

# PALO VERDE NUCLEAR GENERATING STATION

## Mechanical Maintenance

### Lab



<b>Mechanical Maintenance Training</b>	<b>Date: February 13, 2007</b>
<b>LP Number: NME15L000401</b>	<b>Rev Author: Curt Cluff</b>
<b>Title: Multi Stud Tensioner Practical</b>	<b>Technical Review:</b>
<b>Duration : 10 Hours</b>	<b>Teaching Approval:</b>

**INITIATING DOCUMENTS:**

Task Analysis of Tasks

**REQUIRED TOPICS**

NONE

**CONTENT REFERENCES**

31MT-9RC30: Reactor Vessel Head Removal and Installation

Maintenance and Operating Manual: Modification of Multi-Stud Tensioning System, Wenutec, BA 823 039

Feb 13, 2007 Curt Cluff Clarified wording and expectations and criteria. [Reference TCSAI 2970213]

Tasks and Topics Covered

The following tasks are covered in Multi Stud Tensioner Practical:

Task or Topic Number*	Task Statement
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Lab: [Multi Stud Tensioner Practical](#)

<a href="#">MST001</a>	<a href="#">Operate Reactor Head M.S.T.</a>
<a href="#">MST002</a>	<a href="#">Troubleshoot and repair M.S.T.</a>
<a href="#">MST003</a>	<a href="#">Set up and adjust Double Stud Turning Tool</a>

Total tasks or topics: 3

**TERMINAL OBJECTIVE:**

- 0.0 Given work documents and permission to perform the task the maintenance technician will, operate the Multi-Stud Tensioner for a tensioning or de-tensioning operation in accordance with the procedure as demonstrated on the Lab Practical Evaluation.
  
- 0.1 Practice lab safety and use Prevent Events tools appropriately
  
- 0.2 Tension/De-tension Reactor Vessel Studs
  
- 0.3 Remove Stud in Auto and recover in Manual
  
- 0.4 Insert Stud in Auto and recover in Manual
  
- 0.5 Perform Lab Practical Evaluation

## Lab Introduction: Multi Stud Tensioner Practical

The following items are things to consider in your Lesson Introduction. They are not mandatory. You should develop your own introduction and place that material in the Program Hierarchy in the Lesson Introduction Tab or appropriate Training Unit.

CONTENT	METHODS & ACTIVITIES
I. Motivation	Focus student attention on “What’s In It For Me”.
A. Show that you can safely operate the MST for tensioning/de-tensioning operations	
B. Show that you can safely operate the DSTT in auto and manual operations	
C. Ensure you can recover from minor equipment malfunction	
D. Use safety equipment as required	Remind them of basic safety rules – they can add comments
1. Safety Glasses	
2. Safety Chains	
3. Gloves not required – may use if desired	
E. Prevent Events and Human Performance Skills	
1. Use self and peer checking as appropriate	Right tool, e.g.
2. Use 3-leg communication on the locking latch	Pass/Fail criteria
3. Use 2-minute drill whenever interrupted	Ensure on right tool, know condition and determine what’s next
F. Evaluation	
1. Will be given time to practice as necessary	
2. Can use any resources provided	
3. Show ability to perform tasks required	

**CONTENT**

**METHODS & ACTIVITIES**

II. Lesson Introduction

Introduce the lesson material

A. Lesson Terminal Objective

Read and/or discuss the lesson objectives

Given work documents and permission to perform the task the maintenance technician will operate the Multi-Stud Tensioner for a tensioning or de-tensioning operation in accordance with the procedure as demonstrated on the Lab Practical Evaluation.

B. Lesson Enabling Objectives

EO01 Practice lab safety and use Prevent Event tools appropriately

EO02 Tension/De-tension Reactor Vessel Studs

EO03 Remove Stud in Auto and recover in Manual

EO04 Insert Stud in Auto and recover in Manual

EO05 Perform Lab Practical Evaluation

<b>T.Obj 0.0</b>	<b>Given work documents and permission to perform the task the maintenance technician will, operate the Multi-Stud Tensioner for a tensioning or de-tensioning operation in accordance with the procedure as demonstrated on the Lab Practical Evaluation.</b>
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<b>EO 0.1</b>	<b>Practice lab safety and use Prevent Events tools appropriately</b>
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**0.1.1 Main Idea**

**CONTENT**

**METHODS & ACTIVITIES**

- I. Tripping Hazards
  - A. Typical of cavity hazards
    - 1. Keep neat – trip hazards exist
    - 2. Keep as out-of-the-way as possible
  - B. Use Self and Peer checking to watch for each other
- II. Pressure hazards
  - A. Air and hydraulic pressure – generally protected
  - B. Use appropriate PPE
    - 1. Hard Hat
    - 2. Safety Glasses
    - 3. Gloves for self cleanliness or removing burs on the studs (protection)
- III. Pinch Hazards
  - A. Hazards
    - 1. Moving parts on DSTT

Have them identify hazards and Prevent Events tools – these are examples

2. Stud setting into block

3. Potential for falling stud

B. Prevention

1. Use 3-leg communication and self and peer check

2. Self-check/Peer check

IV. Additionally, being a training environment, please be aware of the following:

A. Keep as out-of-the-way as possible when not performing the activities

1. Still monitor the activities for your learning

2. Provide your input on safety and human performance improvements

B. Be aware of the moving parts on the DSTT and keep all body parts and equipment clear of these locations.

C. Be aware of activities that create pinch points and keep clear.

**NOTE:** The potential for a falling stud always exists, though not probable. Be sure to monitor the equipment and actions to prevent dropping a stud and prevent injury if it does occur.

<b>EO 0.2</b>	<b>Tension/Detension Reactor Vessel Studs</b>
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**0.2.1 Main Idea**

<b>CONTENT</b>	<b>METHODS &amp; ACTIVITIES</b>
<ul style="list-style-type: none"> <li>I. Verify Ready For Tensioning/Detensioning Operation                             <ul style="list-style-type: none"> <li>A. Procedure available</li> <li>B. Operations signature verifies approval                                     <ul style="list-style-type: none"> <li>1. Can visually verify the signature</li> <li>2. Can receive word from Team Leader (instructor) that Control Room signature has been obtained</li> </ul> </li> <li>C. All cords and cables are hooked up                                     <ul style="list-style-type: none"> <li>1. Route them to minimize potential for being damaged</li> <li>2. Ensure cords are watched when moving the MST, lifting or lowering</li> </ul> </li> <li>D. Power and air are on for the MST</li> </ul> </li> <li>II. Pre-Job Brief                             <ul style="list-style-type: none"> <li>A. Individual responsibilities                                     <ul style="list-style-type: none"> <li>1. Panel</li> <li>2. Watching pressure</li> <li>3. Verifying split coupling evolutions</li> </ul> </li> <li>B. Communication                                     <ul style="list-style-type: none"> <li>1. Split couplings</li> <li>2. Verifications acceptable</li> </ul> </li> </ul> </li> </ul>	<p style="padding-left: 20px;">Emphasize the setup requirements</p> <p style="padding-left: 20px;"><b>Prevent Events</b> – Peer check to prevent damage to the cabling</p> <p style="padding-left: 20px;">Emphasize the need and purpose of the pre-job brief</p>



**CONTENT**

**METHODS & ACTIVITIES**

C. Emergency actions

- 1. Leak
- 2. Imminent danger

Note locations of emergency stop button

III. Tension/Detension

Follow the procedure steps – if unable to in the lab environment, receive instructions from the instructor

A. Verify initial conditions

- 1. Split couplings
- 2. Latches
- 3. Elevation

B. Close split couplings

- 1. Communication
- 2. Verification

If communication is not sufficient, instructor will stop and verify before continuing. This constitutes failure of the tensioning evolution in the evaluation

If verification is not sufficient, instructor will stop and verify before continuing. This constitutes failure of the tensioning evolution in the evaluation

C. Start LP pumps

- 1. Monitor for pressure
- 2. Timely start of HP pumps

Instructor will ensure adequate monitoring of pressure to preclude damage to components

**CONTENT**

**METHODS & ACTIVITIES**

D. Start HP pumps

1. Monitor for pressure
2. Shut off at appropriate point

Instructor will ensure adequate monitoring of pressure to preclude damage to components

E. Return piston

1. Only 1 pump used
2. Shut off at appropriate point
3. Verification pistons are down

Instructor will ensure only 1 pump running for piston return

F. Open split couplings

1. Communication
2. Verification

If communication is not sufficient, instructor will stop and verify before continuing. This constitutes failure of the tensioning evolution in the evaluation

If verification is not sufficient, instructor will stop and verify before continuing. This constitutes failure of the tensioning evolution in the evaluation

G. Complete evolution – de-energize MST

<b>EO 0.3</b>	<b>Remove Stud in Auto and recover in Manual</b>
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**0.3.1 Main Idea****CONTENT****METHODS & ACTIVITIES**

- I. Remove Stud in Auto
  - A. Set up initial
    1. Align over studs
    2. Remove pin
    3. Power up the DSTT
      - a. Panel switches in proper position
      - b. Power on at the electric panel
    4. Test the Lamps
    5. Turn on the Controls for auto removal of stud
  - B. Press **Start** on both Near and Far tools
    1. Verify stud engages at proper position
    2. Monitor position and evolution at all times
    3. Be able to switch to manual during the evolution if required
  - C. When “*Close Latch*” reads on the screen
    1. Verify position

They must be able to perform the entire evolution, but note steps you will evaluate for pass/failure based on human performance

**Ensure it is checked each time.**  
(Sometimes will be set, sometimes not)

**P/F Must Check once – first time**

- 2. Have assistance below to close locking lever

P/F – Must verify – **3-leg communication**

D. Press **Start**

E. When “*Safe Latch?*” reads on the screen

- 1. Verify position
- 2. Have assistance below to verify position

**P/F – Must verify – 3-leg communication**

F. Press **Start**

G. Removal is completed

**Verify final position**

II. Recover in Manual

**P/F know where to start in the manual procedure steps**

A. When Auto Function fails to operate

- 1. Clear fault if one exists
- 2. Switch to Manual control
- 3. Perform the remaining steps that were not done in the auto mode

**OR**

- 4. Set the stud down (Lower Tool), turn compensation off, **disengage stud**, and **Lift Tool** to return to home.

B. Engage stud

- 1. Ensure **Stud Disengage** light is on, press if not
- 2. Press **Lower Tool** button - At proper elevation, press and hold **Remove/Left** button
  - a. Tool should turn
  - b. Tool should drop to stud flange
  - c. Release **Remove/Left** button

3. Press **Engage Stud**

- C. Remove stud

1. Press **Compensation On/Off**
2. Press **Remove/Left** button and hold if necessary
3. When stud begins turning rapidly, release **Remove/Left** button
4. When stud stops turning
  - a. Press **Lift Stud**
  - b. Press and hold **Remove/Left**
5. When stud is free of threads, release **Remove/Left** button

- D. Latch Stud in the MST

1. Verify position **P/F – Must verify – 3-leg communication**
2. Have assistance below to close locking lever
3. Press **Lower Stud**
4. Have assistance below to verify position **P/F – Must verify – 3-leg communication**

- E. Disengage stud

1. Press **Compensation On/Off**
2. Press **Disengage Stud**
3. Press **Lift Tool** **Verify final position**

<b>EO 0.4</b>	<b>Insert Stud in Auto and recover in Manual</b>
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**0.4.1 Main Idea****CONTENT****METHODS & ACTIVITIES**

- I. Install Stud in Auto
  - A. Set up initial
    - 1. Align over studs
    - 2. Remove pin
    - 3. Power up the DSTT
      - a. Panel switches in proper position
      - b. Power on at the electric panel
    - 4. Test the Lamps
    - 5. Turn on the Controls for auto installation of stud
  - B. Press **Start** on both the Near and Far tools
    - 1. Verify stud engages at proper position
    - 2. Monitor position and evolution at all times
    - 3. Be able to switch to manual during the evolution if required
  - C. When *Open Latch!!* Reads on the screen
    - 1. Verify position
    - 2. Have assistance below to open locking lever

They must be able to perform the entire evolution, but note steps you will evaluate for pass/failure based on human performance

**P/F – Must verify 3-leg communication**

D. Press **Start**

1. Verify reverse rotation at proper level
2. Verify air compensation and speed proper during operation
3. Verify slows down at proper location

## E. Installation is completed

1. Verify final position is correct
2. Verify stud is disengaged and tool returns to *Home*

## II. Recover in Manual

Perform those function necessary to complete the evolution being performed

## A. When Auto Function fails to operate on one tool,

**P/F** must respond to the proper tool's fault using self-peer check techniques

1. Clear fault if one exists
2. Switch to Manual control
3. Perform the remaining steps that were not done in the auto mode

**OR**

4. Set the stud down (**lower stud**), turn **compensation off, disengage stud, and lift tool** to return to home

## B. Engage stud

1. Ensure **Stud Disengage** light is on, press if not
2. Press **Lower Tool** button and at proper elevation, press and hold **Remove/Left** button
  - a. Tool should turn
  - b. Tool should drop to stud flange

- c. Release **Remove/Left** button
  - 3. Press **Engage Stud**
- C. Unlatch stud
  - 1. Lift tool and stud
    - a. Press **Weight Comp On/Off**
    - b. Press **Lift Tool**
  - 2. Verify position
  - 3. Have assistance below to open locking lever P/F – Must visually verify **hands free** or use **3-leg communication**
- D. Insert the stud
  - 1. Press **Lower Tool**
  - 2. When on the threads, press and hold **Remove/Left** button
  - 3. When stud drops, release **Remove/Left** button
  - 4. Press and hold **Insert/Right** button
  - 5. When the stud begins to move quickly, release **Insert/Right** button
  - 6. Release **Lower Tool function** by pressing **Weight Comp On/Off** twice
- E. Disengage Stud and return to home position
  - 1. Press **Weight Comp On/Off** to turn it **OFF**
  - 2. Press **Lower Tool** button
  - 3. Press **Disengage Stud** button
  - 4. Press **Lift Tool** button



III. When completed with stud

Have each perform the following to set up for the next person

- A. Turn controls off
- B. Engage locking pins
- C. Turn power off at electrical panel

**EO 0.5 | Perform Lab Practical Evaluation**

**0.5.1 Main Idea**

**CONTENT**

**METHODS & ACTIVITIES**

**I. Practice**

Review the safety concerns and responsibilities and give them enough time to practice on the DSTTs so they are ready for the evaluation

- A. Perform all verifications while practicing
- B. Use 3-leg communication with assistance below for both equipment and personnel safety
- C. Follow all procedure steps: Can use Job Aid alone if knowledgeable enough
- D. Practice recovery from Auto error
- E. Request any assistance or coaching desired from peers and instructor
- F. **EVERYONE** use peer and self-checking to ensure no unsafe actions above or below – all need to learn from each other

## II. Evaluation

Specifics not included here – on the Lab Practical Evaluation form.

- A. One at a time
- B. Must not use other personnel as a resource
- C. Can use procedure and/or job aid
- D. Must perform verifications and use 3-leg communication
- E. Will be required to reperform evaluation if not successfully completed
- F. Those not performing the actions will:
  - 1. Take notes to perform feedback sessions on activities, including prevent-event tools
  - 2. Stop activity only if an unsafe act is about to be performed that could injure someone or damage equipment

## SUMMARY OF MAIN PRINCIPLES

The following items are things to consider in your lesson summary. They are not mandatory. You should develop your own summary.,

### Objectives Review

Review the Lesson Objectives

Topic Review

Restate the main principles or ideas covered in the lesson. Relate key points to the objectives. Use a question and answer session with the objectives.

### Questions and Answers

Oral questioning

Ask questions that implement the objectives. Discuss students answers as needed to ensure the objectives are being met.

### Problem Areas

Review any problem areas discovered during the oral questioning, quiz, or previous tests, if applicable. Use this opportunity to solicit final questions from the students (last chance).

### Concluding Statement

If not done in the previous step, review the motivational points that apply this lesson to students needs. If applicable, end with a statement leading to the next lesson.

You may also use this opportunity to address an impending exam or practical exercise.

Should be used as a transitional function to tie the relationship of this lesson to the next lesson. Should provide a note of finality.