BOILER INSTALLATION

NORTH DAKOTA BOILER INSPECTION PROGRAM

NORTH Dakota

Be Legendary.™

MAILING ADDRESS:

Department of Environmental Quality
Boiler Inspection Program
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WHERE DO WE HAVE JURISDICTION?

- Any size of boiler in a six-unit apartment or greater.
- Any size of boiler in buildings where the public is invited. Exemptions are federally controlled buildings and farm use buildings.
- Any water heater or pool heater greater than 200,000 BTU/HR input at above locations.
- Antique/historical boilers at public shows.

TOPICS TO COVER:

- Installation of hot water heating systems
- Clearances – make a good plan from the start
- Requirements and controls for all boilers
- Other boiler installation tips
- Water heater and pool heater installations
- Installer form - required

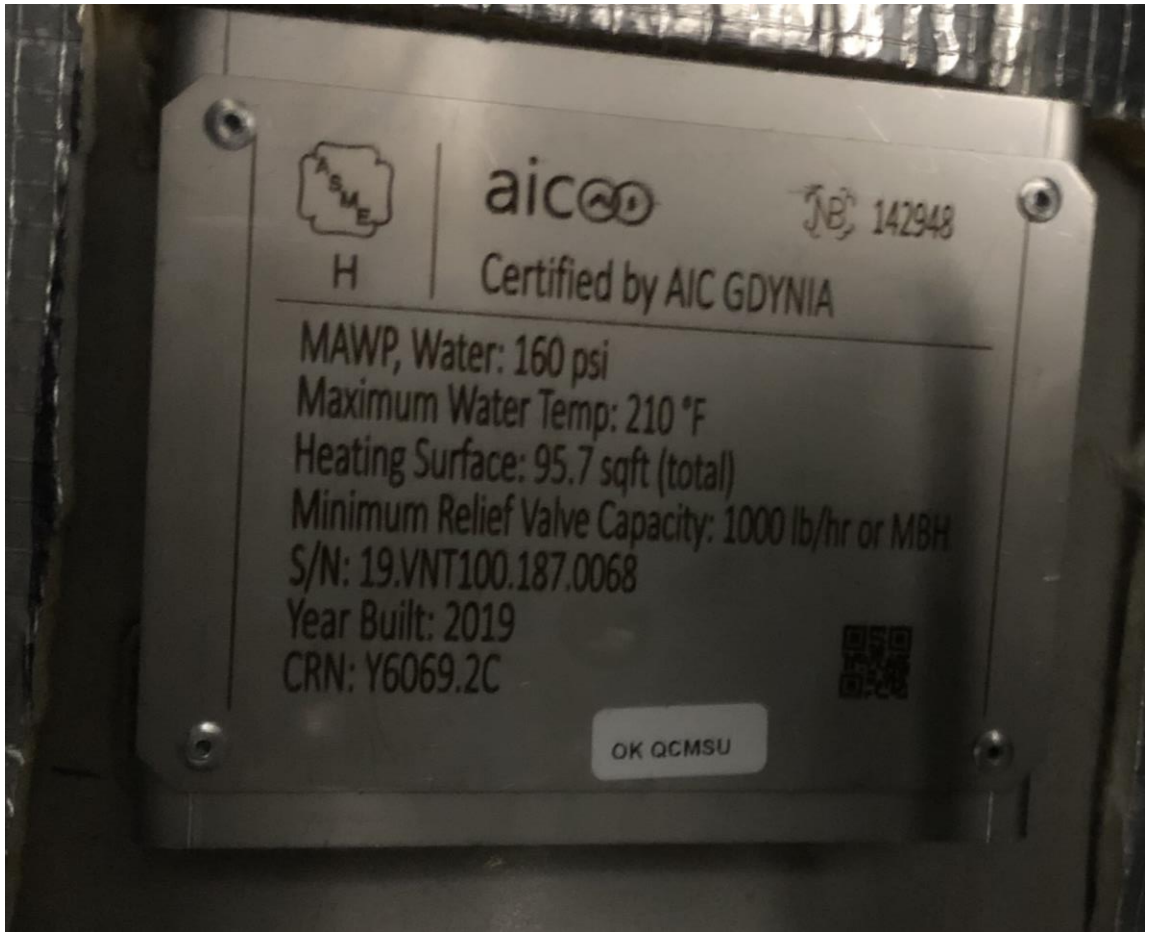
BOILER CLEARANCES:

- Heating boilers shall have a minimum distance of at least 36” between all sides of the heating boiler and adjacent walls, structures, or other equipment.
- Alternative clearances in accordance with the manufacturer’s service and maintenance recommendations are subject to acceptance by the Chief Inspector.
- If it will not fit, it cannot be installed.
- It will **not** be easier to obtain forgiveness after the fact than to get permission beforehand.

GOOD SPACING, CLEAN BOILER ROOMS

BOILER STAMPING:

- Steel, stainless steel, and electric boilers must have an ASME stamp and be National Board registered.
- Cast iron and cast aluminum boilers must have an ASME stamp.



SOME BOILER DESIGNS ARE NOT ACCEPTABLE:

- Code stamped boilers, but not allowed in State due to internal piping, control issues and safety relief valve placement.

- NOTE: Please call us before installing a boiler you have not used before as new products come on the market all the time and may not meet State Boiler Code even with the correct ASME and National Board stamping

BOILER REQUIREMENTS AND CONTROLS:

1. Two temperature controls – one with manual reset and lockout
2. Testable low-water cut off with manual reset and lockout, or flow switch
3. Expansion tank with stop valve
4. Safety relief valve
5. Temperature and pressure gauge
6. Isolation valves
7. Drain valve
8. Electrical switch
9. Emergency stop (required over 400,000 BTU/HR input)
10. Makeup water system – not always required (RPZ, regulator with bypass, and feed line stop valve)
11. Combustion Air and Venting
12. Carbon Monoxide Detector/Alarm
13. Recommend condensate neutralizer kit for all high efficiency appliance exhaust drains.

1. TWO TEMPERATURE CONTROLS – ONE WITH MANUAL RESET

Many operating and manual reset high limit controls are built into the new boilers, if the temperature settings are correct and do not exceed the maximum allowable temperature (MAWT) of the boiler, no external temperature controls are required.

- The Honeywell L4006E1125/U or equivalent with a dial range of 100-200F is the correct control for high efficiency boilers that require an external control.

Common MAWT of boilers:

- High Efficiency Stainless Steel 200-210F
- Cast Iron 250F
- Steel 250F
- Copper Fin Tube 210-250F
- Cast Aluminum 200F

The lowest MAWT is the determining factor for setting the manual reset high limit temperature controls on all boilers in the system.

2. LOW WATER PROTECTION…

LOW WATER FUEL CUTOFF

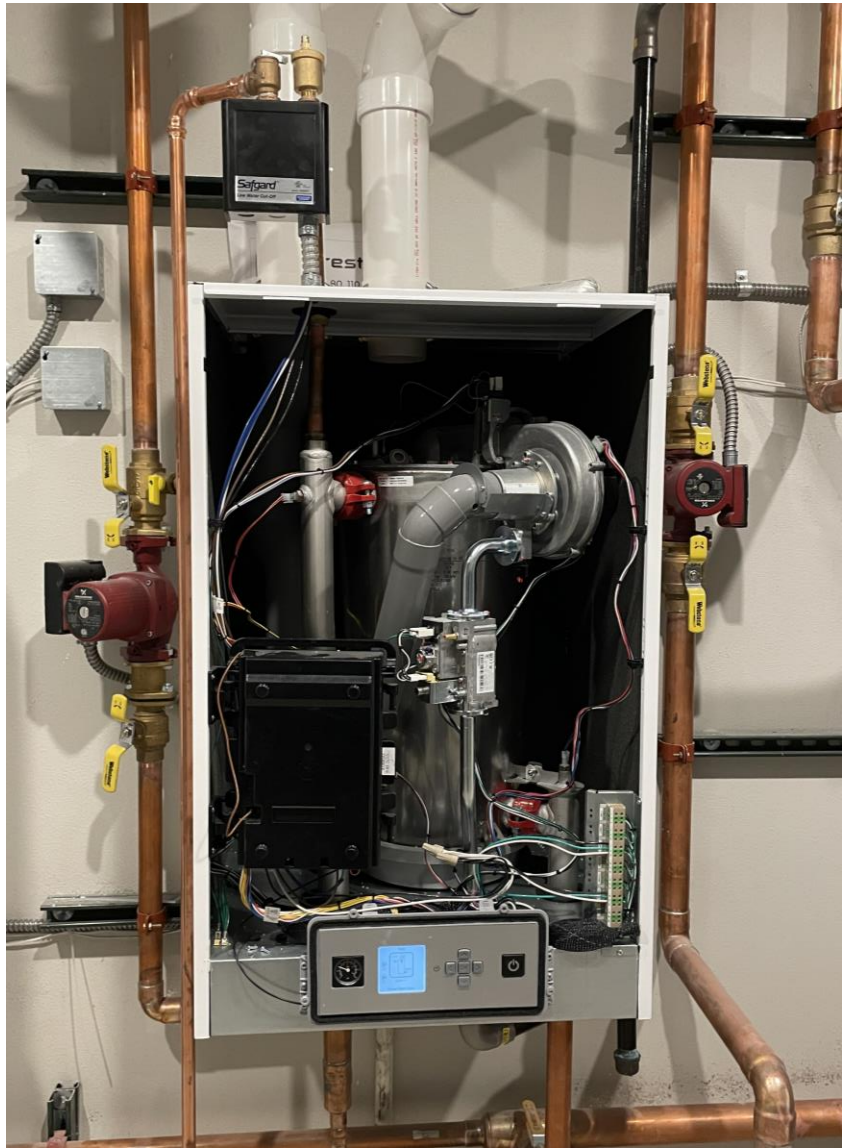
- Low water fuel cutoff is required for **fire tube**, cast iron and some electric boilers.
- Must be testable with manual reset and lockout. (per ASME CSD-1)
- Must be installed on the boiler proper or above the safe water line on the boiler supply outlet piping (hot side) before the first isolation valve. May not be installed beneath the boiler.

FLOW SWITCH

- Flow switch is required for **water tube** boilers, fired coil boilers, pool heater and some electric boilers.
- Consider the size of piping and flow rate of the boiler to the type of flow switch.
- Must be installed in the primary piping for primary/secondary piping.
- Recommend install within the boiler isolation valves – easier to service.
- TEST once installed to verify it shuts down the boiler.

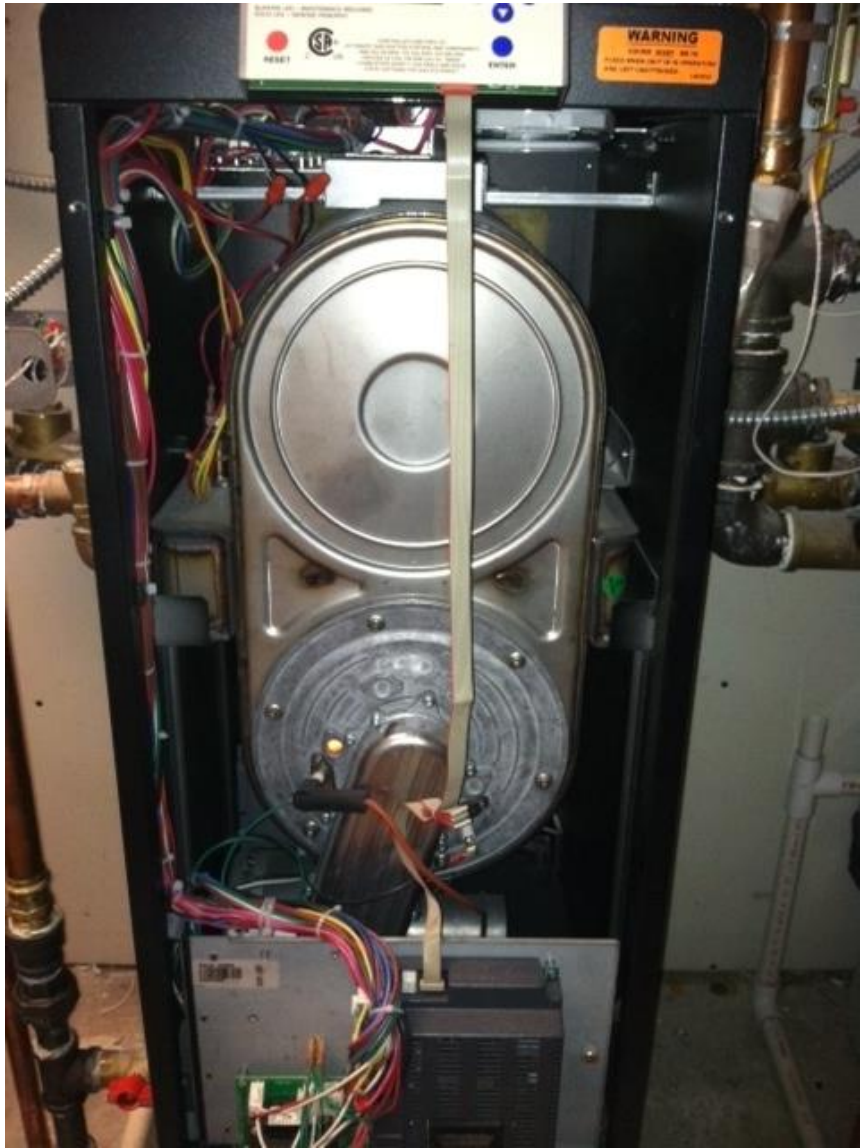
2A. FIRE TUBE – LOW WATER

tall vertical cylinder



WATER TUBE – FLOW SW

burner on face of boiler



2B. LOW WATER FUEL CUTOFF EXAMPLES:

Correct install for fire tube vertical tube:

Correct install for cast iron:

2C. FLOW SWITCH EXAMPLES:

Correct installation for water tube boiler:

Correct installation electric boiler:

2D. ELECTRIC BOILERS AND LOW WATER PROTECTION:

Low water protection:

- For vertical element designs (i.e. Electro Industries, Thermolec) a low water fuel cutoff is acceptable.
- For horizontal element designs (i.e. Slant Fin Monitron) a flow switch is required by the manufacturer.
- For very large electric boilers the low water protection is usually built in and determined by the manufacturer.

3. EXPANSION TANK WITH STOP VALVE

- ASME Expansion tank

ASME expansion tank – a stamping plate is welded to the tank with a code symbol and nameplate data.

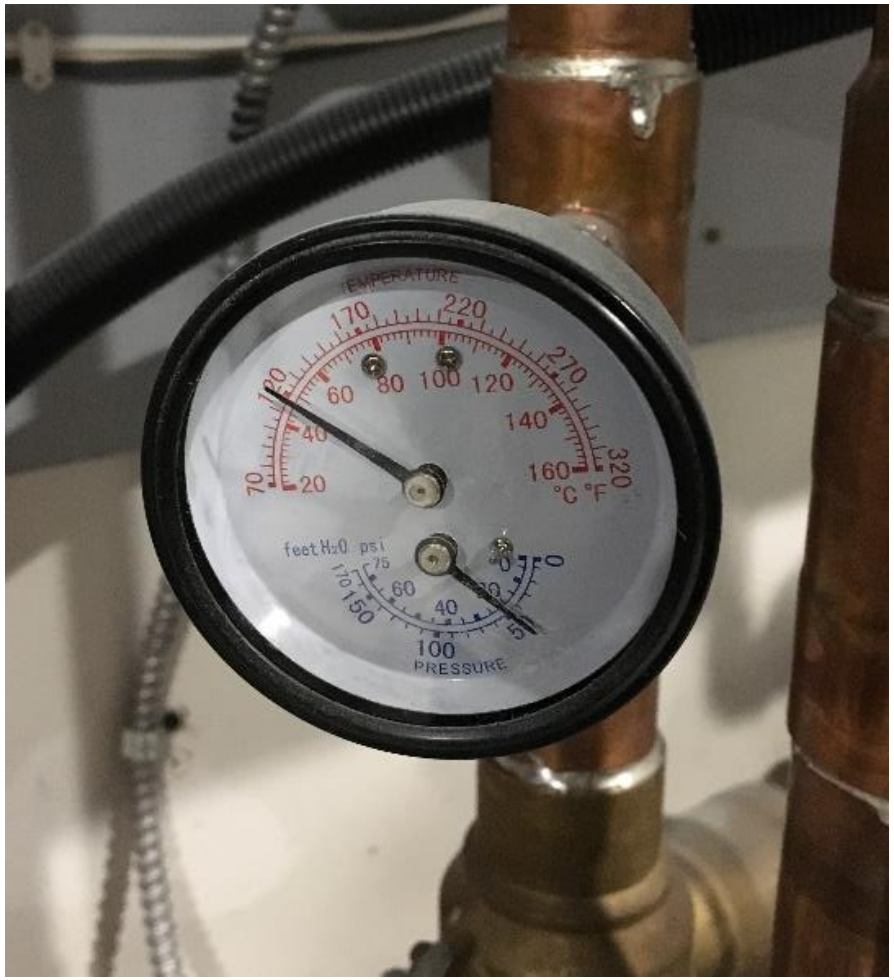
- Non-ASME Expansion tank

Paper or sticker tag on the tank with information.

4. SAFETY RELIEF VALVES

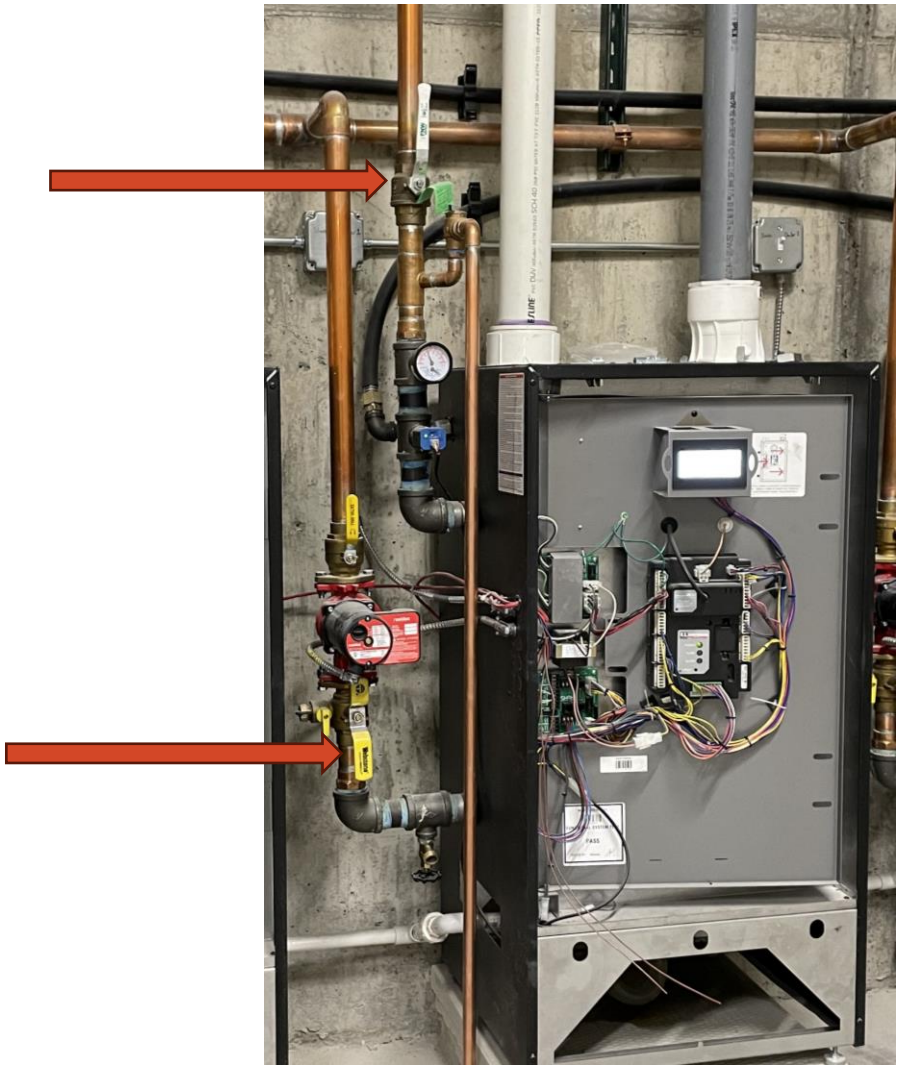
- All safety valves **must** be installed in the **vertical** position.
- Metallic discharge piping is required – copper or black iron. Plastic is not permitted.
- If a non-ASME expansion tank is installed the safety relief valve must not exceed 30 psi.
- If more than one boiler is installed in the system, the **lowest** boiler MAWP determines the safety relief valve setting for **all** of the boilers in the system.

5. PRESSURE/TEMPERATURE GAUGE

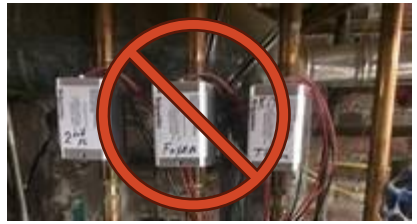


- The dial range of the pressure gauge must be 1 ½ to 3 ½ times the setting of the safety relief valve set pressure.
- The pressure/temperature gauge must be installed on the boiler proper or on the outlet piping before the first isolation valve.
- If the boiler has a 30 psi relief valve the dial range of the gauge is required to be a minimum of 0-45 psi and a maximum of 0-105 psi.

6. ISOLATION VALVES



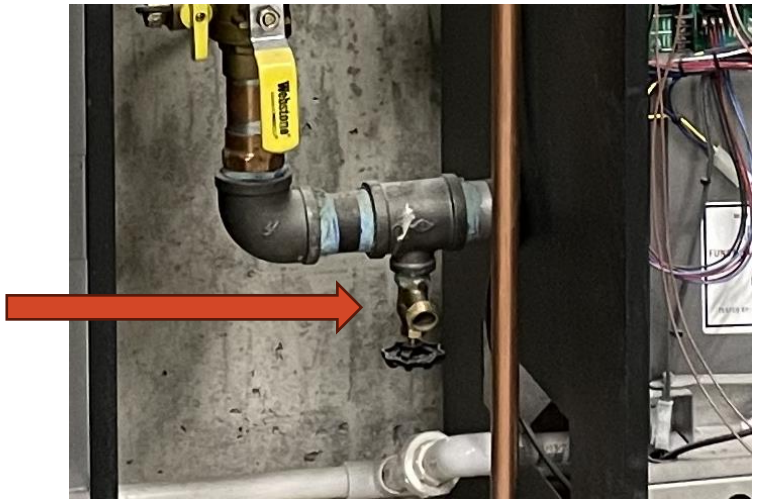
- Boiler isolation valves are required on the inlet and outlet of the boiler.
- They may not isolate any controls from the boiler with the exception of a flow switch.
- For primary/secondary piping, the isolation valves must be in the primary piping.
- Zone valves and flow control valves are <u>not</u> the required isolation valves.



Zone valves

Flow control

7. DRAIN VALVE



- Each boiler must have a drain valve.
- The minimum size of the drain piping and valves shall be NPS 3/4 .
- The drain valve must be inside the boundary of the inlet and outlet stop valves.
- For primary/secondary it must be on the primary piping inside the stop valves.

8. ELECTRICAL SWITCH

- Every boiler must have an on/off electrical switch.
- If there is not a factory installed switch on the boiler, a readily accessible electrical switch must be installed near the boiler.
- On/off switches on the ceiling are **not** accessible.

9. EMERGENCY STOP -

For all boilers over 400,000 BTU/HR input

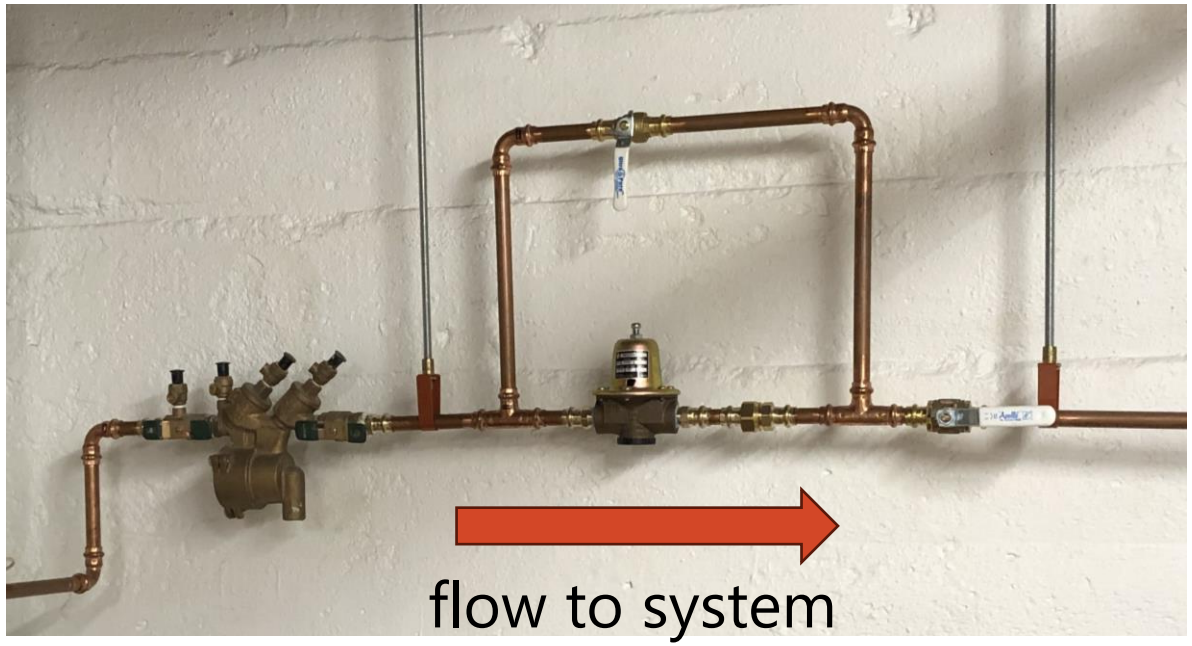
- A manually operated emergency shutoff switch must be located just outside the most commonly used boiler room door and marked for easy identification.
- If the boiler room door is on the building exterior, the switch must be located just inside the door.
- Consideration should be given to safeguard against tampering.

10. MAKEUP WATER SYSTEM –

AUTOMATIC WATER FEED ON, OFF OR NOT REQUIRED

- A boiler needs low-water protection. A low water cutoff or flow switch satisfy that requirement for new boilers. No feed water regulator is required, and it may be turned off if desired.
- Older boilers – low-water cutoffs were required in 1994. If the boiler is installed prior to 1994 and does not have testable low water protection a feed water regulator is required and it must be left on.
- Broken feed lines require, at a minimum, a vacuum breaker on the city water side. (See Plumbing Code)

10A. CORRECT FEED WATER REGULATOR WITH RPZ BACKFLOW PREVENTER



- RPZ backflow preventer
- Feed water regulator with piped bypass line
- Feed line stop valve before entering the boiler system.
- Feed water must enter the boiler system on the return, or line to the expansion tank.

11. COMBUSTION AIR AND VENTING

Combustion Air:

- Most high efficiency boilers required to vent directly to outside.
- Check combustion air is sized adequately for replacement boilers.
- Combustion air:

  1 sq in per 4,000 btu/hr input – 2 openings

  1 sq in per 3,000 btu/hr input – 1 opening
- Professionally designed combustion air recommended for any other design.
- Dampers, louvers and supply fans must be interlocked with burner, consider air exhausting as well when sizing combustion air.

Venting:

- Space correctly from combustible materials.
- Modifying vent hoods is **not** allowed.
- Common venting upsize 50% for area of any additional vent.
- Horizontal piping must have at least 2% upslope.

12. CARBON MONOXIDE DETECTOR/ALARM

The owner or user shall install a carbon monoxide (CO) detector/alarm in equipment rooms where fuel fired boilers and/or fuel fired pressure vessels are located in accordance with the authority having Jurisdiction.

13. CONDENSATE NEUTRALIZER KIT

Recommended for all high efficiency boilers and water heaters

Washes away surrounding concrete, metal drains and piping. This is after 3 years.

Condensate neutralizer – one example

More Boiler Installation Tips...

REPLACEMENT BOILERS

- New boilers must be installed to current code, you cannot exchange like for like without making updates to the system.
- Considerations for old systems and new boilers
  - not all high efficiency boilers are tolerant of old piping and dirty systems – cleaners and filters may be needed
  - some new boilers require special water treatment
- Clearances must meet state boiler code.

SHOP INSTALLATION

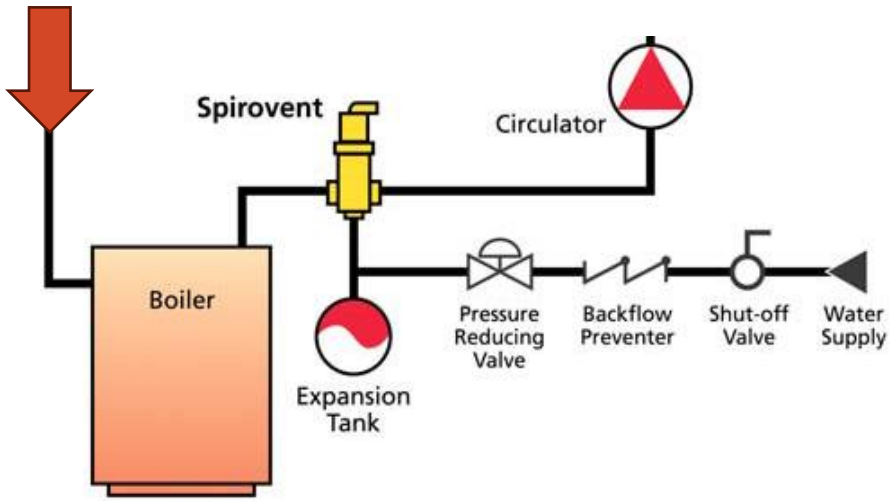
- Boilers installed in a shop where vehicles can be stored must have the burner at least 18” off the floor.
- If the boiler is installed in a mechanical room with access from the shop it must still be 18” off the floor.
- This includes sealed combustion boilers.

BOILERS ABANDONED IN PLACE + NEW BOILER

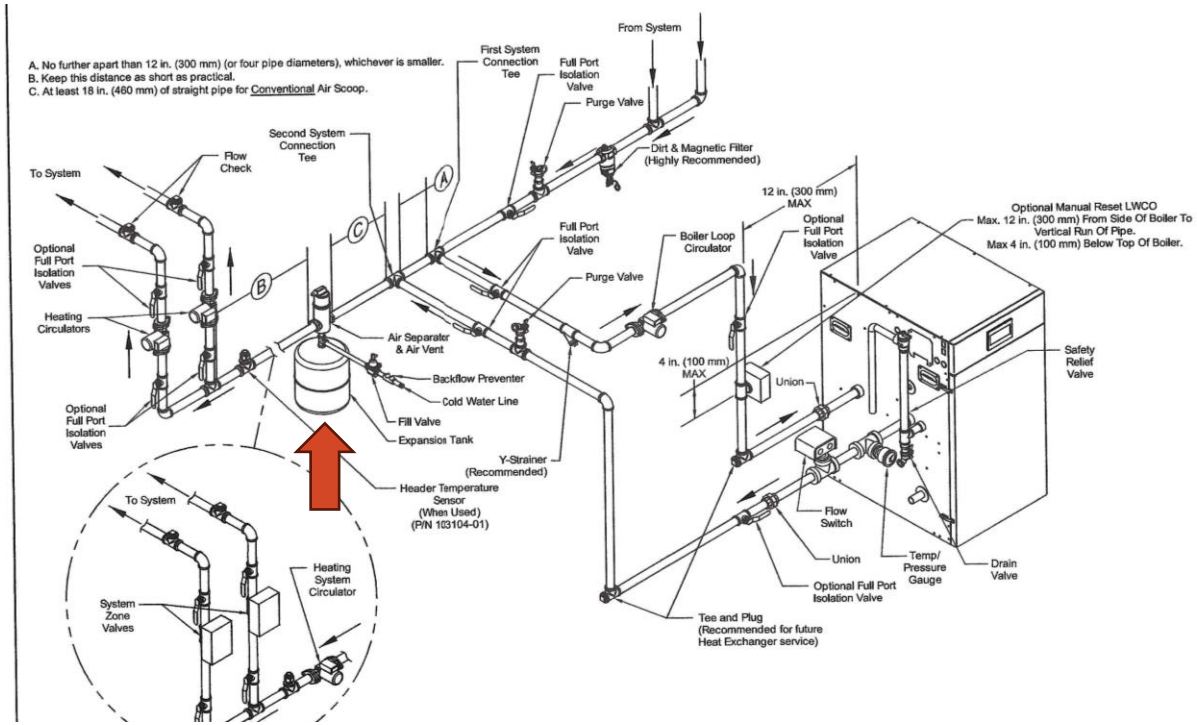
- Boilers must be installed in parallel, we require each boiler be installed such that either one can operate independent of the other.
- Adding a new boiler to an old system may require isolation valves to be added to old boiler that was previously “grandfathered” without valves.
- Boilers abandoned in place - must have both electric and gas disconnected from the boiler as a minimum requirement.

EXPANSION TANKS AND AIR ELIMINATORS

Single boiler piping – conventional vs primary/secondary



Expansion tank with air eliminator on hot side of boiler



Expansion tank and air eliminator on secondary piping and suction side of circulating pumps

STORAGE WATER HEATER AND HLW BOILERS

- Small non-ASME expansion tanks are permitted for hot water supply systems. However, if the expansion tank is **OVER 5 GALLONS** in size it must be an **ASME expansion tank.**
- Storage water heaters are not required to be ASME code, unless they exceed 120 gallons.
- Storage water heaters or hot water supply boilers stamped ‘HLW’ are **not allowed** for space heating purposes.

POOL HEATERS

- Pool heaters must be ASME constructed with an “H” or “HLW” designation and be National Board registered.
- Pool heaters with stop valves installed between the boiler and pool must have a flow switch installed in the piping.
- Pool heaters smaller than 200,000 BTU/HR input do not fall under our jurisdiction.

MATRIX AND INSTALLER REPORT

BOILER MATRIX

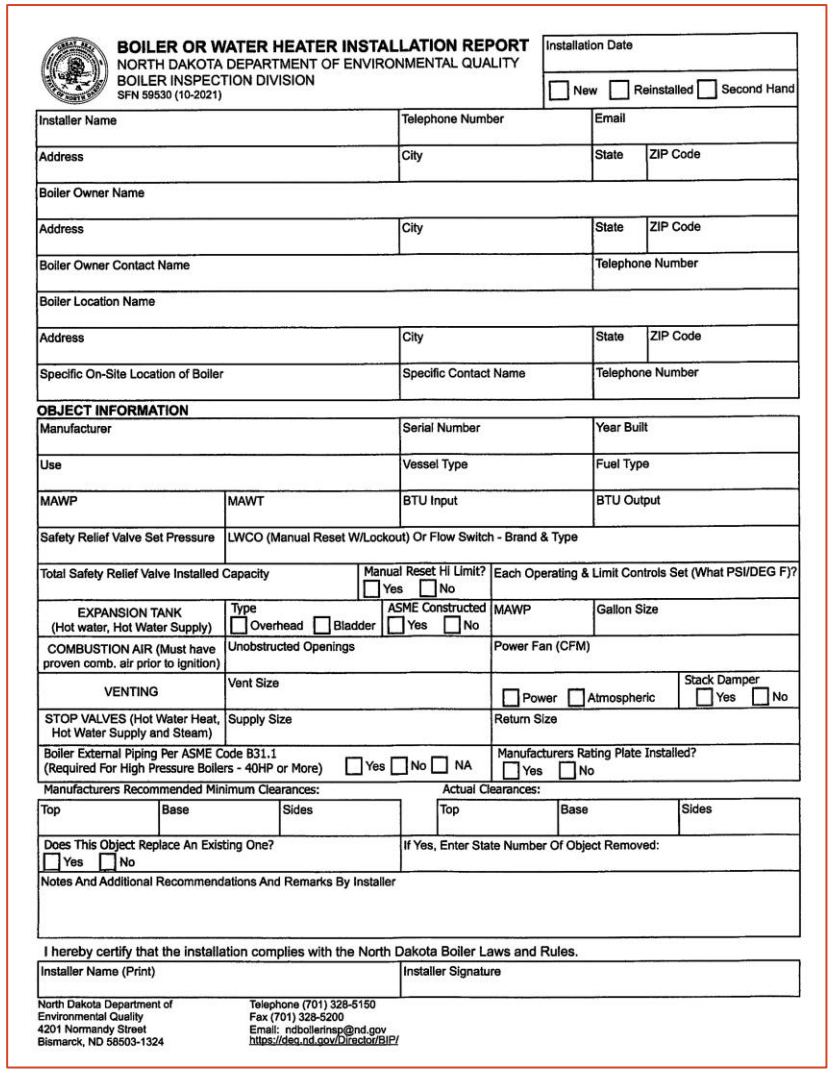
ND BOILER INSPECTION PROGRAM - INSTALLATION MATRIX - MARCH 2024

LOW PRESSURE BOILERS, WATER HEATERS, & POOL HEATERS - (DOES NOT INCLUDE OBJECTS IN APARTMENT HOUSES LESS THAN SIX UNITS)

BOILER INSTALLATION ITEM:	CAST IRON BOILE		FIRE TUBE BOILE		WATER TUBE BOILE		WATER HEATERS		POOL HEATER
	HWH	STM	HWH	STM	HWH	STM	STG WT HTR	F COIL & WT	F COIL & WT
STEAM PRESSURE GAUGE	NO	YES	NO	YES	NO	YES	NO	NO	NO
WATER PRESSURE GAUGE - 1.5 TO 3.5 X SAFETY VALVE SET	YES	NO	YES	NO	YES	NO	NO	NO	NO
GAUGE GLASS	NO	YES	NO	YES	NO	YES	NO	NO	NO
2 PRESSURE CONTROLS - 1 MANUAL RESET REQUIRED	NO	YES	NO	YES	NO	YES	NO	NO	NO
2 TEMPERATURE CONTROLS -1 MANUAL RESET REQUIRED	YES	NO	YES	NO	YES	NO	NO	YES	YES
1 LOW-WATER FUEL CUTOFF - MANUAL RESET/LOCKOUT REQ	YES	NO	YES	NO	NO	NO	NO	NO	NO
2 LOW-WATER FUEL CUTOFFS - 1 MANUAL RESET REQUIRED	NO	YES	NO	YES	NO***	YES	NO	NO	NO
FLOW SWITCH	NO	NO	NO	NO	YES***	NO	NO	YES	YES
TEMPERATURE GAUGE	YES	NO	YES	NO	YES	NO	NO	YES	YES
PROPER ELECTRICAL WIRING	YES	YES	YES	YES	YES	YES	YES	YES	YES
EMERGENCY SHUTDOWN SW - REQ'D OVER 400,000 INPUT	YES	YES	YES	YES	YES	YES	NO	NO	YES
BOILER ELECTRICAL SW - REQUIRED ON OR NEAR BOILER	YES	YES	YES	YES	YES	YES	NO	YES	YES
SAFETY VALVE	NO	YES	NO	YES	NO	YES	NO	NO	NO
SAFETY RELIEF VALVE	YES	NO	YES	NO	YES	NO	YES (T&P)	YES	YES
PROPER PIPING SUPPORTS	YES	YES	YES	YES	YES	YES	YES	YES	YES
EQUALIZING LOOP	NO	YES	NO	YES	NO	YES	NO	NO	NO
CLEAN OUTS	NO	NO	NO	YES	NO	YES	YES	NO	NO
FEEDWATER PIPING	NO	YES	NO	YES	NO	YES	NO	NO	NO
FEEDWATER STOP & CHECK (BOILER, STOP VLV, CHECK VLV)	NO	YES	NO	YES	NO	YES	NO	NO	NO
MAKEUP WATER PIPING	YES	NO	YES	NO	YES	NO	NO	NO	NO
MAKEUP STOP VALVE (BETWEEN BOILER & F/W REGULATOR)	YES	NO	YES	NO	YES	NO	NO	NO	NO
RPZ BACK FLOW PREVENTER	YES	NO	YES	NO	YES	NO	NO	NO	NO
SUPPLY & RETURN VALVES - RATED FOR SYSTEM PRESSURE	YES	NO	YES	NO	YES	NO	YES	YES	OPTIONAL
EXPANSION TANK - ASME IF OVER 30 PSI S.R. VALVE	YES	NO	YES	NO	YES	NO	NO	NO	NO
EXPANSION TANK STOP VALVE	YES	NO	YES	NO	YES	NO	NO	NO	NO
BLOWOFF VALVE - SIZED TO SAFETY VALVE CAPACITY	NO	YES	NO	YES	NO	YES	NO	NO	NO
DRAIN VALVE	YES	YES	YES	YES	YES	YES	YES	YES	YES
FEED WATER REGULATOR WITH PIPED BYPASS	YES	NO	YES	NO	YES	NO	NO	NO	NO
SUITABLE FOR FLOOR MATERIAL	YES	YES	YES	YES	YES	YES	YES	YES	YES
BOILER CLEARANCES - 36 INCHES ALL AROUND	YES	YES	YES	YES	YES	YES	YES	YES	YES
PROPER COMBUSTION AIR & VENTING	YES	YES	YES	YES	YES	YES	YES	YES	YES
CHIEF BOILER INSPECTOR NOTIFIED OF INSTALLATION	YES	YES	YES	YES	YES	YES	YES, IF OVER 200,000 BTU INPUT		
INSTALLATION FORM SUBMITTED TO CHIEF INSPECTOR	YES	YES	YES	YES	YES	YES	YES, IF OVER 200,000 BTU INPUT		
CARBON MONOXIDE DETECTOR/ALARM	YES	YES	YES	YES	YES	YES	YES, IF OVER 200,000 BTU INPUT		
***some large HWH water tube boilers may have a low water cutoff instead of a flow switch for low water protection, please consult your inspector									

Good tool, Additional notes printed on the back of the matrix.

BOILER OR WATER HEATER INSTALLATION REPORT



BOILER OR WATER HEATER INSTALLATION REPORT
NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
BOILER INSPECTION DIVISION
SFN 59530 (10-2021)

Installation Date
☐ New ☐ Reinstalled ☐ Second Hand

Installer Name	Telephone Number	Email	
Address	City	State	ZIP Code
Boiler Owner Name			
Address	City	State	ZIP Code
Boiler Owner Contact Name		Telephone Number	
Boiler Location Name			
Address	City	State	ZIP Code
Specific On-Site Location of Boiler	Specific Contact Name	Telephone Number	

OBJECT INFORMATION

Manufacturer		Serial Number	Year Built
Use		Vessel Type	Fuel Type
MAWP	MAWT	BTU Input	BTU Output
Safety Relief Valve Set Pressure	LWCO (Manual Reset W/Lockout) Or Flow Switch - Brand & Type		
Total Safety Relief Valve Installed Capacity	Manual Reset Hi Limit? ☐ Yes ☐ No	Each Operating & Limit Controls Set (What PSI/DEG F)?	
EXPANSION TANK (Hot water, Hot Water Supply)	Type ☐ Overhead ☐ Bladder	ASME Constructed ☐ Yes ☐ No	MAWP / Gallon Size
COMBUSTION AIR (Must have proven comb. air prior to ignition)	Unobstructed Openings	Power Fan (CFM)	
VENTING	Vent Size	☐ Power ☐ Atmospheric	Stack Damper ☐ Yes ☐ No
STOP VALVES (Hot Water Heat, Hot Water Supply and Steam)	Supply Size	Return Size	
Boiler External Piping Per ASME Code B31.1 (Required For High Pressure Boilers - 40HP or More) ☐ Yes ☐ No ☐ NA		Manufacturers Rating Plate Installed? ☐ Yes ☐ No	

Manufacturers Recommended Minimum Clearances:			Actual Clearances:		
Top	Base	Sides	Top	Base	Sides

Does This Object Replace An Existing One? ☐ Yes ☐ No	If Yes, Enter State Number Of Object Removed:
Notes And Additional Recommendations And Remarks By Installer	

I hereby certify that the installation complies with the North Dakota Boiler Laws and Rules.

Installer Name (Print)	Installer Signature

North Dakota Department of Environmental Quality
4201 Normandy Street
Bismarck, ND 58503-1324

Telephone (701) 328-5150
Fax (701) 328-5200
Email: ndboilerinsp@nd.gov
https://deq.nd.gov/Director/BIP/

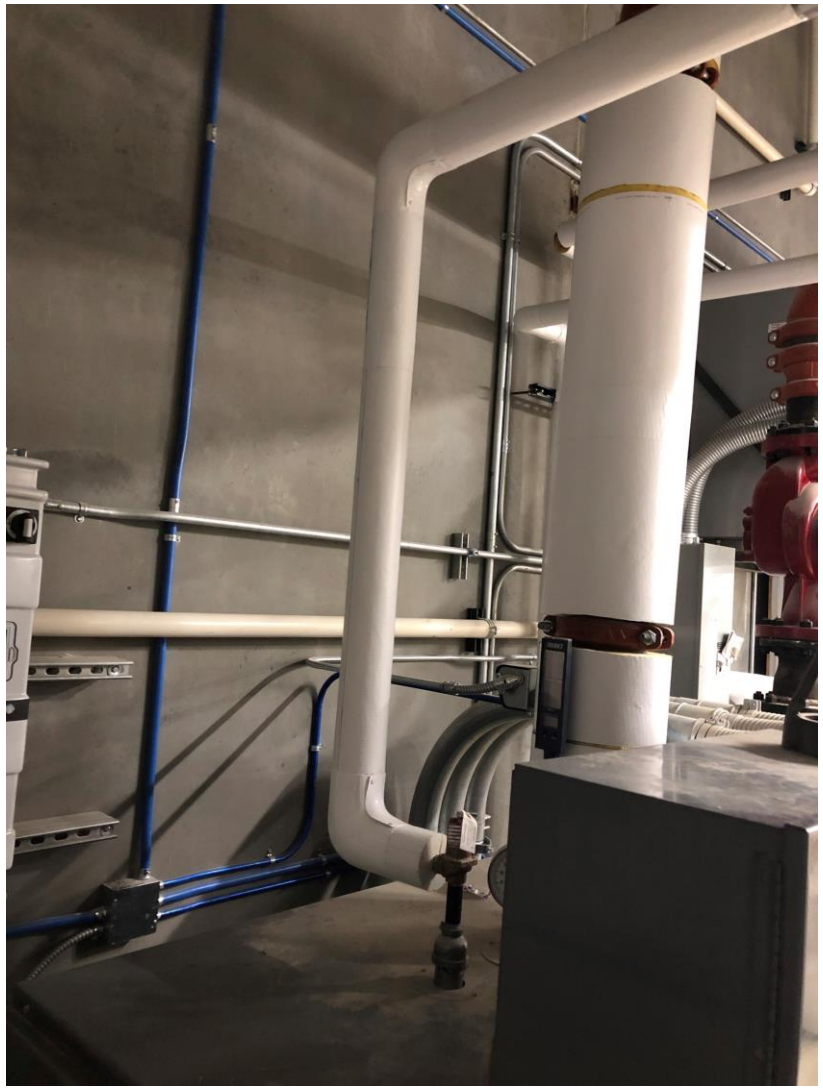
- The installation report form is a requirement. The form is fillable and available on our website.
- The completed form must be submitted to the Chief Inspector.

WHAT NOT TO DO...

HOMEMADE BOILERS….NO…

Submitted by Kimberley from the Plumbing Board

Two safety relief valves?

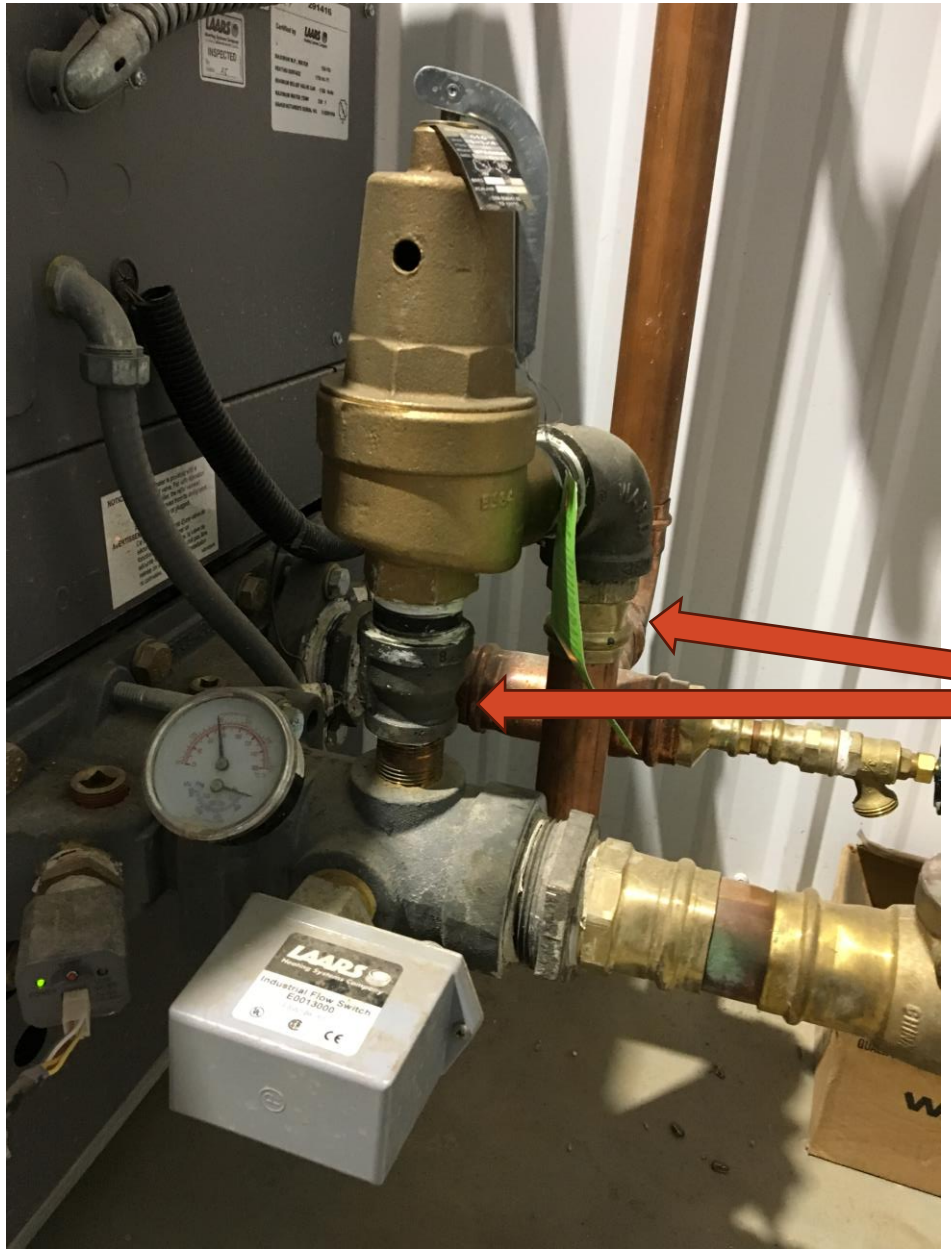


Safety valve discharge piping up…?

Water flows downhill…

Fan support?

- Wrong expansion tank for storage water heaters, bigger than 5 gallons… must be ASME



Reduced safety relief valve inlet and outlet…

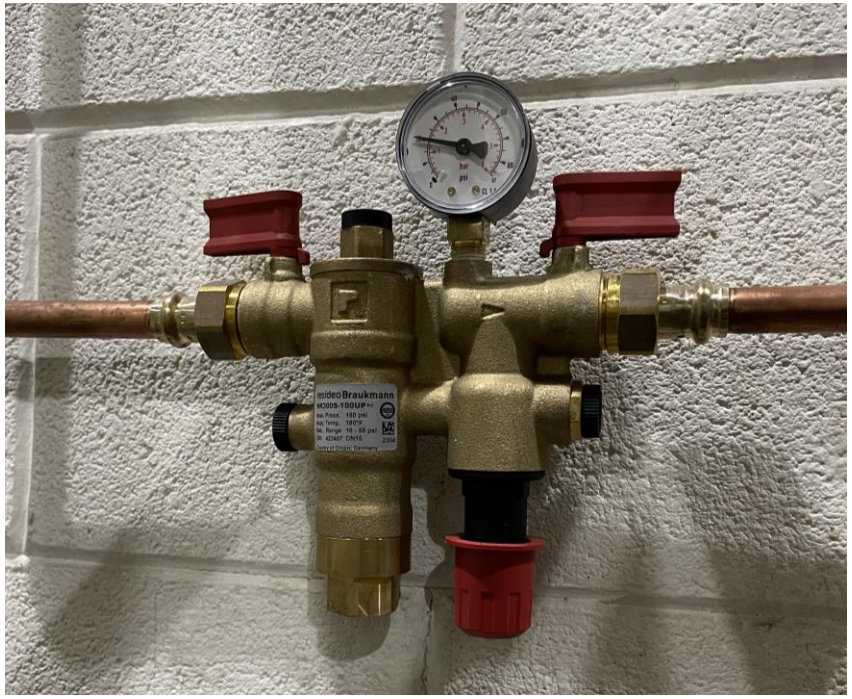
both must be FULL size

Low water fuel cutoff in the secondary piping after coming out the bottom of the boiler

Safety relief valve horizontal and maybe on return?

Residential style low water fuel cutoff, test but no manual reset

Feed line troubles – not RPZ, on low side, no bypass and no feed stop valve



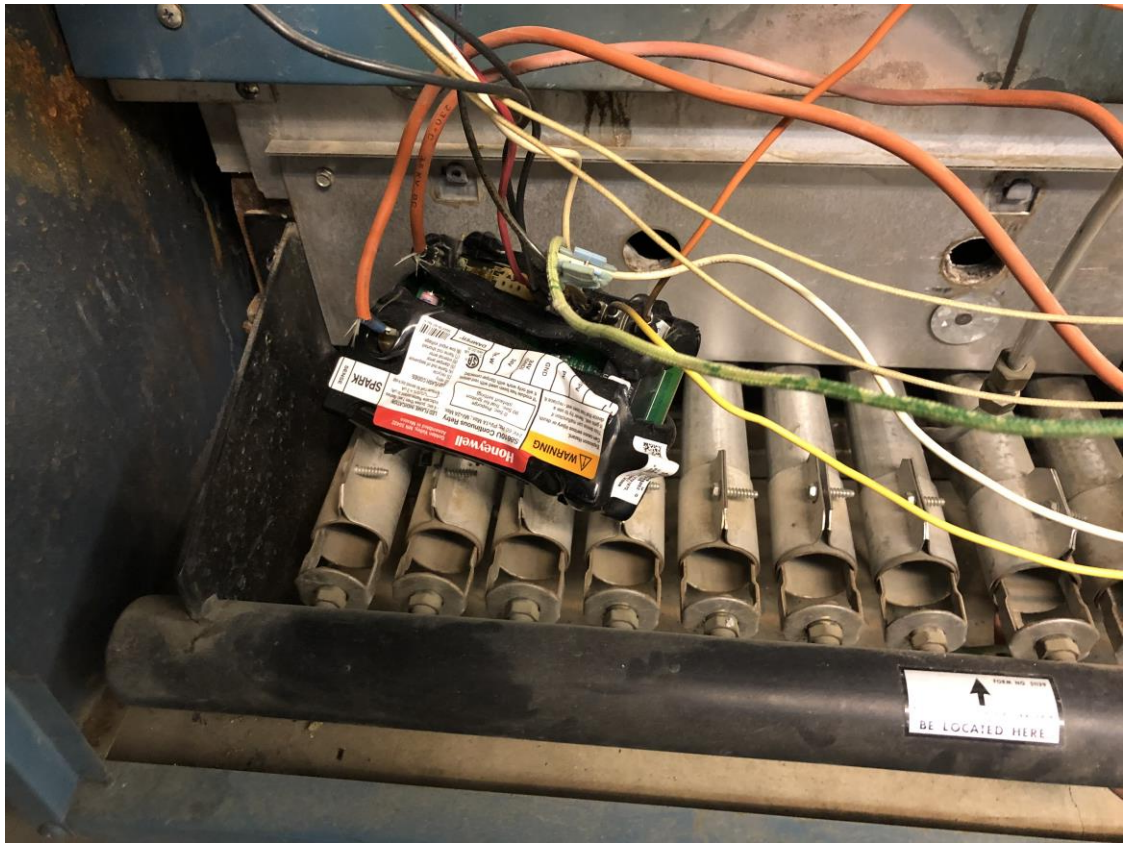
Feed trouble – cannot install bypass for regulator and not RPZ – not for commercial install

Isolated two controls from the boiler

Bypass just the feed water regulator, not the backflow preventer

RPZ over electric boiler?

Backside of cast iron boiler



Sparker troubles

SUMMARY

- Many items must be taken into consideration on every boiler installation.
- Use Manufacturer’s Installation Manual to help organize process and what you need.
- Call with any questions prior to starting an installation.

QUESTIONS?

Website:

https://deq.nd.gov

- Click on Office of the Director
- Click on Boiler Inspection Program

THANK YOU

North Dakota Boiler Inspection Program