

Technical Application Bulletin



Adprufe® Watertight Concrete

Adprufe® 100 is a proprietary liquid admixture that contains a hydrophobic pore blocker to minimize water ingress and a shrinkage reducer for long term drying shrinkage reduction.

Adprufe® 100 makes the concrete less permeable and reduces drying shrinkage, both the incidence and width of cracks

Whilst providing superior hardened properties, the fresh properties of concrete containing Adprufe® 100 are similar to conventional concrete and no special procedures are required to place, compact and finish the concrete and good site practice should prevail.

Design

- Concrete containing Adprufe® should be designed in accordance with the requirements of EN 1992-1-1 having a maximum crack width of 0.3 mm; water retaining structures should be designed in accordance with EN 1992-3 having a maximum crack width of 0.2 mm, when the hydrostatic pressure/wall thickness is ≤ 5 .
- Special consideration should be given to early-age thermal contraction and concrete, particularly walls, should be designed to take this into account. Detailed guidance is provided in CIRIA Report C766 Control of cracking caused by restrained deformation in concrete.

Concrete Mix Design

- Concrete shall be a designed mix conforming to EN 206 and BS 8500-2.
- The concrete should contain GCP Adprufe® 100 at a dosage of 2.5 litres/m³
- Concrete containing Adprufe® should be designed to have an effective water/cement ≤ 0.45 .
- Concrete containing Adprufe® should have a minimum cement content of 350 kg/m³
- Adprufe® is compatible with all common cements and combinations and type II additions, ground granulated blastfurnace slag (ggbs) and fly ash.
- The use of ground granulated blastfurnace slag (ggbs) and fly ash is recommended by CIRIA Report C766 to reduce early-age thermal cracking.
- The concrete mix design has to be approved by GCP Applied Technologies before supply.
- Concrete should contain GCP ADVA® superplasticizer.
- GCP Applied Technologies may carry out a trial mix before Adprufe® concrete is supplied to site to verify the mix design.

General

- Before discharging concrete the delivery ticket should be checked to ensure the correct grade of concrete has been supplied and that it contains Adprufe®.

Temperature

- Upon delivery, the concrete temperature should not be below 5°C in cold weather or above 35°C in hot weather.

Concrete Supply

- Concrete is to be supplied by a producer currently certified by a body accredited to EN 45011 for product conformity certification of ready-mixed concrete.

Slump/Consistence

- The minimum slump for Adprufe® concrete should be 120 mm or slump class S3.

Water addition

- No additional water shall be added to Adprufe® concrete.

Weather conditions

- *Hot weather* – take precautions to ensure that the temperature of the concrete is not more than 35°C at the time of placing. Ensure proper curing takes place.
- *Cold weather* – take precautions that the temperature of concrete does not fall below 5°C at any time during placing or compacting. Do not place on ice or frozen surfaces and protect the concrete from freezing once placed.

Workmanship

- Concrete containing Adprufe® 100 is no different to any other concrete and good site practice should prevail.
- Workmanship should comply with the requirements of BS 8000-2.2 Workmanship on building sites – Part 2: Code of practice for concrete work – Section 2.2 Sitework with in situ and precast concrete and EN 13670 Execution of concrete structures.

Placing concrete

- Ensure all rubbish, debris and free water is removed from the formwork.
- Place concrete as close to its final position as possible – do not use the poker to move concrete around the formwork.
- Place concrete through the reinforcement so as to avoid segregation.
- Where reinforcement is congested use chutes or trunking to direct concrete into position.
- Ensure that waterstops are not displaced whilst placing concrete.

Compaction

Compact the concrete ensuring that:

- It forms a solid mass with no voids
- It fully encases the reinforcement
- It fills all the formwork
- There is no segregation
- It is amalgamated with previous loads
- The correct size vibrators are used and suitable for the job
- The operatives are experienced and know the correct routine.
- In deep sections place and compact concrete in layers, ensure each layer extends the length and width of each section. Each layer should normally be less than the height of the poker vibrator.
- Place succeeding layers without delay to avoid cold joints and ensure they are combined with the layer below; ensure that vibrators go through the top layer of concrete into the layer below.
- Check for plastic settlement cracking and re-vibrate as necessary.

Inadequate compaction may seriously affect the properties of the hardened concrete.

Finishing

- Surface finishing should not result in laitance.
- Water, cement, surface hardeners or other materials should not be applied to the surface of the concrete during finishing operations.

Curing

All concrete should be cured and protected:

- To minimise plastic shrinkage cracking
 - To minimise early-age thermal cracking
 - To ensure adequate surface strength
 - To avoid damage from freezing
 - To minimise excessive temperature gradients
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- Commence curing as soon as finishing operations are completed, if required temporary curing shall be applied prior to finishing to prevent plastic shrinkage cracking.
 - Curing methods should ensure low evaporation rates from the surface of the concrete, or keep the surface of the concrete permanently wet, guidance is given in Annex F of EN 13670.

Methods of curing include:

- Keeping the formwork in place;
- Covering the concrete surface with polythene sheets, secured at the edges and joints to prevent a wind tunnel effect;
- Placing wet hessian on the surface and ensuring that it doesn't dry out;
- Keeping the concrete surface visibly wet with suitable water;
- Application of a suitable curing compound.
- Curing compounds should not be applied to construction joints.
- Concrete should be protected from frost and should not be allowed to fall below 0 °C until the concrete has achieved a minimum compressive strength of 5 N/mm².
- The peak concrete temperature within the construction should not exceed 70 °C unless data is provided to prove that, with the combination of materials being used, higher temperatures will have no significant adverse effect on the service performance of the concrete.

The duration of applied curing shall be a function of the development of the concrete properties in the surface zone and is defined by the curing period or percentage of the specified characteristic 28 day compressive strength, according to the table below (EN 13670:2009: Table 4 - Curing classes)

	Curing Class 1	Curing Class 2	Curing Class 3	Curing Class 4
Period (hours)	12 ^a	NA	NA	NA
Percentage of specified characteristic 28 day compressive strength	Not applicable (NA)	35%	50%	70%
^a Provided the set does not exceed 5 hours, and the concrete surface temperature $\geq 5^{\circ}\text{C}$				

- The minimum curing periods for each Curing Class are detailed in Annex F of EN 13670 Execution of concrete structures.