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Mechanical Assisted Clearance Operations

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Mechanical Assisted Clearance Operations

1. Introduction

Mechanically assisted clearance is an essential tool for mine/ERW clearance operations in Afghanistan and shall be part of an integrated approach with the associated organisational structure, logistics and administrative support, in order to provide sustainability and allow interoperability with Demining Teams (DT) and Mine Detection Dogs (MDS) assets.

2. Scope

This chapter covers the minimum requirements for the conduct of mechanical assisted mine clearance operations within Afghanistan.

3. MDU Operations

Mechanical Demining Unit (MDU) operations within Afghanistan fall into 3 categories.

- a) Ground Preparation
- b) Ground Processing
- c) Verification Operations

A. Ground Preparation:

Ground preparation involves reducing or removing obstacles that impede clearance operations. Ground preparation activities are carried out in order to assist in improving productivity of a clearance asset. The following actions typically fall under ground preparation:

- a) Removal of natural or manmade obstacles,
- b) Tripwire removal
- c) Vegetation removal
- d) Metal contamination removal
- e) Ground loosening
- f) EOD support operations
- g) Threat reduction operations

Ground preparation operations can be carried out using both intrusive and non-intrusive methods. Ground preparation does not clear ground of hazard. Typical activities carried out in order to prepare ground include but are not limited to:

- a) Flailing
- b) Rotary tilling
- c) Raking (scratching/pecking)
- d) Ripping (includes scarifying)
- e) Rolling
- f) Lifting/removing obstacles etc

Ground preparation progress shall be reported in M²

B. Ground Processing:

Ground processing is the practice of removing soil, subjecting it to an approved procedure in order to separate the soil from hazard. The following actions typically fall under ground processing:

- a) Sifting
- b) Crushing
- c) Excavation

Ground processing operations can be carried out using both intrusive and non-intrusive methods. Ground processing operations are carried out in order to clear ground of hazard. Typical activities carried out during ground processing include but are not limited to:

- a) Excavation for inspection or process using a excavator/bucket backhoe/front end loader (FEL);
- b) Gill/ALLU bucket operations;
- c) Skeleton bucket operations;
- d) Star basket use;
- e) Front basket;
- f) Internal grill basket;
- g) Rotary Mine Comb (RMC) operations;
- h) Sifting trailer; and
- i) Orbit screen.

Note1: Gill, skeleton and star basket buckets are buckets designed to sieve contaminated soil. ALLU buckets are modified commercial rock crushers designed to fit FEL's. Ground processing progress shall be reported in M³.

C. Verification Operations:

Verification is the practice of confirming that ground does not contain hazard. Verification can occur during area reduction operations and/or concurrently within clearance operations. The following MDU actions can be carried out in support of verification operations:

- a) Rolling
- b) Flailing
- c) Rotary Tilling

Verification operations are carried out using intrusive capable machines. Verification operations are not carried out within the area defined as containing hazard unless it is undertaken after a clearance asset has cleared the ground, and is carried out as part of QA.

Verified ground is not handed back to the community as cleared but released/cancelled due to low or tolerable risk of the ground containing hazard.

Verification shall be reported in M²

4. Follow Up

The requirement for follow up action on mechanically worked ground is as follows;

- a) Ground Preparation – Follow up action required – **YES**
- b) Ground Processing – Follow up action required – **YES**
- c) Verification -- Follow up action required – **NO**

Note: Ground processing through Gill system in Anti-vehicle minefields and Raptors do not need follow up.

5. Limitations

MDU flails are not to be used in a verification application unless authorized by the MACCA operations department.

MDU assets such as the front end loader, loader/excavator/sifter combination can be used for primary clearance of contaminated earth spoil and rubbish piles so long as the sifting device is fitted with grating designed to capture the smallest form of hazard expected on the site or, additional procedures are implemented to achieve this. DT or MDD assets may be employed to assist this process.

When MDU operations involve excavation to locate deep buried UXO, excavation shall not occur closer than one (1) metre from the indicated item from any direction. The MACCA operations department may authorize variance of the 1 metre rule on a site by site basis based on recognition of precise locating technology and/or type of excavation equipment.

6. Vehicle Protection

Minimum specification for protective plating for use on a machine designed to be operated from its cabin within an area containing hazard is not less than 8mm armoured plating, (or 16mm mild steel) and 53mm bullet proof glass. Lesser thickness material(s) can be used if it can be proved by the user that their use by either design, type of material and construction methods meets or exceeds protection as afforded by the afore mentioned materials.

7. Mechanical Test and Evaluation

The aim of a mechanical system test and evaluation is to trial and assess any mechanical asset for suitability in its intended role. The CEN Workshop Agreement (CWA) 15044:2004 provides standardized methodology for T & E provides standardized evaluation for testing Mechanical demining machines

The CWA shall be applied in part or whole on a case by case basis to all mechanical assets prior to their introduction to operations within the MAPA.

Parameters for each systems approach will vary, but in general, each system shall:

- a) Be safe for the system operator and be adaptable in order to cater to the specific mine threat and specific ground conditions.
- b) Have an internal organisational structure in order to be able to integrate fully with other clearance assets as required.
- c) Be designed and structured in such a way that it accelerates mine clearance operations in a safe, cost effective and productive manner.
- d) Attain accreditation from MACCA as qualified to undertake demining operations within Afghanistan.

The development and employment of MDU assets shall take into account the following factors:

- a) The specific mine/ERW threat.
- b) The simplicity of design and operation.
- c) The maintainability and sustainability of the equipment in the area of operations.
- d) The ability to deploy itself, or be deployed to the clearance site.
- e) The adaptability of the MDU assets in differing terrain conditions.
- f) The ability to achieve the clearance depth requirement of 20 to 30 cm.

8. General Safety Precautions

The following safety precautions shall always be adhered to:

- a) Safety distances as stated in Table 10, this chapter unless written approval has been given by the MACCA operations department for variance
- b) All mines or mine parts that include a fuse component that are discovered during flailing/rotary tilling or roller operations shall be destroyed in-situ.
- c) A thorough investigation of the mine/ERW threat in the area prior to the deployment of a MDU asset shall always be carried out.
- d) Worked lanes should be as straight as possible and include an overlap.
- e) Flails and rotary tillers shall be at operating depth prior to passing the start point and shall continue past the finish point before lifting.
- f) During flailing/rotary tilling or roller operations, all detonations and visible throw-outs shall be recorded.
- g) When conducting MDU support operations, all minefield markings damaged or destroyed by the MDU asset shall be replaced once MDU clearance is completed. This should be completed prior to follow-up DT/MDD/EOD moving into the area in order to ensure that these assets know the boundaries of previously worked areas. This will also assist the follow up clearance assets in determining the overlap clearance required.
- h) Areas worked by MDU assets shall be marked at all times to prevent personnel moving into the area until total clearance has been conducted.

9. EOD Inspection Areas

Before commencing MDU operations a designated EOD inspection area shall be established and the following should always be adhered to:

- a) This area shall be free from hazard, clearly marked and situated at least 100m from the Control Point.
- b) The MDU TL shall ensure that on completion of all MDU operations the vehicle is also checked and cleared of all hazardous items. This may be achieved by positioning the vehicle within the designated EOD inspection area and a visually check performed by a qualified deminer or EOD Technician wearing full PPE.
- c) Only once the EOD inspection has been completed and the vehicle has been deemed as “clear” of mines and ERW may it be brought closer to the CP.
- d) The mine clearance organisation shall inform the MDU TL immediately in the event of an item such as a mine or piece of a mine or an ERW being located within the working parts of the vehicle. Only a qualified EOD Technician shall deal with the item.
- e) All MDU assets and attachments shall to be cleaned of accumulated spoil and an EOD check conducted prior to being moved between sites.

10. Vehicle Recovery Drills

Vehicle recovery drills should be conducted on a monthly basis for each individual MDU asset. The recovery should be conducted as if the vehicle was immobilized in un-cleared ground, regardless of whether the machine is of the intrusive type or not. These drills shall be logged in the Daily Work Diary of the team being supported and the vehicle logbook.

It is not a requirement for this drill to be conducted during live operations. This drill may be conducted during stand-down, training days or during site set up. Recovery drills do not have to be conducted on every new minefield unless the site, or mechanical application, presents challenges that necessitate a different recovery approach from normal practice.

The damaged or unserviceable vehicle may be cleared up to using DT or MDD assets or reached by another MDU of adequate ballistic protection for the purpose of attaching recovery strops. All personnel involved in the recovery operation shall be at a safe distance from the operation or inside of the machine cabin during machine movement inside an un-cleared area.

If the casualty machine is stuck in un-cleared ground and the recovery machine is required to excavate/manoeuvre in and around the immediate location of the casualty machine, all ground affected by the movement and excavation carried out shall be regarded as not cleared and shall be rechecked for hazard. Under no circumstance should personnel dismount into un-cleared ground.

11. CASEVAC Drills

In the event of injury to personnel (other than the operator) the machine will stop work and return to a designated parking area. CASEVAC drills shall be carried out as per standard demining accident CASEVAC procedures.

12. Personnel

In order to achieve effective mechanical application within clearance operations, personnel involved with MDU operations shall be appropriately qualified, possess a thorough understanding of mechanical demining and be competent in its application.

All MDU operations conducted on a site shall be under the control of the DT/EOD TL being supported. Although the MDU TL retains technical control over the utilization of the machine.

In addition to normal site requirements, MDU operations shall not proceed if the DT/EOD TL in control of the site is absent from the site. Any changes to this level of supervision shall be authorised by the MACCA and shall be requested in writing from the clearance organisation. If the MDU is configured to work independently, work can commence under the control of the MDU TL.

An MDU TL shall possess a thorough understanding of all mechanical demining applications and be competent in reporting MDU activities as per MACCA reporting format requirements.

A machine shall be operated manually or remotely by a competent and diligent operator. An MDU mechanic shall be equipped and capable of carrying out field servicing and basic machine maintenance as required.

13. Safety Shelters

Annex A of this chapter contains minimum acceptable safety distances for MDU operations within Afghanistan. For some MDU operations, positioning an observer close to the operation is advantageous from both a productivity and safety point of view. This can be achieved by use of special shelters designed to protect demining personnel from landmine or ERW detonation. The following types of shelters are authorised for use:

- a) Ballistic protective shields that have been approved for use by MACCA
- b) An excavation, structure or effective use of existing ground that provides adequate protection for a minimum of 2 x personnel.

14. MDU Support to EOD

MDU support to EOD Teams shall generally be the conduct of excavation in order to assist in locating deep buried ERW or clearance of obstacles and ground processing in support of collapsed bunker clearance operations.

Deep buried ERW excavation:

- a) Excavation in order to facilitate the location of deep buried ERW shall be overseen by the EOD TL. The EOD team being supported is responsible for the placement of all marking.
- b) Excavation shall be carried out in layers and the ground checked by metal detection equipment and confirmed clear before further excavation takes place. The depth of layer shall not exceed the detection depth of the metal detection equipment.

- c) Where indications are received using a metal detector, excavation shall be carried out manually until the source of the indication is removed. When magnetometers or any other electronic depth finding means is employed, MDU excavation shall not occur closer than 1 metre from the indicated item from any direction.
- d) The MACCA operations department may authorize variance of the 1 metre rule on a site by site basis based on recognition of precise locating technology and/or type of excavation equipment.
- e) Where excavation is deeper than 1.5 metres, measures shall be undertaken whilst personnel are engaged in operations within the excavation to ensure the face of the excavation remains stable under all conditions of work and weather.

Collapsed Bunker Support:

- a) MDU support provided to EOD Teams shall be removal of obstacles and soil that prevent EOD team members from detecting buried ERW. Munitions identified by the EOD team as safe to move by bucket, may be transported using MDU means to a central storage area.
- b) All MDU activities conducted in support of an EOD operation shall be under the control of the EOD TL. The EOD team being supported is responsible for the placement of all marking. Access from safe ground to the point of excavation shall be free from landmines and ERW.
- c) If used, the inspection area should consist of two separate inspection bays; one bay for un-cleared soil and one bay for building debris and obstacles not considered dangerous. The inspection areas shall be situated on known clear ground.
- d) Inspection areas shall have perimeters marked and contain clear internal marking showing what soil remains un-cleared. For inspection purposes, the un-cleared spoil shall be levelled with the bucket, to a maximum depth of each lift/layer no greater than 13cm prior to checking by EOD. Each lift/layer shall be inspected prior to the placement of the next lift/layer. If rakes are being used, rake tines shall be spaced close enough to detect small fuses and AP mines.
- e) Personnel within inspection teams shall remain in shelters in accordance with safety distances stated in Annex A during movement and tipping of contaminated soil.
- f) Medium FEL's can be used to assist in EOD/Bunker clearance operations when it is known there is no threat from HEAT or ammunition larger than 82mm. Subject to MACCA approval, suitably up-armoured heavy FEL's can be used to assist in EOD/Bunker clearance operations where there is a threat from HEAT or ammunition larger than 82mm.

15. MDU Assets in Afghanistan

This section provides guidelines on the application of mechanical demining assets within the MAPA. Annex A specifies minimum safety distances that pertains to all mechanical demining assets.

16. Soil Depth Analysis

Prior to any flailing or rotary tilling operation taking place on a new site or on an existing site where a significant change of ground has been encountered, and when the intention of the operation is for tooth or boot ground penetration, a soil depth analysis (test strip) shall be undertaken. A soil depth analysis determines boot or tooth penetration.

The soil depth analysis shall be carried out over a 50m run and measured at equally spaced intervals. Penetration will be determined by use of profile boards made of 3 – 6mm plywood or other like material. The profile board shall be at least 10% wider than the working drum width and be at least 300mm tall.

The profile board shall be buried in the ground level with the natural ground surface. Forward speed of machine, drum RPM and number of passes shall be recorded in the machine log book. The stated average soil depth penetration achieved will be the depth the profile board has been broken away over 90% of its length. This depth shall be incorporated into the clearance plan and will be representative of what depth can be expected to be achieved during operations.

17. Ground Preparation by Flails or Rotary Tillers

The following guidelines shall be adhered to when utilizing flails or rotary tillers in ground preparation activities;

- a) A thorough investigation of the mine/UXO threat in the area prior to the deployment of a flail or rotary tiller asset shall always be carried out.
- b) Control measures shall be in place to prevent foot/vehicular traffic from entering the work area whilst flailing or rotary tilling is taking place.
- c) Intrusive operations shall start and end in known safe ground.
- d) Start points and end points shall be clearly marked.
- e) Flails and rotary tillers shall be at operating depth prior to passing the start point and continue past the finish point before lifting.
- f) Worked lanes should be as straight as possible and include an overlap.

Allowance and a procedure for taking care of throw outs shall be taken into account within any clearance plan.

18. Summary of Restrictions for Flail and Rotary Tillers

Flails and rotary tillers shall not be operated from the machine cabin in AT minefields unless the machine has undergone successful operator and machine survivability trials. The onus of proof is on the organisation operating the flail or rotary tiller,

19. Ground Preparation by Armoured Front End Loaders

Ground preparation using offset ripper/cultivators;

- a) Control measures shall be in place to prevent foot/vehicular traffic from entering the work area whilst ripping is taking place. FEL's shall work from known clear ground only.
- b) Start points and end points shall be clearly marked.
- c) Offset rippers/cultivators shall be at ripping depth prior to passing the start point and shall continue past the finish point before lifting.
- d) Ground prepared by offset rippers/cultivators should be checked by metal detector prior to manual checking.

20. Ground Processing

Excavation:

- a) The FEL shall commence excavation in safe ground. The FEL shall be level with bucket at required clearance depth prior to passing the baseline;
- b) When widening a lane, adequate bucket overlap shall be maintained in the previously excavated lane in order to prevent loose un-cleared soil from spilling into the previously excavated lane;
- c) The excavation shall be flat and free from remnants of loose soil. If an obstacle prevents the excavation from not being to required depth, this area shall be cleared using DT or MDS assets;
- d) Ground excavated to the required clearance depth is regarded as clear; and
- e) Marking showing cleared and un-cleared ground shall be clear, unambiguous and be present during all phases of excavation.

21. Haul Roads

The route used to haul un-cleared soil to the inspection area shall be smooth, clearly marked and free from loose soil. Any loose soil shall be assumed to be spillage from the bucket and shall be cleared immediately. Personnel crossing the haul road should do so, on cleared lanes or avoid walking on obvious spillage.

22. Inspection/Stockpile Areas

The stockpile area may be an area selected to bulk store un-cleared soil for further handling i.e. dumped into a crusher etc, or an area where stockpiling and inspection by clearance assets occur. In either case, it shall be located on known clear ground.

The stockpiling/inspection area shall have its perimeter marked and contain clear internal marking showing what soil remains un-cleared

Soil excavated for processing shall be returned to its original location unless dispensation is given by MACCA operations,

23. Ground Preparation

The excavator shall be positioned on safe ground with the center of the slew motor no closer than 2m from the baseline. If using the teeth of a bucket to break hard ground, the ground should take on an even corrugated appearance with no stockpiles of soil.

If using a rotary tiller or flail to break hard ground, the ground should take on an even ploughed appearance with no stockpiles of soil. Under no circumstance shall spoil from prepared ground be allowed to be dragged back behind the baseline.

24. Ground Processing

The excavator shall be positioned on safe ground with the center of the slew motor no closer than 2m from any baseline, Marking shall be clear, unambiguous and take into account not only the spoil inspection area but also the bucket swing route.

If not stockpiling as part of a 'system's approach', the unclear spoil shall be levelled with the bucket, with a maximum depth of each lift/layer no more than 13cm and subjected to a follow up clearance procedure.

Soil excavated for processing shall be returned to original location unless dispensation is given by MACCA operations.

25. Summary of Restrictions for Excavators:

Excavators shall not be deployed in areas where there is a threat of large IEDs, Directional Fragmentation mines and HEAT projectiles.

Excavators operated from the cabin shall not be used for the clearance of AT mines or ERW unless the machine has completed successful operator and machine survivability testing for AT operations.

Excavators shall be operated from previously cleared or designated safe areas. Excavators shall only traverse over cleared ground, designated safe areas or ground that has been subjected to an action that lessens the chance of the machine detonating a mine with its tracks or tires.

For operations using armoured excavators that fall outside of the outlined activities above, authorisation from MACCA is required prior to task commencement.

A qualified and accredited operator shall operate the Excavator.

26. Armoured Bulldozer

Armoured bulldozers are primarily used in open area clearance operations. Armoured bulldozers are generally used as part of a systems approach. An armoured bulldozer is defined as a wheeled or track mounted machine designed to excavate and push spoil short distances using a front mounted blade.

Armoured bulldozers may also be used in the construction of access routes outside of an SHA and removal of debris and large rocks from the site after clearance.

A typical operation carried out by an armoured bulldozer is stockpiling or windrowing un-cleared soil, as part of a systems approach in support of a ground processing operation. Ground excavated by armoured bulldozers shall be required to have follow up action by a clearance asset or approved bucket/sifting system before being regarded as clear.

27. Ground Preparation

Armoured bulldozers may be equipped with offset rippers in order to carry out ground preparation operations. For armoured bulldozers used in this capacity, see the paragraph on FEL - Ground preparation using offset ripper/cultivators.

28. Excavation in Support of Ground Processing Operations

- a) The armoured bulldozer shall commence excavation in safe ground and be level with the blade at required clearance depth prior to passing the baseline.
- b) When widening a previously excavated lane, the overlap cut shall be carried out in such a way that no spillage of contaminated soil occurs into the previously excavated ground.
- c) The excavation shall be flat and free from remnants of loose soil. If an obstacle prevents the excavation from being flat or not to required depth, this area shall be cleared using manual clearance assets.
- d) Marking showing cleared and unclear ground shall be clear, unambiguous and be present during all phases of excavation. Soil excavated for processing shall be returned to its original location unless dispensation is given by MACCA operations.

29. Summary of Restrictions for Armoured Bulldozers:

Armoured Bulldozers classified as light (<5t) shall not be used in AT operations.

Armoured Bulldozers shall not be deployed in areas where there is a threat of large IEDs, HEAT or Directional Fragmentation mines.

Armoured Bulldozers shall not be tracked on ground suspected of containing AT mines unless conducting excavation or other steps have been taken to minimize the machine detonating a mine with its tracks.

For operations using armoured bulldozers that fall outside of the outlined activities above, authorisation from MACCA is required prior to task commencement.

A qualified and accredited operator shall operate the armoured bulldozer.

30. Rollers

Rollers are primarily used in open area verification operations and threat reduction activities. Rollers may be towed behind mine proof vehicles, controlled remotely by winches or pushed from behind by an armoured push unit or excavator arm.

Rollers do not clear ground as they only have the potential to activate functioning mines. Ground subjected to MDU rolling will normally be followed up by a clearance asset.

The MACCA operations department may authorize MDU rolling without a second asset clearance on a site-by-site basis. Ground treated in this manner is not handed back to the community as 'cleared' but released due to negligible risk of the ground containing hazard.

31. Ground Preparation

Excavator mounted roller:

- a) The excavator shall be positioned on safe ground with the center of the slew motor no closer than 2m from any baseline.
- b) Rolling shall commence or cease in safe ground.
- c) Lane overlap should be $\frac{1}{2}$ the width of the effective rolling unit.
- d) Marking showing rolled and un-rolled ground shall be clear, unambiguous and be present during all phases of rolling,

Winch controlled roller:

- a) Rolling shall commence and cease in safe ground.
- b) Lane overlap should be $\frac{1}{2}$ the width of the effective rolling unit.
- c) Personnel shall stand clear of by Steel Wire Rope under tension and not be positioned directly in the path a roller would travel downhill, due to cable failure.
- d) All detonations shall be recorded.
- e) Marking showing rolled and un-rolled ground shall be clear, unambiguous and be present during all phases of rolling.

32. Verification

Verification using rollers:

- a) Rolling shall commence and cease in known clear ground.
- b) Lane overlap should be $\frac{1}{2}$ the width of the effective rolling unit.
- c) A rolling pattern which allows for a minimum of 4 passes from 4 different directions should be utilized.
- d) If an obstacle or lay of the land prevent the roller from making full contact with the surface of the ground, the area shall be marked for clearance by a clearance asset.
- e) Marking showing rolled and un-rolled ground shall be clear, unambiguous and be present during all phases of rolling.
- f) If a detonation takes place during an area reduction rolling operation, rolling should stop, the roller extracted and clearance assets deployed.
- g) Safe lanes shall always be cleared through rolled areas using DT or MDS assets prior to entry into the area by demining personnel.

The MACCA operations department may authorize MDU rolling without a second asset clearance on a site-by-site basis. Ground treated in this manner is not handed back to the community as 'cleared' but shall be released due to negligible or tolerable risk of the ground containing hazard.

33. Summary of Restrictions for Rollers

Rolled ground does not guarantee the ground is cleared,

The MACCA operations department may authorize MDU rolling without a second asset clearance on a site-by-site basis. Ground treated in this manner is not handed back to the community as 'cleared' but shall be released/cancelled due to low or tolerable risk of the ground containing hazard.

Rolled ground shall be cleared using DT or MDD means if demining personnel require access. This shall be regardless if the land is going to be released due to negligible or tolerable risk of the ground containing hazard.

Rollers are not to be used in areas where there is a likelihood of HEAT ERW.

For operations using rollers that fall outside of the outlined activities above, authorisation from MACCA is required prior to task commencement

Only qualified and accredited operators can operate rollers within a MDU rolling operation.

34. Armoured Haul Machines

Material Handling:

- a) Armoured haul machines are used to transport un-clear spoil from excavations to inspection/processing areas and return cleared soil back to point of origin. Armoured haul machines are generally truck based vehicles and used as part of a systems approach.
- b) Armoured haul vehicles shall have provision for protecting the driver/operator should a munitions detonation occur within the tray.
- c) The deck shall be cleaned down between loads of different materials i.e. un-clear soil, cleared soil.
- d) The haul vehicle shall be loaded in such a way, no spillage of un-cleared soil occurs during transit.
- e) The operator shall remain in the cabin of the haul vehicle or away in a designated waiting place that conforms to site safety distance requirements.
- f) When using an armoured excavator/clamshell grab crane to load the haul vehicle, the load shall not to be swung over the cabin of the haul vehicle.
- g) Armoured haul machines shall only be driven on clear ground.

- h) For operations using armoured haul vehicles that fall outside of the outlined activities above, authorisation from MACCA is required prior to task commencement.
- i) An accredited operator shall operate the armoured haul machine.

35. Armoured Clamshell Grab Cranes

Armoured clamshell grab cranes have proved to be extremely useful in conducting deep excavation in places too deep for general excavation machines or in places where increased standoff are desirable. Armoured clamshell grab cranes are generally used as part of a systems approach. Ground excavated by an armoured clamshell grab crane shall be required to have follow up action by a clearance asset or approved bucket/sifting system before being regarded as clear. An armoured clamshell grab crane is defined as a track mounted machine fitted with a clamshell grab bucket designed to excavate and dump spoil from a stationary position using a slew motion.

36. Ground Processing

The armoured clamshell grab crane shall be positioned on safe ground with the center of the slew motor no closer than 15m from the point of excavation.

Marking shall be clear, unambiguous and take into account not only the spoil inspection area but also the bucket swing route.

Under no circumstances shall a bucket containing unprocessed spoil be allowed to swing over cleared ground.

If munitions detonate during the excavation/swing cycle, the cycle shall be completed. Once the clam bucket has been emptied, the clam bucket and cables shall be inspected for serviceability.

If not stockpiling as part of a 'system's approach', the unclear spoil shall be levelled, with a maximum depth of each lift/layer no more than 13cm prior to checking by manual or MDD assets.

Soil released from the clamshell bucket shall be released at a height no higher than 1 meter from the ground surface/stockpile.

Soil excavated for processing shall be returned to original location unless dispensation is given by MACCA operations.

37. Summary of Restrictions for Armoured Clamshell Grab Cranes:

The armoured clamshell grab crane shall work from levelled clear ground.

The armoured clamshell grab crane shall be positioned on safe ground with the center of the slew motor no closer than 15m from the point of excavation.

Armoured clamshell grab cranes shall only traverse over previously cleared ground, known clear ground or when steps have been taken to minimize the machine detonating a mine with its tracks.

An accredited operator shall operate the armoured clamshell grab crane.

38. MDU Sifting

MDU sifting is a technique used in sifting contaminated earthen spoil and rubbish. The use of MDU assets in this type of clearance greatly reduces the risk to DT members and MDD assets who maybe required to clear areas where mines have been disturbed from their original position. Mines that have been moved by previous MDU disturbance or by nature's elements may be more sensitised and therefore more dangerous to manual or MDD clearance assets. All sifting systems shall be fit for purpose and constructed and operated in a manner that does not allow the expected threat to slip between the Gill/Grating. Regular internal QA checks shall occur in order to verify the cleared status of processed soil.

- a) The use of MDU sifting methods is an acceptable means of clearance of areas containing AP mines only. MDU sifting is not to take place on areas that contain AT mines or large ERW.
- b) Mechanically sifted ground is deemed clear, and
- c) All MDU sifting whether it is by MDU attachments or independent table sifts shall undergo an in-country test and evaluation prior to use or, produce objective evidence of successful operation in another mine action program.

39. Factors to be Considered when Conducting Sifting Operations

An assessment of the extent of the area to be sifted shall be conducted and procedures implemented specific to each site. The exact requirements of any sifting operation shall be stated in a written clearance plan approved by the MACCA. The plan shall include what size grating/grill is going to be utilized,

When incorporating DT or MDD assets into the sifting process these assets shall be fully conversant with all safety procedures associated with that machine,

Mechanical assets involved with conducting sifting operations shall only traverse over previously cleared ground, known clear ground or steps have been taken to minimize the machine detonating a mine with its tires or tracks, and

If an AT mine or ERW greater in size than 82mm threat exists then MDU sifting shall not be used.

40. Actions on Detonation During Sifting Operations

If a detonation occurs during any sifting operation then the machine shall stop immediately and the machine or sifting table shall be inspected. If the machine or table is damaged then sifting operations will stop until the damage is repaired.

If the machine or sifting table is not damaged then the supervisor may continue operations.

41. Manual Clearance of Sifted Material

As well as normal mine clearance safety procedures the following rules apply when manually clearing sifted processed material:

Only trained deminers and personnel shall be employed when dealing with mines located during MDU sifting.

Personnel dealing with mines located during sifting operations shall wear full PPE. The handling of all located items shall be kept to a minimum, due to the possible increased sensitivity of the mines or parts of mines and fuses.

Where ever possible mines shall be moved by remote means to a demolitions pit to reduce the risk to manual deminers.

Ballistic protective shields that have been approved for use by MACCA or purpose built observation dugouts shall be used by deminers when observing sifting operations.

42. MDD Clearance of Sifted Material

As well as normal MDD clearance safety procedures the following rules apply when clearing sifted processed material by MDS:

MDD assets used for searching sifted material shall be accredited for checking mechanically processed ground.

MDD clearance of sifted material shall be no sooner than 2 days after the sifted material has been laid out and provided it has rained during this period or 5 days or longer if not.

Sifted material to be cleared by MDD shall be no deeper than 13 cm in one layer.

All MDD indications shall be investigated by DT means prior to the next sifted layer being applied.

When using MDD all sifted spoil shall be laid out over previously MDD cleared areas only.

43. MDU Crushers

MDU crushers are not currently used in Afghanistan for mine clearance however these assets maybe employed in the future. Any introduction of this type of MDU asset into Afghanistan shall require field-testing and evaluation by the MACCA prior to accreditation for operational use. Safety precautions test and evaluation criteria shall apply as for all other MDU assets in country.

The following additional rules apply for MDU crushers:

- a) Any MDU crusher shall have approved SOP's prior to it commencing operations,
- b) Any MDU crushers used in Afghanistan shall be set and operated in a manner that does not allow the expected threat to slip between its jaws. Regular internal QA checks shall occur in order to verify the cleared status of processed material.

- c) All crushers shall have sufficient armoured protection to withstand blast and fragmentation from AP blast and fragmentation mines as well as non-metallic AT blast mines,
- d) UXO over 60 mm in diameter shall not be processed through any crusher systems in Afghanistan,
- e) Metallic encased AT mines shall not be processed through any crusher system,
- f) Although crusher processed material is deemed clear, it shall be subjected to internal QA checks. This can be done by manual or MDD.
- g) Only trained deminers and personnel shall be employed when dealing with mines or explosive items located during MDU crushing operations.
- h) Personnel dealing with mines or explosive items located during crushing operations shall wear full PPE. The handling of all located items shall be kept to a minimum, due to the possible increased sensitivity of the mines or parts of mines and fuses located during the MDU process.
- i) Where ever-possible mines or parts of fuses and mine shall be moved by remote means to a demolitions pit to reduce the risk to manual deminers.
- j) Ballistic protective shields that have been approved for use by MACCA or purpose built observation dugouts shall be used by deminers when observing crushing operations.

44. Communications

All MDU assets operating shall be fitted with appropriate communications means to allow immediate communications between the MDU operator and the MDU TL for work and other instructions.

Vehicle communications shall be such that the operator can hear any commands over the machines operating noise.

All communications shall be tested at the Control Point before any machine moves into the danger area.

45. MDU Assisted Demining Operations Site Layout

When opening a new clearance site and the first asset to commence clearance operations is an MDU, the site layout shall be as that of any other clearance site. For example:

- a) A Control Point shall be cleared and set up in the same manor as that of any other clearance site.
- b) All marking shall be as per company SOP's and AMAS
- c) A designated EOD check area shall be cleared and constructed no less than 100m from the CP.

Annex (A)

Minimum Safety Distance to be Observed When Operating MDU Assets within Afghanistan

Ser	Anti Personnel Blast & Fragmentation (All Machines Except Flail/Tiller Operations)	Distance
1	Admin area to EOD vehicle checkpoint	100m
2	EOD Vehicle checkpoint to working machine	25m
3	Admin area to working machine	100m
4	Personnel in PPE <u>without</u> protective shelter to working machine in AP Blast SHA	25m
5	Personnel in PPE <u>without</u> protective shelter to working machine in AP Fragmentation SHA	50m
6	Personnel in PPE with protective shelter to working machine in AP Blast SHA	10m
7	Personnel in PPE with protective shelter to working machine in AP Fragmentation SHA	10m
8	Armoured machine/vehicle to armoured machine/vehicle	50m
9	General public to MDU work area	100m

Ser	AP Blast/Fragmentation Minimum safety distances for Flail/Tiller Operations	Distance
1	Admin area to EOD vehicle checkpoint	100m
2	EOD Vehicle checkpoint to working machine	25m
3	Admin area to working machine	100m
4	Personnel in PPE <u>without</u> protective shelter to working machine in AP Blast SHA	50m
5	Personnel in PPE <u>without</u> protective shelter to working machine in AP Fragmentation SHA	75m
6	Personnel in PPE with	25m

	protective shelter to working machine in AP Blast SHA	
7	Personnel in PPE with protective shelter to working machine in AP Fragmentation SHA	50m
8	Armoured machine/vehicle to armoured machine/vehicle	50m
9	General public to MDU work area	100m

Ser	AT mines Minimum safety distances	Distance
1	Admin area to EOD vehicle checkpoint	250m
2	EOD Vehicle checkpoint to working machine	50m
3	Admin area to working machine	250m
4	Personnel in PPE <u>without</u> protective shelter to working machine in AT SHA	100m
5	Spotter/remote operator/deminer in PPE <u>with</u> protective shelter to working machine in AT SHA	75m
6	Armoured machine/vehicle to armoured machine/vehicle	50m
7	General public to MDU work area	250m

Ser	MDU support to EOD operations	Distance
1	Admin area to EOD vehicle checkpoint	150m
2	EOD Vehicle checkpoint to working machine	150m
3	Admin area to working machine	300m
4	Personnel in PPE with protective shelter to working machine	50m
5	Armoured machine/vehicle to armoured machine/vehicle	150m
6	General public to MDU work area	300m