QUALITY AND ECONOMY IN

BUILDING SERVICES PIPING CONSTRUCTION

A Guide for Owners, Architects and Engineers

ANSI/ASME B31.9
BUILDING SERVICES
PIPING CODE

RECOMMENDED BY:
NATIONAL CERTIFIED PIPE WEDLING BUREAU
1385 Piccard Drive, Rockville, MD 20850-4340
(301) 869-5800
www.ncpwb.org

WHY ASME B31.9?

For years there existed no clear-cut standards that covered heating, air conditioning and other piping systems in industrial, institutional, commercial and public buildings, or multi-unit residences. As a result, engineers, contractors and owners had to improvise, and many times they arbitrarily selected standards or applied inappropriate Codes when designing or specifying the installation or examination of such piping. This resulted in overdesign, underdesign, extra costs and confusion. To solve this problem, ASME formed a committee composed of architects, engineers, contractors, manufacturers, government officials, consumers and others to develop a new national standard specifically for building services piping. Working under the guidelines of the American National Standards Institute, a new code, ASME B31.9, *Building Services Piping*, evolved and was published in 1982. This code joined other well-known ASME B31 *Code for Pressure Piping* sections such as B31.1, *Power Piping* and B31.3, *Process Piping*. B31.9 has been revised and updated several times since then, most recently in 2008.

WHAT 1S COVERED UNDER B31.9?

The B31.9 code prescribes minimum requirements for the piping systems containing water for heating and cooling, steam and steam condensate, air, combustible liquids and other nontoxic, nonflammable fluids in industrial, institutional, commercial and public buildings, or multi-unit residences. These requirements cover:

- Design
- Materials
- Fabrication
- Installation
- Inspection
- Examination
- Testing

This code applies to piping containing piping not exceeding the following:

- Dimensional limits
  - Carbon steel: NPS 42 (DN 1050) and 0.500 inches (12.7 mm) wall
  - Stainless steel: NPS 24 (DN 600) and 0.500 inches (12.7 mm) wall
  - Aluminum: NPS 12 (DN 300)
  - Brass and copper NPS 12 (DN 300), 12.125 in (308 mm) for copper tube.
  - Thermoplastics: NPS 24 (DN 600)
  - Ductile Iron: NPS 24 (DN 600)
  - Reinforced Thermosetting Resin: NPS 24 (DN 600)

- Pressure and temperature limits
  - Compressed air, steam and steam condensate to 1035 kPa (150 psi) gage
  - Steam and steam condensate from ambient to 186ºC (366ºF)
  - Other gases from ambient to -18 to 93ºC (0 to 200ºF)
  - Liquids to 2415 kPa (350 psi) gage and from -18 to 121ºC (0 to 250ºF)
  - Vacuum to 1 Bar (14.7 psi).

- Piping connected directly to a steam boiler or hot water heating unit before the first valve (i.e., Boiler External Piping) exceeding 103 kPa (15 psi) gage steam or water heating units exceeding 1103 kPa (160 psi) gage and 121°C (250°F).

The code does not apply to certain types of piping already covered by local codes and other ASME standards. For example, B31.9 does not cover:

- Refrigeration Piping
- Potable water piping
- Sanitary and storm drainage systems
- Fire protection
- Other fuel piping

THE ROLE OF DEVELOPERS, OWNERS, ARCHITECTS AND ENGINEERS

B31.9 benefits everyone concerned with building services piping, from developers and owners to engineers and architects to contractors and the general public. But to receive these benefits, B31.9 must be incorporated into the work from the very beginning of the project and requirements to follow it must be included in all appropriate specifications.

This is simple to do. If you are a building developer or owner, require your engineer or architect to design and analyze your building services piping in accordance with B31.9 by including it in your bid documents. If you are the engineer or architect, specify that installation of the piping be in accordance with B31.9 and your engineering drawings and specifications. That's all it takes to ensure that your next project has building services piping that has been designed and installed to be safe and as cost-effectively as possible without being underdesigned or overdesigned.

WHAT ABOUT WELDING?

Under B31.9, each employer is responsible for all welding done by his employees; accordingly, B31.9 requires that the contractor provide his welders with a "welding procedure specification (WPS)," which is a "recipe" for making a weld. The WPS describes the base metals that may be welded, the welding process, the electrode or filler metal, the groove design to be used, the preheat temperature and postweld heat treatment that is required and other welding conditions.

Contractors must qualify the welding procedures they intend to use by welding and testing test pieces following each WPS that their welders will follow. Contractors must also qualify the welders that they employ by having them demonstrate that they can produce sound welds following the Contractor's WPSs.

B31.9 specifies that qualification of WPSs and welders be done in accordance with the ASME Boiler and Pressure Vessel Code, Section IX, *Welding and Brazing Qualifications*. Because of these and other requirements in B31.9, construction engineers and building owners can be confident that building services piping is fabricated and installed in a proper and safe manner by knowledgeable contractors using qualified workers.

WHAT IS THE "INTERCHANGE" OF WELDERS?

B31.9 permits "interchange" of welders among contractors after they have been properly qualified by one contractor provided the welder's new employer accepts responsibility for qualification performed by the other contractor. By interchanging qualified welders, contractors do not have to repeat the time-consuming testing of workers. In some areas of the country, it costs $2,000 to qualify a welder. This welder interchange provision results in large savings for building developers and owners, with no reduction in quality or safety when that interchange is conducted under the auspices of the National Certified Pipe Welding Bureau.

THE NATIONAL CERTIFIED PIPE WELDING BUREAU AND B31.9

For many years, the National Certified Pipe Welding Bureau (NCPWB) has promoted the highest quality and most cost effective pipe welding methods. The Bureau has also developed welding procedures that are "best practices" among member contractors, and the NCPWB coordinates and facilitates the interchange of qualified welders between its member contractors. By belonging to the NCPWB, contractors can draw on the pool of welders qualified by Bureau members all over the United States.

Since it began work in 1945, the NCPWB has developed more than 100 WPSs which conform with ASME Section IX. These

procedures cover all types of welding, including shielded metal arc welding, gas tungsten arc welding, gas metal arc, flux core and torch brazing on materials ranging from mild steel to high-performance stainless steel and nickel alloys to titanium.

NCPWB local chapters together with the United Association, assist in the promotion of quality welding by conducting the tests for welders and by maintaining records of welders certified for interchange. Further, since all welders follow the same WPSs regardless of the NCPWB contractor for whom they work, both the contractor and the Owner/Engineer can be sure that the welders are

INCORPORATION OF B31.9 INTO CONTRACT DOCUMENTS

The NCPWB recommends that the building developer/owner include the following in his contract documents:

1. Design and materials for all hot and chilled water, steam and steam condensate, compressed air and vacuum piping shall be in accordance with ASME B31.9, *Building Services Piping*, current edition.

2. The engineer shall perform stress analysis and prepare installation drawings which shall include the pipe materials, sizes and schedules, layout and elevation, location of supports and anchors, equipment connections, painting and insulation requirements. Where responsibility for any of these aspects of engineering is delegated to the Contractor, those aspects shall be clearly identified in the engineer's specification. Where the engineer determines that additional examinations beyond the requirements of B31.9 are appropriate, those examinations shall be included in the architect or engineer's specifications.

The NCPWB recommends that the architect or engineer include the following in his specifications:

1. All hot and chilled water, steam and steam condensate, compressed air and vacuum piping shall be installed, examined, inspected and tested in accordance with the requirements of ASME 31.9, *Building Services Piping*, current edition, and the requirements of this specification and the engineering drawings.

2. Before any welding is performed, the contractor shall submit to the owner or his authorized representative copies of any welding procedure specifications and their supporting procedure qualification records for review and acceptance. Copies of welder qualification records shall be made available for review to the owner or his representative at the construction site.

3. Where the engineer determines that additional examinations beyond the requirements of B31.9 are necessary, those examinations will be shown on the drawings. The degree of examination, examination method and acceptance criteria will be specified and accepted by the contractor prior to the start of work.