

WARRANTY CONDITIONS

USER'S MANUAL FOR THE FOLLOWING INDUSTRIAL FLOOR TYPES (V 1.19):
 hardened with dry shake topping, concrete, self-levelling cement
 screeds and screeds applied with wet-on-wet technique

INFORMATION AND ACTIVITIES RELEVANT TO CORRECT USE OF INDUSTRIAL FLOORS

1. General:

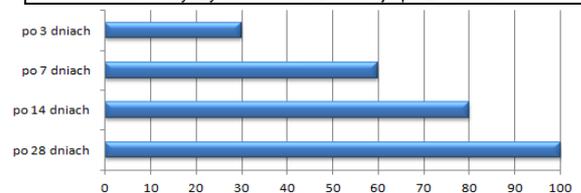
Cement or concrete floor with dry shake topping requires special care. Below are the guidelines to be followed in this respect:

- a) In the period of low ambient outside temperatures the Employer/Ordering Party is bound to maintain the temperature of min. +5° C inside the hall (in the area of works execution) during the floor execution and for at least 14 days following completion of the floor and prevent the floor from being penetrated with cold. Heating of the hall provided by the Employer/Ordering Party shall be done in such a way to prevent overheating and overdrying of the floor surface (among other, it is forbidden to aim warm airflow onto the floor surface, it is forbidden to cause direct contact of the floor with a heating tube) and in a manner not causing carbonization (combustion fume exhaust system shall be in place). The floor affected by cold, overdrying or carbonization is significantly weaker and susceptible to damages of its top layer, which cannot be subject to warranty claims.
- b) Frost protecting agents added to the mix to allow installation at low temperatures will make the floor surface more dull.
- c) For 14 days from installation construction machines (electric lifts, battery-powered trucks, etc.) should not be allowed on the floor.
- d) The personnel must follow the equipment operation and maintenance manual.
- e) Floor mats should be provided at personnel and vehicle access doors, as appropriate for the application.
- f) Skidding of tires must be excluded by prohibiting rapid acceleration, braking and turning with loss of grip of machine or FLT tyres.
- g) The recommended speed of forklift vehicles in locations of limited visibility and accessible to pedestrians should be 3 km/h and in other cases 6 km/h.
- h) Loads should be moved above the floor surface, lifted and deposited exactly at pre-defined locations and dragging of loads on the floors is strictly prohibited!
- i) FLT batteries must be charged only at designated charging points. Spilled electrolyte must be immediately neutralized and removed from the floor surface.
- j) The floor should be protected from mechanical damage of concrete during its operation, i.e. spalling and chipping of joint edges as a result of concrete shrinkage, damage caused by welding, cutting with angle grinders and other equipment, falling of tools and materials, scratching and damaging the surface, also at joint edges by forks of FLT and other forklift equipment, palletes, foreign matter, etc. Protection of dummy joints (sawed shrinkage control joints) and construction joints – FLT traffic, dragging or pushing pallets or other materials on the floor surface will result in spalling of joint edges and loss of joint filler. Besides, nails often protrude under pallets causing imminent scratching and damage to the floor surface. The repair technique will depend on the severity of spalling and chipping and Owner's preferences. Mechanical damages are not covered by the warranty and are repaired at a charge.
- k) Throughout service spilled oil and grease should be removed from the surface, since smooth surface of the floor may easily become slippery posing a safety hazard to personnel and equipment. Moreover, spilled oil and grease may penetrate through the floor and produce difficult to be removed stains.
- l) Due to natural shrinking of floor concrete the width of the floor expansion joints shall be changed over time. Therefore the flexible mix filling of contraction (sawn) joints, working and technological joints (system joints recommended to be filled in about a year from the date of floor execution when the expansion joints are the widest) may debond over time and gaps may occur, what, due to natural working of the perimeter expansion joints (around walls, posts, etc.) with final filling in form of PE foam may be filled in with use of flexible mix against a charge however, due to natural shrinkage of concrete filling in the gaps and repair of debonding is not subject to a warranty claim as well. The above mentioned situations are not proof of design drawbacks or shortcomings in execution of the industrial floor.
- m) While using the slab floor (with sawn-cut expansion joints) there is a possibility of vertical dislocations of the slabs within the expansion joints (especially in highly used passing areas of forklifts or other vehicles). The above results from empty spaces between the floor slab and the subbase mainly due to dynamic impact of forklift or other vehicles on the floor. Therefore the subbase under the floor slab (refers to slab floors and seamless floors as well) should have the same required technical parameters on the entire floor surface and additionally, while being used, the floors may not be subject to deformation or settlement. The result of settlement or consolidation of the subbase is visible in form of floor damages consisting in concrete chipping on the expansion joints edges and cracking of floor slabs. These defects are not subject to warranty claims (floor contractor is not responsible for the quality of subbase layers and quality of sub-soil).
- n) The floor must not be exposed to continuously dripping or flowing water or other liquids which may in time wash out the cement paste.
- o) In places steel fibre may be visible on the concrete surface - this is usual in fibre reinforced floor slabs. Wearing of the surface may increase the number of fibres visible on the surface and this is not to be attributed to design of workmanship defects. Moreover, the fibres will rust in normal moisture/ water conditions, which may be visible on the floor in form of rusty stains. The above is not subject to warranty claim.
- p) Flaking of a thin (2-4 mm) superficial layer of topping may occur sporadically. The flaking mechanism has not been fully understood and probably there are a few factors behind it, such as differential binding of the concrete surface. The repair treatment consists of re-bonding the detached piece by injecting low viscosity epoxy resin at the interface between the piece and the base. Should this treatment be ineffective a fragment of floor is cut out around the flaking location and filled with cement or epoxy-based mortars.
- q) On industrial floors with hardened surface a network (resembling a spider's web) of fine surface cracks is visible (a.k.a. crazing). It is a quite common phenomenon, variable in character and while there are no effective technical countermeasures it does not affect the performance and mechanical properties of the floor, as confirmed by BEB (German) and TR34 (British) reports and as such it is not to be considered a snag or defect. Crazing does not affect the slab construction. One should bear in mind that cleaning agents (even if inert to the floor surface) may increase the severity of the problem by penetrating into the cracks and widening them in time. In order to minimize the above phenomenon the

floor, while being used, should be protected with properly selected curing agents approved by the floor contractor. The severity of crazing depends on the in-service exposure factors, including rapid variations of indoor temperature and humidity of air and rapid heating up the space soon after floor installation up to the design temperature may result in development of tight or even open shrinkage cracks together with curling, which defects are not covered by the warranty. Hence it is of primary importance to consult the flooring contractor before the first heating up the space after floor installation. Crazing will be more severe in spaces with higher design temperature (especially if higher than 18 Deg. C) and where under floor heating is used. Moreover, crazing may be more visible in heavier trafficked areas.

- r) The floor exposed to thermal shock caused by, e.g. step changes in temperatures, impact of high temperatures (e.g. in the area of ovens, heaters) and working with open fire without floor protection shall be more susceptible to increased rate of micro-cracks and higher rate of shrinkage cracks and even to deformation of the floor structure, what is not subject to a warranty claim.
- s) Please note that the around piers, at docks, floor trenches and foundations are particularly sensitive to cracking and other damage due to vibrations and displacements of structure, even with additional reinforcement in place. These problems are not due to any design or workmanship defects and, as such, they are not covered by the warranty.
- t) The floor surface in the area of posts, walls, floor expansion joints and in the area of construction of docks, channels or foundations where the floor is trowelled manually due to limited access of power trowels will not have the same level of roughness as the remaining part of the floor – fully mechanically trowelled.
- u) During trowelling small grains (coming from dry shake topping or concrete mix) may fall under the blades, resulting in circular imprint visible on the finished surface. These imprints are not a critical quality defect and may gradually disappear during floor operation.
- v) Execution of induction cables for controlling transportation trolleys in the hall (most frequently by placing ducts in cut-out furrows in the floor) constitutes interference with the floor structure and the floor Contractor shall not be responsible by virtue of a warranty for related consequences (e.g. chipping out, scratches).
- w) Discoloration and stains – concrete floors are not usually uniform in terms of their color, especially during concrete curing period and in the period of complex physical and chemical processes of the concrete, however differences in the floor color disappear to a large extent over time; moreover, in case of using impregnating silicate agents which create a chemical reaction with the surface layer of the floor there are natural salt stains on the floor as brighter parts of the surface not affecting floor quality or functionality; in course of floor cleaning and using the stains also become uniform. The above also refers to the stains resulting from covering the floor surface with a protective film in the period of floor maintenance.
- x) Considering the temperature of min. +15°C the following surface force loads (per 1m²) of the floor prior to achieving the 28-day guaranteed strength are accepted (refers to concrete and Portland-cement mortars):

| |
|---|
| do 30% wytrzymałości obliczeniowej - po 3 dniach |
| do 60% wytrzymałości obliczeniowej - po 7 dniach |
| do 80% wytrzymałości obliczeniowej - po 14 dniach |
| 100% wytrzymałości obliczeniowej - po 28 dniach |



For lower temperatures these times must be increased accordingly.

If Portland slag cement is used (CEM III) concrete may achieve full strength after 56 days of curing. Point applied loads (shelves, trolleys) should not be applied within 14 days from the date of execution and after the 14-day period half of the above load value can be applied.

y) It is recommended to observe the following rules in order to ensure optimal condition of the floor:

- load application on the floors should be even to the extent possible – (refers to loads applied directly on the floor and on shelves); in particular the impact of such loads is adverse if for one single seamless slab a load close to its maximum is stored on some part of the floor and the remaining part of the floor is not loaded – the above may cause cracks of the floor;

- while fixing elements to the floor (e.g. machines, devices, shelves, door stops, covers, etc.) support bases of these elements may not be situated over floor expansion joints (sawn, system joints) as it will result in coupling of the joints via anchoring screws and blocking free horizontal dislocation of floor slabs, what is unfavorable in terms of proper work of the floor and causes occurrence of scratches.

2. Floors' surface:

Industrial floors in production, storage and retail areas are exposed to wearing as no other component and for this reason it is critical to observe the following principles of operation. Typical sources of industrial floor pollution are:

- a) home dust, atmospheric dust and dirt,
- b) tyre marks,
- c) oil, grease, and stains of chemicals,
- d) stains resulting from damage of packaging,
- e) sand brought in by employees, etc.

It is a natural phenomenon that the surface zone of the floor is subject to a natural wear and tear while using it and the above shall not be subject to warranty claims. Moreover, in locations of intensive use and operation impact on the floor the floor the wear and tear rate of the floor surface may be higher. It is important to take special care of cleanliness of the floor in locations which are under high communication impact, e.g. communication routes, dock areas and pay special attention to

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removal of substances with adverse impact on the floor, e.g. sand, glass, foreign matters, corrosive substances affecting the flooring. Defects caused by the above are not subject to a warranty claim.

Concrete industrial floors with surface hardening and protected with use of an impregnating agent are wear floors. In order to retain the warranty and have the floor in proper usable condition for as long as possible a regular floor cleaning and maintenance program shall be implemented. One has to bear in mind that if maintenance activities are repeated at shorter intervals the floor will be more lasting in terms of its usability.

In order to retain proper functionality of the executed floor it is required to observe the following rules:

- In case of contact of any liquid or loose chemical substances such as organic acids, non-organic low-concentrated acids, saline solutions, grease, solvents, oil, sugar, vinegar, etc. with the floor they have to be immediately removed from the floor surface and if necessary, neutralized,
- Any substance with damaging and corrosive impact on concrete floors may not be left on the floor,
- Any substances affecting corrosion of steel fibers used for concrete reinforcement may not be left on the floor,
- after each use or spillage of the above-mentioned chemicals the surface must be washed with clean warm water,
- stains, discolouration and other damage may still appear on the surface, which are not covered by the warranty,
- floor mats should be provided at each pedestrian or vehicle access and the floor should be regularly cleaned and swept to remove foreign matter including oil, aggressive chemicals, grains of sand and other aggregates which may abrade the surface,
- hard brushes or pads must not be used in cleaning machines which could scratch the surface (soft or medium-hard pads should be used, depending on the type of dirt),
- day-to-day cleaning is best carried out with sweepers and wet cleaning equipment. After wet cleaning the floor should be left to dry up completely.
- solutions of mild detergents specifically designed for maintenance of industrial floors (see Sec. 3).

In areas of traffic routes, warehouse aisles, near vehicle access doors and loading docks the floor (and in particular its topping layer) will be wearing faster.

As a result, there will be more steel fibres visible on the surface (see 1o) and crazing (see 1q) and wearing of the topping will be more severe.

Features of the floor and damages of the floor caused by failure to observe the rules and requirements specified in point 1 "General information" letter "a" to "o" and letter "q" to "x" shall not be subject to a warranty claim and repair thereof (of technologically possible) can be carried out against a charge.

3. Cleaning

Dry shake toppings are a mixture of pigments, aggregates and cement. Thus, while increasing the strength and reducing absorption dry shake toppings have rather limited effect on improving their resistance to chemicals.

Consequently, concrete floors, sealed and hardened with dry shake toppings are not resistant to all chemicals. The most important principle in choosing the cleaning agents for keeping the floor clear is that the agents should be free of any compounds with destructive and/or corrosive impact on the cement matrix, reinforcement steel.

This excludes use of chemical solvents (such as acetone, toluene, xylol, trichloroethylene, etc.). Cleaning agents shall not contain strong alkalis and organic solvents, even in low concentrations. Moreover, acidic cleaning agents, such as hydrochloric and acetic acids, even if diluted. Moreover, the floor may be affected with salts and salt solutions, chlorides, sulphates and their derivatives. Alcohols and glycols shall not be used as they may also cause damage to the floor surface by weakening the bonding of cement. The floor structure may be affected also by gaseous substances, such as elementary chlorine, sulphur dioxide, carbon dioxide, hydrogen fluoride, as well as oil and grease. Chemicals and other aggressive solutions must be neutralised and removed from the floor surface immediately. However, discolouration, stains and in the worst case even pitting and widening of fine cracks may occur anyway.

For maintenance of hardened floors, similarly to all other cement-based products special wet cleaning and cleaning agents must be used, i.e. the concentrate (base) of chemical must be neutral or slightly alkaline i.e. with $7 \leq \text{pH} \leq 9$. As a recommendation wet cleaning agents should have sealing properties to control excessive drying and maintain appropriate reaction. The technical brochure must be read before application as not all floor cleaning agents are suitable for concrete floors.

Domestic and atmospheric dust and dirt - hardened and sealed industrial concrete floors feature high resistance to dusting. Nevertheless, domestic and atmospheric dust and dirt will accumulate on the surface.

The joint filler may become rather unsightly during operation. Tire marks - rubber leaves marks on the surface, which can be removed with special chemicals.

Oil, grease and stains after chemicals - for safety and hygienic reasons oil and grease stains should be wiped and removed from the surface as soon as possible. The same applies to spilled chemicals (such as battery acid). As the next step the surface should be rinsed with neutralizing agent and clean water.

Maintenance of hardened concrete floor should include the following treatments:

- wet cleaning and maintenance of the surface with day-to-day cleaning agent, which helps to maintain good condition of the floor surface by forming a protective film, which will be removed together with dirt in next cleaning;
- through cleaning of the floor from time to time when heavily stained. When the surface has dried up after cleaning an additional curing layer should be applied to seal the pores and capillary openings in the floor (applied at a rate providing saturated surface). This will restore desirable properties, which have been reduced by thorough cleaning: high resistance to dusting, reduce absorption of water and oil and facilitate cleaning.

One has to be aware that an agent applied directly following trowelling the floor during execution of the floor is a technological agent mainly used for the purpose of maintaining proper moist for cement hydration which is subject to gradual tear in course of using the floor. Therefore in order to ensure proper durability of the floor and air-tightness and in order to minimize weakening of the surface of the floor it is necessary to maintain the above mentioned floor while it is used. Applica-

tion of impregnating agents and/or surface agents suitable to be used on such floors are meant by maintenance. Such maintenance activities should be carried out by units with proper qualifications and expertise in such works.

Performance of maintenance service by units (companies) without proper qualifications or performance thereof with use of improperly selected agents may not bring about the expected result compliant with their appropriation/function or may even contribute to permanent disruption of the top layer of the floor. Finishing agents based on silicates, synthetic resins, firm waxes should be used. Selection of agents used for maintenance of the floor has to be previously discussed with manufacturer of such materials. Floor user is bound to hold comprehensive technical documentation concerning agents used on the floor and machines used for keeping the floor clean within the floor operational area. The frequency of applying finishing agents on the floor depends on the intensity of floor use and the principle of shorter intervals between maintenance of floor areas with higher use rate should be observed.

The required maintenance of the floor carried out by the User is mainly done in order to keep the floor and the facility clean, protect it from excessive wear and tear or from being damaged during use.

Maintenance carried out at proper time intervals results in longer life of the floor by strengthening the cement binding agent prior to rinsing also under impact of cleaning agents and other substances which may be present on the floor.

In order to retain the granted warranty the User is bound to submit to the floor Contractor, without a separate demand, a daily, weekly, monthly and annual cleaning plan specifying: the cleaning method, used agents and concentration thereof, type of cleaning devices, water temperature. A comprehensive floor maintenance procedure should take place at least once a year with a recommendation that such a procedure is repeated every 6 months. Irregular cleaning, improperly trained staff and imprecise brushing prior to cleaning (sand getting under the bag or machine brushes and scratches the surface) and using improper cleaning agents significantly affects tear and wear of the floor and the extent of floor damage.

Failure to provide the floor Contractor with a floor cleaning plan prevents the contractor from verification of proper floor use thereby releases the Contractor from warranty claims referring to the condition and technical properties of the floor. Floor damage resulting from the reasons specified in the present point shall not be Subject to warranty claims and any repairs may be carried out against a charge.

4. Application of painted signs and lines

Painted signs and lines may be applied on the surface of industrial floor. Make sure that the compound will not cause any damage to the floor. Manufacturers of floor sealers and hardeners recommend to apply the required number of coats of coloured epoxy-based paint on floor surface prepared by cleaning (degreasing), dulling by light grinding and priming with epoxy primer. Prior to painting it is necessary to consult the manufacturer of sign materials.

5. Compatibility between industrial floors and the overlaid compounds

Additional layers on the basis of epoxy, acrylic and polyurethane resins may be used on surface hardened floors assuming that the subbase was suitably prepared. In any case prior to applying further layers it is necessary to consult with the manufacturer of the materials supplying the overlaying system. However, it is recommended to carry out an adherence test each time for new layers on part of the floor.

6. Repairing localised damage

Localised damage may occur during normal use of the floor, resulting for example from falling of objects or insufficient protection of the surface during construction. Repairs of such damage should be carried out by a specialist construction company.

The places which are most sensitive to damage are the edges and corners in docks and at construction docks, which are exposed to trafficking by hard tired forklift trucks. As measure to mitigate such damage sections or joint armoring may be installed at construction joints (end of day's pours). Lack of such protection releases the contractor from any responsibility for damage to edges and corners, including without limitation chipping and cracking and such damage may be repaired at a charge if installation of protective measure was not accepted by the Owner/ Employer.

A certain number of tight and open cracks and curling occurring at various places throughout the surface is an intrinsic feature of both jointed and jointless floors being multi-layered structures. These problems occur primarily: at columns and joints, thresholds of personnel and vehicle access doors, floor pits and foundations and are caused by intrinsic shrinkage of concrete and various and indefinite stresses in the floor structure which are beyond our control (according to BEB, Sec. 7, Cracking). This type of cracking and curling does not affect the structural performance and does not indicate any design or construction defects (according to ACI report No. 302.1R-96) Cracks should be monitored and action should be taken only when deterioration of the floor surface has started (crack spalling). For aesthetic reasons inactive cracks (which do not change in time) may be repaired with joint filler. Repair of expanding and propagating cracks which may be accompanied spalling should start with routing the crack and then filling the cut and patching spalls with resinous patch. If movement of crack is expected with displacement of slabs along the crack it may be "stitched" with steel bars placed across the joint (inserted into pre-drilled holes and adhered with resinous adhesive).

At repair locations wet cleaning should be stopped at least 3 days in advance as dry base is critical to the effect and durability of repair. The repair location should be isolated and excluded from operation. After repair the slab should be left to rest for at least 3 days (to allow curing of repair materials). Failure to comply with these requirements will make the warranty void.

The repairs are always visible on the surface and the damage may reappear after some time which does not mean that the repair was done incorrectly.

7. Final notes

Premature wearing of the surface may result from:

- irregular cleaning and cleaning personnel not provided with training,
- sand at entrances accompanied with lack of doormats to trap sand and moisture from shoes,
- oil, grease, liquid foods, chemicals spilled on the floor surface,
- ineffective sweeping before wet cleaning (grains of sand may come under the machine and scratch the surface),

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- use of wrong chemicals, causing dissolving, weakening of the floor finish and lowering of pH,
- use of harsh degreasing and highly acidic products,
- use of brushes instead of pads, use of too hard pads.

In winter measures should be taken to limit brining in winter maintenance slat on wheels of forklift trucks.

Please consult the specialist floor cleaning companies and manufacturer of the chosen floor hardening system in order to chose the most appropriate floor cleaning and finishing products and the best cleaning technique.

8. Maximum operational loading of floor: - as per design (floor engineering documentation).

The warranty does not include damages of the floor slab structure caused by special loads, i.e.: rapid temperature changes (heating up or cooling, overdrying or cold penetration), impact floor loading (moving heavy items on the floor, hitting caused by heavy items falling onto the floor, exceeding usable loads), defects caused by defective execution of subbase and lower floor subbase (excessive deformation, subbase settlement), impact of aggressive chemical agents and emergencies, e.g. fire.

NOTE: wherever a reference is made to hardened or concrete floors, the provisions apply also to cement floors, self-levelling wet screeds, screeds applied with wet-on-wet technique.

Jointless floor is a floor slab divided into panels corresponding to pour areas with expansion joint profiles (such as EPD) without saw-cut joints within the panels.

Jointed floor is a floor slab in which panels corresponding to pour areas, separated with expansion joint profiles (such as EPD) are sub-divided with sawn control joints.

Failure to comply with the above requirements may result in damage or premature wearing of the floor, which will not be covered by the warranty.