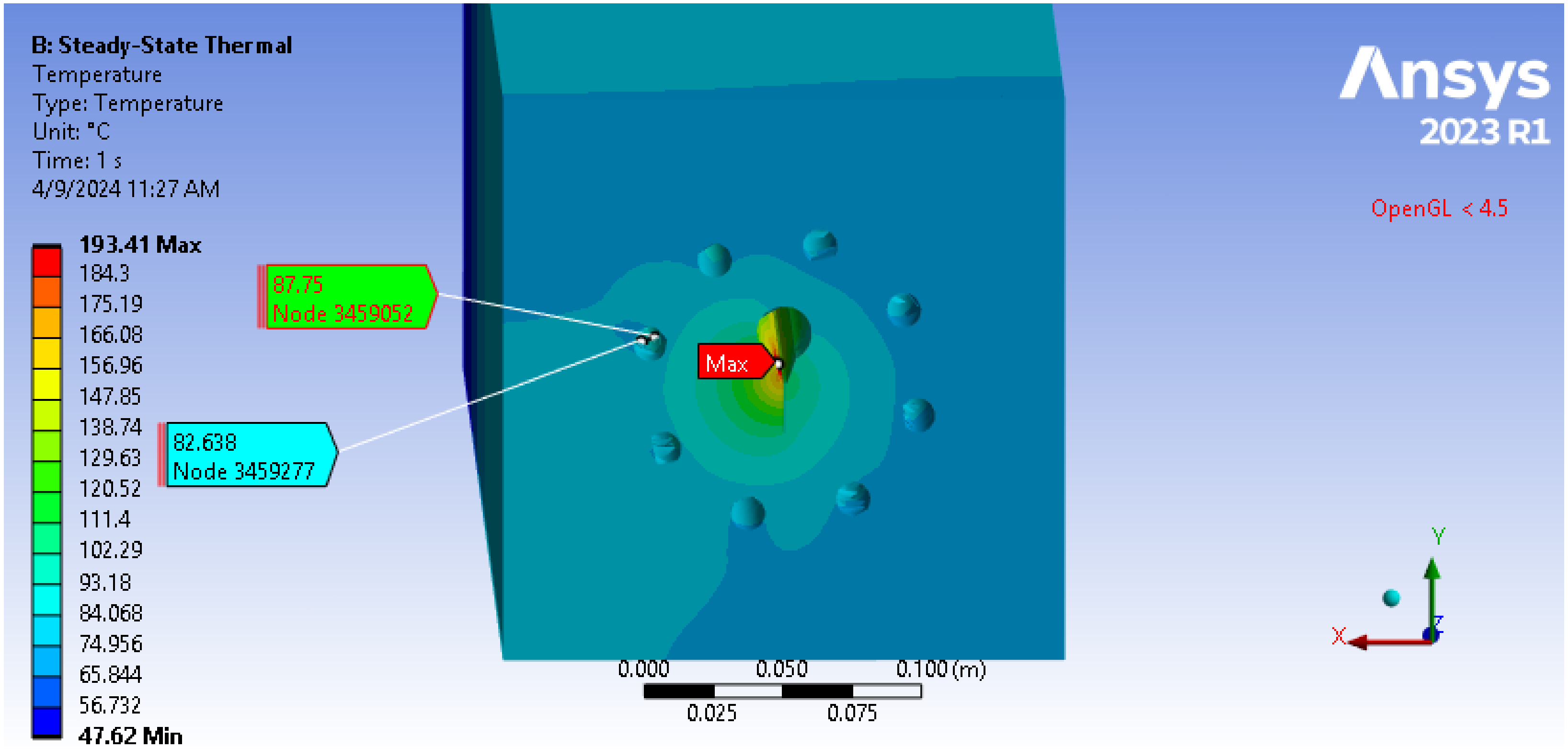
Pavel 78, .2mm mesh at bottom of keyhole, 40C water, 5000w/M^2-K, ½" holes on 5cm from center. 51.14KW , 1mm X offset



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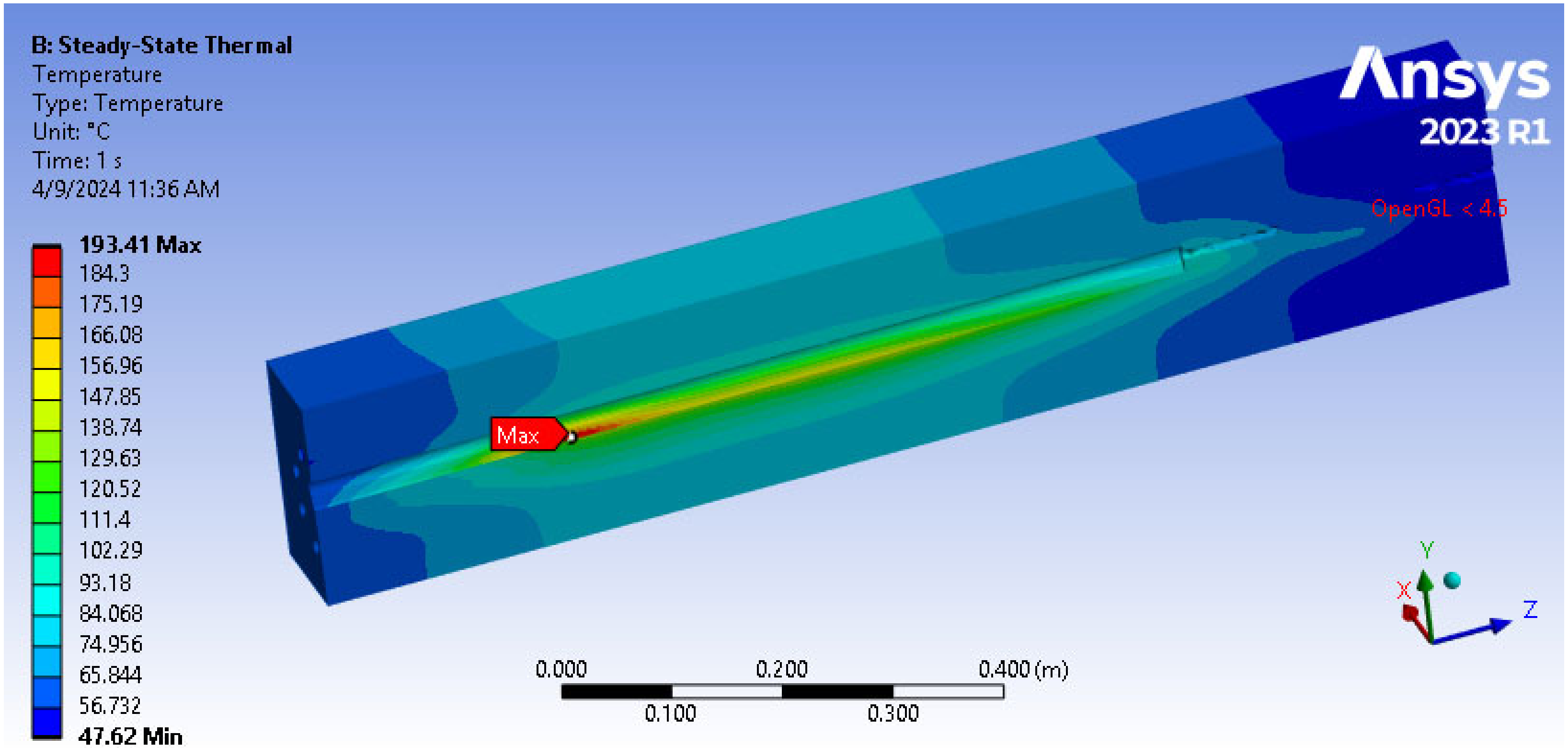

Max wall temp at water channel = 90C

h= 5059W/m^2-K

KLong CPS 52KW total, 4circuits LCW, max pump cap. 20 gpm

	Units		Units		Units			
d		12.7	mm	0.0416667	ft	0.0127	M	ID of tube
L	10	m	10000	mm				
epsilon				0.000005	ft	e/d =	0.00012	
nu	0.00000929	ft^2/sec	at 37°C					
Coil Power	13	kW	13000	W				

Twater-in 41 C

$$v = -2\sqrt{\frac{2g\Delta P}{0.433}\frac{d}{L}}\,\log_{10}\left(\frac{\varepsilon}{3.7d} + \frac{2.51}{\frac{d}{\nu}\sqrt{\frac{2g\Delta P}{0.433}\frac{d}{L}}}\right)$$

$$\frac{1}{\sqrt{f}} = -2\log_{10}\left(\frac{\varepsilon}{3.7d} + \frac{2.51}{\frac{d}{\nu}\sqrt{\frac{2g\Delta P}{0.433}\frac{d}{L}}}\right)$$

$$q\left(\frac{gpm}{circuit}\right) = v\frac{\pi d^2}{4} = v\left(\frac{ft}{\sec}\right)\frac{\pi d^2}{4}\left(ft^2\right)\times\frac{gal}{0.1337\,ft^3}\times 60\,\frac{\sec}{\min}$$

$$\left(\frac{\varepsilon}{3.7d} + \frac{2.51}{\frac{d}{\nu}\sqrt{\frac{2g\Delta P}{0.433}\frac{d}{L}}}\right)$$

$$Re = \frac{vd}{\upsilon}$$

$$\Delta T = \frac{3.8P}{q}$$

DeltaP	$\sqrt{\frac{2g\Delta P}{0.433}\frac{d}{L}}$			f	v	Re	q	DT
(psi)	(ft/sec)	(no units)	(no units)		(ft/sec)		(gpm)	(deg.C)
2	0.614632957	0.0009429	6.0510294	0.0273112	3.7191621	16680.849	2.275790863	21.70674
3.2	0.777456028	0.0007523	6.247271	0.0256224	4.8569785	21784.08	2.9720316	16.621627
8	1.229265914	0.0004877	6.6237167	0.0227927	8.1423091	36519.147	4.98235682	9.9149864
20	1.94364007	0.0003204	6.9887206	0.0204741	13.583557	60923.741	8.311908658	5.9432799
40	2.748722147	0.000236	7.2540703	0.0190036	19.939424	89430.498	12.2011241	4.0488073
45	2.915460105	0.0002244	7.298013	0.0187755	21.277066	95429.968	13.01963995	3.7942678
50	3.073164786	0.0002145	7.3370058	0.0185764	22.547828	101129.48	13.7972315	3.5804284
55	3.223162419	0.0002061	7.3720129	0.0184004	23.761195	106571.56	14.5397025	3.3975936
60	3.366483352	0.0001987	7.4037437	0.018243	24.92458	111789.47	15.25158889	3.2390068
65	3.503946966	0.0001921	7.4327351	0.018101	26.04391	116809.78	15.93651731	3.099799
70	3.636217612	0.0001863	7.459403	0.0179718	27.124012	121654.16	16.5974426	2.9763622
75	3.76384281	0.0001811	7.4840761	0.0178535	28.168886	126340.54	17.23681085	2.8659594
80	3.887280139	0.0001764	7.5070189	0.0177445	29.181885	130883.95	17.85667477	2.7664725
85	4.006916653	0.0001721	7.5284467	0.0176437	30.165858	135297.18	18.45877729	2.6762336
90	4.12308322	0.0001682	7.5485376	0.0175499	31.123249	139591.18	19.04461364	2.5939093
95	4.236065323	0.0001645	7.5674404	0.0174623	32.056172	143775.44	19.6154782	2.5184194

P=mCpdeltaT
3.8 factor= 1kg/s=15.83gpm
Cp = 4.18 KJ/Kg*K
KW=KJ/s=(kg/s)(kj/kg*C)C

V	DP
8.1423091	8
13.583557	20
19.939424	40
21.277066	45
22.547828	50
23.761195	55

Heat Exchange with water at 70 psi DP

Twater =	5[illegible].85336988	C	average	62.70674 m
N_{ud} =	62		From Oliver & Meyer pap	
K =	0.623	W/MK	From White pg 550	
Pr =	4.84	extrapolate from White appendix F		
f =	0.[illegible]27407511	friction factor		
h =	Nud K/[illegible]	W/M^2 K		
h =	5059.700713			
q =	hA(Tw-Twall)	=	mCpdeltaT =	co
A =	piDL	use L for area inside cooling blocks, 2		
Twall =	80.09755618	ave	90.95093	max

h

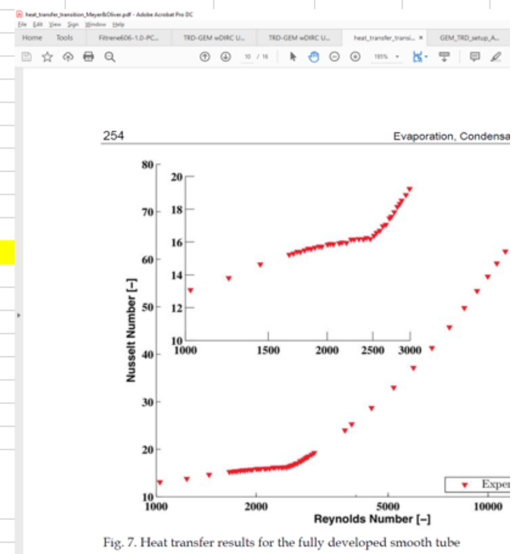

Fig. 7. Heat transfer results for the fully developed smooth tube

2 paral circuits | air-n2 Hx