Boiler & Pressure Vessel
Jurisdictional Inspection Services

Every Device, Test it Twice!

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Every Device, Test it Twice!

Your Presenter:

Dave Sutheimer started his career with boilers in the United States Navy, serving 4 years active and 20 years in the Reserves as a Boiler Technician, retiring in 2004.

He has worked continuously with boilers for 40 years, as a inspector and trainer for several major multi-national insurance carriers, and as a State inspector in Kansas. He was also employed as a factory trained boiler start-up mechanic and service manager in the Kansas City area. He is currently employed by One CIS Insurance Company, the US boiler & Pressure Vessel Insurance and Inspection company of Bureau Veritas. Bureau Veritas is a Global Safety, Quality Control and Inspection company covering all industries.

Dave holds National Board Inspectors Commission #9662, Kansas Special Inspector Commission #450 and various other State Special Inspector Commissions. He holds the ARM (Associate in Risk Management), ALCM (Associate in Loss Control Management) AIM (Associate in Management) and ARM-E (Associate in Enterprise Wide Risk Management) from the Insurance Institutes of America.

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Operation & testing of controls and safety devices

We will be going over the requirements for Safety Controls, and the Testing and Maintenance of these controls

- Learning objectives
  - How controls are set
  - How controls are tested and maintained
  - Who should perform testing

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Operation & testing of controls and safety devices

Majority of this presentation will cover:

ASME Code CSD-1 2009 Edition

Non Mandatory Appendix D

Recommended preventive maintenance schedule

Some text in this presentation adapted from ASME code CSD-1 – 2009[3]

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Operation & testing of controls and safety devices

This presentation and material is for general informational use only and is not intended to provide specific instructions on equipment, controls or testing. Each installation is different and any training or instruction for installation and testing of controls must be per the manufacturer's instructions.

All boiler operation and testing of controls must only be performed by qualified personnel.

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Operation & testing of controls and safety devices

ASME Code CSD-1 2015 Edition is a great resource for installers, inspectors, and maintenance personnel. It can be purchased from the ASME website, ASME.org, for $93.00.

There is also a CSD-1 on-line training module on the National Board website, nationalboard.org, for $150.

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Operation & testing of controls and safety devices

The major perils in operating automatically fired boilers are:

1. Loss of water (low water),
2. Overpressure, and overtemperature
3. Furnace explosion

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Operation & testing of controls and safety devices

According to the ASME and National Board,

The Principle causes of accidents to automatically fired boilers are:

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Operation & testing of controls and safety devices

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Operation & testing of controls and safety devices

According to the ASME and National Board,

The Principle causes of accidents to automatically fired boilers are:

- lack of proper controls and safety devices,
- lack of adequate maintenance, improperly trained operators,
- failure to test controls and safety devices,

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Operation & testing of controls and safety devices

According to the ASME and National Board,

The Principle causes of accidents to automatically fired boilers are:

- lack of proper controls and safety devices,
- lack of adequate maintenance, improperly trained operators,
- failure to test controls and safety devices,
- complacency on the part of operators due to long periods of trouble free operation.

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Who should perform the test?

Only qualified personnel trained and familiar with the equipment and the controls should attempt to perform the testing and maintenance.

That means the BOILER OPERATOR, SERVICE TECHNICIAN or OWNER/USER performs the tests, ***not the Jurisdictional Inspector***

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Never allow anyone to bypass safety controls!

Here a purge was bypassed to save time while testing

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Operation & testing of controls and safety devices

So which of the following is responsible for giving the boiler operator instructions on how to test the Safety Devices and Controls?

1. The safety control manufacturer
2. The boiler/burner manufacturer
3. The boiler installer
4. The boiler owner

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Operation & testing of controls and safety devices

So which of the following is responsible for giving the operator instructions on how to test the Safety Devices and Controls?

1. **The safety control manufacturer**
2. **The boiler/burner manufacturer**
3. **The boiler installer**
4. **The boiler owner**

All of the above!

The persons/entities in 1, 2 & 3 must furnish the maintenance and testing instructions and the owner, #4, is responsible for instituting a maintenance and testing program and making sure it gets completed.

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Operation & testing of controls and safety devices

The **Manufacturers of the controls and safety devices** furnish detailed instructions covering the how to clean the controls and how often. When the controls are ordered from the manufacturer and shipped to the boiler or burner manufacturer, the instructions are included. It is then up to the boiler/burner manufacturer to send them to the customer.

Also, the **boilers and burner manufacturers** furnish detailed instructions on how to **test** the controls and safety devices. These instructions cover **both when the boiler is operating and when it is out of service**.

Boiler, boiler unit, and burner manufacturers then furnish detailed instructions on **maintenance and service procedures** for the burner and fuel train. This includes the controls and safety devices installed with the unit.

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Operation & testing of controls and safety devices

These installation and maintenance instructions include a requirement that cover plates, enclosures, and guards shall be maintained in place at all times, except during maintenance.

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Operation & testing of controls and safety devices

The boiler, boiler unit, burner, and control manufacturers' operation and maintenance instructions that are furnished with the equipment **are required to be retained and made available to the boiler operator**.

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Operation & testing of controls and safety devices

The installation of the controls, safety devices and burners must be in accordance with the manufacturer's instructions.

Wiring and piping diagrams showing the connections for the controls and safety devices also need to **be furnished by the unit manufacturer.**

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Operation & testing of controls and safety devices

Installing contractors obtain from the manufacturer all the operating, testing, servicing, and cleaning instructions for the controls and safety devices.

Then it is the responsibility of the installing contractor to deliver these instructions and the complete wiring and piping diagrams to the owner / user and to obtain a receipt for the instructions.

Included is a written precaution that the operating, testing and servicing only be performed by a qualified individual.

They get a receipt for these instructions and file this receipt with the installation report.

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Operation & testing of controls and safety devices

The effective operation of all safety devices depends on their ability to respond to their activating impulses. The only way to assure this is to **established and perform a systematic and thorough maintenance program.**

The operation of control systems and safety devices **must be tested by the installing contractor prior** to release to the owner/user. This is when they complete the required CSD-1 installation Report

Then the owner or user must develop and maintain a formal system of periodic preventive maintenance and testing. Tests need to be conducted on a regular basis, and the results recorded in a boiler log or in the maintenance record. Always follow the manufacturer's instructions.

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Operation & testing of controls and safety devices

Excerpted from ASME code CSD-1:

(a) An inspection and maintenance schedule shall be established and performed on a periodic basis, the minimum needs to be at least that required by the equipment manufacturer.

(b) **Operation** and **set points** on all devices need to be verified by periodic testing, and the results recorded in some form of written record such as the boiler log, maintenance record, or service invoice.

(c) Any defects found shall be brought to the attention of the boiler owner and shall be corrected immediately.

(d) Inspection, adjustment and cleaning must be done during initial startup to ensure all safety controls and devices are functioning as intended and are in a reliable operating condition.

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Operation & testing of controls and safety devices

The qualified individual performing inspections and tests shall be trained and familiar with all operating procedures and equipment functions and shall be capable of determining the equipment is in a as-designed operating condition. The individual shall be familiar with all precautions and shall have complied with the requirements of the authority having jurisdiction.

The Kansas Fire Marshal, Boiler Inspection Unit is the Authority having Jurisdiction!

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Operation & testing of controls and safety devices

Operation and set points on all devices are required to be verified by periodic testing, and the results recorded.

This means there are 2 types of tests

1. Operation (Functional)
2. Set Points

Every Device, Test it Twice!

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Operation & testing of controls and safety devices

For Example a Float Type External Mounted Low Water Cutoff

A Quick Drain test would be what type of test?

Functional

A slow drain test would be what type of test?

Set Point Verification.

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Primary Safety Circuit Testing

BMS – Burner Management System or FSG – Flame Safeguard Control
In this presentation I use the terms interchangeable.

First off, there are two main manufacturers of BMS, I will call them Red and Blue.

Boiler manufacturers will take these controls and paint them the color of their boilers and put their name on them, but they are still either red or blue.

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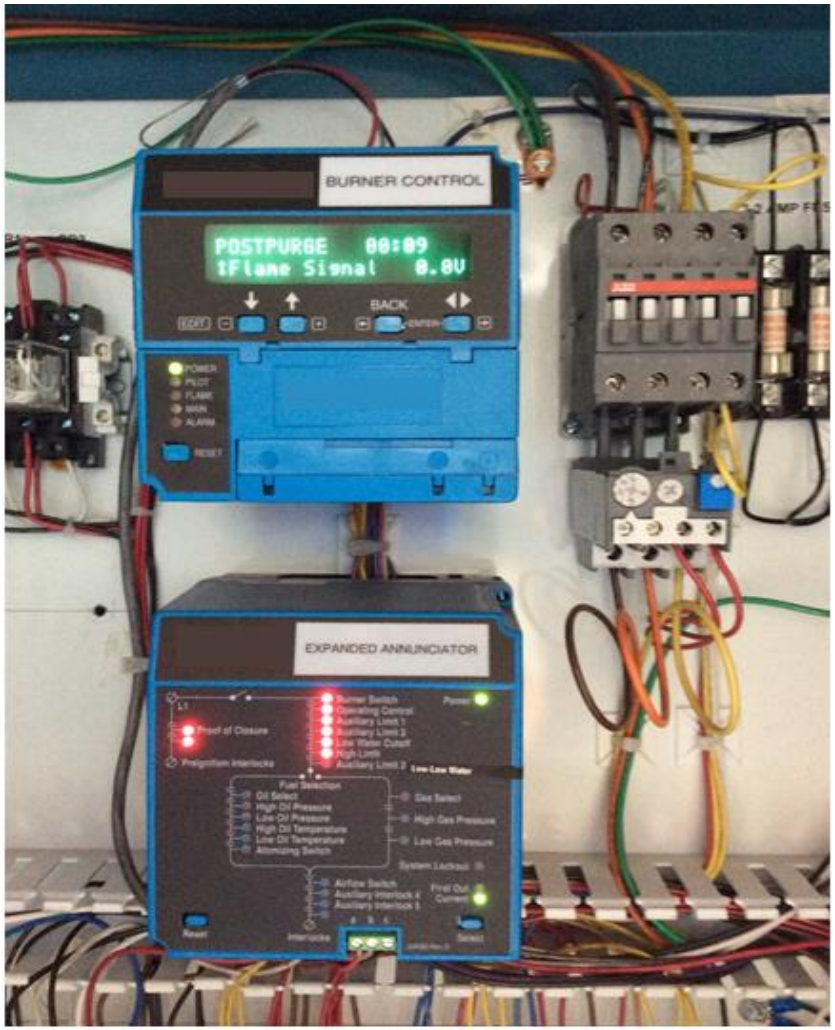
Interlock Circuit

Primary Safety Circuit Testing

BMS Serves many purposes among them:

- Pilot Flame and Main Flame Supervision
- Purge and burner Timing
- Burner sequencing
- SSOV Response times
- Manual reset and Action upon Lockout



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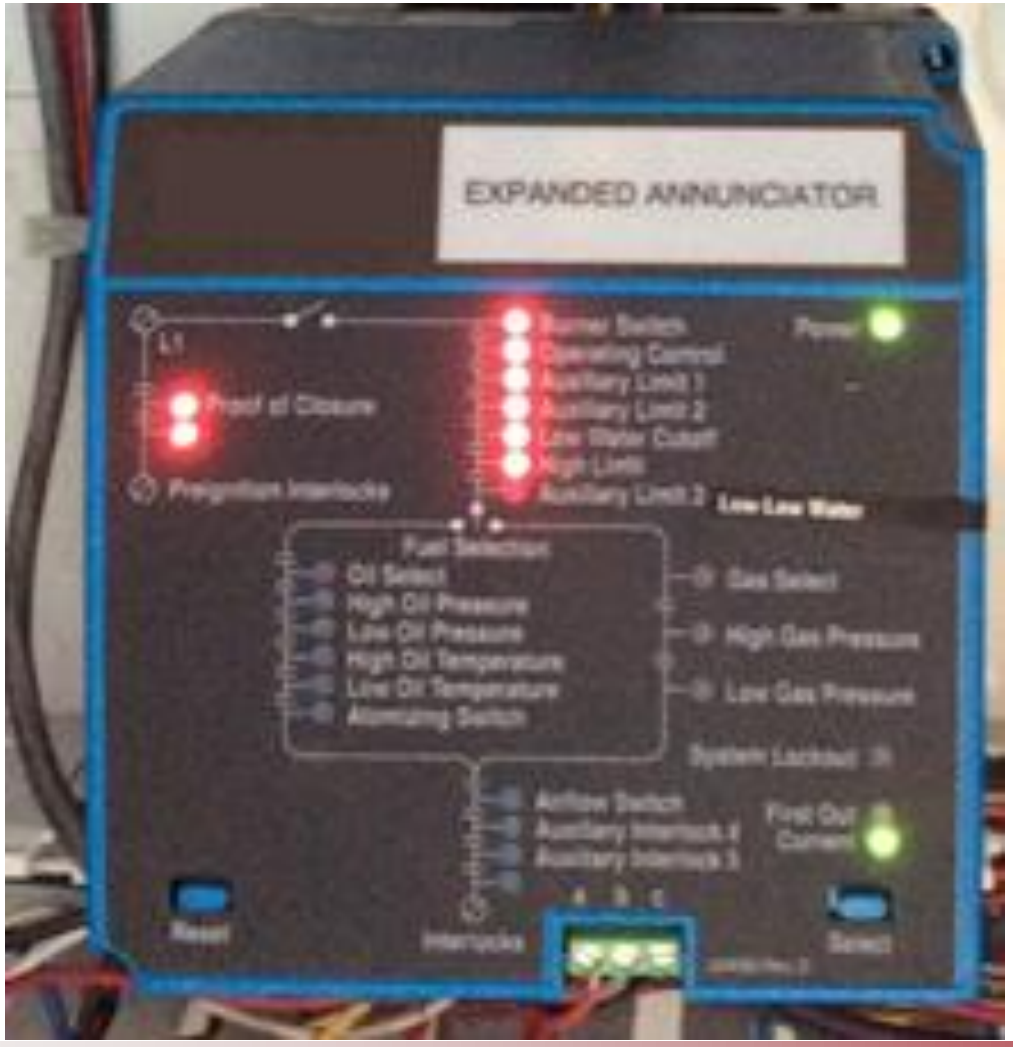
Interlock Circuit

Primary Safety Circuit Testing



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Primary Safety Circuit Testing

A Word about Rebuilt Controls:

Where does the code states that rebuilt controls may not be used?

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Primary Safety Circuit Testing

Rebuilt Controls:

Rebuilt controls loose their Listing when someone other than the original manufacturer works on them.

CG-310 requires UL, FM, CSA or similar listing.

These entities give the listing to the original manufacturer. Any time the component is broken into by someone other than the original manufacturer, that listing is lost and the control is no longer legal to use per ASME codes.

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Primary Safety Circuit Testing

Second, we still see some Honeywell BCS 7000 series BMS out there.

The manufacturer stopped making these controls, and parts are no longer maintained by the manufacturer or available, except through ACME of Chicago.

Why do these controls **NOT** meet ASME code CSD-1?

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Primary Safety Circuit

On/Off Switch
Electrical Lockout
ESS
Operating and High Limit Controls
LWFCO
Gas supervision
Combustion Air Interlock
Proof of Closure
Burner Air Flow
Other – O2, Stack Temperature, Door Interlocks, Etc.

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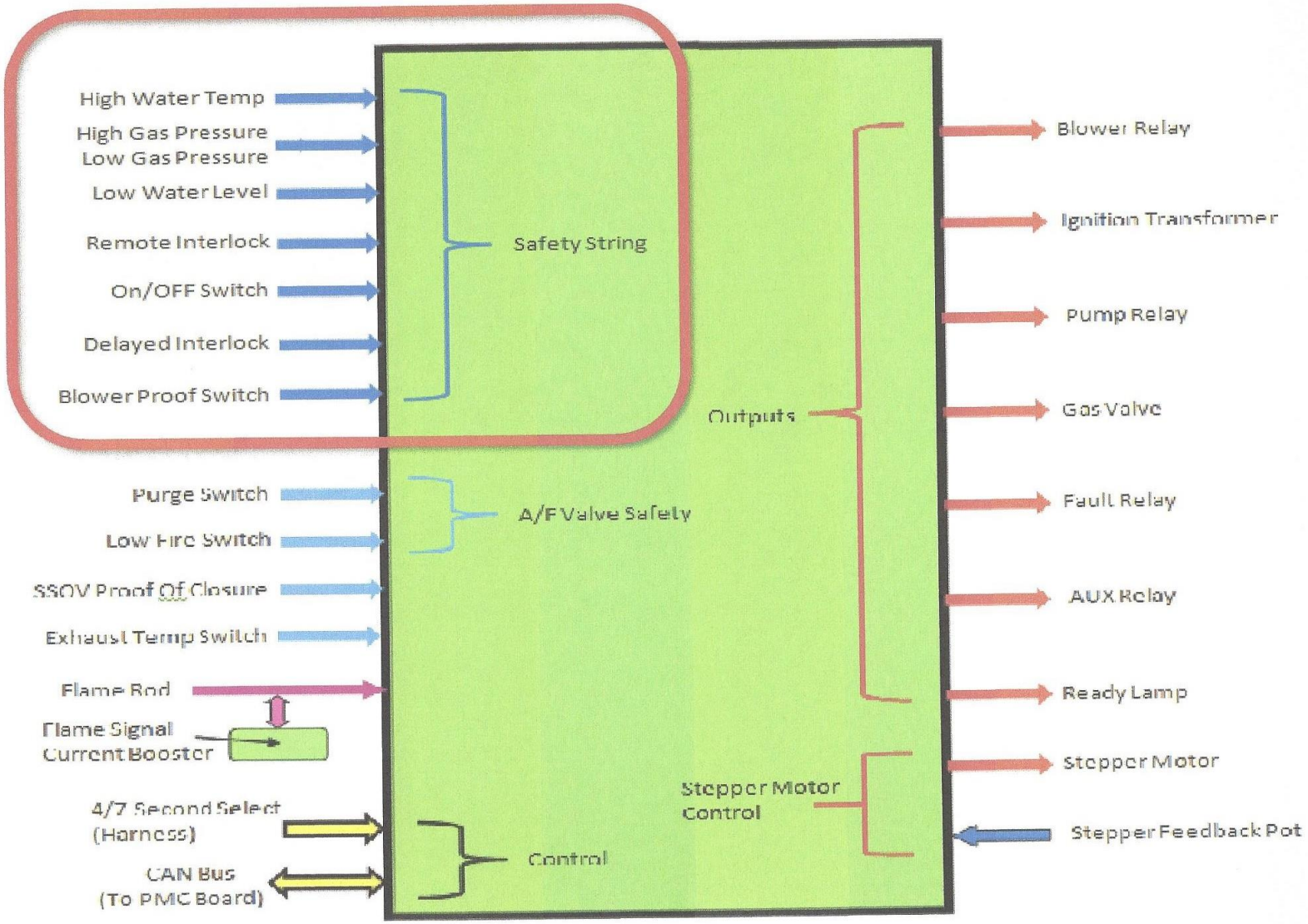
Interlock Circuit



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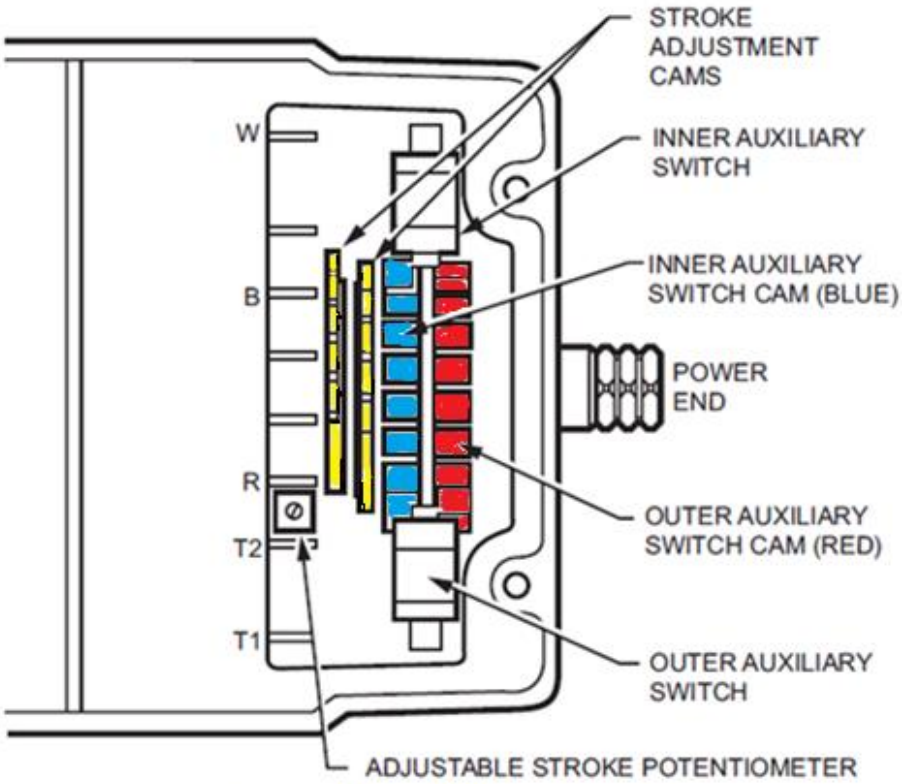
Secondary Safety Circuit

Low Fire Start

Low Temperature Hold

Other as required by individual installation



There are high torque (150 - 300 lb per inch) and low torque models of modulating motors. Depending on your model, there may be only one (brown) internal stroke adjustment cam, or two (yellow) adjustment cams.

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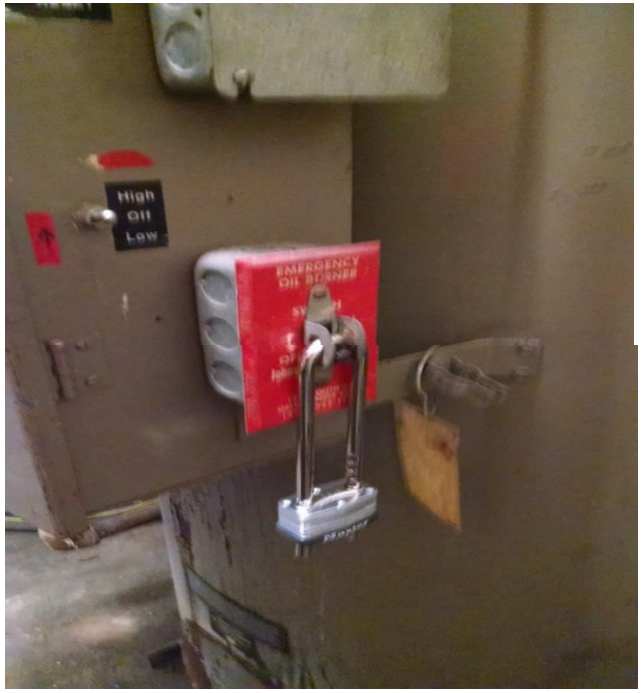
Boiler Controls

Primary Safety Circuit

On/Off Switch
Electrical Lockout
ESS



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Boiler Controls

Primary Safety Circuit

Operating and High Limit Controls

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Boiler Controls

Primary Safety Circuit

Operating and High Limit Controls

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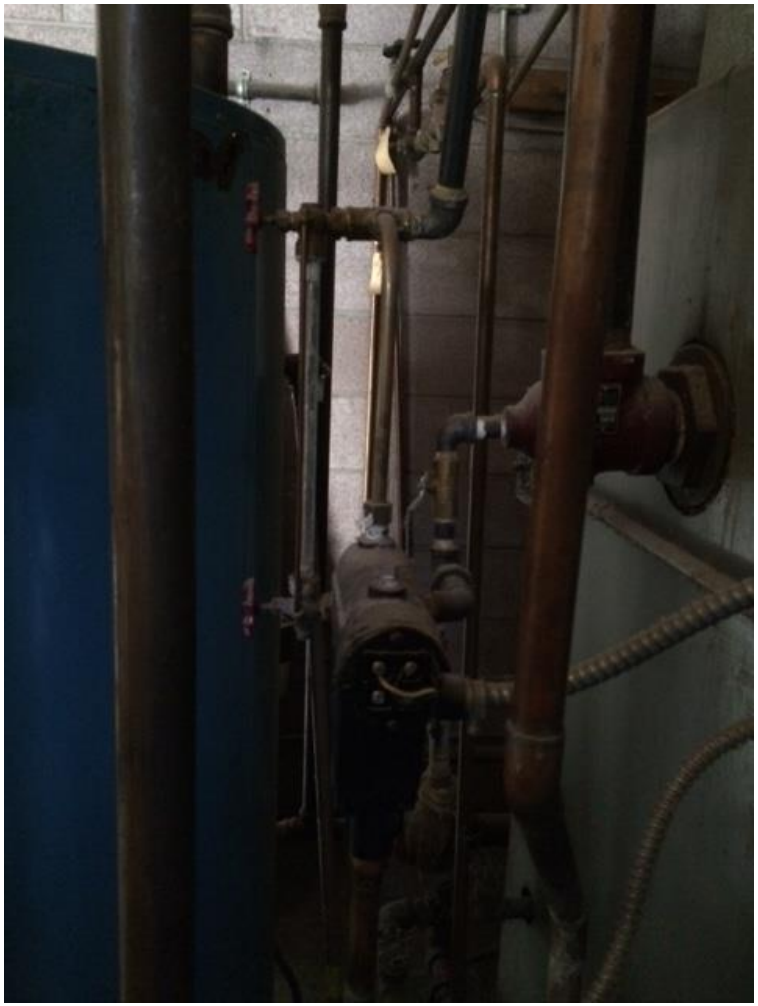
Boiler Controls

Primary Safety Circuit

LWFCO



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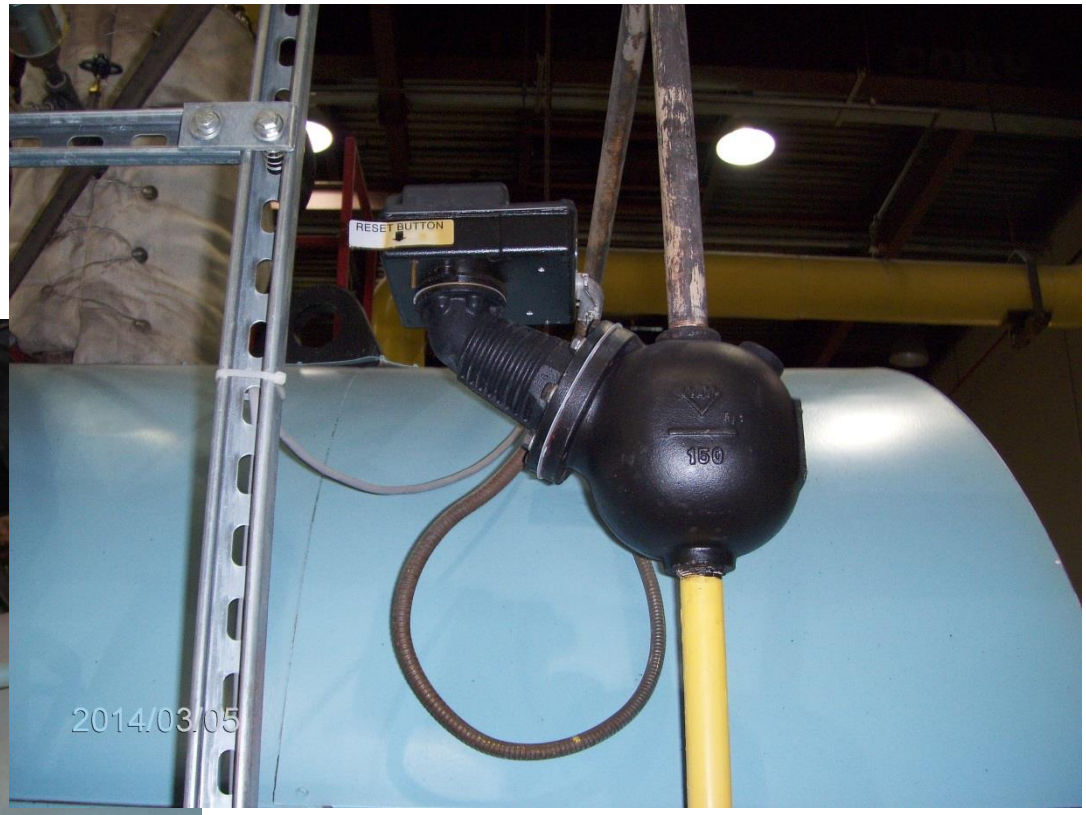
Boiler Controls

Primary Safety Circuit



LWFCO

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Boiler Controls

One thing to point out:

Instead of having a LWFCO, a water tube or coil-type boiler that requires forced circulation to prevent overheating and failure of the tubes or coils, is allowed to have another type of safety control to prevent burner operation at a flow inadequate to protect the boiler unit.

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Boiler Controls

Primary Safety Circuit

Flow Switch

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Recommended preventive maintenance schedule

And just like the LWFCO, this safety control must shut down the burner and prevent restarting until an adequate flow is restored.

Codes requires a positive way to determine during testing that the safety control has functioned upon an inadequate flow condition. This is usually by the boiler shutting down.

And the positive means needs to enable the safety control while remaining in the running safety lock circuit during testing. This means no shunt switch or bypass would be allowed.

The safety control must also be automatically restored to service after completion of system testing, so no manual reset is required or needed.

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Boiler Controls

Primary Safety Circuit

LWFCO or Flow Switch?

What's wrong with this picture?

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Recommended preventive maintenance schedule

Allows either a flow switch or a temperature sensing devices for forced circulation boilers.

What are the two most common boiler types that have temperature sensing devices?

Steam Generators & Pool Heaters

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Recommended preventive maintenance schedule

Requirements for flow or temperature sensing devices for forced circulation boilers.

What are the two most common boiler types that have temperature sensing devices?

Steam Generators & Pool Heaters

Does everyone know how to test a flow switch?

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Recommended preventive maintenance schedule

CW-210 Requirements for flow or temperature sensing devices for forced circulation boilers.

What are the two most common boiler types that have temperature sensing devices?

Steam Generators & Pool Heaters

Does everyone know how to test a flow switch?

Easy way is to slowly close the outlet isolation valve and stop the flow.

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Boiler Controls

Primary Safety Circuit

Gas supervision

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Recommended preventive maintenance schedule

"…The gas Pressure at the outlet of the regulator shall be within +/- 10% or the regulator set point at all firing rates. A pressure test port shall be provided to permit measuring the gas pressure to confirm compliance with the requirements of this paragraph." Best practices is to have a gas pressure gauge installed.

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Recommended preventive maintenance schedule

For boilers with an input over 2500 MBH (2,500,000 btu/hr) Gas Pressure switches interlocked to do a safety shutdown and lockout in the event of either high or low gas pressure are required .

High Gas Pressure – Shutdown and lockout at maximum **150%** of the boiler/burner's main manifold gas pressure. Located downstream of the regulator and may be downstream of all gas valves and controls.

Low Gas Pressure – Shutdown and Lockout before manifold gas pressure is less than **50%** of the boiler/burner's main manifold gas pressure. Located upstream of the SSOV.

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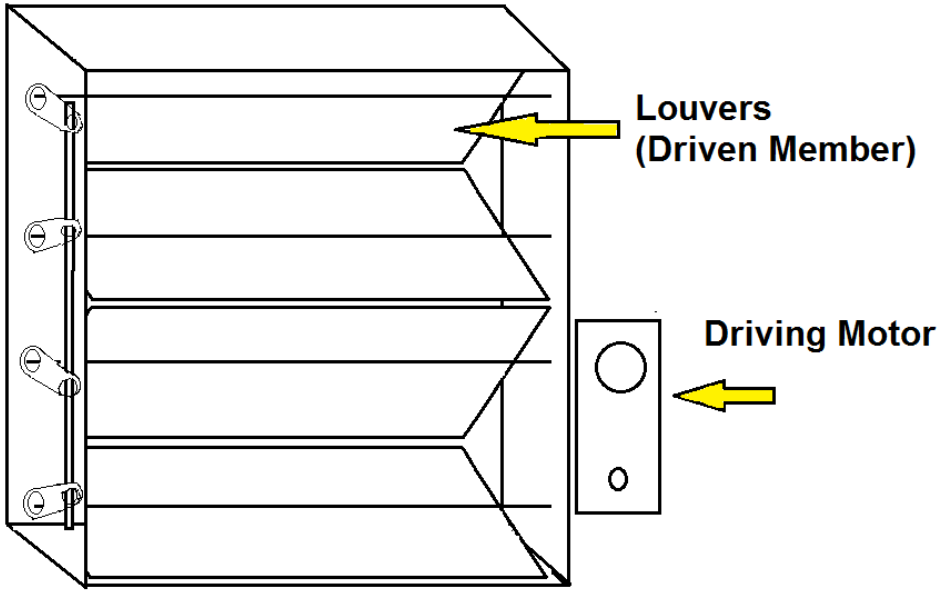
Primary Safety Circuit

Combustion Air Interlock

- Louvers and grills are required to be fixed in the open position or interlocked with the equipment so that they are opened automatically during equipment operation. The interlock is on the **driven member**.
- Fans supplying air to the boiler room for combustion are interlocked with the burner so that air flow is proven during equipment operation.



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Boiler Controls

Primary Safety Circuit

Proof of Closure

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Boiler Controls

Primary Safety Circuit

Burner Air Flow
Other – O2, Stack Temperature, Door Interlocks, Etc.

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Daily Boiler Checks

Check Gauges, Monitors and Indicators

Check Instrument and Equipment Settings

For HP Boilers, quick-drain test LWFCO and Alarms

Check Burner Flame

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Recommended preventive maintenance schedule

Check Gauges, Monitors and Indicators

Check Instrument and Equipment Setting

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Recommended preventive maintenance schedule

For HP Boilers, quick-drain test LWFCO and Alarms

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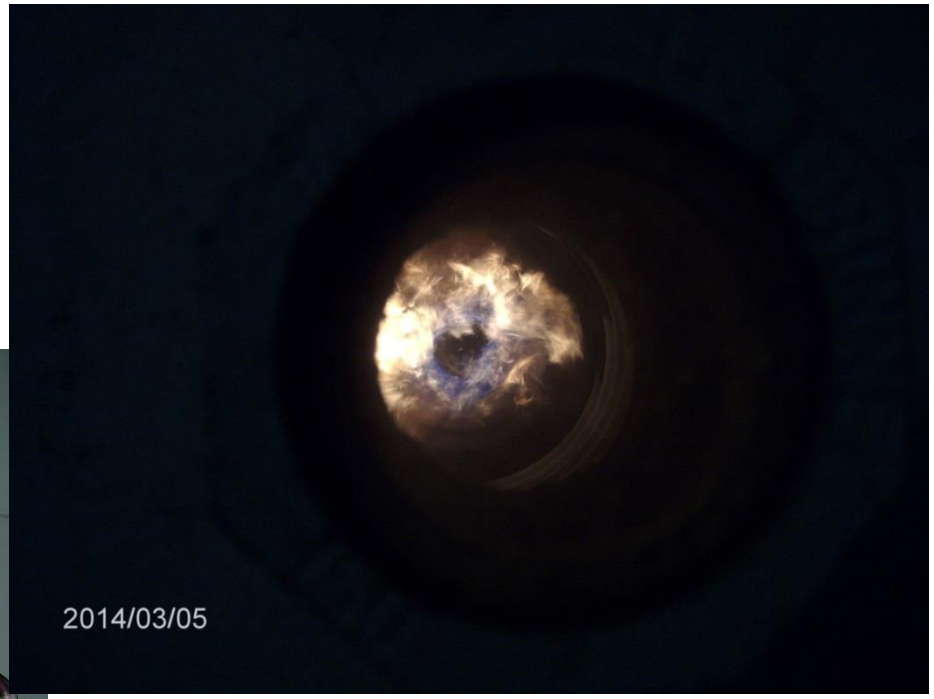
Recommended preventive maintenance schedule

Check Burner Flame



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Weekly Boiler Checks

For LP Boilers, quick-drain test LWFCO and Alarms

Check Igniter

Check Flame Signal Strength

Check Flame Failure detection

system components

Check Firing Rate Control

Look and Listen to the Pilot and Main Fuel Valve Opening and Closing

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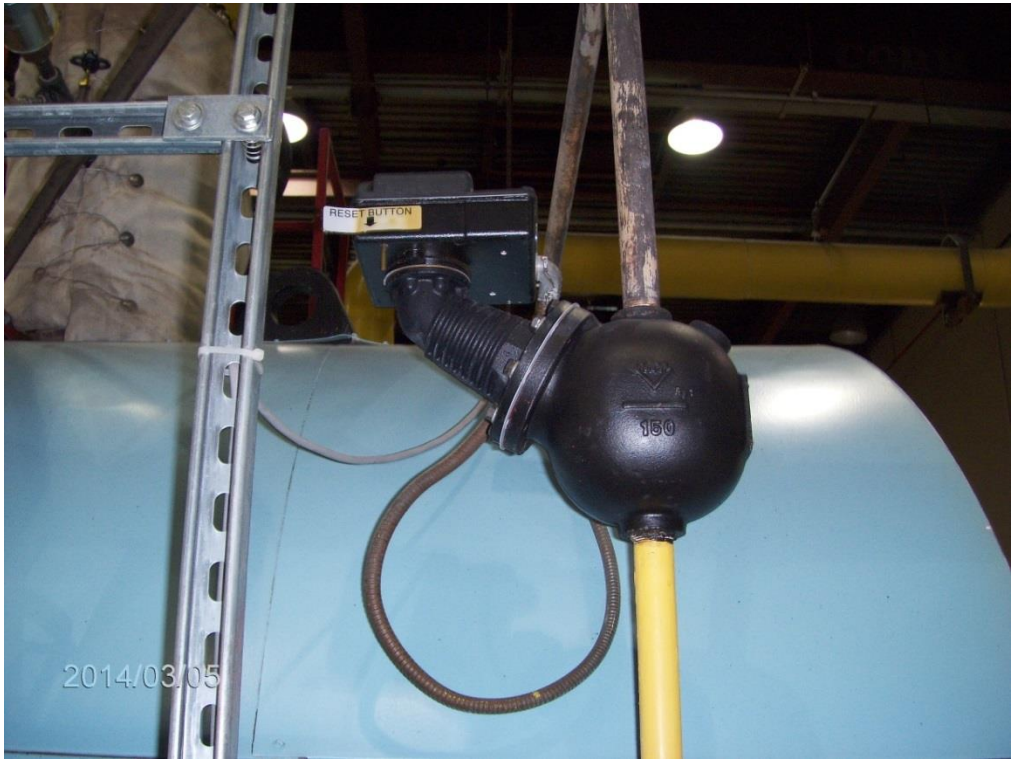
Recommended preventive maintenance schedule

Weekly boiler checks

For LP boilers, quick-drain test LWFCO and alarms



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Recommended preventive maintenance schedule

Weekly boiler checks

Check igniter

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Recommended preventive maintenance schedule

Weekly boiler checks

Check flame signal strength (pilot and main flame)

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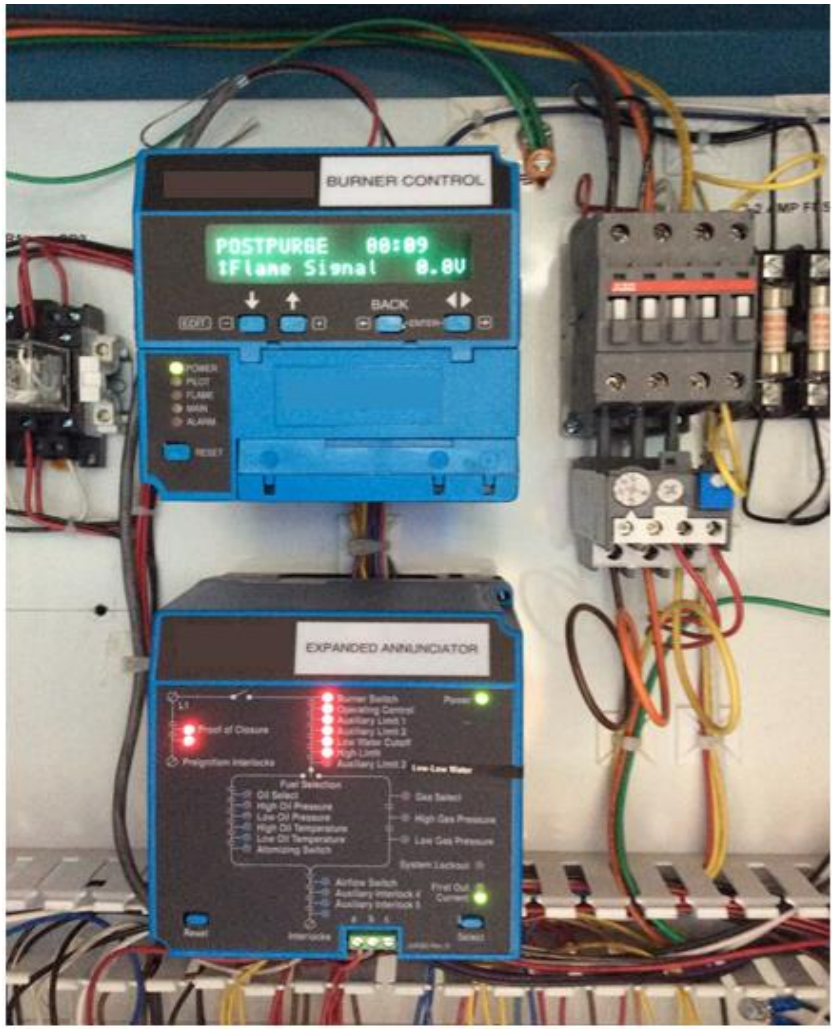
Recommended preventive maintenance schedule

Weekly boiler checks

Check flame failure detection

System components



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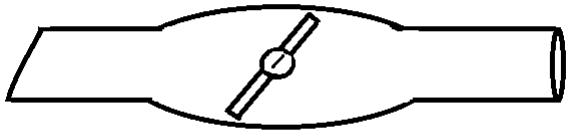
Recommended preventive maintenance schedule

Weekly boiler checks

Check firing rate control

(modulator control and valves)



•Butterfly modulating gas valve

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Recommended preventive maintenance schedule

Weekly boiler checks

Look and listen to the pilot and main fuel valves opening and closing

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Recommended preventive maintenance schedule

Weekly boiler checks

Take the time to watch and listen for at least one full cycle

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Recommended preventive maintenance schedule

Don’t forget the proving switches, if applicable

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Monthly boiler checks

Check flue, vent, stack or outlet dampers

Test low draft, fan air pressure, and damper position switches

Check low-fire start switch

Test high & low oil pressure and temperature switches

Test high & low gas pressure switches

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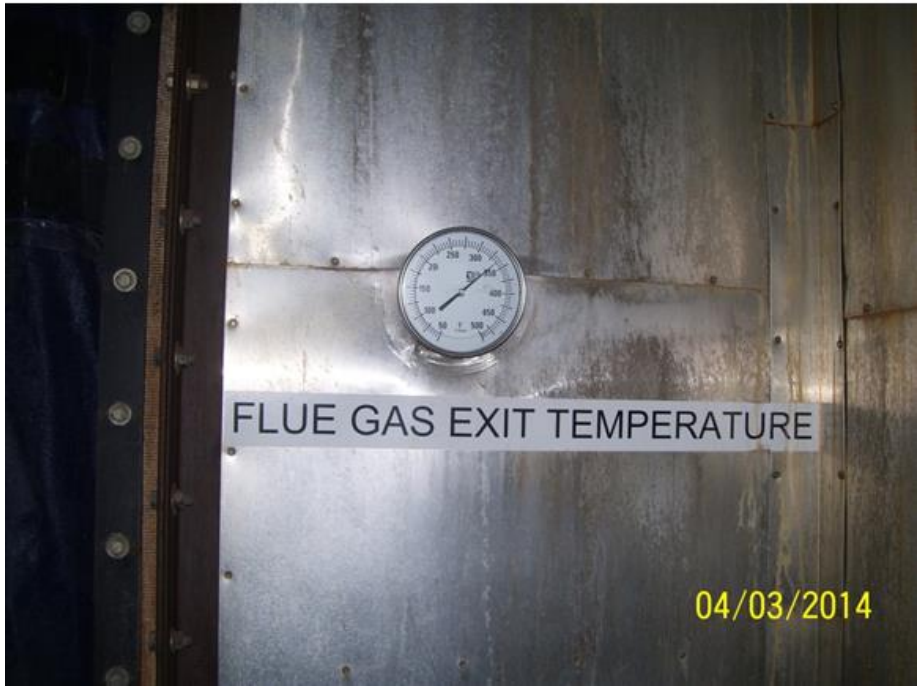
Recommended preventive maintenance schedule

Monthly boiler checks

Check flue, vent, stack or outlet dampers



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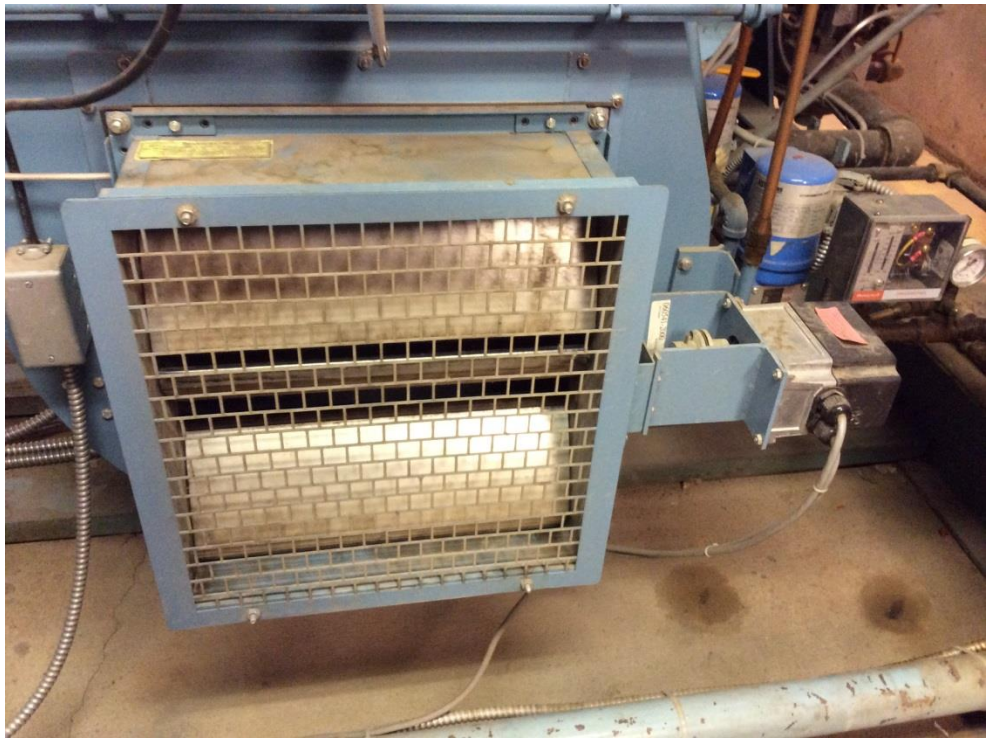
Recommended preventive maintenance schedule

Monthly boiler checks

Test low draft, fan air pressure, and damper position switches



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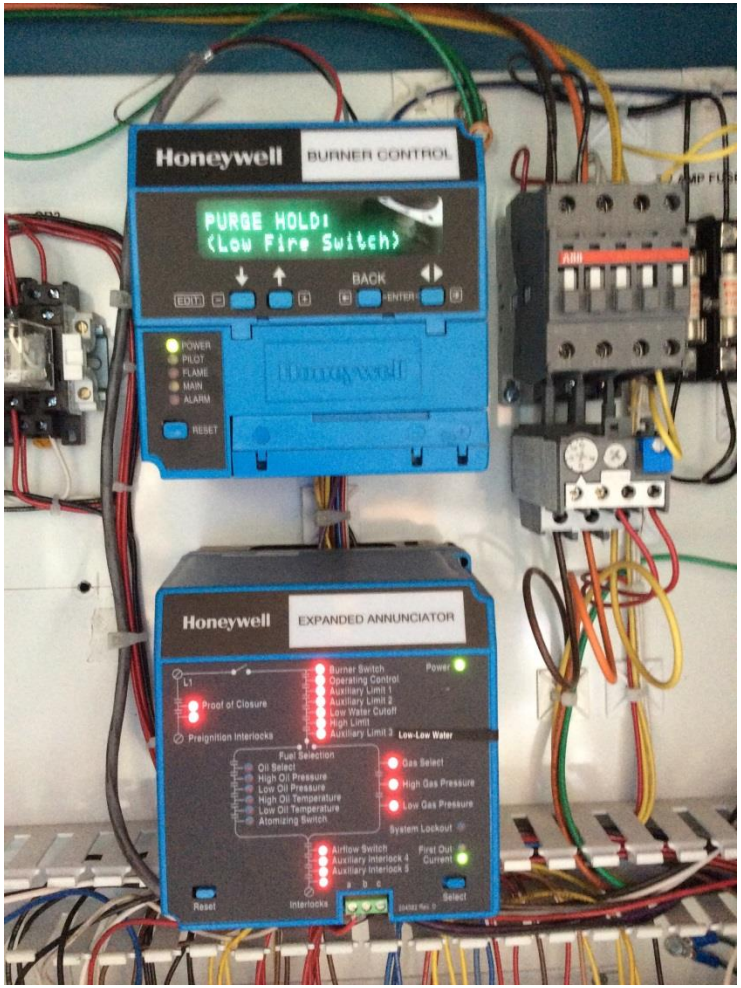
Recommended preventive maintenance schedule

Monthly boiler checks

Check low-fire start switch



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Recommended preventive maintenance schedule

Monthly boiler checks

Test high & low oil pressure and temperature switches

Test high & low gas pressure switches

Regulator pressure, pressure switches, etc.

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Recommended preventive maintenance schedule

- Filters or strainers: Fuel cleaning equipment such as filters or strainers are recommended for use in the main gas supply line to the unit.
- Sediment traps or drips: A sediment trap shall be installed upstream of the gas controls.

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Recommended preventive maintenance schedule

Semi-Annually

Recalibrate all gages

For Steam Boilers, slow-drain test LWFCOs and Alarms

Check Flame Failure detection system components

Check Firing Rate Control

Check piping & Wiring of all interlocks and shut-off valves

Inspect Burner Components

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Recommended preventive maintenance schedule

Semi-Annually

Recalibrate all gages

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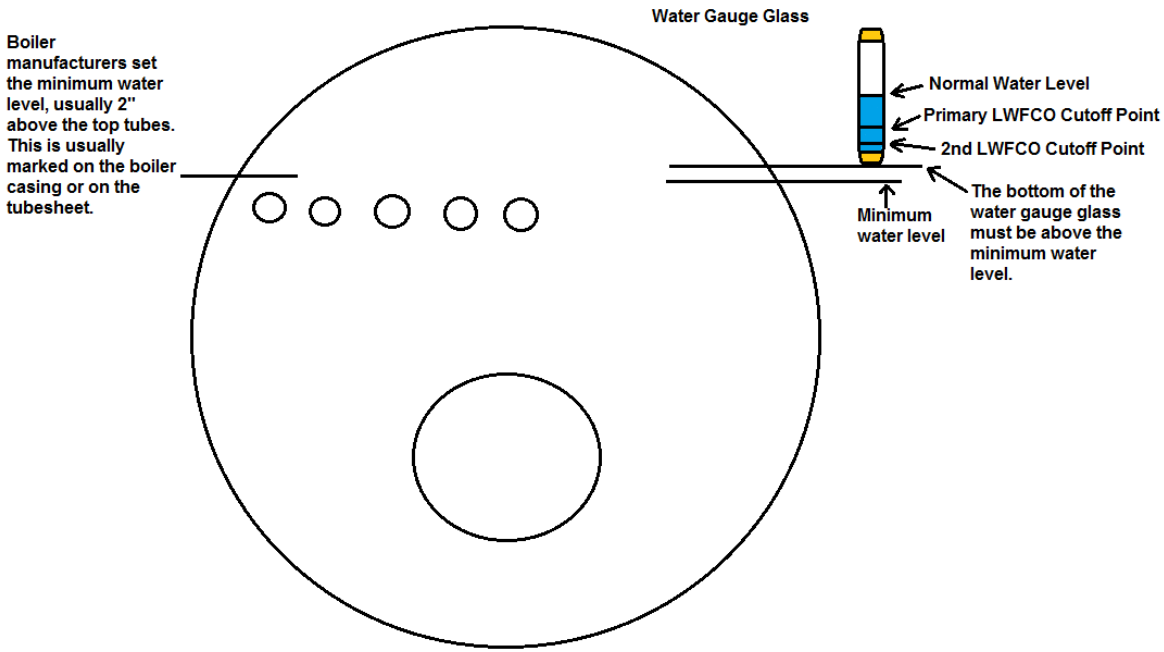
Recommended preventive maintenance schedule

Semi-Annually

For Steam Boilers, slow-drain test LWFCOs and Alarms



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Recommended preventive maintenance schedule

Semi-Annually

Check Flame Failure detection system components

Check Firing Rate Control

NFPA Recommends, and Kansas boiler code requires, that boilers that do not cycle off at least once every 24 hours have a self-checking UV scanner.

This prevents the quartz crystals from burning into the lens, causing a false flame signal.

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Recommended preventive maintenance schedule

Semi-Annually

Check Flame Failure detection system components

Check Firing Rate Control

My Favorite for these is the PTFI and MTFI Test

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How to do a quick PTFI and MTFI test with an interrupted pilot

What does the PTFI & MTFI test tell you?

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How to do a quick PTFI and MTFI test with an interrupted pilot

What does the PTFI & MTFI test tell you?

1. Burner control timing and Sequencing

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How to do a quick PTFI and MTFI test with an interrupted pilot

What does the PTFI & MTFI test tell you?

1. Burner control timing and Sequencing
2. High & Low Purge Firing Rate switches Making

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How to do a quick PTFI and MTFI test with an interrupted pilot

What does the PTFI & MTFI test tell you?

1. Burner control timing and Sequencing
2. High & Low Purge Firing Rate switches Making
3. Flame Scanner or Detector

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3. Flame Scanner or Detector
4. FFRT

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2. High & Low Purge Firing Rate switches Making
3. Flame Scanner or Detector
4. FFRT
5. SSOV Valve Closure Rates

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How to do a quick PTFI and MTFI test with an interrupted pilot

What does the PTFI & MTFI test tell you?

1. Burner control timing and Sequencing
2. High & Low Purge Firing Rate switches Making
3. Flame Scanner or Detector
4. FFRT
5. SSOV Valve Closure Rates
6. MSOV Functioning

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How to do a quick PTFI and MTFI test

You must know what type of Pilot you have:

1. Constant, (Standing)
2. Intermittent
3. Interrupted
4. Direct Spark

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How to do a quick PTFI and MTFI test with an interrupted pilot

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How to do a quick PTFI and MTFI test with an interrupted pilot

1. First, cycle the boiler and observe the timing & Sequencing of the Burner and Burner Management Control

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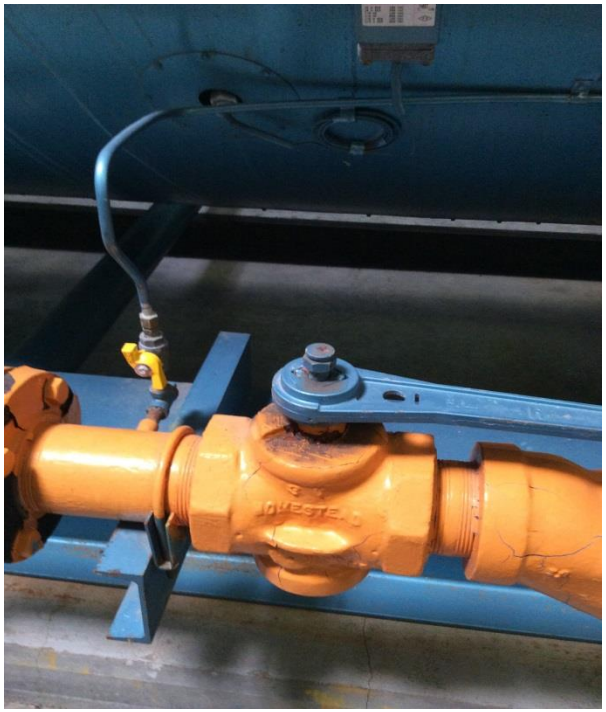
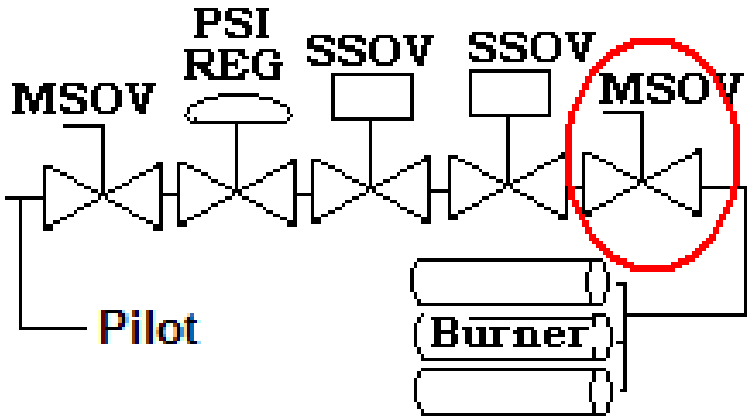
3. Close the Pilot Valve and the 2nd Main Gas MSOV





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How to do a quick PTFI and MTFI test with an interrupted pilot

1. First, cycle the boiler and observe the timing & Sequencing
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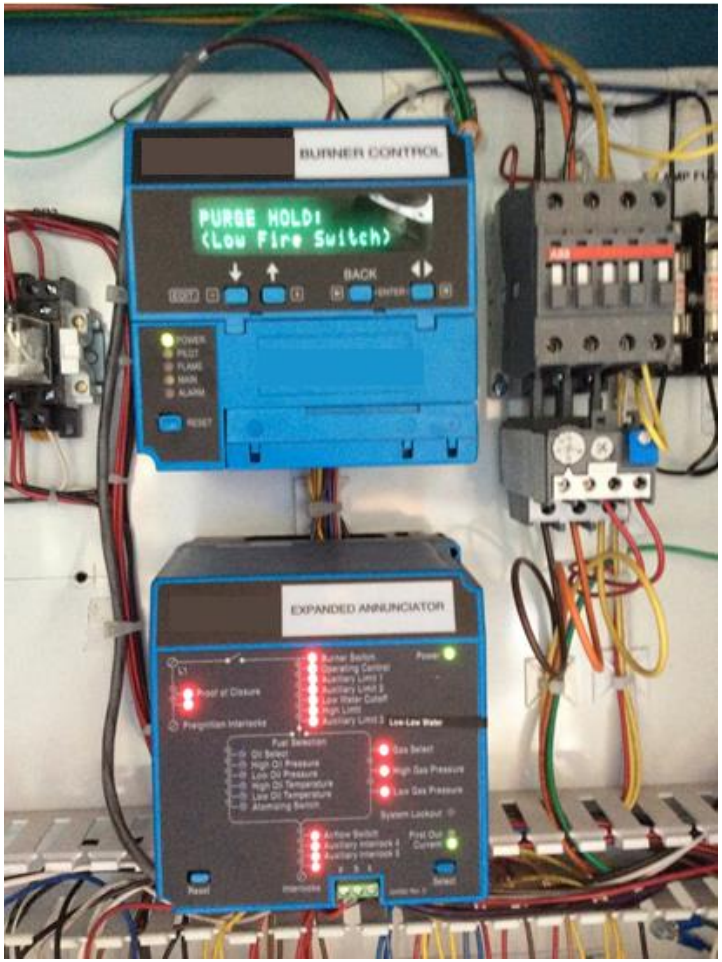
4. Allow the Burner to restart



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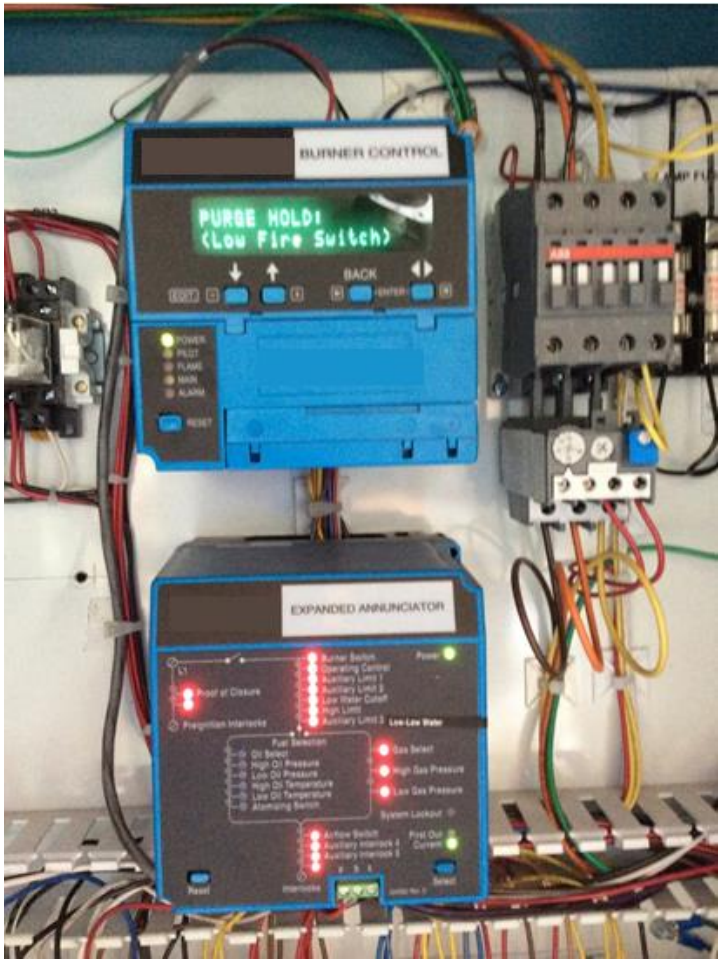

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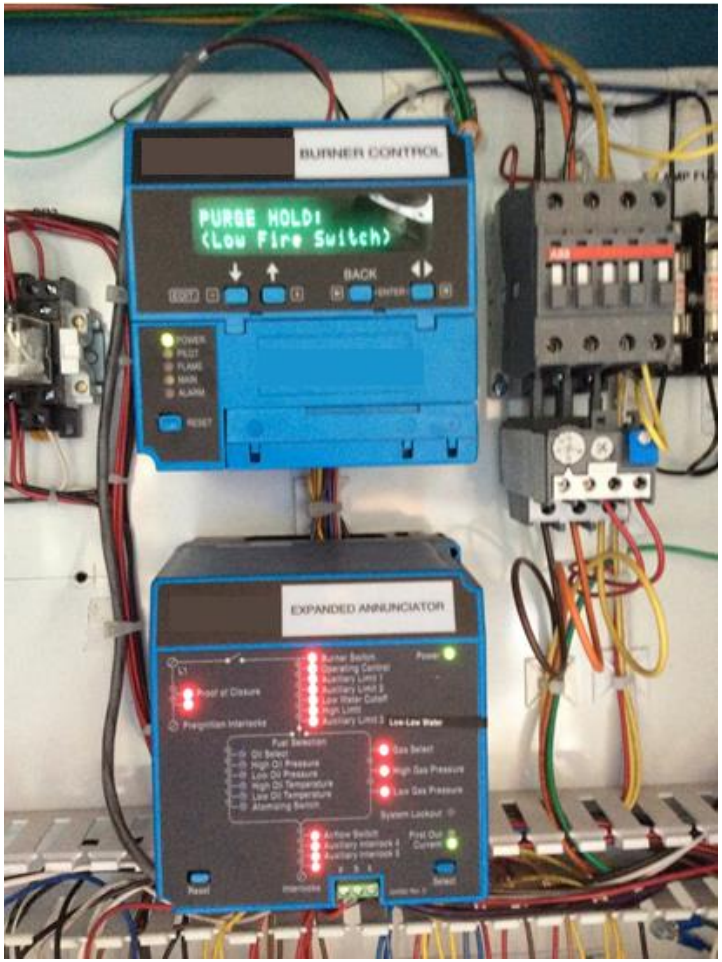

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How to do a quick PTFI and MTFI test with an interrupted pilot

7. Allow the Burner to restart

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How to do a quick PTFI and MTFI test with an interrupted pilot

7. Allow the Burner to restart

8. Observe the PTFI and Pilot Flame Signal, Time the MTFI, It Should Run for 10 Seconds, then Lockout before another 5 seconds.

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How to do a quick PTFI and MTFI test with an interrupted pilot

7. Allow the Burner to restart

8. Observe the PTFI and Pilot Flame Signal, Time the MTFI, It Should Run for 10 Seconds, then Lockout before another 5 seconds.

9. Cycle the boiler again and observe the timing & Sequencing of the Burner and Burner Management Control. Assure everything is back to normal!

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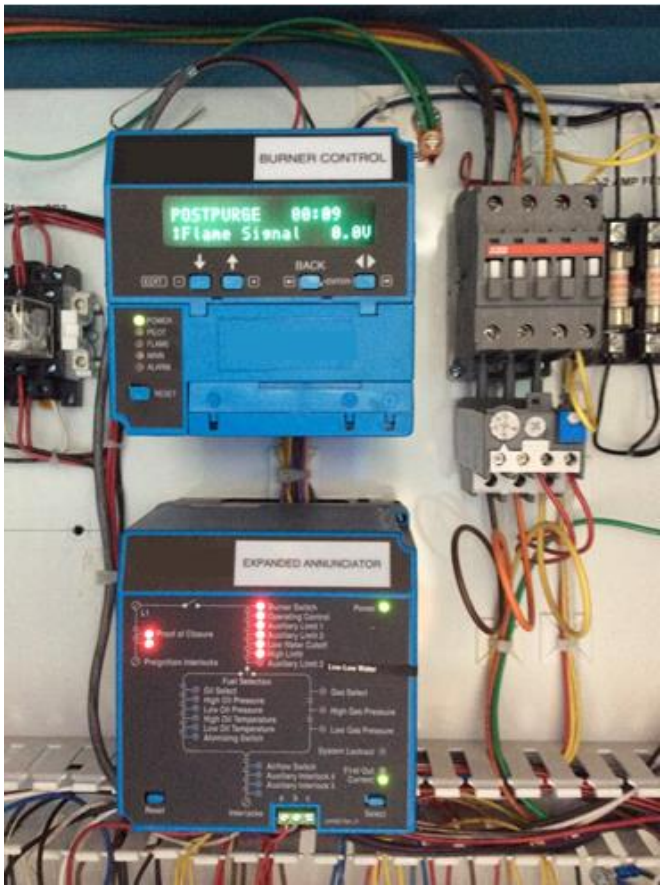
How to do a quick PTFI and MTFI test with an interrupted pilot

What does the PTFI & MTFI test tell you?

Burner control timing and Sequencing



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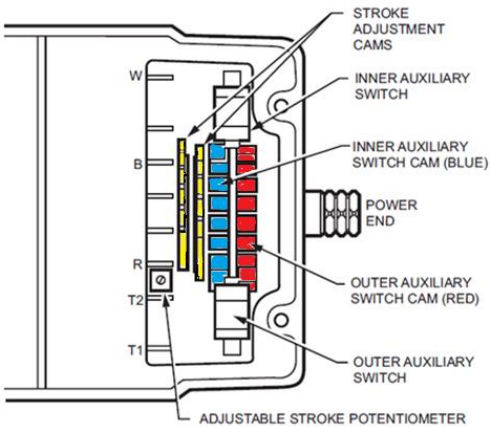
How to do a quick PTFI and MTFI test with an interrupted pilot

What does the PTFI & MTFI test tell you?

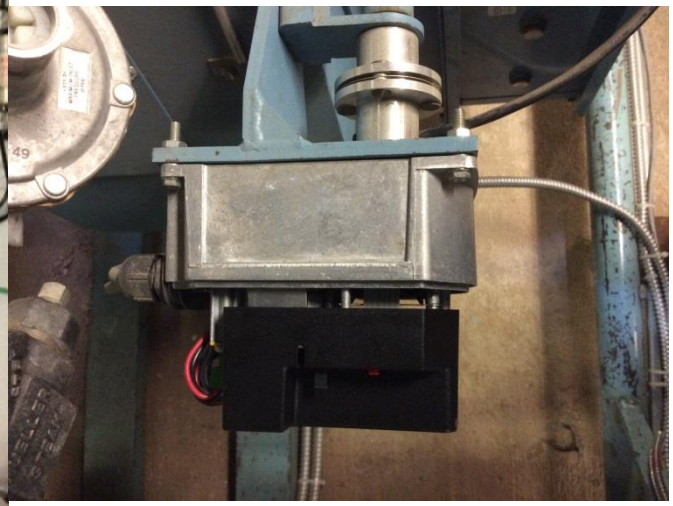
Burner control timing and Sequencing

High & Low Purge Firing Rate switches Making



There are high torque (150 - 300 lb per inch) and low torque models of modulating motors. Depending on your model, there may be only one (brown) internal stroke adjustment cam, or two (yellow) adjustment cams.

•Honeywell Series 90 Modutrol IV™ Motors product data sheet 63-2190-3 (1)



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How to do a quick PTFI and MTFI test with an interrupted pilot

What does the PTFI & MTFI test tell you?

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Flame Scanner or Detector is Functioning

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How to do a quick PTFI and MTFI test with an interrupted pilot

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FFRT & SSOV Valve Closure Rates

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How to do a quick PTFI and MTFI test with an interrupted pilot

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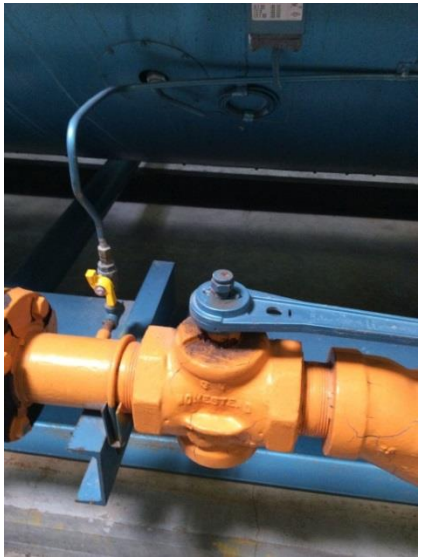
- Flame Scanner or Detector
- FFRT
- SSOV Valve Closure Rates
- **MSOV Functioning**



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Recommended preventive maintenance schedule

Semi-Annually

Check piping & Wiring of all interlocks and shut-off valves

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Recommended preventive maintenance schedule

Semi-Annually

Inspect Burner Components

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Testing pressure controls

Functional test

To quickly assess the condition and operating integrity of a high limit control, you will need to get up close to the control. In many instances this will require using a ladder and your fall protection gear. **Your SAFETY is Paramount!**

- ► The boiler should be operating.
- ► Remove the faceplate of the control.

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Testing pressure controls

Functional test

- If it is a mercury-type control, check the level and line of the control. These controls must be perpendicular to the pipe they are installed on and level.

- If a mercury-type control, use your flashlight and check for visual separation of the mercury or dark discoloration caused by age and frequent arcing/sparking

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Testing pressure controls

Functional test

- Check for dirty contacts, frayed wiring, etc.
- You can use a ‘Tweeter’ to check for power to the correct contacts to the switches. With the tweeter **close** to the wires and contacts, the Tweeter should light up and “Tweet”. If the switch is functioning properly, when the boiler is operating, the mercury will be all the way to the right, forming a puddle (in the glass bulb) around the electrical contacts.

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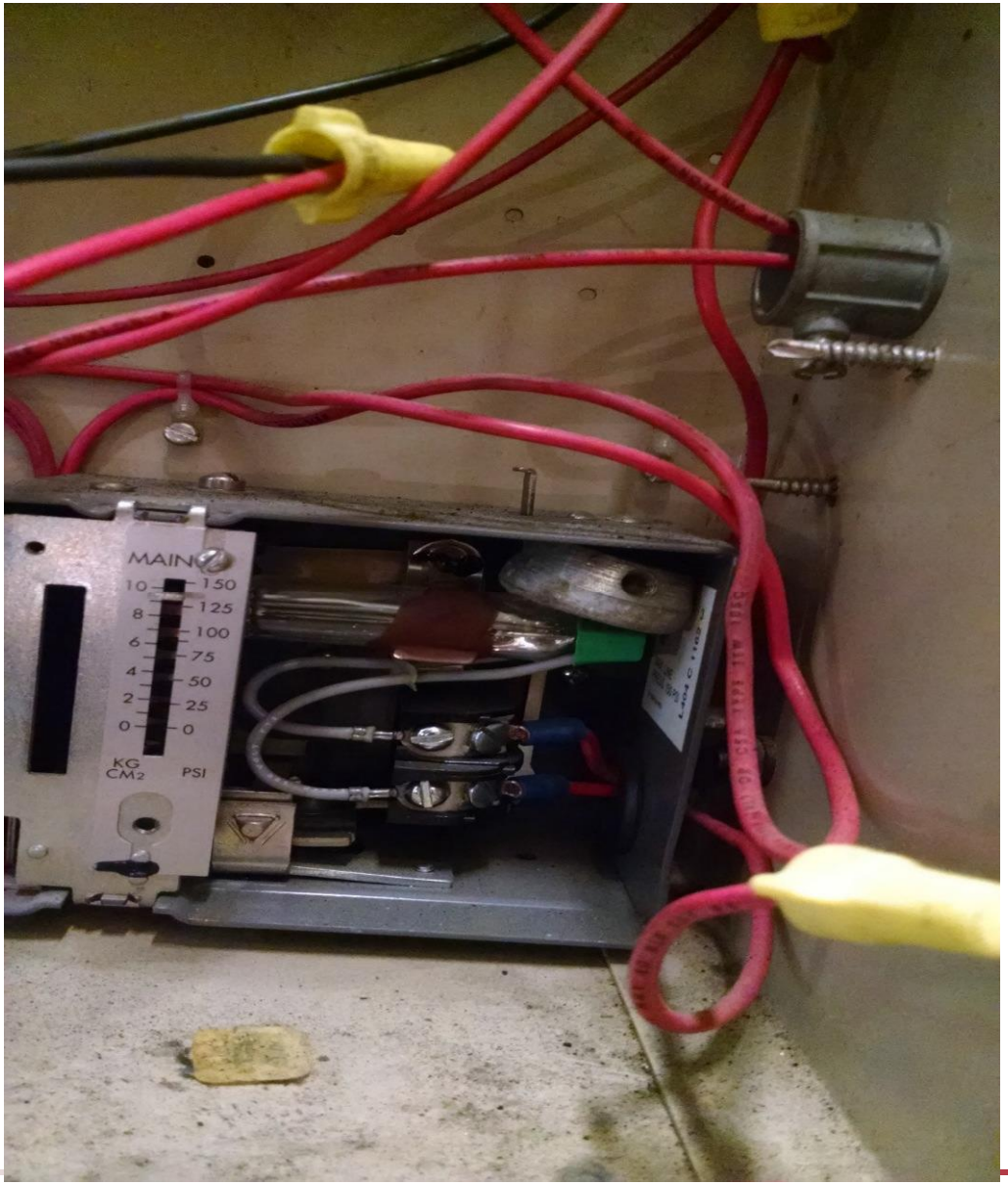
Testing pressure controls

Functional test

What's wrong with this picture?



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Testing pressure controls

Functional test

What's wrong with this picture?

High limit would not reset, so it was rigged with a metal slug!

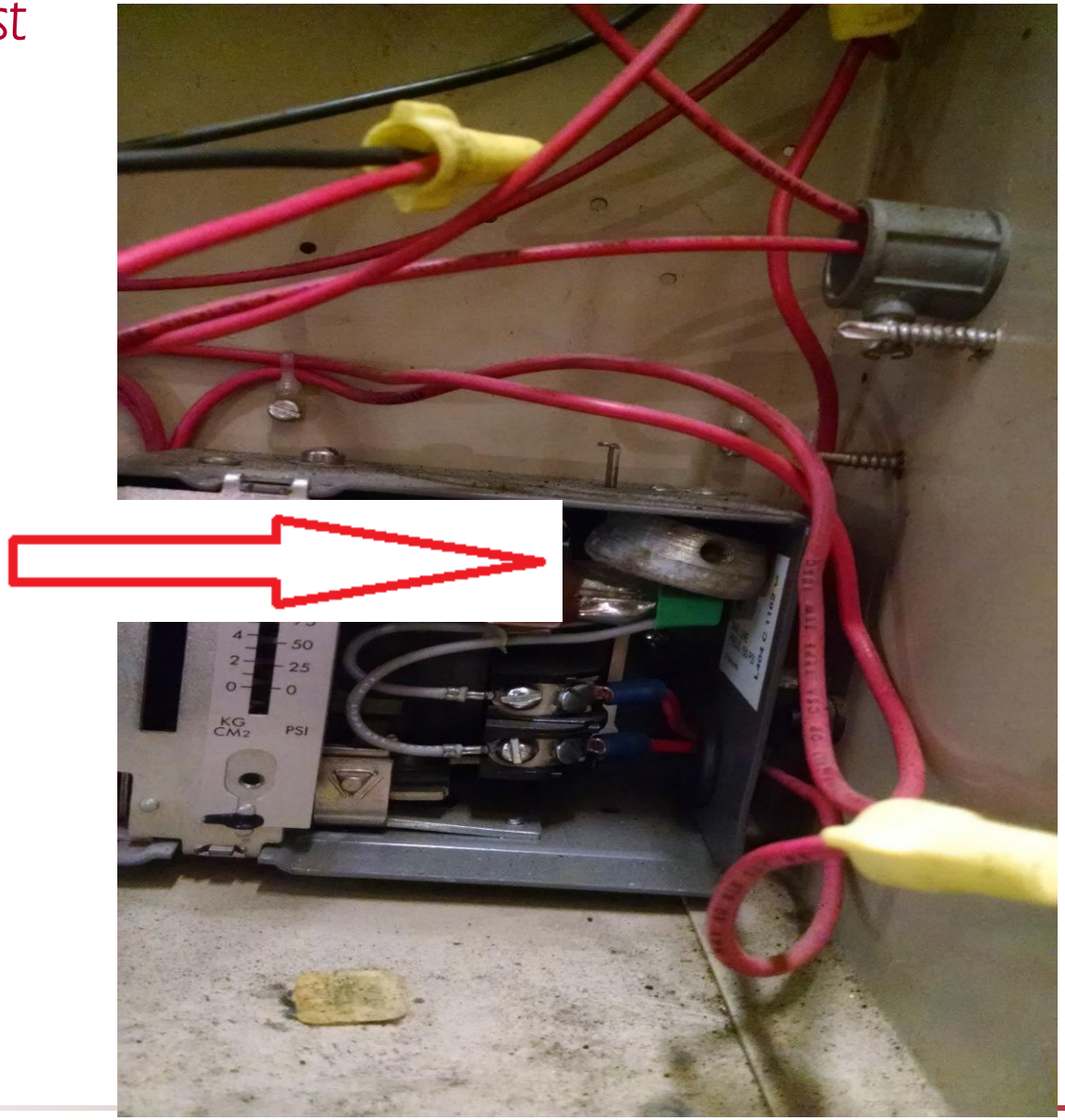

Photo by Dave Pleiss, Nebraska Deputy Inspector

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Testing pressure controls

Functional test

If it is a mercury-type steam pressure control, use your Tweeter to gently push down the mercury switch until the control shuts down and locks out. **Always use the correct tool for this.** ***NEVER USE A SCREWDRIVER OR OTHER METAL OBJECT THAT CAN CONDUCT ELECTRICITY!*** You should be able to hear the boiler burner shut off from where you are standing at the control.

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Testing pressure controls
Set point verification

To illustrate how a high limit set point test is performed, we use the example of a low pressure steam boiler. ***CONSTANT SUPERVISION OF QUALIFIED OPERATIORS DURING THE TEST IS ESSENTIAL!*** A low pressure steam boiler has an operating control and a manual reset high limit control. Both have a maximum setting of 15 psi, the MAWP of the boiler.

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Testing pressure controls

Set point verification

For this example, let's say the operating control is set at 8 psi normal operating pressure and the high limit control is set at 10 psi. If the only way to test if a high limit control is going to work is to put the control under a high limit condition and allow the control to function, we must allow the boiler to get to 10 psi where the high limit control is set. This is done by first ensuring the high limit control is set at the point where we want it to function, at 10 psi.

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Testing pressure controls

Set point verification

Then the operating control is manually adjusted so it has a set point higher than the high limit control. Since we never want to get close to the MAWP of the boiler, we will set it at 12 psi. If the high limit control does not function correctly at 10 psi, then the operating control should shut the boiler down at 12 psi before we get to the MAWP of the boiler.
CONSTANT SUPERVISION OF QUALIFIED OPERATIORS DURING THE TEST IS ESSENTIAL!

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Testing pressure controls

Set point verification

If the high limit control functions correctly, the boiler will shut down at 10 psi and the control will lock out. Then the operating control is returned to its proper setting and tested for correct functioning. This test should be done semi-annually by a qualified boiler operator or service firm and the pressure where it trips should be recorded in the boiler logs. The testing and maintenance records should be available for review by the inspector during the routine assessments.

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Testing temperature controls

Functional test

If the control is a thermostatic control on a hot water boiler, note where he control is set. Make a small mark on the dial if necessary to return the dial to the exact point upon completion of the test. Use a small flat-end screwdriver and turn the dial clockwise, reducing the set point until the boiler shuts down.

•(NOTE: The boiler temperature must be above the lowest temperature on the dial for this to shut down the boiler.)

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Recommended preventive maintenance schedule

Annually

Pilot turndown test (***by qualified personnel only!***)

Hot refractory hold-in test (IR flame detectors only)

Gas SSOV leakage test

Test purge air switch

Test low fire start interlock

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Recommended preventive maintenance schedule

Annually

Pilot Turndown Test **(By Qualified Personnel ONLY!)**

This test is required for any type of flame detector. The purpose is to assure the flame detector is not positioned in a way that it will detect a pilot which is not large enough to safely and reliably light off the main burner. The minimum pilot is the smallest possible pilot flame that the flame detector sees and will hold in the flame relay on the FSG control. This minimum flame signal strength is contained in the manufacturer's literature or technical bulletins.

WARNING

Fire or Explosion Hazard.
Can cause severe injury, death or property damage.
Only fully qualified, experienced, flame safeguard technicians should make adjustments on the valve.

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Recommended preventive maintenance schedule

Annually

Hot Refractory Hold-In Test (IR Detectors Only)

Infrared flame detectors can sight in on hot refractory, and combined with the “shimmer” inside the combustion chamber caused by the flame, this can cause IR detectors to indicate a false flame.

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Recommended preventive maintenance schedule

Annually

Gas SSOV Leakage test

This is a test for checking the leakage (Closure tightness) of the SSOV.
This test should only be done by trained, experienced flame safeguard technicians.

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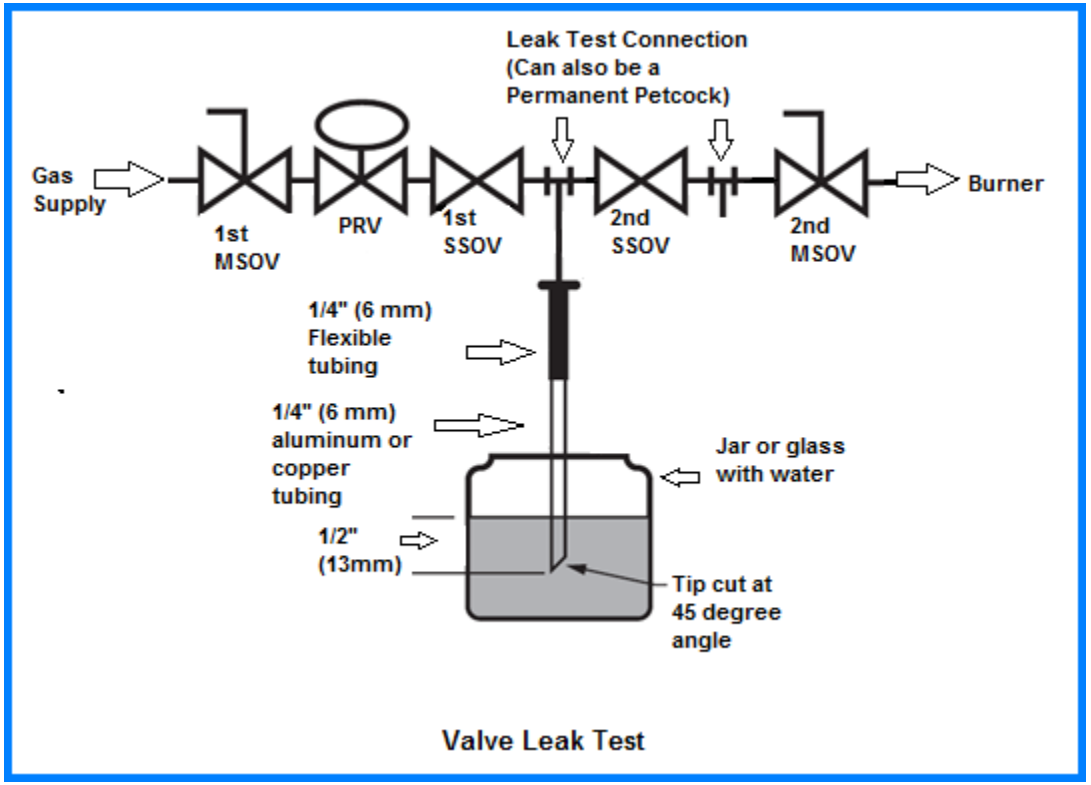
Gas SSOV Leakage test

Gas SSOV Leakage test



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Gas SSOV Leakage test

When bubbles stabilize, count the number of bubbles in a 10 second period. For this particular valve, each bubble represents a flow rate of 0.001 cfh. For other valves and valve manufacturers, the rate will be in the valve manual or literature.

Maximum Bubbles per Pipe Size.

Pipe Size (in. NPT)	Maximum Seat Leakage (UL)	Maximum Number of Bubbles in 10 seconds
1/2 - 3/4	235 cch	6
1	275 cch	7
1-1/4	340cch	8

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Gas SSOV Leakage test

Gas SSOV Leakage test – excerpted from the Honeywell manual provided with the gas SSOV valves [2]:

After the Tests are completed:

1. Make sure the 2nd MSOV is still closed.
2. Make sure 1st MSOV is open.
3. Check for leaks at test connections and valve threads/flanges with soap and water solution.
4. De-energize the system
5. Open all MSOV and restore system to normal operation

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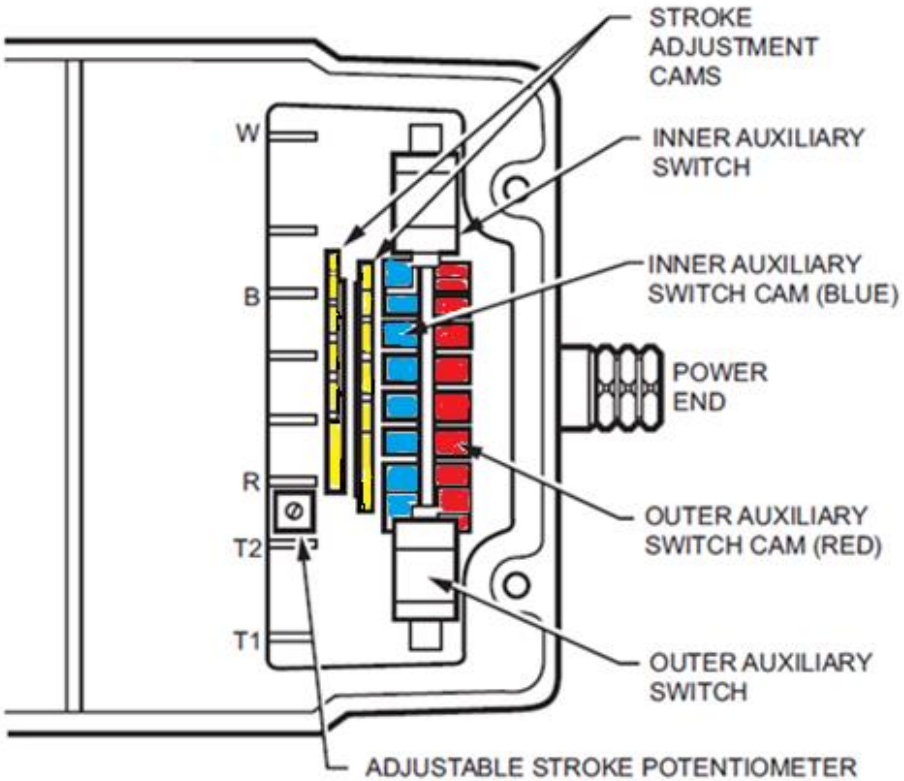
Recommended preventive maintenance schedule

Annually

Test Purge air switch



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Recommended preventive maintenance schedule

Annually

Test low fire start interlock

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ASME code CSD-1 Non mandatory appendix D

Recommended preventive maintenance schedule

Daily Boiler Checks	Check Gauges, Monitors and Indicators
	Check Instrument and Equipment Settings
	For HP Boilers, quick-drain test LWFCO and Alarms
	Check Burner Flame
Weekly Boiler Checks	For LP Boilers, quick-drain test LWFCO and Alarms
	Check Igniter
	Check Flame Signal Strength
	Check Flame Failure detection system components
	Check Firing Rate Control
	Look and Listen to the Pilot and Main Fuel Valve Opening and Closing
Monthly Boiler Checks	Check Flue, Vent, Stack or outlet Dampers
	Test Low Draft, Fan Air Pressure, and Damper Position Switches
	Check low-fire start Switch
	Test High & Low Gas Pressure and High & Low Oil Pressure and Temp Switches
Semi-Annually	Recalibrate all gages
	For Steam Boilers, slow-drain test LWFCOs and Alarms
	Check Flame Failure detection system components and Firing Rate Control
	Check piping & Wiring of all interlocks and shut-off valves
	Inspect Burner Components
Annually	Pilot Turndown Test
	Hot Refractory Hold-In Test
	Gas SSOV Leakage test
	Test Purge Air switch
	Test Low Fire Start Interlock

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Thank you

References

1. Honeywell Series 90 Modutrol IV™ Motors product data sheet 63-2190-3
2. Honeywell V5055A-F Industrial gas valves product data sheet 60-2307-19
3. ASME code CSD-1, 2009 edition

The information in this presentation was compiled by The Bureau Veritas US from sources believed to be reliable and is for informational purposes only. All sample tests, policies and procedures herein should serve as a guideline, which a boiler owner/operator can use to create specific policies and procedures tailored to their equipment. Any and all information contained herein is not intended to constitute legal advice, and you should consult with your own attorneys when developing programs and policies. We do not guarantee the accuracy of this information or any results and further assume no liability in connection with this presentation and sample policies and procedures, including any information, methods or safety suggestions contained herein. This presentation cannot be assumed to contain every acceptable safety and compliance procedure or that additional procedures might not be appropriate and/or necessary under the circumstances.

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