KRONOS ecochem

Technical Information 2.01

Transport, Storage and Metering

Salts

QUICKFLOC
Ferrous sulfate
QUICKFLOC S
Ferrous sulfate

Commercially available precipitants and flocculants are supplied in three different forms: salts, granules and solutions.

The salts are moist, crystalline products whose external properties can best be described as "snowlike". The most important representative of this product class – and, indeed, the only one at the moment – is ferrous sulfate with 7 molecules water of crystallisation and 2 to 6 % residual moisture.

1. Transport

QUICKFLOC is delivered either in packaged form or in bulk in trucks. Both dumper trucks and dump semitrailers are used, as well as truck/trailer combinations. The size of a batch is 25 t, corresponding to 25 m^3. The vehicles are fitted with a tarpaulin cover.

The vehicles are unloaded by rear dumping. Adequate manoeuvring space is required for this purpose. In addition, the structural design of the storage tank filling port must be such as to allow safe, unproblematic unloading (Section 2.2.1).

QUICKFLOC is delivered by experienced specialist carriers. They can provide detailed information on the delivery vehicle and the unloading operation.

Rail transport in special wagons or containers is another option, although it has very rarely been used to date.

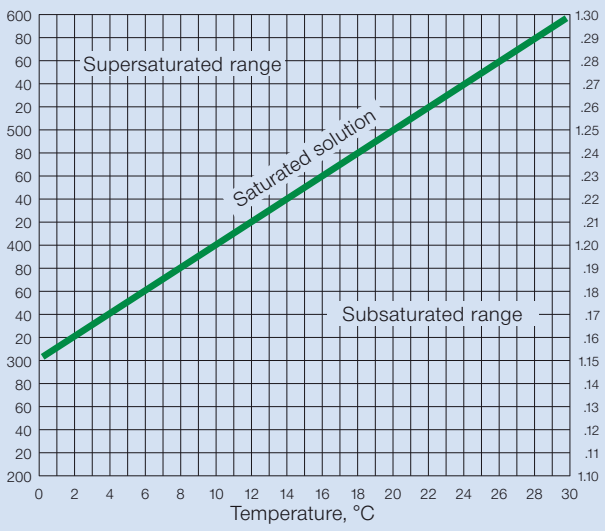
2. Storage and dissolution

It is not advisable to store QUICKFLOC in the form in which it is supplied, because the product hardens and oxidises, and seepage liquid may escape.

A combined method – known as the soaking technique – is most suitable for storing and dissolving QUICKFLOC. The heart of this kind of installation is an underground tank which simultaneously acts as a storage and dissolving unit and operates according to the principle of saturated solutions.

2.1 Process description

QUICKFLOC dissolves very easily in water. Approx. 300 to 500 g/l can be dissolved, depending on the temperature (Fig. 1). If a tank is filled with QUICKFLOC and water is then added from below for dissolution, a saturated iron sulfate solution is formed above the salt layer. The prerequisites for a defined dissolution process are an even distribution of the water at the bottom of the tank and a sufficiently thick, continuous layer of undissolved salt at all times. The more shaft-like the shape, i. e. the smaller the base area of the tank, the easier this will be.



This illustration is reproduced in enlarged form on the rear as a working diagram.

Figure 1: Solubility and density of QUICKFLOC ferrous sulfate in water

2.2 Soaking tank

The storage and dissolving installations for QUICKFLOC, known as soaking tanks, are generally made of protected reinforced concrete and have an operating volume of approx. 40 to 60 m^3. They consist of the filling port, the storage and dissolving tank and a pump tank (Fig. 2).

2.2.1 Filling port

The filling port must be designed in such a way that the dump truck can easily reverse into position, approach at a steep angle and dump cleanly (see Section 1). In this context, it must be ensured that the entire load of up to 25 t can slide from the platform into the tank in one go. The energy released must be absorbed by sturdy grating. At the same time, the grid cover fulfils safety requirements in relation to accident prevention.

Recommended filling port dimensions:

Width:	4 m
Depth:	2 m
Rear wall height:	1.50 m
Front edge height:	max. 0.30 m
Grid:	Preferably made of stainless steel, Mat. No. 1.4571, e.g. of approx. 10 to 15 mm thick, cross-stabilised flat steel bars with a spacing of approx. 15 to 25 cm. Stable anchoring at road level or lower.
Cover:	Made of corrosion-proof metal or plastic with suitable opening aids and the necessary “wind stability”. Opening angle: min. 90°.
Miscellaneous:	The area in front of the tank should be designed so that residual iron sulfate can be rinsed off (preferably asphalted). Iron salts cause rust-coloured stains. The colour scheme of the filling port and adjacent structures should be selected accordingly.

2.2.2 Linings

QUICKFLOC is acidic and a sulfate, anti-corrosion finishing of the tank is standard. We recommend using GF-UP in the form of a vacuum-monitored leakproof lining.

Monitored leakproofing is stipulated by the authorities because ferrous sulfate is rated as a water hazard (Water Hazard Class 1) and is subject to the requirements of Section 19 of the German Water Resources Management Act (WHG), the Specimen Ordinances on Installations Involving Water-Hazardous Substances (Muster-VAwS) and/or the Ordinances on Installations Involving Water-Hazardous Substances (VAwS) of the federal states. In this context, reference is also made to the stipulated double-wall design.

2.2.3 Water feed

As shown in Fig. 2 (right-hand section), the system of water pipes must be designed in such a way as to obtain the most uniform distribution of the water over the entire base area. This is achieved by the following:

Pipe spacing:	<50 cm
Hole spacing:	<50 cm, staggered
Hole diameter:	<5 mm
Outlet angle:	45°, downwards

The water pipes should be designed for individual regulation and installed in parallel with the longitudinal axis of the filling port so that, if necessary, the water feed can be controlled. To afford mechanical protection of the water pipes, they must be covered with a bed of gravel (approx. 20 mm grain size). This is indispensable, particularly when using plastic pipes.

2.2.4 Intermediate storage tank

The intermediate storage tank holds the saturated solution and serves as a pump tank or – if of appropriate size – also as a solution storage tank.

The intermediate storage tank can be integrated in the dissolving tank (Fig. 2, on the left in the left-hand section) or located externally. In either case, the arrangement must be such that the saturated solution flows over from the dissolving chamber of the soaking tank into the intermediate storage. Furthermore, the design must include a device which allows the solution level in the dissolving chamber to be lowered before refilling with salt (indicated by a dotted line between the intermediate storage and dissolving tank in Fig. 2).

2.3 Operation of the soaking tank

Before filling for the first time, water must be used to test the tanks and the metering devices for leaks and proper functioning. Once the water has been pumped out, 25 t QUICKFLOC is poured into the tank. In the case of tanks with an operating volume of more than 50 m^3, two deliveries are often needed when filling for the first time, as up to approx. 5 t salt can remain undissolved and must be taken into account (Section 2.1). The space requirement for ferrous sulfate that has been soaked, but not yet dissolved, is approximately 0.8 m^3/mt.

The salt is dissolved by flooding the tank via the water feed pipes. The saturated solution overflows into the pump tank until a maximum is reached and the water feed is switched off. Once the metering pump has emptied the intermediate storage tank to a minimum, the water feed system is auto-

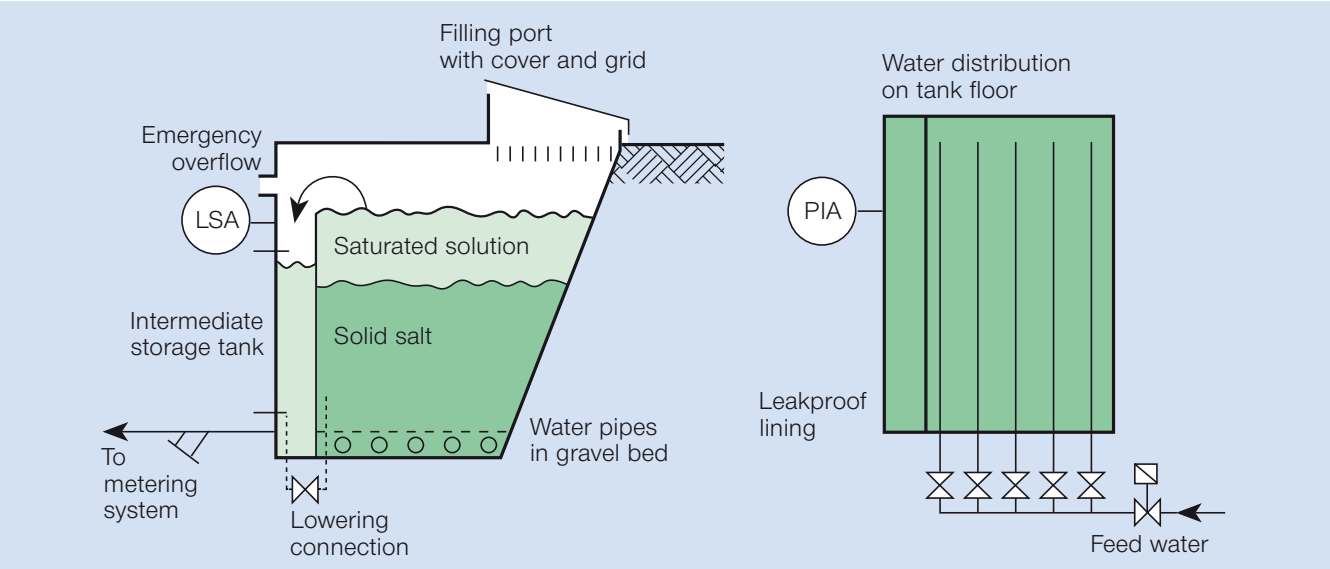


Figure 2: Diagram of a storage and dissolution installation (soaking tank) for salts

matically activated again. This cycle is repeated until the salt has been dissolved down to a residual layer of approx. 30 cm. This time can be ascertained by measuring the quantity of feed water (2 m^3 water is required to dissolve 1 t QUICKFLOC at a concentration of 400 g/l).

The saturation or content of the QUICKFLOC solution is determined by measuring the density (Fig. 1). This is generally done manually, using a hydrometer or by weighing, but can also be achieved using continuous measuring equipment. The density should not be less than 1.15 g/cm^3 (see Section 3, No. 3).

In order to have at least 20 m^3 of space available for refilling, the level of the saturated solution in the dissolving tank has to be lowered. To do this, the dissolving tank and the pump tank are connected in communicating fashion, the feed water supply is switched off and the solution is metered off. If the intermediate storage tank is large enough and the necessary technical equipment is available, the entire solution can be pumped out of the dissolving tank, thus providing an adequate buffer volume until such time as the dissolving tank is refilled.

2.4 Alternative designs and processes

The storage and dissolving installations described are usually designed and constructed jointly by different companies for the concrete work, the lining and the equipment. Industry has recently started to offer complete, prefabricated installations from a single source. The characteristic feature of these is that they are manufactured under controlled conditions at a single production facility, can be put into operation more quickly and can handle both salts and precipitant solutions.

In the same way as tank installations for solutions, soaking tanks can also be housed in a basement with the filling port above. Suitable designs include, for example, special steel (Mat. No. 1.4571) with a concrete catch basin.

Monitored leakproofing for soaking tanks can also be achieved by means of an “external” double-wall design. The structure then has to be installed in a sealed drainage system with inspection chambers.

Naturally, QUICKFLOC can also be processed by the “total” or “batchwise” dissolution method. In this case, it must be noted that solutions under 25 % can be unstable and that a very large volume of water is required for dissolution. For instance, 83 m^3 is required to dissolve 25 t QUICKFLOC into a 300 g/l solution. The energy input required for total dissolution is best provided by recirculation with pumps. This can also help to achieve saturation in soaking tanks which work poorly, e. g. as a result of an excessively shallow design.

When processing packaged QUICKFLOC, it is customary to prepare a solution of approx. 25 % by means of agitators.

3. Metering

Metering and transport of the iron sulfate solution from the intermediate storage tank to the dosing point is best achieved with metering diaphragm pumps. The metering equipment corresponds to the method for solutions described in our Technical Information 2.03 (Sections 3 and 4, Fig. 2).

The following special points must be noted:

1. The temperature in the metering lines must not be lower than that in the tank. Otherwise, crystallisation will occur as a result of supersaturation.
2. The temperature of the solution must not drop below – 2 °C as this will cause freezing, regardless of the concentration.
3. The saturated solution must not be diluted excessively (a pH value of 3 should not be exceeded) as ferric hydroxide may otherwise be precipitated.

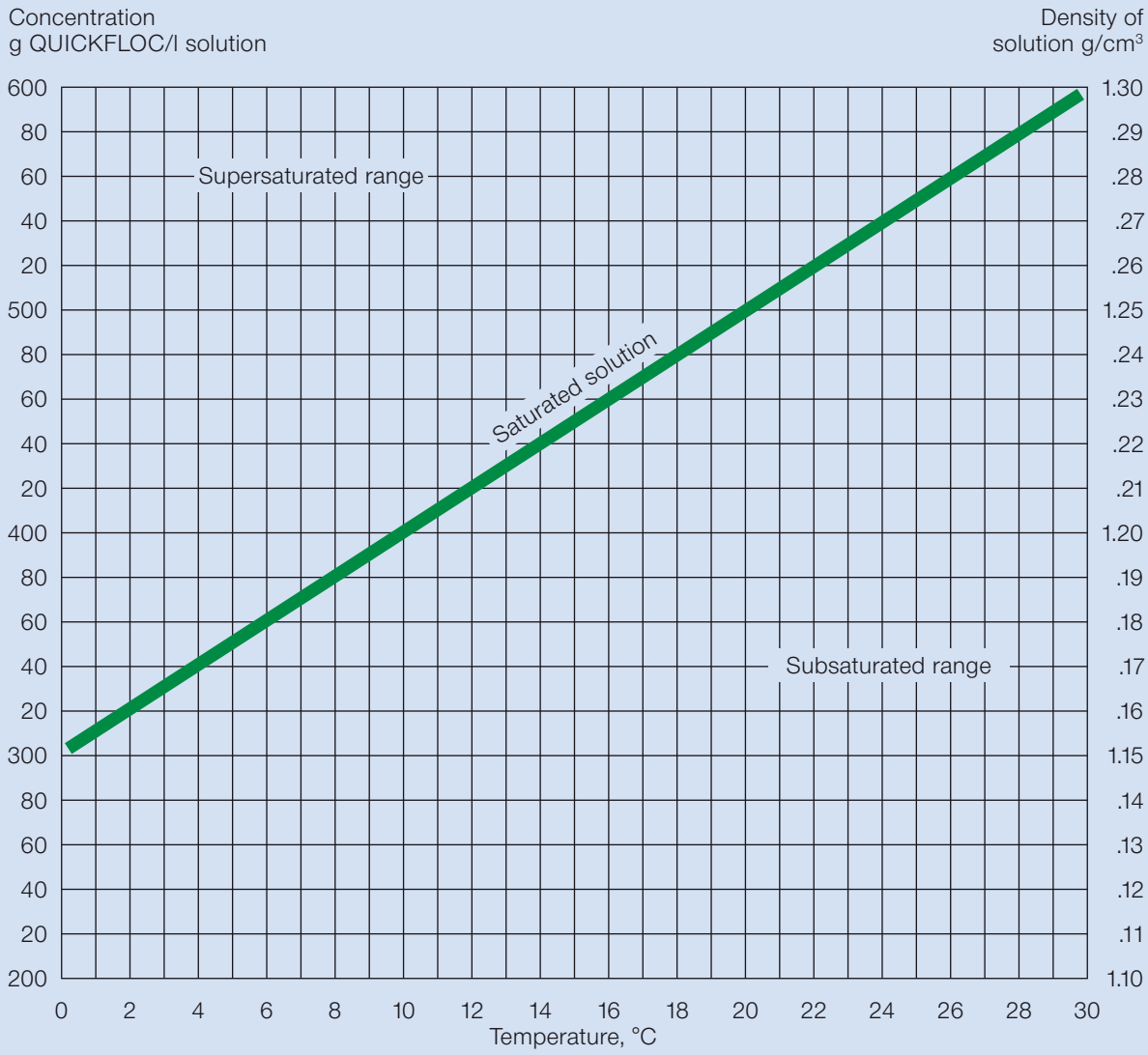
4. List of suppliers

On request, KRONOS can provide an informal list of specialist companies which have experience in the soaking of ferrous sulfate and are recognised as specialists in accordance with Section 19 l WHG. A distinction must be made between the following:

– Vendors of complete installations
– Suppliers of dissolving and metering equipment
– Specialists for leakproof linings

5. Safety

Before using any of our products, please consult our Safety Data Sheets.



Notes on using the diagram:

1. Saturation check: Determine and enter the density and temperature.
   The point of intersection should be as close to the diagonal line as possible.
2. Determination of concentration: Enter the density on the right-hand ordinate.
   Read off the concentration on the left-hand scale (g Fe/l = g QUICKFLOC/l · 0.178).

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