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I. Instructions concerning water treatment and cleaning of DLW delifol swimming pools

I.1 Procedure combinations

Swimming pool water is a favourable breeding ground for micro-organisms like bacteria, fungi and algae. Some of the bacteria and fungi are pathogenic and involve the danger of infection for the swimmers, but even harmless bacteria and fungi can lead to slimy deposits if they grow in masses and in extreme cases can make the water muddy. Effective elimination of the micro-organisms is important so that the swimming pool water constantly remains in sanitary condition. This is obtained by combining physical and chemical water treatment procedures (basin hydraulics and filtering).

I.2 Basin hydraulics

Basin hydraulics is another term for the water circulation in the pool. Well designed basin hydraulics provide an optimum distribution of the water disinfectants which will reduce the risk of reproduction of micro-organisms or algae in dead zones. The capacity of the circulation pump should be determined in accordance with the basin volume.
In maximally 4 hours the total volume should have circulated once. It is a general rule that the quality of the water is better the more often it circulates.

I.3 Filtering

Filtering is a means to clean the pool water mechanically from all coarse pollution material (hairs, dust, leaves, etc.). Attention must be paid to a sufficient size of the filter, the rate of filtration and the height of the filter bed.

I.4 Filter backwashing

Filter backwashing removes all accumulated pollution matter from the filter into the sewage system. At least onebackwashing weekly is necessary for private pools during the bathing season, unless the filter resistance level indicates that backwashing is required more often.
It is of special importance to maintain the recommended rinsing water speed and the rinsing period.

I.5 Disinfection and oxidation

Disinfection is essential for quick elimination of all pathogenic agents of contagious diseases in the water so that there is no risk of infection for the bathers. The disinfectant should be added to the filtered water, i.e. directly below the filter. Which disinfectant is chosen depends on the use of the pool, its size and its operation conditions.

Sodium hypochlorite (chlorine bleaching)

This method is the oldest chorine bleaching method. When sodium hypochlorite is used it has to be taken into account that its activated chlorine content (max. 12.5 %) will decrease considerably within short time, that the pH-value of the water due to the high alkalinity of the lye has to be corrected with the help of additional acid and that the handling of this caustic lye is a safety risk for the maintenance staff.

Sodium hypochlorite must not be mixed with other solutions, only with water!

Chlorinated lime

Chlorinated lime in granulates contains at least 65 % active chlorine and has storage stability, unlike sodium hypochlorite. It contains considerable quantities of calcium which causes water hardening, so it is suitable only for soft water. It increases the pH-value of the pool water.

Do not mix it with other chemicals!

Chlorine/ozone application

Ozone is a strong oxidizing agent and has to be used exclusively in the circulation apparatus and not in the pool water. Ozone is no substitute for water disinfectants like chlorine. The additional application of ozone in the water conditioning section of the circulation system kills germs and oxygenates water soluble organic pollution material, so that the chlorine consumption of the pool water can be reduced and the water quality is improved.

Bromine

Like chlorine, bromine is a halogen and is available in bromine tablets. The advantages of bromine: it contains approx. 30 % chlorine. Unlike the chloramines (combined chlorine), bromamines are inodorous and do not irritate the mucous membranes. The disinfection effectiveness of bromine is not so dependent on the pH-value. However, the disadvantages are its low oxidation ability, its higher price and the caustic effect of the elementary bromine.

Chlorinated isocyanurates (stabilized chlorine products)

Chlorinated isocyanurates are fixed chlorine compounds in the form of granulates or tablets. Advantage: high content of active chlorine (56–90 %), stability, easy and safe handling, as well as no pH-value change of the water. Disadvantage: in higher concentrations (approx. 40 mg/l and higher) the organic carrier substance impairs the germ destroying rate of chlorine so that this must be compensated by raising the chlorine content of the pool water (0.6–1.0 mg/l). This involves a risk of fading the swimming pool coating.

Activated oxygen

Oxygen separating compounds like hydrogen peroxide are used as oxidants and disinfectants. However, the oxidizing or disinfecting effect is maintained only for a short time after addition. The admixture of an algicide will activate the disinfecting effect. Activated oxygen in tablets allows addition of chlorine at any time, whereas hydrogen peroxide and chlorine neutralize each other.

Conclusion

When you apply disinfectants please pay attention to the correct quantity as specified by the relevant manufacturer. If chlorination is carried out correctly, it is an excellent procedure for water treatment and disinfection.

Chloric products should have a content of free, active chlorine between 0.3 and 0.6 mg per litre water. This value depends strongly on the pH-value.

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Swimming pool water which "smells" of chlorine, does not contain too much, but too little, free chlorine and can cause irritations of the mucous membranes and the eyes. For this reason the content of fixed chlorine (chloramine) must not exceed 0.2 mg/litre water.

Should the swimming pool water happen to "turn", in many cases a shock chlorination will help. A rule of thumb: one 20 g tablet (quick-dissolving) per m^3 water.

Please do not throw disinfectants in granulates or tablets directly into the pool water and avoid constant overdosing, this can cause discolorations or fading.

I.6 Flocculation

Microscopical contaminations (bacteria, germs, human fats, cosmetics, etc.) distributed invisibly in the water can not be retained completely by even highly effective filters (with the exception of diatomite filters). If flocculents are added regularly to the water before it passes through the filter, the flocculents remain in the filter bed. The effective-ness of flocculents depends on the pH-value. If they are not correctly applied, flocculation can persist in the pool water and cause discoloration or cause poor water quality. Flocculents can only be used when sand filtering systems are installed.

I.7 Filling water

Water treatment depends of course on the composition of the water which is used to fill the pool. Water containing iron and/or manganese may show discolorations from a slight clear green shade to nearly black or turbid. In order to remove the undesired metal oxides as completely as possible, the following procedure should be carried out:

1) shock chlorination to oxygenate all iron and manganese;

2) adjustment of the pH-value to 7.0–7.4;

3) collection of the hydroxides during operation of the filtering system. After approx. 3 days backwashing. Spring water often contains much iron.

If the pool water has a high copper content (e.g. due to corrosions), black stains on the swimming pool lining may occur, the built-in parts may get blackened, or in extreme cases blond hair may appear green.

Copper can be filtered out of the pool water as follows:

1) raise the pH-value to 7.5–7.7;

2) add flocculent, let circulate for approx. 48 hours, then backwash;

3) reset the pH-value to 7.0–7.4.

It may be necessary to repeat this procedure. The copper is removed when the backwash water has no longer a green-blue discoloration.

I.8 Algicides

In areas of poor circulation, if the water is not regularly treated, if it has high contents of carbon dioxide and phosphates. If in warm water, if the weather is sultry, or after thundershowers, algae may thrive in the water. Beside ugly green deposits on walls and floor, algae present the danger of accidents when stairs and ladders become slippery. Algae infestation can be prevented by Quats (quaternary ammonium compounds). Quats are chlorine-compatible. Algae elimination: remove the algae with a soft brush, the pH-value should be 7.0–7.4 and a chlorine shock dosage should be added to the water. Subsequently, add a double quantity of algicide.

I.9 pH-value control

Different treatment measures can alleviate corrosion, calcium precipitations, flocculations, the disinfecting effectiveness of the chlorine, and the comfort of the bathers which depend on the pH-value. The ideal value lies between 7.0 and 7.4. (DIN 19643: 6.5-7.6)

Please take into account that poor water quality is often caused by the pH-value. So please check it in regular intervals.

For a 7.0 pH-value you need 0.3 mg free chlorine/litre and for a 7.4 pH-value 0.6 mg free chlorine/litre is sufficient to keep the water free from germs.

In principle, the relevant instructions of the manufacturer of the water treatment system have to be observed.

I.10 Fresh water addition

Even in swimming pools with the best maintenance care, salts (chlorides, sulphates, nitrates, calcium) will concentrate gradually which can be neither removed by filtration nor by chemical procedures. To prevent possible incidents, e.g. corrosion on metal or concrete parts, health hazards, muddy water, lime precipitations, clogging of the filter, the pool water should in part be replaced by fresh water at regular intervals. In private swimming pools 3–5 % of the basin content should be renewed weekly.

I.11 Hardness stabilization

Even with a constant pH-value, water with a hardness of over 15 dH may show lime precipitations and deposits. The results are rough surfaces, poor quality water, operation problems caused by clogged filters, and energy losses in the heat exchanger. A hardness stabilizer added once, corresponding to the water hardness and the basin volume can stabilize the hardeners contained in the water. Also metal ions are altered with the result that metallic deposits can be prevented.

I.12 Water temperature

The higher the water temperature, the greater is the consumption of disinfectants. As a permanent water temperature 34° C must not be exceeded.

I.13 Basic cleaning

After brushing and washing down the DLW delifol swimming pool lining, basic cleaning with an acidic cleanser is carried out in order to remove lime deposits. If they can not be removed, alkaline cleansers are required. Please take care that this order is kept: first the acidic, then the alkaline cleanser.

Rinse thoroughly with clear water, thereafter the pool can be filled. An additional measure to prevent algae attacks is to spread an algicide solution over the

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walls and the floor before filling.

I.14 Maintenance cleaning

Regular maintenance cleaning is carried out with slightly alkaline universal cleansers or neutral cleaning agents. They dissolve human fats and surface contaminations. After cleaning rinse thoroughly with water.

Domestic detergents, abrasives and solvents are in no case suitable.

In general it should be taken care that only small quantities of the cleaning agents get into the pool water. They spoil the water quality and can produce foam.

I.15 Cleaning instruments

For daily maintenance we recommend a cloth, a sponge and soft brushes. The floor can be cleaned with a half or fully automatic floor vacuum cleaner and floor brushes.

If high-pressure or stream jet cleaners are used, hold the jet not too close and spray large areas with a wide fanned stream, no thin jet. Avoid overheating and prolonged cleaning at one place.

Cleaning instruments and equipment should be bought exclusively from specialized shops. Wire brushes, steel wool, or other sharp instruments are not suitable.

I.16 Holiday maintenance

If you are absent for an extended time the pool water should be "prepared" to remain germ-free and clear. This can be obtained by disinfectants with long-term effect. The water circulation can be reduced, however, the total volume of the pool should circulate once a day.

I.17 Winter maintenance

We recommend to keep DLW delifol pools filled with water during winter. DLW delifol swimming pool lining will be less exposed to weather conditions and contaminations and discolorations caused by leaves can be prevented. The addition of wintering agents will not only facilitate cleaning in spring but has influence on algae growth and calcareous deposits. It is a further advantage if you can cover the basin, this keeps dirt and leaves out. The pool walls can be protected against ice pressure by means of planks or cushioning covers.

Do not forget: water carrying pipes have to be emptied if they are not frost-protected.

I.18 Water inspection

During the first 4 weeks after putting your pool into service, the pH-value and the chlorine value have to be checked several times a week. Thereafter at least once a week. These inspections can be carried out with the help of devices that are easy to handle and nevertheless produce exact results.

I.19 Attention

Any direct contact of the DLW delifol swimming pool coating with bitumen, tar, technical oils and greases, solvents, colour paints, etc. must be avoided.

Please take care when you use rubber material (rubber boots, shoes, hoses, cables, etc.) for cleaning purposes or activities. If rubber is in contact with the lining for some time, expecially in direct sunlight, it can leave stains.

I.20 Our advice

Do not experiment with chemicals. If you have doubts, don't hesitate to ask the specialists of our technical department or the manufacturer of the relevant water treatment agent.

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I.21 Helpful hints

Problem	What can be done?
Poor water quality	adjust pH-value to 7.0–7.4, carry out shock chlorination*, locculation if you have a sand filter installed
Slippery walls and floor Formation of algae	check the pH-value, clean with brush, shock chlorination*, add double dose of algicide
Unpleasant chlorine smell	check chlorine content of water, check pH-value, shock chlorination, filter backwashing
Lime precipitations	clean with acidic cleanser, add hardness stabilizer
Stains due to polyester subbase (mostly grey-black)	adjust pH-value to 7.0–7.4, shock chlorination*, chlorine content to be 0.5 mg/l
White or grey slimes	check pH-value, shock chlorination*, clean with brush, flocculation (sandfilter), continuous filtration filter backwashing
Coloured water – green water – yellow or black water	adjust pH-value to 7.0–7.4, shock chlorination*, continuous filtration, flocculation (sandfilter), vaccuum cleaning of walls and floor
Eye irritations	adjust pH-value to 7.0–7.4, shock chlorination*
Corrosion	adjust pH-value to 7.0–7.4
Skin irritations	adjust pH-value to 7.0–7.4

* Shock chlorination: one quick-dissolving chlorine tablet of 20 g per m^3 water volume.

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