INSTITUTE OF INTERNATIONAL CONTAINER LESSORS

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APPENDIX E: SURFACE PREPARATION AND PAINTING: AN ADDENDUM TO THE *REPAIR MANUAL FOR STEEL FREIGHT CONTAINERS* (FIFTH EDITION)

PURPOSE OF THIS ADDENDUM

Over the last decade, the use of full-scale refurbishment as a preventive maintenance procedure has fallen practically to zero. This development results from a number of factors, including the dramatic drop in the price of new containers and the fact that the panel material used on dry-van containers is now predominantly corten steel, which is highly corrosion-resistant.

IICL published its first edition of the *Specifications for Steel Container Refurbishing* in 1979 and its second edition in 1993. This manual is now out of print and, because the use of refurbishing has nearly vanished, IICL does not intend to reprint the second edition or publish a third edition. However, a number of items in this manual, including specifications and techniques for surface preparation and painting are applicable to repairs, particularly large-size repairs.

IICL has decided to extract key information from the Refurbishing manual and incorporate it as an addendum to the IICL *Repair Manual for Steel Freight Containers* (fifth edition). By including detailed information regarding surface preparation and painting, the Repair manual should be more useful to readers while eliminating the need to purchase and stock a separate Refurbishing manual. The information in this Bulletin supplements the information contained in Sections 2.5 and 2.9 of the Repair manual, and becomes Appendix E of that manual.

INFORMATION INCLUDED IN APPENDIX E

The new Appendix E included in this Bulletin includes supplementary sections dealing with the following subjects:

- **Surface preparation**
- **Abrasive blasting**
- **Selection of paints**
- **Application of primer and top coat(s)**
- **Undercoating**
- **Restoration of markings and removed components**

REPLACEMENT PAGES

In addition to Appendix E, this Bulletin includes several pages to insert into your copy of the Repair Manual in place of existing pages (please discard the existing pages). They include:

- A new title page, indicating that the manual has been revised in June 2000.
- The third and fourth page of the Table of Contents, listing Appendix E and its page number.
- New pages 3 and 4, with a revised first paragraph of Section 2.5 at the bottom of page 4.

- New pages 5 and 6, with revisions to the first paragraph on the top of page 6.
- New pages 13 and 14, with revisions to Section 2.9.

The new Appendix E consists of five pages and starts on page 114. It should be inserted after page 113 at the end of the manual (just before the last, unpaginated page listing IICL members).

All the replacement pages have been punched with three holes to allow insertion into the Repair manual three-ring binder. Please note that IICL has not yet revised the *CD version* of the Repair manual, only the printed version.

READER COMMENTS

IICL welcomes comments and suggestions from readers on the content of this Technical Bulletin amendment to the Repair manual. Please address your remarks to IICL at the e-mail address, fax number or mailing address below.

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REPAIR MANUAL FOR STEEL FREIGHT CONTAINERS

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FIFTH EDITION, 1999 (REVISED JUNE 2000)

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REPAIR MANUAL

This manual describes the best procedures for the repair of containers known to the Institute and takes into account the need for safe, efficient and economical container performance. However, because any repair operation depends largely upon the skill of human beings, the machinery employed, the conditions under which the repair is performed and many other variables whose significance may not be apparent, the Institute and its members and personnel cannot and do not assume any liability for damage to persons or property or other consequences of any procedures referred to herein or of any omissions relating to repairs, practices and procedures.

CREDITS

The drawings and information on container dimensions in Appendices A, B and C is adapted and reprinted from ISO 668: 1988/Amd 1: 1993 and ISO 1496-1: 1990/Amd 1: 1993 with permission of the American National Standards Institute (ANSI) on behalf of the International Organization for Standardization. No part of these Standards may be copied or reproduced in any form, electronic retrieval system or otherwise, or made available on the Internet, a public network, by satellite or otherwise, without the prior written consent of the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, USA. Copies of International Organization for Standardization (ISO) publications may be purchased from ANSI, fax 1-212-302-1286.

IICL gratefully acknowledges the assistance of Interport Maintenance of Newark, New Jersey, who made their depot, equipment and repairers available for photographing the repairs illustrated in this manual; and of Paul Raitano of Triton Container International, who took the photographs.

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SECTION 2 GENERAL REPAIR PROCEDURES

2.1 **Introduction**—The 5th edition of the *Repair Manual for Steel Freight Containers* sets forth step-by-step descriptions of repair procedures for steel components **once only**, in Section 2.8 on pages 7 - 13. Exceptions are repair methods recommended for *wood floors, door gaskets, door hardware and ventilators,* where complete procedures are provided in the sections of the manual pertaining to those components.

The repair method selected should be the most economical one possible within the limitations set forth in this manual. Whenever possible, damaged components or portions of components should be straightened, welded, or straightened *and* welded, rather than removed and replaced with inserts, sections or entire replacement components.

In some cases, undamaged or lightly damaged components may need repair if they are adjacent to damaged areas requiring repair. A proper repair should restore the profile of the damaged component and surrounding areas as close as possible to the original profile. Repaired containers should meet all applicable requirements of ISO standards, the International Convention for Safe Containers (CSC), the Customs Conventions on Containers and the Convention on the International Transport of Goods Under Cover of TIR Carnets.

2.2 **Safety Precautions**—IICL expects all repair personnel to observe appropriate safety precautions when repairing containers. Safety clothing and equipment should be worn, including hard hats, safety goggles, gloves, hearing protection, masks and any other devices that may be needed.

Some of the sealants, adhesives, solvents and lubricants used in container repair may pose environmental and personal safety risks if not handled and disposed of in a proper and responsible manner. Repairers should be well informed about these products and the recommended manner of application and disposal. In the United States, manufacturers of these products prepare and make available OSHA material safety and data sheets (MSDS) which indicate hazardous substances present and appropriate safety measures for handling them.

2.3 **General Principles Involved in Making Repairs**—In order to make satisfactory repairs, the following general principles should be observed:

- Determine if the damage requires repair, using criteria in the latest edition of the IICL/ICS *Guide for Container Equipment Inspection*.
- If the damage requires repair, determine the most economical type of repair that will correct the defect satisfactorily. Do not perform a repair more extensive or involved than is necessary to achieve a satisfactory result,

unless doing so will be more economical to perform than a simpler repair.

- Select the appropriate tools and arrange supports and other fixtures as necessary for the repair job.
- Temporarily remove, relocate or shield any nearby undamaged components that could become damaged in the repair process, particularly wooden flooring which is highly susceptible to burn damage.
- Proceed with the repair as described in the appropriate section below. Ensure that any new metal components that will not be exposed after repair is complete are cleaned and primed before covering them.
- Ensure that, once painted, the finished repair will be of satisfactory cosmetic appearance. If not, correct any flaws before painting.
- If the paintwork is broken on existing metal, or if a new metal piece is to be installed, prepare the surface of metal components for painting by cleaning and priming, as described below under "surface preparation".
- Apply top coating (including undercoating for the underside of replacement flooring) to exposed surfaces. *(EXCEPTION:* The *interior* side of panel patches and inserts do *not* need to be top coated, unless the owner so requires.) Once coating is dry, replace markings required by regulations, ISO standards and owners as necessary.
- Put back any temporarily removed or relocated components into place, and remove any shielding or other temporary fixtures.

2.4 **Replacement Quality**—After repair, the strength of the repaired area should be greater than or equal to the original. Materials and parts used should be equal to ("like-for-like") or of higher quality, strength and thickness than the original. If the original material is corten (corrosive-resistant high-strength low-alloy steel conforming to Japanese Industrial Standard G3125 or its equivalent) or other material with special chemical properties, that material must be used in replacement. If there is any doubt as to the type of material used in a container, consult the owner. If the original type of steel is unknown, use corten steel to repair panels, since it has both high-tensile and corrosion-resistant properties. Welding material must be at least as strong as the parent materials being welded (see Section 2.7, Welding).

Fasteners used for repair must have shear strength and material composition equivalent to the original fasteners replaced. If applicable, fasteners must also conform to customs (TIR) requirements. Dissimilar metals (*i.e.* aluminum/steel) should be avoided in attachments to minimize electrolysis; use barrier material to separate dissimilar metals if they must be placed together. In case of any doubt as to which fasteners to use, consult the owner.

2.5 **Surface Preparation**—Upon completion of any repair that damages the original surface coating, the repaired areas must be cleaned and prepared for painting. Appendix E supplies details of surface preparation and painting requirements. All weld smoke, spatter, rust, burned and loose paint, grease and grit must be removed to allow proper adhesion of the coating material. Grease or oil should be removed with a cleaning solvent. Painting equipment and cans should be cleaned and cleaning agents and other residues disposed of in a manner consistent with local environmental regulations and painting equipment suppliers' recommendations.

A grinding disc, abrasive blasting, a chemical cleaner, or a combination of

these should be used to remove other contaminants, and to provide a suitable "anchor profile" for proper adhesion of paint. Consult Appendix E, owner or paint supplier for more detailed advice. Abrasive blasting to a minimum of Swedish Standard SA $2^1/_2$ (or, on the underside, SA 2) is strongly recommended. Steel sheet that is pre-blasted and pre-primed by the steel supplier is recommended for large repairs (one panel sheet of 122 x 244 cm [4 x 8 ft] or greater in size). Handling of blasted panels must be minimized to prevent them from being exposed to skin oils and dirt.

Areas inaccessible to blasting should be cleaned before priming; use a needle gun or a mechanical wire brush. Burned paint edges should be feathered and the cleaned area marked off with masking tape in a square or rectangular pattern.

After surface preparation, repairs to steel components should be primed and painted as soon as possible. See Section 2.9 and Appendix E for further details regarding painting.

Photo 2.1 shows the result of proper abrasive blasting of a panel patch. Photo 2.2 shows how inadequate surface preparation during repair can eventually lead to corrosion. Photo 2.3 shows a panel patch prepared for painting by grinding and wire-brushing. Note that welds as well as parent metal must be properly cleaned and prepared.

2.6 **Tools**—Before beginning any repair work, ensure that the proper tools are at hand to perform the required job. Examples of tools commonly used are mechanical tools, such as hammers, chisels and hydraulic jacks; cutting tools, such as oxygen-acetylene torches, plasma cutters, disc cutters and circular wood saws; grinding tools; painting equipment, such as airless spray pumps and guns; and cleaning equipment, such as abrasive blasters, needle guns and wire brushes. Tools should always include measurement devices, such as measuring tapes and sticks and paint thickness gauges, which are needed to verify alignments and successful completion of repairs. Paint thickness gauges that measure dry-film thickness are always necessary, and gauges that measure wet-film thickness are also necessary if "wet-on-wet" paint applications are performed (see Photo 2.34). Properly aligned jigs and fixtures aid in ensuring maintenance of ISO and other required dimensions.

2.7 **Welding**—All welding must be done by qualified welders, using materials (welding rods, steel sheet, etc.) equal to those used in the manufacture of original equipment. If the weld materials are unknown, follow the recommendations in Table 2.1, making sure the welding wire or rod has a minimum yield point of 46 kg/mm^2 (65,000 psi) or greater. Welding should conform to requirements of recognized technical societies such as the American Welding Society, British Standards, etc. Reference to *Welding Inspection* (published by the American Welding Society) may be helpful.

Integrity of welds usually can be verified by visual inspection. A magnifier is useful. The inspection should determine that the weld is:

- watertight and free of porosity
- smooth in appearance (no roughness, weld spatter, etc.)
- free of craters
- dimensionally accurate (including warpage)
- free of undercutting

TABLE 2.1: WELDING DATA SHEET

STEEL GRADE	DIN NUMBER	AWS NUMBER	WELDING SYSTEM	ELECTRODE/WIRE OR ROD DIAMETER (MM)	GASES	ELECTRODES DIN	ELECTRODES AWS
Mild (MS)	1.0114		MIG	1.0 - 1.2	Argon 82% CO_2 18%	UNION K56	ER70-B6
High-Tensile (MTS)	1.0841		MIG	1.0 - 1.2	Argon 82% CO_2 18%	UNION K56	ER70-B6
Muffler-Grade (MTS)	1.4512		MIG TIG	0.8 - 1.0 1.0/2.4	Argon 97.5% Argon 100%	1.4370 1.4370	E307 E307
Stainless (SS)	1.4301		MIG TIG	0.8 - 1.0 1.0/2.4	Argon 97.5% Argon 100%	1.4370 1.4316	E307 E308L
Corten A	8559	5.18	MIG	A) 1.0 - 1.2 mm wire (use with 4.5 mm & thicker steel) B) 0.9 mm wire (use with 1.9 mm - 4.5 mm steel) C) 0.6 mm wire (use with up to 1.9 mm steel)	Argon 80% CO_2 20%	1913	A5.1

2.8.5.7 Continuously weld into place the new component and any adjoining welded components previously detached. Any components which were detached, removed or freed-up by any means other than welding must be reinstalled as applicable, and any shielding must be removed.

Photo 2.25 shows a replacement corner post continuously welded into place. Photo 2.26 shows a detail of the welding in the critical area adjoining the corner fitting. Photo 2.27 shows skip welding of the interior side of the lap joint between a front corner post and the end of the side panel. Lap joints of corner posts must be skip welded on the interior side; lap joints of panel patches may be skip welded and caulked or simply caulked on the interior. Use the remaining post[s] to determine proper pitch arid length of the skip welds.

2.8.5.8 Clean, mask, prime and top coat the interior and exterior of the repaired area according to Sections 2.5 and 2.9. *NOTE:* The interior side of a repaired panel does not have to be top coated unless required by the owner. See Section 2.9 for further details.

Photo 2.28 shows the priming of a replacement front corner post. Photos 2.29 and 2.30 show the completed, top-coated post on the exterior and interior, respectively.

2.8.5.9 Apply sealant (where applicable) along interior seams.

2.9 **Painting and Marking**—Areas that will be overlapped by another component when the repair is completed must receive surface preparation (see Section 2.5 and Appendix E, Sections E.3 and E.4 for details) and priming *before* the overlapping component is fitted. Such areas include the portion of a panel to be covered over by a patch, the uppermost flanges of roof bows, the inside of stiffening channels, etc.

For all other components, repairs must include surface preparation, priming and top coating of all new metal and the original metal whose paint film has been broken. Both prime and top coat the cleaned area with owner-approved paint or use an owner-approved one-coat combination coating that includes a rust inhibitor. *EXCEPTION:* The interior side of panel patches and inserts and new panels may be primed with rust-inhibitive primer designed for use *without a top coat*. Such a primer must be able to withstand contact with, and not contaminate, cargo (compliance with U.S. Food and Drug Administration [FDA] requirements recommended). Alternatively, the interior side of panels may be primed and top coated with an FDA-compliant top coat. Note that certain primers, such as zinc-rich epoxy primer, must be top coated or they will oxidize and deteriorate. Top-coat color must match owner's specifications; primer should have a contrasting color. The primer and top coat used must be compatible with that originally applied to the container and with each other. Follow the paint manufacturers' recommendations for coating application and dry-film thickness.

Completed and painted repairs should have a neat appearance. To achieve this condition, it is recommended to square off and mask areas to be painted. Photo 2.31 shows application of masking. Photo 2.32 shows completion of priming within the masked area. Photo 2.33 shows the neat appearance of the repair after painting and removal of masking.

Ensure that film thickness of each coat meets requirements by measuring

dry-film thicknesses (wet-film thickness of any coat that will be overcoated before drying is complete). Photo 2.34 shows the use of an electronic dry-film thickness gauge. This is especially important for panels, because the corrugation profile may make paint application more difficult than on flat surfaces.

Lastly, decals and other markings must be replaced as required by the owner and applicable standards and regulations (see Appendix E, Section E.6 for details). Reuse legible marking plates unless the owner specifies otherwise. Do not apply decals and plates until the paint is fully dry to the touch.

Due to tightening environmental regulations, water-borne paints may be in use in some repair shops, and may be required by some container owners. Use only paints which meet local environmental requirements, such as regulations specifying the maximum permitted amount of volatile organic compounds (VOC's).

2.10 **Non-Conforming ("Improper") Repairs**—*Non-conforming repair* is a condition resulting from a repair not being performed in accordance with IICL recommendations. This condition is often called "improper repair". Depending upon the condition observed, the non-conforming repair may be considered unacceptable, requiring correction, or acceptable, requiring no corrective action. Individual owners should be consulted for guidance with respect to correction of these conditions.

Leased containers present special problems in regard to non-conforming repairs. Non-conforming repairs performed after delivery of the container to the user may have to be corrected, at owner's discretion, upon redelivery of the container by the user to the owner's depot. Sometimes a non-conforming repair that is discovered upon redelivery was performed before delivery of the container to that user. On-hire documentation or obviously advanced age of the repair may indicate that a non-conforming repair preceded the present use of the container. Depending upon the nature of the non-conformance, whether the repair presents a safety hazard and owner's policies, some non-conforming repairs must be corrected by repairing again, while others may require no action. Consult the owner in order to find out whether a particular non-conforming repair must be corrected. Further guidance on the correction of improper repairs may be found in the *IICL Supplement on Container Inspection and Repair: Gray Areas*.

2.11 **Quality Assurance and Management**—A quality assurance program assists depot management to ensure consistently satisfactory repair quality. Such a program may include checking materials received for use in repairing containers, verifying that proper preparation, authorization and repair activities take place, and ensuring proper completion of repair orders before the container is returned to service. The need for repairers' own quality assurance programs is not superseded by audit programs conducted by container owners and/or users.

The adequacy of quality assurance procedures may be demonstrated by obtaining registration by an accredited registrar for ISO 9000 process control standards. These standards have been published by the International Organization for Standardization (ISO). Even if ISO 9000 registration is not obtained, voluntary conformance with ISO 9000 procedures may aid the repairer in simplifying operations, minimizing correction of non-conforming repairs, and winning owner and user confidence.

APPENDIX E SURFACE PREPARATION AND PAINTING

E.1 Surface Preparation

Whenever steel inserts, sections or replacement components are installed on a container, the steel must be properly cleaned before any primer is applied. All dirt, moisture, oil, grease, loose rust and other surface impurities that can prevent paint adhesion must be removed. For small areas, grinding discs, wire brushing or needle guns plus chemical/solvent application as necessary may be used for this purpose. For larger areas (*e.g.* one or more side panels in size), abrasive blasting of the steel is recommended.

E.2 Abrasive Blasting

Abrasive blasting may be applied to new steel to be installed on the container or to steel already part of the container. Although blasting and painting of the entire steel container, called "full refurbishing" or "full reconditioning," is no longer commonly performed, touching-up of the cosmetic condition of containers by means of blasting of limited corroded areas of steel containers (with subsequent repainting of the entire container) may occur. This touching-up process is called "spot-blast refurbishing" and relies on the same abrasive-blasting principles shown below for application to newly installed steel. Note that the self-healing "patina" or finish that forms on a corten steel surface protects the steel against further corrosion, and is not the same as mild-steel corrosion. The corten patina need not be removed by blasting during spot-blast refurbishing.

E.2.1 Preparation for Abrasive Blasting

When abrasive blasting is performed, all oil, grease and surface dirt must first be removed by steam cleaning with a small amount of detergent, followed by rinsing with clear water. The steel material must then be dried prior to blasting. In addition, if the steel has already been installed, all adjacent door hinge pins, bushings, door gaskets and other parts susceptible to being damaged or impaired in future operation by blasting must be masked for protection with a suitable material or removed for refitting after painting. If the owner directs, door gaskets and other components prone to blast damage must be removed before blasting.

E.2.2 Abrasive Blasting Requirements

In conventional full-blast refurbishment, the entire surface of the container (exterior, interior or both) is blasted with an abrasive consisting of steel grit, crushed slag or quartz. Sand may be used if permitted by local regulations. Blast quality must be to a minimum "near-white" surface condition (Swedish

Standard SA 2½, Steel Structures Painting Council SSPC-SP10 or British Standard 4232, Second Quality). The understructure steel may be blasted to a minimum "commercial" surface condition (Swedish Standard SA 2, Steel Structures Painting Council SSPC-SP6 or British Standard 4232, Third Quality) if the owner permits.

Upon completion of blasting, the surface anchor profile (ridge-to-valley height differential) should be 25-35 microns (1 to 1½ mils), unless a different profile is recommended by the paint primer manufacturer. Blasting may remove surface metal as well as corrosive products. The amount of metal remaining after blasting, however, must be 95% or more of the original specified metal thickness. This is especially important on components such as panels and on corten parts where the original thickness is relatively low and missing metal is more critical to structural integrity.

Air blasting is recommended, with a nozzle pressure of 6-7 kg/cm^2 (90-100 psi). Moisture traps are needed to prevent introduction of water vapor or oil contaminants into the blasting stream. If water blasting is employed, a suitable rust inhibitor must be used with the water to prevent blush rusting before priming. Consult blast equipment manufacturers or paint suppliers for information about rust inhibitors, and determine whether use of a particular inhibitor is permitted by local regulations.

E.2.3 Post-Blast Requirements

A high-pressure air stream or equivalent method should be directed to the steel surface immediately after blasting to remove traces of abrasive material and surface contaminants. Air compressors generating the air stream should be equipped with an aftercooler and moisture separator or equivalent devices to prevent contamination of the air stream with moisture or oil. If the abrasive is recycled for reuse, grit particles that are too small or of inadequate roughness and surface contaminants must be removed by filtration prior to recycling.

After all grit and blast contaminants have been removed, the container is to be light-leak tested carefully, to determine if any pinholes or other damage have developed or been disclosed as the result of blasting. Repair (which should occur after completion of priming) or replacement of the blasted material is necessary to correct these defects.

The blasted surface must be primed within ***one hour*** after completion of blasting, to prevent the development of further corrosion due to oxidation. Freshly blasted steel is completely unprotected against rusting and other corrosion. If the application of a prime coat is delayed beyond the time limits specified above or by the paint manufacturer, blasted areas may require reblasting if there is any evidence of rust (or "blush" rusting) or other contamination or corrosion. The blasted surface must be kept scrupulously clean (no fingerprints, oils or other contaminants) before, during and after priming. Any contaminants may affect the adhesion of primer to steel or top coat to primer and will lessen the corrosion protection of the primer.

E.2.4 Environmental and Safety Considerations in Abrasive Blasting

Precautions must be taken to retain dust, spent grit, paint and corrosion removed by blasting within a controlled area. These products must not be

released into the atmosphere or water supply, since swallowing or breathing this material may be harmful, and its release may violate local environmental regulations. All blast residue must be disposed of in a manner consistent with environmental and local regulations. Safety precautions for blasting are critical, since a misused blast hose may cause severe injury or death. In addition, workers operating the blasting equipment as well as any other personnel exposed to the operations should have protective clothing and a clean, filtered, fresh-air supply. The condition of equipment and safety devices, especially emergency blast cutoffs, should be checked at least daily.

E.3 Selection of Paints

An anti-corrosive primer, such as zinc-rich epoxy primer, has traditionally been used to protect steel. However, certain steels, such as corten or stainless steel, incorporate anti-corrosive components in the alloy which may not need to be duplicated in the primer. Moreover, local or national regulations may restrict or prohibit the use of some traditional primers, due to their effect on the environment. Water-borne and other types of primers have been developed which are more friendly to the environment. In fact, some owners' policies may require the use of such environmentally friendly paints. The repairer should use the paints specified by the owner, or alert the owner if the specified paint system (primer, top coat and intermediate coat, if needed) cannot be used because of environmental or other local regulations.

Unless the owner specifies to the contrary, it is good practice to use a complete paint system from the same paint supplier. Use of primers and subsequent coats made by different manufacturers may not work properly together and may invalidate paint warranties. It is also good practice to select contrasting colors for primer, top coat and intermediate coat (if needed), in order to help ensure that each coat is properly applied.

Newly applied primer must be chemically compatible with the remaining old paint. Check the interior of the container, on the right side near the door, for a marking indicating the original top coat, or consult the owner for this information. The integrity and adhesion of the new primer may be affected if the old and new paints are not compatible. The paint supplier is the best source of information regarding compatibility.

E.4 Application of Primer and Top Coat(s)

To the greatest extent possible, all paints, including primer, must be applied in accordance with the paint supplier's recommendations. Care must be taken to ensure proper application temperature and relative humidity, as well as proper mixing and curing conditions.

Most primers must be applied to a clean surface with a suitable application profile. The thickness of the primer must be checked (usually in the wet condition with a wet-film thickness gauge) for adequacy before applying subsequent coats. Unless the subsequent coats are approved by the paint manufacturer for "wet-on-wet" application (*i.e.*, before the previous coat is completely dried), the primer must be allowed to dry adequately before applying intermediate and/or top coats as may be required by the owner. If the steel has become damaged as the result of surface preparation and handling, it must be repaired after priming and reprimed as necessary, or replaced.

After completion of all priming, including any necessary repairing, repriming and curing, the top coat may be applied. Note should be taken of the primer's minimum curing time before application of the top coat: curing of water-borne primers may take longer than solvent-based or other types of primers. The top coat must not be applied prematurely, or in very cold temperatures or under other unfavorable conditions. The paint supplier can assist in helping determine which conditions are suitable for proper top coat application.

It is often possible to apply water-borne top coats over solvent-borne primers. Again, the paint supplier should be consulted to ensure compatibility of top coats with primers. Proper drying techniques should be confirmed with the paint supplier, as certain paint systems may require force-drying or other special methods. Careful note of paint manufacturer's requirements is necessary before moving a newly painted container to an open area. Even when paint is cool and dry to touch, the container may still not be ready for full exposure to the weather.

E.5 Undercoating

Repairs to the underside of the base structure (crossmembers, flooring, interior of the bottom side rails and sills) of the container should be coated as directed by the owner. Normally, a special undercoating material is applied to these surfaces. Application of undercoating material may require different surface preparation procedures from those applicable to exterior paints. However, sometimes conventional paints are used and applied only to the steel portions of the understructure. The undercoating should be applied to the minimum dry film thickness recommended by the coating manufacturer. The underlying surface may require priming before undercoating is applied; check with the owner for requirements.

Application and drying conditions recommended by the coating manufacturer should be followed. Note that certain undercoatings do not fully dry and can easily be transferred to clothing and skin even if apparently "dry". Appropriate care should be taken in handling parts of the container where such undercoatings are applied.

E.6 Restoration of Markings and Removed Components

After the last application of the top coat has cured as specified by the paint manufacturer, the repairer must replace any identifying marks on the container that were removed as directed by the owner or that are required by regulation. Existing marking plates, if still legible, may be re-installed as directed by the owner. The owner should be consulted for instructions if new plates are required. Owner's requirements must be followed regarding sealing of plates and types of fasteners. Use of stainless steel fasteners is recommended.

While decals are preferable in remarking a container, other marking systems (such as direct silk-screening, stencils and hand-painting) may be used if authorized by the owner. Containers must not be released without ensuring that required markings, such as CSC plates and ISO markings, are in place. Serial numbers must be carefully checked against records and punch marks to ensure matching.

If components have been removed due to owner's requirements or other

reasons, they should be replaced after final paint curing. When replacing gaskets, check the condition of gasket retainers. Verify with the owner when to reuse existing gasket retainers, and what retainer material specification must be used if a retainer needs replacement. Owners often require replacement of worn-out or damaged retainers in the case of stainless steel retainers. Also pay attention to owner's requirements regarding new fasteners; stainless steel fasteners should be used unless the owner indicates otherwise.