

## Differences in the Piping Requirements between ASME Codes B31.3-2010 and B31.9-2011.

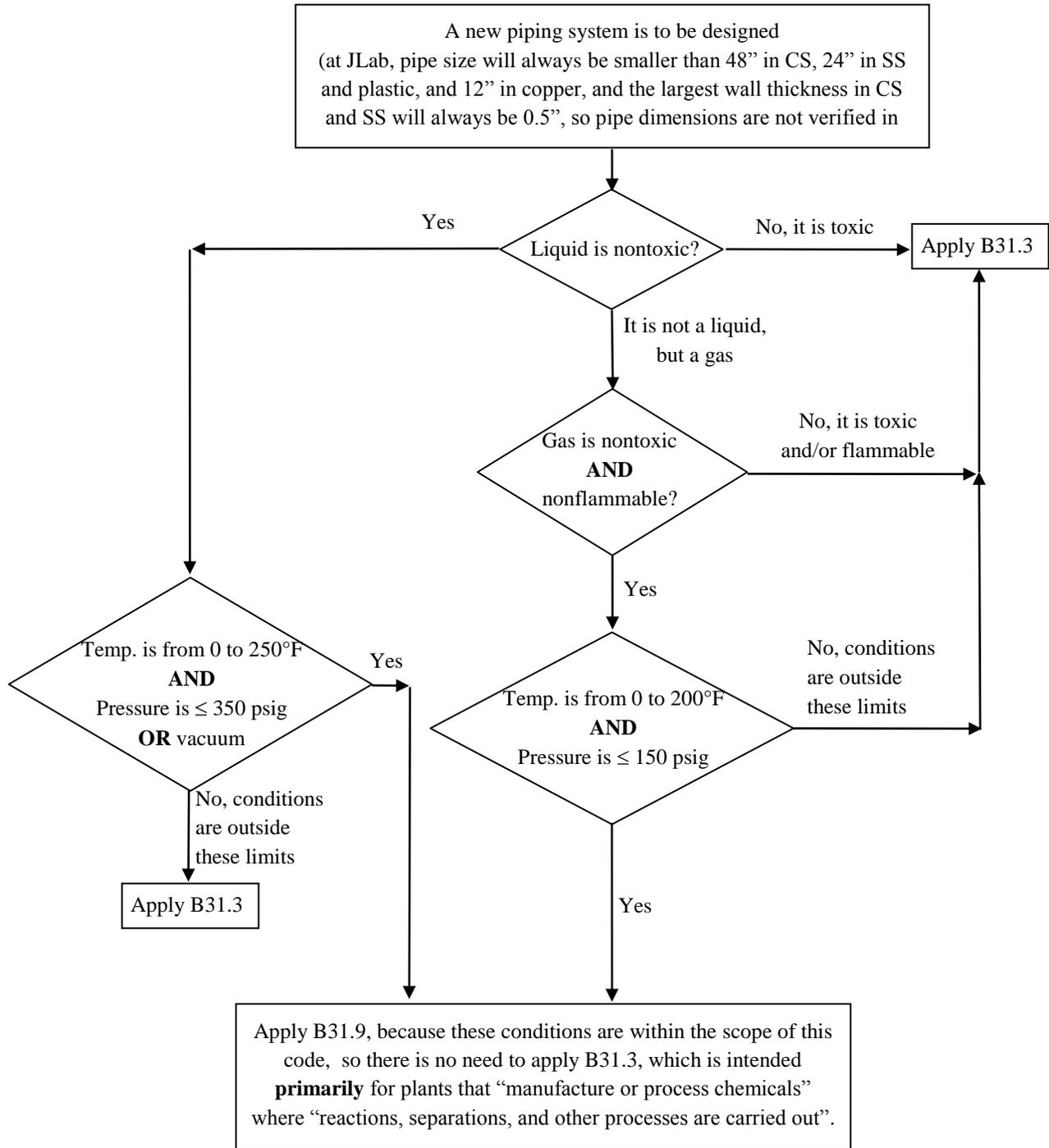
This comparison applies only to Category D piping of B31.3, which is the least severe and strict of this code, because usually this would be the applicable Category for JLab (fluids of this group are nonflammable, nontoxic, not able to cause damage to human tissue, with design pressure not exceeding 150 psig, and temperature between -20 and 366°F). If the system does not meet all these criteria, such as the most probable situation here, which would be a design pressure above 150 psig, then the applicable fluid service category at JLab would usually be “Normal” (the other service options are: “Elevated Temperature”, “High Pressure”, “High Purity”, or Category M for highly toxic fluids), and this classification would require the implementation of techniques and measures that are not usually used at JLab, for example, radiographic examination of a minimum of 5% of the welds to detect internal porosities and inclusions. However, for liquids at design pressures between 150 and 350 psig, this requirement is avoided if the system is designed under B31.9.

Regarding design requirements, the methods, formulas, and criteria, indicated in these two codes, are essentially the same. This means that following B31.9 does not imply automatically that a simplified analysis is allowed, and applying B31.3 does not lead automatically to a mandatory exact analysis: the right analysis method for a piping system, under either of these codes, is to be selected on a case-by-case basis, considering its temperature, pressure, pipe size, and the requirements of the pieces of equipment to which this pipe will be connected to. Of course, the design chapter of B31.3 is double the length of that one of B31.9, but this is because B31.3 covers the whole range of services and materials, while B31.9 is very limited but it refers, in ten different places, to design sections of the stricter B31.1 “Standard for Power Piping”. Allowable stresses according to B31.9 are generally lower than those indicated in B31.3 so, regarding pressure design, the pipe wall calculated with B31.9 is slightly thicker than what is determined using B31.3, but these calculated values are usually so much smaller than commercially available pipe thicknesses, that this difference does not have any practical impact.

B31.3 leaves to the engineer the decision of the right method of analysis. This freedom is indicated on page 38, subsection 319.4.2, titled “Formal Analysis Requirements”: its paragraph (a) reads “a piping system...shall be analyzed by a simplified, approximate, or comprehensive method of analysis, as appropriate”, leaving the definition of what is “appropriate” intentionally vague: its paragraph (b) indicates that “a simplified or approximate method may be applied only if used within the range of configurations for which its adequacy has been demonstrated”, but the requirements and conditions of this “adequacy demonstration” are not given, not even implicitly. Furthermore, as indicated in paragraph (c) “acceptable comprehensive methods of analysis include analytical and chart methods”, so they are not limited only to computerized stress analysis using FEA software. This is confirmed on page 41, subsection 320.1, which reads “sustained loads may be evaluated by detailed analysis, approximate methods, or simplified means such as span tables”. One important application of the engineer’s authority is defined on page 42, subsection 321.1.2, that also exemplifies the wide range of design approaches from which he/she can select from: “In general, the location and design of pipe supporting elements may be based on simple calculations and engineering judgment. However, when a more refined analysis is required, and a piping analysis is made...”.

The only differences between B31.9 and Class D of B31.3 that have been found, are respect to examination and testing. The Acceptance Criteria for welding imperfections of B31.9 (page 43, subsection 936.6.1), are less severe than those of B31.3, (pages 74 to 76), regarding lack of fusion, incomplete penetration, and height of reinforcement. However, the requirement for an acceptable welding with undercutting in B31.9, is stricter than that of B31.3. Both codes allow an Initial Service Leak Test instead of a Hydrostatic Test, but B31.9 is stricter, because it allows this substitution only if the system meets the pressure and temperature limitations indicated on page 45, while B31.3 has no specific limitations and leaves this decision to the owner (page 81, parag. 345.1(a) and page 84, subsection 345.7).

FLOWCHART FOR DETERMINATION OF THE APPLICABLE PIPING CODE (B31.3 vs. B31.9)



Note: These conditions are indicated in B31.9, pages 1 and 3, paragraph 900.1.2.