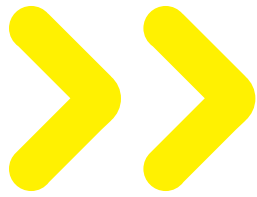


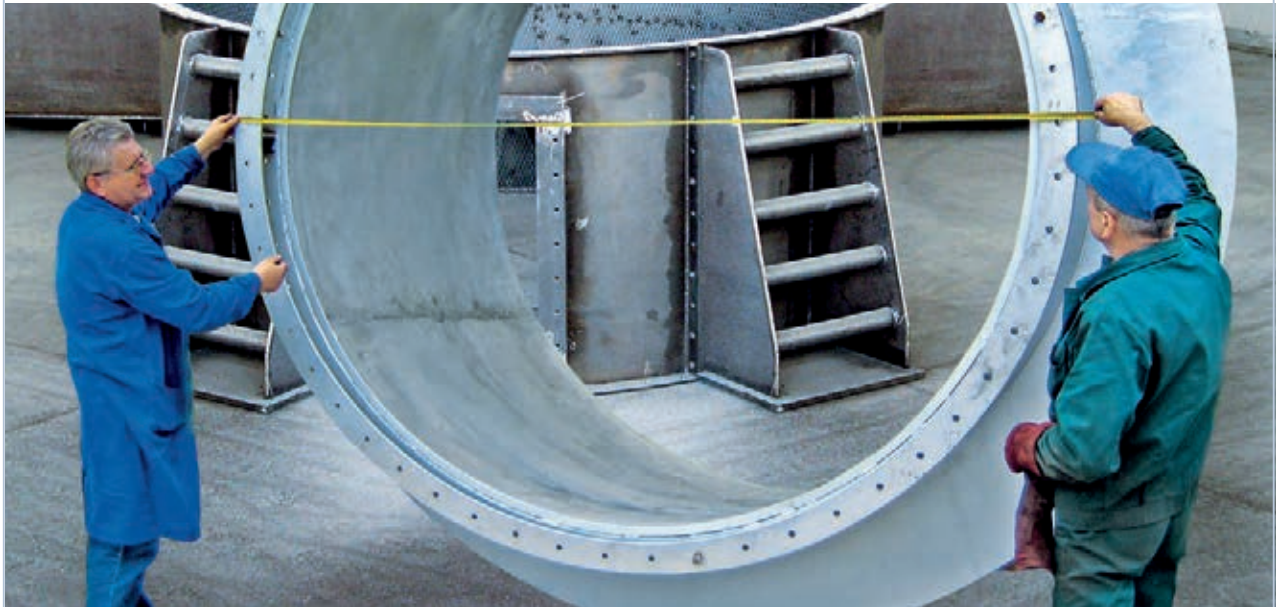
>> KALCRET
Hard Compound

User Handbook
Version 6





Hard Compound **KALCRET**



KALCRET hard compound for wear protection lining of pipe components, cyclones and other shaped elements.

Take advantage of many benefits:

- high wear-resistant
- seamless lining
- easy workability
- high temperature resistance up to 1,200 °C / 2,152 °F
- lining of complex geometries



KALCRET for troweling, casting or spraying



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Kalenborn
Wear Protection Solutions

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1. What is KALCRET?
2. Preparatory work – general
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7. Quality assurance samples

Note on application

This brochure and all other technical data submitted by us are meant for your information and advice.

All technical data have been based on the evaluation of tests made on specific samples. They cannot be interpreted as a guarantee for which we assume legal liability. Material data sheets and safety data sheets must be observed. Technical changes and errors to be excepted.

Please let us know if you need assistance. We are prepared to assist you.

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as of 2020-09

>> 1. What is KALCRET?

KALCRET hard compound is the general term for cement bonded wear protection materials. They are based on inorganic materials of high strength and good wear resistance. The use of nothing but extremely hard materials like bauxite and corundum ensures the high quality of the wear protection compound.

The mixture includes defined additives and is made up of:

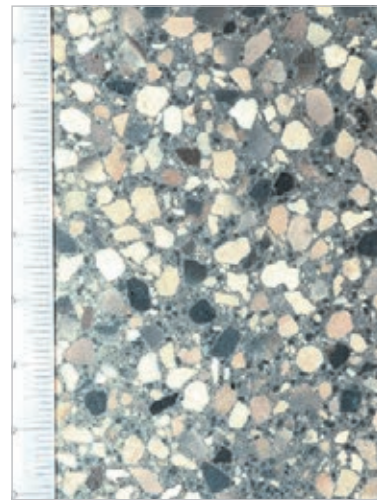
- hard aggregate materials
- cement binder
- micro- and nano-silica

Specific fiber components can be added to enhance the structural strength.



KALCRET, wear protection material out of a bag

		KALCRET
Hard material particle size	mm	0.1 - 4
Density	g/cm ³	2.4 - 3.1
Ultimate compressive strength	MPa	135 - 190
Ultimate bending tensile strength	MPa	15 - 26
Max. application temperature	°C (°F)	400 / 1,200 (752 / 2,152)
Percentage of hard material	%	70



Structural composition of KALCRET: high strength cement matrix, hard aggregate materials 0.1 - 4 mm size (basalt, bauxite or corundum)

KALCRET

↑
↑
↑

Wear rate
X = applied by trowelling
Y = applied by casting
S = applied by spraying

Temperature limits
N = up to 400 °C / 752 °F
T = up to 1,200 °C / 2,152 °F

Working procedure
A = a.o. basalt hard material
B = bauxite hard material
C = corundum hard material



KALCRET trowelled compound

This compound allows protection of horizontal, vertical, inclined and curved surfaces. Furthermore, safe overhead working is feasible.



KALCRET cast compound

This material will be particularly useful for protecting flat surfaces against wear or if formwork can be used.



KALCRET sprayed-on compound

KALCRET sprayed-on compound allows large surfaces to be lined in a minimum of time. It may be applied by spraying horizontally, vertically or even overhead without any problems.

Advantages of KALCRET

- **high strength and abrasion resistance to sliding friction**
- **excellent abrasion values**
- **large surface lining**
- **varying lining thickness depending on the stress due to wear**
- **can be used after 24 hours**
- **suitable for temperatures up to 1,200 °C / 2,152 °F**
- **high thermal shock resistance**
- **even complicated geometries are feasible**
- **easy overhead working**
- **ideally suited for repairs**
- **can be installed at the site by locally available staff**

>> 2. General Preparatory Work

Installation requirements

In preparing for a KALCRET installation, the specific installation requirements at the site need to be checked and measures adapted accordingly.

Preparing the installation

After the specific installation requirements have been determined, details of the installation procedure will be planned accordingly.

Tools and accessories for working KALCRET

Special tools and accessories are required for installing KALCRET.

It is recommended to use the tools and accessories tested by Kalenborn for KALCRET installations.

For more information see chapter 6

Packaging

Standard packaging for **KALCRET** hard compound is in **25 kg / 55.1 lb bags**.

The **curing liquid** is available in **10 or 20 kg / 22 or 44 lb** containers.

Storage and durability

The minimum shelf life for **KALCRET** products is **12 months** after production. KALCRET has to be stored dry at 5 - 30 °C / 41 - 86 °F. This has to be taken into consideration for inventory stocking and also for job site storage.

The application of KALCRET in case of longer shelf life or other storage conditions is possible after clarification with Kalenborn.

The minimum shelf life for the **curing liquid** is **12 months** with unopened containers stored at 5 - 30 °C / 41 - 86 °F and without allowing it to freeze.

Shelf life facts

Batch number and production date are printed onto the KALCRET bags.

The production date is printed on the curing liquid container.

Check list

- **clarify installation requirements**
- **select suitable working machinery and tools**
- **check correct power supply and connections**
- **confirm sufficient supply of compressed air for KALCRET S**
- **pay special attention to the ambient conditions for both installation and storage of KALCRET**

Bulk-density and quantity needed

KALCRET-materials	Bulk-density (g/cm ³)	Consumption (kg/m ²) at lining thickness		
		20 mm /	25 mm /	30 mm /
		0.78 inches	0.98 inches	1.18 inches
KALCRET ANX	2.4	51	63	75
KALCRET BTX	2.7	56	70	84
KALCRET BNX	2.7	56	70	84
KALCRET BTS	2.7	56	70	84
KALCRET BTY	2.7	56	70	84
KALCRET CTX	3.1	62	77.5	93
KALCRET CNX	3.0	60	75	90

The minimum lining thickness is 15 mm / 0.59 inches.

The optimal lining thickness is 20 to 25 mm / 0.78 to 0.98 inches.

The curing liquid required is 0.25 kg/m² / 55.55 lb/1.550 sqin.

Loss rate

A specific loss rate has to be taken into account when working with KALCRET.

For **trowable and castable KALCRET** the loss rate is **approx. 5 to 10 %**:

- up to 10 m²/ 108 sqft: 10 %
- up to 100 m²/1,080 sqft: 8 %
- from 101 m²/1,087 sqft: 5 %

For **sprayable KALCRET** the loss rate is **approx. 25 %**.

Fiber components

Depending on the application specific fiber components are offered; typical qualities include: steel or plastic.

The choice of fiber components depend on the particular application and requirements. Major criteria are the following:

- workability
- temperature
- chemical stress
- etc.

The hard compound mixture either contains fiber components or they are delivered in standard packages (normal: 1 bag of KALCRET – 1 small bag of fiber components).

Working temperature environment / structural components

The optimal working temperature ranges between **10 °C / 50 °F and 30 °C / 85 °F**. Working at temperatures **below 5 °C / 41 °F** requires heating of the system to be lined.

Check list

- provision for sufficient quantities of KALCRET including the fiber components
- safe supply of clean water (potable quality)
- water temperature 10 – 25 °C / 50 – 77 °F; to be cooled/heated if necessary
- installation tools and accessories available
- protected working zone
- no direct sunlight
- confirm required working temperature
- provide surface sealing system
- personal protection (gloves, helmet, goggles, mask)
- observe safety data sheets
- closely observe working instructions
- follow instructions given on KALCRET bags

>> 3. Surface Preparation

Cleaning

The use of KALCRET hard compound requires a careful preliminary treatment of the surfaces to be lined:

- Steel surfaces require cleaning (they must be free of loose particles). Sandblasting is not necessary.
- Concrete surfaces require cleaning (they must be free of forming oil and loose particles) and shall be wetted (as it is standard practice for the application of the cement bonded materials).

Reinforcement system

All KALCRET materials, whether applied on a base of steel or concrete, require the installation of a suitable reinforcement system. The standard system uses an appropriate type of wire mesh, providing a very good attachment to the surface being lined. The materials shall be matched to the specific application.

With KALDETECT visual KALCRET wear monitoring, the indicator stones are fixed through the wire mesh on the base of the component. The position is based on the desired laying plan for the stones.

Working sections

Larger areas should be subdivided into working sections of **1,000 mm x 2,000 mm** (approx. 2 m² / 21.52 sgft).

In case of overhanging lining areas, smaller working fields can be useful. The working sections are established by mounting separating strips on the wire mesh with the thickness of the lining to be applied. The strips, e.g. made of plastic, are fitted vertically on the surface.

The strip between the completed section and the next working section is removed before filling the next section, resulting in a jointless lining. This process is repeated for each new section.

Check list

- **cleaning the surfaces, free of loose particles**
- **sandblasting not required**
- **concrete surfaces shall be free of forming oil, loose particles**
- **concrete surfaces to be wetted**

Check list

- **provision for reinforcement system, e.g. wire mesh**
- **check and provision for tools to fasten the reinforcement system**
- **correct material choice to be observed**
- **mounting the reinforcement system**
- **Glue in indicator stones if necessary**

Check list

- **check drawings for data concerning the working sections**
- **plan provision of working sections if necessary**
- **maximum dimension of working sections: 1,000 x 2,000 mm (approx. 2 m² / 21.52 sgft)**

Expansion joints

When operating temperatures **exceed 50 °C / 122 °F** the selective provision of expansion joints may be necessary to equalize the varying coefficients of expansion. This arrangement will avoid building up of stress as well as reduce the risk of cracks in the lining.

Expansion joints are mounted with due regard to the particular conditions of operation and components. Normally, they consist of 5 mm thick rigid foam strips. The wire mesh should be interrupted along the direction of the expansion joints. If appropriate, the expansion joints can be installed at the boundaries of the working sections.

Otherwise expansion joints should be designed in direction against the material flow.

After completion of the lining work the rigid foam strips should be removed.

Check list

- **check selective provision of working sections at operating temperatures above 50 °C / 122 °F**
- **plan mounting of expansion joints or check existing drawings**
- **prepare sufficient number of rigid foam strips**
- **fasten rigid foam strips**
- **fill sections with KALCRET hard compound**
- **remove rigid foam strips after lining has been completed**

Retaining strips

Steel retaining strips are necessary at transitions and lining ends. The lining may be thinned at the end within zones not exposed to load.

Check list

- **check drawings for data concerning retaining strips**
- **plan mounting of retaining strips as needed**
- **steel retaining strips shall be fastened by dowels (concrete surface) or welded (steel)**
- **take running out zones into account, if needed**

>> 4.1 Working KALCRET - Trowelled Compound

4.1.1 Job preparation

This compound allows protection of horizontal, vertical, inclined and curved surfaces. Overhead working is easily done.

Reinforcement system

All KALCRET materials, whether applied on a base of steel or concrete, require the installation of a suitable reinforcement system.

The wire mesh is mounted at a **distance of approx. 5 mm / 0.19 inches** utilizing the necessary hardware. The attachment points are **spaced at approximately 250 mm / 9.84 inches** making the wire mesh stiff and rigid.

In addition, other reinforcement systems may be used if needed.

Check list

- provision for sufficient quantity of all materials including KALCRET and fiber components
- for KALCRET-X a loss rate of approx. 5 - 10 % has to be taken into account
- confirm that a forced circulation mixer is available – if required with wear protected mixing tank
- necessary bricklayer tools and equipment
- graduated flasks for measuring water



Welding the wire mesh to the surface: spacing approx. 250 mm / 9.84 inches



Stiff and rigid fastening – distance to the wall to be lined: about 5 mm / 0.19 inches

Check list

- provision for reinforcement system, e.g. wire mesh
- check and provision for tools to fasten the reinforcement system
- correct material choice to be observed
- mounting the reinforcement system

Forced circulation mixer

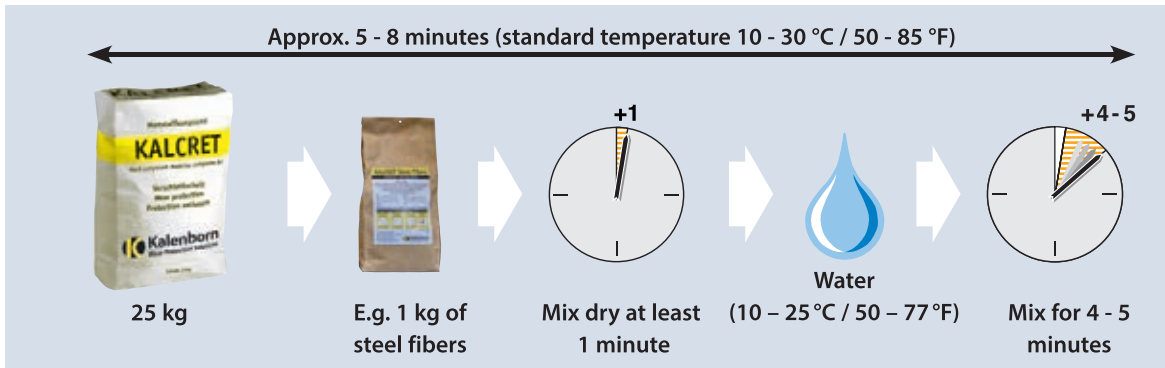


Material feeding into the forced circulation mixer



Wear protected tank of a Kalenborn forced circulation mixer

4.1.2 Prepare KALCRET compound



Empty the bag of KALCRET hard compound in the mixer



Check list

- place KALCRET in a clean forced circulation mixer
- 1 bag of KALCRET yields approx. 9 liters / 549 cuin of compound
- remove or breakup any lumps in the fibres

Adding fiber components

- We recommend that steel or PP fibres be added for reinforcement.
- The fiber components are either included in the hard compound or added during the mixing time.
- Gradually add the fiber components slowly to avoid clogging.



2.1 Fiber components matched to the specific application are offered



2.2 Add fiber components slowly and continuously and mix dry for 1 minute

Check list

- add e.g. 1 kg of steel fibers per bag of KALCRET (25 kg / 55.1 lb)
- or
- add e.g. 1 small bag other fibers per bag of KALCRET (25 kg / 55.1 lb)
- make sure the correct materials have been selected
- store fibers in a dry environment
- remove or breakup any lumps in the fibres
- add fibers slowly and continuously
- mix dry for 1 minute
- carefully observe the mixing process

Adding water

- Closely observe water dosing rate as specified in the **working instructions**.
- Exactly measure the required water quantity and slowly add it during mixing.

Adding water for KALCRET material

KALCRET-materials	Adding water
KALCRET ANX	1,625 - 2,125 ml / 99.1 - 129.6 cuin
KALCRET BTX	1,625 - 2,125 ml / 99.1 - 129.6 cuin
KALCRET BNX	1,750 - 2,625 ml / 106.7 - 160.2 cuin
KALCRET BTY	1,300 - 1,800 ml / 79,3 - 109,8 cuin
KALCRET CTX	1,400 - 1,800 ml / 85.4 - 109.8 cuin
KALCRET CNX	1,550 - 2,050 ml / 94.5 - 125.0 cuin

- Make sure only clean potable water of a **maximum temperature of 25 °C / 77 °F** and a **minimum temperature of 10 °C / 50 °F** is used.
- The desired stiff / plastic working consistency will be reached after 4 - 5 minutes mixing.



3. Add water as specified in the working instructions



4. Mix for 4 - 5 minutes and check result

KALCRET compound ready for use



5. The compound should have a stiff / plastic consistency



6. The stiff / plastic KALCRET compound (X) to be applied by trowelling with the aid of simple bricklayer tools

Check list

- the mixing period and the required water quantity may vary within narrow limits depending on the ambient conditions and the product properties
- if the KALCRET compound is too dry, add water at steps of 25 ml / 1.52 oz each per 25 kg / 55.1 lb KALCRET
- all standard data are valid for an ambient temperature range from 10 - 30 °C / 50 - 85 °F
- in case of higher temperatures contact Kalenborn or duly observe information contained in annex 3

Check list

- the KALCRET compound is ready for use as soon as it features a stiff / plastic working consistency
- the finished KALCRET compound shall be completely free of lumps

4.1.3 Applying trowelled compound

Following homogeneous mixing KALCRET hard compound can be applied with the appropriate tools to the prepared surface. To begin with, the wire mesh should be filled completely. Depending on the lining thickness, the material is applied by layers, i.e. successively on the freshly applied layers. Normally, the layer thickness ranges **between 20 and 40 mm / 0.78 and 1.56 inches**. The surface is subsequently smoothed.

Working temperature and setting time

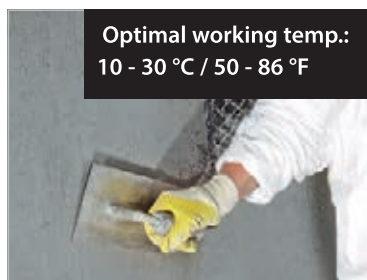
- The optimal working temperature is **10 - 30 °C / 50 - 85 °F**.
- Direct sunlight should be avoided.
- KALCRET should **not be applied** at temperatures **below 5 °C / 41 °F**.
- The working time after mixing is up to **1 hour at 20 °C / 68 °F**.
- The working time may be shorter at higher temperatures.
- The **minimum setting time** is **24 hours** at an ambient temperature of 20 °C / 68 °F. Lower temperatures will require longer setting times.

Check list

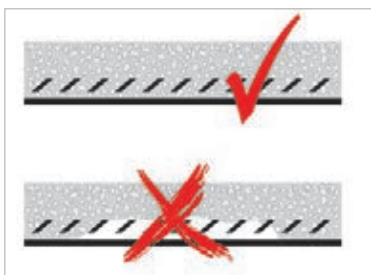
- make sure the surfaces are clean
- securely fasten the reinforcement system
- prepare a good stiff / plastic KALCRET compound for trowelling
- make sure the correct water quantity is added
- mix for at least 4 - 5 minutes
- check whether the mixture is free of lumps; if not, mix again
- apply KALCRET
- completely fill the reinforcement system
- check layer thickness
- smooth KALCRET surface as needed



1. Overhead working is feasible without problem



2. After trowelling, easy to make smooth



3. Ensure complete filling of the reinforcement system



4. Check layer thickness and equalize it, if necessary

>> 4.2 Working KALCRET – Cast Compound

4.2.1 Job preparation

The KALCRET cast compound will be particularly useful for protecting flat surfaces. Also prefabricated products can be made with the KALCRET cast compound (e.g. tiles for lining).

Reinforcement system

KALCRET materials require the installation of a suitable reinforcement system. The standard system uses an appropriate type of wire mesh, providing a very good attachment to the surface being lined. The materials shall be matched to the specific application.

The wire mesh is mounted at a distance of **approx. 5 mm to 20 mm / 0.19 in to 0.78 inches** to the underground to be lined, depending on the lining thickness.

A distance between the attachment points of **approx. 250 mm / 9.75 inches** is sufficient.

Formwork

KALCRET cast compound is particularly effective in lining flat surfaces. Normally simple formwork will be made for vertical and inclined surfaces; that formwork will then be backed. The formwork should be as smooth as possible on the KALCRET side.



Prepare formwork, attach reinforcement system

Forced circulation mixer



Material feeding into the forced circulation mixer



Wear protected tank of a Kalenborn forced circulation mixer

Check list

- provision for sufficient quantity of all materials including KALCRET and fiber components
- for KALCRET-Y a loss rate of approx. 5 - 10 % has to be taken into account
- confirm that a forced circulation mixer is available – if required with wear protected mixing tank
- necessary bricklayer tools and equipment
- graduated flasks for measuring water

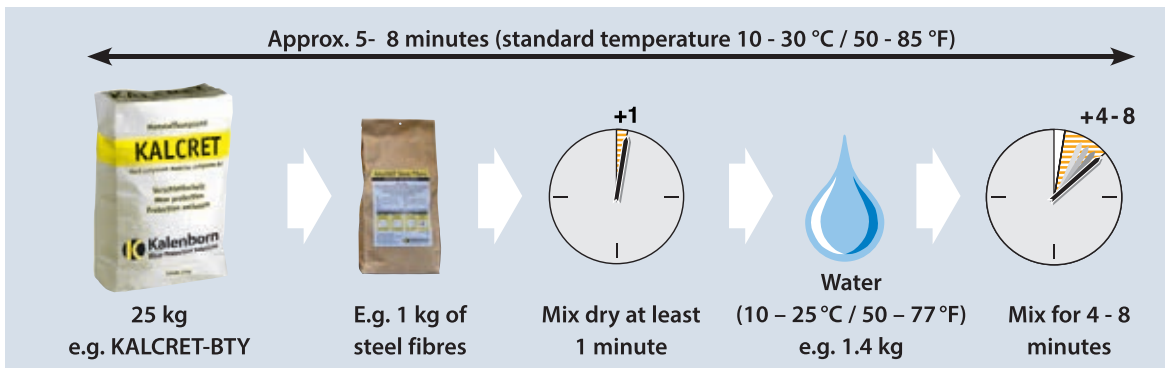
Check list

- provision for reinforcement system, e.g. wire mesh
- correct material choice to be observed

Check list

- carefully prepare formwork
- make sure surfaces are clean

4.2.2 Prepare KALCRET compound



KALCRET



1. Empty the bag of KALCRET hard compound in the mixer

Check list

- place KALCRET in a clean forced circulation mixer
- 1 bag of KALCRET yields approx. 9 litres / 549 cuin of compound
- remove or breakup any lumps in the fibres

Adding fiber components

- We recommend that steel or PP fibres be added for reinforcement.
- The fiber components are either included in the hard compound or added during the mixing time.
- Gradually add the fiber components slowly to avoid clogging.



2.1 Fiber components matched to the specific application are offered



2.2 Add fiber components slowly and continuously and mix dry for 1 minute

Check list

- add e.g. 1 kg of steel fibers per bag of KALCRET (25 kg / 55.1 lb)
- or
- add e.g. 1 small bag other fibers per bag of KALCRET (25 kg / 55.1 lb)
- make sure the correct materials have been selected
- store fibers in a dry environment
- remove or breakup any lumps in the fibres
- add fibers slowly and continuously
- mix dry for 1 minute
- carefully observe the mixing process

Adding water

- Closely observe water dosing rate as specified in the **working instructions**.
- Exactly measure the required water quantity and slowly add it during mixing.
- Make sure only clean potable water of a **maximum temperature of 25 °C / 77 °F** and a **minimum temperature of 10 °C / 50 °F** is used.
- The desired plastic working consistency will be reached after 4 - 8 minutes mixing.



3. Add water as specified in the working instructions



4. Mix for 4 - 8 minutes and check result

Check list

- **CAUTION: closely observe the working instructions (bag imprint)**
- **the mixing period and the required water quantity may vary within narrow limits depending on the ambient conditions and the product properties**
- **if the KALCRET compound is too dry, add water at steps of 25 ml / 1.52 cuin each per 25 kg / 55.1 lb KALCRET**
- **all standard data are valid for an ambient temperature range from 10 - 30 °C / 50 - 85 °F**
- **in case of higher temperatures contact Kalenborn or duly observe information**

KALCRET compound ready for use



5. The compound should have a plastic consistency

Check list

- **the KALCRET compound is ready for use as soon as it features a plastic working consistency**
- **the finished KALCRET compound shall be completely free of lumps**

4.2.3 Applying cast compound

The KALCRET cast compound is mixed as specified, filled in the prepared formwork and compacted with the aid of a vibrator. Slow admission and compacting of small quantities at a time will ensure uniform wear protection.

Working temperature and setting time

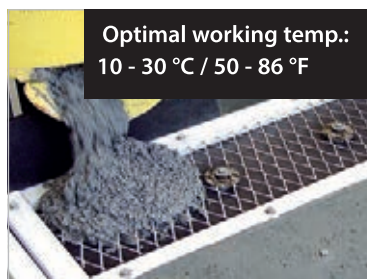
- The optimal working temperature is **10 - 30 °C / 50 - 86 °F**.
- Direct sunlight should be avoided.
- KALCRET should **not be applied** at temperatures **below 5 °C / 41 °F**.
- The working time after mixing is up to **1 hour at 20 °C / 68 °F**.
- The working time may be shorter at higher temperatures.
- Surfaces supported in formwork can be stripped after about 8 - 24 hours (depending on the layer thickness) at ambient temperatures of 20 °C / 68 °F. They shall be protected afterwards against quick evaporation of the residual moisture. This can either be done by means of a surface sealing spray or by covering with polyethylene sheeting.
- After stripping formwork, the minimum setting time is 24 hours.

Check list

- carefully prepare formwork
- make sure surfaces are clean
- use a proper reinforcement system
- prepare a good plastic KALCRET compound for casting
- duly observe correct addition of water
- mix for at least 5 - 8 minutes
- make sure the mixture is free of lumps; if not, mix again
- cast and compact KALCRET
- use vibrator
- check filling
- establish smooth KALCRET surface
- have surface sealed after casting or
- cover with polyethylene sheeting



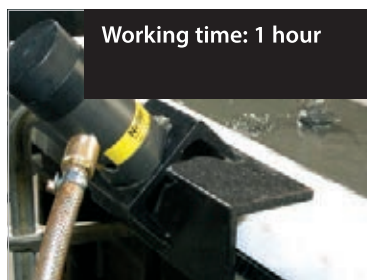
1. Prepare formwork



2. Prepare cast compound as instructed



3. Carefully fill formwork



4. Use external vibrator for compacting

>> 4.3 Working KALCRET – Sprayed-on Compound

General working instruction

Technical advice from Kalenborn is recommended before the installation of KALCRET sprayed-on compound is attempted.

4.3.1 Job preparation

KALCRET sprayable hard compound is used to line large surfaces in a relatively short time with installation rates of more than 5 m²/ 53.8 sgft/hour (at 25 mm / 0.98 inches thickness).

Spraying can be done horizontally and vertically. It can even be worked overhead and enables the lining of complicated surfaces without difficulty.

Reinforcement system

All KALCRET materials, whether applied on a steel base or concrete, require the installation of a suitable reinforcement system.

The wire mesh is mounted at a distance of **approx. 5 mm / 0.19 inches** utilizing the necessary hardware. The attachment points are spaced at **approx. 250 mm / 9.84 inches** making the wire mesh stiff and rigid.

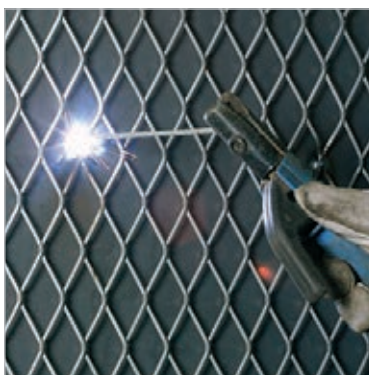
In addition, other reinforcement systems may be used if needed.

Check list

- all materials incl. KALCRET and fibre-components have to be available in sufficient quantity
- for KALCRET a loss rate of approx. 15 - 20 % has to be taken into account

Check list

- provision for reinforcement system, e.g. wire mesh
- check and provide for tools to fasten the reinforcement system
- correct material choice to be observed
- mounting the reinforcement system



Welding the wire mesh to the surface: spacing approx. 250 mm / 9.84 inches



Stiff and rigid fastening – distance to the wall to be lined: about 5 mm / 0.19 inches

Kalenborn spraying system



Kalenborn spraying system

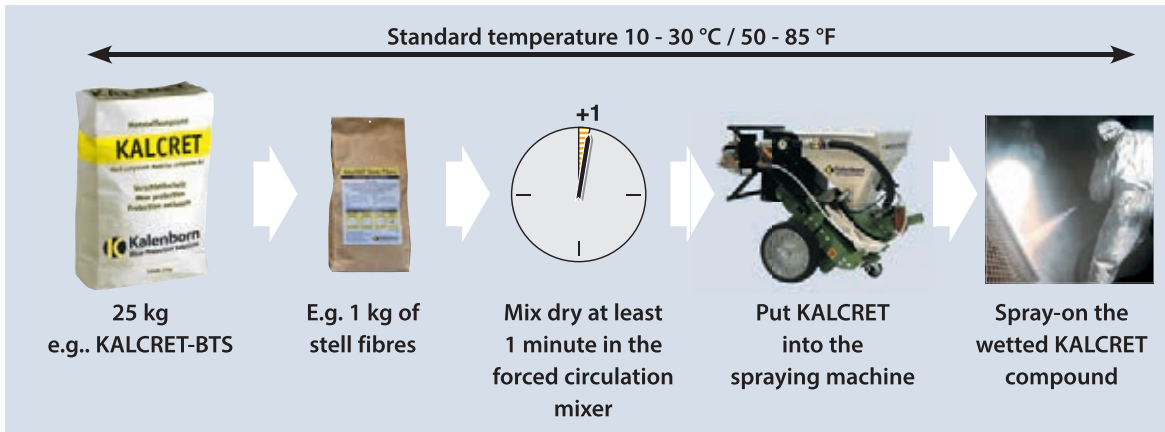


Wear protected tank of a Kalenborn forced circulation mixer

Check list

- spraying system specially developed for working KALCRET
- continuous and homogeneous delivery of the KALCRET compound up to the spray nozzle
- water amounts and timing of injection have been developed to ensure proper moisture level and distribution in KALCRET
- adding of steel or other fibres, if necessary
- spraying system, complete with materials and tools, can be containerized for installation on site
- working distance 800 - 1,200 mm / 31.5 - 47.3 inches from the surface to be protected
- delivery distance of the sprayed compound up to 100 m / 328 ft; vertically 40 m / 131 ft

4.3.2 Prepare KALCRET compound



KALCRET



1. Empty the bag of KALCRET hard compound in the mixer

Adding fiber components

- We recommend that steel or PP fibres be added for reinforcement.
- The fiber components are either included in the hard compound or added during the mixing time.
- Gradually add the fiber components slowly to avoid clogging.



2.1 Fiber components matched to the specific application are offered



2.2 Add fiber components slowly and continuously and mix dry for at least 1 minute

Check list

- add e.g. 1 kg / 2.2 lb of steel fibers per bag of KALCRET (25 kg / 55.1 lb)
- or
- add e.g. 1 small bag other fibers per bag of KALCRET (25 kg / 55.1 lb)
- make sure the correct materials have been selected
- store fibers in a dry environment
- remove or breakup any lumps in the fibres
- add fibers slowly and continuously
- mix dry for 1 minute
- carefully observe the mixing process
- put KALCRET into the spraying machine
- spray-on the wet KALCRET compound

4.3.3 Applying sprayed-on compound

After adding the appropriate fibers in the dry mixing process, KALCRET hard compound is loaded into the spray machine. The material is transported through special hose by compressed air to the spray nozzle where the water is added.

An ideal consistency of the hard compound material will be reached by the precise addition of water. The wet KALCRET hard compound is then systematically sprayed on the prepared area to be lined.

To begin with, the wire mesh should be filled completely. Depending on the lining thickness, the material is applied by layers, i.e. successively on the freshly applied layers. Normally, the layer thickness ranges **between 20 and 50 mm / 0.78 and 1.96 inches**. The surface is subsequently smoothed.

Working temperature and setting time

The optimal working temperature is **10 - 30 °C / 50 - 85 °F**.

Direct sunlight should be avoided.

KALCRET should **not be applied** at temperatures **below 5 °C / 41 °F**.

The working time after mixing is up to **1 hour at 20 °C / 68 °F**.

The working time may be shorter at higher temperatures.

The **minimum setting time is 24 hours** at an ambient temperature of 20 °C / 68 °F. Lower temperatures will require longer setting times.

Check list

- provision for all materials, including KALCRET and steel or other fibres in sufficient quantities
- safe supply of clean, potable water, power and compressed air
- surfaces must be clean
- check proper installation of reinforcement system
- apply KALCRET by spraying
- working distance 800 - 1,200 mm / 31 - 47 inches from the surface to be protected
- check layer thickness
- generate smooth KALCRET surface
- have surface sealed after spraying or
- cover it with polyethylene sheeting



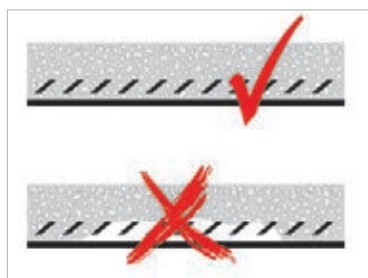
1. Kalenborn spraying system



2. Spraying



3. After spraying, easy to make smooth



4. Ensure complete filling of the reinforcement system

>> 5. After Working KALCRET

Surface sealing

After installing KALCRET and following an initial drying phase of approx. 60 minutes, the surface needs to be sealed with **curing spray** or be covered with **polyethylene sheeting**.

Otherwise, the KALCRET compound will dry too quickly. In that case neither strength nor proper setting of the material will be guaranteed.

Shrinkage cracks

Micro cracks may occur during setting and hardening because of the product specification. These are not defects.

Start-up curves

During the curing of KALCRET only part of the mixing water is bonded in crystalline form. The balance remains and must be forced out by careful heating. When operating temperatures of more than 50 °C / 122 °F are anticipated, the first heat up should be done slowly. Otherwise the lining may be damaged.

Differentiation has to be made between operating temperatures up to 150 °C / 302 °F and above 150 °C / 302 °F.

Operating temperatures up to 150 °C / 302 °F

- Maximum temperature change 40 °C/h (104 °F/h)

Check list

- determine sealing method to be used
- keep curing spray ready for use
- spray sealing liquid systematically and thoroughly over the surface
- rate approx. 250 ml/m² / 15.25 cuin/10.76 sqft
- otherwise use polyethylene sheeting
- completely cover KALCRET surface with polyethylene sheeting

Check list

- min. setting time 24 hours
- earliest start of equipment after 24 hours
- longer setting times required at temperatures below 20 °C / 68 °F

Check list

- shrinkage cracks may occur
- they are not defects

Check list

- clarify plant operating conditions
- use KALCRET-T at operating temperatures above 400 °C / 752 °F
- carefully observe special start-up curves for operating temperatures above 50 °C / 122 °F
- Caution: failure to observe these instructions may damage the lining

Operating temperatures above 150 °C / 302 °F

- 1 First start up** of the plant after application of KALCRET, i.e. also after repairs:

Allow minimum setting time of 24 hours. Afterwards start up plant. The maximum temperature rise is 40 °C/h (104 °F/h) up to a temperature of 150 °C / 302 °F. Following first start up after KALCRET application maintain temperature of 150 °C / 302 °F for a period of 12 hours. After that holding time the maximum temperature rise can be 100 °C/h (212 °F/h) up to operating temperature.

- 2** Upon **re-start** of the system after a shutdown period (longer than 24 hr, temperature below dew point, condensation of humidity, etc.):

The maximum temperature rise is 40 °C/h (104 °F/h) up to a temperature of 150 °C / 302 °F. Beyond that level the maximum temperature rise is 100 °C / 212 °F until operating temperature has been reached.

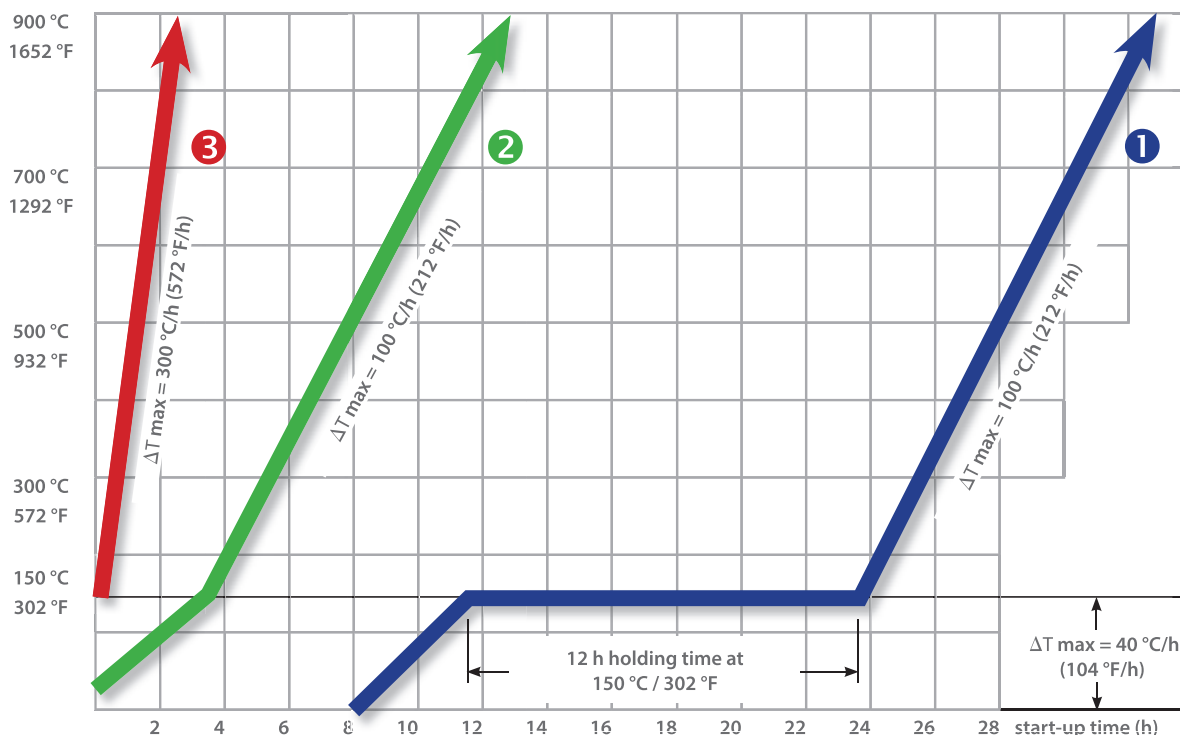
- 3** In case of **regular running up and running down** of the plant without extended shutdown periods (less than 24 h) and without the temperatures falling much below 150 °C / 302 °F:

The maximum temperature rise is 300 °C/h (572 °F/h).

Check list

- allow a minimum setting time of 24 hours upon first start up after application of the lining; watch holding time; slowly run up system to operating temperature
- with regular running up and down of the system, quickly reaching the operating temperature is possible

Starting curves for operating temperatures above 150 °C / 302 °F



Cleaning tools and equipment

It is an absolute must that all tools and machinery are systematically cleaned during and after completion of work with KALCRET. It is suggested that cleaning be carried out with a pressure washer normally used for cleaning mixing vessels.

Failure to observe that requirement may result in breakdown of tools and equipment.

This cleaning requirement has to be observed during and/or when concluding the job at the end of a shift or when completing the order, but especially when working with different types of KALCRET, e.g. when changing over from KALCRET-BNX to KALCRET-BTX or from KALCRET-BNY to KALCRET-BTY.

Technical check of tools and equipment

It is just as important that all tools and machinery are subjected to a technical inspection after completion of a job. Similarly, e.g. the following requirements shall be observed:

- all tools and equipment shall be clean
- they shall be complete
 - they shall be technically functional
 - all electrical connections shall be checked
 - the state of wear shall be ascertained, e. g. that of tools and of the mixing vessel
 - worn down parts shall be replaced

Check list

- **carefully clean tools and machinery after completing the lining job**
- **the use of a pressure washer will be expedient**
- **Caution: failure to comply with this requirement may ruin tools and equipment**
- **the cleaning requirement also has to be observed when changing over to another type of KALCRET**

Check list

- **verifying proper technical function of all tools and machinery**

>> 6 Accessories and Tools for KALCRET-X material

6.1 Accessories and tools for KALCRET trowelled compound



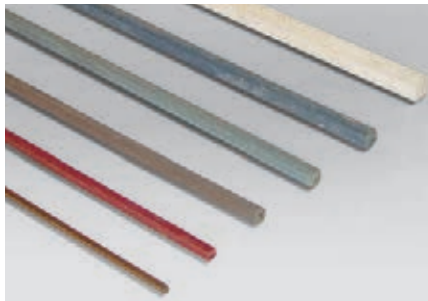
Forced circulation mixer

if required with wear protected mixing tank



Various bricklayers tools

trowel / plastering trowel / bucket



Separating strips

working sections / lining end



Wire mesh



Welding equipment / electrodes

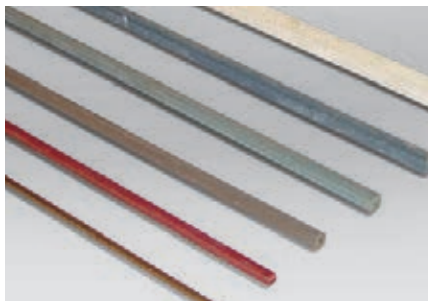
6.3 Accessories and tools for KALCRET sprayed-on compound



Spraying machine



Various bricklayers tools
trowel / plastering trowel / bucket



Separating strips
working sections / lining end



Wire mesh
incl. welding equipment
and electrodes



**Spraying hose /
spraying nozzle**

7. Quality assurance samples

Compliance with the provided preconditions and handling requirements is crucial for a successful KALCRET installation. This KALCRET handbook Version 6 provides all necessary information to ensure high quality installations.

Please find the download of this handbook on our global Kalenborn website:



To support your installation project, Kalenborn offers a surveillance and attestation of KALCRET product properties based on the analysis of a selected wear parameter. Our laboratory will focus on erosion resistance. The testing method is in accordance with ASTM C 704-15 for erosive wear resistance.

Kalenborn's laboratory is able to determine deviations from preconditions and handling requirements using product samples that were produced under on-site conditions during the installation. Standardized plastic sample forms 320 x 300 x 40 mm are being provided within the scope of the extended quality program.

Customer's benefits:

- Increased overall quality control
- Prove of correct material handling and installation by predominant KPI.
- Increased quality control of installation companies

Test methods exceeding this standard package can be arranged and ordered from our laboratory.

Detail of the overall sample quantities, handling instructions, sample archiving and cost will be given in the proposal and accompanied contractual documents. All exceeding items shall be agreed with Kalenborn.

Customer's benefits:

- Improved overall quality assurance
- Better differentiation between installation shortcomings and product quality complaints
- Improved potential for quality control of installation companies



**Plastic sample form:
320 x 300 x 40 mm**

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