CASE 4: Hot Day (heat soak) (Oil inlet temp = 240F, 800 rpm)

Select Journal Radius (Inch), Length (Inch), Load (lbf), and Oil Inlet Temp (F)

$r := \frac{0.75}{2}$ $L := .75$ $W := 51.0$ $T1 := 240.0$ $rpm := 800$

Define Radial Clearance Range (0.0002 - 0.003 inch)

$c := 0.0002, 0.0004 .. 0.0022$

Define Journal Speed (rev/sec)

$N := \frac{rpm}{60}$

Define Average Oil Temperature (F), i.e., Tavg = T1 + DT/2 (Guess on oil DT, and iterate on calculated value)

$DTGUESS(c) := 25 \cdot \left(\frac{0.0002}{c}\right)^{1.2}$

$T(c) := T1 + \frac{DTGUESS(c)}{2}$

Define Viscosity (Reyns) vs. Temp for 10W30 oil

$\mu(c) := 0.7323 \cdot T(c)^{-2.4735}$

Define Unit Load Capacity (P)

$P := \frac{W}{2 \cdot L \cdot r}$

Define Sommerfeld Number (S) as a function of clearance (c), since c is a design variable

$S(c) := \left(\frac{r}{c}\right)^2 \cdot \mu(c) \cdot \frac{N}{P}$

Define bearing performance parameters in terms of curve fits provided

(a) Min Film Thickness, ho

$ho(c) := c \cdot \left(0.0247 + 4.2606 \cdot S(c) - 10.2144 \cdot S(c)^2 + 11.4556 \cdot S(c)^3 - 4.664 \cdot S(c)^4\right)$

(b) Friction Factor, f

$f(c) := \frac{c}{r} \cdot \left(0.7316 + 18.9931 \cdot S(c) + 0.1877 \cdot S(c)^2\right)$

(c) Flow Variable Q

$Q(c) := (r \cdot c \cdot N \cdot L) \cdot \left(4.8281 - 4.6055 \cdot S(c) + 5.9194 \cdot S(c)^2 - 2.7516 \cdot S(c)^3\right)$

(d) Side Flow Qs

$Qs(c) := Q(c) \cdot \left(0.9614 - 2.6056 \cdot S(c) + 3.4272 \cdot S(c)^2 - 1.6012 \cdot S(c)^3\right)$

CASE 1

Calculate Oil Temp Rise

$$DT(c) := \frac{0.103 \cdot P}{\left(1 - 0.5 \cdot \frac{Qs(c)}{Q(c)}\right)} \cdot \left(\frac{r}{c}\right) \cdot \frac{f(c)}{\frac{Q(c)}{(r \cdot c \cdot N \cdot L)}}$$

Print the variable values

c =	S(c) =	ho(c) =	c) =	Q(c) =	Qs(c) =
$2 \cdot 10^{-4}$	0.4327	$1.44079 \cdot 10^{-4}$	0.00479	0.00279	$9.65256 \cdot 10^{-4}$
$4 \cdot 10^{-4}$	0.11603	$1.59441 \cdot 10^{-4}$	0.00313	0.00655	0.00461
$6 \cdot 10^{-4}$	0.05268	$1.33458 \cdot 10^{-4}$	0.00277	0.01035	0.00863
$8 \cdot 10^{-4}$	0.02993	$1.14689 \cdot 10^{-4}$	0.00277	0.01409	0.01249
0.001	0.01926	$1.03061 \cdot 10^{-4}$	0.00293	0.01778	0.01622
0.0012	0.01343	$9.61047 \cdot 10^{-5}$	0.00316	0.02145	0.01989
0.0014	0.00989	$9.21806 \cdot 10^{-5}$	0.00343	0.02511	0.0235
0.0016	0.00758	$9.02933 \cdot 10^{-5}$	0.00374	0.02876	0.02709
0.0018	0.006	$8.98269 \cdot 10^{-5}$	0.00406	0.0324	0.03065
0.002	0.00487	$9.03862 \cdot 10^{-5}$	0.00439	0.03604	0.0342
0.0022	0.00403	$9.17082 \cdot 10^{-5}$	0.00474	0.03968	0.03773

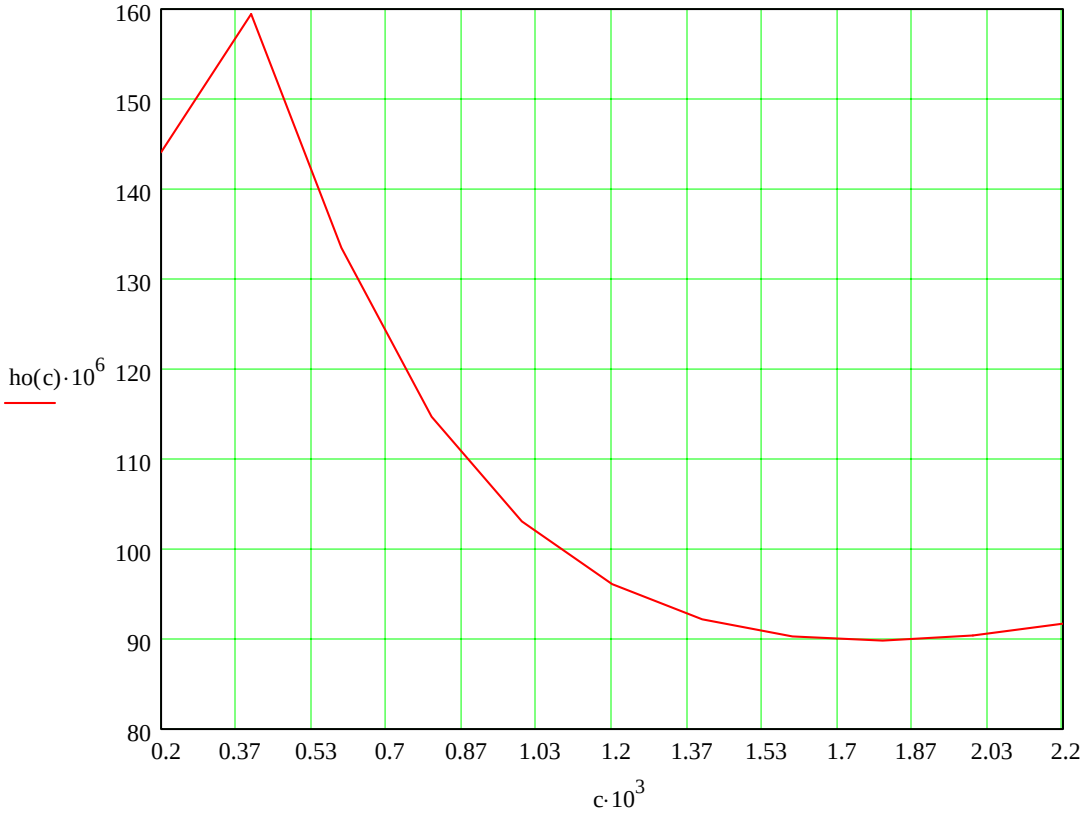
Print Oil Temperature Rise (guess and calculated), Average Oil Temp, and oil Viscosity

	(Calculated DT)	Avg oil temp	
DTGUESS(c) =	DT(c) =	T(c) =	$\mu(c) \cdot 10^6$ =
25	27.26827	252.5	0.83694
10.88188	9.68129	245.44094	0.89775
6.68951	6.0284	243.34476	0.917
4.73661	4.64434	242.36831	0.92616
3.6239	3.97526	241.81195	0.93144
2.91178	3.60251	241.45589	0.93485
2.42004	3.37417	241.21002	0.9372
2.06173	3.22439	241.03087	0.93893
1.78998	3.12094	240.89499	0.94024
1.57739	3.04653	240.7887	0.94127
1.40692	2.99125	240.70346	0.94209

CASE 1

Plot Variables

Min Film Thickness Vs. Clearance



Oil Temp Rise (F) Vs. Clearance