

Study Purpose

Evaluate ASME BPVC 1992 vs. 2015 editions for equivalent level of safety

- Equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety
- Technical documentation



ORNL Study Compared 1992 vs. 2015 ASME BPVC Sections

- Quantitative and qualitative comparative analysis of rules
- Baseline for safety comparison is 1992 ed.
- Concentrates on construction codes, Section I, Power Boilers and Section VIII, Div. 1- Pressure Vessels, and Section VIII, Div. 2, Alternatives Rules for Pressure Vessels



ASME BPVC Section I – Power Boiler

A boiler is used to heat water in order to produce steam.



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U.S. Department of Transportation
Pipeline and Hazardous Materials
Safety Administration

To Protect People and the Environment From the Risks of
Hazardous Materials Transportation



ASME BPVC Section VIII Div. 1 & 2 Pressure Vessels

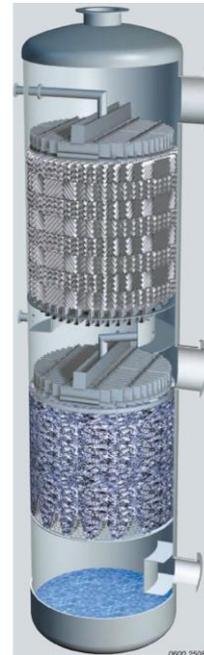
A container designed to hold gases or liquids at a pressure substantially different from atmospheric pressure



Containers



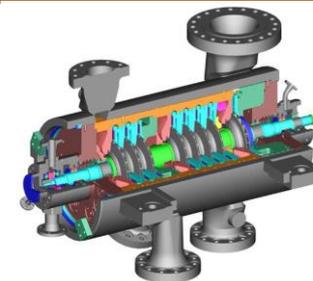
Fractionation
Column



Adsorber



Heat Exchanger



Compressor



Report's Primary Focus

Equivalency Evaluation

- ✓ Materials
- ✓ Design (including Strength Theories, Limit Design Theory, Design Margins, Failure Modes)
- ✓ Fabrication
- ✓ Inspection and Examination
- ✓ Pressure Testing
- ✓ Overpressure Protection



What Changed?

Hydrostatic Pressure Test Limits

Section I - Negligible change

- 1.5 MAWP to 1.59 MAWP & $P_m \leq 0.90 S_y$ (1992)
- 1.5 MAWP & $P_m \leq 0.90 S_y$ (2015)

Section VIII, Division 1

- 1.5 MAWP (1992)
- 1.3 MAWP (2015)

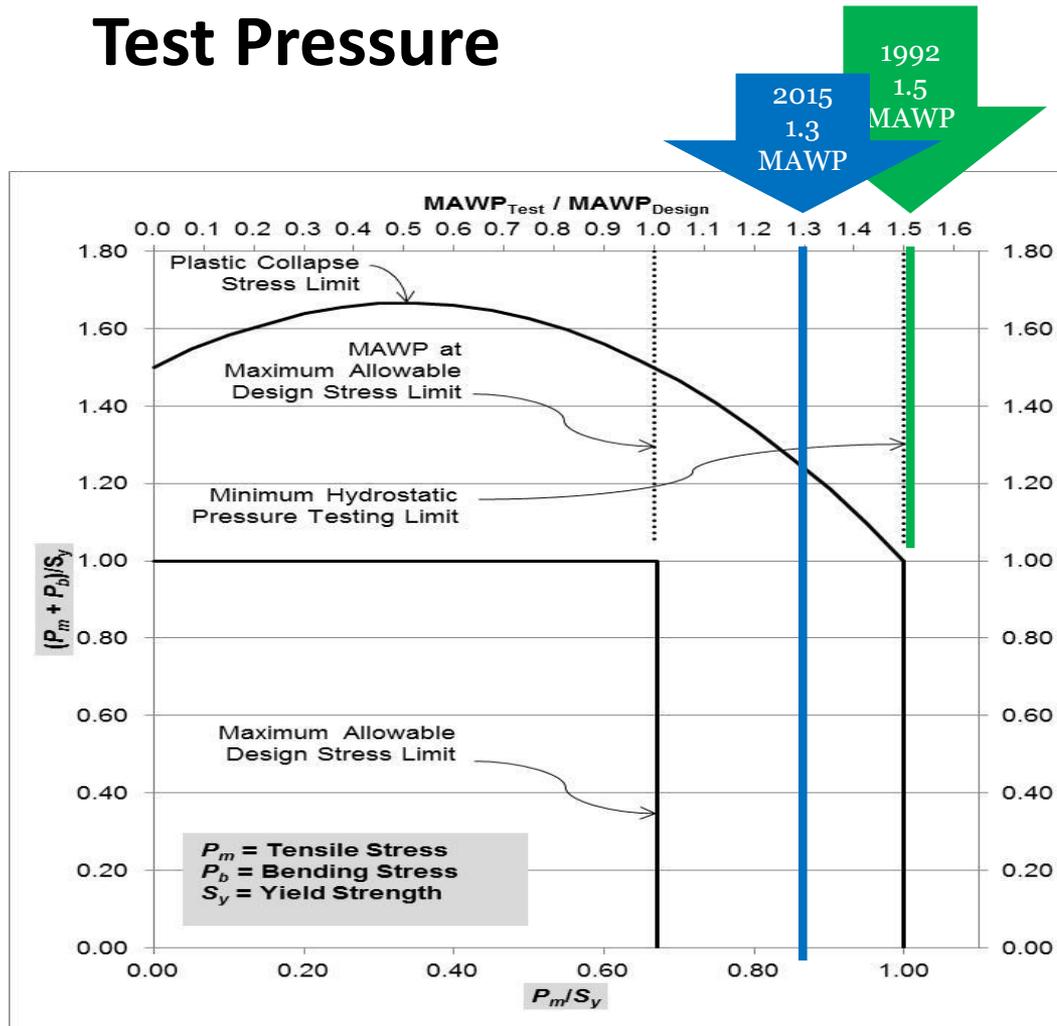
Section VIII, Division 2

- 1.25 MAWP & $P_m \leq 0.90 S_y$ (1992)
- Greater of 1.43 MAWP or 1.25 MAWP (S_T/S) & $P_m \leq 0.95 S_y$ (2015)

7 Where P_m = maximum general membrane stress limits



Section VIII, Division 1 – 1992 to 2015 Hydrostatic Test Pressure



Note: Section I test pressure factors remain substantially unchanged.



What Changed?

Pneumatic Pressure Test Limits

Section I - Not permitted

Section VIII, Division 1

- 1.25 MAWP to 1.1 MAWP

Section VIII, Division 2 - Negligible change

- 1.15 MAWP & $P_m \leq 0.80 S_y$ (1992)
- 1.15 MAWP (S_T/S) & $P_m \leq 0.80 S_y$ (2015)

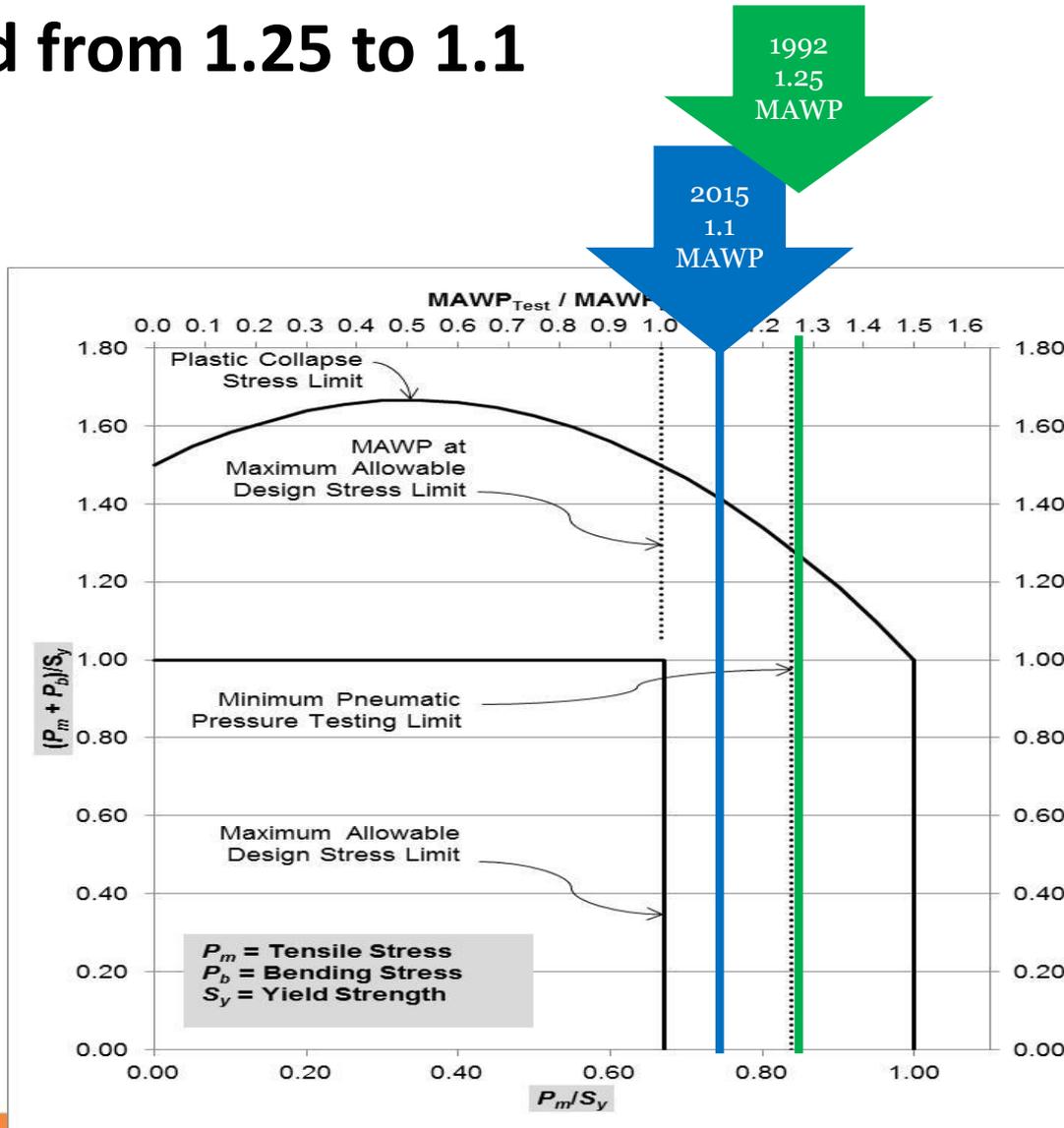
Where P_m = maximum general membrane stress limits

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Section VIII, Division 1 – 1992 vs 2015 Pneumatic Test

– Reduced from 1.25 to 1.1



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Overpressure Protection by Pressure Relief Device

Section VIII, Division 1 and Division 2 - 1992 and 2015 editions

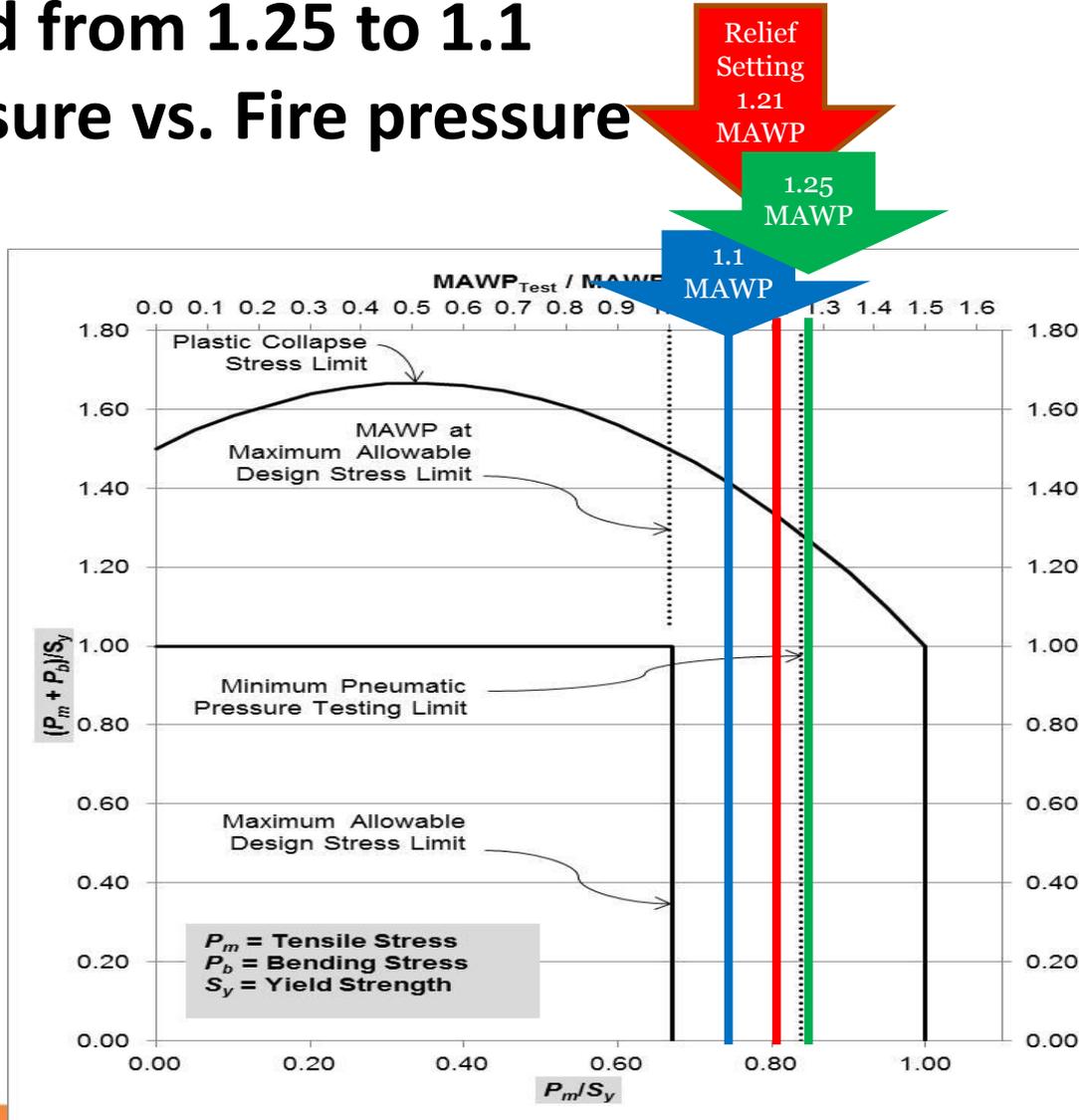
- Overpressure protection rules state that when a pressure vessel can be exposed to fire or other unexpected sources of external heat, the pressure relief device(s) must be capable of preventing the pressure from rising more than 21% above the MAWP. (i.e., **1.21 MAWP**).



Section VIII, Division 1 – 1992 vs 2015 Pneumatic Test

– Reduced from 1.25 to 1.1

Overpressure vs. Fire pressure



Pressure in vessel can exceed test pressure under from unexpected external sources of heat !

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ORNL Study Conclusions

- Design and construction of boilers and pressure vessels in accordance with rules of the ASME BPVC-1992 is not possible.
- ASME BPVC 2015 edition Section I and Section VIII, Div. 1 & Div. 2 provides *equivalency in safety to the corresponding rules and requirements specified the 1992 edition and provides the technical documentation needed to demonstrate equivalency under NFPA 59A.*
 - **With the following observations...**

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Report Observations (From ORNL)

- Applicable to Section VIII, Division 1 and 2 pressure vessels, an additional regulatory requirement to subject pressure vessels that are pneumatically tested to a pressure equal to or greater than the overpressure protection limit of 1.21 MAWP would provide a means for ensuring that the pressure vessel will never experience a maximum overpressure while in service that is greater than the pneumatic test pressure.
- Post-construction activities are considered beyond the scope of the ASME BPVC.
- The IBR of API 579-1/ASME FFS-1, the NBIC, and API 510 would provide a means for ensuring an acceptable level of safety in evaluating the structural integrity of vessels while in service.

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Thank You Questions?

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