



GUIDE TO THE CORRECT USE OF CONCRETE AND ROCK HYDRAULIC SPLITTERS

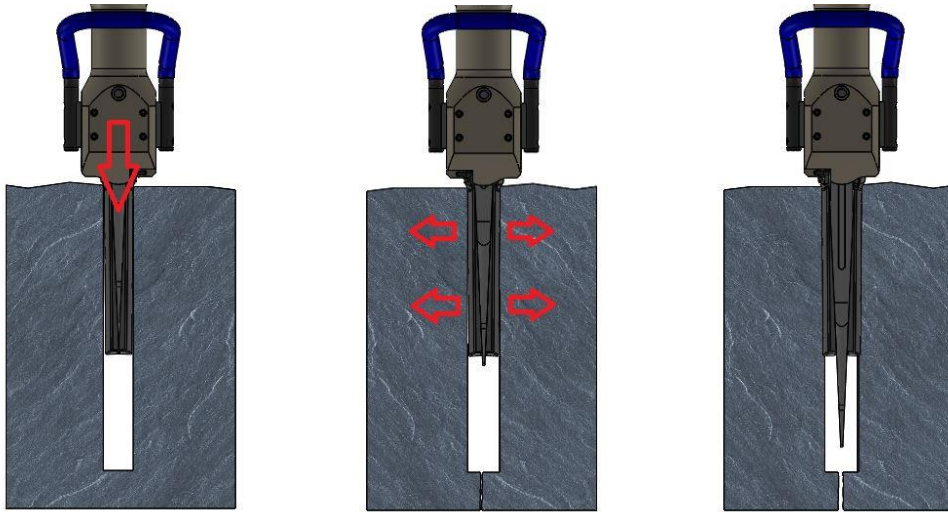
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1) Introduction – What it is and how it works.

Rock and concrete have a remarkable compressive strength but a very low tensile strength (the ratio is about 1 to 10), therefore applying an expansive force from the inside it is possible to break large blocks of rock or concrete in a simple way and with limited effort.

The splitter consists of a hydraulic piston that pushes a central wedge against two counter wedges inserted inside a hole previously made at a precise depth and diameter.

The hydraulic pressure pushes the central wedge against the counter wedges forcing them to spread against the walls of the hole and this action causes an extreme splitting force that transmitted to the rock or concrete results in their failure.



2) Preliminary activities

Before starting the splitting process, it is advisable to carry out some tests to establish the properties of the material and its behavior to optimize parameters such as the distance between the various holes.

In the case of reinforced concrete, it is important to establish the size, position, and shape of the reinforcement to understand where to make the holes avoiding encountering them during drilling.

In the case of rock, other aspects must be considered such as the presence of seams, the shape and size of the blocks to be made.

Since there are no fixed rules, but only precautions dictated by experience, it is necessary to carry out an accurate preventive analysis to choose the best strategy to pursue.



WARNING

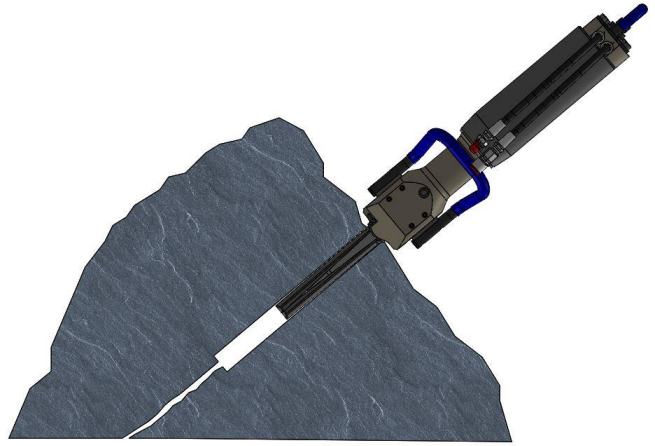
Large boulders or concrete blocks can move or fall during splitting processes.

For this reason, it is important to keep a safe distance and assess in advance where each block might fall.

In the same way, the tool could also be exposed to impacts and it is therefore advisable to take the necessary precautions to safeguard its integrity.

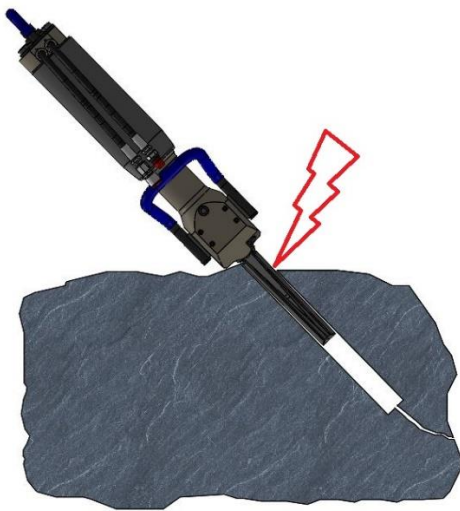
3) Correct position

To optimize tool performance, it is important to find the correct position to drill the hole. It is generally recommended to drill the hole perpendicular, i.e., at a 90-degree angle to the flat surface and as close to the center of the rock block to be demolished as possible.



WARNING

If the position is not correct, it is probable that only a small part of the block will break because the breakage follows the principle of least resistance and **in this circumstance, the set of wedges could also be at risk of deformation or rupture due to the unequally distributed stresses on them.**



If it is not possible to drill at 90° from the start, as in the case of a floor or wall with no free sides, it is advisable to start with slanted holes to create the opening and then bring the angle back to 90° to work in a balanced manner, with both counter wedges of the tool inserted full length into the material to be removed.

Before proceeding with the splitting process, verify that only the set of wedges and no other part of the tool encounters the block to be demolished and at the same time determine how the rock will behave once it is split to provide straps to support the tool and prevent it from falling and being damaged.

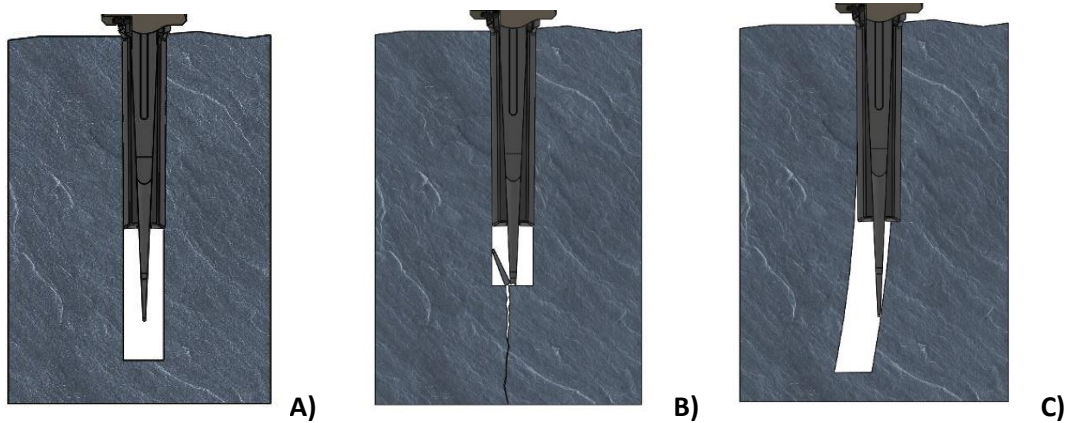
4) Size and shape of the hole

During the drilling phase, it is very important that the specific diameter and length parameters for each tool are respected (see table at the end of this guide).

If the diameter is too small it will not be possible to insert the wedge set, vice versa if it is too large part of the spread will be lost with the risk that the tool will not be effective in demolition **(A)**.

Similarly, if the depth is not sufficient due to various reasons including the presence of dirt and/or rock fragments, the center wedge of the tool may hit the bottom of the hole and break off **(B)**.

The straightness of the hole is also very important to avoid problems of deformation or breakage of the wedge set during tool operation **(C)**.



Therefore, once the holes have been drilled, it is recommended to clean them thoroughly, making sure to remove all debris and dust on the bottom, then check for correct straightness with the aluminum pipe provided with the tool.

The wedge set should preferably be inserted completely into the hole. If this is not possible, it is recommended to insert it at least 3/4 of its length.

In the case of short holes, you can keep the tool slightly backward, but never more than 18-20 cm.

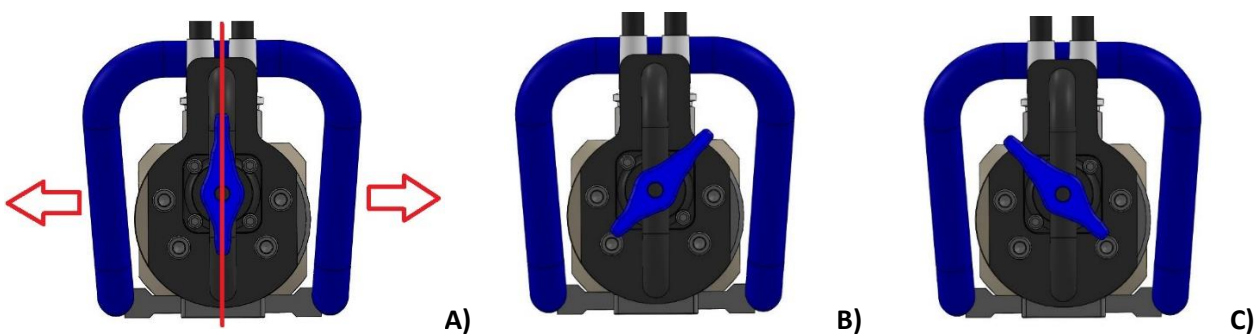
Regarding the distance between holes, it is advisable to do some breaking tests starting from 45/65 cm and gradually increasing or decreasing it depending on the strength of the material.

5) Split direction

The direction of the split can be determined before starting the process as it will coincide with the orientation of the rear handle of the tool.

6) Stages of the splitting process

1. Insert the tool wedge set into the previously made hole (with a drill or drilling rig in the case of rock, with a core drill in the case of concrete structure).
2. Rotate the rear handle of the tool to the desired direction of the crack **A)**.
3. Turn the control cam clockwise to activate the tool and extract the central wedge **B)**.
4. Wait for the pressure in the circuit to reach a peak of 600 bar and then drop to 50/100 bar, confirming that the central wedge has reached the end of its stroke.
5. Turn the control cam counterclockwise to retract the center wedge **C)**.
6. Pull out the tool and move it to the next hole.





WARNING

At no stage in the splitting process exert forces on the tool or use it as a lever to facilitate the removal of blocks. **Any such action will result in damage to the wedge set and internal parts of the instrument.**

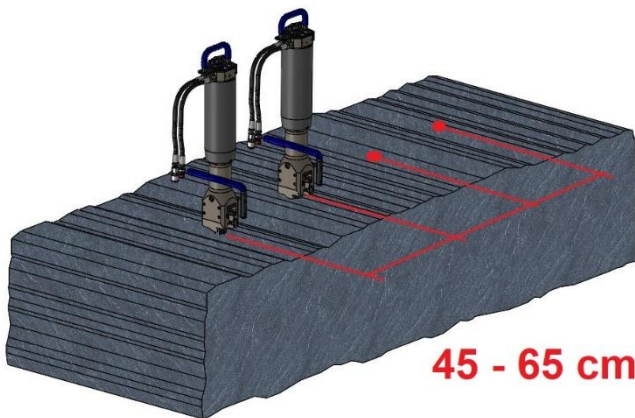
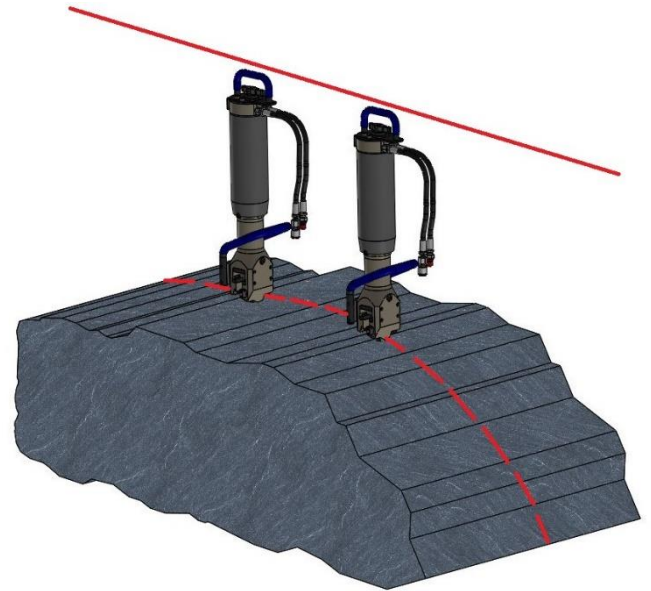
7) Simultaneous use

If the blocks to be demolished are particularly large or hard one tool may not be adequate, so it is recommended to use two to three tools simultaneously to divide the effort over several machines.

The result will be a splitting force equal to the sum of the forces of each tool.

For this type of use, it is necessary for all tool handles to be oriented in the same direction.

Simultaneous use may also be necessary in situations where long and precise splitting is required, such as when part of a concrete structure must remain without being damaged by the demolition process or when large blocks of natural stone are to be produced reducing material waste to a minimum.



In the first case, it is recommended to drill holes in a straight line at intervals of about 45 to 65 cm (depending on the hardness and thickness of the material) along the entire length of the block. Then proceed with partial splits, paying attention to the formation of the split and repositioning the pair of tools in the subsequent holes with each splitting cycle.

It will probably not be necessary to use all the holes; those not used will still serve to mark the progression of the split because the material structure has been weakened at these points.

8) Lubrication of the wedges

Before using the tool, it is necessary to ensure that the set of wedges is lubricated with the appropriate grease supplied with the tool to prevent them from binding together, reducing the power of the tool and increasing the risk of damaging it.

This can be done by using a screwdriver to separate the counter wedge from the center wedge.

Once apart, access the contact surfaces and apply the grease with a spatula.



WARNING

This lubrication operation must be repeated every 5/6 splitting processes (or sooner if working on very hard rock) first carrying out a quick visual check to verify that there are no fragments which, under the extreme pressure of the splitting process, **could damage the surface of the wedges.**

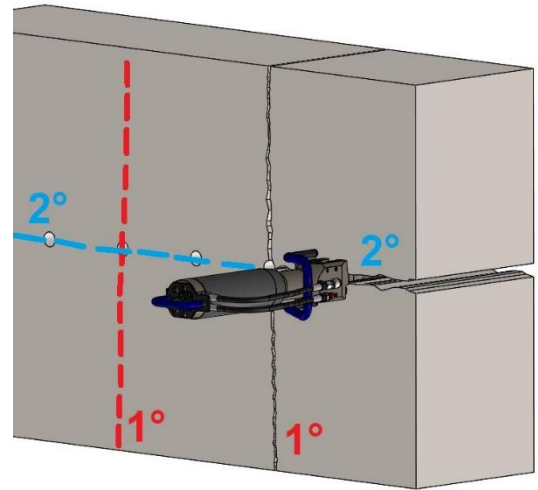
CONCRETE DEMOLITION

9) Demolition of concrete walls containing medium-light strength reinforcement

Before proceeding, it is advisable to determine the maximum size of the blocks that can be removed and drill the holes to produce blocks of the desired size.

Subsequently, first perform partial vertical splits (**1°**) to separate the blocks from the portion of the wall to be preserved and then horizontal splits (**2°**) to reduce the blocks to the desired size.

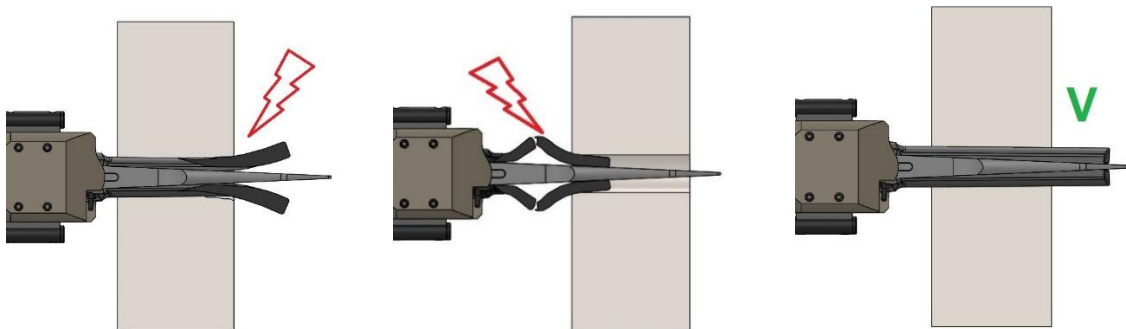
The distance between the holes depends on various factors including the size and thickness of the wall, the type of reinforcement and the size of the blocks to be split according to the subsequent transport needs.



10) Demolition of thin walls

Where the wall thickness is less than the length of the counter wedges, hold the tool partially rearward ensuring the center of the side wedges are in the hole.

If at least half of the length of the counter wedges are inside the material, there is a good chance that the splitting process will be effective.

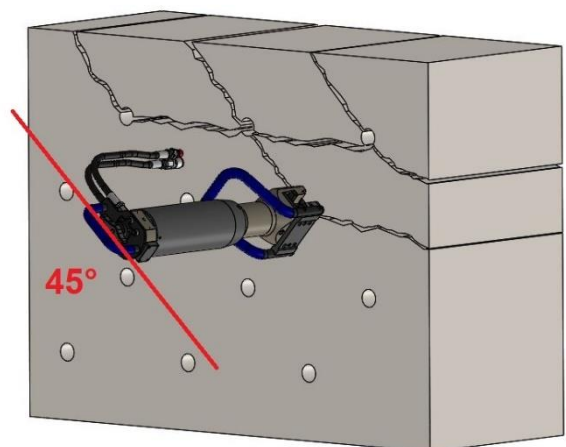


11) Demolition of concrete walls containing high-strength reinforcement

The hydraulic splitter is particularly suitable for the controlled demolition of reinforced concrete because it allows breaking both the concrete and its bond with the reinforcing rods.

For maximum effectiveness, it is recommended to drill the holes in the center of the mesh resulting from the intersection of the horizontal and vertical reinforcement bars.

Then position the tool with the rear handle rotated at 45° to the direction of the reinforcement rods to slide the concrete along the reinforcement rods and thus break the bond that holds them together.



Repeat this process for each mesh to crumble the concrete and allow it to be removed with a jackhammer or larger hammer.

The pre-splitting process saves time on subsequent demolition by jackhammer.

12) Demolition of chimneys or conical reinforced concrete structures

Drill through holes in the conical walls and orient the rear handle of the tool so that the material is pushed toward the free side of the structure or the upper end of the chimney.

Repeat the processes step by step starting from the top to the base of the structure.

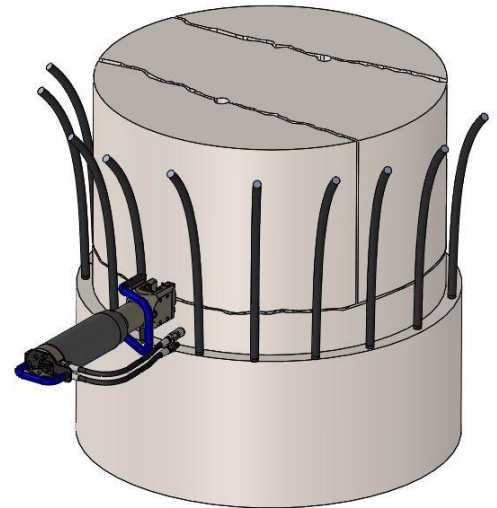
13) Pile breaking

If the piles are not connected to each other, it is possible to split them into large blocks by performing horizontal splits.

Otherwise, it is necessary to demolish the posts from top to bottom by performing vertical splits.

Before starting it is necessary to understand what type of reinforcement is present in the pile and its dimensions, therefore remove the external layer of concrete with a jackhammer to expose the reinforcing rods.

Subsequently carry out a horizontal limit division to limit the height at which the top of the pile will be separated from the rest of the structure, and from here on up the material can be hooked up and removed by crane or reduced further by vertical splitting processes.



If the pile is particularly large, use two or three splitters simultaneously placed on opposite sides.

The more tools you use at the same time, the greater the productivity.

The choice of the most suitable tool model depends on the diameter of the pile.

14) Demolition of walls without free side

Since the hydraulic splitter requires at least one of the faces of the block to be demolished to be free, when this is not possible as in the case of walls it is first necessary to make an opening to which the demolished material can be pushed by successive division processes.

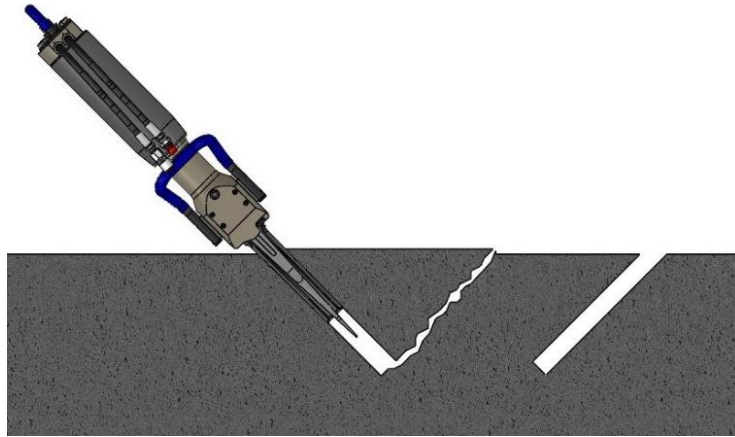
This opening can be made with a series of intersecting holes drilled with a core drill.

Then it will be necessary to make holes for the splitter around this opening and orient the rear handle of the tool so that the material broken up by the splitting processes is always pushed toward it.

15) Demolition of floors without free side

Again, you must first create an opening that can be used as a free side, and this can be done by drilling holes that are not perpendicular to the floor surface, but rather at 45° to it.

In this way the splitting processes cause the pieces to be pushed towards the surface, gradually creating the necessary opening.



16) Demolition of thick concrete slabs

In the case of very thick slabs, it is possible to proceed with a removal in stages.

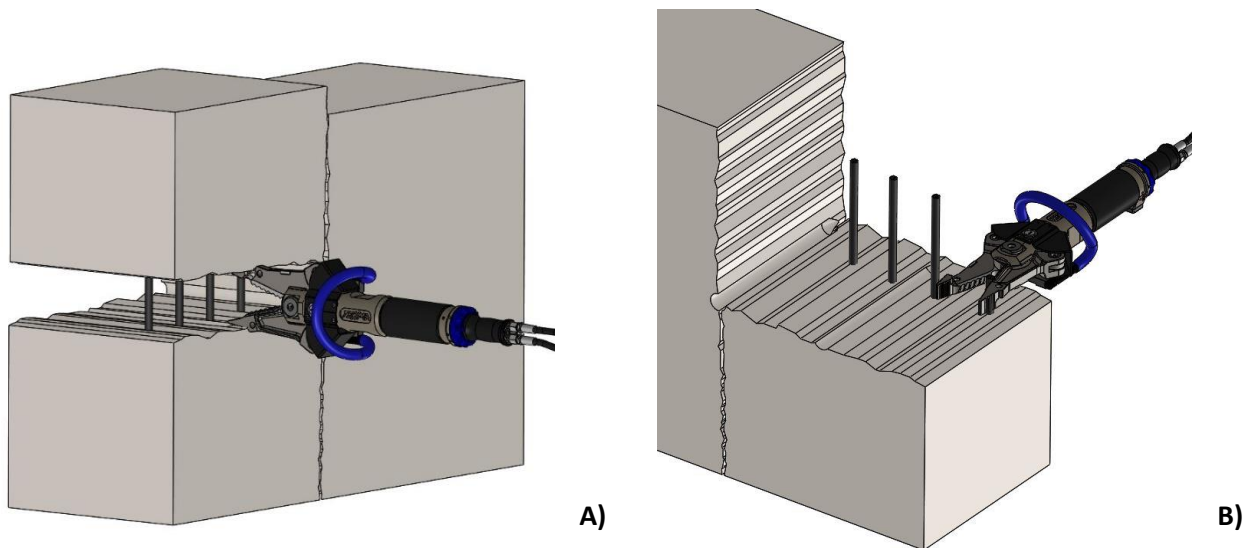
In this case, it is recommended to drill the holes directly with the maximum depth so that they can be used for subsequent demolition levels.

The depth of each level will depend on the length of the counter wedges. Up to this depth the material will be removed and then it will be necessary to make a new pass using the same holes.

17) Enlargement of cracks and cutting of reinforcing bars

Once the rebar has been exposed following a splitting process, it can be cut with a welding torch or angle grinder.

A very valid alternative is to use the combi shear to first widen the cracks between the previously split blocks **A)** and then cut the reinforcements without risk of splinters and sparks **B)**.



ROCK DEMOLITION

18) Stratified/seamy rock.

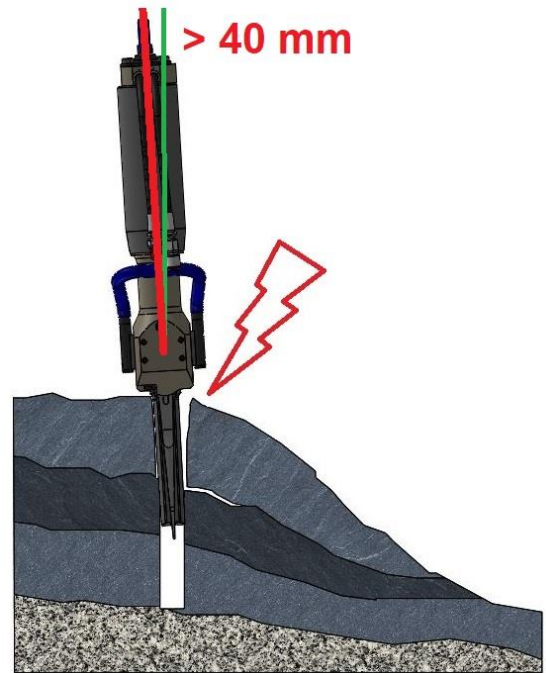
Rock with many veins tends to break irregularly and crack where the first layer (natural vein) forms.



WARNING

It may happen that splitting stops only at the first layer under the tip of one of the two counter wedges and as a result the tool will tilt during operation.

If the tool should tilt more than 40mm retract the center wedge immediately so as not to risk damaging the wedge set.



19) Demolition of a blocked rock

If the rock is not free to move, its breakage will cause different movements of separated blocks.

In some cases, such as wedged rock blocks that cannot be separated laterally or a large boulder with a rounded bottom, one part will tend to move upward pushing up the counter wedge resting on it, while the other part will tend to move downward moving the other side wedge toward the end of the center wedge.



WARNING

These thrusts can swing the tool to the point of bending or even breaking the wedge set.

As a rule of thumb, it is necessary to immediately retract the center wedge if the tool should tilt more than 40mm and proceed with a new process in another position.



20) Demolition of a rock below ground level

In this case, proceed to demolish the part protruding from the ground with a vertical division. Then dig slightly below ground level and make horizontal divisions by orienting the rear handle of the tool so that the material is pushed toward the surface.

21) Demolition of rocks with vertical seam

To create a free face, holes can be drilled near the vein at a 45-degree angle to the surface. Position the tool by turning the rear handle parallel to the vein. This will cause the splitting process to blast the portion of rock between the hole and the vein, thus creating the free face for the subsequent splitting processes.

22) Trenches excavation

As in the case of a concrete wall, it is necessary to create an opening to be used as a free face to which material can be pushed during the initial splitting processes until a side is large enough to proceed effortlessly.

To maintain a minimum level at the bottom of the rock in a trench excavation, it is recommended that the holes be drilled so that the level coincides with the depth of the counter wedges, and that the excess of the hole below the level serve only to allow the center wedge to descend to the end of the course. The break in this way will stop at this level.

23) Pipejacking

It can happen that you come across a rock obstacle while pipejacking.

In cases like this, using a hydraulic splitter is a quick solution to break the boulder into smaller pieces that can be removed to proceed with the work.

24) Widening of tunnels

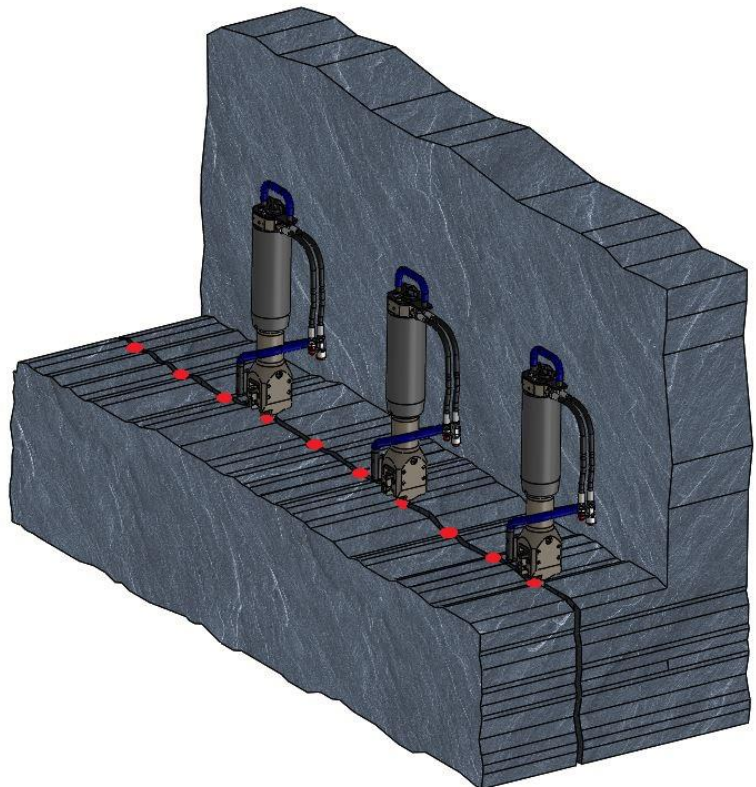
The hydraulic splitter is a good and effective solution for tunnel widening, given the absence of vibration. The inner layer of the tunnel wall is split by drilling holes at an angle to the tunnel wall, orienting the rear handle to push the material inward.

25) Production of natural stone blocks

To minimize material waste in the production of valuable rock blocks, the use of simultaneously driven splitters is recommended.

As a preventive measure, it is necessary to estimate the desired size of the blocks and possibly separate them considering the natural vein of the material.


Then drill holes at small intervals of 20/25cm along the desired division line. Insert a hydraulic tool every 2-3 holes, rotate all handles in the same direction and operate the tools simultaneously. In this way the division will be done in the most efficient, quickest, and economical way.



26) Areas of application

AREAS OF APPLICATION			
	SP400-SW	SP400	SP600
Hole diameter	Ø35-36mm	Ø45-48mm	Ø45-48mm
Hole depth	440 mm	440 mm	640 mm
Concrete demolition			
Demolition of medium-thickness concrete structures (e.g., plinths, floor slabs, stairways, column, and beams).		V	v
Demolition of large-thickness concrete structures (e.g., foundations, bridge decks and abutments, retaining walls).		v	V
Demolitions in confined spaces (e.g., basements, elevator shafts, near gas, water & sewer mains).		V	v
Stone and concrete wall demolition		V	V
Demolition of concrete pile heads		V	V
Secondary cutting of large concrete blocks		V	v
Interventions in presence of the water and underwater demolitions.		V	V
Rock demolition			
Rock removal (e.g., building foundation, trenching work)	V	v	V
Cross passage in tunnels	V	v	V
Tunnel work	V	V	v
Secondary cutting of rock	V	V	V
Rock demolition in trench works		v	V
Enlarging work in underground mining	V	v	v
Pipejacking work	V	V	
Block production in the natural stone industry			
Granite	V		V
Marble	V		
Sandstone		V	
Rescue			
U.S.A.R. (Urban Search and Rescue) applications (e.g., to remove large stones or rubble caused by earthquakes, floods and explosions due to gas leaks).	V	V	V
Mines rescue	V	v	V

27) Quick start Guide

- 1) Read the tool manual and this guide carefully before using the equipment, having clear the dangers highlighted by the  **WARNING** sign.
- 2) Use the appropriate tool according to the job to be carried out (see areas of application)
- 3) Always respect the appropriate drilling parameters for each tool:
 - SP400-SW hole diameter 35-36 mm depth 440 mm
 - SP400 hole diameter 45-48 mm depth 440 mm
 - SP600 hole diameter 45-48 mm depth 640 mm
- 4) Holes should always be perpendicular to the surface, except in cases where it is necessary to demolish a floor or flat face with no free side.
- 5) Place the wedges set entirely in the hole or at least 3/4 of their length if this is not possible.
- 6) The orientation of the handle and the position of the holes will determine the direction of the crack because the structure has been weakened at those points.
- 7) In the case of thin concrete slabs, be sure to place the counter wedges in the middle so that expansion does not occur before or after the hole.
- 8) For very large blocks, use one or more tools simultaneously (the total force will be equal to the sum of the force of each tool).
- 9) For maximum division accuracy, it is recommended to:
 - Reduce the distance between holes.
 - Use several tools at the same time.
- 10) When using tools simultaneously, start by placing the tools at 45-65 cm from each other and then gradually reduce or increase this distance according to the result of the splitting processes and the hardness and thickness of the material to be demolished.
- 11) If the tool begins to tilt more than 40mm during the splitting process, the center wedge must be retracted immediately to prevent the forces applied by the split blocks damaging the wedges set.
- 12) In the case of reinforced concrete blocks, the rods can be cut with the hydraulic shear.
- 13) Grease should be applied every 5 division processes or sooner in case of very hard materials.