MAS

NORTH ATLANTIC TREATY ORGANIZATION
ORGANISATION DU TRAITE DE L'ATLANTIQUE NORD

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MAS/977-PPS/4489

17 September 1999

See CNAD AC/310 STANAG distribution

STANAG 4489 (Edition 1) - EXPLOSIVES, IMPACT SENSITIVITY TESTS

Reference(s)
AC/310-D/146, dated 10 January 1998

1. The enclosed NATO Standardization Agreement which has been ratified by nations as reflected in page (iii) is promulgated herewith.

2. The references listed above are to be destroyed in accordance with local document destruction procedures.

3. AAP-4 should be amended to reflect the latest status of the STANAG.

ACTION BY NATIONAL STAFFS

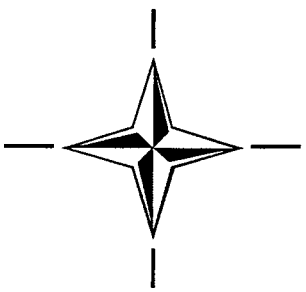
4. National staffs are requested to examine page (iii) of the STANAG and, if they have not already done so, advise the Defence Support Division through their national delegation as appropriate of their intention regarding its ratification and implementation.

A. GRØNHEIM
Major General, NOAF
Chairman MAS

Enclosure:
STANAG 4489 (Edition 1)

STANAG No. 4489
(Edition 1)

NORTH ATLANTIC TREATY ORGANIZATION
(NATO)



MILITARY AGENCY FOR STANDARDIZATION
(MAS)

STANDARDIZATION AGREEMENT
(STANAG)

SUBJECT: **EXPLOSIVES, IMPACT SENSITIVITY TESTS**

Promulgated on 17 September 1999

A. GRØNHEIM
Major General, NOAF
Chairman, MAS

STANAG 4489
(Edition 1)

RECORD OF AMENDMENTS

No.	Reference/date of amendment	Date entered	Signature
1	NSA/1157(2013)-LMC/4498 19 September 2013	20-09-2013	W. Duensing NSA SIMS

EXPLANATORY NOTES

AGREEMENT

1. This NATO Standardization Agreement (STANAG) is promulgated by the Chairman MAS under the authority vested in him by the NATO Military Committee.

2. No departure may be made from the agreement without consultation with the tasking authority. Nations may propose changes at any time to the tasking authority where they will be processed in the same manner as the original agreement.

3. Ratifying nations have agreed that national orders, manuals and instructions implementing this STANAG will include a reference to the STANAG number for purposes of identification.

DEFINITIONS

4. Ratification is "In NATO Standardisation, the fulfilment by which a member nation formally accepts, with or without reservation, the content of a Standardization Agreement" (AAP-6).

5. Implementation is "In NATO Standardisation, the fulfilment by a member nation of its obligations as specified in a Standardization Agreement" (AAP-6).

6. Reservation is "In NATO Standardization, the stated qualification by a member nation that describes the part of a Standardization Agreement that it will not implement or will implement only with limitations" (AAP-6).

RATIFICATION, IMPLEMENTATION AND RESERVATIONS

7. Page (iii) gives the details of ratification and implementation of this agreement. If no details are shown it signifies that the nation has not yet notified the tasking authority of its intentions. Page (iv) (and subsequent) gives details of reservations and proprietary rights that have been stated.

STANAG 4489
(Edition 1)

RATIFICATION AND IMPLEMENTATION DETAILS
STADE DE RATIFICATION ET DE MISE EN APPLICATION

NAPTAIYOS	NATIONAL RATIFICATION REFERENCE REFERENCE DE LA RATIFICATION NATIONALE	NATIONAL IMPLEMENTING DOCUMENT DOCUMENT NATIONAL DE MISE EN APPLICATION	IMPLEMENTATION/MISE EN APPLICATION					
			INTENDED DATE OF IMPLEMENTATION DATE ENVISAGEE DE MISE EN APPLICATION			DATE IMPLEMENTATION WAS ACHIEVED DATE EFFECTIVE DE MISE EN APPLICATION		
			NAVY MER	ARMY TERRE	AIR	NAVY MER	ARMY TERRE	AIR
BE								
CA	2441-4489(DAPM4-4) of/du 26.03.1999	STANAG	05.99	05.99	05.99			
CZ								
DA	MA204.69-S4489/MAM3-8629 of/du 16.04.1998	STANAG	11.99	11.99	11.99			
FR	516/DGA/DSA du 16.04.1999	AFNOR NFT 10-500	06.99	06.99	06.99			
GE	BMVG-FüSIV1-Az 03-51-60 of/du 12.06.1998	STANAG	12.99	12.99	12.99			
GR								
HU								
IT								
LU								
NL	M9800 2323 of/du 26.05.1998	STANAG	04.98	04.98	04.98			
NO								
PO								
POSP								
TU	TUDEL-98/STAN-1992 of/du 8.05.1998	STANAG	-	08.01	-			
UK	DStan 12/15/4489 of/du 30.07.1998	STANAG	08.99	08.99	08.99			
US	DoD memo of/du 24.07.1998	STANAG	08.99	08.99	08.99			

RESERVES/RESERVATIONS

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STANAG 4489
(Edition 1)

NAVY/ARMY/AIR

NATO STANDARDIZATION AGREEMENT
(STANAG)

EXPLOSIVES, IMPACT SENSITIVITY TESTS

Annexes:

A. ERL/Bruceton Machine with Type 12 Tools
B. Rotter Impact Machine
C. BAM Impact Machine
D. Impact Sensivity Test Sheet

Related documents:

STANAG 4170: Principles and Methodology for the Qualification of Explosive Materials for Military use.

AIM

1. The aim of this agreement is to standardize test apparatus and test procedures for the determination of the impact sensitivity of explosives.
The use of the test apparatus and test procedures should facilitate the exchange and direct comparison of test data in conjunction with qualification testing according to STANAG 4170.

AGREEMENT

2. Participating nations agree to accept the tests described in this STANAG as standard procedures and to determine impact sensitivities and exchange data as described herein. For the determination of impact sensitivity only one of the tests described in the annexes is required.

GENERAL

3. Test apparatus to be used

The impact sensitivity of an explosive will be determined using one of the following apparatus:

a. ERL/Bruceton Machine with Type 12 Tools;
b. Rotter-Type Impact Machine;
c. BAM Impact Machine.

The apparatus and the test procedures are described in Annexes A, B, and C.

4. Procedure

A Bruceton up-and-down procedure will be applied for the determination of the impact sensitivity. From the data received the mean (M), the logarithm of the drop height which causes 50% positive reactions of the sample explosive (H_{50}), and the standard deviation (S) of the mean are determined as follows:

a. First the data are examined to determine the number of positive reactions and the number of negative reactions. The lowest of those two numbers is selected for the analysis of the data;

b. The lowest drop height step for the reaction indicated above is assigned an i value of 0. Successive higher steps are assigned values of 1, 2, 3, etc. Then:

$N = \sum_i n_i$ = total number of positive or negative reactions during series including step 0

$A = \sum_i i n_i$

$B = \sum_i i^2 n_i$

where n_i is the number of positive or negative reactions at step i.

c. Then the mean (M) is calculated by applying the equation:

$$M = C + D\left[\frac{A}{N} \pm \frac{1}{2}\right]$$

C is the logarithm of step height 0 and D is the step interval in logarithm units.

The plus sign is used if the number of negative reactions is lower than the number of positive reactions. The minus sign is used if the number of positive reactions is lower than or equal to the number of negative reactions.

d. The standard deviation (S) of the mean (M) is calculated using the following equation:

$$S = 1.620\ D\ [((NB-A^2)/N^2) + 0.029]$$

The validity condition for the Bruceton procedure shall be recorded, i.e. $0.5 \leq S/D \leq 2.0$.

This analysis assumes a normal distribution.

e. Spreadsheets for collection and evaluation of test data are available from the Defence Investment Division Web portal (https://diweb.hq.nato.int) under CASG > SG/1 > Documents > Documents.

5. Exchange of data

Impact sensitivities of explosives determined according to this STANAG will be exchanged in the form of 50% probability of positive reaction data using the standard data sheet as provided in Annex D.

6. IMPLEMENTATION OF THE AGREEMENT

The STANAG will be considered implemented when ratifying countries comply with the test procedures described in this STANAG for the impact sensitivity tests.

ERL/BRUCETON MACHINE WITH TYPE 12 TOOLS

1. Description of the ERL/Bruceton Machine with Type 12 Tools

1.1 *Principle*

Impact energy is provided by a free-falling weight dropped from varied heights onto one end of a steel cylinder, called the striker. This metered stimulus is delivered through the striker to the explosive test sample placed between the other end of the striker and a steel block called the anvil. The sample response is measured with an electronic noisemeter with which a threshold is established to differentiate between positive reactions (go's) and negative reactions (no-go's). By a series of trials, the drop height which causes 50% of the test samples to explode is determined.

1.2 *Apparatus*

The apparatus (Fig. 1) consists of a free-falling weight of hardened steel (Fig. 2), tooling to hold the explosive sample, and a supporting frame. Although other weights are available (2 or 5 kg), a 2.5 kg weight is almost always used. By means of a hand windlass attached to an electro-magnet, the weight can be positioned at any height above the striker to a maximum of 320 cm. When the magnet is deenergized, the weight falls between three guide rails, hits the striker, and rebounds upward. The test operator then activates a device which catches the weight, not allowing it to impact the striker a second time.

1.3 *Impact Device*

The striker (Fig. 3) is a steel cylinder, 3.18 cm (1.25 in.) in diameter and 8.89 cm (3.50 in.) long with the face ground to 40.6 µcm (16 µin). The end which is struck by the falling weight (Fig. 2) is slightly rounded with a radius of curvature of 6.35 cm (2.50 in.). The anvil is a steel cylinder, 3.18 cm (1.25 in.) in diameter and 3.18 cm (1.25 in.) high, backed by a massive steel and concrete base. Both the striker and the anvil are tool steel, hardened to Rockwell C 60-63.

2. Sample Preparation

The test sample consists of approximately 35 mg of loose granular powder piled in the center of a 2.54 cm (one inch) square piece of 180Å garnet sandpaper. Unless the sensitivity of other specific particle sizes is required powders are sieved and the fraction passing through a 0.50 mm sieve (No. 35) is used for the test. Cast materials are crushed prior to sieving.

For PBX-type materials, the sample is remotely ground with a mortar and pestle type device. The sample is then also pushed through a 0.50 mm sieve (No. 35). If this technique proves impractical, solid samples are sliced as uniformly as possible to a thickness of approximately 1-2 mm. These samples are then placed on the sandpaper.

3. Test Preparation

The sample and paper are centered on the anvil, and the striker is lowered carefully through its guides onto the sample. In one variation, described as "bare tools", the sample is placed directly on the anvil, without the sandpaper. Formulations containing ammonium perchlorate or potassium perchlorate should be tested on bare tools because of interaction with the sandpaper glue.

In the standard impact test, shot samples are 35 mg piles of loose powder placed in the center of squares of sandpaper, which are centered on the anvil. To save time, individual samples are not weighed. Instead, the appearance of 35 mg of the test explosive in a small scoop is determined volumetrically; then equal appearing scoop loads are used for subsequent shots. By careful application of this method, 35 mg (± 5 mg) samples can be quickly dispensed.

4. Types of Reaction

Any type of reaction evident by crackling, scorching, or an explosion is considered a positive reaction called "go". However, two criteria must be satisfied. First, the sandpaper upon which the sample is placed must be scorched, frayed, or some evidence of sparking seen. Secondly, a noise-meter shall record a decibel level greater than that produced with no sample present. This decibel level is measured 78 cm away by a microphone which is calibrated to a standard for each explosive tested.

5. Test Procedure

A test sample (explosive on sandpaper) is placed in the center of the anvil and the striker is lowered gently so that it rests on the top of the explosive pile. The drop weight is elevated to a preselected height. Selection of the height used for the first drop is a matter of judgment. If the sensitivity of the test material has been previously measured, the first drop height will be chosen in the range where "go's" have occurred. If the material is of completely unknown sensitivity an arbitrary starting height is used based on the sensitivity of similar compositions.

The weight is then dropped and the result is indicated by the noisemeter. After initial rebound the weight is caught by a sliding stop moved into position by the operator. This prevents multiple impacts between weight and striker.

After the first "go" has been obtained (which may take 3 to 4 preliminary drops with an unknown material) successive drop heights are governed by the results of the previous drop. That is, if the result is a "go", the drop height for the next shot is lowered by one step. If it is a "nogo", the next height is one step higher. Drop height steps are chosen to have equal intervals of 0.1 on a logarithmic scale, with a 10 cm drop height taken as 1.0. Testing continues by this procedure for a total of 25 shots. After each shot the striker and anvil are cleaned with an appropriate solvent such as acetone and inspected for damage.

6. Determination of Results

The impact sensitivity of a test explosive is determined according to the procedure established in paragraph 4.

7. Reporting of Results

The impact sensitivity of a test explosive as calculated according to paragraph 4 is reported as H_{50}, the drop height in cm which causes a sample to explode 50 % of the time. For the exchange of data the standard data sheet as provided in Annex D is used.

8. Typical Results

PETN	13 - 17 cm
RDX (Class 5)	18 - 22 cm
HMX (Class 5)	20 - 26 cm
Tetryl	32 cm
TNT	154 cm

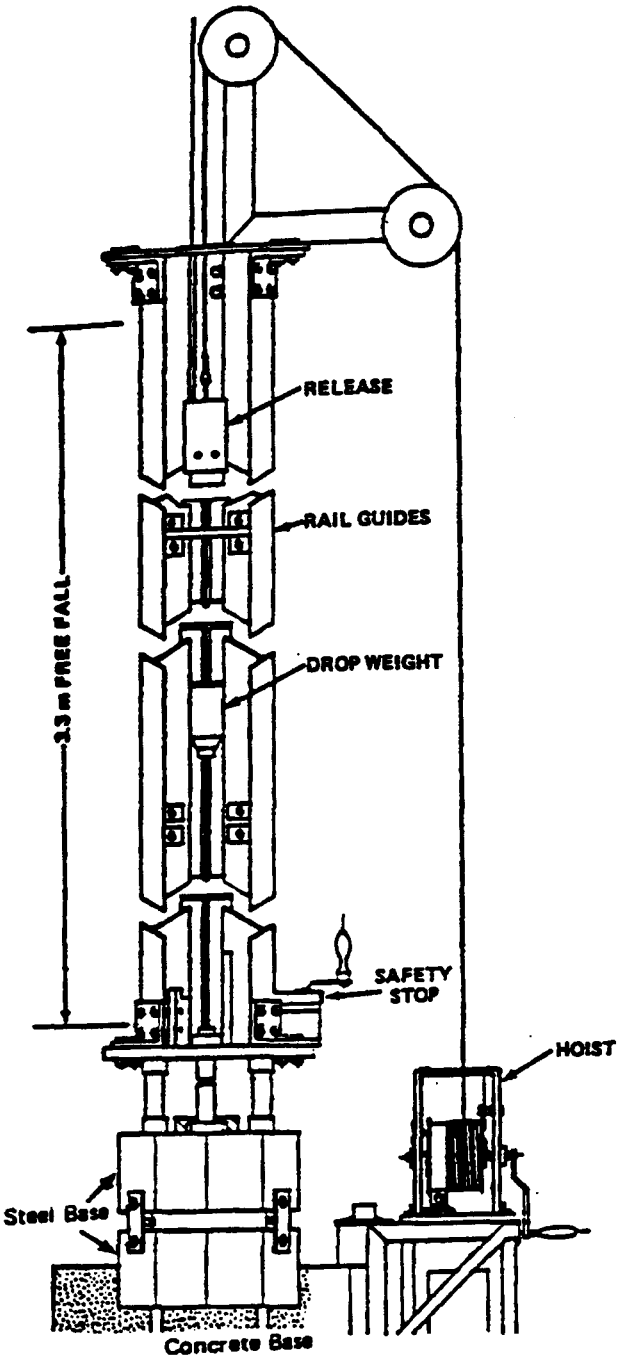


Fig. 1 - DROP WEIGHT IMPACT MACHINE, ERL MODEL, TYPE 12 TOOLS

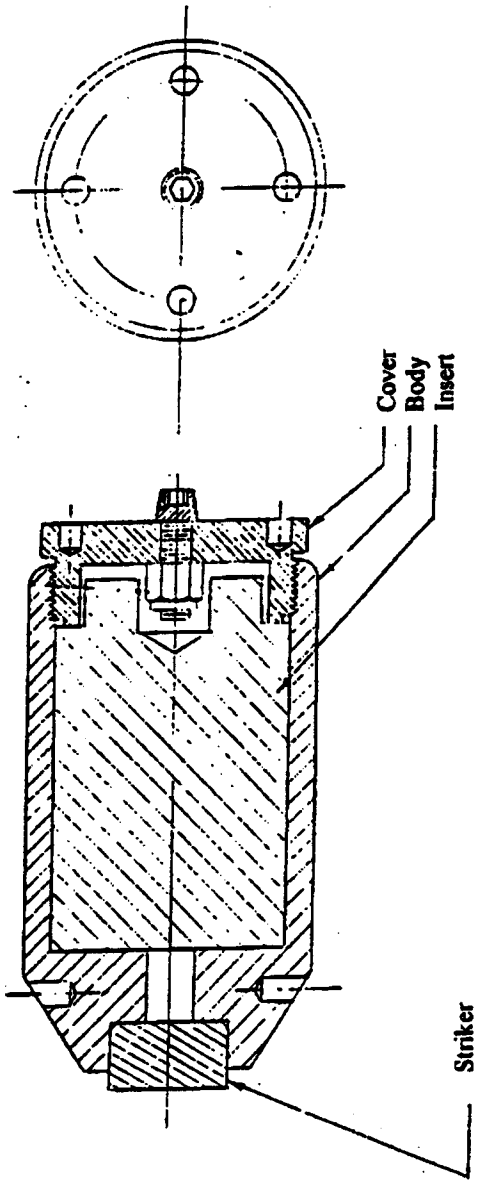


Fig. 2 - DROP WEIGHT ASSEMBLY

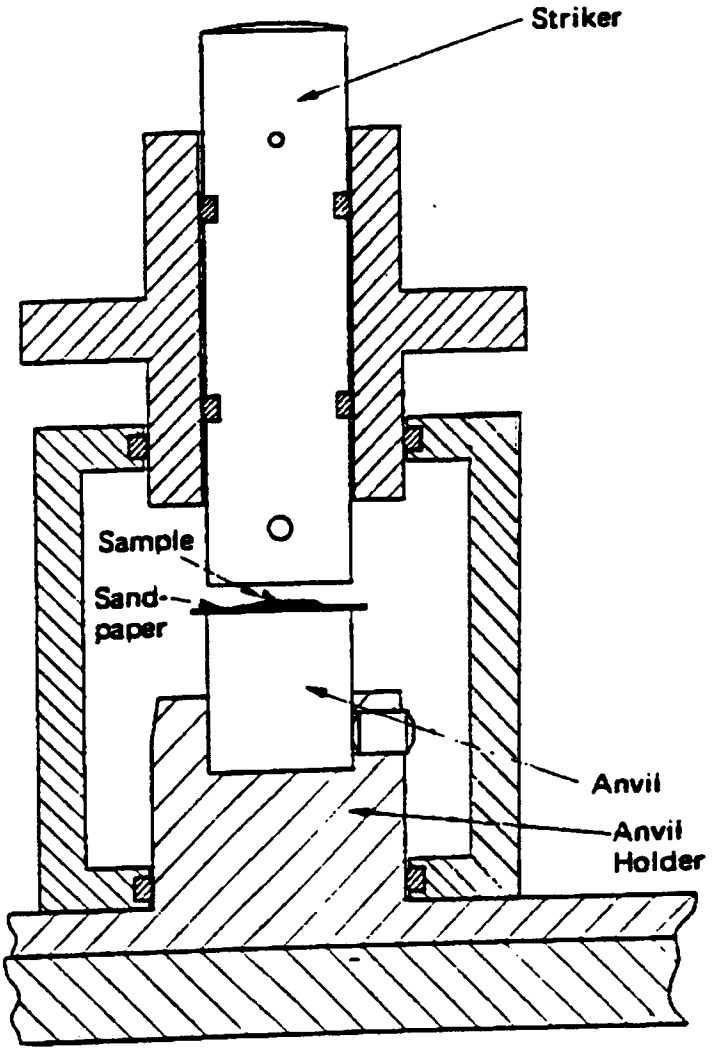


Fig. 3 - ANVIL Striker Arrangement, ERL Machine

ANNEX B to
STANAG 4489
(Edition 1)

ROTTER IMPACT MACHINE

1. Description of the Rotter Impact Machine

1.1 *Scope*

The apparatus and test procedure is suitable for the assessment of the drop-weight impact sensitiveness of all solid explosives.

1.2 *Principle*

A measured volume of the material under test is crushed between the top of a hardened steel anvil and a loosely fitting brass cap by the action of a 5 kg drop-weight. The diameter of the top of the anvil is about 8.5 mm. Ignition detection is by a gas burette linked to the anvil housing.

1.3 *Apparatus*

The apparatus (Fig.1) consists of a prescribed solid foundation below floor-level with a drop-weight machine resting on top of it. The drop-weight can be raised and lowered inside 2.5 m guide-rails using an electro-magnet attached to a calibrated winch. At the bottom of the guide-rails an intermediate drift is located and below that the anvil housing (Fig.2) can be slid under the machine. In action the impulse from the drop-weight is transferred through the intermediate drift, then through a smaller intermediate component in the anvil housing lid (the striker), then through the brass cap and the sample, the anvil and on into the base of the machine. The sample is crushed under the brass cap and is forced to flow radially across the face of the anvil and if the stimulus is sufficiently large, this results in ignition of the sample. Associated equipment includes that used for sample preparation and the gas burette. The latter is connected to the otherwise sealed anvil housing by a tube.

2. *Sample Preparation*

Unless specifically requested otherwise, powders are passed through a 850 µm standard sieve. If the powder is too coarse to all pass the sieve its particle size is reduced by gently crushing it using a pestle and mortar. A volumetric cap loading device is used to dispense 30 µl of the sample into each cap. If the sample is a low bulk-density powder, a tamping device is used to fill the dispensing device more uniformly. Rubbery or dough-like samples are cut into slices and cork-bored to fit the loading device before dispensing into caps. Samples are conditioned to the test bay temperature for at least 12 hours before testing.

Cast brittle materials are broken up, crushed when necessary, and sieved.

3. Types of Reaction

Positive reactions to the applied stimulus range from the smallest detectable amount of decomposition of the sample to complete reaction accompanied by a shattered brass cap. Negative reactions are all those not judged as positive. The behavior of the gas burette fluid is the primary ignition witness. If minor reaction is thought to have occurred, e.g. rapid displacement of the burette fluid which settles at a reading of between 0.5 and 1 ml, additional confirmatory evidence such as the presence of smoke or sooty deposits is required before judging it to be positive.

4. Test Procedure

Approximately fifty-five caps are loaded and a starting drop-height is chosen. A scale of drop-heights is used which passes through 0.1 m and has a logarithmic increment of 0.075. The actual starting point of the run is determined either formally using a standard procedure or from experience, but in any case the first two trials in the run must give opposite responses. A fifty shot Bruceton staircase procedure is performed. Each shot or trial in the run involves setting the drop-weight at the desired drop-height using

the calibrated winch, fitting one of the filled brass caps onto the steel anvil pip by inversion of the anvil and then reinversion, fitting this assembly into the anvil housing and rotating the cap to spread the sample. Next the housing lid is fitted, effectively sealing it and the striker is brought into contact with the top of the cap. The housing is slid under the machine so that the drift is resting on and aligned with the striker and then the valve on the gas burette outlet is closed. With the drop-weight catching bars held open the weight is released and is caught in the catching bars after striking the drift once. From observation of the gas burette fluid and any additional checks which may be necessary, the outcome of the trial is judged to be either positive or negative, the cap is discarded and the anvil is cleaned ready for the next trial. If an unacceptable degree of wear is observed on any item of equipment during testing this should be replaced before proceeding further. In any event the anvil is changed after each 50 cap test has been completed.

The result of each trial in the run is recorded on a worksheet together with the burette reading. Also recorded are the sample reference number, anvil number, date, drop-heights used, operator names and to sum the number of positive and negative events at each drop-height.

Every week a test is performed using a specially produced standard sample of RDX and the results are fed into the updating of a running mean calculation having a block size of six. All drop-weight impact test results are expressed relative to this standard running mean drop-height.

5. Determination of Results

The impact sensitivity of a test explosive is determined according to the procedure established in paragraph 4.

6. Reporting of Results

The impact sensitivity of a test explosive as calculated according to paragraph 4 is reported as the Figure of Insensitiveness (F of I), which is determined from the median drop-height (M) and the current running mean value (RM) as follows:

$$F \text{ of } I = 80\ M / RM$$

Results are reported on a data sheet and this collects together all the results from small scale tests on the sample.

Should it be considered necessary to work back from a F of I to a median drop-height, a value of 109 for RM can be assumed unless more accurate information is available.

The impact sensitivity of a test explosive is exchanged using the standard data sheet as provided in Annex D.

7. Typical Results

	Typical Median Height	**F of I**
PETN	70 cm	50
RDX	110 cm	80
HMX	85 cm	60
Tetryl	125 cm	90
TNT	210 cm	150

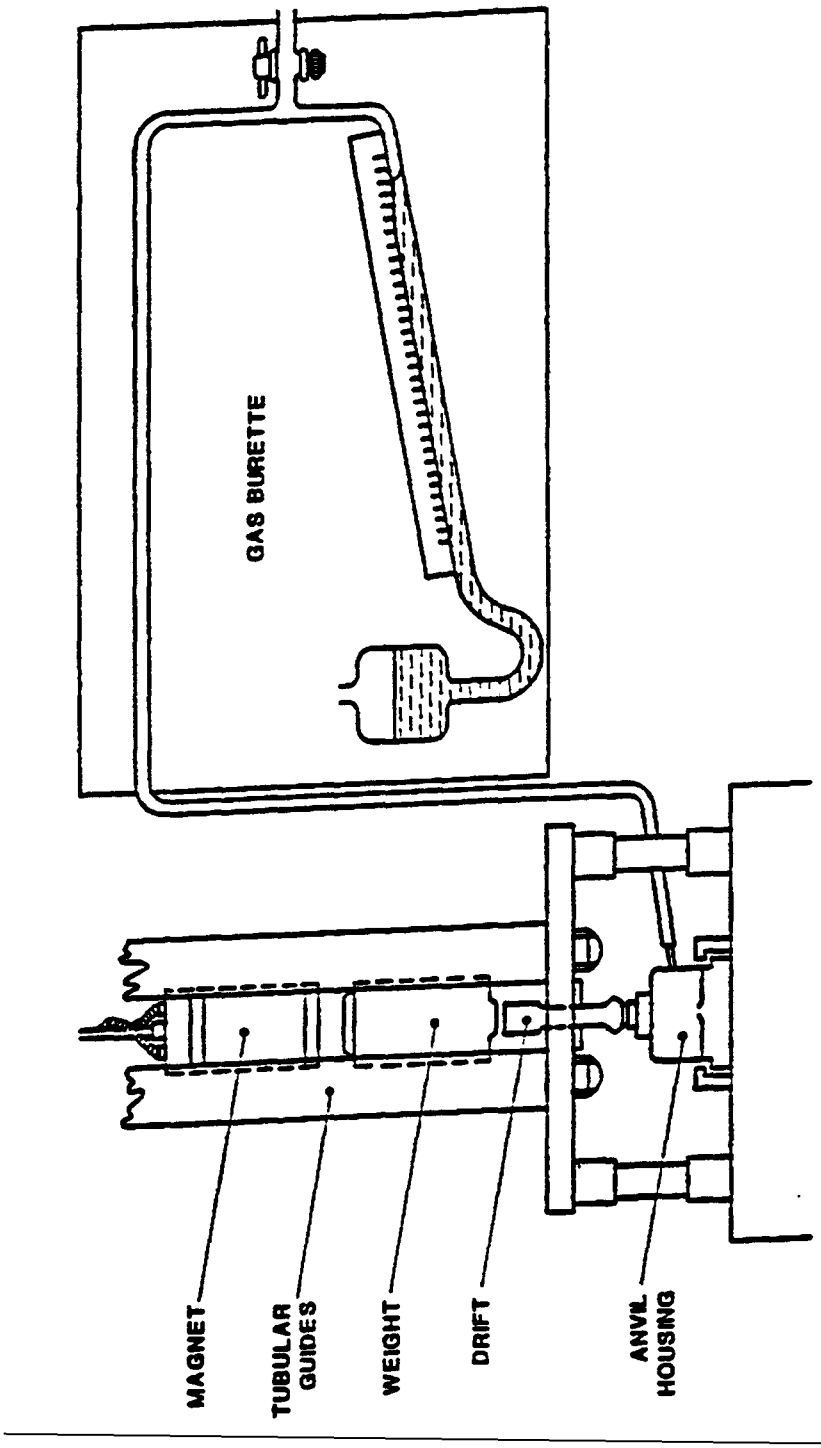


FIG.1 - DIAGRAMMATIC REPRESENTATION OF ROTTER IMPACT SENSITIVENESS MACHINE

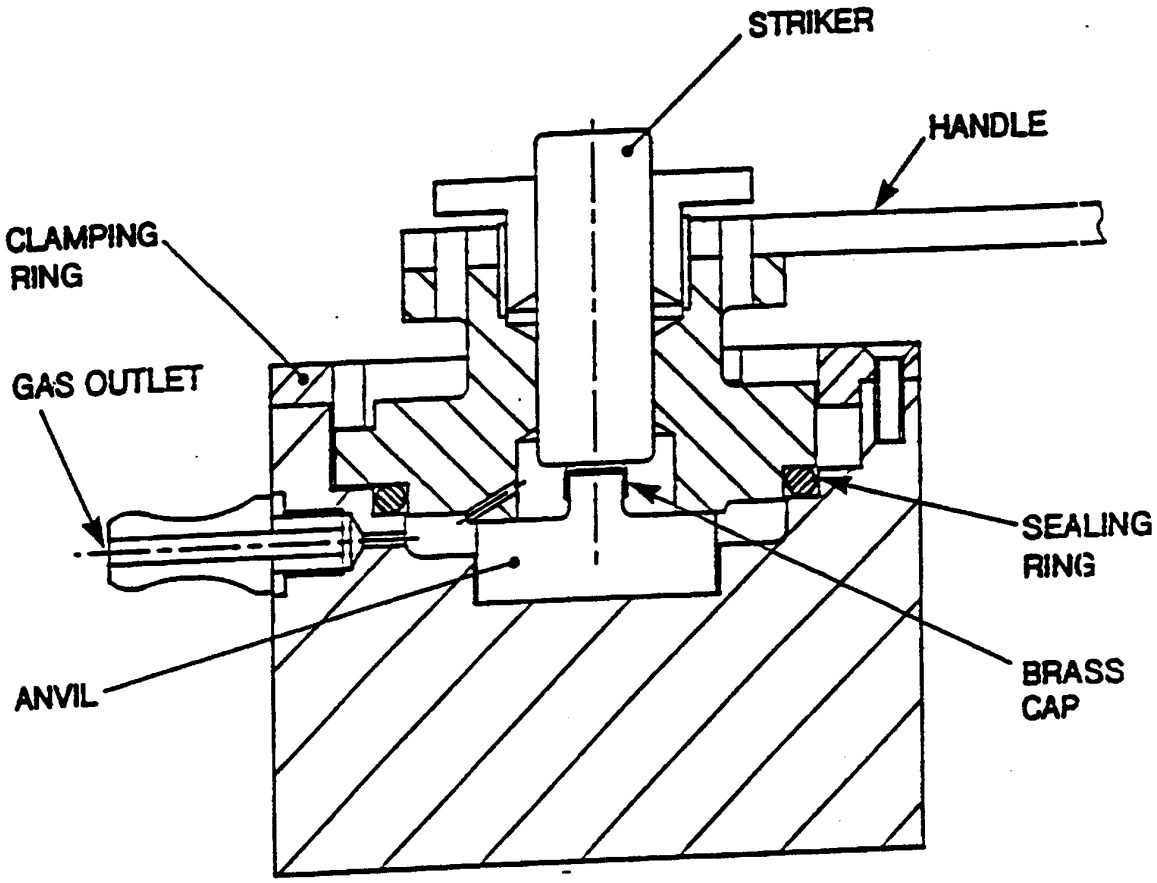


FIG.2 - ANVIL HOUSING, ROTTER IMPACT MACHINE

ANNEX C to
STANAG 4489
(Edition 1)

BAM IMPACT MACHINE

1. Description of the BAM Impact Machine

1.1 *Principle*

A measured amount of explosive substance is crushed between steel cylinders by the action of a drop weight.

1.2 *Apparatus*

The BAM Impact Machine (Fig. 1 to 4) consists of a cast steel block whose base is bolted to a concrete block. Imbedded in the steel block is the main anvil on which the intermediate anvil holding the impact device rests. Attached to the rear of the steel block is a column supporting two guide rails by means of three cross-pieces. These guide rails facilitate free vertical movement of the drop weight and the release mechanism. To arrest the rebounding drop weight a toothed rack is incorporated in one of the guide rails. The drop weight is positioned at varied heights either by hand or by means of a motor-driven winch. This lowers or raises the release mechanism connected to the drop weight before each test. A wooden protective box with inner lead plating encloses the lower part of the machine during testing and a suction device removes reaction gases or dust from the box.

1.3 *Impact Device*

The impact device consists of two coaxially arranged steel cylinders held in place by a cylindrical steel guide ring. The cylinders are roller bearings 10 mm in diameter and 10 mm in height with polished surfaces and rounded edges. They are hardened to Rockwell C 58-65. The guide rings have an inner diameter of 10 mm, an outer diameter of 16 mm, and a length of 13 mm.

The impact device rests on the intermediate anvil, a steel cylinder of 26 mm diameter and 26 mm height. It is centered there by means of a steel ring containing six concentrically arranged holes that permit the escape of the reaction gases.

1.4 *Drop Weights*

Drop weights of 1, 2, 5, and 10 kg are available for testing. The body of each drop weight has two guide grooves in which it moves between the guide rails. It is equipped with a suspension spigot that arrests the weight in the release mechanism and is further provided with a rebound catch, a height marker, and the cylindrical striker. The striker is of steel with a minimum diameter of 25 mm. It is hardened to Rockwell C 60-63.

1.5 *Drop Heights*

Depending on the version of the impact apparatus, a weight can be positioned at any height up to a maximum of 1 or 2 m. In testing according to this STANAG a scale of drop heights starting at 10 cm with a logarithmic interval of 0.05 is used.

2. Sample Preparation

Powdered substances are sieved and the fraction with a particle size of 0.5 to 1.0 mm is used for testing. Pressed or cast substances are crushed and then sieved. Rubbery or composite materials are carefully cut into slices of 3 mm thickness and approximately 4 mm length and width.

3. Test Preparation

The impact device is prepared by partially pushing one of the cylinders into a guide ring. This open impact device is then positioned on the intermediate anvil fitted with the locating ring. Using a measuring spoon, 40 mm^3 of the substance (or one slice of rubbery or composite material) are placed inside the open impact device making sure that a center heap is formed. The impact device is then closed with a second cylinder by carefully pressing it into the guide ring until it touches the sample.

4. Types of Reaction

IMPACT SENSITIVITY TEST SHEET

In judging the results distinction is made between no reaction, decomposition, and explosion. Decomposition can be recognized by flame, smoke or by inspection of the impact device for sooty deposits after the upper cylinder has been removed. Of the three possible types of reaction decomposition and explosion are considered positive reactions when testing according to this STANAG.

5. Test Procedure

After the required number of impact devices has been prepared as described in section C-3., a starting level is chosen near the anticipated median. On the basis of this anticipated median a drop weight is chosen from the set of weights described in section C-1.4.

Together with the intermediate anvil the first impact device is placed on the main anvil. The drop weight is attached to the release mechanism and positioned at the desired height. Then the protective box is closed and the drop weight released. After the result has been recorded the suction device is actuated to remove the reaction gases.

5.1 *Determination of the Starting Level*

The determination of the starting level follows a fixed pattern. Starting at a level near the anticipated median approximately ten preliminary trials are conducted using an up-and-down procedure with equally spaced logarithmic intervals. The results should be grouped around a certain level, which can easily be identified and is taken as the starting level for the determination of the 50 % point. If the results of the ten trials consistently tend toward higher or lower levels a new starting level is chosen and preliminary testing is repeated.

5.2 *Determination of the 50 % Point*

Beginning at the starting level established in section C-5.1, a 30 trial Bruceton up-and-down run is performed to determine the drop height which causes 50% positive reactions of the samples. Using a logarithmic interval of 0.05 the drop height is raised or lowered by one interval for each succeeding trial depending on whether the outcome of the previous trial is negative or positive.

6. Determination of Results

The impact sensitivity of the explosive substance tested is determined according to the procedure established in paragraph 4.

7. Reporting of Results

The impact sensitivity of the explosive substance as calculated according to paragraph 4 is reported as follows: The drop height, in meters, for 50% positive reactions and the standard deviation, in meters, are multiplied by the mass of the drop weight used, in kilograms, and the gravitational constant, which for simplicity is set equal to 10 m/s^2. The values thus determined are the impact energy which causes 50% positive reactions of the samples and the standard deviation, both in Joule.
The impact sensitivity of a test explosive is exchanged using the standard data sheet as provided in Annex D.

8. Typical Results

PETN	5 Joule
RDX	8 Joule
HMX	9 Joule
Tetryl	17 Joule
TNT	30 Joule

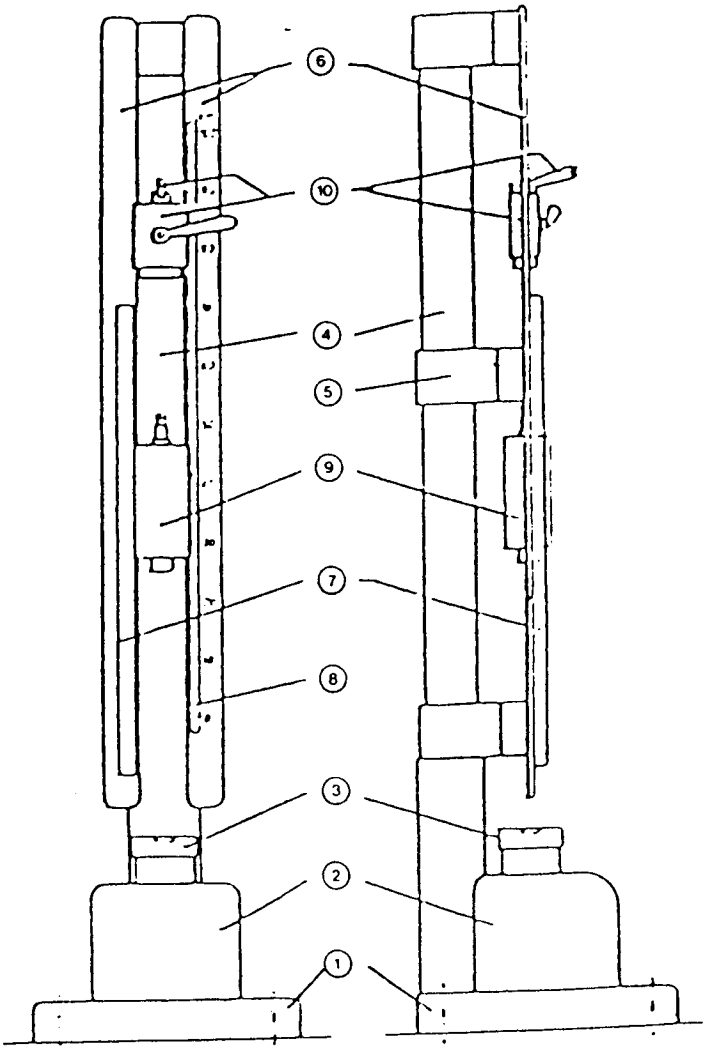


Fig. 1 - BAM IMPACT MACHINE
dimensions in mm

(1) Base 450 x 450 x 60
(2) Steel block 230 x 250 x 200
(3) Anvil 100 diam. x 70
(4) Column
(5) Middle cross-piece
(6) Two guides
(7) Toothed rack
(8) Graduated scale
(9) Drop weight
(10) Holding and releasing device

IMPACT SENSITIVITY TEST SHEET

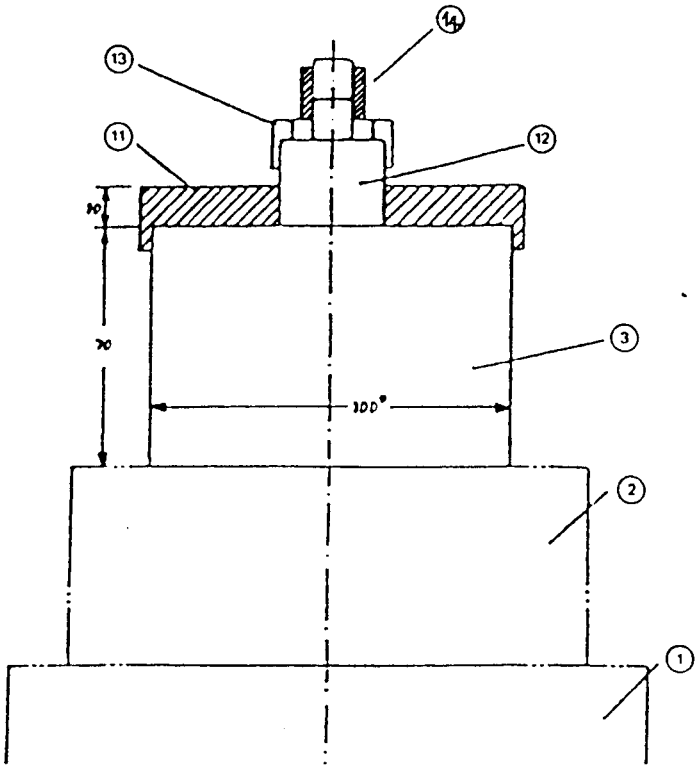
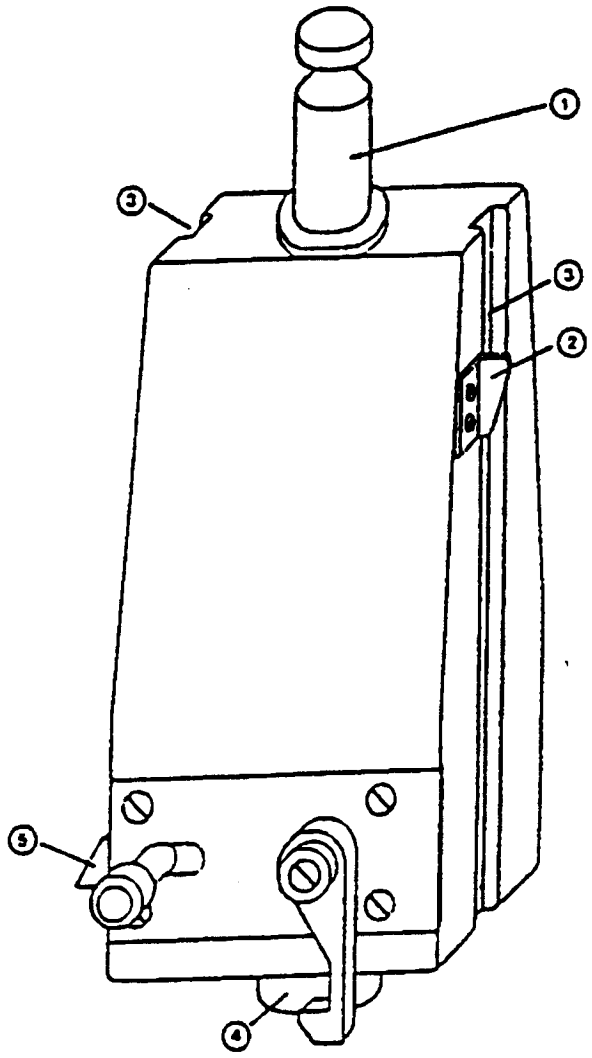


Fig. 2 - BAM IMPACT MACHINE
Lower part
dimensions in mm

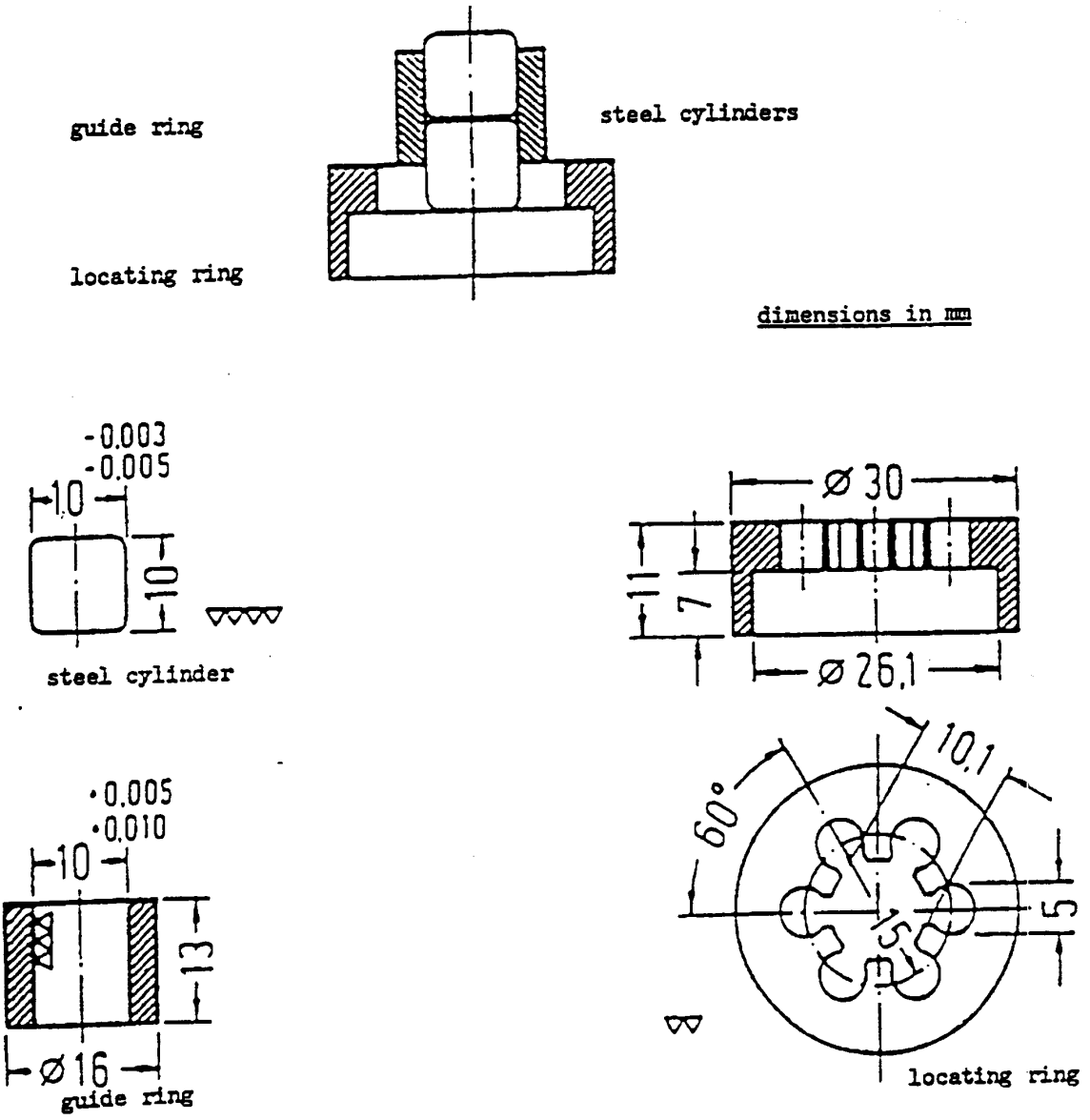
(1) Base 450 x 450 x 60
(2) Steel block 230 x 250 x 200
(3) Anvil 100 diam. x 70
(11) Locating plate
(12) Intermediate anvil 26 diam. x 26
(13) Locating ring
(14) Impact device



(1) Suspension spigot
(2) Height marker
(3) Positioning groove
(4) Cylindrical striking head
(5) Rebound catch

Fig. 3 - BAM IMPACT MACHINE

IMPACT SENSITIVITY TEST SHEET



Impact Device

Fig. 4 - BAM IMPACT MACHINE

ANNEX D to
STANAG 4489
(Edition 1)

IMPACT SENSITIVITY TEST SHEET

Test Apparatus Used	ERL/Bruceton machine with type 12 tools
Explosive Material Tested	
Condition of Sample	
Test Organization	
Test Date	

TEST CONDITIONS

Drop Weight [kg]	
Log. Interval	0,1
Number of Trials	25

TEST RESULTS

50% Point [cm]	
Standard Deviation [cm]	
Bruceton Procedure Valid	
S/D	

Drop Height [cm] — Trial Number

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
10,0																									
12,6																									
15,8																									
20,0																									
25,1																									
31,6																									
39,8																									
50,1																									
63,1																									
79,4																									
100,0																									
125,9																									
158,5																									
199,5																									
251,2																									
316,2																									

x = pos. reaction; o = neg. reaction

IMPACT SENSITIVITY TEST SHEET

Test Apparatus Used	Rotter Impact Machine
Explosive Material Tested	
Condition of Sample	
Test Organization	
Test Date	

TEST CONDITIONS

Drop Weight [kg]	5
Log. Interval	0,075
Number of Trials	50

TEST RESULTS

50% Point [cm]	
Standard Deviation [cm]	
Bruceton Procedure Valid	
S/D	
Running Mean Value [cm]	
F of I	

Drop Height [cm] / Trial Number

—	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
2,5																																																		
3,0																																																		
3,5																																																		
4,2																																																		
5,0																																																		
6,0																																																		
7,1																																																		
8,4																																																		
10,0																																																		
11,9																																																		
14,1																																																		
16,8																																																		
20,0																																																		
23,7																																																		

x = pos. reaction; o = neg. reaction

ANNEX D to
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IMPACT SENSITIVITY TEST SHEET

TEST CONDITIONS		TEST RESULTS	
Test Apparatus Used	BAM Impact Machine		
Explosive Material Tested		Drop Weight [kg]	
Condition of Sample		Log. Interval	0,05
		Number of Trials	30
Test Organization		50% Point [cm]	
Test Date		Standard Deviation [cm]	
		Bruceton Procedure Valid	
		S/D	
		Impact Energy [50%, J]	

Drop Height [cm] — Trial Number

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	29	29	30
10,0																														
11,2																														
12,6																														
14,1																														
15,8																														
17,8																														
20,0																														
22,4																														
25,1																														
28,2																														
31,6																														
35,5																														
39,8																														
44,7																														
50,1																														
56,2																														
63,1																														
70,8																														
79,4																														
89,1																														
100,0																														
112,2																														
125,9																														
141,3																														
158,5																														
177,8																														
199,5																														

x = pos. reaction; o = neg. reaction