

# LATTICE SECTION INSPECTION AND LACING REPLACEMENT

## Lattice Boom Crawler Cranes\* (see NOTE)

*This publication replaces all previous publications with the above topic, to include Bulletin 96.*

*This publication also replaces Folio 823 and Folio 1354.*

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**NOTE** The instructions in this publication do not apply to the following cranes: all Small Crawler crane models, MLC650, and the 31000. Contact the Manitowoc Crane Care Lattice Team for the lacing inspection and replacement procedure for these crane models.

### GENERAL

Crane owners should use this publication as a guide for properly inspecting and repairing lattice sections in the field.

Do not operate crane with damaged lattice sections.

*For inspection or repair procedures not covered in this publication, contact your Manitowoc distributor.*



### WARNING

#### Component Failure!

If damage was caused by overload or shock load or if there is damage to other major structural components, we recommend that a thorough inspection be made by a qualified person. A nondestructive test of all critically stressed members must be made.

### INSPECTION INTERVALS

Regular inspection is necessary to ensure that the attachment can safely lift its rated load. Inspection should be performed by a *qualified person* at the following intervals:

- Routinely on a weekly basis (this interval can vary depending on operating conditions, application, and crane history).
- Prior to initial use.
- After transport.
- After an overload or shock load condition has occurred.
- If the attachment has come into contact with another object — for example: power lines, building, another crane.
- If the attachment has been struck by lightning.

**Table 1** Lacing and Chord Wall Thickness

This table applies only to past production cranes. Lacing and chord wall thicknesses for current production cranes are located in the Lacing Drawings in the Attachment Section of the Parts Manual supplied with the crane.

<b>Boom, Jib, Tower, or Mast Number</b>	<b>Lacing Wall Thickness in (mm)</b>	<b>Chord Wall Thickness in (mm)</b>
8	0.095 (2,4)	Angle (NOTE 1)
9A	0.095 (2,4)	Angle (NOTE 1)
17	0.109 (2,8)	0.340 (8,6)
18	0.095 (2,4)	0.25 (6,4) Butt 0.156 (4,0) Top & Inserts
22A, B, C	0.095 (2,4)	Angle (NOTE 1)
23	0.095 (2,4)	0.188 (4,8)
27	0.095 (2,4)	Angle (NOTE 1)
27A-27	0.095 (2,4)	Angle (NOTE 1)
27B	Butt: 3-3/4 (95,3) OD = 0.188 (4,8) 3-1/2 (88,9) OD = 0.156 (4,0) 3-1/4 (82,6) OD = 0.095 (2,4) 2-3/4 (69,9) OD = 0.095 (2,4) Top & Inserts = 0.095 (2,4)	Angle (NOTE 1)
39	0.095 (2,4)	Angle (NOTE 1)
39A	0.095 (2,4)	Angle (NOTE 1)
40	0.095 (2,4)	Angle (NOTE 1)
42	0.095 (2,4)	0.25 (6,4) (NOTE 2)
45	0.120 (3,0)	0.156 (4,0)
46	0.120 (3,0)	0.188 (4,8)
47	0.120 (3,0)	0.25 (6,4)
62	4-1/2 (114,3) OD = 0.156 (4,0) 3-1/2 (88,9) OD = 0.156 (4,0) 3 (76,2) OD = 0.095 (2,4)	Angle (NOTE 1)
65	4-1/2 (114,3) OD = 0.156 (4,0) 3-1/2 (88,9) OD = 0.156 (4,0) 3-3/4 (95,3) OD = 0.188 (4,8)	Angle (NOTE 1)
122A	0.095 (2,4)	0.188 (4,8)
123	0.095 (2,4)	0.156 (4,0)
124	0.109 (2,8)	0.109 (2,8)
125	0.095 (2,4)	0.188 (4,8)
128	0.109 (2,8)	0.109 (2,8)
130	0.120 (3,0)	0.120 (3,0)

**NOTE 1** Measure a good section of chord to determine the thickness.

**NOTE 2** The two top chords on the boom top have 0.188 in (4.8 mm) wall thickness.

## INSPECTION GUIDELINES

1. Position the crane on a level surface.
2. Block the attachment so it is level; blocking should be placed under each connection point to eliminate all sag.
3. Thoroughly clean the attachment of all dirt, grease, oil, etc. so a thorough inspection can be made.
4. Visually inspect the entire attachment looking for the following types of damage:
  - a. Dents in lacings, chords, and platework.
  - b. Corrosion or abrasion in lacings, chords, and platework.
  - c. Bent, kinked, or distorted lacings, chords, and platework.
  - d. Cracked lacings, chords, and platework.
  - e. Cracked welds.
5. Closely examine those areas where the paint is chipped, wrinkled, or missing and where faint rust lines or marks appear.
6. Fill in the inspection checklist at the end of this publication and make a detailed report of the type and degree of damage found.



### WARNING

#### Structural Failure!

If damage exceeds allowable criteria, do not operate crane until appropriate lattice section has been properly repaired or replaced.

Operating crane with damaged lattice sections including lacings, can result in structural failure or collapse of attachment and may cause personal injury or death.

7. Repair or replace damaged lattice sections.

## REPLACEMENT CRITERIA

1. Any lacing damage exceeding the allowable criteria given in this publication must be replaced.
2. Contact Manitowoc Crane Care for any damage to chords or platework exceeding the allowable criteria contained in this publication. Special instructions are required for repair or replacement of these components.

Refer to Table 1 for the wall thickness of tubular lacings and chords on various past production attachments.

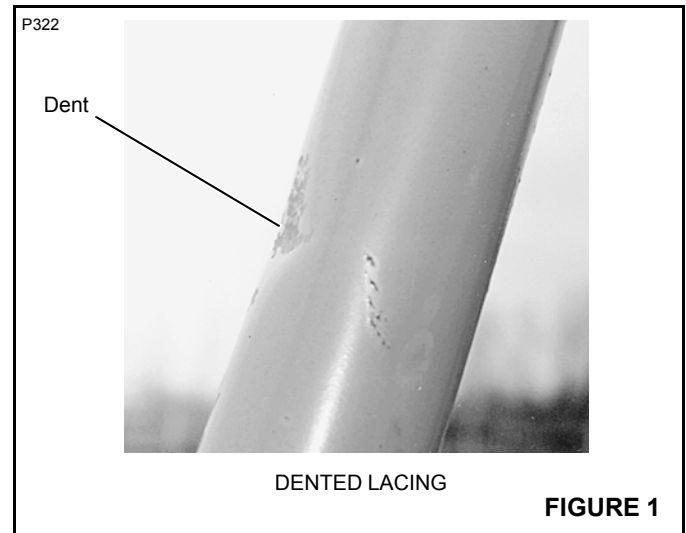
**For attachments not listed, refer to the Lacing Drawings in the Attachment Section of the Parts Manual supplied with your crane, or contact your Manitowoc distributor.**

## Dents

Refer to Figure 1.

For tubular lacings or chords, dents must not be deeper than the wall thickness or 1/8 in (3.2 mm), whichever is less.

For angular lacings or chords and all platework, dents must not be deeper than 1/8 in (3.2 mm).

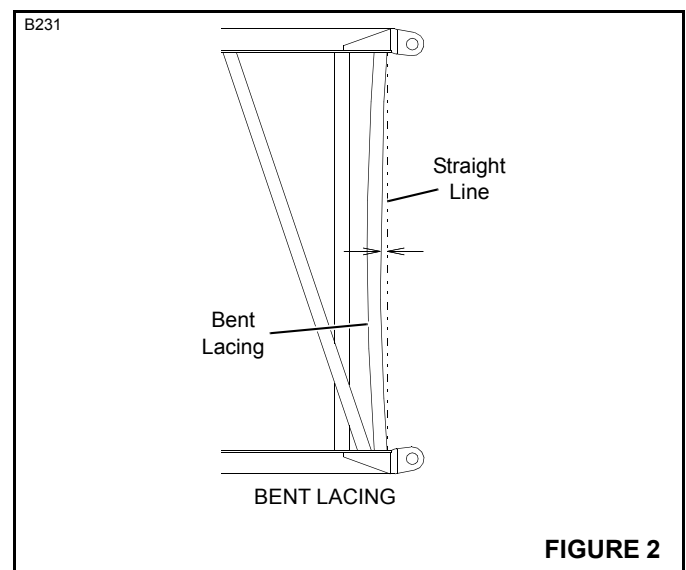


## Gradual and Sweeping Bends

Refer to Figure 2.

For tubular lacing, gradual and sweeping bends must not deviate from straight more than 5 percent of the lacing diameter.

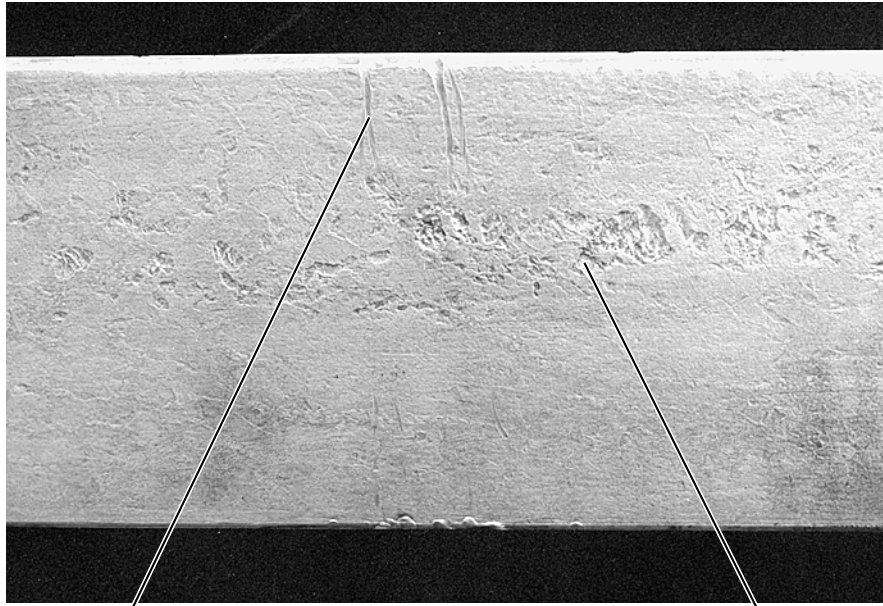
For angular lacing, gradual and sweeping bends must not deviate from straight more than 5 percent of the angle leg length.



Gradual and sweeping bends in lacings can be straightened by cold bending them back into alignment. Take extreme care not to kink or further damage the lacings.

CORRODED CHORD

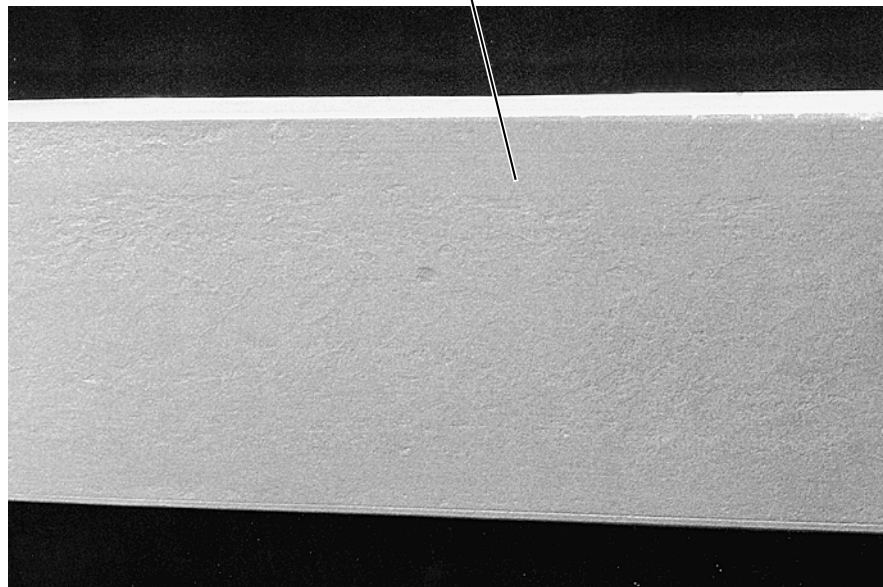
P325



**Not Acceptable**  
Abrasion from handling with  
chain exceeds allowable limit

**Acceptable**  
Surface is relatively smooth:  
within allowable limit

**Not Acceptable**  
Surface is badly pitted;  
exceeds allowable limit



P326

FIGURE 3

## Corrosion and Abrasion

Refer to Figure 3.

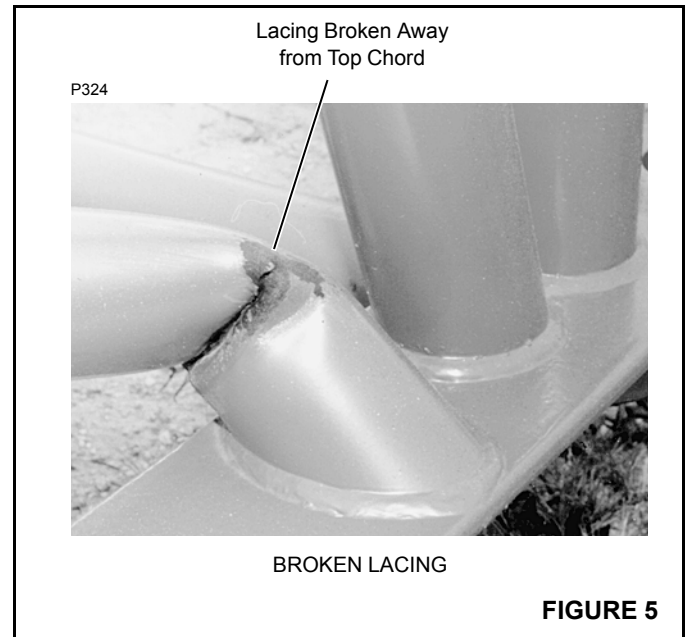
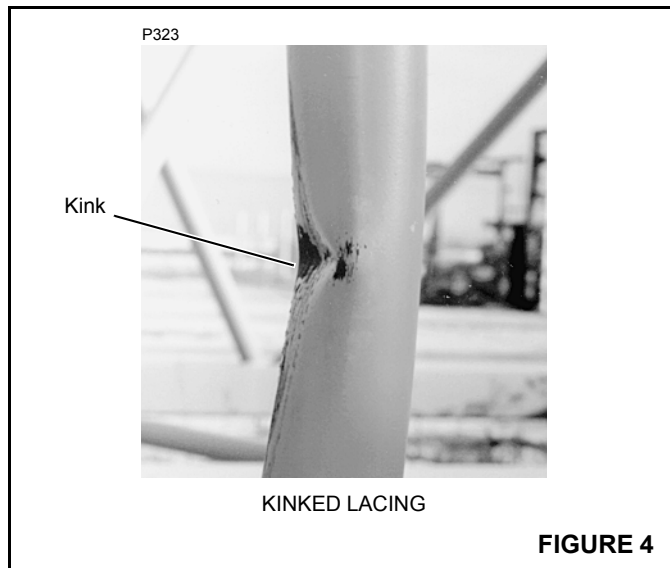
Corrosion and abrasion must not be deeper than 10 percent of the wall thickness, the angle thickness, or the plate thickness.

## Kinks

Refer to Figure 4.

Kinked lacings must be replaced; *do not bend kinked lacings back into alignment.*

If any chord or platework is kinked, contact Manitowoc Crane Care for approved repair instructions. *Do not bend kinked chords or platework back into alignment.*



## Cracks and Breaks

Refer to Figure 5.

Cracked and broken lacings must be replaced; *do not attempt to repair cracked or broken lacings.*

If any chord or platework is cracked or broken, contact Manitowoc Crane Care for approved repair instructions. *Do not attempt to repair cracked or broken chords or platework.*

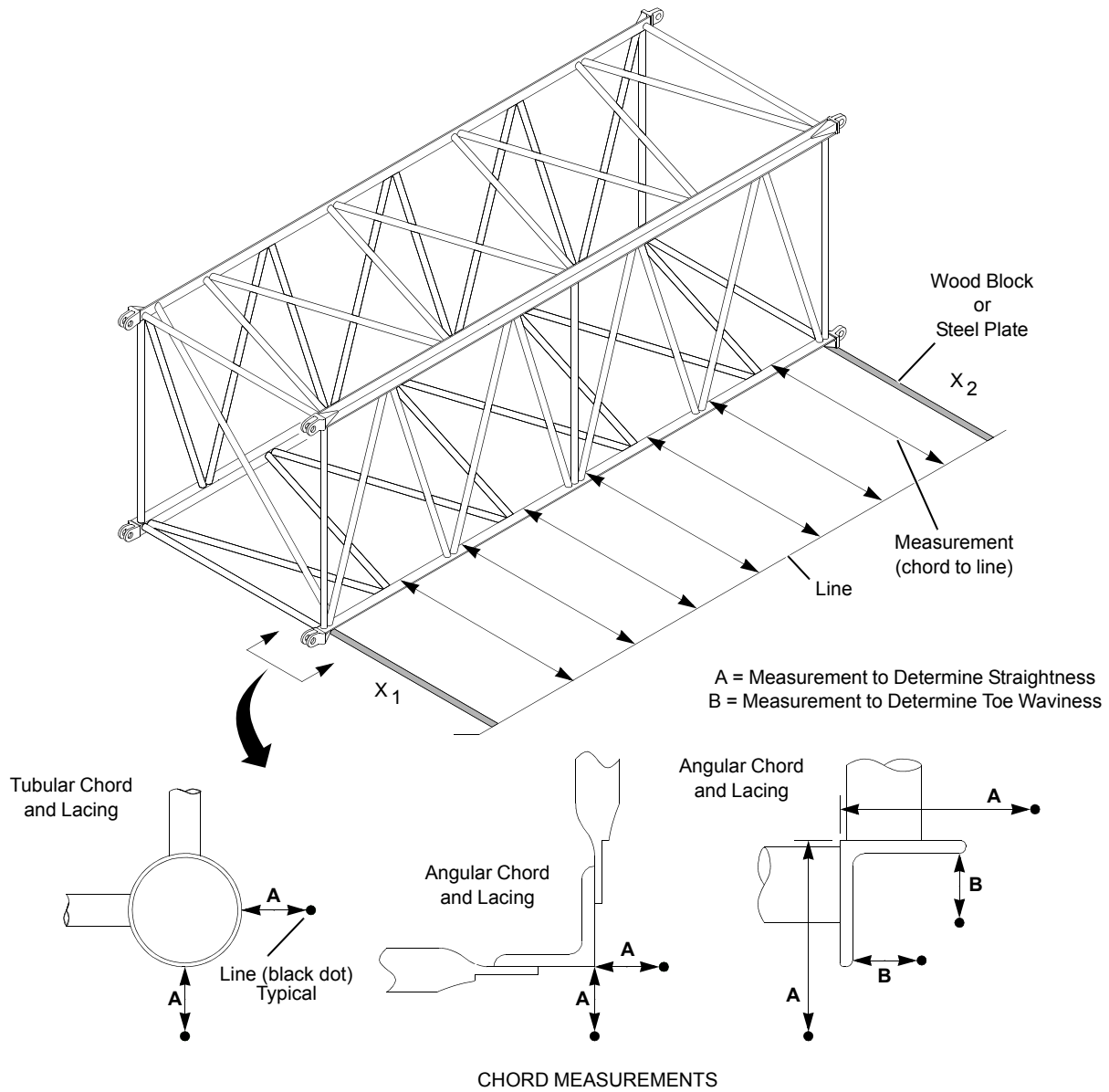


FIGURE 6

### Chord Straightness

Refer to Figure 6.

If visual inspection indicates that a chord may not be straight, proceed as follows:

1. Remove the suspect lattice section from the attachment.
2. Place wood blocks or steel plates having the same thickness against both ends of the section ( $X_1$  and  $X_2$ ).
3. Stretch a line (string or wire) over the outside of the wood blocks or steel plates.
4. Stretch the line as tight as possible and tie it off at both ends.
5. Measure the distance from the chord (on either side of lacing intersection) to the line as shown in Figure 6.
6. Measurements must be taken in two planes at each chord (dimensions A and B). To eliminate the effect of sag in the line, take all measurements in the horizontal plane.
7. Take the first set of measurements, then roll the insert over 90 degrees, and take the second set of measurements.
8. Tubular and angular chords must not deviate from straight more than plus or minus 3/16 in (4.8 mm) at any lacing intersection (dimension A). Deviation between any two adjacent lacings must not exceed plus or minus 3/16 in (4.8 mm).
9. On angular chords, *waviness at toe of chord* (dimension B) must not deviate from straight more than plus or minus 1/4 in (6.4 mm) at any point. Furthermore, waviness between any two adjacent lacings must not exceed plus or minus 1/4 in (6.4 mm).

Gradual and sweeping bends in chords can be straightened by cold bending them back into alignment. Take care not to kink or further damage the chords.

### ORDERING LACINGS

This topic is divided into two sections:

- a. Ordering boom or jib lacings from LACING DRAWINGS contained in the Attachment Section of the Parts Manual furnished with the crane.
- b. Ordering boom or jib lacings when LACING DRAWINGS ARE NOT AVAILABLE.

### Assistance

If you are in doubt as to which lacings to order, DO NOT GUESS. Contact your Manitowoc distributor for assistance.

### Boom or Jib Identification

All parts orders for lacings must contain the boom or jib identification number and the component part number:

- **Past Production (View A):**

Boom or jib number, component part number, and manufacturing code stamped into two connectors (diagonally opposite) on both ends of each insert and on end of top and butt.

- **Current Production (View B):**

Boom or jib number, component part number, and manufacturing code stamped into a plate mounted on all four chords of each lattice section.

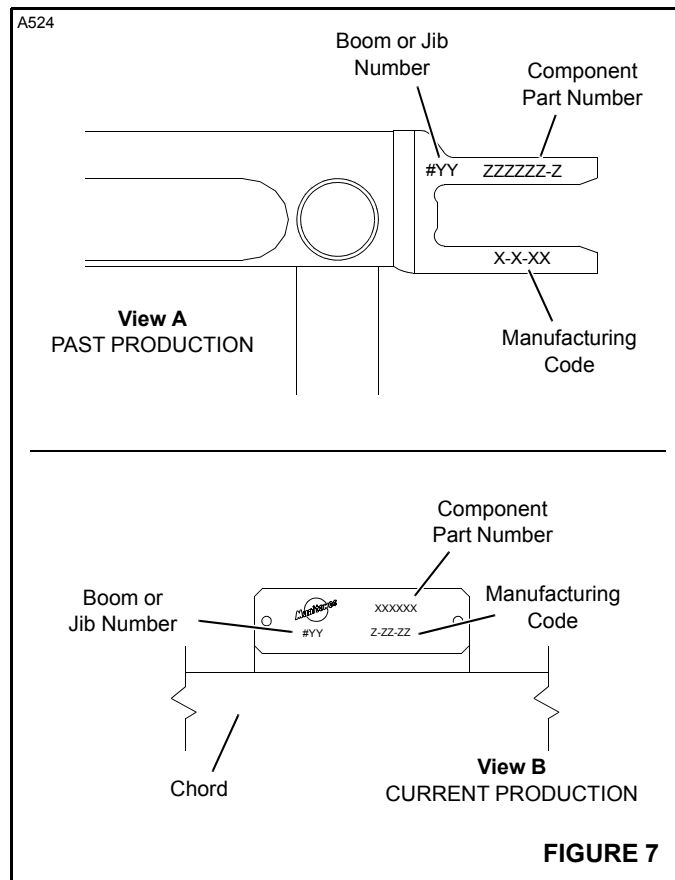


FIGURE 7

### A. Ordering Lacings from Lacing Drawings

The parts order must contain the following information to ensure that Manitowoc provides you with the correct lacings:

1. Crane serial number (can be found on builders plate in operator's cab.)
2. Boom or jib identification number.
3. Quantity of lacings.
4. Component part number and lacing identification number (from lacing drawing in Section F of Parts Manual).
5. Component name.

**EXAMPLE:** Assume you have a number 22 boom and the lacings with circled letters in Figure 9 are damaged. Your parts order should be similar to the following example:

Crane Serial Number: **00000** (from Crane Identification Plate).

Boom Identification Number: **#22 Boom**

Required:

- 1 each 48153-9 (N) for 30 ft Butt
- 1 each 33426-3 (B) for 20 ft Insert
- 1 each 33426-3 (D) for 20 ft Insert
- 1 each 50453-2 (C) for 40 ft Top

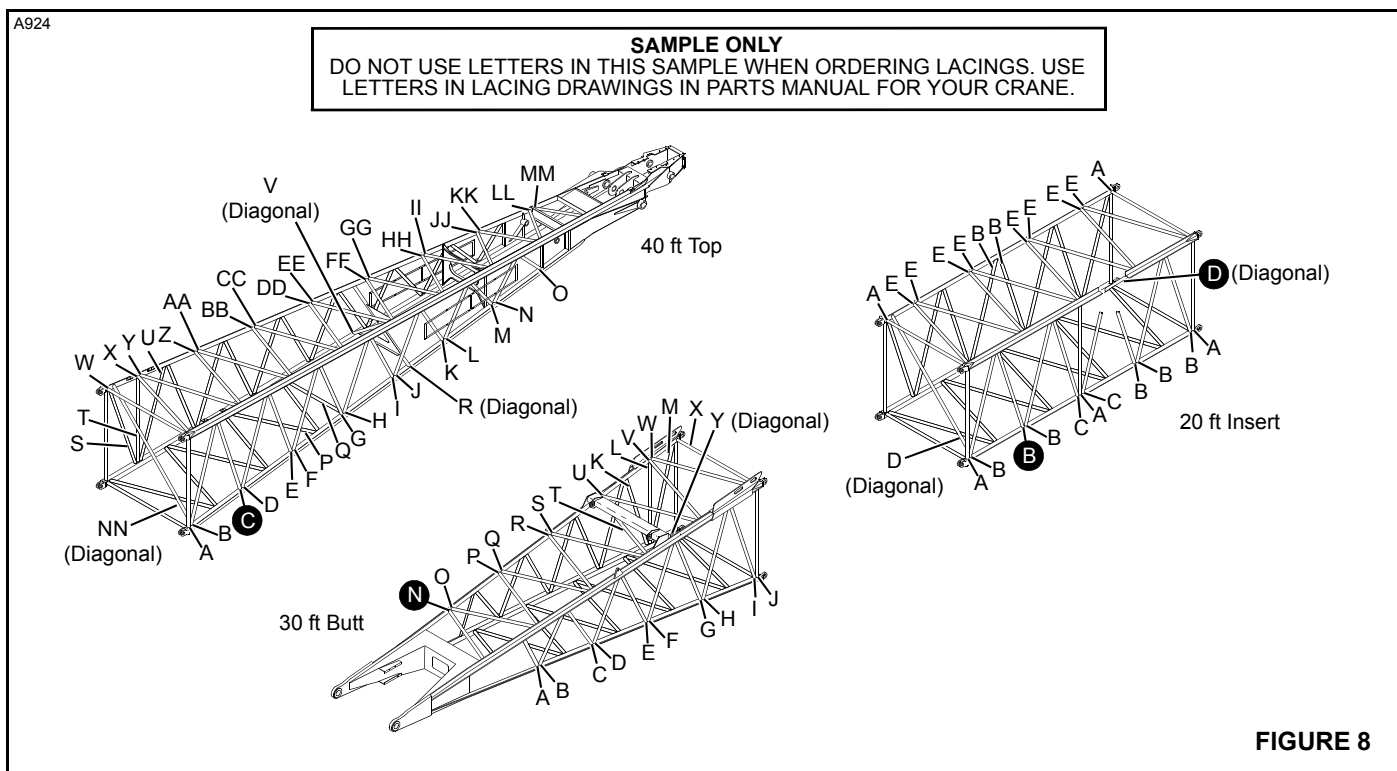
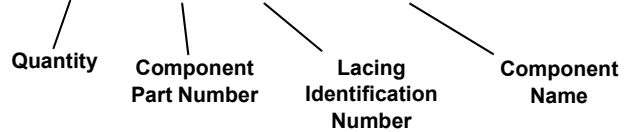


FIGURE 8



## B. Ordering Lacings without Lacing Drawings

The parts order must contain the following information to ensure that Manitowoc provides you with the correct lacings:

1. Crane serial number (can be found on builders plate in operator's cab.)
2. Boom or jib identification number.
3. Quantity, lacing location, and lacing number.
4. Boom or jib component name (butt, insert, or top) and part number.

**NOTE** To obtain the lacing location and number, view the boom or the jib from the butt end looking forward. Identify the side on which the damaged lacing is located: left side, top side, right side, or bottom side. Count each lacing up to and including the damaged lacing, starting with **first lacing nearest butt end** of the component as shown in Figure 9.

Do not count a diagonal lacing as the first lacing. Identify diagonal lacing separately; lower end diagonal lacing or upper end diagonal lacing.

**EXAMPLE:** Assume you have a number 22 boom and the lacings with circled numbers in Figure 9 are damaged. Your parts order should be similar to the following example:

Crane Serial Number: **00000** (from Crane Identification plate).

Boom Identification Number: **#22 Boom**

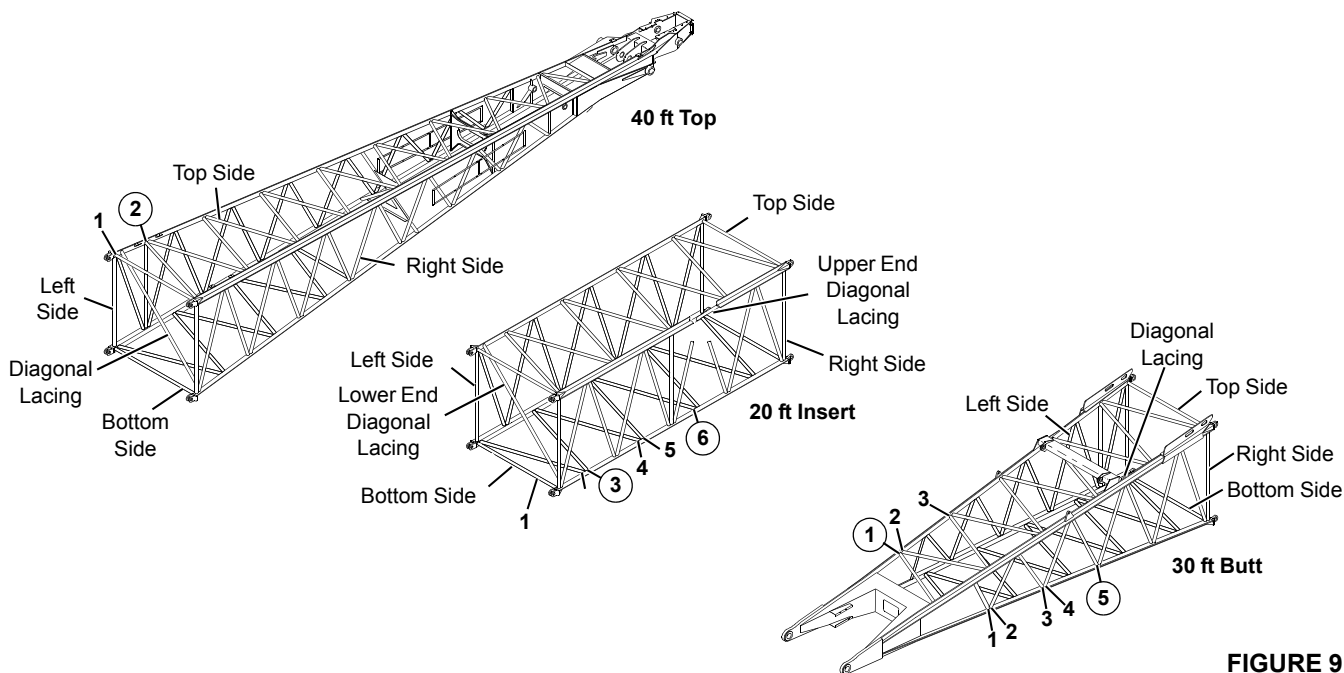
Required:

- 1 each Top Side Lacing (1) for 30 ft Butt 48153-9
- 1 each Right Side Lacing (5) for 30 ft Butt 48153-9
- 1 each Bottom Side Lacing (3) for 20 ft Insert 33426-3
- 1 each Bottom Side Lacing (6) for 20 ft Insert 33426-3
- 1 each Top Side Lacing (2) for 40 ft Top 50453-2

Quantity	Lacing Location	Lacing Identification Number	Component Name and Part Number
1	Top Side	(1)	30 ft Butt 48153-9
1	Right Side	(5)	30 ft Butt 48153-9
1	Bottom Side	(3)	20 ft Insert 33426-3
1	Bottom Side	(6)	20 ft Insert 33426-3
1	Top Side	(2)	40 ft Top 50453-2

A924

**SAMPLE ONLY**  
DO NOT USE LETTERS IN THIS SAMPLE WHEN ORDERING LACINGS. USE LETTERS IN LACING DRAWINGS IN PARTS MANUAL FOR YOUR CRANE.



**FIGURE 9**

## REPAIR PROCEDURE

### Extent of Repair

Field repair is limited to replacing damaged lacings — **unless otherwise approved by Manitowoc** — but only if the following conditions are complied with:

- The lacings are ordered from Manitowoc.
- The welding is done by *competent welders* qualified to work with the types of steel involved. *Manitowoc recommends that welders be qualified per Section 5 of AWS D1.1 Structural Steel code or an equivalent code.*
- The welding procedures and specifications supplied by Manitowoc are adhered to.



### **WARNING** Component Failure!

**Unless otherwise approved by Manitowoc**, no welding shall be done to chord members or platework except to attach lacings.

No chord member or platework may be replaced in whole or in part. The complete lattice section must be replaced if damage to chords or platework exceeds the allowable criteria contained in this publication.

Welding chord members or platework without approval from Manitowoc could result in structural failure of the attachment.

### Preparing for Welding

Many of Manitowoc's current production cranes are equipped with sensitive electronic equipment and controls. To prevent serious damage to these components, take the following precautions before you start welding:

1. Obtain factory approval before performing any welding.
2. Stop the engine and disconnect all positive (+) and negative (-) battery cables from the batteries. **Do not rely on battery disconnect for this purpose.**
3. Do not attach welding cables to or near any electrical components. If welding is required near any electrical components, the component should be removed from the unit prior to welding and reinstalled after welding is completed.
4. Attach the welding ground cable as near as possible to the area being welded. Do not lay the welding ground on the lattice section — secure it tightly with a C-clamp if necessary.
5. Do not bridge electrical components and machined bearing surfaces.
6. Cover electrical components and machined surfaces as required prior to welding to protect them from welding sparks and spalls.

### Repair Facility

To ensure proper welding, the repair area must:

1. Be heated to 70° F (21° C) minimum.
2. Be free of wind drafts.
3. Be rain and snow proof.
4. Have proper ventilation.
5. Have proper lighting and electrical service.
6. Have proper air compressor capacity to support air arc gouging and grinding equipment.
7. Have sufficient room to pin another lattice section to the work piece if necessary.

### Outdoor Repairs

Welding shall not be done when the outside temperature is lower than 45° F (7° C) or when surfaces are wet or exposed to rain, snow, or high wind velocities.

Welding is permitted if a heated structure or shelter is constructed around the weld area to maintain the temperature adjacent to the weldment at 45° (7°C) or higher.

**REGARDLESS OF OUTSIDE TEMPERATURE, THE BASE MATERIAL TEMPERATURE MUST BE MAINTAINED AT THE MINIMUM INTERPASS TEMPERATURE DURING ALL WELDING OPERATIONS.**

### General Equipment Requirements

The following equipment is required:

1. 350+ amp DC power source (needed for carbon arc gouging and welding).
2. Stick electrode (see page 19 for determining required amount).
3. Carbon arc torch.
4. Stick electrode oven and proper storage for electrodes.

**NOTE** Stick electrode can be purchased in hermetically sealed packages from Manitowoc Crane Care.

- Electrode: A.W.S. A5.5
- 3/32 in (2,5 mm) E9018M-H4
- 1/8 in (3,2 mm) E9018M-H4

The maximum exposure time to the atmosphere for E9018-M stick electrode is one hour. The electrode must then be returned to an oven that is held at a minimum of 250°F (121°C) for four hours.

5. Safe and properly sized rigging for lifting and blocking equipment.
6. Proper safety equipment for working at heights above the ground.
7. Proper safety apparel.
8. Safe and proper hand tools (wire brush, clamps, grinder, etc.).

9. Oxy-fuel cutting and preheating torch.
10. Heat resistant blankets for covering the weld repairs and protecting the lattice section from sparks and spalls.

### Repair Procedures and Processes

Manitowoc Crane Care will supply the following documentation when required:

1. Welding instructions.
2. Modification drawings.
3. Non-destructive testing and inspection requirements.
4. Straightening requirements and processes.
5. Machining requirements.
6. Paint requirements and recommendations.

### Lacing Replacement

1. The lacing/lacings will need to be identified prior to removal. Do not remove more than one lacing at a time on a panel to ensure straightness of the chords. Use a fillet weld gauge to measure the toe/heel of the weld and record the dimension for reference.

**NOTE** Always replace diagonal lacings first. Diagonal lacings run from one corner to another (for example, from upper left chord to lower right chord).

Always replace the center lacing first in a series of damaged lacings. This will assist in maintaining the cross sectional dimensions of the section. Then replace the remaining lacings, first on one side and then on the other side of center.

Special instructions are provided starting on page 12 for removing:

- End lacing.
  - Lacings on a tapered lattice section.
  - Lacings on a lattice section with a bent or bowed chord member.
2. Use a paint marker to reference the location of the damaged lacing on the chord member (Figure 10). Transfer the marks out of the repair area so they are not removed during the lacing replacement process. These marks will help locate the replacement lacing.

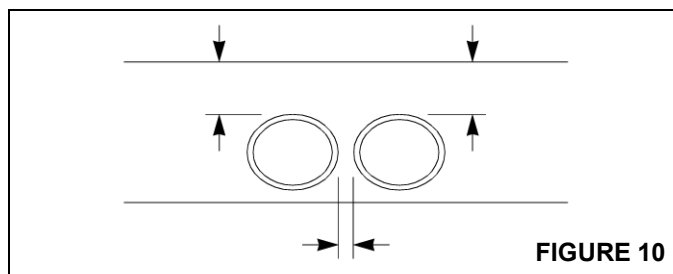


FIGURE 10

3. Use the following settings for the carbon arc electrode size being used:

Table 2 Carbon Arc Parameters

Electrode Size	Minimum Amperage	Maximum Amperage
5/32 in (4,0 mm)	90 amps	150 amps
3/16 in (4,8 mm)	200 amps	250 amps
1/4 in (6,4 mm)	300 amps	400 amps

4. Leave a minimum of 1/8" (3,2 mm) of material and grind the remaining material to match the existing chord profile. Take care not to damage the chord or reduce the wall thickness.
5. A cutting torch may be used to remove the lacing. Leave at least 1/4 in (6 mm) of material and grind the remaining material to match the existing chord profile. Take care not to overheat or gouge the chord when using a torch for removal.
6. Gouge marks on the chord are unacceptable. **Stop all work if chord is damaged and contact Manitowoc Crane Care via your Manitowoc Distributor.**
7. M.T. or P.T. inspect the chord for soundness prior to fitting the new lacing.

**NOTE** Manitowoc recommends the N.D.T personnel be certified to A.S.N.T. Level II.

8. Remove all grease, paint and oil from the weld zone on the replacement lacing.
9. Fit and tack the new lacing using the reference marks and existing lacings on both sides for location.  
The gap between the chord and lacing must not exceed 1/16 in (1,6 mm) at either end.
10. Use S.M.A.W. for tacking (Figure 11). All tack welds must be crack free and small enough to weld over. Use 3/32 in (2,4 mm) diameter stick electrode for tacking the lacing.
  - A total of two tack welds are to be made only in the locations shown in Figure 11. **Do not tack weld toe or heel of lacing.**
  - The tacks should be 1-1/2 in (38,1 mm) long and located on the sides of the lacing.

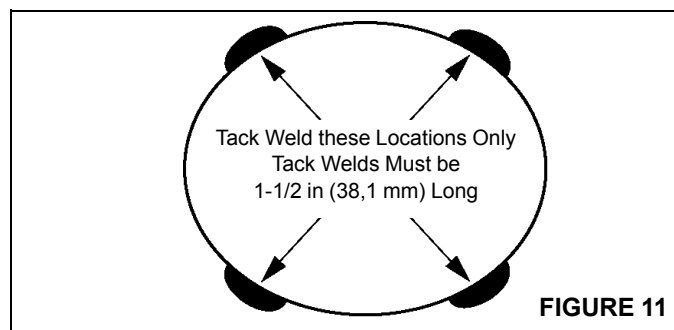
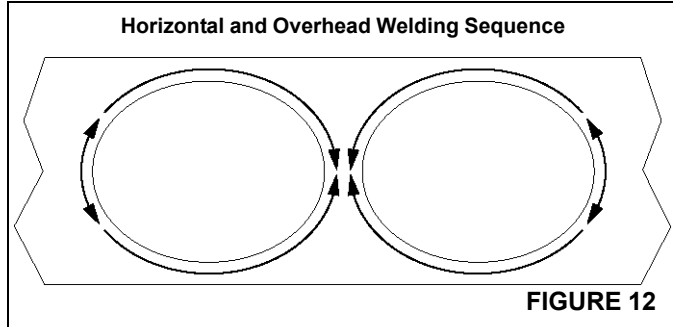


FIGURE 11

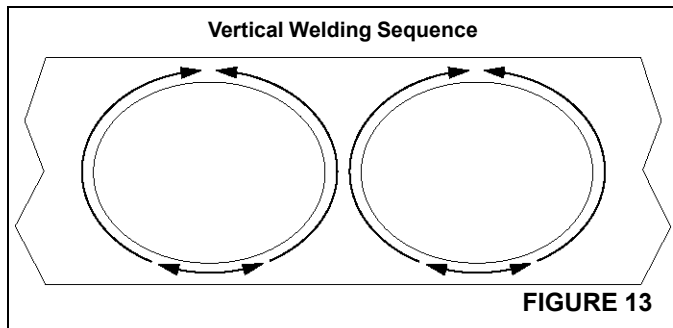
11. Whenever possible, welding shall be done in the horizontal position.
- Use the following sequence for horizontal and overhead welding. The weld pass should start at the heel of the lacing and end on the toe (Figure 12). Pass placement will differ from the horizontal and the overhead position.

**NOTE** See Figure 16 for pass placement.



- Use the following sequence for vertical welding. The weld pass shall start at the 6:00 O'clock position and end at the 12:00 O'clock position (Figure 13).

**NOTE** See Figure 16 for pass placement.



Weld profiles shall be smooth and blend gradually into the base metal. Undercut shall not exceed 0.010 in (0.25 mm) deep on any lacing-to-chord joint. **No piping porosity is allowed in any weld repairs.**

12. Use the following preheat and interpass temperatures:

- Minimum of 150°F (66° C)
- Maximum of 350°F (177° C)

**NOTE** All welders are required to monitor minimum and maximum interpass temperatures by use of temperature sticks. Apply heat evenly to avoid spot heating any one area.

13. Use the weld size dimensions recorded during Lacing Replacement step 1 on page 11 to determine the weld size for the replacement lacings. Refer to Figure 16 for weld size and pass placement. The finished weld must match the profile and size of the corresponding lacings.

No excessive weaving is allowed. The Maximum bead width is 5/16 in (8 mm).

14. Allow all finished welds to cool slowly to ambient temperature.

15. Visually inspect for proper workmanship and correct weld size. M.T. or P.T. inspect for soundness 48 hours after welding is completed.

**Do not use the lattice section during the 48 hour wait period.**

**NOTE** The 48 hour wait period prior to the final M.T. or P.T. inspection can be waived if welding was performed by a qualified Manitowoc representative.

Any welder that has taken and passed Manitowoc's Boom Lacing Replacement Class is considered qualified by Manitowoc.

Manitowoc recommends the N.D.T personnel be certified to A.S.N.T. Level II.

16. Prime and paint the welded area.

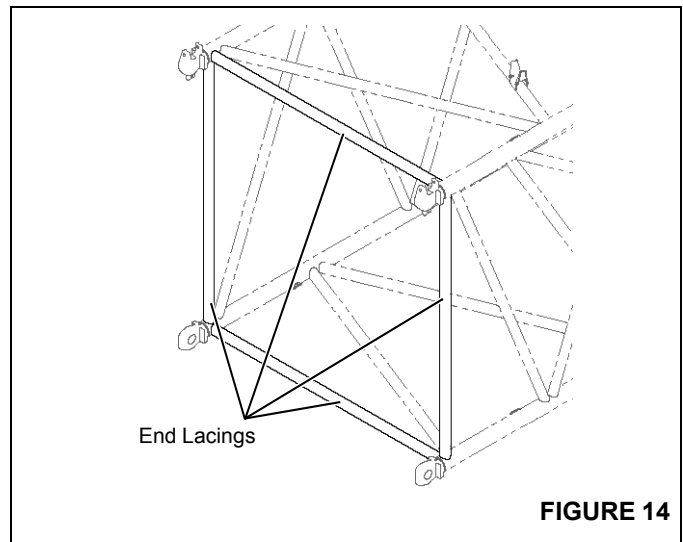
17. Send all completed inspection reports to Manitowoc Crane Care. If possible, digital photographs should be taken and submitted with the inspection reports.

### End Lacing Replacement

End Lacings are the lacings that are closest to the connectors and run perpendicular to the chords as shown in Figure 14.

The end lacings hold the back-to-back and diagonal dimensions of the chords and connectors. It is critical that the original manufacturing connector tolerance be maintained. Removing these lacings without properly bracing the lattice section will make it extremely difficult to pin the repaired section to another section.

Only one lacing should be replaced at any given time to help hold the dimensions of the chords and connectors. The procedure for removing the end lacings from an insert is different from the procedure for a top or butt lattice section.



### End Lacing Replacement on an Insert (Angle and Tubular Chords)

1. This procedure can be used for replacing the end lacing on a top or butt lattice section with angle chords.
2. Pin another lattice section to the end of the section being repaired. The connectors should be wedged over to ensure no lateral movement.
3. If another lattice section is not available, tack weld a temporary brace to the connectors parallel to the damaged lacing (see Figure 15).

Care must be taken to not damage the machined surface of the connector.

- The temporary brace will need to be strong enough to not allow the connectors to move in or out. A minimum 4 in (102 mm) by 4 in (102 mm) by 3/8 in (10 mm) angle is required.
  - The connectors shall be preheated to a minimum of 150°F (66° C) before tacking.
  - Use 3/32 in (2,5 mm) E9018-M stick electrode for tacking the temporary brace.
  - Tacks shall be 1 to 1-1/2 in (25 to 38 mm) long. The tacks shall be sound with no undercut to the connector.
  - Do not tack to any machined surfaces.
4. Use the same process for removing and replacing lacing as specified in Lacing Replacement on page 11.
  5. Remove the temporary bracing without damaging the connectors.

Do not cut or gouge the connector. **Stop all work if connector is damaged and contact Manitowoc Crane Care.**

6. Send all completed inspection reports to Manitowoc Crane Care. Digital photographs should be taken and sent with the inspection reports.

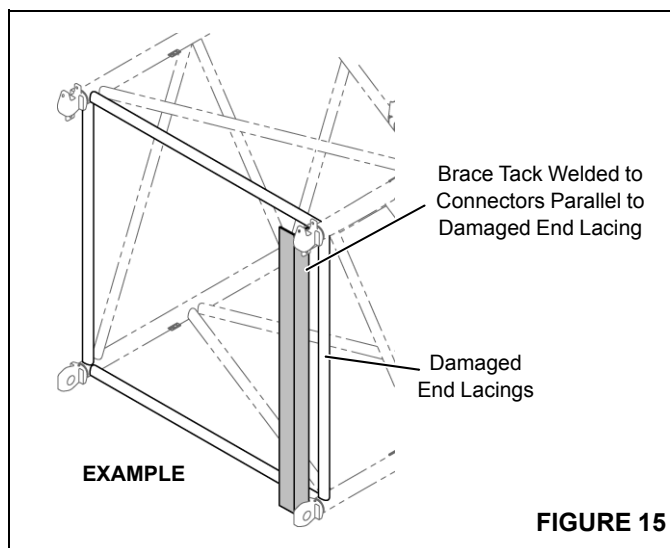


FIGURE 15

### End Lacing Replacement on Tapered Sections (Tubular Chords)

1. This procedure applies specifically to tapered lattice sections that have tubular chords. Examples: tops, butts, and transition inserts.
2. The replacement end lacing cannot be installed into a tapered lattice section due to clearance issues with the connector. For this reason, the connectors cannot be restrained to install the replacement lacing. Therefore the section being repaired must be pinned to another section.
3. Perform Lacing Replacement steps 1-7 on page 11. **Do not replace more than one lacing at a time.**
4. The lacing must be installed and not tack welded.
 

**Safety Note:** Make sure the lacing cannot fall out and injure someone.
5. Pin another lattice section to the end of the section being repaired. The connectors should be wedged to prevent lateral movement of the sections.
6. Only after the section is pinned to another section can the replacement end lacing be tack welded into position.
7. Perform Lacing Replacement steps 8-14 starting on page 11.
8. Send all completed inspection reports to Manitowoc Crane Care. Digital photographs should be taken and sent with the inspection reports.

### Lacing Removal — Boom Section with a Bent or Bowed Chord Member

1. This procedure applies to all lattice sections that have a bent/bowed chord member. Perform the Chord Straightness inspection on page 7 to determine if the chord is out of allowable tolerance.
2. Bent or bowed chords in a lattice section are typically the result of some form of structural damage such as kinked lacings. Perform a thorough inspection of the lacings and identify the lacings that will need to be replaced.
3. Remove all of the damaged lacings by performing Lacing Replacement steps 1-7 on page 11. It may be necessary to remove more than one lacing to straighten the chord.

**NOTE** Pin another lattice section to the end of the section being repaired or install a temporary brace if replacing an end lacing.

4. Check the chord for straightness after removing the damaged lacings.

It may be necessary to manipulate the chord to achieve the desired results: use a pipe and a jack to move the chord out or a lever-operated hoist to bring the chord in.

Check the back-to-back dimensions to the inside of the chord on an insert.

5. Remove all grease, paint and oil from the weld zone on the replacement lacing.
6. Fit and tack weld all of the new lacings. Use the reference marks and any existing lacings on both sides of the section to properly locate the new lacings.  
All of the lacings should be tack welded before welding is started.
7. Perform Lacing Replacement steps 8-14 starting on page 11.
8. Send all completed inspection reports to Manitowoc Crane Care. Digital photographs should be taken and submitted with the inspection reports.

**Determining Amount of Stick Electrode Needed**

Use the following formula to determine approximately how much stick electrode (weld metal) is needed to replace lacings. Actual use could be higher or lower depending on a number of factors outside of Manitowoc’s control, such as over or under welding, damaged electrodes, length of discarded electrode stubs, etc.

$$W=2 F^2DL$$

- **W** = amount of weld metal that should be ordered (in pounds)
- **F** = required fillet weld leg size (in inches)
- **D** = lacing tube diameter (in inches)
- **L** = number of lacings being replaced (quantity)

EXAMPLE: If ten 4-1/2 in diameter lacings will be replaced and a 3/8 in fillet weld is required —

$$W = 2 \times F^2 \times D \times L$$

$$W = 2 \times 0.375^2 \times 4.50 \times 10$$

**W = 12.7 lb**

Stick electrode can be ordered from your Manitowoc distributor in hermetically sealed foil packs using the following parts numbers:

E9018M-H4 Electrode Size	Quantity	Part Number
1/8 in (3,2 mm)	4.4 lb Package	409758
3/32 in (2,5 mm)	3.0 lb Package	409759

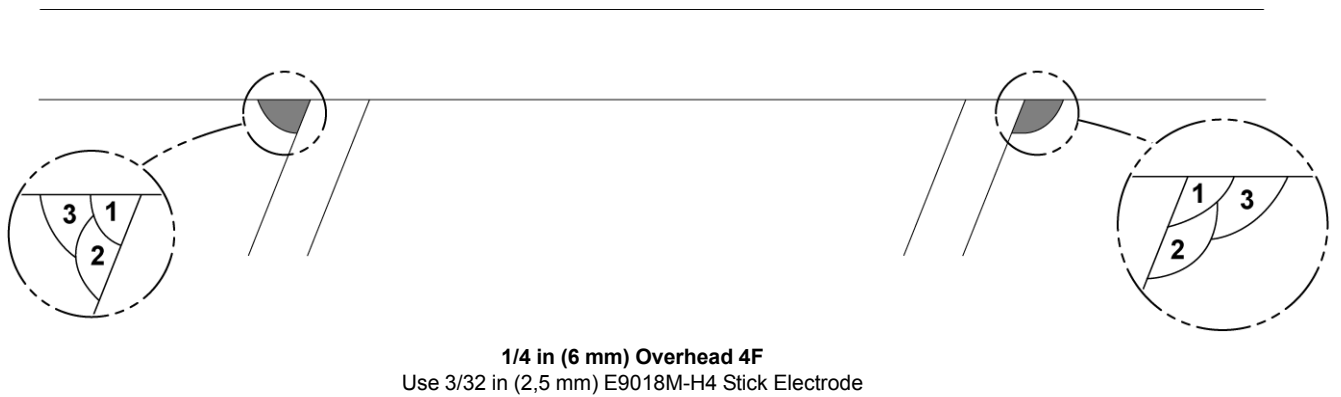
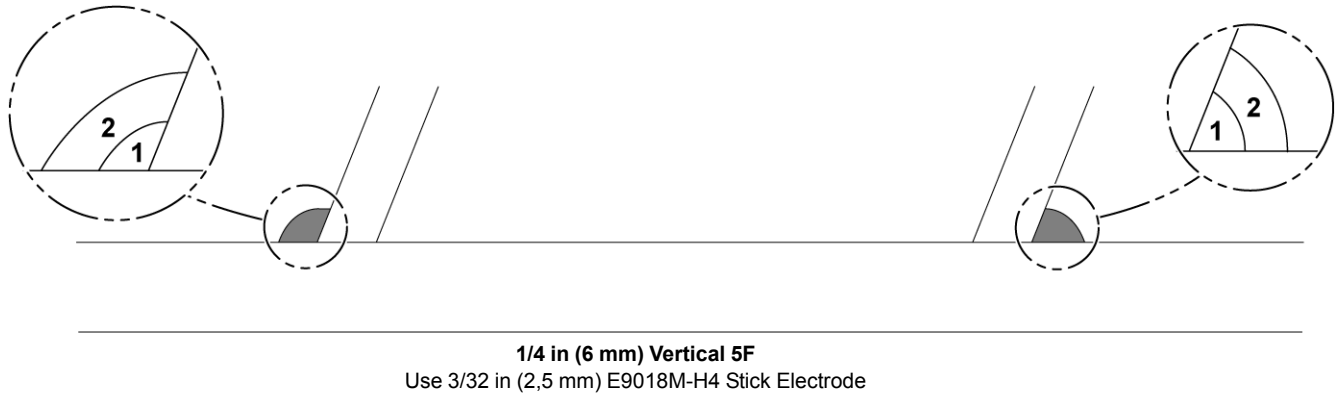
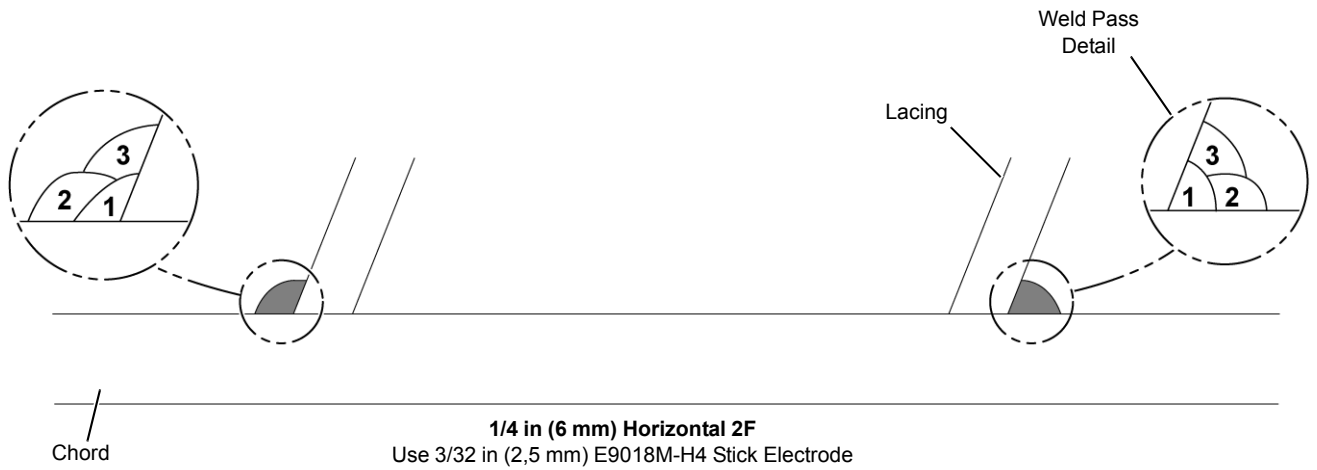


FIGURE 16

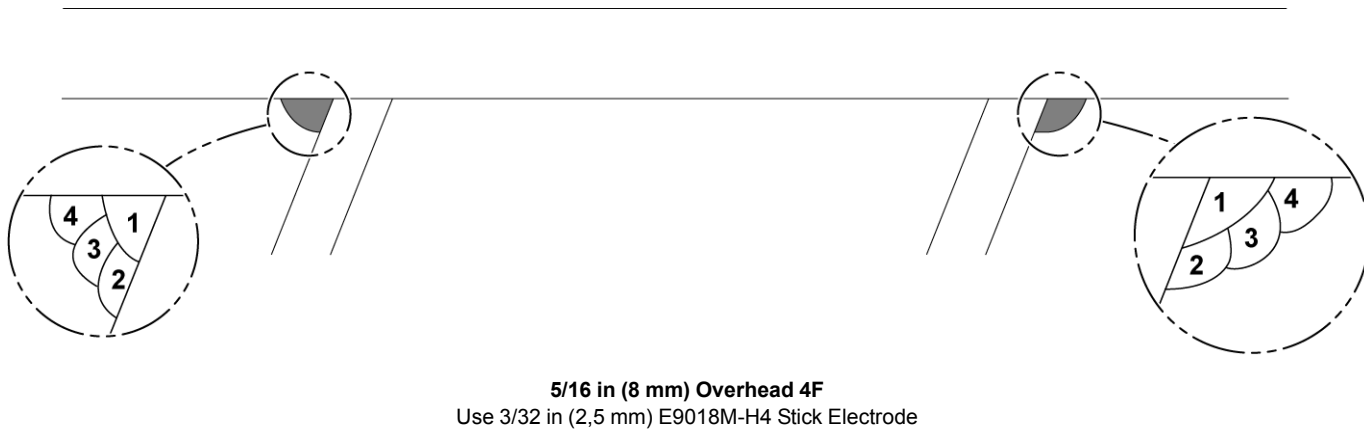
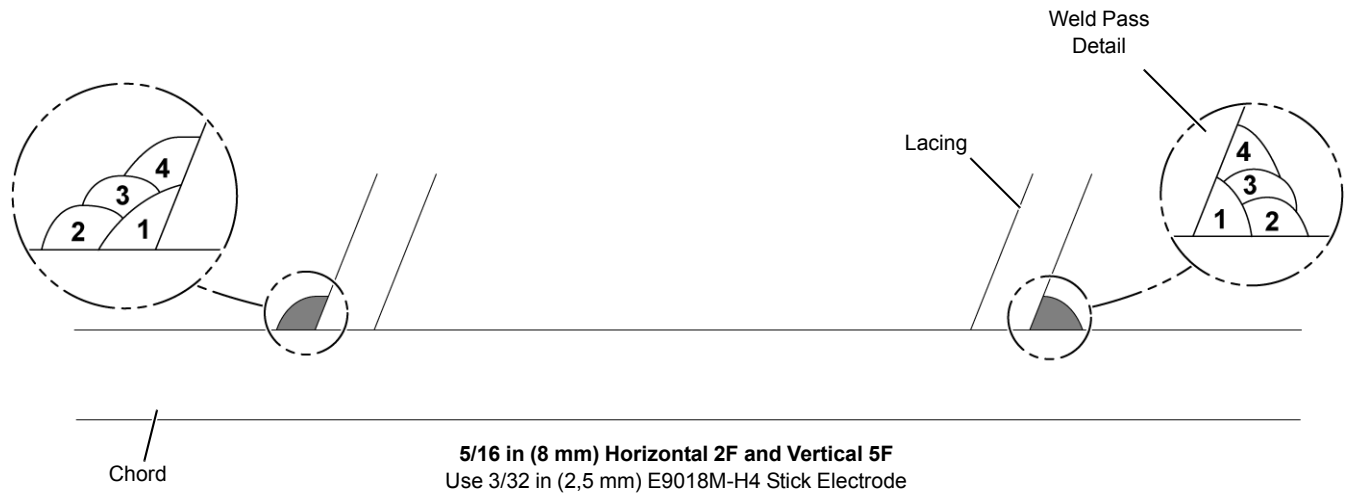
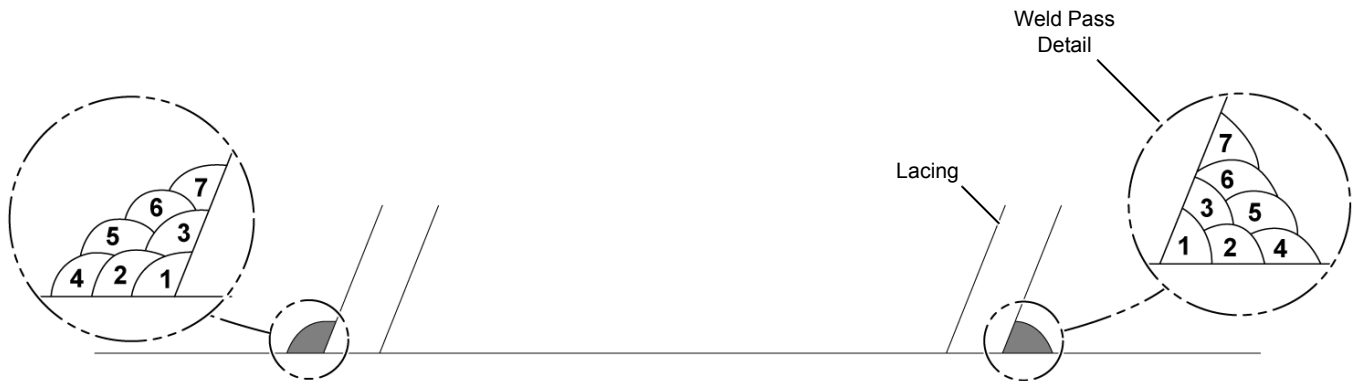


FIGURE 16 continued





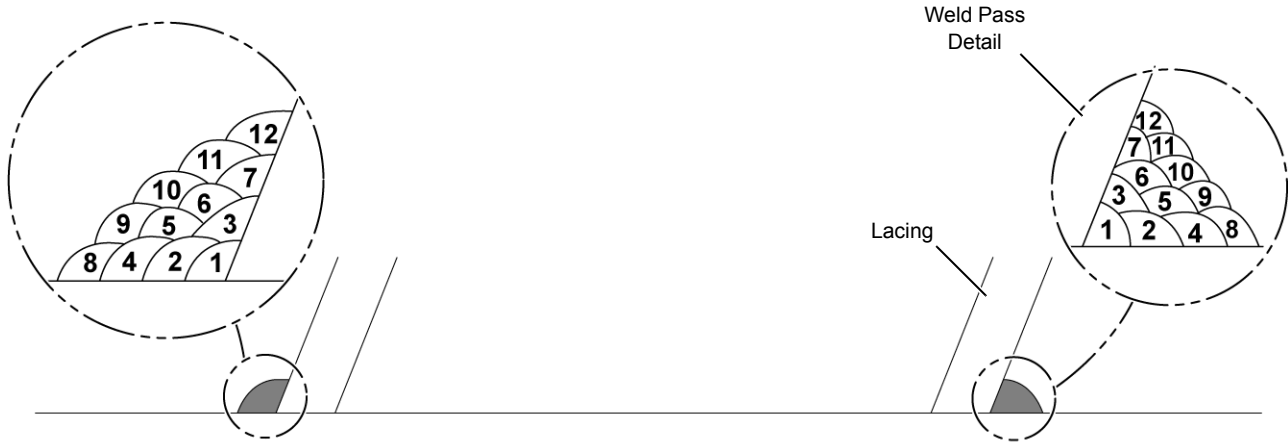
Chord

**3/8 in (10 mm) Horizontal 2F and Vertical 5F**  
 Use 3/32 in (2,5 mm) E9018M-H4 Stick Electrode  
 OR  
 1/8 in (3,2 mm) E9018M-H4 Stick Electrode



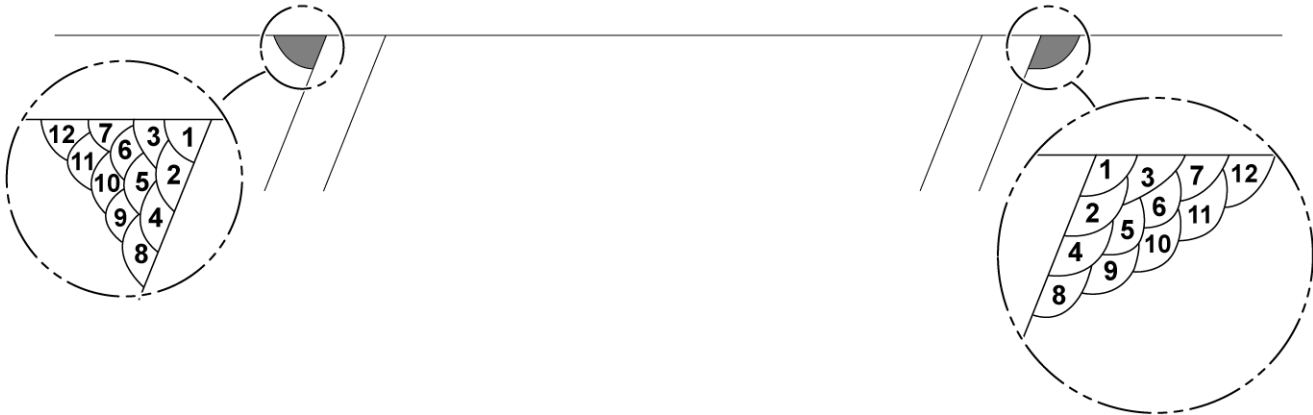
**3/8 in (10 mm) Overhead 4F**  
 Use 3/32 in (2,5 mm) E9018M-H4 Stick Electrode  
 OR  
 1/8 in (3,2 mm) E9018M-H4 Stick Electrode

FIGURE 16 continued



Chord

**1/2 in (12 mm) Horizontal 2F and Vertical 5F**  
 Use 3/32 in (2,5 mm) E9018M-H4 Stick Electrode  
 OR  
 1/8 in (3,2 mm) E9018M-H4 Stick Electrode



**1/2 in (12 mm) Overhead 4F**  
 Use 3/32 in (2,5 mm) E9018M-H4 Stick Electrode  
 OR  
 1/8 in (3,2 mm) E9018M-H4 Stick Electrode

FIGURE 16 continued

### INSPECTION CHECKLIST

Use the following checklist to record any damage found while inspecting lattice sections.

If no damage is found or the damage is within the allowable criteria, check the box next to the item to indicate that the section is okay.

If the damage is not within the allowable criteria, indicate so in the box next to the item — for example: **D** to indicate damage. Then make a detailed report of the type and degree of damage found. Space is provided for drawing sketches or attaching photographs.

It is recommended that damaged areas be marked for quick identification by repair personnel. Brightly colored tape works well for this purpose. As a reminder, the type of defect can be noted on the tape.



### WARNING

If damage found that is not within allowable criteria, do not operate crane until appropriate lattice section has been properly repaired or replaced.

Operating crane with damaged lattice sections can result in structural failure or collapse of attachment.

### RECORD KEEPING

A separate copy of this checklist must be filled out for the boom, jib, tower, and mast on each crane you own.

Signed and dated copies of completed checklists must be kept on file at all times, as they may be required to verify warranty or product liability claims.

Crane Serial No. \_\_\_\_\_ Boom  Jib  Tower  Mast  Number \_\_\_\_\_

Inspector's Name \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

**BUTT:** Manufacturing Code \_\_\_\_\_ Part Number \_\_\_\_\_

Dents <input type="checkbox"/>	Bends <input type="checkbox"/>	Kinks <input type="checkbox"/>	Cracks <input type="checkbox"/>	Breaks <input type="checkbox"/>
Corrosion <input type="checkbox"/>	Abrasion <input type="checkbox"/>	Straightness <input type="checkbox"/>	Welds <input type="checkbox"/>	Other <input type="checkbox"/>

**TOP:** Manufacturing Code \_\_\_\_\_ Part Number \_\_\_\_\_

Dents <input type="checkbox"/>	Bends <input type="checkbox"/>	Kinks <input type="checkbox"/>	Cracks <input type="checkbox"/>	Breaks <input type="checkbox"/>
Corrosion <input type="checkbox"/>	Abrasion <input type="checkbox"/>	Straightness <input type="checkbox"/>	Welds <input type="checkbox"/>	Other <input type="checkbox"/>

**Insert:** Length \_\_\_\_\_ ft Manufacturing Code \_\_\_\_\_ Part Number \_\_\_\_\_

Dents <input type="checkbox"/>	Bends <input type="checkbox"/>	Kinks <input type="checkbox"/>	Cracks <input type="checkbox"/>	Breaks <input type="checkbox"/>
Corrosion <input type="checkbox"/>	Abrasion <input type="checkbox"/>	Straightness <input type="checkbox"/>	Welds <input type="checkbox"/>	Other <input type="checkbox"/>

**Insert:** Length \_\_\_\_\_ ft Manufacturing Code \_\_\_\_\_ Part Number \_\_\_\_\_

Dents <input type="checkbox"/>	Bends <input type="checkbox"/>	Kinks <input type="checkbox"/>	Cracks <input type="checkbox"/>	Breaks <input type="checkbox"/>
Corrosion <input type="checkbox"/>	Abrasion <input type="checkbox"/>	Straightness <input type="checkbox"/>	Welds <input type="checkbox"/>	Other <input type="checkbox"/>

**LATTICE SECTION INSPECTION AND LACING REPLACEMENT**

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**Insert:** Length \_\_\_\_\_ ft Manufacturing Code \_\_\_\_\_ Part Number \_\_\_\_\_

Dents	<input type="checkbox"/>	Bends	<input type="checkbox"/>	Kinks	<input type="checkbox"/>	Cracks	<input type="checkbox"/>	Breaks	<input type="checkbox"/>
Corrosion	<input type="checkbox"/>	Abrasion	<input type="checkbox"/>	Straightness	<input type="checkbox"/>	Welds	<input type="checkbox"/>	Other	<input type="checkbox"/>

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**Insert:** Length \_\_\_\_\_ ft Manufacturing Code \_\_\_\_\_ Part Number \_\_\_\_\_

Dents	<input type="checkbox"/>	Bends	<input type="checkbox"/>	Kinks	<input type="checkbox"/>	Cracks	<input type="checkbox"/>	Breaks	<input type="checkbox"/>
Corrosion	<input type="checkbox"/>	Abrasion	<input type="checkbox"/>	Straightness	<input type="checkbox"/>	Welds	<input type="checkbox"/>	Other	<input type="checkbox"/>

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**Insert:** Length \_\_\_\_\_ ft Manufacturing Code \_\_\_\_\_ Part Number \_\_\_\_\_

Dents	<input type="checkbox"/>	Bends	<input type="checkbox"/>	Kinks	<input type="checkbox"/>	Cracks	<input type="checkbox"/>	Breaks	<input type="checkbox"/>
Corrosion	<input type="checkbox"/>	Abrasion	<input type="checkbox"/>	Straightness	<input type="checkbox"/>	Welds	<input type="checkbox"/>	Other	<input type="checkbox"/>

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**Insert:** Length \_\_\_\_\_ ft Manufacturing Code \_\_\_\_\_ Part Number \_\_\_\_\_

Dents	<input type="checkbox"/>	Bends	<input type="checkbox"/>	Kinks	<input type="checkbox"/>	Cracks	<input type="checkbox"/>	Breaks	<input type="checkbox"/>
Corrosion	<input type="checkbox"/>	Abrasion	<input type="checkbox"/>	Straightness	<input type="checkbox"/>	Welds	<input type="checkbox"/>	Other	<input type="checkbox"/>

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**Insert:** Length \_\_\_\_\_ ft Manufacturing Code \_\_\_\_\_ Part Number \_\_\_\_\_

Dents	<input type="checkbox"/>	Bends	<input type="checkbox"/>	Kinks	<input type="checkbox"/>	Cracks	<input type="checkbox"/>	Breaks	<input type="checkbox"/>
Corrosion	<input type="checkbox"/>	Abrasion	<input type="checkbox"/>	Straightness	<input type="checkbox"/>	Welds	<input type="checkbox"/>	Other	<input type="checkbox"/>

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**Insert:** Length \_\_\_\_\_ ft Manufacturing Code \_\_\_\_\_ Part Number \_\_\_\_\_

Dents	<input type="checkbox"/>	Bends	<input type="checkbox"/>	Kinks	<input type="checkbox"/>	Cracks	<input type="checkbox"/>	Breaks	<input type="checkbox"/>
Corrosion	<input type="checkbox"/>	Abrasion	<input type="checkbox"/>	Straightness	<input type="checkbox"/>	Welds	<input type="checkbox"/>	Other	<input type="checkbox"/>

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**Insert:** Length \_\_\_\_\_ ft Manufacturing Code \_\_\_\_\_ Part Number \_\_\_\_\_

Dents	<input type="checkbox"/>	Bends	<input type="checkbox"/>	Kinks	<input type="checkbox"/>	Cracks	<input type="checkbox"/>	Breaks	<input type="checkbox"/>
Corrosion	<input type="checkbox"/>	Abrasion	<input type="checkbox"/>	Straightness	<input type="checkbox"/>	Welds	<input type="checkbox"/>	Other	<input type="checkbox"/>

NOTES

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DRAW SKETCHES OR ATTACH PHOTOGRAPHS HERE AND NEXT PAGE

