0. FOREWORD

0.1 This specification has been prepared by the Material Standardisation Sub Committee on the authority of 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 specification is a revision of JSS 0465-01:1988 and supersedes the same.

0.4 This specification would be used to guide procedure, inspection and testing of the phosphate treatment on ferrous surfaces of Armament stores for protection against corrosion.

0.5 Enquiries regarding this specification related to any contractual conditions should be addressed to the Quality Assurance Authority named in the tender or contract. Other enquiries should be referred to the Director, Directorate of Standardisation, Ministry of Defence, 'H' Block DHQ PO , New Delhi - 110 011.

0.6 Copies of this specification can be obtained on payment from :

(a) The Controller
Controllerate of Quality Assurance (Weapons)
Jabalpur - 482 001

(b) The Controller
Controllerate of Quality Assurance (Ammunitions)
Kirkee
Pune - 411 003

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

JSS 0465-01:1994
Revision No .1
(Supersedes JSS 0465-01:1988)

1. SCOPE

1.1 This specification applies to the treatment of ferrous surfaces of Armament Stores to produce coat essentially of metal phosphates that are intended to be used conjunction with supplementary finishes for protection aga corrosion.

1.2 This specification covers three classes of phospha processes i.e. accelerated and non-accelerated, which are de nated in terms of the compositions and mass of the coatings given in clause 6.5.

1.3 The dimensions of the finished components shall be of the components after phosphating and before the applicati the supplementary finish or as specified in the drawing/specification.

1.4 This specification does not cover treatments which very thin coating of mass below than that specified in class in Clause 6.5 (c).

1.5 The class of phosphate finish and the type of suppl tary finish required (e.g. oil, grease, paint etc) shal stipulated in the contract or specification or on the dr governing the manufacture of the component.

2. RELATED SPECIFICATIONS AND DOCUMENTS

2.1 Reference is made in this specification to :-

(i) IS 75:1973	Linseed oil, raw & refin (second revision). (Amendments 2) Reaffirmed 1990
(ii) IS 168:1973	Ready mixed paint air- semi-glossy/matt for g purposes (second revision) (Amendment 3) Reaffirmed 1998
(iii) IS 245:1988	Trichloro ethylene (third revision)

(vi)	IS 496:1982	Specification for automotive internal combustion engine lubricating oils (fourth revision)
(v)	IS 507:1980	Specification for general purpose grease, Grease LD 280 (second revision) Reaffirmed 1990
(vi)	IS 533:1973	Gum spirit of turpentine (oil of turpentine) (first revision) Reaffirmed 1990
(vii)	IS 798:1986	Ortho-phosphoric acid (second revision) Reaffirmed 1991.
(viii)	IS 1745:1978	Specification for petroleum hydrocarbon solvents (second revision) Reaffirmed 1989
(ix)	IS 3618:1966	Phosphate treatment of iron and steel for protection against corrosion
(x)	IS 5340:1981	Lanoline, anhydrous for cosmetic industry (first revision) Reaffirmed 1987
(xi)	JSS:8010-3:1971	Lacquer, clear, oil base
(xii)	JSS:8010-19:1977	Stain, Varnish black
(xiii)	JSS:8010-28:1984 Reaffirmed 1991	Varnish stoving APC No.221 G Grade 1 and varnish, oil stoving APC No.221 G Grade 1 special.

(xiv)	JSS:8030-12:1979	Protective, PX-6
(xv)	JSS:8030-22:1980	Protective PX-11
(xvi)	JSS:9150-11:1977	Oil, OX-52
(xvii)	IND/SL/3244	Lacquer, clear stoving
(xviii)	WPN/GEN/2	Painting of metallic surfaces of weapons and ancillary stores

2.2 Copies of Indian Standards can be obtained on payme from :-

Bureau of Indian Standards
Manak Bhavan
9, Bahadur Shah Zafar Marg
New Delhi-110 002

or

their regional/branch offices.

2.3 Copies of Joint Services Specification 0010--28 can obtained on payment from :-

The Controller
Controllerate of Quality Assurance (Miltary Explosiv
Kirkee
Pune - 411 003

2.4 Copies of Joint Services Specifications 8010-03, 8 19, 9150-11, 8030-12, 8030-22 and Specification IND/SL/3244 ca obtained on payment from :-

The Controller
Controllerate of Quality Assurance (Materials)
Post Box No. 229
Kanpur - 208 004

Copies of Specification WPN/GEN/2 can be obtained on ment from :-

The Controller
Controllerate of Quality Assurance (Weapons)
Gun Carriage Factory Post
Jabalpur - 482 011

DEFINITIONS

(a) Supplementary finish A coating material usually of an organic nature, (e.g. oil, grease, lacquer, varnish or paint) applied immediately after phosphating, washing and drying, used in conjunction with phosphate coating to form the complete protective scheme.

(b) Accelerated process A process in which the phosphating solution is of the metal phosphate/ phosphoric acid type but contains additions that accelerate the coating formation such as water solution oxidising agents (e.g. nitrate, nitrite, chlorate etc)

(c) Non-accelerated process A process in which the phosphating solution is of the plain metal phosphate/phosphoric acid type without additions that accelerate the coating formation.

(d) Sealing The application of any supplementary finish to a phosphated surface immediately after phosphating, washing and drying.

(e) Staining The application of a colour or dye, dissolved in water or spirit so as to impregnate a phosphated surface uniformly.

(f) Pointage A measure of the total acidity of a phosphate solution. The pointage of a phosphating bath is the number of millilitres of 0.1 N Sodium Hydroxide solution (4.0 g per litre) required to neutralise 10 millilitres of the phosphating solution using Phenolphthalein as indicator.

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(g) Contractor Contractor means the firm/factory on whom order for the treatment of the components has been placed by a competent authority under the Ministry of Defence.

4. PREPARATION

4.1 Immediately before phosphating, all paint, grease, oil, varnish, rust, scale and foreign matter shall be removed from the surface of the components to be treated by a method or combination of methods approved by the Quality Assurance Authority and suitable for particular phosphating process.

4.2 Components may be degreased in a solvent vapour or solvent (e.g. Trichloro ethylene, Technical conforming to IS 245) bath by a mechanical washing plant, using a hot detergent solution or by using spirit, white or mineral vapourising oil.

4.3 Paint, varnish or lacquer coatings on components requiring treatment, may be removed by immersion in a suitable hot (preferably boiling) alkaline solution or Trichloro ethylene (as per Clause 4.4) until the coating is sufficiently loosened or softened. The components are then to be washed in warm water and the coating immediately removed by scrubbing with bristle or wire brushes or by shot blasting with grade 90 shot.

4.4 Composition of alkaline solution: A suitable alkalin cleaner, for removal of paint etc, prior to treatment is a 5 pe cent solution of the following mixture:-

Soda ash	50 per cent by mass
Caustic soda	30 per cent by mass
Sodium metasilicate	20 per cent by mass

4.5 Components, already subjected to phosphate or some oth surface treatment process, requiring re- treatment must be fr from all traces of the original treatment including rust, dir greasy matter etc.

4.6 If a phosphated component after removal of the origi coating shows a distinct brown film, it should be immersed in per cent bath of rust removing solution or in 25 per c solution of Phosphoric acid conforming to IS 798 for a minutes and then thoroughly washed in water.

4.7 Components with folds; seams or crevices must receive a special attention to ensure complete removal of oil, grease, etc and subsequent removal of cleaning material used as per IS 1745 . If necessary, the cleaned components shall be adequately washed in cold or hot water to remove the residues of cleaning materials as it would otherwise affect the quality of the phosphate coating or the efficiency of the phosphating solution . Cleaned components must be completely dried before phosphating.

5. PHOSPHATING PRECAUTIONS

5.1 The method of application of the phosphate coating shall be to the satisfaction of Quality Assurance Authority. The phosphate treatment shall be carried out strictly in accordance with the operating instructions issued by the proprietors of the process and in such a manner that the coating formation is complete i.e.by proper attention to time of phosphating, solution temperature and composition and avoidance of air locks. No departure from the agreed process shall be made without the written sanction of the Quality Assurance Authority.

5.2 Care shall be taken at all stages to prevent contamination of the surfaces being treated by touching with bare hands, splashing with undesirable liquids or the condensation of moisture on components after drying etc.

5.3 It is advisable to take care to avoid the use of unsuitable materials in the plant construction e.g. copper or brass heating coils which adversely affect the quality of the phosphate coating produced.

6. PHOSPHATING PROCESSES

6.1 The following proprietary processes have been approved for use on stores where phosphate treatment is permitted :-

Name of processes	Marketed by
Granodising	Imperial chemical Industries Ltd.
Parkerising	The Pyrene Co. Ltd.
Rovalising (Phosphate)	International Corrodeles Ltd

Walterising	Walterisation Co. Ltd
Parkerising and Bornderizing Indigenous Processes	M/s Pyrene Rai Metal Treatment Ltd. Bombay Schedule of operation for the process may be obtained from the Controller, Controller-ate of Quality Assurance (Materials) PB No., 229, Kanpur 208 004.

Note (i) None of the above processes is complete without supplementary finish.

(ii) 'Granodine '30' and 'Parker 'D' are accelerated processes'.

6.2 Other processes may be used subject to the prio written approval of the Quality Assurance Authority.

6.3 The contractor should notify the Quality Assuran Authority of the exact proprietary designation of the phospha process which is proposed to be used before proceeding with t work. The contractor, if required, must supply to the Quali Assurance Authority with a copy of current instructions issued the proprietors in respect of the process.

6.4 The class of phosphate treatment to be used sh normally be indicated in the description of the treatment proc stipulated on the drawing or specification or in the contr governing the manufacture of the component.

6.5 Classes of Phosphating processes

(a) Class I Processes giving coatings that consi essentially of Manganese/Iron and Zinc phosp or both and have a coating mass of not less 7.5 g/m^2 of treated surface. This class will normally be used where heavy or deep phosph is required for bearing or sliding surfaces, where maximum protection is desired, in pa lar with oil or grease finishes. This class includes the normal non-accelerated and ac accelrated processes.

(b) Class II processes giving coatings that consist essentially of Zinc or other metal phosphates and have a coating mass of not less than 4.3 g/m^2 of treated surface. This class will normally be used for general protective purpose under paint coatings and under oil or greases for less severe duty than class I, Class II includes most immersion type accelerated processes.

(c) Class III Processes giving coatings that consist essentially of Zinc and other metal phosphates and have a coatings mass of not less than 1.6 g/m^2 of treated surface. This class will normally be used only for pretreatment of light gauge steel sections under paint, varnish or lacquer coatings of high protective value. It includes most of the accelerated spray type processes.

6.6 For creviced components, composite articles, springs and high tensile steels, the following instructions are to be followed :-

6.6.1 Creviced components: Components with folds, seams or crevices shall receive special attention to ensure removal of grease, oil, treatment chemicals etc, especially when accelerated phosphating process has been used.

6.6.2 Composite Articles: Composite articles made up of ferrous and non ferrous shall normally have their ferrous parts phosphated before assembly into the article. Exceptions can be allowed provided in case of composite article containing Zinc base material or copper base material (where copper base material does not constitute more than 10 percent of the total surface) provided that the joint is unlikely to be penetrated by the phosphating solution.

6.6.3 Springs: Springs or other components, subject to flexing made from steels with a specified minimum tensile strength of 1000 MPa or more shall not be phosphated in compression or torsion i.e. while they are under applied stress. Unless otherwise agreed, the phosphating process used in such cases shall be accelerated (but copper free) type and the pointage of the shall not exceed 30.

6.6.4 High Tensile Steels: Parts made of steel with a minimum specified tensile strength of 1000 MPa or greater shall be given a suitable stress relieving treatment before phosphating if the parts contain residual stresses which may cause cracks or loss of ductility to develop during phosphating. A recommended stress relieving treatment consists of heating the parts to 130 to 200 °C or upto the tempering temperature for not less than half an hour. Steels which have been carburised, flame or induction hardened or carbonitrided should not be heated over 150 °C.

6.7 Immediately after phosphating, washing and drying and before the application of the supplementary finish, parts made of steels having a minimum tensile strength within the range of 1000 to 1400 MPa shall be baked at 130 to 200 °C for not less than one hour to relieve embrittlement. Parts made from steels of minimum specified tensile strength of greater than 1400 MPa shall be baked at 150 to 200 °C for not less than four hours or not less than one hour when the section thickness does not exceed 6.30 mm. For certain springs and components with soldered joints, the baking temperature may be required to be restricted to not more than 130 °C.

7. AGEING OF THE SOLUTION

(Propriétary or Departmental Process)

7.1 The freshly made up solution tends to produce coarse coating on the first few loads or works processed. This condition soon disappears and an uniform coating is obtained. This may be avoided by ageing of the solution at the first stage which will later give consistent coatings as and when the baths are used.

7.2 The solution may be aged by placing a quantity of scrap iron or mild steel plate (roughly equivalent to one work load) in the bath for requisite duration and temperature prescribed by the process in use.

7.3 Continuous use of the phosphating bath affects the strength of the solution. Though the symptoms arising are not definite, yet a regular internal checking of the bath solution is recommended. Usually 7 to 10 per cent iron may be tolerated but above this the bath is spent and should be discarded. The amount of iron present may be found by titrating 1 ml of the solution against N/10 Potassium Permanganate in the presence of sulphuric acid.

Per cent iron (w/v) in bath = 0.56 x burette reading

8. WASHING

8.1 After the phosphate treatment the components shall be washed thoroughly to remove residues of the treatment solution as follows :-

(a) After treatment by non-accelerated process, components shall be thoroughly rinsed in cold or hot water and then in hot dilute 'Chromic solution' (see Note below).

(b) After treatment by an accelerated process components shall be rinsed thoroughly first in running cold water and then in hot water at minimum temperature of 75 °C and shall be rinsed finally in hot dilute 'Chromic solution (See Note below).

8.2 Accumulation of treatment chemicals in rinse water must be avoided by maintaining a sufficient flow of cold water and by periodic renewal of hot water. Accumulation as measured by the acidity of the hot water shall never be allowed to be greater than that corresponding to 9.75 ml of 0.1 N Sodium Hydroxide solution (4.0 g/litre) when tested by the method described in Appendix 'A'.

NOTE : The 'Chromic' rinse shall consist of neither more than 0.50 kg nor less than 0.125 kg of 'chromic' acid or alkali metal chromate or dichromate or a mixture containing approximately equal parts of chromic and phosphoric acids per 1000 litres of water.

9. STAINING

9.1 Where necessary and appropriate, the phosphated components shall be stained by water stain or spirit stain.

9.1.1 Water staining consists of treatment in a solution of water soluble dye. Water stain shall be applied after rinsing. This only improves the appearance and has no corrosion resistance properly.

9.1.2 Spirit stain consists of shellac dissolved in methylated spirit and spirit soluble dye. This shall be applied after drying. It gives additional corrosion resistance due to the film of shellac deposited on the phosphated surface.

10. DRYING

10.1 Components after rinsing shall be dried (preferab force dried) thoroughly, special attention being paid to t parts with pockets or crevices. Drying of component may be ca

ried out on hot plate at a temperature of 80 to 90 °C.

11. APPEARANCE

11.1 After washing and drying, the phosphated surfa should be ensured that surface shall not have an excessive cry talline appearance. The surface must be free from untreat patches and flaky/uneven deposits (which sometimes form due the presence of sludge in the phosphating bath).

11.2 Any surface dust should be removed (e.g. by brushin but the method of removal must not damage the main coating.

11.3 Surfaces originally treated by the Browing proce after phosphating, may vary in colour form and be rougher t that normally given by the phosphate process and/or be patchy colour. Minor variations in colour or increase in roughness acceptable. Components having surfaces in an unacceptable con tion may be wire brushed and subjected to a further phospha treatment.

12. SEALING

12.1 Immediately after rinsing and drying normally phosphate coating shall be sealed by the application of a supp mentary finish. The type of finish required (e.g. oil, grea paint etc) and the mass or thickness of coating in the case paint, varnish or lacquer shall be stipulated in the contract specification or on the drawing governing the manufacture of components.

12.1.1 Care must be taken in the treatment of component w folds, seams or crevices, to get the proper finish so that penetrates fully and adequately into each crevice.

12.2 Where no supplementary finish is stipulated, the tre ment is to be completed with the following :-

(a)	For external surfaces and working parts.	Oil OX-52 lubricating oi (internal com engine prese or lanoline white spirit

(b)	For internal surfaces (non-working parts)	Lacquer, clear.
(c)	For internal surfaces (working parts)	Oil OX-52 or lubricating oil (internal combustion engine preservative)

2.3 Where the part is to be finished by paint, varnish or lacquer, a time interval is likely to occur between the phosphating and the first stage of supplementary finishing treatments. During this interval, the components shall be protected from contamination and condensation of moisture on the surface. However, with the approval of the Quality Assurance Officer, where there is a risk of condensation, the component shall be coated with 10:90 solution of linseed oil in spirit, white, except in case where this finish can not provide a satisfactory base for the type of paint, varnish or lacquer.

3. FINISH

3.1 The various types of supplementary finishes, quality of materials or the type of the paint to be used on the component shall be as called for in the store drawing/specification. Methods of application etc are as given below :-

(a) Paint The component is to be painted with one of the finishing paints, as detailed in Section II of specification WPN/GEN/2 or as called for in the store drawing/specification. Two coats of paint should be applied preferably by spraying, the second not being applied until the first has thoroughly set. For ready mixed paint, air drying, semi-glossy/matt conforming to IS:168 and for painting on metallic surfaces of weapons and ancillary stores CQA(W) department specification WPN/GEN/2 may be consulted.

(b) Stoving Paint In case of stoving paints, the first coat may be 'flash dried' where the second one must be stoved at the temperature and for the period appropriate to the stove and to the paint, to ensure that the paint is fully stoved.

(c) Stoving Lacquer The component is to be coated with clear stoving lacquer conforming to JSS 8010-28 or JSS 8010-3 or IND/SL/3244 or of the type as appropriate to the store concerned and to the method to be used for applying and stoving the lacquer. When coated, the component is to be stoved at the temperature and for the period appropriate to the store and to the lacquer, to ensure that the lacquer is fully stoved.

(d) Grease The component is to be treated by brushing Grease LG 280 conforming to IS 507, protective PX-6 conforming to JSS 8030- 12 or protective PX-11 conforming to JSS 8030-22 for soft thick film.

(e) Lanoline

(i) The component is to be dipped in a solution of lanoline conforming to IS 5340 in spirit, white, maintained in the proportion of 10:90. After dipping, the component should be allowed to drain in a current of warm, air.

(ii) The component is to be coated by dipping in homogeneous solution of 35 per cent Lanolin and 65 per cent spirit, white for soft thin film. The component is to be allowed to stan until the coating has set. Setting of th Lanoline solution is aided by directing a current of warm , dry air over the components. The solution must be maintained in the correct proportion by adding spirit, white, as necessary to replace that lost b evaporation.

(f) Stain The component is to be immersed in the stipulated water stain solution, or in sta varnish black conforming to JSS 8010-19 (spiri stain) for the period recommended for that pp ticular process. The component has to be dri thoroughly by stoving or by force drying as app opriate and any loose powder or deposit shall removed.

Note Water stain may be heated if necessary spirit stain should not be heated.

(g) Oil The component is to be applied by dipping or spraying with oil OX-52 conforming to JSS 9150-11 or lubricating oil, conforming to IS 496 (internal combustion engine preservative). After dipping all surplus oil must be allowed to drain off and the oil film allowed to dry in warm dry atmosphere.

Note Wiping for removal of surplus oil is not allowed.

(h) Lacquer, clear The clear lacquer is to be applied by spraying or dipping when the component is sufficiently hot.

(j) Linseed Oil The component is to be wiped or brushed lightly with a solution of linseed oil refined (conforming to IS 75) in spirit, white or in turpentine conforming to IS 533 in the proportion 10:90. The component is to be allowed to dry, after draining if dipped, in warm air or is to be oven dried.

14. COLOUR

14.1 Unless otherwise stipulated, the final finish or external surfaces are to be black.

14.2 Where lacquers are used, this may be attained by incorporation of appropriate dye in the lacquer. Where oil, lanoline or grease are used, colouration may be achieved by application of a stain (water, spirit or solvent) subsequent to phosphate treatment and washing.

14.3 The colour of an internal non-working surface is immaterial but may be the same as the external surface of the component. Dye or stain are not to be used in the treatment of working surfaces which must be left in the 'natural' colour of the phosphate treatment.

15. REPHOSPHATING

15.1 (a) Defective phosphate layers are removed by means of sand blasting if the construction so permits.

(b) Pickling in hydrochloric acid or sulphuric a should be avoided but is allowed after obtain specific permission from the Quality Assura Authority and is to be followed by a care rinsing (in cold and hot water) and hydro elimination.

15.2 The heat treatment for hydrogen elimination is to st as soon as possible after phosphating and as a rule, is carr out at a temperature of 107°C ± 15 degC for 15 hours or at 2(for at least 5 hours.

16. INSPECTION

16.1 The treatment will be subjected to inspection at stages and the components may be inspected during and a completion of the treatments. If on examination, any sample found not to conform to the drawing or this specification, whole consignment may be rejected.

17. TESTING

17.1 Samples of the finished components shall be teste indicated below to the requirements and satisfaction of Quality Assurance Authority. If the samples fail at any tes the treatment is not to the satisfaction of the Quality Assu Authority, the batch or batches being represented by these ples shall be rejected, subject to the approval of the Qu Assurance Authority. Rejected batches may be reprocessed submitted for inspection, examination and testing.

17.2 Presence of Coating : After phosphating and b application of the supplementary finish, the presence of co may be checked qualitatively by one or more of the foll methods :-

(a) Rub the treated surfaces with steel wool (g 000). Phosphated steel will look dull and ma but the untreated steel will have a bright nished appearance.

(b) Scrape the surface once with a blunt kni A phosphated surface will show a whitish str

(c) Scrape a small area with a sharp blade. A phd hd ed surface will yield a powder.

Note: Components which undergo and comply with these tests may, subject to the agreement of the Quality Assurance Officer, be given the appropriate finishing treatment and submitted with the remaining components of the batch. Test methods (b) & (c) above may not give very marked indications of the presence of thin coatings produced by Class I process.

7.3 Coating mass : The phosphate coating mass when determined as described in Appendix 'B' shall be not less than the following minimum values :-

Process	Mass of Coating
Class I	7.5 g/m^2
Class II	4.3 g/m^2
Class III	1.6 g/m^2

17.4 Freedom from corrosive residues : The phosphate and sealed components may be subjected to the test described below to conform to the washing efficiency procedure employed. No rust or other defect of the finish (e.g. blistering or flaking of paint coatings) shall be visible at the end of the test.

17.4.1 Test : Phosphated components after the application of the supplementary finish (the first paint coating only in the case of multiple paint systems) will be suspended for 7 days at 15.5 to 21 °C in a closed vessel in which the air is kept humid by a layer of water in the bottom of the vessel. At the end of the test, the components will be removed and inspected immediately for the signs of rust or other defects of the finish.

Note : The test will indicate the presence of all harmful types of water soluble matter under the paint film and is particularly valuable for showing contamination by finger marks or through splashing.

17.5 Resistance to corrosion

17.5.1 After phosphating and application of the supplementary finish, selected components will be subjected to salt droplet spray test.

17.5.2 Salt Droplet Spray Test : The components will be suspended by waxed thread or supported by a non-metallic base and sprayed with sea water by a hand operated atomizer to coat the test surface all over with small droplets. The spraying must not be so heavy that the droplets coalesce and drain off. The sprayed components (or sprayed surface of a large component) together with a dish of water to maintain humidity, will be covered with an inverted sheet metal box or glass cover having a capacity of $0.014\ m^3$ and left for 24 hours. The cover is to be removed, the spraying process repeated and cover replaced at the commencement of each 24 hours of the period indicated for the type of finish. On completion of the appropriate period of the test, the surface will be examined visually (under magnification not exceeding 5). No rust must be visible except slight rusting at sharp corners or point of suspension or support after the following periods:-

	Finishing Treatment	Period of test
(a)	Oil OX-52	24 h
(b)	Lubricating oil, internal combustion Engine preservative	24 h
(c)	Lacquer, clear, oil base	24 h
(d)	Stain, Varnish black	24 h
(e)	Lanoline, 35 per cent solution in spirit white	72 h
(f)	Lacquer, clear stoving	72 h
(g)	Grease LG 280	72 h
(h)	Protective PX- 6	72 h
(j)	Paint, air drying	

(k)	Protective PX-11	168 h
(l)	Paint stoving	168 h
(m)	Varnish air drying	24 h
(n)	Varnish stoving	72 h

Note: Where genuine sea-water is not available, a synthetic sea water can be made by dissolving the following salts in distilled water.

Salt	Mass in g
Calcium sulphate	1.3
Magnesium chloride	2.6
Magnesium sulphate	1.7
Sodium chloride	21.4
Water	To make up to 1 litre.

17.5.3 At the discretion of the Quality Assurance Authority, the component will be tested by suspending in sea water (or synthetic sea water) by fine thread for 24 hours. Immediately after removal from sea water (or synthetic sea-water), the surface will be examined visually. The component must be free from rust.

17.6 Resistance to abrasion : The resistance of the phosphated surface to abrasion is to be tested by rubbing 50 times with a strip of clean white cotton cloth of medium quality. At least 1 per cent of components will be subjected to the rubbing test. After rubbing, the sample component is to be dipped in lanoline or oil OX-52 and the surplus oils wiped off. The sample should not show bright spots or appreciable difference in shade when compared to a similar component that has not been rubbed but only treated with oil after phosphating.

19. SUGGESTIONS FOR IMPROVEMENT

19.1 Any suggestions for the improvement in this document may be forwarded to :-

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

APPENDIX 'A'

DETERMINATION OF THE ACIDITY OF THE HOT WATER RINSE

A.1 Procedure

A.1.1 Thoroughly stir the hot water and withdraw a 50 sample. Cool the sample and titrate with 0.1 N Sodium Hydrox solution (4.00 g/l) using phenolphthalein as indicator, until permanent colouration is obtained. The acidity of the sample expressed as ml of Sodium Hydroxide solution required to neutr lise the sample.

APPENDIX 'B'

DETERMINATION OF THE COATING MASS

B.1 The coating mass will be determined on a sample component after treatment by phosphating, washing and drying and before application of a supplementary finish. At the discretion of the Quality Assurance Authority, the determination can be carried out on a test sample of similar composition and surface conditions and treated alongwith the actual components being phosphated. A convenient surface area of the test specimen is about 50 cm^2 in line with IS 3618.

B.2 Procedure

B.2.1 Weigh the sample and immerse in a fresh concentrated Hydrochloric acid containing 20 g of Antimony trioxide per litre at a temperature of 27C $\pm$ 2 degC. When the coating has dissolved (a period of 5 minutes is normally sufficient), remove the sample from the acid and wash for 2 to 3 minutes in running water rubbing off any non-adherent matter with a wet swab. Dry thoroughly and reweigh.

B.3 Calculation

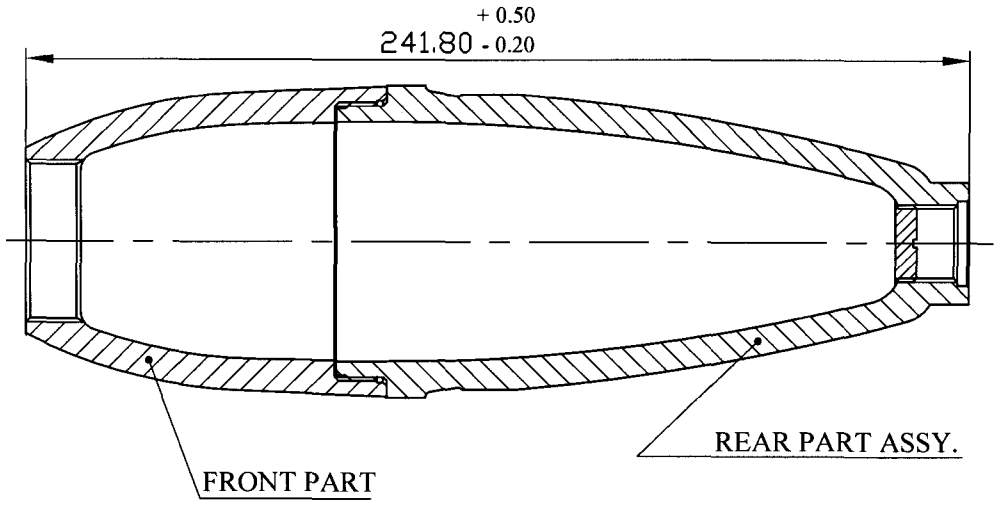
B.3.1 Calculate the surface area of the test specimen and also the difference between initial and final mass. The mass of the phosphate coating shall be expressed in grams per square metre.

MPF AMBERNATH — OPERATION SCHEDULE

SHEET NO. : 01
NO. OF SHEETS : 05

	COMPONENT DETAILS	RAW MATERIAL DETAILS
Store : C - EMPTY BODY	Nomn. :	Group :
Nomn. : BOMB 81mm MORTAR	Drg.No. :	Matl. Spec. :
Drg. No. : ITV - 9A	No./Set :	Special Reqts. :

OPN. NO.	SECTION	MACHINE	OPERATION DETAILS	EQUIPMENT REQUIREMENTS			REMARKS
				FIXTURES	TOOLS	GAUGES	
01	HT		ASSEMBLY : 1) Before assembly Check combine weight of Front part and Rear part assy. 2) Apply Epoxy resin adhesive on Ø72 X 2 (SI) of Rear Part Assy. Adhesive used- Hardner 758 & debeckot 505C resin ⟶ 1:10 3) Assemble Front Part and Rear Part Assy. 4) Clean circumference with Trichloroethylene and wipe out by dry cotton. 5) Check Total Length = $241.80^{+0.50}_{-0.20}$			1)G-VMT-ITV-9A-1-3 2)Weighing Machine	



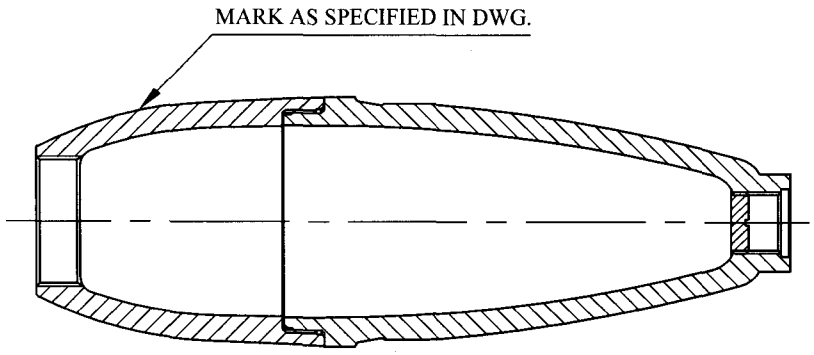
Prepared :	Alterations :	Checked (DO):	Checked (HT):	Approved Div. Officer:
Date : 11/1/16		Date : 12/1/16	Date : 12/1/16	Date : 12/1/16

MPF AMBERNATH

OPERATION SCHEDULE

SHEET NO. : 02
NO. OF SHEETS : 05

MAIN STORES :- C - EMPTY BODY | SUB-ASSY. :- ASSY. (TWO PIECE) | PART NAME : BOMB 81mm MORTAR (ITV-9A)

OPN. NO.	SECTION	MACHINE	OPERATION DETAILS	EQUIPMENT REQUIREMENTS			REMARKS
				FIXTURES	TOOLS	GAUGES	
02	HT	Pneumatic Roll Maker	MARKING : On the circumference of the front part about 30 mm below fuze hole, marking to be stamped in 5 mm type :- 1) Empty Lot No. 2) Contractor's / Manufacturer's Initials 3) Month & Year of manufacture  				
03	HT		FITTING : Apply mineral jelly to front part thread i.e. Ø 42 x 14 TPI Whitworth Form.				

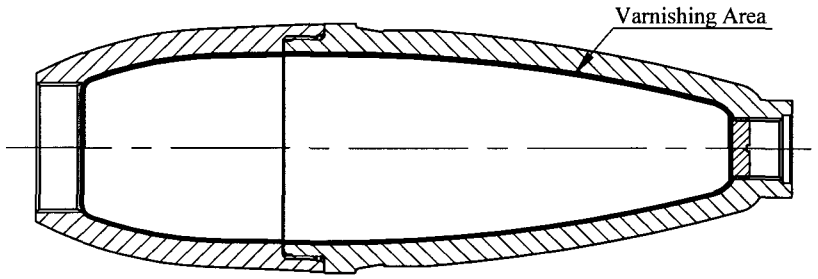
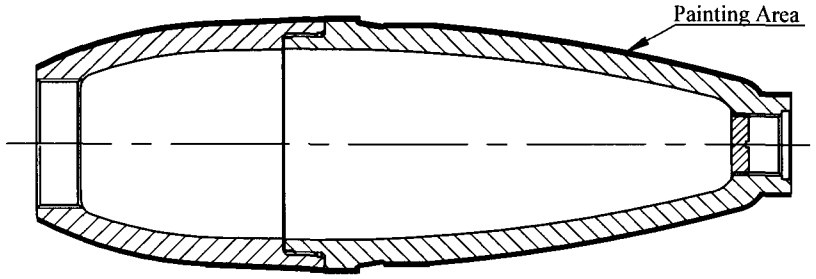
Prepared : Date : 11/11/16	Alterations :	Checked (DO): Date : 12.1.16	Checked (HT): Date : 12/11/16	Approved Div. Officer: Date : 12/1/16

MPF AMBERNATH

OPERATION SCHEDULE

SHEET NO. : 03
NO. OF SHEETS : 05

MAIN STORES :- C-EMPTY BODY | SUB-ASSY. :- ASSY. (TWO PIECE) | PART NAME : BOMB 81mm MORTAR (ITV-9A)

OPN. NO.	SECTION	MACHINE	OPERATION DETAILS	EQUIPMENT REQUIREMENTS			REMARKS
				FIXTURES	TOOLS	GAUGES	
04	HT	Stoving Chamber	VARNISHING & STOVING : 1) Spray varnish APC - 221 inside of Bomb Body Assy.Drg. no. ITV- 9A. 2) Stoving in furnace to temperature 60°C to180°C for duration 30 to 90 min. 				Surveillance point for QAE (W) (Varnishing & stoving)
05	HT	Automatic Painting Booth/ Painting Booth	PAINTING & DRYING : 1) Clean circumference with Trichloroethylene and wipe out by dry cloth. 2) Pressurised Air cleaning. 3) Fit Protective Cap on Rear part thread to avoid Painting of threads i.e. Ø20 X 2 Pitch (SI) 4) Apply ready mix air drying semi glossy finish for general purpose paint shade no. 359 (middle buff) IS : 5 on outside of bomb body 5) Dry in air 				

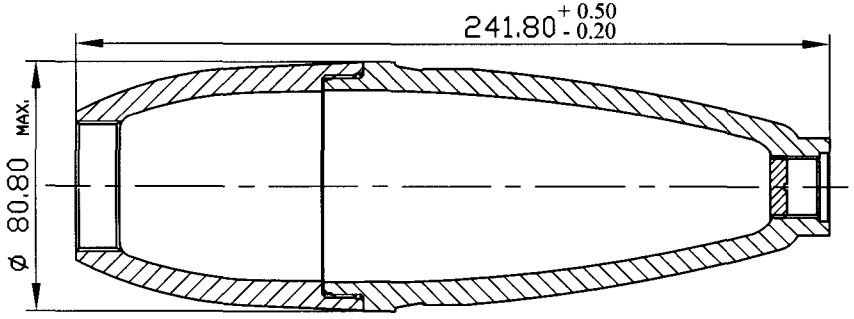
Prepared : Date : 11/1/16 | Alterations : | Checked (DO): Date : 12/1/16 | Checked (HT): Date : 12/1/16 | Approved Div. Officer: Date : 12/1/16

MPF AMBERNATH

OPERATION SCHEDULE

SHEET NO. : 04
NO. OF SHEETS : 05

MAIN STORES :- C-EMPTY BODY | SUB-ASSY. :- ASSY. (TWO PIECE) | PART NAME : BOMB 81mm MORTAR (ITV-9A)

OPN. NO.	SECTION	MACHINE	OPERATION DETAILS	EQUIPMENT REQUIREMENTS			REMARKS
				FIXTURES	TOOLS	GAUGES	
06	HT		FITTING : 1) Remove Protective Cap from Rear part thread i.e Ø20 X 2 (SI) 2) Front part thread cleaning with Hand Tap				
07	HT		LEAK PROOF TEST : 1) Test the assembly for Water proofing Maintain Test Pressure = 690 ± 35 KPa (7.04 ±0.36 kg / cm 2) Duration = 1 Minute 2) Inside cleaning by pressurised air	AIR LEAK TEST ARRANGEMENT Drg. No. F-ITV-9A-4		Pressure gauge	
08	QC		INSPECTION : Inspect the following parameters. 1) Total Length = $241.80^{+0.50}_{-0.20}$ 2) Outside Diameter = 80.80 Max. 3) Thread = Ø 20 X 2 (SI) 4) Thread = Ø 42 x 14 TPI Whitworth Form 5) Weight (Kg) = $2.748^{+0.060}_{-0.080}$ 6) Capacity (cm^3) = 475^{+15}_{-5} 7) Check concentricity within 0.55 and perperdicular within 0.08 as shown in drg. (Drg. no. ITV 9A) 8) Chloride Test:- As per specification CQA (A) 2305 specified in para 8.2.1 , 11.4 & 11.4.1  			1)G-VMT-ITV-9A-1-1 2)G-VMT-ITV-9A-1-2 3)G-VMT-ITV-9A-1-3 4)G-VMT-ITV-9A-1-4 5)G-VMT-ITV-9A-1-5 6)G-ITV31-1-4(b) 7)G-ITV31-1-5 8)G-ITV31-1-6 9)G-ITV31-1-7 10)Weighing machine	Surveillance point for QAE (W) (Chloride test)

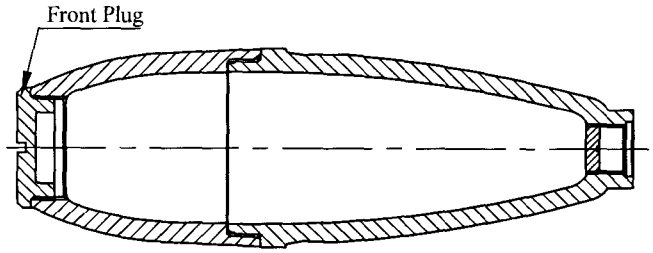
Prepared : Date : 11/1/16	Alterations :	Checked (DO): Date : 12/1/16	Checked (HT): Date : 12/1/16	Checked (QC): Date : 12.1.16	Approved Div. Officer: Date : 12/1/16

MPF AMBERNATH

OPERATION SCHEDULE

SHEET NO. : 05
NO. OF SHEETS : 05

MAIN STORES :- C-EMPTY BODY	SUB-ASSY. :- ASSY. (TWO PIECE)	PART NAME : BOMB 81mm MORTAR (ITV-9A)

OPN. NO.	SECTION	MACHINE	OPERATION DETAILS	EQUIPMENT REQUIREMENTS			REMARKS
				FIXTURES	TOOLS	GAUGES	
09	QAE(W) & QC	Salt Spray Cabinet	SALT SPRAY TEST Salt spray test on 0.5% (10 nos.) samples as per JSS 0465 - 01:1994 (see annexture `A')				
10	QAE(W)		Quality Audit & FAI by QAE(W) 1) Salt spray test 2) Dimensional check 3) Leak proof test 4) Volume and weight check				
11	HT		INSPECTION NOTE				
12	HT		INSERTION : Fit Plug Transit on Front part thread 				
13	STORE		PACKING IN CORRUGATED PACKING BOX IN MULTIPLE OF 8 NOS. PER BOX				

Prepared : Date : 11/1/16	Alterations :	Checked (DO): Date : 12.1.16	Checked (HT): Date : 12/1/16	Checked (QC): Date : 12-1-16	Approved Div. Officer: Date : 12/1/16

MPF AMBERNATH	OPERATION SCHEDULE	SHEET NO. : Annexture`A' NO. OF SHEETS : 01

MAIN STORES :- C-EMPTY BODY	SUB-ASSY. :- ASSY. (TWO PIECE)	PART NAME : BOMB 81mm MORTAR (ITV-9A)

OPN. NO.	SECTION	MACHINE	OPERATION DETAILS	EQUIPMENT REQUIREMENTS			REMARKS
				FIXTURES	TOOLS	GAUGES	

Procedure For Salt Droplet Spray Test On 81mm Bomb Body Painted, Air Dried

Authority: CQA (A) Specification No. 2305 (Para 8.1) and relevant JSS Specification No. JSS 0465-01: 1988 superseded by JSS 0465-01: 1994 Revision No. 1 (Para 17.5.1 & 17.5.2)

After phosphating and application of the supplementary finish, selected components will be subjected to Salt Droplet Spray Test as per the procedure given below:

The component will be suspended by waxed thread or supported by, a non-metallic base sprayed with sea water by hand operated atomizer to coat test surface all over with small droplets. The spraying must be so heavy that droplets coalesce and drain off.

The sprayed components (or sprayed surface of a large component) together with a dish of water to maintain humidity, will be covered with an inverted shit metal box or glass cover having a capacity of 0.014 m3 and left for 24 hours.

The cover is to be removed, spraying process repeated and cover replaced at the commencement of each 24 hours of the period indicated for the type of finish.

On completion of the appropriate period of the test (72 hours for 81mm Bomb Body), the surface will be examined visually.

No rust must be visible except slight rusting at sharp corners or point of suspension or support after the following period: -

Sl.No. Finishing Treatment	Period of Test
1. Oil OX-52	24 h
2. Lubricating Oil, internal combustion Engine Preservative	24 h
3. Lacquer, clear, oil base	24 h
4. Stain, Varnish black	24 h
5. Lanoline, 35 per cent solution in spirit white	24 h
6. Lacquer, clear Stoving	72 h
7. Grease LG, 280	72 h
8. Protective PX- 6	72 h
9. Paint, air drying	72 h
10. Protective PX-11	168 h
11. Paint stoving	168 h
12. Varnish air drying	24 h
13. Varnish stoving	72 h

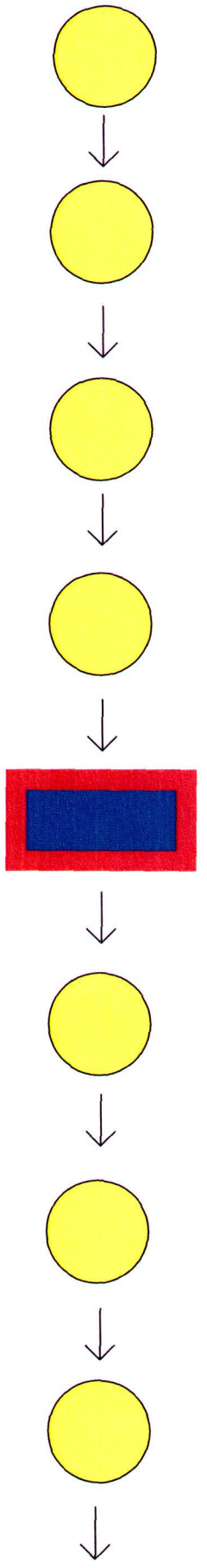
Note: Where genuine sea-water is not available, a synthetic sea water can be made by dissolving the following salts in distilled water

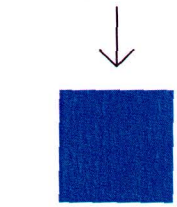
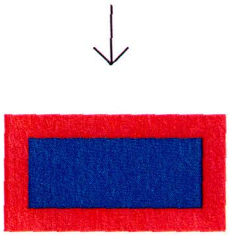
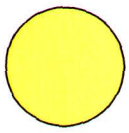
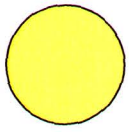
Salt	Mass in gm
Calcium Sulphate	1.3
Magnesium Chloride	2.6
Magnesium Sulphate	1.7
Sodium Chloride	21.4
Water	To make up to 1 litre

Prepared : Date : 11/11/16	Alterations :	Checked (DO): Date : 12.1.16	Checked (HT): Date : 12/1/16	Checked (QC): Date : 12-1-16	Approved Div. Officer: Date : 12/1/16

PROCESS FLOW CHART

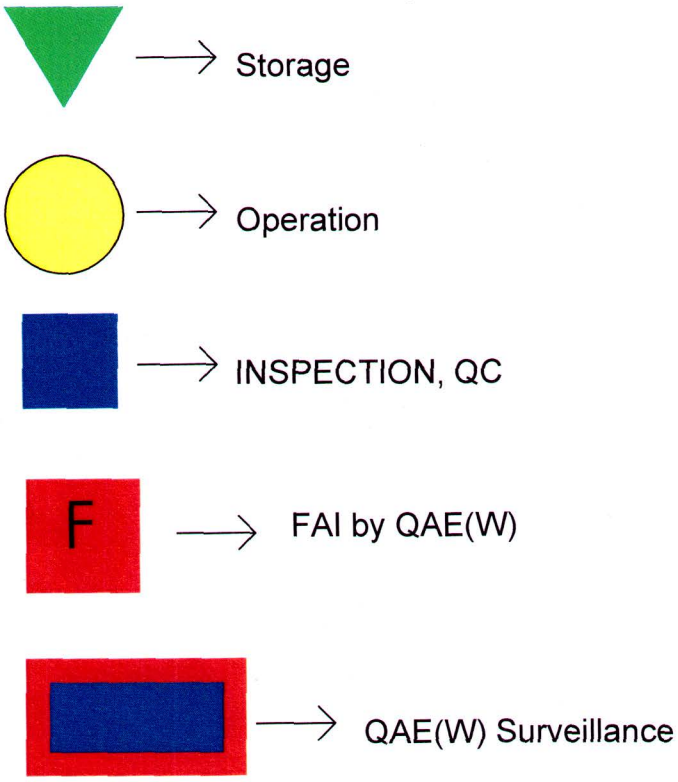
Nomenclature : Bomb 81mm Mortar C Empty body
Drg. No. : ITV- 9A
Store : Bomb 81mm Mortar C Empty body

Flow- Chart	Process/ Operation/ Activity	Remark
	Assembly Marking Fitting Varnishing and stoving Surveillance by QAE(W) Varnishing/ Stoving Painting and Drying Fitting Leak proof test	

Flow- Chart	Process/ Operation/ Activity	Remark
	Inspection	
	Surveillance by QAE(W) -Chloride test	
	Inspection(Salt spray test)	
	FAI by QAE(W) a) Salt spray test b) Dimensional check c) Leak Proof test d) Volume and weight check	
	Inspection note(HT)	
	Insertion	
	Storage	

Flow- Chart	Process/ Operation/ Activity	Remark

LEGENDS



9/12/15	09/12/15	09/12/15
Prepared by(CM/DO)	Checked by(JWM/DO)	Approved by(AWM/ PLG.)
09-12-15	ITV-9A-1	0
DATE	DOCUMENT CONTROL NO.	REV.

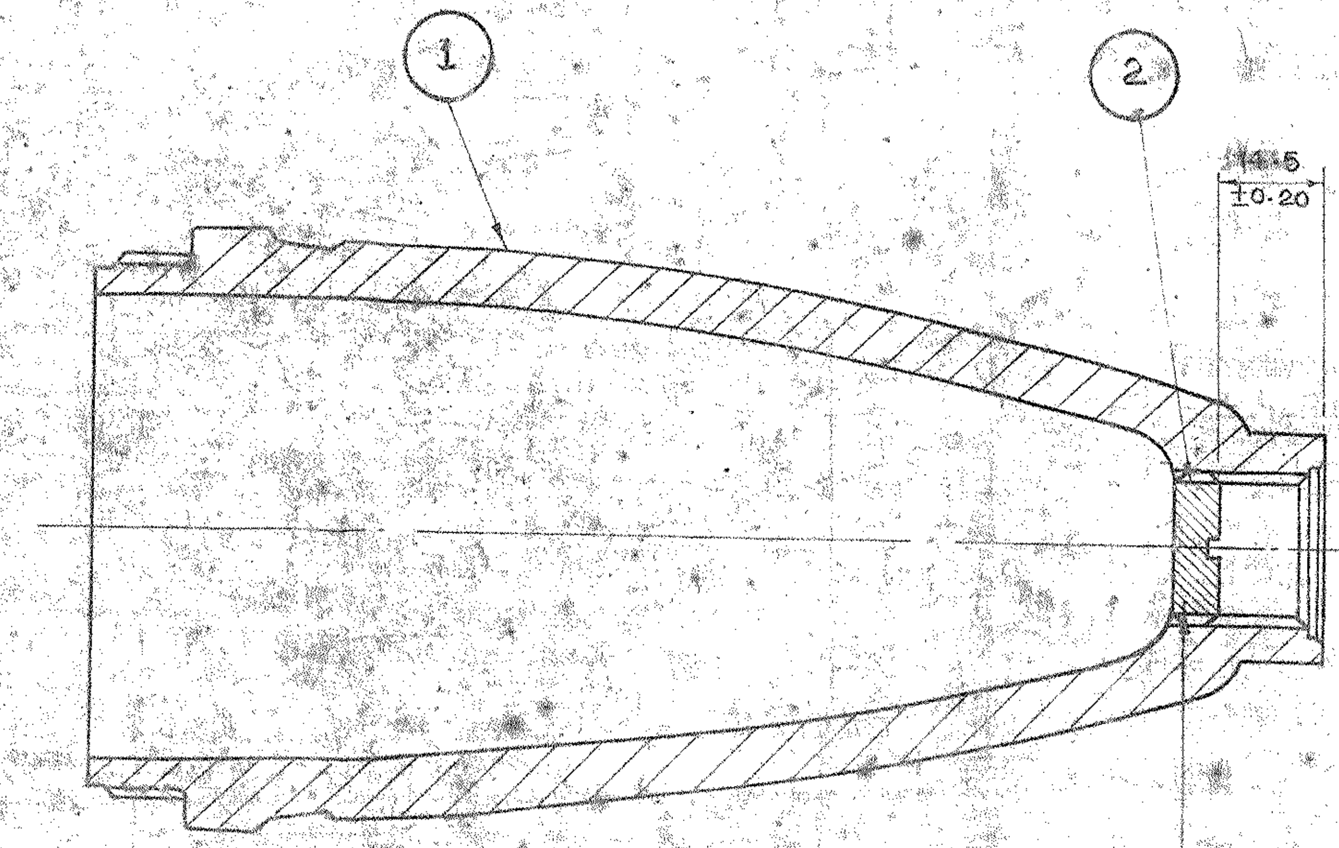
PART Nº ITV 2 SA

D.C. 26092-A.

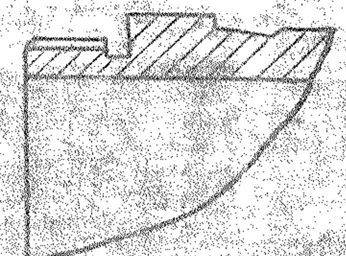
DRAWING CONVENTIONS CONFORM TO IS SPECIFICATIONS.
THIRD ANGLE PROJECTION. DIMENSIONS ARE IN mm

SCHEDULE OF COMPONENTS

ITEM Nº	DESCRIPTION	DRG Nº	PART Nº	Nº PER SET
1	REAR PART	CIA/AMN/867	ITV 52	1
2	PLUG REAR.	CIA/AMN/1582	ITV 52	1



PLUG REAR TO BE PRESSED LOCK BY COMPRESSION BETWEEN TWO PUNCHES OF 17.5 Ø WITH A LOAD OF 314 KN.



ALTERNATIVE VIEW SHOWING AN UNDERCUT FOR MATING THREADS.
OTHER DETAILS SAME AS ABOVE.

PROTECTIVE FINISH:- SEE ASSEMBLY DRG. Nº ITV 9 A.

MATERIAL:- REFER COMPONENTS DRAWINGS
GAUGE SCHD :- I-1676
ESTIMATED mass :- 1kg - 752 g.
SCALE:- 1/1.

D.S. CAT. NO. NOT APPLICABLE
ASSLY DRG.- ITV 9 A
INSP. INSTRS.- NOT APPLICABLE

DRAWN	CHECKED	TRACED	TRN.
V.N. LELE		M.A.K.	Z.K.

CHIEF D'MAN SD/- (VNK RAO)
GROUP OFFICER SD/- D.O.CI(A)
APPROVED SD/- FOR CI(A)
DATE:-

REAR PART

ASSEMBLY WITH PLUG REAR.

DESIGNER'S REF. CIA/AMN/863
DETAIL Nº
PART Nº ITV 2 SA

C.I. (A) KIRKEE.

DATE	AUTHORITY	ZONE	NATURE	SIG. AHSP	SIG. D.O.
20-5-93	D.C. 35508-A		DRG. FORMAT BOX ENTRIES ADDED. VARIOUS NOTES AMENDED.		[signature]
6-5-93			RETRACED WITHOUT CHANGE		
			PREVIOUS D.C.(I) Nºs 26092-A, 26133-A, 22195-A, 28418-A, 30201-A, & 31147-A.		SD/-

AMENDMENTS

DRG. SEALED :- 18-6-66 (PROV.)

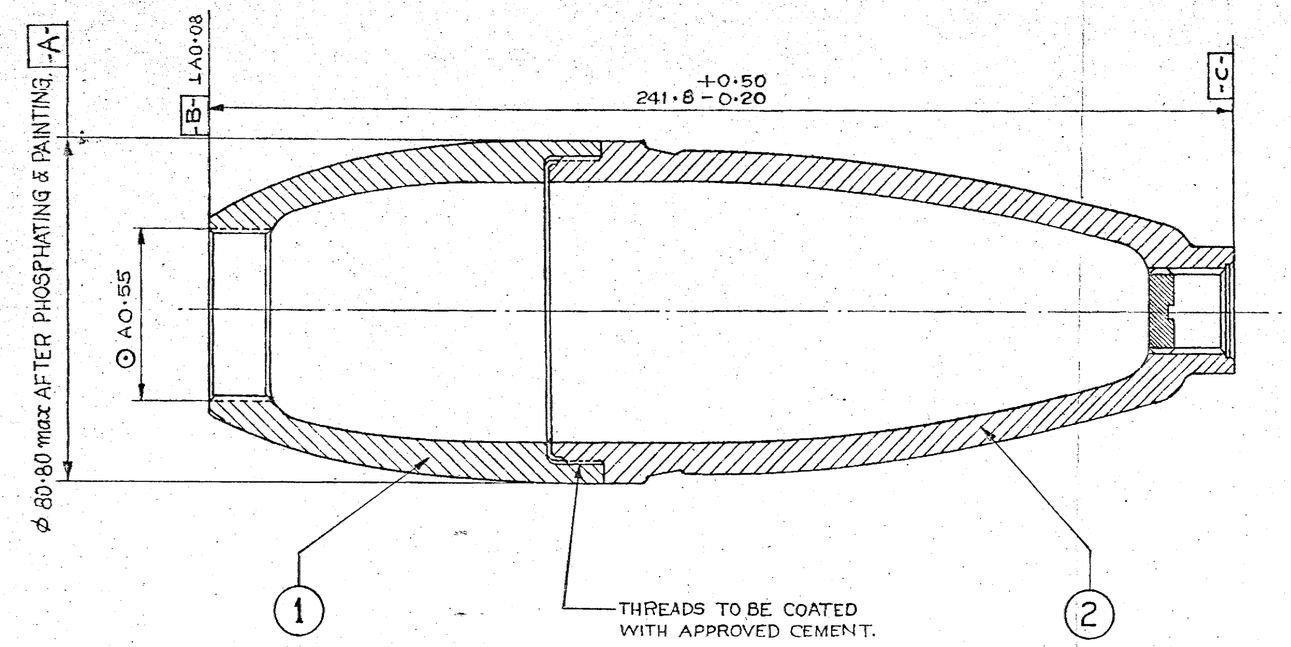
D.O. CI(A)

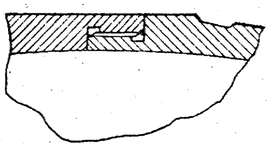
771A

PART No ITV 9A

DRG. CONVENTIONS CONFORM TO IS:SPECIFICATIONS.
DIMENSIONS ARE IN mm.

DC 28092-A.





ALTERNATIVE VIEW SHOWING UNDERCUTS

METHOD OF APPLICATION OF DOBECKOT TO SCREW THREADS OF FRONT AND REAR PARTS OF BOMB.

THE FRONT AND REAR PARTS OF THE BOMB WILL BE ASSEMBLED BY NOT MORE THAN ONE THREAD. THE BOMB WILL THEN BE PLACED ON A WORK BENCH AND DOBECKOT WILL BE APPLIED TO THE EXPOSED THREADS. THE PART UPPER MOST WILL BE SCREWED HOME FULLY THEREBY CAUSING THE DOBECKOT TO BE SQUEEZED DOWNWARDS AND OUTWARDS. ANY EXCESS DOBECKOT OUT SIDE OF THE BOMB WILL BE WIPED OFF. THE INSIDE OF THE BOMB AT THE JOINT WILL ALSO BE WIPED/CLEANED USING A SWAB SOAKED IN BENZENE.

NOTE:-

ONLY SUFFICIENT QUANTITY OF CEMENT THAT CAN BE CONSUMED WITHIN 15-20 MINUTES SHOULD BE PREPARED AT A TIME AS IT GETS HARDENED AFTER THIS PERIOD.

SCHEDULE OF COMPONENTS				
ITEM Nº	DESCRIPTION	DRAWING Nº	PART Nº	Nº PER SET
1	FRONT PART	CIA/AMN/854	ITV 31	1
2	REAR PART ASSY.	CIA/AMN/868	ITV 2 SA	1

IMPORTANT :-

AFTER PAINTING THE BODY BOMB MUST PASS FREELY THROUGH A RING GAUGE OF 80·80 DIA.
CAPACITY = 475 + 15 cm³
− 5 cm³

MARKING TO BE STAMPED IN 5 mm TYPE

81 - mm H.E. - C

ON THE CIRCUMFERENCE OF THE FRONT PART ABOUT 30 mm BELOW FUZE HOLE.
- EMPTY LOT Nº
- CONTRACTOR'S INITIALS
- DATE OF MANUFACTURE :- MONTH & YEAR

ESTIMATED MASS:- 2·748 $^{+\,0.060\ kg.}_{-\,0.080\ kg.}$

NOTES:-

PROTECTIVE FINISH:-

THE WHOLE OF THE INTERIOR AND EXTERIOR OF BODY INCLUDING GUIDE BAND WILL BE RUST-PROOFED BY PHOSPHATING TO SPEC. JSS 0465-01 : 1988, CLASS-II. IT WILL THEN BE COATED INTERNALLY WITH APC Nº 221 TO SPEC. JSS 8010-28, OCT. 84 AND STOVED. WHILE THE VARNISH ON THE INTERNAL SURFACE IS BEING STOVED. LINSEED OIL TO SPEC. IS : 75 : 1973 (SECOND REVISION) (AMENDMENT Nº 2) OR LUBRICATING OIL TO SPEC. IND/ME/417 (a) WITH INHIBITORS BE APPLIED TO THE EXTERNAL PHOSPHATED SURFACE FOR PROTECTION. THE EXTERIOR OF THE BODY WITH THE EXCEPTION OF FACES Ⓑ & Ⓒ BUT INCLUDING THE GUIDE BAND WILL BE PAINTED WITH READY MIXED PAINT, AIR DRYING, SEMI-GLOSSY FOR GENERAL PURPOSES, SHADE Nº 359 (BUFF MIDDLE) OF IS : 5 TO SPEC. IS : 168, 1986 (SECOND-REVISION) (AMENDMENT Nº 3). THE SCREW THREADS WILL NOT BE VARNISHED OR PAINTED. SURFACES Ⓑ AND Ⓒ WILL BE COATED WITH LANOLINE SOLUTION TO SPEC. IND/SL/2804 OR MINERAL JELLY TO SPEC. JSS. 8030-09 SEP. 82 AFTER PAINTING OF BODY.

TECHNICAL REQUIREMENTS

SPEC. Nº CIA 2305(b). PROOF SCHEDULE APPENDIX 'B' TO SPEC. CIA 2305(b). FOR ADVANCE SAMPLES ONLY.

R.Nº	DATE	AUTHORITY	REVISION	ZONE	AHSP SIG.	D.O.
	5-8-03		SCANNED WITHOUT CHANGE			SD/-
	13-9-94	D.C. 55803-A	RETRACED WITHOUT CHANGE, & NEW M/COPY REPLACED IN SUPERSESSION OF EXISTING DILAPIDATED COPY.			
			PREVIOUS D C°(Nos:- 28092-A, 28133-A, 28204-A, 28418-A, 28442-A, 29254-A, 29928-A, 30201-A, 31147-A, 32678-A, 32965-A, 33653-A, 33734-A & 35508-A.			SD/-

DRG SEALED:- 18-5-66 (PROV.)

DRN. VNL	CHD.	TRD. RCD	COMP.
SD/- C.D'MAN.	SD/- O/C D.O.	SCALE :- 1:1	
APPD. SD/- FOR C.Q.A(A)		EST. MASS:- AS ABOVE.	
		GAUGE SCHD:- I-1674	
		DATE :-	
MATERIAL:- SEE COMPONENT DRAWINGS.			
PROTECTIVE FINISH:- AS ABOVE.			

BOMB 81 mm MORTAR - C
EMPTY BODY

ASSY. DRG. ITV 14 GF/ ITV 15 GF/ITV 16 GF

DESIGNER'S REF. CIA/AMN/869

PART Nº ITV 9 A

D S.CAT. Nº NOT APPLICABLE

AHSP:- C.Q.A.(A) KIRKEE

14698