defect such as**:
  - Insufficient / inadequate reinforcement
  - Insufficient / inadequate structural depth
Characteristics / Advantages
- Non corroding
- Very high strength
- Excellent durability and fatigue resistance
- Unlimited lengths, no joints required
- Low system thickness, simple execution of plate intersections or crossings
- Easy transportation (rolls)
- Light weight, very easy to install, especially overhead (without temporary support)
- Minimum preparation of plate applicable in several layers
- Smooth edges without exposed fibers as result of production by pulltrusion
- Extensive testing and approvals available from many countries worldwide

Tests

Approval / Standards
- France: CSTB - Avis Technique 3/10-669, SIKA CARBODUR SIKA WRAP
- Slovakia: TSUS, Building Testing and research institutes, Technical approval No. TO-09/0080, 2009: Systém dodatocného zosilňovania zelezobetonových a drevených konštrukcií Sika CarboDur® a SikaWrap® (Slovak).
- Poland: Technical Approval IBDiM Nr AT/2008-03-0336/1 „Płaskowniki, płyty, kształtki i maty kompozytowe do wzmacniania betonu o nazwie handlowej: Zestaw materiałów Sika CarboDur do wzmacniania konstrukcji obiektów mostowych (Polish)
- Switzerland: SIA 166, 2004 Klebebewehrungen.

Product Data

Form

Appearance / Colour
Carbon fiber reinforced polymer with an epoxy matrix, black.

Packaging
Cut to size as follows in non-returnable cardboard packaging. Supplied in rolls of 100 m in nonreturnable cardboard boxes.

Types

<table>
<thead>
<tr>
<th>Type</th>
<th>Width</th>
<th>Thickness</th>
<th>Cross sectional area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sika CarboDur® S512</td>
<td>50 mm</td>
<td>1.2 mm</td>
<td>60 mm²</td>
</tr>
<tr>
<td>Sika CarboDur® S514</td>
<td>50 mm</td>
<td>1.4 mm</td>
<td>70 mm²</td>
</tr>
<tr>
<td>Sika CarboDur® S1014</td>
<td>100 mm</td>
<td>1.4 mm</td>
<td>140 mm²</td>
</tr>
</tbody>
</table>

Note: Various size and different Tensile E-Modulus available on request and project specific requirement

Storage

Storage Conditions / Shelf Life
Unlimited provided there is no exposure to direct sunlight (UV light), in dry conditions and at temperatures of max. 50°C
Transportation: only in the original packaging, or otherwise adequately protected against any mechanical damage
## Technical Data

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Density</strong></td>
<td>1.60 g/cm³</td>
</tr>
<tr>
<td><strong>Temperature Resistance</strong></td>
<td>&gt; 100 °C</td>
</tr>
<tr>
<td></td>
<td>(according to EN 61006)</td>
</tr>
<tr>
<td><strong>Fiber Volume Content</strong></td>
<td>&gt; 68%</td>
</tr>
</tbody>
</table>

## Mechanical / Physical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Values in the longitudinal direction of the fibers</th>
<th>(according to EN 2561)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E-Modulus</strong></td>
<td>Mean Value 165,000 N/mm²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimum Value &gt;160,000 N/mm²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5% Fractile – Value 162,000 N/mm²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>95% Fractile Value 180,000 N/mm²</td>
<td></td>
</tr>
<tr>
<td><strong>Tensile Strength</strong></td>
<td>Mean Value 3100 N/mm²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimum Value &gt;2800 N/mm²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5% Fractile – Value 3000 N/mm²</td>
<td></td>
</tr>
<tr>
<td></td>
<td>95% Fractile Value 3600 N/mm²</td>
<td></td>
</tr>
<tr>
<td><strong>Strain at break</strong></td>
<td>Minimum Value</td>
<td></td>
</tr>
</tbody>
</table>

## System Information

### System Structure

The system build-up and configuration as described must be fully complied with and may not be changed.

- **Resin Adhesive** - Sikadur®-30 LP (IN)
- Structural strengthening Carbon plates – CarboDur S.

For detailed information on Sikadur®-30 LP (IN) together with the application details, please refer to the Sikadur®-30 LP (IN) Product Data Sheet and the “Method Statement Sika CarboDur® Externally Bonded Reinforcement”

## Application Details

### Consumption

<table>
<thead>
<tr>
<th>Width of CarboDur® plate</th>
<th>Sikadur®-30 LP (IN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 mm</td>
<td>0.25-0.35 kg/m²</td>
</tr>
<tr>
<td>100 mm</td>
<td>0.55-0.80 kg/m²</td>
</tr>
<tr>
<td>120 mm</td>
<td>0.65-1.00 kg/m²</td>
</tr>
<tr>
<td>150 mm</td>
<td>0.85-1.25 kg/m²</td>
</tr>
</tbody>
</table>

Dependent on the surface plane, profile and roughness of the substrate as well as any plate crossings and loss or wastage, the actual consumption of adhesive may be higher.
**Substrate Quality**

Sika CarboDur® plates externally bonded to the concrete surface:
Recommended minimum concrete pull-off strength after surface preparation
- Mean: 2.0 N/mm²
- Minimum: 1.5 N/mm²
The effective concrete pull-off strength after surface preparation has to be verified.

When the concrete pull-off strength is below the stated minimum requirements, alternative Sika solutions are available:
- CarboDur® applied in slots as near surface mounted (NSM) reinforcement
- SikaWrap® fabrics: Please refer to the Product Data Sheet for the SikaWrap® fabrics

Concrete must generally be older than 28 days (dependent on curing conditions and the type of concrete etc.)

Sika CarboDur® externally bonded to other substrates:
For application of CarboDur® plates to all other substrates (brick, stone, steel, wood, fiber reinforced polymer etc.)
Please refer to the “Method Statement for Sika CarboDur® Externally Bonded Reinforcement”

Sika CarboDur® plates applied in slots as near surface mounted reinforcement:
Please refer to the “Method Statement for Sika CarboDur® Near Surface Mounted Reinforcement”

**Substrate Preparation**

**Concrete and masonry:**
Substrates must be sound, dry, clean and free from laitance, ice, standing water, grease, oils, old surface treatments or coatings and any loosely adhering particles. Concrete must be cleaned and prepared to achieve a laitance and contaminant free, open textured surface.

Repairs and levelling: If carbonised or weak concrete cover has to be removed or levelling of uneven surfaces is needed, the following systems can be applied: (Details on application and limitation see the relevant Product Data Sheets)
- Protection of corroded rebars: SikaTop® Armatec® 110 EpoCem®
- Structural repair materials: Sikadur®-41 / Sikadur®-31 epoxy repair mortar
- Sikadur®-32 LP adhesive.

Please also refer to Method Statement of of Sika CarboDur® Externally Bonded Reinforcement

**Timber surfaces:**
Must be prepared by planing, grinding or sanding. Dust must be removed by vacuum.

**Steel surfaces:**
Must be prepared by blast cleaning to Sa 2.5 free from grease, oil, rust and any other contaminants which could reduce or prevent adhesion. Use the correct primer is essential (see table).

<table>
<thead>
<tr>
<th>1) Maximum waiting time between</th>
<th>+10°C</th>
<th>+20°C</th>
<th>+30°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Blast cleaning of steel and</td>
<td>48 hours</td>
<td>48 hours</td>
<td>48 hours</td>
</tr>
<tr>
<td>- Primer / Sikadur®-30 LP (IN) application</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(without priming possible, if no corrosion protection is needed)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2) Minimum waiting time between</td>
<td>48 hours</td>
<td>24 hours</td>
<td>12 hours</td>
</tr>
<tr>
<td>- Primer and Sikadur®-30 LP (IN) application</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(without additional preparation of the Primer)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3) Maximum waiting time between</td>
<td>7 days</td>
<td>3 days</td>
<td>36 hours</td>
</tr>
<tr>
<td>- Primer and Sikadur®-30 LP (IN) application</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(without additional preparation of the Primer)</td>
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</tbody>
</table>

Plate preparation:
Prior to the application of Sikadur®-30 LP (IN), solvent wipe the bonding surface with Sika® Colma Cleaner to remove contaminants. Wait until the surface is dry before applying the adhesive (> 10 minutes).
Application Instructions

| Application Method / Tools | For externally bonded application
Please refer to the relevant Sika® epoxy adhesive Product Data Sheet:
- Sikadur®-30 LP (IN)

Please refer to the “Method Statement for Sika CarboDur® Externally Bonded Reinforcement”

For near surface mounted application
Please refer to the relevant Sika® epoxy adhesive Product Data Sheet:
- Sikadur®-30 LP (IN)
- Sikadur®-330
- Sikadur®-300
- Sika® AnchorFix®-3+

Please refer to the “Method Statement for Sika CarboDur® Near Surface Mounted Reinforcement”

Notes on Application / Limitations
A suitably qualified Structural Engineer must be responsible for the design of the strengthening works.

Additionally as this application is structural, great care must also be taken in selecting suitably experienced and trained specialist contractors.

Sika CarboDur® strengthening systems with Sika CarboDur® plates must be protected from permanent exposure to direct sunlight, moisture and/or water. Please refer to the relevant Method Statement and Product Data Sheets for the selection of suitable overcoating materials, in situations where systems will be fully or partially exposed.

Please also refer to the relevant Method Statements for further limitations and guidelines:
- “Method Statement Sika CarboDur® Externally Bonded Reinforcement”
- “Method Statement Sika CarboDur® Near Surface Mounted Reinforcement”

Detailed advice can always be obtained from Sika Services AG and your local Sika Technical Services Department

Fire Protection
Where required for local regulations, Sika CarboDur® plates can also be over coated with additional fire protection materials.

Value Base
All technical data stated in this Product Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.

Health and Safety Information
For information and advice on the safe handling, storage and disposal of chemical products, users shall refer to the most recent Material Safety Data Sheet containing physical, ecological, toxicological and other safety-related data.

Legal Notes
The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product's suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.