NATO STANDARD

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EXPLOSIVE ORDNANCE DISPOSAL EQUIPMENT REQUIREMENTS AND EQUIPMENT

Edition C, version 1

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NORTH ATLANTIC TREATY ORGANIZATION

ALLIED EXPLOSIVE ORDNANCE DISPOSAL PUBLICATION

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

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NATO LETTER OF PROMULGATION

26 January 2022

1. The enclosed Allied Explosive Ordnance Device Publication AEODP-07, Edition C, version 1, EXPLOSIVE ORDNANCE DISPOSAL EQUIPMENT REQUIREMENTS AND EQUIPMENT, which has been approved by the nations in the Military Committee Land Standardization Board, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 2897.

2. AEODP-07, Edition C, Version 1, is effective upon receipt and supersedes AEODP-07, Edition B, Version 1, which shall be destroyed in accordance with the local procedure for the destruction of documents.

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4. This publication shall be handled in accordance with C-M(2002)60.

Dimitrios SIGOULAKIS
Major General, GRC (A)
Director, NATO Standardization Office

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
CZE	The Czech Armed Forces will not implement areas of ability and equipment, related to underwater EOD operations (Annex E).
DNK	DNK does not implement additional draining equipment for lowering groundwater levels as described under Comments.
HRV	Paragraph 2.4 Chemical, Biological, Radiological and Nuclear (CBRN) explosive ordnance disposal (EOD)Croatian Armed Forces will not implement capability of explosive or non-explosive CBRN EOD on multinational deployments. In accordance with this reservation Annex D will not be implemented.
LTU	The Lithuania Armed Forces do not plan to test the equipment listed in the standard within their country and do not plan to establish a magnetic field change mitigation system or infrastructure.
LVA	Latvian National Armed forces will use STANAG as guideline for further EOD capability development but do not guaranty that all equipment will meet the operational requirements mentioned in STANAG.
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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CHAPTER 1 INTRODUCTION

1.1. AIM

The aim of this publication is to identify operational requirements for general and EOD-specific tools and equipment (current as well as developmental) and to promote standardization and interoperability between multinational EOD forces in the execution of the inter-service EOD mission and associated sub-functions. Specific mission phases and associated sub-functions along with EOD equipment requirements are identified in Annex A through Annex E. The types of equipment listed are meant as examples of highly recommended equipment that would fulfil the operational capabilities.

1.2. INFORMATION

It is designed to serve as a guide for general information relative to design, construction, application and performance standards of EOD equipment. The following principles are generally applicable:

a. Units of Measurement **-** All EOD equipment shall be primarily specified and dimensioned in Standard International Units.

b. Selection of Materials **-** Materials and the design configuration used in fabrication shall, if practicable, be selected based on the propensity of that material or configuration to safely interact with energetic material and permanent or induced influence fields designed to function or influence fuzing/firing systems. The first design choice should be nonferrous metals, plastics, or composite based materials.

c. Radiated Emissions **-** Electrical, mechanical, hydraulic, or pneumatic power sources and breathing apparatus should be designed and fabricated to emit the minimum radiated electromagnetic, acoustic, and seismic field signatures. Amplifying information can be found in Annex B.

d. Passive Design **-** Detection and location equipment shall, ideally, be passive in design. Consideration should be given to minimizing (and quantifying) the electromagnetic field radiated by power supplies and components, separately or in combination.

e. Operator Safety **-** Equipment should be designed to ensure that operating personnel are not exposed to undue hazards. National occupational safety standards should be applied as a minimum.

These may include hearing, vision, respiratory, and electrical safety standards.

f. Static Fields **-** Underwater EOD Equipment **-** In addition to the above criteria, the materials and the design configuration used in fabrication shall, if practicable, be selected (or coated) to minimize the static electric (SE) field signature and the associated corrosion-related static magnetic (SM) field signature which can occur when metals of dissimilar electrochemical potential are electrically connected and immersed in sea water. Further amplification may be found in Annex B.

g. Policy for Use of Non-Magnetic EOD Equipment **-** The operational use and application of non-magnetic equipment is determined by the risk of actuation of magnetic influence-fuzed munitions. Each situation should be evaluated and appropriate signature reduction techniques and/or equipment utilized. The non-magnetic criteria for materiel design and construction of EOD equipment is detailed in Annex B.

1.3. AGREEMENT

1. Participating nations agree to consider restriction and/or protection of proprietary rights as may be proposed.

2. Participating nations agree to adhere to the design principles and standards for performance and testing contained herein. The following additional information is included:

a. Annexes A through E identify required capabilities aligned with the elements of an EOD operation and exemplifies types of EOD equipment which can be used.

b. Annex F identifies the various influence signature threats and provides signature reduction standards, as well as design and test criteria for related EOD Equipment.

c. Annex G provides NATO Inter Service EOD Research and Development Targets.

CHAPTER 2 EXPLOSIVE ORDNANCE THREAT

2.1. THE EXPLOSIVE ORDNANCE THREAT

Regardless of the NATO operation on land or in the maritime environment, Explosive Ordnance (EO) and their threats are ever present. This variable EO threat to NATO operations requires Commanders to use the most updated intelligence assessments and employ suitably equipped forces to conduct Counter-EO activities.

2.2. CONVENTIONAL MUNITIONS

Munitions that present a threat to operations and do not contain a chemical, biological, radiological or nuclear filler. When encountered, the conventional munition may be unexploded explosive ordnance (UXO) or abandoned explosive ordnance (AXO). Either may include delay or influenced fuzing.

2.3. IMPROVISED EXPLOSIVE DEVICES (IED)

Ranging in design from simple to complex; Improvised Explosive Devices (IED) may be constructed from readily available cheap household materials and components or to the extent of sophisticatedly engineered by a hostile nation’s military and scientific resources.

2.4. CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR (CBRN) EXPLOSIVE ORDNANCE DISPOSAL (EOD)

Defined as a fully engineered assembly designed to cause the release of a chemical or biological or radiological material onto a chosen target or to generate a nuclear detonation. This EO threat is expected to continue against NATO operations due to the proliferation of CBRN agents, and accessibility of toxic industrial materials. NATO could encounter non-explosive CBRN devices; such as a non-explosive Improvised Spraying Device (ISD) or non-explosive Improvised Dispersal Device (IDD). Details on CBRN EOD operations is outlined in NATO STANAG 2609, AEODP-08 Interservice Chemical, Biological, Radiological, and Nuclear Explosive Ordnance Disposal, Operations (CBRN EOD) on Multinational Deployments.

2.5. SENSORS

Many ordnance types employ the use of sensors that are set to recognize a predetermined environment as “normal”. Introduction of a single or combination of

influences may cause the sensor's environment to change to a condition outside of the "normal" parameters, causing the sensor to provide an arming or firing signal to an ordnance fuzing system. The various levels of these influences are referred to as their "signatures".

2.6. FUZING

Influence fired fuzing systems are most commonly used with underwater ordnance such as sea mines and torpedoes. However, they are also used with various surface ordnance types like land mines and other "area denial" munitions. Additionally, there is the potential for Improvised Explosive Devices (IEDs) to contain influence firing systems.

2.7. INFLUENCE FIRING SYSTEMS

The most commonly used influence firing systems are set to respond to one or combinations of the following influence signatures:

a. Magnetic.
b. Acoustic.
c. Seismic.
d. Underwater Electric Potential.
e. Infrared.
f. Ultrasonic.
g. Microwave.

2.8. INFLUENCE SIGNATURES

The influence signatures identified above are addressed in more detail in Annex F. The EOD equipment issues associated with these influence signatures mainly revolve around signature reduction measures in the design and construction of equipment. As such, the construction and testing of EOD equipment to reduce its magnetic signature is most applicable. Specific criteria for design and testing is contained in Annex B. Tactics and procedures to reduce other influence signatures are addressed in other EOD publications.

2.9. FIRST-SEEN TECHNICAL EXPLOITATION

In the execution of operations, adversaries will endeavor to use new EO against NATO and its Partners to achieve a tactical advantage. Commanders need to remain agile against this threat. As EO technologies evolve, adding technical exploitation (TE) capabilities to NATO operations offers Commanders the agility to counter technically advanced 'first seen' EO. Technical exploitation will allow Commanders to seize and

retain the initiative, maintain an advantage over the adversaries EO as well as opportunities to exploit their weaknesses and develop countermeasures. NATO must have TE capabilities to enable rapid identification and functioning of 'first seen' EO. For further information on TE operations refer to NATO STANAG 6502; Allied Intelligence Publication (AIntP) - 10 Technical Exploitation.

2.10. DEVELOP NEW TOOLS AND EQUIPMENT

There is a critical-linkage between EOD and TE to mitigate potential loss of vital intelligence (e.g. newly discovered/modified munition), as well as enable rapid development of new capability/equipment or countermeasures. NATO EOD should be prepared to enable or conduct 'first-seen' TE and an ability to directly contact or reach back to theater and/or national-level exploitation facilities. This feed of information directly supports NATO and National efforts to develop new EOD procedures, tools and equipment.

2.11. INFORMATION SHARING

Issues surrounding the sharing of EOD information between partner nations should be resolved at the earliest opportunity. The information derived from 'first-seen' TE of explosive ordnance should be disseminated in minutes-to-hours from the point of collection. This initial activity may generate time-sensitive information and outcomes, enable rapid follow-on operations, answer Commanders Critical Information Requirements (CCIR), and meet/support standing strategic initiatives. In order to safeguard, classifying, re-grading or declassifying of EOD information and protect it from potential adversaries; the Alliance needs to apply STANAG 2186, AEODP-12; Explosive Ordnance Disposal Information Security Standards.

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ANNEX A EOD EQUIPMENT REQUIREMENTS FOR EOR

Mission Phase	Sub Function	Type of Equipment	Equipment Standard
Reconnaissance	Detect-Surface	Binoculars Spotting Scopes Night Vision Thermal UAS/ Drone	To comply with situational requirements and National Acquisition Standards
	Detect-Subsurface	Ordnance Detectors Mine/Bomb Probes Ground Penetrating Radar	Must be capable of detecting 250 kg ferrous metal bomb at 6m, min diameter 75mm. National Acquisition Standards
	Detection-Standoff	Neutron Interrogation Acoustic Interferometry Thermal Radiography	National Acquisition Standards
	Marking	Warning signs Stakes Pickets Barbwire	NATO STANAG 2036 Annex B

Mission Phase	Sub Function	Type of Equipment	Equipment Standard
Identification	Initial	EO Handbook NATO EOD Electronic Publications	NATO STANAG 2369/AEODP-14 NATO EOD Publication Set (NEPS) Mission/Joint Operating Area National Standard
		Camera Mirrors Flashlights	As approved by National acquisition

ANNEX B EOD EQUIPMENT REQUIREMENTS FOR CMD

Mission Phase	Sub Function	Type of Equipment	Equipment Standard
Reconnaissance	*As in Annex A EOR*	*As in Annex A EOR*	*As in Annex A EOR*
		Blast and Fragmentation Calculator	
General	Publications	National EOD Publications	National Standards
		NATO EOD Publications	STANAG 2369/AEODP-14 NATO EOD Publication Set (NEPS)
	Access and Uncovering	Remotely Controlled Vehicle (RCV)	National Acquisition Standards (*Recommend*) ASTM E54.09 Standard Test Methods for Response Robots
	Remote	Hook and Line Kit	National Acquisition Standard
	Access Defeat Influence Fuzing Signature Reduction Measures Defeat Anti-Intrusion/Disturbance Devices	Sensor Detectors RF, IR, ultrasonic, etc.)	To comply with situational requirements.
	Monitor	Acoustic (stethoscope) Microwave Interrogation Electronic Safe/Arm Indicator	To comply with situational requirements.

Mission Phase	Sub Function	Type of Equipment	Equipment Standard
	Breach of Physical Barrier	Hand Tools Power Tools Shaped Charges Pyrotechnic Torches/Flares Special Purpose Charges (water/plaster/steel shot/etc.) Excavation Equipment Shafting Equipment Draining Equipment Trepanning Equipment Abrasive Cutting Equipment	To comply with situational requirements. Requirement is to cut a 100mm diameter hole through 5mm steel in less than 15 minutes.
Identification	*As in ANNEX A*	*As in ANNEX A*	As in ANNEX A
		Radiographic Equipment	National Acquisition and Testing Standard
	Explosive Material Composition	Explosive Analyzers	National Acquisition and Testing Standard
	Examine Internal Features	Mirrors Flashlights Radiographic Equipment Ultrasonic Imaging Fiber Optics Equipment	National Acquisition and Testing Standard
Render Safe/Disposal	Protection	PPE Eye Protection Head Torso	NATO STANAG 2920/Allied Engineering Publication (AEP) AEP-2920 *Procedures for the Evaluation and Classification of*

Mission Phase	Sub Function	Type of Equipment	Equipment Standard
		Gloves	*Personal Armour* NATO STANAG 4296/AEP-4296 *Eye Protection for the Individual Soldier – Ballistic Protection* National Acquisition Standard
	Neutralize/Disrupt/Remove a Fuse	Disruptor/Dearmer	National Acquisition Standard
		Remote Rocket Wrench	Equipment to remove at high speed, tail, nose, and side fuzes from munitions with special adaptors as necessary, operated by propellant gases.
		Remote Impact Wrench	A wrench kit to remove nose cone and tail fuzes up to 100mm diameter.
	Deflagration	Per EO Encountered	As in approved EOD Procedure
	Burning/Detonate	Thermite/Incendiary Shaped Charge Sniper Rifle/SMUD Tool	National Acquisition Standard
	Protect from Fuze Arming Action	**External:** Tape, Plaster, Epoxy, Wire **Internal:** Plaster /Epoxy Injection Tool Set Magnetic Clock Stopper	As in approved EOD Procedure

Mission Phase	Sub Function	Type of Equipment	Equipment Standard
	Protective Works	Water Bags Aerated Concrete Blast/Frag Suppressive Foam Earth Works Frontal/Overhead Frag Shelters Explosive Containment Vessels	Frag- At the 99% confidence level stop fragments from a 1.5 kg pipe bomb at a distance of not more than 3 m. Blast – A system to attenuate the blast effects of bombs up to 250 kg by 66%. To comply with situational requirements.

ANNEX C EOD EQUIPMENT REQUIREMENTS FOR IEDD

Mission Phase	Sub Function	Type of Equipment	Equipment Standard
RECON	Remote	Remote Controlled Vehicle (RCV)	National Acquisition Standards (Recommend) ASTM E54.09 Standard Test Methods for Response Robots
Identification and Diagnosis	Detection	Handheld Detector Sensor HME Detection Radiography	National Acquisition Standards
	EOD Electronic Countermeasures	Dismounted/Portable	National Acquisition Standards STANAG 2607/AEODP–11 *Guidelines for Interservice Electronic Warfare (EW) Support to EOD Operations on Multinational Deployments*
		Vehicle Mounted	
Render Safe	Protection	As in ANNEX B EOD Suit/Bomb Suit	**As in Annex B** National Acquisition Standards (*Recommend*) USA Public Safety Bomb Suit NIJ Standard 0117.00 (*Recommend*) ASTM E54.04 (18-03) Blast Overpressure Testing of Bomb Suits

Mission Phase	Sub Function	Type of Equipment	Equipment Standard
	Disruption	Disruptor/Dearmer Hook and Line Kit	National Acquisition Standard
Exploitation	Evidence Collection	Collection Material Plastic Bags Plastic Gloves	National Standard STANAG 6502/AINTP-10 Technical Intelligence STANAG 2289/ACIEDP-02 – NATO Weapons Intelligence Team (WIT) Capabilities
		Explosive Material Transportation/Container	National Standard STANAG 6502/AINTP-10 Technical Intelligence STANAG 2298/ACIEDP-02 – NATO Weapons Intelligence Team (WIT) Capabilities
	In Field Examination	Film Camera Hand Tools Power Tools Digital Camera Video Camcorder Radiographic Equipment	To comply with national requirements. Low Power- Capacity to penetrate 13mm steel. Hi Power – Capacity to penetrate 75mm steel.

ANNEX D EOD EQUIPMENT REQUIREMENTS FOR CBRN EOD

Mission Phase	Sub Function	Type of Equipment		Equipment Standard
General	Physical Protection - Individual Protective Equipment (IPE)	EOD	As listed in Annex B, C	STANAG 2920/AEP-2920 - Classification of Personal Armour STANAG 4296/AEP-4296 - Eye Protection for the Individual Soldier – Ballistic Protection
		CBRN	Protective mask Protective ensemble	STANAG 2352/ATP-84 – Chemical, Biological, Radiological and Nuclear (CBRN) Defence Equipment – Operational Guidelines STANREC 4548/AEP-38 – Operational Requirements, Technical Specifications and Evaluation Criteria for CBRN Protective Clothing
	CBRN Warning and reporting Automatic data processing system	Desirable - A system that is able to perform all functions regarding hazard warning and hazard prediction according to ATP-45 and AEP-45.		Equipment based on national Acquisition standards comply with: STANAG 2103/ATP-45 - Warning and Reporting and Hazard Prediction of Chemical, Biological, Radiological and Nuclear (CBRN) Incidents

Mission Phase	Sub Function	Type of Equipment				Equipment Standard
						(operators manual) STANAG 2497/AEP-45 - Warning and Reporting and Hazard Prediction of CBRN Incidents (reference manual)
Reconnaissance	Surface Detection	EOD	As listed in Annex A, B, C	CBRN		Equipment based on national Acquisition standards comply with: STANAG 2352/ATP-84 – Chemical, Biological, Radiological and Nuclear (CBRN) Defence Equipment – Operational Guidelines STANAG 4730/AEP-75 – Capability and Systems Requirements for Nuclear and Radiological Detection, Identification and Monitoring Equipment STANAG 4835/AEP-4835 (Only Study draft)-NATO Capability and System Requirements for Chemical and Biological Detection Identification and Monitoring (CB DIM) Equipment STANAG 2036 – Land Mine Laying,
	Subsurface Detection				CBR monitors and point detectors	
	Stand-off Detection				UAV´s, Remote Controlled Vehicles, equipped with CBR detectors	
	Remote				Warning Signs and Marking sets	
	Marking					

Mission Phase	Sub Function	Type of Equipment	Equipment Standard
			Marking, Recording and Reporting Procedures, Annex B STANAG 2521/ATP-3.8.1, Vol. I – CBRN Defence on Operations, Annex 10A – Warning Signs for the Marking of CBRN Contaminations
Identification and Diagnosis	Sampling	Equipment Common to All types of Sampling and specific equipment depend on type of CBRN Substance	Equipment based on national Acquisition standards comply with: STANAG 4521/AEP-07 – CBRN Contamination Survivability Factors in the Design, Testing and Acceptance of Military Equipment STANAG 4701/AEP-66 – NATO Handbook for Sampling and Identification of Biological, Chemical and Radiological Agents (SIBCRA), Appendix D – Checklists – D-1 through D-7
	Identification	In situ Analysis via portable GC-MS, IR, Raman and radiac instruments	Equipment based on national Acquisition standards comply with: STANAG 4701/AEP-66 – NATO Handbook for Sampling and Identification of Biological, Chemical and Radiological Agents (SIBCRA)

Mission Phase	Sub Function	Type of Equipment	Equipment Standard
		Chemical, Biological, Radiological deployable analytical laboratories	Equipment based on national Acquisition standards comply with: STANAG 4632 – Deployable NBC Analytical Laboratory
	Packaging	Sample containers and sample quantities depends on type of sample	Equipment based on national Acquisition standards comply with: STANAG 4701/AEP-66 – NATO Handbook for Sampling and Identification of Biological, Chemical and Radiological Agents (SIBCRA), Appendix D – Checklists – D-8
Render Safe	As listed in ANNEX B and C	As listed in ANNEX B and C	
Recovery	Decontamination	• Containers for solid-waste and liquid-waste streams (e.g., waste receptacles), • Marking material: CBRN marking kit, • Recommend heavy-duty or tear and puncture resistant plastic bags, • Pressure-sensitive tape, • Personal decontamination materials, • CBRN detection equipment, • Funnel for pouring liquid waste into collection containers, • Sandbags,	National procedures and Theater SOPs Equipment based on national Acquisition standards comply with: STANAG 4521/AEP-07 – CBRN Contamination Survivability Factors in the Design, Testing and Acceptance of Military Equipment, STANAG 4783/AEP-4783 – CBRN Contaminated Waste Management

Mission Phase	Sub Function	Type of Equipment				Equipment Standard
		• Retention tray.				
	Leak Sealing and Packaging					
Exploitation	Evidence Collection	EOD	As listed in Annex B	CBRN	Tasks for evidence collection from perspective of CBRN Exploitation Capabilities are covered by CBRN "Sampling" sub-function	
	In Field Examination				Tasks for in field examination from perspective of CBRN Exploitation Capabilities are covered by CBRN "Identification" sub-function	
Disposal	Waste Management	• Containers for solid-waste and liquid-waste streams (e.g., waste receptacles),				National procedures and theatre SOPs Equipment based on national

Mission Phase	Sub Function	Type of Equipment	Equipment Standard
		• Marking material: CBRN marking kit, • Decontamination materials, • CBRN detection equipment, • Funnel for pouring liquid waste into collection containers,	Acquisition standards comply with: STANAG 4521/AEP-07 – CBRN Contamination Survivability Factors in the Design, Testing and Acceptance of Military Equipment, STANAG 4783/AEP-4783 – CBRN Contaminated Waste Management

ANNEX E EOD EQUIPMENT REQUIREMENTS FOR UNDERWATER EOD

Mission Phase	Sub Function	Type of Equipment	Equipment Standard
General	Conduct ROV Operations	Remotely Operated Underwater Vehicle (ROV) Unmanned Underwater Vehicle (UUV)	National Acquisition Standards
	Conduct Diving Operations	**Diving Systems:** Self Contained Underwater Breathing Apparatus (SCUBA), Surface Supplied Diving Systems, Compressors, Oxygen/Helium, Support Kits, Generators	STANAG 2897 – AEODP-7 Annex F National Acquisition Standards
	Conduct Small Craft Operations	Small Craft: Inflatable boat and support Craft Outboard Motors Vehicles – Trailers	National Acquisition Standards
	Communications	Compatible Radios/HF/UHF/VHF	National Acquisition Standards
Locate - Identify	Locate – Conduct UW Search Operations	Underwater Sonar Equipment Underwater Imaging System, Ordnance Locators/Metal Detectors, Handheld GPS	STANAG 2897 – AEODP-7 Annex F
	Type Identify Underwater Objects	Obstacle Avoidance Sonar -Side Scan Sonar	National Acquisition Standards STANAG 2897 – AEODP-7 Annex F
	Image External Features of Underwater Objects	Obstacle Avoidance Sonar -Side Scan Sonar	National Acquisition Standards STANAG 2897 – AEODP-7 Annex F

Mission Phase	Sub Function	Type of Equipment	Equipment Standard
Recovery	Protection Stand Off	Underwater Remotely Operated Vehicles (ROVs) Small Craft – Support Craft	National Acquisition Standards
	Recover	Deep Water Lifting Equipment Lines/Pulleys and other Rigging Equipment	National Acquisition Standards
EXPLOITATION	In Field Examination	Film Camera Hand Tools Power Tools Digital Camera Video Camcorder Radiographic Equipment	To comply with national requirements. STANAG 2897 – AEODP-7 Annex F Low Power- Capacity to penetrate 13mm steel. Hi Power – Capacity to penetrate 75mm steel.
DISPOSAL	Burning/Detonation	Thermite/Incendiary Shaped Charge/Disposal Charge Demo Tools for EOD	As in approved EOD Procedure STANAG 2897 – AEODP-7 Annex F
UPDATE	Image External Features of Underwater Objects	Obstacle Avoidance Sonar Side Scan Sonar Underwater Imaging System	
	Protection Stand Off	Underwater Remotely Operated Vehicles (ROVs) Unmanned Underwater Vehicles (UUVs)	
	Recover	Deep Water Lifting Equipment Lines/Pulleys and other Rigging Equipment	

ANNEX F SIGNATURE REDUCTION MEASURES INCLUDING MAGNETIC SIGNATURE DESIGN AND TEST CRITERIA FOR EOD EQUIPMENT USED IN THE PROXIMITY OF MAGNETIC INFLUENCE-FUZED ORDNANCE

F.1 SCOPE

This Annex identifies signature reduction measures and specifies the measurement and evaluation procedures to be used for Contact and Non-Contact EOD equipment. The definitions are:

a. Contact Equipment - Tools, components, fixtures, assemblies and equipment (along with components of such items) that are intended to be placed in direct contact with the surface of magnetic influence mines or munitions. Examples: specialty shaped charges, specialty hand tools, lifting shackles, etc. These are to be tested and specifically marked in accordance with this Annex.

b. Non-Contact Equipment - Tools, components, fixtures, assemblies and equipment (along with components of such items) that are not categorized as contact equipment are considered noncontact equipment. Examples: sonars, magnetometers, pressure vessels etc. They will be tested using the same criteria as for Contact Equipment as specified in this Annex but at three times the standard testing distance and marked in accordance with this Annex.

F2. REQUIREMENTS

The following requirements apply:

a. Magnetic Signature:

(1) All EOD non-magnetic equipment referred to in paragraph 1 will be initially tested in accordance with the test procedures described in this Annex. Every item submitted for acceptance shall be tested in accordance with paragraphs F4 - F5.

(2) EOD equipment will not be placed into service based on taking statistical samples of production items, but will be placed into service based on an individual test of each item. EOD equipment will be subject to a 100% inspection.

(3) All EOD equipment that contains, in any quantity, alloys with iron, nickel, or cobalt shall be re-inspected not more than every three years. This inspection will be certified and the equipment appropriately marked.

(4) Any item which has been repaired or reconfigured or placed in contact with objects containing iron, nickel, or cobalt will be rechecked in accordance with this Annex.

(5) Items which have been painted or had any other substances used on them, such as cleansers or lubricants, will be rechecked unless the substances have been tested in accordance with this Annex.

b. Acoustic Signature Reduction - Acoustic signature reduction standards are contained in the Confidential Supplement to AMP-15. Nations are requested to provide additional comments/suggestions if applicable.

c. Underwater Electric Potential (UEP) Reduction - Nations are requested to provide recommendations for UEP Signature Reduction standards.

d. Other Signature Reduction Measures - Nations are requested to identify other SR requirements and propose SR measures for those. (IR, PIR, Microwave, Ultrasonic, Seismic, etc.)

e. TOTAL MAGNETIC FIELD SIGNATURE LIMIT - It is the goal of the test procedure in all cases to find orientations and operating configurations which produce the maximum fields. The total magnetic field signature shall not exceed 5 nT.

F3. SIGNATURES

The magnetic signature of an item will be determined by adding the maximum **absolute values** of the following:

a. STATIC SIGNATURE - The magnetic signature due to ferromagnetic materials (which contain iron, nickel, or cobalt and thereby may have either or both an earth's field-induced magnetic signature or a permanent magnetic signature).

b. MAGNETIC EFFECTS - The magnetic signature due to the magnetic fields generated by uncompensated electric currents in electronic or electric sub-systems.

c. EDDY CURRENT SIGNATURE - The magnetic signature due to materials whose conductivity is sufficient and physical configuration appropriate to support magnetic field producing eddy currents when the item is rotated in the earth's magnetic field.

F4. TEST PROCEDURES

1. Background magnetic flux density limit - All magnetic effect measurements should be performed in a minimum background magnetic flux density of 4.5 x 10^ 4 nT or 45,000 nT (a nominal, ambient earth's magnetic field). When necessary signatures can be determined in smaller fields (places where the earth's magnetic field is smaller than 4.5 x 10^4 nT or 45000 nT) by increasing the value of the induced and the eddy current magnetic fields by a factor F, where

$$F = \frac{4.5 \times 10^4 \text{ nT (or 45,000 nT)}}{B_e}$$

B_e = magnitude of ambient field,

or by certifying the equipment only for use in the particular geographic area where the measurements were made.

2. Temperature - Measurements should be made at a nominal temperature.

3. Reference Axes - For each measurement a unique orientation will be determined which provides the maximum magnetic signature.

4. Equipment - Testing will be conducted by nations at a suitable magnetic measurement facility. Measurements will be made with either a field component magnetometer or a total field magnetometer with a self noise in the frequency range of 0.2 to 4.0 hertz. If a differential magnetometer/ gradiometer/field component gradiometer is used, the distance between the sensors must be at least twice the measuring distance.

5. Test Distances.

a. Contact - The specified distance for the test is 10.0 cm +/- 0.5cm.

b. Non-Contact - The specified distance for the test is 30.0 cm +/- 0.5cm.

F5. MEASUREMENT TYPES

1. Static Signature

   a. Idealization shall consist of placing each test item in a uniform magnetic field of five gauss, with the item's reference axis aligned parallel to the field. A cycled, pulsed magnetic field is superimposed parallel to the five gauss field. A six second cycle shall consist of the following: a two second square positive pulse, one second off, a two second square negative pulse of equal amplitude, and finally one second off. The amplitude of the positive pulse of the first cycle shall be between fifty and sixty gauss. The amplitude of the positive pulse of the each successive cycle shall be reduced by no more than one gauss per cycle. The cycling shall continue until the amplitude is reduced to zero. The purpose of idealization is to attempt to temporarily magnetize the test item to provide a worst case condition.

   b. Magnetic Effect Measurement - The direction of the measurement shall be paralleled to the background flux density, that is the ambient earth's field. If a field component magnetometer is used, at least one axis must be oriented so that it reads initially the magnitude of the total ambient earth's field, that is, the maximum value. Before measuring the signature of the item, the value of the ambient earth's field will be determined. To make a measurement, the item will be placed at the specified distance on a line drawn from the magnetometer sensor in the direction of the ambient field. The item will be slowly rotated (angular velocity < 5 revolutions per minute) one revolution around several axes in a search to find the largest and smallest magnetometer reading.

      The Static Magnetic Signature will be the following: the greater of M_1, M_2, or M_3:

      $M1 = B_e - B\text{maximum}$

      $M2 = B_e - B\text{minimum}$

      Or if ($B_{\text{minimum}} < B_e$) and ($B_{\text{maximum}} > B_e$)

      $M3 = B\text{maximum} - B\text{minimum}$ where
      B_{maximum} and B_{minimum} are measured values.

      Note: Distance is measured from the magnetometer sensor to the external surface of the item.

Note: If a self-nulling magnetometer is used, the rotation of the item through one revolution must be accomplished faster than the time constant of the nulling circuit.

2. Induced Static Signature - Under certain circumstances, it may be useful to measure separately the permanent and earth's field induced components of the static magnetic signature. Demagnetization of the item can be attempted by placing the item in an A.C. magnetic field of 1. x 10 nT and slowly withdrawing it from the field along the magnetization axis of the A.C. field, or by slowly reducing the field amplitude to zero. If demagnetization is done, the procedure of paragraph F5.1.b. is repeated.

NOTE: An item which has failed the acceptance criteria after idealization and then passed after demagnetization has failed the test.

3. ELECTRIC CURRENT SIGNATURE - If the equipment is powered electrical, the test procedure of paragraph F5.1.b. is to be used for all power on configurations and settings. Particular attention is to be paid to electrical cables and battery boxes. New or fully charged batteries are to be used for these tests.

4. EDDY CURRENT SIGNATURE - The test procedure of paragraph F5.1.b. is used except that an angular velocity of approximately 15 revolutions per minute is used around axes which are perpendicular to the ambient earth's field and for a variety of item orientations. If the item cannot be rotated without changing its physical location, the test is done by oscillating the item around the desired axis of rotation for the desired item orientation at an equivalent peak angular velocity.

F6. SPECIAL CONSIDERATIONS FOR UNDERWATER EOD EQUIPMENT

1. In addition to the magnetic tests specified in paragraphs 1-4 above, Underwater Breathing Apparatus (UBA) and other equipment designed for the underwater EOD role may undergo tests to confirm the following signatures in a dynamic underwater environment:

a. Static, Electric Current and Eddy Current (see para F3.1.).

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b. Static Electric (SE) and associated corrosion-related Static Magnetic (SM).

F7. MEASUREMENT PROCEDURES

1. Tests should be conducted in the following environments:

   a. Controlled (i.e. test tank of seawater of 4 Siemens per metre or conductivity of operational environment).

   b. Operational (i.e. open sea water).

   2. The recommended test procedures and conditions are:

   a. Diver Swim Past - Straight line constant speed swim at 1 metre plan distance from measuring unit/target.

   b. Diver Survey - Visual and tactile survey (360^{O}) of target employing full diver magnetic safety precautions (as detailed in AEODP-1 Volume 1). The specified distance for this test equates to that for Contact Equipment items.

3. Magnetic Signature Limit - The total magnetic field signature from any electromagnetic fields caused by the diver, in seawater, shall not exceed 5 nT.

F8. RECOMMENDED MARKING PROCEDURES FOR NON-MAGNETIC EOD EQUIPMENT

1. The means for marking any item of EOD equipment which meets or exceeds the magnetic signature requirements at Annex F shall be selected by the national authorities developing the tools and equipment.

2. Marking - General

   a. Marking of Individual Items - To facilitate equipment recognition, it is recommended that permanent marking of individual EOD tools and equipment is achieved by use of:

      (1) Engraved or molded markings.
      (2) Labels.

   b. Labels are to be sized commensurate with item size.

   c. Labels may be attached with adhesive or, if this cannot be achieved, secured by non-magnetic wire, plastic monofilament, or string.

d. Lettering, when it is used, will be:

(1) White on a light green background to indicate that an item has met the required standard.

(2) White on a red background to indicate an item has failed to meet the required standard. See para 5 below.

e. Color specifications are to comply with national requirements.

f. External Marking of Cases - In addition, package cases and storage boxes may be marked externally with identification labels (of non-magnetic materials) to indicate that non-magnetic equipment is carried inside. These labels should, whenever possible, be configured according to Paragraph F8.2 as applicable.

3. Contact Items

a. The following minimum information is relevant to tools and equipment which meet the Contact standard. All items shall carry mandatory (M) information. Other optional (O) information may be included in accordance with national requirements.

(1) The letters "NM-A". (M)
(2) Inspection date (in format MMYY). (M)
(3) Range location (one or two letter identifier). (O)
(4) Unique certification number. (O)

b. The precise format of the above information is to be determined by national authorities. Additional national information codes may be added as required.

c. To aid in recognition of small, difficult to mark items, where necessary, these items may be sealed in individual transparent polythene bags and the bags marked/labelled accordingly.

4. Non-Contact Items

a. The following minimum information is relevant to tools and equipment which do not meet the Contact standard but meet the Non-Contact standard. All items shall carry mandatory (M) information. Other optional (O) information may be included in accordance with national requirements.

(1) The letters "NM-B". (M)
(2) Inspection date (in format MMYY). (M)
(3) Range location (one or two letter identifier). (O)

(4) Unique certification number. (O)

b. The precise format of the above information is to be determined by national authorities. Additional national information codes may be added as required.

c. To aid in recognition of small, difficult to mark items, these items may be sealed in individual transparent polythene bags and the bags marked/labelled accordingly.

5. Failed Items

Any item which fails to meet the Contact or Non-Contact standards is to be clearly marked.

a. The following minimum information is relevant to tools and equipment which fail to meet the Contact Equipment and Non-Contact Equipment standards. All items shall carry mandatory (M) information. Other optional (O) information may be included in accordance with national requirements.

(1) The word “FAILED". (M)
(2) Inspection date (in format MMYY). (M)
(3) Range location (one or two letter identifier). (O)
(4) Unique certification number. (O)

b. The precise format of the above information is to be determined by national authorities. Additional national information codes may be added as required.

c. To aid in recognition of small, difficult to mark items, these items may be sealed in individual transparent polythene bags and the bags marked/labelled accordingly.

ANNEX G NATO INTER-SERVICE EOD RESEARCH AND DEVELOPMENT TARGET-BRIEF DESCRIPTIONS

1. Reconnaissance - A system which will show by the fastest possible means, on a display representative of an establishment, e.g., an airfield, the point of impact of air delivered ordnance and which will desirably indicate point of rest.

2. Remote EOD - Equipment or systems affording the maximum degree of operator standoff, which will attack and destroy in situ UXO and IEDs on the surface. This may include EOD Remote Controlled Vehicles, Underwater Remotely Operated Vehicles, disrupters, dearmers, and other neutralization systems.

3. Disposal of Submunitions - Equipment or systems which will allow the rapid restoration of mobility to forces following the use of area denial submunitions/weapons (ADW).

4. Neutralise UXO, (Detonation Unacceptable) - System or techniques which will neutralise UXO where detonation is unacceptable and with the least practicable degree of risk to EOD personnel.

5. Neutralise UXO, (Detonation Acceptable But Not Desirable) - System or techniques which will neutralise UXO where detonation is acceptable but not desirable. The system or technique should reduce, to the smallest extent, risk to EOD personnel, and damage consequent upon clearance.

6. Location of Large Subsurface UXO - Equipment which will automatically and accurately locate in three axis the presence of a subsurface ferrous or nonferrous UXO, and which will desirably indicate its size.

7. Remote Access to Subsurface UXO - A system or systems to remotely gain access to large UXO under the ground or hardened surfaces, in order to render safe or dispose of this UXO.

8. Diagnostic Equipment - Equipment or systems capable of determining the status of electronic fuzing systems and composition of energetic and other hazardous filler material.

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