Standard (standing) Operating Procedures (SOPs) for the use of the MV-4 mini-flail

This SOP has been prepared to comply with the guidelines of the UN's International Mine Action Standards (IMAS) as published at the time of writing. Where no clear guidelines exist, this document has been written with a view to promoting safety while achieving operational efficiency.

This document is provided as a starting point for the creation of user-specific SOPs. Users should study and adapt this document to meet their needs. The author and distributors of these SOPs accept no liability for errors or omissions.

Prepared by: …….. Date: ……..

Approved by: …….. Date: ……..

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Revision record sheet

This page provides a record of all revisions and appendices added to these SOPs after the original issue date in April 2005.

All amendments shall be processed through the approved authorities before implementation and inclusion in the record below.

Revision:	Date:	Subject	Pages changed:	Approved by:
1				
2				
3				
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Definitions

The following definitions are used throughout these SOPs:

Area Cancelled: *Area cancelled* during a Task or prior to a Task (without being subjected to any formal clearance or area-reduction systems).

Area Cleared: the area subjected to processing using a thorough ground-clearance system that leaves total confidence that no threat remains to the required depth will equal the Area Cleared.

Area preparation: the passage of a mechanical asset (such as the MV-4) over an area to remove vegetation and/or prepare the ground surface for subsequent clearance.

Area Reduced: the area subjected to an Area Reduction system will equal the Area Reduced.

Area Released: The sum of the Area Cleared, Area Reduced and Area Cancelled will equal the Area Released.

Clearance, Cleared-area, [mine-clearance]: An area shall only be defined as "clear" when it has been subjected to processing by a system or systems that ensure the discovery and removal of all explosive devices to a specified depth. That depth shall be determined during the Task Assessment which is a continuous process and so may be varied as a Task progresses. Generally that depth is determined by the National Mine Action Authority, or defaults to a minimum 13cm below the original ground level (before the passage of the MV-4 flail) as defined in the IMAS[1].

Device(s): The term "Devices" is used to cover mines and ordnance whether fuzed, fired or otherwise, and all explosive devices whether mass-produced or improvised.

Task: A Mine Action Task that may be a Demining "Clearance" Task or a Technical Survey Task.

Uncertain area (Suspected area; suspect area): an area about which there is a suspicion of danger from mines or UXO but where the danger is currently unconfirmed.

Unprocessed area: an area included in a Task that has not yet been subjected to clearance or area-preparation drills.

Acronyms

HMA – Humanitarian Mine Action

IMAS – International Mine Action Standards (UN)

Should, Must & Shall

Throughout this document the distinction made between the terms "should" and "shall" used in the IMAS is adopted.

When *"shall"* or *"must"* is used, those working to these SOPs must follow the procedure as written. No variation is permitted.

When *"Should"* is used, those working to these SOPs must follow that procedure unless they have a reason to vary it that is approved by the senior staff with operational responsibility. Variations must be recorded in writing (usually in the site log) and the person(s) making them identified.

[1] International Mine Action Standards http://www.mineactionstandards.org/links.htm (May, 2005)

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Contents

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1 The MV-4 and Humanitarian Demining

Machines are used in Humanitarian Demining for two main reasons. The first is to enhance the safety of the operators, and the second is to increase the speed with which deminers can produce cleared land. The MV-4 has a proven track-record in both of these areas.

While the MV-4 is designed to detonate pressure-sensitive devices when it is deployed appropriately, it does not clear the ground of mines and ordnance[2]. Devices that are not designed to be initiated by applying pressure will usually be left behind the machine. Even devices that are designed to be initiated by pressure may not be initiated by the machine and could be left in a fully functional state. They may also be broken and left in an unusually sensitive state. Some mines are designed to be very resistant to impact pressure and are unlikely to be initiated by any flail.

1.1 Increasing safety

Where there is a threat from anti-personnel fragmentation devices, especially tripwire operating bounding fragmentation mines, the MV-4 can be used to remove undergrowth and detonate or disrupt the devices at a safe distance from personnel. This ground preparation has been proven to significantly reduce risk for the deminers who clear the ground after the machine has passed. Devices that are not disrupted or detonated are left in ground that is relatively easy for deminers to clear.

Where there is significant vegetation and/or hard ground, the MV-4 can remove undergrowth and break up the ground surface in a way that significantly increases the speed with which deminers can use manual drills to clear the ground after the machine has passed.

There is evidence that the frustrations caused by clearing in hard ground cause accidents. Most demining accidents occur while a deminer is attempting to uncover a concealed device[3]. Preparing the ground with a flail can make the deminer's task faster, safer and easier.

N Deminers following an MV-4 flail must be trained in how to approach the kind of damaged and disrupted devices that may be encountered when carrying out their clearance drills after the machine's use.

1.2 Main uses in Humanitarian Demining

The main uses of the MV-4 in Humanitarian Demining are to:

- prepare safe-lanes and exploratory breaches into a suspect area;
- prepare wide areas for manual clearance drills;
- prepare wide areas for MDD area-reduction.

When the correct conditions apply, the MV-4 can also be used to:

- locate anti-personnel mine-belts by flailing into them and detonating one or more of the mines present;
- increase confidence that reduced areas are mine-free.

N An area that has been processed by the MV-4 should *never* be recorded as "cleared", but as "prepared for clearance". Any pressure to certify flailed areas as having been "cleared" without the flail having been followed up by thorough clearance procedures must always be resisted.

2 Evaluating the threat at a Task

Before the MV-4 is used in an area, a professional Threat assessment documenting the anticipated threats at the task site must be prepared. The technical characteristics of the anticipated devices will inform how the MV-4 is used, and may lead to an assessment that its deployment would be inappropriate.

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[2] "Clearance" to IMAS requires the removal of all mines and ordnance, functional or otherwise, to a previously specified depth.

[3] Database of Demining Accidents (DDAS), UNMAS GICHD, 2005

Only those Tasks at which the Threat assessment identifies anti-personnel mines as the anticipated threat should be considered for ground-preparation using the MV-4. The MV-4 is a relatively lightweight machine and despite its armour, it cannot be expected to survive a major explosion without sustaining severe damage.

The MV-4 was designed to initiate small anti-personnel blast mines with its flail or the roller following the flail (not always fitted). Most anti-personnel blast mines have a relatively small High Explosive content (28 -200g) but a few contain up to 300g of High Explosive. Small anti-personnel blast mines can generally be initiated without the significant damage to chains and hammers. Larger mines may cause more regular chain and hammer loss, and so make the deployment of the MV-4 more expensive.

The MV-4 is also designed to initiate anti-personnel fragmentation devices. Where there is a threat from these devices, especially tripwire operating bounding fragmentation mines, the MV-4 can prepare the ground in a way that significantly reduces risk for the deminers who clear the ground after the machine has passed. This is achieved by detonating or disrupting devices at a safe distance from personnel. Devices that are not disrupted or detonated are left in ground that is relatively easy for deminers to clear.

N The MV-4 is not designed to withstand the detonation of anti-tank mines or of large items of ordnance and IEDs. It should not be deployed in areas where these threats are anticipated.

2.1 Initiation of devices by the flail

Even in ideal test conditions with newly laid pressure-initiated mines, 100% initiation is so rare that it should never be expected.

Some anti-personnel mines are designed to be resistant to impact pressure and are unlikely to be initiated by any flail. Common examples are the VS-50 and the PMN-2. The Threat assessment should both identify the kind of mine anticipated and include a technical knowledge of those devices.

N The operator must never walk in the tracks of the machine in areas where mines resistant to impact-pressure are anticipated.

Also, when evaluating the threats their condition can be relevant. Some mines that have been placed for long periods in a hot and wet environment have deteriorated and are very unlikely to function as designed. A judgement must be made over whether their condition makes initiation unlikely before the MV-4 can be used to try to locate a mine-belt by initiating members of the belt, or to increase confidence that an area is mine-free.

When the MV-4 is first used in a region, it is wise to test its ability to detonate or disrupt the anticipated devices in controlled trials so that its effectiveness in similar conditions can be predicted. Those trials must involve the use of real devices in the same condition and the same environment as those expected, so it can be appropriate to conduct the trial in a known mined area, and then follow the flail with full manual clearance to determine the result.

3 Constraints on MV-4 use

The MV-4 should only be deployed in areas where a threat assessment has been carried out and anti-tank mines or sensitive items of ordnance are not anticipated.

The MV-4 should not be used to cut mature trees or to penetrate barbed-wire defences. Both can cause the machine unnecessary damage.

The MV-4 must only be used with the greatest caution in areas where deep ravines, wells or entrapments are anticipated (ensuring that the operator has a clear view of the flail-head whenever possible so that its movement can be rapidly corrected).

With all remotely controlled machines, it can be a problem for the operator to maintain visual contact with the machine. This can be overcome by protecting the operator in a suitably armoured vehicle close to the machine, but this adds to expense and may not be desirable.

The operator of the machine should have been trained as a deminer and understand the drills that will be used after the machine.

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3.1 Deployment plan

Before use, a deployment plan should be prepared, detailing where the machine is to prepare ground and the depth of ground penetration required. The operator should also plan the ground-pattern over which to run the machine in order to ensure that he can see clearly while standing at the required distance. The operator may stand in the tracks of the machine or at a convenient safe vantage point, but should never stand in front of the machine as it works.

When preparing the deployment plan, attention should be paid to any adjacent areas that may be used by the general public. Whenever possible, the plan of the ground-pattern should avoid running the MV-4 with its flail facing towards public areas.

4 Safety

All MV-4 Tasks should be strictly monitored and while the machine is in use, appropriate variations to the general safety distances should be applied.

An appropriate safety distance for the explosive threat at the site should have been determined during the Task assessment and Threat assessment. Where there is uncertainty about the nature of the explosive devices present, the Task Commander should impose distances appropriate for the greatest possible threat.

When the MV-4 detonates a device with its flail, blast and fragmentation may be deflected forwards and to the sides.

N The risk when the MV-4 flail is working is more than that associated with the kind of explosive device that may be initiated. Flail chains and hammers may break during an explosion or when striking an immovable obstruction. They may be “thrown” a great distance and with considerable force.

All personnel (other than the MV-4 operator) at a Task site with an identified anti-personnel mine threat should always maintain a distance of at least 150 metres from the MV-4.

Other personnel deployed at a Task site should not be deployed to work within 150 metres of the MV-4’s working area. Manual deminers clearing behind the machine should not normally be deployed while it is working except where natural protection or extensive distances give the Task Commander confidence that it would be safe to do so.

Personnel at a distance of less than 150 metres from the machine must wear protective clothing comprising (as a minimum) a fragmentation vest with a NATO STANAG 2920 v50 rating (dry) in excess of 450m/s and a 5mm blast visor as described in the International Mine Action Standards (IMAS) 10.30.

The Operator of the machine must wear the above PPE and be at a distance from the machine that exceeds the safety distance determined for the Task site during the Task assessment. Generally that will be at least 25 metres. The Operator should stand opposite to the direction of motion of the machine and the working flail.

N The operator must never walk in the tracks of the machine in areas where mines resistant to impact-pressure are anticipated.

When the operator of the machine is inside an armoured vehicle or behind fixed protection (such as a wall) the safety distance and orientation may be varied at the discretion of the Task Commander.

Unprotected visitors must be kept at least 250 metres from a working MV-4. Work must stop immediately if people or animals approach closer than 250 metres. Personnel should not enter the uncleared area to remove livestock or intruders. Informing local people of the risks can reduce their curiosity, and so should always be a part of the Task clearance plan.

If the MV-4 is deployed in close proximity to occupied buildings (within 200 metres) the occupants should be advised to avoid going outside and, where possible, to withdraw to a place where their safety can be guaranteed. In the event of an unintended initiation of a large device, the shock-wave and fragments associated with the explosion may cause damage at a considerable distance.

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N When the MV-4 is operated in close proximity to a road or area where people may be present, the machine should be oriented so that it works *away* from those areas.

Except in exceptional circumstances (which should be recorded in the Site Log) the only people authorised to walk on the mechanically prepared ground surface left by the MV-4 are the machine's operator and QA personnel (see 5.3 Quality Assurance), and they must only walk in the clearly defined tracks of the machine after inspecting them for items "thrown-out" by the flail. The operator is permitted to do this so that he can remain in relatively close proximity to the MV-4 (not closer than 25 metres while it's flail head is engaging the undergrowth or the ground). Extensive experience gives confidence that functional pressure operated devices do not remain in the tracks of the MV-4, so although the ground is not "cleared", it can be "safe" to walk on. The Operator should stand at the approved distance for that Task site and opposite to the direction of movement of the machine and the working flail.

During MV-4 ground preparation and all subsequent demining activities at a Task there must be a fully equipped ambulance and medic available at the site.

All MV-4 operators and support personnel must obey the general rules and SOPs of their demining group and obey all appropriate site disciplines as directed by the Task Commander.

When the MV-4 is supported by a task-marking team, the marking may not be done within 150 metres of a working machine, and all those engaged in marking must wear the PPE required for demining at the Task site.

4.1 Checking the MV-4 following normal flail use

At the end of each working session the tracks, shields, flails, roller and all moving parts of the MV-4 should be carefully searched for trapped remains of mines or unexploded material. It is necessary to be extremely cautious whenever remains of mines or UXO are discovered in any part of the machine. If this occurs, the operator should withdraw and seek ask for the assistance of appropriately trained EOD specialists or experienced deminers. The operator must, under no circumstances, attempt to remove mines, devices, or parts thereof, that are discovered in parts of the machine or its attachments.

Before any person attempts to remove trapped items, the Task Commander must ensure that medical provision is still on site, that appropriate PPE is worn and that only one person approaches the machine at a time.

Any non-activated mines or UXO located should be destroyed in accordance with the appropriate general SOP.

5 Responsibility

5.1 Operator of the MV-4

The machine operator and/or dedicated support staff is/are responsible for the maintenance and the safe operation of the MV-4. Generally it should not be part of their work to mark the processed area or inspect any features that the ground-preparation has revealed. Dedicated deminers should be used to mark and investigate as necessary.

The operator is to be constantly alert for missing flail chains. As soon as one or more chain is lost, the MV-4 must be moved to a safe area and the chains replaced. The operator must ensure that any area flailed when chains were missing is re-flailed.

The operator is responsible for ensuring that any requirement to flail to a depth is consistently achieved, and when that is not possible, for reporting that fact to the Task Commander.

5.2 Task Commander and MV-4

The Task Commander is ultimately responsible for all aspects of MV-4 operations and must ensure that all personnel on site apply these SOPs and drills. MV-4 operations should stop if the Site Commander is required to leave the site.

5.3 Internal quality assurance

Quality assurance of the mechanically prepared area should be carried out by responsible persons as directed by the Task Commander. Because the MV-4 does not clear any ground

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of mines and hazardous devices, quality control is usually limited to visually ensuring that the vegetation has been cut appropriately and the ground surface broken as required. Generally Quality Assurance personnel should not be required to enter the prepared area. If the site layout is such that they must enter the area in order to get a clear view of the prepared area, they must always walk on the clearly defined tracks of the MV-4 machine, after scanning those tracks for any devices that may have been exposed or thrown out by the flail. When necessary, the MV-4 operator may finish the preparation by making a final set of tracks in which the QA personnel can walk.

6 Terrain requirements for MV-4 deployment

The terrain selected as suitable for mechanical ground preparation should be:

- level, or with a maximum inclination of 25º;
- have sparse of medium vegetation (occasional stems not more than 8cm in diameter, with most growth much thinner);
- have a minimum area of 50 x 50 metres;

The ground surface should have a covering of soil that is deeper than the required flailing depth. Rocky terrain or areas with stone below a thin layer of soil may be flailed, but the damage to chains and hammers may make the cost of doing this prohibitive.

The following terrain conditions indicate an area that is NOT suitable for use of the MV-4:

- any area where anti-tank mines or large explosive devices are anticipated;
- wet or swampy ground with soft mud or water with a combined depth greater than 20cm;
- ground where reeds are growing thickly;
- ground covered with dense vegetation with a stem diameter greater than 8cm;
- ground crossed by drainage canals, streams or deep ditches;
- ground crossed by walls, fences, barbed-wire or barriers, or beneath severed electrical cables;
- areas with an inclination of above 25º;
- areas with boulders, exposed bedrock or cliffs;
- areas where the ground surface is very uneven;
- areas where machine/vehicle wrecks or other obstructions may be concealed in the undergrowth;
- urban areas or places with infrastructural assets.

The MV-4 may be used with caution by an experienced operator in some of the above areas, especially when vision is not inhibited by too much vegetation. In these cases it is probable that the MV-4 would only be used to prepare parts of the area, but that can still have considerable speed and safety advantages for the deminers following. The Task Commander should weigh the advantages of deployment against the risk of damage to the machine and make an appropriate decision when making the Task Clearance Plan.

7 Plan of the Task site and organisation of work

If the Task site has no access via a known safe area, a Safe-lane should be prepared. When the threat is unknown, this should be done using manual assets. When the threat is limited to anti-personnel devices, the area may be flailed first and then cleared using manual assets. To ensure the MV-4's safe passage, the clearly marked Safe-lane should be at least three metres wide.

The flail should engage the ground at least two metres before it enters the suspect area. This gives the flail rotation time to stabilise to so give a constant depth. This distance should be increased depending on the ground conditions. When the presence of dense roots or concealed rock prevents the flail achieving a constant depth, that fact must be recorded and made known to the Task Commander.

A plan of the ground-pattern over which the machine will pass should be integrated into the Task Clearance plan before the machine is deployed. Arrows indicating a flailing direction should be included in the ground-pattern plan. This plan may be varied as work progresses

and more is discovered about the Task., at the discretion of the Task Commander or persons to whom that responsibility is delegated. All variations to the Clearance plan should be documented before being implemented so that the reason for the variation is recorded.

The following personnel must always be present on the demining site while the MV-4 is being used:

- MV-4 operator;
- medic, and ambulance driver;
- Task security team (ensuring that livestock and people stay away);
- Task Commander.

A marking and demining team will usually also be on site, or available for deployment as soon as the MV-4 is withdrawn. No work should take place without the Task Commander present.

A copy of the Task plan should be filed with weekly operation reports in the MV-4 log that accompanies the vehicle wherever it may be deployed.

7.1 Avoiding damage to the MV-4

The MV-4 can withstand repeated detonations of anti-personnel mines, but may sustain damage to its chains and hammers. The operator should withdraw the machine after each such detonation to check that the chains and hammers are not damaged. Running the flail with missing chains puts the spindle out of balance and may cause bearing damage. It also risks leaving some parts of the ground surface unflailed.

If anti-tank mines or large devices are found during the MV-4's work, the machine should be withdrawn and the plan for its deployment varied so that the higher threat area can be avoided. The higher threat area will have to be cleared without the assistance of the MV-4.

The picture above left shows a damaged mini-flail after the activation of stacked anti-tank mines. Repairs for this kind of damage may be too expensive to consider. Lesser damage like that shown in the picture above right (after initiation of a single AT mine), will involve prolonged downtime during which the machine cannot be used.

The greatest threat to the machine itself may not be the explosive devices. Barbed-wire entanglements, cables and concealed metal or concrete obstructions can cause considerable damage to the flail. If any such obstruction is encountered, the machine should be withdrawn and any damage repaired before being redeployed to avoid the obstruction. When barbed wire has become entangled in the flail spindle it must be removed before the flail is used. The wire can so obstruct movement that the flail drive overheats and severe damage results. Wire or cable can also worm along the spindle and damage its bearings.

N The flail must *NEVER be run with wire or cable wrapped around the spindle.*

8 Procedures for ground preparation

Generally the MV-4 passes over the area to be prepared just once, (with a suitable overlap). When dense vegetation or an unusually hard ground surface prevents effective coverage and ground penetration, the area may be flailed a second or third time. The first pass may be with the flail raised to penetrate dense vegetation. The operator's training should have prepared him to be able to accurately gauge the depth that the flail has reached in the ground, and so

make an appropriate judgement about the number of passes required to achieve the required depth.

The follow-up clearance of the ground prepared by the MV-4 should be completed as soon as possible after it has finished work. In some climates, the ground will harden and vegetation start to grow very quickly, so follow-up work should usually start no more than a week after the MV-4 completes its preparation.

8.1 Operator position

The machine operator should control the MV-4 from a place that gives good visibility while respecting the safety distance appropriate at the Task site. This often means that the operator must move his position from time to time. Operator movements must be made with the MV-4 stationary so that he can apply full attention to the tracks he is following, looking for any "throw-outs" and exposed devices that may be in his path. If mines or devices are located, the operator should act as described in Section 8.3.3 *Marking discovered mines or devices.*

The MV-4 is often run first in one direction, then the other. The operator must stay to the side or behind the machine, and should never stand directly in front of it as it drives towards him. When cutting in a back and forth pattern, this may mean that the operator has to use the flail cut spurs to the side so that he has somewhere suitable to stand.

Diagram A shows the path of the MV-4 starting from Point B. At Point C, the machine is turned to the left and used to cut a spur at least as long as the approved safety distance for the task. Then the machine returns to C and carries on towards Point D. Before it turns around at Point D, the operator stops the machine and moves to stand at the end of the spur at Point E, from which he can control the MV-4 as it passes in both directions.

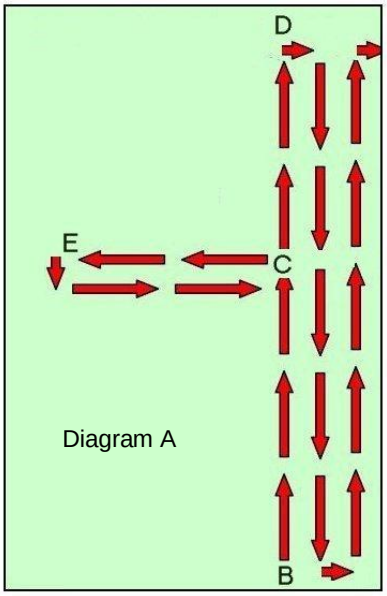


Diagram A

8.2 Patterns of deployment

When an area is to prepared by the MV-4 flail, this is usually achieved by using the machine in the patterns outlined below. Variations to these patterns are permitted and may be essential when an area includes obstacles that must be avoided. Whatever the variation, when MV-4 passes are adjacent, they must always overlap by at least 50cm.

8.2.1 Traversing the boundary

Diagram A below shows how the area is processed by following its sides. This often allows the operator to maintain line-of-sight to the MV-4 from the required distance, but may mean that he has to move frequently.

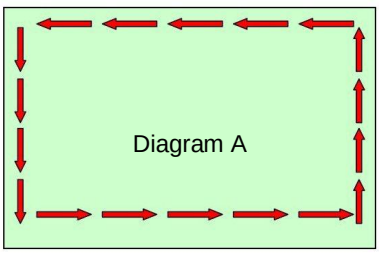


Diagram A

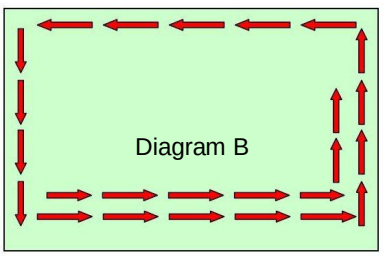


Diagram B

On the second pass, (shown in diagram B) the inside edge of the first pass marks the new outer boundary. The operator should ensure that the flail-head has at least a 50cm overlap with the previously flailed area to ensure that no areas are missed. The flail-head width is 165

cms, so when calculating how many passes it will take to process an area, each flail-run should be presumed to have covered a width of 140 cms or less.

8.2.2 Overlapped back&forward passes

When appropriate the MV-4 can be run in a parallel back and forth direction, first passing in one direction, then turning to pass in the opposite direction as shown in diagram C on the right.

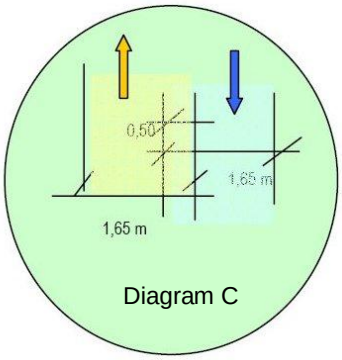


Diagram C

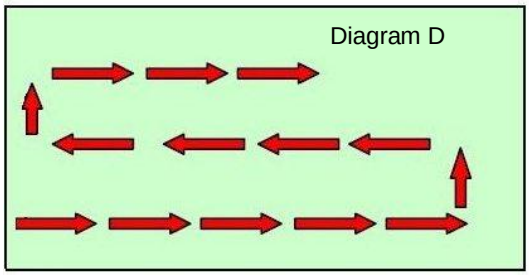


Diagram D

The machine moves in the pattern shown in diagram D.

8.2.3 Covering the same strip in forward and reverse gears

When there is confidence that the operator will *not* need to walk in the tracks of the MV-4 to keep visual contact (such as when the operator can stand on high ground and see the entire area to be prepared) the MV-4 can be used to flail while moving in reverse. The operator makes one pass in one direction, then stops and reverses the direction of rotation of the flail. The operator then controls the MV-4 so that it reverses back along it own tracks to its original starting point. This can be useful when a single pass does not achieve the depth of ground penetration required at the site.

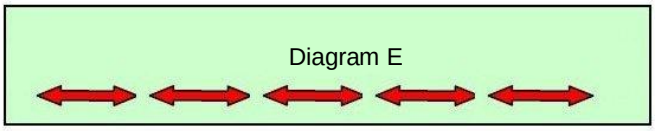


Diagram E

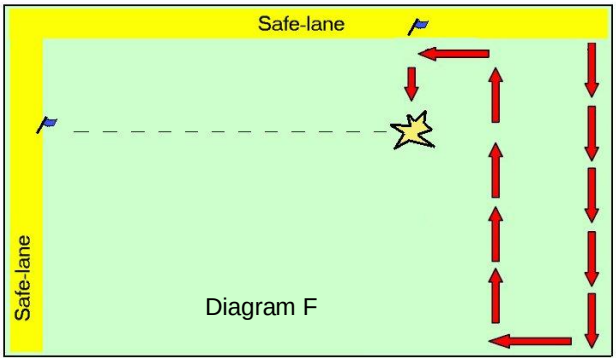
The disadvantage of this method is that flailed ground is spread over the tracks made by the machine, so erasing them. If the operator is likely to need to walk over that area in future any action that erases the tracks must be avoided.

8.3 Marking detonations and devices

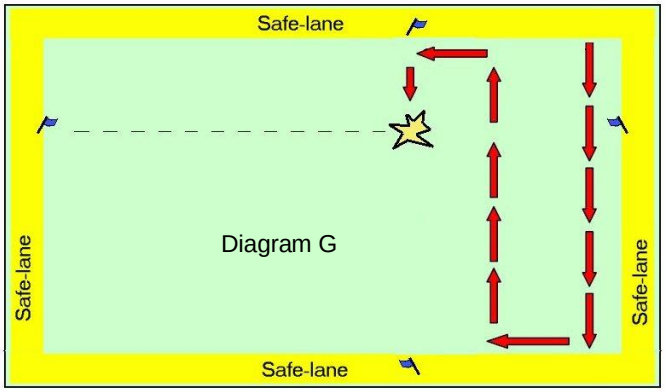
While preparing an area, it is usually desirable to mark the approximate location of any detonation that occurs. This can sometimes be done by reference to fixed points such as trees, but usually requires some kind of ground marking if it is to be accurate. The preferred way to mark is by using Safe-lane reference points, but marking may also be done by ground marking when it is safe to do so.

8.3.1 Marking by reference to Safe-lane reference points

When there is a Safe-lane on at least two sides of the area being prepared, the operator can place a stake in line with the detonation in both of the Safe-lanes. A series of colour coded markers should be used when the position of more than one detonation is to be marked. The markers in Diagram F below are shown as blue flags.



After the detonation the machine is stopped and either the operator or a designated member of the marking team places a flag in the two Safe-lanes to approximately line-up with the place where the MV-4 is standing. When the tracks of the flail are used to provide a straight line in the axis representing the MV-4's direction of travel, this can generally be accurate to within five metres.



Accuracy can be improved by placing a third or fourth flag when the Safe-lanes exist, as shown in diagram G. Of course, areas to be prepared are rarely rectangles, but when there are Safe-lanes all around an irregular area, a position can be marked by sighting from flag to flag with a high level of accuracy.

8.3.2 Marking initiations in the MV-4 tracks

When there is a detonation, the machine is immediately halted and the flail stopped. The operator advances in the machine's tracks towards the rear of the MV-4, always looking for exposed devices and throw-outs as he advances. When he reaches the back of the machine, he places a flag or painted marker (often a stone)in one of the tracks. This marker will be within five metres of the initiation in one axis, and within two metres in the axis representing the MV-4's direction of travel.

After returning to a safe distance, the operator must manoeuvre the MV-4 to return without damaging the marker that has been placed.

8.3.3 Marking discovered mines or devices

If mines or devices are located, the operator should place a marker within 30 cm of their position. When a demining team is on-site, the operator should stop the machine and withdraw while the device is appropriately dealt with. If no demining team is on-site, the operator can proceed with caution past the device when he is confident that it is safe to do so. Some devices may be in an unstable condition and when these are discovered, the operator must always withdraw and call for assistance.

8.4 Area preparation

When a wide-area is to prepared by the MV-4 flail, this is usually achieved by using the machine in either pattern 8.1.1 *Traversing the boundary or pattern* 8.1.2 *Overlapped back&forward passes* described above.

When the MV-4 has prepared a wide-area, the boundaries of that area should be marked and mapped, along with suitable reference points. The position of any detonations should be shown as accurately as possible on the map. The area marking used should comply with that approved in the general SOP.

8.5 Preparing safe-lanes

Safe-lanes are used to access a Task site and are often made in an area with no anticipated threat. When no threat is anticipated, the MV-4 can be used without manual clearance as a follow-up. Even when no threat is expected, all safety distances must be maintained during MV-4 operation because the flail itself poses a small threat to personnel nearby.

When a Safe-lane is made in an area where a threat may exist, the lane prepared by the machine must be cleared by manual deminers after the machine has withdrawn or reached the appropriate safety distance for the Task.

A Safe-lane must be wide enough to permit the safe passage of medics with a casualty on a stretcher, and is usually a minimum of two metres wide. To prepare a lane of 2 metres width, the MV-4 must pass over it twice with an overlap. The operator should ensure that the flail-head has at least a 50cm overlap with the previously flailed area to ensure that no areas are missed.

When the MV-4 will need to use the Safe-lane to access other areas, the lane must be wider than 2 metres because the outer width of the flail head is 2 metres and lane marking would be damaged as it passed if its width were not increased. The Safe-lane width should be three metres.

When making a Safe-lane the operator must stay to the side or behind the machine, and should never stand directly in front of it as it drives towards him. If necessary the MV-4 should be used to prepare “spurs” in which the operator can safely stand to control the machine. See Section 8.1 *Operator position*, above.

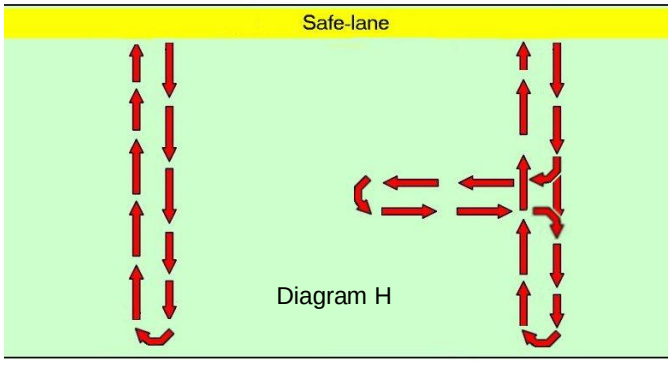
After the Safe-lane has been prepared by the MV-4, the machine should be withdrawn and a clearance and/or marking team deployed as determined in the Task Clearance plan.

8.6 Preparing exploratory breaches

The MV-4 can be used to prepare breaches into an unknown area, starting from a Safe-lane. Breaches are usually made in order to try to access a suspected belt (or pattern) of mines without manually clearing more un-mined land than is necessary.

The MV-4 flail can prepare an area over 1.6 metres wide. Generally, a short breach width of 1.6 metres is acceptable. When breaches of more than 10 metres length are planned, the MV-4 should make two overlapped passes to ensure that the breach exceeds 2 metres in width. The increased width has three advantages:

1. It increases safety in the event of a subsequent CASEVAC requirement.
2. It simplifies manual follow up by allowing adjacent one metre lanes to be cleared in the prepared ground.
3. It increases the likelihood of uncovering or detonating mines in a mine-belt or pattern.



Depending on the operator having a safe vantage point, breaches may be prepared by driving the MV-4 out from the safe lane and then back again, with or without a “spur” to one side in which the operator can stand to avoid having the flail driving directly towards him on its return pass (as shown in diagram H). When the spur has been prepared, and before the MV-4 is turned around to return, the operator moves to stand at the end of the spur. The spur must always be at least as long as the safety distance determined for the anticipated threat at the Task site.

While the MV-4 can flail while driving in reverse, this should never be done when the operator or others will want to walk in the machine’s tracks to assess an area later (because running it in reverse erases the tracks).

If a detonation occurs while preparing a breach, the MV-4 should be stopped and returned to the Safe-lane. The length of the breach then marks the whereabouts of the device that exploded.

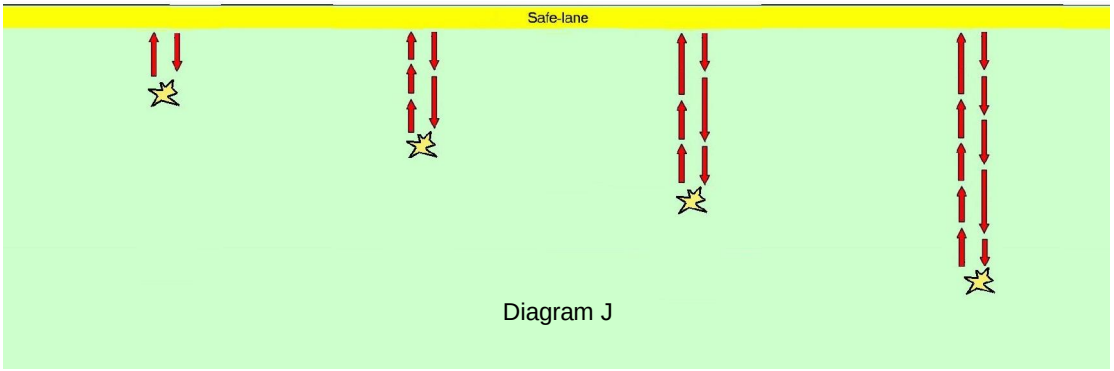


Diagram J

When preparing an area in which most of the anti-personnel mines are in good functional condition, a series of breaches can reveal a mine row or mine belt as shown in Diagram J.

8.7 Increasing confidence that reduced areas are mine-free

The passage of the MV-4 over an area does not constitute clearance as defined in the IMAS. It does not guarantee detonation of pressure-operated devices, and is unlikely to detonate ordnance or damaged/decayed devices. These will remain in the ground and may present a future threat to the users of the land.

While land prepared by the MV-4 is not cleared, the ground processing involved does give considerable confidence that functional pressure-operated devices are unlikely to remain. After a mine-belt has been located and the area surrounding the mine pattern subjected to thorough clearance to the required depth using manual methods, it can be desirable to increase confidence that no other belts of mines remain inside the original Task margins.

The remaining parts of the original Task area may be reduced in several ways, each giving a different level of confidence but none constituting “clearance” except where dogs are used AND no indications are made. If approved and effective dogs are used and indicate the presence of explosive, the area will have to be cleared using another method, but if they fail to indicate, the area may be classed as “cleared”.

The land may be:

A) subjected to a simple visual scan when there is little or no undergrowth
B) scanned with metal-detector designed (or tuned) to miss small metal fragments and only signal on articles large enough to be articles of ordnance
C) checked by dogs
D) covered by the MV-4

Or any combination of the above. Generally, the more methods applied to an area the greater the level of confidence that there is no threat present will be. When there is undergrowth, the use of the MV-4 adjusted to flail to a shallow depth can be a fast method of preparing the area for A, B, or C above. When making a visual search after the MV-4, the search will be for devices and broken parts of devices. In dusty environments, the chances of seeing them can

be very low. Spraying with water can increase the chance by washing dust from the broken parts. The use of dogs after the flail raises some concerns because shattered explosive items may be spread around, but in an area that has no devices present this will not present a problem.

9 Procedures in case of breakdown or damage

If properly maintained, the MV-4 should run reliably inside the Task area. If problems with the flail arise, the machine should be manoeuvred to a safe area for the problem to be addressed.

In the event of an engine breakdown or disabling damage to the machine during its deployment inside a Task area, all other work within 150 metres of the machine must be stopped.

A team of manual deminers must clear an access route to the machine that is at least 4 metres wide. They must maintain the safety distance between working deminers that is appropriate for the site and so the first lane of the route can only be widened after its length exceeds the appropriate safety distance.

When the deminers approach the machine, they should extend their clearance to cover an area at least five metres around the machine in all directions. The cleared area must be marked using an approved marking system so that there is no confusion about which areas have been “cleared” and which have only been “prepared”.

When the access route and area surrounding the machine has been cleared, the machine’s service team can approach it and either carry out the necessary repairs or arrange for its removal.

If it is suspected that anti-tank mines or large devices may be in front of the machine, the suspect area must be manually cleared prior to resuming MV-4 operations.

10 Procedures in case of fire

The MV-4’s recommended cleaning and maintenance schedules should prevent fire arising without an outside cause (such as a damaging detonation).

Under no circumstances should any personnel enter an area that is not yet cleared in order to extinguish a fire on the MV-4. The operator should attempt to move the machine into a safe area and if that is not possible, shut down the engine.

An emergency approach can only be made by personnel inside a suitably armoured/protected vehicle at the discretion of the Task Commander. When that is done, all attempts to extinguish the fire should only be made by using fire-fighting equipment from within the safety of the second vehicle.

11 Reporting requirements

In addition to any internal reporting requirements made by the Task Commander, the following information should be recorded in a weekly report compiled by the MV-4 operator or other designated person:

- number of working hours;
- square metres of prepared surface;
- approximate depth to which the flail has processed the ground;
- description of undergrowth cut;
- type and number of intact mines located;
- type and number of damaged mines located;
- number of detonations counted (and devices identified when possible);
- quantity of fuel consumed;
- chains and hammers replaced;
- unusual events, breakdowns, repair requirements;
- service actions carried out.

Copies of all weekly reports should be filed in the MV-4 log that accompanies the vehicle wherever it may be deployed.

12 General characteristics of the MV-4

(The following information should be checked and adjusted to match the specification provided with the machine you are using.)

The MV-4 mini-flail is manufactured for use in Humanitarian Demining DOK–ING d.o.o., Zagreb, Croatia. It is the fourth revision in the ongoing development of “MV” type light machines. A series of technical improvements have been made to achieve better working results and enhance reliability. With a weight of 4.9 metric tons, it is generally classed as a “light” Humanitarian Mine Action (HMA) machine.

With a 155 hp motor and robust construction and components, the MV-4 has excellent power distribution allowing it to work at speed and with great manoeuvrability.

The “MV-4” mini-flail is designed for use on land where there are anti-personnel (AP) mines, or explosive devices containing quantities of High Explosive similar to that found in AP mines.

The working tool is a flail behind which is a roller. The working width of the flail is 1650 mm. 40 chains are attached to the flail spindle in a spiral pattern. Each chain ends with a hammer. The spinning chains and hammers are able to clear low and medium-height vegetation, and to dig the ground to a depth of 20cm (maximum recommended).

The machine is controlled using a hand-held remote-control device (data communication FSK – 433 MHz). The operator can be:

in an open area (at a safe distance determined by the threat assessment at the site)
in a suitably armoured support vehicle close to the MV-4
or behind a suitable armoured screen and close to the MV-4.

13 Technical characteristics of the MV-4

The following information should be checked and adjusted to match the specification provided with the machine you are using.

Dimensions without flail-head:

- Length: 3,780 mm
- Width: 1,500 mm
- Height: 1,330 mm

Dimensions with flail-head:

- Length: 4,230 mm
- Width: 1,950 mm
- Height: 1,330 mm

Weight: 4.9 tons

Motor: “Perkins 1006-60 TW”

- Number of cylinders in motor: 6
- Power of motor: 123.50 kW (165.61 HP) at 2200 rpm
- Motor volume: 5,985 cm3

Type of fuel: diesel

- Fuel tank capacity: 70 litres
- Average fuel consumption: 10 – 15 l/h

Quantity of coolant: 33 litres

Engine oil quantity: 15 litres

Quantity of hydraulic fluid: 178 litres (HIDRAOL HDS 46 – 68)

Working tools: flail-head (including roller)

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- Flail power hydrostatic system, two separate electronically regulated piston pumps, possibility of rotating flail in two directions
- Flail width:80 mm
- Flail rotation direction forward/backward
- Cutting width: 1725mm
- Ground cutting depth: up to 20 cm
- Flail diameter: 800 mm
- Flail rotating speed: 0 – 900 rpm
- Number of chains with hammers: 40
- Shape of hammers: “mushroom”
- Weight of chain with hammer: 600 grams
- Length of chains with hammers: 250 mm

Chassis: 8 mm steel plate

Armour plate: 10 mm thickness

Propulsion: tracks

- Width of tracks :300 mm
- Length of tracks on surface: 2,100 mm
- Specific pressure of tracks on surface: 0.38 kp/cm2

Speed:

- Transport speed of machine: up to 6 km/h
- Working speed: 0.5 – 2.0 km/h
- Normal working speed: 0.6 – 0.9 km/h

Machine control microprocessor, remote-control device

- Data communication FSK 433 MHz
- Equipment for maintenance, minor repairs and basic spare parts for the MV-4 should be located in a support vehicle and available during working periods.

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