Contractor Support for the Concrete Repair and Protection of Chimneys and Cooling Towers

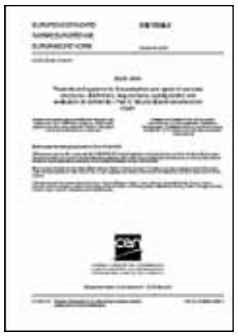
(in Accordance with EN 1504)

Sika Support for Contractors in the Successful Repair
In Accordance with European Standards EN 1504

Total Project Understanding and Technical Competance

Sika has long been the preferred partner of the pioneering specialist engineers, contractors and access equipment manufacturers, producing tailored products and systems for these very special structures and their unique requirements. In close cooperation with these leading experts Sika has developed problem solving repair and protection systems for all areas of chimney and cooling tower structures, zones 1, 2 and 3 externally, plus internally on large natural draft cooling towers.

Integrated Proposals with Repair Systems to EN 1504



Sika is the clear global market and technology leader in concrete refurbishment and specifically in all of the materials necessary for the concrete repair, protection and strengthening of chimneys and cooling towers. All of these Sika products and systems are fully in accordance with European Standards EN 1504, indeed many Sika experts from many different countries were also involved in the development of these Standards.

All Available Technologies and Value Engineering Support

Sika has all of the available material technologies in-house and produces all of the different materials required. This includes systems for all of the different methods of installation and application according to the condition, location and exposure of the concrete and steel surfaces. Threrfore Sika is your ideal partner to support value engineering and adaptions to service life requirements and site limitatins.

The Sika Advantages

- **Single source supply and support**
- **No split responsibilities**

The Sika Advantages

- **Fully integrated materials systems**
- **Tested and proven compatibility**

The Sika Advantages

- **All available methods and materials**
- **Technically competent value engineering for every eventuality**

and Protection of Reinforced Concrete

Worldwide Experience and Technical Expertise

Sika has more than 12 000 employees and manufacturing facilities in more than 70 countries. We have successfully completed reference projects for all different types of chimneys and cooling towers all around the world. Qualified Sika people are available to support you locally on every project. Unique Sika systems are available to suit all different climate and environmental exposure conditions, wherever the structures are located and at whatever time of year the works must be undertaken.

The Sika Advantages

- **Global technical support**
- **Worldwide testing and approvals**

Cost Performance for Competitive Advantage

Sika technologies and systems are also developed focussed on helping to achieve easier and faster application and reduced curing times. This results in faster overall project completion and reduced down times when combined with highly competitive cost performance pricing, these Sika advantages all help to dramatically reduce costs and extend service life, thus also reducing future maintenance requirements and costs. Sika gives you real competitive advantage.

The Sika Advantages

- **Fully integrated materials systems**
- **Easier, faster, more cost effective**

The Sika System Approach (acc. EN 1504)

These are the key stages in the repair process according to European Standard EN 1504 and as originally developed and established by Sika:

- **Assessment of the structure:** A detailed Condition Survey with Sika checklists to determine the type and extent of visible, non visible and potential damage.
- **Identification of the type and causes of damage:** Sika technical support to identify the type of concrete defects and attack – mechanical, chemical and physical, plus assess damage due to reinforcement corrosion
- **Evaluation of repair objectives and options:** Considering the alternative options and value engineering with different Sika technologies according to the limiting factors including access, structural and programme requirements.
- **Selection of the appropriate repair principles and methods:** With the Sika systems in accordance with EN 1504 and also specially developed and adapted for these structures
- **Specifications and method statements:** Full documentation and support from Sika for all of the necessary project proposals and contract documents.

The Complete Sika System Approach – to Repair and

Removal of the Damaged Concrete and Protection of the Steel Reinforcement

Surface Cleaning and Damaged Concrete Removal

Complete surface cleaning and damage area identification and marking for removal or further investigation. Following the results of the Engineer's Condition Survey all of the damaged concrete must be removed following structural guidelines and any exposed steel reinforcement cleaned thoroughly – preferably by blastcleaning to a standard equivalent to SA 2½. (In accordance with EN ISO 8501-1).

The Sika Advantages

- Diagnostic support on site
- Minimise break out with Sika technologies

EN 1504 Part 10 Section 7

Exposed and Corroding Steel Reinforcement

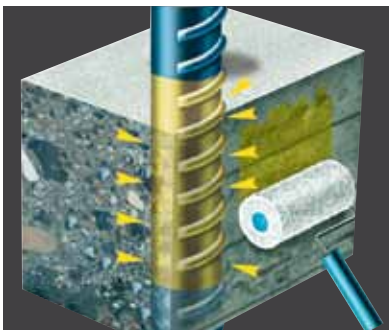
There are several special Sika insulating and protective coatings to protect the clean, exposed steel prior to concrete replacement. These include **Sika MonoTop®-910 and SikaTop® Armatec®-110 EpoCem®,** which are both particularly suitable for the large exposed steel areas frequently required on cooling towers. They can be applied by brush or by spray for larger areas of steelworks.

The Sika Advantages

- Anti-corrosion rebar coatings
- Spray application on large areas

EN 1504 Part 9 Principle 11 (CA), Method 11.2

Embedded Steel Bars at Risk of Corrosion



Additional corrosion protection can also be provided to steel that is not yet exposed or actively corroding, but is at risk in carbonated or inadequate concrete cover, by the application of **Sika® FerroGard®** corrosion inhibitors. These are applied as the penetrating impregnation **Sika® FerroGard®-903+**, or as admixtures in the replacement concrete or mortar with **Sika® FerroGard®-901**.

The Sika Advantages

- Prevent incipient anode development
- Protects the steel even in carbonated concrete

EN 1504 Part 9 Principle 11 (CA), Method 11.3

Replace the Concrete Damage

Replacing and Restoring the Damaged Concrete

Hand/Trowel Applied Local Patch Repairs

Sika produces an extensive range of prebatched hand trowel applied repair systems for localised patch repairs. These include chemically resistant materials to protect against aggressive acidic gases and liquids. The most frequently used systems for these structures are **Sika MonoTop**® cementitious mortars for general repairs and **Sikadur**® epoxy resin based mortars for chemically exposed repairs.

The Sika Advantages

- **Easy high build application and surface finishing**
- **Vapour tight and vapour permeable products**

EN 1504 Part 9 Principle 3 (CR), and Part 3 Class R4

Machine Applied Repairs for Large Areas or Volumes

Pumped and spray applied Sika concretes and mortars are generally used for larger volume repairs and where complete recasting is required, or for larger areas and areas with difficult access. These are purpose designed for optimum flow and minimal shrinkage, or with non sagging high build properties and low rebound respectively. **Sika**® **ViscoCrete**® self Compacting Concretes, **Sika MonoTop**® 'wet' spray and **SikaCem**® **Gunite** 'dry' spray systems are ideal for these purposes on chimneys and cooling towers.

The Sika Advantages

- **Every available application technique**
- **Fast and secure application by every method**

EN1504 Part 9 Principle 3 (CR), and Part 3 Class R4

Levelling and Restoring the Concrete Surface

A fundamental pre-condition for the successful application of protective coatings to concrete surfaces is by the EN 1504-9 Principles for repair. The concrete surfaces must be clean and also free of surface defects such as blowholes/bargholes or voids that could allow the entry of aggressive agents. These must be filled with a surface levelling or smoothing coat such as with **Sika MonoTop**®**-723 N** generally, or with **Sikagard**®**-720 EpoCem**® to further increase the level of surface protection for high risk internal surfaces and externally in Zone 1 and Zone 2 where necessary.

The Sika Advantages

- **Sealed and uniform concrete surfaces ideal for coating**
- **Additional corrosion protection**

EN 1504 Part 9 Principle 3 (CR), and Part 3 Class R4

The Complete Sika System Approach – To Provide Fut

Protection of the Repaired and Exposed Concrete Surfaces

External Zone 1: The Tops of the Structures

Normally Zone 1 is the top 5m of the chimney or tower. The most severely exposed external surfaces should always be sealed and levelled with **Sikagard®-720 EpoCem®**. Special Sika systems are then applied to provide high levels of protection with lightfast finishes including ICAO Aircraft warning colours. These include **Sika® Icosit®-2406** with **SikaCor® EG-5** Topcoat, or for surfaces subject to potential movement and cracking, the elastic crack bridging **Sikafloor®-390** with **Sikagard®-363** elastic topcoat.

The Sika Advantages

- **Highly chemically resistant**
- **Brush, trowel or spray application**

EN 1504 Part 9 Principle 6 (PC) and Part 2

External Zones 2 and 3: The Rest of the Structures Surface

Zone 2 – The middle section, normally 5 – 30 m and Zone 3 – the rest of the external surfaces, up to 70% of the surface area. The ideal combination of **Sikagard®** hydrophobic impregnations followed by **Sikagard®-680 S** is widely used for the bulk of the external surfaces and this also conforms to the OS2 classification of the German Federal Regulations for concrete protective coating systems. **Sikagard®-550 W** elastic coating is used where additional crack bridging performance is required.

The Sika Advantages

- **Anti-carbonation coatings**
- **Elastic crack-bridging properties**

EN 1504 Part 9 Principle 6 (PC) and Part 2

Internal Surfaces of Natural Draught Cooling Towers

The level of internal chemical exposure is dependant on the level of the flue gas desulphurisation system (FGDS) installed. However the protection required is the same and only the thickness can be varied. All internal surfaces must first be sealed and levelled with **Sikagard®-720 EpoCem®**. Then the specially developed coating **Sika® Icosit®-2406** are applied according to the local specifications and regulations. As the top section is also open to UV light and solar radiation, these areas require an additional top coat of **Sikagard®-363** to provide the necessary additional protection for these extreme levels of exposure.

The Sika Advantages

- **Systems with the highest UV and chemical resistance combined**
- **Unique Sika cooling tower solutions**

EN 1504 Part 9 Principle 6 (PC) and Part 2

ture Protection for the Concrete Surfaces

Additional Sika Remedial Technologies and Solutions

Cracks and Joints: Repair, Bonding and Sealing

Cracks and joints must be sealed to prevent the ingress of aggressive agents. Structural cracks are resealed and bonded with **Sika® Injection** systems to transfer load as intended. 'Non-moving' surface cracks are sealed with **Sika MonoTop®** repair and levelling mortars. Fine surface cracks can be safely accom-modated by the **Sikagard®-500** range of elastic crack bridging coatings. Large moving cracks with no structural significance are treated as moving joints, witch are sealed with the **Sikaflex®** joint sealant or the **Sikadur® Combiflex® System,** a highly chemically resistant over-banding joint/crack sealing solution.

The Sika Advantages

- **Secure crack sealing and bonding**
- **Elastic movment joint sealing**

EN 1504 Part 9 Principle 4 (SS), Method 4.6 and Part 5

Structural Reinforcement and External Strengthening

Sika® AnchorFix® cartridge packed adhesive fixing and resin anchoring systems include ETA and ICBO approved materials and are in accordance with EN 1504 Part 6. Where additional external structural strengthening is required, this is achieved by the bonding of external plates in accordance with EN 1504 Part 4. This uses the innovative composite CFRP based **Sika® CarboDur®** plates and **SikaWrap®** fabrics, bonded with chemically resistant **Sikadur®** epoxy resins. These are all fully tested and proven in practice on many cooling towers and chimneys.

The Sika Advantages

- **Full design details and guidelines**
- **Detailed method statements for installaion**

EN 1504 Part 9 Principle 4 (SS), Methods 4.2 and 4.3, plus Part 6

Associated Steelwork: Durable Corrosion Protection

During the concrete refurbishment of huge structures it is usually also an opportunity to refurbish the associated structural and ancillary steelwork surfaces. This is also an area of special Sika expertise. This steel surface exposure is classified as being at least according to ISO 29 444 Part 2: 'Heavy Industrial'. Sika produces systems for every requirements: **Sika® Poxitar** system for direct chemical exposure: **Sika® Poxicolor** system for aggressive industrial atmos-pheres: plus the **SikaCor® EG** system for the highest combined stress of high chemical exposure in direct UV light and solar radiation.

The Sika Advantages

- **World beating performance**
- **Complete range of systems**

ISO 12944 Part 2: Heavy Industrial

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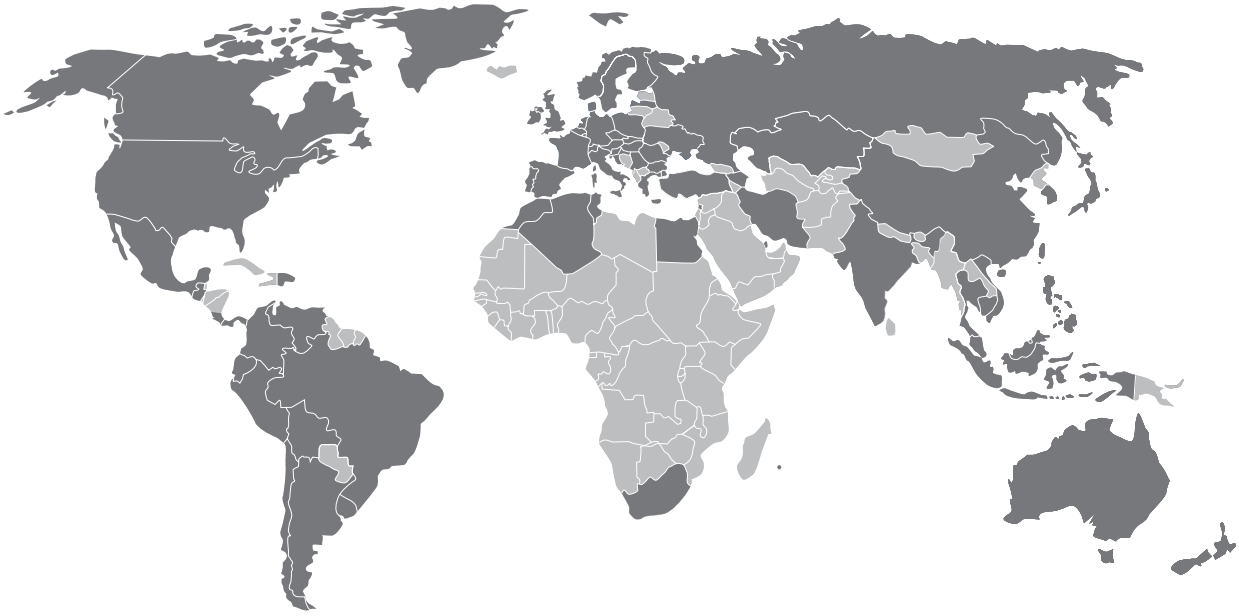

Your Partner in any Part of the World

Sika is a globally active company in the speciality and construction chemicals business. It has subsidiary manufacturing, sales and technical support facilities in over 70 countries around the world. Sika is the global market and technology leader in waterproofing, sealing, bonding, dampening, strengthening and protection of buildings and civil engineering structures. Sika has approx. 12'000 employees worldwide and is therefore ideally positioned to support the success of its customers.

Also available from Sika

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