PALO VERDE
NUCLEAR GENERATING STATION

Mechanical Maintenance

Classroom Lesson

Mechanical Maintenance Training	**Date: 05/29/2008**
LP Number: NMF35C000301	**Rev Author: Tim Steinmetz**
Title: Valves associated with the fire protection system	**Technical Review:** Steinmetz, Tim P(Z99348) Digitally signed by Steinmetz, Tim P (Z99348) DN: cn=Steinmetz, Tim P(Z99348), email=Tim.Steinmetz@aps.com Reason: I have reviewed this document Date: 2008.05.29 14:48:59 -07'00'
Duration : 2 hours	**Teaching Approval:** Jeffrey Freitas Digitally signed by Jeffrey Freitas DN: cn=Jeffrey Freitas, c=US, o=Maintenance Training, ou=9611, email=Jeffrey.Freitas@aps.com Reason: I am approving this document Date: 2008.05.29 14:51:29 -07'00'

INITIATING DOCUMENTS:

NONE

REQUIRED TOPICS

NONE

CONTENT REFERENCES

Lesson Plan Revision Data

May 21, 2008	Vinas Gustave	Adding new lesson too include valve information

Tasks and Topics Covered

The following tasks are covered in Valves associated with the fire protection system:

Task or Topic Number*	Task Statement

Total tasks or topics: 0

TERMINAL OBJECTIVE:

1.1 When presented with training aids or illustrations, the Fire Protection Mechanic will, describe valve: terms, function, components, inspection IAW Manufacturer Technical Manual and Plant procedures, as demonstrated by scoring 80% or more on a written examination.

1.1.1 State the (5) principle functions of valves

1.1.2 Identify the components and their function on a stem operated valve

1.1.3 Identify the pre-requisite prior to valve rework

1.1.4 State the steps to perform an external valve inspection

1.1.5 Identify the list of terms associated with various valves

Lesson Introduction: Valves associated with the fire protection system

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.

CLASSROOM GUIDELINES

- If applicable, remind students of class guidelines as posted in the classroom.
- Pass the attendance sheet around and have it signed in Dark ink.
- Ensure that student materials needed for the class are available for each student.
- Emphasize student participation and remind them of your philosophy on asking and answering questions, if applicable.

ATTENTION STEP

- Give a brief statement or story to get student concentration focused on the lesson subject matter.

LESSON INTRODUCTION

- Give a brief statement that introduces the specific lesson topic. Should be limited to a single statement.

MOTIVATION

- Focus student's attention on the benefits they derive from the training. At Instructor's discretion. The need for motivation in each succeeding lesson must be analyzed by the Instructor and presented as necessary.
- Instructor should include how the STAR process can be used to improve or enhance Operator Performance, if applicable.
- Read and discuss lesson terminal objective and review lesson enabling objectives, if desired.
- If applicable, briefly preview the lesson topic outline and introduce the major points to be covered. The objective review may have been sufficient.
- REINFORCE the following PVNGS management expectations as opportunities become available:

  Nuclear Safety
  Industrial Safety Practices
  STAR and Self-Checking
  Procedure Compliance
  Communication Standards
  ALARA
  Prevent Events

T.Obj 1.1	**When presented with training aids or illustrations, the Fire Protection Mechanic will, describe valve: terms, function, components, inspection IAW Manufacturer Technical Manual and Plant procedures, as demonstrated by scoring 80% or more on a written examination.**

EO 1.1.1	**State the (5) principle functions of valves**

1.1.1.1 Main Idea

****Objectives/Sequence****	****Methods & Activities****
I. Five Principle functions of valves	Inform students it would be good to know the Five Principle functions of valves
A. Starting & Stopping Flow	
1. Function of most valves	
2. Gate valves are well suited for this purpose.	
3. When open, gate valves permit fluid to move in a straight line through the valve with minimum turbulence to restrict flow or lose pressure.	
B. Regulating or Throttling Flow	
1. Is done more efficiently with globe valves.	
2. Body/Disc construction permit closer regulation of flow.	

C. Preventing Backflow

1. Check valves perform this single function of preventing flow in one direction.

2. Positive flow keeps these valves open.

3. Reverse flow closes the check automatically.

D. Regulating Pressure

1. Regulator is used in lines where it is necessary to reduce incoming pressure to the required service pressure.

2. They not only reduce pressure, but maintain it at the required pressure point.

3. Fluctuations in inlet pressure to a regulator do not affect the outlet pressure.

E. Relieving Pressure

1. Spring loaded valves, which open automatically when system pressure exceeds set limit.

2. Will be covered in a separate course

EO 1.1.2	Identify the components and their function on a stem operated valve

1.1.2.1 Main Idea

******Objectives/Sequence****** ******Methods & Activities******

I. Valve Components

A. Body

1. Largest structural part of the valve, direct the liquid flow.

2. Provides the means to attach valve to system components or piping.

3. Can be welded, flanged or threaded to component.

B. Bonnet

1. Upper portion of the valve which is the removable half of the pressure boundary.

2. House the packing

3. Support for all valve upper parts

a. Actuator or Handwheel

b. Yoke

C. Gasket/seal

1. Between the body and the bonnet

2. May be a flanged gasket or other type of seal, depending on the construction of the body to bonnet joint

D. Disc

1. The Component part of the valve that opens or closes against the seat to start or stop flow.

2. There are several designs for various seating applications.

E. Seat

1. Located inside the valve body

2. The area where disc closes on the valve body to stop or reduce flow through valve.

3. In some cases seat is cast as part of the body.

4. Other cases it is press fit, threaded or welded into the body.

5. In high temperature or high pressure systems a combination of threading and welding is used to prevent leakage.

6. Seating areas of the disc and seat must be smooth and fit together perfectly.

7. Materials for seat construction can vary depending upon the valve's application.

8. Seats can be constructed from:

   a. Bronze – a soft alloy used on valves normally having a low priority class in terms seating

   b. Teflon – A soft material used on valves in low temperature applications, normally the seats are quickly interchangeable, seen on systems usually that have a viscous fluid content.

   c. Stellite – High quality seat material, made of a hard face alloy

      1) It is the most used disc/seat combination at a Nuclear Power plant.

F. Backseat — Show backseat on GATE valve

1. A Seating arrangement that provides a seal between the stem and bonnet
2. Prevents system pressure from building against packing.
3. Seating area on backseat is similar to a globe valve disc.

G. Handwheel — **Slide**

1. Controls movement of the disc by virtue of the stem.
2. Open/Close rotation often identified on handwheel.

H. Stem

1. Transfers the motion of the handwheel to the internal disc opening or closing the valve.
2. The Stem is attached to a disc by one of four means.
   a. Split-type joint — **Slide** shows threaded and staked disc-to-stem
   b. Threaded
   c. One Piece
   d. Pins or cotter keys

I. Yoke

1. Support element
2. Connecting element between bonnet and stem.
   a. Bushing type connection
   b. Bearing type connection

J. Gland Flange or Follower Flange

1. Compress's Gland
2. Bolted or threaded to valve bonnet

Note: The CONVAL Gland follower is a one-piece unit and has a unique design.

Could pass around a Conval

K. Gland follower [sometimes called the gland]

1. Holds and compresses packing in place
2. Two piece or single piece design (may be made integral part of the Gland flange).

L. Stuffing Box

1. Location for packing to be placed
2. Has a specified diameter and depth for a given number of packing rings.

M. Packing – creates the seal between the stem and the bonnet

EO 1.1.3	Identify the pre-requisite prior to valve rework

1.1.3.1 Main Idea

****Objectives/Sequence****	****Methods & Activities****
I. Valve Repair Pre-requisites	
A. Valve designs differ but the prerequisite tasks should all include the following:	
1. Contact Shift Supervisor - His signature releases the valve to maintenance and grants permission to begin work.	
Note: There still may be steps required for his approval within the procedure to perform system requirements.	
2. Ensure the permit is hung and accepted - It is a requirement that a system is walked down sufficient to verify the system is safe to open.	
3. Check and document the Valve position	
a. It is required to leave a valve in the as found position unless specifically identified differently by the work document	
b. This has been a problem in the past and configuration control is critical to the safety of the plant	Ensure they understand WHY
4. Housekeeping - General working area.	

5. Foreign Material Exclusion

    a. Introducing foreign material can affect nuclear safety and/or plant operability — Ensure they understand WHY

    b. Prevent introduction of foreign material

    c. Maintain class cleanness - Valve and system prescribes certain class cleanness to prevent the introduction of foreign materials. Class A,B,C,D

II. SOER 85-02 MISPOSITIONING EVENTS INVOLVING HUMAN ERROR — **Slide**

A. SUMMARY: — Give students a few minutes to read the SOER in the handout

1. Mispositioned valves have resulted in functional degradation of safety systems and reduced plant availability. — Self check/Peer check

2. Mis-positioned auxiliary feed-water valves were a contributing factor to the accident at Three Mile Island.

3. The frequency of valve positioning errors has not noticeably decreased over the last five years even though a number of initiatives have been taken to reduce these events.

4. <u>Human error</u> is the predominate cause of Mispositioned valves. — What is the predominant cause of mispositioned valves?

    Answer: Human error

5. Improved management controls can prevent and detect human error in valve manipulation.

6. INPO initiated a study of Four Case studies on valve mispositioning events.

B. The Analysis revealed (4) weak areas:

1. Administrative — Self check/Peer check

    a. tracking of tag placement and removal

    b. tracking of valve operations

    c. administrative control to prevent valve mis-positioning

    d. logging the manipulation of locked valves

    e. review of steps in a procedure upon task completion

2. Procedures

    a. failure to verify associated support functions during system restoration and testing

    b. incomplete task-specific procedures

    c. failure to complete all steps of a procedure

    d. inadequate implementation or adherence to existing procedures

3. Training

    a. Insufficient training or experience in methods of determining valve position

    b. Insufficient training in administrative controls of equipment for valve positioning.

    c. Use of oral communication for task assignment, without task completion feedback.

    d. failure to use a valve checklist

4. Hardware

    a. insufficient local valve identification

EO 1.1.4	State the steps to perform an external valve inspection

1.1.4.1 Main Idea

****Objectives/Sequence****	****Methods & Activities****
I. External Valve Inspection	**Slide** Ask the class the question "How many of you perform an external inspection prior to valve rework"?
A. Purpose	**Click:** Ensure they understand WHY
1. Ensure the maintenance can be done safely	
2. Confirm external problems that were identified by the originator	**Click**
3. Identify any problem that was not identified by originator	**Click**
4. Evaluate the resources to rework the valve Manpower, Rigging, Tools etc.	**Click**
B. External inspection checklist	**Slide**
1. Handwheel - Bent, Broken	**Click**
2. Reachrods – Hard operation, loose roll pins, misalignment	**Click**
3. Stem - Severe nicks or gouges	**Click**
4. Packing Gland - Signs of leaking, missing nuts, Gland follower to stuffing box engagement.	**Click**
5. Body to Bonnet joint - signs of leaking, Damp or Boron build up.	**Click**
6. Nuts/Stud - Missing, proper thread engagement, tightness	**Click** **Slide** photo for reviewing process

EO 1.1.5	Identify the list of terms associated with various valves

1.1.5.1 Main Idea

****Objectives/Sequence****	****Methods & Activities****
I. Glossary of Valve Terms	**Use PowerPoint slides as appropriate** Review TERMS in handout especially those in the lesson plan.

A. Actuator – The part of a valve that applies the force to open or close the valve

B. Ball valve – A type of plug valve having a spherical disc

C. Bluing – A method of checking surface contact between mating surfaces; bluing shows concentricity, amount of disc/seat contact, and whether or not contact is continuous

D. Bonnet – The part of a valve containing the valve stem and packing

E. Bridge wall marking – Symbol on body of valve showing the relationship of the disc to the inlet and outlet ports.

F. Butterfly valve – A quarter-turn valve having a plate-like disc which stops flow by the outside area of the disc sealing against the inside of the valve body.

G. Cavitation – The formation and subsequent collapse of air or steam bubbles in a system, which can cause deterioration of surrounding metal.

H. Check valve – A valve that allows flow in one direction only.

I. Deformation – A change in the shape of a material or component [strain] due to an applied force [stress]

****Objectives/Sequence****	****Methods & Activities****
J. Disc – Part of a valve used to control the flow of system fluid	
K. Disc holder – A device which retains a valve disc on the spindle or stem.	
L. Diaphragm valve – A valve that uses a flexible material to separate the valve bonnet from the system fluid and may also use the flexible material to control flow through the valve.	
M. Flanged bonnet – A valve bonnet that has a flange through which bolts or studs connect it to a mating flange on the valve body.	
N. Gate valve – A valve having s straight-through flow design, which exhibit very little resistance to flow; normally used for open/shut applications.	
O. Globe valve – A valve in which flow is always parallel to the stem as it goes past the seat.	
P. Gland – generic term used to identify either of the following 1. Closure device used to compress packing in stuffing box [a.k.a. gland follower] 2. The stuffing box, especially when referring to a filled box as in "gland stress" referring to the compression of the packing	Note that the spec [13-PN-0220] uses "gland" and "gland follower" interchangeably to mean the same thing Ditto with "gland" and "stuffing box"
Q. Gland Follower - Closure device for a stuffing box (also Packing follower or even packing flange if all one piece)	
R. Gland Flange - Flat cross-member that is pushed down by the threaded fasteners to compress the packing – generally in conjunction with the gland follower.	

******Objectives/Sequence****** ******Methods & Activities******

S. Junk ring – A ring contained in the bottom of packing chamber which maintains a close diametrical clearance to eliminate the extrusion of packing; it also supports the valve stem

T. Lantern ring – A ring contained in a valve packing chamber that allows escaping system fluid to be vented

U. Lapping – The removal of mating surface defects using an abrasive compound

V. Male and female Joint bonnet – A valve in which the bonnet gasket surface is inserted slightly into the body gasket mating surface for alignment purposes, gasket retention, and gasket compression

W. Packing – Material used to make a dynamic seal, preventing system fluid leakage around a valve stem

X. Packing Chamber – The part of a valve bonnet used to retain the packing; also known as the stuffing box

Y. Packing gland – A device used to retain packing within a packing chamber [see gland]

Z. Plug valve – A quarter-turn valve having a ported disc

AA. Pressure-sealed Bonnet – A valve bonnet which seals tighter as system pressure increases

BB. Seat – The part of a valve against which the disc presses to stop flow through the valve

CC. Stop check Valve – A valve that will allow flow in one direction only or can be manually closed to stop all flow through it

DD. Throttling –The regulation of flow through a valve

EE. Valve body – The part of a valve containing the passages for fluid flow, valve seat, and inlet and outlet connections

******Objectives/Sequence****** ******Methods & Activities******

FF. Valve stem – The part of a valve which raises, lowers, or turns the valve disc

GG. Wedge – A term for the disc in a gate valve

HH. Wiper ring – The upper and/or lower rings of valve packing, which clean the stem during stem movement

II. W.O.G. – Water, Oil, Gas

JJ. W.S.P. – Working Steam Pressure

KK. Yoke bushing – The bearing between the valve stem and the valve yoke.

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.