KMMCS

Krohn'sches Mechanical Mine Clearing System

Standing Operating Procedures (SOP)
System description (Standing Operating Procedures SOP) for the KMMCS

With these new and revised SOP of the KMMCS we submit the newest status from March, 10., 2005.

Proceeding of a clearing

The proposed markings, warning notices, safety areas and safety margins are identically to the SOP of manual demining actions and are obligatorily taken, used, and kept. The details are not described more exactly here for they are considered as known to the specialists.

KMMCS operates in two procedures:

1. Mechanical mine clearing operation by activating or destroying functional and not functional mines and other combustible agents of all kinds (bazookas, hand grenades, small rockets etc.) with the mill of the machines I or II. Even at the way to the mine-suspected area the machine has to mill its path with minimum of 20 cm depth.

2. Internal Quality Control with aftercare of the cleared area (visual survey without necessity for the person to have physical contact to the soil and secure removal of not fully broken mine debris) with machine III and the attachments disk harrow and Cambridge Roller.

The contractor exactly defines mine-suspicioned areas and minefields by specification of the coordinates or by landmarks.

At mine-suspicioned areas Machine I or Machine II mills once.

Mine fields, i.e. where several mines were found spatially close together are milled twice for safety reasons.

Both mine suspicion areas and mine fields are treated with following Internal quality control. Mine suspicion areas are controlled once with the machine III, mine fields several times.

The employed Machines I, II und III

Machine I and Machine II destroy explosives

Machine I and Machine II are equal. They are mostly used in minefields together as a clearing unit, so in case of a defect the other machine can rescue the broken one from the minefield in a safe manner.
This machine is equipped with a 3 m wide double-mill, rotating contrary to the direction of the driving. It can work with an operating speed of 1-3 km/h and, depending on need, with exactly pre-defined soil-depth up to 50 cm.

All detonable mines explode during the de-mining process.

All undetonated personal mines and anti-tank mines and also other objects like tree, trunks, bush, concrete parts and other similar obstacles are all disintegrated.
The vegetation is evenly replaced back in the soil. The black and white painted stick shows the depth of 100cm to that the white wooden shred have been evenly mixed from the surface by the Krohn Machines into the full volume of the soil in this demonstration.

The white line shows the solid ground.

The UN requirements for depth is 20 cm for manual demining, but our machines achieve with normal setup up to 50 cm working depth into the soil. That exceed up to 2.5 times the normal working depth if needed.

The machines, which have 3 m wide twin roters, ploughs 50 cm overlapping stripes through the complete volume of the minefield that is totally overturned that way.

The driving at a minefield or a mine suspected area is allowed only in conjunction of milling with minimum depth of 20cm.

At practical work was proven that only a small number of the mines actually explode because the system destroys most mines from their bottom before they have the chance to explode by the ignator, that is at the top side.
Our machines protect the operating driver from explosion splinters which are equivalent to 10kg TNT. The strongest Anti Tank-Mines (ATM) known have a detonation power of 5-7kg TNT equiv., very rarely 10kg TNT equiv.

In front of the machine a hollow charge of 6 kg TNT equiv. exploded without damaging the machine.

Accidentally existing mines with extreme thick case (approx. 1 cm cast-iron) are all cut from their outer ignator, but may not be disrupted totally on a mechanical manner. These UXO’s (UXOs - unexploded objects, here MUXO´s) with thick steel case and already separtated ignator are collected and destroyed in the following working process, the Internal Quality Control with Aftercare, to prevent the reuse.
Machine III for Quality Control

This machine serves as vehicle for the internal quality control and helps the machines I and II in case of breakdown. The machine III is only allowed to roll at the soil that already had been milled.

The machine III can have a different appearance to this picture.

Internal Quality Control with aftercare

After the mechanical demining with machine I or II ALL mines and UXO’s are destroyed. The level of safety is even over 99,9%.

For security reasons an internal quality control with aftercare is done.

Mechanical agriculture machines are used. They have to be adapted to the local soil conditions for each project. As standard machine is declared:

At machine III a combination of a disk-harrow (to turn the soil and uncover hidden mine-fragments) and a Cambridge Roller (breaking up earth-clod and flattening the area) is attached.

At the back of this combination over the full width of 3 m a platform with 3 seats is located, from where 3 controllers can watch a strip of 5 meters without touching the ground. Suspected pieces are marked with colorspray. The Operation's Supervisor identifies the fragments and decides how to waist them regarding the local regulations.

As far as necessary the fragment is milled by the machine I or II and mechanically destroyed.

A minefield is treated several times with the combination attachment and controlled.

Doing so the area is prepared for seed or planting.

Should the control detect a clearance fault, that is a mine with intact ignator or other dangerous piece, that may explode by touch or pressure (mishandling), that piece has to be marked and one machine mills this area again.

In case there is an explosion the fragment is regarded as a clearance fault and the area of 1 ha around this point has to be milled again.
In case there is no explosion then the marked piece is not regarded as a clearance fault.

The control then certifies the area as free from dangerous explosives.

After this "Internal Quality Control with aftercare" the area is reported as minefree and ready for final external certification to the customer.

The final external certification by the customer also can be done at the last drive. By that the full 100% of the area can be controlled by the authorities of the customer and not only some spots of 5-10% of the area as usually done by manual demining.

The working speed of machine III is up to 6 km/h, the working width is 3 m.
The field is free from mines and dangerous explosives now and can be certified by authorities from Mine Action Center.

**Iib.) Additional equipment**

1 flatbed-truck  
1 repair truck  
1 crane truck  
1 vehicle for personnel transportation  
1 ambulance  
2 jeeps  
1 diesel fuel tanktrailers  
1 electricity generator  
6 walkie-talkies  
1 Cambridge Roller  
1 disk-harrow

**Iic.) Personnel/ Team Staff**

**Project Manager (Director)**  
He is responsible for the preliminary inspection. He is in charge of the overall management of the mine-clearing operation. He is responsible for organizing personnel and keeps in touch with contractor's supervisory offices. He organizes collaboration with local authorities.

**Operation’s Supervisor**  
He is responsible for general supervision and he controls mine-clearance-operations. He is in charge of radio communication and coordinates the use of the machines. Every team member of the Krohn Mechanical Mine-Clearing System (KMMCS) follows his personal instructions exclusively.

6 Machine-Drivers  
For each machine a team of two drivers with technical skills is needed to be able to work efficiently.

**Safety Expert**  
He is responsible for the observation of all safety regulations, including the cordonning off of the safety zone, which has a radius of 300 metres around the mine-clearance area. The safety officer is in constant contact with the operation's supervisor and stands in for him while he is absent.

**Safety Executives**  
The safety executives follow the instructions of the safety expert while establishing the safety zone.

**First Aid specialist (doctor)**  
The First Aid Specialist monitors the state of health of the KMMCS team and gives first aid in any emergency. His equipment meets standard UN specifications.