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CANADIAN GOVERNMENT SPECIFICATIONS BOARD

SCHEDULE OF INSTRUCTIONS

FOR

THE PRETREATMENT AND PAINTING OF H. M. C. SHIPS

CGSB Schedule 1-GP-62, dated 30 December 1950, is Cancelled as of 21 November 1958.

NOTE: The Royal Canadian Navy is now using a more recent publication:
Schedule of Instructions for the Pretreatment, and Painting of H. M. C.
Ships, - An Interim Issue, Dated March, 1958.



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OF
INSTRUCTIONS
FOR THE
PRETREATMENT AND PAINTING
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H.M.C. SHIPS

1-GP-62

30 DECEMBER 1950

REFERENCE COPY

NATIONAL RESEARCH COUNCIL, OTTAWA, CANADA

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30 December 1950

CANADIAN GOVERNMENT SPECIFICATIONS BOARD

SCHEDULE OF INSTRUCTIONS
FOR
THE PRETREATMENT AND PAINTING OF H.M.C. SHIPS

This SCHEDULE is based on Naval Service draft N.C.C.109, B.R.C.N., "Manual of Instructions for the Pretreatment and Painting of HMC Ships", revised to include comments of the Marine and Technical Panels of the C.G.S.B. Committee on Specifications for Paints, Pigments and Related Commodities. It has been prepared for publication and issue at the request of the Naval Service of the Department of National Defence.

At the request also of the Naval Service, their series of paint specifications is being reviewed and superseded by 1-GP specifications. Where considerable work has already been done and 1-GP numbers for the new specifications assigned, these numbers appear in the text of this SCHEDULE. In due course the remaining Naval specifications will also be superseded. All the specifications referred to in this SCHEDULE are listed on pages 72 and 73.

Inquiries regarding the contents of this SCHEDULE should be addressed to the Naval Constructor-in-Chief, Section 4, Naval Headquarters, Department of National Defence, Ottawa. Copies may be obtained from the Canadian Government Specifications Board, National Research Council, Ottawa.

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SCHEDULE OF INSTRUCTIONS
FOR
THE PRETREATMENT AND PAINTING OF H.M.C. SHIPS

INTRODUCTION

The following remarks are of first importance in making clear, both to Naval Personnel and to Civilian Personnel employed in Naval construction and repair, the issues involved in paint application.

First of all it must be clearly and fully understood that a complete revolution has taken place in the paint manufacturing industry. Until approximately 1942 all paints manufactured for the R.C.N. were of linseed oil base, with lead pigments. These paints were excellent in their finish, providing high gloss, high durability, and, by virtue of many coats, high corrosion resistance.

There are many reasons, however, both economic and practical, why such paints were abandoned. In the first place, manufacturers in wartime wanted to be rid of their dependence upon an agricultural product like linseed oil. Then again, the Navies in particular wanted to rid themselves of the very real fire hazard that thick coats of oil paints presented.

To change the character of the paints required much diligence, research and experimentation. The lead was probably given by the U.S.A. manufacturers. Canadian manufacturers, however, and in particular the R.C.N., took up the investigation with commendable vigor and our modern fire-retardant synthetic resin paints are the result. There has been some objection to these paints, founded upon the extremely poor appearance of H.M.C. ships. It is not to be assumed, however, that the paints are not good. On the contrary, modern synthetic resin paints are extremely good. The important fundamental point of divergence lies in the application of these paints.

For practical purposes we shall call the period prior to 1942 the pre-synthetic stage, and the period following 1942 the post-synthetic stage. During the pre-synthetic stage the pretreatment and cleaning of surfaces for painting was the straightforward application of oil, usually linseed oil, as both cleaner and anti-corrosive. Since the paints to be applied on these surfaces were oil based, this method was very successful and induced the high gloss finish so much admired in oil paints.

Now that we are in the post-synthetic stage, the whole process of cleaning and preparing is changed. Linseed oil as a pretreatment is a positive hazard to synthetic resin paints. Any oil whatever, whether applied to the surface before painting or added to the paint, will immediately ruin the paint and destroy both its appearance and adhesive qualities. Oils as either pre-cleaners or thinners are therefore definitely out, so long as synthetic resin paints are used.

What then takes the place of these oils? As a pretreatment: phosphoric acid solution (2 per cent). As a thinner: mineral spirits.

Why not a good coating of white lead under these synthetic resin paints? Because most synthetic resin paints are lead free; that is, they contain no lead whatever, and lead (and oil) as a primer destroys both the composition and the adhesion of synthetic resin paints unless such lead paints are themselves produced in a synthetic resin vehicle.

How are these new paints cleaned after they have been applied for a while? With synthetic "soapless" soaps, as defined in specifications 2-GP-21* or 2-GP-22*. These synthetic detergents can be used in soft, hard, or salt water, and contain no injurious caustic (alkali) which may flake and chalk the paintwork.

Thus the whole picture of cleaning and preparation is changed and unless painters change their methods accordingly, H.M.C. Ships will continue to look poor.

The following are a few DON'TS:

1. Never prepare a steel surface for painting by the use of linseed oil or caustic soda wash.
2. Never thin naval paint with linseed oil.
3. Never prime a surface with red or white lead unless of synthetic resin base.

The following are a few MUSTS:

1. Always prepare surfaces by cleaning off old paint to the bare metal with power driven wire brushes or by wet sandblasting.
2. Always wash down such surfaces with a solution of 2 per cent aqueous phosphoric acid solution or its equivalent.
3. If thinning is required, thin with white mineral spirits, never with oil.
4. Always wash paintwork with synthetic detergents to specifications 2-GP-21* or 2-GP-22*.

If these simple rules are followed with care and enthusiasm it will be found that:

1. Modern paints are just as good as the older types.
2. Appearance is just as smart as R.N. and U.S.N. ships which follow the same practice with the same synthetic resin paints.
3. Morale of the water-borne personnel will rise as they take pride in a tiddley ship.

The carrying out of these rules is a matter for all concerned, from the Superintendents of H.M.C. Dockyards down to the Dockyard Maties, and from the Commanding Officers down to the O.D. with a spray gun in his hand.

These are your ships. Headquarters has provided the best materials available. You must do the best job possible with these materials.

* 2-GP-21: Synthetic Detergent Bar for Use in Sea Water and Hard Water.

2-GP-22: Synthetic Detergent - Flake and Powder Form, for Use in Soft, Hard and Sea Water.

CHAPTER 1

GENERAL INSTRUCTIONS1.1 AUTHORITY

The instructions contained in this SCHEDULE shall govern work done by Contractors or Naval Dockyards and no departure shall be made from them without authority. The term "Contractor" shall herein refer both to private firms and Naval Dockyards.

1.2 SCHEDULE

Before a vessel under construction is 25 per cent complete, a painting schedule shall be prepared by the Contractors and submitted to Naval Headquarters for approval. This schedule shall show each section and compartment, listing the painting and cementing required and making reference to the appropriate specifications.

1.3 DELIVERY

Upon delivery, the painting and cementing of a vessel shall be in acceptable service condition, and the Contractor shall be required to effect such repairs and replacements as will produce this condition to the satisfaction of the Principal Ship Overseer.

1.4 SPECIFICATIONS

All materials used in painting and cementing shall conform to the applicable specifications. Such materials and their usage shall be in accordance with this SCHEDULE.

1.5 TESTS

All materials shall be subject to test at any time and must be kept available for inspection. Samples for test shall be sent to Inspection Services, Department of National Defence, 70 Lyon Street, Ottawa, Ontario, or their authorized representatives. Contractors may request that samples be tested by private laboratories at their own expense, and the results of such tests must be reported to Naval Headquarters. Materials failing tests shall be rejected for use and work already done with these materials shall be removed.

1.6 APPLICATION

1.6.1 Recently formulated paints of synthetic resin base and fire-retardant quality are superior in every respect to older formulae. These paints are formulated to have good hiding power and durability in thin coats, and are applied in order to minimize fire hazard, prevent cracking and peeling, and conserve weight. All old paint shall be removed to the bare metal by means of power driven wire brushes or wet sandblasting. This shall be followed by inhibiting with an aqueous, 2 per cent solution of phosphoric acid and hot air drying. Primers are most effective in thicknesses of 1 to 1.5 mils and are to be applied accordingly.

1.6.2 For general interior painting a two-coat system is considered adequate, viz:

1.6.2.1 One complete coat of iron oxide primer 1-GP-48, Type A. In new construction this may be the original "after-pickling"

coat which may be touched up at the discretion of the Principal Ship Overseer.

- 1.6.2.2 One complete finishing coat. This system shall not be in excess of 3 mils thickness when applied.
- 1.6.3 For general exterior painting, a four-coat system shall be applied as follows:
 - 1.6.3.1 One complete "after-pickling" coat of iron oxide primer 1-GP-48, Type A.
 - 1.6.3.2 A second complete coat of iron oxide primer 1-GP-48, Type A.
 - 1.6.3.3 One complete first top coat 1-GP-61.
 - 1.6.3.4 One complete finishing coat 1-GP-61.
- 1.6.4 Galvanized exteriors will not require the "after-pickling" primer, and a three-coat system will suffice in such areas.
- 1.6.5 All paint shall be sprayed wherever possible, except for touching up and marking.

1.7 PRESERVATION AND PICKLING OF NEW-CONSTRUCTION STEEL

- 1.7.1 As soon as possible after delivery, all steel for the main portions of the several decks, shell, stem, stern, and bulkheads, shall be pickled in a bath containing a 7 per cent aqueous solution of hydrochloric acid to which has been added an approved inhibitor. This solution is to be maintained at approximately 70°F during pickling which is normally to continue for 30 minutes. This treatment is to be followed by thoroughly hosing with cold fresh water, followed by hot water until all acid is removed. This process is to be followed by a passivating treatment comprising a warm bonderising bath, or a spray of 2 per cent aqueous solution of phosphoric acid, or other approved treatment. As soon as possible after hot air drying, the steel is to be primed with marine primer fire retardant 1-GP-48, Type A, and stacked on edge, under cover if possible, until required.
- 1.7.2 During building, welded areas are to be wire brushed before the metal is cool and swabbed with a 2 per cent solution of phosphoric acid, and when dry, repainted with primer as above to discourage the onset of corrosion.
- 1.7.3 Any areas of actual corrosion which may develop during building before the final painting are to be treated with a phosphoric acid base or other approved rust remover and primed.
- 1.7.4 All aluminum alloys are to be treated in accordance with the requirements of Clause 2.3 and Specification NCC. 103: Application of Aluminum in the Construction of H.M.C. Ships.
- 1.7.5 As soon as possible after final welding has taken place on the berth, the whole of the structure is to be cleaned and degreased with approved solvents and given one coat of priming paint 1-GP-48, Type A. All care is to be taken that no rusting or corrosion is allowed to establish itself in any part of the structure, and if in the Overseer's opinion the paint coating is at any time not in sufficiently good condition to ensure this, further coats are to be applied as directed.

CHAPTER 2

PREPARATION2.1 GENERAL

- 2.1.1 The most important prerequisite for acceptable paint performance is pretreatment, and thorough cleaning is absolutely essential.
- 2.1.2 Cleaning procedure shall include pickling of all black steel and inhibiting in a 2 per cent aqueous solution of phosphoric acid, complete removal of rust and mill scale, the solvent removal of any oil and grease, and thorough drying.
- 2.1.3 Painting at or below temperatures of 50°F shall not be done without express permission from Naval Headquarters.
- 2.1.4 Under conditions of high humidity the temperature of the structure shall be increased or the air in compartments cooled and dried to prevent condensation and to maintain a dry surface.
- 2.1.5 Steel which is not to be galvanized shall have rust and mill-scale effectively removed by acid pickling, flame descaling, power wire brushing, or by an approved wet sandblasting process.
- 2.1.6 Grease shall be removed with nonflammable solvent and surfaces wiped dry with rags.

2.2 WELDING

If specifically required by the Dockyard Superintendent, pitted surfaces otherwise acceptable may be welded provided due caution is taken against the incidence of weld decay. In such cases the following procedure is to be adopted:

- 2.2.1 The corroded areas shall be cleaned to bright steel by the use of power driven wire brushes or wet sandblasting.
- 2.2.2* Small corrosion pits shall be opened up to the sound metal by using a cup-faced drill or by grinding.
- 2.2.3* Similarly, the larger corroded areas shall be cleaned to the sound metal by grinding.
- 2.2.4* The areas shall then be washed thoroughly with a 2 per cent aqueous solution of phosphoric acid, or a fresh water solution of sodium dichromate.
- 2.2.5 The work shall be preheated before welding and as necessary during the welding operation.
- 2.2.6 Electrodes shall be to the requirements of CSA Standard W48: Iron and Steel Arc-Welding Electrodes, and small enough to negotiate the smaller pits. Saddle welds shall be avoided.

Note: A new, low hydrogen, lime-ferritic type of electrode has been developed for welding high carbon steels and may be used if available.

* Processes 2.2.2, 2.2.3 and 2.2.4 are to follow one another very closely.

- 2.2.7 In the larger corroded areas the first run shall be made using a small electrode. Finish may be with any suitable size electrode available.
- 2.2.8 Upon completion all welds shall be ground flush with the parent metal.
- 2.2.9 Stress shall be relieved by heat treatment.
- 2.2.10 The work shall then be washed down with sodium dichromate or phosphoric acid solution, and immediately upon drying two coats of iron oxide primer 1-GP-48, Type A, shall be applied.

2.3 ALUMINUM ALLOY

- 2.3.1 Wherever possible cleaning of aluminum alloy shall be done prior to assembly of parts. Cleaning before assembly shall be accomplished by immersing the part in, or swabbing with, a 10 per cent aqueous solution of phosphoric acid and organic solvents. The solution temperature shall be about 70°F and shall not remain in contact with the metal for more than 15 minutes. Residual solution shall be washed off with cold fresh water followed by hot water until no trace of acid is detected.
- 2.3.2 When necessary to clean after assembly, the assembled parts shall be cleaned with mineral spirits, benzine, carbon tetrachloride, trichlorethylene or a mixture thereof.
- 2.3.3 Where welded parts have been connected with an electric arc system, they shall have all traces of flux removed before painting. This may be achieved by brushing the welds while they are immersed in boiling water. Inaccessible welds may be treated by immersing in a cold solution of 10 per cent sulphuric acid for 30 minutes or 5 per cent solution of sulphuric acid held at 150°F for 10 minutes. The acid should contact both inside and outside surfaces. These treatments shall be followed by a thorough rinse in clean warm water until no trace of acid is detected. Residual flux may be detected by leaching the surface with distilled water adding a few drops of 5 per cent silver nitrate to the leach. The presence of flux is indicated by a white precipitate.

2.4 GALVANIZED SURFACES TO BE PAINTED

All zinc-coated surfaces which are to be painted shall be treated with an approved cleaner consisting of phosphates, phosphoric acid, suitable solvents and cutting agents, to enable the surfaces to be coated with a thin phosphate coating. Where galvanized plating has not been procured in the treated condition, a 10 per cent solution of phosphoric acid shall be painted on the surface with a large brush, allowed to act, and then thoroughly washed off with cold water and hot water. When dry, iron oxide primer 1-GP-48, Type A, or Zinc Dust Primer shall be applied. Handling of the surfaces following coating and prior to the application of primer should be minimized.

CHAPTER 3

PRIMING TREATMENTS3.1 STEEL (NOT GALVANIZED)

- 3.1.1 Pickled or furnace material when clean and dry after scale removal shall be spray painted with one coat of iron oxide primer 1-GP-48, Type A.
- 3.1.2 During construction, areas which become bare or where rust shows shall be touched up after wire brushing with one coat of iron oxide primer 1-GP-48, Type A.
- 3.1.3 Before launching, the exterior only shall receive one complete second coat of iron oxide primer 1-GP-48, Type A. (This coat may be tinted darker above the water-line so as to show no light spots if the subsequent topcoat peels.)
- 3.1.4 All decks and platforms shall be given a similar second coat of iron oxide primer which shall subsequently be removed to the bare bright metal in those areas where linoleum, latex, or other deck coverings are to be laid. This removal shall be in accordance with the cleaning procedure already laid down in para. 2.1.
- 3.1.5 After completion of interior construction, the after-pickling coating shall be touched up and other surfaces not already painted shall receive one coat of iron oxide primer 1-GP-48, Type A.

3.2 ZINC COATED METAL

- 3.2.1 Exterior galvanized structure shall be primed and painted. Interior galvanized structure shall be painted at the discretion of the Principal Ship Overseer.
- 3.2.2 Galvanizing, galvanized mesh or expanded metal, destroyed by welding, cutting, or burning, shall be touched up with iron oxide primer 1-GP-48, Type A and shall be finish coated in accordance with the painting scheme, except in fuel or fresh water tanks where the area shall be recoated with sprayed zinc metal.
- 3.2.3 All galvanized areas to be painted shall receive one coat of iron oxide primer 1-GP-48, Type A.

3.3 ALUMINUM ALLOY

- 3.3.1 Frames and stanchions of aluminum pipe berths shall not be painted. Crew's clothes lockers, bins, shelves, etc., when constructed of aluminum shall be left unpainted. Aluminum alloy uprights, battens, fittings, etc., in magazines shall be left unpainted. All aluminum surfaces which are to be painted shall be given a coat of zinc chromate primer 1-GP-40, which shall be applied immediately after the work has been cleaned, rinsed and dried. If necessary, this priming coat shall be touched up before the application of subsequent coats.
- 3.3.2 Where aluminum surfaces are not to be painted, the priming coat will not be required. These surfaces shall instead be given one coat of phenolic resin varnish or wax polish, or left bright and cleaned with a damp cloth.

Specification for Phenolic Resin Varnish

Weight per gallon, pounds	8.88
Solids, per cent by weight	55
Solids, per cent by volume	50

	<u>Pounds</u>
Phenolic Resin 100%	100
Chinawood Oil	259 (27.5 Gals.)
Mineral Spirits	235
Hi-Flash Naphtha	28
Dipentene	20
Lead Naphthenate (24%)	6.5
Manganese Naphthenate (6%)	3.0
Cobalt Naphthenate (6%)	1.5

Run resin and oil to 460°F in 48 minutes. Hold for 7" string from cold plate. Reduce to 450°F and add drier.

Resin shall conform to the following specification: Specific Gravity 1.03 to 1.06; Melting Point 185-210°F. Shall polymerize in 40-50 minutes at 480°F in 25 gallon Tung Oil. Shall be compatible with LOW Lub. Oil and in 50-gallon Tung Oil Varnish.

- 3.3.3 Where aluminum surfaces are to be given finishing coats, or where appearance is unimportant, the same surfaces shall be coated with zinc chromate primer 1-GP-40. Where aluminum surfaces are not to be painted, the faying surfaces shall be coated with phenolic resin varnish. Each of the faying surfaces shall be painted and allowed to dry before being brought together, but just before being brought together each shall be given an additional coat of the required paint or varnish.
- 3.3.4 For non-watertight surfaces and joints, aluminum shall be protected from contact with dissimilar metals including galvanized steel, and from contact with wood or other absorbent materials which may become water-soaked, by an approved gasket material impregnated with phenolic resin varnish. In the case of aluminum which is to be painted, these gaskets may be impregnated for not less than 12 hours in zinc chromate paste 1-GP-46. Where such gaskets are used, the application of a second coat of primer or varnish to faying surfaces may be omitted. All gaskets are to be applied wet. (See Specification NCC. 103). Wood in contact with aluminum shall be painted before assembly with one coat of phenolic resin varnish.
- 3.3.5 Where aluminum must be caulked to dissimilar metals and where gaskets and insulants cannot be used, an approved sealing composition or caulking compound must be applied to the faying surfaces.
- 3.3.6 Asbestos paper or other absorbent material shall not be used in contact with aluminum.
- 3.3.7 All threaded parts of aluminum alloys, whether aluminum to aluminum, or aluminum to dissimilar metals, shall be coated before assembly with anti-seize mixture as laid down in Specification NCC. 103, or a suitable mixture of 50 per cent zinc dust and 50 per cent petrolatum.

3.3.8 Aluminum gratings shall be primed before assembly. Bolts which are to be used in aluminum shall be coated with phenolic resin varnish and have the threads treated with the above mentioned anti-seize mixture.

3.3.9 Inaccessible surfaces of aluminum shall be given two coats of zinc chromate primer 1-GP-40. The cleaning, painting and general treatment of aluminum shall be in accordance, with Specification NCC. 103: Application of Aluminum in the Construction of H.M.C. Ships.

3.4 OTHER METALS

3.4.1 Copper and brass gauge cases, electrical fixtures, hatch and door frames, covers, ladder strings, pipes outside machinery spaces and parts not requiring frequent handling shall receive one coat of zinc chromate primer 1-GP-40, and be finish painted.

3.4.2 Corrosion resisting steel and copper-nickel alloy shall be left bright or painted for appearance at the discretion of the Principal Ship Overseer.

CHAPTER 4

GALVANIC CORROSION4.1 GALVANIC SERIES

- 4.1.1 Galvanic corrosion may be defined as an electrochemical corrosion produced when one metal is in electrical contact with another more noble metal, both being immersed in the same corroding medium (called the electrolyte). Table I: Galvanic Series of Metals and Alloys, is given for general information. The series ranges from anodic or least noble to the cathodic or most noble.

Table IGalvanic Series of Metals and Alloys

Corroded End (Anodic or least noble)
 Magnesium, Magnesium Alloys
 Zinc
 Aluminum 2S
 Cadmium
 Aluminum 17S
 Steel or Iron, Cast iron
 Chromium-Iron (active)
 Ni-resist
 Stainless Steel, 18-8 (active); Stainless Steel, 18-8-T (active)
 Lead-Tin solders, Lead, Tin
 Nickel (active); Inconel (active)
 Brasses; Copper; Bronzes; Copper-Nickel Alloy; Monel
 Silver Solder
 Chromium-Iron (passive); Stainless Steel, 18-8 (passive)
 Stainless Steel, 18-8-T (passive)
 Silver
 Graphite; Gold; Platinum
 Protected End (cathodic or most noble)

- 4.1.2 It will be noted that some of the metals in Table I are grouped together. These group members have no strong tendency to produce galvanic corrosion on each other and from the practical standpoint are relatively safe to use in contact with each other, but the coupling of two metals in different groups and distant from each other in the list will result in galvanic or accelerated corrosion of the one higher up on the list.

- 4.1.3 The chromium-iron and chromium-nickel-iron alloys appear in two places on the table because they frequently change positions as indicated, depending upon the corrosive media.

4.2 PROPELLERS

- 4.2.1 It will be seen from the foregoing that a source of trouble is occasioned by the galvanic action between bronze propellers and steel hulls, especially during the fitting-out period of a new construction ship. It is therefore desirable that the fitting of propellers be deferred until the pre-trials docking. The exposed shafting after being cleaned in the manner already prescribed for steel is to be coated before launching with an approved material.

- 4.2.2 The propellers may be further protected until they are required by covering with canvas, coated with iron oxide primer, and enclosed in wood battens.
- 4.2.3 When fitting the propellers all traces of protective coating are to be removed with a suitable stripping solution or paint remover 1-GP-77.

4.3 HOOK-UP OF WELDING MACHINE LEADS

A further source of corrosion is due to the improper grounding of a vessel during the fitting-out stage when welding is an almost continuous operation. The coupling of welding machines and the grounding of the ship shall therefore be in accordance with the following instructions:

- 4.3.1 Whenever practicable, welding motor-generator sets including resistors and all direct current welding cable shall be installed on the ship where welding is to be done. A welding generator on one ship grounded to that ship shall not be used to perform welding on a ship alongside.
- 4.3.2 If it is not practicable to install the welding machine on board ship it should be installed on shore in a location as close as possible to the ship. The generator shall be grounded directly to the vessel on which welding is being done and care shall be taken to insure that no intermediate contact of the lead and ground cables is made between the generator and the vessel. In addition, no ground connections shall be made between the vessel and the shore or adjacent vessels for welding. The ground cable shall have an area of at least 1 million circular mils per 1000 amperes maximum welding current. Care should be taken to avoid having cables hang or sag in the water where there is considerable tide. This condition must be carefully avoided.
- 4.3.3 Entirely separate generators and their circuits shall be established when two or more ships are serviced from dockside generators. In no case should outlets from a single multiple-operator set be used on two or more water-borne ships at the same time. All other metallic connections shall also be avoided as set forth in paragraph 4.3.2 above.
- 4.3.4 Diagram I illustrates correct methods for installing welding generators.
 - 4.3.4.1 In all of the illustrated cases it should be noted that only one ground in the circuit is to the ship so there is no possibility of current flowing from the ship's hull into the water. It is entirely safe to place the welding generator on the pier or have it installed permanently in a building near the ship, provided both positive and negative cables to the ship are well insulated from ground and all other grounded structures, and that no welding connections are returned from vessels to shore or adjacent vessels for welding in either location.
- 4.3.5 Diagram II illustrates incorrect methods for installing welding generators.
 - 4.3.5.1 Case I illustrates conditions when one generator is used to weld on two ships.

4.3.5.2 Case 2 illustrates the conditions when the negative side of the generator is grounded to the pier. This might occur if the negative leads are connected to crane tracks, pipe lines or submerged or buried structure, or if the negative cables are immersed in water at some points.

4.3.5.3 Case 3 illustrates the condition when a welding generator, placed on a vessel and with the negative cable grounded to that vessel, is used to weld on another vessel. This situation often occurs when a welding generator on a tender or repair ship is used to weld on another vessel.

4.4 CORROSION FROM OTHER CURRENT SOURCES

4.4.1 The above conditions refer entirely to direct current welding equipment. Corrosion of ships' hulls may result from other sources of direct current power. For example, if a grounded neutral of a 3-wire D.C. system used to supply power to a ship is permanently or accidentally grounded on the ship, this will cause currents to flow to or from the hull of the ship. Electric railways or crane tracks may also cause current discharge from vessels' hulls if the vessels are in metallic contact with these structures.

4.4.2 Alternating current is not responsible for corrosion, but occasionally grounded alternating current systems may carry appreciable direct current. Accordingly, it is preferable to carry alternating current power leads from shore to ship rather than supplying such power leads from sources of direct current, and it is preferable not to ground even alternating current power lines to the ship's structure.

4.4.3 In order to insure good contact it is necessary to have unpainted contact of the cross section welded to a heavy member of the vessel to which the ground connection is securely bolted.

4.5 ANODES

4.5.1 The whole field of underwater protection is under review, and zinc anodes shall be fitted at re-entry spaces as described herein unless other materials and methods are specified.

4.5.2 Among other materials and methods which may be required for underwater protection are magnesium anodes, flame sprayed synthetic rubber, or chlorinated rubber.

4.5.3 In all cases, and wherever the process is practicable, underwater surfaces shall be wet sandblasted, washed down with fresh water, and coated within 20 minutes of washing with 2 per cent phosphoric acid solution before the application of the anti-corrosive paints. Where zinc anodes are applied:-

4.5.3.1 They shall be fastened to the steel by means of stainless steel bolts;

4.5.3.2 The bolts shall be prevented from slacking by means of tinned copper wire, threaded through the heads;

4.5.3.3 Anodes so fastened shall not be painted.

4.5.4 All nonferrous sea cocks seated on the outer bottom shall have zinc anodes fitted in the orifice. Those seated on the inner bottom

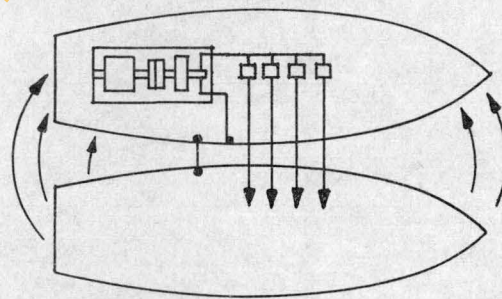
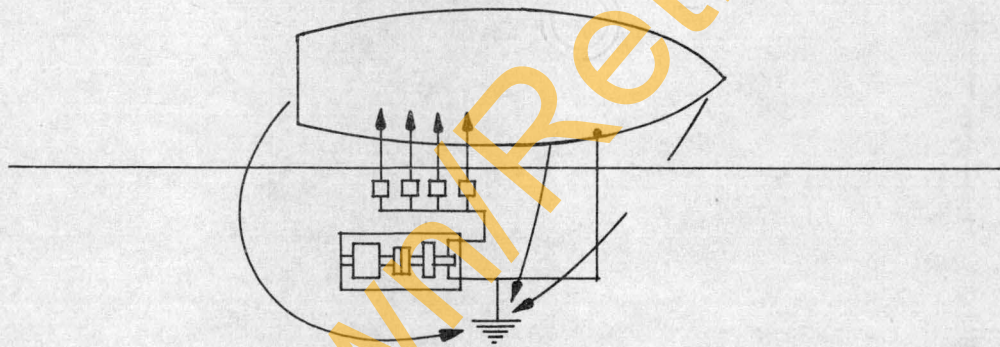
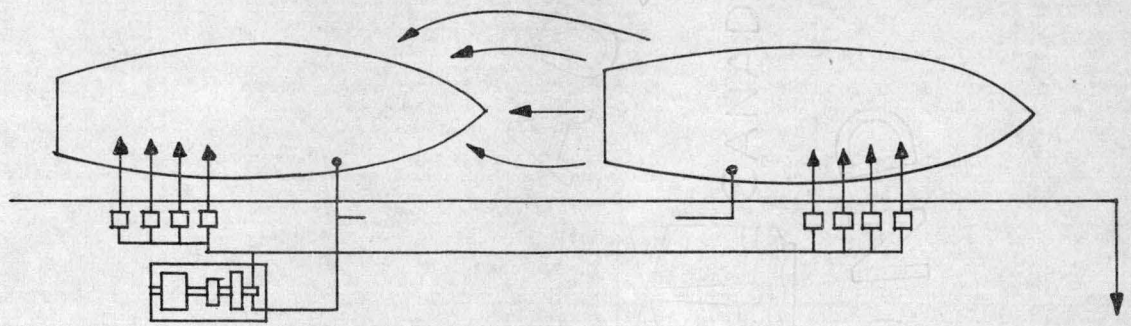


DIAGRAM II INCORRECT HOOK-UP OF WELDING LEADS ON WATER-BORNE VESSELS .

shall have anodes fitted inside the orifice and the upper and lower ends of the inlets.

- 4.5.5 All nonferrous discharge overboard fittings, when located below the deep water line, shall have zinc anodes fitted around the orifice at the shell. Galvanized steel gratings, where fitted in way of inlets, shall be fastened to the hull with stainless steel bolts, the threads of which shall be well greased. These gratings shall be treated as for zinc-coated steel and coated with the anti-corrosive and antifouling paints used elsewhere on the hull. The protection of underwater surface is to be in accordance with Naval General Order F.3, Section 1.*

4.6 SHAFTS

- 4.6.1 To avoid shaft fracture due to corrosion fatigue, it is necessary that pitting be prevented. In order to insure this, the outboard shafting shall be carefully wet sandblasted prior to painting. Immediately after blasting the shafting shall be given a coating of 2 per cent phosphoric acid solution, and when dried and lightly brushed, one coat of iron oxide primer 1-GP-48, Type A, shall be applied whether the shaft is blasted after installation or in the shop. Prior to launching or undocking an additional coat of iron oxide primer shall be applied. Allow 8 hours to dry, and apply one coat of anticorrosive paint (for U.S.N. paints use U.S.N. No.14 or 14D). Allow 4 hours to dry and then coat with hot or cold plastic. If plastics are not available, proprietary antifouling coats may be applied, but only in accordance with the manufacturer's recommendations.
- 4.6.2 All those parts of the shafting which are inaccessible for painting and not protected by bearing sleeves or casings shall be covered by rubber or other specially approved materials. Inboard sections of the shafting shall receive two coats of iron oxide primer 1-GP-48, Type A, and one coat of heat-resisting enamel 1-GP-76, in accordance with the color scheme for Machinery Spaces, Table IIIA, page 33.
- 4.6.3 In order to minimize corrosion, Naval Headquarters may specify special coatings for propeller shafts, A-Brackets and rudders. Such coatings may include thiokol or some equivalent form of flame sprayed synthetic rubber or chlorinated rubber. The interiors of bilge keels and rudders are to be filled with bituminous primer N.279 and drained.

*"Underwater Protection and Docking".

CHAPTER 5

PAINTING OF SHIP BOTTOMS5.1 SCHEDULE OF BOTTOM PAINTING

- 5.1.1 The preservation of underwater hulls is of first importance since the adverse effects of fouling and corrosion are manifest in loss of speed, increased fuel consumption, and frequent docking to counter deterioration.
- 5.1.2 The durability of any paint is critically dependent on the pretreatment of the surface, and for that reason all steel vessels shall have their hulls wet sandblasted during the pre-trials docking, and the steel treated with 2 per cent phosphoric acid solution where this has not already been done during construction. The programme of underwater painting shall be generally as indicated in Table II, page 16.
- 5.1.3 The most satisfactory antifouling paints to date are the hot and cold plastic types developed by the United States Navy, the Admiralty, and recently by Canadian manufacturers. These, together with their compatible anticorrosive undercoats, shall be applied on H.M.C. Ships whenever they are available. Where these are not available other approved underwater coatings may be applied. Vessels in commission shall have the underwater hulls, boot-toppings, and top sides treated in accordance with Table II, page 16, and at the discretion of the Superintendent of the Dockyard. Vessels in commission shall have their interior and exterior superstructure painted in accordance with this SCHEDULE, and at the discretion of the Senior Officer.
- 5.1.4 Where wet sandblasting is employed and a phosphate solution is introduced into the slurry, corrosion products may be washed away by shutting off the slurry and ejecting a jet of the solution. When the phosphate is not introduced into the slurry the corrosion products shall be washed away by shutting off the slurry and ejecting fresh water. This procedure must then be followed in not more than 20 minutes by a stream of 2 per cent phosphoric acid solution. If more than 20 minutes elapses between the washing and the inhibiting, light atmospheric corrosion will manifest itself and shall be blasted or brushed off before any paint is applied.
- 5.1.5 Where U.S.N. plastics are used, not less than 8 hours shall be allowed for drying between coats. The final coat need not dry more than 4 hours to give an initial set before the ship is waterborne.
- 5.1.6 All paint shall be applied in suitable weather conditions. Weather conditions involving temperature below 50°F, high humidity, or rain shall be avoided and paint shall be applied in dry, warm, windless conditions whenever possible.
- 5.1.7 When a vessel is docked for painting all internal tanks shall be emptied and the ship thoroughly ventilated so as to bring the outside of the hull to a uniform temperature and thereby minimise sweating and condensation. (See Naval General Order F.3, Section 1)

5.2.1 U.S.N. Plastics

- | | | | |
|---------|--|---|--|
| 5.2.1.1 | U.S.N. Hot Plastic HP 15 |) | |
| 5.2.1.2 | U.S.N. Gold Plastic Mare Island 143D,
145A, 146 |) | To be used in
conjunction with
USN anticorrosive
No. 14 |
| 5.2.1.3 | U.S.N. Cold Plastic Norfolk 65-5F |) | |

5.2.2.1 Pocoptic used in conjunction with Pomar anticorrosive.

5.2.3.1 In accordance with manufacturers' requirements.

5.2.4.1 Approved materials shall be used in conjunction with the manufacturers' recommended anticorrosive.

As may be approved by Naval Headquarters.

The condition of the underwater hulls of all H.M.C. Ships when docked shall be reported. The reports shall include:

- 5.4.1 The condition of the hull as to paint, giving relative locations.
- 5.4.2 The condition of the hull as to corrosion on plating, shafts, A-brackets, rubber and all inlets and rivet points.
- 5.4.3 The condition of the hull as to marine growth and its relative position and identity, i.e., slime, weed, shell fish and parasites, both before and after sandblasting.
- 5.4.4 The condition of the underwater anodes whether these be zincs fitted to re-entry spaces and astern, or magnesium anodes fitted to bilge keels. These are to have their surfaces scraped clean at every docking and renewed where necessary, and under no circumstances are they to be painted. These protectives may be:
 - 5.4.4.1 Cold rolled zinc of #125 NDG thickness and 99.99 per cent purity capable of being bent to $\frac{1}{4}$ " radius without fracture.
 - 5.4.4.2 Cast zinc of similar purity.
 - 5.4.4.3 Magnesium alloy containing not more than 0.07 per cent impurities. (See Naval General Order F.3, Section 1).

TABLE II - PAINTING OF SHIPS' BOTTOMS (STEEL - SURFACE VESSELS ONLY)

Columns 1 to 3 shall be followed Prior to Launching - Columns 4 to 6 at Subsequent Dockings

Line	New Construction - First Painting		Touch-up Painting		Complete Repainting	
	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
	FLEET	YARD CRAFT	FLEET	YARD CRAFT	FLEET	YARD CRAFT
A. Surface Preparation	a. Phosphoric acid treatment for black steel as in para. 3.1. b. Phosphoric acid treatment for zinc-coated surfaces as in para. 3.2		When corrosion is quite prevalent or the paint film in poor condition, <u>wet sandblast</u> to bare metal in way of affected areas. If corrosion is slight and paint film fair to good, clean off any fouling and wire brush corroded areas. Follow with 2 per cent phosphoric acid.		<u>Wet sandblast</u> entire underwater area. (Follow with 2 per cent phosphoric acid if not done during construction)	
B. After Pickling Coat	1-GP-48, Type A	1-GP-48, Type A	-	-	-	-
C. Priming Coat	Nil	Nil	Nil	Nil	Nil	Nil
D. Anti-corrosive	USN #14, POMAR, or other approved.	USN #14, as in col. 1	USN #14 (T.U.) as in col. 1	USN #14 (T.U.) as in col. 1	USN #14 as in col. 1	USN #14 as in col. 1
E. Anti-fouling Coat	USN hot plastic HP 15 Mare Island Cold plastic 143E or Norfolk 65-5F Pocoptic Other approved coats	USN cold plastic Mare Island 143E or Norfolk 65-5F Other approved coats	As in col. 1 over any exposed A/C coating	As in col. 2 over any exposed A/C coating	As in col. 1	As in col. 2
F. Boot Topping	USN Mare Island 145A, or other approved.	As in col. 1	As in col. 1	As in col. 1	As in col. 1	As in col. 1
G. Notes: Priming coats are not to be used on underwater surfaces in addition to proprietary anti-corrosive paints			As soon as dock is unwatered an experienced officer shall examine the exposed under body to decide whether or not a complete repainting is to be undertaken, having in mind the existing condition of the bottom, the time, equipment, and personnel available and the probable duration of the ensuing water-borne period.		Only to be done if adequate time in Dock is available for proper surface preparation.	

CHAPTER 6

PAINTING STRUCTURES - EXTERIOR6.1 CAMOUFLAGE

- 6.1.1 When camouflage is necessary the following color shades as shown in the Naval Standard Camouflage Color Booklet, issued June 1945, shall be used for external painting on H.M.C. Ships in accordance with the design requirements of Naval General Order F.1:

<u>Greys</u>	<u>Blue Greys</u>
G.5	B.15
G.10	B.20
G.20	B.30
G.45	B.55

- 6.1.2 These color shades and their nomenclature conform closely to Admiralty camouflage policy. The new nomenclature G.5, B.15, etc., refer only to the shade of paint and its reflection factor, i.e. G.5 is a grey of 5 per cent reflection factor, and B.15 is a blue grey with 15 per cent reflection factor. The gloss and formulation of all these are controlled by specification 1-GP-61.

6.2 EXTERIOR COLOR SCHEMES*

- 6.2.1 In peace time when camouflage schemes are not desirable, and at all times for Yard Craft, etc., H.M.C. Ships shall be painted as follows:

6.2.1.1 Warships (Aircraft Carriers only)

Hull and Superstructures	Grey 1-6
Masts	White 0

6.2.1.2 Warships (Other than Aircraft Carriers)

Hull above water line	Grey 1-9
Superstructures	Grey 1-6
Masts	White 0

6.2.1.3 All Auxiliary Craft

<u>West Coast:</u>	Hull	Grey 1-9
	Upper Works	Grey 1-6
<u>East Coast:</u>	Hull	Black 00
	Upper Works	Grey 1-6

- 6.2.2 The colors in para. 6.1 are shown in the standard camouflage color booklet and all paints used shall meet the requirements of 1-GP-61. In peace time and for increased durability the gloss of these paints shall be a minimum of 45 A.S.T.M. units. This gloss shall be diminished in war time in favor of greater fire retardancy, and low visibility.

* Unless otherwise specified, all colors in this SCHEDULE refer to 1-GP-12a: Schedule of Standard Paint Colors.

6.3 PRIMERS

- 6.3.1 Iron oxide primer 1-GP-48, Type A, may be used universally on ferrous metals.
- 6.3.2 Aluminum primer 1-GP-69 shall be used only where specified.
- 6.3.3 Zinc chromate primer 1-GP-40 shall be used on aluminum and non-ferrous metals.
- 6.3.4 Wooden vessels, having been first sealed with a toxic sealer 1-GP-83, shall be given one coat of copper bottom paint.

6.4 FINISHING PAINTS

- 6.4.1 These are governed by 1-GP-61: Paint; Marine, Exterior, Fire Retardant.
- 6.4.2 Boot-topping when applied shall be of cold plastic wherever possible. This plastic may be either U.S.N. Mare Island, U.S.N. Norfolk, or Canadian plastic, or "Pocoptic". The approved anticorrosive (for plastics, this will be U.S.N. No. 14, "Pomar", or approved Canadian) shall be taken up over the original sandblasted and pickled metal to the upper boot-top line and covered with 2 coats of exterior finish paint 1-GP-61 where this is compatible with the undercoats. Where 1-GP-61 exterior paint is not compatible with the undercoats, the approved anticorrosive shall be stopped at the light load line, and 2 extra coats of primer 1-GP-48, Type A, followed by 2 coats of finish paint 1-GP-61 shall be applied to the boot-top area.
- 6.4.3 Wooden vessels shall be treated as in the above directives, having first been sealed with a toxic sealer 1-GP-83 prior to any painting.

6.5 WEATHER DECKS

- 6.5.1 Where painting is called for on weather decks, they shall first be given a coat of iron oxide primer 1-GP-48, Type A, followed by non-skid paints to specification N.119 (Types A or B).
- 6.5.2 Specification N.119 (Types A or B) is not considered satisfactory where the traffic on the decks is heavy. For such areas specially approved compounds will be specified. At present, heavy traffic areas shall be covered with approved latex-based compounds, but other covering may be specified as the study of deck coverings progresses. (See Chapter 10 of this SCHEDULE for detailed instructions on Deck Coverings).
- 6.5.3 Any materials applied to weather decks not specifically dealt with in this SCHEDULE shall be applied in exact accord with proprietary requirements. All paints for exterior use on H.M.C. Ships shall meet the requirements of specifications 1-GP-48, 1-GP-61, 1-GP-83, and N.119.

CHAPTER 7INTERIOR STRUCTURES7.1 GENERAL

Fire retardancy is of first importance in interior painting. Modern synthetic resin-based paints are more retardant than the old oil-based formulae. Fire retardancy for the paint itself may be generally defined as the percentage relation of the pigment to the binder portion of the vehicle. The higher the pigment percentage, the higher the fire retardancy. The fire retardancy of a paint system, however, may be more particularly described in terms of its film thickness. The greater the film thickness the less fire retardant the system is. The optimum thickness for fire retardancy is 2 to 3 mils. The optimum thickness of each coat is 1 to 1.5 mils. The maximum number of coats for fire retardancy is therefore two. This is the main reason for adopting the two-coat interior system, as described in paragraphs 1.6.1 and 1.6.2.

7.2 PRIMING PAINTS

7.2.1 The interior primary coat of the two-coat system shall be 1-GP-48, Type A. Light alloys shall be primed with zinc chromate paint 1-GP-40 where painting is required. Such interiors as reserve feed tanks, overflow and feed and draining tanks, shall be given a priming coat of aluminum primer 1-GP-69. This primer, however, induces low hiding power in the finishing coat. In such cases it may be necessary to cover the primer with two coats of interior finish white 1-GP-52. Fore and aft peak tanks, ballast tanks, and cofferdams may be given a coat of bituminous primer and hot enamel N.279, or hot plastics. Certain proprietary bituminous materials may be specified but where these are of paint, the priming coat shall be 1-GP-48, Type A.

7.2.2 In engine and boiler room bilges, and in way of permanent ballast, the priming coat shall be 1-GP-48, Type A. Specification N.273 governs the supply of materials for the internal coatings of other fresh water tanks. Approval of any material not at present in use will depend upon a satisfactory six months' trial in service on H.M.C. Ships. When approved materials are not available, cement wash may be applied to drinking water tanks. Where cementing in quantity is required it shall be carried out in accordance with Paragraph 1.7 of this SCHEDULE. All proprietary compositions shall be applied in strict accordance with the manufacturer's requirements. All tanks when coated and dried shall be flushed out with fresh water.

7.3 FINISHING PAINTS

7.3.1 White, tinted or solid-colored fire retardant paint 1-GP-52 shall be used for interior finish.

7.3.2 The use of enamels shall be limited to machinery details and propeller shafting.

7.3.3 Interior color schemes shall be in accordance with Table III of this SCHEDULE, page 28.

7.3.4 All piping shall be painted with fire retardant paint 1-GP-48, Type A and 1-GP-52 paint in the same corresponding shade as the

compartment through which they run. Standard pipe identification markings or stencils are detailed in BR 1294, and the paint so used shall comply with 1-GP-52. Deck coverings shall be in accordance with Table V (page 51) of this SCHEDULE and non-skid deck paints where used shall comply with N.119 (Types A or B).

7.4 ANTI-CONDENSATION MATERIALS

These are to be limited as far as possible, and shall be applied only to the extent necessary to eliminate sweating in living spaces and compartments where perishable stores are maintained. The material shall be vermiculite applied to a suitable binder as described in specification N.118 (Type A). When applied, the vermiculite may be coated with no more than one coat of interior fire retardant paint 1-GP-52, to match the scheme.

7.5 MACHINERY

To reduce the hazards of fire and smoke, the painting of machinery and associated work shall be kept to a minimum. Where painting is necessary, manufacturers, shipbuilders, Dockyards and ships' staffs shall adopt the following procedure:

7.5.1 Surfaces, when cleaned and passivated as laid down in Chapter 1 of this SCHEDULE, shall be given one undercoat of iron oxide primer 1-GP-48, Type A, followed by one coat of interior fire retardant paint 1-GP-52 in accordance with the detailed scheme set out in Table IIIA, page 33.

7.5.2 Machinery may be primed before assembly, and shall have the priming coat touched up on board before the finishing coat is applied.

7.5.3 Oil-based paints shall not be used.

7.6 ELECTRICAL EQUIPMENT

Manufacturers, shipbuilders, Dockyards and ships' staffs shall observe the following procedure for the painting of all electrical machinery and apparatus:

7.6.1 Surfaces, when cleaned and passivated as laid down in Chapter 1 of this SCHEDULE shall be given one undercoat of iron oxide primer 1-GP-48, Type A, and a finish coat of interior fire retardant paint 1-GP-52 to blend with the color scheme.

7.6.2 Equipment may be primed before installation, and shall have the priming coat touched up on board before the finishing coat is applied.

7.7 INSPECTION

All interior paints are subject to inspection by the Inspection Services, Department of National Defence, 70 Lyon Street, Ottawa, Ontario, and approval by the Naval Services prior to use.

CHAPTER 8

PAINTING SCHEME FOR H.M.C. SHIPS - STEEL**8.1 GENERAL**

- 8.1.1 This scheme supersedes all previous specifications and requirements for the interior and exterior painting of H.M.C. Ships being built or in commission.
- 8.1.2 The whole of the ship, including all steel surfaces covered with wood and insulation, shall generally have three or four coats outside and two coats inside of approved paint except where otherwise directed in this SCHEDULE.
- 8.1.3 Wherever possible, the primer or undercoat on exterior and interior shall be toned down or supplied in a light shade to permit adequate obscuration with one coat of the finish paint.
- 8.1.4 Unless otherwise directed, the outside surface of the ship and all fittings visible from outside the ship shall be painted with an approved, smooth, semi-gloss finish paint in the color and design for the ship's class under consideration, the shade and color to be in accordance with Schedule 1-GP-12a, or the Naval camouflage color standard booklet, as directed.
- 8.1.5 The final coat of paint shall be applied after construction work has ceased, and shall be maintained in good condition, firmly adherent and uniform in appearance until the ship is completed in all respects and ready for service.
- 8.1.6 The procedure for cleaning and painting H.M.C. Ships, as outlined in Chapters 1 to 4 of this SCHEDULE, shall be followed.

8.2 EXTERIOR OF SHIP**8.2.1 Underwater Hull**

- 8.2.1.1 Unless otherwise specified, the portion of the steel hull below the waterline shall receive at least two coats of anticorrosive paint and one or more coats of antifouling paint, as approved by the Department or by the manufacturers.
- 8.2.1.2 No marine primers shall be applied to the underwater bottom, unless otherwise directed, and in no case shall ordinary red lead, drying oil-base primer be applied to the exterior of the underwater hull.
- 8.2.1.3 Unless otherwise directed, no boot-topping shall be applied. In lieu thereof the approved anticorrosive paints shall be taken up to slightly above the deep load water line, and on final painting this area shall receive two coats of exterior paint 1-GP-61 instead of antifouling paint, down to the light load water line.

8.2.2 Hull Above Waterline

- 8.2.2.1 The exterior of the hull, above the load water line up to the weather deck, shall receive a total of two coats of priming paint 1-GP-48, Type A.

- 8.2.2.2 This portion of the hull shall receive finally one coat of finish paint 1-GP-61, in the camouflage color and design specified for the particular ship; that is, a total of three coats of paint.

8.2.3 Superstructure

- 8.2.3.1 All steel surfaces above the weather deck shall receive the same paint schedule as the exterior hull from the water line to the weather deck.

- 8.2.3.2 Fire retardant paints shall be used in this area.

8.2.4 Exterior Fittings, etc.

- 8.2.4.1 The Draught Marks shall be set up, cut in and painted white as shown in approved drawings, and shall be checked by the Overseer before being cut in.

8.2.5 Steel Weather Decks

- 8.2.5.1 Unless otherwise directed, steel weather decks shall be painted with one or two coats of primer 1-GP-48, Type A, followed by two coats of the approved color grey or red non-slip paint N.119 (Type B.)

8.2.6 Bridge, Superstructure, Forecastle Decks and Gun Platforms

- 8.2.6.1 These, and other areas, as shown on the deck coverings plan, shall be given one coat of primer 1-GP-48, Type A, and covered with a deck covering N.119 (Type A).

8.2.7 Carley Floats, Canvas, etc.

- 8.2.7.1 Carley floats, canvas, etc., shall be given one coat of the approved preservative treatment C-228 unless this has already been done to Specification C-229.

- 8.2.7.2 All shall then be given one coat of paint 1-GP-61 in approved color design, except that boat covers and canvas awnings shall be left unpainted.

8.2.8 Wood and Wooden Spars

- 8.2.8.1 Unless otherwise directed, wood and wooden spars shall be given one coat of toxic wood sealer 1-GP-83, followed by one coat of wood primer 1-GP-48, Type C, and one coat of finish paint 1-GP-61, in the approved color.

8.2.9 Galvanized Steel

- 8.2.9.1 Unless adequately weathered, galvanized steel shall be given a slight etch in an approved solution, as outlined above in Chapters 1 to 4, and dried before painting.

- 8.2.9.2 Painting shall be similar to the adjacent steel.

- 8.2.9.3 Galvanized inlet grids and zinc protector plates shall be left unpainted.

8.2.10 Exposed Machinery

8.2.10.1 Even when covered with a tarpaulin, all exposed machinery when not painted in the approved manner shall be protected by a liberal application of approved rust preventive grease or compound, periodically renewed.

8.2.10.2 Working parts shall be carefully protected in this manner.

8.2.11 Funnels

8.2.11.1 Funnels shall be given an extra coat of primer, or other approved heat-resistant anticorrosive coating, on the outside.

8.2.11.2 All paints used on funnels shall be fire retardant 1-GP-48 and 1-GP-61.

8.2.11.3 Similar treatment shall be carried out on the inside, except that the finish coat shall be black in color.

8.3 INTERIOR OF SHIP

8.3.1 Except where otherwise directed, all steel surfaces in the interior of the ship shall receive one coat of fire retardant priming paint 1-GP-48, Type A, followed by one coat of finish paint 1-GP-52. Unless otherwise directed, only semi-gloss paints shall be used in the interior.

8.3.2 Areas which are wet or damp, for example, drying rooms, galleys, bath rooms, wash places, heads, W.C's, compartments exposed to the weather, bilges, and most areas which are below the water line shall be given two coats of priming paint 1-GP-48, Type A. See detailed schedule outline in Table III, page 28.

8.4 INTERIOR FITTINGS, ETC.

8.4.1 Wood and Galvanized Steel

8.4.1.1 Unless otherwise directed, all wood and all galvanized steel shall be treated similarly to the wood and steel exposed to the weather on the outside of the ship; that is, any painting shall be similar to that in adjacent areas and fire retardant paints 1-GP-48 and 1-GP-52 shall be used on the interior.

8.4.2 Wood and Steel Furniture

8.4.2.1 Wood furniture shall be "filled" and given one coat of brush or spray polish 25-GP-10; Polish; Furniture, Liquid.

8.4.2.2 Steel furniture shall be coated with approved, fire retardant, baked-on furniture enamel and, when necessary, touched-up with an approved air-drying, fire retardant, semi-gloss enamel of a similar shade or color. At present Grey 1-5 is an approved color.*

*Unless otherwise specified, all colors in this SCHEDULE refer to 1-GP-12a; Schedule of Standard Paint Colors.

8.4.3 Water Line

- 8.4.3.1 A water line shall be centre-punched at a definite and stated distance above the line of the keel, at a draught corresponding to the deepest condition of the ship, and shall be indicated inside the ship by a broken paint line 2 inches wide, in an approved contrasting color of paint 1-GP-52.

8.4.4 Pipes

- 8.4.4.1 All pipes shall be lagged in the approved manner and painted with one coat of the fire retardant paint in the same color as the surfaces to which the pipes are attached. All pipes and electrical circuits shall be stencilled in distinguishing colors. In the cabins, wardroom, and sick bay the pipes and circuits shall be painted the same color as the surfaces to which they are attached. All such paints shall comply with 1-GP-52, shall be of a smooth, semi-gloss finish, and color shall be as shown in BR 1294.

- 8.4.4.2 Each pipe shall be colored for about 2 feet on each side of flange or union connections; the remainder of the pipe may be colored to conform with the color scheme of the compartment.

- 8.4.4.3 The pipes shall be marked at least once in each compartment through which they pass, and if there is no flange or union connections, a band of the flange color 3 inches wide shall be painted on the pipe instead.

8.4.5 Bulkheads

- 8.4.5.1 On all bulkheads bounding the spaces between decks, other than tanks and double bottom compartments, the name of the compartment on the other side shall be painted, so that it may be clearly seen and the letters "OS" shall be added to the name of the compartment.

8.4.6 Cementing

- 8.4.6.1 Cementing shall be carried out only where specified.

- 8.4.6.2 No cement shall be laid in the double bottom compartments.

8.4.7 Decks

- 8.4.7.1 Decks shall be coated as outlined in the deck covering plan. In general, steel decks in passageways and compartments shall be coated with non-skid deck paint N. 119 (Type B).

- 8.4.7.2 In the wardroom and Officers' cabins more resistant coatings N.119 (Type A) shall be used.

- 8.4.7.3 Deck coverings generally shall be in accordance with Table V of this SCHEDULE, page 51.

8.4.8 To Be Tinted

- 8.4.8.1 All living quarters shall be tinted White 0, Cream 6-2, Red 9-1, Green 3-1 or Grey 1-2.

8.4.9 To Be Painted White

8.4.9.1 Unless otherwise directed, Magazines, Spirit Room and Flammable Stores, Store Rooms, Cooling Machinery Compartment, L.P. Room, Offices, Provision Rooms, Canteen, Chart House, Wheelhouse, Galley, Bathrooms, Wash Places, Heads, Pantries, Sculleries, Dishwashing Compartments, and similar spaces shall be painted White O.

8.4.9.2 The underside of the deckhead and the overhead fittings, such as ventilation trunking, shall be painted flat White O, 1-GP-52.

8.4.10 To Be Painted Black

8.4.10.1 Rods and casings, hammock hooks and tanks in store rooms, shall be painted Black OO.

8.4.10.2 Doors shall have black finger-plates fitted.

8.4.11 To Be Painted Cream

8.4.11.1 Bulkheads and ship's sides of the sick bay annexes shall be painted Cream 6-2 with a two-foot dado of Green 3-8.

8.4.12 To Be Painted Green 3-8

8.4.12.1 Swinging cots and stanchions shall be painted Green 3-8.

8.4.13 To Be Painted with a Grey Dado

8.4.13.1 The following compartments shall have a Grey 1-8 dado 12 inches deep:- Provision Rooms, Spirit Rooms, Pantries, Canteens, etc., as below.

8.4.13.2 The following compartments shall have a Grey 1-8 dado 3 feet deep:- Wash Places, W.C.'s, Galleys, Paint Rooms, Diesel Generator Room, Stearing Gear Compartment, Cooking Machinery Room, etc., as below. The color scheme for the Machinery Spaces, Auxiliary Machinery Spaces and Auxiliary Machinery shall be in accordance with Table III A, page 33.

8.4.14 To Be Coated with Acid Resistant Paint

8.4.14.1 The deck of the low power room in the vicinity of the batteries and for 12 inches up the adjacent bulkheads shall be coated with acid-resistant paint 1-GP-80, chlorinated rubber paint, or other approved material. The remainder of the deck and 12 inch dado to bulkheads shall be coated with approved non-slip deck paint or composition.

8.4.15 To be Coated with Anti-Condensation Composition

The following shall be coated with anti-condensation composition:

8.4.15.1 All undersurfaces of steelwork exposed to weather and ship's side in living spaces, Offices, W.C.'s, Sick Bay, Pantries, Magazines, Canteens, Store Rooms, Diesel Generator Rooms, Provision Rooms, Lamp and Paint Rooms,

Asdic Compartments, Steering Gear Compartments, where lagging and linings are not demanded.

8.4.15.2 All pipes conveying cold water, except where they pass through messing and living spaces, hammock stowages and Store Rooms, in which locations they are to be lagged and painted.

8.4.15.3 All mechanical and natural supply ventilation trunks where they pass through Living Accommodation Spaces, Store Rooms, Passageways, etc.

8.4.16 To Be Lined with Sprayed Asbestos, Fibre Glass, or Other Approved Lagging Materials

8.4.16.1 Exposed steel surfaces in accommodation spaces, store rooms, provision rooms, pantries, etc., normally containing dry stores, in Radar Rooms, W/T Offices and A/S Huts, in passageways adjacent to living spaces, on bulkheads and deckheads of machinery spaces and oil fuel tanks adjacent to living spaces, store rooms, etc., where anti-condensation mastic is not applied, shall be lined with sprayed asbestos, fibre glass, or other approved lagging material.

8.4.16.2 Other compartments, e.g., Diesel Generator Rooms etc., shall be lagged only if living spaces are above or adjacent.

8.4.16.3 Unless otherwise directed in mess spaces, the ship's side and deckhead (when an exposed weather deck) shall be insulated with fibre glass, or other approved insulants, and sheathed. Alternatively, laggings of equal efficiency may be submitted for approval if so desired.

8.4.17 Not To Be Coated

8.4.17.1 Zinc protectors and wood battens in magazine and store rooms, screwed threads, boat covers and canvas awnings, and bearing surfaces such as bottle screws, slips, hatch and water-tight door clips, rubber gaskets, moving parts, etc., shall not be coated.

8.5 DETAILED PAINTING SCHEDULE FOR INTERIOR OF STEEL VESSELS

8.5.1 All compartments listed in Table III, page 28, shall be painted as outlined in the Table, unless instructions to the contrary are issued.

8.5.2 Main and auxiliary machinery and machinery spaces, including the following, shall be painted in accordance with the color schemes set forth in Table IIIA, page 33.

Bearing Covers	Fan Flats
Boiler Room Air Intakes	Fire and Bilge Pumps
Boiler Uptakes	Foam Making Machines and Piping
Capstan and Machinery	Gear Bases
Carbon Dioxide Machinery	Generators
Condensers	Gland, Plummer Block and
Diesel Auxiliaries	Shafting Compartments
Evaporators	Glands
	Governor Gear

Hose Racks
Laundry
Lower Power Rooms and
Switchboards
Machine Shop
Main Diesel and Diesel-Electric
Units
Motor Boat Engines

Nuts and Bolts
Portable Pumps
Steering Gear
Turbines
Turbine Auxiliaries
Ventilating Compartments, Air
Trunking and Fan Motors
Workshops and Workshop Machinery

Withdrawn/Retirée

TABLE III *

DETAILED PAINTING SCHEDULE FOR INTERIOR OF STEEL VESSELS

Compartment	Area	Primer 1-GP-48		Finish 1-GP-52	
		No. of coats	Type	No. of coats	Color
Fore peak tank, ballast tanks	Deckhead	2	A or B	-	-
		2 or	Bitumastic solution	-	-
Aft peak tanks, cofferdams	Bulkheads	1	Bitumastic solution and enamel	-	-
		3 or	A or B	-	-
Chain locker	-	3	A or B	-	-
Magazine and shell rooms	Bulkhead above flats	1	A	1	White O
D/C Magazines	Bulkheads below flats	2	A	-	-
	Deckhead and/or ship's sides	1	A	2	A/C ** White O N.118
Hardwood battens left bright	-	-	-	-	-
Fresh water tanks	-	1 or 2	Composition to Spec. N.273	-	-
		2 or	Cement wash	-	-
Provision room, provision issue room, canteen, canteen store, lobbies, gyro compass room, wardroom store	Bulkheads	1	A	1	White O
	Deckhead and/or ship's sides	1	A	2	A/C ** White O N.118
	Dado	-	-	1	Grey 1-8 12" deep
Cooling machinery room, lobbies below lower deck, spirit room, A/S compartment	Bulkheads	2	A	1	White O
	Deckhead and/or ship's side	1 or 2	A	2	A/C ** White O N.118
	Dado	-	-	1	Grey 1-8 3' deep

* Unless otherwise specified, all colors in this SCHEDULE refer to 1-GP-12a: Schedule of Standard Paint Colors.

** A/C = Anticondensation Paint.

Table III (contd.)

Compartment	Area	Primer 1-GP-48		Finish 1-GP-52	
		No. of coats	Type	No. of coats	Color
Cold and cool rooms	Steelwork behind lining	2	A or B	-	-
	Back of lining	1	A or B	-	-
	Lining and shelves	-	-	1 or 2	Spirit varnish
Gland compartment	Above flat	1	A	1	Grey 1-3
	Below flat	1	Bitumastic solution and enamel	-	-
		2	or B		
Steering gear compartment *	Below flat	1	Bitumastic solution and enamel	-	-
		3	or A or B		
	Above flat	1	A	1	White O
	Deckhead and/or ship's side	1	A	2	A/C ** White O N.118
	Dado	-	-	1	Grey 1-8 3' deep
Oil fuel tanks	Thoroughly cleaned, dried and coated with approved mineral oil or rust-preventive oil as outlined in instructions.				
Boiler room *	Upper surface of inner bottom, under-side of boiler room flat, boiler bearers, etc.	3	A or B	-	-
	Interior of double bottoms	2	C or as for main feed, reserve feed tank, overflow tank, drain tank		
	Above flat including funnel hatches	1	A	1	White O
	Dado	-	-	1	Grey 1-8 6' deep

* See Table III A, page 33.

** A/C = Anticondensation Paint

Table III (contd.)

Compartment	Area	Primer 1-GP-48		Finish 1-GP-52	
		No. of coats	Type	No. of coats	Color
Engine room *	Underside of engine room flat, engine seating, etc.	3	A or B	-	-
	Above flat	1	A	-	-
	Dado	-	-	1	Grey 1-8 6' deep
Main feed	-	2	1-GP-69	-	1-GP-69
Reserve feed tank, overflow tank, drain tank	-	2	A or other approved material	-	-
Seamen's messes, stokers' messes, C.P.O.'s & P.O.'s messes	Steelwork behind lining	2	A or B	-	-
	Lining	-	-	1	White O
E.R.A.'s messes, steward & cooks messes, chart-house	Deckhead	1	A	2	A/C ** approved lining
	Dado	-	-	1	Grey 1-8 12" deep
Low power room *	Bulkheads	1	A	1	White O
	Deckhead	1	A	2	A/C ** White O
	Dado, adjacent to batteries	-	-	1	Black acid resistant paint
	Deck, in way of batteries	2	Black acid resistant paint 1-GP-80	-	-
	Remainder of deck and Dado	1	A	1 or 2	Deck paint N.119
Workshops: Electric, * engineers, etc., lamp & paint room, diesel generator room	Bulkheads	1	A	1	White O
	Deckhead and/or ship's side	1	A	2	A/C ** White O
	Dado	-	-	1	Grey 1-8 3' deep

* See Table III A, page 33.

** A/C = Anticondensation Paint

Table III (contd.)

Compartment	Area	Primer 1-GP-48		Finish 1-GP-52	
		No. of coats	Type	No. of coats	Color
Stores: Naval Gunners', paymasters', etc., lobbies	Ditto work-shops above				
	Dado	-	-	1	Grey 1-8 12" deep
	Steelwork behind lining	2	A or B	-	-
	Lining	-	-	1	White 0, Cream 6-2 Red 9-1 Green 3-1 or Grey 1-2
	Deckhead where not lagged	1	A	2	A/C ** White 0 N.118
	Dado	-	-	1	Grey 1-8 12" deep
Wardroom pantry	As for above item except no lining fitted in ship's sides	1	A	2	A/C ** White 0
Crew's Heads, Crew's wash-places, C.P.O.'s W.C.'s, C.P.O.'s washplaces, P.O.'s W.C.'s, P.O.'s wash-places	Bulkheads	2	A or B	1	White 0
	Deckhead and ship's side	1	A	2	A/C ** White 0
	Dado	-	-	1	Grey 1-8 3' deep
	Deck	Not painted in washplaces			
Officers' W.C.'s, Officers' Bathroom	As above item except - Dado	-	-	1	Grey 1-8 12" deep
Sick Bay	Steelwork behind lining	2	A or B	-	-
	Lining	-	-	1	Green 3-5
	Deckhead lined with approved lining and coated with flat white, 1-GP-52				
	Dado	See para. 8.4.11		1	Green 3-8 2' deep

** A/C = Anticondensation Paint

Table III (contd.)

Compartment	Area	Primer 1-GP-48		Finish 1-GP-52	
		No. of coats	Type	No. of coats	Color
Ablution cabinet	Bulkhead	1	A or B	1	White O
	Deckhead	1	A	2	A/C ** White O
	Dado	See para. 8.4.11		1	Green 3-8 2' deep
Wheelhouse * passageways, D.C. workshop and lobbies above lower deck	Bulkhead	1	A	1	White O
	Deckhead	1	A	2	A/C ** White O
	Dado	-	-	1	Grey 1-8 12" deep
Fan Rooms * Galleys	Bulkhead	1	A	1	White O
	Deckhead	1	A	1	White O
	Dado	-	-	1	Grey 1-8 3' deep
Galley coal bunker		2	Bitumastic solution		
		2	or A or B		
W/T Radar, A/S Offices, etc.	Steelwork	2	A or B	In accordance with the appropriate W/T Radar or A/S specification	

* See Table III A, page 33.

** A/C = Anticondensation paint

TABLE III A*

COLOR SCHEMES
MACHINERY SPACES AND MACHINERY

I. MACHINERY SPACES

Ia. Main Machinery Spaces

- Ia-1 Main Machinery spaces shall be painted white (1-GP-52).
- Ia-2 Floor plates shall be slatted variety or chequered steel or a combination of both, and shall be kept scrubbed and oiled down at least once every 24 hours.
- Ia-3 Bilges and all pipes therein shall be painted with 1-GP-48, Type A.

Ib. Auxiliary Machinery Spaces

- Ib-1 Deck heads and bulkheads of auxiliary machinery spaces, fan flats, machine shops and gland and plummer block and shafting compartments shall be painted White O with Grey 1-6 dado to a suitable height, using paint to specification 1-GP-52.
- Ib-2 Decks of auxiliary machinery spaces shall be either polished steel or coated with 1-GP-48, Type A.
- Ib-3 In ventilating compartments, air trunking shall be painted White O, and fan motors Grey 1-3, both to 1-GP-52.

Ic. Main and Auxiliary Machinery Spaces - Pipes in

- Ic-1 All piping in main and auxiliary machinery spaces, except as specified below, shall be painted White O or Grey 1-3, 1-GP-52, or in the case of lagged piping, with either white lagging or White O paint, 1-GP-52.
- Ic-2 Where feet or hand marks are continuous, black paint (1-GP-52) may be used to avoid unsightliness.
- Ic-3 All piping shall be suitably marked in accordance with BR 1294.
- Ic-4 All copper piping above the bilge level shall be kept polished with a suitable compound.
- Ic-5 Brass fittings and pipes, such as gauges, clocks, tallies, etc., shall also be kept bright.

Id. Boiler room air intakes shall be painted White O, 1-GP-61.

Ie. Low power rooms, and H.P. and L.P. switch-boards, where fitted in main or auxiliary machinery spaces, shall conform to the color scheme therein.

Note: All steel surfaces, before application of the primary coat, shall be wire scrubbed, and cleaned with a 2 per cent aqueous solution of phosphoric acid.

* Unless otherwise specified, all colors in this SCHEDULE refer to 1-GP-12a: Schedule of Standard Paint Colors.

II. MACHINERYIIa Main MachineryIIa-1. Main Engines, Turbine

- IIa-1.1 Where polished blue steel casings are fitted no further protective coating shall be applied.
- IIa-1.2 Blue steel casings shall be periodically wiped down with a light oil sparingly applied with a soft cloth.
- IIa-1.3 Exposed parts of the turbine casing shall be painted with heat resistant enamel, 1-GP-76, Black 00 or Grey 1-3.

IIa-2. Main Engines, Turbine, Condensers

- IIa-2.1 Main turbine engine condensers and doors, inspection doors, inlet and discharge pipes (except copper bellows expansion pieces which are to be polished), shall be painted White 0, 1-GP-52.

IIa-3. Main Engine Turbine - Gear Cases

- IIa-3.1 Under no circumstances shall the top halves of main gearing cases be painted.
- IIa-3.2 Where casings are of aluminum, the top half shall be kept polished and clean. These may be either wiped with light oil, or black leaded, and polished. Bottom halves may be painted White 0, 1-GP-52.

IIa-4. Main Boilers and Uptakes

- IIa-4.1 Main boiler air casings and boiler fronts shall be painted with aluminum paint, care being taken that the material is heat resistant, or may be black leaded and polished.
- IIa-4.2 Register fronts may be painted black, 1-GP-52 or with 1-GP-48, Type A.
- IIa-4.3 Uptakes shall be painted white, 1-GP-52.
- IIa-4.4 Lagging on boilers shall be painted with white lagging paint, or with White 0 paint 1-GP-52.

IIa-5. Main Diesel Engines and Diesel Electric Units

- IIa-5.1 Main diesel engines and diesel prime movers for diesel electric units shall be painted Grey 1-3 with heat resistant enamel 1-GP-76, with suitable Grey 1-3 dado (1-GP-52) where desired.
- IIa-5.2 Generators and motors in diesel-electric installations shall be painted Grey 1-3, 1-GP-52.

IIa-5.3 Where armature air intakes and discharges are guarded by screening, these shall be kept clean and polished.

IIa-5.4 Copper piping and fuel leads shall be kept polished at all times.

IIb Auxiliary Machinery

IIb-1. Turbine Driven Auxiliaries, Turbines

IIb-1.1 Where polished blue steel casings are fitted, no further protective coating shall be applied.

IIb-1.2 Blue steel casings shall be wiped down periodically with a light oil.

IIb-1.3 Exposed parts of the turbine casing shall be painted with heat resistant enamel Grey 1-3, 1-GP-76.

IIb-2. Electric Driven Auxiliaries, Motors

IIb-2.1 Motors of electric driven auxiliaries shall be painted Grey 1-3, 1-GP-52.

IIb-2.2 Armature air intakes and discharge screens shall not be painted, but shall be kept clean.

IIb-3. Main and Auxiliary Generators

IIb-3.1 Main and auxiliary generators shall be painted Grey 1-3, 1-GP-52.

IIb-3.2 Armature air intakes and discharge screens shall not be painted, but shall be kept clean.

IIb-4. Auxiliary Machinery, Gearing

IIb-4.1 In all cases where a horizontal joint between top and bottom half of auxiliary machinery gearing casings exists (e.g. turbo-driven fans), the top half of the gearing casing shall not be painted, but shall be treated the same as main gearing casing top halves in all respects.

IIb-4.2 Bottom halves shall be painted Grey 1-3, 1-GP-52.

IIb-4.3 In cases where the joint on gearing casings is vertical, paint may be applied, but shall be kept well clear of the joint and joint nuts and studs to avoid chipping of paint.

IIb-5. Auxiliary Machinery, General

IIb-5.1 Auxiliary machinery in machinery spaces, except where otherwise specified, shall be painted Grey 1-3, 1-GP-52.

IIb-5.2 In the case of such machinery as H.P. and L.P. air compressors, turbo-generators, etc., a dado of Grey 1-6, 1-GP-52 may be painted at the discretion of the engineer officer.

IIb-5.3 In cases where mild steel supports are used between prime mover and auxiliary unit, these supports shall be kept polished.

IIb-5.4 In all cases shafting and couplings shall be cleaned, polished, and oiled lightly.

IIb-6. Auxiliary Machinery, Governor Gear

IIb-6.1 In no case shall paints or preparations be used on springs, actuating gear, spindles, etc. of auxiliary machinery governor gear.

IIb-6.2 Governor gear shall be kept bright.

IIb-7. Auxiliary Machinery, Evaporators

IIb-7.1 Where evaporators are fitted with blue steel casings, these shall not have any protective coating, but shall be periodically wiped with light oil.

IIb-7.2 If blue steel or similar casings are not fitted, Grey 1-3 heat resistant enamel, 1-GP-76, shall be used.

IIb-8. Ancillary Equipment

IIb-8.1 All ancillary equipment such as de-aerators, heat exchangers, closed feed controllers, etc., shall be painted Grey 1-3, 1-GP-52.

IIb-8.2 In no case shall moving parts of auxiliary machinery be painted, and extreme care shall be exercised when painting all auxiliary equipment that no drops or splashes of paint come in contact with moving surfaces.

IIb-9. Steering Gear

IIb-9.1 Main steering motors, and pumps, shall be coated with Grey 1-3, 1-GP-52.

IIb-9.2 Ram cylinders, telemotor receivers, etc., may be painted Grey 1-3, 1-GP-52 if so desired.

IIb-9.3 Telemotor receiver springs, hunting gear, and pump actuating levers shall in no circumstances be painted.

IIb-9.4 Special care shall be taken to ensure that no paint is allowed to come in contact with moving surfaces.

IIb-10. Carbon Dioxide (CO₂) Machinery

IIb-10.1 Motors, base plates, and housings of carbon dioxide (CO₂) machinery may be painted either white or Grey 1-3, 1-GP-52, with suitable dado.

IIb-10.2 Compressor cylinder heads shall not be painted, but shall be kept polished.

IIb-10.3 No paint shall be used in or near ice-making machinery except on the actual outside of the brine tank.

IIb-11. Laundry Machinery

IIb-11.1 All machinery in laundries shall be painted White 0, 1-GP-52, with suitable dado to conform with general color scheme.

IIb-12. Capstan Machinery

IIb-12.1 The only units of capstan machinery to be painted are the motors which shall be painted Grey 1-3, 1-GP-52.

IIb-12.2 The remainder of shafting, clutches, and gearing shall be kept polished and suitably greased.

IIb-13. Workshop Machinery

IIb-13.1 All machinery in ships' workshops shall be painted Grey 1-3, 1-GP-52 or as an alternative, Green 3-1, 1-GP-52 with suitable dado if desired.

IIb-13.2 Tool bins, chests, workbench fronts, etc., shall be painted Grey 1-3, 1-GP-52.

IIb-13.3 Workbench tops shall be painted with 1-GP-48, Type A, or covered with linoleum where practicable, or shall be polished steel.

IIb-14. Motor Boat Engines

IIb-14.1 Gasoline or diesel motor boat engines shall be painted Grey 1-3, with special heat-resistant enamel (1-GP-76).

IIb-14.2 All copper piping and fuel leads shall be kept polished.

III. DAMAGE CONTROL EQUIPMENTIIIa. Portable Pumps

IIIa-1. Portable pumps, either diesel or electric, shall be painted Red 9-2, 1-GP-52, with carriage and stand of Black 00, 1-GP-52.

IIIa-2. Copper piping and brass unions shall be kept polished.

IIIa-3. Covers for pumps stowed on weather decks may be painted to conform with superstructure color schemes, but shall be plainly marked, "PORTABLE PUMPS".

IIIb. Fire and Bilge Pumps

IIIb-1. Fire and bilge pumps shall be painted Grey 1-3, 1-GP-52, in accordance with general auxiliary machinery painting specifications.

IIIc. Foam Making Machines and Branch Pipes

IIIc-1. Foam making machines and their attendant branch pipes shall be painted Red 9-2, 1-GP-52.

IIId Hose Racks in Machinery Spaces

IIId-1. Hose racks in machinery spaces shall be painted Red 9-2, 1-GP-52.

IIIf Branch Pipes and Nozzles

IIIf-1. Branch pipes and nozzles shall be kept polished.

IIIf Emergency Valves

IIIf-1. Actuating handwheels, or their covers if fitted, of all remotely operated emergency valves, such as bilge ejector valves, steam fire extinguishing, etc., shall be painted Red 9-2, 1-GP-52.

IV. GENERAL SPECIFICATIONS**IVa Nuts and Bolts**

IVa-1. Nuts and bolts frequently removed shall not be painted but shall be kept clean, and if of mild steel, shall be wiped periodically with light oil.

IVb Glands

IVb-1. Pump, turbine, and valve glands shall not be painted.

IVc Bearing Covers

IVc-1. Protective agents shall not be applied to bearing covers.

IVc-2. Covers shall be kept clean, and oil, black lead, or metal polish only may be applied to that end.

IVd Manufacturers Specifications

IVd-1. These shall be adhered to rigidly.

V. WOODEN VESSELS

Va These regulations shall apply substantially to wooden vessels.

CHAPTER 9

PAINTING SCHEME FOR H.M.C. SHIPS - WOOD9.1 GENERAL

See Chapter 8, Painting Schemes for H.M.C. Ships - Steel and Wood, paragraph 8.1, General.

9.2 EXTERIOR OF SHIP - UNDERWATER

- 9.2.1 Unless otherwise specified, the portion of the ~~cleaned~~ wooden hull below the load waterline and clear of any steel work shall receive one coat of approved toxic wood sealer, 1-GP-83.
- 9.2.2 The seams shall be caulked with a primary thread of No. 1 quality caulking cotton, and not less than one thread, per inch of planking, of No. 1 quality oakum hawed in below flush and filled in flush with an approved trowel cement mixture of red lead and tallow or other approved material. All fastenings shall be payed with a similar cement or material. The hull below the water line shall then receive one coat of wood primer, 1-GP-48, Type C, followed by two coats of approved antifouling undercoating where required for a proprietary compound, and one coat of approved antifouling paint, or 3 coats of approved copper paint (5 coats in all including sealer).
- 9.2.3 Wherever there are two skins to the hull, the under seams shall be caulked with cotton and oakum. Calico of approved quality soaked in preservative C-228, or toxic wood sealer 1-GP-83, shall be fitted between the two skins and attached with copper tacks in the usual manner. The top skin shall then be finished as outlined in paragraphs 9.2.1 and 9.2.2 above.
- 9.2.4 Any steel protection plates below the light waterline shall receive two coats of approved anticorrosive and one coat of antifouling composition.
- 9.2.5 Treenails in underwater hull shall be dipped in copper paint or toxic wood sealer 1-GP-83 before driving, and treenails above the waterline shall be dipped in white lead 1-GP-9 or other approved exterior paint before driving.

9.3 TOPSIDE

- 9.3.1 The exterior of the hull above the deep load waterline up to the weather deck shall receive one coat of approved toxic wood sealer 1-GP-83, followed by a coat of wood priming paint 1-GP-48, Type C. Finally, another coat of the primer and of the finishing paint 1-GP-61, in the camouflage color and design specified for the particular ship, shall be applied.
- 9.3.2 The boot-topping area, between the light and deep load waterline, shall be treated similarly to the hull with toxic sealer 1-GP-83 and underwater undercoats or primers, but no antifouling paint shall be applied. This area shall be finished with two coats of the topside exterior paint. Upper seams of any fender guards shall be caulked with boat cotton and payed flush with approved marine glue. When dry, these fenders shall be coated with one coat of toxic wood sealer 1-GP-83, two coats of wood primer 1-GP-48, Type C, and one coat of finish paint, 1-GP-61 in the approved color (usually black).

9.4 SUPERSTRUCTURE

9.4.1 All exterior wooden surfaces above the weather deck shall receive one spray coating of toxic wood sealer 1-GP-83, followed by two coats of priming paint 1-GP-48, Type C, and finally one coat of fire retardant finishing paint, 1-GP-61. Where there are two skins, calico of an approved quality soaked in preservative, or wood sealer 1-GP-83, shall be fitted between the two skins and attached in the usual manner. The top skin shall be painted as above outlined.

9.5 EXTERIOR FITTINGS

9.5.1 All steel, fittings, etc., on and above the weather deck, shall be coated similarly to that outlined for similar steel and fittings on steel vessels, except possibly for a change in final camouflage color.

9.6 WEATHER DECK SEAMS

9.6.1 Weather deck seams shall be caulked with No.1 caulking cotton and approved quality oakum and payed with an approved marine glue. The marine glue shall be allowed to settle in the seams before surplus is removed, and before acceptance trials the seams shall be flushed and surplus glue removed.

9.6.2 The deck shall be sealed and given one coat of primer 1-GP-48, Type C, followed by one or two coats of approved deck paint or covering N.119 (Type B).

9.6.3 Calico of approved quality soaked in preservative C-228, toxic wood sealer 1-GP-83, or approved toxic solution shall be fitted between the two skins of the deck, where existent, and attached with copper tacks in the usual manner.

9.7 BRIDGE, SUPERSTRUCTURE, FORECASTLE DECKS AND GUN PLATFORMS

9.7.1 Where existent, as shown on the Covering of Decks Plan, these shall be given one coat of Primer 1-GP-48, Type C, and covered with approved deck covering N.119 (Type A).

9.8 WOODEN SHIPS' BOATS

9.8.1 These shall be given one coat of wood sealer 1-GP-83, inside and out. The outside shall then be given two coats of wood primer 1-GP-48, Type C, and one coat of finish paint 1-GP-61, in the approved color. The inside shall be given one coat of the same primer and one coat of the same finish paint.

9.9 ALL WOOD AND WOODEN SPARS

9.9.1 Unless otherwise directed, these shall be given one coat of toxic wood sealer 1-GP-83, followed by one coat of primer 1-GP-48, Type C, and one coat of finish paint 1-GP-61, in the approved color.

9.10 CARLEY FLOATS, CANVAS, ETC.

9.10.1 These shall be given one coat of approved preservative treatment C-228, unless this has already been done to specification C-229. All shall then be given one coat of 1-GP-61, in the approved color and design, except the covers to the boats, and canvas awnings, which shall be left unpainted.

9.11 ALL GALVANIZED AREAS

- 9.11.1 Unless adequately weathered, these shall be given a slight etch in an approved solution as outlined in Chapters 1 to 4, and dried before painting. Painting shall be similar to the adjacent steel, but any galvanized inlet grids and zinc protective plates shall be left unpainted.

9.12 EXPOSED MACHINERY

- 9.12.1 All exposed machinery, even when covered with a tarpaulin, when not painted in the approved manner, shall be protected by a liberal application of rust-preventive compound 3-GP-700, periodically renewed.

9.13 DRAUGHT MARKS

- 9.13.1 Draught marks shall be set up, welded, or carved in, and painted where shown in the approved drawings, and shall be checked by the Overseer before being made.

9.14 WOODEN GRATINGS

- 9.14.1 Wooden gratings to a minimum shall be fitted on the bridge and elsewhere as may be approved. These shall be coated with fire-retardant paint 1-GP-61.

9.15 INTERIOR OF SHIP

- 9.15.1 Except in living quarters and most areas above the waterline, all wooden surfaces in the interior of the ship shall receive one spray coating of toxic wood sealer 1-GP-83, followed by either two coats of priming paint 1-GP-48, Type C, or one coat of priming paint and one coat of finish paint, 1-GP-52. Fire-retardant paint 1-GP-52 shall be used in the interior of the ship.
- 9.15.2 All edges of frames and bulkheads throughout the ship shall be coated with one coat of toxic wood sealer 1-GP-83, followed by an application of primer 1-GP-48, Type C, prior to fitting into the bilge, and shall be bedded into caulking Compound 1-GP-23, or equivalent. Ends of timbers, before fitting, shall always be sealed against moisture penetration with wood sealer 1-GP-83.
- 9.15.3 Areas which are wet or damp, for example, drying rooms, galleys, bathrooms, washplaces, heads, W.C's, compartments exposed to the weather, bilges, and most areas which are below the waterline, shall be given two coats of priming paint 1-GP-48, Type C, over one coat of the wood sealer (1-GP-83). See detailed schedule outlined below.

9.16 INTERIOR FITTINGS

- 9.16.1 Unless otherwise directed, all wood and all galvanized steel, shall be treated similarly to the wood and steel exposed to the weather on the outside of the ship, except that any painting shall be similar to that in adjacent areas and fire-retardant paints shall be used.
- 9.16.2 Wood furniture, shall be "filled" and given one coat of brush or spray polish 25-GP-10.
- 9.16.3 Steel furniture shall be painted similarly to steel furniture in steel vessels, paragraph 8.4.2.2.

- 9.16.4 A waterline shall be centre-punched in inside, at a definite and stated distance above the line of the keel, at such a draught as to cover that corresponding to the deepest condition the ship is likely to reach, and shall be indicated inside the ship by a broken paint line two inches wide, in an approved contrasting color of paint, 1-GP-52.
- 9.16.5 On all bulkheads bounding the spaces between decks, other than tanks and double bottom compartments, the name of the compartment on the other side shall be painted so that it may be clearly seen, and the letters "O.S." shall be added to the name of the compartment.
- 9.16.6 All pipes shall be lagged in the approved manner and painted with one coat of 1-GP-52 in the same color as the surfaces to which the pipes are attached. All pipes and electric circuits shall be painted in distinguishing colors similar to those outlined for similar equipment in steel vessels, paragraph 8.4.4.
- 9.16.7 Cementing shall only be carried out where specified. No cement shall be laid in the double bottom compartments.
- 9.16.8 Decks shall be coated as outlined in the deck covering plan.
- 9.16.9 To be Painted White O (or Clear Varnish) as Detailed below.
Unless otherwise directed, Magazines, Main and Auxiliary Machinery Compartments, Spirit Room and Inflammable Store, Store Rooms, Cooling Machinery Compartment, L.P. Rooms, all Living Spaces, Offices, Provision Rooms, Canteen, Chart House, Wheel House, Galleys, Bath Rooms, Wash Places, Heads and similar places as below, shall be painted White O.
- 9.16.10 To be Painted Black OO
Rods and casings, hammock hooks and tanks in store rooms shall be painted Black OO.
- 9.16.11 To be Painted Cream 6-2 and Green 3-8
As for sick-bay in steel ships, paragraph 8.4.11, page 25.
- 9.16.12 To be Painted with a Grey 1-8 Dado (1-GP-52)
The following compartments, where existent, shall have a Grey 1-8 dado, 12 inches deep:- Mess Places, Provision Rooms, Spirit Rooms, Store Rooms, Pantries, Canteens, Lamp and Paint Room, etc., as below.
The following compartments, where existent, shall have a Grey 1-8 dado 3 feet deep:- Wash Places, W.C.'s, Galleys, Paint Store Room, Diesel Generator Room, Steering Gear Compartment, Cooling Machinery Room, etc., as below.
The following compartments shall have a Grey 1-8 dado 6 feet deep:- Engine and Boiler Rooms.
- 9.16.13 To be Coated with Acid-Resistant Paint
The deck of the low-power room in the vicinity of the batteries, and for 12 inches up the adjacent bulkheads, shall be coated with acid-resistant paint 1-GP-80. The remainder of the deck and 12-inch dado to bulkheads shall be coated with non-slip deck paint or composition N.119.

9.16.14 Not to be coated.

Zinc protector plates, wooden battens in magazines and store rooms, screwed threads, boat covers, canvas awnings and bearing surfaces, such as bottle screws, slips, hatch and watertight door clips, rubber gaskets, moving parts, etc., shall not be coated.

9.17 DETAILED PAINTING SCHEDULE FOR INTERIOR OF WOODEN VESSELS

- 9.17.1 All compartments listed in Table IV shall be painted as outlined in the Table, unless instructions to the contrary are issued.

Withdrawn/Retirée

TABLE IV *

DETAILED PAINTING SCHEDULE FOR INTERIOR OF WOODEN VESSELS

Compartment	Area	Sealer 1-GP-83	Primer 1-GP-48 Type C Finish Paint 1-GP-52
Fore Peak	Bulkheads	1 coat	2 coats Primer or Bitumastic and enamel
Aft Peak	Deckhead	1 coat	2 coats Primer or Bitumastic solution
Chain Locker		1 coat	2 coats Primer
Magazine and shell rooms D/C Magazines	Below flat	1 coat	2 coats Primer
	Above flat	1 coat	1 coat Primer 1 coat White O
Fresh water tanks	Interior	1 or 2 coats approved com- position N.273 or cement wash	
	Exterior	-	2 coats Primer 1 coat Grey 1-3
Provision room, provision issue room, canteen, canteen store, lobbies, Gyro compass room, wardroom store	Bulkhead and deckhead	1 coat	1 coat Primer 1 coat White O
	Dado (clear varnish may be used instead of paint in cer- tain areas)	-	1 coat Grey 1-8 12" deep
Cooling machinery room, engineer's store, spirit room, A/S compart- ment	Bulkheads below flat	1 coat	2 coats Primer
	Bulkheads above flat and deckhead	1 coat	1 coat Primer 1 coat White O
	Dado	-	1 coat Grey 1-8 3' deep
Cold and cool room	Behind lining	1 coat	2 coats Primer
	Lining and shelves		1 or 2 coats Spirit Varnish
Gland compartment	Above flat and deckhead	1 coat	1 coat Primer 1 coat Grey 1-3
	Below flat	1 coat	2 coats Primer or Bitumastic and enamel

* Unless otherwise specified, all colors in this SCHEDULE refer to 1-GP-12a:
Schedule of Standard Paint Colors.

TABLE IV (contd.)

Compartment	Area	Sealer 1-GP-83	Primer 1-GP-48 Type C Finish Paint 1-GP-52
Steering gear compartment	Above flat and deckhead	1 coat	1 coat Primer 1 coat White 0
	Below flat	1 coat	2 coats Primer or Bitumastic and enamel
	Dado	-	1 coat Grey 1-8 3' deep
Oil fuel tanks	Interior	Thoroughly cleaned and coated with approved mineral oil or rust preventive oil as outlined above	
	Exterior	-	2 coats Primer 1 coat Grey 1-3
Boiler room	Upper surface of inner bottom Under side of boiler room flat Boiler bearers, etc.	1 coat	2 coats Primer
	Above flat	1 coat	1 coat Primer 1 coat White 0 or other approved color
	Dado	-	1 coat Grey 1-8 6' deep
Main feed tank, reserve feed tank, overflow tank, drain tank, ballast tanks	Interior	-	2 coats Primer or Aluminum Primer 1-GP-69, or other approved paint
	Exterior	-	2 coats Primer 1 coat Grey 1-3
Messes (CPO's, PO's, ERA's, Stokers', Seamen's, Cooks' and Stewards') Charthouse	Bulkheads and deckhead	1 coat	1 coat Primer 1 coat White 0
	Dado	-	1 coat Grey 1-8 12" deep (clear varnish may be used in certain areas)
L.P. rooms	Bulkheads	1 coat	1 coat Primer 1 coat White 0 or Grey 1-3
	Deckhead	1 coat	2 coats White 0 or Grey 1-3
	Dado 12" and deck in way and adjacent to batteries	1 coat	2 coats Black Acid-resistant Paint 1-GP-80
	Dado and deck elsewhere	1 coat	1 coat Primer 1 or 2 coats Non-skid paint N.119

TABLE IV (contd.)

Compartment	Area	Sealer 1-GP-83	Primer 1-GP-48 Type C Finish Paint 1-GP-52
Workshops, lamp and paint room	Bulkhead and deckhead	1 coat	1 coat Primer 1 coat White O
	Dado	-	1 coat Grey 1-8 3' deep
Stores, Naval, etc., lobbies	As for Work- shops except Dado is only 12" deep	-	-
C.O.'s and officers' cabins, offices, lobbies in cabin, flats, wardroom, regulating office, wardroom pantry	Bulkhead	1 coat	1 coat Primer 1 coat White O or clear varnish
	Deckhead	1 coat	1 coat Primer 1 or 2 coats A/C Mastic White O or White O (1-GP-52)
	Dado (where painted)	-	1 coat Grey 1-8 12" deep
All bathrooms, W.C.'s, Heads and washplaces	Bulkheads and deckhead	1 coat	2 coats Primer 1 coat White O
	Dado (12" deep for offices, CPO's and PO's accommodations but 3' deep for crew's accommodation)	-	1 coat Grey 1-8
Sick Bay ablution cabinet	Bulkhead and ship's side	1 coat	1 coat Primer 1 coat Pale Green 3-5
	Deckhead	1 coat	1 coat Primer 1 coat White O (flat)
	Dado (see paragraph 8.4.11)	-	1 coat Green 3-8 2' deep
Fan rooms, galleys		1 coat	1 coat Primer 1 coat White O
	Dado	-	1 coat Grey 1-8 3' deep
Wheelhouse passageways, lobbies above lower deck	Bulkhead and deckhead	1 coat	1 coat Primer 1 coat White O or finished in clear varnish after sealing
	Dado	-	1 coat Grey 1-8 12" deep
W/T, Radar, A/S offices, etc.		1 coat	Finished in accor- dance with the appropriate W/T, Radar or A/S spe- cification

CHAPTER 10

DECK COVERINGS10.1 TYPES OF DECK COVERINGS

Of the many different deck coverings available to the Naval Service, the following types have been used:

- 10.1.1 Type A: Abrasive-filled Paste - containing heavy duty material suitable for application by hand trowel or spray, e.g., R-Mir-Dek, Dek-Tred.
- 10.1.2 Type B: Abrasive-filled Paint - containing light-weight material suitable for brushing or spraying.
- 10.1.3 Type C: Mineral-coated Fabric and Adhesive - a light-weight, processed fabric, suitable for laying in strips over an adhesive compound, e.g., Dur-X-Sil, Wetordry Safety Walk, Saf-T-Dek.
- 10.1.4 Type D: Latex-based Composition - formed by mixing natural latex with cementitious or cork powders and suitable for application by hand trowel, e.g., Semtex, Aranbee.
- 10.1.5 Type E: Linoleum - cork filled or plastic laid on adhesive compound. For plastic linoleum see DNC/M/92.

10.2 IDEAL REQUIREMENTS FOR DECK COVERINGS

Considerable research has been and is being carried on both in Great Britain and the United States to find suitable deck covering which will withstand all the conditions it is required to meet. The ideal requirements of a deck covering generally are:

- 10.2.1 Light as possible.
- 10.2.2 Non-skid, wet or dry.
- 10.2.3 Suitable for use on weather decks and below weather decks in washrooms, lavatories, showers, galleys and similar spaces undergoing more or less constant wetting and, in the case of galleys, contact with oil and greasy substances.
- 10.2.4 Non-corrosive, applicable to either wood or metal, and resistant to shock (underwater explosion, gunfire, vibration) or flaking.
- 10.2.5 Fire-resistant.
- 10.2.6 Resistant to heat or intense cold.

Note: To date no single deck covering has been evolved which meets all these requirements. As a result, compromise coverings are used which vary for various compartments and weather decks.

10.3 METHODS OF LAYING DECK COVERINGS

Experience under all conditions has shown that any deck covering is successful only insofar as the procedure required for its application is faithfully carried out by the Contractor. Ship Overseers and Dockyard Authorities should therefore familiarize themselves thoroughly with this procedure in order to satisfy themselves and Headquarters that it has been implemented with all the efficiency and accuracy possible.

- 10.3.1 In the case of Type D covering, dockyard personnel are trained in the latest and most accurate method of laying this material. The method of laying Type E covering has already been set out in

Naval General Order F.3, and some additional comments will be added below in this connection. Some good and some poor results were obtained in wartime from coverings Types A and B, the probable explanation of the latter being improper application. They were in any case only a temporary expedient because Type D was not available.

- 10.3.2 Type D covering is obviously the more suitable for weather decks and in spaces subject to contamination by water and oil, while Type E is suitable for accommodation spaces. The procedure for the application of Type E is outlined in the following sections.

10.4 CONVENTIONAL CORK-BASED LINOLEUM AND PLASTIC LINOLEUM

- 10.4.1 It is important that the covering used be first laid out flat in some suitable space, having the edges lifted all around so that the material may freely expand (or, in the case of Plastics, contract) and mature. The linoleum shall be left thus for as long as possible before using.
- 10.4.2 In new construction vessels, the laying of linoleum shall be carried out as late as possible in the programme of work, preferably in dry weather and after sea trials, when the number of shipyard personnel is diminishing. If the weather is cold at this time the compartment to be covered shall be heated.
- 10.4.3 Before application the deck plating shall be thoroughly cleaned to the bare metal, removing dirt, paint and scale, and special attention shall be paid to butts, seams or any crevice where corrosion and dirt are likely to accumulate. The cleaning may be carried out by means of 2 per cent aqueous phosphoric acid solution.
- 10.4.4 When the deck is cleaned and perfectly dry, plate edges and butts or any sharp edges or rivet-heads shall be faired off with latex compound, cork-filled underlayment, or an approved cement, until a flush surface is obtained.
- 10.4.5 Upon this flush surface the approved adhesive mixture shall be laid. (See next paragraph, also paragraph 10.5).
- 10.4.6 If Bostick "C" cement is used the following rules shall be strictly observed:
- 10.4.6.1 When stored over a long period of time at low temperatures Bostick "C" cement increases in viscosity, but can be restored to its normal state by diluting with toluol or an equivalent solvent.
- 10.4.6.2 The materials to be bonded shall be hessian-backed for good adhesion.
- 10.4.6.3 One coat of cement shall be brushed on to each of the completely dry surfaces and allowed to dry two hours.
- 10.4.6.4 After drying, the materials shall be bonded together with as much pressure as possible.
- 10.4.6.5 When one of the materials is porous, as in the case of linoleum, Bostick "C" cement shall be applied to the non-porous surface, and the porous material pressed down into it while the cement is still tacky. If there

is to be stress on the bond it shall be allowed to set 48 hours, but if not, 24 hours is usually sufficient.

- 10.4.7 The linoleum shall be pressed or shored down and well rolled with a heavy roller towards the edges and butts while the solution is still tacky.
- 10.4.8 The edges and butts of the linoleum around hatchways, scuttles and the like, shall be covered with boards and pressed or shored down until the adhesive is quite set. The centre area of the linoleum shall also be heavily weighted down after rolling is complete. It is not sufficient merely to weight the edges of the material.
- 10.4.9 When the adhesive is completely set and the weights, boards and shores are removed, the edges and butts of the linoleum may require to be stopped with appropriate plastic grouting, colored to match the surface.
- 10.4.10 As far as possible the linoleum shall be worked up to an edge strip landed clear of the heel brackets of frames and bulkhead stiffeners, and the deck between the edge of the linoleum and the ship's side or bulkhead shall be thoroughly cleaned and painted.
- 10.4.11 The edges of linoleum in walkways and those parts around hatchways, those in frequent use and the like, shall be covered and secured by strips of aluminum, monel or galvanized steel, fastened to the deck by studs of 5/16 inch diameter, spot-welded to the deck. The nuts shall be countersunk-head and slotted to take a turn screw. Such securing strips shall be kept to a minimum.
- 10.4.12 In certain approved cases it is found advisable to tap the fastenings into steel strips welded to the deck plating.
- 10.4.13 The fitting of securing strips is being reverted to in the Royal Navy after a good deal of trouble encountered during the war as a result of improper application of adhesives. The chief objection advanced by the Royal Navy to the use of securing strips is that the adoption of this practice might lead to less care being taken to secure linoleum properly by adhesives, since the immediate effect is to give the appearance of a well laid job. It cannot be too strongly emphasized, however, that it is essential to take the necessary steps to secure adhesion whether securing strips are used or not.
- 10.4.14 So that refits and renewals will not involve large removals, the linoleum shall not be laid in large pieces.
- 10.4.15 Once the linoleum is laid, the weights and shores removed, edges and butts sealed with putty and edge-strips secured, no water shall come into contact with it for at least one week. If this involves inability on the part of the Contractor to clean the linoleum before acceptance, arrangements shall be made for the ship's personnel to clean it thereafter.
- 10.4.16 It has been found in practice that a slight amount of creep takes place in linoleum after it is laid and secured. This is due mainly to the fact that the linoleum was not spread for a sufficient time before application. In such cases, it is advisable to keep the edge strips released so that the creep may take place uniformly, after which time the strips may be hardened down. It must be clearly understood that this expedient is not a substitute

for the spreading of linoleum before use. Proper spreading of the linoleum is an integral and important part of the method of laying, and must be regarded as such.

- 10.4.17 If adhesion is faulty, water will inevitably seep underneath the linoleum and the hydraulic pump effect of even a small quantity of water will cause it to spread and destroy adhesion elsewhere. In a short time this results in the linoleum cockling over large areas, causing cracking of the linoleum and unhygienic conditions.

10.5 TYPES A AND B COVERINGS

For these types of deck coatings, which come ready mixed, and for any other type requiring the application of adhesives, it is absolutely essential that the deck work to be covered be clean and dry. The method of cleaning already outlined shall, therefore, be faithfully carried out to ensure success.

10.6 STEEL STRIPS

On forecastle decks, it is generally sufficient to lay steel strips to the deck in lattice pattern. These strips, however, shall not be spot-welded, as this method fails to seal off the surfaces in contact and encourages corrosion. The strips shall, therefore, have a continuous light weld to the deck.

10.7 DECK PAINTS AND COVERINGS

- 10.7.1 In accordance with the policy of reducing the fire hazard in H.M.C. Ships, and to decrease weight in smaller ships, all deck coverings of a flammable and heavy nature shall be reduced to a minimum.
- 10.7.2 Table V gives a general guide to the types of deck paint and coverings to be used in H.M.C. Ships. Local conditions, such as the insulation of living spaces, etc., under decks influence the treatment of portions of the deck in different classes of ships and are taken into account when deck covering drawings are prepared.
- 10.7.3 Timber for weather decks is not approved, except in special cases, owing to weight considerations and the increased fire hazard of such a deck covering.

TABLE V
GENERAL GUIDE TO TYPES OF DECK PAINT AND COVERINGS

Forecastle and Upper Decks	Location	Type of Covering
Cruisers Depot Ships	Before the Breakwater	Bare steel with tread strips.
	Remainder	Approved plastic compositions or coatings N.119 Type A.
Aircraft Carriers	Flight Deck	Coating N.119 Type A.
	Forecastle and Quarterdeck	Coating N.119 Type A, or plastic composition.
	Hangars	Bare steel.
Destroyers	Before the Breakwater	Bare steel with tread strip.
	Remainder	Plastic composition in walking spaces; elsewhere coating N.119 Type A.
Frigates Corvettes Minesweepers	Before the Breakwater	Bare steel with tread strips.
	Remainder	Plastic composition or N.119 Type A in walking spaces, and N.119 Type B elsewhere.
Other Weather Decks	Boat decks, gun sponsons and platforms, search-light platforms, open bridges, signal deck, etc.	Plastic composition where men stand or where there is traffic; elsewhere bare steel with tread strips, or coated with N.119 Type A.
	Compass platforms	Wood grating or plastic composition.
Accommodation Spaces	Mess decks, dining hall, Officers' messes and cabins, outside cabins and where there are hammock billets.	Linoleum.
	Recreation spaces, church, lecture rooms, cinema, prisons, pantries, canteen, etc.	Linoleum.
Offices	All offices, including signal, radar, W/T, Pay, Victualling offices and similar spaces.	Non-skid paint N.119 Type B, or linoleum when specifically approved.

TABLE V (contd)

Forecastle and Upper Decks	Location	Type of Covering
Storerooms, etc.	Storerooms and issue rooms normally occupied such as Main Naval Stores, etc.	Non-skid paint N.119 Type B, with linoleum in way of desk and sewing counter.
	Storerooms infrequently occupied.	Non-skid paint N.119 Type B.
	Flour stores, provision rooms, canteen stores, potato and vegetable stores.	Non-skid paint N.119 Type B, with wood gratings under stowages.
Galleys, etc.	Galleys, bakeries, preparing rooms, serveries, sculleries, beef screen.	Cement and tiles only when specifically approved; otherwise non-skid paint N.119.
Heads and Washplaces, etc.	Heads, W.C.'s, urinals, bathrooms, washplaces, laundries and decontamination spaces.	Cement and tiles only when specifically approved. Otherwise non-skid paint N.119 Type A. Gutterways are to be provided in large bathrooms to ensure good drainage. Cement and tiles in decontamination spaces.
Machinery Spaces	Engine Room and Boiler Room floor plates. Auxiliary machinery spaces.	Chequered steel, unpainted.
	Capstan machinery compartment.	Bare steel or steel painted with N.119 Type B, except where hammock billets fitted.
Passages and Flats	Other than those used for sleeping billets.	Bare steel or steel painted with N.119 Type A. Tread strips may be fitted in athwartship passages and wide fore and aft passages; for the latter the sides clear of walking may be painted with N.119 Type B.
Workshops	Heavy workshops, including engineers, blacksmiths, plumbers, ordnance and electrical workshops.	Bare steel with tread strips.
	Light workshops, including optical instrument, radar, gyro adjusting rooms, other workshops where high voltages are used such as aircraft workshops, aircraft W/T test room, light wood working including shipwrights and joiners shop.	Linoleum on working spaces around benches where men stand to reduce risk of damage to delicate instruments, sharp edge tools, etc.

TABLE V (contd)

Forecastle and Upper Decks	Location	Type of Covering
Sick Bay, etc.	Sick bay including Surgeon's examining room, dispensary, isolation ward, surgical dressing room, medical distributing stations, dental surgery.	Linoleum.
	Operating theatre, ablution compartments, sick bay, W.C.'s and bath-rooms.	Cement and tiles when specifically approved, otherwise N.119 Type A.
Magazines and Shell Rooms	Including handling rooms, bomb rooms, etc.	Bare steel and tread strips, or steel painted with N.119 Type B.
Photographic Rooms	Office and printing room.	Linoleum.
	Developing room and chemical mixing room.	Cement and tiles if specifically approved, otherwise black acid-resisting paint 1-GP-80, or N.119 Type A.
Miscellaneous Compartments	Drying rooms.	Steel painted with N.119 Type B.
	Chart house, wheelhouse primary steering positions, damage control headquarters and stations, chart and chronometer room, telephone exchange, switchboard rooms, transmitting stations, compartments where floor is lagged, such as action information centre, briefing rooms, ready rooms, aircraft control rooms, air direction room, operations room, target indicating, Radar display rooms, etc.	Linoleum when specifically approved, otherwise N.119 Type A.
	Metadyne rooms	Steel painted with N.119 Type B.
	Battery-charging rooms and low power rooms.	Acid-resisting paint 1-GP-80.
	Cloakrooms.	Steel painted with N.119 Type B.
	Balloon-filling station.	Bare steel with tread strips, or bare steel painted with N.119 Type B.
	Parachute-packing room	Bare steel with tread strips, or bare steel painted with N.119 Type B.

CHAPTER 11

PAINTING BY SPRAY11.1 FOREWORD

- 11.1.1 In most cases the function of a paint, especially of a protective paint, is to seal the surface from the effects of weather and atmospheric conditions.
- 11.1.2 There are basically two methods of applying paint: one, the age-old method of brushing or rubbing, the brush being, in fact, only an improvement of the early wad of cloth; and two, the modern method of spraying, by atomizing the material and applying it in the form of a fine spray.
- 11.1.3 Both methods have their faults. Brushing is slow and wasteful, and does not apply the material in a smooth and even manner. It is also at a great disadvantage when complicated and uneven surfaces are to be coated; and, in addition, it is wasteful when very large surfaces have to be covered rapidly and economically.
- 11.1.4 Spraying, unless the apparatus is well designed and properly used, may result in over-atomization and in consequence an application of too thin a coat of material, or an excessive amount of possibly damp air being mixed with the material.
- 11.1.5 In the same way that research and exhaustive testing of paints is continually being carried out by paint manufacturers, so is constant experiment and improvement being effected by manufacturers of spray painting equipment.
- 11.1.6 The perfect spray gun should have the following characteristics:
 - 11.1.6.1 It must avoid over-atomization.
 - 11.1.6.2 It must be capable of producing, at will, either a very considerable surface-covering spread, or a narrow clearly defined coat.
 - 11.1.6.3 It must be easily adjustable to light and heavy materials.
 - 11.1.6.4 It must be simple to handle and easy to clean.
 - 11.1.6.5 It must be robust to stand up to heavy industrial work.
- 11.1.7 Modern spray guns fulfil most, if not all, of these requirements. It can be stated with reasonably accuracy that for all purposes of painting, either industrial or from the decorator's point of view, the spray gun fulfils all the functions of the paint brush with considerably more accuracy and economy, due to the speed of its paint application and the avoidance of paint wastage.
- 11.1.8 It is, however, in the more difficult aspects of painting that the spray gun comes into such outstanding relief against the old-fashioned brush.

- 11.1.9 There are many types of paints nowadays that cannot be satisfactorily brushed. Paints of the resin type, non-slip paints, cement paints, and ultra quick drying paints can only be applied properly by spray. They are intended to be sprayed and are compounded mainly for that purpose.
- 11.1.10 Again, in the industrial world there are a multitude of factories and works turning out articles of such size and shape that no brush ever made could satisfactorily apply the necessary coats of paint. For example, in construction steel painting, the under and inner side of girders, bolt heads, and nuts and rivets, which are precisely parts where extreme care in painting is necessary to prevent the subsequent incursion of water and damp, are frequently neglected or only partly coated owing to the difficulty of access and carelessness of workmen.
- 11.1.11 The spray gun, however, can be used on and is adapted to any surface however complicated and difficult of access.

11.2 EQUIPMENT

11.2.1 The Spray Gun

First and foremost in the list of tools the sprayer employs to apply his materials is the spray gun. The gun atomizes the material that is being sprayed, and the operator directs and controls its flow. Spray guns are usually supplied with several different types and sizes of nozzles so as to make possible the handling of any kind of material for all classes of surfaces. A wide fan spray, suitable for spraying large areas, as well as adjustments for the spraying of the smallest and most delicate of surfaces and materials are possible with the modern spray gun.

11.2.2 Suction Spray Gun

Figure 1* illustrates one of the simplest and most elementary of all spray guns. Pressing down the air valve located at the top of the one handle releases a current of air which is blown through the horizontal tube and across the top of the upright tube which reaches down into the material container. This causes a vacuum to be created in the upright tube. The vacuum causes the material to rise in the tube and as it reaches the top it is broken up or atomized by the air that is forced from the horizontal tube. From this simple idea has been developed the modern suction type spray gun in which compressed air at high pressure escapes from a nozzle in the gun head in such a way as to surround the material as it passes through a small orifice in the centre of the nozzle and completely atomize it.

In Figure 2* is shown a modern suction-type production spray gun that is suitable for such a wide range of work as automobile spraying, furniture finishing, exterior decorating, as well as production finishing. It is designed especially for present day methods of applying synthetic and other new materials, besides being adaptable to the application of ordinary lacquers, enamels and paints. The chief feature of this gun is the removable spray head as shown in Figure 3*. It adds wide utility to this gun. One head can be used with paints, lacquers, enamels, varnishes

* At end of Chapter, following page 68.

and similar materials. The other head is for use with heavier types of materials such as synthetics. It can be used either with suction cup, or with the pressure material tank which will be described later. It is adaptable for handling all standard type materials, and permits fine adjustments from a small round spray to a wide fan-shaped spray with all widths in between.

11.2.3 Air Volume Type Spray Gun

Another type of spray gun, which operates on a different principle from the suction type gun, is illustrated in Figure 4*. This is a pressure-type spray gun. It is designed to operate on a large volume of air at a low pressure. Many advantages are claimed for this gun. Because only a very low pressure is needed, there is less material wasted in the form of fume and off-spray than if high pressure were used. A further important result of low pressure is its effect on the wetness of the coating. It is an accepted fact that the volatile content of a material is more susceptible to air pressure than the pigment and binder. This volatile content must reach the surface being coated, in combination with the pigment and binder, to ensure proper results.

When low pressure is used, there is less evaporation of the volatile content in transit from the nozzle to the surface being sprayed. Evaporation of the volatile content, as well as oxidation, should occur after the material is on the surface, not before. When the paint reaches the surface with full content of volatile solvents it not only results in a smooth finish but assures greater penetration.

Compressed air has a chilling effect on the volatile thinners in the material being sprayed. The higher the air pressure the greater the chilling. A chilled paint will not flow out as smoothly as one that is at normal spraying temperature.

Using low air pressure allows for the application of full wet coats that set up with a rich built-up appearance.

In the operation of the pressure-type gun, when the trigger is pulled back slightly a current of air is forced through the nozzle. This may be employed for blowing the dust off the work before commencing to spray. When the trigger is pulled back fully, the paint is released to be atomized at the nozzle of the gun. The pressure-type gun illustrated in Figure 4* may be used either with a material pressure tank or a material cup or container. When using the material cup assembly, a material tube, which corresponds in length to slightly less than the depth of the cup, is screwed to the inside of the threaded projection situated just below the gun head. The cup and its connections are screwed to the outside of the threaded projection.

The material cup pressure-type gun operates in the following manner:

When the trigger is fully pulled back, compressed air is forced into the container. This presses on the material in the cup and, as a consequence, forces the material up through the material tube to the gun head. There it encounters the air which is being forced through the nozzle of the gun where it is atomized, or broken up into fine spray.

* At end of Chapter, following page 68.

With this type of gun, excellent results can be obtained with materials too heavy for application with the ordinary type suction gun.

11.2.4 Material Pressure Tanks

To take care of large scale production, the most practical and economical method of supplying material to the spray gun is by means of pressure type material tanks. They range in capacity anywhere from one gallon to ten gallons or more.

On the cover are mounted a pressure gauge, an air regulating valve to regulate the pressure in the tank, air and material outlet tubes, and cut-off valves. During operation the cover of the outfit must be clamped down tightly to prevent the escape of air.

The principle of operation is as follows: air pressure is forced on the surface of the material in the tank and causes the material to rise up the material tube and through the hose to the gun. When it reaches the gun head it contacts the regulated air being forced through the ports and is broken up, or atomized. This is illustrated in Figure 5*.

Pressure tanks are sometimes provided with inert containers which fit inside the regular material tanks. They make possible frequent changes from one material or color to another, simplify cleaning, and allow the economical use of small quantities of materials.

11.2.5 The Air Compressor

For successful spraying it is essential that the gun have supplied to it sufficient air at the proper pressure. This is accomplished by means of an air compressor which should be of adequate delivering capacity in cubic feet of air per minute to take care of the class of work to be performed.

A fact to be remembered when installing an air compressor is that many manufacturers of such equipment rate compressors in displacement of cubic feet per minute (cfm.) rather than in actual delivery of air in cubic feet per minute. The displacement and actual delivery are never equal. Some compressors have an actual delivery that is approximately 65 to 70 per cent only of their displacement; hence, a compressor rated at 10 cfm. displacement will not deliver over 7 cfm.

The actual delivery of air from the compressor should be sufficient to take care of all the spraying requirements.

11.3 MATERIALS

11.3.1 Oil Paints

Materials which are used for some industrial spraying are ready mixed oil paints, consisting of pigments, vehicles and thinners in varying proportion.

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At end of Chapter, following page 68.

The pigment, or coloring, remains much the same in all types of paint.

The vehicle acts as a binder. It usually consists of drying oils and varnishes which cause the particles of the pigment, as they dry, to hold together and adhere to the surface to which they are applied. Drying oils used as paint vehicles are linseed, tung, perilla, soya bean, and certain synthetic drying oils. Thinners used in paints reduce the consistency of the material to the degree necessary for proper application by spraying; they also increase the penetration of the paint into the surface on which it is applied, giving the coat a better anchorage. Thinners for oil paints are usually turpentine or white spirit.

11.3.2 Enamels

In this material the pigment is extremely finely ground, and the vehicle which carries the pigment and with which it is ground is usually a pale medium, containing bodied oils to give flow. Pure American turpentine is sometimes used as a solvent. There are all types of enamels on the market with varying finishes. When enamels are to be sprayed, they should be specially supplied by the manufacturer as spraying enamels, and in no case should thinners be added to reduce the viscosity except in accordance with the paint manufacturer's recommendation.

11.3.3 Varnishes

These are divided into two main types: oil varnishes, which dry through oxidation of the oil medium; and spirit varnishes, which dry solely through evaporation of the various volatile solvents which they contain.

Varnishes which contain only resins and drying oils are not suitable for spraying; to reduce them to the proper consistency for application by spray, certain thinners are mixed with them during the manufacturing process.

With varnish, as with enamel paint, it is essential that when the material is ordered, spraying quality should be specified.

11.3.4 Lacquers

In a general way all those finishing products which use a nitro-cellulose as a base are classified as lacquers. One distinctive feature of lacquer is that it dries almost solely by evaporation rather than by oxidation. The evaporation of the solvent of a lacquer coating may take only a few minutes, whereas the oxidation of the oil in the ready mixed oil paint may be a matter of many hours or even days.

Lacquers are easily adjusted to special requirements. Characteristics such as viscosity, elasticity, hardness, and drying time can be accurately controlled by the choice, and the amounts, of the various ingredients.

The term "cellulose paint" which is so often used nowadays really refers to lacquers consisting usually of two parts: the non-volatile part forming the film which may be pigmented; and the volatile part which evaporates during the drying process. The

non-volatile ingredients are usually the basic nitrocellulose, the plasticizer controlling the elasticity, and the gums and resins which add the required adhesion, hardness, gloss and other properties.

The volatile ingredients are solvents which carry the nitrocellulose, gums and resins in solution, and the diluents which are added to regulate its solvent power.

Cellulose paints as supplied by the manufacturers are eminently suitable for spraying, the only point to observe being that when thinned, the right type of thinners as recommended by the paint manufacturer must be used. These thinners have no permanent function in the lacquer and evaporate after application, leaving no residue in the finish.

11.3.5 Synthetic Paints

In recent years the manufacture of synthetic paints has progressed very greatly. The point affecting the spray operator is that they are extremely suitable for spraying when brought to the correct viscosity with the thinners supplied by the paint manufacturer. Thinning should therefore be carried out in strictest accord with the manufacturer's requirements.

11.3.6 Water Emulsion Paints

Under this heading come all water paints which are usually divided into two types, non-washable and washable distempers. Non-washable water emulsion paint or whitewash is the simplest type of water paint and consists of a glue solution mixed with whitening. Washable water emulsion paint makes use of casein as the binder, or alternatively oil, varnish or synthetic resin in emulsion with a glue solution as the binding medium, into which is ground special pigments and extenders.

All water paints are perfectly suitable for spraying as long as the material is thoroughly ground. There are certain gritty water paints which are generally used for camouflage or similar purposes. These also can be easily sprayed, rather more pressure being needed than in the case of finely ground paints.

11.3.7 Bituminous Paints

These for the most part are materials with an asphaltum base, and paints of this type, with a bituminous base are used very considerably for the protection of steel surfaces.

Some of the very heavy bituminous cement types are suitable neither for brushing nor spraying, but the standard commercial quality ready mixed bituminous paints are quite suitable for spraying with little or no thinning, and give excellent covering.

11.4 THE TECHNIQUE OF SPRAYING

11.4.1 Foreword

Usually the most skilful spray painter is the man who has been, or is, a first class painter with the brush. His practical experience with materials and the preparation of the surfaces upon which they are applied gives him a better understanding of the

work he is doing than is possible for the man who has just had a spray gun handed to him and been told to "go to it". Besides a fundamental knowledge of the craft, the spray gun operator must thoroughly understand his gun and the machinery and equipment that supplies it with paint and air. The spray gun is a tool capable of very definite results in the hands of a skilful mechanic. It will not do every kind of work nor will it do every job better than a brush. Without a doubt there will always be need for both tools.

11.4.2 Important Rules

The first thing required in spray gun operation is always to spray at right angles to the surface and at the same distance from it as indicated in Figure 6*. The correct distance that the gun should be held away from the work is variable with the different materials being sprayed. It may be 8 inches, 10 inches or even 12 inches, but as soon as the required distance for applying an even coat is found, keep that distance constantly.

Always move the entire arm and body with the gun in order to keep the gun straight on the surface. Failure to maintain this steady sweep, or any appreciable variation of the distance at which the gun is held away from the work, will result in uneven coating and patchiness. Set a steady, even pace or speed of movement of the gun across the work, and always keep it.

Each stroke should pass all the way across the work and be carried a short distance beyond the edge, or the trigger released just a moment at the edge, before returning on the next stroke. This will avoid heavy edges due to the material piling up at those places.

When spraying, it will be observed that the spray stream gives full body coating about three-fourths its width and tapers off to a fine spray at the edges. On account of this it is necessary that each stroke overlap the preceding one about one-third to form an evenly coated surface.

11.4.3 Pivoting and Oblique Spraying

Avoid any pivoting or circular movement of the wrist or forearm as this brings the gun near the surface when directly in front of the body, but when swung to the right or left extremes the gun is pulled from the work.

Oblique spraying, that is, not holding the gun at right angles to the surface being sprayed, will cause trouble, as also will pivoting. The edge of the spray that hits the surface first is heaviest and causes the material being applied to pile up into ripples at that point, making it liable to run and sag, while the opposite edge will be insufficiently coated, thus failing to hide the surface properly. This is illustrated in Figure 7*.

11.4.4 Nozzles

The proper size and design of nozzle for spraying different materials should also be given consideration, especially for the new synthetics. Most spray gun manufacturers have perfected

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improved models, having larger fluid and air ports for use when applying synthetic finishes. In many instances the gums used in these materials cause trouble at the fluid tip or in the mixture chamber by partially clogging and then discharging this set, or partially set, material in the form of specks. This accumulation should be cleaned off with an old tooth brush or a piece of rag soaked in the thinner required for the particular material being applied. This clogging material, if allowed to remain, will cause a distorted or split spray to develop, resulting in an uneven coating.

Using the proper size and design of nozzle, it is then only a matter of always using sufficient atomizing pressure to form the fine mist which is so necessary to produce a fine finish.

11.4.5 Cone and Fan Adjustments

Spray guns are capable of adjustments from a round cone spray suitable for small articles, such as chair frames, and the legs and turnings of cabinets, to a wide fan-type spray applicable to large areas such as panels, cabinets, and walls. Before commencing to spray, careful consideration should be given to a study of the proper nozzle adjustment for the work in hand.

11.4.6 Trigger Control

Proper trigger control is very essential to ensure consistent results. When the trigger is pulled back slightly, air only is released. This makes it possible to blow off any dust that may be on the work. Pulling the trigger back all the way releases both air and material simultaneously.

Always pull the trigger back fully before hitting the surface to be coated so that the work is started with a full spray. Release the trigger when the stroke passes off the work.

11.4.7 Pressure of Application

It is very difficult to lay down any definite rules regarding spraying pressure. There is such a great difference in the viscosity, consistency, and specific gravity of various materials, as well as in materials for similar purposes made by different manufacturers, that it is almost impossible to evolve fairly approximate pressures to use in applying these materials with the greatest speed, least loss, and best results.

The air pressure at the nozzle should be regulated to conform with the amount of material being delivered there. If a pressure material tank is being used, first regulate the fluid pressure by turning the regulator on the tank. Turning the regulator screw to the right raises the pressure on the fluid in the tank, turning it to the left lowers the fluid pressure. The necessary pressure will depend on the "weight" of the paint and the height at which the operator is working above the level of the paint tank.

To adjust the pressure on the paint in the tank, hold the gun at working height, pull the trigger all the way back, and then by means of the material pressure regulating valve gradually raise the material pressure until the paint flows in a steady stream

from the nozzle, as illustrated in Figure 8*. In doing this, allow time for the paint to flow through and fill the hose.

The next thing is to adjust the atomizing air pressure so that as it is forced through the ports in the gun head it will thoroughly break up or atomize the material as it issues from the nozzle. To be sure of proper results, it is recommended that the operator spray a number of panels using different pressures, and note the result of each case.

With practice and good judgment the sprayer will soon become accustomed to the handling of various kinds of materials, and no poor results will be experienced.

11.4.8 Method of Application

- 11.4.8.1 Every object or surface to be sprayed offers its own individual problem regarding method of application. However, there are certain working methods that seem to be more or less standard and that can be utilized in some way in most jobs. The following illustrate two very common spraying operations.
- 11.4.8.2 When spraying an object that is higher than it is wide, the best method is to begin by spraying the sides with left-right right-left strokes, commencing at the lower edge and working upwards until the side is completed. Use the same method on each side and then finish off by spraying the top. To spray the top start at the nearest edge and work away from you. The reason for the left-right right-left movement just described is for ease of spraying and economy of movement. The operator starts in a crouching position and gradually straightens to a standing position. In this way he has perfect control over the gun.
- 11.4.8.3 If the article happens to be wider than it is high, it should be placed at a convenient height for spraying and each side sprayed with an up-down movement. Spraying should be started preferably at the left edge so that the spray strokes may be observed as the work progresses. This should be continued until the side is completed. Spray each of the other sides in the same manner. The top is sprayed last of all by starting at the nearest edge and working away from the operator. By using this method of working all the overspray or fog that has collected on the top during the spraying of the sides will be absorbed into the material as it is applied. Spraying such articles in the manner just described keeps the operator in balance at all times and avoids any unnecessary motions - factors which count for very much in modern production methods.
- 11.4.8.4 The spray gun operator should become familiar with all the conditions that govern the particular job in hand, and then proceed according to such logical standards as his own good judgment dictates.

*At end of Chapter, following page 68.

11.5 CLEANING THE SPRAY GUN

- 11.5.1 One of the most important points in spray gun manipulation is to keep the gun perfectly clean. After considerable spraying of some materials, the nozzle is apt to become gummed up. This causes a defective spray which results in runs, sags, and uneven coating. A good plan is to keep handy a piece of soft rag or an old tooth brush moistened in thinner to clean off the nozzle at such times.
- 11.5.2 To clean the gun at the end of the day, do not place it in lacquer thinner and leave it there over night, as this practice is very injurious to the gun. The effect of this prolonged soaking is to shorten the useful life of the gun due to corrosion. It also hardens the packing around the needle valve and causes the gun to "split".
- 11.5.3 If the operator temporarily sets the work aside, intending to resume spraying an hour or so later, he should remove the nozzle from the gun, clean it thoroughly with thinner and replace it again. When he is through spraying for a while, the gun should be cleaned out immediately to prevent it from becoming clogged up.
- 11.5.4 To clean the gun, remove the cup and pour out the contents, wash out the cup with thinner, then partly refill it again with thinner and replace it on the gun. Open the gun and spray a second or two. Then, with one of the fingers of the left hand, the fluid tip and one air port should be closed simultaneously. This causes the thinner to "back up" into the gun. By repeatedly snapping the fingers off and on, the thinner is made to move forcefully back and forth in the gun, thereby quickly cleaning. The cup is again removed and held in the left hand under the suction tube to catch any drip. The trigger is then pulled back and all excess thinner remaining in the gun is blown out.
- 11.5.5 The same care should be given to pressure containers, fluid hose, and any other equipment used in the process of spraying. Quality will result from cleanliness.

11.6 SPRAYING DEFECTS, THEIR CAUSE AND REMEDY

11.6.1 Crawling

This is a fault which often occurs when varnish or enamel are sprayed on to an oily or greasy surface. Spraying these materials on to a surface that has a high gloss will sometimes cause crawling.

The best practice is always to apply a glossy coat on top of a thoroughly dry dull surface. If through force of circumstances one must apply gloss on top of gloss, the safest plan is to kill the gloss by sanding with a fine grade sandpaper or by washing.

11.6.2 Checking and Cracking

These are failures that are most frequent in paint, varnish and enamel finishes. The cause usually lies in applying hard drying material over soft, elastic, or not thoroughly dried undercoats. When undercoats are more elastic than the top coats, cracking

will result. Due to temperature and drying changes, the more elastic material will expand and contract over a greater distance than the less elastic top coat and as a consequence it cracks and checks.

Most paints, varnishes and enamels dry by a combination of evaporation of the volatile solvent portions and oxidation of the non-volatile oils and gums. When the above materials are applied to a surface, the volatile portions evaporate first and from this point on the drying proceeds by oxidation of the oils and gums. By oxidation of the oils and gums is meant that as they dry they absorb oxygen from the air and through this are changed from liquid to solid form. The process of oxidation takes place from the top down. The gums harden at the surface first but are still more or less soft underneath and considerable time is usually required before they are hard all the way through. If another coat of material is applied before oxidation has proceeded far enough, this coat hardens and prevents oxygen from getting to the underneath coat and this remains soft. When subjected to temperature changes the portion which is not thoroughly dried will expand and contract over a greater distance than will the hardened top coat. The result will be that the top film will break down, causing cracks or checks to appear.

Each coat should be thoroughly dry before another is applied, and even then the danger of checking is not entirely eliminated unless each coat is at least as elastic as the preceding ones.

11.6.3 Distortion

The cross section of a perfect spray stream shows a uniform density all through the entire width except for a short distance at the ends where it fades out. Dried material on part of the fluid tip will restrict the passage at that point, distort the spray pattern, and cause uneven spraying. When dried material gets on one of the side air ports it restricts the passage of the compressed air through it. This causes the full pressure of air from the clean port to force the fan pattern in the direction of the clogging side, thereby distorting the spray pattern and causing uneven coating.

To correct these conditions, the material clogging the fluid tip or side port should be wiped off with a tooth brush or a rag soaked in thinner. Do not try to remove dried material from these openings with a metal instrument for fear of causing damage.

Split spray, or one that is heavy at each end and light in the middle, is usually caused by attempting to get too wide a spray when using the fan type adjustment. Reducing the width of the spray will correct this condition.

11.6.4 Dust, Dirt and Lint

It is almost impossible to enumerate all the conditions that cause dirt, dust, and lint to become embedded in finished work. Careful inspection of the spoiled work by an experienced operator will usually disclose the origin of the dirt.

The unfinished work when delivered to the sprayer should be perfectly clean. All material should be strained before using to

make sure that it is absolutely free from foreign matter. If this has been done and the sprayed work shows dirt, check on the dusting and wiping operations. Some rags give off lint or fine particles of dust which may be left on the work even after it has been supposedly wiped off. To complete thoroughly the dusting and wiping operation, always blow off the work with compressed air.

11.6.5 Peeling

This fault is caused by improper adhesion of the coating to the surface on which it is applied. Greasy and poorly cleaned surfaces are the most common causes of peeling. Metal primers also peel easily from a greasy surface.

11.6.6 Pinholes

These are small holes like pinpricks. Pinholes are often caused by the too liberal application of the spray coating, especially when the material has been thinned too much. Small bubbles are formed, and as they dry they break open and leave what appear to be pinpricks.

11.6.7 Poor Adhesion

This is usually the result of spraying a coating on an improperly cleaned or a greasy surface. Synthetic paint and oil are bitter enemies, and synthetic paint absolutely refuses to hold to an oily or a greasy surface.

If at all possible, run all metal articles that are to be sprayed through a degreasing process in which all dirt and grease are removed by the action of white mineral spirits.

11.6.8 Roughness and Orange-Peel Effect

Roughness is caused by holding the gun too far from the surface being coated, and also by having too much air pressure in proportion to the material being applied. This causes the solvents to evaporate so quickly that the solid particles of spray dust thus formed strike the surface and cause a dry sandpaper-like effect.

When spraying synthetic finishes, orange-peel effect is caused through using too low air pressure. The material is thereby not properly atomized and when it reaches the work being coated, does not level and flow out as it should, but leaves a rough orange-peel effect. The remedy then, when spraying synthetics, is to use a higher pressure. Hold the gun farther away from the work to compensate for the higher air pressure, and spray wet coats.

11.6.9 Runs

These are often caused by applying uneven coats, especially on upright surfaces. The parts that receive an excess of material sag and form runs. Material that is too thin is liable to run easily.

Always keep the gun moving steadily and at an even speed across the surface. Be sure that spraying is continued beyond the edges at every stroke, as failure to do this will cause the material to pile up at these places and cause runs and sags.

11.6.10 Splitting

This is usually caused by worn and dried out packing around the needle valve, or dirt on the fluid nozzle. Dried out needle valve packing permits air to get into the fluid passage.

The remedy is to apply a few drops of machine oil on the packing or in aggravated cases to replace it. Also, remove the fluid nozzle, clean it with thinner, and draw it tightly into place again.

11.6.11 Streaks

A streaky finish sometimes shows up when a large surface is sprayed, especially when a round spray nozzle is used. It is caused by not properly overlapping the spray strokes, and results in thick and thin places in the finish. Each stroke should overlap the preceding one by about one-third. In this way an even coating all over the surface is assured.

11.6.12 Wrinkling

This fault is usually the result when too much varnish has been sprayed on. The reason for the wrinkling is that the outside of the varnish absorbs oxygen and dries faster than the inside, and forms a skin over it. As the outside surface oxidizes, it swells slightly as the skin forms, whereas the under part loses some of its bulk by evaporation of the volatile thinners and remains soft. The outside skin soon becomes larger than the soft under part and is drawn up into wrinkles. Oil paint when excessively applied acts in a similar manner.

The remedy therefore is always to spray light coats and to be sure that the preceding coats, if any, are perfectly dry.

11.7 SPRAY PAINTING FOR MARINE WORK

11.7.1 It is rather extraordinary, in the face of the rapid strides towards labor saving operations in all marine work, that the painting of ships is in most cases practically the same operation as it was nearly a hundred years ago. There have been remarkable and considerable improvements in materials, but practically none in the method of applying them. In new marine work the most important painting problem is the efficient application of the priming coat on the bare metal, which must be relied upon to protect the metal against corrosion and to provide a suitable foundation for the subsequent coats of paint.

11.7.2 There are, of course, many types of priming materials, all produced by manufacturers who know what the essential ingredients of such materials are, but unless this material is applied over all the metal and in a sufficiently effective coat, the subsequent materials, however good, may and probably will deteriorate very soon. If the priming coat is properly applied the subsequent coats have a much better chance of performing their work.

11.7.3 There is no better form of application either for the priming coat or for the following coats than spray, as by this means all parts of the surface are thoroughly coated, even places very difficult and indeed impossible of access by brush.

- 11.7.4 Spray painting lends itself more readily to the efficient painting of ships than to any other type of painting. There are few rules to be observed when painting ships by spray, other than the normal procedures already outlined in this SCHEDULE for the proper handling of the gun. All the materials used are eminently suitable for spraying, and it will be found that a ship which has been spray painted throughout will stand up to weather conditions considerably better than one which has been brush painted.
- 11.7.5 It is necessary that the original surface to be coated should be clean and free of any incipient corrosion. In the painting of ships there are, of course, many different sections of the structure which require different treatment from the anti-corrosion point of view, but whatever materials are used the conditions governing spray painting remain the same.
- 11.7.6 Any of the materials can be sprayed, and should be sprayed, when the very large surfaces which have to be covered with several coats are taken into consideration. Unfortunately many thousands of man hours are wasted in the application by hand brushing of anti-corrosion and decorative materials on ships which could be sprayed more efficiently in a fifth of the time, and furthermore, the amount of material and time wasted with the continual filling and emptying of pots, and the dipping and redipping of brushes can be obviated by the use of 2-, 4-, 6-, or even 10-gallon paint containers which operate any number of spray guns that may be required.
- 11.7.7 In all shipbuilding and shiprepairing yards there is ample air available so that even the cost of the installation of special compressors for paint spraying is unnecessary; all that is required is a small pressure conversion unit reducing the air pressure of the main air-line down to the amount necessary for working the spray guns and the flow of paint to them. Even the stirring of paint is obviated by this method as the air pressure keeps the paint in a constant state of movement.
- 11.7.8 After the ships are completed and commissioned there follows a constant need of repainting and touching up, and here again paint spraying comes into the picture.
- 11.7.9 It is possible nowadays to obtain paint spraying units for operation aboard ship. By this method corrosion and deterioration of paint surfaces can be kept to a minimum.
- 11.7.10 When the time comes for dry-docking and overhaul, once again paint spraying machines come into operation. Below-water surfaces, after cleaning, can be rapidly and efficiently spray painted, saving both time and material. Holds, bunkers and other compartments which are only accessible when in dry dock can be painted with one or more coats in a fraction of the time that brush painting would take. This is an important item as the time a ship spends in dry dock is usually expensive and the sooner repairs and painting can be completed and the ship undocked the better.
- 11.7.11 Most of the materials used for ship maintenance can easily be sprayed. It is merely a question for the dockyard to inform the spray manufacturer of the type of material being used and an efficient outfit suitable for any material can then be supplied.

11.8 SUMMARY

In order to obtain the best results from spraying, the following recommendations are to be observed:

- 11.8.1 Be sure that the surface to be sprayed is perfectly clean and in proper condition for coating; otherwise wet spots, crawling and poor adhesion will result.
- 11.8.2 Always spray at right angles to the surface. Failure to do this will cause uneven spraying, ripples and runs.
- 11.8.3 Maintain an even movement or rate of speed across the work, carrying each stroke all the way across and for a short distance beyond the edge, before returning on the next stroke.
- 11.8.4 Keep the movement of the gun parallel to the surface. Any appreciable variation of the distance at which the gun is held from the work will result in uneven coating and patchiness.
- 11.8.5 Use only enough air pressure to atomize properly the material being sprayed. Too little air pressure, as well as too much, will cause defects such as orange-peel and roughness.
- 11.8.6 Overlap all strokes. Each stroke should overlap the preceding one at least one-third to form an evenly coated surface. If this is not done, thick and thin places and a streaky finish will result.
- 11.8.7 Open the drain cock on the air transformer at frequent intervals to allow trapped oil and water to escape. Failure to do this allows the trapped foreign matter to accumulate and eventually find its way to the gun from which it will be deposited on the work during the spraying operation. The filter pads in the transformer should be examined periodically to see whether they are clogged up and in need of replacing with clean ones.

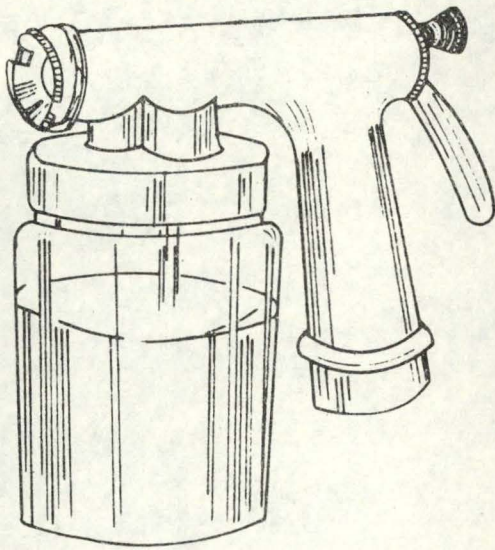


Figure 1
A simple type of suction
feed spray gun.

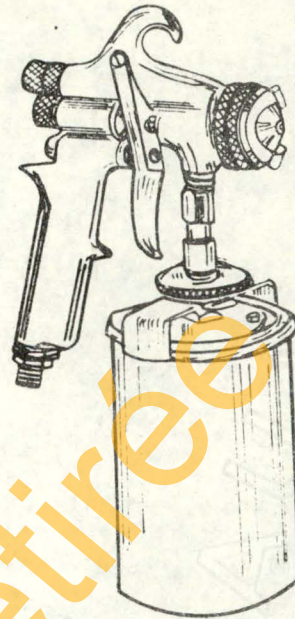


Figure 2
A modern type of suction
feed spray gun.

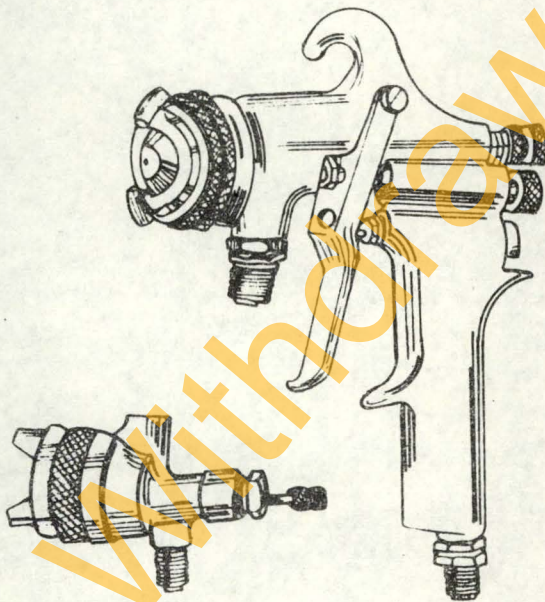


Figure 3
Spray gun showing removable spray
head for quick changeover of
materials.

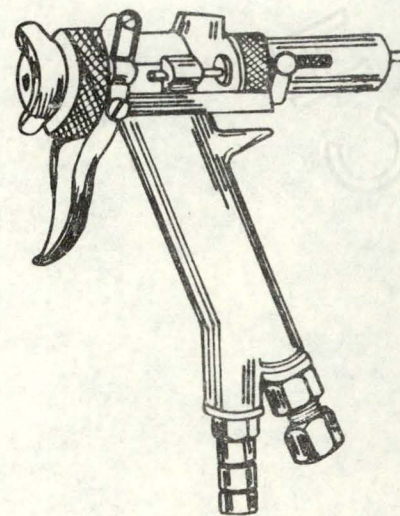


Figure 4
"Air Volume" low pressure
spray gun, suitable for
gravity cup or pressure
material tank feed.

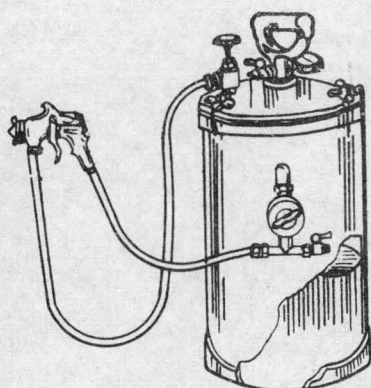


Figure 5
General arrangement for pressure material tank feed. Note regulating valve to control head pressure on paint.

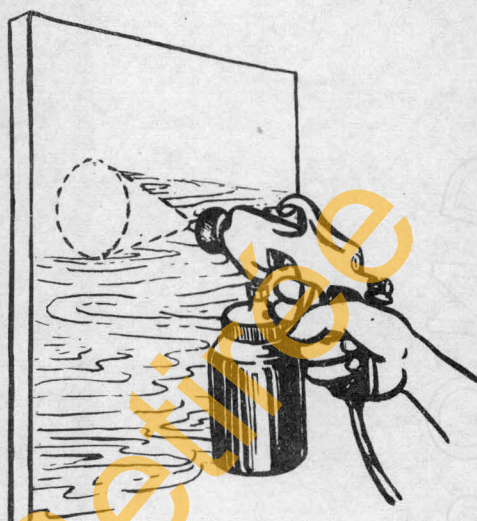


Figure 6
Spray gun must be held at right angles to work and at same distance throughout each stroke.

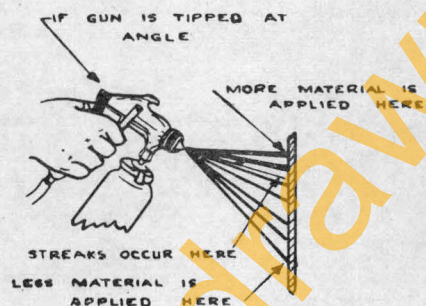


Figure 7
Illustrating faulty or oblique spraying.

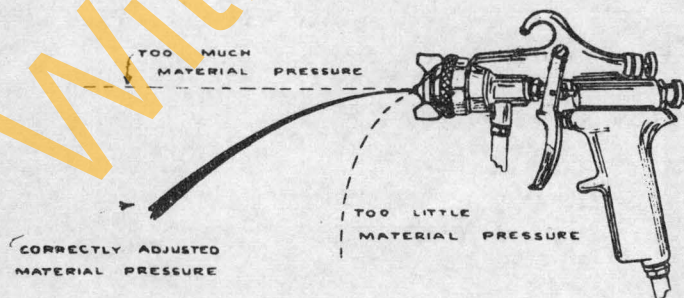


Figure 8
Showing method of gauging correct head pressure on pressure material tank.

CHAPTER 12

INSPECTION PROCEDURE FOR PAINTS12.1 GENERAL

In accordance with the policy of reducing the fire and smoke hazard and the weight of applied paints in H.M.C. Ships, special attention shall be given to the type, quality and quantity of paint used.

12.2 INSTRUCTIONS

The instructions contained in this SCHEDULE shall be strictly adhered to when ordering paint for, and applying paint in H.M.C. Ships, building and in commission.

12.3 This SCHEDULE revises Naval General Order F3 as follows:

- Section 1 - Underwater Protection and Docking. (Revised effective October 1949)
- Section 2 - External and Camouflage Painting. (Cancelled)
- Section 3 - Interior Structures, Tanks, etc. (Cancelled)
- Section 4 - Deck Paints and Coverings. (Cancelled)
- Section 5 - Approved Suppliers and Inspection Procedure. (Cancelled)

12.4 FIRE RETARDANCY, GLOSS AND DURABILITY

- 12.4.1 To decrease the fire hazard, synthetic resin-based paints have been introduced. These, when properly formulated to the approved specifications, are less flammable when applied in thin coats as directed than the previously used oil-based paints. They are considered to be more durable and more resistant to washing than the older paints and also dry more quickly. They may therefore be applied in thinner coats.
- 12.4.2 This is important in that to ensure fire retardancy (that is, the ability to prevent the spread of fire) and to decrease weight, thin coats must be applied. Except for areas of severe corrosive attack, only two coats overall of paint are to be used in H.M.C. Ships. To ensure thin coats, it is better to apply all paint by spray.
- 12.4.3 Standards of gloss have been drawn up for exterior and interior paints. Too high a gloss is not permitted on exterior surfaces during wartime because of high reflection, but some gloss is desirable to ensure durability to weathering and chalking. In interior areas high gloss paints, such as enamels, are not permitted as they decrease fire retardancy and may cause eye strain.
- 12.4.4 Fire retardancy is derived from the proper use of certain materials and to a large extent by using a high percentage of inert pigment in the paint. High pigmentation is not compatible with high gloss, so that the present paints are a compromise between these two factors. Matte (flat) paints may be excellent for fire retardancy (e.g., flat water paints) but their poor resistance to weathering, washing and staining, etc., does not permit their use in ships.
- 12.4.5 Paints considered to be of sufficient durability for marine use are all flammable while wet, since they contain flammable solvents. Even though the flash point of these solvents is maintained relatively high (85°F), due precautions are to be taken during storage and application of such paints.

12.5 PAINT SPECIFICATIONS

- 12.5.1 Table VI, page 72, lists the specifications for the types of paint approved for use in H.M.C. Ships in accordance with this SCHEDULE.
- 12.5.2 The list in Table VI will be amplified and amended as found necessary.

12.6 INSPECTION OF PAINT

- 12.6.1 To maintain quality, inspection of all paint to be used in H.M.C. Ships has been in force since April, 1944.
- 12.6.2 Such inspection has been carried out by officers of the Department of National Defence, Inspection Services, at the source of supply. Inspectors, in the presence of suppliers' representatives, sample paint intended for use in the R.C.N. (and which must have been ordered to one of the above specifications) at the time the paint is being run into the containers. The batch of paint so sampled is then bonded; that is, each container is sealed with a stamp in a suitable manner, or the containers are placed in a sealed room accessible only to the Inspector. The sample is then passed to the Testing Laboratory where it is checked for compliance with the relevant specification. If the sample is satisfactory, the batch is immediately accepted and released from bond, each container stamped with the appropriate approval marking, and the material shipped for use. If not completely satisfactory, the test results are considered by the Naval Constructor-in-Chief and may be accepted for use with certain provisions, or rejected.
- 12.6.3 It is anticipated that this inspection will remain in force although minor changes as to location of the Testing Laboratory and procedure may occur. All authorities concerned will be informed of any changes in policy.
- 12.6.4 All authorities are to ensure that no paint is used in H.M.C. Ships other than that stamped approved under inspection. Any effort to supply other than tested paint indicates that the supplier does not consider his paint will meet requirements and therefore is not as protective or fire retardant as demanded.
- 12.6.5 The inspection markings or stamps are shown in the diagrams on pages 75 to 78. General instructions regarding their meaning and use are given on page 74.
- 12.6.6 It is expected that many paint suppliers will build up stocks of tested and approved paints to these specifications once they realize this policy is to remain in force, and so small orders may be filled immediately upon request.
- 12.6.7 In certain cases where paint is urgently needed and time for testing not available, arrangements can be made through Naval Service Headquarters or the Inspection Authority to release immediately the necessary quantity to the purchaser on the guarantee of the supplier that the material meets the relevant specification. In the past many such batches of "guaranteed" paint have not met specifications, and this procedure is therefore not a desired practice and is to be used only in emergency.

12.7 NOTES

- 12.7.1 Necessary supplies of tested and approved paints to the above specifications should be built up at all H.M.C. Dockyards. Paint should be stored under suitable conditions of temperature and for not longer than one year, but preferably shorter periods.
- 12.7.2 It is advantageous for all paints to be mixed by mechanical stirrers which will stir ready-mixed paints before use. All paint should be stirred prior to issue.
- 12.7.3 Paints to the above specifications are in the ready-to-use condition and should not be adulterated or diluted with oil or solvents unless so directed by the supplier, and then in strict accordance with his recommendation.
- 12.7.4 In peace-time, when inspection facilities are curtailed, the requirements of Section 12.6 above may be relaxed in favor of more rapid sampling and delivery, provided a careful check is maintained by the Inspecting Authorities.

TABLE VI

LIST OF SPECIFICATION REFERENCES

<u>Specification Number</u>	<u>Title</u>	<u>Page Number</u>
CSA-W 48	Iron and Steel Arc-Welding Electrodes	5
C.228	Compound, Fire, Water and Rot Resistant, for Tentage, Canvas, etc.	22,39,40
C.229	Duck, Cotton, White or Colored: Fire, Water and Rot Resistant	22,40
NCC.103	Application of Aluminum in the Construction of H.M.C. Ships	4,8,9
N.118	Marine Anti-Condensation Coating, Fire Retardant	20,28,31
N.119	Marine Deck Covering, Non-Skid	18,20,22,24,30,40,42,45,51,52,53
N.273	Internal Coating for Fresh Water Storage Tanks	19,28,44
N.279	Bituminous Primer and Bituminous Enamel	19
1-GP-9	White Lead - Basic Carbonate, Paste in Oil	39
1-GP-12a	Schedule of Standard Paint Colors	21 et seq.
1-GP-23	Plastic Caulking Compound	41
1-GP-40	Priming Paint for Steel; Zinc Chromate - Iron Oxide Type	7,8,9,18,19
1-GP-46	Primer; Zinc Chromate - Semi-Paste with Thinner for Light Alloys	8
1-GP-48*	Paint; Marine, Priming, Fire Retardant Type A, Iron Oxide Primer - anywhere in ship except outer bottom as primer, and certain areas in interior. See Chapter 3 of this Schedule. Type B, Red Lead Primer - for exterior use except on underwater bottom. For interior use except in living quarters. See Chapters 1, 2 and 3 of this Schedule. Type C, Primer not Necessarily Containing Iron Oxide or Red Lead - for use on wood only.	3,4,6,7,13,16,18-23,33,34,37,39-41
1-GP-52*	Paint; Marine, Interior, Fire Retardant	19,20,23-25,3133-38,41,42,46
1-GP-61*	Paint; Marine, Exterior, Fire Retardant	4,17,18,21-2333,39-41
* 1-GP-48 supersedes NCC.104: Marine Priming Paint, Fire Retardant		
1-GP-52 supersedes NCC.105: Marine Interior Finish Paint, Fire Retardant		
1-GP-61 supersedes NCC.106: Marine Finish Paint, Exterior, Fire Retardant		

TABLE VI (contd.)

<u>Specification Number</u>	<u>Title</u>	<u>Page Number</u>
1-GP-69	Aluminum Paint	18,19,30,45
1-GP-76	Enamel - Heat-resisting	13,34-37
1-GP-77	Paint Remover; Non-Flammable, Solvent Type	11
1-GP-80	Paint; Acid and Alkali Resisting, Black	25,30,42,45,53
1-GP-83	Sealer, for Wood	18,22,39,40,41
2-GP-21	Synthetic Detergent Bar for Use in Sea Water and Hard Water	2
2-GP-22	Synthetic Detergent, Flake and Powder Form, for use in Soft, Hard and Sea Water	2
3-GP-700	Compound; Rust Preventive, Exterior	41
25-GP-10	Polish; Furniture, Liquid	23,41

GENERAL INSTRUCTIONSREASONS FOR MARKING

1. To indicate that the store, or equipment, or assembly, complies with the designated drawings and specifications or control samples set forth.
2. To prevent inferior and even dangerous material from getting into service.
3. To inspire confidence of quality.
4. To indicate by primary and intermediate marks "step-by-step" inspection when material passes from one inspector to another, and to help to ensure that no step in the sequence has been omitted.
5. To prevent substitution of sub-standard stores particularly when packaging and shipment is not under supervision of Inspection Services.

WHEN MARKS ARE TO BE USED

1. It is the prerogative of the design Directorate or the requisitioning authority to call for marking. Otherwise, there is no onus on Inspection Services to mark any store.
2. Marking with primary or intermediate marks is at the discretion of Inspection Services to ensure properly controlled inspection.
3. Final marks are more necessary when there is no serial or registered number to connect the store or equipment or assembly with the advice and inspection note, or when packaging and shipment are not under supervision of Inspection Services.

RESPONSIBILITY FOR MARKING

1. It is intended that stamps will be issued to supervisory personnel on the recommendation of Division Heads. Final marks, and in some cases primary and intermediate marks, will bear a serial number to connect them with a specific employee during his term of employment. The supervisory employee may allow the marks to be applied by staff under his supervision, but it is to be distinctly understood that he must answer for the significance of their application.
2. The delegated inspection mark will be applied by inspection authorities holding a formal approval from Inspection Services. The serial number on this mark will correspond to the serial number on the formal approval.

HOW MARKING IS TO BE DONE

1. Marking must be carried out as called for on drawings and specifications.
2. If it is decided by Inspection Services that further marking is desirable or expedient, such marking must be carried out in such a way as not to interfere with the serviceability of the part, e.g., marking should not be done on working surfaces, nor in places that would tend to weaken the material and induce failure through starting incipient cracks, nor should marking interfere with the protection of surface finishes, etc.
3. Marks may be
 - (a) etched or engraved
 - (b) applied with steel or rubber stamps
 - (c) stencilled with paint or ink
 - (d) applied as a decalcomania transfer
 - (e) embossed on a lead seal
 - (f) applied in any other way found practicable

SOURCE OF SUPPLIES

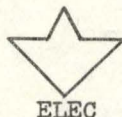
1. Applications for stamps or marking equipment should be made to the Inspector of Gauges; arrangements can be made also for the design of further primary and intermediate marks should they be required.
2. The Inspector of Gauges will keep a registry covering assignment of numbers to identify custodians of marks.

ORDER OF PRECEDENCE

1. Any final mark has precedence over any primary or intermediate mark.
2. The final "Reject" mark, "R", has precedence over all marks.

PRIMARY AND INTERMEDIATE MARKS

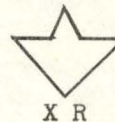
NUMBER 1



ELEC

This mark indicates that the store or equipment has been subjected to the required electrical tests, under control of Inspection Services, and has been found to comply with specifications.

NUMBER 5



X R

This mark indicates that the store or equipment has been subjected to the required X-ray tests, under control of Inspection Services, and has been found to comply with specifications.

NUMBER 2



CHEM

This mark indicates that the store or equipment has been subjected to the required chemical tests, under control of Inspection Services, and has been found to comply with specifications.

NUMBER 6



SS

This mark indicates that the store or equipment has been subjected to the required super-sonic wave tests, under control of Inspection Services, and has been found to comply with specifications.

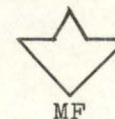
NUMBER 3



PHYS

This mark indicates that the store or equipment has been subjected to the required physical tests, under control of Inspection Services, and has been found to comply with specifications.

NUMBER 7



MF

This mark indicates that the store or equipment has been subjected to the required magna-flux tests, under control of Inspection Services, and has been found to comply with specifications.

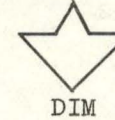
NUMBER 4



Ø R

This mark indicates that the store or equipment has been subjected to the required gamma-ray tests, under control of Inspection Services, and has been found to comply with specifications.

NUMBER 8

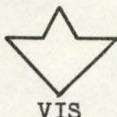


DIM

This mark indicates that the store or equipment has been subjected to the required dimensional examination, under control of Inspection Services, and has been found to comply with specifications.

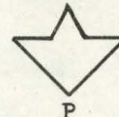
PRIMARY AND INTERMEDIATE MARKS (contd.)

NUMBER 9



This mark indicates that the store or equipment has been subjected to the required visual examination, under control of Inspection Services, and has been found to comply with specifications.

NUMBER 13



This mark indicates that the equipment has been subjected to proof and that after-proof examination has revealed it to be in accordance with specifications.

NUMBER 10



This mark indicates that the store or equipment has been subjected to the required special tests, under control of Inspection Services, and has been found to comply with specifications.

NUMBER 14



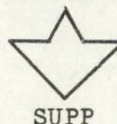
This mark indicates that the store or equipment has been subjected to the required pressure tests, under control of Inspection Services, and has been found to comply with specifications.

NUMBER 11



This mark indicates that no drawings or specifications have been designated to govern inspection. The store or equipment has been subjected to functional tests considered applicable and desirable by Inspection Services.

NUMBER 15



This mark indicates that the store or equipment has been subjected to the required suppression tests, under control of Inspection Services, and has been found to comply with specifications.

NUMBER 12



This mark indicates that the store or equipment has been subjected to the required tests, under the control of Inspection Services. It has been found to depart from plan but such departure has been approved by the design authority.

NUMBER 16

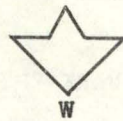


month year

This mark indicates that the equipment was re-inspected in the month and year shown, and that a report is on file at Inspection Services Headquarters, Ottawa.

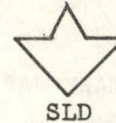
PRIMARY AND INTERMEDIATE MARKS (contd.)

NUMBER 17



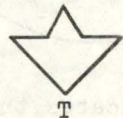
This mark indicates that, under Inspection Services observation, the store or material has been solution treated and needs artificial ageing. (Precipitation treatment)

NUMBER 21



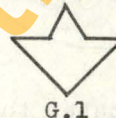
This mark (for sealing purposes) indicates that the stores contained under the seal have been inspected and sealed by Inspection Services and that the results of inspection are indicated in the relevant documents.

NUMBER 18



This mark indicates that, under Inspection Services observation, the store or material has been solution treated and does not require artificial ageing. (Precipitation treatment)

NUMBER 22



Day Month Year
Signature

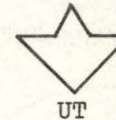
This mark indicates that drawings, specifications or samples so marked currently are considered suitable to govern inspection.

NUMBER 19



This mark indicates that, under Inspection Services observation, the store or material has been solution treated and artificially aged. (Precipitation treatment)

NUMBER 23



This mark indicates that samples have been removed for tests. No further work is to be done until results of the tests have been received.

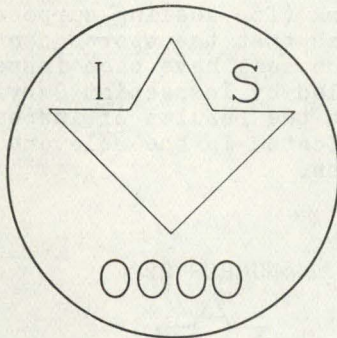
NUMBER 20



This mark indicates that, under Inspection Services observation the store or material has been annealed as called for on drawings and specifications.

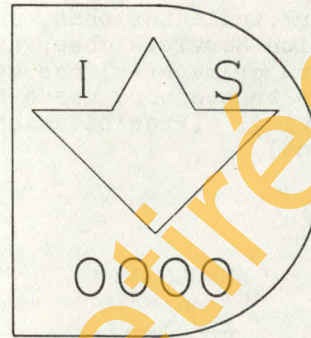
F I N A L M A R K S

FINAL MARK "A"



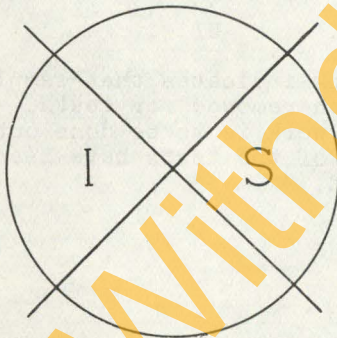
This mark indicates that the store or equipment or assembly has been inspected by Inspection Services and found to conform to all essential requirements of the designated drawings, control samples and specifications.

FINAL MARK "D"



This mark indicates that the store or equipment or assembly has been inspected by an Inspection Authority approved by Inspection Services and found to conform to all essential requirements of the designated drawings and specifications.

FINAL MARK "R"



This mark indicates that the store or equipment or assembly has been inspected by Inspection Services and found to depart from essential requirements of the designated drawings, control samples and specifications to the extent that rectification is not considered feasible.

NOTE - Marks on pages 75-78 are taken from Drawing No. IB(Z)49, Inspection Services, Department of National Defence.