

JIS

JAPANESE INDUSTRIAL STANDARD

**Testing method for constant-
load amplitude tension - tension
fatigue of carbon fibre
reinforced plastics**

JIS K 7083—1993

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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Testing method for constant-load amplitude tension-tension fatigue of carbon fibre reinforced plastics K 7083-1993

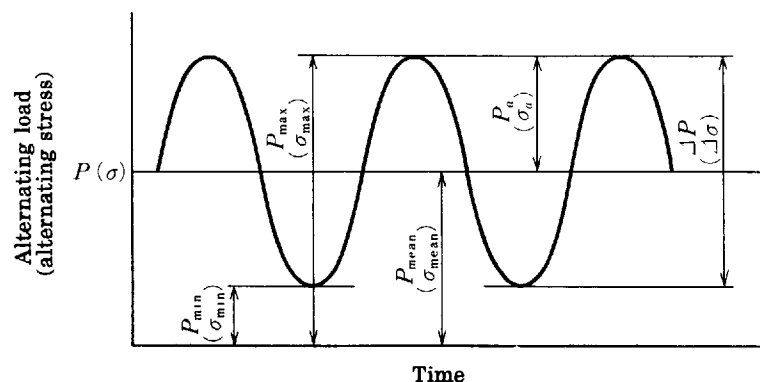
1. **Scope** This Japanese Industrial Standard specifies the testing method for constant-load amplitude tension-tension fatigue of the unidirectional and fabric reinforced materials of laminated carbon fibre reinforced plastics (hereafter referred to as "CFRP").

- Remarks 1. This testing method covers the determination of fatigue properties of CFRP by applying the maximum and minimum alternating tensile loads to the test specimen.
2. In this testing method, the "load" shall mean the loading force or the external force to be loaded to the test specimen by means of a loading mechanism of the testing machine.
3. The standards cited in this Standard are as follows:
- JIS B 7502 Micrometer callipers for external measurement
 - JIS B 7507 Vernier, dial and digital callipers
 - JIS K 6900 Glossary of terms used in plastic industry
 - JIS K 7072 Preparation of carbon fibre reinforced plastic panels for test purpose
 - JIS K 7073 Testing method for tensile properties of carbon fiber reinforced plastics
 - JIS K 7100 Standard atmospheres for conditioning and testing of plastics
 - JIS Z 8401 Rules for rounding off of numerical values
4. The units given in { } in this Standard are based on the traditional units and are appended for informative reference.

2. **Definitions** For the main terms used in this Standard the definitions in JIS K 6900 apply, and the rest of the terms shall be as follows:

- (1) **alternating load** The load which periodically varies between definite maximum value and minimum value (refer to Fig. 1).

Fig. 1. Alternating load (alternating stress)



- (2) maximum alternating load ($P_{\max}$) The maximum value of the alternating load.
- (3) minimum alternating load ($P_{\min}$) The minimum value of the alternating load.
- (4) load range (ΔP) The difference between the maximum ($P_{\max}$) value and minimum ($P_{\min}$) value of the alternating load:

$$\Delta P = P_{\max} - P_{\min}$$

- (5) load amplitude (P_a) Half of the load range (ΔP) hereinbefore defined:

$$P_a = \frac{\Delta P}{2}$$

- (6) mean load (P_{mean}) The arithmetic mean of the maximum alternating load ($P_{\max}$) and the minimum alternating load ($P_{\min}$).

$$P_{\text{mean}} = \frac{P_{\max} + P_{\min}}{2}$$

The term "stress" may be used in place of "load" hereinbefore (1) to (6).

- (7) stress ratio (R) The ratio of the minimum stress ($\sigma_{\min}$) over the maximum stress ($\sigma_{\max}$):

$$R = \frac{\sigma_{\min}}{\sigma_{\max}}$$

- (8) number of cycles The number of cycles of stress when the test specimen is subjected to alternating stress at constant amplitude. This is expressed in N or n , where N represents the number of cycles to produce the fatigue fracture and n represents the number of cycles of stress during the fatigue test.
- (9) endurance limit The upper limiting value of the alternating stress which test specimens can withstand up to a specified number of cycles. After this value, the number of cycles shall be put down in parentheses:

Example: $\sigma_{\max} (10^5)$

- (10) S-N diagram (stress-to-number-of-cycles diagram) A plot of the alternating stress on the ordinate against number of cycles up to fatigue fracture on the abscissa (in the case where the test is completed without breakage, put arrow mark in the right-hand direction on that point.)
- (11) fatigue limit (σ_w) The upper limiting of alternating stress at which test specimen can withstand up to an infinite number of cycles. In most cases, plastic materials do not show the fatigue limit (the alternating stress at which an S-N diagram becomes parallel to the abscissa in the direction on increasing cycles) up to the number of cycles of 10^7 . For this reason, generally the upper limiting of the alternating stress at which the test specimen does not fracture up to the number of cycles of 10^7 is defined as the fatigue limit. In this case, it is necessary to clearly record that the fatigue limit is the upper limiting value of the alternating stress not producing fracture up to 10^7 cycles [refer to (9) endurance limit].
- (12) fatigue strength A generic term for the fatigue limit and the endurance limit.