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Mechanical land release

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Contents

1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Use of machines for land release **2**
4.1 General 2
4.2 Types of machine or attachments, and their usage 2
4.2.1 General 2
4.2.2 Machines or attachments designed to destroy hazards 3
4.2.3 Machine or attachments designed to detect hazard 3
4.2.4 Machine or attachments designed for ground preparation 3
4.3 Blast protected passenger vehicles 3
4.4 Other operations 4
5 General requirements **4**
6 Testing and evaluation **5**
6.1 General 5
6.2 Scope of T&E 5
6.3 T&E of machines and attachments 5
6.3.1 General 5
6.3.2 Suitability assessment 6
6.3.3 Performance test 6
6.3.4 Protection assessment 6
6.4 Records 6
7 Operational accreditation **7**
8 Residual risk **7**
9 Mechanical procedures **7**
9.1 General 7
9.2 EO and other hazards 7
9.3 Management of mechanical land release operations 7
9.4 Medical 7
9.5 Communications 8
9.6 Personnel requirements 8
10 Method and asset selection **8**
11 Integrated approach **8**
12 Support to mechanical land release **9**
12.1 Maintenance and servicing 9
12.2 Recovery requirements 9

12.3 Fire precautions and drills 9
13 Environmental considerations 9
13.1 General 9
13.2 Protection of property and infrastructure 10
14 Responsibilities 10
14.1 National mine action authority (NMAA) 10
14.2 Mine action organizations 10
Annex A (normative) References 12
Amendment record 13

Foreword

International standards for humanitarian demining programmes were first proposed by working groups at an international technical conference in Denmark, in July 1996. Criteria were prescribed for all aspects of demining, standards were recommended and a new universal definition of “clearance” was agreed. In late 1996, the principles proposed in Denmark were developed by a UN-led working group and the International Standards for Humanitarian Mine Clearance Operations were developed. A first edition was issued by the UN Mine Action Service (UNMAS) in March 1997.

The scope of these original standards has since been expanded to include the other components of mine action and to reflect changes to operational procedures, practices and norms. The standards were re-developed and renamed as International Mine Action Standards (IMAS) with the first edition produced in October 2001.

The United Nations has a general responsibility for enabling and encouraging the effective management of mine action programmes, including the development and maintenance of standards. UNMAS, therefore, is the office within the United Nations responsible for the development and maintenance of IMAS. IMAS are produced with the assistance of the Geneva International Centre for Humanitarian Demining.

The work of preparing, reviewing and revising IMAS is conducted by technical committees, with the support of international, governmental and non-governmental organizations. The latest version of each standard, together with information on the work of the technical committees, can be found at www.mineactionstandards.org. Individual IMAS are reviewed at least every three years to reflect developing mine action norms and practices and to incorporate changes to international regulations and requirements.

Introduction

The International Mine Action Standard (IMAS) for mechanical land release is a comprehensive document that provides guidelines and specifications for the safe and effective use of machines in demining operations.

Machines are used in land release operations due to their efficiency and effectiveness in detecting and removing explosive ordnance. This document provides a set of standards and procedures for the safe and effective use of mechanical land release methods in demining operations. It covers a wide range of topics, including equipment evaluation, testing and evaluation, maintenance and servicing, environmental considerations, and the responsibilities of the national mine action authorities and mine action organizations. It emphasizes the importance of proper training and qualification of mechanical operators, as well as the need for an integrated approach to land release operations.

Overall, this document is an essential resource for mine action organizations, governments and other stakeholders involved in land release operations. It provides a framework for ensuring the safety and effectiveness of mechanical land release methods, and it promotes best practices for the management and operation of machines.

Mechanical land release

1 Scope

This IMAS provides specifications and guidelines for mechanical land release operations. It covers the safe and effective use of machines in land release operations, including equipment evaluation, testing and evaluation, maintenance and servicing, environmental considerations, and the responsibilities of national mine action authorities and mine action organizations. It also emphasizes the importance of proper training and qualification of mechanical operators, as well as the need for an integrated approach to land release operations.

2 Normative references

A list of normative references is given in Annex A. Normative references are important documents to which reference is made in this standard and which form part of the provisions of this standard.

3 Terms and definitions

A complete glossary of all the terms, definitions and abbreviations used in the International Mine Action Standards (IMAS) series is given in IMAS 04.10.

In the IMAS series, the words “shall”, “should” and “may” are used to indicate the intended degree of compliance:

- “shall” is used to indicate requirements, methods or specifications that are to be applied in order to conform to the standard;
- “should” is used to indicate preferred requirements, methods or specifications; and
- “may” is used to indicate a possible method or course of action.

3.1
national mine action authority
NMAA
government entity, often an inter-ministerial committee, in an EO-affected country charged with the responsibility for broad strategic, policy and regulatory decisions related to mine action.

Note to entry: In the absence of an NMAA, it may be necessary and appropriate for the UN, or some other body, to assume some or all of the responsibilities of an NMAA.

3.2
mine action organization
organization (government, military, commercial or non-governmental organization/civil society) responsible for implementing mine action projects or tasks.

Note to entry: The mine action organization may be a prime contractor, subcontractor, consultant or agent.

3.3
mechanical land release
use of machines on land release operations

Note to entry: mechanical land release may involve a single machine employing one attachment, a single machine employing a variety of attachments or a number of machines employing a variety of attachments.

3.4
machine
<mine action> unit of mechanical equipment used on land release operations

3.5
attachment
<mine action> working component attached to a machine, such as sifters, rakes, buckets, flails, tillers, ploughs, magnets, etc.

Note to entry: a single machine may use a number of attachments, which may be fixed or interchangeable.

3.6
follow up
demining methods carried out on the same hazardous area (or material) after another demining method has been applied, but has not satisfied land release requirements

Example: After some form of ground preparation.

3.7
residual risk
<mine action> risk that remains despite having applied all reasonable effort during the land release process

4 Use of machines for land release

4.1 General

Machines/attachments may be used in both technical survey and clearance roles. The requirements for technical survey or clearance can differ, depending on the specific operational circumstances.

Land release requirements are outlined in IMAS 07.11, *Land release*. IMAS 08.20, *Technical survey,* provides guidance for developing criteria for reduction through technical survey and IMAS 09.10, *Clearance requirements,* provides details of clearance requirements. Furthermore, IMAS 07.50, *Management of human remains in mine action* sets out considerations for management of human remains. These IMAS form part of the provisions of this document and shall be complied with.

Mechanical land release methods that do not satisfy land release requirements shall be subject to follow-up methods that do satisfy these requirements.

4.2 Types of machine or attachments, and their usage

4.2.1 General

When using machines, the attachment is commonly the working component; the machine itself acts as a platform.[1] The attachment is therefore fundamental to the process. However, there are also mechanical assets that are individual units.[2]

Machines and attachments can be divided into:

1) those designed to destroy hazards;

2) those designed to detect hazards; and

3) those designed to prepare the ground.

Some machines or attachments may be capable of fulfilling more than one of these purposes.

[1] In this context, a platform means a host that things can be attached to. The term “prime mover” is also commonly used.
[2] For example, stand-alone screening or crushing units.

4.2.2 Machines or attachments designed to destroy hazards

Machines or attachments designed to destroy hazards can reduce or, in some cases, eliminate the requirement for follow-up demining operations, that is, where the remaining hazard is considered to be a tolerable residual risk. This destruction process may include detonation of explosive ordnance (EO).

These types of machines or attachments may meet the requirements for land release.

4.2.3 Machine or attachments designed to detect hazard

Machines or attachments designed to detect hazards can do so physically (for example, sifting machines or buckets, ripping/raking or magnets) or by carrying a detection technology, such as metal-detector array. Some physical detection methods may lead to inadvertent detonation of EO during the detection process.

These types of machines or attachments may meet the requirements for land release.

4.2.4 Machine or attachments designed for ground preparation

Ground preparation machines or attachments are primarily designed to improve the efficiency of land release. Ground preparation activities may also serve to make follow-up processes safer.

Examples of ground preparation include:

1) vegetation cutting and clearing;

2) removal of tripwires;

3) loosening of soil;

4) removal of metal contamination; and

5) removal of soil, building debris, boulders, rubble, defensive wire obstacles, etc.

Ground preparation may involve the detonation, destruction or removal of EO.

Ground preparation methods do not meet land release requirements. Therefore, they shall always be subject to follow up by other demining methods.

4.3 Blast protected passenger vehicles

Blast protected passenger vehicles may be used in roles that are not directly related to mechanical land release, in order to improve survivability in the event that EO is inadvertently detonated.

For example:

1) non-technical survey teams conducting operations in new areas, or areas where anti-vehicle mine contamination is expected, and track roads are common; or

2) personnel travelling to and from tasks assessed to contain anti-vehicle mine contamination, on track roads with poorly defined boundaries.

While routes should only be taken by passenger vehicles if assessed as safe, there are circumstances where information is incomplete and/or where road boundaries are not clearly defined.

Blast protected passenger vehicles may be bespoke vehicles designed for that purpose, or appropriate passenger vehicles retrofitted with blast protection.

Blast protection used in this role should not be regarded as a routine protective measure to protect against the effects of EO hazards, but rather, as a further protective measure after all planning, training and procedural efforts to reduce risk have been taken.

The level of armouring of the vehicle may determine the level of risk that is tolerable.

4.4 Other operations

Machines or blast protected passenger vehicles may also be used for other support functions, outside of direct land release activities.

Examples of support functions include:

1) preparing tracks to permit access into areas for demining operations;

2) supporting EOD tasks, including the removal of obstructions;

3) acting as protective shelters to allow close supervision of operations;

4) facilitating emergency recovery in case of accidents or incidents; or

5) supporting development of operational bases/camps.

5 General requirements

Prior to the deployment of mechanical land release assets, certain basic criteria shall be satisfied:

1) machines and attachments shall be evaluated to determine their suitability for the task(s) they are expected to carry out in the conditions in which they will work;[3]

2) each machine shall be assessed and confirmed as safe for the operator and any other person on the worksite. The required protection level for machines shall be established through an evidence-based assessment; and

3) standard operating procedures (SOPs) shall be developed for each mechanical land release method that is used in land release operations. These SOPs should include:

    a) general operating procedures;

    b) procedures specific to the machine and attachment;

    c) defined EO threats and procedures for the integration of the method with other land release operations.

The process of satisfying these criteria should, where possible, draw on existing evidence in order to avoid unnecessary repetition of previously conducted testing and evaluation (T&E).

Further guidance on T&E, to help ensure conformity to these requirements, is provided in Clause 6.

[3] Prior to the deployment of any machine or attachment, an assessment should be made of the in-country infrastructure and support systems to ensure that a machine or attachment can be operationally maintained in the areas where it will be used.

6 Testing and evaluation

6.1 General

Guidance on T&E of mine action equipment can be found in IMAS 03.40, *Test and evaluation of mine action equipment*.

T&E of machines and attachments is carried out to ensure that they are suitable for their intended use in the environment in which they will operate.

It is important to note that, where a machine or attachment has already been through T&E or has demonstrated that T&E requirements have been satisfied (for example, in other comparable locations), additional formal T&E may not be necessary.

However, where certain criteria have not been sufficiently tested, T&E targeted on these criteria may be required.

Acceptance without country-specific T&E should only be permitted if continued performance monitoring is carried out, and recorded, by the mine action organization concerned.

6.2 Scope of T&E

T&E for machines and attachments should be designed to:

1) identify the operational limitations of the machine or attachment;

2) identify the optimal operating conditions for the machine or attachment, in its intended operating environment(s);

3) identify the effectiveness in destroying, detecting, or otherwise removing, different types of EO from hazardous areas in relevant operating environments;

4) identify the residual risk remaining from potential hazards, in the operating environments in which the machine or attachment will work;

5) identify any limitations in the employment of a machine or attachment (for example, potential damage to services, access, inclines, wet soil, hard ground, excessive temperatures, certain explosive hazards, etc.);

6) assess and confirm the safety of the machine or attachment for the operator and any other person on a demining worksite;

7) identify the operating procedures required to ensure that a machine or attachment achieves the specified standards; and

8) identify any potential environmental damage caused through the use of the machine or attachment, such as soil erosion, for example.

6.3 T&E of machines and attachments

6.3.1 General

T&E of machines and attachments should be achieved through the following tests and assessments:

1) suitability assessment. An assessment to ensure that machine or attachment is able to work in the environment in which it is intended to be used;

2) performance test(s). A test, or series of tests, to establish whether a machine or attachment is capable of performing the role for which it is intended under comparable and repeatable conditions; and

3) protection assessment. An assessment to verify that the operator of a machine or attachment is suitably protected against the threat(s) they will face during operations.

Note: It is important to acknowledge that EO threat assessment is an imperfect process that should consider the likelihood of finding and detonating an item. It should not simply disaggregate EO types present in an operational environment and then select the absolute worst case as the protection design threat.

6.3.2 Suitability assessment

The suitability assessment should, in most cases, be a precursor to performance testing. It should be an evidence-based assessment that considers the appropriateness of a machine or attachment for the environment in which it will be used.

The assessment may consider evidence from applications in other industries (for example, construction or agriculture), or from existing mine action applications.

6.3.3 Performance test

Performance tests should be designed to determine if the machine or attachment is able to perform its function reliably. For example, reliably detect or destroy a prescribed item of EO under defined conditions.

Performance testing should include an assessment of the procedures under which the machine or attachment is intended to be used.

6.3.4 Protection assessment

To assess protection requirements, full-scale physical testing of machines and attachments may be unnecessary. Besides, the costs of this process may be unnecessarily high. Therefore, prior to conducting physical testing, it is important to consider existing sources of information that may reduce the requirement for further testing.

This process should consider relevant evidence from:

1) previously conducted physical testing;

2) operational accidents and/or incidents;

3) manufacturer specifications; and

4) scientific literature.

If existing sources of information do not provide the required level of confidence to the NMAA, then representative physical testing should be considered before progressing to full-scale physical testing.

6.4 Records

The NMAA should establish criteria for mine action organizations to record, so that their mechanical land release operations establish a statistical database of information that can be used for operational decision making.

For example:

- hours worked;
- units of work completed (for example, square meters cleared); and
- EO found.

Reporting on non-operational time such as:

- mechanical breakdowns;
- transport between sites and logistical delays; and
- adverse weather conditions.

This can help organizations to improve the efficiency of their demining operations.

7 Operational accreditation

Operational accreditation of a land release method, machine or attachment shall be conducted in accordance with the requirements set out in IMAS 07.30.

8 Residual risk

Identification of residual risk to the end user is an important component of land release operations because it helps to determine the suitability and/or limitations of a particular land release method to reach the required level of risk tolerance.

The determination of tolerable residual risk shall be carried out in accordance with IMAS 07.14.

9 Mechanical procedures

9.1 General

Mine action operators shall ensure that operating procedures developed for mechanical operations include the following topics.

Machines and attachments shall only be employed within the limits of their operational accreditation, as established during T&E and as documented in SOPs.

9.2 EO and other hazards

During operations, if a hazard is identified that a machine or attachment was not designed or approved to be used against, the mechanical land release operation shall cease, and a review of the task shall be carried out.

Machines and attachments shall be periodically inspected to ensure that no EO or hazardous components remain in the working or moving parts. The frequency of these inspections shall be based on the function that the machine or attachment is carrying out and shall be documented in SOPs.

9.3 Management of mechanical land release operations

Mechanical land release operations shall be managed by suitably trained personnel.

9.4 Medical

In addition, accident response plans for mechanical operations that involve directly operated machines or attachments shall include procedures for the extraction of a casualty from the inside of the machine used.

See IMAS 10.20 for guidance on demining response plans.

9.5 Communications

Communications between the site supervisor and the mechanical operator shall be in place at all times while a machine is working.

9.6 Personnel requirements

Mechanical demining worksites shall have sufficient qualified personnel on site while operations are ongoing, to ensure that:

1) standards for operations are maintained;

2) the effective integration with other land release operations is achieved, where applicable; and

3) the necessary support is provided in case of emergency.

10 Method and asset selection

Selecting an appropriate land release methodology, and asset(s) to execute that methodology, is fundamental to safe and effective land release operations.

Below is an example process for selecting appropriate mechanical land release methods and assets:

STEP 1
Identify the problem(s) that needs to be addressed (including specific EO threats)

STEP 2
Identify a method, or series of methods (methodology) to address this problem (or series of problems).

STEP 3
Identify an appropriate mechanical asset, or combination of assets, that can safely conduct the appropriate method(s).

11 Integrated approach

As well as working as a single solution, mechanical land release methods may be included in an integrated approach to land release.

This may be necessary where a single method alone cannot achieve land release requirements. However, there may be circumstances where an integrated approach is not necessary, but is more effective in achieving land release requirements (for example, where a combination of methods is more efficient).

This integrated approach may include methods from one or more of the following categories:

1) mechanical land release;

2) manual land release; and

3) animal detection systems (ADS).

12 Support to mechanical land release

12.1 Maintenance and servicing

Mine action organizations shall make provisions for the maintenance and servicing of machines and attachments that they use in land release operations. Such provisions shall ensure that:

1) machines and attachments are maintained and serviced in a way that is suitable for their operating environment;

2) maintenance and servicing are carried out by qualified staff;

3) routine checks are made on the working components of machines and attachments and, where working components critical to the effective operation are excessively worn, damaged or missing, these components are repaired or replaced before further work continues;

4) routine inspections of safety features on machines and attachments are carried out and, where damage or loss of function is identified, they are repaired before further work continues; and

5) whenever a machine or attachment is subject to a detonation that may have affected the safety of the operation, it is withdrawn from the hazardous area at the next safe opportunity and inspected. Where damage to a machine or attachment may place them in danger from subsequent detonations, staff shall not return to work until the damage is repaired.

A key component of good machine and attachment maintenance is the way that these are operated. Mechanical operators should be qualified and experienced in the operation and maintenance of their machines and attachments.

12.2 Recovery requirements

Operating procedures for mechanical land release operations shall include provisions for the recovery of the operator and machine in the event of a machine becoming stranded in a hazardous area. Such a procedure shall ensure the safe extraction of the operator as quickly as possible, and recovery of the machine in a safe manner and reasonable time.

12.3 Fire precautions and drills

Mine action organizations employing machines and attachments in hazardous areas shall develop procedures to be followed in the event of a fire. These procedures shall cover the immediate actions to be taken and ensure the safe extraction of an operator. Where an on-board operator is present, machines shall be fitted with a fire extinguisher or fire-suppressing systems.

People shall always be prohibited from entering a hazardous area to fight a fire on a burning machine without first clearing a safe access route. Firefighting equipment should be available at all places where refueling of machines is carried out.

13 Environmental considerations

13.1 General

The area where mechanical land release operations are carried out shall be remediated before the land is released. As an example, this may include returning excavated material to its original location and ensuring the site is levelled.

Where mechanical land release operations may cause erosion, mine action organizations shall ensure that limitation measures are put in place.

The operation, repair, maintenance and servicing of machines and attachments shall be carried out in an environmentally acceptable manner (for example, by preventing ground or watercourse contamination from fuel, oil and lubricants).

Local environmental legislation shall be applied. In addition, IMAS 07.13 provides guidance on protection of environment.

13.2 Protection of property and infrastructure

Planning for mechanical land release operations shall take into account any possible damage to property or infrastructure. Where damage to property or infrastructure is possible, the property owners should be consulted prior to starting operations. Where property owners are not contactable, local authorities should be contacted to determine what authorization is required.

When machines are used in hazardous areas, they may remove land boundaries, leading to potential land right dispute. Measures should be taken to determine property ownership prior to starting operations. In addition, any land boundary marking that is removed during operations shall be replaced.

14 Responsibilities

14.1 National mine action authority (NMAA)

The NMAA shall:

1) develop and implement national standards for the employment of machines and attachments on land release operations;

2) accredit mechanical land release methods operationally in accordance with the requirements of the national standard;

3) implement quality management systems to ensure the safe, effective and efficient use of machines and attachments in land release operations;

4) develop an environmental policy for the use and maintenance of machines and attachments; and

5) provide advice to prospective mechanical land release users.

In addition, the NMAA should:

6) establish procedures to ensure the proper T&E of mechanical land release methods prior to their deployment on demining operations;

7) establish reporting systems and procedures for the gathering of data on mechanical land release operations. Such data should be made available to all stakeholders; and

8) provide advice and assistance to mine action organizations in establishing residual risk for mechanical land release operations.

14.2 Mine action organizations

The mine action organizations shall:

1) support the NMAA with the T&E of machines and attachments to be used in demining operations;

2) obtain (from the NMAA) the operational accreditation for mechanical land release operations;

3) obtain (from the NMAA) the operational accreditation for protection of machines to be used in demining operations;

4) comply with the national standards for the employment of mechanical land release methods in land release operations. In the absence of national standards, the mine action organizations shall apply the provisions of the relevant IMAS, or the standards specified in their contract or agreement;

5) develop and apply quality management practices which aim to clear land to the requirements specified in national standards or contracts and agreements;

6) establish and maintain reporting systems, and make the information available on mechanical land release operations as specified by the NMAA; and

7) establish systems and procedures to ensure that machines and attachments used on mechanical land release operations operate effectively, are properly maintained and serviced, and remain safe for the operator and support staff.

In the absence of a NMAA, the mine action organization should assume additional responsibilities. These include, but are not restricted to:

8) agreeing on common mechanical land release standards with other mine action organizations operating in the same country; and

9) assisting the host nation, during the establishment of an NMAA, in developing national standards for mechanical land release.

Annex A
(normative)
References

[1] IMAS 03.40, Test and evaluation of mine action equipment

[2] IMAS 04.10, Glossary of mine action terms, definitions and abbreviations

[3] IMAS 07.11, Land release

[4] IMAS 07.13, Environmental management in mine action

[5] IMAS 07.14, Risk management in mine action

[6] IMAS 07.30, Accreditation of demining organisations

[7] IMAS 07.50, Management of human remains in mine action

[8] IMAS 08.20, Technical survey

[9] IMAS 09.10, Clearance requirements

[10] IMAS 10.20, Demining worksite safety

Amendment record

Management of IMAS amendments

The IMAS series of standards are subject to formal review on a three-yearly basis. However, this does not preclude amendments being made within these three-year periods for reasons of operational safety and efficiency or for editorial purposes.

As amendments are made to this IMAS they are given a number. The date and general details of the amendment shown in the table below. The amendment is also shown on the cover page of the IMAS by the inclusion under the edition date of the phrase "*incorporating amendment #*."

As the formal reviews of each IMAS are completed, new editions may be issued. In this case, amendments up to the date of the new edition are incorporated into the new edition and the amendment record table cleared. Recording of amendments then starts again until a further review is carried out.

The most recently amended IMAS are posted on the IMAS website at www.mineactionstandards.org.

Number	Date	Amendment details