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The fatigue strength at high endurance of notched low alloy steel specimens (in bending and under axial loading, zero mean stress)

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This Item was also accepted for the inclusion in the Stress and Strength Series by the Stress Analysis and Strength of Components Committee. This Committee first met in 1964 and now has the following membership:

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THE FATIGUE STRENGTH AT HIGH ENDURANCE OF NOTCHED LOW ALLOY STEEL SPECIMENS (IN BENDING AND UNDER AXIAL LOADING, ZERO MEAN STRESS)

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1. NOTATION

D	maximum diameter of round bar	m	in
f_t	tensile strength	N/m^2	lbf/in^2
h	depth of stress raiser	m	in
K_t	elastic stress concentration factor based on net cross-sectional area (gross area for round bar with transverse hole)		
N	endurance		
r	root radius of stress raiser	m	in
$\bar{S}_{a0}(N)$	mean fatigue strength at endurance N for unnotched specimens ($N \geq 10^6$, $K_t = 1.0$)	N/m^2	lbf/in^2
$S_{k0}(N)$	fatigue strength based on net cross-sectional area at endurance N for notched specimens ($N \geq 10^6$)	N/m^2	lbf/in^2
W	maximum width of plate	m	in

Both SI and British units are quoted.

2. NOTES

This Item provides data on the fatigue strength at high endurance of notched wrought low alloy steel specimens under constant amplitude loading. The results of tests on specimens containing different types of stress raisers are provided.

The data are presented in Figures 1 and 2, grouped according to whether the specimens were loaded axially or in bending, and are plotted on a basis of $S_{k0}(N)$ against f_t. Each of the data points shown represents a fatigue strength at high endurance ($10^6 \leq N \leq 10^8$ reversals) or a fatigue limit obtained from tests on a series of identical specimens. Different symbols are used to indicate the range of K_t for the test results. In both figures an identical curve, marked $\bar{S}_{a0}(N)$, indicates the mean values for unnotched specimens obtained from Figures 1 and 3 of Reference 3. The data on which this curve is based are for specimens having various degrees of surface finish, from ground or polished to fine turned, see Reference 3. Curves derived for $\bar{S}_{a0}(N)/K_t$ for various values of K_t are also given.

Low alloy steels of tensile strength less than 1000 MN/m^2 (about 150 000 lbf/in^2) normally exhibit a fatigue limit, which is usually apparent at about 10^6 reversals. Low alloy steels of tensile strength greater than 1400 MN/m^2 (about 200 000 lbf/in^2) do not necessarily exhibit a clearly defined fatigue limit even at $N - 10^8$ $N = 10^8$ reversals. This difference in behaviour is indicated on the figures.

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