

# WP 05-WH1743

Revision 6

## Bridge Mounted Power Manipulator 41-T-101

Technical Procedure

EFFECTIVE DATE: 06/24/09

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APPROVED FOR USE

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## INTRODUCTION<sup>1,2</sup>

This procedure provides the instructions for inspecting and operating the Bridge Mounted Power Manipulator, 41-T-101, at the Waste Isolation Pilot Plant (WIPP).

The performance of this procedure generates quality records in the Equipment Logbook.

## REFERENCES

### BASELINE DOCUMENTS

- Title 40 *Code of Federal Regulations* (CFR) §264.15, "General Inspection Requirements"
- DOE Standard 1090-2007, *Hoisting and Rigging*
- DOE/WIPP-07-3372, *Waste Isolation Pilot Plant Documented Safety Analysis*
- 41-T-101, *Operation and Maintenance Manual - GCA/ISG Model 6000 Manipulator Bridge Mounted System*

### REFERENCED DOCUMENTS

- WP 04-IM1000, Issues Management Processing of WIPP Forms
- EA04IM1000-1-0, WIPP Form

## PRECAUTIONS AND LIMITATIONS

- Preoperational Checks are to be completed prior to the operation of the manipulator on each shift.
- Only personnel qualified as Waste Handling Technician/Engineer (WHT/WHE), or trainees under the direct supervision of a qualified WHT/WHE, are authorized to perform the activities specified in this procedure.
- If procedure cannot be performed as written or in sequence, WHE shall be contacted.
- Energize each motion gradually and avoid abrupt, jerky movement of the load.
- Under normal conditions, stop the manipulator trolley, bridge, or hoist prior to engaging limit switches to prevent equipment damage.

- When crossing under the hot cell bridge crane or vice versa in the east/west direction, the hot cell bridge crane grapple is required to be at its highest point and a minimum distance of 4' 6" between the centerline of the hot cell trolley and the manipulator trolley.
- Lifts must not be made above safe capacities. Capacities are as follows:
  - Shoulder Hook 5,000 lb
  - Hook hand with arm in vertical position 1,000 lb
  - Hand in any other position besides vertical 400 lb
- A load suspended from the manipulator or hoist must not be left unattended.
- Safety glasses and a long-sleeve 100% cotton shirt must be worn when opening and closing breakers.

## PREREQUISITE ACTIONS

- 1.0 Review Equipment Logbook for outstanding deficiencies and Action Requests (ARs).
- 2.0 **IF** any concerns of the safe condition of manipulator exist, **THEN** notify WHE immediately.
- 3.0 If a required inspection goes delinquent, perform the following:
  - 3.1 Immediately notify Site Environmental Compliance (SEC) of the delinquent inspection.
  - 3.2 Schedule and complete the inspection.
  - 3.3 Document the following in a letter to SEC within five working days:
    - 3.3.1 Schedule of inspection.
    - 3.3.2 Reason(s) why the inspection was not performed.
    - 3.3.3 Any measures taken to offset the negative impacts resulting from not performing the inspection.
    - 3.3.4 Actions to prevent further delinquencies.
- 4.0 Waste Handling (WH), **GO TO** WP 04-IM1000 and determine if a WIPP Form (EA04IM1000-1-0) is required.
- 5.0 Record Equipment Number and Not Applicable (N/A) run hours in the Equipment Logbook.

- 6.0 WHE, review Equipment Logbook on a weekly basis, generally the last day of the work week.

## PERFORMANCE

### 1.0 PREOPERATIONAL CHECKS<sup>4</sup>

- 1.1 Ensure the hot cell crane is positioned so that it will not interfere with manipulator preoperational checks.

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#### NOTE

If waste is present in the hot cell, the following steps must be performed visually using the closed-circuit television (CCTV) system or hot cell windows.

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- 1.2 Perform the following before energizing the manipulator.
- 1.2.1 Inspect the manipulator for wear and damage.
  - 1.2.2 Ensure bridge path is clear of obstructions.
  - 1.2.3 Ensure carriage path is clear of obstructions.
  - 1.2.4 Verify **NO** oil leakage from the manipulator mechanisms.
  - 1.2.5 Check calibration sticker on the power manipulator control panel (41-P-002A) for calibration due date.
  - 1.2.6 Indicate in the Equipment Logbook if the inspection due date is less than 30 days away.
- 1.3 Energize the power manipulator as follows:
- 1.3.1 Ensure that CB-5B 41-T-101, 41P002A, 41-P-002B, BRIDGE POWER MANIPULATOR breaker is **ON** at 41-P-MCC04/2.
  - 1.3.2 Ensure the MANIPULATOR DISCONNECT (41-P-002A) is **ON**.
  - 1.3.3 **IF** the Panel View Operator interface is **OFF**, **THEN** depress the PROCESSOR START button on 41-P-002A.
  - 1.3.4 Ensure the START-UP SCREEN is displayed on 411-CP-125-101.
  - 1.3.5 From the START-UP SCREEN perform one of the following:
    - [ A ] **IF** the START BUTTON is visible, **THEN** press the START BUTTON.

- [ B ] **IF** the MOTOR DRIVES POWER CONTRL is DISABLED, **THEN** pull out the depressed E-Stop and press the START BUTTON.

1.3.6 Ensure the MAIN CONTACT is CLOSED.

### CAUTION

To prevent contact between the hot cell crane trolley and the power manipulator trolley, a minimum distance of 4' 6" between center lines must be maintained.

- 1.4 Test the power manipulator controls at the POWER MANIPULATOR control console (411-CP-125-101) in the hot cell gallery as follows:
- 1.4.1 Ensure hoist tracks correctly in the up and down position.
  - 1.4.2 Ensure hoist upper limit stops the hoist.
  - 1.4.3 Ensure trolley tracks correctly in north and south directions.
  - 1.4.4 **Visually ensure trolley decreases speed when tracking close to north wall.**<sup>3</sup>

### CAUTION

To prevent contact between the hot cell crane trolley and the power manipulator trolley, a minimum distance of 4' 6" between center lines must be maintained.

- 1.4.5 Ensure bridge tracks correctly in east and west directions.
- 1.4.6 **Visually verify bridge decreases speed when tracking close to west wall.**<sup>3</sup>
- 1.4.7 Perform the following at 411-CP-125-101:
  - Hold the SHOULDER ROTATE control towards SHOULDER ROTATE CW (clockwise) and ensure shoulder rotation moves in the CW direction.
  - Hold the SHOULDER ROTATE control towards SHOULDER ROTATE CCW (counter- clockwise) and ensure shoulder rotation moves in the CCW direction.

- Hold the SHOULDER PIVOT control towards SHOULDER PIVOT YELLOW and ensure the shoulder pivots in the yellow direction.
  - Hold the SHOULDER PIVOT control towards SHOULDER PIVOT BLUE and ensure the shoulder pivots in the blue direction.
  - Hold the ELBOW PIVOT control towards ELBOW PIVOT YELLOW and ensure the elbow pivots in the yellow direction.
  - Hold the ELBOW PIVOT control towards ELBOW PIVOT BLUE and ensure the elbow pivots in the blue direction.
  - Hold the WRIST PIVOT control towards WRIST PIVOT YELLOW and ensure the wrist pivots in the yellow direction.
  - Hold the WRIST PIVOT control towards WRIST PIVOT BLUE and ensure the wrist pivots in the blue direction.
  - Hold the WRIST ROTATE control towards WRIST ROTATE CW direction and ensure wrist rotation in the CW direction.
  - Hold the WRIST ROTATE control towards WRIST ROTATE CCW direction and ensure wrist rotation in the CCW direction.
  - Hold the WRIST EXTEND/RETRACT control towards EXTEND wrist direction and ensure the wrist mechanism extends.
  - Hold the WRIST EXTEND/RETRACT control towards RETRACT wrist direction and ensure the wrist mechanisms retracts.
- 1.4.8 From the RUN SCREEN ensure SET TO CLOSE GRIP is selected then press and hold the RUN GRIP button and ensure the gripper mechanism closes.
- 1.4.9 From the RUN SCREEN ensure SET TO OPEN GRIP is selected then press and hold the RUN GRIP button and ensure the gripper mechanism opens.
- 1.5 If it is desired to de-energize the power manipulator, perform the following:
- 1.5.1 Depress the STOP button on the START-UP or RUN SCREEN.
- 1.5.2 Ensure the MOTOR CONTACT is OPEN.

- 1.5.3 Select SHUT DOWN screen.
- 1.5.4 Depress the SHUT DOWN button.
- 1.5.5 If needed, turn the MANIPULATOR DISCONNECT (41-P-002A) to **OFF**.
- 1.6 Perform the following:
  - 1.6.1 Initiate ARs to address any deficiencies discovered during Preoperational Checks and the status of each (i.e., deficiencies corrected and ARs generated).
  - 1.6.2 Notify WHE and report status of Preoperational Check.
- 1.7 Record the following information in Equipment Logbook:
  - Deficiencies noted
  - Corrective actions taken (outstanding/newly generated ARs, etc.)
- 1.8 Enter time, date, and signature in Equipment Logbook to document performance of Preoperational Checks.
- 2.0 **POWER MANIPULATOR START-UP AND OPERATION<sup>4</sup>**
  - 2.1 Energize the power manipulator as follows:
    - 2.1.1 Ensure the MANIPULATOR DISCONNECT is **ON** at the control panel (41-P-002A).
    - 2.1.2 **IF** the screen on 411-CP-125-101 is **OFF**, **THEN** depress the PROCESSOR START button on 41-P-002A.
    - 2.1.3 Ensure the Initial START-UP screen is displayed on 411-CP-125-101.
    - 2.1.4 Push the green START button.
    - 2.1.5 Ensure the MAIN CONTACT is CLOSED.

- 2.2 Ensure the end of arm CCTV camera is **ON**.

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**NOTE**

Motion control switches combine a switch with a speed variation potentiometer. The further the switch is held in the intended direction of travel, the faster motion occurs.

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- 2.3 Spot the trolley and hoist over the load/job using the appropriate controls.
- 2.4 Align the hoist or tool to perform the lift or work using the appropriate controls.
- 2.5 **IF** a load is to be lifted,  
**THEN** perform the following:

**WARNING**

In order to avoid risk of injury lifts above safe capacities must not be made. Maximum capacity for shoulder hook is 5,000 lb, for the hook hand with the arm in the vertical position 1,000 lb, and for the wrist/hand in any other position is 400 lb.

- 2.5.1 Ensure the load is properly connected.
- 2.5.2 Lift the load until the load is clear of all obstructions.
- 2.6 Spot the load at the desired position using the appropriate controls.
- 2.7 **WHEN** the load is spotted,  
**THEN** lower the load.
- 3.0 CHANGING THE CONTROL PANEL LOCATION
- 3.1 Depress one of the manipulator E-STOP buttons.
- 3.2 Disconnect the yellow control panel cable from the connection box.
- 3.3 Reconnect the cable to the desired connection box.
- 3.4 Reset the E-STOP button.
- 4.0 **CHANGING MANIPULATOR ATTACHMENTS**<sup>4</sup>
- 4.1 To remove a hand attachment, perform the following:
- 4.1.1 Ensure the hand or hook is fully closed.

- 4.1.2 Fully extend the wrist.
- 4.1.3 **IF** hook hand is being removed,  
**THEN** rotate the wrist so that the hook will rest in the notch in the support plate.
- 4.1.4 **IF** parallel jaw hand is being removed,  
**THEN** rotate the wrist so the parallel jaws will rest flat on the support plate.
- 4.1.5 Align arm with hand storage fixture.
- 4.1.6 Align the wrist detent collar with the U-plate in the hand storage fixture.
- 4.1.7 Lower the arm into the hand storage fixture so the wrist detent collar rests in the U-plate in the fixture.

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**NOTE**

The wrist is withdrawn from the hand as the spring loaded detent collar is depressed by the U-plate fixture.

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- 4.1.8 Fully retract the wrist.
- 4.2 To attach a hand perform the following:
  - 4.2.1 Fully retract the wrist.
  - 4.2.2 Align the wrist with the hand in the hand storage fixture.

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**NOTE**

The wrist is connected to the hand as the spring loaded detent collar is depressed by the U-plate fixture.

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- 4.2.3 **WHEN** the wrist is aligned with the hand,  
**THEN** fully extend the wrist.

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**NOTE**

The wrist assembly has a groove which is partially or entirely hidden by the detent collar when the hand is seated and locked to the wrist.

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- 4.2.4 To prevent dropping the hand during use, inspect the wrist/hand connection for proper seating prior to removing the hand from the hand storage fixture.
- 4.3 From the RUN SCREEN, ensure TOOL SELECT position is selected.

- 4.4 Pick up the impact wrench with the override socket adapter as follows:
- 4.4.1 Pivot the wrist to align the protective plug in the wrist receptacle with the plug storage slot.
  - 4.4.2 Lower the hoist until the protective plug depresses the retainer plate under the plug storage slot.
  - 4.4.3 Ensure the protective plug is aligned to move into the slot.
  - 4.4.4 Move the trolley to slide protective plug into the slot.
  - 4.4.5 Ensure the protective plug travels to the back of the slot for storage.
  - 4.4.6 Raise the HOIST to remove the protective plug from the wrist receptacle.
  - 4.4.7 Ensure the hook hand is attached.
  - 4.4.8 Ensure the hook hand is fully open.
  - 4.4.9 Align the hook with the impact wrench with the override socket adapter lift fixture.
  - 4.4.10 Move the hook to pass through the wrench slot and engage the lift fixture.
  - 4.4.11 Raise the hoist and wrench.
  - 4.4.12 **WHEN** the wrench is clear of the tube,  
**THEN** fully extend the wrist.
  - 4.4.13 Close the hand.
  - 4.4.14 Align the wrist receptacle with the power plug in the storage slot.
  - 4.4.15 Lower the hoist to insert the power plug into the wrist receptacle.
  - 4.4.16 Move the trolley to slide the power plug out of the storage slot.
  - 4.4.17 From the RUN SCREEN, test the impact wrench with the override socket adapter in CW and CCW directions using TOOL POWER controls.
    - [ A ] Ensure TOOL SELECT position is selected.
    - [ B ] Choose the FWD or REV direction.

[ C ] Press the RUN TOOL button.

- 4.5 Remove the impact wrench with the override socket adapter as follows:
  - 4.5.1 Pivot the wrist to align the power plug in the wrist receptacle with the plug storage slot.
  - 4.5.2 Lower the hoist until the power plug depresses the retainer plate under the plug storage slot.
  - 4.5.3 Ensure the power plug is aligned to move into the slot.
  - 4.5.4 Move the carriage to slide power plug into the slot.
  - 4.5.5 Ensure the power plug travels to the back of the slot for storage.
  - 4.5.6 Raise the HOIST to remove the power plug from the wrist receptacle.
  - 4.5.7 Align the wrist receptacle with the protective plug in the storage slot.
  - 4.5.8 Lower the hoist to insert the protective plug into the wrist receptacle.
  - 4.5.9 Move the trolley to slide the protective plug out of the storage slot.
  - 4.5.10 Position the wrist/impact wrench with the override socket adapter in the vertical position.
  - 4.5.11 Align the impact wrench with the override socket adapter with the wrench storage tube.
  - 4.5.12 Fully open the hook hand.
  - 4.5.13 Lower the hoist to insert the impact wrench with the override socket adapter in the storage tube.

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**NOTE**

There is a hole in the bottom of the storage tube to accept the drive head. When the wrench is properly stored, the wrench lift fixture sits flush on top of the storage tube.

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- 4.5.14 Ensure the impact wrench with the override socket adapter is correctly stored.
- 4.5.15 Disengage the hook from the wrench lifting fixture.

#### 4.6 POWER MANIPULATOR SHUTDOWN

- 4.6.1 Remove and secure any attached load.
- 4.6.2 Raise the hoist to a safe configuration using HOIST UP.
- 4.6.3 Depress the STOP button on the START SCREEN.
- 4.6.4 Ensure the MAIN CONTACT is OPEN.
- 4.6.5 Select SHUT DOWN screen.
- 4.6.6 Depress the SHUT DOWN button.
- 4.6.7 **IF** needed, turn the MANIPULATOR DISCONNECT (41-P-002A) to **OFF**.