RESTRICTED

GOVERNMENT OF INDIA
MINISTRY OF DEFENCE

PROVISIONAL SPECIFICATION
FOR
DIPHENYL METHANE DIISOCYANATE
(DDI)

. HEMRL/ED/PS/318

HIGH ENERGY MATERIAL RESEARCH LABORATORY
SUTARWADI, PUNE 411 021

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RESTRICTED

RECORD OF AMENDMENTS

AMENDMENT No	SUB HEADINGS TO WHICH AMENDMENT PERTAINS	AUTHORITY	INCORPORATED BY NAME AND RANK	INITIAL

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1. FOREWORD

1.1 This specification has been prepared by High Energy Materials Research Laboratory, Sutarwadi, Pune-411021.

1.2 This specification will be approved by the Ministry of Defence after appropriate sealing action by Controllerate of Quality Assurance (Military Explosives) and will be mandatory for use by Defence Services.

1.3 Before sealing action, any queries regarding this specification may be referred to High Energy Materials Research Laboratory, Sutarwadi, Pune-411021.

2. SCOPE

2.1 This specification is intended to govern supply and Quality Assurance of Diphenylmethane diisocyanate (DDI) also known as 4,4'-Methylene bis (phenyl isocyanate).

2.2 INTENDED USE – This material is intended for use in the Processing of Sheet Explosive and Plastic Bonded Explosive.

3. RELATED SPECIFICATIONS AND DOCUMENTS

3.1 The related document as mentioned in clause 3.2 is applicable at the date of publication of this specification. It is contractor's/manufacturer's responsibility to confirm their current applicability and to obtain from CQA (ME), Khadki. information concerning any change that may be necessary due to cancellation, replacement or supersession of any of those documents.

3.2 The following related specifications has been referred to in the preparation of this specification.

MIL-T-23624(Wep)	Toluene-2,4-diisocyanate

31 Dec 1962

3.3 Copies of the related specification is obtainable as follows:

MIL Standard Specification	Directorate of Standardization Ministry of Defence, DHQ PO, NEW DELHI-110011

4 MATERIAL/FINISH

The Diphenylmethane diisocyanate shall be a product so formulated as to meet the requirements of this specification and shall be a clear liquid, free from foreign matter and visible impurities.

5 MANUFACTURE

5.1 Diphenylmethane diisocyanate shall be manufactured by a process, which will produce the product conforming to this specification.

5.2 Nothing in this specification shall relieve the manufacturer of his responsibility for the safety of his operations.

6 TENDER SAMPLE

6.1 Unless otherwise instructed, the contractor/supplier shall submit free of all charges, two tender samples of 100ml each conforming to this specification in all respects.

6.2 Acceptance of tender will denote that the tender sample has been accepted as standard of supply in accordance with terms of this specification.

7 QUALITY ASSURANCE

7.1 INSPECTION

7.1.1 Diphenylmethane diisocyanate and the containers in which it is packed shall be subjected to inspection by and to the approval of Quality Assurance Officer/Quality Assurance Authority.

7.1.2 Samples of the material may be taken from separate unit containers at random. The samples so selected shall be placed in narrow mouth glass-stoppered bottles and shall be placed in separate air-tight and water tight containers, which shall be nearly filled, covered and sealed to prevent atmospheric effect. Each sample shall be labeled with date, lot number and manufacturer's container identification number.

7.1.3 If, on examination, any sample be found not to conform to this specification, the whole batch/lot/consignment 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 100ml supplied free of charge, shall be drawn at random from any container 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 REQUIRMENTS

7.3.1 Samples taken from any portion of the batch/lot/consignment of the material shall conform to the following test requirements.

Sl No	Characteristics	Passing standard	Reference to test method
1.	Assay, percent by mass, min.	98.2	Appendix-I (Ref. HEMRL Method)
2.	Isocyanate content (percent by mass, min.)	33.0	Appendix-I (Ref. HEMRL Method)
3.	Specific gravity at 25°C	1.23± 0.01	Appendix-II (Ref. MIL-T-23624 (wep))
4.	Refractive Index at 25°C	1.622±0.001	Appendix-III (Ref. MIL-T-23624 (wep))

7.4 STABILITY

When packed in accordance with clause 9 and stored at temperature less than 25°C the DDI shall meet the requirements of this specification for a minimum period of 6 months after acceptance. The shelf life may be extended by 6 months intervals after acceptance testing for conformance requirements of Isocyanate content and assay.

7 PRECAUTIONARY MARKING

In addition to the marking specified in 11.1, the following special marking shall also be included:

Precautionary Marking

Warning: Poison

Avoid contact with skin

Avoid breathing of vapor

Use with adequate ventilation

Keep container closed

Keep away from moisture

Keep away from heat and open flame

8 SUPPLIER'S INSPECTION OF STORES/CONSIGNMENT

Before tendering the store for inspection the supplier shall carry out a thorough inspection of each delivery to satisfy himself that store fully confirms to this specification and shall render certificate to that effect to the Quality Assurance Officer/Quality Assurance Authority.

9 WARRANTY

The stores specified against the contract shall deem to have been warranted against defective material and performance by the contractor/manufacturer for a period of six months from the date of receipt of the stores 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 charge at the consignee's premises.

10 PACKING

10.1 The material shall be supplied in approved containers of suitable si containing an approved quality as ordered by the consignee. The containe shall be coated on the inside with a coating, which shall neither affect, nor affected by the Diphenylmethane diisocyanate packed. The supplier sh certify to the inspecting officer that the coating used complies with tl requirement.

10.2 The inclusion of any foreign matter or impurities in any of the packages sha render the whole consignment liable for rejection.

10.3 Precautions for handling of liquid diisocyanates should be taken as describ in "Chemical safety data sheet SD-73, properties and essential information safe handling and use of Toluene diisocyanate" issued by the manufacturi chemists Association, Inc and the same is applied to Diphenylmeth diisocyanate.

11 MARKING

11.1 All packages containing the material shall be durably and legibly marked w the following details (as applicable):

i) Nomenclature and specification number of the material

ii) Name and address of the consignee

iii) S.O number and date

iv) Consignment number

v) Lot/Batch number and date of manufacture

vi) Gross and net mass

vii) Consecutive number of package and total number of packages in the consignment.

viii) Date of supply

ix) Contractor's initials or recognized trade mark

11.2 STORAGE

11.2.1 Diphenylmethane diisocyanate shall be stored free of moisture in sealed containers and containers shall be stored in moisture free atmosphere below 25 ^{0}C.

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

11.2.3 The paint used for marking shall conform to IS:138-1981 and to the satisfaction of the Quality Assurance Officer/Quality Assurance Authority.

12. SUGGESTIONS FOR IMPROVEMENT

12.1.1 Any suggestion for improvement in this document may be forwarded to High Energy Materials Research Laboratory, Sutarwadi, Pune-411021.

APPENDIX-I

ISOCYANATE CONTENT AND ASSAY

General

Isocyanate groups rapidly react with di-n-butylamine at room temparature. The excess of amine is determined by titration with aqueous acid. Isopropanol is added to prevent the separation of the two phases during the titration. The size of the sample is also reduced so that the titration can be carried out in one liquid phase.

1. REAGENTS

(a) Dry and distilled Toluene

(b) Di-n-butylamine reagent - Add 17.5 ml of di-n-butylamie to 82.5ml Toluene.

(c) Isopropanol

(d) Hydrochloric acid, 0.5 N

(e) Bromothymol blue indicator (dissolve 1g indicator in 16ml 0.1 N NaOH and dilute it to 1 lit by distilled water).

2. PROCEDURE

Weigh accurately about one gram of sample in a conical flask. Dissolve it in 25ml of Toluene and then add 25ml of standard di-n-butylamine mixture (17.5 ml of di-n-butylamine to 82.5ml of Toluene). Keep it for half an hour. Shake well and add 2ml of Bromothymol blue and 65ml of Isopropanol. Then titrate with 0.5 N of HCl. At the end point the colour changes from blue to yellow green. Carry out a blank titration.

CALCULATIONS

$$\text{Isocyanate content (\% by mass)} = \frac{4.2 \times N \times (V_2 - V_1)}{m}$$

$$\text{Purity expressed as DDI \% By mass} = \frac{12.5 \times N \times (V_2 - V_1)}{m}$$

Where

V_2 = titre against the blank, ml

V_1 = titre against the sample, ml

N = Normality of Hydrochloric acid

m = mass of the sample, g

APPENDIX - II

SPECIFIC GRAVITY

The specific gravity of the sample shall be determined at 25°C using standard bolfic gravity bottle.

APPENDIX – III

REFRACTIVE INDEX

The refractive index of the sample shall be determined at 25°C using an Abbe Refractometer or any other equally accurate instrument.