INFORMATION SCRIPT

Concrete Release Agents – Information Script for Users

2nd Edition, April 2020

DEUTSCHE BAUCHEMIE

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INTRODUCTION

This Information Script is intended to contribute towards providing users with an overview of the product class of concrete release agents. Essentially, the user is faced with a complex range of concrete release agents of different technologies, and he needs to choose the appropriate product for the particular construction task with which he is confronted. This report is intended to help the user in taking account of all the important aspects involved, so as to make the right decision.

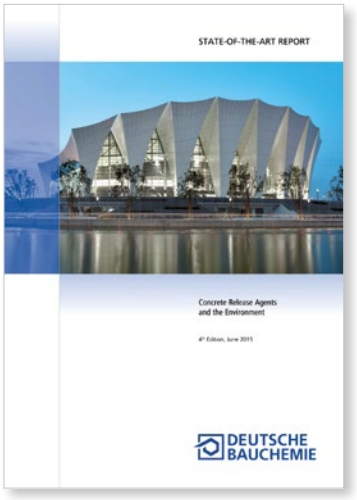
In contrast to the State-of-the-Art Report which appeared in 2015, "Concrete Release Agents and the Environment", the focus here is on advice on actual means of performance and technical aspects. The pamphlet describes the different areas of application in the fields of in-situ concrete construction and prefabricated component production, and, in particular, the connections between careful application and fair-faced concrete quality. The predominant technical application systems are explained, and it will be shown to what extent concrete release agents may be responsible for deficiencies in concrete surfaces. The pamphlet is conceived as being a guideline in the planning phase, by taking account of all the factors surrounding the topic of concrete release agents, so that the actual configuration of the concrete surface is produced true to the aims and in line with the intentions, and so as to ensure that, right from the outset, no defects or deficiencies can occur.

1 HEALTH AND SAFETY AT WORK

In agreement and in accord with Deutsche Bauchemie e.V., GISBAU have carried out a differentiated classification of concrete release agent types, based on the law relating to hazardous materials, in GISCODEs. For each GISCODE there is a GISBAU information, and operating instructions for describing a safe way of carrying out the work.

In general, in the application of concrete release agents there are a series of work and safety measures which need to be taken into account, which are listed as follows:

- Basically, the technical brochure and the safety datasheet provided by the manufacturers are to be followed, and are to be read carefully before the release agent is used for the first time.



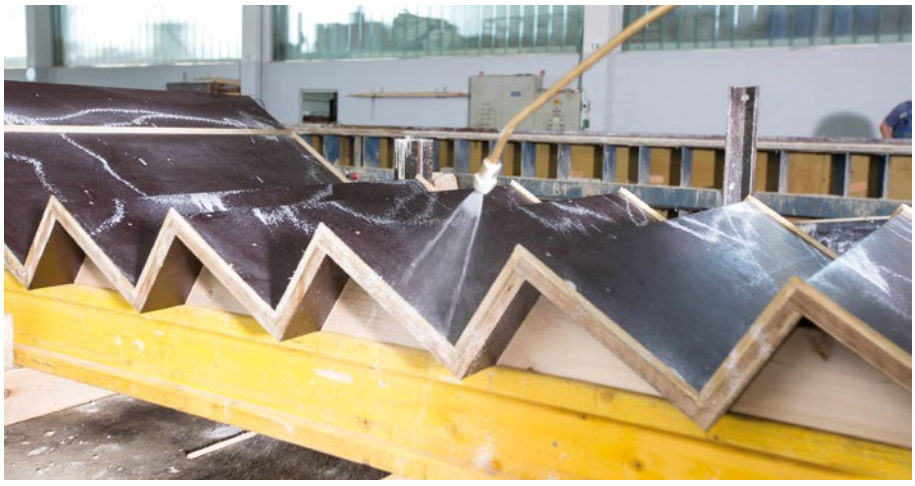
- No food or drink is to be kept or consumed in the working area, and no smoking is permitted.
- When using concrete release agents, skin contact is to be avoided by wearing suitable work clothing and oil-resistant safety gloves.
- Contaminated clothing should be changed and cleaned. Change clothing after finishing work, and keep street clothing and work clothing separate.
- Taking good care of the skin is important. In this context the use of a moisturising cream is recommended, since otherwise allergies and irritations may be caused due to release agents dissolving the natural fat of the skin.
- It should be obvious that protective goggles are to be worn in every situation. Splashes which get in the eyes can cause irritation.
- Make provision for washing facilities, and provide eye baths or eye rinse bottles.
- When working indoors, ensure there is an inflow of fresh air, and doors and windows should be left open. When using concrete release agents in enclosed spaces there is the possibility, due to solvent vapours or spray mist, that high concentrations of hydrocarbon vapours may form. Employers are responsible for carrying out a risk analysis and applying the measures resulting from this, for example by appropriate extraction of the fumes and providing suitable masks. Relevant types can be found in GISBAU information sources and the model operating instructions.
- Keep well away from sources of ignition (including electrical equipment without explosion protection format), and do not smoke.
- No exposure to naked flames (in particular with concrete release agents containing solvents).
- In principle, spraying should not be undertaken against the direction of the wind, or with the spraying equipment held above the head. This can be resolved by working in an appropriate manner with spray extension pipes.
- Ensure that containers are always closed properly.

For more information and more detailed instructions with regard to the GISCODEs, reference can be made to the State-of-the-Art Report "Concrete Release Agents and the Environment", 4th edition, June 2015, from Deutsche Bauchemie, and the GISBAU Internet site.

2 APPLICATION OF CONCRETE RELEASE AGENTS

General

The application of concrete release agents exerts an influence on the surface quality of the set concrete component and the cleanliness of the formwork.



Example of a non-uniform application of concrete release agent, due, for instance, to an inadequate spraying angle or insufficient pressure.

Concrete release agents nowadays are products which are highly effective both chemically and physically. Theoretically, for an adequate separation process a thin separation film of 1/1000 mm, combined with an enclosed uniform application on the formwork, will prove sufficient.

As a rule, under practical conditions this small application quantity cannot really be attained. This means that the right quantity of release agent needs to be adjusted to the particular application situation and taking account of the specific formwork.

Too high an application of release agent on the formwork is essentially unfavourable with regard to quality and costs.

The concrete release agent manufacturers provide a range of different information with regard to the consumption values of their products. The different values result from the composition of the release agent, such as low viscosity (< 5 mm^2/s at 20 °C) and medium viscosity (> 5 mm^2/s to 25 mm^2/s at 20 °C).

Concrete release agents which are free of solvents and water exhibit a rise in viscosity at lower temperatures. This can lead to difficulties when spraying. In order to be able to apply the thinnest possible release agent film despite this possible problem, it may be necessary to increase the spray pressure, and/or to make use of a nozzle with a greater spray volume.

The application quantity of concrete release agent also depends on the absorption behaviour and the surface of the formwork. Absorbent wooden formwork, due to its microscopically larger surface, requires more release agent for wetting than non-absorbent steel formwork types.

Excess applications of release agents can be removed by means of a rubber brush, or the formwork can be wiped down with a clean cloth. To avoid footprints on the concrete surface, avoid walking on the surface after it has been wiped down.

3 FAIR-FACED CONCRETE

Concrete of which the visible surfaces are intended to fulfil design or artistic functions, and which should have a predetermined appearance, are in general referred to as having "fair-faced concrete" surfaces. A visible surface is regarded as being specifically designed when previously agreed requirements for its properties are fulfilled, and the desired visual effects are achieved. The design and preparation of fair-faced concrete is regarded as the "fine art" of concrete construction, since individual wishes with regard to appearance are already considered as very difficult to implement in a bill of quantities or description of performance.

In this context there is a fundamental distinction to be made as to whether these concrete components are to be produced in a prefabricated component plant or in-situ on the construction site. Production in a plant provides good preconditions for uniform and

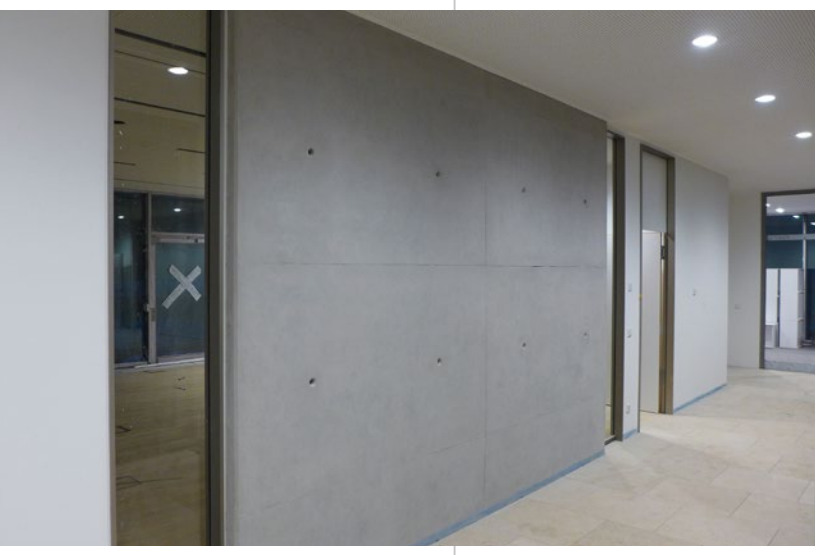
high-value quality, thanks to consistent manufacturing conditions unaffected by the weather, and permanent fixed-position formwork.

The production of fair-faced concrete on the construction site is perceptibly more complex, and requires the successful interaction of design, planning, material technique and technology, and construction procedures.

In view of this complexity, the Deutsche Beton- und Bautechnikverein e. V. has prepared a leaflet with regard to construction work with fair-faced concrete, in which four classes of fair-faced concrete SB 1 to SB 4 are defined, and their relationship to the requirements for texture, porosity, uniformity of colour tone, evenness, joint formation, and formwork skin class. It is also worth mentioning that, for fair-faced concrete with special requirements SB 3 and SB 4, it is strongly recommended that test surfaces be produced, and may be absolutely necessary. For more detailed information, see the DBV leaflet "Fair-faced Concrete" [4].

Fair-faced concrete class			Examples
Fair-faced concrete with	low requirements	SB 1	Concrete surfaces with low visual design requirements, such as basement walls or areas with predominantly commercial use
	normal requirements	SB 2	Concrete surfaces with normal design requirements, such as stairwells or retaining walls
	special requirements	SB 3	Concrete surfaces with high visual design requirements, such as facades
		SB 4	Concrete surfaces with particularly high visual design requirements, such as structural components intended to create a particular impression

Fair-faced concrete classes (extract from [4])



The choice of the suitable release agent is only one of the parameters involved in the procedure as a whole, but it also requires careful planning. With regard to the application quantity, for non-absorbent formwork types the DBV recommends 10 g/m². This can only be achieved with carefully matched spraying equipment and technically specialised personnel. Release agent emulsions or concrete release agents containing solvents offer clear advantages in adjusting to this thin application requirement due to their volatile component proportions.

4 AREAS OF APPLICATION

Which concrete release agent type for which application/construction site situation?
There are many areas of application for release agents, starting from in-situ concrete construction, to civil engineering structures, and on to prefabricated components. The right choice of concrete release agent is a decisive factor in the different areas of application if the best possible results are to be achieved.

The tasks and possible special requirements for different applications are described in the following pages. Recommendations for a particular individual application situation should be obtained from the release agent manufacturers.

The basic objectives of a concrete release agent are, as well as ensuring a perfect separation of the concrete from the formwork skin, also keeping the formwork clean, and problem-free removal of the formwork. In areas subject to water protection regulations, easy biological degradability of the release agent is also a specified requirement.

4.1 In-Situ Concrete Construction

4.1.1 Buildings – Building Elements with Ground Contact

Mention should be made, as a possible special requirement, of compatibility with perimeter insulating boards or slabs, which are used to provide thermal insulation for building elements which are in ground contact on their outsides, such as beneath a foundation slab.

When selecting the release agent, attention needs to be paid to the water hazardous classification. As a rule, a regulatory requirement is the avoidance of adherence-reducing residues of the release agent with subsequent sealing of working joints against ground moisture and sealing of pipe conduits.

4.1.2 Buildings – Building Elements above Ground

In the architectural concrete sector in particular, concrete surfaces are specified which are free of air voids and pores, and which do not exhibit any discolouration. Added to this is an exact formation of the formwork surface on the surface of the concrete, in particular with regard to what are referred to as structural matrices. Subsequent further treatment of the concrete surface, such as plasterwork, wallpapering, painting etc., must not be negatively influenced either (no adherence-reducing residues).

With what are referred to as structural matrices which are made of plastic, in principle the recommendations from the manufacturers of the concrete release agent or of the formwork are also to be taken into account with regard to compatibility.

4.2 Civil Engineering

4.2.1 Bridges

As a rule, bridge building calls for higher classes of fair-faced concrete. A particular requirement here is enhanced resistance to weathering of the concrete release agent.

4.2.2 Hydraulic Structures (Locks, Dams)

The relevant industrial standards and other provisions for requirements for hydraulic construction must be respected, with regard to manufacture, load-bearing capacity, suitability for use, and sustainability of hydraulic structures. The relevant body of regulations in this instance is the ZTV-W (Additional Technical Contractual Specifications – Hydraulic Structural Engineering).

As a rule, ready-mix concrete is used for the construction of hydraulic structures. In this situation, as well as the concrete release agent, a suitable mixer protection agent also needs to be used (see also Point 4.4). There are usually also biological degradability requirements applicable to both products on the part of the project clients. For example, for surfaces which are subjected to water and are in contact with the ground release agents with RAL-UZ 178 ("Blue Angel") are required, which are rapidly biodegradable.

4.2.3 Tunnels

In tunnel construction, a particular requirement is the keeping clean of the formwork carriages, which are used for the production of steel-reinforced concrete formwork in

the slip-form construction process. As a rule, these are made of steel, and accordingly the concrete release agent used should contain a corrosion protection additive.

In addition to this, a concrete release agent must fulfil the technical health and safety at work requirements which are specific to tunnel construction.

4.2.4 Drinking Water Reservoirs

If drinking water reservoirs are made of concrete, then all the materials and substances which come in contact with the drinking water, directly or indirectly, require special attention.

In addition to the KTW Guideline, the DVGW also addresses the matter of drinking water containers in a number of different datasheets and pamphlets. At the present time, the DVGW Leaflet W 347 still applies to products containing cement and concrete release agents (as ancillary construction materials). This shows that the use of a concrete release agent in connection with drinking water must be carefully planned. If a concrete release agent is used, it must be tested in accordance with the KTW Guideline, and it must be without any possible reservations with regard to hygiene (testing in accordance with DVGW Leaflet W 270, as a constituent part of the testing in accordance with DVGW Leaflet W 347). According to the new version of the Drinking Water Directive, the evaluation of cement-bonded materials in contact with drinking water should in future be adopted from the European Chemicals Agency (ECHA). Until a new European basis for evaluation has been determined, cement-bonded materials may continue to be assessed in accordance with the DVGW Leaflet W 347.

4.3 Prefabricated Components and Concrete Products

In the prefabricated component sector, there are ever increasing expectations with regard to the quality of fair-faced concrete. Since this predominantly involves steel formwork, a release agent with corrosion protection is recommended. It must also be ensured that the technical regulations for health and safety at work in interior areas are respected.

4.3.1 Ceiling and Wall Elements, Hollowbody Ceilings

Steel reinforced concrete ceiling and wall elements and hollow-body ceilings for assembly are, as a rule, produced as semi-finished components with reinforcement and mesh support elements, on polished steel tables at the prefabricated component production plant. In this situation, special requirements are imposed on the corrosion protection of the concrete release agent.
The steel formwork and steel tables must be protected against corrosion, due to corrosion products forming on the surfaces of the prefabricated components. As well as this, the steel tables must be cleaned scrupulously (see Section 6, Cleaning of Formwork). The use of release agents on the formwork surface influences both the intrusion of corrosion-incurring ions as well as the passivation of the steel. This is the reason why concrete release agents with corrosion inhibitors are used.

In prefabricated component production plants, such as ceiling periphery plants, the method of vibration compaction is often applied (exclusively the horizontal movement of the formwork). In this situation the release agent must exhibit an appropriate degree of resistance to this method of compaction.
Hydrophobia-incurring effects are in principle not desirable, in order not to incur a negative influence on the further treatment of the fair-face surface.
With matrix formwork, the relevant recommendations from the manufacturers of the concrete release agent and the formwork are to be respected, in order to avoid any material incompatibilities.

4.3.2 Columns and Binding Elements, π-ceilings, Stairways

In addition to the points already referred to under 3.3.1, the high perpendicular surfaces of columns, stairs, etc. are to be taken into account in the production of the elements.

4.3.3 Manhole Rings, Pipes

For the manufacture of steel reinforced concrete pipes, reinforcement cages are embedded as ring-shaped reinforcement and longitudinal bars. With the frequently used vibration process, the compaction of the concrete volume takes place in moulds with formwork vibrators. The requirement is for a surface which is free of air voids and has a low number of pores. With the centrifuge process, with a very high rotation speed, the concrete is forced against the wall of the mould. This requires a particular degree of resistance to abrasion. This method is used in particular for the manufacture of prestressed concrete pipes and pressure pipes for drinking water.

4.3.4 Garages

In the production of prefabricated garages, concrete serves as the outer shell and the load-bearing structure. Use is made of a high quality steel reinforced concrete with a long service life, with a high pressure-resistance class and internal steel reinforcement. External plasterwork protects the garage from moisture, with a layer of dispersion paint being applied in the interior. Hydrophobia effects are accordingly undesirable. The requirement is for a concrete, often in fair-face quality, with a surface free of air voids and pores, and without discolouration.
The garages are in most cases cast as one piece, in pre-heated steel formwork. Particular requirements are incurred due to the large vertical surfaces of the walls and the elevated formwork temperature above 60 degrees.

4.3.5 Concrete Products

Precast concrete product plants manufacture a range of different concrete products, such as flagstones, slope reinforcement blocks, roofing tiles, palisades, etc. for garden and landscaping purposes. This involves a number of different production methods, as a rule with immediate formwork release with different types of formwork. One particular feature is that, without a renewed concrete release agent application, formwork can be used several times over.

In order to achieve a high degree of green stability with the vibratory compaction process, use is made of concretes with a low water-cement value ("earth moist"). The concrete products are often subjected to a heat treatment in order to speed up hardening.
An appropriate type of concrete release agent must be used as a function of the formwork and the manufacturing process involved.

4.4 Mixer Protection

Mixer protection is used for concrete mixers, concrete pumps, concrete mixing plants (compulsory mixers), construction vehicles, etc. The aim is to prevent the adherence of concrete and mortar residues, so that these cannot settle any longer on steel, sheet metal, or painted surfaces. A mixer protection with dewatering properties is often on offer, which causes the material to be mixed to migrate downwards and so form a separation film between the mixer and the concrete. It is also used in concrete component or concrete block production plants.

5 INFLUENCES ON CONCRETE SURFACE QUALITY

Influences with the interaction of formwork, concrete release agents, and concrete
The interaction between formwork, concrete release agents, and concrete involves a complex system, the reciprocal effects of which are not always identifiable in all its details. Nevertheless, a series of manifestations with regard to the causes can be described. Moreover, the concrete recipe, the processing consistency of the concrete, the type of installation, the compaction, the reinforcement, and the subsequent treatment all have an important influence on the concrete quality.

5.1 Discolouration and Stains on Concrete Surfaces

With wooden formwork, individual boards sometimes leave a different colour on the concrete surface. There are a considerable number of causes for this. Wood moisture content, wood sugar (xylose), wood structure, UV effect, and the use of new and old formwork next to one another lead to these effects.

In order to reduce grey tone differences, the best solution is the artificial ageing of the formwork. For this purpose, the formwork is subjected to the application of a cement slurry, which is removed after drying. With non-absorbent formwork in particular, some concrete release agents can incur stains or discolouration on the concrete surface.
In this situation, at points at which too much concrete release agent is applied dirt and dust particles become deposited in the oil film. These deposited particles subsequently adhere to the concrete surface. The excess oil film likewise becomes deposited in the peripheral area of the concrete, which also leads to discolouration.

With the use of formwork types with different absorption characteristics, different water-cement values can cause colour differences to occur at boundary surfaces (peripheral areas).

Concrete components which are produced at different times of the year and under different conditions, regardless of whether they are in-situ or prefabricated, will always exhibit different grey tones if the concrete surfaces are not carefully treated subsequently, and different concrete recipes will also lead to different grey tones.

It is important that the formwork skin forms a tight seal, in order to prevent the escape of cement paste, which can also lead to colour differences.

5.2 Rust Stains on Concrete Surfaces

There may be different causes of rust stains on a concrete surface:

Nails or binding wire which are left in the formwork often cause rust stains, which do not become visible directly after the removal of the formwork but only after a number of days or weeks.

If the reinforcement is pressed against the formwork, there is the possibility of rust points also being caused. Likewise, weathering influences can also cause rust films from the reinforcement to pass onto the formwork and then become apparent on the concrete surface.

Due to their composition, most mineral-based and vegetable oil-based release agents provide protection against the formation of rust with steel formwork. This effect can be substantially enhanced by corrosion inhibitors.

With aqueous release agent emulsions, the selection of a product with corrosion protection additive is particularly important, since the water in the emulsion increases the inclination to rust formation. Since the corrosion protection in the concrete release agent only has a temporary effect, it cannot be used as a preservation agent against rust with steel formwork which is not being used in the long term.

In prefabricated part production plants in particular, with the slight "cupping" of the concrete slabs in the peripheral area of the separation surface, rust may occur due to the formation of condensation water. This may arise, for example, with more extended periods of time for formwork removal. This can be largely avoided, however, by the use of special concrete release agents with higher adhesion to the formwork.

5.3 Influences of Compaction

Compaction defects lead to a number of different manifestations. Inadequate compaction leads to the formation of air voids and pores.

Placing the vibrator on the formwork or the reinforcement can lead to grey tone differences or segregation. Resonating of the formwork likewise leads to grey tone differences, as well as to differences in compaction.

Compaction energy values which are too intensive lead to abrasion of the release agent film. At the removal of the formwork this then results in the cohesive failure of the concrete. Concrete release agents with improved adhesion properties can largely avoid this.

5.4 Formation of Pores and Air-voids

In addition to the influences on compaction, other causes of pores and air voids are also possible. For example,

- too short a venting time
- too thick an application
- a release agent which is incorrectly chosen for the specific use

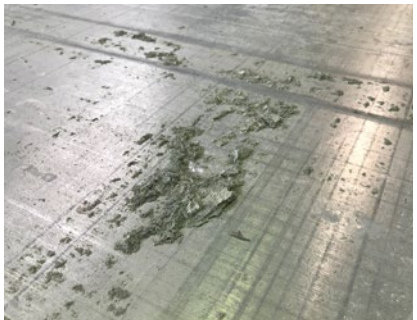
can all contribute to the formation of pores and air voids.

Another frequent cause is the installation of a concrete which can no longer be adequately processed.

5.5 Broken Edges and Adherence

With dry absorbent wood formwork, the water absorption increases the adherence of the concrete to the surface of the formwork. At the removal of the formwork this then leads to broken edges. A possible wood sugar (xylose) effect may also cause problems in this situation. Countermeasures could involve the preliminary wetting of the formwork, or preliminary treatment with a layer of cement slurry.

It is also possible for similar defects to occur with non-absorbent formwork types. Excess release agent runs off the vertical part of the formwork, and collects in the corner areas. There is then the possibility of reduced strength values occurring at these points due to disturbances in the setting process. Among other things, adherence points may form if the formwork is not adequately cleaned (the residue absorbs the release agent, which results in no more release effect being provided at this point), if defect points occur due to incorrect release agent application, if the release effect is too low, or if the release agent is "squeezed" by excessively intense compaction.



5.6 Sanding of Concrete Surfaces

One defect is the flouring effect of the concrete surface, since this leads to inadequate adherence of following layers. There are a number of causes for this, such as grab setting of the concrete surface due to very dry formwork boards. Moreover, too high a proportion of wood sugar (xylose) can delay hydration on the concrete surface. A frequent cause of sanding is also the use of excessive amounts of the concrete release agent.

5.7 Observance of Technical Information Sheets

Observing the technical information sheets and following the instructions provided can have a positive effect on the result of the formwork removal.

6 CLEANING OF FORMWORK

Once the concrete has reached an adequate degree of strength, the formwork is removed from the concrete components and elements. As a rule, this does not happen entirely free of residue, and after the formwork has been used several times it may show signs of damage (such as scratches, defect spots, etc.). For concrete surfaces which follow a good formwork configuration it is important for the formwork to be cleaned and for repairs to be made if necessary. Expenditure and effort can be kept low if the formwork is cleaned immediately after each removal from the concrete.

Concrete residues on the formwork can be removed manually by scraping off the encrustations or by mechanical brush cleaning. In the case of construction site formwork, cleaning by the high-pressure cleaning process with water alone has proved to be a method which saves time and reduces wear on materials.

After cleaning and repair, the formwork elements are to be stored so as to be protected against the absorption of moisture and against drying out.

With regard to handling of rented formwork and its quality, the "Rented Formwork" pamphlet and the guideline entitled "Quality Criteria for Rented Formwork" from the Güteschutzverband Betonschalungen e.V. are to be observed.

7 SPECIAL NOTES REGARDING APPLICATION

7.1 Release Agents on Reinforcement

If a reinforcement element is used for a structural component, the application of release agents takes place before the laying of the component. In rare cases, this is done in the reverse order. In that case, care must be taken that wetting of the reinforcement element by the release agent is avoided, although, as a rule, small quantities will not cause a problem.

7.2 Release Agents on Concrete in Connection Areas

If formwork walls are set up on foundation surfaces which have already been concreted, and the formwork is only sprayed with release agent after erection, care must be taken to ensure that no release agent comes in contact with the already concreted surface. In every instance this will lead to poorer quality bonding.

7.3 Release Agents and Spacers/Formwork

Concrete release agents are made of very widely differing raw materials. Some solvents which are contained can attack formwork, in particular if made of polystyrene foam. As a result, a priority is to test the suitability of the formwork being used for compatibility with the concrete release agent. Most are resistant to the release agents used, although in individual cases with recycling materials decomposition may occur. This means that preliminary tests may be necessary.

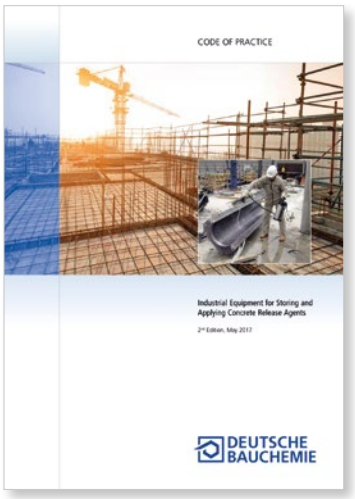
7.4 Composite Adhesion to Subsequent Coatings

The concrete release agent film applied to the formwork is very thin. After the removal of the formwork, as a rule no concrete release agent remains on the concrete surface, and the absorption capacity of the concrete is hardly influenced at all.

If hydrophobic effects occur, which can be identified by a simple wetting test, and depending on the release agent type being used, they can be removed by means ranging from a simple high-pressure water jet to cleaning with cleaning agents containing tensides.

The specifications which apply to the respective coating concerned must be respected. As a rule, additional measures due to the concrete release agent used are not necessary.

8 SPRAYING SYSTEMS AND STORAGE



For detailed information, refer to the Code of Practice entitled "Industrial Equipment for Storing and Applying Concrete Release Agents".

8.1 Spraying Systems

There are predominantly two methods which apply with regard to the application of concrete release agents. On construction sites, use should be made of spraying equipment fitted with flat-jet nozzles, since round-jet nozzles frequently lead to an increased application of concrete release agent.

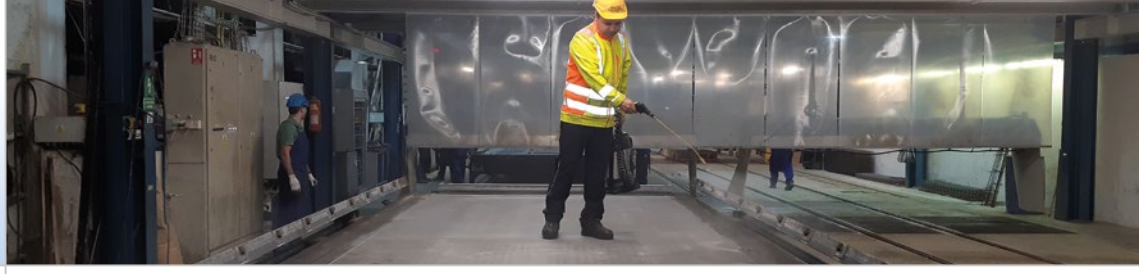
With the industrial production of structural elements in prefabricated component plants, in addition to these portable spraying units, use can also be made of stationary spraying systems and special moulds.

An important point in deciding on spraying systems is the choice of their materials. Materials which are not suitable have a chemical reaction with the concrete release agent. This results in active substances being extracted from the product, and clogging the nozzles of the spraying system.

An example of this is the contact of concrete release agents containing fatty acids with zinc or galvanized steel. The zinc is rearranged by the fatty acids to form zinc soap, which in the form of particles in suspension clogs the spray nozzles. The manufacturers of the concrete release agents can provide information regarding the active substances contained in their products.

8.1.1 Pressurised Manual Spraying Equipment

Effective volume:	5 l or 10 l
Recommended operating pressure:	4 to 6 bar
Recommended material:	Special steel
Recommended nozzles:	Flat-jet nozzles with wide spraying angle and fine bore diameter



8.1.2 Unpressurised Manual Spraying Equipment

Effective volume: From 1 l tank to 10 l tank backpack
Metering: Valve or electric pump
Nozzles: Rotation atomizers

8.1.3 Stationary Spraying Systems in Prefabrication Plants

Operating pressure: 4 to 8 bar
Nozzles: In most cases, 4 to 10 fixed-position flat-jet nozzles spraying jointly, or 2 to 4 floating nozzles, depending, for example, on the width of the spraying path, the spraying angle, the bore of the nozzle, and the distance from the formwork
Special forms:
- Per spraying beam, 1 to 4 ultra low volume rotation nozzles, which create the spray pattern by centrifugal force and the use of a specially developed nozzle disk.
  Advantage: Narrow drop spectrum and very economical application
  Disadvantage: The fine spray mist must be protected against air gusts, for example by encapsulation of the spray beam.
  Less well-suited for higher viscosity release agents.
- High-pressure airless (operating pressure 60 – 250 bar);
  Advantage: Good atomization of highly viscous release agents;
  Disadvantage: Overspray due to high degree of atomization with low-viscosity release agents

8.1.4 Special Spraying Equipment

Spray pistols, which derive from the paint sector. In this context there are systems with compressed-air support (4 to 10 bar) or systems without compressed air ("airless" up to about 250 bar).

8.1.5 Special Application of Concrete Release Agents

Form oil rollers (or mop): No spray mist irritation for the users, uniform application possible
Brush or cloth application: For paste-form concrete release agents (shell waxes)

8.2 Storage

Concrete release agents should be stored safely and securely, in accordance with specifications. This therefore depends on the correct choice of the storage tanks and catchment troughs.

DEFINITION OF TERMS

air voids

Colloquial designation for small, irregularly-shaped cavities in the surface of concrete, which occur during the laying of the concrete due to inclusions of air or water, and which, after the removal of the formwork, are visible as defects on the concrete surface.

pores

Small, regularly-shaped spherical air enclosures, which, after the removal of the formwork, are visible on the concrete surface.

corrosion protection (temporary)

In this context, this means the corrosion protection of the formwork. Release agents can only ensure a short-term temporary protection against corrosion for the formwork, but do not fulfil the function of a long-term conservation agent.

BIBLIOGRAPHY

[1] State-of-the-Art Report "Concrete Release Agents and the Environment" (4th Edition, June 2015), Deutsche Bauchemie e.V., Frankfurt am Main

[2] Leaflet "Industrial Equipment for Storing and Applying Concrete Release Agents" (2nd Edition, May 2017), Deutsche Bauchemie e.V., Frankfurt am Main

[3] Schmincke, Peter: "Fair-faced Concrete – Know how", Practical Tips for Invitations to Tender and Contractors; Beton 40 (1990), Vol. 7, pages 285/290

[4] DBV Leaflet "Fair-faced Concrete", edition of June 2015, Deutscher Beton- und Bautechnik-Verein, Berlin

[5] GSV Leaflet "Rental Formwork", edition of December 2011, Güteschutzverband Betonschalungen Europa e.V., Ratingen

[6] GSV Guideline "Quality Criteria for Rented Formwork", edition of December 2011, Güteschutzverband Betonschalungen Europa e.V., Ratingen

[7] GISBAU Hazardous Substance Information System of BG BAU www.bgbau.de/themen/sicherheit-und-gesundheit/gefahrstoffe/gisbau/

[8] DVGW Technical Rulings in Leaflet W 347 "Hygienic Requirements for Cement-bonded Materials in the Drinking Water Sector – Testing and Evaluation"; May 2006

EPILOGUE

This Information Script was prepared by the Working Group 2.3 "Concrete Release Agents" of Deutsche Bauchemie e.V., and discussed and approved by the Expert Committee 2 "Concrete Technology". It serves to provide information for all members and for the technically interested public.

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It is requested that experiences involving the Information Script be made known to Deutsche Bauchemie e.V., Frankfurt am Main.

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