

The Tripping Point

PMN-2 Land Mine



The PMN-2 is an inexpensive and popular anti-personnel land mine that was first designed in the former Soviet Union. It has been deployed in more than 15 countries in different forms and configurations.

CONSTRUCTION

Height: 53 mm
Diameter: 120 mm
Weight: 550 grams

Key Components

1 Injection Molded Plastic Casing
The case is inexpensive to manufacture, and is non-metallic, which makes it more difficult for conventional metal-sensitive detectors to locate when deployed.

2 Pressure Plate Assembly
The “cap” of the landmine is the **pressure plate** assembly, which consists of a rubber cap, the cross-shaped pressure plate, a mating cutout and a threaded retaining ring. A pair of stiff compression springs supports the pressure plate and determines the load required to trigger the mine. Fabric straps support the arms of the pressure plate in the event of asymmetric loading. Depressing the plate actuates a central plunger.

3 Delayed Arming Assembly
The arming assembly has a time delay mechanism comprised of an arming key, a black rubber air **bellows**, a compression spring, and a round cover plate. Removal of the arming key initiates the mechanical sequence that places the mine in a “live” state where it is ready to be triggered.

4 Slider Assembly
The slider assembly consists of the detonator slide and a powerful compression spring. Prior to arming of the mine, its motion is restricted by the blocking arm linked to the bellows. After arming, its motion is mediated by the compression spring and a ramp feature on the central plunger.

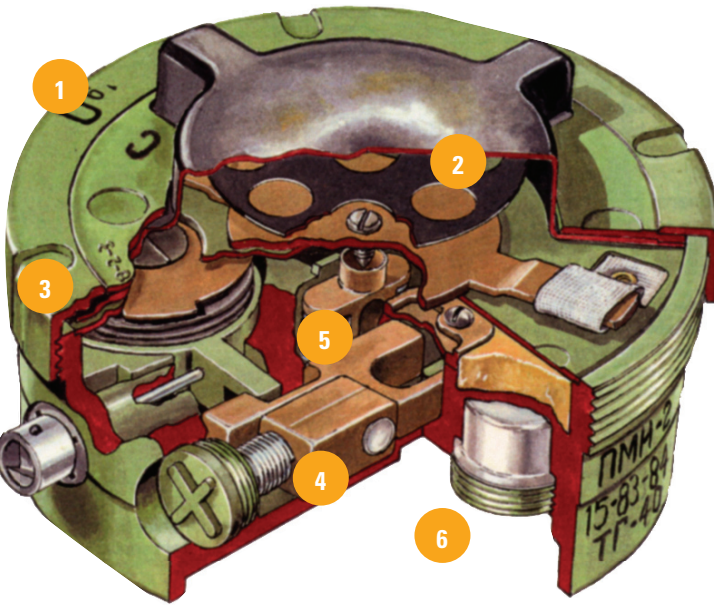


Image courtesy of Jane's Mines and Mine Clearance, ed. Colin King

5 Initiator Cartridge
The first of three blasts in the explosive chain of this mine, the detonator consists of a stab-sensitive initiator cartridge, which is activated when pierced by the striker pin. The striker pin (not visible), like the slider assembly, is released when the plunger is depressed. Its role in the firing system is functionally similar to that of a primer in a rifle cartridge, as it translates the kinetic energy of the firing pin into a chemically generated shaped explosion of flame and hot gas.

6 Booster
The booster assembly is placed into a round chamber on the underside of the mine, and is secured with a threaded **plug**. The second element in the mine's explosive chain, this high explosive transfers the initial “spark” from the detonator to the main charge. In this PMN-2, the booster may be removed by unscrewing the booster plug. In general, without the booster, the detonator cannot initiate the main charge.

7 Main Explosive Charge
The **primary explosive** is typically 100 grams of a mixture of the explosive compounds RDX and TNT. A thick liquid when heated, the explosive charge is poured into its compartment during manufacturing. The main explosive charge cools into a solid form in a few moments, resulting in a snug, cast-in-place assembly.

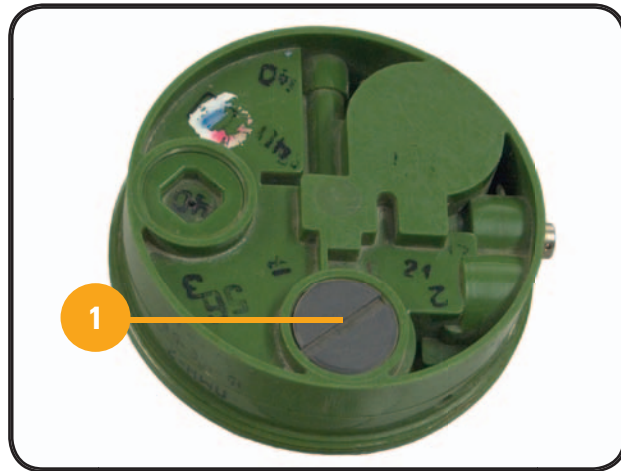
SAFE

It starts out safe and simple to deploy for the setter of the mine, yet, once armed, becomes a dangerously effective tool for injuring enemy foot soldiers. It achieves this transformation with a purely mechanical design; there are no batteries or electronics to run or wear out.

ARMING

Preparing, Placing and Arming the PMN-2

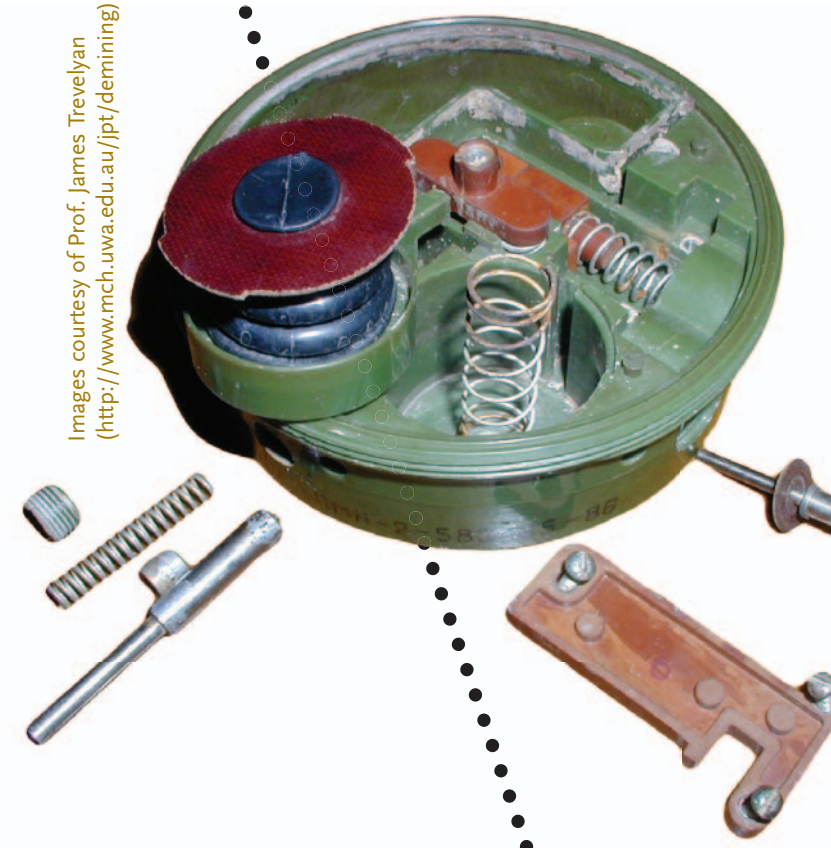
1. Unscrew the booster plug on the underside of the mine, place a booster charge in the cavity, and secure it by screwing in the booster plug.
2. Prepare a hole in the ground by hand or with a hand tool.
3. Rotate the arming key, pull it out of the mine housing, and discard it. This shears the arming pin, which allows the air bellows to be inflated by the compression spring. This expansion lifts a “safety” bar from the path of the slide.
5. This inflation process takes 2-3 minutes and gives the mine setter the time needed to bury, camouflage and escape from the mine safely.
6. Place the mine into the hole with the rubber cap up.
5. Cover the mine with loose dirt and vegetation to camouflage it.



The PMN-2 is safe until the detonator fuze (1) is inserted. The extraction of the arming pin initiates the rising of the bellows (3). The empty chamber in (2) is usually filled with explosive charge.

UNSAFE

Images courtesy of Prof. James Trevelyan (<http://www.mch.uwa.edu.au/jpt/demining>)



Blast Resistant Mines

The designers of the PMN-2 landmine have done much to increase the destructive life of a mine by engineering it to be resistant to false triggers caused by nearby explosions. Designers have exploited the fact that, though powerful, explosive blasts are also typically very brief. A force applied to the PMN-2 doesn't directly detonate the mine but instead initiates the alignment of the pin and detonator that, in turn, initiate the explosive chain.

This alignment takes time and, if the force applied is too brief, the spring loaded plunger returns to its starting position. With this rising of the central plunger, a ramp on the plunger returns the slider mechanism to its initial position, the striker pin is reset, and mine is returned to a state of lethal readiness.

Triggering the PMN-2 Land Mine

1. When a force of sufficient magnitude and duration is applied to the black rubber cap the mine is triggered.
2. The force on the cap is translated to the pressure plate, then to the plunger in the center of the pressure plate.
3. Downward motion of the plunger frees the slider assembly to align with the booster charge.
4. This motion also initiates the release of the striker pin that activates the stab-sensitive detonator carried on the slide assembly.
5. Once pierced by the striker pin, the detonator ignites generating a pulse of hot gases and flame.
6. A pulse of hot gases and flame reaches the booster charge through a small opening in the plastic casing.
7. The booster charge then ignites and explodes.
8. The exploding booster sets off the main explosive charge.

The mine is designed to resist common methods of detection and disarmament. It is relatively insensitive to blast waves and shock, but is easily triggered by a foot stepping on it.

DETONATION

Design Challenges Unearthed

As designers, we are compelled to consider the complete life spans of the products we create. Just as with computers and televisions, where we must consider their reuse, recycling and disposal, so must we address the life and use of landmines beyond times of conflict. There are no permanent battles. Yet, long after conflicts shift both in time and geography, the fields of battle remain.

Millions of inhabitants in over 70 countries strive to manage the peacetime consequences of landmines. The well achieved design requirements of resistance to both detection and neutralization become, in turn, the challenges offered to those seeking to restore mine-infested land to livability and agricultural viability.

Mine clearance is most often undertaken by non-military forces. These well-trained teams typically employ time-intensive manual methods that include systematic probing of the ground and careful unearthing and tagging of any suspected mines. Of equal concern are the reuse of unexploded ordnance in the creation of improvised explosive devices; the care and rehabilitation of civilians injured by mines;



A Cambodian farm boy pulls his family's cow through land that has been marked as a mine field. He and his family have no choice but to live with mines.



A landmine victim now helping to clear Cambodian fields of mines. He is carrying a metal detector used to sense metal components of buried mines.

and the social and political address of the landmine use and disposal.

Unsurprisingly, this functional dissection raises far more questions, opportunities and concerns than it is able to address. Having offered the briefest glimpse into the social and technical challenges raised by the design and use of landmines, we invite you to join us on our blog (www.ambidextrousmag.org/blog) for continued examination and discussion of this important topic. 🙌

Once activated, a PMN-2 mine can be lethal for many years, as it resists both weathering and moisture. Like many other land mines, it has no timed self-destruct mechanism.

AFTERMATH

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