

# Single burner boiler checklist for controls, interlocks, and other protective features for fuel-gas or fuel-oil fired unit

The following is a general outline of features intended to protect a boiler from physical damage due to fire or explosion. This list is based upon NFPA 85 "Boiler and Combustion Systems Hazards Code" (2007). For complete guidance, please refer to NFPA 85.

All devices that perform a protective function should be listed by a recognized testing laboratory for the intended protective function.

Item	Y	N	Feature	Comments
A			<b>Burner Management Control Devices</b>	<b>Devices that perform protective functions and are not associated with the fuel piping.</b>
A.1.			Low Water Cutoff - Primary	Device to shutdown burner if water level is too low to wet boiler surfaces normally protected from excess temperature by the presence of water.
A.2.			Low Water Cutoff - Secondary	Backup device to the A.1. Device diversity is recommended such that the primary and secondary low water cutoff devices will not be subject to a common mode of failure. (Ex. Use of a float-type device for primary and probe-type device for secondary.)
A.3.			Excess steam pressure	Device that is independent of the operating steam pressure control. Select a device that requires a manual reset.
A.4.			Purge airflow rate proving	Device that proves the minimum air flow rate required during the pre-ignition purge interval. This is typically at least 70% of the airflow rate at maximum continuous boiler capacity.
A.5.			Combustion air proving	Device that proves the minimum air flow rate required by the burner.
A.6.			Atomizing media proving	Device that proves the presence of the minimum required fuel oil atomizing media when used. This may include atomizing air pressure or atomizing steam pressure.
A.7.			Purge timer	Device to time the pre-ignition purge interval.
A.8.			Flame safeguard	Device to monitor the burner flame and upon loss of the flame signal, cause a safety shutdown. Also known as a "Master Fuel Trip."
A.9.			Flame safeguard sensor	Device to sense the presence of flame. This may include an ultraviolet (UV) scanner, infrared scanner, flame rod, or photo cell. UV scanners can fail in the unsafe mode, use a self-checking type scanner when UV is used.

A.10.		Remote manual shutdown switch	Manual switch accessible during an emergency to activate a burner safety shutdown, also known as a "Master Fuel Trip."
A.11.		Alarms	Audible and visual indicator to alert appropriate personnel of abnormal conditions such as burner safety shutdowns, also known as "Master Fuel Trips."
B		<b>Burner Management Logic System</b>	<b>The hardwired relay logic or programmable software logic that implements the start-up sequence of a boiler, monitors conditions during operation, and initiates a "Master Fuel Trip" under abnormal conditions.</b>
B.1.		Pre-ignition purge interval	Logic that provides a proven pre-ignition purge air flow interval that will provide four volume changes for a fire tube type boiler and eight volume changes for a water tube type boiler. The volume to be purged includes furnace section of the boiler and the boiler gas passes. The pre-ignition purge may be managed by logic in the flame safeguard.
B.2.		Pre-ignition purge interlocks	Logic that establishes a minimum set of purge conditions to be proven during the pre-ignition purge interval. Purge conditions may vary based upon the specific boiler, but will typically include: <ul style="list-style-type: none"> <li>•Safety shutoff valve proved closed</li> <li>•Low fuel gas pressure okay</li> <li>•High fuel gas pressure okay</li> <li>•Low fuel oil pressure okay</li> <li>•Low fuel oil temperature okay (if heated)</li> <li>•Low water cutoffs okay</li> <li>•Combustion air fan running (motor starter interlock)</li> <li>•Purge air flow rate -or- Purge air pressure and all dampers in air flow path open</li> </ul>
B.3.		Safety shutoff valves proved closed	All pilot and main burner safety shutoff valves are to be proved closed during the pre-ignition purge interval. This may be accomplished with proof-of-closure switches built into the safety shutoff valves or with an external valve proving system. The words "proved closed" refers to either method.
B.4.		Low fire interlock	Prior to pilot and main burner ignition, prove the boiler has returned from the purge air flow position to the low fire position. The low fire sequence may be provided by logic in the flame safeguard.

B.5.			Pilot (or igniter) permissive to light	Logic that will light the pilot burner once purge is complete and a minimum set of running conditions are proven. Running conditions may vary based upon the specific boiler, but will typically include: <ul style="list-style-type: none"><li>•Main safety shutoff valve proved closed</li><li>•Low fuel gas pressure okay</li><li>•High fuel gas pressure okay</li><li>•Low fuel oil pressure okay</li><li>•Low fuel oil temperature okay (if heated)</li><li>•Low water cutoffs okay</li><li>•Atomizing media okay (where needed)</li><li>•Combustion air fan running (motor starter interlock)</li></ul>
B.6.			Pilot (or igniter) trial for ignition	Logic that provides a timed pilot trial for ignition period. The pilot flame is to be proven within ten seconds of opening the pilot safety shutoff valves, or the pilot safety shutoff valves are to close. The pilot trial for ignition may be provided by logic in the flame safeguard.
B.7.			Main burner permissive to light	Logic that will light the main burner to light when a minimum set of running conditions are proven. Running conditions may vary based upon the specific boiler, but will typically include: <ul style="list-style-type: none"><li>•Pilot flame is proven</li><li>•Low fuel gas pressure okay</li><li>•High fuel gas pressure okay</li><li>•Low fuel oil pressure okay</li><li>•Low fuel oil temperature okay (if heated)</li><li>•Low water cutoffs okay</li><li>•Atomizing media okay (where needed)</li><li>•Combustion air fan running (motor starter interlock)</li></ul>
B.8.			Main burner trial for ignition	Logic that provides a timed main burner trial for ignition period. The main flame is to be proven within ten seconds of opening the main safety shutoff valves, or the main safety shutoff valves are to be closed. The trial for ignition period may be extended to 15 seconds where #5 or #6 fuel oil is used. The main burner trial for ignition may be provided by logic in the flame safeguard.
C			Fuel gas piping	<b>The protective devices provided as part of the fuel gas piping train.</b>
C.1.			Manual fuel gas shutoff valve	Device provided at fuel supply connection that allows the entire boiler to be isolated from the fuel supply.

C.2.		Sediment trap (drip leg)	A vertical section of pipe located downstream of the manual fuel gas shutoff valve and upstream of all other devices to capture sediment. See NFPA 54 (2010) figure 9.6.7 for the orientation of sediment trap.
C.3.		Strainer	Device located immediately downstream of the manual fuel shutoff valve and sediment trap to protect downstream devices from debris.
C.4.		Pilot (or ignitor) double valve and vent	Two normally-closed safety shutoff valves wired in series with a normally open vent valve. Locate the normally-open vent valve on a vent line connected between the two safety shutoff valves. Terminate the vent to a safe outside location. Size the vent line per NFPA 85 (2007) table 4.6.2.4.2. Safety shutoff valves should include an integral proof-of-closure switch if a separate valve proving system is not used (see item B.3. above) and a visual position indicator.
C.5.		Main fuel gas double valve and vent	Two normally-closed safety shutoff valves wired in series with a normally open vent valve. Locate the normally-open vent valve on a vent line connected between the two safety shutoff valves. Terminate the vent to a safe outside location. Size the vent line per NFPA 85 (2007) table 4.6.2.4.2. Safety shutoff valves should include an integral proof-of-closure switch if a separate valve proving system is not used (see item B.3. above) and a visual position indicator.
C.6.		Safety shutoff valve leak test	Permanently installed devices to allow periodic fuel gas safety shutoff valve seat leak testing. This applies to safety shutoff valves serving fuel gas pilots and fuel gas main burners. Devices to facilitate testing may include: <ul style="list-style-type: none"> <li>• Normally plugged leak test outlets located downstream of each safety shutoff valve.</li> <li>• Manual valves downstream of the safety shutoff valves to isolate fuel pipe from the burner during leak test.</li> <li>• Momentary pushbutton switch to allow application of power to the normally open vent valve during a leak test.</li> <li>• Momentary pushbutton switches to allow application of power to the upstream safety shutoff valve during a leak test.</li> </ul>
C.7.		Fuel gas low pressure	Device to monitor the fuel gas pressure on the main burner fuel piping and shutdown the fuel gas safety shutoff valves when the fuel gas pressure falls below the design set point.
C.8.		Fuel gas high pressure	Device to monitor fuel gas pressure on the main burner fuel piping and shutdown the fuel gas safety shutoff valves when the fuel gas pressure rises above the design setpoint.

<b>D</b>		<b>Fuel gas piping</b>	<b>The protective devices provided as part of the fuel oil piping train.</b>
D.1.		Manual fuel oil shutoff valve	Device provided at fuel supply connection that allows the entire boiler to be isolated from the fuel supply.
D.2.		Filter or Strainer	Device located immediately downstream of the manual fuel shutoff valve to protect downstream devices from debris.
D.3.		Main fuel oil double safety shutoff valves	Two normally-closed safety shutoff valves wired in series. Safety shutoff valves should include a visual position indicator.
D.4.		Fuel oil low pressure	Device to monitor fuel oil pressure on the main burner fuel piping and shutdown the fuel oil safety shutoff valves when the fuel oil pressure falls below the design setpoint.
D.5.		Fuel oil high pressure	Device to monitor fuel oil temperature on the main burner fuel piping when the fuel oil is heated. The device is to shutdown the fuel oil safety shutoff valves when the fuel oil temperature rises above the design setpoint.

#### Comments

Provide comments for each item checked "NO". Precede comments with item number.

**Trainer/Technician Signature**

**Boiler(s) Identification Numbers**

State #: \_\_\_\_\_ Nat. Board #: \_\_\_\_\_

#### References

1. NFPA 54, National Fuel Gas Code. Quincy, MA: NFPA, 2009. Online
2. NFPA 85, Boiler and Combustion Systems Hazards Code. Quincy, MA: NFPA, 2007. Online

# Training List for New Boiler / Burner

## 1 – Lockout / Tag-out procedures for new burner

- Locate power isolation points on burner

## 2 – Startup – Operation

- Controller – Navigate controller functions
- Cold Start – Low Fire Hold
- Normal Operation
- Changing Setpoints

## 3 – Fault Finding

- Addressing faults on controller
- Locating possible fault points in system

## 4 – Checks and Routine Maintenance

- Walkthrough standard checks and maintenance

**The contractor has provided training on the operation of the new boiler / burner system.**

Customer Signature \_\_\_\_\_

*This signoff should accompany NFPA-85 checklist.*

*Both documents shall be turned into jurisdiction for state records retention of unit(s).*