HQS-Super100 huaqiansu

— — Admixture for lean production of underwater cement and underwater quick-hardening cement,etc.

Uses

HQS-Super100 huaqiansu is an admixture for underwater cement where a non-dispersive,super-fluid,micro-expansion and self-compacting is required.It is especially suitable for the treatment of various kinds of leakage diseases such as large amount of water spraying, water gushing, water gushing and water accumulation in the basement raft, urban comprehensive pipe gallery, cable trench, elevator shaft,etc.

Advantages

- **Anti-dispersion:**Make the cement have the properties of cohesion, lubrication, flow, aggregation, hydrophobicity, anti-erosion, non-dispersion, etc. in static or dynamic water.It is suitable for fresh water, sea water, muddy water and other water environments.
- **High fluidity:**Gives high grout fluidity with low water ratio,thus making placement or injection of the grout easy.The cement mixed with HQS-Super100 huaqiansu can harden in water without formwork or mold without restraint.
- **Expansion rate:**Gaseous expansion system compensates for plastic shrinkage and settlement in properly designed cement grouting material.
- **Impermeability:**reduced water ratio mixes in the grout mix ensures low

permeability and long term durability in service.

■**Strength stability:** It can be achieved that the strength loss is less than 30% in the 300m deep sea where the water velocity is less than 0.5m/s.

underwater cement formula technology

■**Underwater cement formula** (kg/t)

raw material	P.042.5 Ordinary Portland cement/kg	HQS-Super100huaqiansu/kg	Recommended water consumption/kg
f-1	1000	20	280～320
f-2	50	1	14～16

■**Underwater quick-hardening cement formula** (kg/t)

P.042.5 Ordinary Portland cement/kg	SAC42.5 quick-hardening sulphoaluminate cement/kg	HQS-Super100 huaqiansu/kg	Recommended water consumption/kg
750	250	20	280～320
Note:The hardening time can be adjusted by adjusting the proportion of P.042.5 ordinary Portland cement and SAC42.5 quick-hardening sulphoaluminate cement.			

■**Special instructions**

According to the different requirements of the engineering design on the flexibility, 50% to 100% of the mixing water in the "underwater cement" or "underwater quick-hardening cement" formula can be replaced with HQG-3# huaqianjiao to obtain large flow cement with different flexibility.

Dosage

The dosage is 2% of the weight of cement.In particular, the dosage can be increased to 3% or even higher.

Construction technology of waterproof and plugging grouting in water environment

■Waterproof and plugging principle

Water and cement space replacement.

Use the pressure grouting machine to pour the "underwater cement" or "underwater quick-hardening fluid cement" slurry into the back of the reinforced concrete structure, fill all the water storage cavities, and drain all the water at the same time.

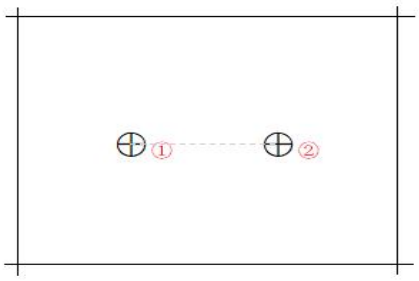
■Distance between holes

In the small area grouting construction using a small press, the distance between holes shall be controlled between 1.5m and 3.5m.If the pressure of grouting equipment is relatively large, the distance between holes can be increased appropriately.

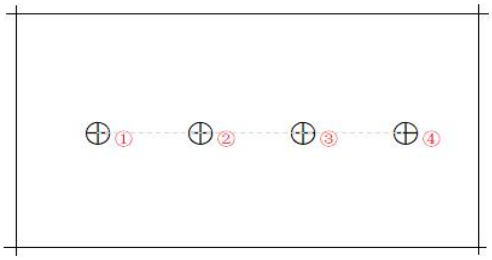
■Grouting hole layout

There are five common types of grouting hole layout,In the following figure, ⊕ represents grouting hole,①②③④⑤⑥⑦represents the grouting sequence.

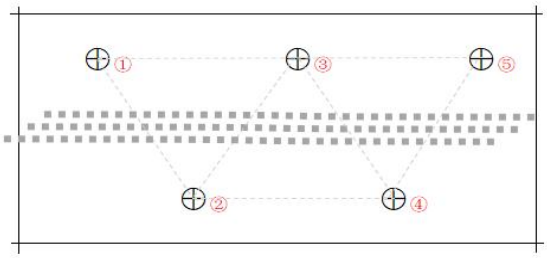
（1） Grouting holes are arranged in point shape, which is suitable for local point leakage grouting.



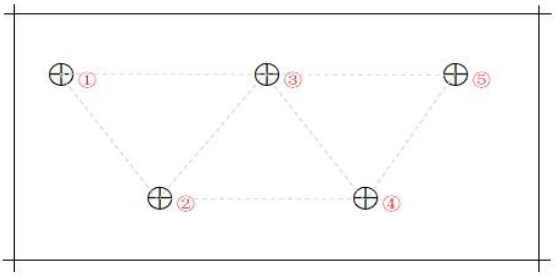
（2）The grouting holes are arranged in a linear manner, which is suitable for the leakage grouting of the long and thin belt parts.



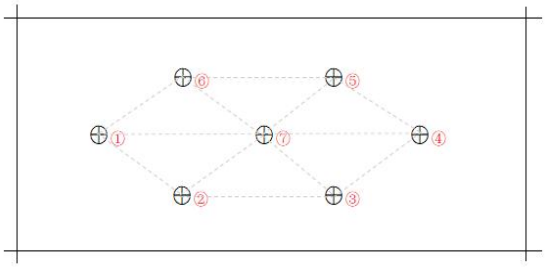
（3）The grouting holes are arranged crosswise along both sides of the crack, which is suitable for leakage grouting at the wide and long joints.



（4）The grouting holes are arranged in a matrix shape, which is suitable for grouting in discontinuous flaky leakage areas.



（5）Plum shaped grouting holes are suitable for large area or overall leakage grouting.



■Grouting principle

Discharge and inject one by one, first inject and then plug.

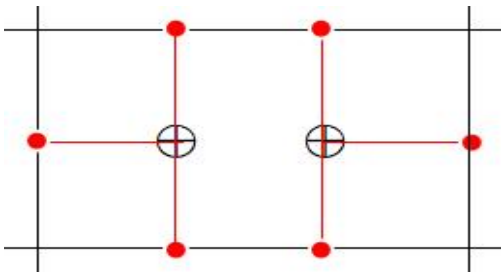
It is different from the "jump injection" method of traditional chemical grouting.When the last grouting hole is changed from "clear water→turbid water→ slurry", do not immediately plug it. Continue to fill the same grouting hole to ensure that the adjacent grouting hole is also full of slurry.

In the construction of large-area porous grouting, grouting shall be carried out in the order of "outside first and then inside".

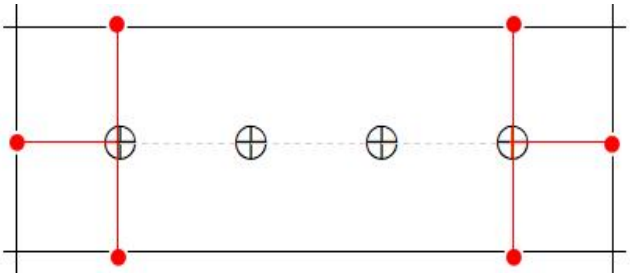
■Area to be grouted

Find 4-5 grouting holes closest to the edge of the area to be grouted at the outermost side of the area to be grouted, and take this grouting hole as the base point, extend 1/2 or 1 hole distance outward, and mark.Then, connect the marked points into a regular rectangle or square with a straight line, and the range enclosed is the effective area to be grouted.

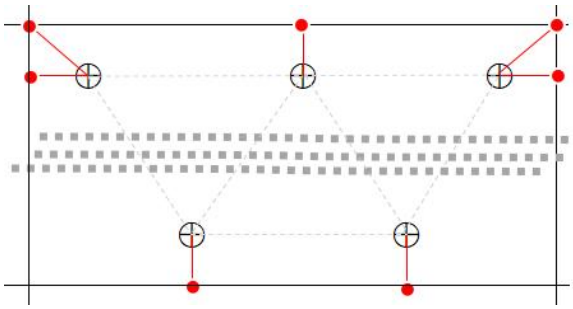
（1）The effective waiting area for grouting holes arranged in the form of dots is shown in the following figure ：



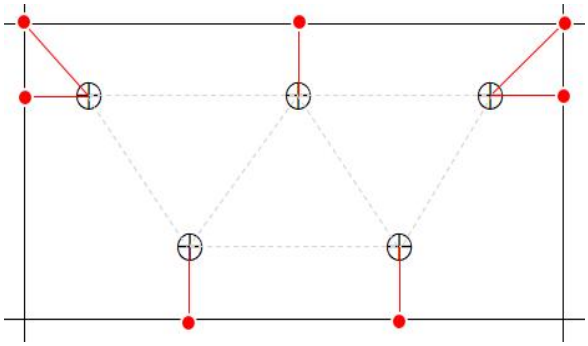
（2）The effective area to be injected when the grouting holes are arranged in a linear manner is shown in the following figure:



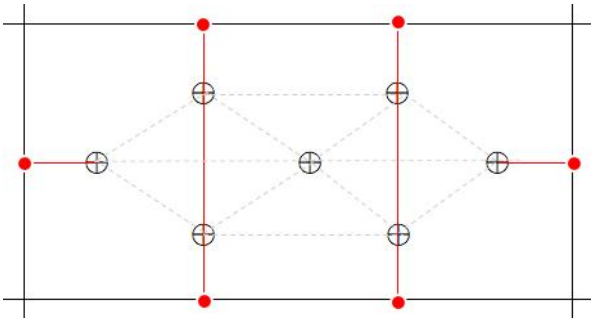
(3) The effective area to be injected when grouting holes are arranged crosswise along both sides of the crack is shown in the following figure:



(4) The effective area to be injected when arranging grouting holes in a matrix is shown in the following figure:



(5) The effective waiting area for grouting holes arranged in quincunx shape is shown in the following figure:



■Special notes

(1) The effective area to be grouted is calculated by taking the wall as the boundary.

(2) When you cannot draw a rectangle or square, you should also draw other regular shapes as far as possible, such as rectangles, trapezoids, etc.

(3) If there are columns in the area, do not subtract the occupied area.

(4) Special cases shall be solved through communication and negotiation.

Construction technology of waterproof and leakage plugging of raft in basement

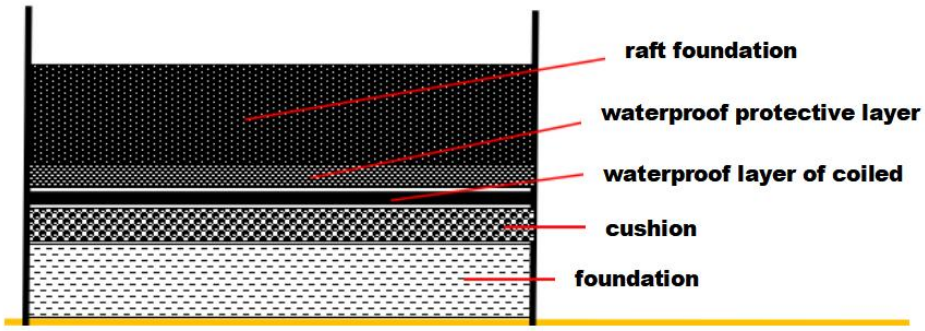
■Plugging principle

Pressure grouting, grouting and drainage shall be synchronized, and drainage shall be carried out with grouting.

Use a grouting machine to inject "underwater cement" or "underwater quick-hardening cement" slurry into the cavity between the bottom of the basement raft foundation and the ground base, discharge the accumulated water through extrusion, and pump it to the municipal pipe network.

■Drilling depth and drill pipe length

Raft foundation structure of basement of a building（See the figure below）, From bottom to top:foundation , 100mm cushion , Double-layer polypropylene coiled material waterproof layer, 40mm waterproof protective layer, 1800mm thick raft foundation.



（1）Raft thickness

It is determined by referring to the design drawings.

If there are no drawings, the raft thickness can be estimated according to the number of floors on the ground.Generally, for civil buildings with more than 5 floors, the raft thickness corresponding to each floor is 50mm-80mm, and for civil buildings with 5 floors and below, the raft thickness shall not be less than 250mm.

For example, a tower has 21 floors above the ground, and the designed raft thickness is 1100mm, and the thickness around the column is 1600mm.

（2）Drill pipe length

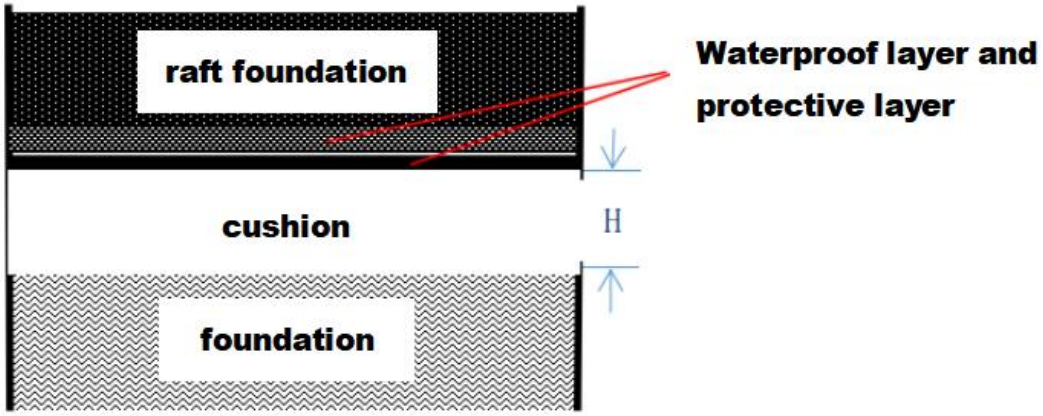
The length of drill pipe shall be greater than the thickness of the whole raft to ensure that the raft can be penetrated，The length of drill pipe shall be greater than the thickness of the whole raft to ensure that it can penetrate the raft and reach the cavity between the bottom of the raft and the basement.

For example, in a 21-storey tower above the ground, the maximum thickness of raft is 80mm/storey × 21 floors=1680mm, the length of drill pipe must be greater than 1680mm.

■Maximum cavity volume to be grouted

Refer to the current national standard GB50007-2011<Code for Design of Building Foundation>,The thickness of the cushion is mostly 100mm, the thickness of the extended foundation cushion is ≥ 70mm, and the thickness of the layered layer is 200-300mm.Then, the maximum thickness of the void part:H_{max}=300mm.

See the figure below:



In theory, the maximum volume of the cavity to be grouted is equal to the volume of the whole cushion, which is expressed by formula (1):

$$Q_{max}=M_{max}\times H_{max} \quad (1)$$

In formula (1),

Q_{max}—maximum cavity volume to be grouted（m^3）

M_{max}—maximum effective area to be grouted（m^2）

H_{max}—maximum void thickness（m）

Take here H_{max}=300mm=0.3m,Formula (1) is simplified as:

$$Q_{max}=M_{max}\times H_{max}=0.3M_{max} \quad (2)$$

■Maximum grouting volume per unit area

The maximum amount of grouting per unit area is the maximum amount of

"underwater cement" or "underwater quick-hardening cement" to be grouted on $1m^2$ of ground.Expressed by formula:

$$W_{max}=Q_{max}\times D=M_{max}\times H_{max}\times D=0.3M_{max}\times D \quad (3)$$

In formula (3),

Q_{max}—maximum cavity volume to be grouted（m^3）

M_{max}—maximum effective area to be grouted（m^2）

H_{max}—maximum void thickness（m）

W_{max}—maximum grouting volume per unit area（kg）

D —dry bulk density of "underwater cement" or "underwater quick-hardening cement"（kg/m^3）

Take here $D=1600kg/m^3$,Formula (3) can be simplified as:

$$W_{max}=0.3M_{max}\times D=480M_{max} \quad (4)$$

If $M_{max}=1$, the maximum grouting amount of "underwater cement" or "underwater quick-hardening cement" to be grouted on $1m^2$ ground is:

$$W_{max}=480M_{max}=480kg \quad (5)$$

Waterproof and plugging construction technology of urban underground comprehensive pipe gallery

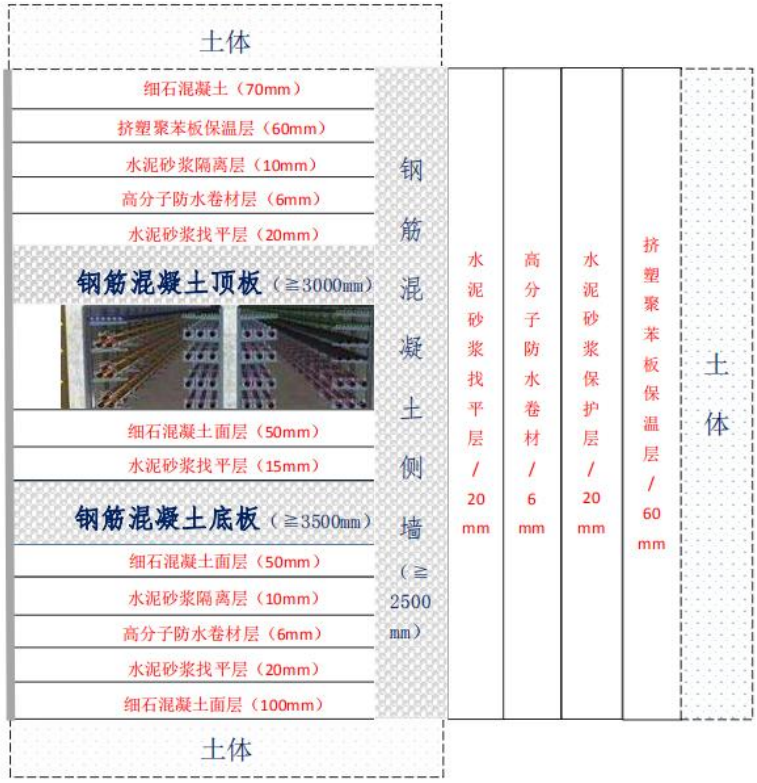
■Common leakage

（1）Leakage of assembly joint, deformation joint and settlement joint.

（2）Leakage of construction joints (cold joints) and irregular cracks.

（3）Point leakage and surface leakage of structural surface concrete.

■Pipe gallery structure



■Plugging principle

Pressure grouting, grouting and drainage shall be synchronized, and drainage shall be carried out with grouting.

Use a grouting machine to grout "underwater cement" or "underwater quick-hardening cement" slurry into the cavity between the top of the pipe gallery roof and the soil mass, or the cavity between the bottom of the floor and the soil mass, or the cavity between the outer side of the side wall and the soil mass, squeeze and drain the accumulated water, and pump it to the municipal pipe network.

■Drilling depth and drill pipe length

（1）Roof drilling depth H_{upper}

H_{upper}=300mm+20mm+6mm+10mm+60mm+70mm=466mm.

When drilling the roof, the length of drill pipe must be greater than 466mm.

（2）Drilling depth of side wall H_{side}

H_{side}=250mm+20mm+6mm+20mm+60mm=356mm.

When drilling the side wall, the length of drill pipe must be greater than 356 mm.

（3）Bottom plate drilling depth H_{bottom}

H_{bottom}=350mm+50mm+15mm+50mm+10mm+6mm+20mm+100mm=601mm,

When drilling the bottom plate, the length of drill pipe must be greater than 601mm.

■Maximum cavity volume to be grouted

Refer to the current national standard GB50007-2011<Code for Design of Building Foundation>,The minimum thickness of cement concrete road cushion is 150 mm.Then, the maximum thickness of the cavity is H_{max}=150mm，The maximum volume of the cavity to be grouted is equal to the volume of the whole road cushion,Expressed by formula:

$$Q_{max}=M_{max}\times H_{max} \quad (1)$$

In formula (1),

Q_{max}—maximum cavity volume to be grouted（m^3）

M_{max}—maximum effective area to be grouted（m^2）

H_{max}—maximum void thickness（m）

Take here H_{max}=150mm=0.15m,Formula (1) is simplified as:

$$Q_{max}=M_{max}\times H_{max}=0.15M_{max} \quad (2)$$

■Maximum grouting volume per unit area

The maximum amount of grouting per unit area is the maximum amount of "underwater cement" or "underwater quick-hardening cement" to be grouted on $1m^2$ of pipe gallery wall, or floor,or roof.Expressed by formula:

$$W_{max}=Q_{max}\times D=M_{max}\times H_{max}\times D=0.15M_{max}\times D \quad (3)$$

In formula (3),

Q_{max}—maximum cavity volume to be grouted（m^3）

M_{max}—maximum effective area to be grouted（m^2）

H_{max}—maximum void thickness（m）

W_{max}—maximum grouting volume per unit area（kg）

dry bulk density of "underwater cement" or "underwater quick-hardening cement"（kg/m^3）

Take here $D=1600kg/m^3$,Formula (3) can be simplified as:

$$W_{max}=0.15M_{max}\times D=240M_{max} \quad (4)$$

If M_{max}=1, the maximum grouting amount of "underwater cement" or "underwater quick-hardening cement" to be grouted on $1m^2$ pipe gallery wall, or floor,or roof is:

$$W_{max}=240M_{max}=240kg \quad (5)$$

Construction technology of rock mass grouting

■Material selection

(1) When the aquifer fissure is less than 0.15 mm, or more than 0.15 mm and the water flow rate is less than 200 m/d, "underwater cement" or "underwater quick-hardening cement" shall be used.

(2) When the water absorption of the aquifer is greater than 7L/min. m and the groundwater flow rate is less than 200m/d, "underwater cement" or "underwater quick-hardening cement" shall be used. Under special circumstances, the double-liquid method of "water glass+underwater cement" can be used for grouting.

(3) When the water flow velocity of the aquifer is greater than 200 m/d, "underwater cement" or "underwater quick-hardening cement" shall be used. Under special circumstances, the double-liquid method of "water glass+underwater cement" can be used for grouting.

(4) The water glass concentration is 40Be, the modulus is 2.2-3.4, the volume ratio of cement and water glass is controlled at 1:0.4-1:1, and the PH value of grouting water is ≥ 4.0.

■Single hole grouting volume

In the rock mass grouting project, the calculation formula of single hole grouting volume of the rock mass to be grouted is quoted as follows:

$$Q_v = A\pi R^2 H\beta n/m \qquad (1)$$

In formula (1),

Q_v—single hole grouting volume of rock mass to be grouted（m^3）

A—grout loss。A value is between 1.2 and 1.5, where A=1.35

R—effective diffusion radius of grouting fluid（m）

H—length of grouting section（m）

n—Porosity of rock mass.n value is 1-5%, where n=1%

β—Filling coefficient of grouting fluid.β is between 0.8 and 0.9, where β= 0.85

m—Grout stone rate.m is between 0.5 and 0.95,When the water-cement ratio is large, take the smaller value; When the water-cement ratio is small, take the larger value.where m=0.95

Substitute the above values into formula (1),The single hole grouting volume of the rock mass to be grouted is simplified as follows:

$$Q_v = 0.03793HR^2 \quad (2)$$

According to the data,The effective diffusion radius of grouting fluid is closely related to the crack width，See Table 1.

Table 1 Relationship between effective diffusion radius and crack width

crack width	effective diffusion radius (R) of grouting fluid	Average value of effective diffusion radius (R) of grouting fluid
0.3mm～2mm	2m～4m	3m
2mm～5mm	4m～6m	5m
5mm～10mm	6m～10m	8m
greater than 10mm	10m～15m	12.5m

By combining Table 1 with Formula (2), the relationship between crack width, effective diffusion radius of grouting fluid (R) and single hole grouting volume of

rock mass to be grouted (Qv) can be obtained,See Table 2.

Table 2 Crack width, effective diffusion radius of grouting fluid, Single hole grouting volume of rock mass to be grouted

crack width	effective diffusion radius (R) of grouting fluid	Calculation formula for single hole grouting volume of rock mass to be grouted. unit:m^3
0.3mm～2mm	2m～4m	Q_v=0.34H
2mm～5mm	4m～6m	Q_v=0.95H
5mm～10mm	6m～10m	Q_v=2.43H
greater than 10mm	10m～15m	Q_v=5.93H

For example, in a rock mass grouting project, it is assumed that the length of the grouting section is H=10m and the crack width is between 5mm and 10mm.

Then, compared with Table 2, the calculation formula of single hole grouting volume of rock mass to be grouted is:

$$Q_v=2.43H=2.43\times10=24.3m^3 \quad (3)$$

■Maximum single hole grouting volume

The maximum amount of grout in a single hole is the maximum amount of "underwater cement" or "underwater quick-hardening cement" to be grouted in a grouting hole of the rock mass to be grouted.Expressed by formula:

$$W_{max}=Q_v\times D \quad (4)$$

In formula (4),

W_{max}—maximum single hole grouting volume (kg)

Q_v—single hole grouting volume of rock mass to be grouted (m^3)

D—dry bulk density of "underwater cement" or "underwater quick-hardening cement"

For example, in a rock mass grouting project, it is assumed that the length of the grouting section is H=10m and the crack width is between 5mm and 10mm.Take D=1600kg/m^3, Combining formula (3) and formula (4), the maximum single hole grouting volume of the rock mass to be grouted is:

$W_{max}=Q_v \times D=24.3m^3 \times 1600kg/m^3=38880kg$ (5)

Packaging, storage and transportation

The packaging specification of this product is 20kg/bag, or 2.0kg/bag.

This product should be stored in a dry and ventilated environment to avoid rain, water, moisture, and sun exposure. The unopened shelf life is 12 months.

This product is nonflammable, non-explosive, non-toxic and tasteless, and does not contain heavy metals, halogenated hydrocarbons, benzene series, formaldehyde, VOC and other harmful substances. It can be stored and transported as general goods.

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■When using, your company must carry out a prior test to confirm whether it meets the use purpose and safety.

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