

EXPANSIVE MORTAR / CRACKING POWDER A NON-EXPLOSIVE CRACKING AGENT

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INTRODUCTION:

Expansive Mortar (Crack Powder) is widely used for splitting the Granite Blocks in Ornamental Granite Quarries in India. This is an alkaline non-explosive chemical powder available in packed bags in the market and this can be purchased, transported, stored and used in quarries without any permission, or license any Government agencies, but some safety precautions need to be taken while storage and use.

The Expansive mortar / Crack Powder is having pH is about 13 and it is non-poisonous, tasteless, silent, which is chiefly made of aluminum acid calcium, silicates, cement, and slow coagulant. The powder is mixed with water and poured into drilled holes and this is powder is eco-friendly no noise, no vibrations, no fly rocks, and no toxic gases. This mixture expands due to chemical reaction, exerts pressure on the wall of drilled holes walls and cracks through the direction of the holes. This mixture does not need any detonator or ignition.

The mixture of Expansive Mortar is capable of exerting pressure about 50 MPa (5000 kg/cm²). Water and ambient temperature are the most important variables in influencing in generation of expansive pressure.

APPLICATION EXPANSIVE MORTAR / CRACKING POWDER:

The Expansive Mortar (Crack Powder) is used in Granite, Marble, Sandstone, Quartz, etc., for splitting or cracking the rock. This powder is also used to demolish the reinforced concrete constructions.

CHEMICAL COMPOSITIONS OF EXPANSIVE MORTAR / CRACKING POWDER:

1. Calcium hydroxide : 60 to 100 %
2. Silica vitreous : 5 to 10 %
3. Diiron trioxide : 1 to 5 %
4. Aluminum oxide : 1 to 5 %

TYPES OF EXPANSIVE MORTAR / CRACKING POWDER:

According to the different ambient and stone temperatures, the produce is divided into three types. Appropriate product should be selected and used depending up on the changes in the temperature.

TYPE	TEMPERATURE RANGE
C-I TYPE	25°C - 40°C
C-II TYPE	10°C - 25°C
C-III TYPE	05°C - 10°C
C-IIII TYPE	40°C - 50°C

SALIENT FEATURES & CHARACTERS OF EXPANSIVE MORTAR / CRACKING POWDER:

1. Expansive mortar (Crack Powder) is a soundless, safe and non-explosive, soundless agent used to develop crack, and split the Granite Blocks in to required size and shape.
2. It is efficiently used in quarrying to split big mass of homogeneous rock in the required shape and size. It can also be used to achieve the perfect blocks from granite rock, or any other type of stone as final product for sale.
3. It is non-explosive, and safe cracking or demolition agent, easy to transport, store, handle and use as alternative solution to blasting in dimensional stone quarries without any license.
4. Large expansion force: It exerts maximum expansion force may hit 1,220 kg/cm².
5. Short Reaction Time: Reaction time is adjustable in the range of 5 minutes to 10 hours.
6. Long shelf time: It can be stored for two years under the conditions of dryness and constant temperature of 15 - 30°C without any breakage in its package.
7. Shelf life of this powder is 12 months when stored in sealed container in dry conditions.

PROCESS OF USING EXPANSIVE MORTAR / CRACK POWDER:

1. The process in short: drilling-stirring-pouring-splitting,
2. First drill the holes in the Stone,
3. Second, pour some of the produce into the plastic bucket with water, the proportion of water and powder is 1:3, and then stir it into a paste/semi-liquid,
4. Third, slowly pour it down in to the drill holes and fill it with the lid,
5. Fourth, allow eight to twelve hours time to develop the crack/split, depending on the type of material choosed and temperature.

TOOLS & PERSONAL PROTECTIVE EQUIPMENTS REQUIRED:

Following are the requirements to be made available before take up of Mixing and Pouring the Expansive mortar (Crack Powder):

1. Clean and cold water for mixing,
2. Plastic bucket is for mixing,
3. Beater or wooden rod for mixing,
4. Safety goggles, shoes, Rubber gloves, Helmet and Dust-proof mask should be used,
5. Thermometer for checking the temperature,
6. Wooden plugs for placing after filling the holes.

MIXING OF EXPANSIVE MORTAR / CRACK POWDER:

1. Make sure you select the correct temperature, specific to the weather.
2. For regular safety reasons and mixing small amounts by hand, it is recommended to use rubber gloves.
3. In a plastic bucket, combine 1.5 Liters of water to one 5 kg bag of Expansive mortar. Or pour water and powder at a rate of 1:3 units by weight.
4. Mix well, using a Beater or Wooden rod. If mixing with a Beater or wooden rod, make sure powder is completely dissolved into the water.
5. Do not mix more than 2 bags (10 kg) for each lot at a time. Never use glass or metal containers for mixing.
6. When mixing, if the cracking agent begins to steam in container, add some water to dilute and process properly.

POURING / FILLING OF EXPANSIVE MORTAR / CRACK POWDER:

1. Make sure the holes are clean and no dust or water and residues left in the holes, or use high-pressure air hose to clean out, before pouring the Expansive mortar slurry.
2. Expansive mortar slurry should be poured into holes within 5-10 minutes after mixing. Do not fill to the top only fill the holes about 15 mm ($\frac{1}{2}$ " to 1") from the top.
3. Mix well and pour into holes while agitating the hole to make sure no air gaps are in the hole. Keep your face away from the holes filled by mortar. Stay away from filled holes at least 3 hours after filling to avoid blow-out shot. Keep people away from job site after filling.

GENERAL PRECAUTIONARY MEASURES WHILE SUE OF EXPANSIVE MORTAR / CRACK POWDER:

1. Make sure that everyone working with expansive mortar understands the possibility of blown out, and aware of safe handling of the material.
2. Expansive mortar is a highly alkaline, skin and eye contacts with the mixture must be rinsed off with large amounts of cold water immediately without rubbing. Consult a doctor quickly for further care.
3. Wear safety goggles and rubber gloves during expansive mortar handling, mixing and filling. Dust-proof mask is recommended in poorly ventilated areas.
4. Warm or bubbling mortar is forbidden to fill into holes, once the filled holes start to smoke or steam, that is the sign they may be about to blow out. Clear the area of people immediately.



Figure: Mixing and Pouring of Expansive mortar (Crack Powder)

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PRECAUTIONS IN QUARRYING:

1. Unscientific selection of the faces without taking into consideration of the geological disturbances like cracks, joint planes, mattas, etc., will affect the performance.
2. Wrong application of expansive mortar may leads to explosion in quarrying while dressing the blocks with less burden of rock or presence of cracks/joints.
3. For releasing the granite blocks from sheet rock (in-situ), it is essential to develop free faces at lease on two sides besides bottom and on the top portion also to avoid blown out.
4. The diameter of drilling has a great effect on the performance, a range of drill hole diameter of 28-40 mm is better.
5. Pitch-row shall be 30-50 cm for reinforced concrete, 10-15 cm for marble, and 10-30 cm for granite based on the hardness and size of the rock.

SAFE OPERATING PROCEDUR FOR USE OF EXPANSIVE MORTAR IN QUARRIES:

1. Mines Manager shall authorize in writing the personnel permitted to draw and use the Expansive Mortar (crack powder).
2. Expansive Mortar (Crack Powder) shall be used under the direct supervision of Blaster or Mate or Competent person authorized by Mines Manager.
3. Before using the Cracking Powder clean up the drilled holes for dust & drill cuttings by using compressed air.
4. Always wear all Personal Protective Equipments such as Safety goggles, Shoes, Rubber Gloves, Helmet and Dust-proof mask, while using cracking powder.
5. Mix the stipulated quantity of the powder & water, Expansive Mortar (Crack Powder) shall be thoroughly mixed with clean water of 30% of overall weight of powder i.e., at the ratio of 1:3 water to powder by weight (1.5 Liters of water to one 5 kg. bag of Expansive mortar).
6. Always use clean & cold water only for mixing cracking powder.
7. Always use the cracking powder prescribed for that particular rock temperature
8. Use only plastic buckets & wooden sticks for mixing the powder & water. Metal buckets are strictly prohibited for mixing.
9. Finish the pouring work of mixture into the drilled holes within the prescribed time of 5-10 minutes and leave the area immediately after pouring the mixture.
10. The workers need to take synchronized operation, especially in hard stone. The quantity of holes each worker responsible to fill has to be moderate. Taking synchronized steps when mixing, stirring and filling will lead to maximum expansive stress with all holes expand at the same time.

11. Do not enter the area for 3 hours where cracking powder sludge has been poured in drilled holes since blown out of powder may take place (it takes 8-12 hours for chemical reaction based on the temperature). Do not see directly from top of the charged holes.
12. For the holes formed with higher temperature, the correct operation is to charge it after its cooling down, preferably after 5 pm.
13. First aid treatment has to be taken if unexpected blown out of powder takes place while mixing & pouring and workers should undergo relevant training for using cracking powder.
14. Return the unused pockets of Crack Powder to stores immediately after completing the job.
15. Daily report of consumption and other details should be recorded in a bound paged register.

Productivity can't be achieved without Safety
Safety can't be achieved without Training...