



Specialist Construction Supplies for Repair, Maintenance, Building & Infrastructure

Dynacem Data Sheet

Specification notes

Product: **Dynacem**

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Dynacem Data Sheet



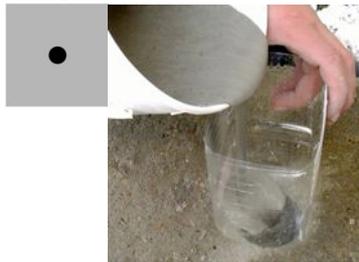
DYNACEM® non-explosive demolition agent

DYNACEM is a highly expanding mortar for non-explosive demolition. It expands soundlessly, tears apart structural elements, separates reinforcing steel from concrete and it's easy to use:

1. Begin by drilling the holes:



2. Mix DYNACEM with water and pour into the holes:



3. DYNACEM expands, BREAKS and TEARS APART boulders, rock and reinforced concrete:



DYNACEM IS SEVERAL TIMES QUICKER THAN HAMMERING!

Appropriate distribution of holes allows:

- breaking into large, or small pieces:



- splitting into sizes suitable for transport:



ADVANTAGES:

- accelerates demolition,
- no noise, vibrations, sparks and exhausts,
- no heavy machinery,
- less hammering and energy consumption,
- no flying debris, fire and toxic gases,
- controlled path/run and pattern of cracking,
- controlled demolition zones,
- "cutting" along designated lines,
- breaking into desired sizes,
- no precautions and qualifications for handling explosive materials are required.

APPLICATIONS:

- dividing beams, bases and foundations into pieces suitable for transport,
- demolition of structures, rock breaking,
- breakouts and openings in slabs and walls,
- tunneling, trenching and rock excavation,
- removal of rocky humps and boulders,
- exposing and releasing steel reinforcement from surrounding concrete,
- cutting concrete piles,
- quarrying stone blocks with minimal waste.

IDEAL SOLUTION when machines, noise, or vibrations are undesirable.



MATERIAL PROPERTIES AND HANDLING

DYNACEM is a grey powder that needs to be thoroughly mixed with water prior to filling the holes previously drilled in the element intended for demolition. As a result of a chemical reaction (hydration with heat evolution) DYNACEM hardens, anchors itself within the holes and expands. Volume increase is accompanied by an increase in pressure exerted by DYNACEM on the walls of the hole. Pressure exerted by DYNACEM is a couple of times higher than the tensile strength of concrete, mineral construction materials and rocks. Once the pressure exceeds the tensile strength of the element, it breaks – gets torn apart as cracks form. They keep on growing as DYNACEM keeps on expanding. Further propagation of cracks lasts for a couple of days and can be accelerated by moisturising the holes with warm water once the product solidifies.

DYNACEM is available in “Standard” and “Summer” versions.

Cracks appear after a couple of hours in the summer and up to several days in winter (around 0 °C). The key factors are: hole size, temperature and properties of the material being splitted. Hard and rigid materials (e.g. high strength concrete) usually fracture more easily than soft materials (e.g. lean concrete) that tend to deform, rather than break under pressure.

30 - 40 mm diameter holes spaced 5 - 15 diameters away (15 - 60 cm) provide effective breaking capabilities in most practical applications. It is, however, safest to account for element temperature (measured within the hole) and the type of material being cracked (concrete, r.c., rocks) in each case individually following the guidelines in the Table:

Set-up depending on temperature and type of material being cracked:		element temperature measured within the hole			
		below 0 °C	0 - 10 °C	10 - 20 °C	20 - 30 °C
- DYNACEM type		STANDARD	STANDARD	STANDARD or SUMMER	SUMMER
- hole diameter ¹	reinforced concrete, granite, basalt, hard rock	5 cm	4 cm	4 cm	3 cm
	concrete, soft rock	4 cm	4 cm	3 cm	2 cm
- mixing water temperature ²		warm	warm	cold	cold
- mixing water per 5 kg of powder		1,5 dm ³ (27 - 33 % powder weight)			
- hole spacing	reinforced concrete, granite, basalt, hard rock	5 - 10 hole diameters			
	concrete / soft rock	10 - 15 / 10 - 20 hole diameters			
- minimum hole depth		5 hole diameters			

CAUTION, increased hole diameter will result in increased DYNACEM reaction rate and resulting temperature. A diameter, which is too large may cause boiling, water vapour disengagement and sudden, dangerous hole blow-out, especially in the summer.

In order to decelerate the reaction and delay the formation of cracks: use DYNACEM SUMMER, mix it with cold water, decrease the hole diameter, increase the hole spacing, increase the amount of water.

In order to accelerate the formation of cracks: use DYNACEM STANDARD, mix it with warm water, increase the hole diameter, decrease the hole spacing, decrease the amount of water.

¹ when dealing with non-reinforced elements DYNACEM expansive grout can sometimes be successfully applied to holes of a diameter smaller than those given in the Table, especially when it's warm outside and the the holes are arranged in a linear pattern (e.g. when temperature exceeds 10/20 °C, holes of 30/25 mm are used in granite applications), or when increased cracking time is acceptable.

² adjust to keep the mixture of water and STANDARD version below 20 °C, water and SUMMER version below 30 °C.



Drilling holes:

- measure the temperature within the first hole. Should the drilling method result in large heat evolution, wait and repeat the measurement after some time allowing the drilling heat to dissipate,
- use the Table above and adjust the hole diameter to the temperature within the element, not surrounding air temperature,
- expansion energy is utilised most efficiently, when the holes are perpendicular to the drilled surface, parallel to the nearest free surface¹ and away from it by more than 4 diameters,
- the easiest way to drill is to use rock drills with drilling rods and chisel or cross bits,
- horizontal and down-facing holes are difficult to fill and may require a mortar pump,
- depth should be as large as possible and at least 5 times larger than the diameter,
- the product does not work in holes of length smaller than 5 x diameter,
- holes should be cleared of any water or dust. The inside surface can be dry, or moist, however should not contain any standing water,
- holes that were accidentally drilled all the way through can be plugged to prevent demolition agent DYNACEM from leaking before it solidifies,
- empty holes should be covered to protect against dust, sunlight, heat, or frost.

Mixing mortar:

- use safety measures and personal protective equipment, as specified in the Material Safety Data Sheet,
- before mixing each batch ensure that all the equipment (mixer paddles, vessels etc.) is perfectly clean and not contaminated with remains from the previous batch,
- begin by precisely calculating and weighting the quantity of DYNACEM powder and mixing water required,
- using rough measures is unacceptable,
- only prepare as much mixed grout as can be used in 3 min. at most. The more DYNACEM/water mixture and the longer the time it sits in a single container, the higher the risk of the mixture heating up and reacting,
- within a span of 1 minute powder should be gradually added into a vessel containing water while being stirred continuously. Stirring should then continue for additional 1 - 2 minutes,
- use a plaster or paint stirrer and stir at low speed to avoid foaming the mixture,
- ready-to-use non-explosive demolition agent should have a homogeneous, liquid consistency,
- avoid mixing fresh product with remains from a previous batch, extended mixing times (especially in the summer), using aluminium containers, mixing and storing tools, powder, or water in places receiving high doses of sunlight, or close to any sources of heat, as it may cause the chemical reaction to start prematurely, during mixing.

CAUTION, if DYNACEM mixture heats up, "smokes", or rapidly dries up, stirring should be stopped immediately and the contents of the vessel should be spread on the ground.

Filling holes:

- use safety measures and personal protective equipment, as specified in the Material Safety Data Sheet,
- do not fill holes immediately after drilling, if the drilling method could have heated the element up,
- check if the holes have not been contaminated since drilling and preparation,

¹ at all times, at least one **free surface** should be made available, i.e. a surface that can move without external resistance, as a result of DYNACEM demolition grout expansion. If such a surface is not available in the existing state (all surfaces are in contact to external obstacles), create it - see HOLE PLACEMENT section.



- use a funnel, or a watering can,
- do not fill the holes up to the top, leave 2 - 3 cm empty,
- DYNACEM hardens and anchors itself within the hole – do not attempt to plug the holes,
- plug the horizontal holes with PVC elbows, use a mortar pump for horizontal and down-facing holes,
- long and/or narrow holes need to be vented to enable complete filling. Wire or a thin rod can be inserted into up facing holes and moved up and down repeatedly during filling,
- holes placed in one line to generate a single crack should be filled one after the other, without any delays,
- filled holes should be covered with bright tarpaulin to protect against dust, sunlight, heat, or cold,
- ensure that no one approaches the holes or looks towards them for at least 12 hours from filling,
- ensure that no one, under any circumstances (even when wearing protective goggles) looks directly into the filled holes,
- remains of the expansive demolition agent should be diluted with water and removed from the vessel to prevent contamination of the following batch.

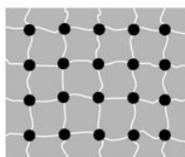
PRODUCT CONSUMPTION

It is best to determine DYNACEM powder demand on the basis of diameter, total length of the holes made, and unit consumption given in the following Table:

Hole diameter:	20 mm	30 mm	40 mm	50 mm
DYNACEM quantity required to fill a hole of 1 m length:	0,6 kg	1,2 kg	2,2 kg	3,4 kg

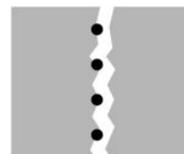
Resulting consumption of DYNACEM depends on the desired way of demolition:

- **BREAKING** is achieved by placing holes in a raster, which results in damage of the entire volume of the element. DYNACEM



consumption is high and is approximately equal to:
 - rocks: 5 - 20 kg/m³
 - concrete: 5 - 15 kg/m³
 - reinforced concrete: 10 - 30 kg/m³

- **SPLITTING** is achieved by linear hole distribution, which results in the element being divided into blocks fit for loading and transport. DYNACEM consumption depends



mainly on the desired block size and is approximately equal to:
 0,5 - 5 kg/m³





HOLE PLACEMENT

Holes interact in formation of cracks. Skilful hole placement allows achieving the desired demolition effects in a short time and at small cost.

In rock and boulder breaking, one central hole causes 3 or 4 cracks to form. Increasing the number of holes will result in more cracks and more chunks being formed.

In order for the cracks to develop and propagate, the element must have at least one free surface that is not in contact with any obstacles, so it can move without external resistance as the result of DYNACEM expansion.

The best results can be achieved drilling holes parallel to the free surfaces. In this case the entire expansion force moves the split fragments towards the free surface.

Option A: a rock is buried in the ground and the only free surface is the horizontal surface of its exposed hump. In this case horizontal holes are the best choice (often impossible to drill). Skewed holes are effective too, while vertical holes are completely ineffective.

Option B: excavating the rock on one side creates a free side surface and allows the vertical holes to become effective.

Option C: if a rock is completely excavated, or rests at the ground level, its entire surface is free allowing every hole direction to be effective.

Slabs and concrete floors contained by walls, or large layers of rock have only one, horizontal free surface and vertical holes are ineffective. Begin demolition by diamond core drilling a line of vertical, overlapping holes to create a free space, or by drilling a lines of skewed holes in order to form a breakout that will expose additional free surfaces. Vertical or skewed holes can be used to demolish the remaining area.

Thickness of the slab/floor cannot be smaller than 5 hole diameters.

Raster hole placement in a non-reinforced element causes breaking and destruction of the entire volume of the element.

Linear hole placement causes splitting of the entire element into blocks fit for loading, transport and further usage, as they are not cracked.

Linear hole placement may, depending on their spacing, result in a single, or multiple cracks.

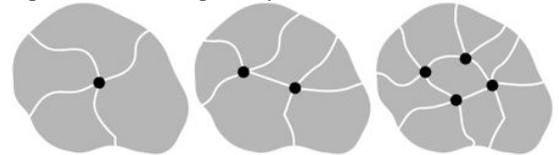
The deciding factors are:

L – hole spacing, and

k – distance of the row from the free surface.

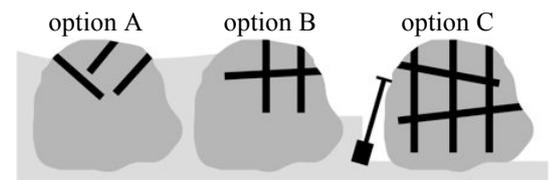
placement allows achieving the desired

Options for hole quantity:

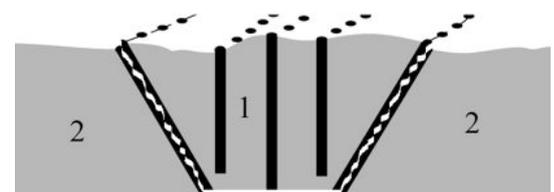


The number of holes is chosen with regard to the rock size (hole spacing and distance to the edge of a rock should not exceed 12 diameters) and to desired chunks size (possibilities of loading, transporting, or usage them on site are important).

Possible placements and directions of effective holes in successive stages of excavation and expansion of the free surface.



Skewed holes create a breakout in the mother rock or a concrete block. Pushing the “wedge” upwards, (towards the horizontal free surface) creates two additional, skewed free surfaces:

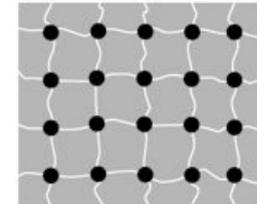


1 - additional vertical holes applied to thick elements help to delaminate and break the “wedge”

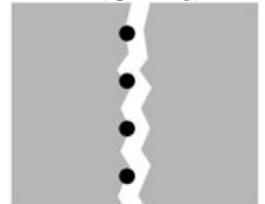
2 - areas where using vertical holes is now possible

Options for hole placement:

- raster (breaking):

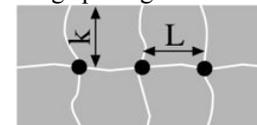


- linear (splitting):



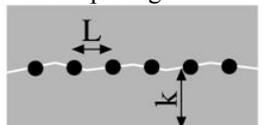
Options for hole spacing within a row:

- big spacing:



$L \geq k$
gives a main and perpendicular cracks,

- small spacing:



$L < k$
gives only a main crack.



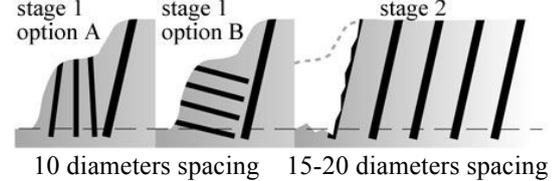
Empty holes "repel" cracks. A row of empty holes sets the breaking boundary.

Cracks do not propagate beyond the empty holes:



Removing a layer of mother rock begins with drilling a few smaller holes to remove the toe and obtain a regular, vertical free surface. Then more holes parallel to the new surface and reaching a few centimetres below the desired cut-off level are drilled. 2 consecutive rows are then filled up every 5 to 15 hours.

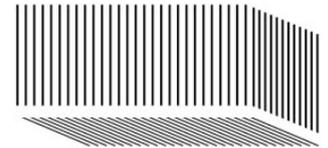
Breaking a rock slope with a toe:



Quarrying blocks of sandstone, granite, and marble is conducted using rows of holes. Common hole spacing is 10 hole diameters. Despite smaller amount of holes being drilled, the number of damaged (cracked) blocks is much smaller than when explosives are used.

Vertical holes should be drilled to 80-85% of the depth of the desired block size.

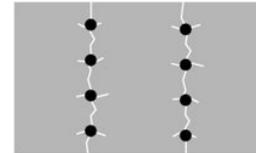
A single layer of horizontal holes should be drilled underneath:



Long concrete and reinforced concrete foundations and beams can be demolished cheaply and quickly by **dividing into pieces**. Holes need to be drilled in a line perpendicular to the element. Inside and within the vicinity of resulting cracks, the reinforcement will be exposed and can be cut through very easily. DYNACEM may tear apart reinforcing bars up to 10 mm diameter.

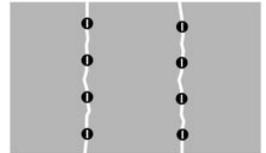
Dividing reinforced concrete into pieces using linear hole placement. Inserting steel or wooden slats into the holes and aligning them with the desired cracking plane causes the entire expansion energy to be used for formation of wide cracks aligned in a given direction.

Holes without inserts:



main and unwanted side cracks form.

With slats inserted:

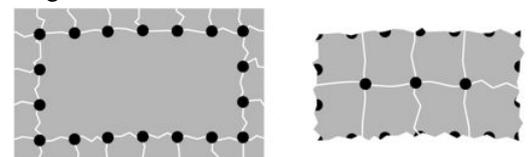


single main cracks without unwanted side cracks form.

When dealing with **reinforced concrete walls or slabs**, it is best to drill holes parallel to the element surface, situated in the middle of the cross section and behind, or between the reinforcement layers.

To break a reinforced concrete element into small chunks, it is recommended to start with making a single row of holes 4 diameters away from the edge of the element. Resistance of the internal concrete block causes the expansion pressure to crush the concrete between the holes and the element surface and to release the reinforcement. Then all that's left is to break, or split the remaining non-reinforced concrete block.

Stages of reinforced concrete demolition:



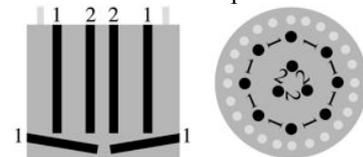
1 - reinforcement release and removal

2 - concrete breaking

With appropriate choice of hole diameter and spacing, the reinforcement is completely released.

Cutting through a concrete pile begins with making the first cut-off crack (using holes drilled radially towards the centre of the pile) and with releasing the reinforcement (using vertical holes drilled right behind the reinforcing bars). Then the remaining stump is crushed.

Cross-section and top-view of the pile head:



1 – holes filled in the first stage

2 – holes filled after removal of concrete crushed in stage 1



SAFETY

DYNACEM non-explosive demolition agent has a Hygienic Certificate HK/B/0748/01/2011 issued by National Institute of Hygiene (Warsaw, Poland).

Similarly to its main constituents (quicklime and cement), it is classified as an irritant. Explosives possession, handling, storage and transportation safety measures are not required. Using the product without complying to the recommendations within this Data Sheet and the Material Safety Data Sheet, or in a different application, than a recommended one can be dangerous for the user. DYNACEM is safe for the environment.

Main hazards:

- once poured into the hole, the product may suddenly heat up, release smoke or dry up quickly, which indicates it is on the verge of boiling and the water vapour contained inside may rapidly blow the hole contents out into the air, resulting in body damage, protective goggles damage and vision loss. This may happen when DYNACEM type (STANDARD/SUMMER), hole diameter and mixing water temperature are not tailored to the temperature of the demolished element, the product is poured into holes still hot after drilling, or the mixture starts reacting in the mixer before being poured into holes,
- when mixed with water, the product may start reacting, releasing heat, boiling and splashing hot liquid outside of the mixing vessel, which may lead to burns or serious eye damage. This may happen when the stirrer and the vessel are unclean and the remains of the previous batch enter the fresh one, aluminium tools are used, mixing time is too long, or the items were stored in a warm place,
- product transport, or stirring may generate dust which forms a highly alkaline environment when in contact with sweat, or tears. This may result in skin and mucous membrane irritation, burns and serious eye damage.

How to mitigate hazards:

- download the up-to date version of the Material Safety Data Sheet (MSDS) and the Data Sheet from www.dynacem.pl/uk,
- assign a capable and responsible person to handle the product. Ensure that they have read the MSDS and the Data Sheet, remember and understand the rules of product handling, safety and personal protection,
- when planning the work, keep in mind that destroying the first element/fragment, may affect the stability of the structure and cause it to collapse,
- ensure there is a high quantity of clean water available on site to wash the skin, or eyes in the event of exposure,
- do not use contact lenses, do use skin protection cream, wash hands before breaks and after work,
- use personal protective equipment marked CE: goggles, chemically resistant gloves, half face dust masks (full face masks for long term work in dusted areas, or in confined spaces), hard hats, and coveralls (long sleeves and legs),
- do not induce dusting,
- adjust the type (STANDARD/SUMMER), hole diameter and mixing water temperature to the demolished element temperature,
- prior to producing a new batch, ensure that the stirrer and the vessel are perfectly clean and free from remains of the previous batch,
- observe the demolition grout during mixing with water. If the mixture starts to heat up, smoke, or dry up rapidly, stop stirring immediately and spread it on the ground,
- never pour the expansive demolition agent into closed receptacles, receptacles with a tapering rim (e.g. bottles) and into holes within wooden elements,



- in the summer, aim to carry out the work away from direct sunlight - in the afternoon or in the morning, do not store the materials in the sun, try to use cool water, vessel and agitator. Use a bright cover to shield filled holes from direct sunlight, or rain,
- ensure that no one approaches the holes or looks towards them for at least 12 hours from filling,
- ensure that no one, under any circumstances (even when wearing PPE including goggles) looks directly into the filled holes,
- store in a dry place.

First aid:

- eye contact: rinse eye in running water for several minutes and consult a doctor immediately,
- skin contact: wash the irritated/burnt area with water and soap and rinse thoroughly,
- inhalation: escort the affected personnel from the dusted area (adhere to PPE guidelines and avoid personal injury) and seek medical help,
- ingestion: rinse mouth with water and drink cold, clean water in small portions. Do not induce vomiting and seek medical help immediately.

Safety labels:



Wear safety goggles



Wear a dust mask



Wear chemically resistant gloves



Never look directly into the holes filled with the product



Never pour into receptacles with tapering rim



Irritant,
Risk of severe eye damage

PACKAGING AND STORAGE

DYNACEM needs to be stored in a dry place. Once a receptacle has been opened it has to be re-sealed as soon as possible. All air must be squeezed out, prior to re-sealing and continued storage, as DYNACEM powder tends to absorb moisture and gradually loses potency when exposed to the atmosphere.

Packaging: 5 kg and 20 kg PE bags and boxes.

DISCLAIMER

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