



रक्षा मंत्रालय
MINISTRY OF DEFENCE

संयुक्त सेवा स्पेसिफिकेशन
JOINT SERVICES SPECIFICATION

ON

DINITRO TOLUENE, GRADE 1 AND GRADE 2

DS Cat. No.

| | |
|----------------|------------------------|
| Grade 1 | 1376 - 000 508) |
| Grade 2 | 1376 - 000 509) |

मानकीकरण निदेशालय
रक्षा उत्पादन विभाग
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RECORD OF AMENDMENTS

| Amendment | | Amendment pertains to : Sl. No. / Para No. / Column No. | Authority | Amended by | Signature & Date |
|-----------|------|---|-----------|--|------------------------|
| No. | Date | | | Name & Appointment (IN BLOCK LETTERS) | |
| | | | | | |

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0. FOREWORD

0.1 This Joint Services Specification has been prepared by Armament Standardisation Sub Committee on the authority of the Standardisation Committee, Ministry of Defence.

0.2 This specification has been approved by the Ministry of Defence and is mandatory for use by the Defence Services.

0.3 (a) First revision was done in the year 1998.

(b) This specification is a revision of JSS 1376 - 04 : 2008 (Revision No.2) and supersedes the same.

0.4 This specification would be used for Manufacture, Supply and Quality Assurance of Dinitro Toluene, Grade 1 and Grade 2.

0.5 Quality Assurance Authority for the item covered by this specification is the Controller, Controllerate of Quality Assurance (Military Explosives), Aundh Road, Pune - 411 020. Enquiries regarding technical parameters shall be addressed to the Quality Assurance Authority, while other enquiries shall be referred to :-

The Director,
Directorate of Standardisation,
Ministry of Defence,
'H' Block, Nirman Bhawan PO,
New Delhi - 110 011.

0.6 Non registered users can obtain the following on payment :-

(a) **Copies of IS from :-**

Bureau of Indian standards,
Manak Bhawan,
9, Bahadur Shah Zafar Marg,
New Delhi - 110 002.

or

Their regional / Branch offices.

(b) **Copies of JSS / JSG from :-**

The Director,
Directorate of Standardisation
Standardisation Documents Centre,
Ministry of Defence
Room No. 05, 'J' Block,
Nirman Bhawan PO,
New Delhi - 110 011.

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0.7 Indian Standard (IS) specifications are available free of cost for registered users on :-

Directorate of Standardisation Website

www.ddpdos.gov.in

For registration visit our website.

0.8 This specification holds good only for the supply order for which it is issued.

0.9 **Directorate of Standardisation Website.** All the approved JSS / JSJs are available on the Directorate of Standardisation Website **www.ddpdos.gov.in**. Defence Organisations desirous of accessing a copy of this document are requested to approach the Directorate of Standardisation for obtaining user id / password to access the website.

1. **SCOPE.** This specification is meant to govern manufacture, supply and quality assurance of Dinitro Toluene, Grade 1 and Grade 2 suitable for use in the manufacture of propellant explosives.

2. **RELATED SPECIFICATIONS / DOCUMENTS**

2.1 Reference is made in this specification to :-

| Sl. No. | Specification No. & Year | Nomenclature |
|----------------|--|--|
| (a) | IS 138 : 1992 (Third Revision) Reaffirmed 2009 AMD 1 | Ready Mixed Paint, Marking for Packages and Petrol Containers. |
| (b) | IS 460 (Part 1) : 1985 (Third Revision) Reaffirmed 2008 AMD 1 | Test Sieves : Part 1 Wire Cloth Test Sieves. |
| (c) | IS 537 : 2011 (Second Revision) | Toluene, Pure Nitration Grade - Specification. |
| (d) | IS 2500 (Part 1) : 2000 (Third Revision) Reaffirmed 2011 | Sampling Procedure for Inspection by Attributes : Part 1 - Sampling Schemes Indexed by Acceptance Quality Limit (AQL) for Lot - by - Lot Inspection. |
| (e) | Drg. No. CI(ME) / DRG / 221 (11 Sheets) | Drum (Ring Lock Type) 25 litres for packing DNT (20 kg) |

2.2 Copies of the CI (ME) Drgs can obtain on payment from :-

The Controller
CQA (ME), Aundh Road
Pune - 411 020

3. **MATERIAL**

3.1 The Dinitro toluene, Grade 1 shall consist essentially of 2 : 4 Dinitro toluene ($C_6H_3(NO_2)_2CH_3$). It shall be in the form of pale crystals free from grit, visible impurities and foreign matter.

3.2 The Dinitro toluene grade 2 shall consist essentially of 2 : 4 Dinitro toluene in flakes or cast form or as specified in the contract. It shall be free from grit, visible impurities and foreign matter.

4. MANUFACTURE

4.1 The Dinitro toluene, Grade 1 and Grade 2 shall be manufactured by a process which has received authoritative approval. The Quality Assurance Authority shall be informed regarding the process used, in writing, and shall be given prior notification of any proposed deviations therefrom. All deviations from the approved process, however slight, shall be recorded immediately and all material affected shall be set aside pending the decision of the Quality Assurance Authority.

4.2 Toluene used in the manufacture shall be of nitration grade and comply with the requirements of IS 537. The following limits in respect of Benzene, Paraffin and Purity of Toluene should be strictly maintained.

| | |
|----------|-------------|
| Benzene | Max. 0.3 % |
| Paraffin | Max. 0.5 % |
| Purity | Min. 99.5 % |

4.3 The method of manufacture adopted shall be such that the finished product when used, performs to the satisfaction of the Quality Assurance Officer / Quality Assurance Authority.

5. TENDER SAMPLE

5.1 The contractor shall submit two tender samples each of 500 g essentially from the same batch of manufacture, free of all charges and conforming to this specification, to the Quality Assurance Authority / Quality Assurance Officer as stated in the tender.

Note. Not applicable when store is manufactured in Ordnance Factories.

6. PRE - INSPECTION OF STORES / CONSIGNMENT

6.1 Manufacturers / Contractors must satisfy themselves that the stores are in accordance with the terms of the contract and fully conform to the required specification, by carrying out a thorough pre - inspection of each lot before actually tendering the same for inspection to the Quality Assurance Officer nominated under the terms of the contract. A declaration by the contractor that a necessary pre - inspection has been carried out on the stores tendered will be submitted alongwith the challan. The declaration will also indicate the method followed in carrying out pre - inspection showing the features checked / tested and will have the test certificate attached to the challan / declaration.

6.2 If the Quality Assurance Officer finds that the pre - inspection of the consignment as required above has not been carried out, the consignment is liable for rejection.

7. QUALITY ASSURANCE

7.1 Inspection.

7.1.1 The Dinitro toluene, Grade 1 and Grade 2 and the packages in which these are packed shall be subject to inspection by and to the approval of the Quality Assurance Officer / Quality Assurance Authority.

7.1.2 Samples of the material and of the packages may be taken from any portion of the batch.

7.1.3 If on examination, any sample is found not to conform to this specification, the whole batch may be rejected.

7.1.4 The foregoing provisions shall equally apply to the prime contractors and sub contractors, if any.

7.2 **Sampling.** Normally two representative samples each of 300 g, one from package Nos. 1 to 25 and second from package Nos. 26 to 50 supplied free of all charges, shall be drawn from each batch of supply / manufacture. However, the number of samples to be drawn shall be at the discretion of the Quality Assurance Officer / Quality Assurance Authority.

7.3 **Test Requirements.** Samples taken from any portion of the batch of material shall conform to clause 3 and in addition shall conform to the following test requirements :-

Test Requirements of Dinitro toluene (DNT), Grade 1 and Grade 2

| Sl. No. | Characteristic | Passing Standard | | Test Method |
|---------|--|---|--------------|--------------|
| | | Grade 1 | Grade 2 | |
| (a) | Volatile matter, % by mass | Max. 0.10 | 0.25 | Appendix 'A' |
| (b) | Melting test | Transparent fluid free from scum or deposit when heated at a temperature of 75 °C to 80 °C. | | Appendix 'B' |
| (c) | Setting point °C | Min. 65.60 Max. 70.60 | 54.0 60.0 | Appendix 'B' |
| (d) | Ash (sulphated), % by mass | Max. 0.05 | 0.10 | Appendix 'C' |
| (e) | Matter insoluble in Benzene, % by mass | Max. 0.15 | 0.15 | Appendix 'D' |

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|-----|--|------|-------|-------|--------------|
| (f) | Acidity calculated as sulphuric acid, % by mass | Max. | 0.005 | 0.015 | Appendix 'E' |
| (g) | Sieving requirement (for grade 1 only): Retained on 850 micrometre IS Sieve, % by mass | Max. | 5.00 | - | Appendix 'F' |

Note.

- (i) Particulars of IS Sieve referred to above will be found in IS 460 (Part 1).
- (ii) Samples shall be drawn and placed in bottles fitted with rubber or waxed cork stoppers. Use of screwed stoppers is prohibited.
- (iii) Setting point will be determined in duplicate from a batch and lower setting point obtained should be reported.
- (iv) Any batch with setting points falling between the maximum of Grade 2 and minimum of Grade 1 variety will be accepted as Grade 2.
- (v) Sieving requirements, at Sl.No.7 will not be applicable for DNT manufactured by HE Factory, Kirkee on the new plant.

8. WARRANTY. The stores supplied against the contract shall be deemed to have been warranted against defective material and performance by the contractor / manufacturer for a period of one year from the date of receipt of the store at the consignee's end and if during this period any of the stores supplied is found defective, the same shall be replaced by the contractor / manufacturer free of charges at the consignee's premises.

9. PACKAGING

9.1 The Dinitro Toluene, Grade 1 and Grade 2 shall be packed in polythene bag of film thickness 0.13 mm and further packed in sound, clean, dry Mild Steel drums of 25 litres capacity to drawing No. CIME / DRG / 221 (Ring Lock Type). The quantity per package shall be 20 kg.

9.2 Any other form of packages shall have the prior approval of the Quality Assurance Officer / Quality Assurance Authority.

9.3 The inclusion of any foreign matter or impurities in any of the packages shall render the whole batch liable to rejection.

9.4 Storage and transportation of DNT shall be governed by Instruction issued on the subject by STEC (Latest edition).

10. MARKING

10.1 All packages containing the material shall be indelibly and legibly marked with the following details :-

- (i) Nomenclature and specification No. of the Material.
- (ii) Name and Address of the Consignee.
- (*iii) A.T. or S.O. No. and Date.
- (*iv) Consignment No.
- (v) Batch No. and Date of Manufacture.
- (*vi) Gross and Net Mass.
- (vii) Consecutive No. of Package and Total Number of Packages in the Consignment.
- (*viii) Date of Supply.
- (ix) Manufacturer's Name, Initials or his Recognised Trade Mark.

***Note.** Not applicable when the store is manufactured in Ordnance Factories.

10.2 UN Hazard division and compatibility group 1.1 D marking of approved pattern, shall be fixed to each container by means of a prescribed label or applied by means of a stencil.

10.3 In addition to the above, the Quality Assurance Officer may suggest some more markings / identifications suitable at the time of inspection.

10.4 The paint used for marking should conform to IS 138 and to the satisfaction of the Quality Assurance Officer / Quality Assurance Authority.

11. SAFETY OF OPERATIONS

11.1 Nothing in this specification shall relieve the manufacturer / contractor / user of his responsibility for the safety of his operation during manufacture, storage and transit or use of the store.

11.2 Safety Certificate No. SC / HE / 66 / 76 is applicable and can be obtained on application from The Controller, Controllerate of Quality Assurance (ME), Aundh Road, Pune - 411 020.

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12. DEFENCE STORES CATALOGUE NUMBERS

12.1 Defence Stores Catalogue Numbers allotted to these stores are :-

Dinitro Toluene Grade 1 - 1376 - 000 508.

Dinitro Toluene Grade 2 - 1376 - 000 509.

13. SUGGESTIONS FOR IMPROVEMENT

13.1 Any suggestion for improvement in this document may be forwarded to :-

The Director,
Directorate of Standardisation,
Ministry of Defence,
'H' Block, Nirman Bhawan PO,
New Delhi - 110 011.

APPENDIX 'A'

A. DETERMINATION OF VOLATILE MATTER

A.1 Place 5 g of the DNT in an Aluminium dish and cover with a glass cone. Weigh and place on boiling water hot plate for 4 hours. Remove, allow to cool for 20 minutes in the air and weigh again.

A.2 The Aluminium dish and glass cone must be in accordance with the standard pattern, which may be seen on application to Quality Assurance Officer.

A.3 Calculation

$$\begin{array}{l} \text{Volatile matter,} \\ \text{\% by mass} \end{array} = \frac{M_1 - M_2}{M} \times 100$$

Where,

M = Mass of sample taken.

M₁ = Mass of dish + cone + sample.

M₂ = Mass of dish + cone + sample after heating for 4 hours and air cooling.

APPENDIX 'B'

B. DETERMINATION OF SETTING POINT

B.1 Melt about 80 g of the DNT in a shallow porcelain dish in a water oven maintained at 75 °C to 80 °C, together with a test tube (15 x 2.5 cm) and an aluminium wire stirrer, continue the heating for two hours after the DNT has fully melted, observe the presence of scum and deposit, if any, and report accordingly. In the meantime place the setting point thermometer of range 53 °C to 72° C graduated in 0.2° C (to drawing No CI / M / 184, obtainable from CQA (ME), Kirkee, Pune) in the oven at 80° C. Fill the tube (15 X 2.5 cm) to within 2.5 cm of the top with the molten DNT. Observe the transparency of the fluid and insert it into a tube (18 x 3.5 cm) supported by a cork, the larger tube being supported in a glass jar by a wooden cover. Without delay insert the stirrer and adjust the setting point thermometer centrally in the melt, so that the extremity of the bulb is 2.5 cm from the bottom of the tube. Place a screen in position round the glass jar. The thermometer is held by a clamp and no corks used. The temperature at this stage should be not lower than 75 °C.

B.2 Commence stirring vigorously at once and continue as the temperature falls until the first rise of temperature occurs. The thermometer reading is determined by means of a lens during the rise in temperature and the maximum temperature indicated is recorded to the nearest 0.2 °C. It is necessary to check by gentle tapping of the thermometer that no sticking of the mercury thread has occurred at the time of reading.

B.3 Without delay, ascertain the temperature of the air adjacent to the exposed stem of the setting point thermometer, the number of degree divisions of setting point thermometer, exposed and make the necessary correction for the emergent stem which is generally given while standardising the thermometer.

B.4 Access of strong light to the DNT during the determination must be avoided and it is therefore essential that a screen wholly covering the sides of the glass jar, should be in place throughout the determination.

APPENDIX 'C'

C. DETERMINATION OF SULPHATED ASH

C.1 Moisten 5 g of DNT with 1 ml of concentrated Sulphuric acid in a porcelain crucible. Heat gently until the DNT ignites and allow the DNT to burn off. Heat gently to drive off the Sulphuric acid and then more strongly to burn off the residual carbon (use goggles during the ignition of DNT).

C.2 Cool in a desiccator to room temperature and reweigh. Calculate the percentage of sulphated ash on the original sample.

C.3 Calculation.

$$\begin{array}{l} \text{Sulphated ash} \\ \text{\% by mass} \end{array} = \frac{M_3 - M_1}{M_2 - M_1} \times 100$$

Where

M_1 = Mass of crucible.

M_2 = Mass of crucible + sample.

M_3 = Mass of crucible + ash.

APPENDIX 'D'

D. DETERMINATION OF MATTER INSOLUBLE IN BENZENE

D.1 Agitate 10 g of DNT with about 100 ml of pure Benzene until no more will dissolve. Heat to about 60 °C to promote further dissolution and to coagulate the insoluble matter. Allow to cool without further disturbance for three hours. Filter the insoluble matter on tared sintered glass crucible and wash with Benzene. Dry in a boiling water oven for two hours. Cool in desiccators to room temperature and weigh. Calculate the percentage of matter insoluble in Benzene on the original sample.

APPENDIX 'E'

E. DETERMINATION OF ACIDITY

E.1 Stir 10 g of DNT vigorously in 100 ml of boiling distilled water until dissolution. As the mixture cools, the DNT granulates. When quite cold, decant off the supernatant liquid. Re - extract the DNT with 50 ml of boiling distilled water and decant off when cold. Titrate the combined aqueous extracts with 0.02N Sodium hydroxide using Phenolphthalein as indicator. Carry out a blank test alongside and apply necessary correction, if any.

E.2 Calculate the acidity as percentage Sulphuric acid using the factor 1 ml of 0.02 N NaOH = 0.00098 g H₂SO₄.

E.2.1 Calculation.

$$\begin{array}{l} \text{Acidity as Sulphuric} \\ \text{Acid, \% by mass} \end{array} = \frac{(t_1 - t_2) \times f \times 0.00098}{\text{Mass of sample taken}} \times 100$$

Where

t₁ = ml of 0.02 N NaOH required for the sample.

t₂ = ml of 0.02 N NaOH required for the blank.

f = Factor of 0.02 N NaOH.

F. SIEVING

F.1 Weigh 10 g of the material and brush it gently on the specified Sieve. Carry out the brushing for 15 minutes or until no further material passes through the sieve (whichever is the shortest time). Express the mass of material retained by the sieve as a percentage on the original sample.

