Wave Washers

TAIYO Stainless Spring Co., Ltd.

Wave washers are ring-shaped, thin metal washers made with wave-like forms designed to achieve spring characteristics against compression; this enables gaining load capacity in limited spaces.

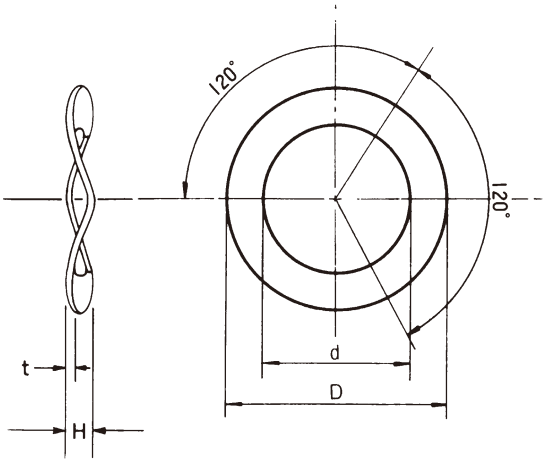
Our Wave Washers comply with JASO F302 Automotive Standard - Wave Washers (Wave Washers for Adjustments).

Calculations for Wave Washers

In wave washer calculations, a significant difference between calculated values and measured values usually exists. The number of waves or the inside-to-outside diameter ratio considerably affects the calculation, as well as the nonlinear change of spring rate of wave washers that occurs when close to their solid height, which makes it difficult to determine values at given points. If a wave washer is assumed to be a continuous beam and its number of waves is 3 or more, the following equation is given to describe the relation between deflection (δ) and load (W), and the stress(σ):

$$K = \frac{W}{\delta} = \frac{Ebt^3N^4}{1.94(dm)^3} \qquad \sigma = \frac{12EtN^2\delta}{\pi^2(dm)^2}$$

K : Spring Rate (N/mm)
W : Load (N)
δ : Deflection (mm)
E : Young's Modulus (N/mm^2)
b : Width (mm) $= \frac{D-d}{2}$
t : Thickness (mm)
N : Number of Waves
dm : Mean diameter (mm) $= \frac{D+d}{2}$
σ : Bend stress (N/mm^2)
D : External diameter (mm)
d : Internal diameter (mm)



Nevertheless, it is recommended to prepare and test a prototype to verify the calculated values.

- Free Height (H) in this Guide is calculated with the above formula with the stress at its solid height set as 4,000 N/mm^2.
- For actual applications, it is recommended to stay within the stress that ensures the free height. The suggested value of stress is 1800 N/mm^2.
- Attention shall be paid in use cases with greater stress, because the free height may be reduced as the spring settles.

Reference: Society of Automotive Engineers of Japan, *JASO F302 Automotive Standard - Wave Washers*