CASE 3: Hot Day (Oil inlet temp = 220F, 2500 rpm)

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

$r := \frac{0.75}{2} \qquad L := .75 \qquad W := 104.3 \qquad T1 := 220.0 \qquad rpm := 2500$

Define Radial Clearance Range (0.0002 - 0.003 inch)

$c := 0.0004, 0.0006 .. 0.0028$

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)

$DTGUESS(c) := 30 \cdot \left(\frac{0.0004}{c}\right)^{1.0}$

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

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) =
$4 \cdot 10^{-4}$	0.19743	$2.19522 \cdot 10^{-4}$	0.00479	0.01935	0.011
$6 \cdot 10^{-4}$	0.09254	$2.04148 \cdot 10^{-4}$	0.00399	0.03129	0.02342
$8 \cdot 10^{-4}$	0.05348	$1.8005 \cdot 10^{-4}$	0.00373	0.04311	0.03585
0.001	0.03479	$1.61049 \cdot 10^{-4}$	0.00371	0.05478	0.04793
0.0012	0.02443	$1.47419 \cdot 10^{-4}$	0.00383	0.06636	0.05971
0.0014	0.01809	$1.37893 \cdot 10^{-4}$	0.00401	0.07788	0.07129
0.0016	0.01393	$1.31368 \cdot 10^{-4}$	0.00425	0.08935	0.08271
0.0018	0.01106	$1.27048 \cdot 10^{-4}$	0.00452	0.10078	0.09403
0.002	0.00899	$1.24376 \cdot 10^{-4}$	0.00481	0.1122	0.10527
0.0022	0.00745	$1.22959 \cdot 10^{-4}$	0.00512	0.1236	0.11645
0.0024	0.00628	$1.22518 \cdot 10^{-4}$	0.00545	0.13498	0.12758
0.0026	0.00536	$1.22847 \cdot 10^{-4}$	0.00578	0.14636	0.13868
0.0028	0.00463	$1.23795 \cdot 10^{-4}$	0.00612	0.15773	0.14975

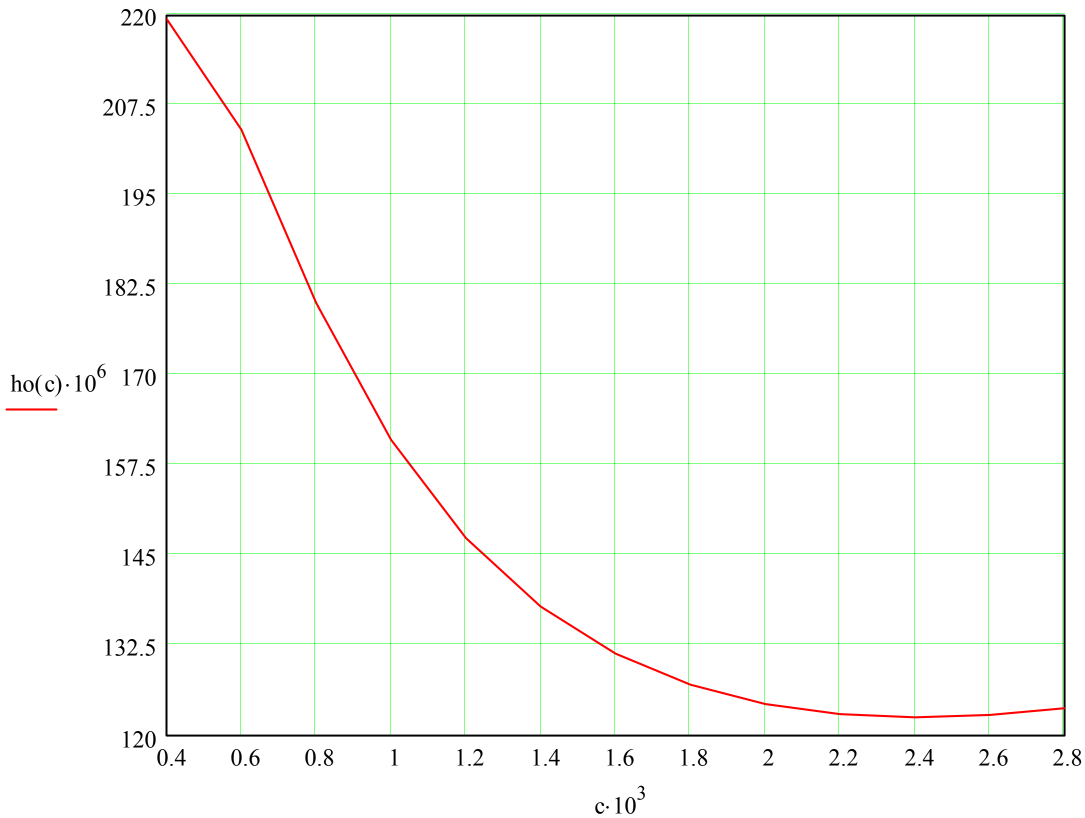
Print Oil Temperature Rise (guess and calculated), Average Oil Temp, and oil Viscosity

	(Calculated DT)	Avg oil temp	
DTGUESS(c) =	DT(c) =	T(c) =	$\mu(c) \cdot 10^6$ =
30	29.00737	235	0.99966
20	17.08048	230	1.05428
15	12.42693	227.5	1.08317
12	10.11297	226	1.10104
10	8.79636	225	1.11318
8.57143	7.97735	224.28571	1.12197
7.5	7.43399	223.75	1.12863
6.66667	7.05542	223.33333	1.13384
6	6.78132	223	1.13804
5.45455	6.57658	222.72727	1.14149
5	6.41968	222.5	1.14437
4.61538	6.29682	222.30769	1.14682
4.28571	6.19883	222.14286	1.14893

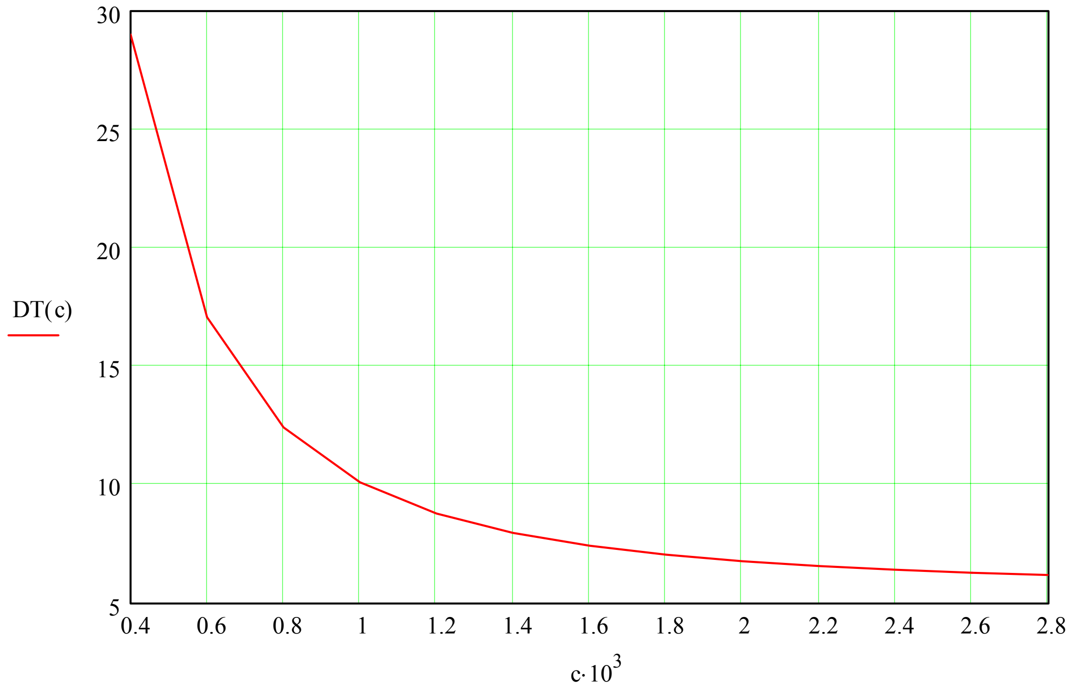
CASE 1

Plot Variables

Min Film Thickness Vs. Clearance



Oil Temp Rise (F) Vs. Clearance



30
25
20
15
10
5
DT(c)
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
c·10^3