#	Material	Density [kg/m^3]	Yield Str S_y [Pa]	Ult. Tens. Str. S_{ut} [Pa]	Elastic Mod. E [Pa]	Frac. Tough. K_{IC} [MPa m$^{1/2}$]	C [m/cycle / Mpa m$^{1/2}$]	m
1	**AISI 4130 Steel**	7850	435000000	670000000	2.05E+11	80.21	6.89E-12	3
2	**6061 Aluminium**	2700	276000000	310000000	68900000000	29	7.88E-09	3.97
3								
4								

Connecting Rod Length, L	0.16	m
Crank Arm Length, b	0.05125	m
Bore/depth	0.1025	m
Cross Section		
Width, B	0.04	m
Height, H	0.04	m
A_c	0.0016	m^2
I_{area}	2.13333E-07	m^4
Mass	2.0096	kg
I_{mass}	0.017148587	kg m^2

$P_{cyl,max}$	8187000	Pa
x_{max}	0	m
$P_{cyl,min}$	101325	Pa
x_{min}	0.1025	m
d_{piston}	0.078846154	m
A_{piston}	0.004882597	m^2
Inertial Torque/Bending Moment$_{MAX}$	2.20760552	N m
Inertial Torque/Bending Moment$_{MIN}$	0	N m
Axial Force, F_{1Max}	124796.3291	N
Axial Force, F_{1Min}	0	N
σ_{xNmax}	-77997705.71	Pa
σ_{xNmin}	0	Pa
$\sigma_{xBendingMax}$	-206963.0175	Pa
$\sigma_{xBendingMin}$	0	Pa
σ_{xMax}	-77790742.7	Pa
σ_{xMin}	0	Pa
$\Delta\sigma$	-77790742.7	Pa
$FoS_{Yielding}$	5.591925015	

Buckling

Condition	1.113696	m
P_{cr1}	16860574	N
P_{cr2}	688817.3	N
$FoS_{Buckling}$	5.519532	

#NUM! (Using $P_{cyl,min}$)

Fatigue

LEFM

β	1	
Critical Crack Size, a_f	0.33841634	m
Initial Crack Size, a_0	0.001	m
LEFM Fatigue Life, N_f	3.31153E+15	cycles

Stress Life

$\sigma_{xamplitude}$	0	Pa
σ_{xmean}	-77790742.7	Pa
$\sigma_{bendamplitude}$	103481.5087	Pa
$\sigma_{bendmean}$	-103481.5087	Pa
σ_a'	103481.5087	Pa
σ_m'	77894224.21	Pa
a	4.51	
b	-0.265	
k_a	0.02066649	
k_b	1.270484109	
Se'	335	MPa
Se	8.79590973	MPa
$FoS_{Soderberg}$	5.240213682	

Figure 5–26

Plate loaded in longitudinal tension with a crack at the edge; for the solid curve there are no constraints to bending; the dashed curve was obtained with bending constraints added.

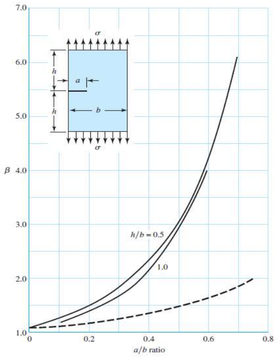

Table 6–2

Parameters for Marin Surface Modification Factor, Eq. (6–19)

Surface Finish	Factor a S_{ut}, kpsi	Factor a S_{ut}, MPa	Exponent b
Ground	1.34	1.58	−0.085
Machined or cold-drawn	2.70	4.51	−0.265
Hot-rolled	14.4	57.7	−0.718
As-forged	39.9	272.	−0.995

From C. J. Noll and C. Lipson, "Allowable Working Stresses," *Society for Experimental Stress Analysis*, vol. 3, no. 2, 1946 p. 29. Reproduced by O.J. Horger (ed.) *Metals Engineering Design ASME Handbook*, McGraw-Hill, New York. Copyright © 1953 by The McGraw-Hill Companies, Inc. Reprinted by permission.

Table 5–1

Values of K_{Ic} for Some Engineering Materials at Room Temperature

Material	K_{Ic}, MPa$\sqrt{m}$	S_y, MPa
Aluminum		
2024	26	455
7075	24	495
7178	33	490
Titanium		
Ti-6AL-4V	115	910
Ti-6AL-4V	55	1035
Steel		
4340	99	860
4340	60	1515
52100	14	2070

Table 6–1

Conservative Values of Factor C and Exponent m in Eq. (6–5) for Various Forms of Steel ($R = \sigma_{max}/\sigma_{min} \approx 0$)

Material	C, $\frac{m/cycle}{(MPa\sqrt{m})^m}$	C, $\frac{in/cycle}{(kpsi\sqrt{in})^m}$	m
Ferritic-pearlitic steels	$6.89(10^{-12})$	$3.60(10^{-10})$	3.00
Martensitic steels	$1.36(10^{-10})$	$6.60(10^{-9})$	2.25
Austenitic stainless steels	$5.61(10^{-12})$	$3.00(10^{-10})$	3.25

From J. M. Barsom and S. T. Rolfe, *Fatigue and Fracture Control in Structures, 2nd ed.*, Prentice Hall, Upper Saddle River, NJ, 1987, pp. 288–291, Copyright ASTM International. Reprinted with permission.