

**National Transportation Safety Board
Internal Inspection Factual
Bellingham, Washington
Accident DCA99-MP008**

Appendix 8 Olympic corrosion defect formula calculations

Cherry Point, Ferndale, Anacortes, Allen to Renton 16.00" O.D., .312" W.T.							Length	
Nominal O.D.	Nominal W.T.	Metal % Loss	Defect Length	Inches Mtl. Loss	Inches D. Length	B =	L =	Maximum Metal % Loss
16.000	0.312	11.20	10.10	0.0349	10.10	4.0000	10.0096	11.20
		20.00	6.60	0.0624	6.60	2.6764	6.6975	20.00
		30.00	3.30	0.0936	3.30	1.3333	3.3365	30.00
		40.00	2.30	0.1248	2.30	0.9500	2.3773	40.00
		50.00	1.80	0.1560	1.80	0.7500	1.8768	50.00
		60.00	1.50	0.1872	1.50	0.6197	1.5508	60.00
ASME B31.4 - 1992 Edition 451.6.2 Disposition of Defects, pages 59-60								
Calculations to find the maximum length of a defect for various metal loss.								
$B = \sqrt{\frac{c}{T_n} \left(\frac{1.1 \cdot c}{T_n} - 0.15 \right)^2 - 1}$ if > 4 , then 4, if < 4 , then calc.								
D = O. D.						To User	Enter	Field area
c = Amount of wall thickness loss in inches							O.D.	A4
Tn = Nominal wall thickness							W.T.	B4
$L = 1.12 \cdot B \cdot \sqrt{D \cdot T_n}$							Mtl Loss%	C4..C9
L = Maximum Length							Dfct Lngth	D4..D9
							MAOP	B41
								Example
ASME B31.4 - 1992 Edition							Data	A27&A28
451.7 Derating a Pipeline to a lower Operating Pressure, page 62								
Pressure Rating of the defect area								
$P_d = 1.1 \cdot P_i \left(\frac{1 - 0.67 \cdot \frac{c}{T_n}}{1 - \left(\frac{0.67 \cdot c}{T_n} \right) \left(\frac{0.893 \cdot L}{D \cdot T_n} \right)^2 + 1} \right)^2$								
Example 54% metal loss, 1.7" length								
$= 1.1 \cdot 1440 \cdot \left(\frac{1 - 0.67 \cdot (0.1685/0.312)}{1 - \left(\frac{0.67 \cdot 0.1685}{0.312} \right) \left(\frac{0.893 \cdot 1.7}{16.0 \cdot 0.312} \right)^2 + 1} \right)^2$								
1439.173 Check to verify the maximum defect example								
Pd = Derated internal design gage pressure, psi								
Pi = Original internal design gage pressure, psi								
c = Amount of wall thickness loss in inches								
Tn = Nominal wall thickness								
$L = 1.12 \cdot B \cdot \sqrt{D \cdot T_n}$ Longitudinal extent of the corroded area								
$G = 0.893 \cdot L / \sqrt{D \cdot T_n}$ A value not to exceed 4.0, if > 4.0, then use the following equation for Pd.								
$P_d = 1.1 P_i (1 - c/T_n)$								
D = O.D. of pipe								
		Inches	Inches	Inches	Inches		PSI	PSI
	Desgn Psi	Dfct Dpth	W.T.	Length	O.D.		Pres Rtg	Pres Rtg
	Pi	c	Tn	L	D	G	Pd (G<=4)	Pd if G > 4
	1440	0.0349	0.312	10.10	16.000	4.0368	1492.06	1406.59
		0.0624		6.60		2.6379	1440.15	1267.20
		0.0936		3.30		1.3189	1440.55	1108.80
		0.1248		2.30		0.9193	1444.49	950.40
		0.1560		1.80		0.7194	1446.80	792.00
		0.1872		1.50		0.5995	1445.68	633.60

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