

STAR-CRACK

TECHNICAL MANUAL

Instructions For Use Of STAR-CRACK Non-Explosive Quarrying & Demolition Agent

An Ideal product for quarrying, mining and demolitions.
NO noise – NO vibration –NO flying rock

PRODUCT INTRODUCTION

WHAT IS STAR CRACK?

Star Crack is an environmental friendly non-explosive demolition agent, which is popular in the Local and International quarrying and demolition market. When mixed with clean and cold water to form a mortar like substance, and poured into pre-drilled holes of rock or concrete, it swells and exerts expansive capabilities on the hole-wall at a unit value of more than 50 Mpa (500kg/ cm²) which is strong enough to cut and crack concrete, marble and granite after a certain period with no noise, no vibration, no ash, no toxic gas and no flying rocks. It is safe, environmentally friendly, non-explosive, requires very little

training of personnel, easy to use and controllable.

In addition the use of Star Crack is not restricted to the holders of blasting certificates alone, which in terms of International and Local Legislation governs the usage of explosive materials.

APPLICATION SCOPE

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Star-Crack can be applied in various situations: -

- a) Granite, marble, sandstone, limestone, quartzite quarrying and cutting.
- b) Rock splitting, fracture and cutting.
- c) Concrete structures demolition where explosives are prohibited.
- d) Fracture and demolition of concrete buildings and structures.
- e) Rock breaking for road construction, pool installations and trenching for various needs.

The advantages of Star Crack in the quarrying industry and concrete demolition

- a) Cutting blocks of Marble and Granite is economically more cost-effective than traditional Wire-saw method.
- b) It can be used to process blocks from Marble and Granite quarries.
- c) It can achieve maximum production time, output and efficiency in quarrying and mining in safety.
- d) Workers can be more productive and cost-effective.
- e) It is ideal in mining for emeralds and other precious stones.
- f) The shape of blocks in quarry can be controllable.
- g) Its application in concrete demolition does not cause any damage to the environment or property.
- h) Easily split and fracture mass rock to isolate small blocks that can be more easily demolished.

READ THIS MANUAL CAREFULLY BEFORE USING STAR-CRACK

STAR-CRACK

STAR-CRACK has been used safely with great results by many contractors and homeowners all over the world. The safe use of the product depends on following instructions, and wearing safety goggles at all times. Although non-toxic, STAR-CRACK is **caustic**, and can cause severe eye injury if splashed into the eyes while mixing or pouring.

The chemical reaction of STAR-CRACK and water **generates heat**. When this reaction takes place too quickly, the temperature goes above the boiling point of water before all the water has chemically combined with the STAR-CRACK. This can result in a **steam-driven explosion** which blows the STAR-CRACK from the hole with sudden force.

To avoid blowouts, follow the instructions regarding mixing, water temperatures and hole sizes chart. Always wear safety goggles, and never use drill holes larger than 60mm diameter (38mm is recommended). Blow dust out of holes after drilling, and keep STAR-CRACK cool before use. Stop filling holes when STAR-CRACK approx 30mm from the top.

HOLE DEPTH:

1. Maximum Hole Depth is 5 meter.
2. Minimum Hole Depth is 4 times hole diameter; for example 100mm depth with 25mm hole diameter, 120mm with 30mm. Holes shallower than 4 times diameter are likely to blow out.
3. In reinforced concrete, drill 85% to 90% of its depth. In ledge, drill as deep as you want to remove. In boulders, drill 2/3 to 3/4 of the rock's thickness.

DEMOLITION DESIGN

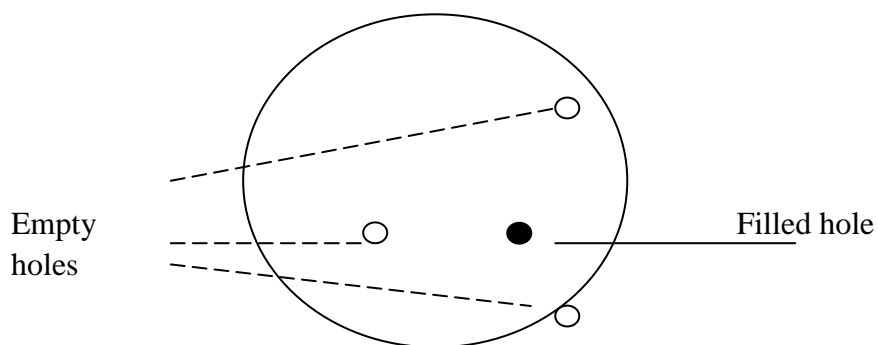
For VERTICAL and downward situations, it is necessary to identify that there is at least one free face available. The diameter of holes is crucial to the cracking results. Holes that are too small are not conducive to the good performance of Starcrack, and over large holes may cause blow out.

Rock drills with a diameter of 30 – 40 mm is recommended. If the cracked objects are isolated, the depth of drilled holes is equal to 80 – 90% of the objects thickness. If used in Marble and Granite quarrying and mining, the depth of drilled holes is equal to 105% of the objects thickness.

<u>Materials to be cracked</u>	<u>Hole design</u>			<u>Starcrack consumption</u> <u>Kg/m²</u>
	<u>Diameter (mm)</u>	<u>Length (cm)</u>	<u>Depth</u>	
Soft Stone	35 - 50	40 - 60	H + 5% H	8 - 10
Hard Stone	35 - 65	40 - 60	H + 5% H	10 - 15
Rock Cutting	30 - 40	20 - 40	H	5 - 15
Plain Concrete	35 - 50	40 - 60	80% H	8 - 15
Reinforced Concrete	35 - 50	15 - 30	90% H	15 - 25

HOLE PATTERN:

1. Holes must be drilled so as to allow a free face for the STAR-CRACK to push forward. For example, drilling at a 45° angle in a flat surface of ledge will push it upwards, but drilling straight down might not allow anywhere for the pressure to go.
2. To demolish a slab without pushing out the walls which surround it, drill a cone shaped pattern at the center and fill these holes first. The cone will pop upwards and create a free face.
3. Hole pattern depends on tensile strength of what you're breaking, amount of rebar if any, and size of the pieces you want when you're done. This can often be determined by experiment.
4. Hole pattern also depends on how fast you need results. More holes spaced closer together will give faster break times and smaller pieces, but this costs more STAR-CRACK.
5. Boulders are much easier to break than reinforced concrete or ledge, and drill holes can be spaced further apart, especially if breaking speed is not limited.
6. When removing part of a slab, to prevent cracks from spreading into the rest of the slab. Drill holes every 15cm in a line between the "demolish" section and the "keep" section. Leave every hole empty along this line.
7. Empty holes can also be used to direct cracks, they cost less than filled holes. For example, if you want to break a boulder into thirds, you can use this pattern:



THESE INSTRUCTIONS ARE ESSENTIAL FOR SAFE AND EFFECTIVE USE OF STAR-CRACK.

ITEMS

Dia Star supplies two types of expansive mortar

Two specifications are available on the basis of job-site environment and temperature.

TYPE	TEMPERATURE
SCA & SP2	Both types will operate successfully at temperatures ranging from +10°C and above. Temperatures below 10°C will result in reaction time being extended beyond the norm refer Pg.5 and 6.

Temperature Chart

Rock or Concrete Temp	Water Temp.	Hole Size
MINUS 10 ⁰ to 4 ⁰ C	40 ⁰ C max.	38MM.
5 ⁰ to 14 ⁰ C	30 ⁰ C max	38MM
15 ⁰ to 25 ⁰ C	15 ⁰ C max.	38MM
25 ⁰ to ABOVE	COLD WATER	38MM

A. mixed with clean and cold water before use. In a ratio of 1:3 of the overall weight, please put the required volume of water 1.5 -1.65 liters into a container, then gradually add one bag of 5kgs of STAR-CRACK powder into water and stir all the time to obtain a smooth, lump-free slurry. If mixing has to be made by hand, **rubber gloves are required.**

B. When rock or concrete is above 20⁰C, add 150g of extra water per 5 kgs STAR-CRACK,.

C. ALWAYS WEAR SAFETY GOGGLES!!!!!!!!!!

NOTES ON TEMPERATURE

- 1.) Hole temperature can often be reduced by waiting until late night or early morning.
- 2.) When rock or concrete is above 25⁰C, do not mix STAR-CRACK with warm water.
- 3.) When rock or concrete is above 25⁰C, do not mix more than one bag of STAR-CRACK (5kgs) at a time.
- 4.) Measure the rock or concrete temperature-**DO NOT GUESS IT!!!!!!!!!!**
Tie a string to a thermometer and drop it into the drill hole deeply.

MIXING STAR-CRACK

1. **Read this manual cover to cover before using STAR-CRACK.**
2. Wear safety goggles and clear the area of all non-essential personnel.
3. Measure temperature of drill holes.
4. Add clean water of proper temperature to a plastic mixing bucket, see temperature chart.
5. Slowly add one bag (5kgs) of STAR-CRACK into bucket with water while you are mixing.
6. Begin mixing immediately with electric drill with mixing attachment or hand with rubber gloves.
7. STAR-CRACK seem dry at first, **DO NOT ADD MORE WATER!!!!!!!!!!!!!!**
8. **ONCE MIXING BEGINS, YOU HAVE ONLY 5 MINUTES TO FINISH MIXING AND FILL HOLES.** Do not stop to take a phone call or fool around, the longer mixing time takes increases the likelihood of blowouts.
9. Fill holes as quickly as possible, Do not plug holes (horizontal holes need capping) or place heavy objects on holes.
10. Cover holes with a tarp if people will remain in the area.

FILLING HOLES

Clean holes before filling using air hose remove excess dust from drilling.

STAR-CRACK slurry should be poured into holes within 5 min. after mixing. Do not fill to the top, only fill the holes to about 30mm from the top.

Mix well and pour into holes while agitating the hole to make sure no air gaps are in the hole. Example: Using a piece of rod or stick to poke holes.

For Horizontal holes, a grouting pump would be most reliable to operate. Or you can insert a slightly smaller plastic pipe into the hole, and then fill the expansive mortar into the pipe slowly, withdrawing the pipe from the hole simultaneously. Quickly block the hole with a cap after filling.

NOTES ON USAGE

1. Never fill glass or metal containers with STAR-CRACK, or any container which widens towards the bottom.
2. Mixing by hand lengthens mix time and is more likely to result in a blowout.
3. When rock or concrete is above 20°C, add 150g of extra water per 5kgs STAR-CRACK,
4. STAR-CRACK is usually not cost effective in slabs less than 10cm thick, a pavement breaker or hydraulic hammer will work better unless noise is a problem.
5. The most cost effective demolition technique for ledge is often a combination of STAR-CRACK (TO PRODUCE CRACKS) and a hydraulic hammer. Drill holes can be spaced out further in this case.
6. The best way to demolish underwater rocks or concrete is to build a coffer dam and pump out the area. STAR-CRACK hardens in fifteen to twenty minutes, and after that

the area can be flooded again. STAR-CRACK CAN BE USED UNDERWATER IF THE ROCK OR CONCRETE IS NOT VERY DEEP, BUT RESULTS ARE NOT ALWAYS SATISFACTORY.

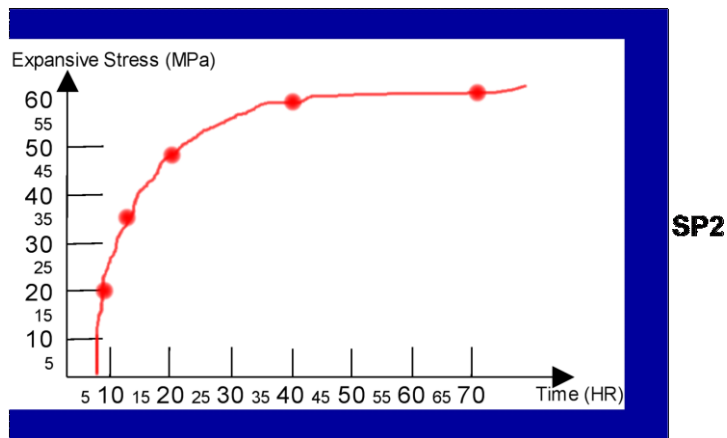
7. STAR-CRACK must be used in holes; pouring it into existing cracks in rock will not work.
8. Safety goggles must be worn at all times by everyone in the area, hard hats and steel toed boots are a good idea on any construction or demolition site.
9. When using the temperature chart, bear in mind that the actual drill hole temperature may be much higher than the surrounding air temperature. This is caused from being in sun or affected by nearby heat from machinery or from drilling the holes.
10. Cold temperature, hard rock, or holes spaced too far apart can lengthen breaking times. If it did not break overnight-wait a while before redoing. STAR-CRACK continues to increase pressure for 3days.
11. If STAR-CRACK drops below freezing, the reaction will very slow, but it will start up again once it thaws.
12. If mixed STAR-CRACK begins to steam in the bucket, add more of water, stir, and throw it away. You've spent too much time in mixing the product.
13. If filled holes start to smoke or steam. That is a sign there may be a blow out. Immediately clear the area of people. The vapors are only steam and are not hazardous or toxic in any way.
14. Make sure that everyone working with **STAR-CRACK understands the possibility of blowouts, has read this technical manual thoroughly, and is wearing safety goggles.**
15. Ledges, boulders, and concrete will vary in strength. It is not a problem for STAR-CRACK to break rock as long as there is a free surface for the rock to break towards.

CHEMICAL PROPERTIES

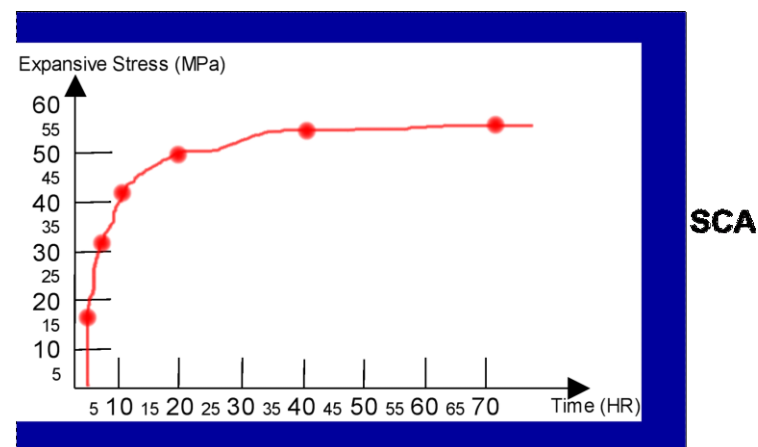
Starcrack is a grayish white powder and is composed of multi-structured inorganic particles. There is no content of any harmful composition.

Factors affecting the expansive pressure of Starcrack

- a) The expansive stress of Starcrack reaches maximum value in about 24 hours of reaction, however, it still increases thereafter.
- b) The expansive stress of Starcrack will decrease if water ratio increases.
- c) The expansive stress of Starcrack will increase with rising temperature.
- d) The expansive stress of Starcrack would be higher if the diameter of pre-drilled hole is bigger. (However the diameter should never exceed 60mm)



FRACTURE MECHANISM



The rock tensile strength is 4 – 10 Mpa and concrete tensile strength 2 –4 Mpa. Mixed with appropriate water and poured into pre-drilled holes in stone or concrete, Starcrack starts a hydration reaction. The solid expansion produced after coagulation and rigidification exerts pressure in the hole-walls exceeding 50 Mpa (500kg / cm²), which is far stronger than the tensile strength of the stone and concrete. Therefore the stone or concrete is cut or demolished easily.

The speed of splitting is determined by the reaction speed, which is up to the temperature of the job site. The higher the temperature, the shorter the reaction time. For all practical purposes, the reaction time of type SCA is 3-4 hours and SP2 slightly

slower at 6-8 ours for a cleaner cut.

PACKAGING AND STORAGE

Starcrack is packed in moisture-proof carton box with 4 plastic bags of 5 kg in each. The net weight is 20 kg. The validity period of Starcrack is one year if stored in a dry place, under constant temperature and without any damage to package.

WHAT CAN CAUSE A BLOWOUT?

1. Using too large a hole diameter, 60MM is maximum. (see temperature chart)
2. Using too warm mix water, (see temperature chart)
3. The ratio of water is less then 1:3, especially when rock or concrete is above 25⁰ C
4. Lots of dry dust in holes can absorb water from mixed STAR-CRACK.
5. Too much time passing between beginning to mix and filling holes.
6. Guessing at drill hole temperature instead of measuring it.
7. Guessing at water temperature instead of measuring it.
8. Holes that are too shallow, Depth must be 4times diameter or more.
9. A “know-it-all” attitude that causes some people to ignore this manual instead of reading it thoroughly, cover to cover. **May cause you to have an accident**

Always wear safety goggles when working with STAR-CRACK
NEVER USE DRILL HOLE DIAMETER LARGER THAT 60mm
Blowouts will usually not occur more than 3hours after filling holes

FILLING

For vertical holes, pour Starcrack mixed with water directly into the hole. Tamp the mortar fill into the holes with a slightly smaller stamp stem. For very long holes, tamp the mortar section by section. For horizontal and slant holes, insert a slightly smaller plastic pipe into the hole, and then fill the expansive mortar into the pipe slowly, withdrawing the pipe from the hole simultaneously. Quickly block the hole with a cap after fill. A slurry pump may also be utilized for filling horizontal holes.

➤ **Cautions**

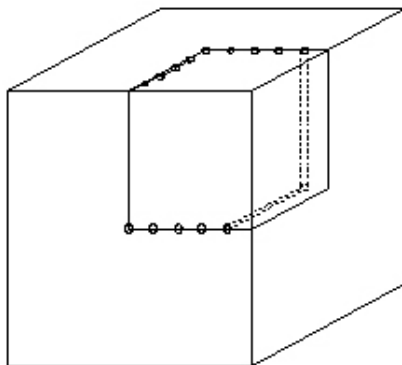
- 1) Make sure the holes are clean and no water and residue is left in the holes, or use high-pressure air hose to clean out.
- 2) Fresh expansive mortar should be poured into the hole within 10 minutes after mixing.
- 3) The feeding depth is 100% of the pre-drilled hole.
- 4) Make sure the temperature of the hole meets the requirement before filling with mortar.

- 5) The batch of Starcrack mixed each time should not exceed the necessary requirement. All the workers on duty should ensure a smooth flow of mixing, stirring and filling, which is the guarantee of maximum expansive stress of all holes occurring at the same time.
- 6) Warm or bubbling mortar must not be used to fill holes. The filled holes have to be watched carefully. Once the holes start bubbling with a hissing sound, blow-out will occur.

CONSULT THIS CHECKLIST BEFORE YOU MIX

1. Are you wearing safety goggles during the operation? _____
2. Is everyone nearby wearing goggles? _____
3. What is rock/concrete temperatures? _____
4. What is drill hole diameter? _____
5. What is water temperature? _____
6. Do you know how to measure 1 liter of water? _____
7. Have you measured extra water if rock/concrete is above 25⁰ C? _____
8. Is electric mixer or rubber gloves all ready to go and operational? _____
9. Has the STAR-CRACK been kept cool? _____
10. Have you read this instruction booklet 100%? _____

Estimating quantity required:



For example, if you want to quarry marble or soft granite block with a size of 200cm x200 cm x 200cm,

Providing that the diameter of predrilled-hole is 38mm, the distance of center hole - center hole is 40cm. So there are 9 holes in vertical direction, and 5 holes in horizontal direction, total 14 holes for cracking agent.

Each hole capacity $1.9\text{cm} \times 1.9\text{cm} \times 3.14 \times 200\text{ cm} = 2,267\text{ cm}^3$,

Standard consumption of STAR-CRACK is $1.6\text{ g} / \text{cm}^3$,

Total consumption for one hole $2267 \times 1.6 = 3627\text{ g} = 3.63\text{ kg}$

Total consumption for 14 holes $3.63\text{kg} \times 14 = 50\text{kg}$

Standard consumption for marble and soft granite $50\text{kg} \div 8\text{M}^3 = 6.25\text{kg} / \text{M}^3$,

Actual consumption may be affected by actual design of holes and
hardness of stone and job-site condition

SAFETY PRECAUTION

The following safety precaution has to be observed closely when dealing with Starcrack.

- a) Safety goggles, dust-proof mask and rubber gloves and helmet MUST be worn while preparing, mixing and filling Starcrack at all times.
- b) Plug the holes immediately after filling and cover the holes with straw or rubber mat. 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 of material. Keep people away from site after filling.
- c) Have clean water and towel on site, in case of contact with the product in eyes and skin, dry or wet form, wash them Immediately with large amounts of Cold Clean water without rubbing. Consult doctor urgently.



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