

Impact of using stress free temperature of 364 F on Shallow Flaw Issue

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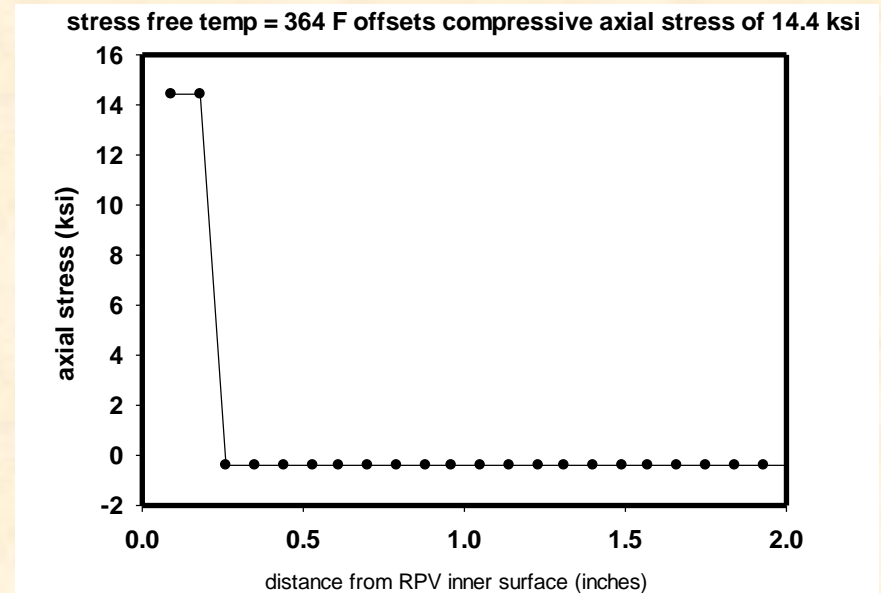
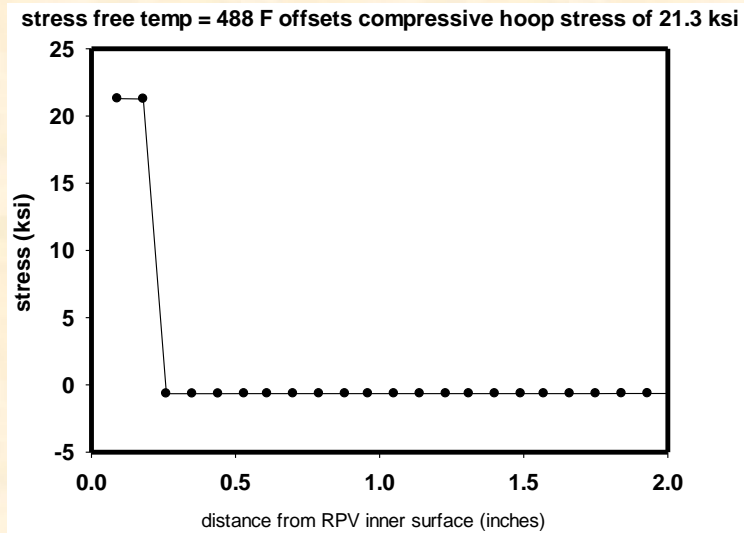
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If the temperature of an unloaded vessel is assumed uniform at 70 F , a stress-free temperature :

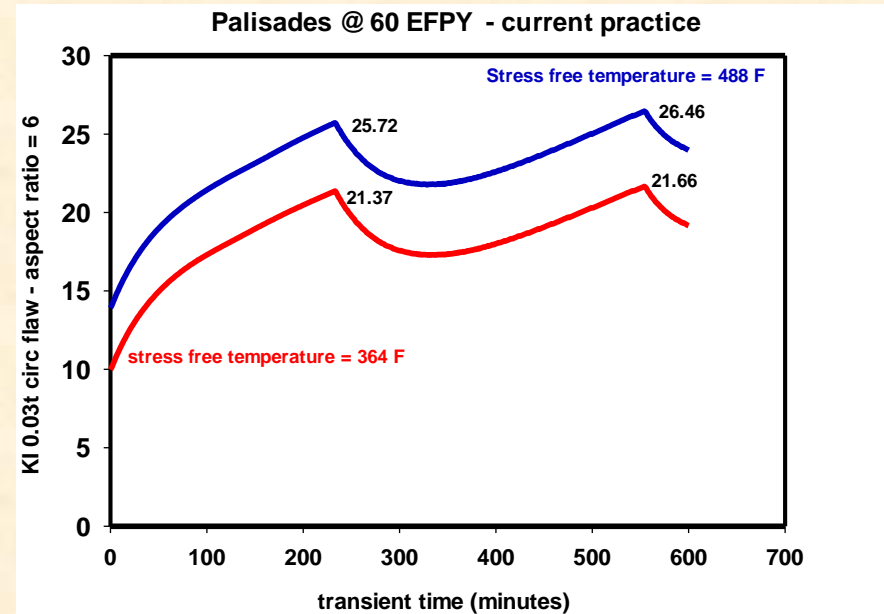
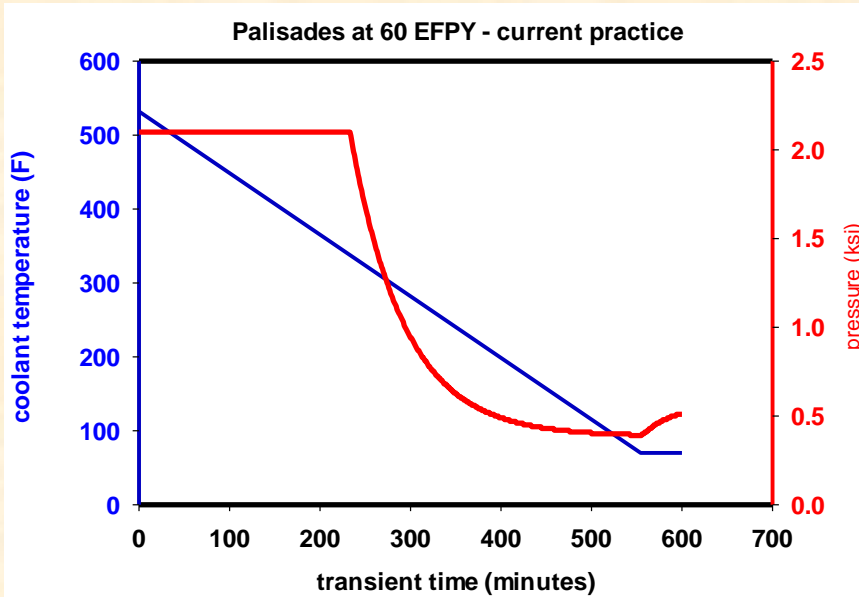
of **488 F** produces an average thru-clad tensile DTE hoop stress of **21.3 ksi** that exactly offsets the compressive **hoop stress**

of **364 F** produces an average thru-clad tensile DTE axial stress of **14.4 ksi** that exactly offsets the compressive **axial stress**

21.3 and 14.4 ksi were derived from finite element analyses in which the measured displacements taken on a test block from an RPV shell segment were used as boundary conditions.

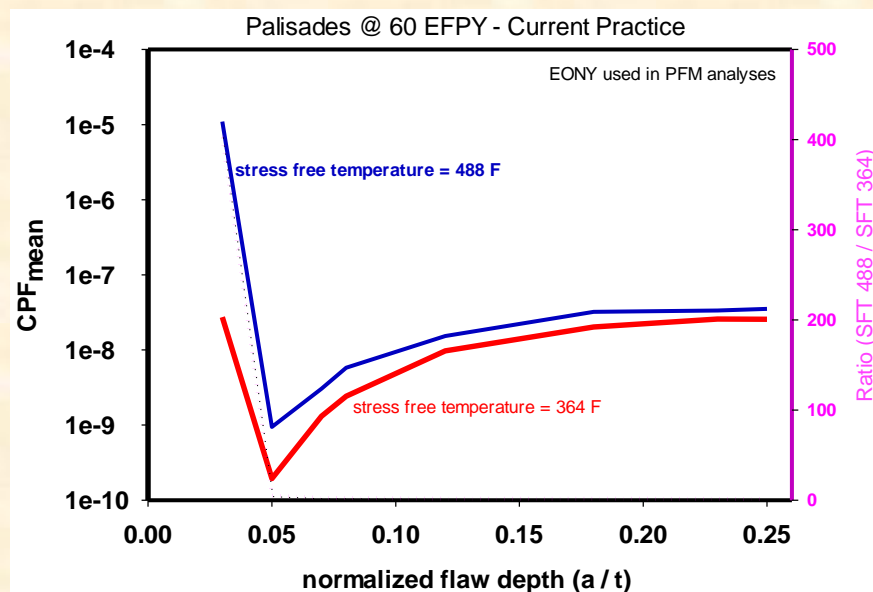
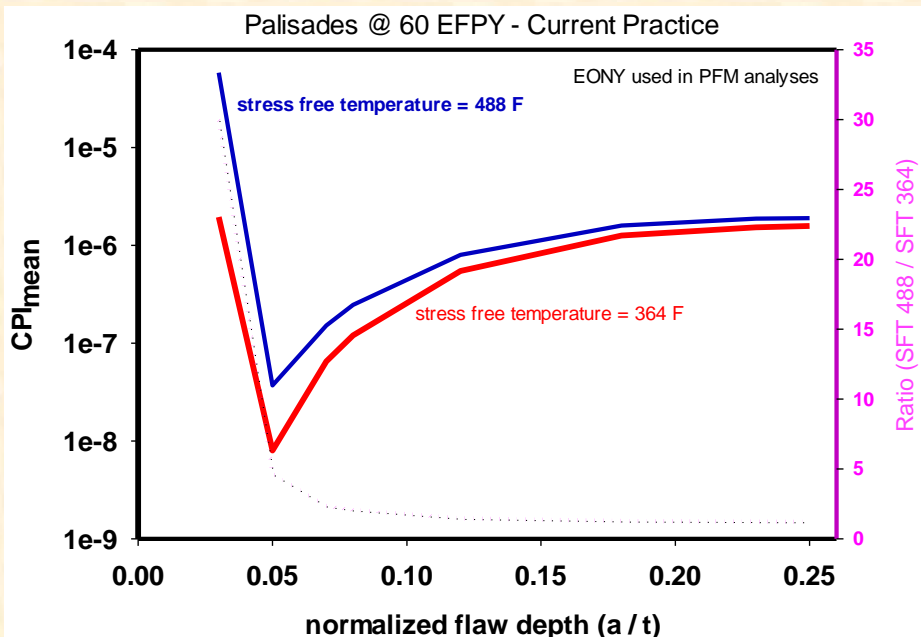


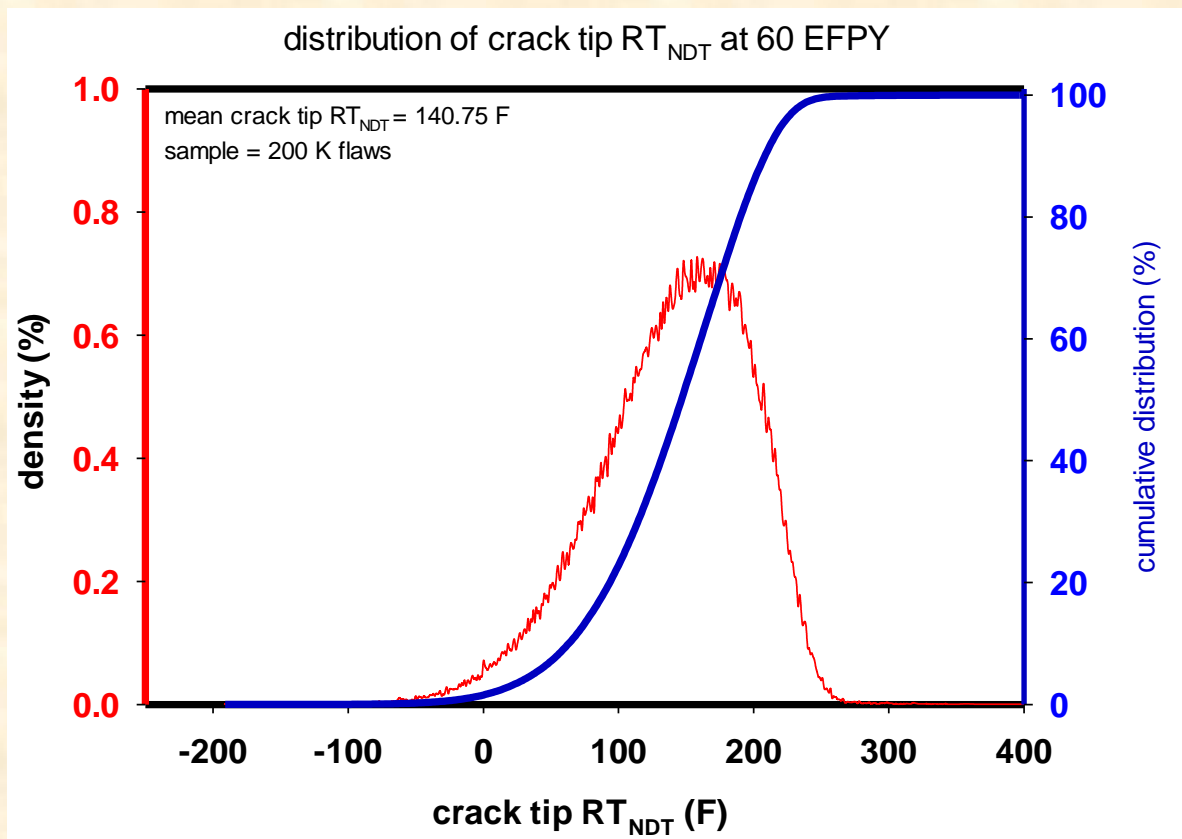
Lower stress free temperature shifts the KI(t) curve down Does not change which peak is maximum



PFM Results: SFT of 364 reduces CPI for 0.03t flaw by factor ~ 30 and CPF by factor of ~ 400

Normalized Crack depth (a / t)	SFT = 488		SFT = 364	
	CPI	CPF	CPI	CPF
0.03	5.84e-5	1.10e-5	1.95e-6	2.73e-8
0.05	3.70e-8	9.44e-10	7.98e-9	1.94e-10
0.07	1.52e-7	3.04e-9	6.50e-8	1.31e-9
0.08	2.47e-7	5.79e-9	1.20e-7	2.42e-9
0.12	8.00e-7	1.53e-8	5.49e-7	9.73e-9
0.18	1.60e-6	3.22e-8	1.26e-6	2.02e-8
0.23	1.88e-6	3.34e-8	1.53e-6	2.58e-8
0.25	1.90e-6	3.52e-8	1.58e-6	2.56e-8





The stress free temperature of 488 °F was derived, using temperature-dependent thermal-elastic material properties, based on producing a through-cladding average tensile DTE stress of 21.3 ksi at an assumed room temperature of 70 °F.

This tensile DTE stress exactly offsets the 21.3 compressive cladding hoop stress derived from finite element analyses in which the measured displacements taken on a test block from an RPV shell segment were used as boundary conditions. In other words, if the temperature of an unloaded vessel is assumed uniform at 70 °F, a stress-free temperature of 488 °F produces a tensile DTE hoop stress of 21.3 ksi that exactly offsets the compressive stress derived from a combination of finite element analyses and experimental measurements.

