

# BOILERS

## What Is A Boiler?

A boiler is defined as...“a closed vessel in which water or other liquid is heated, steam or vapor is generated, steam is superheated, or any combination thereof, under pressure or vacuum, for use external to itself, by the direct application of energy from the combustion of fuels, from electricity or nuclear energy.”

Also included are fired units for heating or vaporizing liquids other than water where these units are separate from processing systems and are complete within themselves. This definition includes; water heaters that exceed 200,000 Btu/hr heat input, or 200 degrees Fahrenheit at the outlet, or 120 gallons nominal water containing capacity.

## North Carolina Boiler Law

The North Carolina General Assembly first enacted a law instituting regulation of high-pressure boilers in 1935. Since then, coverage has expanded to include low-pressure boilers and pressure vessels. In 1975, the General Assembly enacted the Uniform Boiler and Pressure Vessel Act, codified as Chapter 95, Article 7A, of the General Statutes.

## What Are The Construction And Installation Requirements For My Boiler?

Boilers installed after 1935 must be constructed in accordance with the ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code:

- Section I is for the high-pressure boilers. Additionally, ASME B31.1 is the required code for power piping installation for high-pressure boilers.
- Section IV is for low-pressure steam and hot water heating (building heat), and hot water supply boilers.

## How Often Do I Have To Have My Boiler Inspected?

- High Pressure Boilers
  - Internal inspection annually
  - External inspection three to nine months after internal inspection
- Heating Boilers/Hot Water Supply Boilers/Commercial Water Heaters
  - External inspection every two years

## Who Can Legally Inspect My Boiler?

North Carolina law allows for three types of pressure vessel inspectors. They are:

- Boiler & Pressure Vessel Inspector – an employee of the North Carolina Department of Labor, Boiler Safety Bureau. Authorized to inspect any boiler or pressure vessel subject to the Uniform Boiler & Pressure Vessel Act.
- Special Inspector – an employee of an insurance company authorized to underwrite in this State boiler and machinery insurance. Authorized to inspect only what their company insures.
- Owner-User Inspector – an employee of a company operating boilers or pressure vessels, the company must have an inspection program that is under the supervision of one or more engineers having qualifications satisfactory to and approved by the Commissioner of Labor.

## All Inspectors Must:

- Have passed an examination set by the National Board of Boilers and Pressure Vessel inspectors
- Hold a certificate of competency issued by the National Board of Boiler and Pressure Vessel inspectors

- Hold a commission issued by the North Carolina Department of Labor.  
Note: Any person who knowingly and willfully misrepresents himself as an authorized inspector in North Carolina is guilty of a Class 2 misdemeanor. (GS 95-69.18)

### **Why Are Boiler Inspections Necessary?**

Boilers, storage tanks and other pressure equipment are potentially dangerous objects. While operating, they contain large amounts of energy, which when they fail, is released instantaneously, usually with devastating results. When water changes from liquid to steam it expands 1600 times its original volume. In other words, one cubic foot of water instantly converts to 1600 cubic feet of steam. A small boiler having a volume of 10 cubic feet and operating at a pressure of 100 psi (pounds per square inch) has an explosive equivalent of 2278 grams of TNT approximately equal to the anti-tank mine used during Desert Storm.

In order to ensure the continued safety of pressure equipment; it is inspected by qualified commissioned inspectors on a periodic basis. The purpose of the inspection is to ensure that such accidents do not happen. Since inspections are a snapshot in time and can only tell how safe the vessel is at the time of the inspection, there is an implied duty on the owner/operator of the vessel to keep it in safe and proper working order.

### **What Is An Inspection Certificate And Why Do I Need One?**

The inspection certificate is evidence that the Boiler has been inspected and is safe to operate under the pressure and temperatures noted on the certificate.

North Carolina law states that no boiler or pressure vessel may be operated without a current inspection certificate, operating without a current certificate is considered a Class 3 misdemeanor.

### **Boiler Owner Responsibilities**

Within the North Carolina Boiler Code are the owner's responsibilities for:

- Obtaining periodic boiler inspections provided by commissioned boiler inspectors either in the employ of the North Carolina Department of Labor or in the employ of the boiler insurance company. **Note:** The inspector is not responsible for scheduling inspections. It is the owner's responsibility to ensure that a current Certificate of Inspection is in force.
- Paying the required fees for the Certificate of Inspections.
- Posting the current and valid Certificate of Inspection under a transparent cover in the boiler room.
- Obtaining proper repairs and involving the commissioned inspector in all repairs.
- Notifying the Boiler Safety Bureau in the event of an accident.

### **What Do I Do About Repairs To My Boiler?**

The boiler rules state that a repair company must be authorized to perform repairs by the National Board of Boiler and Pressure Vessel Inspectors and hold an "R" stamp.

In all cases, the owner and the repair company must consult an inspector before the repair is attempted and the completed repair is subject to the inspector's acceptance.

### **What Do I Do In The Event Of An Accident?**

The rules state that the owner must notify the Boiler Safety Bureau by submitting a detailed report of the accident. In the event of personnel injury or any explosion, notice shall be given immediately by telephone, telegraph, or messenger, and neither the boiler, nor any parts shall be removed or disturbed

before permission has been given by the Chief Inspector, except for the purpose of saving human life and limiting consequential damage.

### **Is There A Fee For The Inspection?**

The Boiler Safety Bureau is fee funded and does not receive any money from the legislature. Therefore, the Bureau charges a fee for its services. The fee is dependent upon the complexity of work and the time spent inspecting the object it ranges between \$40 to \$400 per object inspected. The fees cover the inspection activity, the maintenance of a data storage system and the issuance of the inspection certificate.

### **How Do I Contact The Boiler Safety Bureau If I Have More Questions? Where Can I Get A Copy Of The Law And The Rules?**

The Boiler Safety Bureau is open from 8:00 a.m. until 5:00 p.m. Monday through Friday except for legal holidays. Copies of the law and the rules are available at a moderate fee. The Chief Inspector and Bureau staff are eager to help you maintain your compliance with the law and to be of service to you. Our telephone number is (919) 807-2760.

# PRESSURE VESSELS

## What Is A Pressure Vessel?

A pressure vessel is defined as...“a vessel in which the pressure is obtained from an indirect source or by the application of heat from an indirect source or a direct source, The vessel proper terminates at: (a) the first circumferential joint for welded end connections; (b) the face of the first flange in bolted flange connections; or (c) the first threaded joint in threaded connections.” Pressure vessels include but are not limited to compressed gas storage tanks (i.e., air, oxygen, nitrogen tanks, etc.), anhydrous ammonia tanks, hydro pneumatic tanks, autoclaves, hot water storage tanks, chemical reactors and refrigerant vessels, designed for a pressure greater than 15 psi and a volume greater than 5 cubic feet in volume or one and one-half cubic feet in volume with a pressure greater than 600 psi.

## North Carolina Pressure Vessel Law

The North Carolina General Assembly first enacted a law instituting regulation of high-pressure boilers in 1935. Since then, legislation has been adopted to include low-pressure boilers and pressure vessels. In 1975, the General Assembly enacted the Uniform Boiler and Pressure Vessel Act, codified as Chapter 95, Article 7A, of the General Statutes.

## What Are The Construction And Installation Requirements For My Pressure Vessel?

Hot water storage tanks installed after 1951 and all other pressure vessels installed after 1975, must be constructed to the applicable ASME Code requirements.

## How Often Do I Have To Have My Pressure Vessel Inspected?

Periodic inspection requirements are in the North Carolina Administrative Code, Title 13, Chapter 13, Paragraph .0211. They are:

- Hydro pneumatic tanks – external inspections every five years.\*
- All other pressure vessels – external inspections every two years.\*
- Internal inspections are conducted if considered necessary by the inspector of record.

## Who Can Legally Inspect My Pressure Vessel?

North Carolina law allows for three types of pressure vessel inspectors. They are:

- Boiler & Pressure Vessel Inspector – an employee of the North Carolina Department of Labor, Boiler Safety Bureau. Authorized to inspect any boiler or pressure vessel subject to the Uniform Boiler & Pressure Vessel Act.
- Special Inspector – an employee of an insurance company authorized to underwrite in this State boiler and machinery insurance. Authorized to inspect only what their company insures.
- Owner-User Inspector – an employee of a company operating boilers or pressure vessels, the company has an inspection program that is under the supervision of one or more engineers having qualifications satisfactory to and approved by the Commissioner of Labor.

## All inspectors must:

- Have passed an examination set by the National Board of Boilers and Pressure Vessel inspectors
  - Hold a certificate of competency issued by the National Board of Boiler and Pressure Vessel inspectors
  - Hold a commission issued by the North Carolina Department of Labor.
- Note:** Any person who knowingly and willfully misrepresents himself as an authorized inspector in North Carolina is guilty of a Class 2 misdemeanor. (GS 95-69.18)

## Why Are Pressure Vessel Inspections Necessary?

Pressure vessels usually fail in a catastrophic manner, releasing vast stores of energy and contents. The results are manifold:

- A shock wave of the vessel contents
- High-speed projectiles

Either result can have devastating consequences. Pressure vessels and storage tanks can fall into several different categories, each with its own risk. However, the end result is:

- Failure poses safety risk to personnel.
- Failure may jeopardize other critical components.
- Failure may result in the release of hazardous or toxic contents.
- Environmental pollution, or loss of production, may occur.

The potential dangers are major: For example, an 80-gallon air tank operating at 200 psi has the equivalence of 393 grams of TNT – enough force to destroy a average business and harm its employees. Inspections ensure that such accidents do not happen. Since inspections are a snapshot in time and can only determine how safe the vessel is at the time of the inspection, owners/operators must keep their pressure vessels properly maintained.

### **What is an inspection certificate and why do I need one?**

The inspection certificate is evidence that the Boiler has been inspected and is safe to operate under the pressure and temperatures noted on the certificate.

North Carolina law states that no boiler or pressure vessel may be operated without a current inspection certificate, operating without a current certificate is considered a Class 3 misdemeanor.

### **Pressure Vessel Owner Responsibilities**

Under the state's Boiler Code, the owner's responsibilities include:

- Obtaining periodic inspections provided by commissioned boiler inspectors with the North Carolina Department of Labor or with a boiler insurance company. Note: Inspectors are not responsible for scheduling inspections. Owners must ensure that a current Certificate of Inspection is in force.
- Paying the required fees for the Certificate of Inspections.
- Posting the current and valid Certificate of Inspection under a transparent cover in the boiler room.
- Obtaining proper repairs and involving the commissioned inspector in all repairs.
- Notifying the Boiler Safety Bureau in the event of an accident.

### **What Do I Do About Repairs To My Pressure Vessel?**

The boiler and pressure vessels rules state that a repair company must be authorized to perform repairs by the National Board of Boiler and Pressure Vessel Inspectors and hold an "R" stamp.

In all cases, the owner and the repair company must consult an inspector before the repair is attempted. The completed repair is subject to the inspector's acceptance.

### **Is there a fee for the inspection?**

The Boiler Safety Bureau is fee funded and does not receive any money from the legislature. Therefore, the Bureau charges a fee for its services. The fee is dependent upon the complexity of work and the time spent inspecting the object it ranges between \$30 to \$150 per object inspected. The fees cover the inspection activity, the maintenance of a data storage system and the issuance of the inspection certificate.

### **What Do I Do In The Event Of An Accident?**

A detailed report of the accident must be submitted to the Boiler Safety Bureau immediately (phone and fax number are provided in this pamphlet). In the event of personnel injury or any explosion, neither the vessel, nor any parts shall be removed or disturbed before permission has been given by the Chief Inspector, except for the purpose of saving human life and limiting consequential damage.

### **How Do I Contact The Boiler Safety Bureau If I Have More Questions? Where Can I Get A Copy Of The Law And The Rules?**

The Boiler Safety Bureau is open from 8:00 a.m. until 5:00 p.m. Monday through Friday except for legal holidays. Copies of the law and the rules are available at a moderate fee. The Chief Inspector and Bureau staff are eager to help you maintain your compliance with the law and to be of service to you. Our telephone number is (919) 807-2760.

# CO<sub>2</sub> TANKS

## CO<sub>2</sub> Tanks Are Pressure Vessels

A pressure vessel is defined as...“a vessel in which the pressure is obtained from an indirect source or by the application of heat from an indirect source or a direct source. The vessel proper terminates at: (a) the first circumferential joint for welded end connections; (b) the face of the first flange in bolted flange connections; or (c) the first threaded joint in threaded connections.”

The North Carolina Uniform Boiler & Pressure Vessel Act applies to all vessels designed for a pressure greater than 15 psi and a volume greater than 5 cubic feet in volume or one and one-half cubic feet in volume with a pressure greater than 600 psi.

## North Carolina Pressure Vessel Law

The North Carolina General Assembly first enacted a law regulating high-pressure boilers in 1935. Since then, legislation has low-pressure boilers and pressure vessels. In 1975, the legislature enacted the Uniform Boiler and Pressure Vessel Act, codified as Chapter 95, Article 7A, of the General Statutes. Although the law since 1976 technically included CO<sub>2</sub> tanks, the N.C. Department of Labor first began to consider inspections of these vessels because of their increasing role in public places.

## What Are the Construction and Installation Requirements for My CO<sub>2</sub> Tank?

CO<sub>2</sub> tanks must be constructed to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, “Pressure Vessels,” requirements. Tanks should be installed in areas away from direct heat, such as boilers or furnaces.

## How often Do I Have to Have My CO<sub>2</sub> Tank Inspected?

External inspections of your CO<sub>2</sub> tank are required every two years.

## Who Can Legally Inspect My CO<sub>2</sub> Tank?

North Carolina law allows for three types of pressure vessel inspectors. They are:

- Boiler & Pressure Vessel Inspector – an employee of the North Carolina Department of Labor, Boiler Safety Bureau. Authorized to inspect any boiler or pressure vessel subject to the Uniform Boiler & Pressure Vessel Act.
- Special Inspector – an employee of an insurance company authorized to underwrite in this State boiler and machinery insurance. Authorized to inspect only what their company insures.
- Owner-User Inspector – an employee of a company operating boilers or pressure vessels, the company has an inspection program that is under the supervision of one or more engineers having qualifications satisfactory to and approved by the Commissioner of Labor.

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North Carolina law states that no boiler or pressure vessel may be operated without a current inspection certificate, operating without a current certificate is considered a Class 3 misdemeanor.

### **Why Are CO<sub>2</sub> Tank Inspections Necessary?**

Pressure vessels usually fail in a catastrophic manner, releasing vast stores of energy and contents. The results are manifold:

- a shock wave of the vessel contents
- high speed projectiles
- oxygen depletion in the immediate surroundings

Consequences can be devastating. For instance, a 400-lb. CO<sub>2</sub> tank operating at 300 psi has the destructive force 30 sticks of dynamite—enough force to destroy an average business and harm its employees. Inspections ensure that these accidents are prevented. Since inspections are a snapshot in time and can only tell how safe the vessel is at the time of the inspection, business owners/operators must keep their pressure vessels properly maintained. An operator safety checklist is available from the Department of Labor, free of charge.

### **CO<sub>2</sub> Tank Owner Responsibilities**

Under state law, the owner's responsibilities include:

- Obtaining periodic inspections provided by commissioned boiler and pressure vessel inspectors either with the North Carolina Department of Labor or with a boiler insurance company. **Note:** Inspectors are not responsible for scheduling inspections. Owners must ensure that a current Certificate of Inspection is in force.
- Paying the required fees for the Certificate of Inspections.
- Posting the current and valid Certificate of Inspection under a transparent cover in the boiler room.
- Obtaining proper repairs and involving the commissioned inspector in all repairs.
- Notifying the Boiler Safety Bureau in the event of an accident.

### **What Do I Do about Repairs to My CO<sub>2</sub> Tank?**

The boiler and pressure vessel rules state that a repair company must be authorized by the National Board of Boiler and Pressure Vessel Inspectors and hold an "R" stamp to perform repairs. In all cases, the owner and repair company must consult an inspector before the repair is attempted. The inspector also must approve the completed repairs.

### **Is there a fee for the inspection?**

The Boiler Safety Bureau is fee funded and does not receive any money from the legislature. Therefore, the Bureau charges a fee for its services. The fee is dependent upon the complexity of work and the time spent inspecting the object it ranges between \$30 to \$150 per object inspected. The fees cover the inspection activity, the maintenance of a data storage system and the issuance of the inspection certificate.

### **What Do I Do in the Event of An Accident?**

A detailed report of the accident must be submitted to the Boiler Safety Bureau immediately (phone and fax numbers are provided in this pamphlet). In the event of personnel injury or any explosion, neither the vessel, nor any parts shall be removed or disturbed before permission has been given by the Chief Inspector, except for the purpose of saving human life and limiting consequential damage.

### **How Do I Contact the Boiler Safety Bureau if I Have More Questions? Where Can I Get A Copy of the Law and the Rules?**

The Boiler Safety Bureau is open from 8 a.m. until 5 p.m., Monday through Friday, except for legal holidays. Copies of the law and the rules are available for a small fee. The Chief Inspector and bureau staff are eager to help you maintain your compliance with the law and to be of service to you. Our telephone number is (919) 807-2760.

# GETTING YOUR HOTWATER HEATING BOILER READY FOR THE HEATING SEASON

The heating season is fast approaching and now is the time to consider the steps necessary to bring your boiler back on line after the summer lay-up. The following serves as a reminder of the most fundamental requirements you should follow when placing your boiler back into service.

Read Your Operating Manual and Follow It. All boilers are supplied with operating manuals by the manufacturer. There is a wealth of information, experience and hints contained in most manuals. Ensure that you have a copy, read, understand and follow it.

Verify that your Boiler Room is Clean. Make sure that there is NO debris or excessive dust or dirt and that NO flammable fluids are stored in the boiler room.

Verify that your Boiler Gets Adequate Combustion Air. Ensure all dampers are clean, free from debris and are open. Adequate draft is necessary to regulate the flow of air to and from the burner.

Verify that your Boiler Exhaust System is Open and Clear to discharge combustion gases out of the furnace into the atmosphere. Ensure that there are no leaks of combustion gases back into the boiler room. Any leak must be repaired before operation of your boiler.

Verify that the boiler furnace is free of debris and other material.

Open the Boiler Vent Valve or top try cock to vent air and fill the boiler with treated water to its proper level. Check that the expansion tank is properly filled.

Test ALL Drains and Blow-offs to ensure they function properly.

Check the Fuel System thoroughly for leaks and ensure that all fuel filters and strainers have been replaced. Check availability of fuel.

Ensure the flame scanner or sensors are properly connected and functioning.

Check that ALL Fuel Valves function as required.

Ensure that all shut-off valves are leak tight. Perform leak tightness test if unsure. (Specifically important for gas valves)

Ensure that all valves in instrument lines function as required.

Verify that vent valve on gas fired boilers is operating as required and that the vent is not clogged.

Ensure that the boiler is purged **before** ignition of the Burner. **NOTE:** Proper purging to clear the boiler of any fuel residues is of utmost importance to prevent furnace explosions.

Check all instruments and safety devices for proper setting. Ensure that the water pressure regulator functions as required.

Ensure the re-circulation pump works as required.

Start the burner and keep it on low fire to warm the boiler slowly.

Test the proper functioning of all boiler controls, i.e.:

- Pressure Gauge

- Low Water Cut Off Devices, including its Manual Reset Button
- Thermometers
- Temperature Controls, including its Manual Reset Button
- Gauge Glass
- Over Pressure Relief Valve

Check that all heating system isolation valves are in functioning properly.

**And Don't Forget:**

During temperature and pressure build up frequently walk around the boiler checking for leaks, proper combustion and functioning. Keep equipment maintenance records and use boiler room log sheets to record boiler operation.

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## BOILER SAFETY CHECKLIST

### Ensure:

- That a current Inspection Certificate is available. This certificate permits the safe operation of the boiler. If your certificate is expired or unavailable call your insurer or the Boiler Safety Bureau immediately.
- That there are no leaks from any part of boiler or piping external to the boiler. Cracked surface must be repaired immediately by a qualified repair organization. Bulges or other deformities indicate defective controls, safety devices or improper burner operation. Call the Boiler Safety Bureau at (919) 807-2760.
- That there are no signs of overheating, corrosion or erosion. Check the operation of the chemical feed pots and pumps. Have defective equipment repaired. Remove all scale and mud from the boiler.
- That the condition of the flame is correct and not smoky. The flame must not impinge on the furnace walls.
- That all gauges and meters are operational. Repair or replace all defective gauges and meters.
- That safety valves are installed in the vertical position and are operating properly. Test safety valves periodically. Replace leaking safety valves.
- That low water fuel cutoff control shuts off the fuel supply to the boiler as required. Inspect low water fuel cutoff control for proper sequence and operation.
- That there are no fuel gas leaks. Check draft, manifold pressure and combustion. Adjust manifold pressure in accordance with the manufacturer's specification. Check the O<sub>2</sub>, CO<sub>2</sub>, CO, and C<sub>0</sub> levels. There should not be any CO<sub>2</sub>.
- That no trash or other combustible material is stored in or near the boiler room.
- That every time the boiler has been purged with air before you start the burners.

### Don't:

- Operate the boiler if it seems unsafe to do so.
- Tamper with any controls, render them inoperative, or bypass them.
- Carry out or have carried out any unauthorized repair(s) on the boiler.
- Inject cold water into a hot operating boiler or pressure piping external to the boiler.

### Do:

- Contact the North Carolina Boiler Safety Bureau if you need help (919) 807-2774.