ATTENTION: CHIEF ENGINEER

SUBJECT: WELD INSPECTION & REPAIR REQUIRED ON THE MAIN BOOM.

BACKGROUND:
A potential weld nonconformance has been identified on the main boom weldment of the Knuckleboom crane, model K80-65.

The units affected are serial number: 1974, 1975, 1993, 2020, 2034, 2036, 2088, 2193, 2194, and 2213. The identified welds on these units must be inspected immediately and repaired, if necessary. Additionally, each unit must add a reinforcement kit (ASC P/N: 83383).

To provide a valid shipping address for the reinforcement kit, or for any other questions, please contact:
Allied Systems Company
Service Department
(503) 625-2560
service@alliedsystems.com

CORRECTIVE ACTION:
Perform an NDT on the weld surfaces identified in Figure 1, per the inspection procedure outlined below. Correct any welds that are found undersized or have any indications of cracks. If welds are found to be severely cracked and show brown leaking Cortec, follow the weld repair procedure below.

Weld re-enforcement kit doubler plates in place using a certified welder, and an approved weld procedure for A514 to A514 steel.

INSPECTION PROCEDURE:

1. Remove the paint and clean the weld surface of all dirt, oil, grease, or debris. Document any brown Cortec fluid leaking from welds.

2. Perform a visual inspection according to AWS D1.1, Section 6.9.

3. Perform NDT according to AWS D1.1, Section 6.10 (ASTM E165).

4. The examination results will determine the repair procedure.
   a. If no defects in the weld surface are identified, immediately install the reinforcement kit according to the reinforcement kit installation procedure below.
   b. If defects in the weld surfaces are identified, the welds must first be repaired according to the weld repair procedure, before moving on to the reinforcement kit installation procedure.
Figure 1. Main Boom Inspection, K80-65
WELD REPAIR PROCEDURE:

Preparation

The inside of the boom is filled with Cortec VPCI-368M corrosion inhibitor. This material is thinned out with mineral spirits.

Potential Hazards

Flammability - refer to the information regarding Cortec VpCI-368M and the mineral spirits below.

Structural Considerations

- Structural Support – the crane is blocked up at the jib.
- Boom Alignment - the boom alignment should not be affected by this repair.
- Additional stresses due to the method of boom support during welding - the boom cylinders are configured as single acting rams so the weight of the booms are the only forces on the boom.

Cortec VpCI-368M Information

- Technical service engineer contact number: 1-651-407-2730
- Ignition Temperature = 410°F
- Material can be removed using an alkaline cleaner such as Simple Green®, or dish soap mixed with hot water. Use the cleaner in a power washer or steam cleaner to get the best results.
- Requires proper ventilation during welding to remove vapors.
- Clean thoroughly 1-2 feet away from the weld.
- If it’s a liquid, then it is mostly mineral spirits and will be more flammable.
- The product is organic and will simply decompose.

Position and Support the Crane for Repair

Position the crane as shown in Figures 2 & 3. The jib boom tip must be supported at all times, while the repairs are underway.
Figure 2. Boom Repair Position
Figure 3. Boom Repair Position

Weld Repair Procedure – Step 1

A. Protect the cab and glass with weld blankets and plywood over the top glass. Protect the hoses and cylinders with weld blankets during cutting, welding, and grinding operations. With personnel in a man-basket, use a mag drill to drill a vent hole in the vertical plate, on center, and 36” from the base plate, as shown in Figure 4. The coating inside is flammable, but not explosive. Use cutting fluid to keep the temperature down below the combustion temperatures of the coatings inside. The material is ½” thickness, ASTM A-514. This hole will be used to purge flammable vapors from the cavity. Choose a hole size appropriate for the pipe bung and plug that will be welded into it. The hole can be up to 3” in diameter.

B. Next, use an inert gas to purge the flammable vapors from the cavity. There should be a pipe bung located on the bottom surface of this section of the boom and the new hole in the top of the boom. Put gas in one hole to fill the void with inert gas and to purge the flammable vapors out the other hole.

C. With the cavity purged, use a cutting torch to create an access hole in the boom, as shown in Figures 4 & 5. The plate that is removed will weigh ~36 lbs. The area will be well ventilated, but personnel must be mindful of fumes in the area and modify the plan if the ventilation is not adequate.

D. If the Jib latch is removed during this step, save for later so it can be reinstalled.
Figure 4. Access Hole Drawing

Figure 5. Access Hole Location
Weld Repair Procedure – Step 2

Use a steam cleaner with Simple Green®, dish soap or some other alkaline cleaner to remove the Cortec VpCI-368M coating within 1-2 feet of the weld area. This will include not only the crack area but also around the new access hole and the new hole for the pipe bung. Use a shop vacuum to remove as much of the moisture as possible once the area is clean.

Weld Repair Procedure – Step 3

Use a drill or die grinder to create round features on the ends of the cracked area to keep the crack from propagating, as shown in Figure 6. Use a grinder to completely remove the cracked weld.

![Figure 6. Remove Cracked Weld](image)

Weld Repair Procedure – Step 4

Prepare the crack area for the new weld by cleaning the crack area once again, to remove any additional Cortec VpCI-368M coating and to finalize the weld preparation.

Weld Repair Procedure – Step 5

Weld the crack, according to Allied SOP 011-5.2 in Appendix A, or equivalent Navy weld procedure, as shown in Figure 7. Wait 48 hours, then NDT the area according to steps 1 through 3 of the above inspection procedure.

Weld Repair Procedure – Step 6

Re-coat the inside of the boom around the repaired crack with Cortec VpCI-368M, then patch the area where the new access hole was cut, as shown in Figure 8. Join using a 1/2" fillet weld all around, following Allied SOP 011-15.1, found in Appendix A, or equivalent Navy weld procedure. The material is ASTM A-514 TO ASTM A-514. The plate weighs ~45 lbs. Weld a pipe bung into the vent hole and plug.
Figure 7. Repair Cracked Weld
Figure 8. Access Hole Patch
REINFORCEMENT KIT INSTALLATION PROCEDURE

Reinforcement Kit Installation Procedure – Step 1

Add the doubler plate (ASC P/N: 83257) over the area, shown in Figure 9. When fitting the plate, fill with weld, any gaps greater than 1/8” before welding. In the area where the weld wraps around the plate, grind a bevel on the existing plates to allow a more fluid weld wrap. Join using a ½” fillet weld all around following Allied SOP 011-15.1, found in Appendix A, or equivalent Navy weld procedure. The material is ASTM A-514 TO ASTM A-514. The plate weighs ~100 lbs. Install remaining doubler plates in accordance with figure 10. Wait 48 hours then NDT all weld areas according to steps 1 through 3 of the above examination procedure.

Figure 9. Doubler Plate Install
Reinforcement Kit Installation Procedure – Step 2

Refer to Figure 10 and follow the Reinforcement Kit drawing, ASC P/N: 83383, found in Appendix B, for the application of the reinforcement plates (ASC P/N: 83343 & 83345). Wait 48 hours then NDT all weld areas according to steps 1 through 3 of the above examination procedure. This drawing also provides instructions for adding clamps back to the underside of the boom. In this reinforcement kit, some of these clamps and clamp mountings have been changed to allow the plumbing to route around the new reinforcement plates while still maintaining clearance between the underside of the boom and the top of the cab.

**Note:** After weld repair is complete, a weight test is required.
Reinforcement Kit Installation Procedure – Step 3

If removed, weld the jib lock back in place and check the fit. If it is mounted to the new patch plate, the finger on the jib boom sheave case may need to be trimmed back ½" or relocated to work properly due to the extra ½" plate it is mounted to. If the jib finger is trimmed back, remove and relocate the gussets on the jib finger to give the latch a larger target. These gussets account for movement of the jib boom inside the main boom and prevent the jib finger from slipping off to the side and then past the latch, see Figure 11.

Additional Jib Lock Information – How it Works

Figure 11. Jib Lock Attachment
When the main boom is down, an adjustable piece on the cab holds the linkage up in place. As the jib is brought back inside the main boom, the finger on the main boom pushes in the spring loaded latch until it moves past at which time the spring loaded latch pops back out and captures the jib finger. This mechanism keeps the jib from drifting down over time.

Once the operator is ready to use the crane again, he raises the main boom, moving the adjustable piece on the cab away from the linkage. This allows the linkage to drop away and the entire assembly to tilt down, allowing the jib finger to move past the spring loaded latch.

When setting up the jib latch, be cautious of the force applied to the adjustable piece on the cab. This piece is used to push the linkage into place and to hold the links slightly less than in-line. If this pushes the linkage over center, the jib latch may hang up / not drop away when it needs to. If this adjustable piece is adjusted too high, then the boom can put too much force on the piece and cause it to break the bolts holding it to the cab. Reference Figure 12.

![Jib Latch Diagram](image-url)
Allied Weld SOP
INTENTIONALLY LEFT BLANK
SOP No.: 011-5.2  Material Spec.: A514 to A514, A572 or A36 (Group II)
Revision: 5  Material Thickness: 1/2” Maximum
Revised Date: 4/26/2011  Diameter (pipe): Greater than 24”
Revised by: B. Tanner  Groove Thickness: Unlimited
Approved by: B. Tanner, B. Nourse  Fillet Thickness:
Implementations date: 9/1/2000  Supporting PQR: 689-96027-14e & 689-96027-14d

JOINT DESIGN USED

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</tr>
<tr>
<td>Back Gouging (Method):</td>
</tr>
<tr>
<td>Root Opening: T thru 2T -1/16”</td>
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<td>Root Face Dimension:</td>
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<td>Groove Angle:</td>
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<td>Radius (J-U):</td>
</tr>
<tr>
<td>Position (Groove): Flat</td>
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<tr>
<td>Position (Fillet):</td>
</tr>
<tr>
<td>Vertical Progression: Up Down</td>
</tr>
</tbody>
</table>

FILLER METALS
AWS Specification: A5.20
AWS Classification: E71T-1CJ/T-12CJ

TECHNIQUE
Stringer or Weave Bead: Stringer 1/4”
Multi-pass or Single Pass (per side): Multi-pass
Contact Tube or Work Distance: 1/2” to 1”
Peening: None
Interpass Cleaning: Weld slag removed

SHIELDING
Flux:  Gas: CO₂
Composition: 100%
Electrode-Flux (Class): Flow Rate: 40-50 CFH
Cas Cup Size: #6

TUNGSTEN ELECTRODE (GTAW if Applicable)
Size: N.A.
Type: N.A.

POST WELD HEAT TREATEMENT
Temperature: N.A.
Time: N.A.

WELDING PROCEDURE

<table>
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<tr>
<th>Pass or Weld Layer(s)</th>
<th>Process</th>
<th>Filler Metals</th>
<th>Current</th>
<th>Volts</th>
<th>Travel Speed (IPM)</th>
<th>Note</th>
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<td>E71T-1</td>
<td>.052”</td>
<td>DCEP</td>
<td>220-260</td>
<td>28-30</td>
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</table>

* Temperature to be checked 3” on each side of weld joint.

Charpy Test Record: 0689106-46a  0689106-46b
Heat Zone Average: 73 Ft Lbs @ -40
Weld Zone Average: 25 Ft Lbs @ -40

Form 60-132, 8/09
**ENGINEERING SOP (WPS)**

**PJP Butt Joint or Corner Joint**

---

**JOINT DESIGN USED**

- Prequalified: BC-P2-GF
- Single
- Double Weld
- Backing Material:
- Back Gouging (Method):
- Root Opening: 0
- Root Face Dimension: 1/32" Minimum
- Groove Angle: 60°
- Radius (J-U):
- Position (Groove): Flat, Horizontal, Vertical
- Position (Fillet):
- Vertical Progression: X Up Down

**FILLER METALS**

- AWS Specification: A5.29
- AWS Classification: E81T1-K2C-H8

**TECHNIQUE**

- Stringer or Weave Bead: Stringer 1/4"
- Multi-pass or Single Pass (per side): Single
- Contact Tube or Work Distance: 1/2" to 1"
- Peening: None
- Interpass Cleaning: Weld slag removed

**SHIELDING**

- Flux: 
- Gas: CO₂
- Composition: 100%
- Electrode-Flux (Class): Flow Rate: 40-50 CFH
- Cas Cup Size: #6

**TUNGSTEN ELECTRODE (GTAW if Applicable)**

- Size: N.A.
- Type: N.A.

**POST WELD HEAT TREATMENT**

- Temperature: N.A.
- Time: N.A.

**PREHEAT**

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<th>Preheat Temp °F</th>
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<td>3/4&quot; to 1 1/2&quot;</td>
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<tr>
<td>1 1/2&quot; to 2 1/2&quot;</td>
<td>200</td>
<td>350</td>
</tr>
<tr>
<td>2 1/2&quot; and up</td>
<td>200</td>
<td>350</td>
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*Temperature to be checked 3" on each side of weld joint.*

Charpy Test Record: 
- Heat Zone Average: 
- Weld Zone Average: 48 Ft Lbs @ -40

---

**UNFEED METALS**

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<tr>
<th>AWS Specification</th>
<th>Brand</th>
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<tr>
<td>A514 to A514, A572 or A36 (Group I &amp; II)</td>
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**WELDING PROCEDURE**

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<th>Current</th>
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<th>Travel Speed (IPM)</th>
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<td>Flat and Horizontal</td>
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**RELEVANT QUALITY MANUAL SECTION(S) (if applicable):**

6.2.2, API-2C Section 15.1, and API-2C Section 15.2

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**Note**

Relevant Quality Manual Section(s) (if applicable): 6.2.2, API-2C Section 15.1, and API-2C Section 15.2
This document is potentially obsolete when printed. Employees must ensure they are using the correct revision level of this document by checking the document revision level in the ASC viewer.

**Procedure no.:** 011-15.1  
**Revision:** 7-1  
**Revised date:** 10/20/2017  
**Revised by:** J. Dryden  
**Prepared by:**  
**Approved by:** M. Albertson  
**Implementation date:** 9/1/2000  
**Q Rep:**  
**Page:** 1 of 1  

**Material Spec.:** A514 to A514, A572, A36, and API X52  
**Material Thickness:** Unlimited  
**Diameter (pipe):** Greater than 24"  
**Groove Thickness:**  

### JOINT DESIGN USED
- **Prequalified:** Fillet (D1.1 Section 3.9)  
- **Single**  
- **Double**  
- **Backing Material:**  
  - **Back Gouging (Method):**  
- **Root Opening:** 0  
- **Root Face Dimension:**  
- **Groove Angle:**  
- **Radius (J-U):**  
- **Position (Groove):**  
- **Position (Fillet):** All  
- **Vertical Progression:** X UP Down

### FILLER METALS
- **AWS Specification:** A5.29  
- **AWS Classification:** E81T1-K2C-H8  

### TECHNIQUE
- **Stringer or Weave Bead:** Stringer 1/4"  
- **Multi-pass or Single Pass (per side):** Multi-pass  
- **Contact Tube or Work Distance:** 1/2" to 1"  
- **Peening:** None  
- **Interpass Cleaning:** Weld slag removed  
- **Number Of Electrodes:**  

### SHIELDING
- **Flux:**  
- **Gas:** CO₂  
- **Composition:** 100%  
- **Flow Rate:** 40-50 CFH  
- **Cass Cup Size:** #6

### TUNGSTEN ELECTRODE (GTAW if Applicable)
- **Size:** N.A.  
- **Type:** N.A.

### POST WELD HEAT TREATEMENT
- **Temperature:** N.A.  
- **Time:** N.A.

### FILLER METALS
- **Brand:** ESAB  

### Min./Max. Preheat and Interpass Temperatures*  
<table>
<thead>
<tr>
<th>Thickness of thickest part at point of welding</th>
<th>Min. Temp °F</th>
<th>Max. Temp °F</th>
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<tbody>
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<td>up to 3/4&quot;</td>
<td>200</td>
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<td>Over 3/4&quot; thru 1 1/2&quot;</td>
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<tr>
<td>Over 1 1/2&quot; thru 2 1/2&quot;</td>
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<tr>
<td>Over 2 1/2&quot; and up</td>
<td>200</td>
<td>350</td>
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</tbody>
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* Temperature to be checked 3" on each side of weld joint.

**Charpy Test Record:**  
**Heat Zone Average:**  
**Weld Zone Average:** 48 Ft Lbs @ -40

### WELDING PROCEDURE
- **Pass or Weld Layer(s):**  
  - **Process:** FCAW  
  - **Filler Metals:** E81T1-K2  
  - **Current:** DCEP  
  - **Volts:** 305-310  
  - **Travel Speed (IPM):** 14.5-22

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<th>Process</th>
<th>Filler Metals</th>
<th>Current</th>
<th>Volts</th>
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<td>E81T1-K2</td>
<td>DCEP</td>
<td>305-310</td>
<td>14.5-22</td>
<td>Flat and Horizontal</td>
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## Joint Design Used

- Prequalified: **Fillet (D1.1 Section 3.9)**
- Single
- Double Weld
- Backing Material: 
  - Back Gouging (Method): 
- Root Opening: 0
- Root Face Dimension: 
- Groove Angle: 
- Radius (J-U): 
- Position (Groove): 
- Position (Fillet): Flat or Horizontal
- Vertical Progression: Up Down

## Filler Metals

- AWS Specification: A5.22
- AWS Classification: E309LT1-1

## Technique

- Stringer or Weave Bead: Stringer
- Multi-pass or Single Pass (per side): Multi-pass
- Contact Tube or Work Distance: 1/2" to 1"
- Peening: None
- Interpass Cleaning: Weld slag removed

## Shielding

- Gas: 75% AR, 25% CO₂
- Composition: 
- Electrode-Flux (Class): Flow Rate: 25-35 cfm
- Cas Cup Size: __________

## Tungsten Electrode (GTAW if Applicable)

- Size: N.A.
- Type: N.A.

## Welding Procedure

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**ENGINEERING SOP (WPS)**

**Single-Bevel-Groove Butt, T and Corner Joints**

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<th>Material Spec.:</th>
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<td>Revised Date:</td>
<td>10/20/2017</td>
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<td>Revised by:</td>
<td>J. Dryden</td>
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<td>M. Albertson</td>
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**JOINT DESIGN USED**

- Prequalified: 
  - Single
- Double Weld
- Backing Material: 
- Back Gouging (Method): 
- Root Opening: 0
- Root Face Dimension: 1/8" Min.
- Groove Angle: 45°
- Radius (J-U): 
- Position (Groove): All
- Position (Fillet): All
- Vertical Progression: X Up Down

**FILLER METALS**

AWS Specification: A5.29
AWS Classification: E81T1-K2C-H8

**TECHNIQUE**

- Stringer or Weave Bead: Stringer
- Multi-pass or Single Pass (per side): Multi-pass
- Contact Tube or Work Distance: 1/2" to 1"
- Peening: None
- Interpass Cleaning: Weld slag removed

**SHIELDING**

- Flux: 
  - Gas: CO₂
  - Composition: 100%
- Electrode-Flux (Class): 
  - Flow Rate: 40-50 CFH
  - Cas Cup Size: #6

**TUNGSTEN ELECTRODE (GTAW if Applicable)**

- Size: N.A.
- Type: N.A.

**POST WELD HEAT TREATMENT**

- Temperature: N.A.
- Time: N.A.

**WELDING PROCEDURE**

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<thead>
<tr>
<th>Pass or Weld Layer(s)</th>
<th>Process</th>
<th>Filler Metals</th>
<th>Current</th>
<th>Volts</th>
<th>Travel Speed (IPM)</th>
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<td>DCEP</td>
<td>305-310</td>
<td>25</td>
<td>14.5-22</td>
</tr>
</tbody>
</table>

*Temperature to be checked 3" on each side of weld joint.*

**Min./Max. Preheat and Interpass Temperatures**

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<thead>
<tr>
<th>Thickness of thickest part at point of welding</th>
<th>Min. Temp °F</th>
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<tr>
<td>Over 2 1/2&quot; and up</td>
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Charpy Test Record:
Heat Zone Average: 
Weld Zone Average: 48 Ft Lbs @ -40
Reinforcement Kit & Jib Latch Install Drawings
BILL OF MATERIAL

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<th>DESCRIPTION</th>
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<td>COVER ASSY (LM)</td>
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<td>COVER ASSY (RP)</td>
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<td>CLAMP ASSEMBLY, REWORK</td>
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<td>247151</td>
<td>PLATE, WELD; SP-3-304SS</td>
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<td>RAIL; FOR MTG CLAMPS 46&quot; LG</td>
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IN AREAS WHERE WELD WRAPS AROUND EDGES, GRIND A BEVEL IN THE EXISTING PLATES TO ALLOW A WELD TRANSITION OF CONSTANT SIZE.

REMOVE EXISTING CHANNEL

SECTION C-C

SECTION B-B

DETAIL A

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3/8" X 45° CHAMFER FOR BEVEL WELD PREP

MAXIMUM GAP 1/4"

MAXIMUM GAP 1/4"

MAXIMUM OFFSET BETWEEN COVER PLATES AND TOP OF BOOM 1/4"

USE COVER AND GUSSET ASSEMBLY TO LOCATE PARTS TACK IN PLACE AND REMOVE COVER PLATES TO FINISH WELD

COVER PLATE

GUSSET

8.5" X 45° CHAMFER FOR BEVEL WELD PREP
POSITION AND WELD ALL COMPONENTS IN FINAL ASSEMBLY AFTER THE JIB, MAIN BOOM, TURRET, AND OPERATOR'S CAB HAVE BEEN ASSEMBLED.

USE ITEM #3 TO LOCATE DRILL & TAP HOLES.

DRILL 0.201" X 0.50 DEEP TAP 1/4-20NC 0.25 DEEP (6 PLCS)