

AS/NZS 4564 Part 3

$$MAOP \leq \frac{2 \cdot MRS \cdot t_{\min}}{C \cdot (OD_{\min} - t_{\min})}$$

Define: $DR = \frac{OD}{t} \Rightarrow OD = DR \cdot t$

Substitute: $\left(\frac{t_{\min}}{OD_{\min} - t_{\min}} \right) = \frac{t_{\min}}{DR_{\min} \cdot t_{\min} - t_{\min}} = \frac{1}{DR_{\min} - 1}$

$$C = f_0 \cdot f_1 \cdot f_2 \cdot f_3$$

$$f_0 = 2.0 \text{ for natural gas}$$

$$f_1 = 1.3 \text{ for temperatures } 30C \leq x \leq 40C$$

$$f_2 = 1.1 \text{ for other than open trench with padding}$$

$$f_3 = 0.9 \text{ for open field}$$

$$C = 2.574 \Rightarrow \frac{1}{C} = 0.389$$



$$MAOP \leq \frac{2 * MRS \cdot \frac{1}{C}}{(DR_{\min} - 1)}$$

ISO Equation

The equation that is included in the ISO standards comes from ASTM D1598-97.

$$MAWP = \frac{2 \cdot HDB \cdot DF \cdot f_1 \cdot f_2 \cdot f_3}{DR - 1}$$

Where:

HDB = 1600psig \Rightarrow Hydraulic Design basis

DF = 0.32 \Rightarrow Design Factor (0.5 for water, 0.32 for gas)

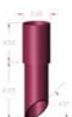
$f_1 = 1.0 \Rightarrow$ Operational life factor (50 yrs = 1.0, 2 years = 1.35)

$f_2 = 0.78 \Rightarrow$ Temperature Factor (73F=1.0, 100F=0.78, 140F=0.5)

$f_3 = 0.5 \Rightarrow$ Enviro Service Factor (1.0 for water, 0.5 for crude and gas)

$$C = DF \cdot f_1 \cdot f_2 \cdot f_3 = 0.1248$$

$$MAWP = \frac{2 \cdot 1600 \cdot 0.1248}{13.6 - 1} = 32 \text{ psig}$$



AS/NZS 4564 vs ISO

	AS/NZS 4564-3	ISO
Restated equation	$MAOP \leq \frac{2 \cdot MRS \cdot \frac{1}{C}}{DR_{min} - 1}$	$MAWP = \frac{2 \cdot HDB \cdot C}{DR - 1}$
Long term pressure	MRS=8 MPag=1160 psig	HDB=1600 psig=11MPa
DR for DN 110 SDR 13.6	15.5	13.6
DR for DN 630 SDR 13.6	13.4	13.6
Derate factors	1/C=0.389	C=0.1248
MAWP for DN 110 SDR 13.6 at 40C	429 kPa = 62 psig	32 psig
MAWP for DN 630 SDR 13.6 at 40C	464 kPa = 67 psig	32 psig

Primary differences in calculation:

- ISO explicitly reduces HDB to 32%, AS implicitly reduces it to 72%
- ISO uses nominal pipe dimensions, AS uses minimum allowable dimensions

The "PN10" designation is for water at 20C and is not used in any calculations in 4564



Observations

- AS/NZS 4130 explicitly (Section 1.1) limits temperature on any thermoplastic pipe to -20C to +35C, but it doesn't have a list of exclusions so it is hard to be sure if it applies
- AS/NZS 4645-3
 - Has a "Exclusions" section that does not mention gas gathering system (therefore it can be assumed to apply)
 - Table 2.2 sets a maximum under any circumstances pressure of 700 kPa and a maximum ever temperature of 40C for HDPE
 - Calculations in this standard are similar to calculations in ASME, ISO, and plastics-industry documentation and while they do extend the operating range somewhat beyond ISO limitations it is not very far beyond
- Queensland-specific and/or APIA-specific standards or guidelines would be expected to increase the restrictions from country-wide standards, I've never seen a state or industry code that was more liberal than the federal code

