

# B101 BOV Flange and Sump Weld

## INSPECTION AND REPAIR BULLETIN



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## Overview of Bulletin

On November 18, 2016, The Federal Railroad Administration (FRA) issued Railworthiness Directive, RWD No. 2016-01 [Revised] (“Directive”) affecting approximately 14,800, Class DOT111 general purpose tank cars built by The Greenbrier Companies (GBX) and ACF Industries (ACF) between 2009 and 2015. The Directive is focused on the welding of the two-piece sump / skid casting and BOV flange to the tank, reference **Figure 1**. The Directive requires that 1) the pre-trip inspection requirement (49CFR173.31(d)) to be documented and 2) each owner must inspect and report to FRA the inspections of the top 15% of their highest mileage cars in hazmat service within 12 months.

Any cars that have relevant indications identified must be repaired prior to returning to interchange service.

Figure 1 – Depiction of Inspection Area



## Applicability of Bulletin

The applicability of this Bulletin is solely for compliance with the FRA Railworthiness Directive, RWD-2016-01 [Revised], as issued on November 18, 2016. The Greenbrier Companies (GBX) has developed this Bulletin and the various aspects of the procedure disclosed in this Bulletin based on GBX’s understanding of the FRA Railworthiness Directive, RWD-2016-01 [Revised] as well as GBX’s know-how and other intellectual property, including, but not limited to copyrights. Accordingly, this Bulletin can only be utilized at an GBX or GBX affiliated shop or any other such shop in accordance with and subject to the Limited License Agreement, see page iv. The Bulletin may be copied, distributed, and/or redistributed solely for the purposes of its review by a car owner and/or the owner’s designees toward the car owner approving utilization of this Bulletin. By authorizing the shop to perform the work described in this Bulletin, the car owner is implicitly stating that they have reviewed and specifically approved the use of the Bulletin on their cars. This Bulletin and the process disclosed herein, in part or in totality, cannot be used, copied, distributed, and/or redistributed for any other purpose without the written consent of The Greenbrier Companies.

All work must be performed be in accordance with the car owner’s specific instructions, following all regulatory, industry and shop safety procedures. Safety requirements include, but are not limited to, local site regulations, specific railroad safety requirements, OSHA, OSHA, FRA, TC, blue flag, interior tank entry, confined space, etc.

Repair facilities performing this work must contact the car owner for specific inspection and repair procedures and obtain approval from the car owner prior to performing this inspection and any repairs.

## Legal Statement

This procedure solely relates to the area of the tank car covered by the Directive and is subject to, and does not supersede or take precedent over any of the following:

- All safety requirements (plant, customer, local, OHSA, OSHA, etc.),
- Applicable requirements of Department of Transportation (“DOT”), Federal Railroad Administration (“FRA”), Transport Canada (“TC”) and Association of American Railroads (“AAR”),
- All car owner instructions,
- The requirements of a tank car facility,
- The tank car facility quality assurance program,

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- (C) IN NO EVENT WILL GRANTOR'S AND ITS AFFILIATES' COLLECTIVE AGGREGATE LIABILITY UNDER OR IN CONNECTION WITH THIS AGREEMENT OR ITS SUBJECT MATTER, UNDER ANY LEGAL OR EQUITABLE THEORY, INCLUDING BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY, AND OTHERWISE, EXCEED THE TOTAL AMOUNT PAID TO THE GRANTOR IN ASSOCIATION WITH THIS AGREEMENT FOR THE LICENSED SUBJECT MATTER THAT IS THE SUBJECT OF THE CLAIM; AND
- (D) THE LIMITATIONS SET FORTH IN THIS SECTION SHALL APPLY EVEN IF YOUR REMEDIES UNDER THIS AGREEMENT FAIL OF THEIR ESSENTIAL PURPOSE.

**10. INDEMNIFICATION** – Grantee agrees to defend, indemnify and hold harmless Grantor from and against liabilities, costs, damages and expenses (including settlement costs and reasonable attorneys' fees) arising from any claims from anybody that result from or relate to Grantee's use of the Licensed Subject Matter.

**11. SEVERABILITY** – In the event any provision of this Agreement is found to be invalid, illegal or unenforceable, the validity, legality and enforceability of any of the remaining provisions shall not in any way be affected or impaired.

**12. ENTIRE AGREEMENT** – Grantee further agrees that this Agreement is the complete and exclusive statement of the Agreement between it and Grantor with respect to the Licensed Subject Matter, which supersedes any and all other communications between Grantee and Grantor relating to the subject matter of this Agreement. This Agreement may only be modified by a written agreement signed by both Grantee and Grantor.

IF YOU DO NOT AGREE WITH EACH AND EVERY TERM OF THIS LIMITED LICENSE AGREEMENT, DO NOT USE THE LICENSED SUBJECT MATTER AND RETURN IT INSTEAD TO THE OWNER OF THE RAILCAR THAT PROVIDED THE MATERIALS TO YOU EXPLAINING THAT YOU DO NOT ACCEPT THE TERMS OF THE LICENSE.

## Training Statement

GBX represents that the requisite training required to perform the requirements of this Bulletin has been conducted at GBX and GBX affiliated locations. GBX will maintain and update the training as appropriate. As such, if additional training is required by the customer, then additional charges, based on the scope of the training, may apply. This does not apply to customers conducting routine periodic audits of this process.

## Questions / Contact Information

For questions regarding a specific aspect of this procedure, contact [info@gbrx.com](mailto:info@gbrx.com). For other questions, contact the car owner.

# APPLICABLE DOCUMENTS, STANDARDS, PERSONNEL REQUIREMENTS AND DEFINITIONS

## Applicable Documents and Standards

1. AAR Manual of Standards and Recommended Practices Section CIII, Specification of Tank Cars, M-1002, November 2014 issue including all applicable appendices.
2. Tank Car Directive Inspection Procedure-Bottom Outlet Valve Flange and Sump Skid (EN B101, Issued 1/17/2017 Revision A)
3. Qualified Local Shop Liquid Penetrant (PT) procedure, if required for welded repair
4. Qualified Local Shop Magnetic Particle (MT) procedure, if required for welded repair
5. Qualified Local Shop Bubble Leak Test (BT) procedure
6. Qualified Local Shop Welding Procedure Specification, if welded repair is required
7. Local Post Weld Heat Treatment procedure, if utilized for a welded repair

## Minimum Personnel Requirements

1. Personnel certified in Visual Inspection, AWS CWI, CSA W178.2 (Level II or Level III), or Appendix T Level II.
2. Personnel certified to Level II in Ultrasonic Flaw Detection.
3. Personnel certified to Level II in Leak Detection Solution Examination.
4. Personnel qualified in the welding process used, if utilized.
5. Personnel certified to Level II Liquid Penetrant Testing, if utilized.
6. Personnel certified to Level II Magnetic Particle Testing, if utilized
7. Personnel qualified for Local Post Weld Heat Treatment, if utilized

### Notes:

- Prior to performing any inspection or procedures, all personnel must be appropriately trained in accordance with all applicable regulatory and local shop requirements.
- NDT personnel are to be certified in accordance with local shop written practice and M-1002, App T as applicable. According to the Directive, this training and testing should include the procedures to be used and samples representing the welds to be inspected consistent with 49 CFR 172, subpart H, and Appendix T.

## Miscellaneous Definitions

The term “relevant indications” is intended to mean an observed condition that exceeds the requirements of AAR MSRP 1002, Appendix W.

Procedure revision – Any procedure referenced in this Bulletin is referring to the latest issued revision of that procedure.

## Application

When directed by the car owner, inspect BOV / Sump area in accordance with the Inspection section below.

## Inspection

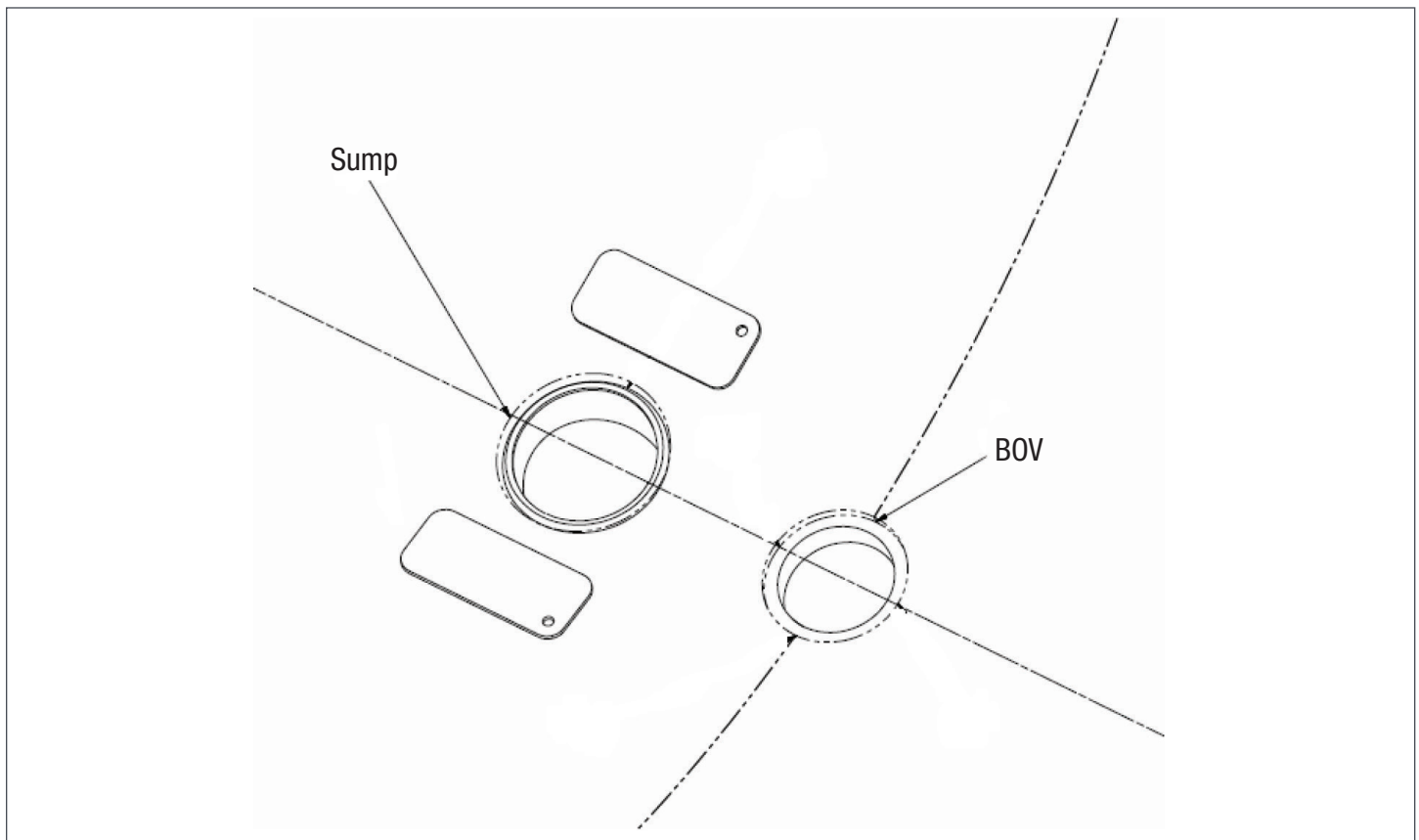
### Acceptance Criteria

The acceptance criteria for the tank welding of the sump or BOV flange is to be in accordance with AAR Appendix W. If relevant indications are present, the following repairs should be completed and the welds re-inspected. All relevant indications must be repaired prior to returning a car to interchange service.

### Inspection Procedure

From the interior of the car a UT and VT inspection of the interior complete joint penetration groove welds of the BOV flange and sump, if equipped, to the tank shell are to be performed per the included procedures in this Bulletin, reference **Figure 2**. EN B101 Sec C requires the removal of coating. Lined cars are to be inspected in a clean condition, with the minimal removal of linings to allow access for inspection. In the instance that the car has a liquid applied lining or equipped with a rubber lining, contact the car owner prior to conducting this inspection.

Figure 2 – View from Inside Car Looking at the Sump and BOV Flange Welds to be Inspected.



When a car is to be inspected pursuant to this Bulletin the following inspection is required:

1. Using the shop procedures verify the car is safe for entry and all safety measures are in place for interior inspection and repair of the car.

**Note:** In the event that area to be inspected has a coating applied, unless the handling of coatings has been specifically agreed to previously, contact owner prior to continuing. In this case the preferred inspection order of affected areas is UT (step 4 below), then VT (step 3 below) in order to limit the area of coating removal required for inspection.



2. Prior to commencing work on any car, the areas to be inspected shall be free of any lading product or coatings that interfere with the examination process.

All surfaces are required to be cleaned or prepared to meet applicable inspection criteria. Surfaces shall be free of any material that could mask discontinuities.

Lined cars are to be inspected in a clean condition, with the minimal removal of linings to allow access for inspection.

3. Using the visual inspection method in procedure EN B101 Sec C, inspect the sump and / or the BOV flange interior tank sheet groove welds for indications. The visual inspection method is to be performed by a qualified inspector.

Indications in excess of the requirements AAR CIII Appendix W are to be documented on EN B101 Visual Inspection Report form included in Appendix B of EN B101 and repaired per the following repair procedure. The Visual Inspection Report is to document the flaw location (including distance from the ID of casting), depth of flaw (if discernible), length and type of indication for inspection methods used. All cars inspected are to have a form completed. If no relevant indications are found, document **“No relevant indications are found”**. **Specifically document any indications through to the surface of the attachment weld.**

4. Using the ultrasonic inspection method in procedure EN B101 Sec B and **Figure 3**, inspect 100% of the sump and BOV flange interior tank sheet groove welds for indications. In the event that the complete inspection of 100% of the sump and BOV flange welds cannot be achieved by the methods used in EN B101 (including use of a smaller transducer), then remove any obstructions to the extent required to properly perform the inspection. This may include a combination of the following:
  - i. removing the eduction pipe guide and “sliding up” the eduction pipe, or
  - ii. removing a portion of the weld attaching the eduction pipe guide pad to the tank and grinding area to a smooth contour to perform the UT inspection, or
  - iii. removing the entire eduction pipe guide pad(s) and grinding area to a smooth contour to perform the UT inspection.

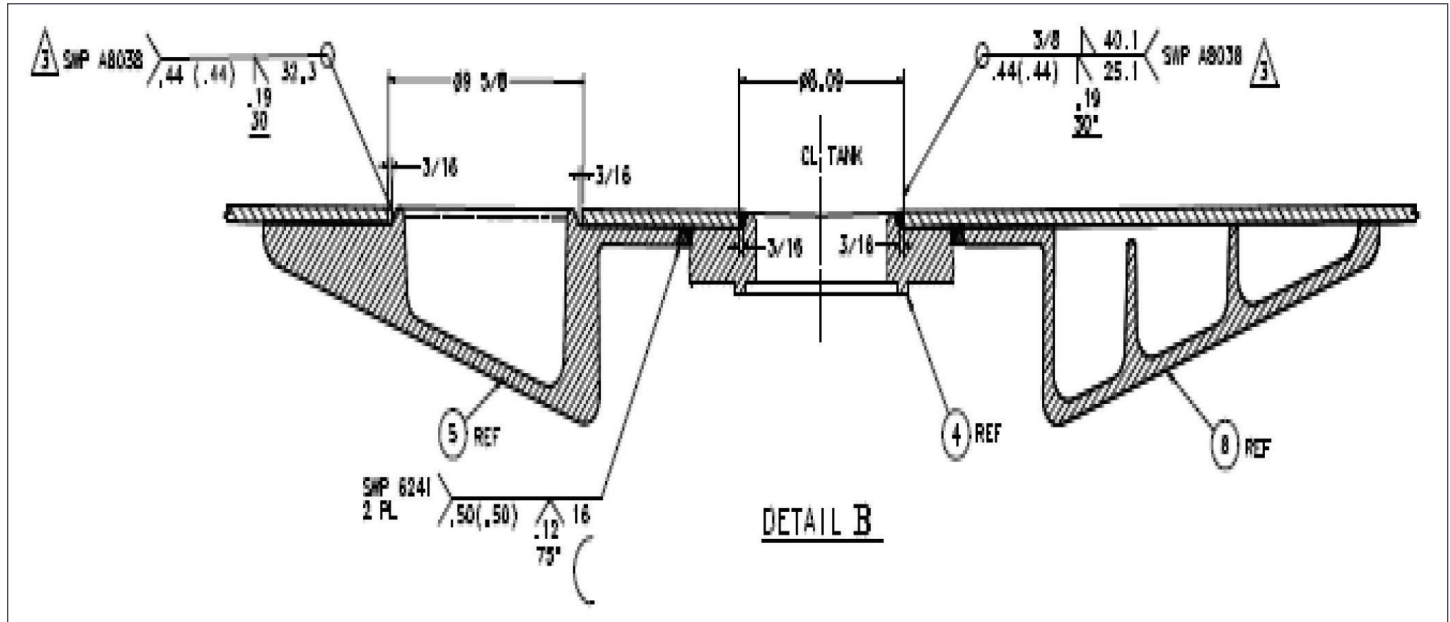
Indications in excess of the requirements of EN B101 Sec B are relevant indications which must be documented on EN B101 Ultrasonic Inspection Report form included in Appendix A of EN B101 and repaired per the following repair instructions. The Ultrasonic Inspection Report is to document the indication location (including distance from the ID of casting), depth of indications, length and type of indication. All cars inspected are to have a form completed. If no relevant indications are found, ensure that all portions of the report form are completed (reference Appendix A of this procedure) including:

- A) Documenting **“No relevant indications are found”** in the circles on page A-2 of 2, and
- B) Marking the **“No”** box for surface crack present on page A-2 of 2.

5. For each relevant indication found during the ultrasonic inspection, one digital record is to be created. If the UT equipment utilized cannot digitally record a screen shot, then the record can be a digital photograph of the UT screen showing the indication. These records / photos are to be included with the inspection report and each record / photo and diagram must be marked to correlate the record / photo to the feature / area noted on the inspection report.
6. After completion of the initial inspection, send the completed report forms along with digital records of relevant indications to info@gbrx.com. After approval, forward the completed report forms along with digital records of relevant indications to the car owner with the necessary work described accordingly. For example, the report may indicate no repairs are required or a BRC will indicate that work is required to excavate and investigate relevant indications.

**Note: Do not proceed with repairs unless specifically advised to by the car owner and the GBX Director of Tank Car Engineering as applicable.**

Figure 3 – Original Groove Weld of Sump and BOV Flange to Tank (Not to be used for repair welding)

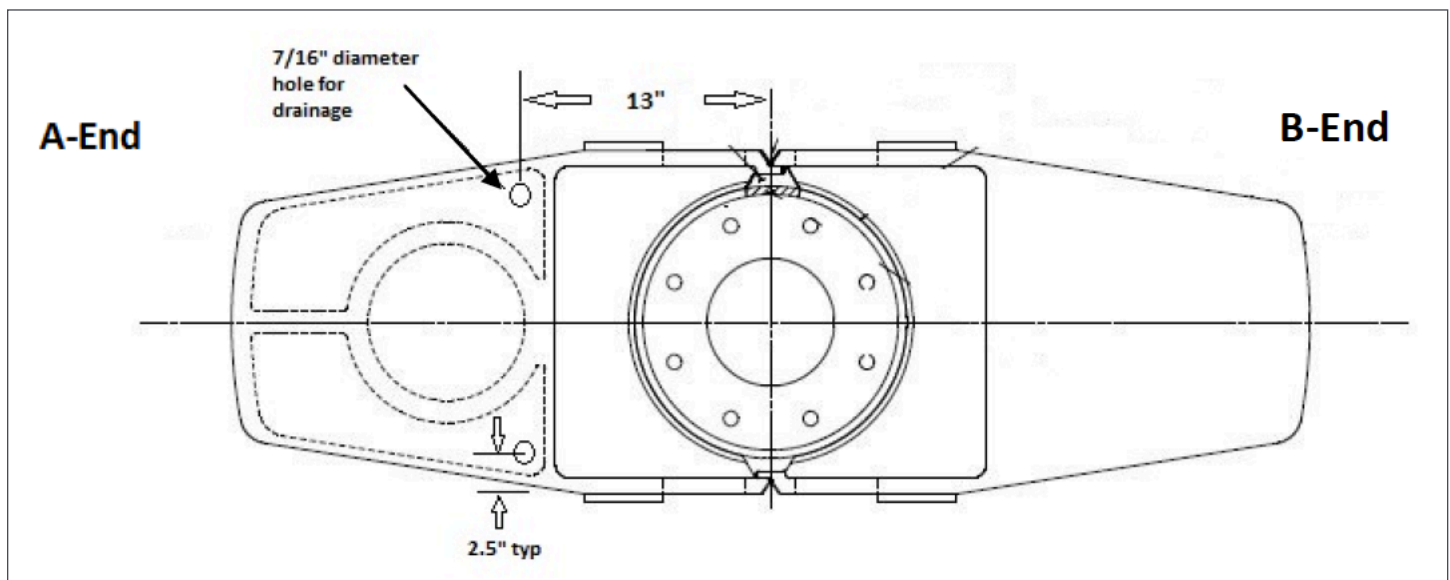


## Repair

### Safety Precaution Requirement Prior To Repair

If a car is suspected to have a leak, then the following precautions are to be taken prior to repair. The sump skid is designed with two casting cavities adjacent to the sump that may have commodity or water trapped within, drill two 7/16" diameter holes for drainage on the A-end skid approximately 13" from the centerline of the skid assembly, and approximately 2 1/2" from the outside edge of the skid, reference **Figure 4**. Flush area with water and inspect the cavities with an appropriate LEL meter to ensure the environment is acceptable for hot work. The 7/16" diameter holes do not need to be repaired or covered.

Figure 4 – View of Skid from Bottom



## Repair Instructions

Repairs can only be performed after specific approval by the car owner.

All weld preparation and welding is to be conducted in accordance with a local shop qualified weld procedure specification per AAR MSRP C-III M-1002.

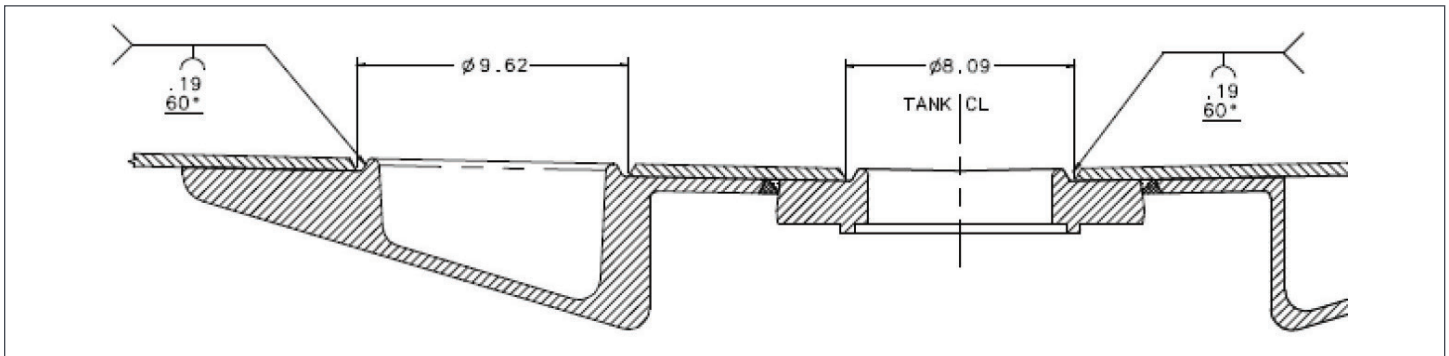
1. For all relevant indications described on the report, carefully remove the groove weld or portion thereof in the area of indications so that the nature and size of indication can be established.

**Note:** It is not required to validate the finding(s), but if confirmed as different from the initial report, email info@gbrx.com for instructions.

Back gouge should not exceed the tank shell thickness or groove weld depth and is to include the entire indication and extend 1" beyond each end of the indication. Minimum finished groove for welding should be 2 ½".

2. Clean all slag/dross from arc gouged areas and prepare surfaces for replacement welding of the sump skid/BOV weld. Use local shop qualified dye penetrant (PT) procedure to ensure entire indication has been removed. Complete dye penetrant inspection report in accordance with applicable procedure. The prepared joint should meet the weld requirements shown in **Figure 5**.
3. Following qualified shop welding procedures apply the repair weld per **Figure 5** including grinding surface to a smooth contour.

Figure 5 – Repair Groove Weld of Sump and BOV Flange to Tank



4. **Note:** Steps A, B and C, below can be performed in any preferred order.
  - A. Using the visual inspection method in procedure EN B101 Sec C, inspect the top surface of the sump and BOV flange welds for indications. If indications exceeding the requirements of Appendix W are found repeat steps 1, 2, 3 and 4.  
Report final VT inspection on the final EN B101 Visual Inspection Report form (reference Appendix A of this Bulletin for instructions) clearly indicating:
    - i. Final VT inspection, and
    - ii. No repairs required, and
    - iii. No relevant indications are present.
  - B. Using the ultrasonic inspection method in procedure EN B101 Sec B, inspect the areas of the sump and BOV flange welds that were repaired in step 3 above. If relevant indications are found, repeat steps 1, 2, 3, and 4.  
Report final UT inspection on the final EN B101 Ultrasonic Inspection Report form (reference Appendix A of this Bulletin for instructions) clearly indicating:
    - i. Final UT inspection,
    - ii. No repairs required, and
    - iii. No relevant indications are present.
  - C. Using a local shop qualified MT or PT procedure, inspect the areas of the sump and BOV flange welds that were repaired in step 3 above. If relevant indications are found, repeat steps 1, 2, 3, and 4.

5. If local stress relief is required by car owner or shop welding procedure, the sump and BOV flange repair welds can be stress relieved in accordance with a qualified shop local post weld heat treatment procedure. Conduct in accordance with Appendix R and qualified shop or customer required procedure including completing stress relief chart which indicates thermocouple location, car number and technician signature.
6. Replace the education pipe guide, pad weld or pad(s) in accordance with original construction, car owner instructions and Appendix R. Any reduction in tank thickness as a result of weld or pad removal must be restored to original thickness. Contact car owner or Engineering with any questions.
7. Ensure all other required work is performed including reassembly of fittings and performance of fittings leak test using a local shop qualified Bubble Leak (BT) test procedure. In accordance with local shop QA processes, ensure car is ready for interchange service.
8. Documentation
  - A. All cars will have the initial inspection reports (EN B101 Visual Inspection Report form and Ultrasonic Inspection Report form) and only cars that have repairs performed will have a second set of inspection reports (same as above) showing that no relevant indications are present, also indicating that all relevant indications have been repaired.

Each report must have all portions completed (reference Appendix A of this Bulletin for instructions), including the tank car facility (station stencil) that performed the inspection(s) and test(s); date(s) the inspection(s) and test(s) were performed; inspection and test method(s) and procedure number(s) used; name(s) of inspector(s) performing the inspection(s) and test(s), level(s) of certification(s), and method(s) certified; inspection and test results and corrective (repair) action(s) taken if applicable.
  - B. Examples of the visual and ultrasonic inspection reports are included in Appendix A of this Bulletin. The latest versions of this Bulletin and EN B101 are located on the GBX web page [www.gbrx.com](http://www.gbrx.com).
  - C. All cars requiring this inspection that arrive shop on or after the date of issuance of the latest revision of this Bulletin will report inspections on the forms included in the current revision of EN B101. All cars in shop prior to the date of issuance of the latest revision of EN B101 will continue to report inspections on the forms associated with the revision of EN B101 as dictated in the car shopping instructions. The form instructions outlined in the most current revision of this Bulletin shall apply to current and any previous revisions of the forms.
  - D. In addition to standard shop processes and the requirements of the Directive, when car is complete, submit inspection reports referenced in EN B101 Appendices A and B, as required per Sec B, 7.2 and Sec C, 13.2 of that procedure to [info@gbrx.com](mailto:info@gbrx.com).

## APPENDIX A

### B101 - Non-Mandatory Appendix A Reporting / Forms

Notes for proper documentation on EN B101 UT Inspection Report Form  
(Page A-1 of 2, Appendix A of EN B101 1/17/2017, Revision A)

**General:** No cursive is allowed on form. Print clearly and in ink. Any blank lines or unfilled text boxes should be marked N/A.

**Note 1:** Document the facility name, location, and station stencil.

**Note 2:** Document the condition of the surface being inspected as either “**bare metal**” or “**coated**”. If lining is either completely removed prior to inspection or locally in area(s) of inspection only, document surface condition of inspected areas as “**bare metal**”.

**Note 3:** Document all frequencies and transducer sizes used during inspection.

**Note 4:** Document all wedges used during inspection.

**Note 5:** Check box indicating “**Initial inspection**” or “**Inspection after repair**”. Two separate reports must be completed for cars requiring repair welds.

**Note 6:** After initial inspection, document either “**No repairs required**” or “**Repairs performed by welding**”. Do not use N/A in this area.

After repair of all relevant indications is complete, document “**No repairs required**”, on final inspection report.

**Note 7:** For Cable type, document at a minimum the transducer cable manufacturer along with the corresponding length(s) used during the shear wave inspection only. Record above cable information for each cable used.

**Note 11:** Document all reference gain values for each corresponding transducer/wedge combination used in inspection (e.g. 2 transducers with 2 wedges each would require 4 reference gain values).

## APPENDIX A EN B101 - ULTRASONIC INSPECTION REPORT

Plant / Location / Station Stencil		NOTE 1			
Reporting Mark and Car No.					
Surface Condition		NOTE 2		Test Date	
UT Procedure:	EN B101 Section B	Revision:	A	Issue Date:	1/17/2017
Flaw Detector					
Model		Calibration Due		Serial No.	
Longitudinal Beam Unit					
Type		Frequency	NOTE 3	Size	NOTE 3
Serial No.				MFG.	
Shear Wave Unit					
Type		Frequency	NOTE 3	Size	NOTE 3
Serial No.				MFG.	
Scanning Face	A	Reference Gain(s)		dB	NOTE 11
Wedge(s) Used	NOTE 4		Couplant Used		
Wedge MFG			Cable Type / Length		
Calibration Blocks					
IIW	Serial No.		Cal Due Date		
DSC	Serial No.		Cal Due Date		
DAC	Serial No.		Cal Due Date		

Initial inspection

Inspection after repair of all relevant indications

Corrective (repair) action taken: \_\_\_\_\_

Straight Beam testing found (circle one) NO RELEVANT Indications / RELEVANT Indications and Sketch is attached indicating locations and Angle Beam Modified Testing as shown on sketch to compensate for laminations detected.

Angle Beam testing found (circle one) NO RELEVANT Indications / RELEVANT Indications with part and records clearly marked with indication(s) relative to location, depth, length and probable flaw type.

All indications shall be noted, with relevant indications sketched showing location, depth, length and classification of flaw. This information shall, in addition, be clearly marked on the part for any necessary repairs.

NDT Technician (Print Name) Method - Level  UT Level II Date \_\_\_\_\_  
(Check all that apply)  UT Level III

NDT Technician Signature \_\_\_\_\_

## Notes for proper documentation on EN B101 UT Inspection Report Form (Page A-2 of 2, Appendix A of EN B101 1/17/2017, Revision A)

**General:** See Page A-1 of this Bulletin for general notes.

**Note 8:** Initial Inspection:

- If no relevant indications are found, document “**No relevant indications are found**” in the circles representing the sump and / or the BOV interior welds as applicable.
- If relevant indications are found, document all required information to indicate flaw size (see example of reporting on next page) and the corresponding location(s) on perimeter of the appropriate circle(s) on page A-2 of Appendix A, EN B101 1/17/2017 Rev A.
- The height, length, distance from ID, depths to top and bottom, along with the transducer(s) and wedge(s) used to identify the indication, are required for all relevant indications and shall be recorded at time of inspection.

**Note:** If the indication is identified by both the 45° and the 60° wedges, document both with the corresponding flaw information. If only one wedge identifies flaw, document only that wedge (45° or 60°) with flaw information.

- Indication type shall be documented using the Level II UT technician’s interpretation of flaw type based on UT scan characteristics (see Minimum Personnel Requirements in Bulletin).

**Final Inspection:** When inspection after repair of all relevant indications is complete and no relevant indications are discovered, document “**No relevant indications are found**” in the circles.

**Note 9:** Mark the “**Yes**” box only if a surface crack is present in the weld (including toe of weld) or the heat affected zone.

**Note 10:** Shell thickness should be determined by straight beam thickness readings taken adjacent to weld inspection areas but not affected by weld geometry.

**Note:** The COC can be used as an initial reference.

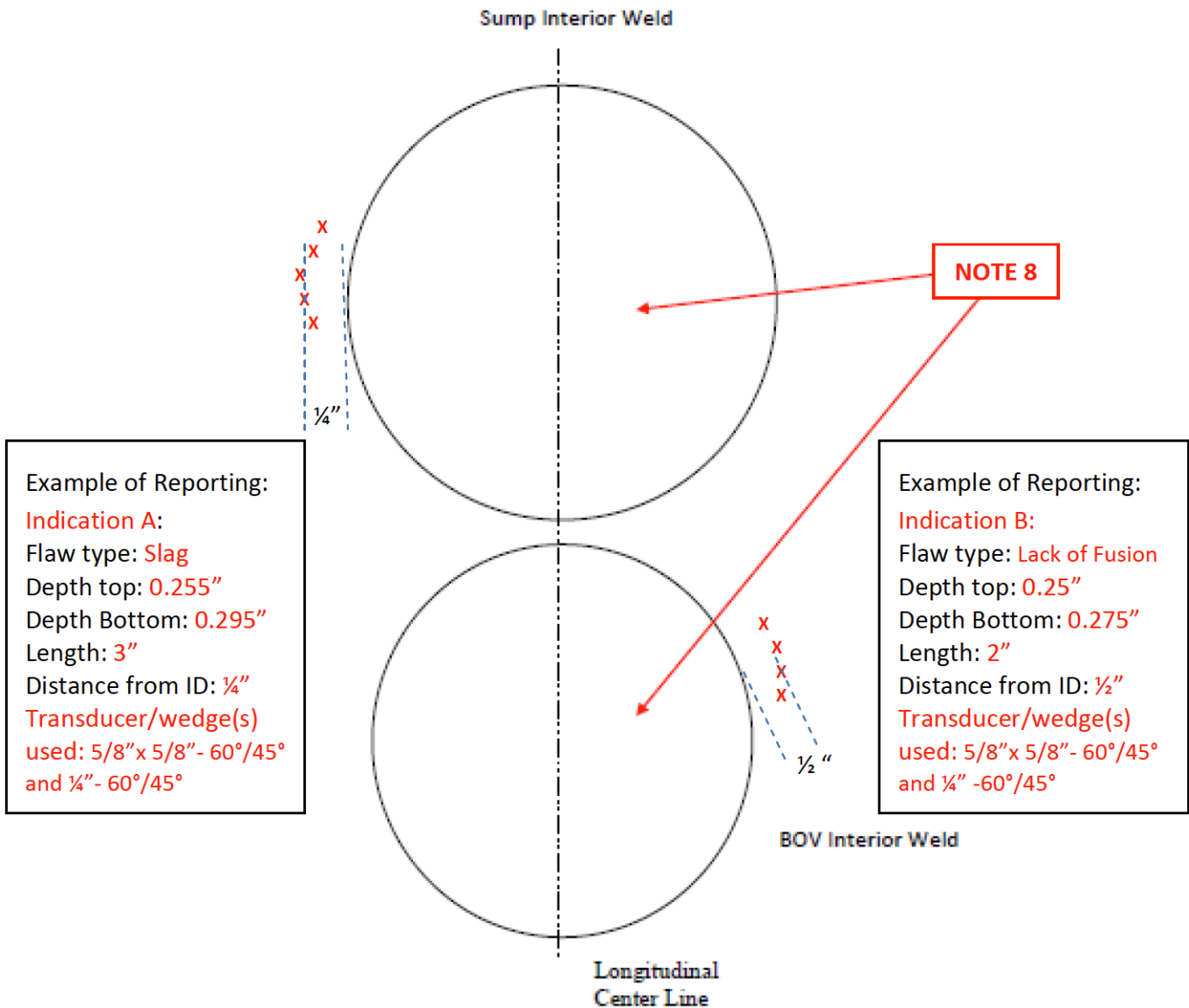
## APPENDIX A EN B101 - ULTRASONIC INSPECTION REPORT

Reporting Mark and Car No.	Date:
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Parts Sketch with relevant indications noted: height (depth top / bottom), length, indication type

Surface crack is present:  Yes  No NOTE 9

Shell Thickness \_\_\_\_\_ (inches, 7/16, 1/2, other) NOTE 10





## Notes for proper documentation on EN B101 VT Inspection Report Form (Page B-1 of 2, Appendix B of EN B101 1/17/2017, Revision A)

**General:** See Page A-1 of this Bulletin for general notes.

**Note 1:** Document the facility name, location, and station stencil.

**Note 2:** Document the condition of the surface in the area being inspected as “**bare metal**”.

**Note 3:** Document all discontinuities (such as surface porosity, or underfill that are acceptable per Appendix W) discovered on the BOV flange and / or the sump welds (as applicable) during visual inspection. **Discontinuities do not need to be documented on page B-2 of the Visual Inspection Report form.**

**Note 4:** Document “**Yes**” if the weld characteristics meet the acceptance requirements of EN B101 Sec C, and Document “**No**” if the weld characteristics exceed the acceptance requirements of EN B101 Sec C.

**Note 5:** Identify all defects (discontinuities that exceed acceptance criteria), documentation should correspond to areas in page B-2 of this form.

**Note 6:** Initial inspection - report document “**N/A**” in blank space provided for “**YES**”.  
Final Inspection report - check “**YES**” after all defects are repaired.

**Note 7:** Initial inspection report - document “**N/A**” in blank space provided for “**YES**”.  
Final Inspection report - check “**YES**” line.

**Note:** The traceable report form is the Final Inspection document.

**Note 8:** Check box indicating “**Initial inspection**” or “**Inspection after repair**”. Two separate reports must be completed for cars requiring any repair of welds.

**Note 9:** After initial inspection, document either “**No repairs required**”, or “**Repairs performed by welding**”. On final inspection document, after repair of all relevant indications are complete, document only “**No repairs required**”.

**Note 10:** Approval of report can only be given by GBX Director of Tank Car Engineering or GBX Manufacturing ASNT Level III(s) of UT and VT via signature, electronic signature or email. If approval is provided via email, the following statement will be documented on the “Reviewed by” line:

**“Approved by (Name of Approver) via email on (Date), see attached.”**

A copy of the email providing approval of report, will be placed in the car file and attached to all reports submitted to car owner (**See attached example report**). The title of approver will be recorded on the “Title” line.

## APPENDIX B EN B101 - VISUAL INSPECTION REPORT

Date: \_\_\_\_\_ Plant / Location / Station Stencil \_\_\_\_\_ NOTE 1

Reporting Marks and Car No. \_\_\_\_\_

Weld Seam #/Specific Area: BOV & Sump

Visual Testing Procedure: EN B101 Section C REV -

Calibrated / Verified Equipment used / Due Date: \_\_\_\_\_

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NOTE 14 SEE NEXT PAGE

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Surface Condition: \_\_\_\_\_ NOTE 2

Discontinuities: \_\_\_\_\_ NOTE 3

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BOV Welds Acceptable: \_\_\_\_\_ NOTE 4

Rejected: (Defects) \_\_\_\_\_ NOTE 5

---

Sump Welds Acceptable: \_\_\_\_\_ NOTE 4

Rejected: (Defects) \_\_\_\_\_ NOTE 5

---

Are all Defects Repaired Acceptably: YES \_\_\_\_\_ NO \_\_\_\_\_ NOTE 6

All Repaired Defects have a traceable report form: YES \_\_\_\_\_ NO \_\_\_\_\_ NOTE 7

Initial inspection  ← NOTE 8

Inspection after repair of all relevant indications  ← NOTE 8

Corrective action taken: \_\_\_\_\_ NOTE 9

ATTACH SKETCH IF NECESSARY:

Inspector Name: \_\_\_\_\_ (Print Name) Method – Level: \_\_\_\_\_  
(Check all that apply)

Signature: \_\_\_\_\_ (Inspector Signature)

Reviewed by: \_\_\_\_\_ NOTE 10

Title: \_\_\_\_\_

- AWS - CWI
- CSA W178.2 - Level 2
- CSA W178.2, Level 3
- VT - Level II
- VT - Level III

## Notes for proper documentation on EN B101 VT Inspection Report Form (Page B-2 of 2, Appendix B of EN B101 1/17/2017, Revision A)

**General:** See Page A-1 of this Bulletin for general notes.

**Note 11:** Intentionally left blank.

**Note 12:** Mark the “**Yes**” box only if a surface crack is present in the weld (including toe of weld) or the heat affected zone.

**Note 13:** Initial Inspection:

- If no relevant indications are found, document “**No relevant indications are found**” in the circles representing the sump and / or the BOV interior welds as applicable.
- If relevant indications are found, document all required information to indicate flaw size (see example of reporting on next page) and the corresponding location(s) on perimeter of the appropriate circle(s) on page B-2 of Appendix B, EN B101 1/17/2017 Rev A.
- Length, indication type, distance from ID and depth (if discernible) are required for all defects and shall be recorded at time of inspection.

Final Inspection: When inspection after repair of all relevant indications is complete and no relevant indications are discovered, document “**No relevant indications are found**” in the circles.

**Note 14 (Previous Page):** Any and all instruments used in the Visual Inspection of the welds should be recorded here, including visual aids such as flashlights, magnifying lens, and any calibrated devices such as, light meters, steel rule, tape measure, weld gages, weld reinforcement height gage, undercut gage, etc., and should be documented with applicable calibration due dates.

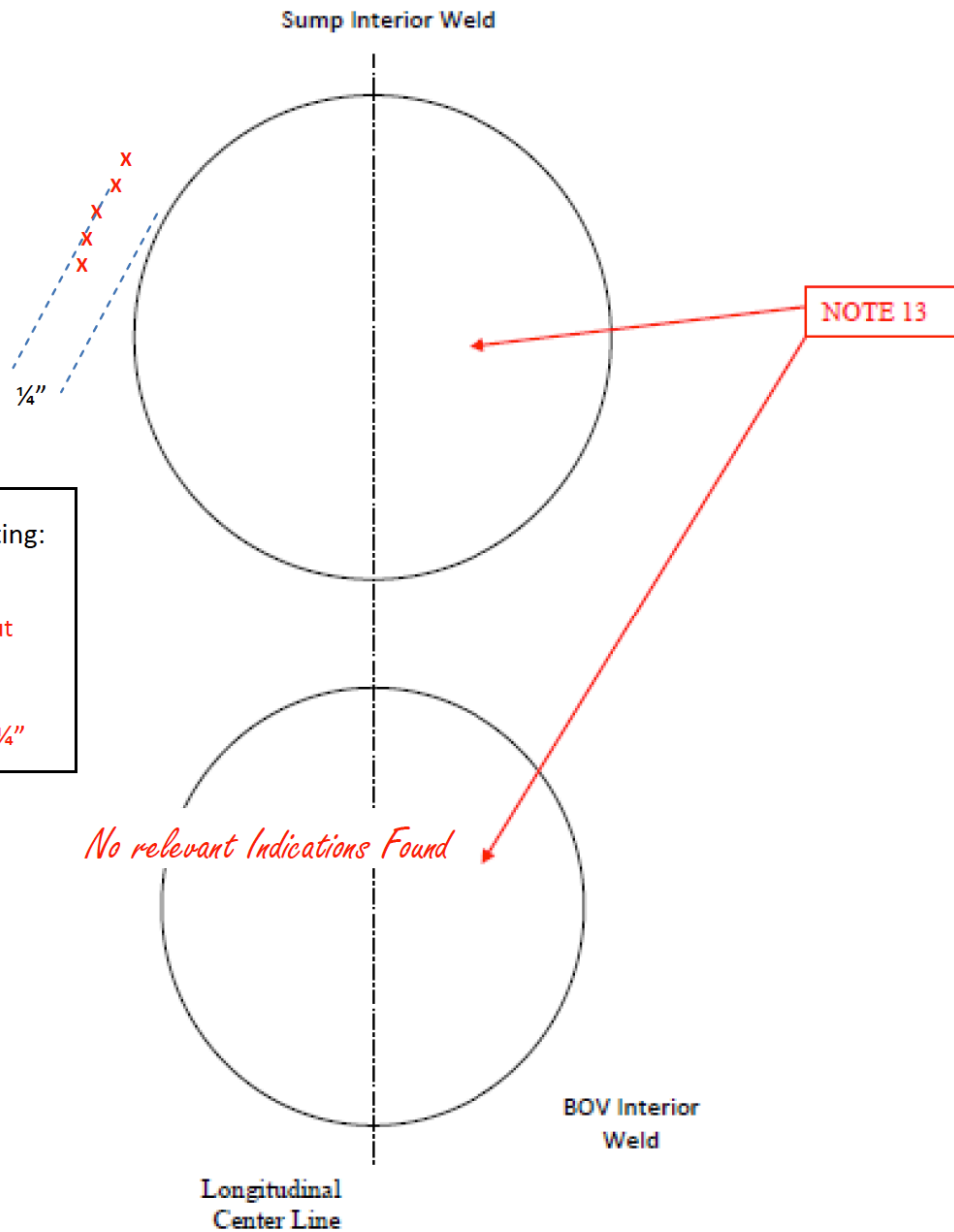
**NOTE:** EN B101 Sec C specifies the visual inspection requirements including lighting levels, etc.

APPENDIX B  
EN B101 - VISUAL INSPECTION REPORT

Reporting Mark and Car No.		Date:	
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Parts Sketch with relevant indications noted: location, length, indication type

Surface crack is present:  Yes  No NOTE 12



Example of Reporting:  
**Indication A:**  
 Flaw type: Undercut  
 Depth: 0.010"  
 Length: 2"  
 Distance from ID: 1/4"

Example of Completed Form

**APPENDIX A  
EN B101 - ULTRASONIC INSPECTION REPORT**

Plant / Location / Station Stencil		ARI – Bude/ Bude, MS / ARIB			
Reporting Mark and Car No.		XXXX 111111			
Surface Condition		Bare Metal	Test Date:		5/10/2017
UT Procedure:	EN B101 Section B	Revision:	A	Issue Date:	1/17/2017
Flaw Detector					
Model	USN-58L	Calibration Due	9/23/17	Serial No.	01R97J
Longitudinal Beam Unit					
Type	Pulse Echo	Frequency	2.25MHz	Size	1" Diameter
Serial No.	82015		MFG.	Technisonic	
Shear Wave Unit					
Type	Pulse Echo	Frequency	2.25MHz	Size	5/8" x 5/8" & 1/4" Diameter
Serial No.	5/8" x 5/8" - 00VFJX 1/4" - 1036732		MFG.	5/8" x 5/8" - Benchmark & 1/4" - Olympus	
Scanning Face	A	Reference Gain(s)	3/4" 60°- 48.2 3/4" 45°- 41.1	5/8" x 5/8" 60°-42.5 5/8" x 5/8" 45°- 42.9	dB
Wedge(s) Used	45° and 60°		Couplant Used	Sonotech	
Wedge MFG	Stroud and Panametrics		Cable Type / Length	Olympus / _____ / 72"	
Calibration Blocks					
IIW	Serial No.	6313	Cal Due Date	1/4/19	
DSC	Serial No.	0039-98	Cal Due Date	10/23/17	
DAC	Serial No.	BD6-001-7775	Cal Due Date	10/23/17	

Initial inspection

Inspection after repair of all relevant indications

Corrective (repair) action taken: Repairs performed by welding

Straight Beam testing found (circle one) NO RELEVANT Indications / RELEVANT Indications and Sketch is attached indicating locations and Angle Beam Modified Testing as shown on sketch to compensate for laminations detected.

Angle Beam testing found (circle one) NO RELEVANT Indications / RELEVANT Indications with part and records clearly marked with indication(s) relative to location, depth, length and probable flaw type.

All indications shall be noted, with relevant indications sketched showing location, depth, length and classification of flaw. This information shall, in addition, be clearly marked on the part for any necessary repairs.

NDT Technician Jon Smith Method – Level  UT Level II Date 5/10/2017  
(Check all that apply)  UT Level III

NDT Technician Signature Jon Smith

## Example of Completed Form



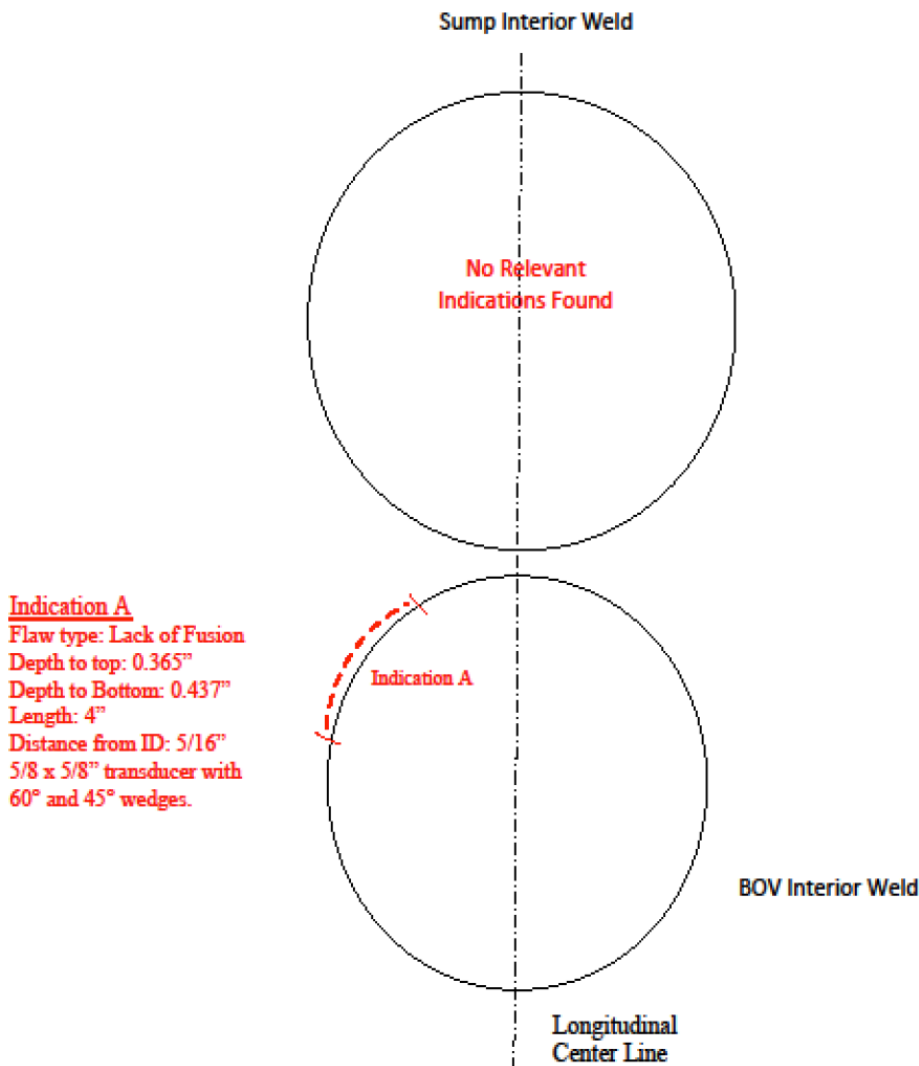
### APPENDIX A EN B101 - ULTRASONIC INSPECTION REPORT

Reporting Mark and Car No.	XXXX 111111	Date:	5/10/17
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Parts Sketch with relevant indications noted: height (depth top / bottom), length, indication type

Surface crack is present:  Yes  No

Shell Thickness 7/16" (inches, 7/16, 1/2, other)



Indication A  
 Flaw type: Lack of Fusion  
 Depth to top: 0.365"  
 Depth to Bottom: 0.437"  
 Length: 4"  
 Distance from ID: 5/16"  
 5/8 x 5/8" transducer with  
 60° and 45° wedges.

## Example of Completed Form

### APPENDIX B EN B101 - VISUAL INSPECTION REPORT

Date: 5/10/17 Plant / Location / Station Stencil ARI - Bude/Bude, MS / ARIB

Reporting Marks and Car No. XXXX 11111

Weld Seam #/Specific Area: BOV & Sump

Visual Testing Procedure: EN B101 Section C Rev A Issued date: 1/17/17

Calibrated / Verified Equipment used / Due Date: \_\_\_\_\_  
Cal date 11-7-16 / Extech Light Meter / Due date 11/7/17  
Verified to meet 100 Ftc light requirement

Surface Condition: Bare Metal

Discontinuities: \_\_\_\_\_  
None

BOV Welds Acceptable: Yes

Rejected: (Defects) None

Sump Welds Acceptable: \_\_\_\_\_  
Yes

Rejected: (Defects) None

Are all Defects Repaired Acceptably: YES N/A NO \_\_\_\_\_  
 All Repaired Defects have a traceable report form: YES N/A NO \_\_\_\_\_

Initial inspection  \_\_\_\_\_  
 Inspection after repair of all relevant indications  \_\_\_\_\_  
 Corrective action taken: No Repairs Required

Inspector Name: Jon Smith Method - Level:  AWS - CWI  
 CSA W178.2 - Level 2  
 CSA W178.2, Level 3  
 (Check all that apply)  VT - Level II  
 VT - Level III

Signature: Jon Smith

Reviewed by: Approved by R. Dalske via email 5/11/17, see attached

Title: ARI Director of Tank Car Engineering

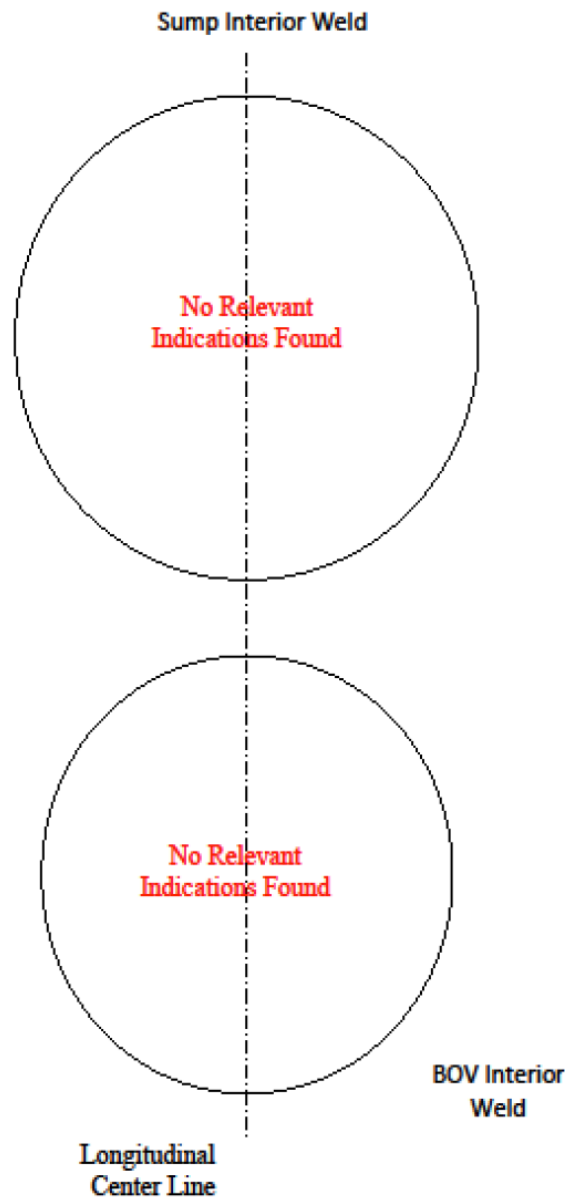
## Example of Completed Form

### APPENDIX B EN B101 - VISUAL INSPECTION REPORT

Reporting Mark and Car No.	XXXX 111111	Date:	5/10/17
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Parts Sketch with relevant indications noted: location, length, indication type

Surface crack is present:  Yes  No





## Example of Approval Email

**From:** [Dalske, Roger](#)  
**To:** [Smith, Jon](#); [Churchwell, Gerry](#); [Smith II, Norman](#)  
**Cc:**  
**Subject:** XXXX 111111 EN B101 Initial Inspection Report  
**Date:** May 11, 2017 10:51:25 AM

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Ok to send to customer, send final UT and VT when complete.

Roger Dalske  
Director of Tank Car Engineering  
American Railcar Industries  
(636) 940-6185  
[Rdalske@americanrailcar.com](mailto:Rdalske@americanrailcar.com)

-----Original Message-----

From: Smith, Jon  
Sent: May 10, 2017 9:21 AM  
To: Dalske, Roger; Churchwell, Gerry; Smith II, Norman  
Cc:  
Subject: XXXX 111111 Initial Inspection

Roger/Gerry,  
Please see attached initial inspection of XXXX 111111.

Thanks!!  
Jon Smith  
Quality Assurance  
American Railcar Industries  
427 South Gerard Street  
Bude, Ms. 39630

# B101 - NON-MANDATORY APPENDIX B FRA RAILWORTHINESS DIRECTIVE RWD NO. 2016-01 [REVISED]

UNITED STATES DEPARTMENT OF TRANSPORTATION  
FEDERAL RAILROAD ADMINISTRATION  
RAILWORTHINESS DIRECTIVE (RWD)  
RWD No. 2016-01 [REVISED]

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This Revised Directive revises and supersedes FRA's Railworthiness Directive No. 2016-01 (Directive), issued on September 30, 2016. FRA is issuing this Revised Directive under 49 CFR 180.509(b)(4). This Revised Directive addresses concerns and requests for clarification FRA received from affected parties since it issued the original Directive. The revisions this Revised Directive makes are discussed in Section II below and the actual revisions to the Directive are in Section III below.

## I. Background

FRA issued the Directive based on its finding that as a result of non-conforming welding practices, DOT-111 tank cars built by American Railcar Industries, Inc. (ARI) and ACF Industries, LLC (ACF) between 2009 and 2015 to the ARI and ACF 300 stub sill design and equipped with a two-piece cast sump and bottom outlet valve (BOV) skid may be in an unsafe operating condition and could result in the release of hazardous materials. As a result of non-conforming welding practices, FRA concluded these cars may have substantial weld defects at the sump and BOV skid groove attachment welds, potentially affecting each tank's ability to retain its contents during transportation. Further, FRA found using the tank cars with the defective welds identified violates the requirements of the Federal Hazardous Materials regulations (HMR; 49 CFR parts 171–180).<sup>1</sup> A more detailed background discussion is in the Directive.

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<sup>1</sup> See 49 CFR 179.200-10.

Generally, this Revised Directive requires tank car owners to: (1) identify tank cars in their fleet covered by the Revised Directive (covered cars); and (2) implement specific inspection and testing procedures to ensure no flaws exist in each tank car's sump and BOV skid groove attachment welds which could result in the loss of tank integrity. Specifically, this Revised Directive requires offerors of covered cars, before offering those cars into transportation, to visually inspect the BOV saddle and sump area to ensure there is no visible leak from those areas. This Revised Directive also requires each tank car owner to identify covered cars in hazardous materials service as of the issuance date of this Revised Directive and of those cars, ensure a 15% sample are inspected and tested by qualified personnel at tank car facilities within 12 months. The Revised Directive requires tank car facilities to use both volumetric inspection methods (ultrasonic testing) and surface inspection methods (e.g., liquid penetrant, magnetic particle or visual inspection) to ensure the welds at issue are completely examined. The Revised Directive also requires the nondestructive testing (NDT) methods used to be able to locate, interpret, evaluate, and size cracks, incomplete penetration, incomplete fusion, and slag inclusions to a level of sensitivity and reliability of 90% probability of detection (POD).

This Revised Directive also modifies certain recordkeeping requirements of the original Directive.

## **II. ARI and ACF Concerns With Directive and Requests for Modification**

In letters, ARI and ACF expressed concerns with the Directive and asked FRA to reconsider certain requirements. Specifically, in its October 7, 2016, letter, ARI: (1) asked FRA to extend the effective date of the Directive 30 days; (2) indicated some

requirements of the Directive “appear to be impractical and confusing”; and (3) questioned the legality of some Directive requirements. In its October 13, 2016, letter, ACF asked FRA to reconsider including ACF-manufactured cars in the Directive, noting ARI had manufactured the failed tank car (CTCX 736177) and asserting no evidence exists that ACF-manufactured tank cars have the same weld conditions as CTCX 736177.

In ARI's October 14 and 27, 2016, letters, ARI asserted that the Directive imposed “unattainable standards for inspection and testing” due to the timeline for completing the required inspections and the requirement for inspection and testing to be conducted to a 90% POD. ARI asked FRA to amend the Directive to allow use of “currently accepted industry inspection” methodologies and asserted that even if FRA did allow the use of currently accepted inspection methodologies, due to capacity constraints at the nation’s approximately 70 tank car shops, industry would need 5 years (until the end of 2021) to complete the inspections the Directive requires. ARI further asserted that by applying the Directive to cars already voluntarily inspected by ARI, Association of American Railroads (AAR) Specification 211 (AAR 211) cars, and cars currently in storage, FRA is applying the Directive to an overly broad class of cars. Accordingly, ARI recommended removal of the Directive’s recordkeeping requirement related to the required pre-transportation visual inspection of the BOV saddle and weld area. ARI also expressed concern regarding the Directive’s requirement to keep the results of ultrasonic testing inspections digitally and to train personnel reviewing, approving, and performing the inspections and tests required under the Directive. Finally, ARI asserted FRA lacks an objective justification for the Directive. In support of its assertions, ARI provided

FRA a summary report of its inspection results from 321 field inspections of cars built to the ARI 300 stub sill design and a summary of ARI's stress and fatigue analysis completed on the bottom fitting weld attachments of the cars.<sup>2</sup>

1. Effective Date.

FRA is extending the first deadline in this Revised Directive by more than 30 days from that of the original Directive to the date this Revised Directive is issued to provide stakeholders additional time to address technical and administrative issues regarding elements of the Directive that required clarification, as well as to provide necessary time to develop and distribute weld inspection procedures that meet the minimum criteria of the Directive.

2. Scope of Cars Subject to the Directive.

ARI and ACF expressed four concerns regarding the scope of cars subject to the Directive. First, noting that ACF manufactured 10% of the tank cars subject to the Directive, ARI and ACF asserted there is no evidence the ACF-manufactured tank cars have the same sump and BOV skid groove attachment weld conditions found in CTCX 736177 or other ARI-manufactured cars. Second, ARI noted that together with CIT Group Inc. (CIT Group Inc. owns a fleet of ARI-manufactured tank cars built to the ARI 300 stub sill design and equipped with a two-piece cast sump and BOV skid), ARI has already voluntarily inspected approximately 750<sup>3</sup> ARI-manufactured cars "without finding any leaks or cracks." Third, ARI and ACF expressed concern with the

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<sup>2</sup> ARI, Summary Report on ARI Tank Cars built with Sump and Bottom Outlets, 2009-2015, ARI Report 1601 (Oct. 7, 2016).

<sup>3</sup> Based on the latest information ARI has provided, FRA understands that to date, ARI and CIT have inspected approximately 900 ARI-manufactured tank cars built to the ARI-300 stub sill design.

Directive's requirement to inspect out-of-service cars within 24 months. Fourth, ARI recommended removal of AAR 211 tank cars from the scope of the Directive.

FRA understands ARI and ACF's concerns, and the concerns of other industry participants dependent on having an ample supply of tank cars to meet their transportation needs.<sup>4</sup> FRA believes the failure of tank car CTCX 736177, and the defective weld conditions identified in a large number of ARI- manufactured cars of the same design, demonstrate the need to ensure all cars built to this particular design are inspected and repaired, as necessary, as soon as practicable. Nevertheless, FRA believes ARI and ACF's concerns about the scope of cars covered by the Directive and the Directive's recordkeeping requirements related to the required pre-trip visual inspection are valid. Accordingly, in this Revised Directive, FRA is revising aspects of the Directive to address these concerns and practical issues.

In response to ARI and ACF's concerns regarding ACF-manufactured tank cars, in this Revised Directive, FRA is implementing a sample inspection program for ACF tank cars to gather additional data to determine if this group of cars should be removed from the scope of the Revised Directive. FRA is also implementing a representative sampling program of the approximately 900 cars CIT and ARI have already voluntarily inspected. These sampling programs may provide data sufficient to exempt these groups of cars from the Revised Directive. However, the minimum inspection criteria of the Directive are different from the criteria ARI and CIT used to voluntarily examine tank cars prior to issuance of the Directive. Thus, after ARI and CIT complete the representative sample of inspections of those cars under this Revised Directive, FRA will

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<sup>4</sup> See letter to Robert C. Lauby, FRA, from Jason F. Huette, Southwest Rail Industries (Oct. 31, 2016) (asserting Directive is "burdensome" on ARI and industry as a whole).

compare those inspection results with the inspection results of CIT and ARI's voluntary inspections. FRA will then determine whether the remaining previously examined tank cars should be exempted from the Revised Directive.

FRA agrees with ARI and ACF's concerns about the requirement to inspect out-of-service cars within 24 months, so FRA is removing the requirement to inspect tank cars not currently in hazardous materials service and the scope of the inspection and test requirement. This requirement now applies to 15% of tank cars currently in hazardous materials service with the highest mileage in each tank car owner's fleet. FRA believes prioritizing inspection of these higher mileage cars, which are more likely to have developed cracks or leaks, will provide the best information regarding the performance and reliability of the affected welds. FRA will monitor and analyze the results of the 15% sample over the next 12 months prior to implementing any additional test and inspection requirements for the remaining fleet of tank cars covered by this Revised Directive.

FRA does not agree, however, with ARI's request to exclude AAR 211 cars from the Directive. FRA believes no evidence exists justifying the exclusion of these cars.

3. Pre-Trip Visual Inspection Record.

ARI requested that FRA revise the requirement for offerors of tank cars to document and submit all pre-trip visual inspection records to the tank car owner. In response to this request, FRA is revising the recordkeeping requirement for the pre-trip inspection to require offerors to maintain the documentation of each visual inspection on-site, but only notify the tank car owner when a defective condition, such as a leak from the BOV/sump/skid area of the car, is detected. FRA agrees the important data from

these pre-trip inspections is whether a defective condition was identified, such as a leak from the BOV/sump or skid area of these cars. Providing notification to the tank car owner for every successful pre-trip visual inspection is an unnecessary burden, and, therefore, FRA is modifying this provision. FRA is, however, requiring offerors to notify FRA and the tank car owner of any leaks identified during the pre-trip visual inspection so FRA, and tank car owners, can monitor ongoing performance and reliability of the cars affected by this Revised Directive.

4. Insufficient Shop Capacity to Perform Required Tests and Inspections Within Timeframe Required.

FRA is modifying the Directive in response to ARI's assertion there is insufficient shop capacity to conduct the inspections and testing the Directive mandates within the timeframes the Directive requires. FRA recognizes the strain the timelines in the Directive may place on existing tank car cleaning, inspection, and repair capacity, but FRA notes that to date, one known hazardous material release has occurred from a car of this design and that release occurred less than 2 years after the car was originally manufactured (8 years prior to its scheduled qualification). Nevertheless, FRA is removing the requirement to test and inspect all covered cars and replacing it with a requirement to test and inspect a 15% sample of covered cars in hazardous materials service with the highest total mileage in each tank car owner's fleet within 12 months of the issuance date of this Revised Directive. In other words, if a tank car owner's fleet consists of 100 covered cars in hazardous materials service, the owner must ensure at least 15 cars (15% of the 100 covered cars in hazardous materials service) are inspected and tested under this Directive and those cars must be the cars with the highest total mileage in the owner's fleet of covered cars. FRA will monitor and analyze the results of



the 15% sample over the next 12 months prior to implementing any additional test and inspection requirements for the remaining fleet of tank cars subject to this Revised Directive.

5. 90% POD Requirement.

In its October 14, 2016, letter, ARI asserted there is a lack of tank car facilities qualified to conduct inspections and tests to the required 90% POD and it could take facilities up to 6 months to become properly qualified. Further, ARI noted the “POD is dependent on the size of the condition or flaw to be found” and “[w]ithout the target condition size information, it is not clear how tank car facilities will be able to create a methodology to satisfy the 90% POD requirement.” ARI also requested clarification whether the 90% POD requirement applies to the entire inspection (surface and volumetric combined) or to each area (volumetric and surface) independently or to each inspection technique used.

FRA is clarifying the required inspection and test methods in response to ARI’s concerns, but FRA believes utilizing a 90% POD is both feasible and necessary given the defects involved. It is important to note the Directive requires the procedure to be verified to 90% POD, as opposed to verifying each individual technician to 90% POD, and that the technicians must receive training on the specific procedure like any other required NDT procedure. FRA believes certifying a procedure to 90% POD is achievable for properly qualified inspectors and expert interpretation given the length of time the industry has had to refine their NDT procedures.<sup>5</sup>

FRA understands ARI has already achieved volumetric NDT procedures with 90% POD for the type and size of defects identified in this Revised Directive.

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<sup>5</sup> 58 FR 48487 (1993).

Therefore, FRA believes ARI's concerns regarding this threshold are without merit. FRA does believe, however, ARI raises a valid technical point and is revising the Directive's inspection procedures to include specific dimensions of weld defects consistent with industry procedures demonstrated to identify surface and volumetric defects at a 90% POD. We are also clarifying the 90% POD applies to surface defects and volumetric defects independently.

6. Digitally Storing Ultrasonic Testing Records.

In its October 14, 2016, letter, ARI asserts "there is no way to physically store" an electronic ultrasonic test. FRA disagrees. FRA believes most ultrasonic testing is done using electronic devices capable of digitally downloading the results of the tests and where devices do not have the capability built in, the same data can be captured and recorded using digital photos and recordings of indications found (e.g., variances from the baseline reading). However, FRA also recognizes requiring digital images of inspections, or portions of inspections, that do not reveal indications is unnecessary and burdensome.

Accordingly, FRA is revising the Directive's requirement to digitally record and maintain the results of ultrasonic testing inspections to clarify digital images (e.g., digital photographs) of indications may be used to meet this requirement. Digital recordings or images are not required to be included in the record of the inspection when the inspection does not produce indications. FRA recognizes digital images or recordings alone are not sufficient, but digital images/recordings with proper records of the equipment used for the testing, the equipment type and settings (e.g., calibration data), and the written procedure used would provide adequate context for digital images or recordings.

7. Potential Shortage of Qualified Inspectors.

ARI expressed concern about a potential shortage of qualified Level II and III certified inspectors available to perform the Directive's required testing and inspection noting that it is not clear how many certified inspectors have been "additionally trained beyond the requirements of Appendix T as mandated by the Directive." Although FRA appreciates the challenge of ensuring a sufficient number of qualified and certified inspectors to carry out the number and types of inspections the Directive requires, FRA notes the Directive does not require training above and beyond Appendix T. NDT technicians are required to be trained on the specific NDT procedure provided by the tank car owner as currently required by Federal regulations for other tank car qualification work. A Level II or Level III qualified NDT technician should already have the technical proficiency in the particular NDT technique and FRA expects only minimal function specific training in the written procedure to be applied to this area of the tank car will be necessary.

8. FRA's Legal Authority to Issue the Directive.

In response to ARI's assertions that some requirements of the Directive may be unlawful and that FRA lacks an objective justification for the Directive, FRA notes that 49 CFR 180.509(b)(4) authorizes it to require the inspection and testing of tank cars outside of the cars' normal qualification intervals "based on the existence of an objectively reasonable and articulable belief that a tank car or a class or design of tank cars **may be in an unsafe operating condition.**" (Emphasis added.) The applicable regulations further define "objectively reasonable and articulable belief" as "a belief based on particularized and identifiable facts that provide an objective basis **to believe or**

**suspect** that a tank car or a class or design of tank cars may be in an unsafe operating condition.” 49 CFR 180.503 (emphasis added). As outlined in the Directive, FRA inspection and testing of the failed tank car (CTCX 736177) built to the ARI 300 stub sill design identified large slag pockets just below the interior weld surface and extending almost completely through the weld thickness. Inspection of almost 400 additional cars built to this same design found 15% of the cars had the same defects as those identified in CTCX 736177, ranging from ½ inch to 22 inches long and from 1/8 inch to 0.39 inches deep. These defects make the cars noncompliant with Federal regulations and, because of this noncompliance, along with facts of the May 9, 2014, failure of tank car CTCX 736177, FRA reasonably believes or suspects and articulated why the cars may be in an unsafe operating condition.

### III. DIRECTIVE

Upon the date of issuance of this Revised Directive, the requirements of RWD No. 2016-01 are revised to require tank car owners to:

1. Identify the railroad tank cars in their fleet manufactured by ARI or ACF to the ARI 300 or ACF 300 stub sill design and equipped with a two-piece cast sump and BOV skid (covered cars) and provide to FRA within 30 days of the issuance of this Revised Directive, the reporting mark and number of (1) all covered cars; (2) all covered cars in the owner’s fleet in hazardous materials service as of the issuance date of this Revised Directive; and (3) of the identified covered cars in hazardous materials service, identify the top 15% of cars with the highest mileage. If 15% of the covered cars in hazardous materials service results in a decimal, then the decimal value must be rounded up (e.g., 15% of 10 tank cars results in a value of 1.5 and thus must be rounded up to 2 tank cars).

a. Before offering a tank car for transportation under the conditions of this Revised Directive, the tank car owner or other offeror of the car, must ensure there is no visible leak from the BOV saddle and sump weld areas, the car complies with all applicable regulatory requirements, and is in a safe condition for transportation.

b. The person performing the inspection must document the inspection and must make the results of the visual inspection available to FRA upon request. If a leak is identified, the results of the inspection must be documented and forwarded to the tank car owner and to FRA via email. Email notifications to FRA must be sent to HMASSIST@DOT.GOV.

2. Inspect and test the sump and BOV skid groove attachment welds as follows:

a. Facilities. All inspections and tests required by this Revised Directive (other than the visual inspection required by paragraph 1 above) must be performed by tank car facilities (defined at 49 CFR 179.2) certified by the AAR consistent with Appendix B of the AAR Tank Car Manual (Tank Car Manual).<sup>6</sup> (Appendix B provides the requirements for tank car facilities to obtain AAR certification.)

b. Procedures. Due to the subsurface location of the identified slag inclusions and related cracks, volumetric inspection methods (ultrasonic testing), must be used in conjunction with surface inspection methods (e.g., liquid penetrant, magnetic particle or visual inspection) to ensure the welds are completely examined.

i. All NDT, including visual inspection, must be performed consistent with written procedures described in Appendix T, paragraph 1.18 of the Tank Car Manual and approved by an individual qualified and certified as a Level III in the NDT method.

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<sup>6</sup> AAR, Manual of Standards and Recommended Practices, Section C-III, Specifications for Tank Cars (Specification M-1002); Nov. 2014.

(Appendix T provides the requirements for qualification and certification of NDT procedures and personnel for tank cars.)

ii. All surface (liquid penetrant, magnetic particle and visual inspection) methods must be able to detect indications 0.188 (3/16) inches long by 0.016 (1/64) inches wide (maximum values) to a 90% POD. Volumetric NDT methods (e.g., ultrasonic testing (UT)) must be able to detect indications of major dimension 0.188 (3/16) inches by 0.125 (1/8) inches deep (maximum values) to a 90% POD. UT methods and techniques used must allow for clearance around internal attachments adequate to perform longitudinal and transverse wave scanning, including procedures for phased array UT, if used.

c. Personnel. All personnel, including subcontractors, reviewing and approving NDT procedures and reports, including visual inspections, must be qualified and certified to Level II or Level III consistent with Appendix T of the Tank Car Manual and the tank car facility's written practice.

i. In addition to the requirements of Paragraph 2.c., all personnel performing NDT on these welds, and reviewing procedures and reports, including subcontractor personnel, must be trained and tested on the procedures to be used and samples representing the welds to be inspected consistent with 49 CFR part 172, subpart H, and Appendix T of the Tank Car Manual.

d. Acceptance Criteria. Interpretations and evaluations of inspections and tests must comply with Appendix W of the Tank Car Manual.

e. Records. All inspection and test results must be documented, including re-inspections of repairs. The documentation must include the information described in

Appendix T, paragraph 1.20 of the Tank Car Manual including the additional reporting requirements of Appendix T for the applicable NDT methods(s) chosen.

i. A separate record must be completed for each inspection and test performed on each tank car.

ii. The results of UT inspections must be recorded and digital recordings or images of indications (i.e., any variance from the baseline reading) found must be maintained with the inspection and test record.

iii. In addition to the record retention periods required by Chapter 1 of the Tank Car Manual for tank car facilities, the tank car owner must retain all records and documentation required by this Revised Directive for 10 years following the completion of the inspections and tests.

f. Schedule. The inspections and tests required by this Revised Directive must be performed according to the following schedule:

i. Within 12 months of the issuance date of this Revised Directive, 15% of each owner's fleet of covered cars in hazardous materials service with the highest total mileage must be tested and inspected;

ii. Tank car owners must include the results of the inspections and tests required by this Revised Directive in the analysis of their qualification and maintenance program at the intervals required by 49 CFR 180.501 and 180.509;

iii. Within 60 days of the issuance of this Revised Directive, each owner of a tank car subject to this Revised Directive must notify all parties under contract to the car owner, including its lessees and/or sub-lessees, using the cars covered by the Revised

Directive of the terms of this Revised Directive and the inspection and testing schedule;  
and

iv. After receiving the notification required by paragraph 2.f.iii, a lessee or other offeror of a tank car subject to this Revised Directive, must document each pre-trip inspection required under paragraph 1 of this Revised Directive.

g. Reports. Owners of tank cars subject to this Revised Directive must report the inspection, test, and repair information to FRA as follows:

i. Tank car reporting mark(s) and number(s) of tank cars in an owner's fleet identified under paragraph 1 of this Revised Directive;

ii. Planned inspection and test schedule for each tank car identified under paragraph 1 of this Revised Directive for inspection (i.e., 15% of the tank car fleet in hazardous materials service with the highest mileage), by reporting mark and number;

iii. Tank car facility (station stencil) that performed the inspection(s) and test(s);

iv. Date(s) the inspection(s) and test(s) were performed;

v. Inspection and test method(s) and procedure number(s) used;

vi. Name(s) of inspector(s) performing the inspection(s) and test(s), level(s) of certification(s), and method(s) certified;

vii. Inspection and test results;

viii. Corrective (repair) action(s) taken; and

ix. The type and date of any accidents, incidents, or releases from the tank car related to the welds that are the subject of this Revised Directive.



The information must be submitted in written hardcopy format or sent electronically to: Larry Strouse, General Engineer, Hazardous Materials Division, Office of Technical Oversight, FRA, 200 West Adams Street, Suite 310, Chicago, Illinois, 60606, (312) 353-6203, email: Larry.Strouse@dot.gov. FRA must receive initial reports within 30 days from the date of issuance of this Revised Directive and subsequent updates every 90 days until a tank owner has met the inspection and testing requirements of paragraph f.1.

h. Repairs. Prior to initiating any repairs, a tank car facility must obtain the tank car owner's written permission and approval of the qualification and maintenance program the tank car facility will use consistent with 49 CFR 180.513 and Appendices D, R, and W of the Tank Car Manual. A tank car facility must report all work performed and all observed damage, deterioration, failed components, or noncompliant parts to the owner under 49 CFR 180.513.

i. Exemption. Notwithstanding the scope of this Revised Directive, FRA may grant relief from this Revised Directive for ACF-manufactured tank cars and/or for tank cars that ARI and CIT voluntarily inspected prior to November 15, 2016, if: (A) a representative sample is inspected consistent with this Revised Directive; (B) the results of the inspections are provided to FRA for review; and (C) the results provide sufficient evidence to warrant FRA exemption of that group of tank cars from this Revised Directive. The required sample sizes to request exemption are as follows:

- (A) ACF tank cars manufactured to the ACF 300 design: 125
- (B) Cars voluntarily inspected prior to November 15, 2016: 80

FRA will continue to monitor the performance of the tank cars subject to this Revised Directive in hazardous materials service and will take all necessary regulatory or enforcement action to ensure the highest level of safety on the nation's railroads is maintained. Regardless of any entity's compliance with this Revised Directive, FRA reserves the right to seek civil penalties or to take any other appropriate enforcement action for violations of the HMR that have occurred.

**IV. Agency Contact for Questions**

If you have any questions concerning this Revised Directive, contact Larry Strouse, General Engineer, Hazardous Materials Division, Office of Technical Oversight, FRA, 200 West Adams Street, Suite 310, Chicago, Illinois 60606, (312) 353-6203, [Larry.Strouse@dot.gov](mailto:Larry.Strouse@dot.gov).

Dated: NOV 18 2016



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Robert C. Lauby,  
Associate Administrator for Railroad Safety  
Chief Safety Officer

# **RWD 2016-01[REVISED] INSPECTION AND REPAIR BULLETIN B101 - NON-MANDATORY APPENDIX C BULLETIN APPROVAL**

## **Appendix C**

### **Bulletin Approval**

<b>Approver</b>	<b>Title</b>	<b>Original Approval</b>	<b>Revision Approved</b>
Norman Smith II	Quality Assurance Manager	1/17/2017	5/26/2017
Roger Dalske	Director Tank Car Engineering	1/17/2017	5/26/2017
Glenn Sandheinrich	Vice President Engineering	1/17/2017	5/26/2017

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# RAILCAR MANUFACTURING PROCEDURE

**Manual:** Engineering  
**Section:** Non-Destructive Testing  
**Sub:** Ultrasonic/Visual  
**Number:** EN B101  
**Title:** Tank Car Directive Inspection Procedure – Bottom Outlet Valve Flange and Sump Skid  
**Issue Date:** January 17, 2017  
**Rev. Date:** May 26, 2017  
**Rev:** A

## Section A: Applicability and Scope

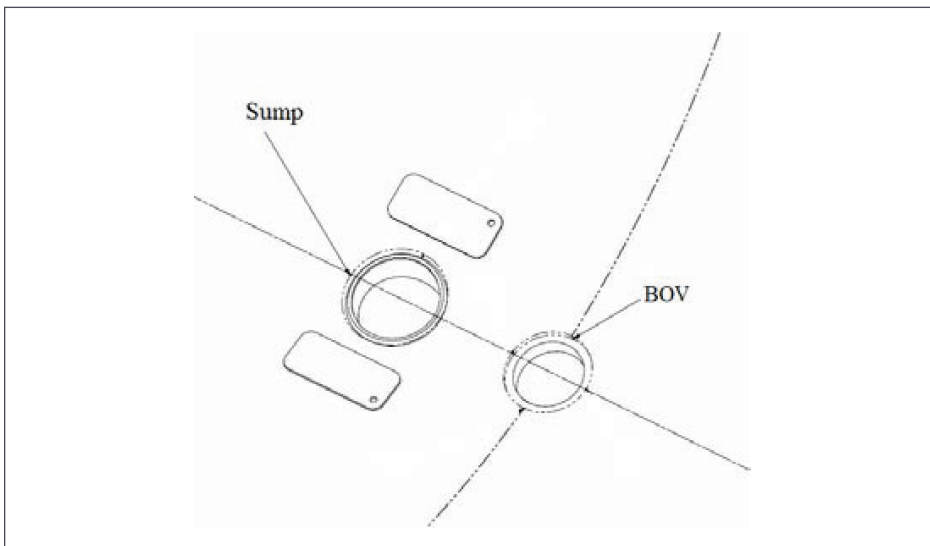
The applicability of this bulletin is solely for compliance with the FRA Railworthiness Revised Directive, RWD-2016-01 [Revised] (the “Directive”), as issued on November 18, 2016 and is to be used only at the direction of the car owner. As such, this inspection must be authorized by the car owner prior to being conducted.

The procedures and methods set forth in this document or the related forms may be amended, modified and supplemented as required by the applicable individual qualified and certified as a Level III, as long as such amendment, modifications and supplemental procedures and methods do not reduce any requirements of the RWD No. 2016-01 [REVISED]. Any and all modifications or revisions must be documented.

This procedure applies only to the BOV flange and sump attachment groove welds, reference **Figure 1**. For reference the original construction welding is shown in **Figure 2**. Contact the car owner with any question regarding construction of the car.

From the interior of the car, a UT and VT inspection of the interior groove welds of the BOV flange and sump (if equipped) to the tank shell are to be performed per this procedure, reference Sections B and C. **Note:** The inspections (UT and VT) can be performed in any order.

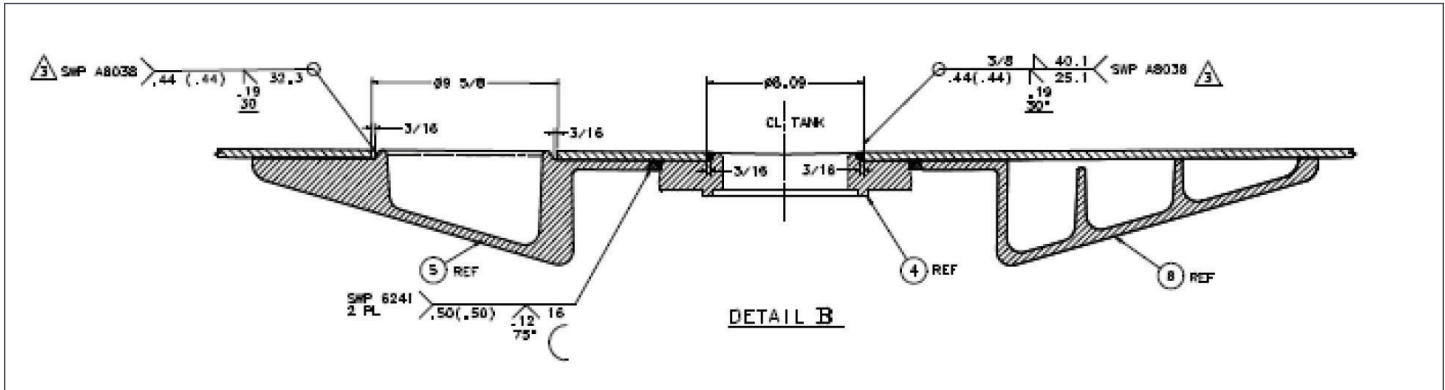
Figure 1 – View from Inside Car Looking at the Sump and BOV Flange Welds to be Inspected



## Tank Car Directive Inspection Procedure – Bottom Outlet Valve Flange and Sump Skid

EN B101 January 17, 2017 Rev: A

Figure 2 – Original Groove Weld of Sump and BOV Flange to Tank



For questions regarding a specific aspect of this procedure, contact info@gbx.com For other questions, contact the car owner.

## Section B: Volumetric (Ultrasonic) Inspection Procedure

### 1.0 PURPOSE/SCOPE/APPLICATION POLICY

- 1.1 **Scope** – This procedure describes the process to be used during ultrasonic testing of complete joint penetration welds on Bottom Outlet Valve Flanges and Sumps on tank cars. This procedure meets or exceeds the requirements found in AAR C-III Appendix T and ASME Section V Article 4. This procedure is prepared for the inspection of weldments with joint configurations as illustrated in Tank Fit Arrangement drawings for each type of tank car, which form a part of this procedure when signed by the GBX NDT Level III and the Senior Manager – Quality Assurance. These Tank Fit Arrangement drawings shall contain all additional dimensional information required to perform the inspection.
- 1.2 **Application Policy** – This procedure is to be applied whenever ultrasonic inspection of the BOV Flange and sump groove welds are required.
- 1.3 **Probability of Detection (POD)** – The technical requirements of this volumetric (ultrasonic) inspection procedure are the same as used in the POD development described in TR-1442 and only valid for this specific procedure at this time.

### 2.0 DEFINITIONS and OTHER REFERENCED STANDARDS

- 2.1 AAR Manual of Standards and Recommended Practices, Specifications for Tank Cars, M-1003, Appendix T, 11/2014 Issue (“Appendix T”).
- 2.2 AAR Manual of Standards and Recommended Practices, Specifications for Tank Cars, M-1003, Appendix W, 11/2014 Issue (“Appendix W”).
- 2.3 Technical terms and definitions are found in appropriate ASNT references for NDT.
- 2.4 ASME Boiler and Pressure Vessel Code Section V Article 4, 2015 Edition.
- 2.5 FRA – Rail Worthiness Directive 2016-01 [Revised].

### 3.0 PROCEDURE

#### 3.1 Personnel

- 3.1.1 Testing to this procedure shall be performed by an NDT Ultrasonic Testing Level II or III who is qualified and certified in accordance with the local shop written practice and the requirements of Appendix T.
- 3.1.2 The NDT Ultrasonic Testing Level II or III shall be provided information regarding the joint design, weld information and any weld repair in the area to be examined. A copy of this procedure for reference during the inspection and the applicable technique shall also be provided.
- 3.2 **Equipment and Materials**
- 3.2.1 **Reference standards** – Reference blocks made of carbon steel or stainless steel as described herein shall be used for calibration. The IIW block is the primary reference block for beam index point location, angle determination and distance calibrations. The IIW block is illustrated in **Figure 3**. The DSC block, illustrated in **Figure 4**, may be used in lieu of the IIW block provided the procedure describing its use is followed during initial calibration. The ASME Basic Calibration Block, illustrated in **Figure 8**, shall be used to set the Reference Sensitivity Level for angle beam testing and used for distance amplitude correction curves.
- 3.2.2 **Angle Beam Search Units** – Angle beam search units shall have a nominal frequency in the range of 2.0 to 2.5 MHz but may be from 1 MHz to 5 MHz, as determined by the type of material being inspected. The transducer crystal shall be square or rectangular in shape and may vary from 5/8" to 1" in width and run from 5/8" to 13/16" in height. The maximum width to height ratio shall be 1.2 to 1.0 and the minimum width to height ratio shall be 1.0 to 1.0. In areas unable to be scanned due to a joint or part geometry using the transducer dimensions listed in AWS D1.1, scan using a reduced transducer size, but not less than ¼" in either height or width, which will allow testing and / or remove the obstructions to the extent required to be properly perform the inspection. All transducer sizes used should be recorded on the UT report. The transducer(s) shall be used with wedges producing an angle of refraction in the steel of approximately 20° (70 degree wedge) for butt joints or as near to perpendicular to the angle of the line(s) of fusion as possible using commercially available wedges that produce 45°, 30° and 20° (45, 60, 70 degree wedges) for all other joint configurations. The specific angle(s) shall be determined by the material thickness or configuration of the weld joint. The search units shall be checked to assure face wear is within tolerance, for index point location, and angle prior to use and at intervals not exceeding 8 hrs of testing. The angle shall be within +/- 2° of the indicated angle designated on the wedge or the wedge must be replaced. Curved wedges may be used, based on surface curvature, provided reference standards are detectable using such.
- 3.2.3 **Straight Beam Search Units** – Straight beam search units shall have a nominal frequency in the range of 2.0 to 2.5 MHz, but may be from 1 MHz to 5 MHz, as determined by the type of material being inspected. The transducer area shall be in the range of ½ to 1 square inches and shall be either round or square.
- 3.2.4 **Ultrasonic Scope** – The ultrasonic instrument shall be the pulse echo, A-scan type and operate in a frequency range of 1 to 5MHz. Amplitude Control Linearity and Screen Height Linearity shall be checked at intervals not to exceed one year for digital type instruments, or prior to the first use thereafter. Screen Height Linearity shall be checked in accordance with Section B-1. Amplitude Control Linearity of the scope shall be checked in accordance with Section B-2.
- 3.2.5 **Couplant** – The couplant shall be sufficient to transfer the sound from the transducer to the component under test such as Ultragel II, or equivalent, and shall be removed upon completion of calibration or testing. The same couplant used for calibration shall be used for examination.
- 3.2.6 **Shop Towels** – Shop towels may be used to remove contaminants and couplant.
- 3.2.7 **Solvent** – A solvent may be used, as necessary, for pre-cleaning.
- 3.2.8 **Mechanical Surface Preparation** – A wire brush, metal scraper or grinder may be used, as necessary to assure surface in the area to be scanned is smooth enough for the inspection to be performed. All weld spatter will be removed.
- 3.3 **Calibration for Testing** – All calibrations shall be made with the reject control turned off. Calibrations shall be made just prior to testing the first weld in a series of welds.
- 3.3.1 **Calibration Checks** – Calibration checks shall be made after a change in operator, after each 4 hrs maximum time interval, at the completion of a series of inspections, and after any electrical circuitry disturbance such as transducer change, battery change, electrical outlet change, coaxial cable change, or power outage. Calibration shall be checked

by determining if at least one reflector on the basic calibration block or simulator block is located at the same horizontal location (+/- 10%) and dB level (+/- 2 dB or 40% FSH) as it was during initial calibration. All examinations shall be redone since the last valid calibration or calibration check if a calibration check is found to be out of the above tolerance.

### 3.3.2 Straight Beam Calibrations

3.3.2.1 **For Base Metal Laminations** – The Range and Delay controls shall be adjusted so that full horizontal screen equals at least twice the base metal thickness. Reference blocks used for calibration shall be made of carbon steel or stainless steel. (Preferred calibration block is the IIW Type 1 block) The 1" thickness dimension of the IIW block shall be obtained and set at 80% FSH + 5%. Any indication prior to the 1" indication should represent a laminar reflection.

3.3.2.1.1 **Sensitivity** – The sensitivity shall be adjusted at a location free of indications so that the first back reflection from the far side of the calibration plate will be 80% of screen height. The .060" hole in the IIW Block shall be detected by the flaw detector at an approximate depth of .60".

3.3.2.1.2 **Straight Beam Distance Calibration** – A minimum of 5 reflections shall show on the flaw detector screen using an IIW block having a thickness of 1 inch. The first indication shall be at 80% FSH and be located at one inch on the Horizontal scale and the 5th indication shall be at 5 inches on the Horizontal scale.

3.3.3 **Angle Beam Calibration** – The Delay and Range controls should be adjusted so that full horizontal screen equals 5 inches for base metal thicknesses up to 7/8" and 10 inches for thicknesses > 7/8" base metal.

3.3.3.1 **Index Point Determination** – Determine the index point by maximizing the response from the 4" radius in the IIW block at position D or the 3" radius in the DSC block at position L. **Refer to Figure 5 for positions.** Mark location on search unit wedge with pen or pencil where maximum response is obtained. This is the index point.

3.3.3.2 **Refracted Angle Determination** – Assure the search unit angle is as described on the wedge by maximizing the response from the 2" diameter hole in the IIW block. For a 70° transducer, **refer to Figure 5 Position C** on the IIW block or Position Q on the DSC block. If angle as determined by location of mark on wedge projected on angle degree scale on the reference block is 68° to 72°, wedge is usable and proceed to 3.3.3.3. If not, replace wedge and begin 3.3.3.1 again.

For 60° angle beam search units, use Position B (refer to **Figure 5**) on the IIW block or to the left of Position Q on the DSC block and accept beam angles from 58° to 62°.

For the 45° angle beam search units, use **Position B on the IIW block and farther to the left of Position Q on the DSC block** and accept beam angles from 43° to 47°.

3.3.3.3 **Distance Calibration** – Assure the full scale horizontal is 5" or 10" using either the IIW or DSC block as follows:

**IIW Block:** Determine if response from 4" radius at **Position D in Figure 5** is located at 4" on the horizontal scale. If not, adjust the fine delay and fine range/sweep controls. Depending on the version of the IIW block used, an additional reflector located at a distance of 1" or 2" will be available from Position D. The response from the additional reflector shall be peaked by adjusting the fine range and delay controls adjusted so that the peaked response is located at 1 or 2, as applicable, on the horizontal scale. Iterate between the reflector at 4" (Position D) and the reflector at 1" or 2" - always checking the location of the peaked response and "tweaking" the fine range and delay controls until both path lengths produce the maximized upside response at the correct location on the horizontal scale.

For ranges of 10", then adjust gain to assure that responses (multiples) from the 4" radius at Position D are obtained at 4 and 9" on the horizontal scale. If not, tweak the fine range/sweep and delay until responses are obtained at 4" and 9". And then reassure that the response from the 1" or 2" reflector is still obtained at 1" or 2", as applicable.

**DSC Block:** Determine if response from 3" radius at Position L in **Figure 5** is located at 3" on the horizontal scale. If not, adjust the fine delay and fine range/sweep controls. Reverse the direction of the search unit at Position L to obtain the reflection from the 1" radius (Position J). The peaked response should be located at 1" on the horizontal scale. If not, make

it peak at 1" by adjusting the fine range and fine delay controls. Iterate between the 3" radius (Position L) and the 1" radius (Position J) - always checking the location of the peaked response and "tweaking" the fine range and delay controls until both path lengths produce the maximized upside response at the correct location on the horizontal scale.

For ranges of 10", then adjust gain to assure that responses (multiples) from the 3" radius at Position L are obtained at 3", 6" and 9" on the horizontal scale. If not, tweak the fine range/sweep and delay until responses are obtained at 3", 6" and 9". And then reassure that the response from the 1" radius (Position J) is still obtained at 1", 2", 3", etc. as applicable.

- 3.3.3.4 **Reference Level Determination and DAC Creation** – Position the transducer on the ASME Basic Block and direct the beam toward the calibration reflector that yields the maximum response in the area of interest. The gain control shall be set so that this response is  $80\% \pm 5\%$  of full screen height. This shall be the primary reference level. The search unit shall then be manipulated without changing instrument settings, to obtain the maximum responses from the other calibration reflectors at their beam paths to generate the DAC. The DAC should be created to cover 2 leg lengths of sound path, 3 legs when possible.
- 3.3.3.5 **Scanning Gain** – Record the Reference dB level obtained in 3.3.3.4 in the Report. Add 6 dB for scanning and proceed to 3.4. When Scanning through lined material, add 12 dB to ensure reliability of signal through the lining, following confirmation of signal through reference lined plates.
- 3.3.3.6 **Calibration Check** – For in process calibration checks and for the final calibration check for straight beam and angle beam inspections at the completion of the inspection, determine that the hole response continues to be within the limits of 3.3.1.
- 3.4 **Inspection**
- 3.4.1 **Surface Preparation** – Assure all surfaces to which a search unit is to be applied are smooth, free of weld spatter, dirt, grease, oil (other than that used as a couplant), paint, and loose scale, and have contours permitting coupling. Linings may remain in place provided evidence of reliability in detection of flaws has been established and documented by PQR.
- 3.4.2 **Straight Beam Inspection**
- 3.4.2.1 **For Base Metal Laminations** – Apply couplant to the surface in all areas where angle beam will travel to and through weld. Scan parallel or perpendicular to weld center line and index to ensure at least 10% overlap between scans. If the first back echo is not lost or a new intermediate response equal to or greater than the back echo response is not obtained, proceed to Angle Beam Inspection. If a loss occurs, mark any area where the first back echo reflection is lost or where a new intermediate signal is obtained that is equal or greater in vertical height than the first back echo. Determine shape and size of loss or new echo by the half amplitude method e.g. peak response from good area or intermediate reflector and adjust to 80% full screen height, move search unit away from center of condition until half the response falls to 40% and then mark part surface at location of center of search unit. Do this in as many directions as necessary until condition's shape is defined on part surface. Determine depth if an intermediate response is obtained and assume condition is within the first 0.030" from the search unit if no response is obtained. Record indication size and depth from surface. Make a sketch showing weld configuration and condition and determine what additional angle beam positions or directions will be necessary to assure 100% angle beam coverage and file this sketch with the Report Records.
- 3.4.3 **Angle Beam Inspections** – Apply couplant to surface in all areas where angle beam will travel to and through weld. The maximum scanning speed shall be determined by the maximum speed at which the reference hole was detected during calibration but shall not exceed 6 inches per second. Ultrasonic inspection of the Bottom Outlet Valve Flange and Sump welds shall consist of angle beam testing with both a 45 degree and a 60-degree wedge to ensure maximum coverage of the weld joint.
- 3.4.3.1 **Axial Scan** – Scan perpendicular to the weld center line and index  $\frac{1}{2}$  search unit widths between scans. Assure complete coverage by performing the inspection from  $\frac{1}{2}$  skip through 1  $\frac{1}{2}$  skips to assure beam coverage. Swivel  $\pm 10^\circ$  to  $20^\circ$  while scanning as illustrated in **Figure 6** Movements A, B and C. **Note: 1)** For weldments joining base metals of different



thicknesses, position search unit to send ultrasound in from the thinner base metal Face A side since if the ultrasound is sent in from the thicker side, an indication will be obtained from the exterior reinforcement portion of the weld.

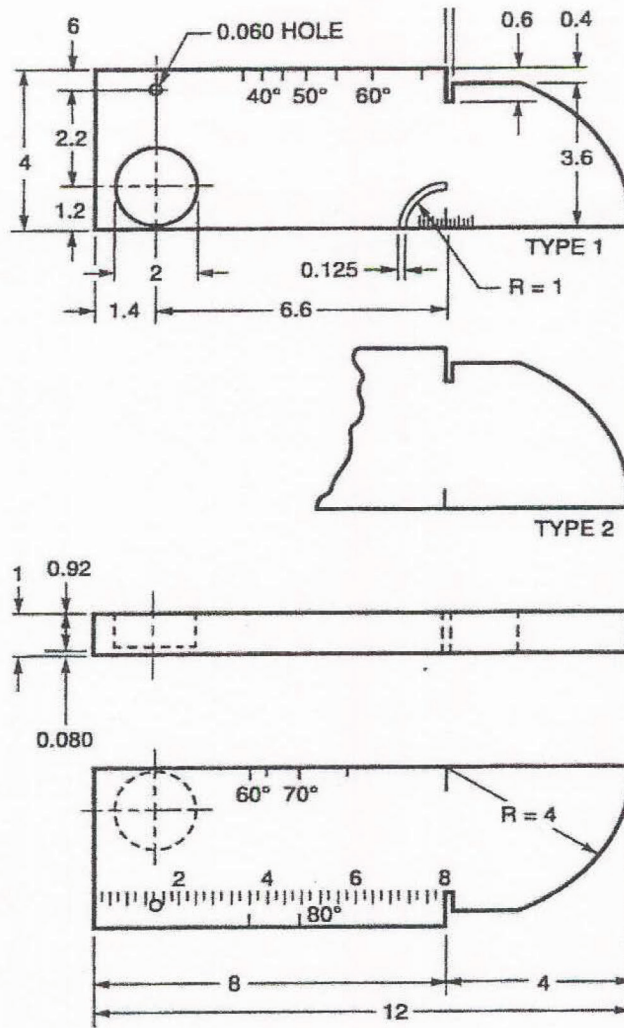
**Note: 2)** Movement C should ensure at least a 10% overlap between scans.

- 3.4.4 **Evaluation for All Scans** – If an indication is detected at the scanning level, the indication is peaked by search unit manipulation and the 6 dB scanning gain is removed. Where possible, use finger damping to determine the location of various anomalous reflectors in the part and the skip positions on the part surfaces to assure that the indication is actually from a potential defect. If: a) the indication is not from an identifiable anomalous surface reflector and b) the indication's peaked response with the 6 dB removed is at least 20% of the amplitude of the DAC at its corresponding position and 12 dB removed if scanning through linings, then the indication shall be investigated to the extent that the operator can determine the shape, identity, and location of all such discontinuities and evaluate them in terms of the acceptance standards given below:
- 3.4.4.1 Indications characterized as cracks, lack of fusion, or incomplete penetration are unacceptable regardless of length.
- 3.4.4.2 Any relevant indication that intersects the surface of the component or weld shall be considered rejected, unless the indication is determined to be caused by a visually (VT) acceptable condition.
- 3.4.4.3 Other discontinuities (slag inclusions included) are unacceptable if the indications exceed the reference level and have lengths that exceed the following:
- 3.4.4.3.1 Linear length in excess of .25 in. for T up to  $\frac{3}{4}$  in., or  $\frac{1}{3}$  T from  $\frac{3}{4}$  in. to  $2\frac{1}{4}$  in. (T is thickness of the thinner plate of the joint)
- 3.4.4.3.2 A group of indications that have an aggregate length greater than T in a weld length of 12(T) or 6 in., whichever is less, except when the distance between successive indications exceeds 6(L), where L is the length of the longest indication in the group.
- 3.4.4.3.3 Any indication that is believed to be non-relevant shall be regarded as a imperfection unless it is shown by reexamination that no unacceptable imperfections are present. Reexamination shall be performed by the same method as previously rejected.
- (T) is the thickness of the weld excluding any allowable reinforcement. For a Complete Joint Penetration (CJP) weld joining two members having different thicknesses at the weld, "T" is the thinner of these two thicknesses. If a complete penetration weld includes a fillet weld, the thickness of the throat of the fillet shall be included in (T).
- 3.4.5 **Disposition of Welds** – Welds found unacceptable shall be repaired and areas of repair retested per this procedure and recorded in the Report. Evaluation of retested repaired weld areas shall be documented on an additional report form.
- 3.4.6 **X and Y Locators** – An "X"-line for flaw location shall be marked on the test face A of the weldment in a direction parallel to the weld axis. The "X" line is typically the centerline of the weld. The "Y" line is the locator that is perpendicular to the weld at some significant location (i.e. – beginning of weld or a weld junction). A + or - "Y" and "X" accompanied with a weld identification number shall be clearly marked on the base metal adjacent to the weld that is ultrasonically tested shall indicate the distance from each line.
- 3.4.7 **Final Calibration Check**–Inspection is not complete until the calibration is checked to assure response amplitude and horizontal position from the hole in the reference block remains the same as described in sections above with the 6 dB scanning gain removed. If the calibration is the same, inspection is complete pending completion of the Report Record. If the calibration is not the same, repeat the inspection of all portions of the weld inspected since the last calibration or calibration check.
- 4.0 SENSITIVITY AND RELIABILITY** – The reliability of this procedure to detect the flaw size of  $\frac{3}{16}$  in. (.1875) length x  $\frac{1}{8}$  in. (.12) height meets 90% POD with a 95% confidence level. (Reference TR-1442)
- 5.0 NDT TECHNICAL EVALUATION** – An NDT Technical Evaluation shall be performed on all NDT Technicians on an annual basis per calendar year and shall become part of their permanent job file. This evaluation will be performed by a minimum Level II Technician designee by a Level III.
- 6.0 MINIMUM CRACK SIZE DETECTABLE** – The minimum detectable crack size by this procedure shall be  $\frac{3}{32}$ " (.094) based on the hole size detected in the ASME Basic Calibration Block for material thickness up to 1".

## 7.0 RECORD KEEPING REQUIREMENTS

- 7.1 Form on pages A-1 and A-2 shall be completed (filled out in its entirety, including documenting any observed indications) by the ultrasonic testing inspector at the time of the initial inspection and forwarded along with the visual report (Form on pages B-1 and B-2) to the car owner. This report shall identify any indications found and include a photograph of the UT display for any indication that exceeds 20% screen height and a method to correlate the indication in the photograph to the specific portion of the weld. The owner shall review and approve any subsequent repairs.
- 7.2 A full set of completed report forms (both initial and post weld repair if applicable) will be sent to the car owner upon completion of the work.
- 7.3 These reports will be maintained for a minimum of ten years after completion of the testing unless specified otherwise.
- 7.4 The annual Ultrasonic Flaw Detector calibration certificates, which include Screen Height Linearity and Amplitude Control Linearity checks, will be kept on file for a period of 24 months. These Linearity checks as noted in Sections B-1 and B-2, are required annually for digital equipment. **Note:** Forms on pages 16 and 18 are NOT required to be submitted to the car owner or included in car file records.

Figure 3: IIW Block

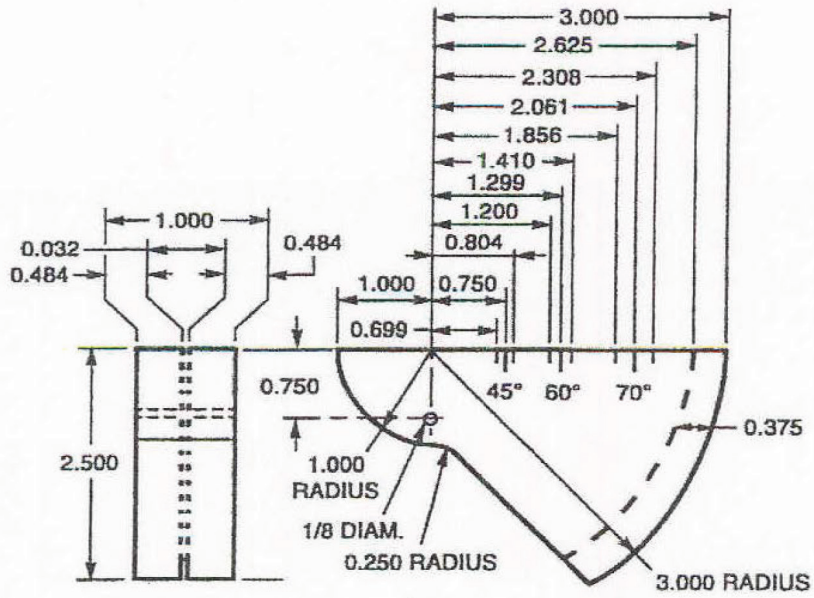


U.S. CUSTOMARY DIMENSIONS

**General Notes:**

- The dimensional tolerance between all surfaces involved in referencing or calibrating shall be within  $\pm 0.005$  in. of detailed.
- The surface finish of all surfaces to which sound is applied or reflected from shall have a maximum of 125 micro-in.
- All material shall be ASTM A 36 or acoustically equivalent.
- All holes shall have a smooth internal finish and shall be drilled at  $90^\circ$  to the material surface.
- Degree lines and identification markings shall be indented into the material surface so that permanent orientation can be.
- Other IIW approved reference blocks with slightly different dimensions or distance calibration slot features are permissible.
- These notes also apply to all sketches in Figure E9.

Figure 4: DSC Block



(A) TYPE DSC—DISTANCE AND SENSITIVITY CALIBRATION BLOCK

Figure 5: Search Unit Positions For Calibrations With IIW And DSC Blocks

**Note:** Either the IIW or the DSC block shall be used for calibration, calibration checks, and prior to competing the inspection.

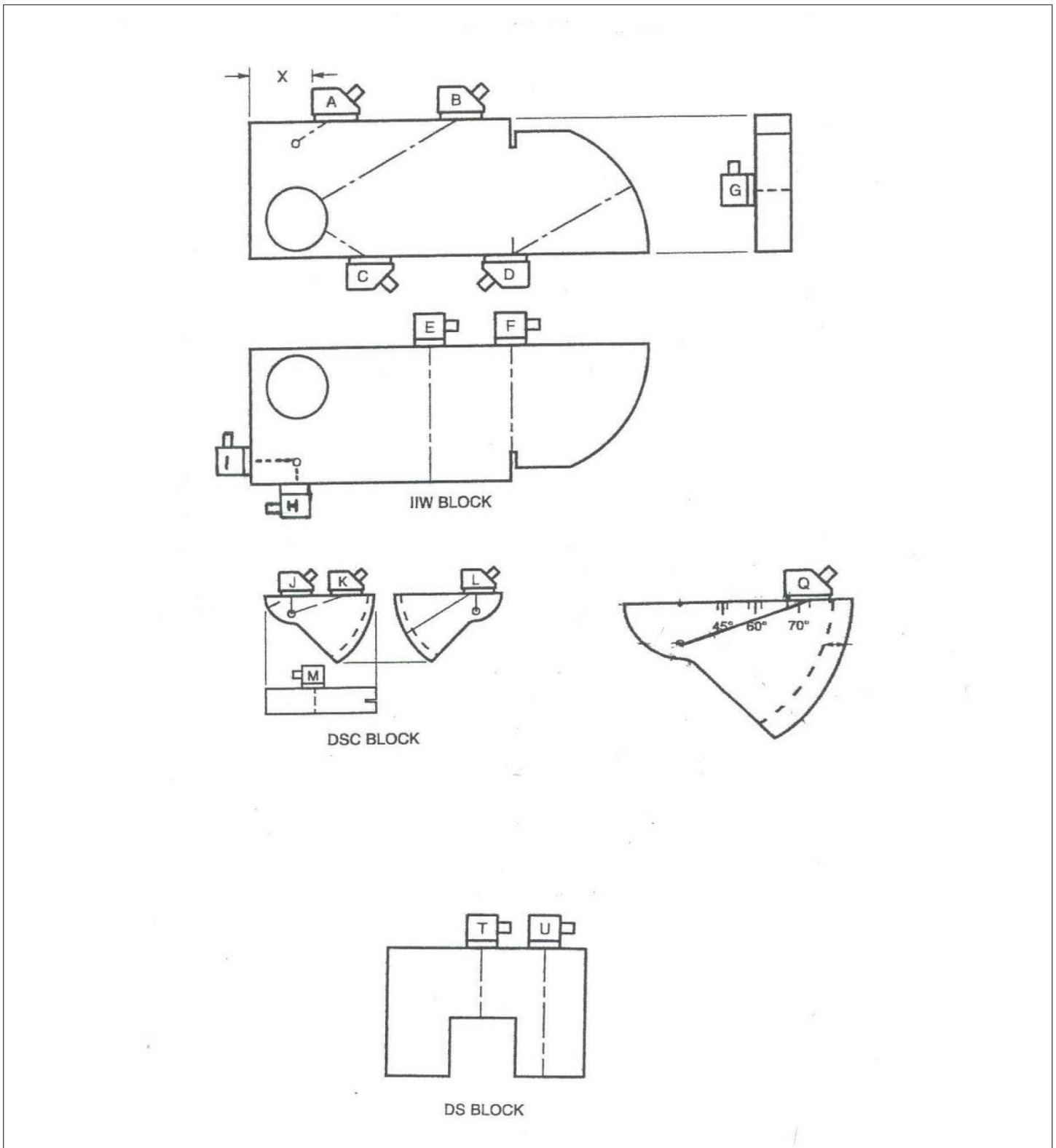


Figure 6: Scanning Criterion

Patterns are all symmetrical around the weld axis

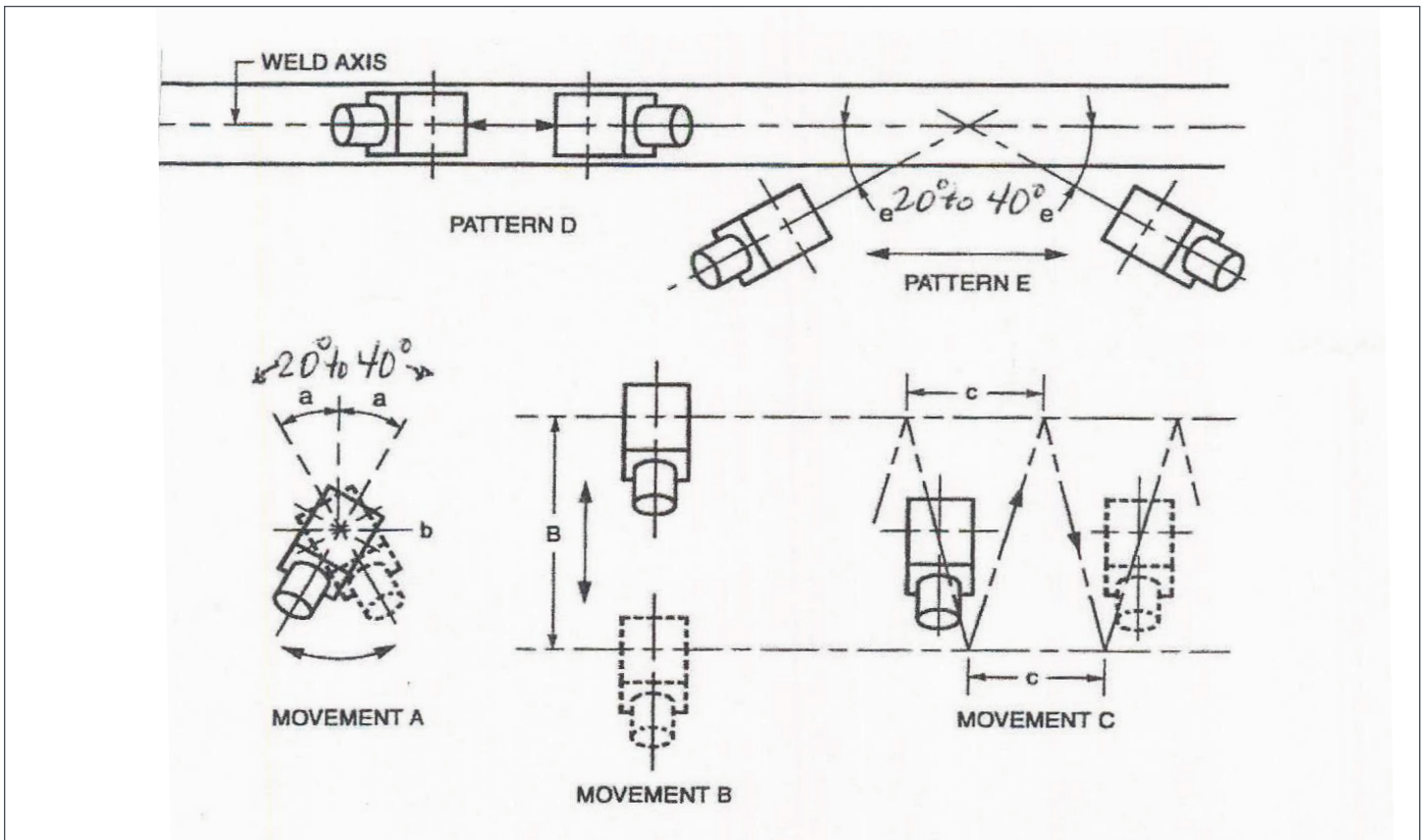


Figure 7: Half Amplitude Method For Angle Beam

For height measurements follow the example for length determination, except peak the response at 95% of full screen height and then move the search unit away from the flaw until the amplitude drops to 45 to 50% and mark the part surface at the index point and then move toward the flaw until it peaks and continue until it drops to 45 to 50% and then mark the part at the index point. The distance between marks is the proportional to the height and can be determined by dividing the measured length by cosine of the refracted angle or by reading directly off horizontal scale using the overlay transparency. Also the height can be determined directly from the screen by observing the 50% loss positions relative to the half and full skip positions or material thickness.

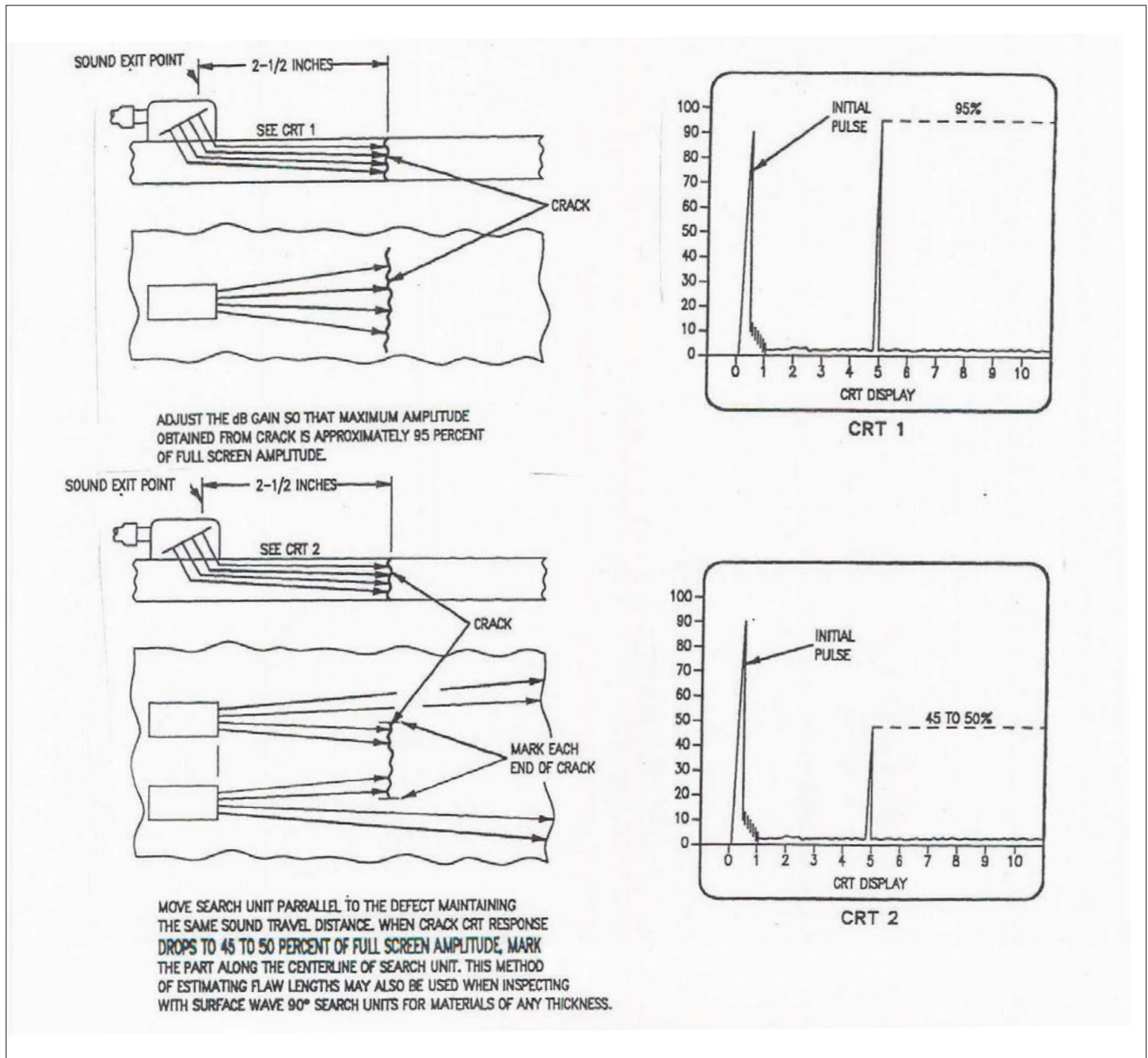
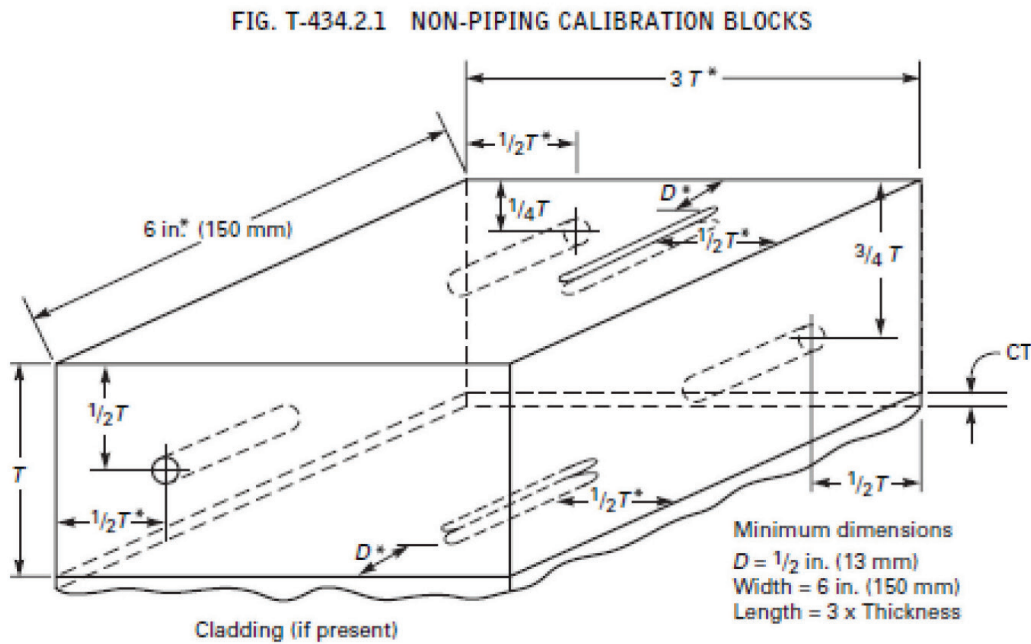


Figure 8: ASME Basic Calibration Block



Weld Thickness, $t$ in. (mm)	Calibration Block Thickness, $T$ , in. (mm)	Hole Diameter, in. (mm)	Notch Dimensions, in. (mm)
Up to 1 (25)	$3/8$ (19) or $t$	$3/32$ (2.5)	Notch depth = $2\% T$ Notch width = $1/4$ (6) max. Notch length = 1 (25) min.
Over 1 (25) through 2 (50)	$1/2$ (50) or $t$	$1/8$ (3)	
Over 2 (50) through 4 (100)	3 (75) or $t$	$3/16$ (5)	
Over 4 (100)	$t \pm 1$ (25)	[Note (1)]	

\* Minimum dimension.

**GENERAL NOTES:**

- (a) Holes shall be drilled and reamed 1.5 in. (38 mm) deep minimum, essentially parallel to the examination surface.
- (b) For components equal to or less than 20 in. (500 mm) in diameter, calibration block diameter shall meet the requirements of T-434.1.7.2. Two sets of calibration reflectors (holes, notches) oriented 90 deg from each other shall be used. Alternatively, two curved calibration blocks may be used.
- (c) The tolerance for hole diameter shall be  $\pm 3/32$  in. (0.8 mm). The tolerance for hole location through the calibration block thickness (i.e., distance from the examination surface) shall be  $\pm 1/8$  in. (3 mm).
- (d) For blocks less than  $3/4$  in. (19 mm) in thickness, only the  $3/2 T$  side-drilled hole and surface notches are required.
- (e) All holes may be located on the same face (side) of the calibration block, provided care is exercised to locate all the reflectors (holes, notches) to prevent one reflector from affecting the indication from another reflector during calibration. Notches may also be in the same plane as the in-line holes (See Appendix J, Fig. J-431). As in Fig. J-431, a sufficient number of holes shall be provided for both angle and straight beam calibrations at the  $1/4 T$ ,  $1/2 T$ , and  $3/4 T$  depths.
- (f) Notch depths shall be  $1.6\% T$  minimum to  $2.2\% T$  maximum. When cladding is present, notch depth on the cladding side of the block shall be increased by the cladding thickness, CT (i.e.,  $1.6\% T + CT$  minimum to  $2.2\% T + CT$  maximum).
- (g) Maximum notch width is not critical. Notches may be made by EDM or with end mills up to  $1/4$  in. (6.4 mm) in diameter.
- (h) Weld thickness,  $t$ , is the nominal material thickness for welds without reinforcement or, for welds with reinforcement, the nominal material thickness plus the estimated weld reinforcement not to exceed the maximum permitted by the referencing Code Section. When two or more base material thicknesses are involved, the calibration block thickness,  $T$ , shall be determined by the average thickness of the weld; alternatively, a calibration block based on the greater base material thickness may be used provided the reference reflector size is based upon the average weld thickness.

**NOTE:**

- (1) For each increase in weld thickness of 2 in. (50 mm) or fraction thereof over 4 in. (100 mm), the hole diameter shall increase  $1/32$  in. (1.5 mm).



# TANK CAR DIRECTIVE INSPECTION PROCEDURE – BOTTOM OUTLET VALVE FLANGE AND SUMP SKID

January 17, 2017 Rev: A

## Section B-1 – Screen Height Linearity

### 1.0 PURPOSE/SCOPE/APPLICATION POLICY

- 1.1 **Scope** – This procedure describes the process to be used to check the screen height linearity of the ultrasonic instrument.
- 1.2 **Application Policy** – This procedure is to be applied at intervals not to exceed 3 months for analog type instruments and **one year for digital type instruments**, or prior to the first use thereafter.

### 2.0 PROCEDURE

- 2.1 Position any transducer (straight or angle beam) on any calibration block containing a minimum of 2 reflectors. (These reflectors must be in close enough proximity so that they will be on the screen at the same time.)
- 2.2 Position the transducer such that the response from the reflectors gives a 2:1 ratio.
- 2.3 Adjust the sensitivity (gain) so that the larger indication is set at 80% of full screen height (FSH).
- 2.4 Without moving the search unit, adjust sensitivity (gain) to successively set the larger indication from 100% to 20% of full screen height, in 10% increments (or 2 dB steps if a fine control is not available), and read the smaller indication at each setting.
- 2.5 The reading shall be 50% of the larger amplitude, within 5% of FSH. The settings and readings shall be estimated to the nearest 1% of full screen. Record the readings of the smaller indication on form on page 16 and circle whether reading is acceptable or not.

### 3.0 SUBCONTRACT

- 3.1 Screen Height Linearity and Amplitude Control Linearity checks may be subcontracted to a third party testing facility for calibration.
- 3.2 Third party facilities shall provide a Certificate of Calibration letter. In addition, a copy of the Calibration Procedure used should be provided, along with data information matching or similar to form on page 16 (Reference Table 1) as proof of calibration.

Table 1: Screen Height Linearity Check Table

Large Indication	Small Indication	Allowable	Acceptable?
100%		45-55%	Y or N
90%		40-50%	Y or N
80%		35-45%	Y or N
70%		30-40%	Y or N
60%		25-35%	Y or N
50%		20-30%	Y or N
40%		15-20%	Y or N
30%		10-20%	Y or N
20%		5-15%	Y or N

Technician: \_\_\_\_\_ Level: \_\_\_\_\_

Date: \_\_\_\_\_ Date Due: \_\_\_\_\_

## Section B-2 – Amplitude Control Linearity Check

### 1.0 PURPOSE/SCOPE/APPLICATION POLICY

- 1.1 **Scope** – This procedure describes the process to be used to check the amplitude control linearity of the ultrasonic instrument.
- 1.2 **Application Policy** – This procedure is to be applied at intervals not to exceed 3 months for analog type instruments and **one year for digital type instruments**, or prior to the first use thereafter.
- 1.3 **Questions** – Questions regarding the applicability of this procedure should be directed to the GBX Level III or to the Senior Manager – Quality Assurance.

### 2.0 PROCEDURE

- 2.1 Position any convenient transducer (straight or angle beam) on any convenient calibration block containing a reflector. Position the transducer to receive an indication from that reflector.
- 2.2 Adjust the sensitivity (gain) as shown in Table 2.
- 2.3 The indication shall fall within the specified limits. (The settings and readings shall be estimated to the nearest 1% of full screen.)
- 2.4 Record the Readings of the indication on form on page 18 and circle whether reading is acceptable or not.

### 3.0 SUBCONTRACT

- 3.1 Amplitude Control Linearity checks may be subcontracted to a third party testing facility for calibration.
- 3.2 Third party facilities shall provide a Certificate of Calibration letter. In addition, a copy of the Calibration Procedure used should be provided, along with data information matching or similar to form on page 18 as proof of calibration.

Table 2: Amplitude Control Linearity Check

Indication Set at % of Full Screen	dB Control Change	Reading	Indication Limits % of Full Screen	Acceptable?
80%	-6 dB	32 to 48%		Y or N
80%	-12 dB	16 to 24%		Y or N
40%	+6 dB	72 to 88%		Y or N
20%	+12 dB	72 to 88%		Y or N

Technician: \_\_\_\_\_ Level: \_\_\_\_\_

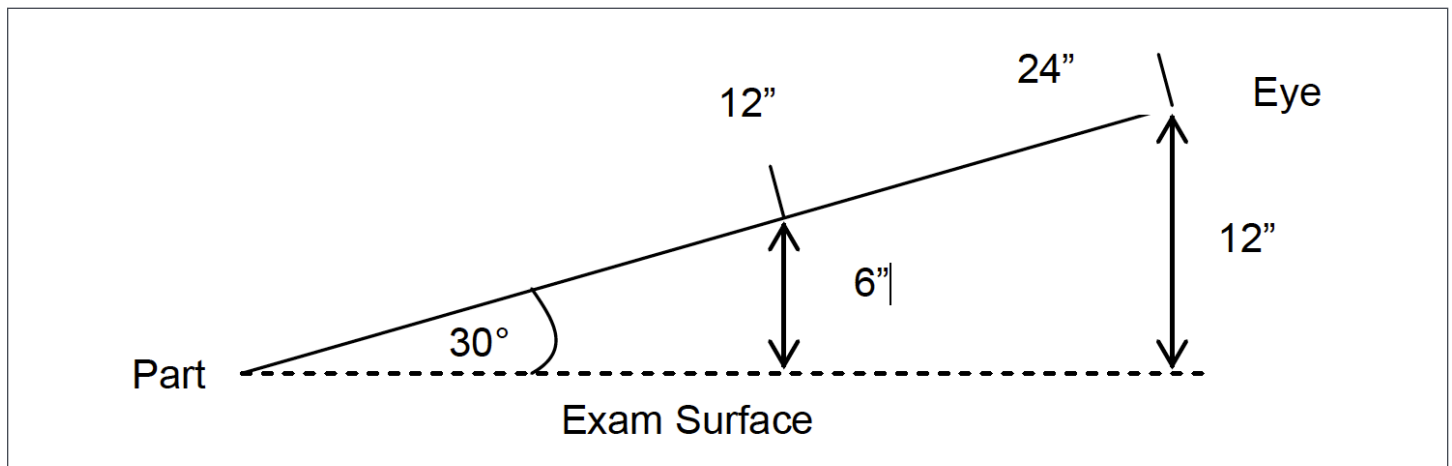
Date: \_\_\_\_\_ Date Due: \_\_\_\_\_

## Section C: Surface (Visual) Inspection Procedure

### 1.0 PURPOSE/SCOPE/APPLICATION POLICY

- 1.1 This procedure provides both the methodology and technical information necessary to ensure a complete and accurate visual groove weld inspection of the sump and bottom outlet flange to the tank in accordance with the Federal Railroad Administration Rail Worthiness Directive No. 201601 [Revised].
- 1.2 This procedure defines the requirements for the internal visual testing of groove welds of railcar sump to tank shell and bottom outlet flange to tank shell of ferrous materials.
- 1.3 **Application Policy** – This procedure is to be applied whenever ultrasonic inspection of the BOV Flange and sump groove welds are required.
- 1.4 **Probability of Detection (POD)** – The technical requirements of this surface (visual) inspection procedure are the same as used in the POD development described in TR-1443 and only valid for this specific procedure at this time.
- 1.5 Visual examination shall be made when access is sufficient to place the eye within 24 inches of the surface to be examined at an angle of not less than 30 degrees to the surface being examined; see **Figure 9** below. Mirrors may be used to improve the angle of vision, and aids such as a magnifying glass may be used to assist examinations.

Figure 9: Demonstration of how to determine 30° from Exam Surface



**Note:** The above figure demonstrates flat surface geometry. Curvature of surfaces must be taken into account.

### 2.0 APPLICABLE DOCUMENTS

- 2.1 AAR C III, M-1002 – Specifications for Tank Cars, Appendix T, 11/2014 Issue (“Appendix T”) 2. 2 AAR C III, M-1002 - Specifications for Tank Cars, Appendix W, 11/2014 Issue (“Appendix W”) 2. 3 Technical terms and definitions are found in appropriate ASNT references for NDT.
- 2.4 Technical terms and definitions are found in appropriate AWS references for weld inspection.
- 2.5 FRA – Rail Worthiness Directive 2016-01[Revised] (“Directive”)

### 3.0 PERSONNEL REQUIREMENTS

- 3.1 Personnel performing visual testing of groove welds of sump to tank car shell and bottom outlet flange to tank car shell with this procedure shall be certified in accordance with the requirements of the local shop written practice per Appendix T and as required by the Directive.
- 3.1.1 Level II certified personnel shall perform testing methods for which they are qualified, and shall be qualified to set up and calibrate equipment and interpret and evaluate results as required by the Directive.

- 3.1.2 Level III certified personnel may be qualified to perform these examinations if designated to do so by testing as described in the written practice and Appendix T and as required by the Directive.
- 3.1.3 An AWS CWI or CSA W178.2 (Level II or Level III) may perform all duties of an NDT Visual Testing Level II as described in the applicable written practice and Appendix T as required by the Directive.

#### **4.0 EQUIPMENT**

- 4.1 All tools and associated equipment shall be in a serviceable, calibrated and/or verifiable condition prior to use, as applicable.
- 4.2 The following tools and equipment are recommended as a minimum for aid in visual testing. Items should be available, as required, for the inspector's use.
- 4.2.1 Listing
- Flashlight(s) with no noticeable reduction in intensity
  - Wire Brush & Scraper
  - Steel 6" Rule
  - Tape Measure (12 foot minimum)
  - Weld Inspection Gages
  - Magnifying Glass
  - Marking Crayon or Paint Stick
- 4.2.2 Illumination Requirements – 100 foot candles of white light is required for inspection. All lighting, either natural or produced, shall be adequate for the inspection being performed. Illumination with supplemental lighting may be required at the discretion of the inspector conducting testing.

#### **5.0 SURFACE REQUIREMENTS**

- 5.1 Prior to commencing work on any car, the areas to be inspected shall be free of any lading product or coatings that interfere with the examination process.
- 5.2 All surfaces are required to be cleaned or prepared to meet applicable inspection criteria. Surfaces shall be free of any material that could mask discontinuities.
- 5.4 Lined cars are to be inspected in a clean condition, with the minimal removal of linings to allow access for inspection.

#### **6.0 VISUAL GROOVE WELD TESTING**

- 6.1 All internal sump and BOV flange groove welds shall be visually inspected in accordance with Appendix W and Table 3 for surface discontinuities.

#### **7.0 POST WELD REPAIR INSPECTION**

- 7.1 In addition to the requirements above, the BOV flange and sump groove weld repair areas shall be also inspected for the following conditions:
- Blistering, bulging, buckling or distortion
  - The criteria of original welds in Section 8.0

**8.0 ACCEPTANCE CRITERIA / EVALUATION** – Final evaluation of discontinuities from Visual Groove Weld Testing, that are considered relevant (exceeding Appendix W or Table 3), shall be made by a certified Visual Testing Level II, Level III, AWS Certified Welding Inspector or CSA W178.2 (Level II or Level III) to the acceptance criteria for groove welds applicable to the bottom outlet valve flange and sump to tank car shell. Table 3, lists weld quality acceptance criteria per Appendix W as required by the Directive.

Table 3: Weld Surface Acceptance Criteria

Defect	T Range	Min Required	Max Allowable
Cracks	All	N/A	None Allowed
Incomplete Fusion	All	N/A	
Incomplete Penetration	All	N/A	None Allowed
Slag	All	N/A	None Allowed
Overlap	All	N/A	None Allowed
Arc Strike	All	N/A	Cracks or blemishes shall be removed
Surface Porosity	All	N/A	None Allowed
Undercut	All	N/A	0.010" & shall not reduce T to less than min T allowed
Weld Spatter	All	N/A	None permitted in areas where it would interfere with the function or corrosion protection of the tank car tank. Weld spatter that resists normal cleaning methods may be permitted.
Reinforcement <sup>a, b</sup>	Up to 5/8"	Weld metal shall be at least flush with the adjoining plate surface	3/32"
Reinforcement <sup>a, b</sup>	Over 5/8"	Weld metal shall be at least flush with the adjoining plate surface	1/8"

<sup>a</sup> = Reinforcement shall have a gradual transition from its maximum allowable crown to the plane of the base metal surface.

<sup>b</sup> = Excessive reinforcement or defects may be removed to create a condition within the above tolerances. Removal shall not reduce T to less than the minimum T allowed when removing reinforcement due to excess build up or for the removal of defects.

- 9.0 RESPONSIBILITIES** – The visual inspector shall be responsible for:
- 9.1 Internal visual testing of groove welds of the bottom outlet flange and sump groove welds to the tank in accordance with this procedure.
  - 9.2 Completion of applicable inspection forms.
- 10.0 SENSITIVITY AND RELIABILITY** – The reliability of the visual inspection process of this procedure to detect a surface flaw size of .016 inches in width x .1875 inches in length x .125 inches in depth, meets 90% POD with a 95% confidence level as required by the Directive. (Reference TR1443)
- 11.0 MINIMUM CRACK SIZE DETECTABLE** – The minimum detectable crack size of this procedure meets the flaw size that is specified in the Directive (.016 inches in width x .1875 inches in length x .125 inches in depth).
- 12.0 SAFETY** – All applicable safety guidelines (i.e., OSHA) and local company safety polices shall be followed to ensure a safe working environment.
- 13.0 RECORD KEEPING REQUIREMENTS**
- 13.1 Form on pages B-1 and B-2 shall be completed (filled out in its entirety, including documenting any observed defects) by the visual testing inspector at the time of the initial inspection and forwarded along with the ultrasonic report (Form on pages A-1 and A-2) to the car owner. This report shall identify any defects found and correlate the defects to the specific portion of the weld. The owner shall review and approve any subsequent repairs.
  - 13.2 A full set of completed report forms (both initial and post weld repair if applicable) will be sent to the car owner upon completion of the work.
  - 13.3 These reports will be maintained for a minimum of ten years after completion of the testing unless specified otherwise.

# APPENDIX A

## EN B101 - ULTRASONIC INSPECTION REPORT

Plant / Location / Station Stencil					
Reporting Mark and Car No.					
Surface Condition				Test Date:	
UT Procedure:	EN B101 Section B	Revision:	A	Issue Date:	1/17/2017
Flaw Detector					
Model		Calibration Due		Serial No.	
Longitudinal Beam Unit					
Type		Frequency		Size	
Serial No.				MFG.	
Shear Wave Unit					
Type		Frequency		Size	
Serial No.				MFG.	
Scanning Face	A	Reference Gain(s)			dB
Wedge(s) Used				Couplant Used	
Wedge MFG				Cable Type / Length	
Calibration Blocks					
IIW	Serial No.			Cal Due Date	
DSC	Serial No.			Cal Due Date	
DAC	Serial No.			Cal Due Date	

Initial inspection

Inspection after repair of all relevant indications

Corrective (repair) action taken: \_\_\_\_\_

Straight Beam testing found (circle one) NO RELEVANT Indications / RELEVANT Indications and Sketch is attached indicating locations and Angle Beam Modified Testing as shown on sketch to compensate for laminations detected.

Angle Beam testing found (circle one) NO RELEVANT Indications / RELEVANT Indications with part and records clearly marked with indication(s) relative to location, depth, length and probable flaw type.

All indications shall be noted, with relevant indications sketched showing location, depth, length and classification of flaw. This information shall, in addition, be clearly marked on the part for any necessary repairs.

NDT Technician \_\_\_\_\_ Method – Level  UT Level II Date \_\_\_\_\_  
 (Check all that apply)  UT Level III

NDT Technician Signature \_\_\_\_\_

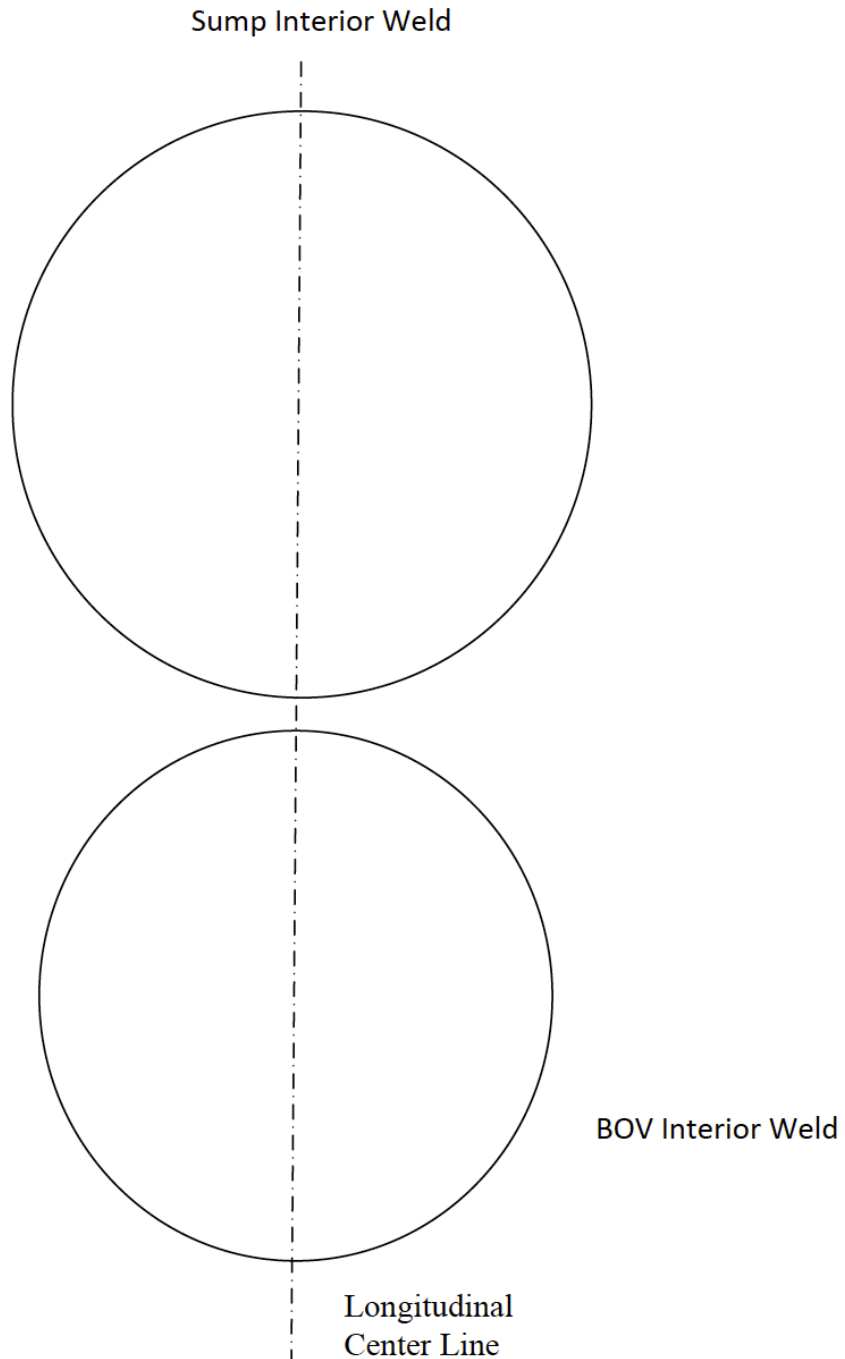
**APPENDIX A**  
**EN B101 - ULTRASONIC INSPECTION REPORT**

Reporting Mark and Car No.		Date:	
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**Parts Sketch with relevant indications noted:** height (depth top / bottom), length, indication type

Surface crack is present:     Yes     No

Shell Thickness \_\_\_\_\_ (inches, 7/16, 1/2, other)





**APPENDIX B**  
**EN B101 - VISUAL INSPECTION REPORT**

Date: \_\_\_\_\_ Plant / Location / Station Stencil \_\_\_\_\_

Reporting Marks and Car No. \_\_\_\_\_

Weld Seam #/Specific Area: BOV & Sump

Visual Testing Procedure: EN B101 Section C Rev A Issued date: 1/17/2017

Calibrated / Verified Equipment used / Due Date: \_\_\_\_\_

Surface Condition: Bare Metal

Discontinuities:

BOV Welds Acceptable: \_\_\_\_\_

Rejected: (Defects) \_\_\_\_\_

Sump Welds Acceptable: \_\_\_\_\_

Rejected: (Defects) \_\_\_\_\_

Are all Defects Repaired Acceptably: YES \_\_\_\_\_ NO \_\_\_\_\_

All Repaired Defects have a traceable report form: YES \_\_\_\_\_ NO \_\_\_\_\_

Initial inspection

Inspection after repair of all relevant indications

Corrective action taken: \_\_\_\_\_

Inspector Name: \_\_\_\_\_ Method – Level: \_\_\_\_\_

(Check all that apply)

- AWS - CWI
- CSA W178.2 - Level 2
- CSA W178.2, Level 3
- VT - Level II
- VT - Level III

Signature: \_\_\_\_\_

Reviewed by: \_\_\_\_\_

Title: \_\_\_\_\_

**APPENDIX B**  
**EN B101 - VISUAL INSPECTION REPORT**

Reporting Mark and Car No.		Date:	
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**Parts Sketch with relevant indications noted:** location, length, indication type

Surface crack is present:     Yes     No

