

Freeze-thaw/de-icing Salt Alternating Storage

Key words

Concrete surface, (protective) coating- and repair system, freeze- thaw and de-icing salt alternating test

Fields of application

Quick test to proof the resistance of concrete, coatings and repair systems with shock temperature changes and (or) freeze thaw /de-icing salt performance, for permission (accreditation) – and suitability (performance) tests in accordance to “Special technical terms of the contract (ZTV-ING)” by the Federal Highway Research Institute „Bundesanstalt für Straßenwesen“ (BAST) and the “Directives of coating- and repair systems (RL SIB)” by the “German Committee for Reinforced Concrete” “Deutscher Ausschuss für Stahlbeton (DAfStB)”.

Methodology and instrumentation

The concrete specimens are stored in the alternating storage basin. An electro-mechanic swivel arm, populated with a pallet and a counting train as well as an electric timing for cyclic loading, is handling the alternating storage. It can be chosen between terms of the customer or in accordance with the corresponding directives. As measuring data both is recorded, temperature of the bath and of the specimen kern, and the number of temperature changes. The tempered alternating storage basin can be filled with water or dilution (if the Temperatures $< 1^{\circ}\text{C}$ a NaCl-dilution is required).

Standard level temperature: $+20/-15^{\circ}\text{C}$ (tests in accordance to ZTV-ING, ZTV-W, DIN EN 13687-1);
Full loading temperature fluctuations $< 2\text{ K}$.

Items tested

Concrete specimens; also coated with repair – and protective coating system
Size of the test objects: normally $30 \times 30 \times 10\text{ cm}^3$ (area of the pallet $80\text{cm} \times 60\text{cm}$)
Weight / Mass of the test objects: crush load ca. 210 kg

Quantities / characteristics tested

Visual estimation of cracks larger $> 0,05\text{ mm}$, limit definition of bond strength by pull-off of the repair systems after passing the freeze thaw/de-icing salt circulation test, compound strength in addition to the number of the cycles; q.v. guidelines ZTV-ING (BAST) and RL SIB (DAfStB)

Uncertainty / reliability of results

The estimation of the cracks and the limit definition of bond strength by pull-off are an important indication for quality and resistance of repair systems for the implementation. The empirical measurement reflects the practical knowledge on construction as a quick test. Tempered: $< 2\text{ K}$ (directly after dipping the larger specimen) normally $< 1\text{K}$; cycle time $< 0,5\text{ min}$

Qualification and quality assurance

Only automatic test facility of its kind in Germany, developed at BAM. Unique test capabilities for heavy test objects: fast (shock) temperature changes at high temperature accuracy and fully automatic control of cycle time and number. Very high level of expert knowledge of test execution and evaluation.

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Further information

The test facility provides for parallel testing of large-scale items with a total mass of about 200 kg with arbitrary test solutions in a wide temperature range. The loading devices, test programs and system control were designed and constructed at BAM. As a distinguished capability, the facility provides for fast (shock) temperature changes at high temperature accuracy as well as a full automatic control of cycle time and number.

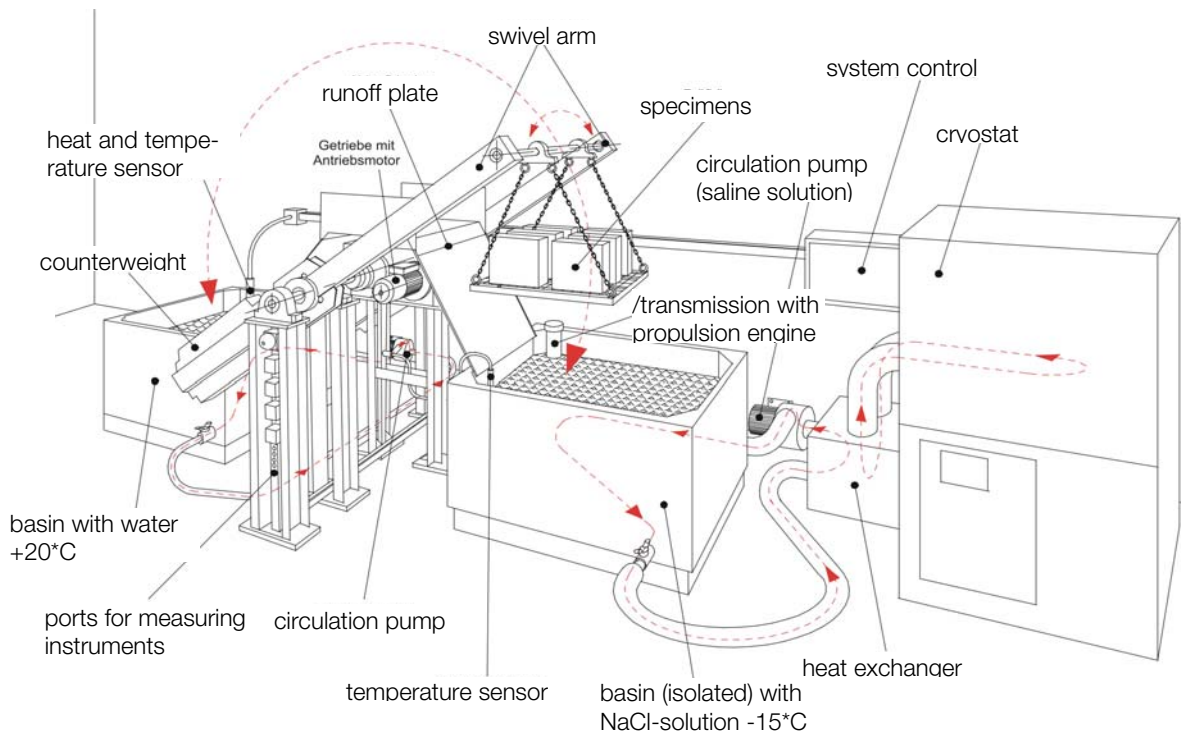
Specimens can be tested in many different variations of performance conditions and constructions.

An electric motorized swivel-arm, with a capacity of 210 kg, pivots the specimens on a pallet of 600 mm x 800 mm in the tempered basin. The temperature of the bathes can be chosen between -15°C up to $+40^{\circ}\text{C}$ and between 20°C up to 23°C . The storage period of the specimens in the basins is between 0 h up to 99 h and the cycle's number can be adjusted on up to 999 cycles. The temperature can be regulated in a time window < 20 s to 99 h. In addition to the changes, an internal (pause) time (e.g. to drip off the specimens) from 0 s up to 99 h is possible.

Other stress combinations are also available (e.g. water/aeration (air) or area irradiation with radiant heater).



View on the facility
(in front the tempered basin with 20°C up to 23°C)



Construction of the facility with the equipment details