



भारत सरकार  
GOVERNMENT OF INDIA  
रक्षा मंत्रालय  
MINISTRY OF DEFENCE

संयुक्त सेवा विनिर्देश  
JOINT SERVICES SPECIFICATION

ON

DYES FOR COLOURED SMOKE COMPOSITIONS

मानकीकरण निदेशालय  
रक्षा उत्पादन विभाग  
रक्षा मंत्रालय  
'एच'-ब्लॉक, निर्माण भवन डाकघर  
नई दिल्ली-११००११

DIRECTORATE OF STANDARDISATION  
DEPARTMENT OF DEFENCE PRODUCTION  
MINISTRY OF DEFENCE  
'H' BLOCK, NIRMAN BHAVAN POST OFFICE  
NEW DELHI-110 011

**LIST OF MEMBERS ASSOCIATED WITH FORMULATION OF THIS STANDARD**

1. The third revision of this Joint Services Specification 6820-02 has been approved by Shri RS Gauba, Sc 'G', Associate Director, PO-II, DRDO, Chairman, Armament Standardisation Sub-committee by circulation.
2. The representatives of following organisations have been present/consulted in approving the document:

<b>S. No.</b>	<b>Organisations</b>
1.	Programme Office-II, DRDO Orgn, New Delhi
2.	ADGWE/GS (WE-2/3), New Delhi
3.	Dte of Arty (GS/Artillery-5), New Delhi
4.	Dte Gen of Naval Armt, Naval HQ, New Delhi
5.	Dte of Armt & Safety Eqpt, Air HQ, New Delhi
6.	DGEME, Army HQ, New Delhi
7.	DGNAI, Naval HQ, New Delhi
8.	DGAQA, JD (Armt) Gp, New Delhi
9.	CQA (ME), Pune
10.	CQA (Amn), Pune
11.	CQA (SA), Ichapur, West Bengal
12.	CQA (W), Jabalpur
13.	HEMRL, DRDO, Pune
14.	ARDE/DRDO Orgn, Pune
15.	Ammunition Factory, Pune
16.	Secretary ASSC

**RECORD OF AMENDMENTS**

<b>Amendment</b>		<b>Amendment pertains to S. No./Para No./ Column No.</b>	<b>Authority</b>	<b>Amended by</b>	<b>Signature &amp; Date</b>
<b>No.</b>	<b>Date</b>			<b>Name &amp; Appointment (In block letters)</b>	

**TABLE OF CONTENTS**

<b>S. No.</b>	<b>Topic</b>	<b>Page No.</b>
<b>0.</b>	<b>FOREWORD</b>	<b>1</b>
<b>1.</b>	<b>SCOPE</b>	<b>3</b>
<b>2.</b>	<b>RELATED SPECIFICATIONS/ DOCUMENTS</b>	<b>3</b>
<b>3.</b>	<b>DESCRIPTION/MATERIAL</b>	<b>3</b>
<b>4.</b>	<b>MANUFACTURE</b>	<b>4</b>
<b>5.</b>	<b>PRE-INSPECTION OF STORES/CONSIGNMENT</b>	<b>4</b>
<b>6.</b>	<b>TENDER SAMPLE</b>	<b>4</b>
<b>7.</b>	<b>QUALITY ASSURANCE</b>	<b>4</b>
<b>8.</b>	<b>WARRANTY</b>	<b>9</b>
<b>9.</b>	<b>PACKAGING</b>	<b>9</b>
<b>10.</b>	<b>MARKING</b>	<b>9</b>
<b>11.</b>	<b>SAFETY OF OPERATIONS</b>	<b>10</b>
<b>12.</b>	<b>DEFENCE CATALOGUE NUMBERS</b>	<b>10</b>
<b>13.</b>	<b>SUGGESTIONS FOR IMPROVEMENT</b>	<b>10</b>
<b>APPENDICES</b>		
<b>APPX 'A'</b>	<b>APPARENT DENSITY</b>	<b>11</b>
<b>APPX 'B'</b>	<b>METHOD FOR DETERMINATION OF SULPHUR AND SULPHIDES</b>	<b>12</b>
<b>APPX 'C'</b>	<b>IDENTIFICATION TEST</b>	<b>13</b>

**0. FOREWORD**

**0.1** This Joint Services Specification has been prepared by the 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** This JSS 6820-02 : 2016 (Third Revision):

- a) was prepared in the year 1996.
- b) was revised in the year 2004 & 2012 and supersedes the same.

**0.4** This specification would be used for Supply and Quality Assurance of Dyes for Coloured Smoke Compositions.

**0.5** Quality Assurance Authority for the item covered in 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 JSSs/JSGs from:**

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

**JSS 6820-02 : 2016**  
**(Third Revision)**

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

Directorate of Standardisation Website:

*[www.ddpdos.gov.in](http://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 JSSs/JSGs are available on the Directorate of Standardisation Website *[www.ddpdos.gov.in](http://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 Supply and Quality Assurance of Dyes for Smoke Compositions suitable for use in the coloured smoke compositions.

## 2. RELATED SPECIFICATIONS/DOCUMENTS

References are made in this specification to:

<i>S. No.</i>	<i>Specification No. &amp; Year</i>	<i>Nomenclature</i>
a)	IS 138 : 1992 (Third Revision) AMD 1 Reaffirmed 2014	Ready Mixed Paint, Marking, for Packages and Petrol Containers-Specification
b)	IS 460 (Part 1) : 1985 (Third Revision) AMD 1 Reaffirmed 2013	Specification for Test Sieves Part 1 Wire Cloth Test Sieves
c)	IS 2087 : 1988 (Third Revision) AMD 1 Reaffirmed 2016	Square Tins for General Purpose
d)	JSG 0112 : 2015 (Second Revision)	General Methods of Tests and Assessment of Impurities in Chemicals/Materials used in the Manufacture of Explosives and Ammunition

## 3. DESCRIPTION/MATERIAL

**3.1** The dye for coloured smoke composition shall be in the form of a fine powder free from diluents or added material, grit, foreign matter and visible impurities.

**3.2** The dye shall consist of one of the following dyestuffs according to the colour required in the terms of contract.

<i>S. No.</i>	<i>Colour</i>	<i>Dyestuff</i>	<i>Colour Index Number</i>	<i>Chemical Composition</i>
a)	Blue	Dye, Cyananthrol R (Base) or Dye, Brilliant Blue G	62085	1-Amino-2 methyl 4 Paratolylamino-anthraquinone. 1:4 Dimethylamino Anthraquinone
b)	Orange	Dye, Oil Orange	12055	Benzeneazobeta-naphthol
c)	Red	Dye, Rhodamine B	45170	Hydrochloride of diethyl-m-amino-phenolphthalein

**Description/Material (Concluded)**

<i>S. No.</i>	<i>Colour</i>	<i>Dyestuff</i>	<i>Colour Index Number</i>	<i>Chemical Composition</i>
d)	Yellow	Dye, Solvent Yellow-33	47000	Symmetrical quinophthalone with a Small proportion of Iso-quinophthalone
e)	Blue Green	Dye CI Solvent Green 3 Type A-Crystalline Type B-Amorphous	61565	1:4 di-p-tolyl-aminoanthraquinone unsulphonated
f)	Blue	Dye, Copper, Phthalocyanine (Substitute for dye, Cyananthrol R (Base))	74160	Unsulphonated Copper phthalocyanine
g)	Red	Dye, Solvent Red 17	12155	Para-crysidineazo Betanaphthol

**4. MANUFACTURE**

The dyes shall be manufactured by a process which will produce the product conforming to this specification.

**5. PRE-INSPECTION OF STORES/CONSIGNMENT**

**5.1** 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 along with 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.

**5.2** 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.

**6. TENDER SAMPLE**

The manufacturer/supplier/contractor shall submit two tender samples of 100 g each, essentially from the same batch/lot of manufacture, free of all charges and conforming to this specification to the Quality Assurance Authority/Quality Assurance Officer as stated in the contract.

**7. QUALITY ASSURANCE**

**7.1 Inspection**



**7.1.1** The dyes for coloured smoke compositions and the packages in which it is 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/lot/consignment.

## **7.2 Criteria for Conformity**

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

## **7.3 Sampling**

Normally two representative samples each of 100 g supplied free of all charges shall be drawn from each batch/lot/consignment of supply/manufacture. However, the number of samples to be drawn shall be at the discretion of the Quality Assurance Officer/Quality Assurance Authority.

## **7.4 Test Requirements**

Samples taken from any portion of the batch/lot/consignment of material shall conform to Clause 3 and in addition shall conform to the test requirements shown in the following table:

**JSS 6820-02 : 2016**  
**(Third Revision)**

S. No.	Characteristics	Passing Standard for Dye									Reference
		Cyananthrol R (Base)	Brilliant Blue G	Oil Orange	Rhodamine B	Solvent Yellow-33	CI Solvent Green 3 Type		Copper phthalocyanin e	Solvent Red 17	
							A	B			
a)	Volatile matter, Percent by mass (Max)										
	1) At 90°C to 95°C	0.20 (1h)	1.0 (1h)	0.5 (1h)	4.0 (3h)	-	0.5 (1h)	-	0.2 (1h)	0.3 (1h)	JSG 0112 Method 1 (a)
	2) Under vacuum for 24 h (over silica gel)	-	-	-	-	0.3	-	-	-	-	JSG 0112 Method 1 (b)
b)	Ash, sulphated Percent by mass (Max)	2.0	2.0	2.5	1.5	0.5	1.0	-	13.3 to 14.3	3.0	JSG 0112 Method 2 (b)
c)	Matter soluble in water, Percent by mass (Max)	1.0	3.0	1.25	-	-	0.5	-	1.0	2.0	JSG 0112 Method 3
d)	Matter insoluble in water, Percent by mass (Max)	-	-	-	1.0	-	-	-	-	-	JSG 0112 Method 4
e)	Apparent density (Min)	0.5	0.3	0.2	0.35	0.4	0.45	0.30 to 0.40	0.30 to 0.37	0.3	Appx 'A'
f)	pH of water extract (Min) (Max)	5.5	6.0	4.5	2.5	2.8	6.0	-	6.0	6.0	JSG 0112 Method 5 (b)
		7.5	8.0	8.0	-	-	8.0	-	8.0	8.0	
g)	Ammonium compounds as NH <sub>3</sub> Percent by mass (Max)	Nil	0.05	Nil	-	Nil	0.05	-	Nil	Nil	JSG 0112 Method 9
h)	Free sulphur and Sulphides as H <sub>2</sub> SO <sub>4</sub> Percent by mass	Nil	Nil	Nil	Nil	Nil	Nil	-	-	Nil	Appx 'B'
j)	Identification Test	Shall pass all the tests as per colour Index No.									Appx 'C'

Test Requirements (Continued)

S. No.	Characteristics	Passing Standard for Dye									Reference
		Cyananthrol R (Base)	Brilliant Blue G	Oil Orange	Rhodamine B	Solvent Yellow-33	CI Solvent Green 3 Type		Copper phthalocyanine	Solvent Red 17	
							A	B			
k)	Water soluble Chlorides as NaCl/Percent by mass (Max)	0.05	-	0.75	-	0.25	-	-	0.05	-	JSG 0112 Method 7 (b)
m)	Water soluble Sulphates as Na <sub>2</sub> SO <sub>4</sub> , Percent by mass, (Max)	0.1	-	0.1	-	0.10	-	-	Nil	-	JSG 0112 Method 8
n)	Acidity or Alkalinity	-	0.05% Max as H <sub>2</sub> SO <sub>4</sub> or Na <sub>2</sub> CO <sub>3</sub> Potentiometric titration to pH 7	-	Acidity of 0.5% solution Calculated as HCL using Potentiometric to pH 4.5 shall be 7.6% Max	10.0% Max As HCL Potentiometric titration to pH 8 end point of phenolphthalein	0.05% Max as H <sub>2</sub> SO <sub>4</sub> or Na <sub>2</sub> CO <sub>3</sub> Potentiometric titration to pH 7	-	-	0.025% Max as H <sub>2</sub> SO <sub>4</sub> 0.025% Max as Na <sub>2</sub> CO <sub>3</sub> Potentiometric titration to pH 7	JSG 0112 Method 5 (a)
p)	Organic matter insoluble in Methylated spirit or rectified spirit Percent by mass (Max)	-	-	1.5	1.0	-	-	-	-	-	JSG 0112 Method 4 (With alcohol as solvent)
q)	Sieving requirements percent retained on:										

**Test Requirements (Concluded)**

S. No.	Characteristics	Passing Standard for Dye									Reference
		Cyananthrol R (Base)	Brilliant Blue G	Oil Orange	Rhodamine B	Solvent Yellow-33	CI Solvent Green 3 Type		Copper phthalocyanine	Solvent Red 17	
							A	B			
	1) 425 micrometre IS Sieve	Nil	Nil	-	-	Nil	-	-	Nil	-	JSG 0112 Method 18
	2) 250 micrometre IS Sieve <i>Max</i>	5.0	-	Nil	Nil	5.0	Nil	-	0.2	Nil	-
	3) 125 micrometre IS Sieve	30.0 <i>Min</i>	5.0 <i>Max</i>	10.0 <i>Max</i>	10.0 <i>Max</i>	-	All to pass 250 micrometre	-	0.5 <i>Max</i>	15.0 <i>Max</i>	
	4) 63 micrometre IS Sieve	50.0 <i>Min</i>	-	-	-	-	-	-	1.0 <i>Max</i>	-	-
r)	Melting point	-	-	128°C to 135°C	-	-	-	-	-	165°C to 170°C	
s)	Practical trial	Shall meet the requirements of practical trial, if and when called for, against end use requirement.									

**NOTE** - Particulars of IS sieves referred to in this specification will be found in IS 460 (Part 1).

## **8. WARRANTY**

The stores supplied against this specification shall be deemed to bear warranty for 12 months from the date of receipt of store at consignee's end and against defective design/material/workmanship/performance. If during this period any of the stores supplied is found defective, the same shall be rectified/replaced by the contractor, free of charge, at the user's premises within a period of three months from date of intimation of defect.

## **9. PACKAGING**

**9.1** The dye shall be packed in sound clean tin containers conforming to IS 2087 (latest issue). The quantity per tin shall be not more than 1 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 foreign matter or impurities in any of the packages shall render the whole batch/lot/consignment liable for rejection.

## **10. MARKING**

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

- a) Nomenclature and specification No. of the material.
- b) Name and address of the consignee.
- c) A/T or SO No. and date.
- d) Consignment No.
- e) Lot/Batch No. and date of manufacture.
- f) Gross and net mass.
- g) Consecutive No. of package and total number of packages in the consignment.
- h) Date of supply.
- j) Manufacturer's initial or recognised trademark.

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

**10.3** The paint used for marking should conform to IS 138 (latest issue) and to the satisfaction of the Quality Assurance Officer/Quality Assurance Authority.

## **11. SAFETY OF OPERATIONS**

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

## **12. DEFENCE CATALOGUE NUMBERS**

Defence Catalogue Numbers allotted to these stores are as under:

<i>S. No.</i>	<i>Nomenclature</i>	<i>DCAN</i>
a)	Dye, Cyananthrol, R (Base)	6820-000 013
b)	Dye, Brilliant Blue G	6820-000 017
c)	Dye, Oil, Orange	6820-000 020
d)	Dye, Rhodamine B	6820-000 010
e)	Dye, Solvent Yellow-33	6820-000 009
f)	Dye, CI Solvent Green 3 Type A	6820-000 008
g)	Dye, Copper phthalocyanine	6820-000 019
h)	Dye, solvent Red 17	6820-000 014

## **13. SUGGESTIONS FOR IMPROVEMENT**

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.

**APPX 'A'**  
*(Clause 7.4)*

**APPARENT DENSITY**

**A-1.** Place 10 g of the material in a stoppered glass cylinder graduated in half millilitres, the cylinder being 15 cm high by 4 cm in diameter. Drop the cylinder vertically from a height of 6 cm on to a piece of hard leather 100 times. Level off the surface of the column of material by the minimum amount of side tapping and read the total volume.

**A-2.** The above procedure is conveniently arranged by sliding the cylinder through two wooden filter stand rings clamped one above the other on the same support, the lower ring being so arranged as to limit the travel of the cylinder to 6 cm.

**A-3. Calculation**

$$\text{Apparent density} = \frac{\text{Mass}}{\text{Volume}}$$

**METHOD FOR DETERMINATION OF SULPHUR AND SULPHIDES**

**B-1.** Weigh accurately 0.5 g of the sample and transfer into 500 ml tall Pyrex beaker. Add 15 ml of concentrated Nitric acid and wet the material with the same. Add in small quantities at a time about 2 g of Potassium chlorate, warm gently till all Potassium chlorate is dissolved. Place the beaker on a sand bath. Start heating gradually on a Bunsen burner. Add 1 g of Potassium chlorate at an interval of every 10 minutes till all the material is oxidised i.e. a clear solution is obtained. Ensure that in the beaker the quantity of Nitric acid is replenished in order that the contents of the beaker do not become completely dry during evaporation. After complete oxidation, evaporate contents to near dryness. Add 20 ml of concentrated Hydrochloric acid. Evaporate to dryness. Repeat the addition of Hydrochloric acid and evaporate to dryness to remove the last traces of Nitric acid completely.

**B-2.** Add 50 ml of dilute Hydrochloric acid (1:2), warm a little and then filter the solution in a beaker and make up the volume of the filtrate to about 500 ml then heat it to boiling. To the boiling solution add slowly 10 ml of 10 per cent Barium chloride solution with stirring and digest on sand bath for 30 minutes. Allow to stand overnight. Filter the precipitate through No. 42 Whatman filter paper, wash the precipitate with hot distilled water till all chlorides are removed. Test the filtrate for freedom from chlorides.

**B-3.** When the filtrate is free from chlorides dry the precipitate in water oven and then ignite it in a tared silica crucible ( $W_1$ ) in a muffle furnace to red hot and weigh after cooling ( $W_2$ ). Carry out a blank using same quantity of the reagents under identical conditions. Deduct the quantity of the precipitate in the blank. The excess obtained is the quantity representing Sulphur content of the sample to be calculated as Sulphuric acid.

**B-4. Calculation**

$$\begin{array}{l} \text{Sulphur and Compounds of Sulphur} \\ \text{as H}_2\text{SO}_4, \text{ Percent by mass} \end{array} = \frac{(\text{W}_2 - \text{W}_1) \times 100 \times 0.4202}{\text{Mass of the sample taken}}$$



IDENTIFICATION TEST

**C-1. Colour Index No. 62085**

- a) Soluble in Alcohol, O-Chlorophenol
- b) Slightly soluble in Acetone, Pyridine
- c) Insoluble in Chloroform, Toluene
- d) Insoluble in water
- e) Sulphuric acid concentrated - Violet, on dilution violet

**C-2. Dye Brilliant Blue 'G'**

*Solubility in*

- a) Water : Insoluble.
- b) Methylated Spirit : Soluble.
- c) Acetone : Soluble.

**C-3. Colour Index No. 12055**

*Solubility in*

- a) Water : Insoluble.
- b) Alcohol : Orange red solution.
- c) NaOH : Insoluble.
- d) Concentrated HCl : Red solution on warming from which a hydrochloride crystallises in dark cantharides green needles.
- e) H<sub>2</sub> SO<sub>4</sub> : Magenta red solution, Orange yellow on dilution.  
precipitate

**C-4. Colour Index No. 45170**

- a) Water : Soluble, Bluish red solution strong fluorescence is obtained on dilution.
- b) Alcohol : Bluish red solution, Strong fluorescence is obtained on dilution.
- c) Reaction with HCl : To aqueous solution of the material add 2 to 3 ml of Hydrochloric acid-Gradual Separation of green crystals of hydrochloride soluble in excess with a scarlet red colour.
- d) Reaction with NaOH : To a small quantity of the NaOH aqueous solution of the material add Sodium hydroxide in excess. On heating a rose red flocculent precipitate is obtained, which is soluble in ether or benzene and gives a colourless solution. An odour of dimethylamine is observed on heating with Sodium hydroxide.
- e) Reaction with H<sub>2</sub>SO<sub>4</sub> : To a small quantity of the material add 2 to 3 ml of concentrated H<sub>2</sub>SO<sub>4</sub>. Yellowish brown solution with a strong green fluorescence is obtained with the evolution of Hydrochloric acid, giving scarlet red solution which turns bluish red on dilution.

**C-5. Colour Index No. 47000**

- a) Appearance : Yellow Powder which crystallises from boiling alcohol in golden yellow needles m.p. 240°C.
- b) Water : Insoluble.
- c) Ethyl Alcohol : Sparingly soluble with yellow colour.
- d) Acetone, Chloroform & Benzene : Soluble with yellow solution.
- e) Hydrochloric acid and Sodium Hydroxide : Insoluble.
- f) Concentrated Sulphuric acid : Soluble-gives yellowish red Sulphuric acid solution and gives yellow flocculent precipitate on dilution.

**C-6. Colour Index No. 61565**

- a) Water : Insoluble.
- b) Hydrochloric acid : Insoluble.
- c) Methylated Spirit : Slightly soluble, yielding blue green solution.
- d) Concentrated Sulphuric : Blue solution, becoming green on dilution, finally yielding a bluish green precipitate.

**C-7. Colour Index No. 74160**

- a) Water : Insoluble.
- b) Ethyl Alcohol and Hydrocarbons : Insoluble.
- c) Reaction with  $H_2SO_4$  : To a small quantity of the material add 2 ml to 3 ml of concentrated Sulphuric acid-Olive green solution is obtained which on dilution gives a blue precipitate.

**C-8. Colour Index No. 12155**

Soluble in Ethanol, Acetone, Benzene and Gasoline.