



Nederlands Forensisch Instituut
Ministerie van Justitie en Veiligheid

Factsheet

Danger assessment of COBRA 8 and similar fireworks



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1. Factsheet in general

The Netherlands Forensic Institute (NFI) conducts a wide variety of investigations. An investigation report from the NFI may be accompanied by a factsheet. This serves as (additional) background information and is of an informative character.

2. Introduction

The expert area of Explosions and Explosives at the NFI frequently receives questions about the dangers of fireworks. A dangerous firework article that frequently appears in the Netherlands is the COBRA 8. This firework article and its effects have been investigated by the NFI. This factsheet summarizes the research results with the aim of providing a general overview of the dangers of an exploding COBRA 8 and similar firework articles.

3. Description COBRA 8

3.1. Other articles with the name COBRA

There are various firework articles with a name that includes 'COBRA'. A well-known example is the 'Super COBRA 6,' about which the NFI has released another factsheet. The factsheet you are now reading is about the 'COBRA 8.' The 'COBRA 8' contains significantly more pyrotechnic charge than, for example, the 'Super COBRA 6.' This factsheet also applies to firework articles with a comparable amount of charge and internal structure as the described 'COBRA 8.' If in doubt, you can contact your forensic explosives expert.

3.2. External characteristics and internal structure of the COBRA 8 (without effect charge)

The COBRA 8 (without effect charge) is a pyrotechnic article¹ consisting of a cardboard tube with a shiny silver paper label featuring stars (see photo 1). This label always includes the designation "COBRA 8" and a drawing of a green snake. Fonts, colors, and details on the label may vary.



Photo 1. Example of an intact COBRA 8.

Photo 2. Internal structure of the COBRA 8 in photo 1.

The internal structure of this type of COBRA 8 is visible in photo 2 and schematically depicted in figure 5. This COBRA 8 has a cardboard tube of approximately 23 centimeters long and approximately 5 centimeters in

diameter, closed at both ends with a cardboard disk. The tube contains two compartments, separated by another cardboard disk. One of the compartments is empty. The other is filled with a grey powder. Based on multiple articles of this type of COBRA 8 examined by the NFI, it is known that the grey powder has the composition of flash powder² and that there are roughly between 80 and 110 grams of flash powder present. At one end, a green firework fuse protrudes through a cardboard disk. This fuse extends inside the tube and into the flash powder. Sometimes this fuse is additionally secured to the cardboard disk with glue.

3.3. External characteristics and internal structure of the COBRA 8 (with effect charge)

The NFI also investigated a variant of the COBRA 8 that contained an effect charge of black powder (see photo 3).



Photo 3. Example of an intact COBRA 8 with effect charge.

Photo 4. Internal structure of the COBRA 8 in photo 3.

The internal structure of this type of COBRA 8 is visible in photo 4 and schematically shown in figure 6. This COBRA 8 has a cardboard tube of approximately 22 centimeters long and approximately 4 centimeters in diameter, closed at one end with a black plastic cap. The other end is closed with a lump of compressed black powder³. A green firework fuse lies against the black powder. This type of COBRA 8 contains approximately 40 grams of black powder and approximately 90 grams of flash powder.

¹ A pyrotechnic article is a device containing a pyrotechnic charge. A pyrotechnic charge is a single substance or - in almost all cases - a mixture of two or more substances which together form an (explosive) flammable material. Pyrotechnic mixtures can for example be used in fireworks and firearms. Mixtures of this kind comprise at least one substance which serves as fuel (reductor) and one substance that serves as oxygen supplier (oxidizer).

² In this factsheet, flash powder refers to a pyrotechnic mixture consisting of potassium perchlorate (oxidizer) with a metal

powder (fuel) which may or may not be mixed with sulphur (fuel). In most cases, the COBRA 8 contains a mixture of potassium perchlorate and aluminium, but there are other compositions of flash powder. The precise composition of the flash powder in a COBRA 8 has no significant influence on the hazards in the event of an explosion.

³ Black powder is a pyrotechnic mixture consisting of sodium- or potassium nitrate and charcoal, with or without sulfur (mostly with).

3.4. Variations and similar firework articles

The internal structure of both COBRA 8 types is shown schematically in figures 5 and 6.

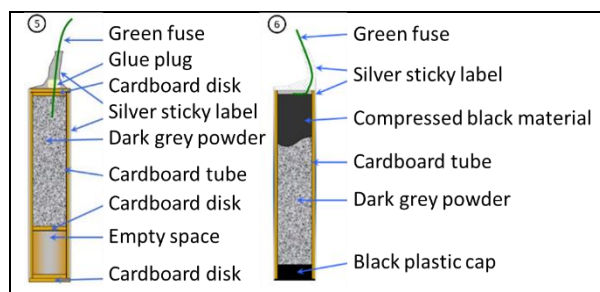


Figure 5. Schematic overview of the Cobra 8 in photo 1.

Figure 6. Schematic overview of the Cobra 8 in photo 3.

There are other (fireworks) articles—with names other than COBRA 8—that contain a comparable amount of flash powder, enclosed in a cardboard tube with a similar structure as in Figures 5 and 6, and therefore pose the same dangers. The NFI can determine whether a particular firework article belongs to this group based on previous or new research.

3.5. Legal aspects in the Netherlands

The COBRA 8 is factory-produced as a commercial firework article. The definition of fireworks according to the Dutch Fireworks Decree is: 'pyrotechnic articles for entertainment'. In short, a pyrotechnic article like the COBRA 8 can only be called fireworks if it is used for entertainment purposes. Whether a COBRA 8 meets this definition depends on the specific situation and circumstances of a case. This is up to the court to determine. Depending on the user's apparent intended use, the NFI can, upon request, conduct an assessment against the Fireworks Decree and the RAC⁴ or, for example, the Weapons and Ammunition Act.

Assuming the COBRA 8 is deemed a firework, it will always be considered a professional firework according to the Fireworks Decree.⁵ This is because cardboard tubes containing in the order of 100 grams of flash powder always pose a significant danger and are intended exclusively for use by persons with specialized knowledge (in accordance with the Fireworks Decree, Article 1.1.2a). Therefore, the COBRA 8 should never be made available to the general public.

4. Danger assessment of COBRA 8

4.1. Functioning and effects

The intended operation of a COBRA 8 without an effect charge (Figure 5) is as follows: the green fuse is ignited and burns until the fuse's flame reaches the flash powder in the cardboard tube. The total burning time depends on the fuse length and is usually between approximately 5 and 10 seconds. As soon as the fuse's flame reaches the flash powder, the flash powder explodes instantly with a very loud bang and a flash of white light. This produces heat, flames, and a pressure wave. The COBRA 8 is ripped apart, and the hot cardboard fragments are thrown out.

The intended operation of a COBRA 8 with an effect charge (Figure 6) is as follows: the green fuse is ignited and burns until the fuse's flame reaches the black powder. The total burning time depends on the fuse length and is usually between approximately 5 and 10 seconds. The compressed black powder doesn't explode, but burns with an orange-red flame. The function of the compressed black powder is that of a color-effect charge. This effect charge also delays the detonation, because only once the black powder has completely burned (which usually takes between 10 to 20 seconds) does the flash powder explode instantly with a very loud bang and a flash of white light. This produces heat, flames, and a pressure wave. The COBRA 8 is ripped apart, and the hot cardboard and plastic fragments are thrown out.

4.2. Mass explosivity

A cardboard tube containing about 100 grams of flash powder can exhibit mass explosive behavior under certain conditions. This means that a COBRA 8 can explode simultaneously with one or more other flash powder-containing articles when they are in very close proximity. In this case, the flash powder in the other articles do not explode because a fuse is lit, but because (another) COBRA 8 explodes. A sufficiently powerful explosion in the immediate vicinity of one or more COBRA 8 firework articles can also cause them to explode (simultaneously). This aspect of mass explosivity contributes to a greater risk and is relevant in cases involving more than one COBRA 8 article or a COBRA 8 located near other flash powder-containing articles (for example, in a storage location or in a backpack).

⁴ RAC = Regulation on the Designation of Consumer Fireworks pursuant to Article 1.1.1 and Article 2.1.1 of the Dutch Fireworks Decree.

⁵ Upon request, the NFI can provide full substantiation in the form of an assessment according to the Dutch Fireworks Decree.

4.3. Dangers during the explosion of the COBRA 8

The dangers posed by an exploding COBRA 8 depend on many factors⁶. It is not possible to include all scenarios in this factsheet. Therefore, this section will give a general danger assessment. If more specific information is required (in a criminal case), a forensic explosives expert should be consulted.

In the case of a COBRA 8 with effect charge, there is an initial risk of fire and burns due to the flame. The flame may also lead people to believe the item is a (pyrotechnic) torch and underestimate its danger, resulting in direct contact with or being very close to the COBRA 8 when it subsequently explodes. In fact, there are known Dutch cases of people kicking, picking up, or holding a burning professional firework article at the moment it explodes.

When a COBRA 8 (with or without an effect charge) explodes (see photo 7), it poses dangers to people and property nearby. When a COBRA 8 explodes directly against an object, it will almost always damage that object. The level of injuries caused by the explosion to individuals depend, among other things, on their location relative to the explosion. For example, physical contact with a single COBRA 8 at the time of the explosion will always result in very serious or even fatal injuries⁷ due to the pressure wave and the heat. In the event of (nearly) direct contact with, for example, the head, neck, or torso of an unprotected person, the injury is fatal.

At greater distances, the specific circumstances determine whether, and to what extent, the heat and pressure wave will cause injury. For example, the heat released by the explosion can ignite highly flammable surrounding materials (e.g., synthetic clothing), leading to fire and burns.

The pressure wave can cause lung damage within half a meter and can lead to permanent hearing damage such as eardrum rupture⁸ up to several meters away from the explosion. This pressure wave can also cause other forms of (temporary) hearing damage up to tens of meters away. The occurrence and severity of hearing damage depend on specific local factors and the condition of the individuals involved.⁹

In addition to the injuries described above from the blast wave and heat of the explosion, injuries can also occur from the impact of shards and fragments. At relatively short distances, hot fragments of cardboard and (if present) plastic from a COBRA 8 can cause skin injuries. If the COBRA 8 damages a nearby object, shards and fragments can be thrown from that object at high speeds. If these shards and fragments are made of a hard material such as glass, metal, or stone, they can cause bodily harm up to tens of meters away (in a open path). The severity of the injury depends on the shape, weight, and velocity of the shard or fragment. All forms of injuries⁷ are possible here. The chance of being hit depends, among other things, on the number of fragments/shards released during an explosion and can vary significantly due to specific local conditions.

For the specific scenario in which a COBRA 8 is thrown at professional emergency responders and law enforcement officers, the above-mentioned dangers apply too, if they are not wearing protective clothing or hearing protection and/or are hit on an unprotected part of their body. The NFI cannot comment on the effect of an exploding COBRA 8 on a person wearing protective clothing without further investigation. This is due to the wide variation in properties of protective clothing. Previous research by TNO has shown that the explosion of a COBRA 8 can, in certain cases, puncture protective clothing and thus lead to injury.⁸

⁶ Dangers are only described in broad terms in this factsheet given that a specific description of the location where the explosion occurs is not provided. Objects present at a location can contribute to more or less danger for bystanders. The position of a person's body is not taken into account either (upright or squatting, for instance), nor the height at which the explosive device explodes, in relation to that person (at eye or on the ground, for example). The number and the position of bystanders at a location also play a role in assessing the dangers. Generally, more tests must be performed in order to precisely determine the dangers for one specifically described scenario.

⁷ The Explosives and Explosions department at the NFI uses the following series for the level of injury (in ascending order):

- Physical injury: minor injuries requiring doctor's treatment and/or reversible injuries (ears – no deafness, eyes – no blindness).

- Severe physical injury: irreversible injuries (in the case of ears – deafness, eyes – blindness) or injuries which will have serious consequences if untreated.
- Very severe physical injury: permanent disfigurements which could lead to death, if untreated.
- Fatal injury: injury which results in almost instantaneous death.

⁸ TNO-report: TNO 2017 R10577 | 2, Onderzoek naar de impact van illegaal vuurwerk. Opdrachtgever: Politie, Staf Korpsleiding, Directie Operatiën, Den Haag.

⁹ Entitlement eligibility guidelines, hearing loss, MPC 00646, ICD-9 389.1 (Sensorineural Hearing Loss), 389.0 (Conductive Hearing Loss), veterans affairs Canada, April 2006.

As explained at the beginning of this section, the dangers posed by an exploding COBRA 8 depend on many factors. If this factsheet does not provide sufficient insight into the dangers posed in a specific case, it is recommended to contact your forensic explosives expert. This also applies if a case involves more than one COBRA 8 or a single COBRA 8 in combination with other fireworks (see also §4.2). Contacting a forensic explosives expert is also recommended if any modifications have been made to the COBRA 8 (such as the addition of an spray can, nails, a bottle of gasoline, etc.).



Photo 7. Explosion of a COBRA

For general questions, you can contact the NFI by phone +31(70) 888 68 88.

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