PALO VERDE
NUCLEAR GENERATING STATION

I&C Program

Classroom Lesson

I&C Program	**Date: 2/25/2011 1:48:08 PM**
LP Number: NIA97C000703	**Rev Author: DANIEL R. REED**
Title: Flow Control Valves	**Technical Review:** De Dea, Thomas J(Z31735) Digitally signed by De Dea, Thomas J(Z31735) DN: cn=De Dea, Thomas J(Z31735) Date: 2012.04.19 09:34:02 -07'00'
Duration : 30 HOURS	
	Teaching Approval:

INITIATING DOCUMENTS

None

REQUIRED TOPICS

None

CONTENT REFERENCES

Instrument Engineer's Handbook, Liptak 1969

Instrumentation for Process Measurement and Control, Anderson 1980

Process Instruments and Controls Handbook, Considine 1974

SOER 85-02 "Valve Mispositioning Events Involving Human Errors"

SOER 85-03 "Excessive Personnel Radiation Exposures"

REVISION COMMENTS

Feb 25, 2011	Jeff De Dea	changed evaluation from LPE to a written Exam

Tasks and Topics Covered

The following tasks are covered in Flow Control Valves :

Task or Topic Number*	**Task Statement**

Lesson: Flow Control Valves

PRO43	Maintain valve positioner
PRO052	Calibrate valve actuator

Total task or topics: 2

TERMINAL OBJECTIVE:

1 Given appropriate equipment and procedures, the I&C Technician will calibrate and maintain flow control valves in accordance with all applicable standards. Mastery will be demonstrated by successful completion of a written Exam with a score of 80% or better.

1.1 Describe how Procedure Use & Adherence applies to calibrating control valves

1.2 Describe the function of the various subassemblies of a pneumatic control valve

1.3 Contrast the various valve types including design, flow characteristics and applications

1.4 Determine the failure position of a pneumatic valve

1.5 Describe the theory of operation of valve positioners

1.6 For a valve having red and green position indicators, explain the operation of the position indicators including the appropriate limit switch contact arrangement

1.7 Calibrate the control valve to include the following:

a. Bench set
b. Valve stroke
c. Valve seating
d. Limit switches
e. Positioner

TO: 1	**Given appropriate equipment and procedures, the I&C Technician will calibrate and maintain flow control valves in accordance with all applicable standards. Mastery will be demonstrated by successful completion of a written Exam with a score of 80% or better.**

EO: 1.1 Describe how Procedure Use & Adherence applies to calibrating control valves

Main Idea

Procedure Use & Adherence

Increasingly procedures are guiding our activities concerning valve setup and calibration where before technician knowledge was relied on.

Ensure we use work orders, PMs and procedures when working on valves.

Methods & Activities

Expectations:

Follow procedures as they are written.

Understand the procedure level of use, when

to STOP for resolution and use of sign-offs

and place keepers.

Determine a level of use for all procedures

(procedure owners)

Actively participate in procedure

improvement.

Ensure activities are completed as provided

for in procedures, regardless of level of use.

Standards

When: During performance of work that is guided by

procedures.

How:

STOP and resolve the issue if a procedure

can not be followed as written. Notify your

leader to assist in resolution.

Validate that you have the current revisions.

Use place keepers and sign-offs as required.

Provide procedure enhancements, training or

feedback to create a continuous improvement loop.

Ensure we know the level of use.

Use procedures according to level of use:

Continuous Use – The procedure is used "in-hand," with steps completed as provided for in the document.

Reference – Reviewed prior to or referred to periodically during performance of activities.

Information – Refer to as needed based on frequency of use, individual knowledge and proficiency.

Combined Use – Use each procedure section according to the level identified. (Some procedures contain multiple usage levels).

EO: 1.2 Describe the function of the various subassemblies of a pneumatic control valve

Main Idea

Control Valve

Optional Methods & Activities:

Prevent Events: Hazard Assessment – *Beware of Potential of Injury from Pinch points, Hi Energy mechanical components, and Hi Stress Loading when working on Control Valves.*

A. Components/Function

Powerpoint slides on control valves

1. Valve - controls fluid flow through piping

When stroking control valves, be sure the system is in a condition that can tolerate valve movement.

   a. Body

   b. Bonnet

   c. Stem

   d. Plug

   e. Seat

2. Actuator – controls mechanism for moving the valve stem

   a. Stem

Prevent Events: Hi Stress Loading, possible / pinch point, missile hazard. - *Actuator stem connected, with coupling device, to valve stem. Exercise extreme causing whenever uncoupling Actuator stem from valve stem.*

   b. Diaphragm

   c. Diaphragm case

d. Tensioning spring

Prevent Events: Hi Energy mechanical components. – pinch point, missile hazard. *Exercise extreme causing whenever working around or with Tensioning Spring.*

3. Positioner

Ask why we use positioners and where we need them. Where do we not need them?

a. Recieves a low volume position signal from an I2P or other source

1. Delivers a high volume pneumatic signal to the actuator

b. Receives a position feedback signals from the valve stem

EO: 1.3 Contrast the various valve types including design, flow characteristics and applications

Main Idea

II. Types of Valves

A. Globe Valve TP02

1. Throttling or fine flow control
2. High Head Loss

B. Gate Valve TP03

1. Poor throttling, almost full flow for small opening
2. Lower head loss, turbulence from sharp edges

C. Plug Valve TP04

1. Isolation or flow control
2. Similar to ball valve 90^{o} for full open

D. Check Valve TP05

1. Limits flow to one direction
2. Variations include lift check, ball check, swing check, articulated swing check

E. Needle Valve - Very fine flow control for small amounts of fluid TP06

F. Ball Valve TP07

1. Used for isolation
2. Not used for throttling
3. Open/Close in 1/4 turn
4. Relatively low head loss

G. Butterfly Valve TP08

1. Usually Isolation
2. Flat Disc connected to shaft
3. Disc is in center of flow path when open
4. Throttling creates impingement forces on the disc

Prevent Events: Use Operating Events - *Discuss Event in Unit 1:* Valve in circ water discharge from condenser. Approx.10 ft. Diameter valve. Flow caused oscillation of disc which caused key way to sheer. The valve slammed shut causing a pressure excursion which burst circ water piping in the turbine building and damage to condenser tubes

III. Diaphragm Operated Actuator TP09

A. Air is applied to a surface area of several hundred in^2

B. Air opposes and overcomes spring pressure

EO: 1.4 Determine the failure position of a pneumatic valve

Main Idea

C. Determining Fail Position

1. Which way does the stem need to move to seat valve

2. Is Air admitted to top or bottom of actuator

EO: 1.5 Describe the theory of operation of valve positioners

Main Idea

IV. Valve Positioners: Fisher model 3582 Valve Positioner, the most common valve positioner on site

Optional Methods & Activities:

Prevent Events: Hazard Assessment – *Beware of Potential of Injury from Pinch points, Hi Energy mechanical components, and Hi Stress Loading when working on Control Valves and Positioners*

A. Principles of operation

PPT slides on valve positioners

1. Feed back from valve actuator comes in via positioner linkage and cam

Note the many new digital or Milliamp input positioners we are getting.

The positioner takes a direct 4-20 ma input and outputs a valve position. No separate I2P is needed as the I2P is built into the positioner.

2. Cam acts as both balancing input and beam pivot
3. Tension wire pivot is opposite end of effective lever
4. Movement appears in two planes 90 degrees apart
5. Gain is adjusted by varying angle of flapper on floating lever - changes degree of effect of each link on floating beam
6. Use opposite quadrant to change to reverse acting

B. Operation for increase in input pressure

1. Input bellows lifts input pressure
2. Flapper moves closer to nozzle
3. Relay output pressure rises

4. Actuator moves

5. Position Feeds back to reposition cam to lower cam height

6. Baffle moves out slightly to new equilibrium - system balanced

7. Make zero adjustment by varying nozzle clearance and span adjustment by varying position of pivot on D-ring

Potential Problems: D-ring jumps off pivot points, cam and roller get worn spots or even get cut through on valves in high vibration environments or on poorly adjusted control loops.

EO: 1.6 For a valve having red and green position indicators, explain the operation of the position indicators including the appropriate limit switch contact arrangement

Main Idea

V. Valve Limit Switches – provide remote indication of valve position

Optional Methods & Activities

A. Indications

Use Powerpoint slides for valve limit switches

1. Red light – valve open
2. Green light – valve shut
3. Both lights – valve intermediate

B. Operation

1. Generally two switches per valve
2. Open switch
   a. Closed from the time the valve leaves the open seat until approximately 90% or 95% open
   b. Power being supplied to the green light during this valve stroke
3. Closed switch
   a. Closed from the time the valve is approximately 5% or 10% open
   b. Power being supplied to the red light during this valve stroke
4. Intermediate position
   a. Between 5% and 95%, or 10% and 90%
   b. Power being supplied to both lights

VI. Stroking Valves

A. Benchset - Pressure needed to fully stroke the valve without process pressure

B. Valve Stroke - Distance stem travels full open to full close

C. Positive Seat - Firm contact between seat and disc

VII. Industry Events ***Prevent Events: Use Operating Experiences – Read SOER's 85-2 & 85-3***

A. SOER 85-2 Valve Mispositioning Events Handout

B. SOER 85-3Excessive Personnel Radiation Exposures Handout

EO: 1.7 Calibrate the control valve to include the following:

a. Bench set

b. Valve stroke

c. Valve seating

d. Limit switches

e. Positioner

Main Idea

Using Laboratory Practical Exercise's NIA97L001811, NIA97L001911 and NIA97L002011, calibrate a control valve to include bench set, valve positioner and limit switches.

Observe the precautions and general conditions on the LPE.

During initial instructor lab demonstration and pre job brief PPE is not required as long as there are no actual safety hazards. During training, practice and evaluations simulating work in the field, personal protective equipment and electrical protective equipment are required in designated areas of the lab. PPE may be required in non-designated areas as deemed necessary by the instructor.

All requirements of the LPE must be met to satisfy this objective.

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.