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MILITARY SPECIFICATION

DECALCOMANIAS, PROCESS FOR APPLICATION OF

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope - This specification provides instructions for the application of decalcomanias for use on interior and exterior surfaces of military equipment.

2. APPLICABLE DOCUMENTS

2.1 The following specifications and publications, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Federal

TT-N-95	Naptha, Aliphatic
TT-X-916	Xylene (For Use in Organic Coatings)
UU-T-106	Tape, Pressure-Sensitive Adhesive, Masking, Paper

Military

MIL-V-6894	Varnish, Oil Type, Gloss Finish, Glyceryl Phthalate Base
MIL-D-8634	Decal, Elastomeric Pigmented Film, for Use on Exterior Surfaces
MIL-D-8635	Decals, for Use on Interior Surfaces
MIL-F-8799	Film, Elastomeric, Pigmented, for Use in the Manufacture of Aircraft Decalcomanias

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Military (Cont'd)

MIL-L-19537	Lacquer, Acrylic-Nitrocellulose, Gloss (for Aircraft Use)
MIL-T-19544	Thinner, Acrylic-Nitrocellulose Lacquer
MIL-C-22543	Cleaning Compound, Water-Emulsion
MIL-F-22735	Film, Elastomeric, Fluorescent, for Weapons Systems
MIL-C-22750	Coating, Epoxy-Polyamide, Chemical and Solvent Resistant for Weapons Systems
MIL-C-25769	Cleaning Compound, Aircraft Surface, Alkaline Waterbase

PUBLICATIONS

NAVWEPS CHART 07-1-503	Materials used on Naval Aircraft in Stripping, Cleaning, Brightening, and Polishing Operations
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(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. SURFACE CLEANING

3.1 Surface cleaning - The receiving surfaces for all decals must be thoroughly cleaned to remove all traces of dirt, dust, lint, greases, and oils.

3.1.1 Materials - The cleaning material used prior to the application of any type decal to exterior or interior surfaces, whether painted or unpainted or of plastic should be a mild solvent such as aliphatic naphtha, TT-N-95, or a detergent solution.

CAUTION: When using solvents other than aliphatic naphtha, be sure they will not damage the surface to be cleaned.

3.1.2 Method - When a detergent is used, a clean cloth shall be soaked in the detergent and the surface shall be thoroughly washed and flushed with clear water. Surfaces shall be wiped dry with a clean cloth. When aliphatic naphtha is used, a clean cloth shall be dampened, not soaked, with the solvent and the surface wiped thoroughly. The surfaces shall be wiped dry with a clean cloth before evaporation occurs and then flushed with clean water and again wiped dry.

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3.1.2.1 Epoxy surfaces - Weathered or aged epoxy surfaces may require a light sanding prior to application of decals in order to insure proper adhesion. As an alternate method, the surface may be mist coated with epoxy-polyamide coating, MIL-C-22750, and air dried for four hours before application of the decal.

4. AREAS OF APPLICATION OF DECALS

4.1 Exterior - Detailed requirements are covered for exterior type decals and film in MIL-D-8634 and MIL-F-8799.

4.1.1 Solvent-activated type - The solvent-activated type decal is a tough durable plastic film which is highly resistant to weather, corrosion, and fuel. It is a non-reflective decal intended for use on painted and unpainted exterior surfaces, both fabric and metal. It should be used for areas on weapons systems which are subjected to hard usage.

4.1.2 Pressure-sensitive type - The pressure-sensitive type decal is a durable plastic based film, highly resistant to weathering, corrosion, and weapons systems fuels, which can be applied to clean painted and unpainted exterior surfaces, both fabric and metal.

4.1.2.1 Fluorescent - Fluorescent pressure-sensitive decals should be used chiefly for daytime safety markings on conventional weapons systems. Detailed requirements for fluorescent film are covered in MIL-F-22735.

4.1.2.2 Non-fluorescent - Non-fluorescent pressure-sensitive decals should be applied to weapons systems exterior surfaces that will not be subjected to extreme temperature changes, excessive abrasion, or enormous pressures.

4.2 Interior - Detailed requirements are covered for interior type decals and film in MIL-D-8635 and MIL-F-8799.

4.2.1 Water-applied type - Water-applied decals may be used on interior surfaces, painted or unpainted. The decals should be used on surfaces not subject to scratching, abrasion, or other adverse condition causing lifting and peeling. Whenever water-applied decals are used, a bead of varnish conforming to MIL-V-6894 should be brushed at the faying surface to at least a distance of 1/4 inch over both the decal and the substrate, to prevent edge lifting.

4.2.2 Varnish-applied type - Varnish-applied decals may be used on painted or unpainted interior surfaces where heavy usage or high humidity may be expected. Whenever varnish-applied decals are used, a thin coating of a rapid drying varnish conforming to MIL-V-6894 properly thinned shall be applied over the decal.

4.2.3 Solvent-applied type - Solvent-applied decals shall be used only over lacquered surfaces.

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4.2.4 Solvent-activated type - Solvent-activated decals should be used when the decals are to be subjected to hard usage, particularly abrasion, and where retention of legibility of the legend on the decal is considered of prime importance.

4.2.5 Pressure-sensitive type - Pressure-sensitive decals may be used on any interior surface, painted or unpainted.

5. APPLICATION PROCEDURES FOR DECALCOMANIAS

5.1 Exterior surface - Application procedures for exterior surface mounting shall be utilized in accordance with the type of decal used and the size of the decal to be mounted.

5.1.1 Solvent-activated - Decals used shall be in accordance with MIL-D-8634 and MIL-F-8799. The adhesive shall be activated with a solvent type activator such as cyclohexanone or a solvent recommended or supplied by the manufacturer.

5.1.1.1 Pre-masked decals - Decals may be supplied with application tape already applied to face and cut to exact shape. No preliminary preparations shall be necessary for these pre-masked decals before activation.

5.1.1.2 Preparation of large decals before activation - The large decals which are normally supplied in sections shall be applied by first mounting sections of decals (insignia, letters, or numbers) on an application tape similar to SCMP-3, manufactured by the Minnesota Mining and Manufacturing Company or its equivalent. A piece of application tape shall be cut 2 inches wider and longer than the decal being applied. This tape shall be applied to the painted face of the decal since its translucency will permit visual location of the decal. Letters and numerals may be mounted in groups to maintain uniformity of spacing and alignment. The application tape shall be placed, adhesive side up, on a smooth, hard surface. One corner of the decal film shall be separated from its liner by drawing a piece of coarse sand or emery paper (60-100) grit down over the face side edge of the decal. The loosened paper shall be creased to aid in easy removal of the liner in subsequent application. The decal shall be placed face side down, on the application tape. Starting at the center, the decal shall be wiped firmly to the application tape using overlapping strokes with a plastic squeegee.

5.1.1.3 Activation of adhesive - A felt squeegee shall be placed in a tote pan or equivalent container of cyclohexanone or activator supplied by the manufacturer. The activator shall be allowed to wick up the felt squeegee. The excess activator shall be blotted into a clean white cloth or absorbent paper to avoid over-activation. The squeegee shall be passed across the adhesive, using parallel over-lapping strokes, applying evenly to avoid puckering of the decal. The activator shall be applied 1/2 inch beyond the edges of the adhesive to insure complete coverage. One pass over the surface should be sufficient to activate the adhesive.

5.1.1.4 Application instructions - Sections of decals should always be applied in such a sequence that overlap is away from the slip-stream. The decal shall be held temporarily in position on the receiving

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surface with small pieces of masking tape conforming to UU-T-106, Type I. Using a continuous piece of 2-inch masking tape (UU-T-106, Type I) one edge of the decal shall be secured to the receiving surface. This will form a hinge to insure proper relocation after activation. The edge to be taped will depend upon the contour of the surface. The small temporary pieces of tape shall be removed, and the decal folded back 180 degrees against the hinge. The paper liner shall be removed, beginning at the loosened corner. The adhesive shall be activated in accordance with 5.1.1.3. The decal shall be folded down, and great care must be taken to hold it slightly away from the receiving surface to prevent premature adhesive contact. Starting at the center of the tape hinge, the decal shall be wiped out to each edge with firm, overlapping strokes of a plastic applicator. All edges shall be re-wiped to insure good adhesion. Any loose edges should be reactivated and pressed down firmly. The application tape shall be removed from the decal face, carefully starting at one edge and pulling back parallel to the receiving surface. Any blisters caused by the entrapment of air should be pricked with a pin or sharp pointed instrument and the air worked out with a finger or a plastic applicator.

5.1.1.5 Loose edges - Where loose edges occur, the decal shall be peeled back to the point of good adhesion and the area shall be reactivated and again rubbed down.

5.1.1.6 Post mounting procedures - The carrier tape shall be carefully removed by starting at one edge of the decal and peeling it back parallel to the receiving surface to prevent loosening of the decal. After removal of the carrier tape, any excess contamination may be removed with aliphatic naphtha conforming to TT-N-95.

5.1.1.6.1 Entrapped air blisters - The decal area shall be checked for bubbles or entrapped air. Bubbles may be removed by pricking with a sharp pointed instrument along one edge and then forcing the entrapped air through the hole with the finger or the plastic applicator.

5.1.1.7 Medium size decal application - A 4-inch strip of paper liner shall be removed from one edge of the decal. The decal shall be placed on absorbent paper, adhesive side up, and the exposed adhesive activated. The decal should be positioned on the receiving surface with the activated portion held away from the surface until it is wiped down. Using the applied section as a hinge, the decal shall be folded back on to a piece of absorbent paper or cardboard. All paper liner, except a 1-inch portion, shall be removed and the adhesive activated and applied. Finally the remaining 1-inch portion of paper liner shall be removed and the adhesive activated and applied.

5.1.1.8 Small decals - The carrier sheet shall be removed and the decal placed face down on absorbent paper or cardboard. A felt pad or squeegee shall be moistened (not soaked) with cyclohexanone or with the activator furnished by the manufacturer. The adhesive shall then be lightly wiped to make it tacky, not wet, beyond all edges. The decal shall be set carefully in place on the surface and rolled down. Once centered, the film shall not be removed.

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5.1.1.9 Pressurized areas - When application is made over a pressurized area, the film shall be ventilated over each rivet with a pin or sharp instrument to prevent blistering from internal leakage.

5.1.2 Pressure-sensitive type - Decals used shall be in accordance with MIL-D-8634 and MIL-F-8799.

5.1.2.1 Temperature - Pressure-sensitive decalcomanias should be applied without adhesive activation at temperatures above 60° F (15.6° C). If necessary to make application at temperatures below 60° F, the adhesive shall be activated with isopropyl alcohol or other appropriate solvent recommended by the manufacturer using a felt wick as described in 5.1.1.3. Any moisture from condensation shall be removed with aliphatic naphtha conforming to TT-N-95.

5.1.2.2 Pre-masked decals - Carrier tape application will not be required when pre-masked decalcomanias are used or when decal is 1 square foot or less, except when spacing of letters (such as the word NAVY) is required for uniformity.

5.1.2.3 Mounting of large decals - The decal shall be set in place, and removal of the paper backing started. The decal shall be prepared in accordance with 5.1.1.2. Application shall be completed by grasping the carrier tape at the opposite side of the hinge and removing the liner. The decal shall be hinged back and pressed to the receiving surface with overlapping firm strokes of a rubber roller. The edges shall be re-rolled to insure good adhesion. Where a metal break is encountered the decal shall be cut at the metal break and pressed firmly into the break with the sharp end of the squeegee.

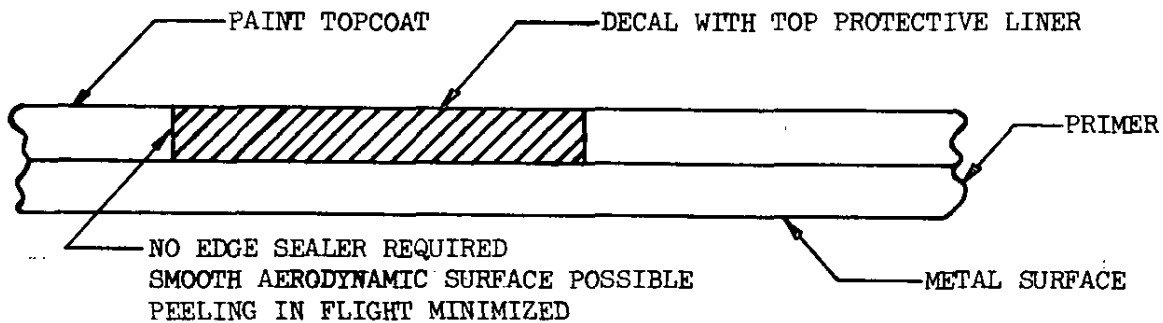
5.1.2.4 Small decals up to 1 foot square - The complete carrier sheet shall be removed from the adhesive, and the decal aligned to the receiving surface using the finger to secure one edge. The remainder of the unapplied decal shall be pressed to the receiving surface with a rubber roller using firm, overlapping strokes. When the decal is applied to the primer undercoat, the top liner shall not be removed until all painting is completed. This top liner maintains the spacing of letters and numbers.

5.1.2.5 Medium decals up to 18 inches by 30 inches - The decal shall be taped into position with small pieces of masking tape conforming to UU-T-106, Type I. Tape 1 inch wide shall be applied over one edge to serve as a hinge. The narrow edge should be taped where possible. The decal shall be folded back over the tape hinge and the liner removed. The decal shall be hinged back and pressed firmly to the receiving surface using overlapping strokes with a rubber roller. The edges shall be firmly rolled again.

5.1.2.6 Application of stripes or striping - The backing paper shall be pulled off for approximately one foot to expose the adhesive, and the adhesive shall be applied as the backing is removed. A rubber roller shall be used to press the striping firmly to the receiving surface making certain that all edges have adhered to the surface.

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5.1.2.7 Edge sealing - Where the leading edge of a decal is in a critical area such as on the leading edge of wings, vertical stabilizer, or nose of a weapons system, an edge sealer shall be used to protect the decal. In general, edge sealers may be used for any area which is subjected to severe stress, heavy washing or cleaning procedures. Two coats of lacquer conforming to MIL-L-19537 or an equivalent edge sealer recommended by the manufacturer shall be applied to the edges by brush. For areas subject to lubricating and hydraulic fluids the use of acrylic lacquer conforming to MIL-L-19537 is recommended. Drying time between coats shall be approximately 1 hour. When a pre-masked decal is applied to a primer undercoat, application tape shall be left intact until the topcoat is applied. In this case no edge sealer is necessary. See diagram below:



5.1.2.8 Lacquer coating - When improved resistance to weapons system fluids is desired, a stencil is recommended.

5.2 Interior surfaces - The type of decal to be used shall determine the application procedure used for all interior surface decal mounting. Detailed requirements for interior decals are covered in MIL-D-8635.

5.2.1 Water-applied - The entire decal shall be immersed in water for a period of 20 to 30 seconds. Whenever the decal is of face-up construction, the loosened image shall be slid from the paper backing and the image positioned. When the decal is of face-down construction the image and paper backing shall be positioned, and rolled or firmly pressed down. The paper shall be soaked thoroughly and the paper backing slid from the image. Where small entrapped air bubbles are present in the form of blisters, each blister shall be punctured with a pin or needle and pressed flat. The mounted decal shall be sponged thoroughly with water to remove excess glue which may remain from the transfer paper. The decal shall be allowed to dry thoroughly.

5.2.2 Varnish-applied - Decals shall be applied by brushing one coat of varnish conforming to MIL-V-6894 properly thinned on the adhesion surface of the decal. The varnish shall be allowed to dry until it becomes sufficiently tacky to allow the decal to adhere to the fingertips. When this condition is reached the decal shall be dipped in water to which a wetting agent has been added and the decal shall be applied and rolled smooth. The paper backing shall be removed by soaking with water applied by sponge or cloth, and the face of the decalomania shall be washed with water and rolled again.

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5.2.3 Solvent-applied - An outline of the decal should be traced on the surface to avoid smearing surrounding area during application. The decal shall be immersed in a tote pan or equivalent vessel containing diacetone alcohol (diluted to 20 percent by volume with water) or a solvent recommended by the manufacturer. After 5 to 10 seconds it shall be removed and placed on the receiving surface and carefully and firmly pressed in place. The mounted decal shall be sponged thoroughly to remove any remaining solvent.

5.2.4 Solvent-activated - The carrier sheet shall be removed, and the decal placed face down on absorbent paper or cardboard. A squeegee or felt pad shall be moistened with cyclohexanone or a solvent recommended by the manufacturer. The adhesive surface shall be lightly wiped to make it tacky, not wet. Wetting or soaking the adhesive surface shall be avoided. The decal shall be set carefully in place and rolled down. Once the decal has come in contact with the receiving surface, no attempt shall be made to relocate the decal.

5.2.5 Pressure-sensitive - The carrier sheet shall be removed. The decal shall be set carefully in place and rolled down, making two passes over the decal with the roller. Once in place, the decal shall not be removed. Use of a top liner to maintain spacing is very essential. This pressure-sensitive adhesive material is applied to the painted face of the decals prior to removing the backing paper. It is transparent and allows visual location of the decal.

5.3 Special applications -

5.3.1 Application over doped fabric - Caution: The following recommended procedure should be tested on a small scale before application of decals. Adhesion should be checked forty-eight hours after application. Mask off area surrounding location selected for decal. Spray with cyclohexanone or other suitable solvent to make the surface tacky. Apply pressure-sensitive decal.

5.3.2 Retroreflective material - Apply as specified for decals, then edgeseal and overcoat as specified by the manufacturer.

6. APPARATUS

6.1 Cart - A small roll-away type cart with smooth metal top covered with kraft-type paper and having two or more drawers with a lifting top to carry decalcomanias may be used for the application of large exterior decalcomanias. These carts may be manufactured locally as required. See Figure 1.

6.2 Sandpaper - A 60- or 100-grit sandpaper cut in pieces 1 by 3 inches may be used for removal of backing from the vinyl decalcomania film stock material.

6.3 Tote pan - A tote pan, 4 by 8 by 3 inches deep, or equivalent may be used as a container for the activator solution.

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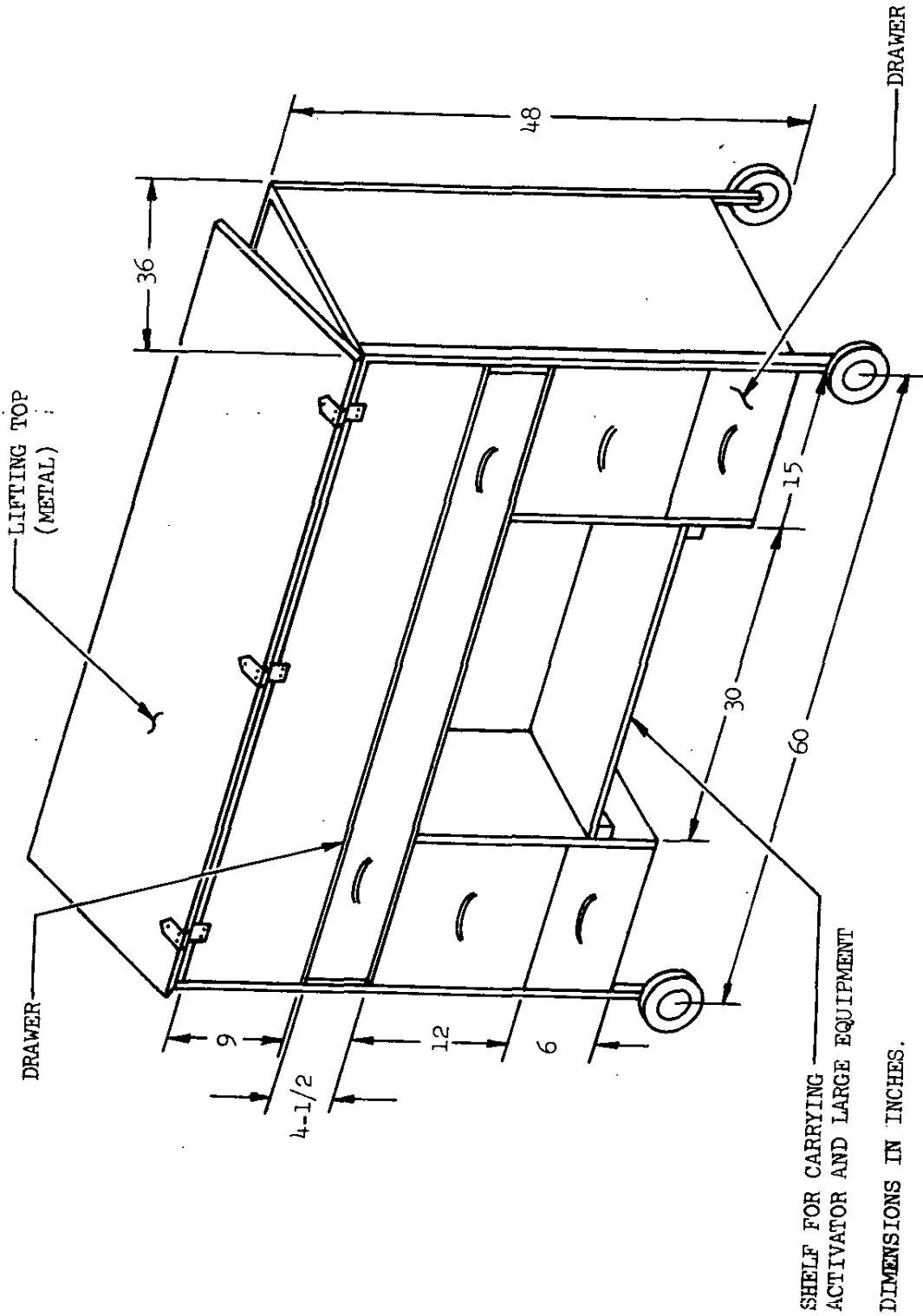


Figure 1. ROLL-AWAY TYPE CART

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6.4 Squeegee - A 6-inch felt squeegee (firm grade) can be used to retain the activator. A 3-inch wood block with a felt squeegee attached can also be used.

6.5 Plastic applicator - A polyethylene applicator may be used for wiping the decalomania firmly on the receiving surface.

6.6 Masking tape - 1 inch or 2 inch - Masking tape shall be used to secure large exterior decals to the receiving area during application.

6.7 Black china marking pencil - A china marking pencil may be used for applying register marks or tracing of decal on the receiving surface prior to application. Grease type pencils shall never be used.

6.8 Pin point tool - A pin point tool, such as a straight pin, safety pin, or hypodermic needle shall be used to puncture any air bubbles remaining in film after application.

6.9 Rubber roller - A rubber-covered roller, 3 1/2 inches in diameter by 1 3/4 inches in width and weighing 4 1/2 pounds, should be used to apply pressure-sensitive type decals, both interior and exterior. The surface of the roller shall have a durometer hardness value within the range of 70 to 80.

7. MAINTENANCE OF APPLIED DECALCOMANIAS

7.1 Brightening and cleaning - Decals may be cleaned and brightened after usage and exposure to weather.

7.1.1 Cleaning compound - Decalcomanias shall be cleaned in accordance with NAVWEPS CHART 07-1-503. A cleaning compound conforming to MIL-C-22543 or MIL-C-25769 shall be employed for all degrees of soiling.

7.1.1.1 Mildly soiled surfaces - Where the decal surface is mildly soiled, cleaning shall be accomplished using 1 part cleaning compound (MIL-C-22543) by volume to as much as 10 parts of water by volume; or with one part concentrated alkaline waterbase cleaner (MIL-C-25769) to 7 parts of water by volume. The cleaning solution may be applied by brushing or spraying, followed by a thorough water rinse.

7.1.1.2 Heavily soiled surface - Where the decal is heavily soiled, cleaning may be accomplished using 1 part cleaning compound (MIL-C-22543) by volume to 5 parts water by volume; or with one part concentrate alkaline waterbase cleaner (MIL-C-25769) to 3 parts of water by volume. Surface soils may be loosened by mild brushing and then removed with a thorough water rinse.

7.2 Restoration of solvent-activated and pressure-sensitive decals - A thin coat of clear lacquer conforming to MIL-L-19537 may be applied to aged and weather dulled decals to restore appearance. Where lettering or coloring is deteriorated to the point of obscurity, the decal shall be replaced.

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7.3 Limitations of durability - Under normal operating conditions, the varnish-applied and water-applied decals may be durable for a period of two years. Pressure-sensitive and solvent-applied types may be durable for three years. Severe exposure conditions encountered in certain exterior applications will result in reduced durability of the decals.

8. REMOVAL PROCEDURES OF DECALCOMANIAS

8.1 In general, removal of pressure-sensitive and solvent-activated decals will affect the entire paint system so that the surface will have to be cleaned down to bare metal and then refinished. The following procedures for removal of decals are suggested methods which should be used only under circumstances of emergency.

8.2 Exterior surfaces - Exterior surface decals shall be removed and replaced by new ones when age and exposure have caused fading, cracking, chipping, or peeling beyond the point of effective restoration.

8.2.1 Removal of solvent-activated decals - The surface area surrounding the decal shall be masked. The decal shall be brushed with cyclohexanone beginning at the top of the decal. As the film loosens it shall be scraped downward and blotted up with waste or cloths. The procedure shall be repeated until the adhesive is softened, and removal may be completed with xylol or lacquer thinner conforming to MIL-T-19544. (See 8.1.)

8.2.2 Removal of pressure-sensitive decals - Most pressure-sensitive type decals can be removed by gently working a putty knife under the edge of the decal stripping the film from its adhesive. Removal may be made easier by applying heat directly to the film surface with a steam spray to soften the film and adhesive. When removal is difficult, the area around the decal shall be masked, and the decal surface abraded with sandpaper. Lacquer thinner conforming to MIL-T-19544, or xylol shall be carefully applied to the decal. After the film has been lifted and scraped off, the remaining adhesive may be removed with lacquer thinner or xylol. (See 8.1.)

8.2.2.1 Fluorescent - After exposure (approximately six months) the fluorescent pressure-sensitive decals can be removed by peeling without damage to the undercoat. Application of heat by steam spray will assist removal.

8.3 Interior surfaces - Interior surface decals shall be removed and replaced when peeling, cracking, or chipping has destroyed usefulness. (See 8.1.)

8.3.1 Water-applied and varnish-applied - Worn decals of the water-applied and varnish-applied types may be removed by scraping with a razor blade or similar instrument. Care should be taken to avoid injury to the underlying surface. (See 8.1.)

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8.3.2 Solvent-applied - Solvent-applied decals may be removed by scoring with a razor blade and then masking the area around the decal to prevent damage to the surrounding lacquer. The removal shall be completed by scraping the scored decal from the surface with a razor blade or similar instrument. Solvent-applied decals may also be removed with cyclohexanone or xylol, conforming to TT-X-916. (See 8.1.)

8.3.3 Solvent-activated - The area surrounding the decal shall be masked, and the decal brushed with cyclohexanone. As the film loosens, it shall be scraped downward and blotted up with waste or cloths. The procedure shall be repeated until the adhesive is softened and the removal may be completed with carefully applied xylol or lacquer thinner. (See 8.1.)

8.3.3.1 Baked enamel surfaces - Solvent-activated decals may be removed from porcelain or baked enamel surfaces with a solution consisting of 75 percent methyl-ethyl ketone (MEK) and 25 percent toluol. The decal shall be covered with absorbent material or paper towels. The solution shall be poured on the material or towel. After allowing to set for 5 to 6 minutes the towel shall be removed, and most of the film will be removed with it. Any remaining pieces of the decal may be wiped away with a cloth soaked in the solution. (See 8.1)

8.3.4 Pressure-sensitive - Most pressure-sensitive type decals can be removed by working a putty knife gently under the edge of the decal, and stripping the film from its adhesive. Removal may be made easier by applying heat directly to the decal surface with a spray of steam, to soften the film. When removal is difficult, the area around the decal should be masked and the decal surface abraded with sandpaper. Paint and varnish remover shall be applied to the decal. After the film has been lifted and scraped off, the remaining adhesive may be removed with lacquer thinner. (See 8.1.)

9. NOTES

9.1 Solvent-activator - Decals of the solvent-activated type are adversely affected by overuse of the solvent. Over-activating should be avoided since this will cause puckering and softening of the film as well as premature failures due to entrapment of solvents in the paint substrate. The activator shall never be allowed to touch the film surface.

9.2 Heated surfaces - Decals used in this specification are not to be used on surfaces which become heated above 150° F (65.6° C).

9.3 Areas subjected to diester oil spillage - On areas subjected to diester oil spillage, the decals should be overcoated with clear lacquer (MIL-L-19537).

9.4 Storage of decals - Decals should be stored in a cool dry place, and used within approximately 1 year after purchase.

