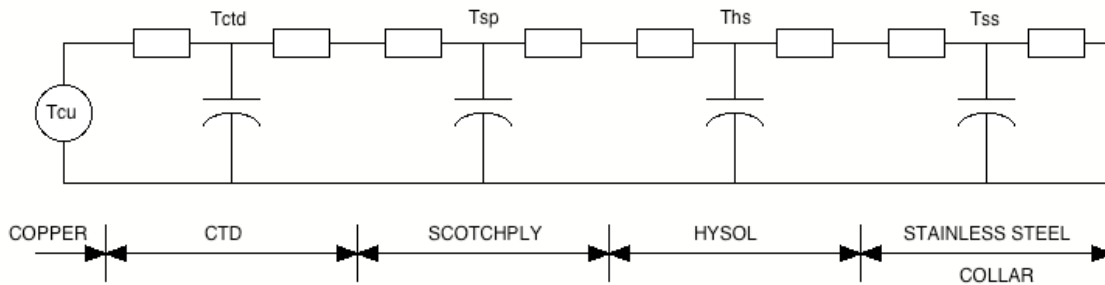


**TO: DISTRIBUTION**  
**FROM: C NEUMEYER**  
**SUBJECT: HEAT FLOW FROM COPPER TO TORQUE COLLAR**

A thermal analog model was created for the heat flow from the TF inner leg copper out to the torque collar as shown below.



Assumed material properties were as follows...

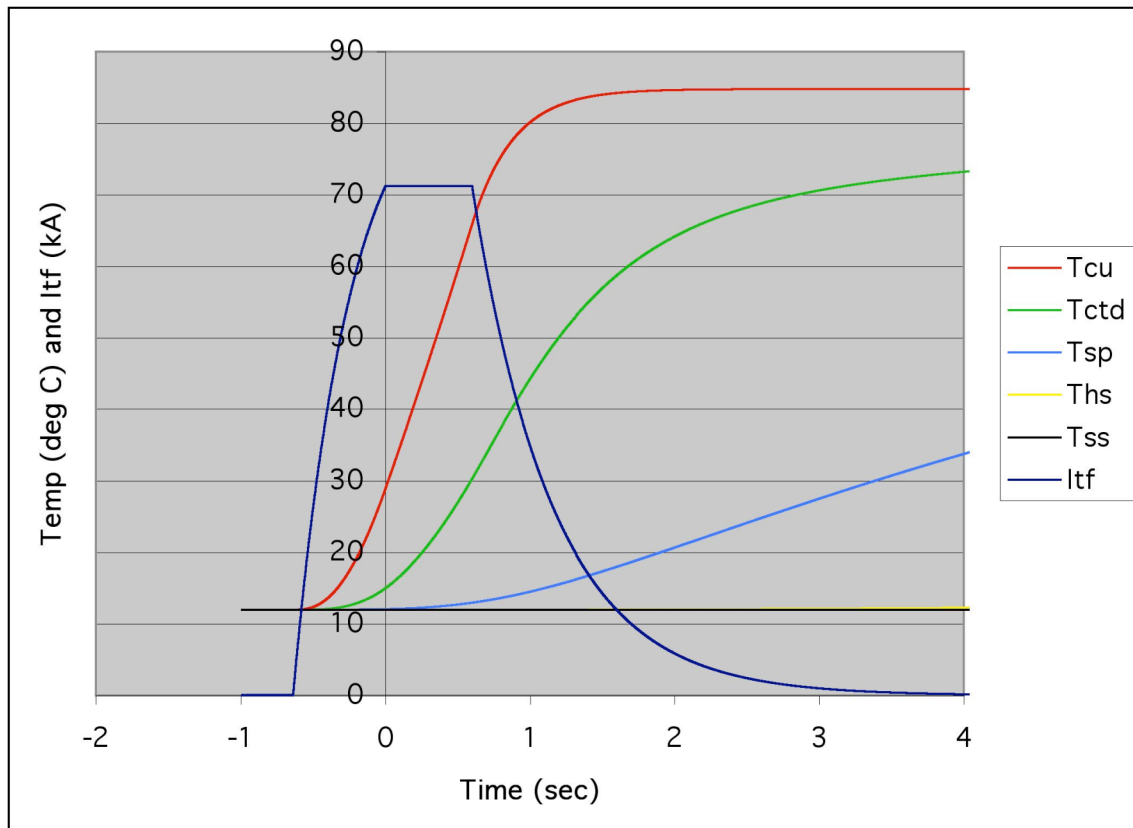
			Assumed G10 Property
<u>G-10 (CTD)</u>			
Thermal Conductivity	0.600	W-m/m <sup>2</sup> -deg C	
Specific Heat	1.151	J/gm-C	
Density	1.420	gm/cc	
<u>Scotchply</u>			
Thermal Conductivity	0.336	W-m/m <sup>2</sup> -deg C	
Specific Heat	1.151	J/gm-C	*
Density	1.420	gm/cc	*
<u>Hysol</u>			
Thermal Conductivity	0.209	W-m/m <sup>2</sup> -deg C	
Specific Heat	1.151	J/gm-C	*
Density	1.080	gm/cc	
<u>SS</u>			
Thermal Conductivity	16.300	W-m/m <sup>2</sup> -deg C	
Specific Heat	0.500	J/gm-C	
Density	7.900	gm/cc	

Note that G10 properties were assumed were assumed for the CTD and for some of the Scotchply and Hysol properties when specific information was not available.

Using the above properties, the following thermal resistances and capacitances were calculated....

	Copper	CTD	Scotchply	Hysol	SS	
Inner Radius	0	3.848	3.88	3.934	4.184	in
Thickness	3.848	0.032	0.054	0.25	0.5	in
Outer Radius	3.848	3.88	3.934	4.184	4.684	in
Height	3.25	3.25	3.25	3.25	3.25	in
Fill	0.811	1	1	1	1	
Volume	122.6	2.5	4.3	20.7	45.3	in <sup>3</sup>
	2009.2	41.4	70.6	339.6	741.9	cc
Density		1.4	1.4	1.1	7.9	gm/cc
Mass		58.7	100.2	366.6	5860.8	gm
Thermal Resistance		2.66E-02	7.93E-02	5.68E-01	1.33E-02	C/W
Thermal Capacitance		67.6	115.3	421.8	2930.4	Joule/C
Thermal Tau		1.8	9.1	239.4	39.1	sec

Using the rated 6kG, 0.6sec flat top, L/R decay TF waveform, the heating of the copper and the diffusion of heat through the layers out to the stainless steel was simulated. Waveforms are shown in the following figure.



These results indicate that, at end of flat top, the temperature difference between the Hysol and Scotchply layers is of order 1 degree C, which is ignorable.

Cc:

J Chrzanowski      T Egebo      C Jun P Heitzenroeder      M Kalish      M Ono  
J Schmidt      A VonHalle      M Williams      I Zatz