Box repair and surveys

Must be blasted prior to repair

If not done …..
corrosion due to improper surface preparation

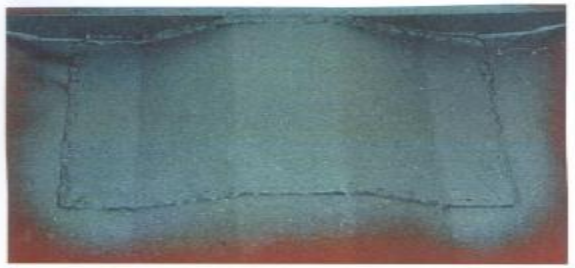


Photo 2.1 / Abrasive blasting of panel patch before priming

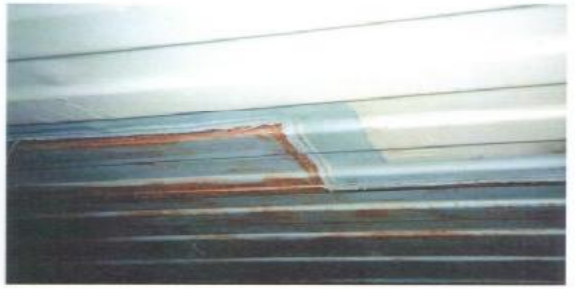


Photo 2.2 / Corrosion due to improper surface preparation of roof panel patch

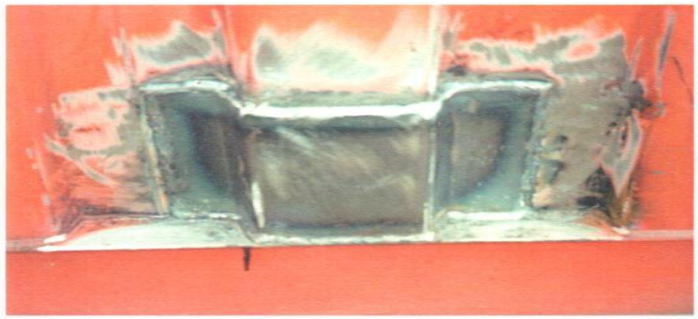


Photo 2.3 / Preparation of a panel patch by grinding and wire-brushing (note clean, bright weld condition)

Photo 2.4 / Using a jack with a backing plate to straighten a side panel

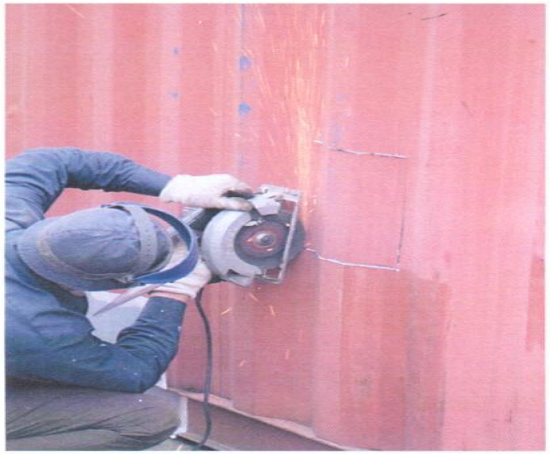


Photo 2.5 / Removing a portion of panel using a disc cutter (disc grinder)

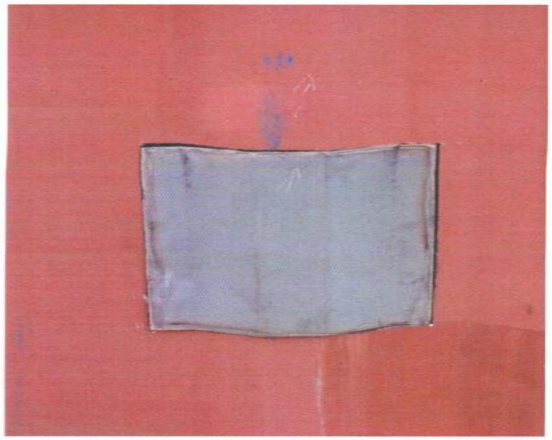


Photo 2.6 / Panel insert fitted into place (before welding)

SIDE PANEL REPAIR

SIDE PANEL REPAIR

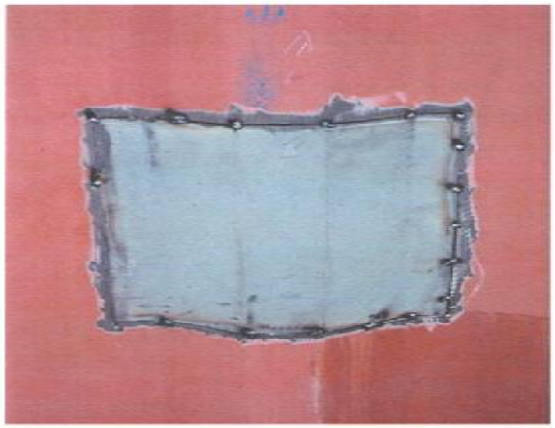


Photo 2.7 / Panel insert tack welded in position

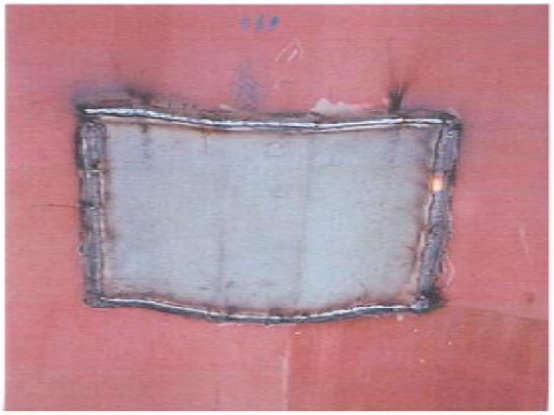


Photo 2.8 / Panel insert continuously welded

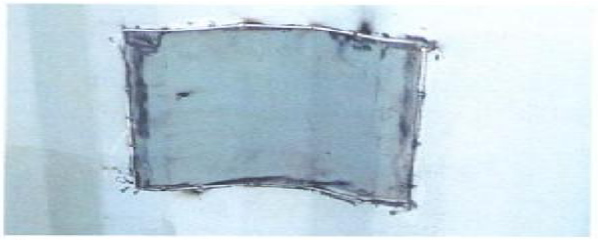


Photo 2.9 / Full penetration of continuous panel insert weld to interior side

Photo 2.10 / Masking and priming of panel insert repair

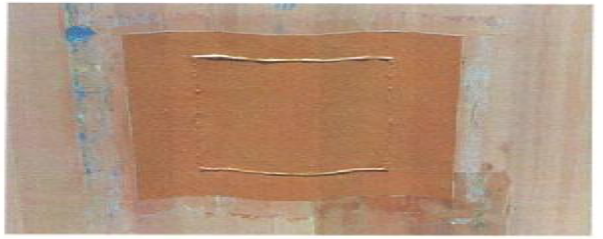


Photo 2.11 / Completed panel insert repair, fully top coated

SECTION
ROOF TOP REPAIR

Photo 2.12 / Damaged top side rail area removed before installing a new section. Note that the roof panel has been detached beyond the edges of the removed area, and the edges of rail have been beveled.

Photo 2.13 / Jacking up of roof sheet to provide clearance for removal of damaged material and rewelding of top side rail section

Photo 2.14 / Tube-type top side rail section cut to size, cleaned and beveled

Photo 2.15 / Tube-type top side rail section tack-welded into position

Top rail Section type and how is welded

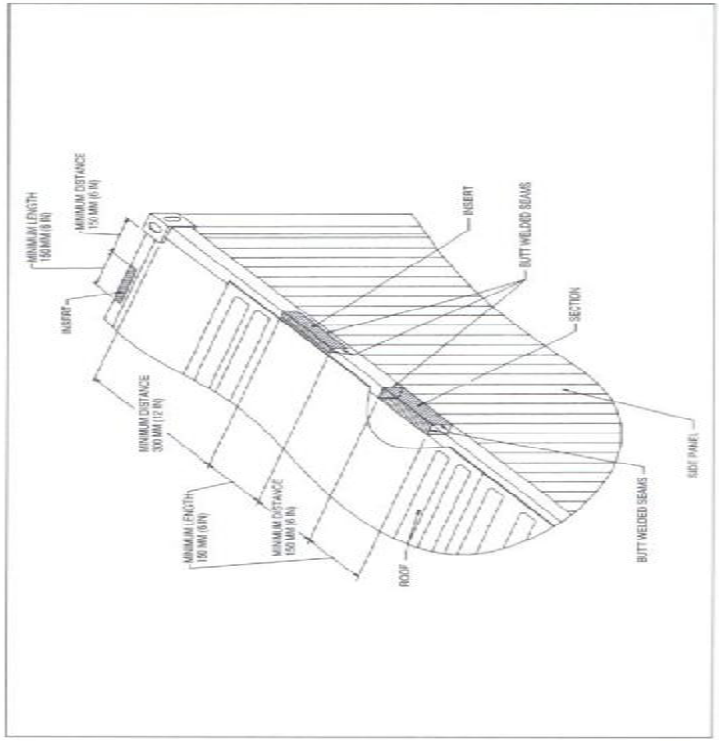


Fig. 5.1/Top rail insert and section limitations

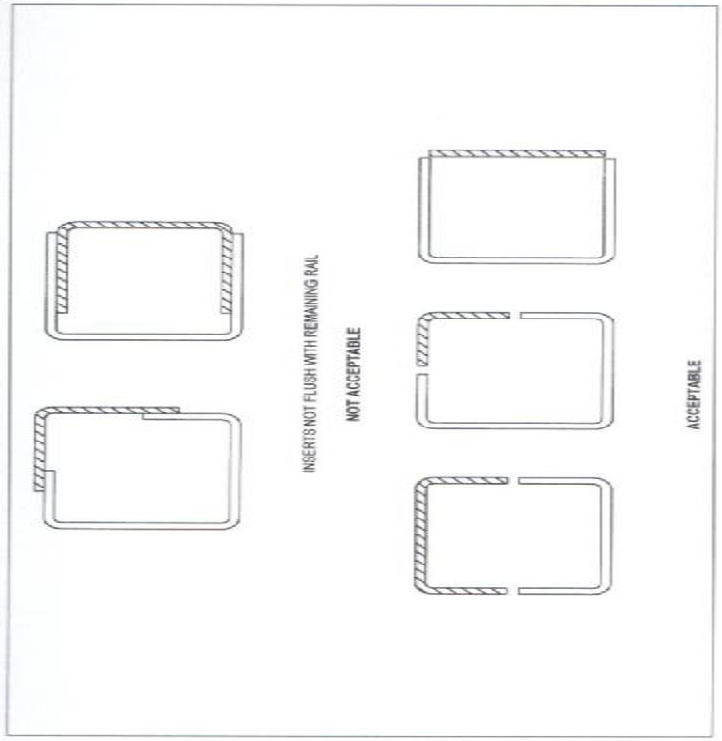


Fig. 5.2/Cross sections of top rail inserts (before welding)

Finishing roof top repair

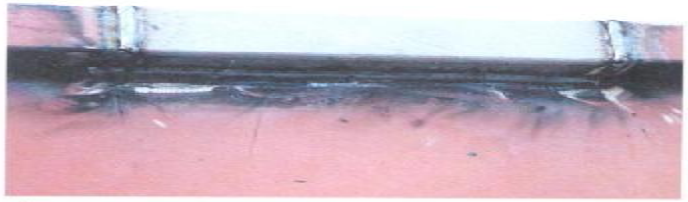


Photo 2.16 / Tube-type top side rail section continuously welded (exterior view)

Photo 2.17 / Tube-type top side rail section continuously welded (interior view)

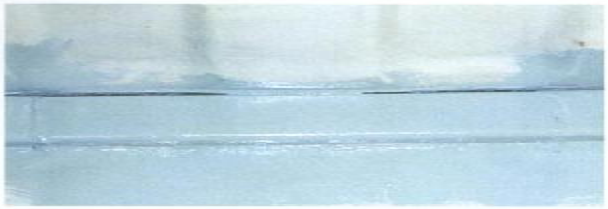


Photo 2.18 / Priming of tube-type top side rail section and adjacent surfaces on the interior. NOTE: For a neater finished appearance after painting, mask a rectangle around the area to be primed and top coated before paint is applied.

Photo 2.19 / Priming of tube-type top side rail section and adjacent surfaces on the exterior. See note above for Photo 2.18.

Photo 2.20 / Top-coating of tube-type top side rail section and adjacent surfaces on the exterior. See note above for Photo 2.18.

Corner post repair

Photo 2.25 / Front corner post continuously welded in place

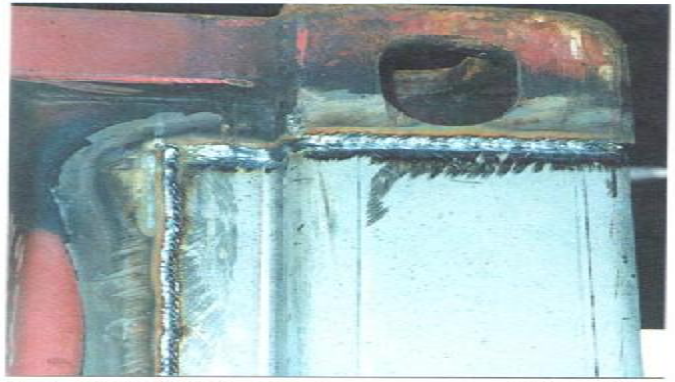


Photo 2.26 / Detail of front corner post welding adjacent to corner fitting

Photo 2.27 / Skip welding of interior of corner post/panel lap joint

Photo 2.28 / Priming of replacement front corner post

Repair longitudinal bottom beam and corner casting

Photo 2.33 / Top coating of bottom rail section completed.

Photo 2.34 / Use of an electronic dry-film paint thickness gauge

SECTION 3 CORNER FITTINGS

3.1 General

Corner fittings are the key components through which the container is handled. Since each fitting may have to handle up to one-half the container maximum gross weight in the lifting mode, filling of cracks, etc., is **not** permitted. *Corner fittings may be repaired **only** by replacement.* Extra care must be taken to ensure proper placement of fittings to ISO specifications; *no allowance beyond the dimensions defined by ISO standards is allowed.* See Appendix A, ISO Dimensions and Tolerances.

Before undertaking any repairs, refer to Section 2 for general repair principles and step-by-step repair procedures, as well as recommendations on replacement materials, surface preparation, tools, welding, painting and marking.

3.2 Corner Fitting Replacement

To replace a corner fitting, cut out the damaged fitting with an oxygen acetylene torch as described in Section 2.8.5. Carefully grind all existing welds back to base metal with a disc grinder. To ensure complete penetration of welds, parts adjacent to connections should have their edges ground to a 45° bevel and be positioned with gaps of no more than 2 mm (5/64 in) before welding. *Do not bevel the corner fitting itself.* When possible, connections to the fitting should be fully welded on both sides of the joint. Welds must be uniform, free of scale, pin and blow holes, and with full penetration.

All welds to corner fittings should be made with low-hydrogen welding rods or wire in order to minimize any chances of hydrogen embrittlement in the weld. Embrittlement may lead to failure in time. Low-hydrogen welding rods and wire must be kept dry and stored in a dry place in order to keep the protective flux coating intact, and, if exposed to moisture, carefully dried with heat before use. Typical low-hydrogen material in use for corner fitting welding includes AWS E7016 and E7018 electrodes.

Corner posts allowed sectional repair

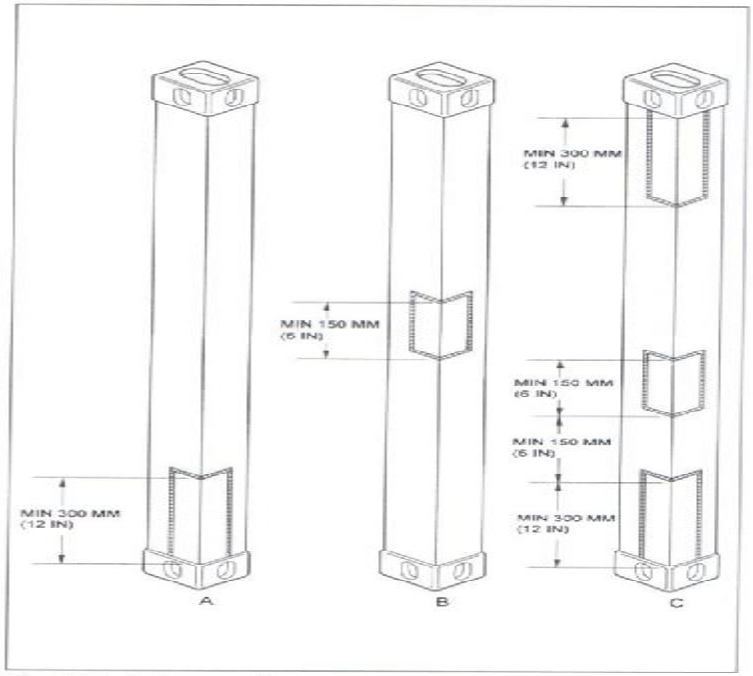


Fig. 4.2/Typical acceptable corner post inserts

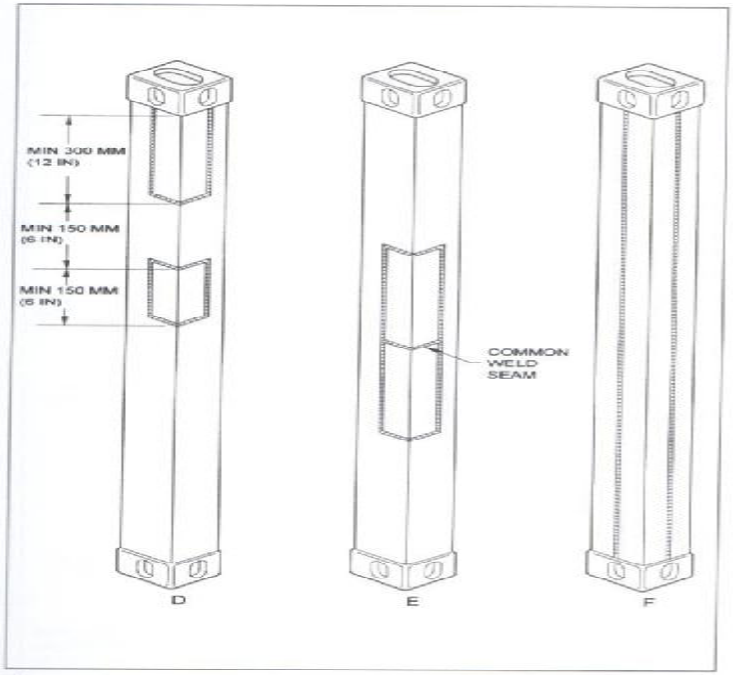


Fig. 4.2/Typical acceptable corner post inserts (continued)

The wrong manner to repair coner posts

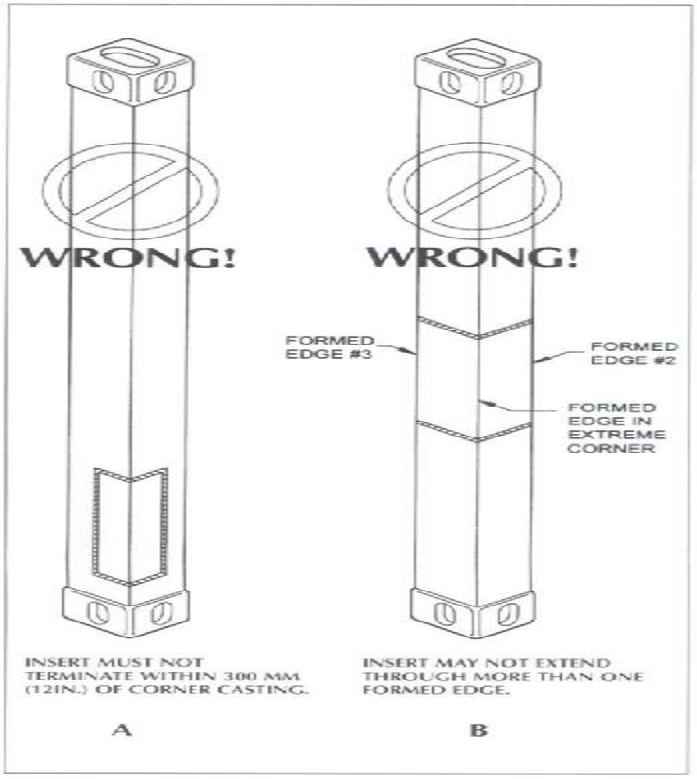


Fig. 4.3/UNACCEPTABLE corner post inserts

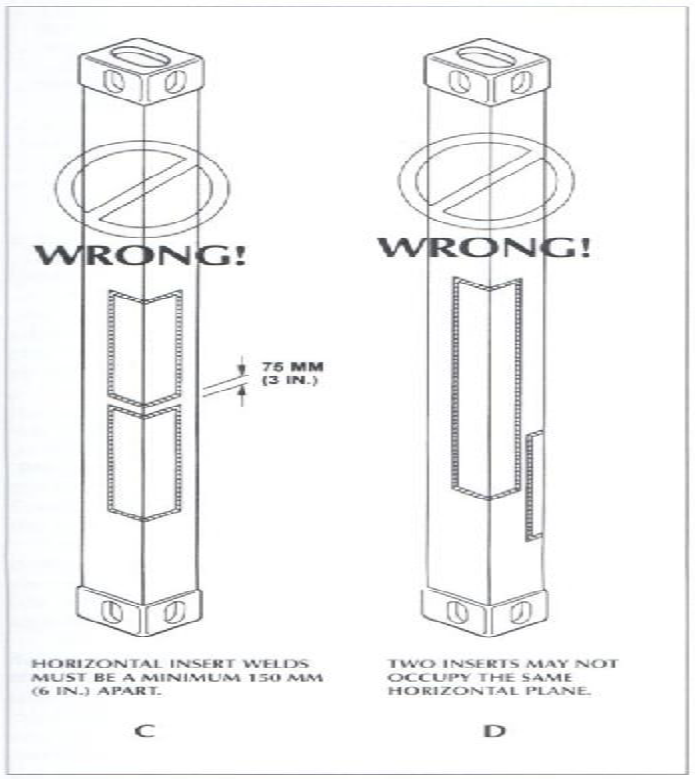


Fig. 4.3/UNACCEPTABLE corner post inserts (continued)

Bottom rail sectional repair

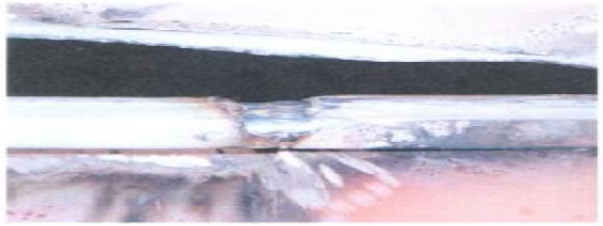


Photo 5.4 / Welding of flat-bar top side rail section to original rail (second pass)

Photo 5.5 / Welding of flat-bar top side rail section to original rail (third pass)

Photo 5.6 / Completed welding of flat-bar top side rail section. A portion of the welds between the section and the original rail has been ground down to permit proper reattachment of the roof sheet.

Photo 5.7 / Removal of damaged portion of bottom side rail. Note cutting of welds to side panel beyond the removed area of rail.

Photo 5.8 / Welding of bottom rail section to original rail, panel and crossmember

Photo 5.9 / Undercoating bottom rail section (primer was applied beforehand)

Repair of corrugated side panels

or equivalent ("near-white cleaning"), primed and (on the exterior) top coated. See Sections 2.5 and 2.9 for additional details regarding surface preparation and painting.

See Sections 6.5.1 on replacement material and 6.5.2 on welding a panel to a corner post. Additional special considerations for panel assembly replacement follow:

6.6.1

■ Cutting out the panel assembly: It may be necessary to cut the panels to be removed into smaller pieces for ease of handling.

6.6.2

■ Completing the repair: In addition to replacing markings, etc., per Section 6.1.1, light-leak test to ensure that there are no pin holes in the welds. Ensure that butt welding penetrates through the entire panel thickness to the interior.

Photo 6.1 / Example of good panel straightening, with well-formed corrugation profile (although with a few hammer marks)

Photo 6.2 / Example of fair panel straightening, with fair corrugation profile and more serious hammer marks

Example of bad side wall repair – should have been replaced all together

Photo 6.3 / Example of poor panel straightening, with numerous deep hammer marks and poor corrugation profile

Photo 6.4 / Example of poor panel straightening. The damaged area has been painted, but no attempt has been made to straighten the dents.

Photo 2.33 / Top coating of bottom rail section completed.

Photo 2.34 / Use of an electronic dry-film paint thickness gauge

Bottom side rail repair ok

Front sill repair and paint thickness measurement

Photo 4.3 Finger crack (in circled area) on underside of floor, directly below the impact shown in Photo 4.2. Since this is accompanied by a sign of impact, this is considered *damage*.

Photo 4.4 Delaminated plywood board, *without* indication of either impact or overloading and *without* breakage of an outer veneer. This is a *wear* item.

Photo 4.5 Wavy floor is a sign of delamination. Check for accompanying conditions (*e.g.* sagging crossmembers under the wavy area) to determine whether this is a damage or wear condition.

Photo 4.6 Numerous scratches on recessed as well as standing corrugations. This is a *damage* condition.

Floor and side damages to be repaired and cleaned

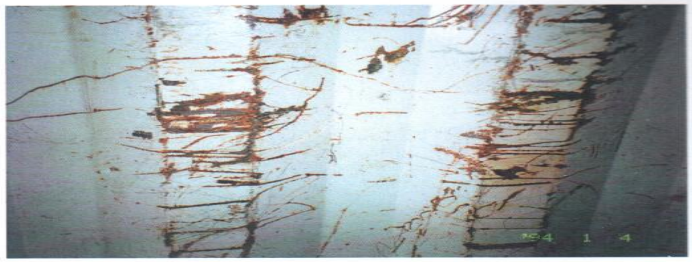


Photo 4.7 Individual deep scratches on corrugations. This is a *damage* condition.

Photo 4.8 Normal-use scratches on standing corrugations. Note the relative absence of scratches on recessed corrugations. This is a *wear* condition.

Photo 4.9 Bottom horizontal gasket with cuts. This gasket does *not* require repair as long as it is still watertight.

Photo 4.10 Use of the inspector's hammer: if the corroded area shown permanently deforms or becomes holed when struck by a short series of light blows from the hammer, repair is necessary. This is a *wear* condition. If there is no deformation or holing, no repair is required.

Panel and outer side panel to be cleaned and above door seal badly placed

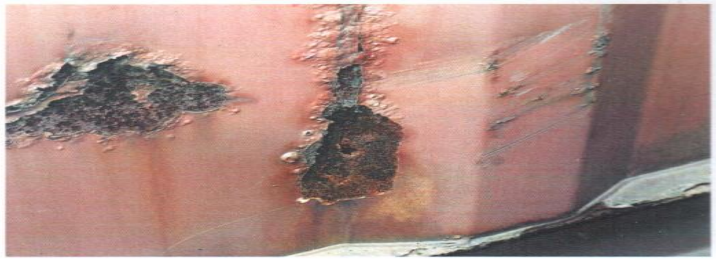


Photo 4.11 Corroded area holed by the inspector's hammer test. This is a *wear* condition which must be repaired.

Photo 4.12 Surface corrosion due to improper surface preparation and painting of a panel patch (interior view). The degree of corrosion does not require repair by itself, although the condition still may be repairworthy depending on the owner's policy on correcting improper repairs of this type.

Photo 4.13 Surface corrosion due to improper surface preparation and painting of top side rail and panel patch (exterior). The degree of corrosion does not require repair by itself, although the condition still may be repairworthy depending on the owner's policy on correcting improper repairs of this type.

Photo 4.14 Good straightening of a front panel. No rework required.

Examples of bad repair

Photo 4.15 Acceptable panel straightening. Despite many hammer marks, the corrugation profile was reasonably restored; rework is not required.

Photo 4.16 Borderline-quality panel straightening. Numerous hammer marks and only a feeble attempt made to restore corrugation profile. The need to rework is dependent on owner's policies.

Photo 4.17 Poor-quality panel straightening. Only a feeble attempt made to restore corrugation profile, using a large-headed hammer without a corrugation dolly. There is significant stretching of metal. No attempt at surface preparation has been made. Rework subject to owner's policies.

Photo 4.18 Poor-quality panel straightening. No attempt made to restore corrugation profile. Poor-quality painting and paint mismatch. Rework required (subject to owner's policies).

Continued examples of bad repair

Photo 4.19 Poor-quality panel straightening. Numerous hammer marks and no surface preparation or painting. Rework required (subject to owner's policies).

Photo 4.20 Insert to a roof panel with a different corrugation profile at the end. No rework required.

Example of bad repair , wrong corrugated plate was used

SECTION 1 INTRODUCTION

1.1 The Need for Inspection

The purpose of a freight container is to carry cargo safely and efficiently. A container must be seaworthy and be able to withstand the rigors of road and rail movement and depot and terminal handling in widely varying temperature and climatic conditions. The container is a modular element of an entire system of freight movement. Preservation of its dimensions within recommended tolerances and of its structural integrity is crucial to the ability of the system to operate.

While containers are built of durable materials, they are not invulnerable to damage or the deteriorating effect of the elements. Inspections of containers are made in order to reveal conditions that may be unsafe or which may reduce the usefulness or life of the container. Such conditions must be repaired. It is in the long-term interest of all parties to ensure that proper inspections are carried out and that appropriate repair of acceptable quality are made.

1.2 Purpose of Guide

The *Guide for Container Equipment Inspection* is the most comprehensive and broadly circulated reference available to determine whether containers need repair. Inspection is particularly important when containers are interchanged from one company to another, as for example from lessor to lessee or from lessee to lessor. At interchange, it must be determined by inspection what conditions, if any, need to be repaired, so that containers may be delivered to operators in safe and serviceable condition. In the case of leased containers, the Guide should be used in conjunction with an owner-approved Equipment Interchange Receipt (EIR), gate receipt or corresponding electronic message to document the inspection (see Section 1.4). Any allocation of responsibility for damage and repair should be done promptly on the basis of accurate information. The recommendations and definitions of terms must be applied consistently, both at on-hire and off-hire interchanges.

An additional purpose of this Guide is to assist in compliance with the International Convention for Safe Containers (CSC). Under the CSC, the owner, or by agreement, the lessee or bailee is responsible for the examination of the container. Inspections carefully conducted in accordance with this Guide should assist in

revealing defects which could place any person in danger, and such inspections should therefore assist in complying with the CSC. The inspections may be performed as "Thorough Examinations" in connection with a major repair, refurbishment or on-hire/off-hire interchange. The owner's government will issue directives for implementation of the CSC, including those involving periodic examinations and Approved Continuous Examination Programs (ACEP).

Inspection according to the Guide will facilitate the segregation of containers requiring repair from those which do not. Reference should be made to the latest edition of IICL's repair manuals or to owner's instructions for repair procedures. Relevant IICL publications include: *Repair Manual for Steel Freight Containers* and the *General Guide for Container Cleaning*, which are summarized in Section 6 of this guide.

1.3 Role of the Inspector

The inspector is the most important judge of container condition. On all inbound containers, it is the inspector's responsibility to ensure that any repairworthy damage is found and designated for repair and that the appropriate extent and method of repair is indicated to correct the damage. The inspector should identify wear and deterioration conditions (hereafter, "wear"), so that timely repairs can be made which maximize the useful life of the container.

The inspector should also examine all outbound containers in order to ensure that equipment released has been completely and correctly repaired and that no repairworthy damage or wear remains. Containers in service should be examined to ensure that they continue to be safe and serviceable.

1.4 Documentation Requirements

As noted in Section 1.2, damage and wear for which repairs are needed should be recorded, in the case of leased containers, on the owner's approved form or on an Equipment Interchange Receipt (EIR). An electronic (computerized) report may be used to supplement or substitute for paper forms, if all parties to the transaction agree. An EIR or electronic report attests to the satisfactory completion of an interchange. The form of the document may vary according to the requirements of the container owner. Statements in an EIR or electronic report regarding repairs required due to damage are key elements in establishing responsibility and financial

Basics of the task of the inspectors that survey the containers

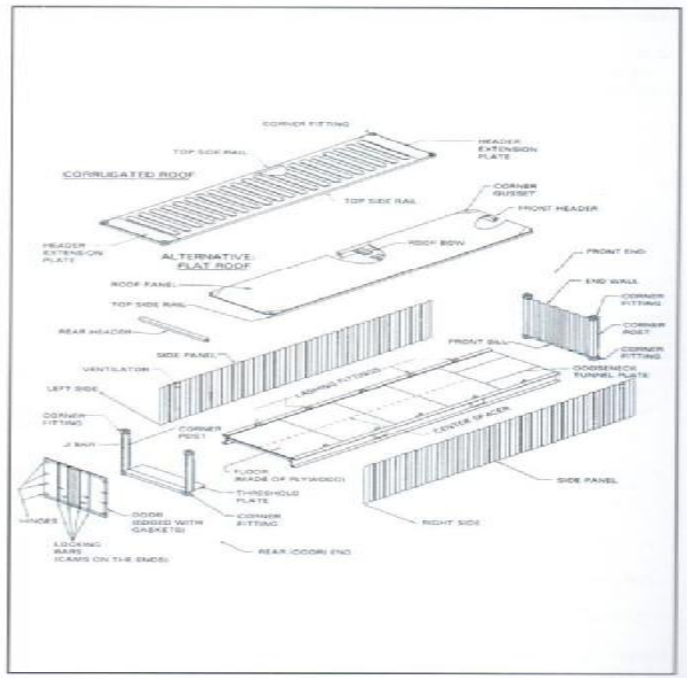


Fig. 1/General arrangement of 40-foot container components

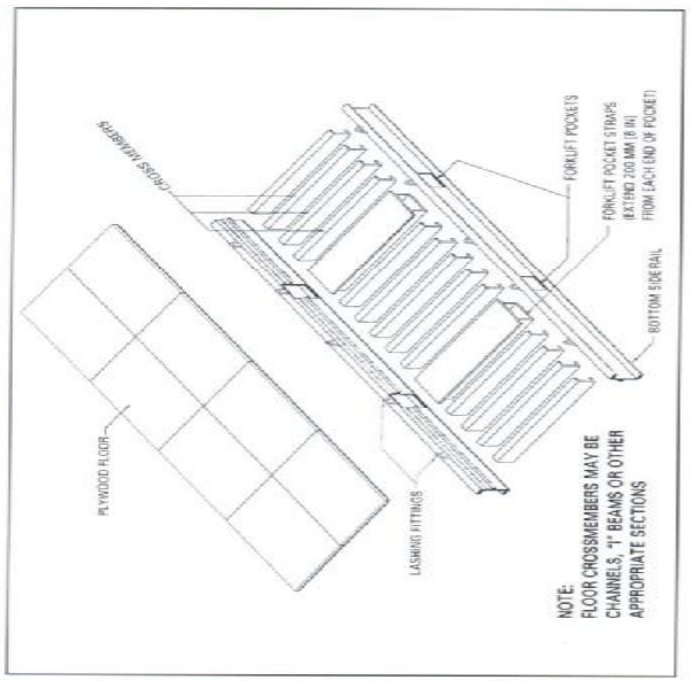


Fig. 2/Exploded diagram-base and flooring of 20-foot container

Container parts list

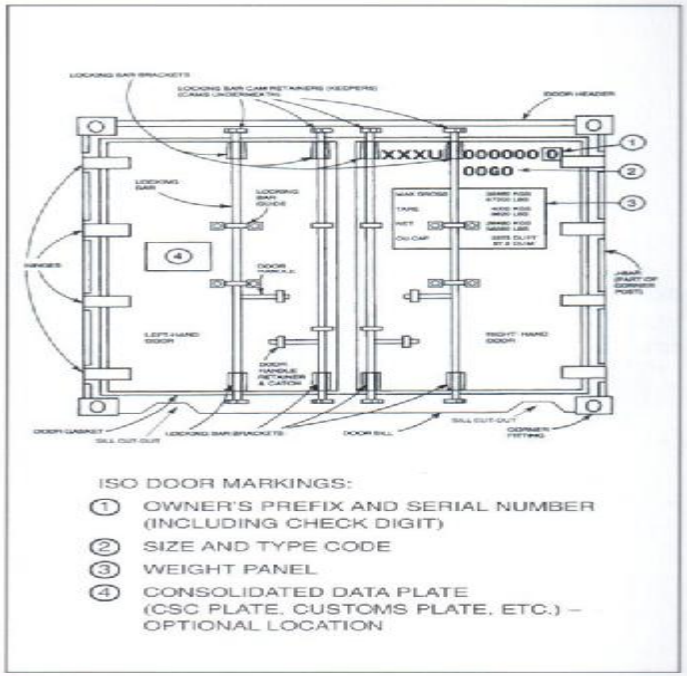


Fig. 3/Door (rear) end component detail

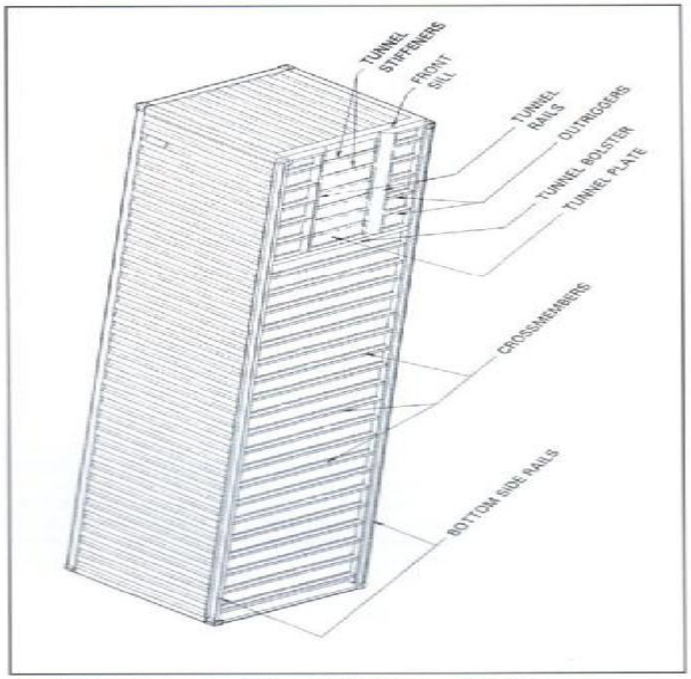


Fig. 4/Understructure and tunnel of 40-foot container

Container parts continued

pages, should be corrected. Wear-related defects from corrosion which threaten the structural integrity of the container should also be repaired.

If there is a conflict in measuring between metric and U.S. Customary dimensions when determining whether or not damage should be repaired, the metric dimension is to take precedence.

In order to make a complete and proper repair, certain rules apply governing the extent and finished condition of repairs. For example, components adjacent to repairworthy damages may also require repair, even if they themselves are not damaged beyond the listed criteria. See Section 3.3 for a complete description of these rules.

5.1 RAILS – EXAMPLES OF DAMAGE CONDITIONS

REPAIR NOT REQUIRED
Flat bar top side rail dented less than 25 mm (1 in).

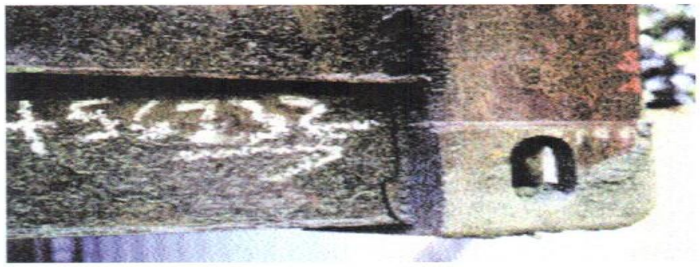
REPAIR REQUIRED
Bottom side rail torn and weld broken.

Front sill damaged next to corner casting

REPAIR NOT REQUIRED
Flange of bottom end rail not torn, cracked or cut, and web undamaged.

REPAIR REQUIRED
Front header deformed more than 25 mm (1 in).

NEED TO REPAIR UNDETERMINED
Since dent to bottom side rail is within 250 mm (10 in) of corner fitting, the weld to the fitting must be carefully examined and repaired if there is any evidence of break, cut, tear, crack or other damage.



REPAIR REQUIRED
Bottom rail cracked.

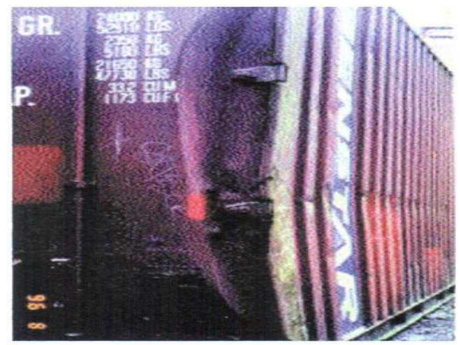
Examples of containers to be repaired and not

TABLE 5.1 RAIL INSPECTION CRITERIA (Continued)

COMPONENT	CONDITION	ACTION REQUIRED
Bottom side rails, front and door sills	Any deformation such as bend, bow, dent, etc. ON A WEB	If more than 50 mm (2 in) deep, REPAIR
	Any deformation such as bend, bow, dent, etc. ON A FLANGE	If torn, cracked or cut, REPAIR
Door headers and sills	Interference with door closure, securement and/or weathertightness	REPAIR

5.2 POSTS – EXAMPLES OF DAMAGE CONDITIONS

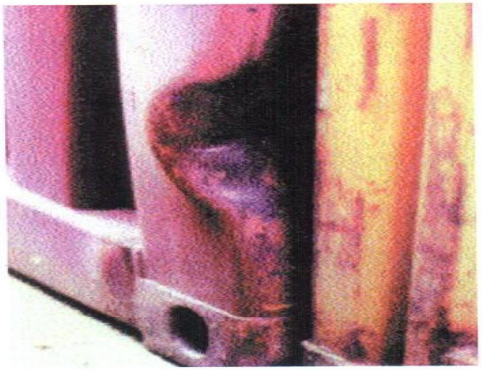
REPAIR REQUIRED
Corner post holed.



NEED TO REPAIR UNDETERMINED
Measure depth of bow in post and also dent in adjacent door panel, and check door operation. NOTE: If *either* post *or* door panel is repairworthy, *both* components must be repaired.

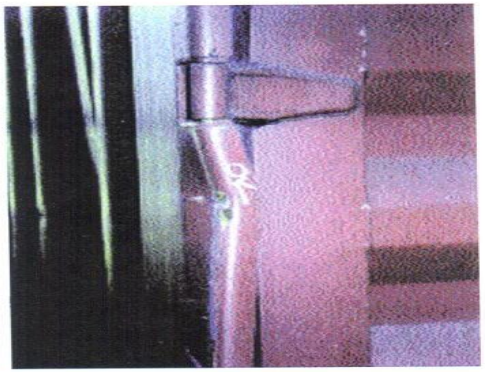
Damaged boxes repair required

REPAIR NOT REQUIRED
Corner post not dented in excess of 25 mm (1 in).



REPAIR REQUIRED
Corner post dented more than 25 mm (1 in).

REPAIR REQUIRED
J-bar bend impairs door operation.



REPAIR NOT REQUIRED
Bent J-bar does not impair door operation or securement.

Damaged boxes repair required

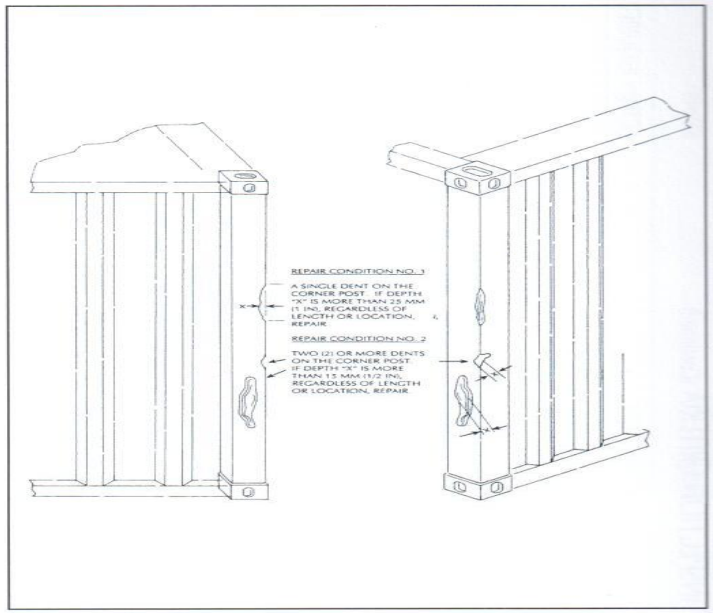
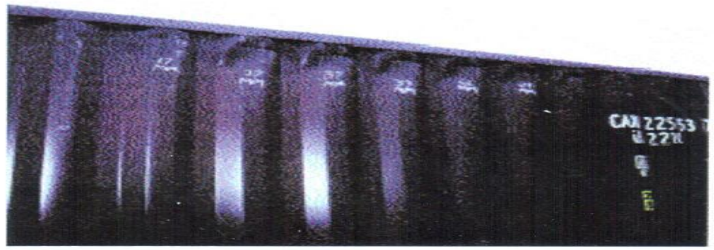
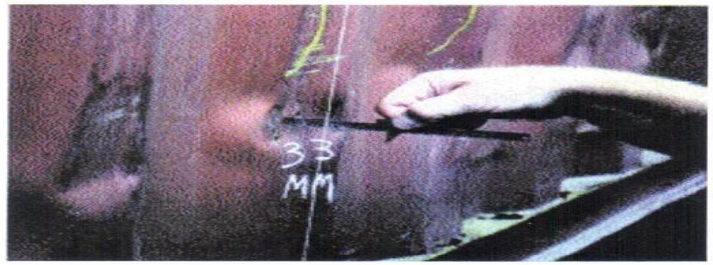


Fig. 6/Dented corner post

5.3 SIDE/FRONT PANELS – EXAMPLES OF DAMAGE CONDITIONS



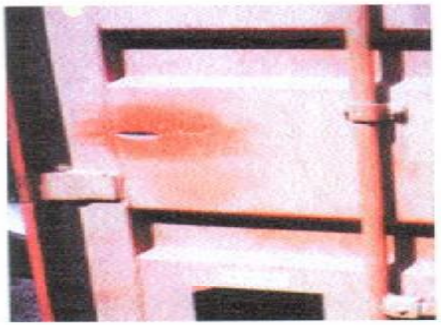
REPAIR REQUIRED
Outboard corrugation of side panel dented more than 35 mm (1-3/8 in). Repair is only required to 37 mm (1-7/16 in) dents; the other dents do not have to be repaired, as the compression rule no longer applies.



REPAIR NOT REQUIRED
Outboard corrugation of side panel dented less than 35 mm (1-3/8 in).

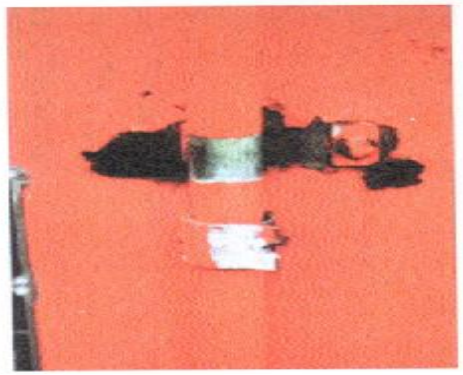
Examples of corner posts and side panels to be repaired

5.4 DOORS – EXAMPLES OF DAMAGE CONDITIONS



REPAIR REQUIRED
Hole in door panel

REPAIR NOT REQUIRED
Bent door handle does not impair door operation or securement.



REPAIR REQUIRED
Broken locking bar guide.

NEED TO REPAIR UNDETERMINED
Door panel dented less than 35 mm (1-3/8 in), which does not require repair. However, if door is **not both** water-tight **and** light-tight, repair **would** be required.

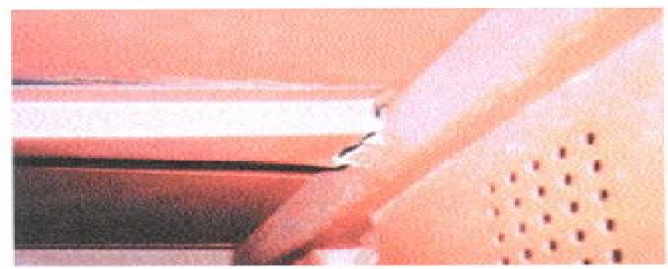
Damages to be repaired

TABLE 5.4 DOOR INSPECTION CRITERIA (Continued)

COMPONENT	CONDITION	ACTION REQUIRED
Door panels	Any deformation such as bend, dent, etc.	If more than 35 mm (1-3/8 in) deep, REPAIR
	Any bow involving the length or height of a panel	If internal dimensions are reduced more than 50 mm (2 in) at any point, REPAIR
Door gaskets	Loose or missing	REPAIR
	Cut, torn, cracked or burned	If not light-tight AND water-tight, REPAIR

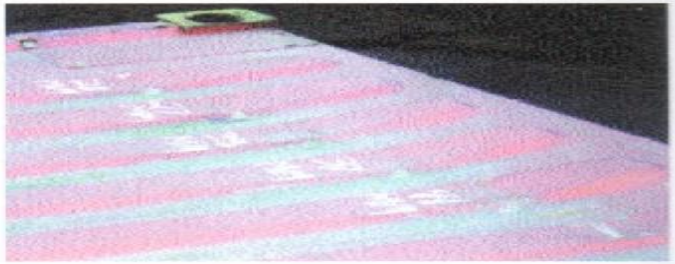
5.5 ROOFS – EXAMPLES OF DAMAGE CONDITIONS

REPAIR REQUIRED
Corner protection plate holed.

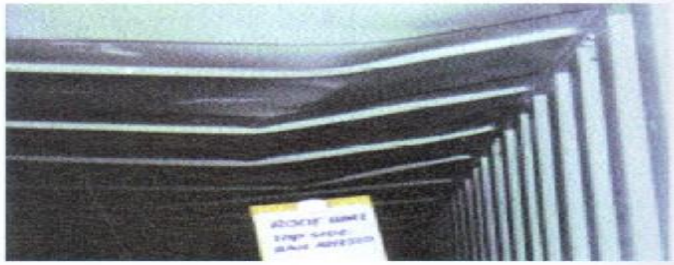


REPAIR REQUIRED
Roof bow weld to top side rail is broken.

To be repaired



REPAIR REQUIRED
Dent in corrugation more than 35 mm (1-3/8 in) deep. Only the 41 mm (1-5/8 in) and 37 mm (1-7/16 in) dents need to be repaired.



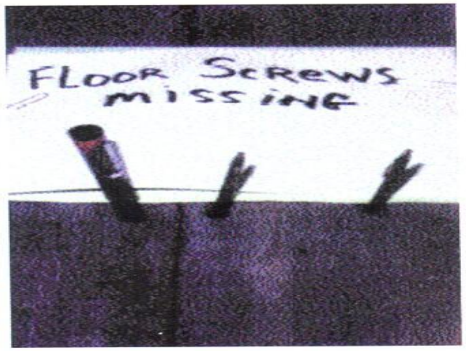
NEED TO REPAIR UNDETERMINED
Measure depth of roof panel dent and tip side rail deformation to see if either exceeds damage limits. Check deformation against ISO tolerances.

NEED TO REPAIR UNDETERMINED
Repair if dent is more than 35 mm (1-3/8 in).

REPAIR NOT REQUIRED
Damage to header extension plate does not reduce internal dimensions by more than 50 mm (2 in).

To be repaired

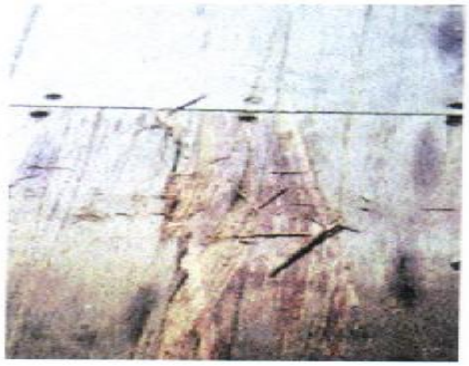
5.6 FLOORS – EXAMPLES OF DAMAGE CONDITIONS



REPAIR REQUIRED
Fasteners missing.

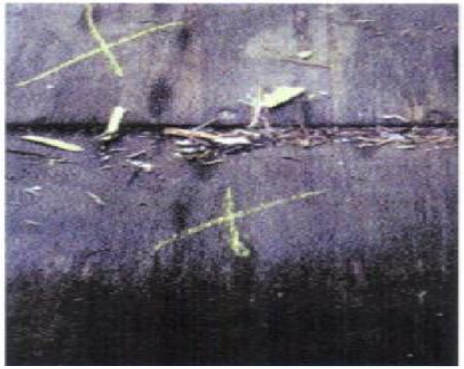
REPAIR REQUIRED
Splintered.

Floor to be repaired



REPAIR NOT REQUIRED
Gouge in top veneer of plywood less than 150 mm (6 in) wide and 5 mm (3/16 in) deep.

REPAIR REQUIRED
Delamination.



REPAIR REQUIRED
Heights of adjacent plywood panels differ by more than 5 mm (3/16 in).

REPAIR REQUIRED
Gouge in floor boards more than 15 mm (9/16 in) deep.

Floor to be repaired

5.7 UNDERSTRUCTURE – EXAMPLES OF DAMAGE CONDITIONS

REPAIR REQUIRED
Forklift pocket side holed.

REPAIR REQUIRED
Forklift pocket strap weld cracked.

REPAIR REQUIRED
Crossmember web deformed more than 50 mm (2 in).

REPAIR REQUIRED
Forklift pocket strap missing.

All to be repaired – bottom rail bent – fork pockets

FLOORS

Dust and Dirt

CONDITION PHOTO 6.5/Dust and dirt that is *unacceptable* to shippers or lessees for shipment of dry-van cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Hot high-pressure wash

FLOORS

Mud Foot Prints

CONDITION PHOTO 6.6/Transferable or non-transferable *dried* mud foot prints that would normally remain after a sweep out, and that would *not* damage dry-van general cargo.

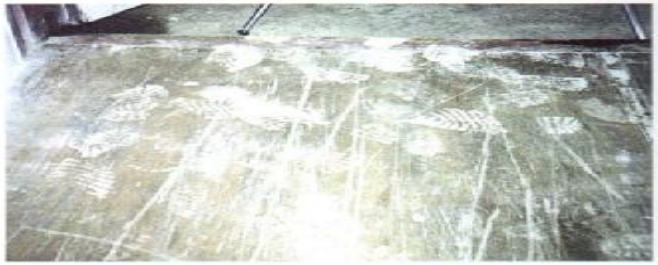
Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

All to be cleaned and steamed

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Mud Foot Prints



CONDITION PHOTO 6.7/Raised mud foot prints (*ie.*, footprints having a discernable thickness) in excess of what normally would remain after a sweep out.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Sweep

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Floor Stains

CONDITION PHOTO 6.8/Dry dust covering dried floor stains as would normally remain after a sweep out.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

All to be cleaned and steamed

FLOORS

Floor Stains

CONDITION PHOTO 6.9/Dry dust covering floor stains in an amount greater than would normally remain after a sweep out, and that would *not* be acceptable to the shipper or lessee.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Sweep

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Floor Stains

CONDITION PHOTO 6.10/Transferable damp floor stain that would *not* damage dry-van general cargo.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

All to be cleaned and steamed

FLOORS

Floor Stains

CONDITION PHOTO 6.11/Transferable or non-transferable dried floor stains that will *not* damage dry-van general cargo.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

FLOORS

Floor Stains

CONDITION PHOTO 6.12/Transferable or non-transferable dried floor stains that will *not* damage dry-van cargo.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

All to be cleaned and steamed

FLOORS

Floor Stains

CONDITION PHOTO 6.13/Damp oil stain that is transferable and that would damage dry-van general cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Hot high-pressure wash

FLOORS

Floor Stains

CONDITION PHOTO 6.14/Damp and transferable oil stains that would damage dry-van general cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Hot high-pressure wash

All to be cleaned and steamed

FLOORS

Floor Stains

CONDITION PHOTO 6.15/Transferable, damp, liquid stain that would damage dry-van general cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Cold high-pressure wash

FLOORS

Floor Stains

CONDITION PHOTO 6.16/Pooled oil on floor surface that would damage cargo and impede the safe loading and operation of the container.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Spot clean

All to be cleaned and steamed

FLOORS

Floor Stains

CONDITION PHOTO 6.17/Tar stain that would damage cargo and impede the safe loading and operation of the container.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Scrape/ spot clean

FLOORS

Floor Stains

CONDITION PHOTO 6.18/Wet, standing and pooled liquid that would damage cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Hot high-pressure wash

All to be cleaned and steamed

FLOORS

Tire Marks

CONDITION PHOTO 6.19/Forklift tire marks on floor that would *not* damage dry-van general cargo.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

FLOORS

Tire Marks

CONDITION PHOTO 6.20/Forklift tire marks on floor that would *not* damage dry-van general cargo.

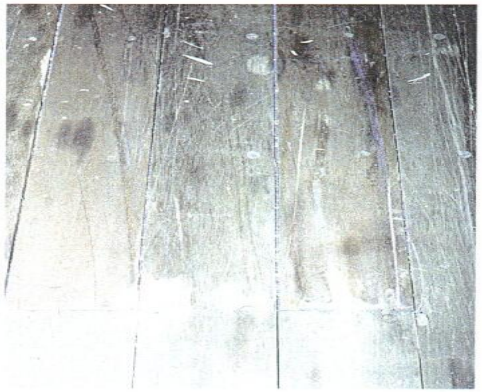
Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

All to be cleaned and steamed

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Cargo Residues



CONDITION PHOTO 6.21/Polyethylene beads between floorboard grooves and on floor surface that would normally remain after a sweep out and would *not* damage dry-van general cargo.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Cargo Residues

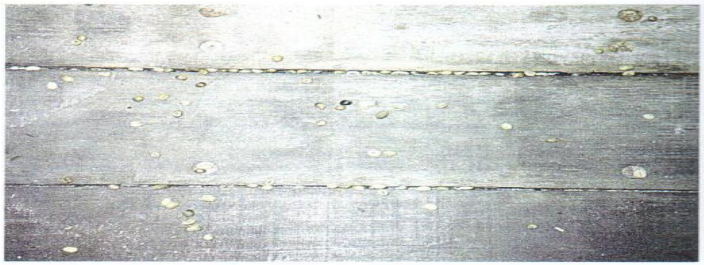
CONDITION PHOTO 6.22/Polyethylene beads remaining on floor surface and stuck to caulking that would impede the safe loading and operation of a container.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Sweep

All to be cleaned and steamed

FLOORS

Cargo Residues



CONDITION PHOTO 6.23/Organic residue (*e.g.*, coffee beans) remaining inside container. All organic materials inside the container *must* be removed.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Scrape/sweep

FLOORS

Cargo Residues

CONDITION PHOTO 6.24/Organic residue on floor. All organic materials inside the container *must* be removed.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Sweep

All to be cleaned and steamed

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Damage

CONDITION PHOTO 6.25/Debris and dunnage that would damage dry-van general cargo and impede the safe loading and operation of the container.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Remove

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Spillage

CONDITION PHOTO 6.26/Paint spills that will *not* transfer to cargo.

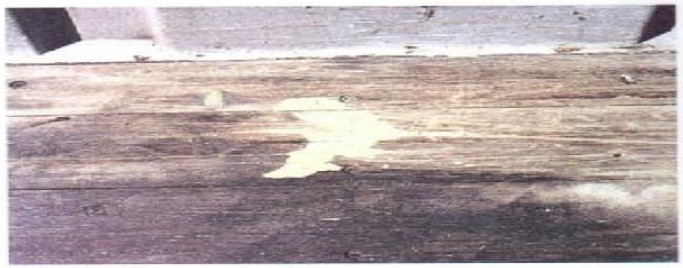
Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

All to be repaired and cleaned and steamed

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Spillage



CONDITION PHOTO 6.27/Paint spills that will *not* transfer to cargo.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Spillage

CONDITION PHOTO 6.28/Major paint spillage that would *not* be acceptable to a shipper or lessee.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Power sanding

All to be cleaned and steamed and paint scrubbed off

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Burn Marks

CONDITION PHOTO 6.29/Transferable burn marks on floor that will *not* damage dry-van general cargo.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Burn Marks

CONDITION PHOTO 6.30/Transferable burn marks on floor that could damage dry-van general cargo and are *not* acceptable to shippers or lessees for dry-vans.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Power sanding

All to be repaired and cleaned and steamed

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Floor Screws

CONDITION PHOTO 6.31/Floor screw corrosion that will not damage dry-van general cargo.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Nails

CONDITION PHOTO 6.32/Nail heads that are flush to surface and will *not* damage dry-van general cargo and will *not* impede the safe loading and operation of the container.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

All nails and screws to be removed and steamed

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Nails

CONDITION PHOTO 6.33/Nails protruding above floor which could damage dry-van general cargo and could impede the safe loading and operation of the container.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Remove

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

FLOORS

Nails

CONDITION PHOTO 6.34/Nails protruding above floor surface which will damage dry-van general cargo and impede the safe loading and operation of the container.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Remove

All nails and screws to be removed and steamed

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

WALLS

Dust and Dirt

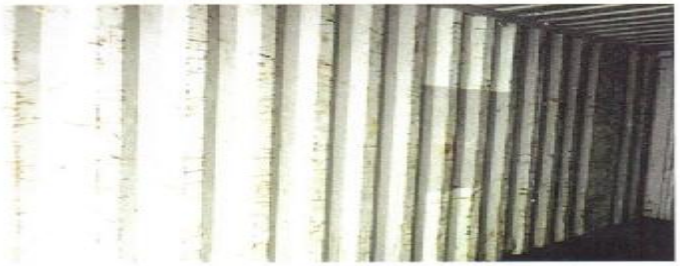
CONDITION PHOTO 6.35/Dust and dirt on walls that will damage dry-van general cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Washing

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

WALLS

Scratches



CONDITION PHOTO 6.36/Accumulated scratches due to normal use of container.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

All dust and to be removed and steamed and scratches repainted

WALLS

Scratches

CONDITION PHOTO 6.39/Scratches due to cargo loading that would *not* be acceptable to a shipper or lessee for shipment of dry-van general cargo, but *would* be acceptable for open-top cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Grind/ paint

WALLS

Scratches

CONDITION PHOTO 6.40/Scratches due to cargo loading that would *not* be acceptable to a shipper or lessee for shipment of dry-van general cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Grind/ paint

Scratches to be repainted

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

WALLS

Stains

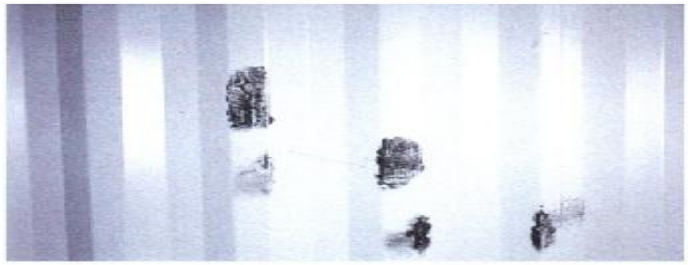
CONDITION PHOTO 6.43/Non-transferable stains that would *not* damage dry-van general cargo.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

WALLS

Stains



CONDITION PHOTO 6.44/Non-transferable stains that would *not* damage dry-van general cargo and that would be acceptable for shipment of general cargo.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

Stains to be removed or repainted

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

WALLS

Stains

CONDITION PHOTO 6.47/Non-transferable wall stains that would be acceptable for shipment of dry-van general cargo.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

WALLS

Stains

CONDITION PHOTO 6.48/Non-transferable wall stains that would be acceptable for shipment of dry-van general cargo.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

To be Steam cleaned

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

WALLS

Stains

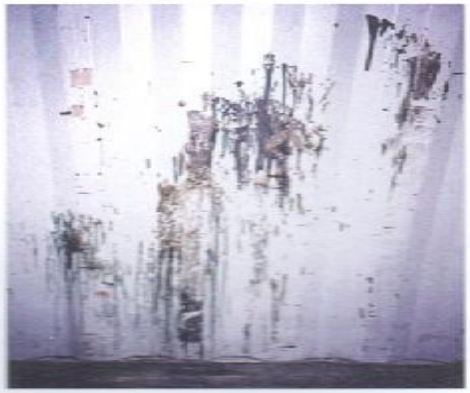
CONDITION PHOTO 6.49/Non-transferable wall stains that would be acceptable for shipment of dry-van general cargo.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

WALLS

Stains



CONDITION PHOTO 6.50/Non-transferable wall stains that would *not* be acceptable to a shipper or lessee for shipment of dry-van general cargo.

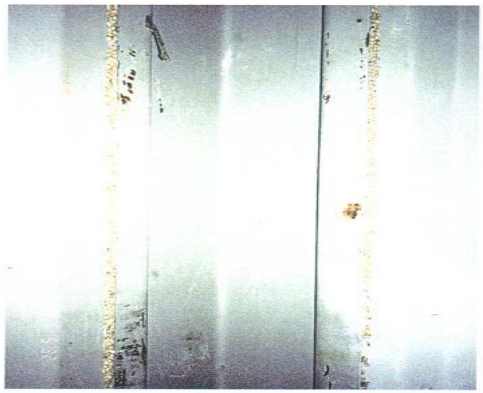
Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Power grind/ paint

To be Steam cleaned

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

WALLS

Cargo Residues



CONDITION PHOTO 6.53/Organic residues stuck to caulking. All organic materials in the container *must* be removed.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Scrape

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

WALLS

Mold

CONDITION PHOTO 6.54/Mold and/or mildew. All organic materials *must* be removed.

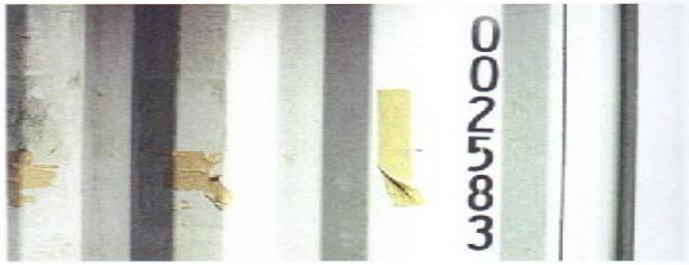
Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Hot high-pressure wash

Cargo residue to be removed and Steam cleaned

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

WALLS

Tape



CONDITION PHOTO 6.55/Tape remaining on walls that would *not* be acceptable to a shipper or lessee for shipment of cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Scrape/ spot clean

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

WALLS

Lining Paper

CONDITION PHOTO 6.56/Lining paper remaining on walls that would *not* be acceptable to a shipper or lessee for shipment of cargo.

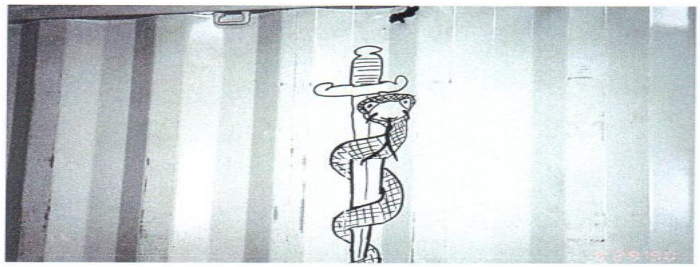
Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Scrape

Residue of tape to be scraped off and cleaned

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

WALLS

Graffiti



CONDITION PHOTO 6.61/Graffiti, not related to cargo, that would *not* be acceptable for shipment of general dry-van cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Paint over

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

ALL INTERIOR SURFACES

Hazardous Material

CONDITION PHOTO 6.62/Evidence of possible toxic or hazardous material regardless of quantity or transferability.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	*1

**1 The container may be rejected at the gate, at the discretion of the depot operator. Otherwise, the container must be segregated and the redelivery agent contacted to establish the type of contamination present and the appropriate action required.*

Graffiti removed or over painted and hazardous cargo to removed with caution and based on clear information on the product

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

ALL INTERIOR SURFACES

Infestation

(PHOTO NOT AVAILABLE)

CONDITION 6.65/Infestation such as insects, rodents, etc., which will damage dry-van cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Hot high-pressure wash

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

EXTERIOR

Graffiti

CONDITION PHOTO 6.66/Depot marks that would be acceptable for shipment of dry-van cargo.

Action Required If This Condition Is Present	No repair
Recommended Cleaning Method	Not applicable

NO action

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

EXTERIOR

Graffiti

CONDITION PHOTO 6.67/Customer marks that would *not* be acceptable for shipment of dry-van cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Spot clean/ paint

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

EXTERIOR

Graffiti

CONDITION PHOTO 6.68/Graffiti that would *not* be acceptable for shipment of dry-van cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Paint over

NO action

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

EXTERIOR

Labels

CONDITION PHOTO 6.73/Painted-over labels that would *not* be acceptable for shipment of dry-van cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Scrape

Repair/scrape

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

EXTERIOR

Spillage

CONDITION PHOTO 6.74/Spillage on exterior that renders ISO markings illegible and would *not* be acceptable for shipment of dry-van cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Spot clean

Repair/clean

CONDITION PHOTOGRAPHS, CRITERIA & RECOMMENDED ACTION:

EXTERIOR

Spillage

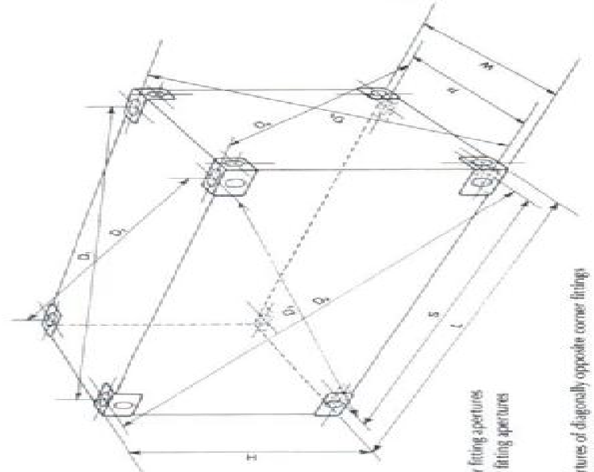
CONDITION PHOTO 6.75/Spillage on exterior that attacks paint and that would *not* be acceptable for shipment of dry-van cargo.

Action Required If This Condition Is Present	Repair
Recommended Cleaning Method	Blast/paint

Repair/blast & paint

APPENDIX B ISO DIMENSIONS AND TOLERANCES

(Adapted from International Standard ISO 668: 1995 and ISO 1496-1: 1990; 1990/Amd 1: 1993)



S = Length between centers in corner fitting apertures
P = Width between centers in corner fitting apertures
L = External length of the container
W = External width of the container
D = Distance between centers of apertures of diagonally opposite corner fittings
K_1 = Difference between D_1 and D_2 or D_3 and D_4
K_2 = Difference between D_5 and D_6
H = Overall height

EXTERNAL DIMENSIONS AND TOLERANCES IN MILLIMETERS AND IN FEET AND INCHES

Height - 8 ft. high: 2 438 $^{+0}_{-5}$ mm (8 ft 0 in. $^{+0}_{-3/16}$ in.) Height - 8 1/2 ft. high: 2 591 $^{+0}_{-5}$ mm (8 ft 6 in. $^{+0}_{-3/16}$ in.)

Height (external) - 9½ ft. high: 2 896 $^{+0}_{-5}$ mm (9 ft 6 in. $^{+0}_{-3/16}$ in.) Width - All containers: 2 438 $^{+0}_{-5}$ mm (8 ft 0 in. $^{+0}_{-3/16}$ in.)

Freight container designation	Length (external)			S			P			K_1 max.		K_2 max.	
	mm	ft	in	mm	ft	in	mm	ft	in	mm	in	mm	in
40'	12 192 $^{+0}_{-10}$	40	0 $^{+0}_{-3/8}$	11 985	39	3-7/8	2 259	7	4-31/32	19	3/4	10	3/8
30'	9 125 $^{+0}_{-10}$	29	11-1/4 $^{+0}_{-3/8}$	8 918	29	3-1/8	2 259	7	4-31/32	16	5/8	10	3/8
20'	6 058 $^{+0}_{-6}$	19	10-1/2 $^{+0}_{-1/4}$	5 853	19	2-7/16	2 259	7	4-31/32	13	1/2	10	3/8

MINIMUM INTERNAL DIMENSIONS

Freight container designation	Minimum height	Minimum width		Minimum length		
		mm	in	mm	ft	in
20'	Nominal container external height minus 241 mm (9-1/2 in)	2,330	91-3/4	5,867	19	3
30'				8,931	29	3-5/8
40'				11,998	39	4-3/8

Tolerances after repair

APPENDIX C TOLERANCE LIMITS FOR DAMAGE (ISO AND IICL TOLERANCES)

The International Organization for Standardi-zation (ISO) prescribes certain minimum and maximum dimensions that are to be preserved, with positive and negative tolerances (i.e., allowances above and beyond the specified dimensions). To determine whether to repair damage which may affect these dimensions, IICL permits an *additional* tolerance beyond the ISO tolerance, i.e., 5 mm (3/16 in) for end frame components (corner posts, front panel, doors [including door hardware], headers, sills, and corner fittings), and 10 mm (3/8 in) for all other components. However, the ISO limits must be followed for the diagonal measurements between corner fitting apertures (including dimensions D_1-D_6, K_1, K_2, P and S shown in Appendix B); there is no *additional* IICL tolerance. See also ISO Standards 668 and 1496-1.

The following table shows the container dimensions defined by ISO and the IICL limits of acceptability. *If the dimension measures less than the IICL minimum limit, or more than the IICL maximum limit, for these dimensions, repair is required.*

Components	IICL + ISO damage limits
Top side rails	OUTWARDS: Maximum 10 mm (3/8 in) beyond plane of side surfaces of corner fittings
Side panels	UPWARDS (rails): Maximum 4 mm (5/32 in) above plane of upper surfaces of top corner fittings
Bottom side rails	OUTWARDS: Maximum 10 mm (3/8 in) beyond plane of side surfaces of corner fittings DOWNWARDS: Not below the plane of the lower surfaces of the bottom corner fittings
Front and door headers	OUTWARDS: Maximum 5 mm (3/16 in) beyond plane of end surfaces of corner fittings
Front and door panels	UPWARDS (headers): Maximum 4 mm (5/32 in) above plane of upper surfaces of top corner fittings
Front and door sills (20' containers) Door sill (40' containers)	OUTWARDS: Maximum 5 mm (3/16 in) beyond plane of end surfaces of corner fittings DOWNWARDS: Not below the plane of the lower surfaces of the bottom corner fittings
Front sill (40' containers)	OUTWARDS: Sill face must be at least 1 mm (1/32 in) *behind* plane of end surfaces of corner fittings DOWNWARDS: Not below the plane of the lower surfaces of the bottom corner fittings

(Continued on page 166)

Tolerances after repair

Appendix C—Tolerance Limits for Damage (ISO and IICL Tolerances), continued

Components	IICL+ISO damage limits
Corner posts	INWARDS: Follow IICL criteria in Table 5.2 (25 mm [1 in] maximum, or 15 mm [9/16 in] maximum for 2 or more dents) OUTWARDS: Maximum 5 mm (3/16 in) beyond plane of *either* end surfaces or side surfaces of corner fittings
Roof panels	DOWNWARDS: Follow IICL criteria in Table 5.5 (35 mm [1-3/8 in] maximum UPWARDS: Maximum 4 mm (5/32 in) above plane of upper surfaces of top corner fittings
Crossmembers, outriggers, fork-lift pocket sides and gooseneck tunnel rails	DOWNWARDS: Lower flange must be at least 1 mm (1/32 in) above plane of the lower surfaces of the bottom corner fittings INWARDS (fork-lift pocket sides): See "Fork-lift pocket opening WIDTH" below
Fork-lift pocket strap	DOWNWARDS: Minimum 10 mm (3/8 in) above plane of the lower surfaces of the bottom corner fittings UPWARDS: See "Fork-lift pocket opening HEIGHT" below

(Continued on page 167)

Appendix C—Tolerance Limits for Damage (ISO and IICL Tolerances), continued

Components	IICL+ISO damage limits	
Fork-lift pocket opening	WIDTH:	"LOADED" pockets: Minimum 345 mm (13 5/8 in) "EMPTY" pockets: Minimum 295 mm (11 5/8 in)
	HEIGHT:	"LOADED" pockets: Minimum 105 mm (4 1/8 in) "EMPTY" pockets: Minimum 92 mm (3 5/8 in)
Gooseneck tunnel	LENGTH L: Minimum 3140 mm (123 7/8 in); Maximum 3510 mm (138 1/4 in)	
	WIDTH of tunnel opening X_t: Minimum 1019 mm (40 1/8 in); Maximum 1042 mm (41 in)	
	HEIGHT of tunnel opening B_t: Minimum 107 mm (4 1/4 in); Maximum 130 mm (5 1/8 in)	
Door opening	WIDTH:	Minimum 2281 mm (89-13/16 in)
	HEIGHT:	8' high container: Minimum 2129 mm (83-13/16 in) 8'6" high container: Minimum 2256 mm (88-13/16 in) 9'6" high container: Minimum 2560 mm (98-13/16 in)

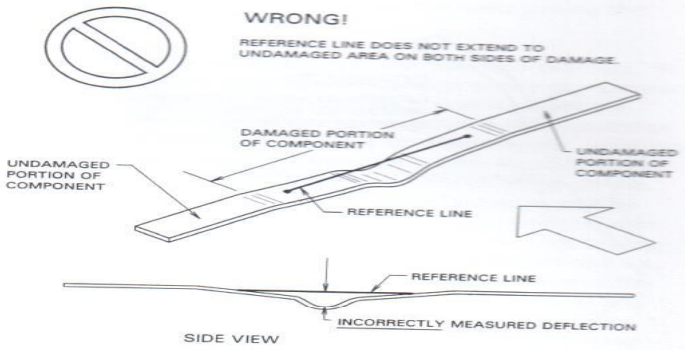


Fig. 2.2/INCORRECT placement of reference line: full damage NOT measured. See Section 2.1.1.

2.1.2 Measuring Bends, Dents and Bows (Convex Damage and Damage to Non- Linear Surfaces: "Space Out/Measure Back" Method)

Two exceptions exist for the measurement method described above in Section 2.1.1: first, when damage is convex with respect to the reference line (that is, when damage extends out into the path of the reference line); and second, when the damage occurs on a non-linear surface. The first exception is explained below and in 2.1.2.1, and the second in 2.1.2.2. In addition, there are cases where the reference line cannot be placed directly over the damage because adjacent components would extend into the reference line.

When convex damage cannot be measured from the opposite side (with the reference line positioned on the concave side, as described in Section 2.1.1), the "space out/measure back" method should be used. The reference line is "spaced out" (*i.e.*, placed away) from the component by a known distance in order to clear all obstacles. "Spacers" of a known thickness (height) are used to position the reference line away from the damaged component. A spacer is placed on either side of a

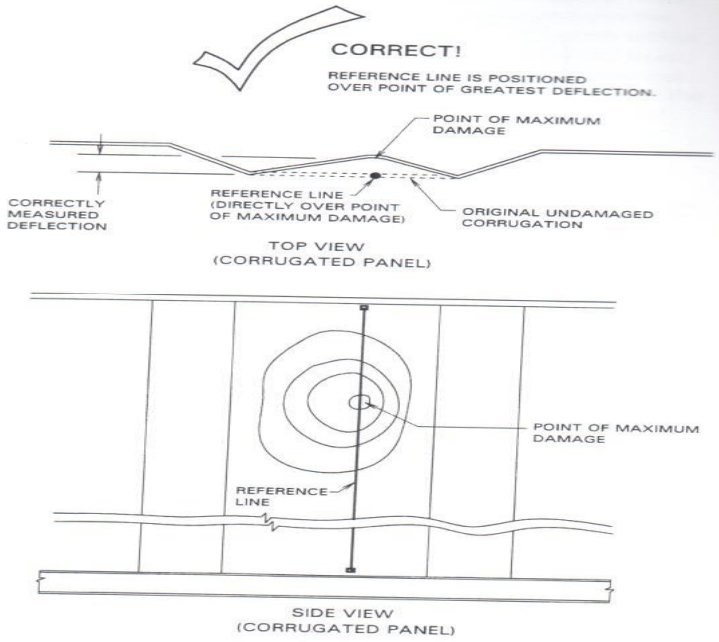


Fig. 2.3/Correct placement of reference line: placed over point of damage. See Section 2.1.1.

Measuring of damages – to be repaired or not

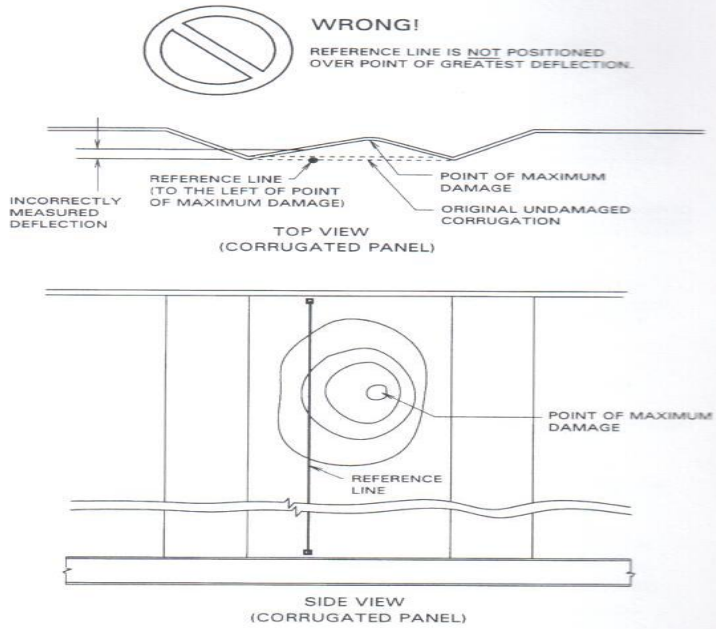


Fig. 2.4/INCORRECT placement of reference line: ***NOT*** placed over point of maximum damage. See Section 2.1.1.

component, and the reference line is extended from the top surface of one spacer across to the top surface of the second spacer. A measurement is then made from the reference line to the point of maximum deflection within the damage. This measurement is then subtracted from the distance that the reference line has been spaced out from the component to determine the actual depth of the damage. For the purposes of this manual, this method will be referred to as the "space out/measure back" method.

For the drawings in this manual illustrating situations where damage measurements that are made by calculation, such as in the method described above, the capital letter "S" will denote a spacer thickness, "M" a measured dimension; and "D" a calculated dimension of damage.

2.1.2.1 Using Space Out/Measure Back Method to Measure Damage in Two Directions

Figure 2.5 shows the space out/measure back technique used to measure web damage to a crossmember that has been bent in two directions. The string line cannot be placed directly on either side of the web because the adjacent damage interferes with running the line over the entire length of the crossmember. Consequently, the reference line is spaced back from the crossmember web (in actual practice, the reference line is held against the bottom side rail webs a known distance away from the crossmember web), and the damage is determined by measurement and calculation as shown in the figure.

2.1.2.2 Measuring Damage on Non-Linear Surfaces (Roof Sheets)

The second case where damage cannot be measured using the common method described in Section 2.1 involves the measurement of damage on non-linear surfaces (*i.e.*, roof sheets). Because the reference line is straight, it cannot follow the original curved surface of the roof sheet; therefore; the original undamaged position of the damaged surface cannot be precisely determined. To provide a common framework for assessing this type of damage and to assure consistent field measurement results, this Guide recommends that the curvature of the roof sheet in such cases be *ignored*; the reference line should simply be placed across the entire

Measuring of damages – to be repaired or not

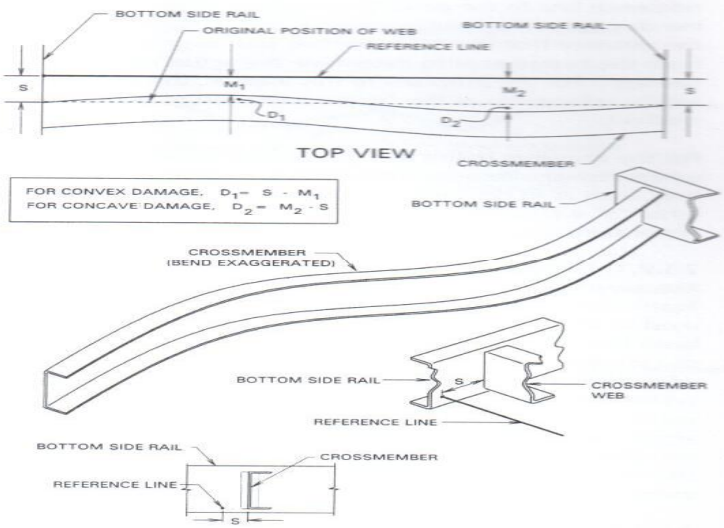


Fig. 2.5/Measuring crossmember web damage when reference line cannot be placed along web. See Section 2.1.2.1.

length of the damaged component, and the measurement taken from reference line to the point of maximum damage just as in Section 2.1. The reference line should be placed on the concave side of the damage. If this is not possible, the reference line may be placed on the convex side of the damage, and the "space out/measure back" method of measurement used.

Figure 2.6 (on next page) shows an upward bend on the interior surface of a roof sheet in the flat area between corrugations. As the camber (curvature) of the roof cannot be followed by the reference line, the damage measurement is made from a reference line placed horizontally across the roof sheet width, and roof camber is ignored.

2.2 Measuring Damage to Check "Envelope" Limits (ISO Dimensions Plus ISO/IICL Tolerances)

In the cases discussed above, it was necessary to measure the depth of damage and compare to the permissible limit for that component to determine if repair was required. Certain IICL criteria, however, are not based on acceptable limits for a particular bend, dent or bow. Instead, they require that the damage not pass beyond certain prescribed limits defined by ISO, with added tolerances permitted by IICL ("IICL tolerances"). These criteria, commonly known as the "out-of-ISO" and "into-container-cube" limits, are also measured with the use of a reference line. Instead of measuring a dent to ascertain if the depth exceeds a limit, the damage is measured to see if it exceeds ISO dimensions and ISO plus IICL tolerances. In these cases, the reference line is used to establish the limiting surface (as, for instance, corner fitting faces) and the damage is checked to see if it reaches that limit.

2.2.1 Using "Space Out" Method With Limiting Surface as Reference Point

Figure 2.7 shows a situation in which an impact to a corner post has pushed material outward so that it could possibly exceed the IICL criteria for end frame dimensions of "ISO + 5 mm (3/16 in)"; that is, no end-frame damage may extend more than 5 mm (3/16 in) beyond the vertical plane defined by the vertical surfaces of the corner fittings. In this case, the reference line is spaced out 5 mm (3/16 in) from the corner fitting surfaces, and

Measuring of damages – to be repaired or not

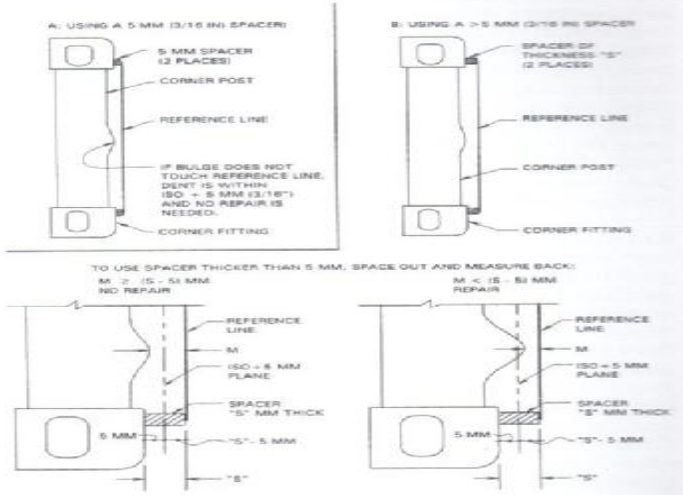


Fig. 2.7/Using a spacer to determine if corner post damage exceeds ISO + IICL tolerances. See Section 2.2.1.

joining top rail to panel, and extending down to the weld joining bottom rail to panel. The bend, dent or bow depth should be measured in the standard way, from reference line to the point of maximum damage. The assumption is made that the interior surface of an undamaged outboard corrugation is located 8 mm (3/8 in) inwards of the outside vertical face of the corner fittings. The reference dimension in the case illustrated in Figure 2.8 is **18 mm (11/16 in)**. *Therefore, if the measurement exceeds **18 mm (11/16 in)**, the outward bulge exceeds the ISO + 10 mm (3/8 in) criterion, and must be repaired.*

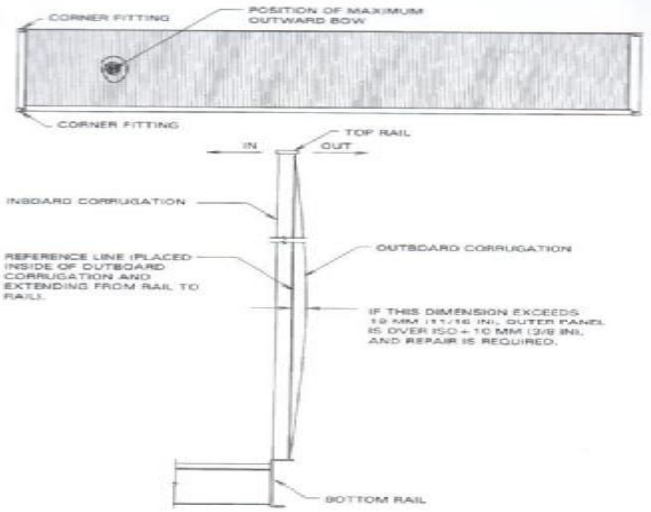


Fig. 2.8/Checking ISO + IICL tolerances when reference line cannot be positioned between two corner fittings over point of maximum damage. See Section 2.2.2.

2.2.3 Variations and Special Cases

The categories described above—measuring bends, dents and/or bows for damage limits, and measuring to check the envelope—cover most damage measurement situations. There are many variations of the fundamental measuring techniques as well as a few special cases that require a different approach. Section 4 of this Guide will describe these variations in measurement methods and the techniques that can be used to handle cases where the basic procedures in this Section cannot be followed.

Measuring of tolerances exceeded or not

SECTION 3 TOOLS REQUIRED FOR DAMAGE MEASUREMENT

3.1 Basic Measurement Tools

Damage measurement requires a certain minimum number of tools. The inspector should keep these tools on hand at all times when inspecting a container. Basic measurement tools consist of the following:

1. Retractable reference line of at least 2.9 meters (9.5 feet), with magnet attached to end
2. Damage scale. This generally consists of a ruler of at least 150 mm (6 in), preferably with gauges for 5 mm (3/16 in) and 15 mm (9/16 in) gouges attached.
3. Several magnetic spacers of various heights or thicknesses (some spacers have protruding pins of varying heights to which reference lines can be attached, as in the photos on page 50)
4. Taper gauge (a triangular flat bar which shows the increasing width measurements away from the pointed end)
5. Standard tape measure, approximately 3.5 m (12.5 ft)

The following other tools or equipment are also required for general container inspection, and should be kept on hand at all times during a container inspection:

1. Corrosion testing hammer (having a tapered end with a rounded point)
2. Aluminum weather-resistant clipboard

The top photo on page 18 illustrates the tools listed above.

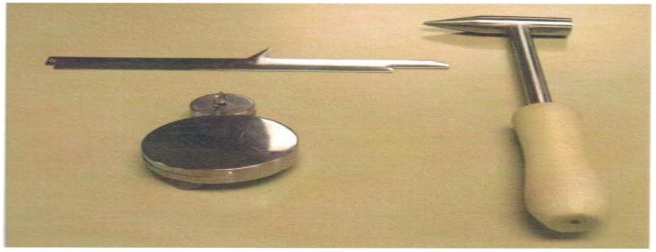
3.2 Recommended Additional Tools for Container Inspection

In addition to the basic tools required for damage measurement and general container inspection, an inspector should have access to a number of other tools that are needed for less common measurement situations. These additional tools, although not required to be in the inspector's possession at all times as are those listed in Section 3.1 above, should be readily available in the depot where the inspections are performed. They are:

1. A 15.3 meter (50 feet) retractable chalk line or string line
2. A 15.3 meter (50 feet) measuring tape
3. A small autofocus camera
4. Chalk and/or magnetic clip and note paper
5. A multi-purpose folding tool, such as a "Leatherman" tool or Swiss Army knife
6. IICL inspection manuals. To obtain guides and manuals from IICL, see the "Credits" page (back of title page).

See the bottom photo on page 18 for an illustration of some of the tools listed above in this section.

NOTE:
The IICL, understanding the need for basic inspection tools, has procured the retractable reference line, ruler, and corrosion testing hammer (see below photo). These tools can now be purchased on line through the IICL web site (www.iicl.org). Additional tools such as those referenced in section 3.1 and 3.2 should be purchased at your own discretion.



Measurement tools of the surveyor

Basic measurement tools for a container inspector. At the left, from top to bottom: a retractable reference line with a magnet attached to end and three magnetic spacers with protruding, notched pins of different heights for holding the reference line. In the center: a taper gauge and a damage scale with 5 mm (3/16 in) and 15 mm (9/16 in) gauges attached. At the far right: a corrosion testing hammer and a standard 3.5 m (12.5 ft) tape measure. The tools are resting on weather-resistant clipboard. See Section 3.1.

Recommended additional tools for container inspection. Clockwise, starting at top right with red knife: a Swiss Army knife; a multi-purpose folding tool (Leatherman's tool); a 15.3 m (50 ft) retractable string line with magnet attached to end; a 15.3 m (50 ft) retractable measuring tape; and a small autofocus camera. In the center: chalk and a magnetic clip and note paper. See Section 3.2.

SECTION 4 MEASUREMENT METHODS FOR SPECIFIC AND UNUSUAL CASES

4.1 Measurement Methods for Specific Components and in Individual Cases

This section describes how to apply basic damage measurement methods to specific components and situations, and what methods to use in unusual or difficult cases. Components covered include rails, corner posts, side panels, doors, roof panels and roof sheets, floors and crossmembers.

4.2 Methods of Measuring Damage to Rails

To measure damage to rails, follow the basic methods described in Section 2, "Fundamentals of Damage Measurement". Figures 4.1 - 4.5 illustrate these methods as applied to specific cases of damage to rails.

4.2.1 Measuring Localized Damage to Side and End Rails

As explained in Section 2, placement of the ends of the reference line to measure damage to a side rail depends upon the type of damage encountered. If damage to a side rail is localized, as in the case of a downward bend over a small portion of a flat-bar top side rail, a reference line is positioned between the undamaged portions of the damaged rail on either side of the damage, as shown in Figure 4.1. In this case, since it is clear that there is no overall downward bow of the entire side rail, the reference line does *not* need to extend across the entire length of the rail. When the reference line is in place, a measurement is made from the line to the point of maximum deflection (see Figure 4.1 and Section 2.1.1).

On the other hand, if there is localized damage to an *end* rail, the reference line must be placed over the *full length of the rail*.

Measurement tools of the surveyor

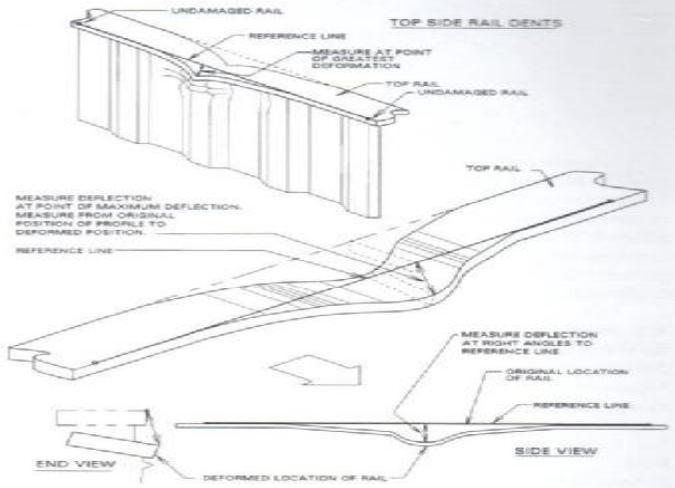


Fig. 4.1/Measuring localized damage to top rail. See Section 4.2.1.

4.2.2 Checking Rails for ISO Dimensions

Figure 4.2 illustrates a situation where a top side rail has an outward bow which the inspector suspects may exceed the IICL criteria for ISO dimensions and tolerances (ISO plus 10 mm [3/8 in]). In this case, the "space out" method must be used. The reference line is spaced out 10 mm (3/8 in) from the surfaces of the corner fittings; if the damage touches the reference line, the container is "out-of-ISO" and must be repaired (See Figure 4.2 A and Section 2.2).

If spacers measuring 10 mm (3/8 in) in thickness are not available, the inspector can use spacers of any thickness

over 10 mm (3/8 in) that places the reference line out beyond the damage, and can apply the "space out/measure back" method shown in Figure 4.2 B. In the example shown in this drawing, a reference line is positioned using spacers measuring 13 mm (1/2 in) in thickness, 3 mm (3/8 in) more than the IICL limit over ISO tolerances. In the situation illustrated on the bottom left drawing in Figure 4.2 B, a measurement from the reference line back to the point of maximum outward deflection shows more than 3 mm (1/8 in) between line and bow. Since the spacer thickness minus the measurement from the reference line to the point of maximum deflection is less than 10 mm (3/8 in), the bow is within the IICL plus ISO tolerances and repair is *not* required.

The bow in the drawing on the bottom *right* of Figure 4.2 B, however, *does* require repair: measurement reveals that *less than 3 mm (1/8 in)* remains between reference line and point of maximum bowing when a 13 mm (1/2 in) thick spacer is used. This means that the bow extends a little over IICL's 10 mm (3/8 in) limit beyond the surface of the corner fittings and therefore exceeds the IICL tolerance of 10 mm (3/8 in) beyond ISO.

See Section 2.2 for basic instructions in the "space out/measure back" method of checking the ISO envelope.

4.2.3 Measuring Bows or Gradual Deformation to Rails

If there is bowing over the entire length of a side or end rail, the reference line must extend over the *full* length of the rail. When measuring bow deformation, do not forget to include any accompanying bend or dent depths in the measurement. See the bottom color photo on page 22.

Measurement methods of the surveyor

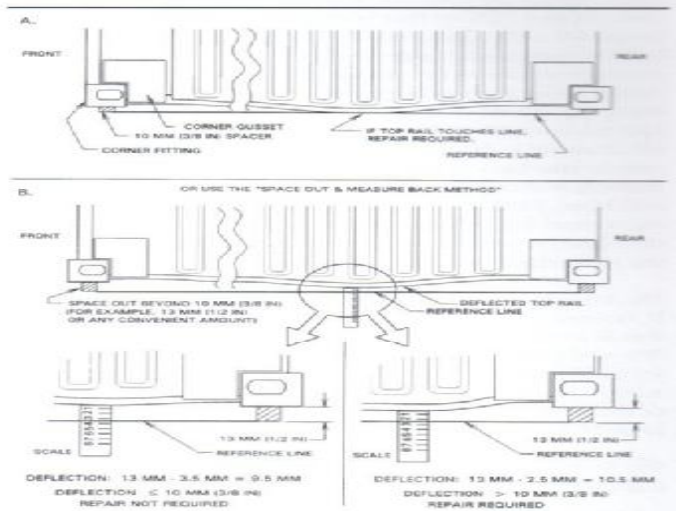
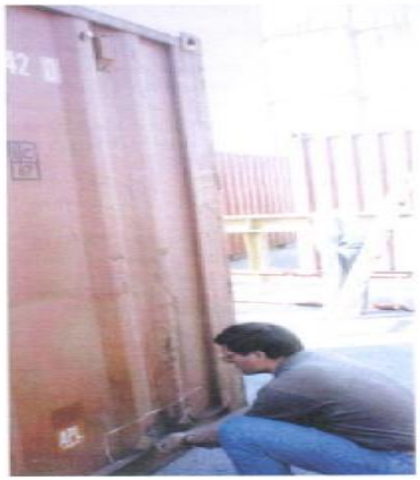


Fig. 4.2/Measuring outward bow in top rail. See Section 4.2.2.

Measuring bows to rails: the inspector measures distance from reference line to point of maximum deflection in a flat-bar top side rail. In the case of bows, the reference line must be extended across the full length of the rail. See Section 4.2.3.



Measuring damage to side panels: the inspector measures a dent to a side panel impacted from outside. Note that the reference line extends vertically over the full height of the panel. See Sections 2.1.1, 4.4 and 4.4.1.

Measuring damage to corner posts: the inspector measures the distance from reference line to point of maximum deflection in a corner post bow. The reference line extends over the full height of the post. See Section 4.3.

Measurement methods of the surveyor

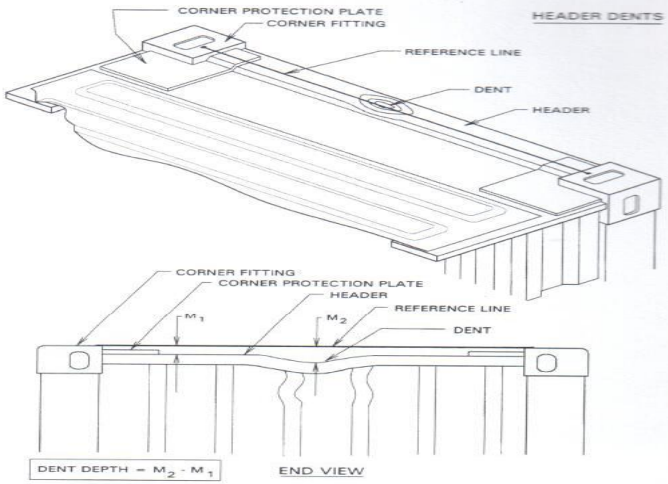


Fig. 4.3/Measuring damage to top header when corner protection plates prevent placing reference line over full length of header. See Section 4.2.4.

4.2.4 Measuring Damage to Headers with Corner Protection Plates

The location of the corner protection plates may prevent a reference line from being positioned over the full length of the header. In this case, the reference line may be placed on the corner protection plates where they overlap the header, and the damage depth ("D") is determined by subtracting the thickness of the corner protection plates from the measurement between reference line and point of maximum damage. The reference line may also be placed on the top surfaces of the corner fittings, as shown in Figure 4.3, and the depth of damage can be calculated using the "space out/measure back" method: the distance from rail to corner fitting top surface is subtracted from the dimension between reference line and point of maximum damage.

4.2.5 Measuring Damage to Bottom Rail Webs

Figure 4.4 illustrates several different situations involving measurement of damage to bottom rail webs. Whenever possible, the reference line should be placed so that the damage extends away from the reference line and the maximum deflection of the web may be easily measured. If the flange is in the way and makes it impossible to measure the web deflection, use the method illustrated in Figure 4.28. Although the flange may be deflected, only damage to the web should be measured. Flange deflections should be ignored.

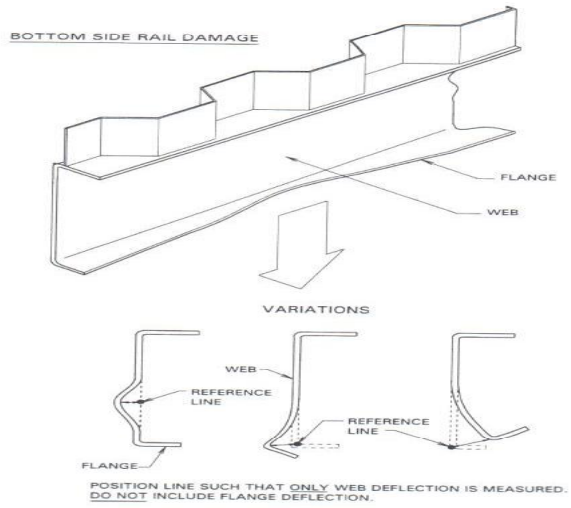


Fig. 4.4/Measuring damage to bottom rail web. See Section 4.2.5.

Measurement methods of the surveyor

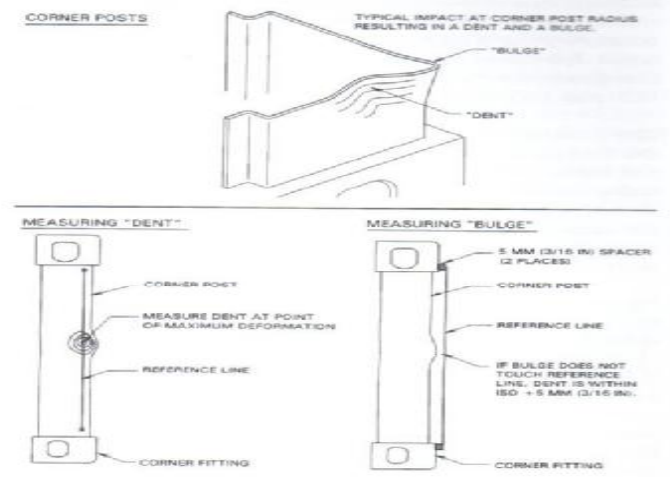


Fig. 4.6/Measuring damage to corner posts. See Section 4.3.

4.4 Measuring Damage to Side and Front Panels

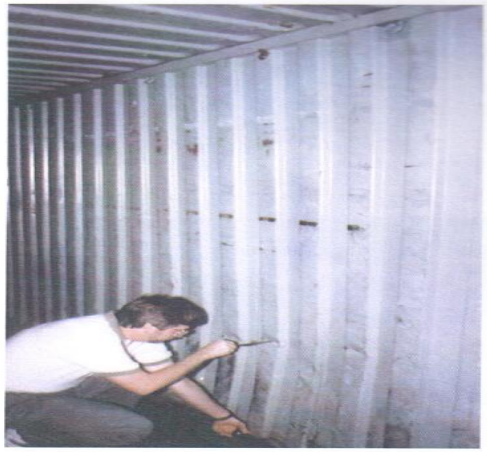
The general measurement method for panels differs from that used for structural members such as rails and posts, in that the reference line must be positioned *over the entire height of the panel* whenever possible. In other words, any type of damage to panels, including bends, dents *and* bows, requires the reference line to be placed over the full height of the panel. The line should be positioned vertically, from top to bottom of the panel.

IICL criteria for panels, however, are different for localized damage such as bends or dents, and for gradual damage over the length of a panel, such as bowing. Inspection criteria for bends and dents consist of specific depth limitations. All types of panel damage are subject to limits on reduction of the interior cube, as well as by ISO plus IICL tolerances.

For color photos showing measurement of side panels, see the bottom photo on page 22, the photo below and the photo on page 30.

Measuring dents to side panels impacted from the *outside*: the inspector measures the distance from reference line to point of maximum inward deflection. Note that the reference line extends vertically over the full height of the panel. See Section 4.4.1.

Measurement methods of the surveyor



Measuring dents to panels impacted from the *inside*: the inspector inside the container measures the distance from reference line to point of maximum outward deflection. Note that the reference line extends vertically over the full height of the panel. See Section 4.4.2.

4.4.1 Measuring Bends or Dents in Panels (Impacted from Outside)

As stated above, bends and dents in panels must be measured by extending the reference line vertically over the *entire height of the panel* from top to bottom, and making a measurement of the distance from the reference line to the point of maximum deflection, as shown in the photo on page 29. As explained in Section 2.1.1, the reference line must be placed directly over the point of maximum damage. Figure 4.7 illustrates this measurement method as applied to two common examples of panel damage. In these examples, the damage is from outside the container extending inwards. As mentioned in Section 4.3 above, the repairworthiness criterion is based on the depth of the dent or bend.

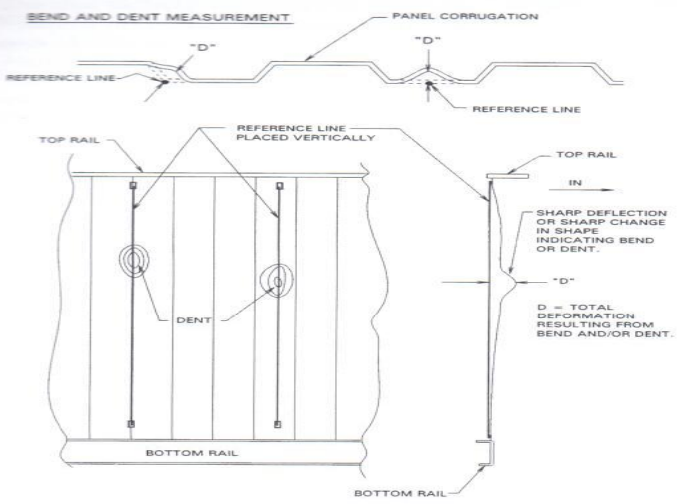


Fig. 4.7/ Measuring dents in side panels. See Section 4.4.1.

4.4.2 Measuring Bends or Dents in Panels (Impacted from Inside)

The same method as described above in Section 4.4.1 should be used to measure damage from the *inside* of the container extending *outwards*, as shown in the photo on page 30. In this case, however, both the depth limitation and also the ISO plus IICL tolerances must be considered. If damage extends beyond the ISO cube plus the additional IICL 10 mm (3/8 in) tolerance, it must be repaired. The procedure recommended by IICL for determining if the damage exceeds ISO plus IICL tolerances is illustrated in Figure 4.8, and is explained further in the following section.

Measurement methods of the surveyor

4.4.4 Calculating Cube Reduction Caused by Opposite Damage

It is possible for the cube or internal width of the container to be reduced by more than 50 mm (2 in) without this limit being exceeded by any one dent, bend or other form of damage. This occurs when inward damage on *opposite walls* totals more than 50 mm (2 in) when added together.

For the purposes of this manual, "opposite damage" is defined as two or more incidents of inward damage on inboard corrugations that are directly opposite to each other. Furthermore, the opposite damage must be located vertically within a 200 mm (8 in) band on either side of the container measured from the floor surface of the container. Inward damage on opposing panels that does not fall within this band is not considered "opposite", and is therefore subject to the single damage criteria covered above in Sections 4.4.2 - 4.4.3.

Figures 4.9 and 4.10 show how to measure opposite damage on panels. Each individual dent, bend or bow must be measured from the outside using the standard reference line methods for measuring damage to panels.

4.5 Measuring Damage to Doors

The method of measuring damage to door panels is the same as that used for side and front panels described above. A reference line is placed over the full width or height of the panel, and a measurement is made of the distance from reference line to maximum point of damage.

Damage to door *frames* is also measured by placing the reference line over the full width or height of the frame and measuring damage depth from the reference line.

DEFINITION OF "OPPOSITE" DAMAGE

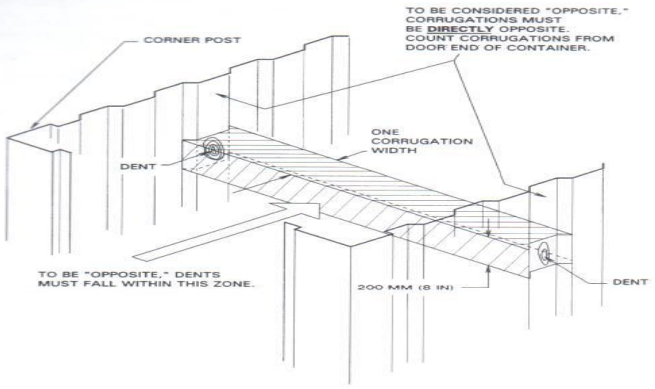


Fig. 4.9/Measuring opposite dents in side panels. See Section 4.4.4.

Measurement methods of the surveyor

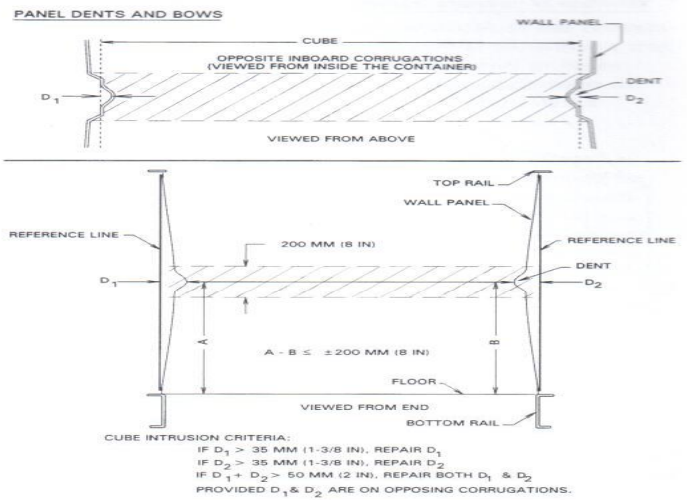


Fig. 4.10/Measuring opposite damage to determine if interior cube is reduced by more than 50 mm (2 in). See Section 4.4.4.

4.6 Measuring Damage to Roofs

The container roof presents some of the most challenging measurement problems in container inspection. First, the camber or curvature that is built into all container roofs as well as the flexibility of container roof panels makes it difficult to locate a reference plane. As explained in Section 2.1.2.2, this Guide recommends certain standardized procedures for measuring non-linear surfaces such as container roofs. However, since methods of measuring damage to roofs vary according to the location and direction of the damage, each type of situation is described separately in the following subsections.

An additional challenge in determining if a container roof requires repair is presented by the subtle variations in the IICL criteria for repairworthy roof damage. Table 5.5 in the *Guide for Container Equipment Inspection*, 5th edition (IICL-5), provides several different roof inspection criteria, according to the type and location of the damage, as follows:

- *Header extension plate*: bends, dents, bows or a combination of these are subject to two limits:
  50 mm (2 in) for intrusion into the cube in the *downward* direction
  ISO plus IICL tolerance of 10 mm (3/8 in) in the *upward* direction*
  There is *no* other dent limitation.
- *Roof panel*: bends or dents (alone or in combination with a bow) are subject to two limits:
  35 mm (1-3/8 in) depth in any direction (up or down)
  ISO plus IICL tolerance of 10 mm (3/8 in) in an *upward* direction*
- *Roof bows*: bows (with no accompanying dents or bends) are subject to two limits:
  50 mm (2 in) for intrusion into the cube in the *downward* direction.
  ISO plus IICL tolerance of 10 mm (3/8 in) in the *upward* direction*

The 35 mm (1-3/8 in) depth limit does *not* apply when the damage consists of a bow only, and does not include a dent or bend.

The terms "header extension plate", "standing corrugations" and the "panel area between corrugations", which will be referred to throughout this section, are illustrated in Figure 4.11.

* In general, the maximum height of any part of the roof, including the extra IICL tolerances, is **4 mm (5/32) above the plane of the top surfaces of the top corner fittings**. If any part of the roof extends higher than this limit, repair is required.

Measurement methods of the surveyor

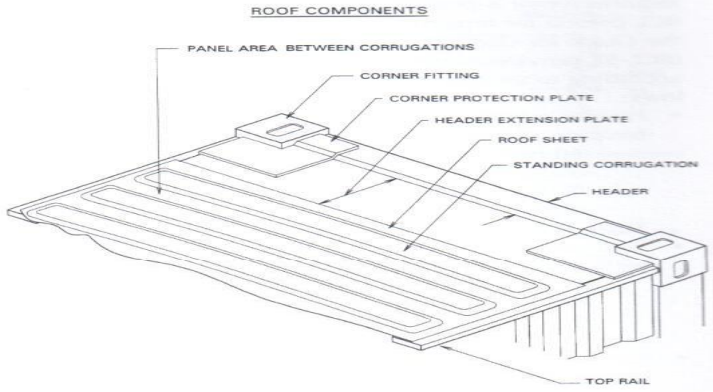


Fig 4.11/Location of container roof components. See Section 4.6.

4.6.1 Measuring Downward Damage on a Standing Corrugation

As stated in Section 2.1.2.2, this Guide recommends that roof camber (curvature) be ignored when measuring roof damage. In the case of downward damage on a standing roof corrugation, the damage depth is measured from the reference plane of the corrugation ends. The reference line is extended along the corrugation from just inside the radii at the tips of the formed ends of the corrugation. A measurement is then made of the distance from the reference line to the point of maximum downward deflection. Figure 4.13 and the top photo on page 41 illustrate this method.

In some cases, the end(s) of the corrugations will be damaged and therefore cannot be used to position the reference line. In this case, the reference line is spaced up from the top surfaces of the top side rails to clear the roof completely. The distance from the reference line to an undamaged corrugation end is measured just inside

the corrugation end radius. A second measurement is made from the reference line to the deepest point in the damage. The first measurement is then subtracted from the second to calculate the depth of damage. Figure 4.12 below describes this method.

4.6.2 Measuring Downward Damage on the Panel Area Between Corrugations

Damage to the panel area between corrugations on a roof is measured as described in the section above, except that the reference line should be placed between the standing corrugations and extend across the roof from just inside the welds at either side of the roof sheet, as in Figure 4.13. The bottom photo on page 41 illustrates this method.

ROOF PANELS

IF CORRUGATION END IS DAMAGED SO THAT REFERENCE LINE CANNOT BE PLACED ON CORRUGATION END, SPACE UP AND MEASURE BACK.

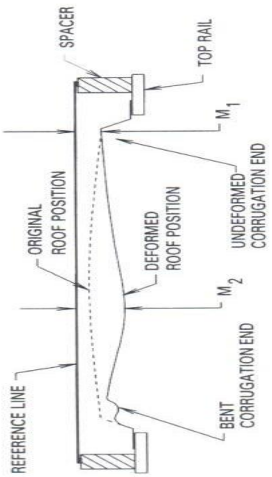


Fig. 4.12/Measuring damage to roof panels when reference line cannot be placed on corrugations: spacers should be used. See Section 4.6.3.

Measurement methods of the surveyor

ROOF PANELS

THE EFFECT OF ROOF CAMBER WILL BE NEGLECTED FOR THE PURPOSES OF MEASURING DOWNWARD ROOF BENDS. THEREFORE, STRETCH REFERENCE LINE OVER ENTIRE LENGTH OF CORRUGATION. IF DAMAGE IS IN FLAT AREA, STRETCH LINE ACROSS ROOF FROM RAIL TO RAIL.

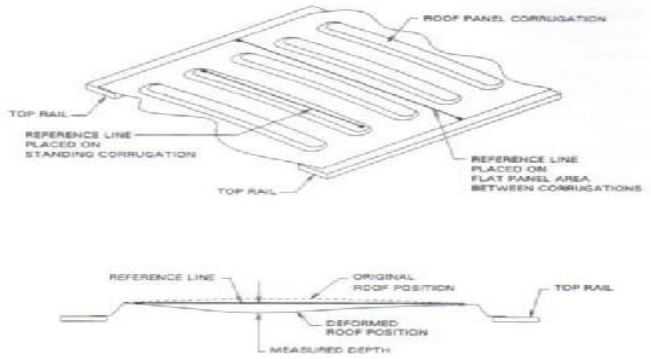


Fig. 4.13/Measuring downward damage on roof panel standing corrugations and flat areas between corrugations. See Sections 4.6.1 and 4.6.2.

Measuring downward damage on a standing roof corrugation: the inspector measures the distance from reference line to point of maximum downward deflection. Note that the reference line extends along the corrugation across the full width of the roof. See Section 4.6.1.

Measuring downward damage on the flat panel area between corrugations: the inspector measures the distance from reference line to point of maximum downward deflection. Note that the reference line has been placed on the flat panel area between corrugations, and extends across the full width of the roof. See Section 4.6.2.

Measurement methods of the surveyor

4.6.3 Measuring Downward Damage on a Standing Corrugation End

When the end of a standing corrugation has been damaged, the reference line should be placed on the nearest undamaged corrugations on either side of the damaged corrugation and extended across the damaged area. The depth of damage is measured from the reference line down to the point of maximum deflection, as shown in Figure 4.14.

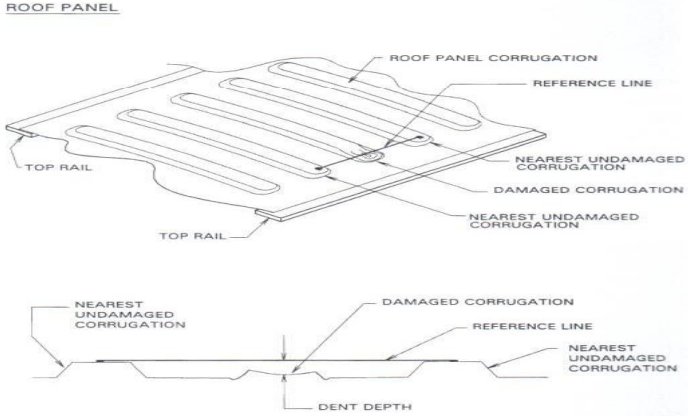


Fig. 4.14/Measuring downward damage on standing corrugation end. See Section 4.6.3.

4.6.4 Measuring Downward Damage on a Standing Corrugation End at the Roof Ends

When the end of the last corrugation on either end of a roof sheet is damaged, it is not possible to use the method described above in Section 4.6.3. In this case, the procedure illustrated in Figure 4.15 is recommended: a spacer is placed on the flat panel area on the opposite side of the nearest undamaged corrugation, and a spacer of equal height is placed on the flat panel area adjacent to the damaged corrugation. The reference line is extended between the two spacers over the damaged area. The inspector should first measure the distance from the reference line to the undamaged corrugation (shown as dimension "M_1" in Figure 4.15), and then from the reference line to the point of maximum damage (shown as dimension "M_2" in Figure 4.15). The first measurement is subtracted from the second to calculate the depth of damage.

See the color photos on pages 45 and 46 for an illustration of this method.

Measurement methods of the surveyor

ROOF PANELS

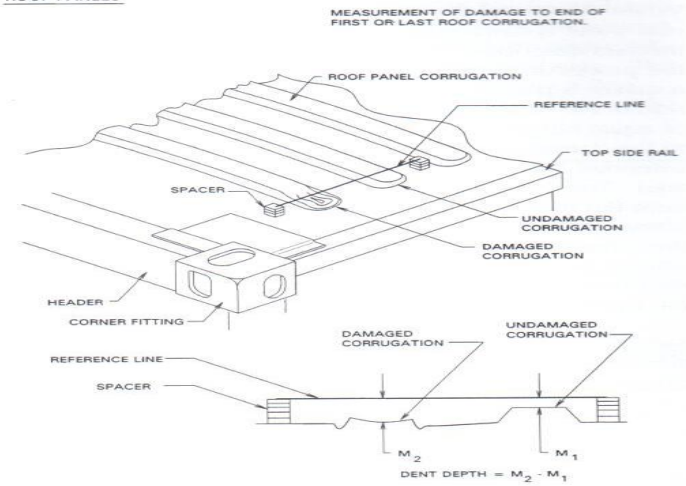
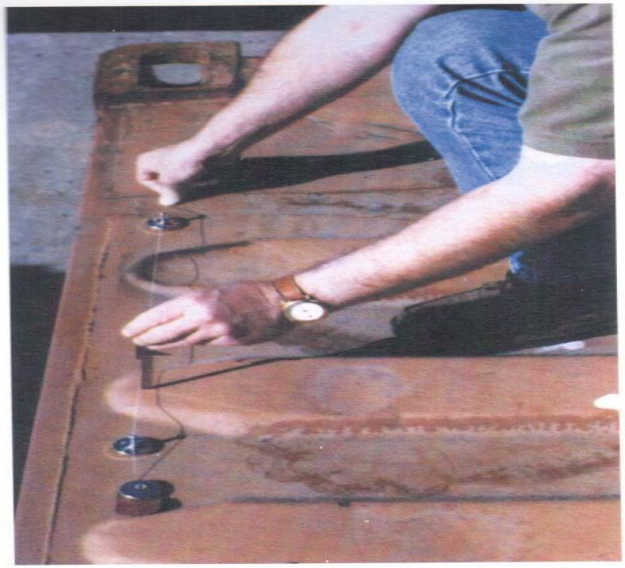


Fig. 4.15/Measuring damage to standing corrugation at roof ends, when end of last corrugation is damaged. See Section 4.6.4.



Measuring downward damage on a standing corrugation end at roof ends, Step #1: one spacer has been placed on the flat panel area on the opposite side of the nearest undamaged corrugation, and another on the flat panel area next to the damaged corrugation. A reference line has been extended between the two spacers (the two round objects just below the inspector's hands; each spacer has a protruding vertical pin to hold the reference line over the corrugations). The inspector is measuring the distance from reference line to the surface of the undamaged corrugation to establish a reference plane. See Section 4.6.4.

Measurement methods of the surveyor

Measuring downward damage on a standing roof corrugation end at roof ends, Step #2: the inspector measures the distance from reference line to point of downward maximum deflection. To calculate the depth of damage, the first measurement made in Step #1 is subtracted from the second measurement made in Step #2. See Section 4.6.4.

4.6.5 Measuring Upward Damage on the Panel Area Between Corrugations

When measuring upward damage to roofs, roof camber (curvature) should be ignored, as has been recommended above in Sections 2.1.2.2 and 4.6.1 above. In this case, the measurements are made from within the container. The reference line should be extended across the roof width from just inside the top side rails on either side of the damage, and dent depth measured from the refer-

ence line to the point of maximum upward deflection. Figure 4.16 below illustrates this method.

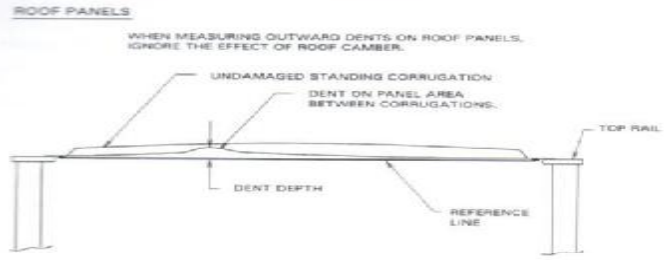


Fig. 4.16/Measuring upward damage on roof panels between corrugations. See Section 4.6.5.

4.6.6 Measuring Upward Damage Within Corrugations; Upward Bows to Roof Sheets; and Upward Damage to Header Extension Plates

Because an upward dent within a standing corrugation will reach the IICL criterion of ISO plus 10 mm (3/8 in) limit before it reaches the 35 mm (1-3/8 in) limit for dents, the ISO plus IICL limit governs for this type of damage. Upward bowing of the roof sheet (without an accompanying dent or bend) and upward header extension plate damage of any kind are also subject to the ISO plus IICL criterion. Therefore, all three conditions are measured by the same basic technique.

To provide a simplified and standardized method of determining whether the types of damage to corrugated roofs described above exceed ISO plus IICL tolerances, this Guide has devised a method similar to that recommended for side and front panel damage in Sections 2.2.2 and 4.4.3. Damage is compared to a set reference dimension that includes ISO plus IICL tolerances. For the purposes of determining if upward roof damage exceeds IICL's limit of ISO plus 10 mm (3/8 in), *IICL has set a reference plane* ***38 mm (1-1/2 in)*** *above the upper surfaces of the top side rails*. Therefore, if damage extends into or

Measurement methods of the surveyor

4.6.7.2 Measuring Downward Bows to Roof Sheets and Downward Damage to Header Extension Plates: Flat-Bar Top Rails

If the top rail is a flat-bar type, a reference line is spaced downward from the top surface of the side rails 50 mm (2 in). If the roof sheet touches the reference line, repair is required. Figure 4.19 illustrates this method.

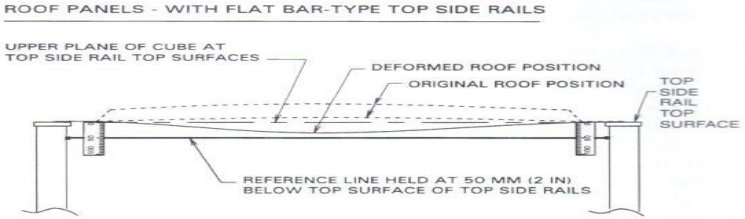


Fig. 4.19/Measuring downward bow of roof sheet (flat-bar rail). See Section 4.6.7.2.

4.7 Measuring Damage to Floors

IICL has two inspection criteria for floor gouges. One sets limits for gouge *depth* only, and the other limits both depth *and width*.

4.7.1 Measuring Gouges for Depth Only

In the first case, a straight-edge is placed horizontally on edge across the gouge to establish the position of the undamaged floor surface. A scale or ruler is used to measure the distance from the straight-edge to the bottom of the gouge. The same basic approach is used to measure height differences between planks. This method is shown in Figure 4.21 opposite.

Alternatively, the inspector can use a type of scale with a 15 mm (5/8 in) protrusion, as shown in Figure 4.20 opposite. If the protrusion does not touch the bottom of the gouge, repair is required.

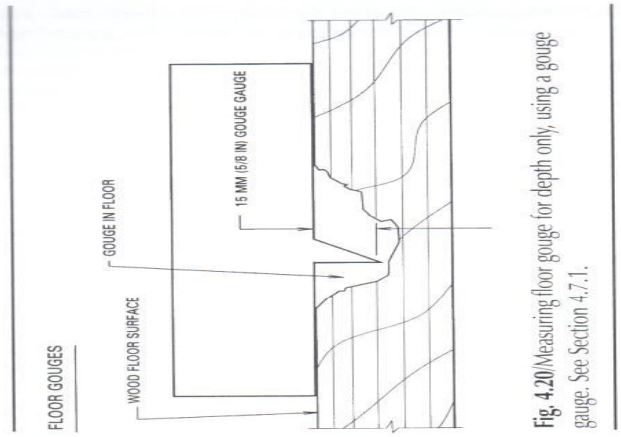


Fig. 4.20/Measuring floor gouge for depth only, using a gouge gauge. See Section 4.7.1.

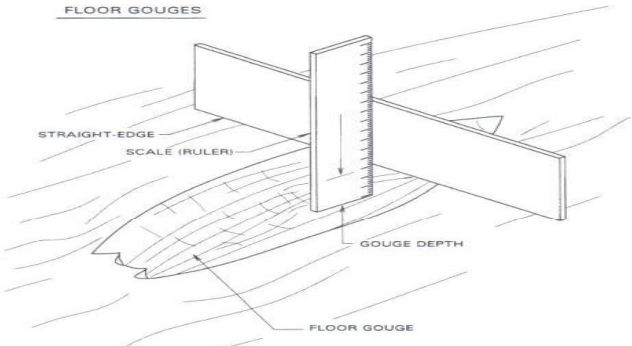


Fig. 4.21/Measuring floor gouge for depth only, using a straight-edge and a scale (ruler). See Section 4.7.1.

Measurement methods of the surveyor

4.7.2.2 Measuring Depth and Width of Gouges with a Special Gouge Scale

The depth and width of a gouge can also be measured using a special scale that is designed with a 150 mm (6 in) by 5 mm (3/16 in) protrusion on one side. The scale is placed across the gouge with the protrusion face down in the gouge and perpendicular to the gouge length. If the ends of the scale beyond the protrusion on either side rest firmly on the undamaged floor surfaces on either side of the gouge, the gouge must be repaired. If the ends of the scale on either side of the gouge do not touch the floor (*i.e.*, if there is space between the bottom edges of the scale and the undamaged floor), the gouge does not require repair. This method is illustrated in Figure 4.24.

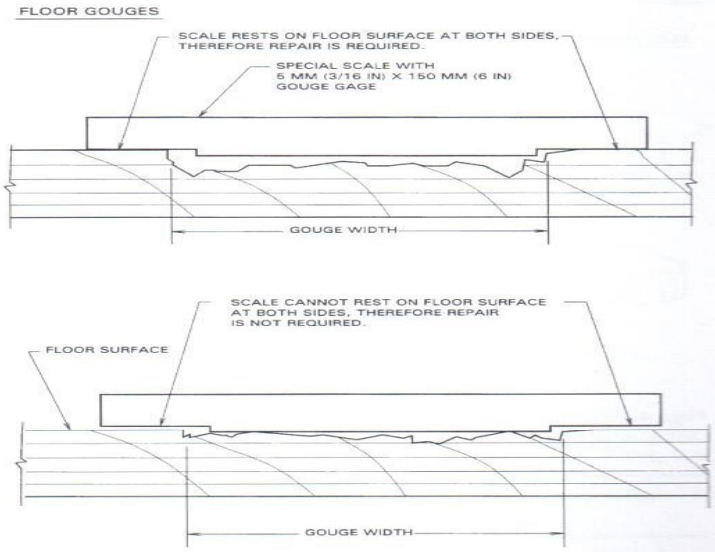


Fig. 4.24/Measuring floor gouge for depth ***and*** width, using a special scale (ruler). See Section 4.7.2.2.

4.8 Measuring Damage to Understructure

Most damage to understructure can be measured using the standard methods described in Section 2. Variations in this method are explained in the subsections below, and are illustrated in Figures 4.25 - 4.30.

Since IICL criteria do not require repair of damaged bottom flanges that are not cut or torn, most damage measurements involve the crossmember web.

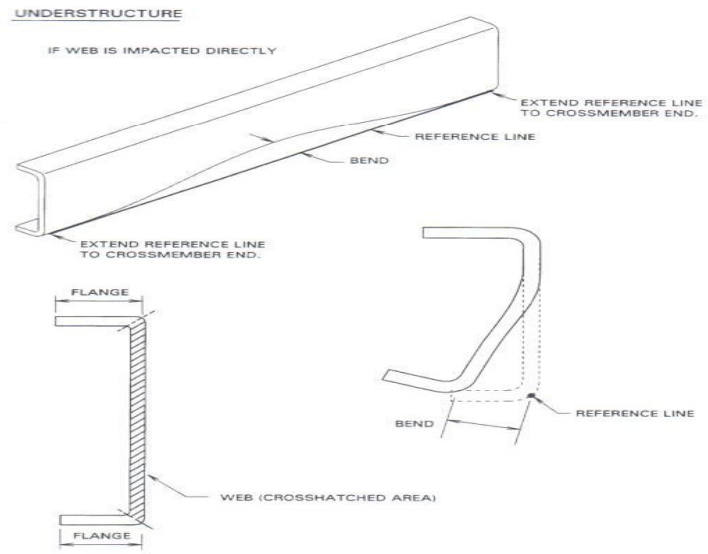


Fig. 4.25/Measuring damage to crossmember web when impacted directly. See Section 4.8.1.

Measurement methods of the surveyor

4.8.1 Measuring a Direct Impact to a Crossmember Web

Figure 4.25 shows a common type of crossmember web damage in which the web has been damaged by a direct impact. In this case, a reference line is extended over the crossmember from one side rail to the other, outside the points of attachment of the formed edge between web and flange. The distance between the reference line and the point of maximum deflection is measured to determine if the web requires repair. Figure 4.25 on page 55 and the photos on page 57 opposite illustrate this method.

Measuring direct impact to crossmember web: the inspector measures the distance from reference line to point of maximum deflection in the web. Note that the reference line extends across the full width of the crossmember along the formed edge between web and flange. See Section 4.8.1.

Measuring direct impact to crossmember web: as in the photo on the top of the page, the inspector has extended the reference line along the full width of the crossmember from rail to rail, and is measuring the distance from reference line to maximum point of the web deflection. See Section 4.8.1.

Measurement methods of the surveyor

4.8.2 Measuring an Impact to a Crossmember Web from the Flange Side

Figure 4.26 shows another common type of crossmember web damage. In this case, the web has received an impact from the flange side of the crossmember. The reference line is extended from one side rail to the other *along the inside radius* of the crossmember where the web meets the flange, as shown in Figure 4.26. A measurement is then made from the reference line to the point of maximum deflection in the web. This is the preferred method of measurement.

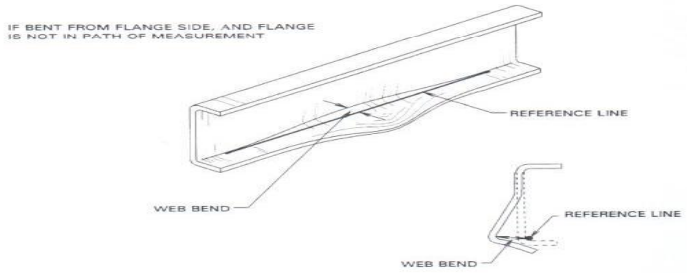


Fig. 4.26/Measuring damage to crossmember web when flange side has been impacted. See Section 4.8.2.

4.8.3 Measuring Crossmember Web Damage at the Web Center

In some case, damage occurs at the center of a crossmember web. Figure 4.27 shows how this type of damage should be measured. The reference line is extended along the web surface along the entire length of the crossmember. A measurement is made from the reference line to the point of maximum deflection in the web.

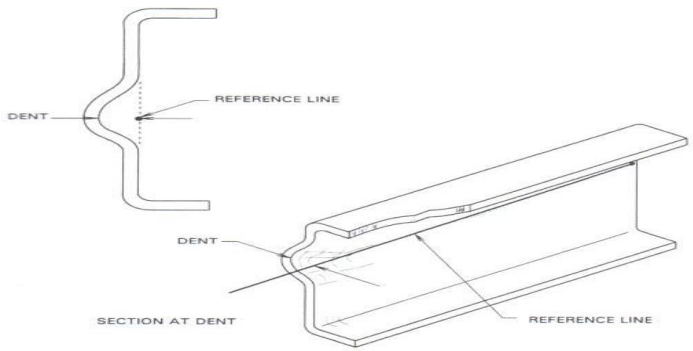


Fig. 4.27/Measuring damage to center of crossmember web. See Section 4.8.3.

Measurement methods of the surveyor

4.8.4 Measuring Crossmembers Bent in Two Locations

There are some situations in which the reference line cannot be placed directly on the crossmember. This is the case when the same crossmember is damaged in two locations, such as when (1) both web side and flange side have been damaged, or (2) the flange has been pushed upward against the web so that a reference line cannot be positioned on the inside formed edge where web meets flange. In these cases, the "space out/measure back" method should be used, as shown in Figure 4.28.

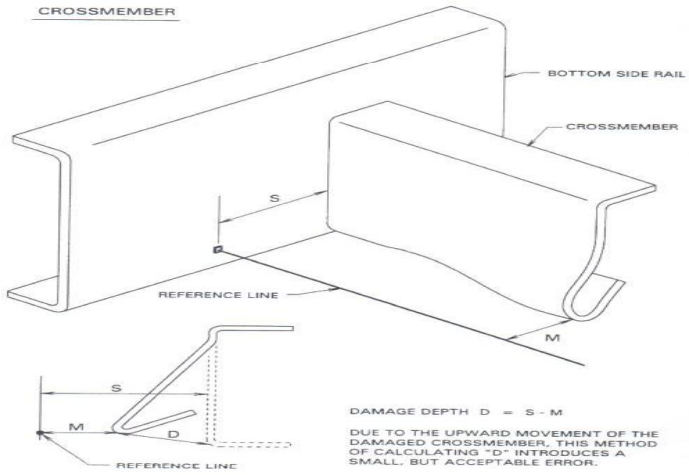


Fig. 4.28/Measuring damage to crossmember when bent in two locations (web and flange sides). See Section 4.8.4.

4.8.5 Separation of Crossmembers from Underside of Floor

If the top flange of a crossmember is pulled away from the underside of the floor, measure the separation as follows:

4.8.5.1
Mark the web at each floor screw location.

4.8.5.2
Insert a taper gauge into the separation at each mark, or measure with a scale as shown in Figure 4.29. Do *not* insert gauge at other locations.

4.8.5.3
Measure the width of the gauge at the point where it just emerges from the outer surface of the web. If this distance is greater than 10 mm (3/8 in), repair is required.

Note that the width of the taper gauge is *not* measured at the shank of the screw, but rather at the outer web surface. Also, do *not* measure at any location along the crossmember other than the locations of floor screws.

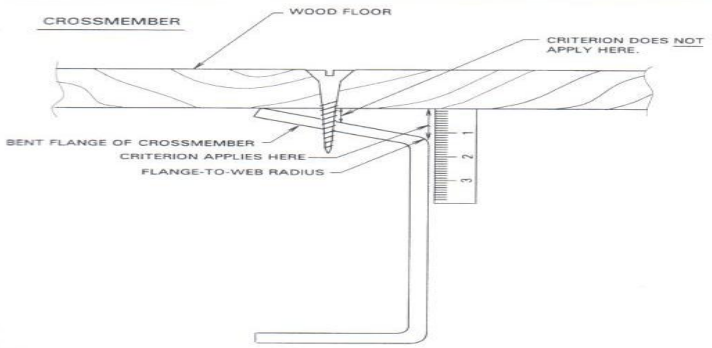


Fig. 4.29/Measuring separation of crossmember flange from floor (at point on flange adjacent to formed radius). See Section 4.8.5.

Measurement methods of the surveyor

4.8.6 Crossmembers Outside ISO plus IICL Tolerances

Generally, the bottom surfaces of the lower crossmember flange is at or near the lowest permissible height allowed in the ISO standards. Since IICL allows an additional tolerance of 10 mm (3/8 in), measure any downward deflection of lower crossmember flanges as follows:

4.8.6.1
Run a reference line inside the crossmember at the top surface of the lower flange from one side rail to the other.

4.8.6.2
Measure the distance from the line to the lowest point of the top surface of the lower flange. If this distance is greater than 10 mm (3/8 in), repair is required. See Figure 4.30.

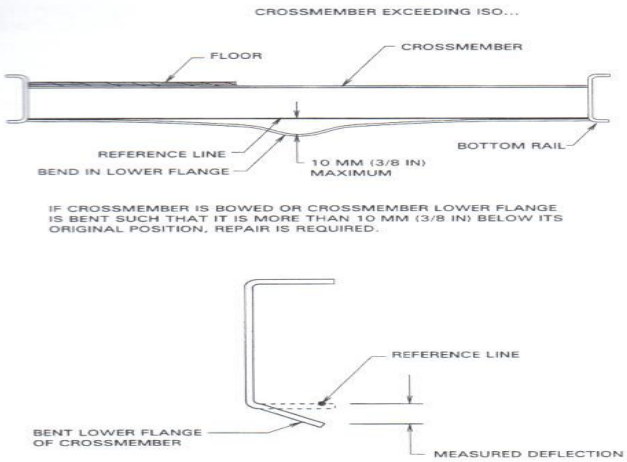


Fig. 4.30/Measuring crossmember damage to determine if ISO + IICL tolerances are exceeded. See Section 4.8.3.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