

NAMMCO



## NORTH ATLANTIC MARINE MAMMAL COMMISSION



### **Manual for the maintenance and use of weaponry and equipment deployed in hunting of baleen whales in NAMMCO member countries**

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## **ACKNOWLEDGEMENTS**

The North Atlantic Marine Mammal Commission – NAMMCO – is proud to present this manual for the instruction on the maintenance and use of weaponry and equipment deployed in whaling of baleen whales in NAMMCO member countries.

NAMMCO would like to especially acknowledge the work of Dr Egil Ole Øen who has generously shared his broad expertise of hunting techniques and equipment related to whaling with the harpoon gun with explosive grenades and rifles. Dr Øen has been instrumental in the development of this manual; without his dedicated input the production of this manual would not have been possible.

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*Cover photo: SK Knudsen*



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## PREFACE

Coastal people's right to hunt and utilise marine mammals has always been a firmly established principle in the North Atlantic Marine Mammal Commission – NAMMCO. Embedded in this right is also the obligation for hunters and the competent authorities to conduct the hunt in a sustainable way and in such a manner that it minimises animal suffering associated with the hunting and killing methods, and take into account hunters' safety.

The Committee on Hunting Methods, formally established in 1994, facilitates NAMMCO's work in this field and gives advice on hunting methods to the Council and the member countries. Advice given should be based on the best available scientific findings, technological developments and users' knowledge, and with due consideration to safety requirements and the efficient use of the resources. The Committee has organised much of its work through the convening of international workshops and expert group meetings on specific topics. A recurring recommendation has been to enhance hunters' training.

During the capture of large whales, the harpoon gun and harpoon with explosive grenade are used. As a backup weapon, a large calibre rifle with full jacket bullets is employed. Over many years there has been a focus on the development and improvement of whaling equipment, capture techniques and training of gunners. Whaling has nevertheless continued to be a high risk business in terms of safety for personnel, and during the recent 15 years there have been some bad accidents caused by accidental shots from the whale gun.

NAMMCO's Committee on Hunting Methods has produced this manual for the maintenance and use of weaponry and equipment deployed in hunting of baleen whales in NAMMCO member countries. The target group is primarily the whalers and gunners, but also includes inspectors, observers and others engaged in whaling. The whalers and weaponry producers have been consulted in connection with this task, but the manual is the direct responsibility of the Committee on Hunting Methods.

The manual handles the killing with the whaling gun (cannon) in Greenland, Iceland and Norway and is structured in three parts as follows:

- 1) Information that everyone **must** know. This relates to essential safety information concerning the use of the weapon, gunpowder and explosives.
- 2) Information that everyone **should** know. This relates to technical data, function and maintenance of the Whale Grenade-99, the whaling gun (cannon), harpoon and rifle.
- 3) Information that is **useful** to know. This relates to an overview concerning control and maintenance of the whaling gun, safety tests for approving the Whale Grenade-99 and user advice and safety warnings about the Whale Grenade-99.

Some information is repeated in several chapters.

Tromsø, February 2014

NAMMCO's Committee on Hunting Methods:

Eyþór Björnsson, Nette Levermann, Kristján Loftsson, Justines Olsen, Kathrine A. Ryeng,  
Hild Ynnesdal, Egil Ole Øen



# **IMPORTANT SAFETY INFORMATION**

**THE WHALING GUN MUST ALWAYS BE HANDLED AS IF LOADED**

**NEVER STAND IN FRONT OF A LOADED GUN**

**THE GUN BARREL MUZZLE MUST ALWAYS POINT TOWARDS THE SEA**

**THE BREECHBLOCK MUST NEVER BE USED TO KNOCK IN A CARTRIDGE CASE THAT IS STUCK IN THE BARREL**

**THE GUN, HARPOON AND CARTRIDGE CASE MUST ALWAYS BE MAINTAINED**

**THE HARPOON MUST BE STRAIGHT AND FIT THE GUN BARREL**

**HARPOONS THAT HAVE TO BE KNOCKED INTO THE BARREL MUST NEVER BE USED – THE STRIKING ACTION CAN IGNITE THE BLACK POWDER AND RELEASE THE SHOT**

**FOLLOW THE USER ADVICE FOR THE GRENADE**

**THE GRENADE MUST BE HANDLED CAREFULLY BECAUSE IT CONTAINS EXPLOSIVES AND OTHER IGNITABLE MATTER**

**THE GRENADE MUST BE HAND-SCREWED ONTO THE HARPOON – NEVER USE TOOLS**

**HARPOONS WHERE THE GRENADE CANNOT BE HAND-SCREWED ON MUST NOT BE USED**

**NEVER SHOOT WITH A GRENADE WHERE THE TRIGGER HOOK OR TRIGGER LINE IS LOOSE**

**NEVER PULL ON THE TRIGGER LINE**

**IF ONE IS UNCERTAIN ABOUT WHETHER OR NOT A GRENADE HAS DETONATED, THE HARPOON MUST BE REMOVED BY CUTTING IT LOOSE FROM THE WHALE'S BODY**

**WHEN THE BOAT IS ALONGSIDE THE QUAY, THE GRENADE MUST BE UNSCREWED FROM THE HARPOON AND THE IGNITION CARTRIDGE REMOVED FROM THE GUN**

**NEVER PUT THE RIFLE AWAY WITH A SHOT IN THE CHAMBER**

**EMPTY OUT OR REMOVE THE MAGAZINE WHEN THE RIFLE IS NOT IN USE**



## PART I: WEAPONS AND EQUIPMENT: USE AND SAFETY INFORMATION

For safety reasons it is important to always follow the loading procedure.

1. Load the gun (cannon). Set in the harpoon and secure the forerunner to the harpoon.
2. Take out the grenade from the transportation box (Fig.1). Remove the transport security lid and hold on to the screw.
3. Screw the grenade right in to the harpoon so that it is armed and ready for the shot. Do not use tools, but tighten only with the hands. The trigger hook should be standing about midway between the claws of the harpoon, and be facing up (Fig. 27).
4. Check that the grenade is detonated (exploded) after the shot. If there is uncertainty regarding detonation and the harpoon with the grenade is inside the whale, the harpoon must be cut loose and not dragged out of the whale.

### Examples indicating that the grenade has detonated:

- Noise from the detonation
- Shaking in the animal
- The whale blows out air and rolls onto its back
- The whale sinks without moving

### HARPOON FAILURE

Grenades that will not screw in completely by hand indicate a fault in the harpoon threads. The grenade is not armed. Such harpoons **MUST NOT** be used.



Fig. 1. Whale Grenade-99 in transport box.

Photo: Nette Levermann

## THE WHALING GUN (CANNON)



*Fig. 2. 50 mm Kongsberg whaling gun with harpoon and Whale Grenade-99.  
Photo: Björgvin Guðmundsson*



*Fig. 3. 90 mm Kongsberg whaling gun with harpoon and modified Whale Grenade-99.  
Photo: EO Øen*



*Fig. 4. 60 mm Henriksen whaling gun with harpoon and Whale Grenade-99.  
Photo: SK Knudsen*

## 50 MM KONGSBERG WHALING GUN (FIG. 2)

Appendix I shows the 50 mm Kongsberg whaling gun identifying the most important parts.

### Safety Rules

- The gun must only be used by experienced personnel.
- The gun must always be handled as if it is loaded.
- The breechblock must never be used to knock in a cartridge case that is stuck in the barrel. If the cartridge case must be used anyway, put a wooden block between the breechblock and the cartridge such that it can be fixed in position. The wooden block must not press on the primer cap of the cartridge. This kind of cartridge should be removed or calibrated.
- Each time the gun is loaded, check that the firing pin does not stick out forward of the shock bottom of the breechblock.
- A correctly mounted firing pin projects 1.2 mm forwards of the shock bottom at the moment of firing and springs back into the breechblock.



*Fig. 5. Shock bottom in the breechblock of a 50 mm Kongsberg whaling gun. The firing pin is in the rear (secure) position.*

*Photo: EO Øen*

- Correct mounting and length of the firing pin can be checked by sliding the firing pin forward in front of the shock bottom and measuring the length.
- When the firing pin is replaced, the new firing pin must be adapted to suit the gun with the correct length.

- If the firing pin ranges itself after shooting, this is a sign that something is wrong with the mechanism, the harpoon or propellant. The failure must be rectified immediately as otherwise it may create a very big risk of an accidental shot.
- The harpoon must never be set into the barrel before the cartridge is sitting in the chamber and the firing pin is in the rear (safe) position.
- The harpoon must be straight and fit into the gun barrel. Harpoons that have to be forced into the gun barrel with tools (e.g. hammer) must not be used. If the firing pin is in the forward position the shot may go off.
- When the gun is loaded, the barrel muzzle must always point out to sea.
- Never stand in front of a loaded gun.
- When the harpoon is placed in the gun barrel, one should stand to the side of the barrel.
- Unscrew the grenade from the harpoon and remove the cartridge case when the boat is alongside the quay.

NB! The firing pin can unscrew and become loose after use and should therefore be secured with Loctite type 243 in the threads.

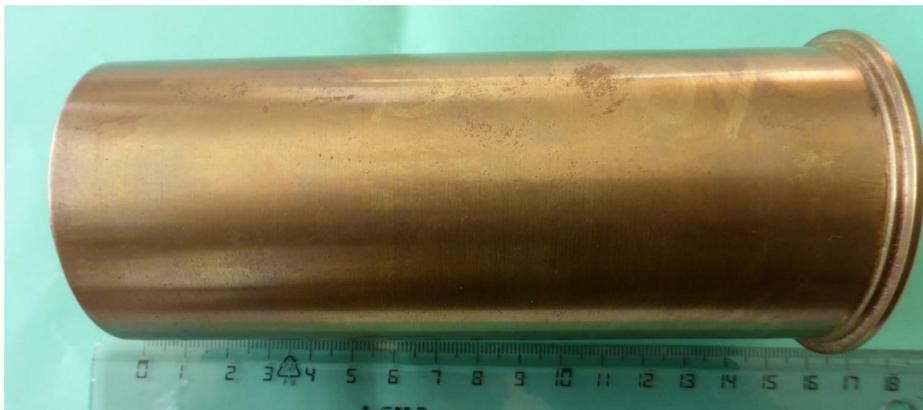


Fig. 6. Cartridge for a 50 mm Kongsberg whaling gun.

Photo: Nette Levermann

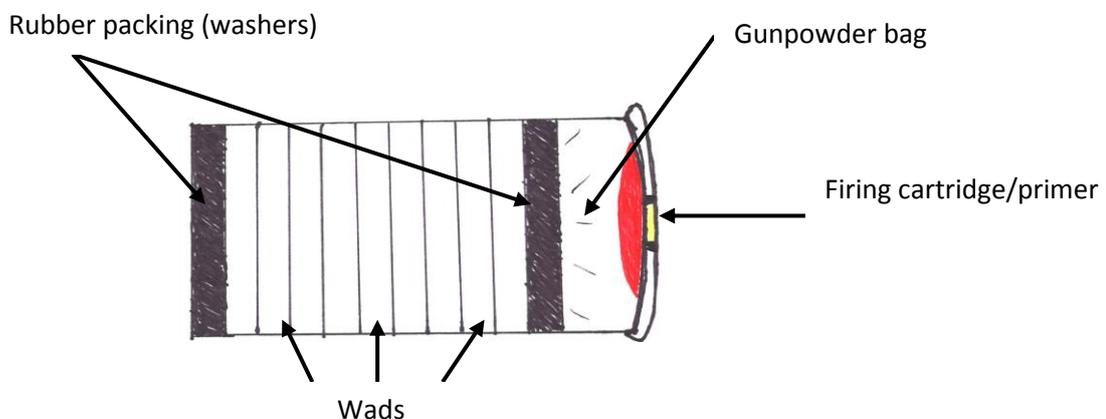


Fig. 7. Loaded cartridge. Seen in section through.

Illustration: C Winsnes



Fig. 8. Example of primers/firing cartridges for a 50 mm Kongsberg whaling gun.  
Photo: Nette Levermann



Fig. 9. Gunpowder bag for Kongsberg whaling gun.  
Photo: EO Øen



Fig.10. Wads with rubber packing (washers).  
Photo: Nette Levermann

## Loading

1. Open the gun's breechblock.
2. Check that the barrel is clean. Clean the barrel if necessary.
3. Check that the cartridge case goes into the chamber (cartridge sleeves expand with use and should periodically be calibrated or replaced).
4. Place the gunpowder bag in the cartridge case, with the red part against the opening to the primer pocket.
5. Put in the wads with rubber packing (washer) against the gunpowder bag and finally a rubber washer on the top of the cartridge case.
6. Put the primer in place on the primer pocket of the cartridge case.
7. Place the loaded cartridge in the chamber. The breechblock must never be used to ram in the cartridge.
8. Check that the firing pin is in the rear (safe) position before closing the breechblock (Fig.5).
9. Place the harpoon into the gun barrel and fasten the forerunner to the harpoon.
10. Screw on the grenade.
11. Cock the gun and put at safety.
12. The gun is now ready to fire.
13. After each shot, the gun barrel must be cleaned in order to remove powder residue and remains of the gunpowder bag and wadding.

The loaded cartridge case should slip easily into the chamber. If this is not the case, then the cartridge must be replaced or calibrated.

If the cartridge case is used anyway, place a wooden block between the breechblock and the cartridge such that it can be fixed in position. The wooden block must not press against the primer. If the cartridge case does not fall into position using this method, it must **NOT** be used.

It is dangerous to ram the cartridge into the chamber.

It is dangerous to ram the harpoon into the gun barrel with tools. If the firing pin is in the forward position the shot may go off.

It is dangerous to shoot with a grenade that has a loose forerunner or trigger hook. Loose parts can contribute to the grenade exploding in front of the gun barrel.

## 90 MM KONGSBERG WHALING GUN (FIG. 3)

### Safety rules

- The gun must only be used by experienced personnel.
- The gun must always be handled as if it is loaded.
- The harpoon must never be placed in the barrel before the cartridge has been set into the chamber and the firing pin is in the rear (safe) position.
- The harpoon must be straight and fit the gun barrel. Harpoons that have to be forced (hit) into the gun barrel with hammers must not be used. Striking the harpoon can ignite the gunpowder bag and cause the gun to fire.
- When the gun is loaded, the barrel muzzle must always point out to sea. (Fig. 11).



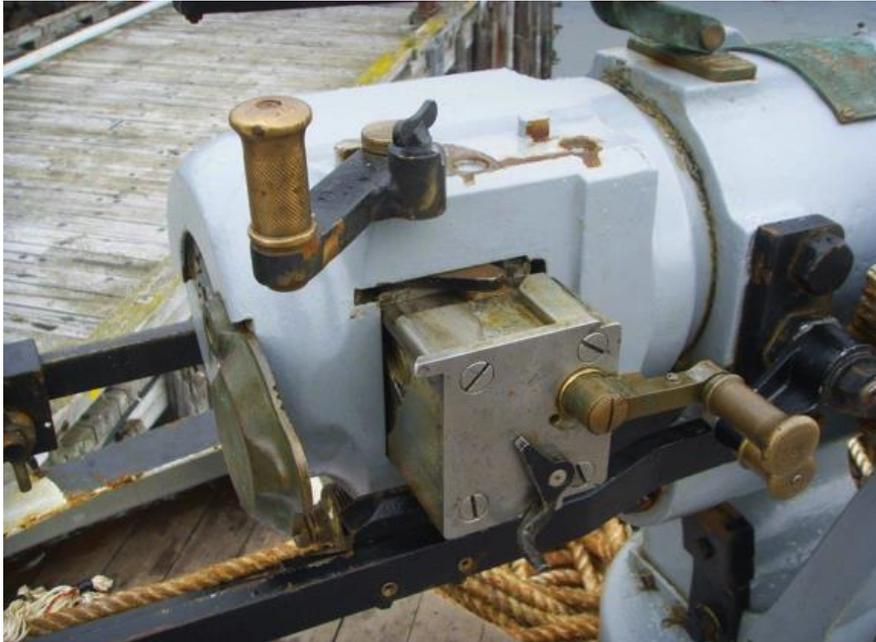
*Fig. 11. Ready loaded 90 mm Kongsberg whaling gun.*

*Photo: EO Øen*

- Never stand in front of a loaded gun.
- Unscrew the grenade from the harpoon and remove the cartridge and harpoon when the boat is alongside the quay.

### Loading

1. Open the whaling gun's breechblock (Fig. 12).
2. Check that the barrel is clean. Clean the barrel if necessary.



*Fig. 12. 90 mm Kongsberg whaling gun with open breechblock.  
Photo: EO Øen*

3. Check that the cartridge case goes into the chamber (cartridge cases expand with use and must periodically be calibrated or replaced) (Fig. 13).



*Fig. 13. Checking the cartridge case.  
Photo: K Loftsson*

4. Place the gunpowder bag into the cartridge case with the red part against the Primer pocket opening.
5. Place the wadding with two rubber washers into the cartridge case. The largest surface of the rubber washer with sloping walls must lie against the gunpowder bag. The other surface lays against the harpoon. (Figs. 14 and 15).



*Fig. 14 and 15. Wadding and rubber washer for 90 mm Kongsberg harpoon gun. The rubber washer with sloping walls to the right.*

*Photo: EO Øen*

6. Set the primer into the primer pocket of the cartridge case.
7. Put the loaded cartridge into the chamber (Fig. 16).



*Fig. 16. Loading of 90 mm Kongsberg harpoon gun.*

*Photo: K Loftsson*

8. Place the harpoon with the forerunner into the gun barrel. (Fig. 17).
9. Screw on the grenade and fasten the trigger hook on the serving wire. Tighten the trigger line and tape it fast to the grenade so that loose loops of line do not occur. (Fig. 18).
10. Cock the gun and put at safety.
11. The gun is now ready for firing.

12. Before each shot the gun barrel must be cleaned to remove powder residue and remnants of the gunpowder bag and wadding.



*Fig. 17. A harpoon is put into the barrel.  
Photo: K Loftsson*



*Fig. 18. 90 mm Kongsberg whaling gun with a harpoon and modified Whale Grenade-99 used for large whales. The trigger hook is fastened on the serving wire.  
Photo: EO Øen*

It is dangerous to shoot with a grenade that has a loose line or trigger hook. Loose parts can cause the grenade to explode in front of the gun barrel.

## 60 MM HENRIKSEN WHALING GUN (FIG. 4)

### Safety rules

- The whaling gun must only be used by experienced personnel.
- The whaling gun must always be handled as if it were loaded.
- Check that the opening between the primer and gunpowder bag is not clogged by looking through the barrel.
- Place the rubber washer on the wadding against the knot of the gunpowder bag.
- The harpoon must be straight and fit the gun barrel. Harpoons must not be struck into the gun barrel with hammering. The strikes against the harpoon can ignite the gunpowder bag so that a shot may be fired.
- When the gun is loaded the muzzle must always point out to sea.
- Never stand in front of a loaded gun.
- Unscrew the grenade from the harpoon and remove the primer when the boat is alongside the quay.

### Loading

1. Before loading the whaling gun, the gun barrel must be thoroughly cleaned (Fig. 19). Check that the barrel is entirely free of remains of the wadding and gunpowder. Glowing remains in the barrel can ignite the gunpowder bag. Grease/oil the barrel when necessary with fat that will not contaminate the whale meat.



*Fig. 19. Cleaning of the barrel of the whaling gun. (From test shooting of whale grenades)  
Foto: EO Øen*

2. Ensure that the opening between the primer and the powder charge is open. This is done best by twisting the firing mechanism to the side of the HHMV firing mechanism (Fig. 23) and looking through the barrel. In guns with the Remington mechanism (Fig. 24), the primer must be removed.

- Put the wadding on the gunpowder bag. The “hole” side of the rubber washer on the wad should be placed against the knot of the gunpowder bag. (Figs. 20 and 21).



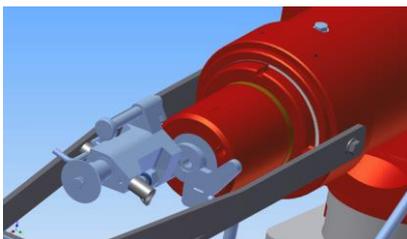
*Figs. 20 and 21. Loading of 60 mm Henriksen whaling gun. (From test shooting of whale grenades) Photo: EO Øen*

- The gunpowder bag with the wadding is slid all the way in to the barrel so that the red part of the gunpowder bag comes up against the hole in the bottom of the barrel. Use a loading (charging) stick. (Fig. 22).



*Fig. 22. Gunpowder bag is slid in to the bottom of the barrel with the charge stick. Photo: EO Øen*

- Set the harpoon into the barrel and fasten the forerunner to the harpoon.
- Screw on the grenade.
- Trip the cock and set in the primer.
- Put in the primer and close the firing mechanism again (HHMV mechanism).
- Put at the safety (HHMV mechanism).
- The gun is now ready to shoot.



*Fig. 23. HHMV firing mechanisms (blue colour) of a 60 mm Henriksen whaling gun.*



*Fig. 24. Remington firing mechanism of a 60 mm Henriksen whaling gun. Photo: EO Øen*

## WHALE GRENADE-99

The grenades must always be stored and transported in a transport box.

### MOUNTING

1. Unscrew the transport security lid. Take care of the lid and screw so that the grenade can, if necessary, be secured for transport again. (Fig. 25).
2. Screw the grenade all the way in to the harpoon. NB! Lefthanded screw.
3. Screw in only with the hands. Tools must not be used that could damage the grenade. Regarding correct mounting, the trigger hook should stand about midway between the claws of the harpoon and face up (Fig. 27). The grenade is now armed and ready to shoot.
4. If the grenade cannot be screwed in by hands alone, there is a fault in the thread of the harpoon. The grenade will not be armed and will not detonate. **SUCH HARPOONS MUST NOT BE USED.**
5. An undamaged grenade is automatically set in safe mode when unscrewed from the harpoon. This can be checked by investigating that the arming mechanism has gone back completely. (Figs. 26 and 37).

An armed grenade cannot detonate before the trigger line is tightened so much that it lets off the firing mechanism in the grenade.

#### **How can one check that the grenade is safe?** (Figs. 26 and 37)

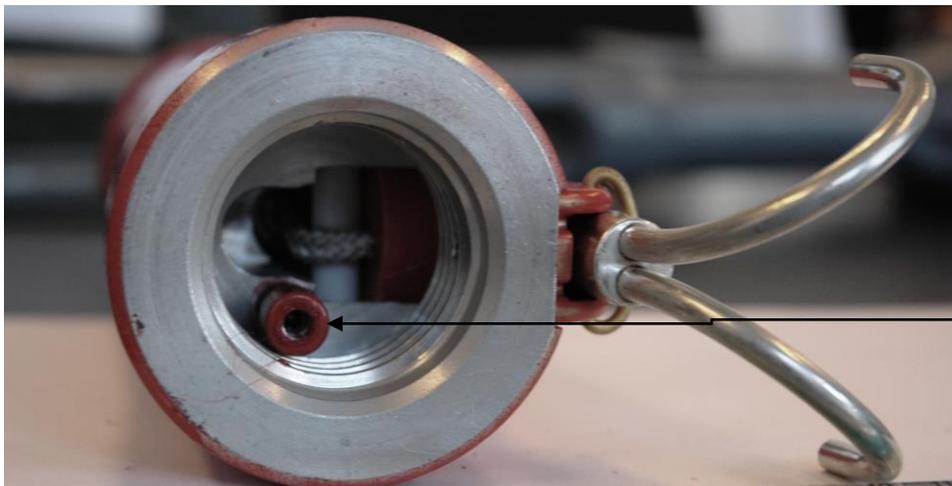
Unscrew the grenade from the harpoon. Then the threaded hole and arming rod are visible at the back end. The outermost 10 mm of the arming rod is painted red.

On a **safe** (unarmed) grenade **both the red and the uncoloured part** of the arming rod are visible.

On an **unsafe** (armed) grenade **only the red part** of the arming rod is visible.



*Fig. 25. Whale Grenade-99 secured for transport with the transport lid  
Photo: Nette Levermann*



*Fig. 26. Whale Grenade-99 as seen from the back with the arming rod in the back (safe) position  
Photo: Nette Levermann*

## **FIRING OF SHOTS**

### **Strikes**

As a rule, with a strike (hit), one can hear the grenade detonate and/or see the reaction of the whale. See the red (text) box on page 11.

As a rule, the harpoon goes straight through a minke whale after the grenade has detonated. In a detonated grenade, the red aluminium cartridge case on the grenade is ripped off (Fig. 28) or the grenade is broken in two. Grenades that have not detonated are handled as DUDS. See page 26.



Fig. 27. Whale Grenade-99 with the triggerhook. (From test shooting of whale grenades).  
Photo: EO Øen



Fig. 28. Whale Grenade-99 after detonation.  
Photo: EO Øen

Should the harpoon not go through the whale and one is uncertain about whether or not the grenade has detonated, the harpoon **MUST ALWAYS BE CUT LOOSE**. The harpoon **MUST NOT BE PULLED OUT** because the triggerhook can catch fast and detonate the grenade.

### Misfire and stray shots

A misfired (wasted) shot is when the grenade does not detonate and it can be used again. A stray grenade can have the triggerhook pulled loose but not detonate. When the harpoon is hauled on deck, the grenade can be unscrewed in the usual manner from the harpoon. Make sure that the grenade is safe. (See red text box on page 23 and Figs. 26 and 37). If the trigger hook is loose, it must be fastened on the hook holder with a new brass pin. Afterwards place the line down in the plastic cup and secure with two rounds of solid tape. If the line is worn away, the grenade cannot be used again and must be returned to the transport case with the transport lid in place.

After a wasted shot, the triggerhook and trigger line must be carefully fastened before the next shot. (Fig. 29)



Fig. 29. Whale Grenade-99 where the loose trigger string is layed back in the plastic cup and taped fast.

Photo: EO Øen

A grenade that has been in salt water should be rinsed in freshwater before being put in the transportbox.

## DUDS

If the grenade is inside the whale, it must be cut loose and not pulled out.

A dud shot is a grenade that has gone in or through the whale without detonating. **As long as such grenades sit on the harpoon, they remain armed** (unsafe) and should be handled in the following way:

1. Unscrew the grenade from the harpoon.
2. Check that the arming rod goes back into the safe position. (Figs. 26 and 37).
3. If the arming rod is back, then the grenade is safe. If the trigger line is intact, the grenade can be used. If the trigger line is missing, the grenade cannot be used.
4. Should the arming rod not go back into the safe position on its own, one can try to draw it back with the screw in the transport lid. Afterwards place the lid on and store the grenade in the transport box so that it can be destroyed (Fig.1).
5. If one is unable to secure the grenade and the trigger line is in place, cut it off close to the opening. Remove the triggerhook before the grenade is placed in the transport box for destruction. **DO NOT PULL THE LINE.**

Cut off the trigger line and remove the trigger hook from grenades that are placed in the transport box for destruction.

## SECONDARY WEAPON (BACK-UP)

It is common to have a backup method should the whale not die immediately as a result of the first killing attempt, or there is uncertainty about the result of the shooting. In the minke whale hunt, a rifle is used instead of firing a new grenade. In the hunt for larger whales the backup method is to load and fire a new grenade.

## ANATOMY AND TARGET SITES

### GUN/RIFLE SHOTS

Guns are used as the secondary weapon in the minke whale hunt. The gunshot is directed to the brain of the animal. The site of the brain in minke whale in relation to the outer body characteristics such as eye and blowhole are shown in Fig. 30. The chart has been produced by the Norwegian Veterinary High School based on measurements of minke whale skulls.

The NAMMCO member countries have different requirements for calibre and ammunition for secondary weapons.

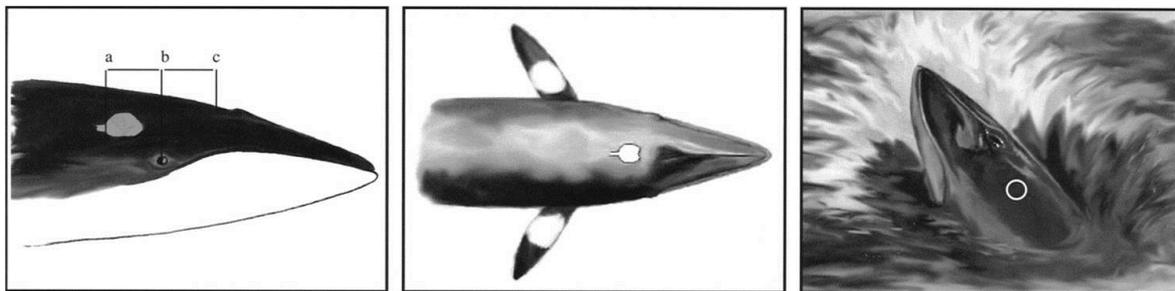


Figure 1  
Minke whale head with the brain as seen from the side

Figure 2  
Minke whale head with the brain as seen from above

Figure 3  
Minke whale head with the characteristic target point for the rifle seen obliquely from the back

*Fig. 30. The brain's location in the minke whale and target sites for gunshot from different positions. (SK Knudsen, H Rud and EO Øen)*

*Seen from the side, the brain is positioned on a plane mid-way between the eye and dorsal surface of the head. Fig. 1 shows the back edge of the brain laying along a projection on a horizontal line (a) as far behind the eye (b) as the blowhole (c) extends to the front of the eye. The brain of the minke whale is about 20 cm wide, 20 cm long and 15 cm high. The centre of the brain lays about 55 cm back from the blowhole opening in a small (5.5 m) minke whale and about 75 cm back from the blowhole opening in a large (8.5 m) minke whale.*

### Safety Rules

- The gun must always be handled as if loaded.
- Never put the gun away with a shot in the chamber.
- Empty out the magazine when the gun is not to be used immediately.

- Clean the weapon frequently to avoid rusting and malfunctioning.
- Concerning loading and use, the gun barrel must always point out to sea and not inwards to the deck.
- The cartridge should go easily into the cartridge chamber. If it is to be pushed in hard with the bolt, check for mechanical problems or dirty chamber/ barrel or wrong type of ammunition, which can lead to the barrel blowing up when the shot is fired.
- A weak recoil or a hissing sound following a shot can mean that the bullet has not left the barrel. The gun barrel must be checked to ensure it is empty before the next shot is fired.
- If the shot does not go off the most usual reason is lack of maintenance or fat/powder residue on the firing pin.
- If the shot goes off on loading (accidentally) it can be blamed on the firing pin projecting forward from the end piece because fat/powder residue is stopping it from going back into the safety position.

Rifle bullets are slowed quickly in water, regardless of the calibre and weight of the bullet. To ensure that the bullet penetrates the brain, the shot must be fired when the head is above water.

### **WHALING GUN (CANNON) SHOTS**

The Whale Grenade-99 is constructed so that it should detonate when it has penetrated to a depth of 65-70 cm inside the whale. The Whale Grenade-99 made for large whales (fin whale, bowhead and humpback whale) should detonate close to 110-120 cm deep inside the whale.

The heart and lungs together with their major blood vessels lay in the chest cavity. Above the chest cavity lies the back region with the spinal column that goes up to the brain. These organs are essential to life and will therefore form the greatest and most important target region of the animal. Detonation in this region causes the whale to die instantly or in a moment. The grenades are especially made to detonate in the middle of the chest cavity when the shot is directed against the chest and from the side. (Figs. 31 - 34).

Direct the shot from the whaling gun against the chest region and as much as possible from the side.

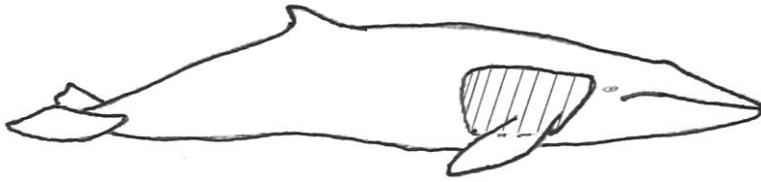


Fig. 31. Vital vulnerability area (hatched area) regarding detonation of a grenade in a minke whale (*Balaenoptera acutorostrata*).

Illustration: S Kessler and EO Øen



Fig. 32. Vital vulnerability area (hatched area) regarding detonation of a grenade in a fin whale (*Balaenoptera physalus*).

Illustration: S Kessler and EO Øen

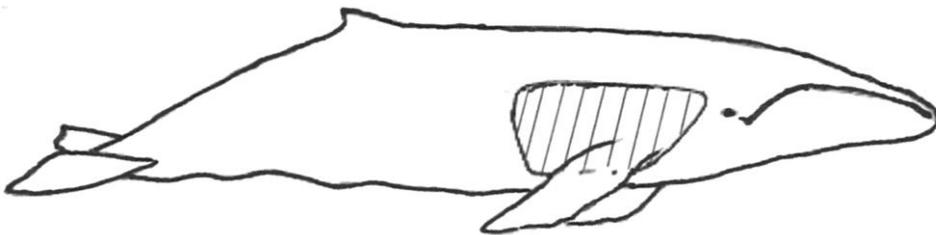


Fig. 33. Vital vulnerability area (hatched area) regarding detonation of a grenade in a humpback whale (*Megaptera novaeanglia*).

Illustration: S Kessler and EO Øen

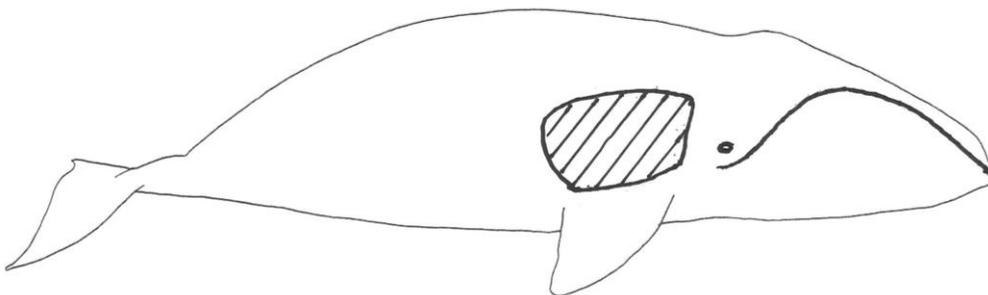


Fig. 34. Vital vulnerability area (hatched area) regarding detonation of a grenade in a bowhead whale (*Balaena mysticetus*).

Illustration: S Kessler and EO Øen

## **PART II: TECHNICAL STRUCTURE, FUNCTION AND MAINTENANCE**

### **WHALING GUN / CANNON**

There are three types of harpoon guns in use among NAMMCO member countries (see page 12). The guns have different calibre (inner diameter of the barrel) and are called as follows - 50 mm Kongsberg, 60 mm Henriksen and 90 mm Kongsberg. Both Kongsberg guns are back-loading but the Henriksen gun is muzzle-loading. The 50 mm Kongsberg is primarily used in the minke whale hunt in Greenland, Iceland and Norway, but has also been used in Greenland when hunting fin whales, humpback and bowhead whales. In Norway many hunters prefer the 60 mm Henriksen in the minke whale hunt. The 90 mm Kongsberg is used in the fin whale hunt in Iceland.

A two-component gunpowder bag is used for all guns. In the back-loading guns (50 mm and 90 mm) the gunpowder bag lies in a cartridge (shell case) that is locked fast in the barrel with a breechblock. The firing pin in the breechblock ignites a primer which ignites the gunpowder bag in the shell. In the muzzle-loading gun (60 mm), the gunpowder bag is slid into place in the barrel together with the wadding using a charge stick. The charge is ignited by a firing pin and a primershell. A line, the forerunner, is fastened to the harpoon. The forerunner rests in a coil under the gun barrel and as a rule, is associated with another line or cable (wire) to the winch.

The gun stands on a support, a gun carriage, which is solidly attached to the deck and is strengthened with a strong restraint that prevents the gun from moving when fired. The gun tube lies in a holder, “cradle/fork” on the gun carriage so that the barrel can move freely. The cradle is equipped with bearings that can be checked and adjusted as needed.

The gunsight is often open, but on many boats the open sights have been supplemented with modern optical sights.

The cannon support must be solid and properly fixed to the deck. If necessary, the deck must be reinforced.

### **THE GUNPOWDER BAG AND WADDING**

The gunpowder bag comprises a bag with smokeless powder. The amount of powder varies with the calibre. The gunpowder bag ignites from a minor charge

of black powder (red colour, see Fig. 9). Between the gunpowder bag and the harpoon there is a washer, the so-called wadding of porous plates with one plate of rubber in the end that rests against the gunpowder bag. With the 90 mm cannon this is standard – see Figs 14 and 15. In addition some use a single rubber washer on top of the wad. The wadding and washers protect the gunpowder charge against damp from sea spray, etc. and the rubber washers also prevent pressure from the burning powder bag leaking out when the shot is fired. If the pressure from the gunpowder bag is released, the speed and accuracy of the harpoon are reduced. The “hole” side of the rubber washer should rest against the gunpowder bag so that the rubber washer can expand and seal the barrel when the shot fires.

## **THE SHOT**

When the shot fires, a strong pressure builds up inside the gun, driving the harpoon out of the barrel at a speed of 90-100 m/s. This drive power causes a counterforce, a recoil, which is partly absorbed by an inbuilt recoil brake in the gun and partly by the gun carriage and restraint on the boat deck. Failure in the recoil brake, gun carriage, restraint or weakness in the deck can cause the gun barrel to move uncontrollably (tilt) when the shot fires such that the harpoon does not hit where it is aimed. Good maintenance of the gun with storage and the restraint will be favourable to the function and accuracy.

## **SAFETY AND MAINTENANCE OF THE WHALING GUN (CANNON)**

Some simple rules are provided below for the maintenance of the gun and harpoon together with some general safety rules. Control and maintenance are found in Appendices II and III.

## **ACCIDENTAL SHOTS**

Accidental shots are shots that occur unintentionally. In the 50 mm Kongsberg this has happened in connection with the breechblock driving forward to lock or when the harpoon is placed in the barrel and the firing pin not being in the correct position. Thus this can ignite the primer/cartridge case without drawing the trigger. Therefore it should always be checked that the firing pin is back and in the secure position while loading. The reason that the firing pin projects forward from the shock bottom can be because of poor cleaning of the firing pin or pinions, a loose or too long firing pin or a failure in the safety mechanism (self loading).

With the 60 mm whaling gun accidental shots happen during loading of the gun. The reason has been burning waste from the wadding and paper in the barrel that has ignited the gunpowder bag while loading. Therefore cleaning of the barrel is important before loading. If the harpoon is so badly sized (deformed) that it must

be hammered into the gun barrel, the black powder in the gunpowder bag can ignite. Harpoons that are too narrow in the barrel must not be used.

#### **GENERAL MAINTENANCE OF THE WHALING GUN (CANNON)**

- The gun (cannon) and all whaling equipment above must at all times be in optimal condition.
- In cleaning the gun, a high pressure hose with warm water in combination with soap can be used to remove powder residue, salt, acid and such. In cleaning of the gun barrel, a rotary brush mounted on a drill can be used.
- After cleaning, all parts must be reassembled with rust-preventing weapon spray or oil.
- Before the whaling gun is used in the hunt, the moving parts in the mechanism must be polished dry in order to avoid function failure.
- In the final greasing of harpoons in connection with loading, vegetable oil or food oil that does not contaminate the whale meat is recommended.

## HARPOONS

The harpoon is used to shoot the grenade into the whale and to afterwards crook it easily so that it can be pulled in once it is dead. The harpoons usually weigh 15-17 kg (50 mm), 17-19 kg (60 mm) and about 70 kg (90 mm) and are slid into the gun barrel from the front.

So that Whale Grenade-99 shall function as planned, the tab with threads on the harpoon must be exactly 27 mm long and right angled at the end. (Fig. 37a). The grenade must be screwed completely in to the harpoon (Fig. 37c) by hand. Tools must not be used nor any form of packing between the harpoon and grenade. If the grenade does not screw on by hand, there are damaged harpoon threads. Such harpoons must not be used. Concerning correct mounting, the trigger hook should stand midway between the claws of the harpoon and face upward when the grenade is screwed on (Fig. 27).

The harpoon's character and maintenance are of great significance in accuracy. The harpoon must be straight and suit the gun barrel. Worn, bent or badly shaped harpoons malfunction. They reduce the range and accuracy. The back end of the harpoon shall precisely match the gun barrel and should be placed completely in against the wadding. An opening or air pocket between the wadding and the harpoon reduces the speed of the harpoon. The legs shall be parallel so that the line runs freely. The forerunner shall lie as close to the barrel muzzle as possible to avoid too much curving of the forerunner when it is drawn out. Curving destabilises the harpoon and reduces the accuracy.

## **WHALE GRENADE-99**

The Whale Grenade-99 is used in the whaling gun hunt in the NAMMCO member countries. The grenade was originally developed for the hunt of minke whale in Norway during 1997-99, but was later also modified to suit the fin whale hunt (Iceland) and fin whale, humpback whale and bowhead (Greenland).

The Whale Grenade-99 used for minke whale hunting is made of aluminium with a nose of steel and weighs 1.75 kg (Fig. 35). A thin tube of aluminium and inside sealing with O-rings protects the inner parts of the grenade (firing mechanism, explosive and safety mechanisms) against mechanical damage and damp. The explosive charge is composed of 30 g pressed penthrite. The trigger line (42-43 cm length) is designed to explode the grenade at a depth of 65-70 cm and a drag on the line of about 50 – 70 kg. This butt-nosed grenade shape attempts to stop the harpoon/grenade from skidding when it contacts water and/or the whale, but continues directly forward.

This modified Whale Grenade-99 is used for large whale hunting in Iceland with the 90 mm Kongsberg whaling gun (Fig. 18). It is built around a kernel of steel with an aluminium shell outside. The explosive charge is 100 g pressed penthrite. The trigger line (90 cm length) is designed such that the grenade shall explode at a depth of 110-120 cm.

In the large whale hunt in Greenland a modified Whale Grenade-99 for the 50 mm Kongsberg whaling gun is used. This is identical to the original Whale Grenade-99 apart from the explosive charge, trigger line, and the yellow colour marking of the nose piece. The explosive charge comprises 45 g pressed penthrite and a trigger line (90 cm length) suited to an explosive depth of 110-120 cm.

### **TRANSPORT SAFETY**

In the back end of the grenade sits a transport safety device (Fig. 25). This is an aluminium lid that is screwed tight to the arming rod and secures that the grenade cannot be armed during handling and transportation. The lid should always be in place when the grenade is removed from the harpoon. The lid is fastened with a screw, and as long as the transport security lid is in place, the arming rod is locked fast in the secure position.

### **THE FIRING MECHANISM**

The firing mechanism is reversible. This involves the grenade being armed when it is screwed on the harpoon, and automatically goes back again (reverses) into the secure position when the grenade is unscrewed from the harpoon. This is

controlled by checking that the arming rod is visible at the back end of the grenade. When the arming rod is in the safe position, it is pushed completely back so that both a red and an unpainted part of the rod are visible (Figs 26 and 37b). If only the red part of the rod is visible, the grenade is armed (Fig. 37c).

Even though the grenade is armed, it cannot go off unless the firing pin (Fig. 36) is activated and drawn back.

The trigger mechanism has a kick trigger and comprises a double hook (trigger hook), that is fixed with a brass pin to a hook holder (Figs. 35 and 36). A strong line (trigger line), goes from the trigger hook to the firing pin (Fig. 36) inside the grenade. The firing pin cannot set off the grenade before it has been activated by a spring. This spring is first activated when the trigger line is drawn completely out and tension increases to 50-70 kg. However, the activation mechanism is also reversible. Should the drag on the line not reach 50 kg or more, the firing pin automatically goes back into the safe position when the tension in the trigger line is released.

The trigger line is coiled up inside a plastic cup filled with wax (Fig. 35) that stops the line becoming loose during the shot. A loose hook and/or line can cause the grenade to go off in the air. The length of the trigger line decides at which depth inside the whale the grenade explodes.

The grenade must be screwed in completely on the harpoon threads. With the correct length of threads (27 mm), the trigger hook sits in the middle of the claws of the harpoon. The harpoon should be turned thus that the trigger claws point up in order to secure that they do not snag the line when the shot is fired.

## **THE SHOT**

Regardless of the result of the shot (completely inside the whale, stray shot, wasted shot), it should always be ascertained whether or not the grenade has detonated when the harpoon or the whale is hauled in. If all or parts of the red aluminium shell are missing, the grenade has gone off. If the red shell is intact, the grenade has not exploded. Should the harpoon lie inside the whale such that the grenade is not visible, and one is uncertain whether or not the grenade has exploded, the harpoon should always be cut out and not pulled out with the winch.

Grenades that have not detonated must be unscrewed from the harpoon immediately. It must be checked that the arming rod has gone back into the secure position. If the rod is not in the secure position one can try to pull it back with the transport safety screw. If this cannot be done, the grenade must be

placed back in the transport box with the transport lid secured and later destroyed.

Regarding stray shots, the aluminium shell case on the grenade becomes damaged (dented) and the trigger hooks loosen without detonating the grenade. If the trigger hook is loose, it should be fastened with a new brass pin and the trigger line placed down in the plastic cup and fixed with strong tape. Should the shell case become dented, it may be that the arming rod does not go back on its own. As a rule it can be pulled back and the grenade secured with, for example, the screw for transport safety. If the arming rod goes back into the safe position, the grenade will usually function normally and can be (re-)used. If the arming rod cannot be pulled back again into the safe position with the screw, the grenade shall not be used, but placed into the transport box with the transport safety lid on and destroyed.

In the case of the wasted shot, the grenade can usually be used again. After hauling in, lay the harpoon on the deck and unscrew the grenade. One must ensure that the arming rod is in the safe position before the grenade is either re-used or placed in the transport box with the transport lid on. If the triggerhook has been ripped loose, it should be fastened with a new brass pin and the trigger line laid down in the plastic cup and secured with a couple of rounds of strong tape around the grenade.

It is dangerous to shoot with a grenade that has a loose line or trigger hook. Loose parts can cause the grenade to detonate when the harpoon comes out of the barrel.

## **THE EXPLOSIVE CHARGE**

The explosive charge comprises explosive penthrite (Pentaerythritol tetranitrate – PETN) pressed in rings. Penthrite is a so-called secondary explosive. Secondary explosives are more stable, have a potentially large explosive power per unit weight and are less sensitive to external influences than primary explosives such as black powder. Black powder ignites with heat, friction, striking and electrical discharge; factors that do not affect penthrite to the same extent.

Penthrite is insoluble in water and is not regarded toxic. The detonation occurs with hypersonic speed (6,500 – 8,400 m/s) when the penthrite gives off natural gases and water ( $\text{CO}_2 + \text{CO} + \text{O}_2 + \text{NO} + \text{N}_2 + \text{H}_2\text{O}$ ) that at the exit point give off neither smell nor taste to the meat. Penthrite burns at a temperature of 150°C, but at normal pressure it must be exposed to extremely high temperatures of

about 4,250°C before it will detonate. Investigation with Whale Grenade-99 has shown that while it rests in the transport box, it will not detonate itself in a fire in over half an hour. (See safety tests, Appendix IV).

When the penthrite detonates and transforms to the gas phase, a powerful pressure increase occurs that extends rapidly (hypersonic) and spreads out like a bubble in the surroundings. There occurs a series of pressure waves of over and under pressure that can be fatal for living tissue and organs also a long way distant from the detonation site. Vital organs such as nerves and brain tissue, heart and blood vessels can be damaged and unconsciousness and death can happen in a moment.

Research has shown that when Whale Grenade-99 explodes centrally in the forward half of the animal (chest, backbone, neck/head) almost 100% of minke whales die instantly. The gunner must therefore target the chest region and generally from the side.

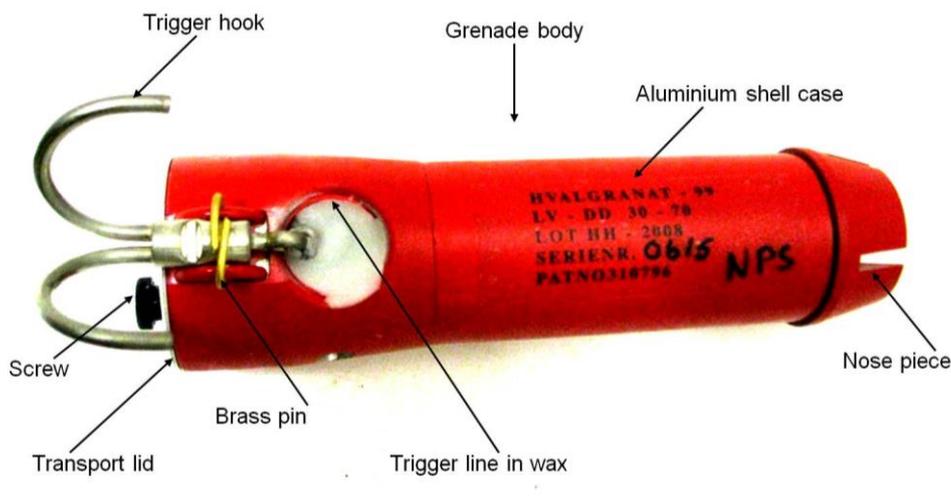


Fig. 35. Whale Grenade-99  
Photo: EO Øen

Whale Grenade-99 shall have the following information on the aluminium casing:

Example of text on a minke whale grenade:

**LV – DD 30 – 70:**

**LV** (Loading weight) provides the amount of penthrite in grams,  
**DD** (Detonation depth) provides the detonation depth inside the whale in cm

**LOT HH - 2008** provides the place and year of manufacturing

**SERIENR.** is the grenade's identification number

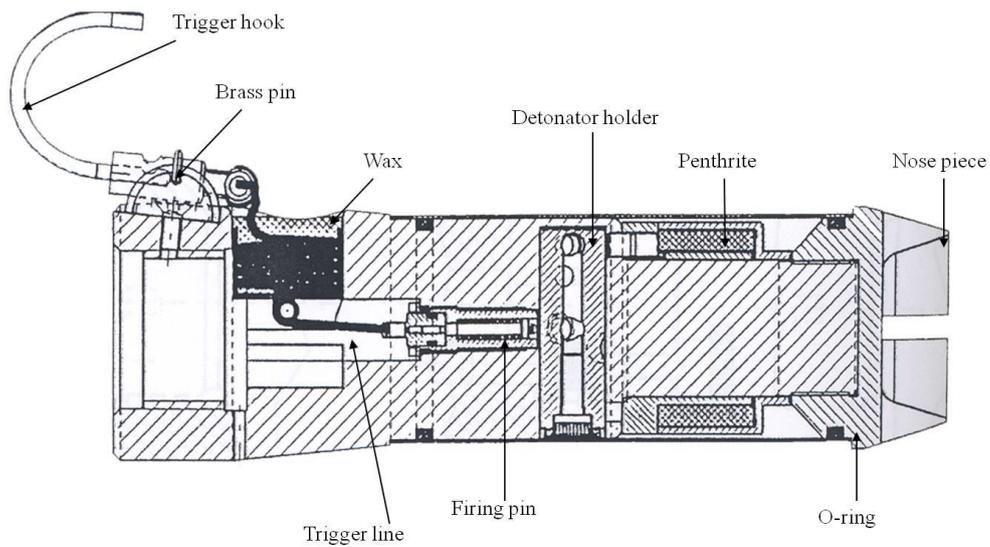


Fig. 36. Trigger system in the Whale Grenade-99. Seen in section through.

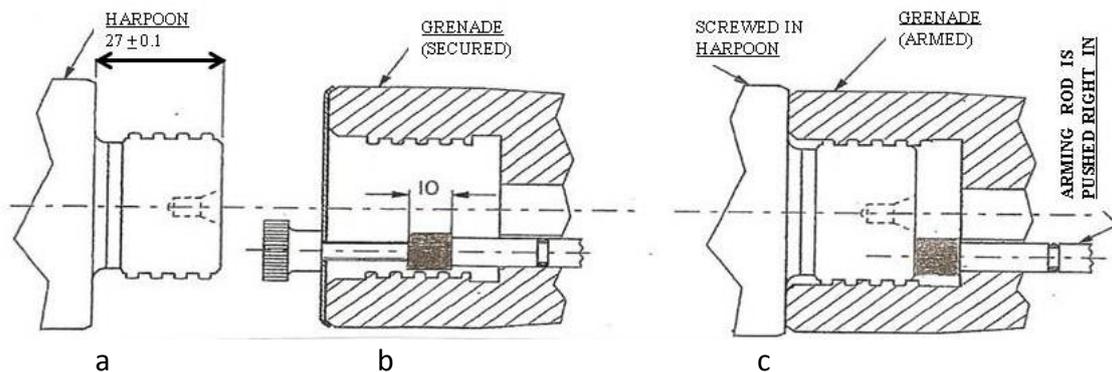


Fig. 37. The figures show the front part of the harpoon (a) and backpart of the grenade (b) and the grenade screwed onto the harpoon (c)  
 (a) Harpoon's joining piece with threads  
 (b) The threads in the Whale Grenade-99 with transport safety and arming rod in the safety position.  
 (c) The grenade correctly mounted on the harpoon with the arming rod in the armed position.

## RIFLES /GUNS

It is common to have a backup method should the whale not die as a result of the first killing attempt, or there is uncertainty about the result of the shooting. In the large whale hunt the backup method is to shoot a new grenade. In the minke whale hunt, a coarse calibrated hunting rifle with ammunition that can penetrate hard bones (cranium) is used as a backup. The shot is directed at the brain or the foremost part of the neck region from a relatively short distance (<15m), and only when the whale has its head above water. If necessary, should the head not emerge from the water, the shot can be aimed at the heart.

## CALIBRE

The weapon designation “rifle” refers to a gun where the inside of the barrel has four spiral grooves throughout the length of the barrel. The parts between the grooves are called riflings. The calibre relates to the distance between the riflings in millimeter or 100-parts or 1000-parts of an inch. Regarding the complete calibre designation, the cartridge (shell case) length is also provided. A commonly used calibre for hunting is calibre 7.62 x 63. This is also called calibre .30-06. This states that the barrel diameter (distance between the riflings) is 7.62 mm or 0.30 inches, and that cartridge is 63 mm. The 06 stands for 1906, the year this calibre was introduced in the USA.

In the 1990s a systematic investigation of the effect of shots at the brain/neck of the minke whale with different bullets and calibres was conducted by researchers in Norway. The research resulted in the standardised least permitted calibre for minke whale being set as 9.3 mm in the Norwegian minke whale hunt. Meanwhile the most common calibre today is larger, precisely .375 (9.525 mm) and .458 (11.633 mm). The least allowed calibre in Greenland is .30-06 (7.62 x 63).

## AMMUNITION



*Fig. 38. The figure shows different types of bullets. From the left: pointed, full metal jacket calibre .308, soft nosed calibre .30-06, round nose, full metal jacket calibre 9.3, and round nose, full metal jacket calibre .375.*

*Photo: EO Øen*

*Full metal jacket* has a relatively soft centre surrounded by a cap of hard metal (jacket) that is open at the back end. The front part (ogive) can have different shapes, from pointed to hemispherical. Full metal jacketed projectiles are reckoned to penetrate deep inside the target. Pointed bullets however, can easily skid (ricochet) off bone, while round-nosed bullets or butt-nosed types more easily penetrate into and go through bones without skidding or becoming deformed. With respect to shots at hard bones such as the skull or neck vertebrae of the minke whale, a full metal jacketed, round-nosed bullet must be used, such as required in the Norwegian minke whale hunt. The ammunition type is not defined in the Greenlandic hunt.

*Soft- or hollow pointed* bullets are common in hunting ammunition. These types of bullets have a soft centre covered by a jacket that is open at the front and closed at the back. They are reckoned to crack up and expand like a mushroom at impact creating a wide wound channel when passing through soft tissue. They may however disintegrate and often stop or skid when at the impact of bones. Soft- and hollow pointed bullets are thus not recommended for killing large whales or dolphins.

*Full metal bullet.* These projectiles are made of metal alloy that expands (enlarges) in the same manner as soft- and hollow pointed bullets and are not suitable for whales larger than dolphins.

## **SIGHTS**

The gun must have good sights. They are generally equipped with open sights with shed and grain. This is a simple sight that requires the eye to focus on three points at the same time. It is cumbersome and many prefer the more modern, optical sights (binocular sights, redpoint sights) where such difficulties are eliminated. The magnification is usually adjustable and will appear on the binoculars. As back up for whale there is no advantage with great magnification as this gives problems with finding the target area quickly. The gunner must therefore himself evaluate what is best.

Electronic sights (point sights) show the sight point as a red dot on the target. Such sights have become normal in the whale hunt both with rifles and whaling guns (cannons).

Different ammunition has dissimilar trajectory. The rifle must therefore always be tested with ammunition that is employed prior to the hunt.

## CARE AND MAINTENANCE OF THE RIFLE/GUN

When used at sea, the weapon will be exposed to damp and salt water. It is very important that the weapon is cleaned and oiled to prevent rusting. It can be necessary to brush the weapon (barrel, mechanism, outside) daily. Powder residue on the end piece and cartridge chamber should be removed with a cleaning cloth. A solid brush (cleaning) stick is used in the barrel. Afterwards the parts should be put back with gun oil. After each season, the weapon should be given a thorough clean and oiled before being put away. If there is much debris on the weapon, one can use soap and boiling water in cleaning off matter that is not removed with the brush set. Before the weapon is used again, it is important to wipe the weapon dry otherwise it can misfire. This is really important in cold atmospheres. After some seasons, a gunsmith should open the mechanisms and check the weapon.

## MISFIRE AND MALFUNCTION

Misfire - meaning that the shot does not go off, occurs. The commonest reasons are poor maintenance or weapon error/failure:

- A broken or damaged firing pin
- A failure in the spring to the firing pin
- Fat (grease) or dirt (powder residue) that slows down the firing pin
- Powder residue or fat in the cartridge chamber.

## DANGEROUS MALFUNCTION

### ***The bolt is hard to open***

Should the bolt become stuck fast or be difficult to open, it is always a **DANGER SIGNAL** that can indicate too high pressure with the firing of the shot. All use (of the gun) should be stopped until it can be clarified what the reason is and the condition has been corrected.

### ***Unusual noise and /or recoil***

A weak or missing recoil or a hissing sound at the firing of the shot can indicate a shot with an erroneous/failed loading and a danger that the bullet is sitting in the barrel. This can happen especially with selfloading of ammunition. In such circumstances the barrel must be checked as empty before a new shot is fired.

Hissing noises or sounds like a can of mineral water being opened in connection with the shot, is a sure sign ALWAYS that THE BULLET IS STUCK FAST INSIDE THE BARREL. The barrel MUST be checked before a new shot is fired.

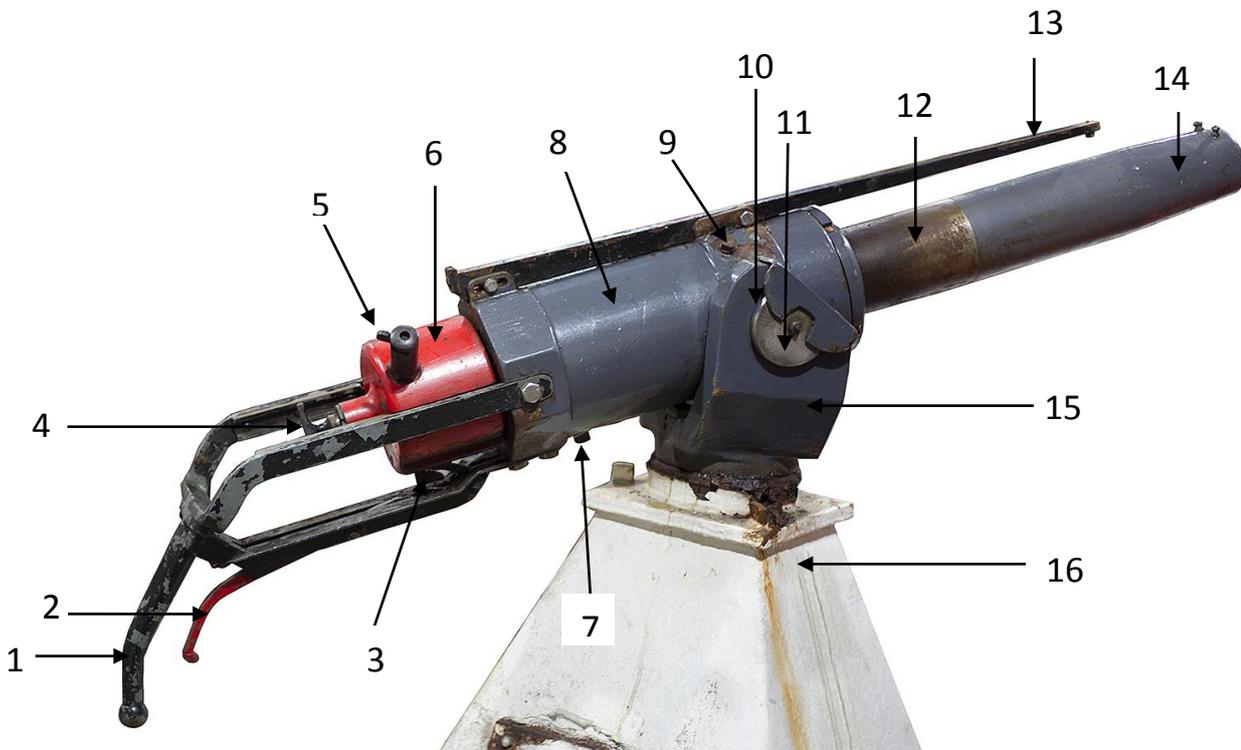
"A double sound" or significant delay between the triggering and firing of the shot is a sign of bad ignition.

## **POOR ACCURACY**

- Poor ammunition
- Improper mounting or bad fixing of the mechanism to the gun stock
- The gun stock is sticking to the barrel because of damp
- Badly affixed sights
- Poor cleaning, with lead, jacket and powder residue in the barrel
- Too much oil in the barrel
- Strong wind and/or cold
- Incompetent gunner

## **ACCIDENTAL SHOTS**

Accidental shots are ones that go off unintentionally. It can happen, for example, that a shot goes off when the bolt is driven in without pulling the trigger. This is most often in conjunction with a semi-automatic rifle of a military type, but can happen in all weapons where the firing pin sticks out of the bolt or the primer/firing cap sticks out from the primer pocket of the cartridge (selfloading).

**I: 50 MM KONGSBERG CANNON**

1. Grip
2. Trigger
3. Trigger pull
4. Cock for firing pin
5. Safety catch
6. End piece
7. Nut for drawing off glycerol
8. Cannon sleeve
9. Nut for filling with glycerol
10. Bearing
11. Nut for the side bracket (cradle)
12. Recoil field
13. Sight
14. Gun barrel
15. Cradle
16. Base /gun carriage

## II: CONTROL AND MAINTENANCE FORM FOR 50 MM AND 90 MM KONGSBERG WHALING GUNS (CANNONS)

|  | Date | Sign. | Date | Sign. |
|--|------|-------|------|-------|
| <p><b>Control before and during the hunt:</b></p> <ul style="list-style-type: none"> <li>– Check that the base is well fastened</li> <li>– Check that the side bearings do not have slack.</li> <li>– Check that the pin and shell case are not oval and have radial slack (forward and back) or axially (up and down).</li> <li>– Check visually all welding points on the cannon, the cradle and the base.</li> <li>– Take apart the breechblock and clean all parts.</li> <li>– Place the parts in rust protecting oil (for example, hydrolic oil) before mounting.</li> <li>– Wash the cannon outside and inside. Generally use a rotating steel brush in the barrel, together with warm water, high pressure with cleaning fluid. Put rust preventing weapon spray or for example hydraulic oil inside the gun.</li> <li>– Change glycerol before each season.</li> </ul> <p><b>Regular maintenance (during the hunting):</b></p> <ul style="list-style-type: none"> <li>– Clean/check the breechblock's channels (50 mm and 90 mm cannon), and the pinions with firing pin together with the gas channel, at least after every tenth shot. Grease/smear with rust preventing weapon spray or alternatively hydraulic oil.</li> <li>– Check periodically the glycerol level.</li> <li>– Protect the recoil field with acid free, thin fat.</li> <li>– If the whaling gun leaks glycerol, the washer nut on the corresponding side should be tightened (90 mm cannon) about 5 mm measured on the circumference (50 mm cannon). Afterwards a test shot should be fired before tightening up further.</li> </ul> |      |       |      |       |

### III: CONTROL AND MAINTENANCE FORM FOR THE 60 MM HENRIKSEN WHALING GUN (CANNON)

|   | Date | Sign. | Date | Sign. |
|---|------|-------|------|-------|
| <p><b>Control before and during the hunt:</b></p> <ul style="list-style-type: none"> <li>– Check that the base is well fastened.</li> <li>– Check that the side bearings do not have slack.</li> <li>– Check that the pin and shell case are not oval and have radial slack (forward and back) or axially (up and down).</li> <li>– Check visually all welding points on the cannon, the cradle and the base.</li> <li>– Take apart the ignition mechanism and clean all parts.</li> <li>– Place the parts in rust protecting oil (for example, hydraulic oil) before mounting. Wash the cannon outside and inside. Generally use a rotating steel brush in the barrel, together with warm water, high pressure with cleaning fluid. Put rust preventing weapon spray or for example hydraulic oil inside the gun.</li> <li>– Change glycerol before each season.</li> </ul> <p><b>Regular maintenance (during the hunting):</b></p> <ul style="list-style-type: none"> <li>– Clean/check the firing mechanism’s channels, pinions, the firing pin together with the gas channel at least at each shot</li> <li>– Smear with rust preventative weapon spray, alternatively, with hydraulic oil.</li> <li>– Check periodically that the mechanism runs easily and freely.</li> <li>– Check periodically the glycerol level. Protect the recoil field with acid-free, thin fat.</li> <li>– If the whaling gun leaks glycerol, the washer nut on the corresponding side should be tightened about 5 mm measured on the circumference. Afterwards a test shot should be fired before tightening up further.</li> <li>– With the use of HHMV trigger mechanism on the cannon, the fixing bolt should be tightened up until there is an axial clearing of about 1 mm between the disc and the mechanism. This is necessary for the firing mechanism such that the bolt just functions as a draining point.</li> </ul> |      |       |      |       |

## IV: CONTROL AND SAFETY TESTS OF WHALE GRENADE-99

Before Whale Grenade-99 was allowed for transport and use in the hunt, it was subjected to a series of obligatory international safety tests before approval was granted by the Norwegian Directorate for Fire and Explosion Protection (DBE then DBS). The following safety conditions were tested:

- detonation safety (detonation transfer, detonation security, fire test)
- combustability
- drop test – load, transshipment (drop from 12 metres onto a concrete floor in a box)
- drop test – handling (drop of the grenade from 2 metres onto a concrete floor)
- fire tests (to evaluate the safety for fire teams in connection with flames)

In addition the grenades were tested for

- trigger safety
- density and function test concerning shots in water (waste shots)

### Detonation transfer

This test was performed to investigate if one grenade that went off accidentally could set off a detonation of the other grenades in the transport box. The test was carried out by exploding one of the grenades in the transport box. The result showed that none of the other grenades exploded, but the box was ripped up and the inner packing exploded into pieces. The aluminium tube on the neighbouring grenades was torn up, and the penthrite charges crushed, but there was no sign of an explosive reaction.

### Detonation safety

This test was done in connection with trial shooting. The purpose of this test was to try to see if the detonator could convert the main charge even though the grenade was not armed, but was partially in a secure position. The result showed that the grenades did not detonate.

### Drop tests

These tests were done to investigate if the grenades could go off during transport and transshipment, or during handling. In the "transport tests" the boxes with grenades were released from 12 metres height onto a concrete floor. In the "handling test" the grenades were flung sideways, backwards and forwards from 2 metres height onto a concrete floor. The results showed that none of the grenades detonated under any of these tests.

### Fire tests

It was investigated whether or not the grenades would detonate in the transport box should a fire start where the grenades were stored. This was undertaken by stacking several boxes with grenades inside in a bonfire that was ignited and burned with an intensive heat increase over 30 minutes. After the fire was extinguished, and the boxes cooled down, they were opened and the contents inspected. The results showed that the inner lining in the boxes was charred. The grenades were damaged and in certain grenades the penthrite charge had burnt up, but none of the grenades had detonated.

### **Trigger security**

This trial was undertaken in order to investigate whether the grenade could be triggered off accidentally – for example in connection with handling of the grenade or with hauling of a harpoon that had misfired with a loose trigger hook. The tests showed that the grenade would not go off when drawn in by hand. With cautious handling, it is thus neither dangerous to handle the grenade in an armed condition nor to bring onboard a harpoon with an armed grenade.

### **Density and function test on shooting in water**

The grenade was tested for waterproofing/water resistance in connection with a misfire, to determine if it could be re-used.

This was done by shooting into the sea. Afterwards the harpoon was allowed to sink to a depth of 100 metres before being drawn up again. This was done several times without indicating damage or leakage in the grenade. One grenade was shot this way into the water 12 times in all. After 40 days the grenade was disassembled and inspected for damp. There was no sign of damp or leakage. The grenade was later used in the hunt and functioned normally.

The grenades passed all tests prescribed by DBE without detonating, but the grenades became unuseable after fire. After a collective evaluation, Whale Grenade-99 was listed in transport/danger class UN 1.4.D. Transport boxes, *etc.*, followed with the marking of this number (symbol) or with an affixed label with information for all personnel that should handle the product. (For details about the danger classification, see [http://www.unece.org/trans/danger/publi/manual/Rev5/English/01en\\_part1.pdf](http://www.unece.org/trans/danger/publi/manual/Rev5/English/01en_part1.pdf) ) pages 58-60.

Danger classification 1.4.D is relatively low (a little higher than for ammunition for shot guns that are classified as 1.4.S, but lower than for gunpowder that is used in the whaling gun (cannon) and involved in 2000 when the grenade was approved, that Whale Grenade-99 in principle can be transported by plane in the transport box.

## V: FORM WITH INSTRUCTIONS AND SAFETY REGULATIONS FOR WHALE GRENADE-99 THAT FOLLOWS WITH THE TRANSPORT BOX

FEBRUARY 2000

### INSTRUCTION AND SAFETY MANUAL FOR WHALE GRENADE-99

For the Whale Grenade-99 to function, the threaded end of the harpoon must be correct and have the correct length (Figure 1). The grenade must be screwed completely in to the harpoon in order to be armed. The trigger hook should be in the middle of the claws.

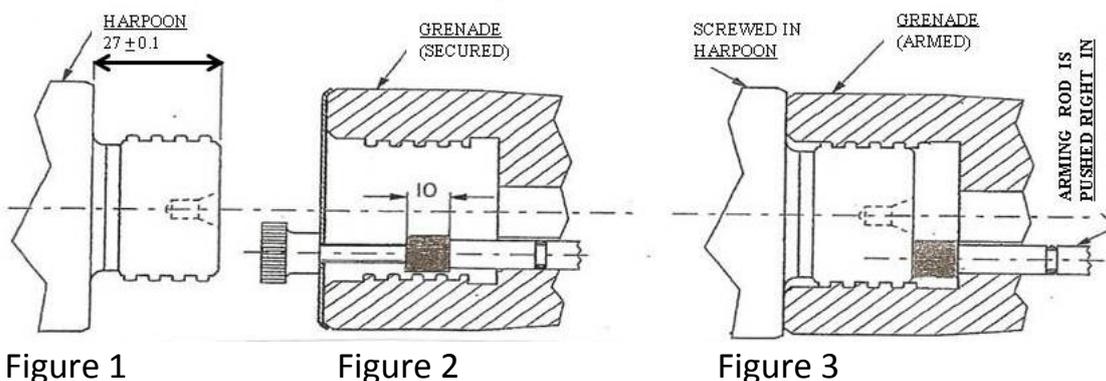
The arming (priming) happens when the grenade is screwed on the harpoon and the spring-loaded rod is pushed right in by the harpoon (Figs 2 and 3). The arming rod is visible in the threaded hole of the grenade. The outermost 10 mm of the rod is red painted. The grenade is armed when just the red part is visible (Figure 3). However the pinions are not primed by the grenade being armed. It is primed at the same time as the trigger hook tightens the trigger line.

When the grenade is unscrewed from the harpoon, the arming rod goes back into the exit (safe) position. Should this not go all the way back, pull it back with the screw from the transport safety lid (Figure 2).

#### Mounting instruction

**NB. The grenade shall always be stored in the transport box.**

1. Load the cannon. Put in the harpoon and fasten the forerunner line.
2. Take out a grenade and remove the transport lid.
3. Screw the grenade completely into the harpoon using hand force only. Do not use tools that can damage the grenade. Should the grenade not screw on by hand, there is a problem with the threads on the harpoon.
4. When the grenade is removed from the harpoon, it should be secured with the transport lid and placed down in the transport box.



## CONTROL OF EXPLOSION

Each time a shot is fired, it should be checked that the grenade has exploded. Often a noise from the detonation inside the animal is heard. If the harpoon has gone through the animal, one can see from the grenade casing whether or not it has exploded. If the harpoon has not gone through the animal, so that the grenade is sitting inside the whale, it should be cut out when the whale is flensed.

### Duds

The grenade has not exploded if the red cartridge case is in place. If the trigger hook is in place, the grenade is safe to handle. If the trigger hook has loosened or the line is worn off, the grenade should be handled like a dud until it can be checked whether or not the arming rod has gone back into the secure position.

Should the grenade be a dud, and the arming rod has not gone back on its own, one should try to pull it back to the secure position with the screw in the transport lid. Afterwards put the transport lid on and store the grenade in the transport box until it can be destroyed. If one is unable to secure the grenade, cut the line if the trigger hook is on before the grenade can be placed in its own box until destruction.

### Misfires

When harpoons miss, the grenade fails to detonate. It can be pulled in again on deck and used again. During the hauling in, one must take care that the trigger hook is not ripped loose while the grenade is armed. A tug on the line of 50-70 kg can cause the grenade to detonate.

**NEVER PULL ON THE LINE.**

Once the harpoon has been hauled on deck, the grenade is unscrewed. It should be checked that the arming rod is in the secure position before it is used or placed in the transport box with the transport lid on.

Should the trigger hook be pulled loose because of a stray shot or some such, it can be fastened with the help of the accompanying sheare pin. The line is lain down in the cup and fastened with tape.

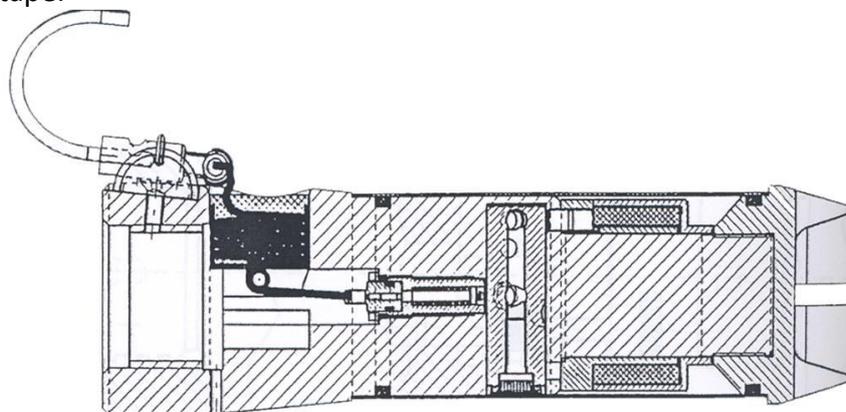


Figure 4. Whale Grenade-99 (through section) in the safe mode