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JAPANESE INDUSTRIAL STANDARD

General Rules for
Fatigue Testing of Metals

JIS Z 2273 —1978

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General Rules for Fatigue Testing of Metals

Z 2273-1978

1. Scope

This Japanese Industrial Standard specifies the general rules for fatigue testing of metals by the use of standard test pieces in the atmospheric air at room temperature, covering fatigue life under the number of stress cycles not less than 10^4 times.

2. Definitions2.1 Terms Concerning Stress and Number of Stress Cycles

2.1.1 Nominal Stress Stress calculated elastically without taking into consideration the stress concentration due to notches or others. The normal stress is expressed by σ and the shearing stress by τ .

Applicable Standard:

JIS Z 8401-Rules for Rounding Off of Numerical Values

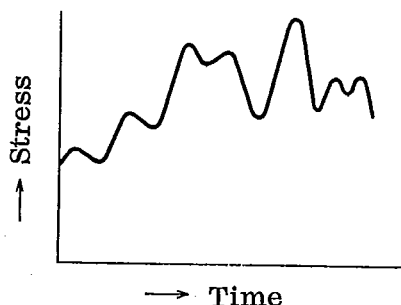
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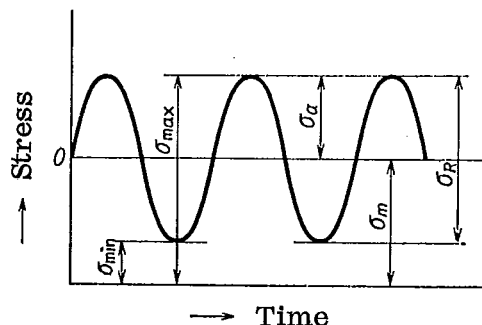
2.1.2 Varying Stress Stress the magnitude of which changes with time (Fig. 1).

2.1.3 Repeated Stress Stress varying simply and periodically between the constant maximum and minimum values (Fig. 2).

Fig. 1. Varying Stress



Rig. 2. Repeated Stress



2.1.4 Maximum Stress σ_{max}, τ_{max} The highest algebraic value of repeated stress (Fig. 2).

2.1.5 Minimum Stress σ_{min}, τ_{min} The lowest algebraic value of repeated stress (Fig. 2).

Remark: In the case of tensile and compressive stresses, the maximum and minimum stresses take, considering sign, positive sign for tensile stress and negative sign for compressive stress. In the case of shearing stress, if one direction takes positive sign, so the opposite direction negative sign.

2.1.6 Mean Stress σ_m, τ_m One-half of the algebraic sum of the maximum and minimum stresses of the repeated stresses (Fig. 2).

2.1.7 Stress Amplitude σ_a, τ_a One-half of the algebraic difference between the maximum and minimum stresses of the repeated stresses (Fig. 2).

2.1.8 Range of Stress σ_R, τ_R The algebraic difference between the maximum and minimum stresses of the repeated stresses (Fig. 2).

2.1.9 Stress Amplitude-Mean Stress Ratio A The algebraic ratio of the stress amplitude to the mean stress.

$$A = \frac{\sigma_a}{\sigma_m} \quad \text{or} \quad A = \frac{\tau_a}{\tau_m}$$

2.1.10 Minimum-Maximum Stress Ratio R The algebraic ratio of the minimum stress to the maximum stress.

$$R = \frac{\sigma_{min}}{\sigma_{max}} \quad \text{or} \quad R = \frac{\tau_{min}}{\tau_{max}}$$

2.1.11 Symmetrical Reversed Stress Stress alternating repeatedly between two values opposite in sign but equal in magnitude (where $\sigma_m=0$ or $\tau_m=0$, Fig. 3).

2.1.12 Asymmetrical Reversed Stress Stress alternating repeatedly between the positive maximum value and the negative minimum value, the absolute values of which are different (where $0<|\sigma_m|<\sigma_a$ or $0<\tau_m<\tau_a$, Fig. 4).

Fig. 3. Symmetrical Reversed Stress

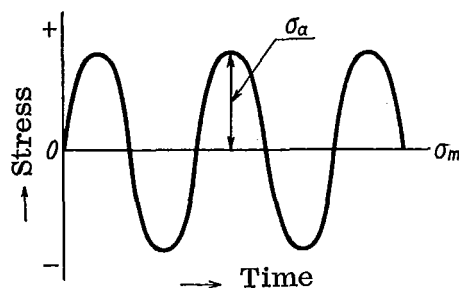
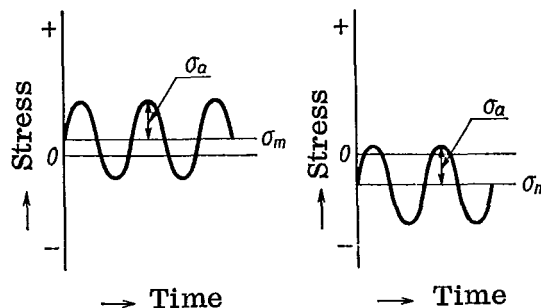


Fig. 4. Asymmetrical Reversed Stress



2.1.13 Completely Fluctuating Stress Stress alternating repeatedly between 0 and the maximum value, or between 0 and the minimum value (where $|\sigma_m|=\sigma_a$ or $\tau_m=\tau_a$, Fig. 5).

2.1.14 Partially Fluctuating Stress Stress alternating repeatedly between the maximum value and the minimum value of the same sign (where $|\sigma_m|>\sigma_a$ or $\tau_m>\tau_a$, Fig. 6).

Fig. 5. Completely Fluctuating Stress

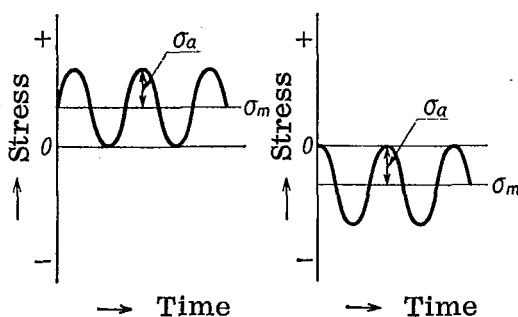
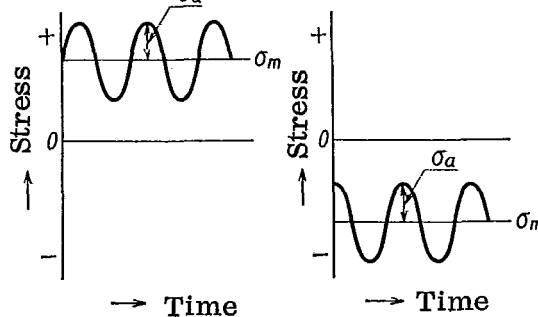


Fig. 6. Partially Fluctuating Stress



2.1.15 Number of Stress Cycles n The number of stress cycles applied during the fatigue test.

2.1.16 Endurance N The number of stress cycles to fatigue failure.

2.1.17 Cycle Ratio n/N The ratio of the applied stress cycles, n to cycles to failure, N .