

Sika[®] CarboDur

Heavy-Duty CFRP Strengthening System

Construction

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|-------------------------------|---|
| Description | Sika CarboDur is a heavy-duty strengthening system for reinforced concrete and timber. It consists of two components: Sikadur-30 adhesive for bonding reinforcement and Sika CarboDur-laminates. |
| Uses | The Sika CarboDur system can be used to strengthen reinforced concrete and timber structures due to: <ul style="list-style-type: none"> ▪ Loading increases. ▪ Damage to structural parts. ▪ Change in structural system. ▪ Design or construction defects. |
| Advantages | <ul style="list-style-type: none"> ▪ Low in weight. ▪ Available in any length. ▪ Low overall thickness. ▪ Easy to transport. ▪ No preparation of Sika CarboDur-laminates. ▪ Laminate intersections are simple. ▪ Economical application – no heavy handling and installation equipment. ▪ Very high tensile or flexural strengths can be achieved. ▪ High modulus of elasticity. ▪ Outstanding fatigue resistance. ▪ Can be coated without preparation. ▪ Alkali resistant. |
| Storage and Shelf Life | When not exposed to direct sunlight, Sika CarboDur-laminates have unlimited shelf life. Sikadur-30, when stored in the original sealed containers within the temperature range of +5°C to +25°C will keep for a minimum of three (3) years. |
| Instructions for Use | |
| Surface Preparation | <p>The concrete or timber surface must be clean and free from grease and oil, dry, and have no loose particles or laitance.</p> <p>This can be prepared by blast cleaning, scabbling or grinding. The concrete age should be 3 to 6 weeks minimum, depending on thickness, curing conditions etc.</p> <p>The surface to be coated must be level, with steps and formwork marks not greater than 0.5mm.</p> <p>After cleaning remove all dust from the surface with an industrial vacuum cleaner.</p> |
| Mixing | Sikadur-30 is supplied in factory proportioned units comprising the correct quantities of Part A (Resin) and Part B (Hardener). Thoroughly stir both components separately using a low running drill/stirrer with a helical paste mixer (max. speed 600rpm). Decant all Part B into Part A and mix thoroughly together until a uniform colour is achieved (typically 3 minutes). A streaky colouration is indicative of inadequate or incomplete mixing. Apply immediately. Small units may be hand mixed provided an even colour is achieved. |

Application

If any necessary patching work needs to be done on the surface, this must be done with Sikadur-41, on the day preceding the actual bonding operations. Apply the well mixed Sikadur-30 adhesive carefully to the prepared substrate with a spatula to form a first layer of at least 1 mm. Place the Sika CarboDur-laminate on a table and clean it with Sika Colma Cleaner. Apply the Sikadur-30 adhesive across the width of the laminate, ensuring a total coverage. The adhesive should be minimum 1 mm deep at each side, to minimum 2 mm deep at the centre. This is best done using a plastic spatula shaped on site to achieve this profile.

Within the open time of the adhesive, depending on temperature, place the Sika CarboDur-laminate onto the concrete surface. Using a roller, press the laminate into the epoxy material until the adhesive is squeezed out on both sides of the laminate.

Remove surplus epoxy adhesive. Samples should be made up on site to check the adhesive used in respect of curing rate and final strength. Measure the compressive bending and adhesive strength after curing. As a final check, test the laminates for drumminess by tapping lightly.

There is no need for mechanical equipment to press strips onto the substrate nor is it necessary to provide clamps or supportive devices to keep overhead strips in place. Once cured the top of the laminates can be painted with a coating material such as Sikagard-62, Sikagard-670W or Sikagard-680S.

Cleaning

Clean tools immediately with Sika Colma Cleaner. Wash hands and skin thoroughly in warm soapy water. Cured material can only be removed mechanically.

Technical and Physical Data**A. Sika CarboDur-Laminates**

| | | | |
|-------------------------------|---|----------------------------------|----------------------------------|
| Colour | Black | | |
| Base | Carbon fibre reinforced with an epoxy matrix | | |
| Apparent Density | 1.6g/cm ³ | | |
| Temperature Resistance | Between 150°C and 500°C | | |
| Elastic Modulus | Sika CarboDur S > 165,000 MPa | Sika CarboDur M > 210,000 MPa | Sika CarboDur H > 300,000 MPa |
| Tensile Strength* | >2,800 MPa | >2,400 MPa | >1,300 MPa |
| Mean Value of Tensile* | | | |
| Strength at Break | 3,050 MPa | 2,900 MPa | 1,450 MPa |
| Elongation at Break | > 1.7% | > 1.2% | > 0.45% |
| Packaging | Supplied in rolls of 250 m or palletised in pre-cut sections. | | |

* Mechanical values obtained from longitudinal directions of fibres.

| Availability | Type | Width mm | Thickness mm | Cross Sectional Area mm ² |
|------------------------|----------------------|-------------|-----------------|---|
| Sika CarboDur S | Sika CarboDur S512* | 50 | 1.2 | 60 |
| | Sika CarboDur S612 | 60 | 1.2 | 72 |
| | Sika CarboDur S812* | 80 | 1.2 | 96 |
| | Sika CarboDur S1012 | 100 | 1.2 | 120 |
| | Sika CarboDur S1212 | 120 | 1.2 | 144 |
| | Sika CarboDur S614 | 60 | 1.4 | 84 |
| | Sika CarboDur S914 | 90 | 1.4 | 126 |
| | Sika CarboDur S1214* | 120 | 1.4 | 168 |
| Sika CarboDur M | Sika CarboDur M614 | 60 | 1.4 | 84 |
| | Sika CarboDur M914 | 90 | 1.4 | 126 |
| | Sika CarboDur M1214* | 120 | 1.4 | 168 |
| Sika CarboDur H | Sika CarboDur H514 | 50 | 1.4 | 70 |

(*Readily available, other types available on demand.)

Technical and Physical Data (continued)

Sikadur-30 Adhesive for Bonding Reinforcements

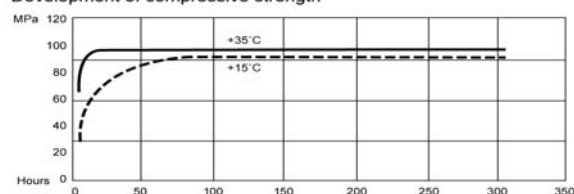
| | | |
|---------------------------------|---|------------------------------|
| Appearance | Part A | White paste |
| | Part B | Black paste |
| | Part A + B | Light grey when mixed |
| Mix Ratio | A : B = 3 : 1 | (parts by weight and volume) |
| Density | 1.77 kg/L | (A + B) |
| Pot Life* | 40 minutes | (at 35°C) |
| Open Time* | 30 minutes | (at 35°C) |
| Sag Flow* | 3-5 mm | (at 35°C) |
| Shrinkage* | 0.04% | |
| Glass Transition Point* | 62°C | |
| Static E-Modulus* | 12,800 MPa | |
| Adhesive Strength (wet)* | 4 MPa | (Concrete Failure) |
| Shear Strength* | 15 MPa | (Concrete Failure) |
| Coefficient of Expansion | 9×10^{-5} per °C | (-10°C to 40°C) |
| Consumption | See Technical Data Sheet for Sikadur-30 | |
| Packaging | 5 kg tins | Part A 3.75 kg |
| | | Part B 1.25 kg |

*To F.I.P. Federation Internationale de la Precontrainte

Note: The values given may vary according to amount of air entrained during mixing.

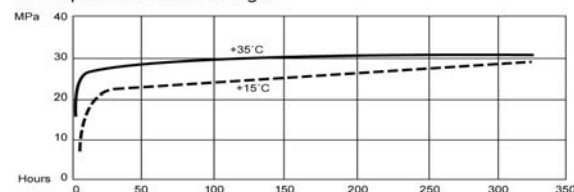
Compressive strength
(DIN 1154.7)

Development of compressive strength



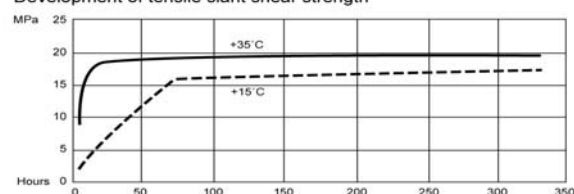
Tensile strength
(DIN 43455)

Development of tensile strength



Tensile slant shear strength (Sika Test)

Development of tensile slant shear strength



Design Notes

- A Sika CarboDur-laminate has no plastic deformation reserve.
- Maximum bending resistance of a strengthened section is reached when laminate failure occurs during steel yield and before concrete failure.
- Mode of failure is influenced by the laminate cross section.
- To limit crack widths and deformation the yield point should not be reached in the reinforcing bars under service conditions.
- Any shear cracks which occur must be prevented from causing displacement on the strengthened surface and shearing of the laminate.
- Stress and deformation calculations can be made by the normal methods.
- When assessing the condition of the structure, look at the dimensions, quality of existing construction materials, climatic conditions and agreed conditions of service.

Design Notes (continued)

- Design aspects to be verified in a Sika CarboDur Strengthening system:
 - Bearing safety
 - non strengthened structure (total safety factor $g \approx 1.2$)
 - strengthened structure (mode of failure mentioned above, check on strains)
 - shearing of laminate must not occur
 - anchorages
 - Fatigue resistance
 - check concrete and steel stresses
 - Serviceability
 - deformation (with average strains, elasti behaviour of the structure and time-based strain changes in concrete).
 - Steel stresses (no plastic deformation in service conditions).
 - Limit crack widths (by limited the steel stresses to less than the yield point under service conditions)

A full Sika Design Manual is available. Contact our Technical Department for details.

Important Notes

- Do not apply Sikadur-30 to surfaces with standing water. Maximum moisture content of the concrete 10%.
- Always mix a full kit to avoid mix ratio error.
- Only mix as much material as can be applied within the stated potlife.
- Do not dilute the product with solvent as this will affect the cure and in service performance.
- Constant exposure to service temperatures $>50^{\circ}\text{C}$ may affect the performance of the product.
- Sika CarboDur can be fire-rated if required using standard fire rating materials.
- The temperature at which Sikadur-30 is stored at during the 24 hours before it is mixed will govern it's potlife when mixed.
- Compressive strengths etc. of epoxy resins must be qualified by the testing method eg. Test Standard or size of specimen under test and the rate at which the test piece is loaded under test, as these factors will effect the result markedly. Faster loading rates will generally give higher ultimate loads and vice versa. Also, a specimen at lower temperature will show higher strengths and vice versa.
- Sikadur-30 Parts A and B are a water pollutant and should not be discharged into drains, waterways or soil.

Handling Precautions

- Avoid contact with the skin, eyes and avoid breathing it's vapour.
- Wear protective gloves when mixing or using.
- If poisoning occurs, contact a doctor or the Poisons Information Centre.
- If swallowed, do NOT induce vomiting. Give a glass of water.
- If skin contact occurs, remove contaminated clothing and wash skin thoroughly.
- If in eyes, hold eyes open, flood with water for at least 15 minutes and see a doctor.

Important Notification

The information, and, in particular, the recommendations relating to the application and end-use of Sika's 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 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 proprietary rights of third parties must be observed. All orders are accepted subject of our terms and conditions of sale. Users should always refer to the most recent issue of the Technical Data Sheet for the product concerned, copies of which will be supplied on request.

PLEASE CONSULT OUR TECHNICAL DEPARTMENT FOR FURTHER INFORMATION.

