PALO VERDE
NUCLEAR GENERATING STATION

Mechanical Maintenance Training

Classroom Lesson

Mechanical Maintenance Training	**Date: 5/27/2010 9:54:56 AM**
LP Number: NMS01C000100	**Rev Author: MARK TAGUE**
Title: Snubber Prerequisites	**Technical Review:**
Duration : 2 HOURS	**Teaching Approval:**

INITIATING DOCUMENTS

Task Analysis of Tasks

REQUIRED TOPICS

None

CONTENT REFERENCES

EER 87-XM-096, Staking Spherical Bearings

IE Circular 81-05: Staking Bushings on Snubbers

IE Circular 84-67: Snubbers Failures

NMAC Good Bolting Practices, Vol.2, EPRI, Dec. 1990. Pg.11

VTM -P-970-00001: Paul Monroe S/G & RCP Snubbers [P209-B, P209-B2, 50-3, 51-1, 52-1]

Station Procedures 73ST-9ZZ10, 73ST-9ZZ21, 73ST-9ZZ22, 73ST-9ZZ23, 31MT-9ZZ15, 73DP-9ZZ16

VTM-P029-00001, PSA snubber Tech. Manuals [PSA-192, 193, 194, 141.]

Course NMF20, Measuring and Testing Devices

REVISION COMMENTS

May 27, 2010	Curt Cluff	Changed to Vision Format with minor editing for clarification - update task numbers (TCS 2681217), and include safety and prevent events information [TCS 2686688].

Tasks and Topics Covered

The following tasks are covered in Snubber Prerequisites :

Task or Topic Number*	Task Statement
Lesson:	Snubber Prerequisites
SNUB001	Maintain hydraulic snubbers
SNUB003	Remove/inspect/reinstall mechanical snubbers

Total task or topics: 2

TERMINAL OBJECTIVE:

1 Given a maintenance situation on a snubber, the student will , describe the prerequisite knowledge required for locating and inspecting snubbers as demonstrated by passing the final written exam with a minimum score of 80%.

1.1 Describe the method of locating snubbers

1.2 Explain the use of a rule (scale)

1.3 Explain the use of a Torque Wrench and Multipliers

1.4 Identify the types of calibration labels at PVNGS

1.5 Explain the responsibilities of the user of Measuring and Test Equipment

CONTENT	METHODS & ACTIVITIES
I. Motivation	Focus student attention on "What's In It For Me".
A. IE Circular 81-05, Staking Bushings on Snubbers B. IEC 81-05 SELF ALIGNING ROD END BUSHINGS FOR PIPE SUPPORTS C. In July of 1980 Bechtel Power Corp. notified the NRC of generic deficiencies in pipe support sway struts (snubbers). The specific deficiency involved the clamp end of the snubber becoming loose and possibly disengaging from the bushing. The manufacturer was identified as Corner and Lada. Then in October of 1980 Bechtel notified the NRC of the same deficiency involving ITT Grinnel. Subsequent action was taken by the vendors to stake the bushings in place. Palo Verde received a number of its snubbers in 1978, so Bechtel was tasked with a ten percent inspection to insure all bushing were staked. D. IE Circular 84-67, Snubber Failures E. IEC 84-67 RECENT INSERVICE TESTING WITH HIGH FAILURE RATES. 1. In April 1984, at the Surry Power Station in Virginia, of the 160 hydraulic snubbers tested, (30%) 48 failed. Of the 66 mechanical snubbers tested, (44%) 21 failed. In that same month at the Turkey Point Plant in Florida approximately 100 mechanical snubbers were tested in each of units 3 and 4. 46 failures were found in Unit 3 and 31 in Unit 4. The mode of failures were varied. Free moving, found locked up, locked up during testing, failed drag/breakaway test. And so on!	Note some problems that have occurred on snubbers and why we need to know how to inspect them
II. Course Introduction With today's increase in seismic requirements, snubbers/shock arresters are used more extensively in Nuclear Power plants than ever before. With this increased usage and operating experience, numerous inoperative snubber units have been detected. The causes leading to these inoperative snubbers are varied. Comprehensive examination and testing programs are increasing the confidence level in the functional reliability of snubbers. Since degradation of snubbers may occur for many different reasons during their service life, it is necessary to perform periodic visual examinations and functional tests to assure their operability.	Briefly introduce the course subject and how this course fits into the qualification program.

CONTENT	METHODS & ACTIVITIES
III. Course Objective Given a maintenance situation on a snubber, the student will state how to locate and inspect mechanical and/or hydraulic snubbers in accordance with most recent snubber procedure revision, and remove and replace mechanical snubbers in accordance with the applicable maintenance procedures. This will be demonstrated by passing a written exam with a minimum score of 80%.	Read and/or discuss the course terminal objective
IV. Schedule	Identify the schedule for the training and expectations for break and start times.
A. Required elements to perform snubber inspections	
B. Basic construction of snubbers	
C. Inspection techniques for mechanical and hydraulic snubbers	
D. Perform an inspection and document it on an inspection sheet	
V. Qualification Will be qualified to perform snubber inspections and to remove and replace snubbers upon completion of this course – does not include testing	Identify what they will be qualified to perform when completed with this course
VI. Lesson Introduction	Introduce the lesson material
A. Lesson Terminal Objective Given a maintenance situation on a snubber, the student will describe the prerequisite knowledge required for locating and inspecting snubbers as demonstrated by passing the final written exam with a minimum score of 80%.	Read and/or discuss the lesson objectives
B. Lesson Enabling Objectives EO01 Describe the method of locating snubbers. EO02 Explain the use of a rule (scale) EO03 Explain the use of a Torque Wrench and Multipliers EO04 Identify the types of calibration labels at PVNGS EO05 Explain the responsibilities of the user of Measuring and Test Equipment	

CONTENT	METHODS & ACTIVITIES
VII. Prevent Events Strategies	Perform pre-job briefing of this training session
A. What's our job today? Do you understand it (terminal objective)	
B. What could go wrong? (hazard assessment in the classroom) How do we prevent it?	
C. What safety gear might I need? (if going to the lab, identify safety gear required in the lab)	Note that many additional safety items will be brought up as they are identified during the course.

TO: 1 Given a maintenance situation on a snubber, the student will , describe the prerequisite knowledge required for locating and inspecting snubbers as demonstrated by passing the final written exam with a minimum score of 80%.

EO: 1.1 Describe the method of locating snubbers

Main Idea

CONTENT	METHODS & ACTIVITIES
I. Snubber Locator Data Sheets	Note that this is the primary method presently used to find snubbers
A. Information on the data sheets	**Slide** data sheet info
1. Key data about the snubber	
2. Accessibility and scaffold requirements	
3. Identifies location map	
B. Location maps	**Slide** – using data sheets and maps in the back of the handout, have them locate a snubber
1. Modified RP survey maps	
2. Shows location of all snubbers in the area	
3. Includes elevation and map location	
4. Any team leader who has snubbers will have a copy of these maps	
II. There are three sets of plant drawings that will assist in locating snubbers throughout the plant.	This is the alternative method to locate them using standard grid coordinates and drawings. Be brief in this
A. System line drawings	
B. Isometric drawing	Show example **Slide**
C. Plant Zone drawings	Show example **Slide**

CONTENT	METHODS & ACTIVITIES
D. Zone drawing designator 1. Z - general arrangement 2. Second character designates the building a. A – auxiliary b. C – containment, MSSS c. F – fuel d. G - diesel generator e. J – control f. R – radwaste g. T – turbine 3. Third character designates which level. a. 1 - 100 ft. first level above ground b. 2 - second level and on up c. A - First level below ground d. B - second level down and on down 4. Fourth character is the area sequence number	Use **Slide**

EO: 1.2 Explain the use of a rule (scale)

Main Idea

CONTENT

METHODS & ACTIVITIES

NOTE: If all participants have already completed M & TE, remainder of this lesson plan may be omitted as deemed appropriate

I. General rules for using M & TE

A. To minimize wear

1. Keep clean: Dirt, grit, and foreign matter can:

a. Wear parts rapidly

b. Between the measuring surfaces and the tool can cause errors in the measurements

c. Create a corrosive environment

2. Moving parts should be lubricated sparingly as required with an approved lubricant

B. To minimize potential of damage

1. Avoid banging tools against other tools or equipment

2. Protect exposed surfaces

a. Wipe with an oily rag or other material as needed

b. Helps prevent corrosion to the surfaces

3. Keep tools with moving parts away from extremes of heat and cold

4. Use measuring tools only for their intended use

a. Never use them as pry bars, screwdrivers, or slugging wrenches

CONTENT	METHODS & ACTIVITIES
b. Improper use can severely damage the tools' outside and internals	
II. Flat rule	Use TA01 and **Slide** to show the typical flat rule
A. Appearance similar to a common ruler	
B. Gradations can be in mm or inches broken commonly into 16th in., 32nd in., & 64th in.	Point out 32nds of an inch on the bottom of slide and 64ths on the top.
1. This is called the "scale" of the rule	
2. Marks for lower subdivisions are shorter in length	
3. Some have graduations on the end also. This is for measuring shoulders, grooves, etc. It provides extra stability	**Slide** shows a rule with end graduations
C. Reading the scale	
1. Record the reading of the nearest mark	
a. Generally reduce the fraction	
b. May not want to reduce the fraction if the degree of accuracy is to be indicated in the reading	Give example of what this means (22/32 rather than 11/16 indicates the accuracy is to the nearest 1/32")
2. Often start with the 1 in. mark for one end of the distance to be measured	Ask them what "burning an inch" means and discuss why
a. The end of the rule is not looked at in the same manner as a line	
b. The end may be slightly damaged	
c. Often called "Burning an inch"	
3. Must remember to take an inch off of the measurement when looking at the final dimension.	

CONTENT	METHODS & ACTIVITIES
D. Cautions when taking reading	**Prevent Events** self-check when taking readings to ensure accuracy
1. Must be viewed from straight down on the rule for accurate measurement to the edge of the material	Discuss the meaning of "parallax error"
2. The rule should be flat against the material	
3. Care should be taken not to bend the rule while taking measurements	
E. Taking internal measurements	Illustrate the swing of the rule to take pipe ID on the board
1. Butt the end of the rule against one wall, as close to the end as possible	
2. Swing the other end of the rule in a small arc, noting the longest reading	
3. This longest reading is the diameter	
F. Taking parallel distance measurements	Illustrate the parallel measurement swing on the board
1. Similar to taking internal measurements	
2. Butt one end of the rule against one wall	
3. Swing the other end of the rule in a small arc	
4. The <u>shortest</u> of the readings is the actual reading	
III. Care of the Rules	
A. Prevent the ends from becoming damaged	
B. Wipe with oily rag to prevent rust	

EO: 1.3 Explain the use of a Torque Wrench and Multipliers

Main Idea

CONTENT	METHODS & ACTIVITIES
I. Torque Wrench Types	
A. Dial type	**Slide** to illustrate the dial type
1. Deflection is measured on a dial type of gauge	
2. Indicator for signaling when torque has been reached	
a. Some have a second pointer which is turned to the setpoint which the indicator will touch when the value is reached	
b. Some have a light which will come on when the setpoint is reached as the pointers touch	
c. Allows you to see when you reach the torque without looking straight down on the dial	
B. Micrometer type	**Slide** & **Training Aid** show the micrometer type
1. Torque value is set using the micrometer type of thimble on the handle	
a. Done prior to performing the torquing operation	
b. Do not have to look at the wrench during torquing	Not having to look is the primary advantage of the micrometer-type
c. Reading this type of scale will be discussed with the micrometers	
2. Torque value is set on the handle	
3. When applying the torque, a noticeable "click" will be heard when the desired value is reached	

CONTENT	METHODS & ACTIVITIES
a. You must still have some "feel" of what the desired value is, or you may end up exceeding the torque value without even noticing the "click".	
b. When the click is felt, stop pushing or you could exceed the torque value.	
II. Precautions	
A. Torque must be applied at a right angle to the beam, not pushing up nor down. Otherwise:	**Prevent Events** – hazard assessment when pushing on torque wrench – prevent injury to self or damage/inaccuracy to torquing
1. Some of the force would be bending force	
2. Would cause the tension to be less in the bolt or even damage the bolt	
B. Most torque wrenches have a force location where the hand must be placed	
1. Torque wrench is calibrated assuming the force is applied at this point	
2. Any other point changes the stresses in the handle	
3. May cause erroneous readings (out of the tolerance allowed)	
4. A crows-foot will change the moment arm of a torque wrench and therefore the indicated torque.	**Slide** – Torque Wrench with Correction for crow's foot
a. Must adjust for change of length (ratio: wrench length ÷ distance from force location to pivot point)	
b. Adjustment not required if crow's-foot is used at a 90º angle	
C. A counter-torque may need to be applied at the head of the wrench	
1. Especially when using an extension on the socket	

METHODS & ACTIVITIES

CONTENT

2. Minimizes the sideways force on the nut/bolt

3. Prevents erroneous torque reading or damage to the bolt

D. Do not use an extension on the handle

1. If extensions are used, damage to the wrench may occur

2. Wrenches are designed to be taken to max. value with the efforts of a normal man

3. The torque reading may not be accurate because the force is not applied at the required point

E. Torque reading should be taken while the wrench is moving instead of stationary

1. Prevents the errors caused by static friction (the friction which prevents movement)

2. Static friction is greater than moving friction

F. Torque wrenches should be checked/calibrated regularly

1. They are precision instruments

2. A force is regularly applied to try to bend the parts

3. Time will eventually alter the reading unless adjusted/compensated for

4. Inspected with each use

G. Never use a clockwise torque wrench to loosen nuts

1. May have a need to know the break-a-way torque or torque left-handed threads

2. Would require a counter-clockwise calibrated wrench

3. Accuracy of the wrench may be affected

CONTENT	METHODS & ACTIVITIES
a. Studies have shown that torque wrenches used in both directions loose their calibration tolerances more rapidly	
b. The few occasions when CCW torquing is required does not justify the shorter calibration check intervals which would be required	
H. Storage of Micrometer-type Torque Wrenches	Basis of storage requirements is an EPRI study
1. If wrench dropped with no load on its spring, calibration may change, parts may come loose.	
2. If the wrench is stored with torque setting above 50% of maximum range for extended periods of time-	
a. Helical wound spring will take a set.	
b. Accuracy of wrench is affected.	
c. Best storage is 20-25% of maximum range.	
3. PVNGS guidelines require torque wrenches be stored at 20% of full range	**Prevent Events** – self-check prior to setting a torque wrench aside – reset to 20%

EO: 1.4 Identify the types of calibration labels at PVNGS

Main Idea

CONTENT	METHODS & ACTIVITIES
I. PVNGS M&TE calibration label	**Slide** shows the tag
A. Identification	Note that this is the normal tag to be found on M & TE
1. Black on white	
2. Attached to the item &/or its container (a box)	
B. Used when the M & TE is subject to any of the following	Note that these are the procedure terms
1. Drift	
2. Wear	
3. Deterioration	
C. Contents of the label	
1. ID number of the item	
2. Date of calibration	
3. Date next calibration required	
4. Identification of the person/organization performing the calibration	
II. PVNGS M&TE Restricted calibration label	**Slide** shows the tag – This is the tag generally found on all torque wrenches and pressure gages
A. Identification	
1. Black on a yellow background	
2. Similar attachment	

CONTENT	METHODS & ACTIVITIES
B. When used	Example, torque wrench has 2 restrictions: Direction and lower limit at 20% of total range are restrictions
1. There are restrictions for the use of the equipment to meet calibration specifications	
2. Examples:	
a. The equipment only meets accuracy requirements within a specified range	
b. Torque wrench can only be used in one direction	
c. Equipment calibrated for use only with specific accessories or meters	
C. Contents of the label	
1. Similar to the calibration label	
2. A remarks section stating the function, range, or sections for which it cannot be used	
III. PVNGS M&TE Additional information label	**Slide** shows the tag – may supplement the restricted calibration label
A. Identification	
1. Black on yellow background	
2. Similarly attached	
B. When used	
1. Additional information is required for proper use of the M&TE, then this tag is attached	
2. Example of horizontal use in the procedure	
C. Label contents	
1. Information or instructions for use	

CONTENT

METHODS & ACTIVITIES

2. Tell where to go for information

EO: 1.5 Explain the responsibilities of the user of Measuring and Test Equipment

Main Idea

CONTENT	METHODS & ACTIVITIES
I. Prerequisite	
A. Know if there is an accuracy or range requirement of the M & TE	
1. This data is generally identified by the planner	
a. Specified in the work document	
b. If not measuring to a work document, you must go to the design documents themselves and verify if there is an M & TE accuracy or range requirement	If they need an example, Parallel Path Work (Working while the Work Order is being written) is one
2. If there is no M & TE accuracy and/or range specified	
a. Use of any calibrated M & TE is acceptable	
b. Ensure it is used within its operating range (e.g., Torque wrenches cannot be used in their lower 20% range)	
c. The increments must be small enough to distinguish the tolerance.	
1) For example, if the tolerance on a torque is ±10 ft-lbs, the tool must be able to read in increments of at least 10 ft-lbs (preferably 5 ft-lbs)	
2) A tool with reading increments of 25 ft-lbs would not be acceptable	
d. Any measurement within the tolerance of the parameter measured is acceptable	
e. **Example:** *Verify clearance is .005" ± .001".*	

CONTENT

METHODS & ACTIVITIES

1) No M & TE accuracy is stated, only a tolerance (± *.001"*)

2) Any calibrated measuring tool would be acceptable

3) Any measurement between reading anywhere between .004" and .006" is acceptable, with .005" being preferred.

f. A slight exception is the Torque Wrench

1) Torquing procedures require that the torque be in the middle of the tolerance range

2) If not possible, go as close as possible to the mid-range

3) All torque wrenches have an accuracy of ± 5% of the given value

3. If there is an accuracy and/or range of the M&TE specified in the design document:

a. Verify the M & TE is sufficiently accurate and/or is the proper range for the measurement

b. If accuracy is not known or stated on the cal sticker, contact metrology to determine the accuracy (x-3591 or x-7545)

A multi-meter would be an example of a piece of M & TE without an accuracy on the cal sticker

c. **Example:** *Use a 500 psi pressure gage with accuracy of ± 2 psi.*

1) **Requires range** of 500 psi

2) **Requires accuracy** of 2 psi

3) The accuracy will be on the cal sticker

4) Any variations must be approved by engineering prior to use

CONTENT	METHODS & ACTIVITIES
II. Upon receiving the equipment	Identify user responsibility upon receipt of M & TE
A. Check label on the equipment to verify that the Calibration is current (if required)	**Prevent Events** – self check to ensure M & TE is acceptable
1. Check for calibration type (as described above)	
2. Check cal date and due date (if applicable)	
3. If unable to read the calibration tag information	
a. Take it to metrology for evaluation and re-tagging	
b. If not possible, and must be used, cal status must be verified first through metrology and the label replaced ASAP	
B. Verify equipment condition visually	**Prevent Events** – attention to detail during inspection
1. Free of damage which might render it useless. The micrometer torque wrench for example:	Go through a good inspection of the micrometer-type torque wrench for an example of an inspection
a. No significant cracks or dents on head or handle	
b. Ratchets through every tooth, none broken	
c. Adjustment handle lock functions	
d. Adjustment hole plugged	
2. Proper range for the job	
C. ID is readable	
1. Must be able to log the number in the work order	
2. If label is on a box, the ID on the M & TE must match that on the box	May wish to illustrate the potential for mismatched numbers by using one of the micrometers as an example

CONTENT	METHODS & ACTIVITIES
D. Perform required functional tests	
1. For example, the functional test for torque wrenches	
2. Satisfactory functional test before and after performing the torque job verifies that the wrench would have been satisfactory when it was used on the job	
3. Who can perform functional tests? One of the following	
a. Metrology lab personnel	
b. Personnel in the user department/section <u>trained and certified</u> to perform the specific functional test	
c. Other functional test qualified personnel as necessary	
4. Documentation of functional tests	
a. Performed according to a functional test work order instruction	
b. SWMS entries into discipline work specific Work Order by responsible group	
III. When using	Discuss the user's responsibilities while using M & TE
A. Record the M&TE no. on the work order	
B. Record the WO no. (or equivalent) on the usage record (computer record) for the M & TE	Some work groups have a single person who performs this function
1. In case of an out of tolerance finding upon recalibration, they know which equipment had the device used on it	
2. Quality related equipment would have to be re-measured or the measurement evaluated for acceptability by engineering	

CONTENT	METHODS & ACTIVITIES
3. Ensure Work Order is sufficiently clear to indicate exactly where the M & TE was used	
a. Exact equipment	
b. Exact item measured	
C. Take care to not exceed normal operating limits to prevent damage to the equipment	
D. If M & TE becomes suspect:	
1. The equipment must be tagged ***Out-Of-Service***	**Slide**, OOS tag
2. Can have the tool issue room tag it for you	
3. Prevents tool being used by someone else while not functioning properly	
E. Use all the proper care in handling and storage of the equipment	
F. Take extra precautions for handling M & TE in a contaminated area	Identify additional requirements for M & TE in a contaminated area
1. Do not mix potentially contaminated M&TE with non-M&TE items	
2. Ensure the M&TE is bagged in a manner to preclude damage	
3. Notify RP that there is potentially contaminated M&TE in the bag	
4. If decontamination may cause the M&TE calibration to be affected, Metrology must be contacted first	

CONTENT

METHODS & ACTIVITIES

G. M & TE Control

1. M & TE must always be retrievable by metrology.
2. If the tool control is to be transferred to another individual or organization, this transfer must be documented.
3. Contact the Tool Room to notify them of the transfer in case of a recall.
4. To ensure availability and control of M & TE, controls are in place for checking it out.
    a. If checking out M & TE, it must be returned at the end of the shift.
    b. If required for more than one shift, it must be checked out to the Work Order.
    c. If the M & TE is required for long-term use, it will be checked out to the Section Leader.

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.