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**COMMITTEE OF EXPERTS ON THE  
TRANSPORT OF DANGEROUS GOODS AND ON THE  
GLOBALLY HARMONIZED SYSTEM OF CLASSIFICATION  
AND LABELLING OF CHEMICALS**

**REPORT OF THE COMMITTEE OF EXPERTS ON THE TRANSPORT OF  
DANGEROUS GOODS AND ON THE GLOBALLY HARMONIZED SYSTEM OF  
CLASSIFICATION AND LABELLING OF CHEMICALS ON ITS FOURTH SESSION  
(Geneva, 12 December 2008)**

Addendum

Annex II

Amendments to the fourth revised edition of the Recommendations on the Transport of  
Dangerous Goods, Manual of Tests and Criteria (ST/SG/AC.10/11/Rev.4)

**INTRODUCTION**

**Section 1**

In Table 1.2, after the entry for Test series 6, type (c), add the following new row:

"6 (d) 6 (d) Unconfined package test"

**PART I**

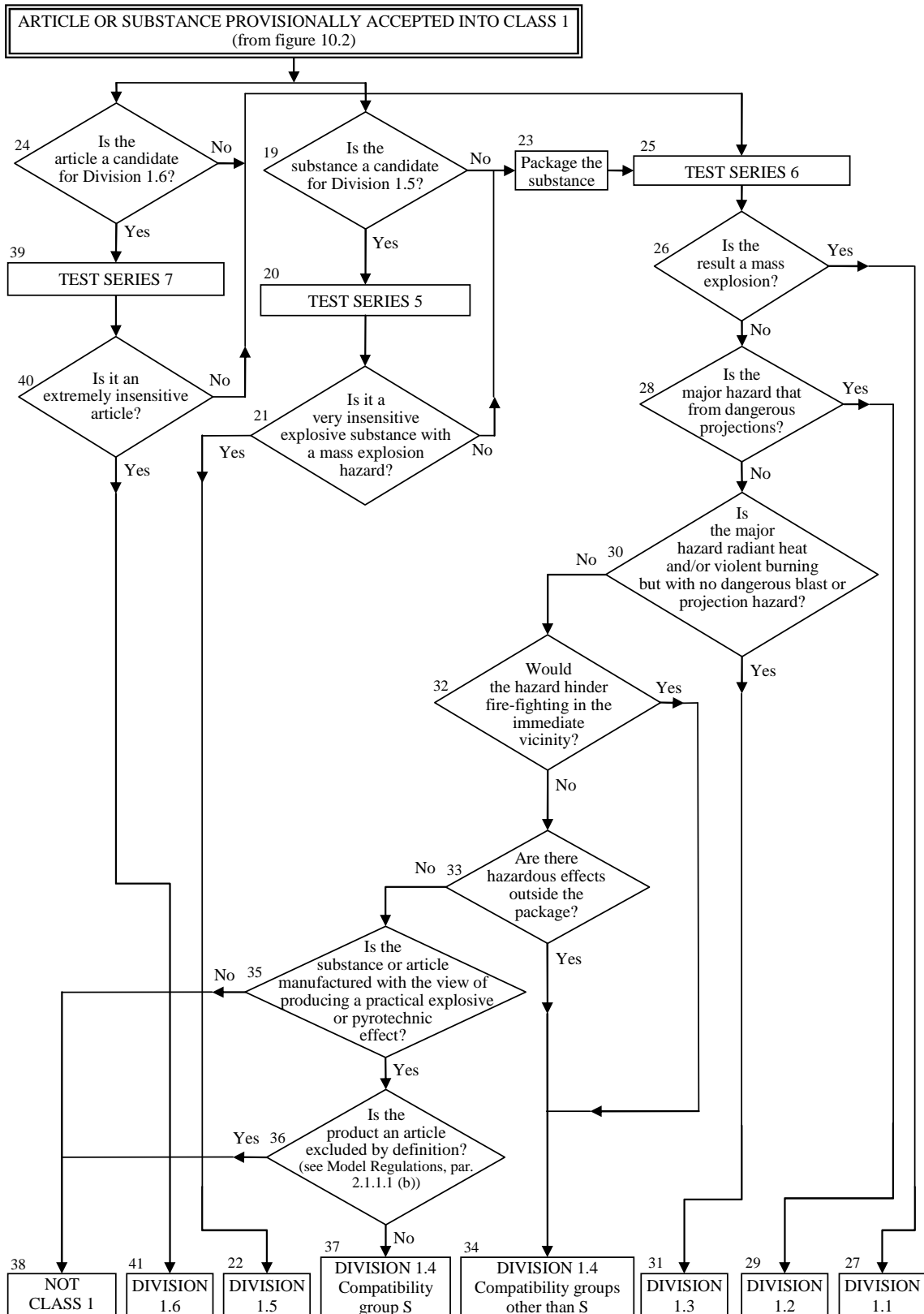
**Section 10**

10.4.2.3 In the first paragraph, replace "three types" with "four types" (twice).

At the end of the description of Type 6 (b), delete "and". At the end of the description of Type 6 (c), replace the full stop with "; and". Add a new paragraph at the end to read as follows:

"Type 6 (d): a test on an unconfined package of explosive articles to which special provision 347 of Chapter 3.3 of the Model Regulations applies, to determine if there are hazardous effects outside the package arising from accidental ignition or initiation of the contents."

Figure 10.3 Amend to read as follows:

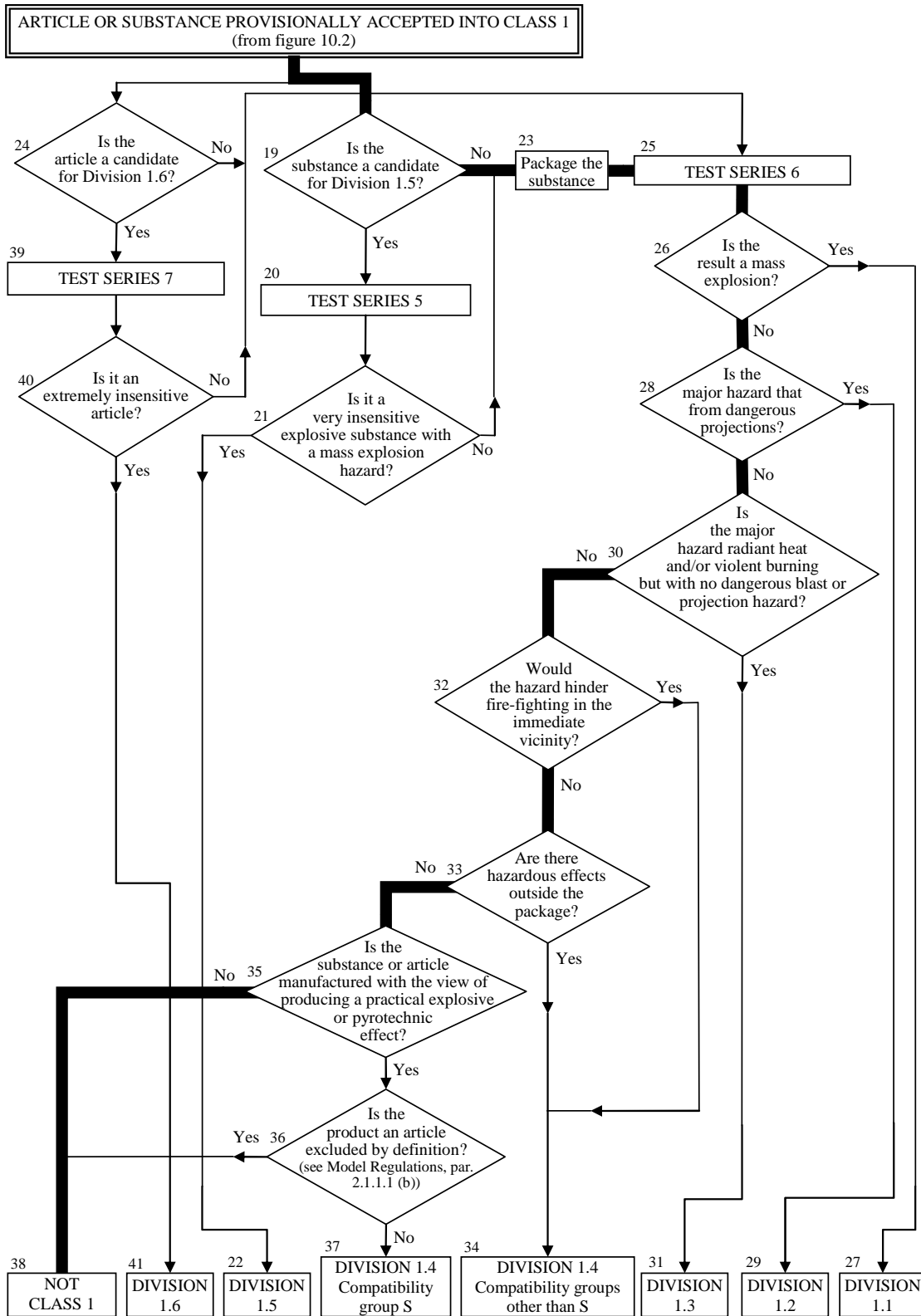


10.4.3.4 In the first sentence, replace "and 6 (c)" with ", 6 (c) and 6 (d)". In the second sentence, replace "three types" with "four types". At the end, add:

"Test type 6 (d) is a test used to determine whether a 1.4S classification is appropriate and is only used if special provision 347 of Chapter 3.3 of the Model Regulations applies.

The results of test series 6 (c) and 6 (d) indicate if 1.4S is appropriate, otherwise the classification is 1.4 other than S."

Figure 10.8 Amend to read as follows:



**Section 11**

Add a new paragraph 11.3.5 to read as follows:

"11.3.5 For organic substances and mixtures of organic substances with a decomposition energy of 800 J/g or more, test 1 (a) need not be performed if the outcome of the ballistic mortar Mk.IIIId test (F.1), or the ballistic mortar test (F.2) or the BAM Trauzl test (F.3) with initiation by a standard No. 8 detonator (see Appendix 1) is "No". In this case, the result of test 1 (a) is deemed to be "-". If the outcome of the F.1 or F.2 or F.3 test is "Not low", the result of test 1 (a) shall be deemed "+". In this case, a "-" can only be obtained by performing test 1 (a)."

**Section 12**

Add a new paragraph 12.3.4 to read as follows:

"12.3.4 For organic substances and mixtures of organic substances with a decomposition energy of 800 J/g or more, test 2 (a) need not be performed if the outcome of the ballistic mortar Mk.IIIId test (F.1), or the ballistic mortar test (F.2) or the BAM Trauzl test (F.3) with initiation by a standard No. 8 detonator (see Appendix 1) is "No". In this case, the result of test 2 (a) is deemed to be "-". If the outcome of the F.1 or F.2 or F.3 test is "Not low", the result of test 2 (a) shall be deemed "+". In this case, a "-" can only be obtained by performing test 2 (a)."

**Section 16**

16.1.1 In the first paragraph, replace "three types" with "four types" (twice).

At the end of the description of Type 6 (b), delete "and". At the end of the description of Type 6 (c), replace the full stop with "; and". Add a new paragraph at the end to read as follows:

"Type 6 (d): a test on an unconfined package of explosive articles to which special provision 347 of Chapter 3.3 of the Model Regulations applies, to determine if there are hazardous effects outside the package arising from accidental ignition or initiation of the contents."

Table 16.1 Amend to read as follows:

Test code	Name of Test	Section
6 (a)	Single package test <sup>a</sup>	16.4.1
6 (b)	Stack test <sup>a</sup>	16.5.1
6 (c)	External fire (bonfire) test <sup>a</sup>	16.6.1
6 (d)	Unconfined package test <sup>a</sup>	16.7.1

<sup>a</sup> *Recommended test.*

16.2.2 In the first sentence, replace "and 6 (c)" with ", 6 (c) and 6 (d)". At the end, add:

"Test type 6(d) is a test used to determine whether a 1.4S classification is appropriate and is only used if special provision 347 on Chapter 3.3 of the Model Regulations applies.

The results of test series 6 (c) and 6 (d) indicate if 1.4S is appropriate, otherwise the classification is 1.4 other than S."

16.6.1.3.2 In the last sentence, replace "wood" with "wooden laths" and insert "horizontal" before "direction".

16.6.1.4.6 Insert "and if hazardous effects are confined within the package," after "immediate vicinity,".

Add a new sub-section 16.7 to read as follows:

**"16.7 Series 6 type (d) test prescription**

**16.7.1 Test 6 (d): Unconfined package test**

16.7.1.1 *Introduction*

This is a test on a single package to determine if there are hazardous effects outside the package arising from accidental ignition or initiation of the contents.

16.7.1.2 *Apparatus and materials*

The following items are required:

- (a) A detonator to initiate the article; or
- (b) An igniter just sufficient to ensure ignition of the article; and
- (c) A sheet of 3.0 mm thick mild steel to act as a witness plate.

Video equipment may be used.

16.7.1.3 *Procedure*

16.7.1.3.1 The test is applied to packages of explosive articles in the condition and form in which they are offered for transport. Where explosive articles are to be carried without packaging, the tests should be applied to the non-packaged articles. The decision to use either an initiating stimulus or an igniting stimulus is based on the following considerations.

16.7.1.3.2 For packaged articles:

- (a) Articles provided with their own means of initiation or ignition:

The functioning of an article near the centre of the package is stimulated by the article's own means of initiation or ignition. Where this is impracticable, the article's own means of initiation or ignition is replaced by another form of stimulus having the required effect;

- (b) Articles not provided with their own means of initiation or ignition:

- (i) an article near the centre of the package is caused to function in the designed mode; or
- (ii) an article near the centre of the package is replaced by another article which can be caused to function with the same effect.

16.7.1.3.3 The package is placed on a steel witness plate on the ground without confinement.

16.7.1.3.4 The donor article should be initiated and observations made on the following: denting or perforation of the witness plate beneath the package, a flash or flame capable of igniting an adjacent material, disruption of the package causing projection of the explosives contents; or full perforation of the packaging by a projection. **A safe waiting period, prescribed by the test agency, should be observed after initiation.** The test should be performed three times, in different orientations, unless a decisive result is observed earlier. If the results of the recommended number of tests do not enable unambiguous interpretation of the results, the number of tests should be increased.

16.7.1.4 *Test criteria and method of assessing the results*

Inclusion in Compatibility Group S requires that any hazardous effects arising from functioning of the articles in this test are confined within the package. Evidence of a hazardous effect outside the package includes:

- (a) Denting or perforation of the witness plate beneath the package;
- (b) A flash or flame capable of igniting an adjacent material such as a sheet of  $80 \pm 3$  g/m<sup>2</sup> paper at a distance of 25 cm from the package;
- (c) Disruption of the package causing projection of the explosives contents; or
- (d) A projection which passes completely through the packaging (a projection or fragment retained or stuck in the wall of the packaging is considered as non hazardous).

The competent authority may wish to take into account the expected effect of the initiator when assessing the results of the test, if these are expected to be significant when



compared to the articles being tested. If there are hazardous effects outside the package, then the product is excluded from Compatibility Group S.

16.7.1.5 *Examples of results*

<b>Article</b>	<b>Packaging</b>	<b>Initiation system</b>	<b>Events</b>	<b>Result</b>
Cartridges, power device	Fibreboard box containing 20 articles (300 g of propellant each) each in a plastic bag	One of the articles	Articles ignited one by one, producing flames up to 2 m high outside package	Not consistent with Compatibility Group S
Detonator assemblies, non-electric	Fibreboard box containing 60 assemblies each in a plastic bag with its shock tube coiled in a figure 8, with attenuators on the detonators	One of the articles	One out of 60 detonators fired and no visible effects outside the box.	Consistent with Compatibility Group S
Detonators, electric	Fibreboard box containing 84 assemblies, each bundled with its wire so that the blast from a firing detonator would be attenuated	One of the articles	One out of 84 detonators fired. The reaction caused the box to break open and released some of the assemblies but it was judged that there were no hazardous effects outside the package.	Consistent with Compatibility Group S
Charges, shaped (open-face 19 g perforators)	Fibreboard box containing 50 charges in two layers so that pairs of charges were focused toward each other	Detonator with approximately 60 mm of detonating cord	Three trials were conducted. In each of the trials, the witness plate was perforated with three to four charges reacting. The packages were blown apart scattering the remaining charges over a wide area.	Not consistent with Compatibility Group S
Detonators, electric	Fibreboard box containing 50 detonators each with a 450 mm lead wire. Each assembly was contained in its own fibreboard inner box. The boxes were separated by fibreboard panels	One of the articles	One out of 50 detonators fired causing one of the box flaps to open. There were no hazardous effects outside of the package.	Consistent with Compatibility Group S

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**Section 18**

18.6.1.2.2 At the end, replace "50 °C to 250 °C" with "135 °C to 285 °C".

## **PART II**

### **Section 21**

21.2.2 At the beginning, insert "and self-reactive substances" after "For organic peroxides". In the text between parentheses, insert "for peroxides, and any test of series F except tests F.4 and F.5 for self-reactive substances" after "except test F.5".

## **PART III**

### **Section 32**

32.4.1 Amend to read as follows:

#### **"32.4.1 *Non-viscous flammable liquids***

The following methods for determining the flash point of flammable liquids may be used:

#### International standards:

ISO 1516  
ISO 1523  
ISO 2719  
ISO 13736  
ISO 3679  
ISO 3680

#### National standards:

*American Society for Testing Materials International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, Pennsylvania, USA 19428-2959:*

ASTM D3828-93, Standard Test Methods for Flash Point by Small Scale Closed Tester  
ASTM D56-93, Standard Test Method for Flash Point by Tag Closed Tester  
ASTM D3278-96, Standard Test Methods for Flash Point of Liquids by Setaflash Closed-Cup Apparatus  
ASTM D0093-96, Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester

*Association française de normalisation, AFNOR, 11, rue de Pressensé, 93571 La Plaine Saint-Denis Cedex:*

French Standard NF M 07 - 019  
French Standards NF M 07 - 011 / NF T 30 - 050 / NF T 66 - 009  
French Standard NF M 07 - 036

*Deutsches Institut für Normung, Burggrafenstr. 6, D-10787 Berlin:*

Standard DIN 51755 (flash points below 65 °C)

*State Committee of the Council of Ministers for Standardization, 113813, GSP, Moscow, M-49  
Leninsky Prospekt, 9:*

GOST 12.1.044-84".

32.6 Add a new sub-section 32.6 to read as follows:

**"32.6 Test methods used for determining initial boiling point**

The following methods for determining the initial boiling point of flammable liquids may be used:

International standards:

ISO 3924

ISO 4626

ISO 3405

National standards:

*American Society for Testing Materials International, 100 Barr Harbor Drive, PO Box C700,  
West Conshohocken, Pennsylvania, USA 19428-2959:*

ASTM D86-07a, Standard Test Method for Distillation of Petroleum Products at  
Atmospheric Pressure

ASTM D1078-05, Standard Test Method for Distillation Range of Volatile  
Organic Liquids

Further acceptable methods:

Method A.2 as described in Part A of the Annex to Commission Regulation (EC)  
No 440/2008<sup>2</sup>."

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<sup>2</sup> *Commission Regulation (EC) No 440/2008 of 30 May 2008 laying down test methods pursuant to Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (Official Journal of the European Union, No. L 142 of 31.05.2008, p.1-739 and No. L 143 of 03.06.2008, p.55) .*

**Section 38**

(as amended by ST/SG/AC.10/11/Rev.4/Amend.2)

38.3.2.1 Replace sub-paragraphs (a) and (b) with the following sub-paragraphs (a) to (c):

- "(a) For primary cells and batteries, a change of more than 0.1 g or 20% by mass, whichever is greater, to the cathode, to the anode, or to the electrolyte;
- (b) For rechargeable cells and batteries, a change in Watt-hours of more than 20% or an increase in voltage of more than 20%; or
- (c) A change that would materially affect the test results,".

At the end, separate the last sentence ("In the event that...") from the rest of the text and place it as a new last paragraph.

38.3.2.2 In the Note under the definition of *Battery*, insert ", "modules" or "battery assemblies"" after ""battery packs"".

Amend the definition of *Large battery* to read as follows:

"*Large battery* means a lithium metal battery or lithium ion battery with a gross mass of more than 12 kg;".

Amend the definition of *Small battery* to read as follows:

"*Small battery* means a lithium metal battery or lithium ion battery with a gross mass of not more than 12 kg;".

38.3.3 (a) Before sub-paragraph (i), insert "in the quantity indicated" after "tested". In sub-paragraph (iii), delete "and". In sub-paragraphs (iii) and (iv), insert "small" before "batteries". At the end, add the following two new sub-paragraphs:

- "(v) four large batteries in undischarged states; and
- (vi) four large batteries in fully discharged states."

38.3.3 (b) Amend to read as follows:

"(b) When testing rechargeable cells and batteries under tests 1 to 5 the following shall be tested in the quantity indicated:

- (i) ten cells, at first cycle, in fully charged states;
- (ii) four small batteries, at first cycle, in fully charged states;
- (iii) four small batteries after 50 cycles ending in fully charged states;

(iv) two large batteries at first cycle, in fully charged states; and

(v) two large batteries after 25 cycles ending in fully charged states."

38.3.3 (c) Before sub-paragraph (i), insert "in the quantity indicated" after "tested". In sub-paragraphs (iii) and (iv), delete "and five cells after 50 cycles ending in fully discharged states". In the last paragraph, delete "for each of the states of charge being tested,".

38.3.3 (d) Before sub-paragraph (i), insert "in the quantity indicated" after "tested". In sub-paragraphs (i) and (ii), replace "rechargeable" with "small". In sub-paragraph (i), delete "and". At the end, add the following new text:

"(iii) two large batteries, at first cycle, in fully charged states; and

(iv) two large batteries after 25 cycles ending in fully charged states.

Batteries not equipped with overcharge protection that are designed for use only in a battery assembly, which affords such protection, are not subject to the requirements of this test."

38.3.3 (e) Before sub-paragraph (i), insert "in the quantity indicated" after "tested".

38.3.3 Add the following new sub-paragraph (f):

"(f) When testing a battery assembly in which the aggregate lithium content of all anodes, when fully charged, is not more than 500 g, or in the case of a lithium ion battery, with a Watt-hour rating of not more than 6200 Watt-hours, that is assembled from cells or batteries that have passed all applicable tests, one battery assembly in a fully charged state shall be tested under Tests 3, 4, and 5, and, in addition, Test 7 in the case of a rechargeable battery assembly. For a rechargeable battery assembly, the assembly shall have been cycled at least 25 cycles."

Amend the last paragraph to read as follows:

"When batteries that have passed all applicable tests are electrically connected to form a battery assembly in which the aggregate lithium content of all anodes, when fully charged, is more than 500 g, or in the case of a lithium ion battery, with a Watt-hour rating of more than 6200 Watt-hours, that battery assembly does not need to be tested if it is equipped with a system capable of monitoring the battery assembly and preventing short circuits, or over discharge between the batteries in the assembly and any overheat or overcharge of the battery assembly."

## **PART IV**

### **Section 41**

(as amended by ST/SG/AC.10/11/Rev.4/Amend.1)

41.2 Amend to read as follows:

#### **"41.2 Permitted design variations**

The following variations in container design from an already tested prototype are permitted without additional testing:

##### **41.2.1 *Portable tanks***

- (a) A reduction of no more than 10% or an increase of no more than 20% in capacity, resulting from variations in diameter and length;
- (b) A decrease in maximum permissible gross mass;
- (c) An increase in thickness, independent of design pressure and temperature;
- (d) A change to the grade of material of construction provided that the permitted yield strength meets or exceeds that of the tested portable tank;
- (e) A change in location of, or a modification to, nozzles and manholes.

##### **41.2.2 *MEGCs***

- (a) to (k) *Text of existing sub-paragraphs (a) to (k)."*

## **APPENDICES**

### **Appendix 6**

In the NOTE under 3.2, at the end, add the following two new sentences: "For organic substances and mixtures of organic substances with a decomposition energy of 800 J/g or more, tests 1 (a) and 2 (a) need not be performed if the outcome of the ballistic mortar Mk.III d test (F.1), or the ballistic mortar test (F.2) or the BAM Trauzl test (F.3) with initiation by a standard No. 8 detonator (see Appendix 1) is "No". In this case, the results of test 1 (a) and 2 (a) are deemed to be "-"."

4.1 Amend the text before the sub-paragraphs to read as follows:

"4.1 The procedure only applies to possible flammable mixtures<sup>1</sup> containing known flammable liquids in defined concentrations although they may contain non-volatile components

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<sup>1</sup> *Up to now, the calculation method is validated for mixtures containing up to six volatile components. These components may be flammable liquids like hydrocarbons, ethers, alcohols, esters (except acrylates), and water. It is however not yet validated for mixtures containing halogenated, sulphurous, and/or phosphoric compounds as well as reactive acrylates.*

e.g. polymers, additives etc. The flash point of these mixtures need not be determined experimentally if the calculated flash point of the mixture, using the method given in 4.2, is at least 5 °C<sup>2</sup> greater than the relevant classification criterion (23 °C and 60 °C, respectively) and provided that:".

Amend sub-paragraphs (b) and (c) to read as follows:

- (b) The lower explosion limit of each component is known (an appropriate correlation has to be applied when these data are extrapolated to other temperatures than test conditions) as well as a method for calculating the lower explosion limit of the mixture;
- (c) The temperature dependence of the saturated vapour pressure and of the activity coefficient is known for each component as present in the mixture;

## **Appendix 7**

Add the following new appendix 7:

### **"APPENDIX 7**

#### **HSL FLASH COMPOSITION TEST**

##### **1. Introduction**

This test is used to determine whether pyrotechnic substances in powder form or as pyrotechnic units as presented in the fireworks, that are used to produce an aural effect, or used as a bursting charge or lifting charge, are considered to be flash compositions for the purposes of determining the classification of fireworks using the UN default fireworks classification table in 2.1.3.5.5 of Model Regulations.

##### **2. Apparatus and materials**

2.1 *Insert same text as 11.6.1.2.1 with the following modifications:*

In the first sentence, replace "Figure 11.6.1.1" with "Figure A7.2". In the second sentence, insert "cone in" before "firing plug". In the last sentence, replace "5 ms" with "1 ms".

2.2 *Insert same text as 11.6.1.2.2, first three sentences, with the following modification:*

In the first sentence, insert "cone in" before "firing plug".

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<sup>2</sup> *If the calculated flash point is less than 5 °C greater than the relevant classification criterion, the calculation method may not be used and the flash point should be determined experimentally.*

2.3 *Insert same text as 11.6.1.2.2, two last sentences, and 11.6.1.2.3 with the following modification:*

In the first sentence, replace "Figure 11.6.1.2" with "Figure A7.8".

2.4 *Insert same text as 11.6.1.2.4*

2.5 The ignition system consists of a Vulcan electric fusehead, with lead wires, of the type commonly used for igniting pyrotechnic substances. Fuseheads with equivalent properties may be used.

2.6 The wires of the fusehead are cut to such a length that the fusehead sits 10 mm above the substance contained within the cone of the firing plug (see Figure A7.1). The fusehead leads are held in position using the grub screws (see Figure A7.3).

### **3. Procedure**

3.1 The apparatus, assembled complete with pressure transducer but without the aluminium bursting disk in position, is supported firing plug end down. 0.5 g of the substance is introduced into the cone of the firing plug. The apparatus is tapped three times on a hard surface after filling. Where the pyrotechnic substance is in consolidated form greater than 0.5 g it should be broken to produce a piece as close to 0.5 g as possible. Where the pyrotechnic substance is in consolidated form less than 0.5 g then whole and broken units should be chosen to give 0.5 g pyrotechnic substance. The lead washer and aluminium bursting disk are placed in position and the retaining plug is screwed in tightly. The charged vessel is transferred to the firing support stand, bursting disk uppermost, which should be contained in a suitable, armoured fume cupboard or firing cell. An exploder dynamo is connected to the external terminals of the firing plug and the charge is fired. The signal produced by the pressure transducer is recorded on a suitable system which allows both evaluation and a permanent record of the time/pressure profile to be achieved (e.g. transient recorder coupled to a chart-recorder).

3.2 The test is carried out three times. The time taken for the pressure to rise from 690 kPa to 2070 kPa above atmospheric is noted. The shortest interval of three firings should be used for classification.

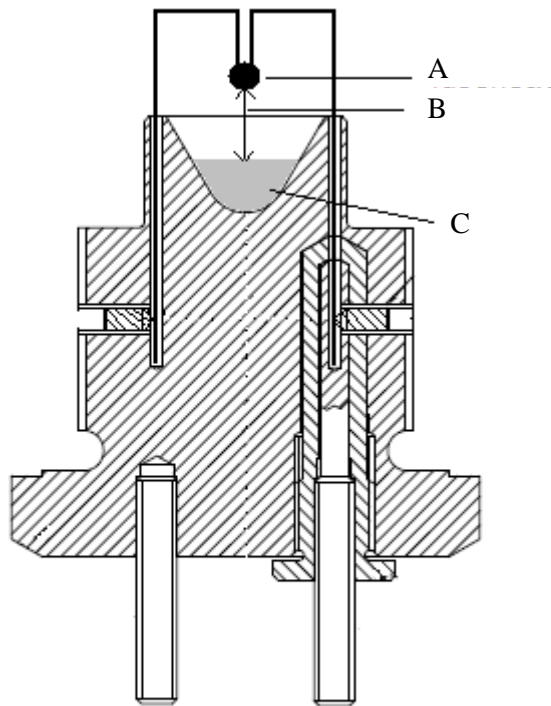
### **4. Test criteria and method of assessing results**

The test results are interpreted in terms of whether a gauge pressure of 2070 kPa is reached and, if so, the time taken for the pressure to rise from 690 kPa to 2070 kPa gauge. The pyrotechnic substances in powder form or as pyrotechnic units as presented in the fireworks, that are used to produce an aural effect, or used as a bursting charge or lifting charge, is to be considered as flash composition if the minimum time taken for the pressure rise is shown to be less than, or equal to, 8 ms for 0.5 g of pyrotechnic substance.



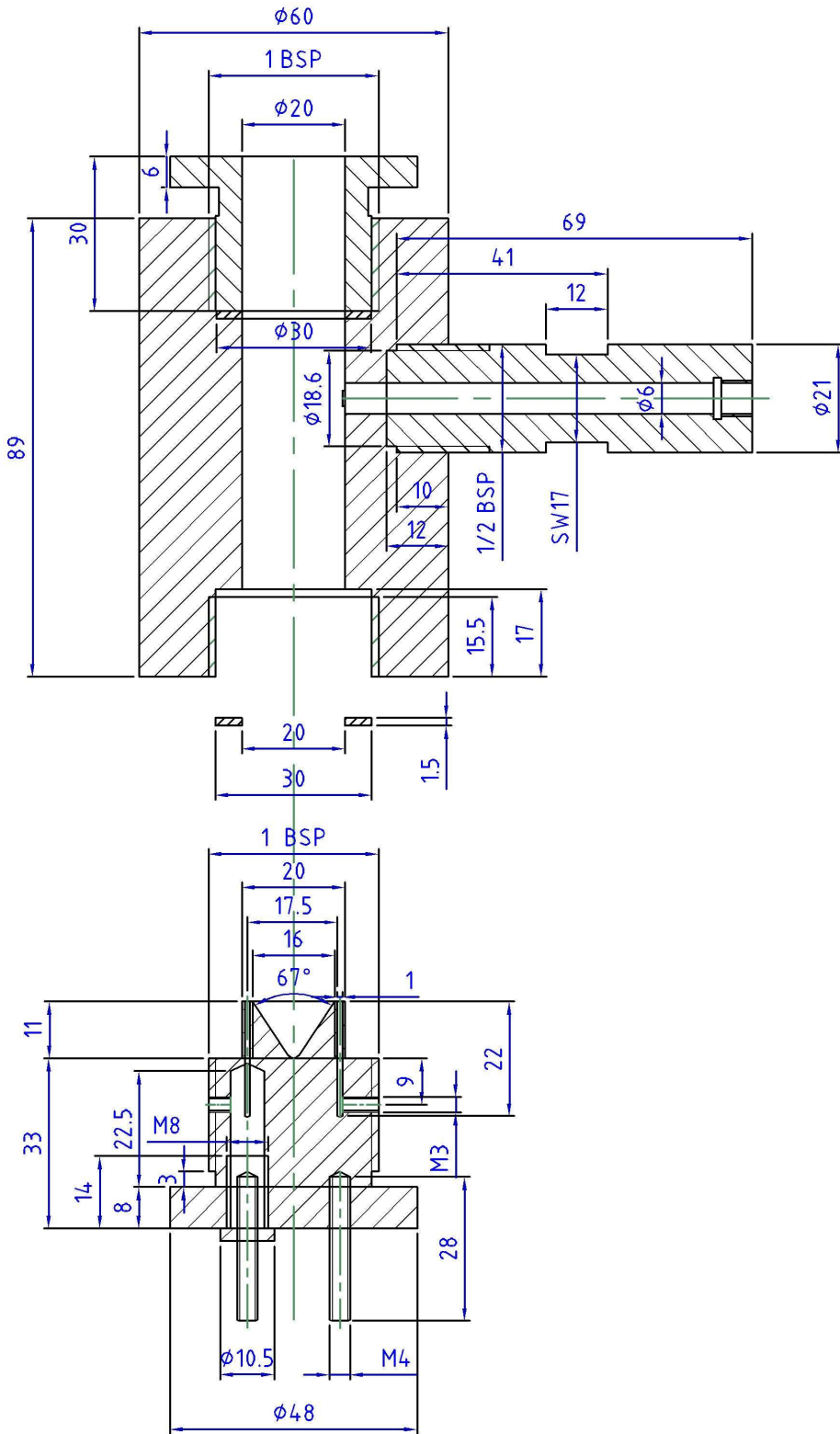
**Examples of results:**

Substance	Maximum pressure rise (kPa)	Mean time for a pressure rise from 690 to 2070 kPa (ms)	Result
1	> 2070	0.70	Flash composition
2	> 2070	4.98	Flash composition
4	> 2070	1.51	Flash composition
5	> 2070	0.84	Flash composition
6	> 2070	11.98	Not flash composition



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- (A) Fusehead
  - (B) 10 mm gap
  - (C) Substance under test
- 

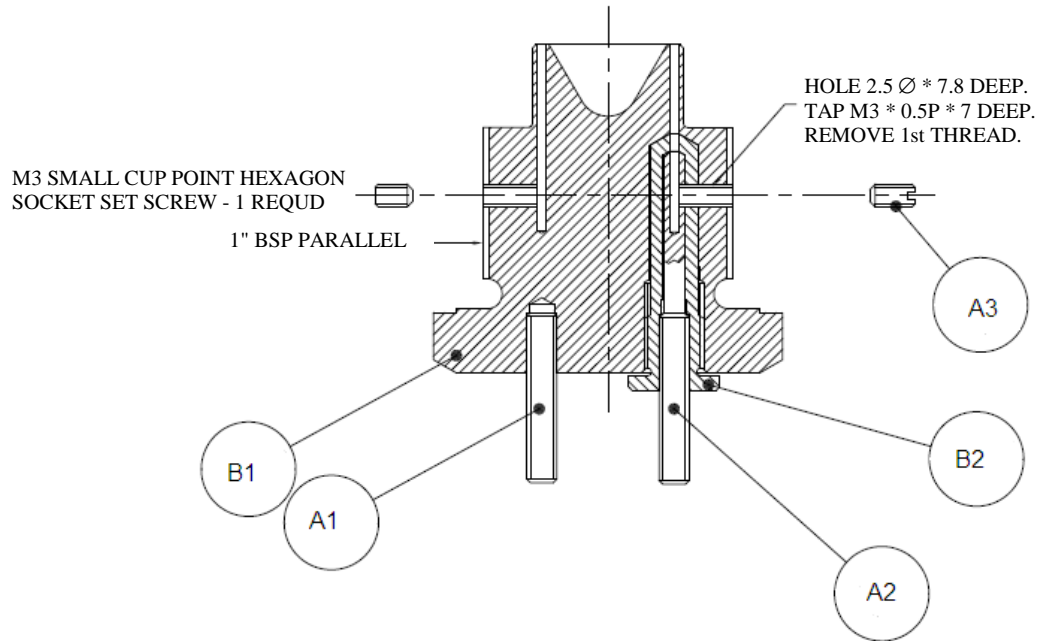
**Figure A7.1: SAMPLE SETUP**



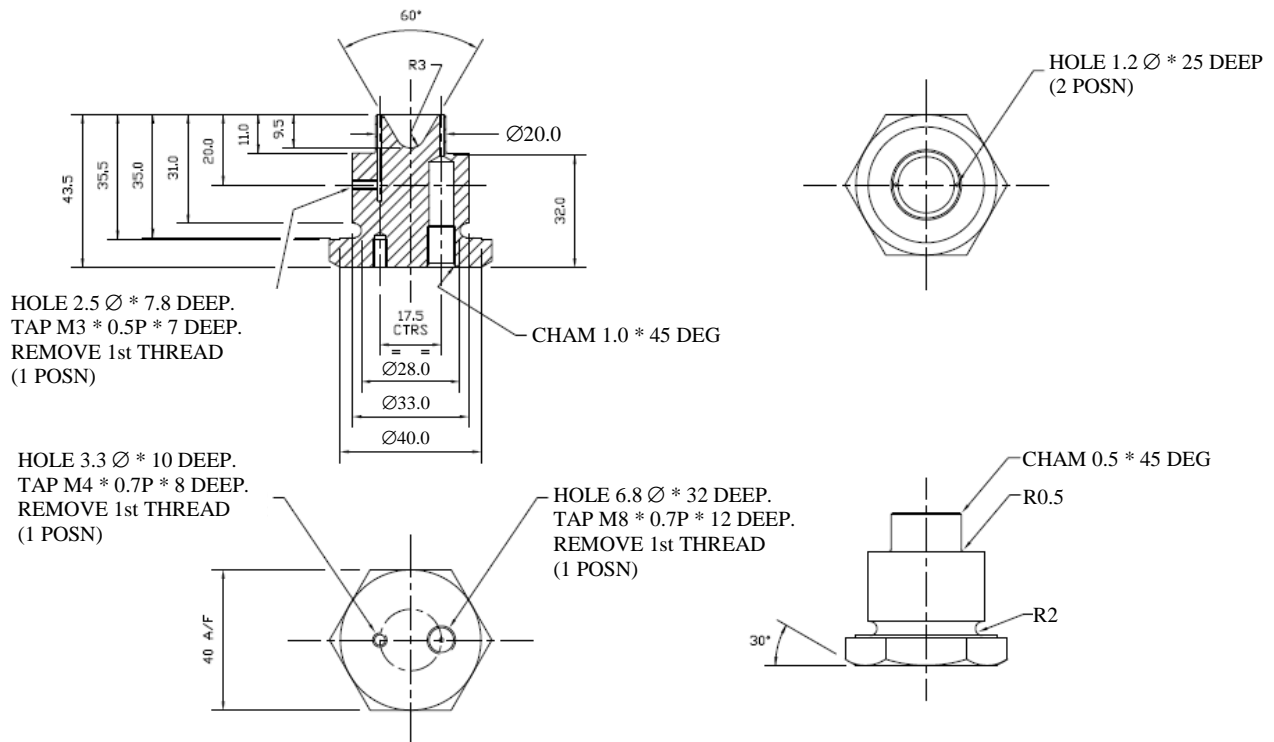
**Figure A7.2: APPARATUS**

MACHINING/ASSEMBLY SEQUENCE

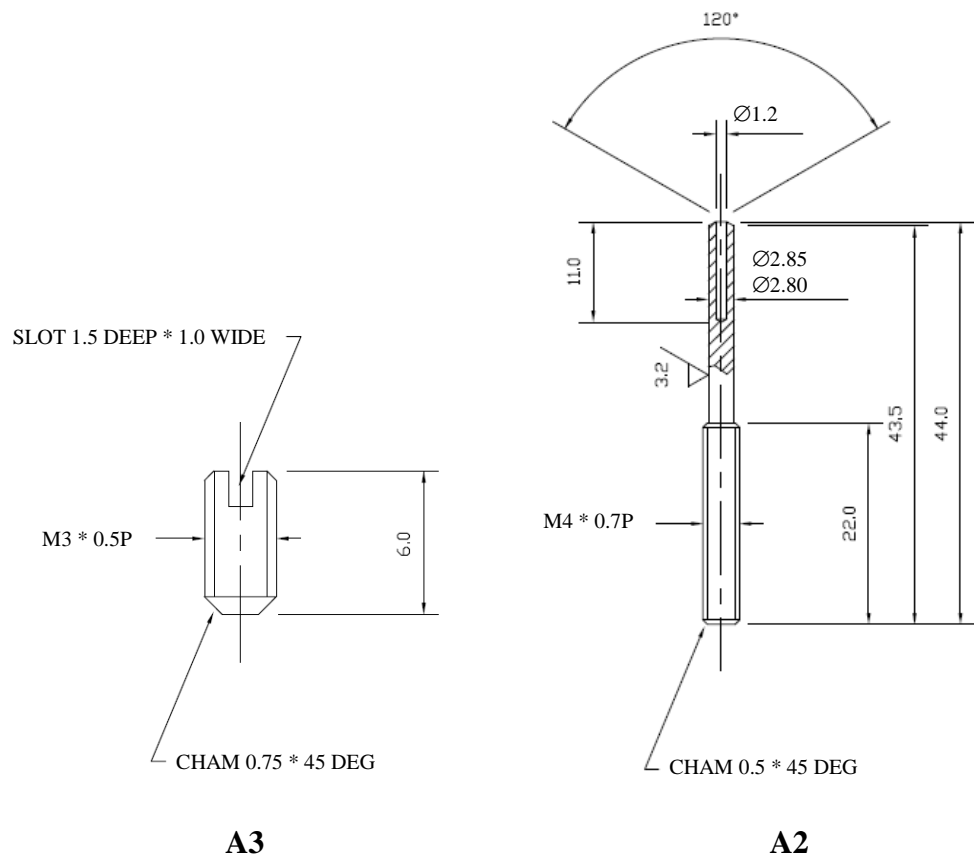
1. SCREW JN0003490:B2 INTO PRESSURE PLUG BODY
2. SCREW JN0003490:A2 INTO JN0003490:B2
3. DRILL AND TAP M3 \* 0.5P \* 7 DEEP HOLE
4. SCREWCUT 1" BSP PARALLEL THREAD ON PRESSURE PLUG BODY.



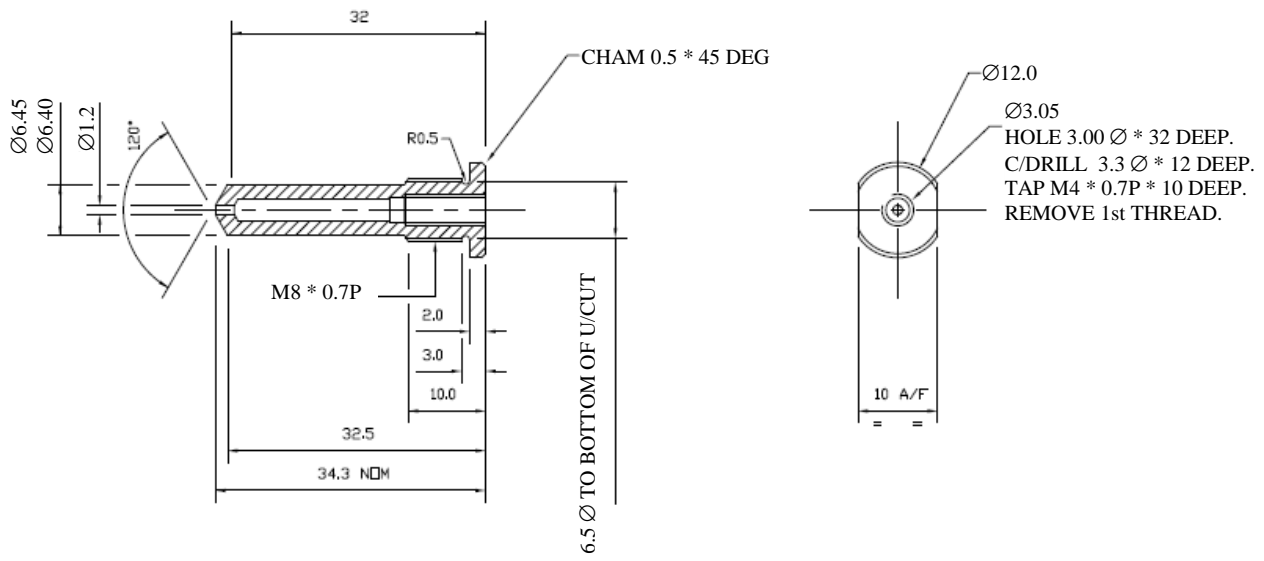
**Figure A7.3: ASSEMBLY**



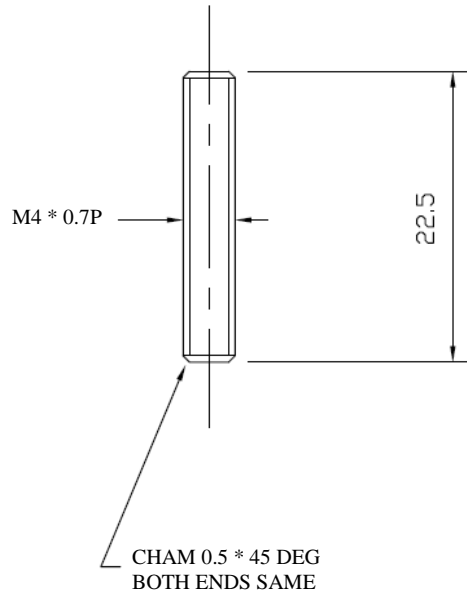
**Figure A7.4: PART B1**



**Figure A7.5: PARTS A3 AND A2**



**Figure A7.6: PART B2**



**Figure A7.7: PART A1**

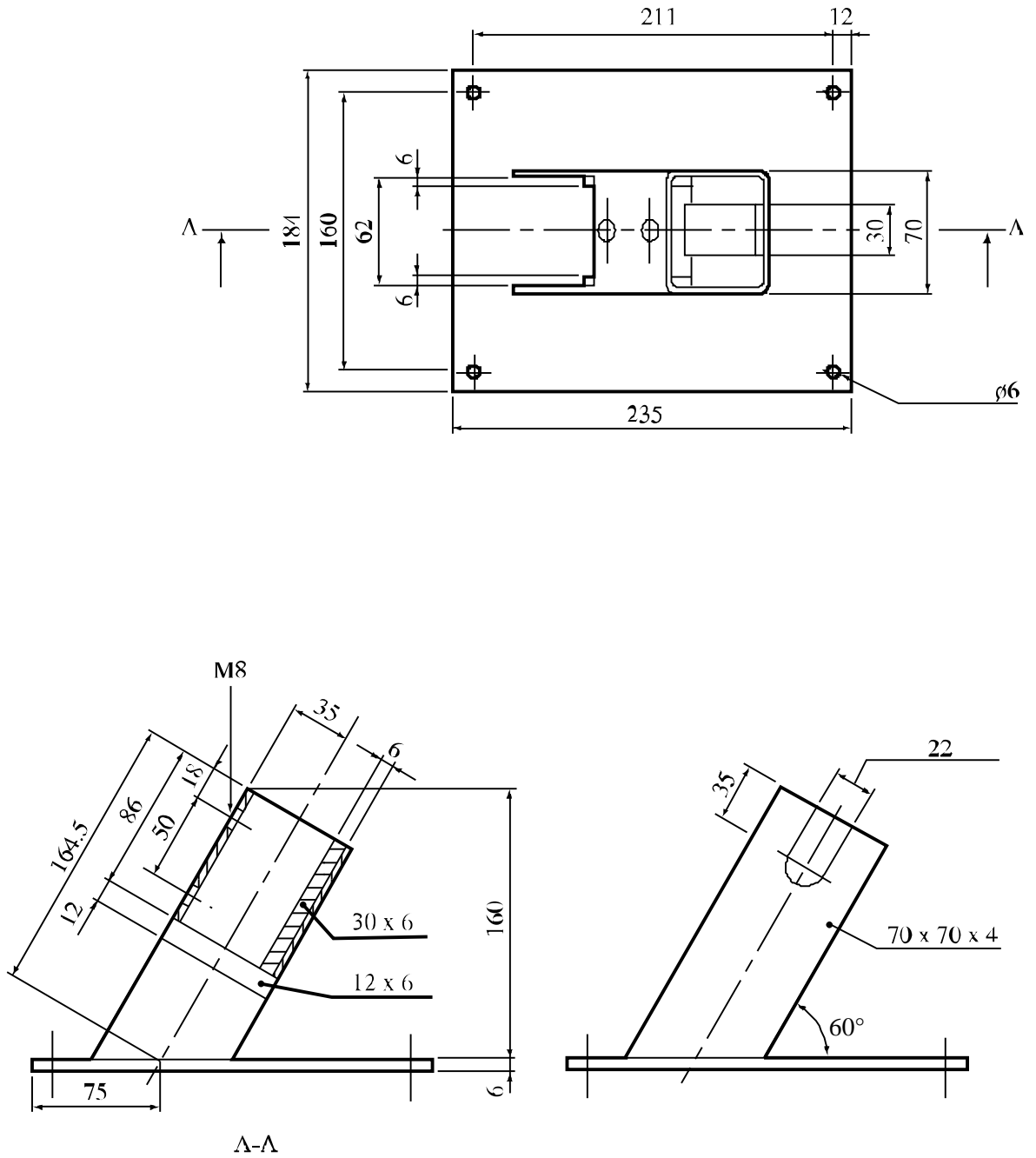


Figure A7.8: SUPPORT STAND".

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