UTILITIES DEPARTMENT
APPROVED SAFE WORK PROCEDURE

TEST FOR SILICA — Procedure No. D-1

Theory of Test

The presence of silica in the feedwater of high pressure boilers is apt to cause silica scale on the boiler tubes, superheater tubes and the turbine blades. The presence of this scale is extremely objectionable and must be prevented. Hence, the silica in the effluent from the secondary anion units must be kept to a minimum.

This test is based on the development of the "heteroply blue" or "molydenum blue" color. The addition of oxalic acid destroys any color contributed by phosphates.

When running this test, keep in mind that some of the chemicals to be used are harmful to the skin and eyes, and caution should be exercised to prevent injury. If by accident any of these chemicals should get on the body or into the eyes, wash thoroughly with water.

Apparatus Required

(a) 1 - Colorimeter
(b) 1 - Cylinder, graduated, 100 ml. capacity
(c) 2 - Pipettes, 5 ml. capacity

Chemicals Required

(a) Hydrochloric Acid 1:1
(b) Ammonium Molybdate
(c) Oxalic acid
(d) Amino-Naphthal-Sulfonic acid solution

Procedure

To a 100-ml. sample of water, add in rapid succession with mixing, 4 ml. of ammonium molybdate solution and 2 ml. of hydrochloric acid. Wait 5 minutes and then add 3 ml. of oxalic acid solution; mix, and after 5 minutes add 4 ml. of amino-haphthal-sulfonic acid reducer. Wait 5 minutes and measure color on Klett colorimeter.

Calculation of Results

The scale reading of the colorimeter is used to read the ppm SiO_2 from a curve prepared for that purpose.

Ref: Standard Methods for the Examination of Water and Sewage, 10th Edition, 1955.

Betz Handbook of Industrial Water Conditioning, 4th Edition.

UTILITIES DEPARTMENT
APPROVED SAFE WORK PROCEDURE

TEST FOR pH (GLASS ELECTRODE METHOD) Procedure No. D-2

Theory of Test

The pH hydrogen ion concentration of a solution may be measured by determining with a potentiometer the voltage developed by two electrodes which are in contact with the solution. The voltage of one electrode known as a calomel half-cell is fixed, while the voltage of the other electrode varies with the pH of the sample. Several types of electrodes may be used, but, in general, a glass electrode is the most applicable for industrial use. A glass surface of the proper composition separating two solutions gives potentials which are directly proportional to the pH. Due to the highresistance of the circuit, it is necessary to employ some type of electronic device (vacuum tube) to amplify the current.

Apparatus Required

(a) 1 - Electrometric pH meter, complete.

Procedure for Test

The exact mechanical procedure for determining pH will vary slightly with the instruments furnished by different manufactureres. However, in general, the instrument is first standardized by using a buffer solution of known pH. The temperature of the sample to be tested is observed and a temporature correction dial on the instrument is adjusted. The glass electrodes are then inserted in the water sample and the pH is read directly on a dial on the instrument.

Limitation of Test

Glass electrode potentials are not affected by oxidizing or reducing agents, gases, dissolved organic compounds, colloids or suspended matter. The pH of various solutions or highly colored solutions may be obtained by this method. Accuracy is superior to colorimetric methods. In high concentrations of sodium ions, an error is introduced which can be corrected by suitable curves or by standardizing the instrument for that range.

Ref: Betz Handbook (1953)

UTILITIES DEPARTMENT
APPROVED SAFE WORK PROCEDURE

CHLORIDE TEST — Procedure No. D-3

When running this test, keep in mind that some of the chemicals to be used are corrosive to the skin and eyes, and caution should be exercised to prevent injury. If by accident any of these corrosive chemicals should get on the body or into the eyes, wash thoroughly with water.

Procedure for Test

If the P or M alkalinity has already been determined, the same sample may be used directly for the chloride test without further neutralization. If the P or M alkalinity has not been determined, the sample must be properly neutralized with sulfuric acid. Take a 50 ml. sample of water to be tested, add 4 to 5 drops of pheolphthalein indicator and, by means of a dropper, just sufficient sulfuric acid (N/50) to neutralize to the colorless side of phenolphthalein as described under alkalinity.

Add to the neutralized sample 5 drops of potassium chromate indicator which will turn the solution to a bright yellow. Add silver nitrate from a burette slowly to the sample, stirring constantly until 1 drop produces a permanent reddish color. This reddish color is to be taken as the endpoint and not a brick red color that will develop if additional silver nitrate is added.

A blank of 0.2 ml. for this strength silver nitrate solution should be subtracted from this determination as this is the quantity of silver nitrate required to produce the endpoint with distilled water.

Chemicals Required

(a) Sulfuric Acid, N/50
(b) Silver nitrate, 1 ml. = 1 mg. Cl.
(c) Phenolphthalein Indicator
(d) Potassium Chromate Indicator

Apparatus Required

(a) 1 - Burette, automatic, 25 ml., complete
(b) 1 - Casserole, Porcelain, 210 ml. capacity
(c) 1 - Cylinder, graduated, 50 ml. capacity
(d) 1 - Bottle, with dropper, 8 oz. capacity
(e) 1 - Stirring rod, glass

UTILITIES DEPARTMENT
APPROVED SAFE WORK PROCEDURE

ALKALINITY TEST — Procedure No. D-4

Theory of Test

The basic alkalinity tests are pheonolphthalein test (P test) and the methyl purple test (M test). The P and M tests measure the kinds of alkalinity that are present in the water. The P test measures none of the bicarbonates, half of the normal carbonates, and all of the hydroxide alkalinity. The M test measures the total of all alkalinity present.

When running this test, keep in mind that some of the cohemicals to be used are corrosive to the skin and eyes, and caution should be exercised to prevent injury. If by accident any of these corrosive chemicals should get on the body or into the eyes, wash thoroughly with water.

Apparatus Required

(a) 1 - Burette, automatic complete
(b) 1 - Casserole, porcelain, 210 ml. capacity
(c) 1 - Cylinder, graduated, 100 ml. capacity
(d) 1 - Stirring rod, glass

Chemicals Required

(a) Sulfuric Acid, N/50
(b) Phenolphthalein Indicator
(c) Methyl purple Indicator
(d) Sodium Thiosulfate

Procedure for Test

Measure 100 ml. of the water to be tested into the casserole. (The sample must be clear; filter, if necessary.) If free chlorine is present in the sample, add two drops of sodium thiosulfate. Stir thoroughly.

Add two drops of phenolphthalein indicator. This may impart a pink color to the water, but if pink color is not produced, record the p as zero. If the pink color is produced, add N/50 sulfuric acid from the burette slowly. Be sure the burette is filled to the zero mark. Stir the solution and continue adding acid until the pink color just disappears. Read the burette and record the readings as P on the log sheets.

After completing the P test, add to the same sample four drops of methyl purple indicator. This will turn the water a pale green color.

Use the acid remaining in the burette after completing the P test without refilling the burette. Add a few drops of the acid at a time, stirring as before, until the green color turns to purple. If uncertain that the color change has occurred, read the burette, note the reading, then add a few more

ALKALINITY TEST (continued)

drops of acid. Should the color become darker, the previous reading was incorrect. If it does not, add more acid until the color change occurs.

The total ml. of acid used including that used in making the P test, is the M. Record the M reading on the log sheet.

UTILITIES DEPARTMENT
APPROVED SAFE WORK PROCEDURE

WATER TREATING PLANT
Procedure No. E-1

LOSS OF 2400 VOLT POWER, L-82

Check with Power Control Room to determine that power on L-82 has been lost at Substation 8.

Caution: If power has not been lost at Substation 8, DO NOT use this procedure. Refer to procedure No. E-1a.

At 2400 Volt Service Entrance Pole:

1. Open and Red Tag L-82 line switch.
2. Close the Bus Tie Switch that is already open, as indicated. Under normal operation one Bus Tie Switch will be open and one will be closed.

Safety Notes:

1. Before operating each switch, visually inspect to see that the ground strap is attached to the switch handle and to the ground wire on pole.
2. Make sure that all three blades of the switch open or close as desired. If any blade on either switch fails to open or close, DO NOT attempt any further operation of the switch.

UTILITIES DEPARTMENT
APPROVED SAFE WORK PROCEDURE

WATER TREATING PLANT
Procedure No. E-1a

LOSS OF 2400 VOLT POWER, L-82 (W.T. ONLY)

Caution: This procedure is to be used only if power has been lost on L-82 in Water Treating and not on L-82 at Substation 8.

This condition indicates that a fault has occurred somewhere on the 2400 volt system within the Water Treating Block. In order to eliminate further equipment damage and personel safety hazard, electrical tie will be made at only the 480 volt level.

At Motor Control Center:

1. Open and red tag main disconnect to MCC-7B.
2. Close Tie Breaker on MCC-7A.
3. Close Tie Breaker on MCC-7B.
4. Equipment may now be started on MCC-7B. DO NOT let bus loading exceed 300 amps on the meter on the tie Breaker or 600 amps on the meter for L-63 to MCC-7A.

At 2400 volt Service Entrance Pole:

1. Open and red tag L-82 Switch.
2. Red Tag the open Bus Tie Switch.
3. Have the Power Plant rack-out and red tag the Water Treating Backup Feeder.

UTILITIES DEPARTMENT
APPROVED SAFE WORK PROCEDURE

WATER TREATING PLANT
Procedure No. E-2

LOSS OF 2400 VOLT POWER, L-63

Check with Power Control Room to determine that power on L-63 has been lost at Substation 6.

Caution: If power has not been lost at Substation 6, DO NOT use this procedure. Refer to procedure No. E-2a.

At 2400 volt Service Entrance Pole:

1. Open and Red Tag L-63 line switch.
2. Close the Bus Tie Switch that is already open, as indicated. Under normal operation one Bus Tie Switch will be open and one will be closed.

Safety Notes:

1. Before operating each switch, visually inspect to see that the ground strap is attached to the switch handle and to the ground wire on pole.

2. Make sure that all three blades of the switch open or close as desired. If any blade on either switch fails to open or close, DO NOT attempt any further operation of the switch.

UTILITIES DEPARTMENT
APPROVED SAFE WORK PROCEDURE

WATER TREATING PLANT
Procedure No. E-2a

LOSS OF 2400 VOLT POWER, L-63 (W.T. ONLY)

Caution: This procedure is to be used only if power has been lost on L-63 in Water Treating and not on L-63 at Substation 6.

This condition indicates that a fault has occurred somewhere on the 2400 volt system within the Water Treating Block. In order to eliminate further equipment damage and personel safety hazard, electrical tie will be made at only the 480 volt level.

At Motor Control Center:

1. Open and red tag main disconnect to MCC-7A.
2. Close Tie Breaker on MCC-7B.
3. Close Tie Breaker on MCC-7A.
4. Equipment may now be started on MCC-7A. DO NOT let bus loading exceed 300 amps on the meter on the Tie Breaker or 600 amps on the meter for L-82 to MCC-7B.

At 2400 Volt Service Entrance Pole:

1. Open and red tag L-63 Switch.
2. Red Tag the open Bus Tie Switch.
3. Have the Power Plant rack-out and red tag the Water Treating Backup Feeder.

UTILITIES DEPARTMENT
APPROVED SAFE WORK PROCEDURE

CHLORINE SYSTEM — Procedure No. F-4

Chlorine gas is utilized in the water treating process for disinfection and algae control. The gas is mixed with water by chlorinators (aspirator-type) and then injected into the various streams -- raw, process, and potable water.

Normal supply of chlorine gas is received by pipeline from the Chlorine Plant at approximately 150#. An emergency standby supply is provided in one-ton cylinders. The 150# supply is vaporized (a steam coil and steam tracing arrangement), pressure reduced to 50#, and filtered prior to injection at the chlorinators. (See attached diagram). System pressure is alarmed at 20# (low) and 80# (high). The chlorine dosage is controlled by the chlorinators.

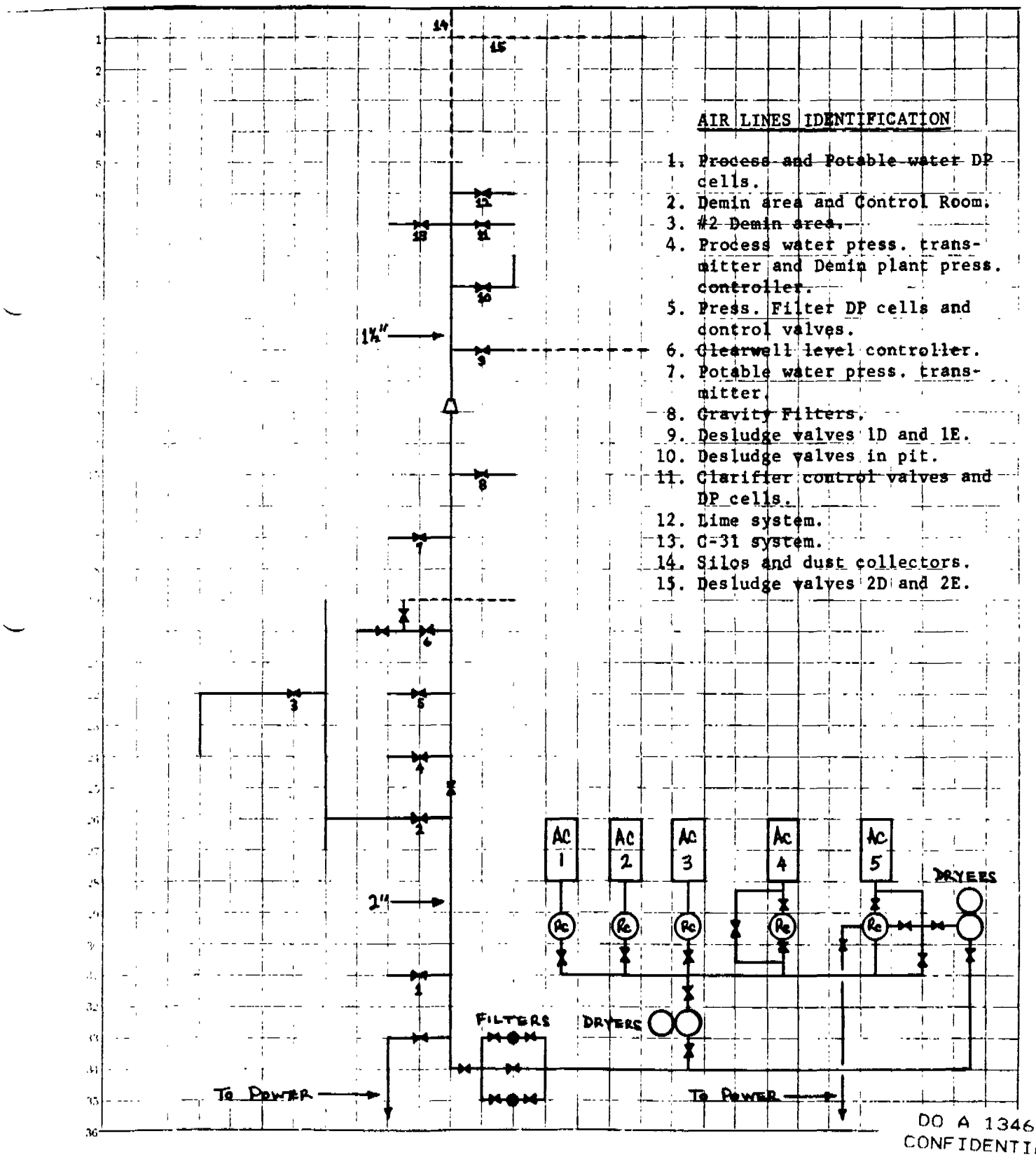
The standby one-ton cylinders are connected to the same system, just downstream of the vaporizer arrangement. The cylinders are connected to the piping system through 3/8" tubing. The connection to the cylinder valve requires a lead gasket (usually supplied with the cylinder). Spare gaskets can usually be found in the Instrument Cabinet above the workbench in the Control Building. The other end of the tubing is connected to the piping through a 1/2" ball valve. As a safety precaution when making or breaking these connections, a full-face gas mask is required.

The system is normally leak-tight; however, leaks can develop when connections are broken and re-made (filter changes, chlorinator change-outs, etc.). Chlorine gas is poisonous -- refer to write-up in Procedure No. A-1.

UTILITIES DEPARTMENT
Approved Safe Work Procedure

Water Treating Air System

Procedure No. F-5



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