0.1 title : KM-620

1 Equations

KM-620.1

$\epsilon_{ts}\left(\sigma_t, E_y, \gamma_1, \gamma_2\right) = \frac{\sigma_t}{E_y} + \gamma_1 + \gamma_2$

KM-620.2

$\gamma_1\left(\epsilon_1, H\right) = \frac{\epsilon_1}{2} \cdot \left(1 - \tanh\left(H\right)\right)$

KM-620.3

$\gamma_2\left(\epsilon_2, H\right) = \frac{\epsilon_2}{2} \cdot \left(1 + \tanh\left(H\right)\right)$

KM-620.4

$\epsilon_1\left(\sigma_t, A_1, m_1\right) = \left(\frac{\sigma_t}{A_1}\right)^{\frac{1}{m_1}}$

KM-620.5

$A_1\left(\sigma_{ys}, \epsilon_{ys}, m_1\right) = \frac{\sigma_{ys} \cdot (1+\epsilon_{ys})}{(\log(1+\epsilon_{ys}))^{m_1}}$

KM-620.6

$m_1\left(R, \epsilon_p, \epsilon_{ys}\right) = \frac{\log(R)+\epsilon_p-\epsilon_{ys}}{\log\left(\frac{\log(1+\epsilon_p)}{\log(1+\epsilon_{ys})}\right)}$

KM-620.7

$\epsilon_2\left(\sigma_t, A_2, m_2\right) = \left(\frac{\sigma_t}{A_2}\right)^{\frac{1}{m_2}}$

KM-620.8

$A_2\left(\sigma_{uts}, m_2\right) = \frac{\sigma_{uts} \cdot e^{m_2}}{{m_2}^{m_2}}$

KM-620.9

$H\left(\sigma_t, \sigma_{ys}, \sigma_{uts}, K\right) = \frac{2 \cdot (\sigma_t - (\sigma_{ys} + K \cdot (\sigma_{uts} - \sigma_{ys})))}{K \cdot (\sigma_{uts} - \sigma_{ys})}$

KM-620.10

$R\left(\sigma_{ys}, \sigma_{uts}\right) = \frac{\sigma_{ys}}{\sigma_{uts}}$

KM-620.11

$\epsilon_{ys}() = 0.002$

KM-620.12

$K\left(R\right) = 1.5 \cdot R^{1.5} - 0.5 \cdot R^{2.5} - R^{3.5}$

KM-620.13

$\sigma_{utst}\left(\sigma_{uts}, m_2\right) = \sigma_{uts} \cdot e^{m_2}$

2 Tables

Table KM-620

Material
Ferritic steel
Austenitic stainless steel and nickelbased alloys
Duplex stainless steel
Precipitation hardening, nickel based
Aluminum
Copper
Titanium and zirconium

Max. Temp. (°F)	m_2	m_3	m_4	m_5	ϵ_p
900	$0.6 \cdot (1.0 - R)$	$2 \cdot \log\left(1 + \frac{El}{100}\right)$	$\log\left(\frac{100}{100-RA}\right)$	2.2	$2.0e-5$
900	$0.75 \cdot (1.0 - R)$	$3 \cdot \log\left(1 + \frac{El}{100}\right)$	$\log\left(\frac{100}{100-RA}\right)$	0.6	$2.0e-5$
900	$0.7 \cdot (0.95 - R)$	$2 \cdot \log\left(1 + \frac{El}{100}\right)$	$\log\left(\frac{100}{100-RA}\right)$	2.2	$2.0e-5$
1000	$1.09 \cdot (0.93 - R)$	$1 \cdot \log\left(1 + \frac{El}{100}\right)$	$\log\left(\frac{100}{100-RA}\right)$	2.2	$2.0e-5$
250	$0.52 \cdot (0.98 - R)$	$1.3 \cdot \log\left(1 + \frac{El}{100}\right)$	$\log\left(\frac{100}{100-RA}\right)$	2.2	$5.0e-6$
150	$0.5 \cdot (1.0 - R)$	$2 \cdot \log\left(1 + \frac{El}{100}\right)$	$\log\left(\frac{100}{100-RA}\right)$	2.2	$5.0e-6$
500	$0.5 \cdot (0.98 - R)$	$1.3 \cdot \log\left(1 + \frac{El}{100}\right)$	$\log\left(\frac{100}{100-RA}\right)$	2.2	$2.0e-5$

NOTE: Ferritic steel includes carbon, low alloy, and alloy steels, and ferritic, martensitic, and iron-based age-hardening stainless steels.

3 Nomenclature

Mandatory Appendix 1: Nomenclature

A_1 = curve fitting constant for the elastic region of the stress-strain curve (KM-620)

A_2 = curve fitting constant for the plastic region of the stress-strain curve (KM-620)

E_y = modulus of elasticity evaluated at the temperature of interest, see ASME Section II Part D

El = minimum specified elongation, %

H = undefined

K = undefined

m_1 = undefined

m_2 = value calculated from Table KM-620

m_3 = value calculated from Table KM-620

m_4 = value calculated from Table KM-620

m_5 = value listed in Table KM-620

R = Sy/Su

RA = minimum specified reduction of area, %

γ_1 = true strain in the micro-strain region of the stress-strain curve (KM-620)

γ_2 = true strain in the macro-strain region of the stress-strain curve (KM-620)

ϵ_p = stress-strain curve fitting parameter (KM-620)

ϵ_{ts} = true total strain (KM-620)

ϵ_{ys} = 0.2% engineering offset strain (KM-620)

ϵ_1 = true plastic strain in the micro-strain region of the stress-strain curve (KM-620)

ϵ_2 = true plastic strain in the macro-strain region of the stress-strain curve (KM-620)

σ_t = true stress at which the true strain will be evaluated (KM-620)

σ_{uts} = engineering ultimate tensile stress evaluated at the temperature of interest (KM-620)

σ_{ys} = engineering yield stress evaluated at the temperature of interest (KM-620)

σ_{utst} = true ultimate tensile stress evaluated at the true ultimate tensile strain