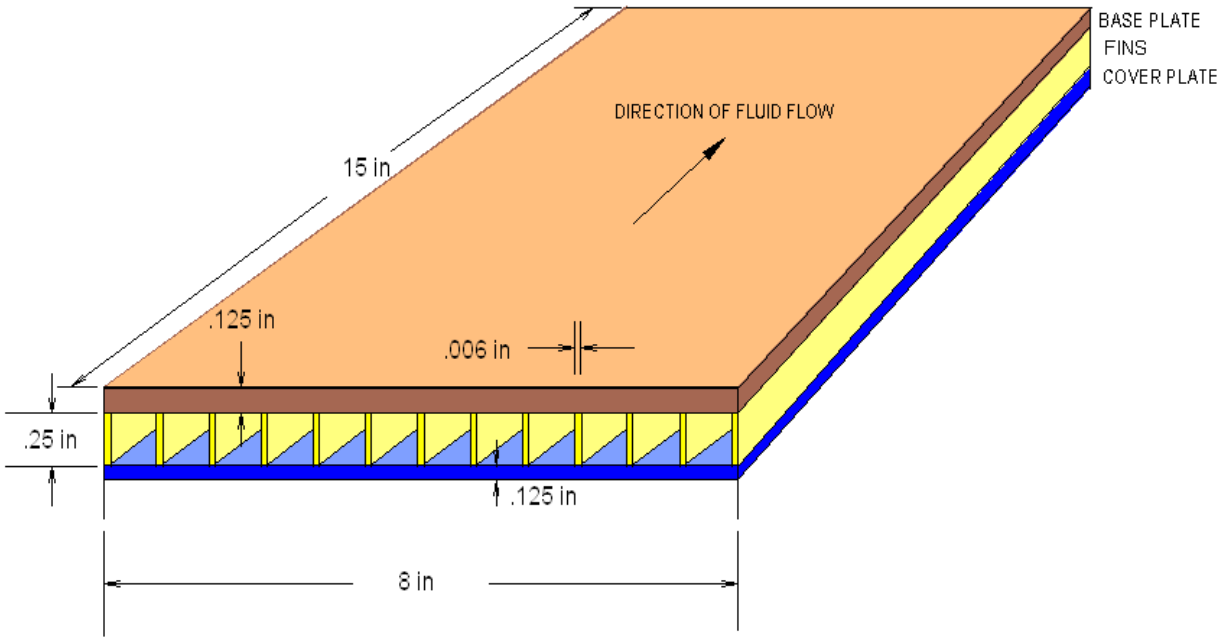
Kraus and Bar-Cohen Sample Problem 15.9 Comparison

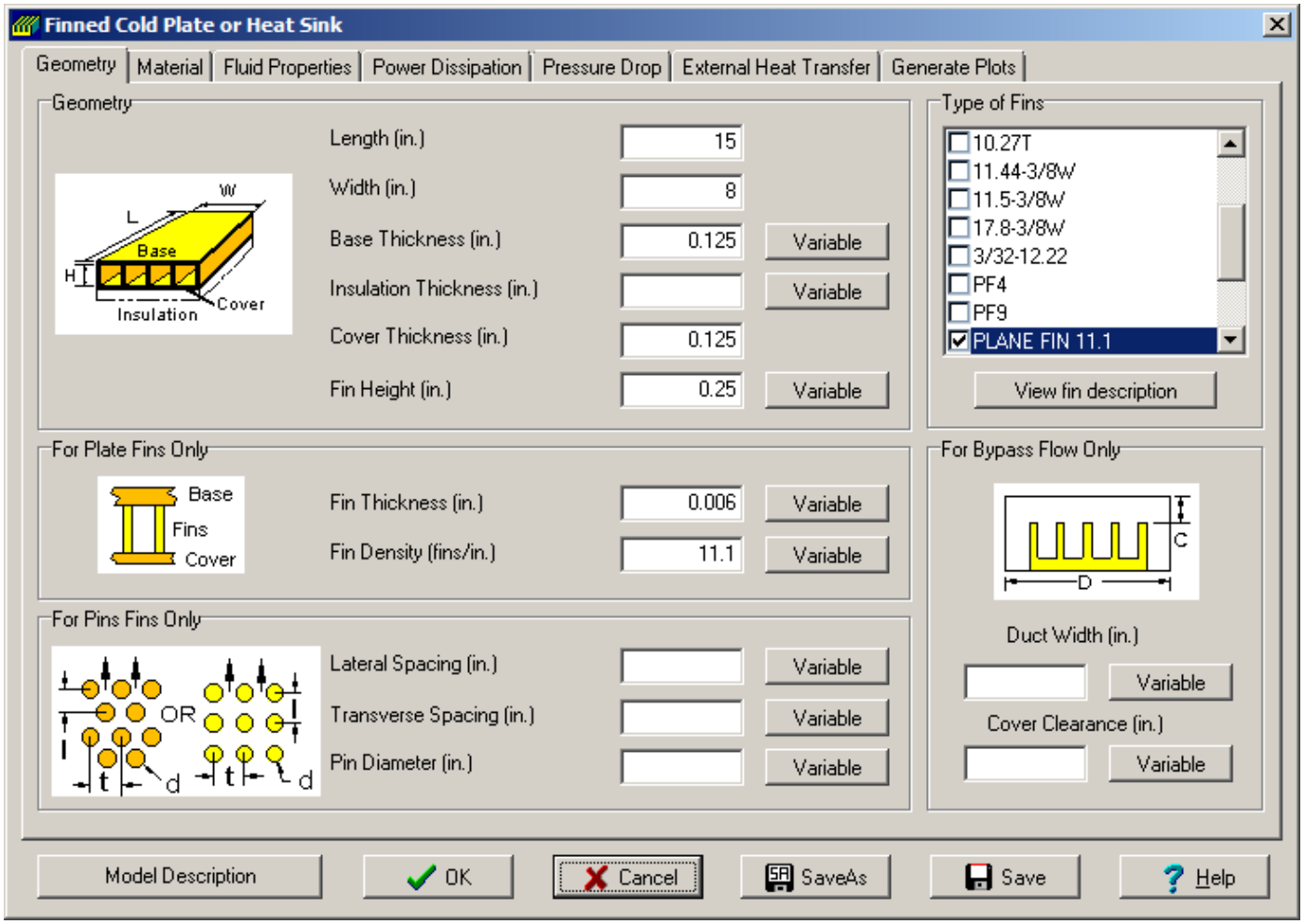
Compare the results of sample problem 15.9 of Allan Kraus and Avram Bar-Cohen book "Thermal Analysis and Control of Electronic Equipment" to COLDPLATE results.

Below is a list of input parameters for their sample problem.

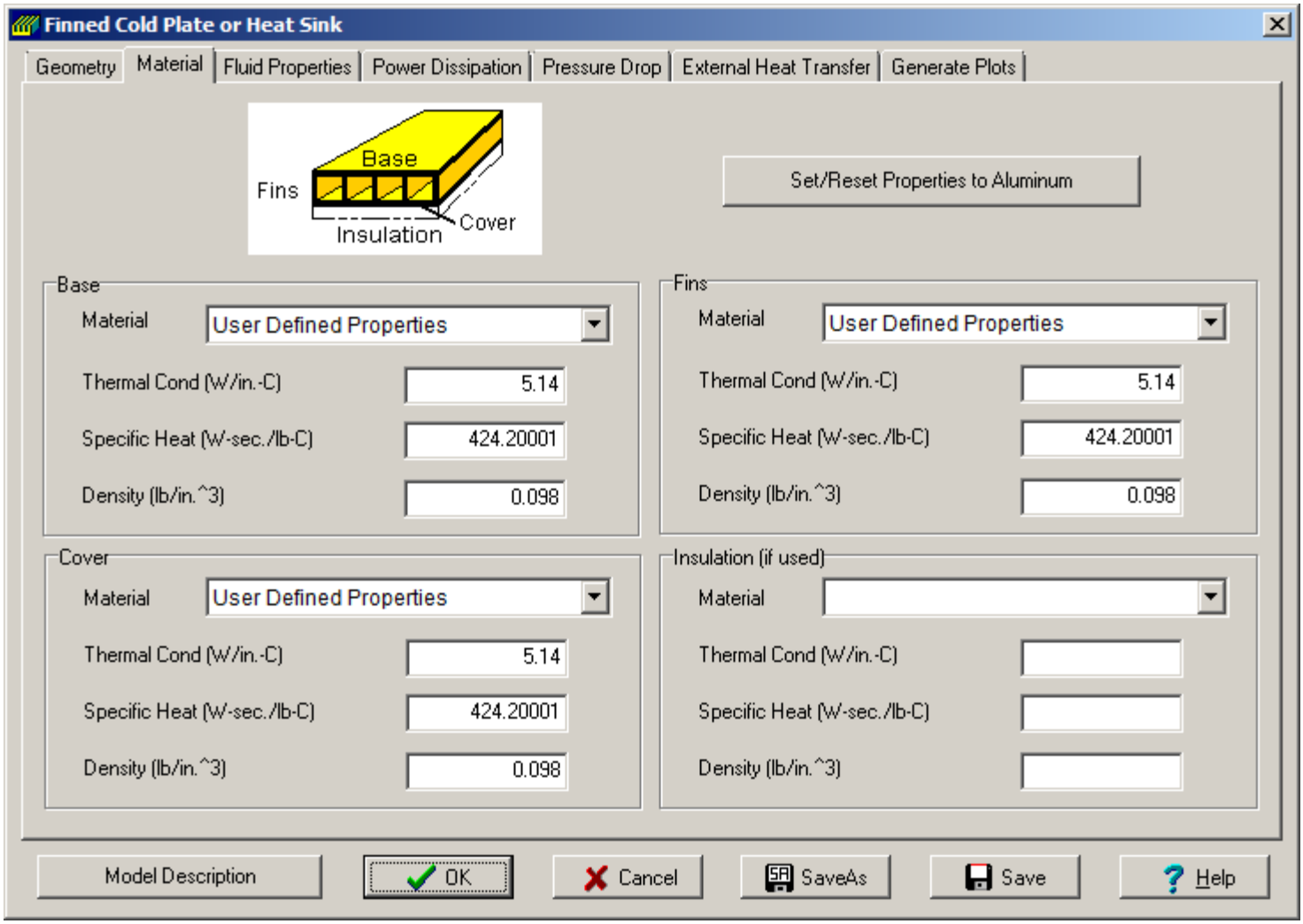
- Length L is 15 inches
- Width W is 8 inches
- Fin height H is .25 inches
- Fins are to be .006 inches thick
- Fin type is rectangular 11.1
- The fin density is 11.1 fins/inch
- Cover plate is .125 inches
- Base plate is .125 inches thick
- The inlet fluid temperature is 12.8C
- The inlet fluid pressure is 14.7 PSI
- Cooling fluid is air
- Mass flow rate is 1.56 lb/min
- 1000 Watts on one side, uniformly distributed
- Base, fins and cover are made of aluminum, K = 5.14 W/(in-C)



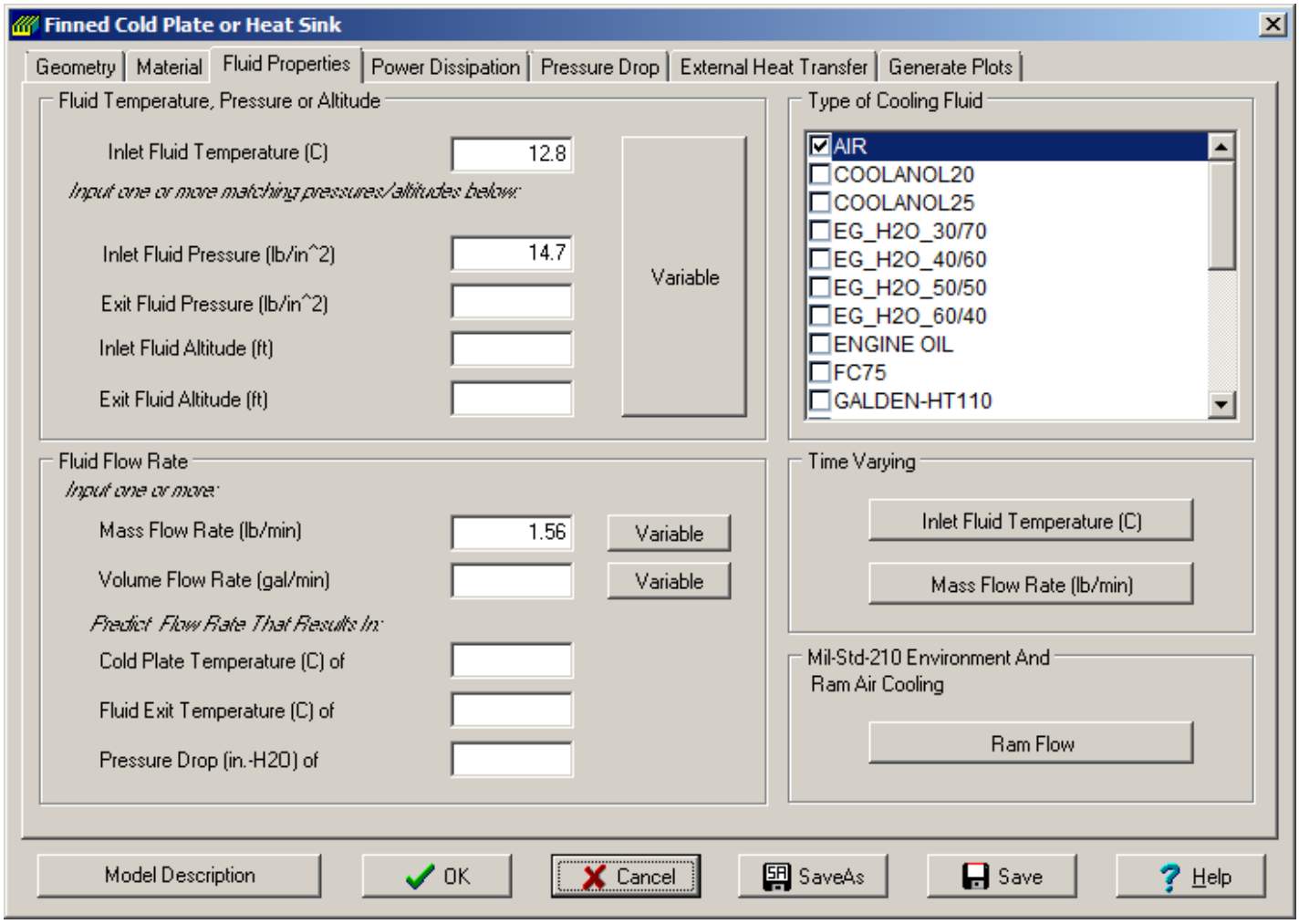
Input the geometry on this tab sheet.



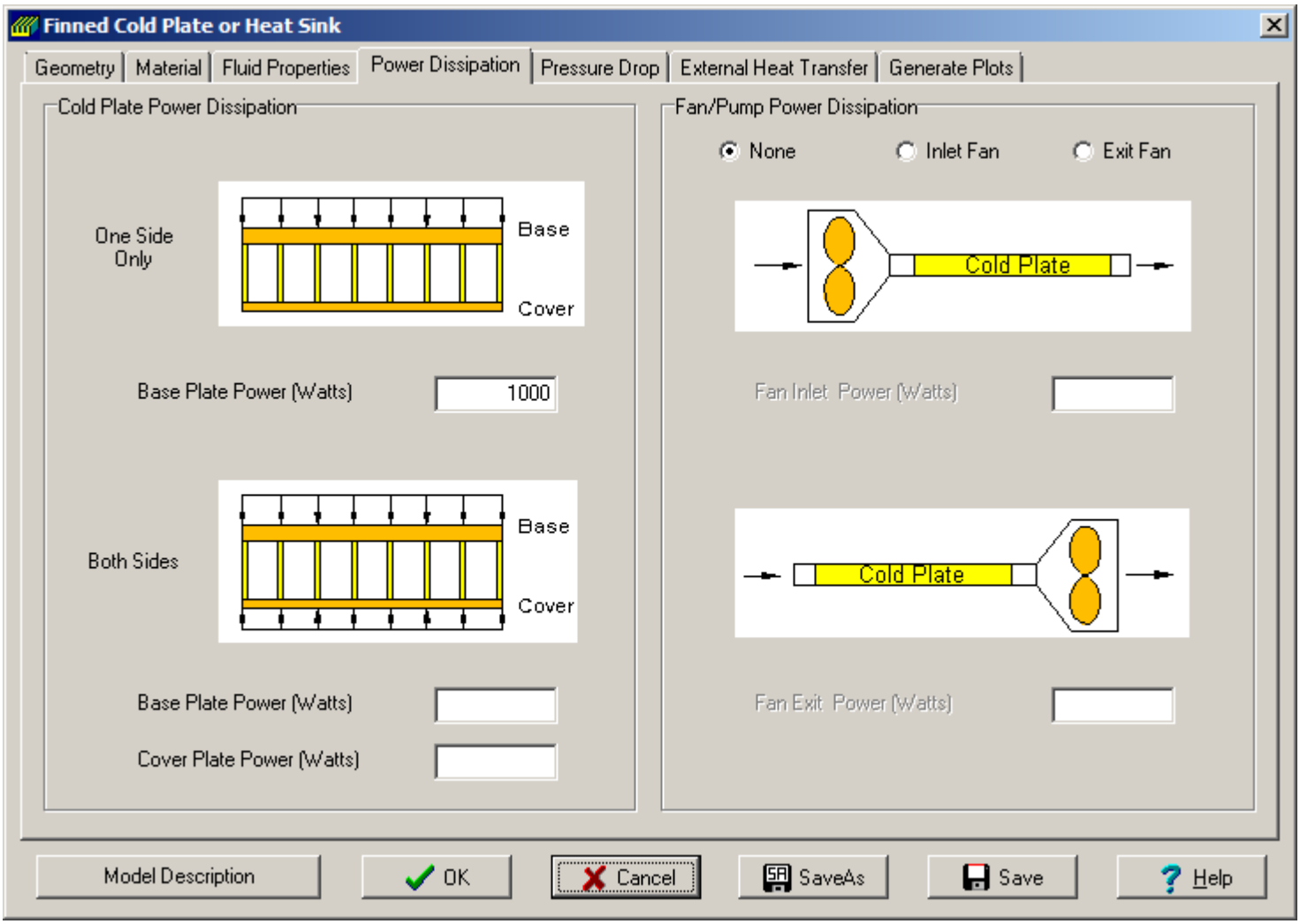
Input the base plate, cover and fin conductivity on this tab sheet.



Input the temperature, pressure, flow rate and air as the fluid on this tab sheet.



Input the power dissipation on this tab sheet.



Here are the results with power on both sides

FINNED MODEL WITH HEATING ON ONE SIDE ONLY

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************************ VARIABLE INPUTS ***************************
THE TYPE OF FINS SPECIFIED ARE:                      PLANE FIN 11.1
FIN HEIGHT, INCHES                                          0.250
BASE THICKNESS, INCHES                                      0.125
FIN THICKNESS, INCHES                                       0.0060
FIN DENSITY, FINS PER INCH                                 11.1
STATIC INLET FLUID TEMPERATURE, DEG C                      12.8
INLET PRESSURE, LBS/IN2                                    14.70
MASS FLOWRATE, LBS/MIN                                      1.56
THE POWER APPLIED TO ONE SIDE ONLY, WATTS                1000.00
THE COOLING FLUID IS:                                 AIR

**************** INTERMEDIATE CALCULATED PARAMETERS ****************
FREE FLOW CROSS SECTIONAL AREA, IN2                         1.867
HYDRAULIC DIAMETER, INCHES                                  0.126
COLDPLATE WEIGHT, LBS                                       3.14
TOTAL VOL FLOWRATE,     [GAL/MIN] FT3/MIN [  170.99]       22.858
COLDPLATE VOL FLOWRATE, [GAL/MIN] FT3/MIN [  170.99]       22.858
COLDPLATE VELOCITY, FT/SEC                                 29.39
AVERAGE DENSITY, LB/FT3                                     0.068
AVERAGE CONDUCTIVITY, W/(IN-C)                              0.00072
AVERAGE SPECIFIC HEAT, W-MIN/(LB-C)                         7.622
AVERAGE DYNAMIC VISCOSITY, LB/(MIN-IN)                      0.000066
PRANDTL NUMBER                                              0.702
REYNOLDS NUMBER                                          1596.
EQUIVALENT FRICTION LOSS COEFFICIENT, KFRICTION             7.00
INLET LOSS COEFFICIENT, KINLET                              1.10
EXIT LOSS COEFFICIENT, KEXIT                               -0.07
FILM COEFFICIENT, [BTU/(HR-FT2-F)] W/(IN2-C)  [   9.74]     0.0357
THE FIN EFFICIENCY WITH HEAT ON ONE SIDE ONLY IS            0.938

*************************** PRESSURE *******************************
INLET PRESSURE, [LB/IN2] INCHES-H2O      [ 14.700]        407.077
INLET PRESSURE DROP, INCHES-H2O                             0.293
ACCELERATION PRESSURE DROP, INCHES-H2O                      0.093
FRICTIONAL PRESSURE DROP, INCHES-H2O                        1.233
EXIT PRESSURE DROP, INCHES-H2O                             -0.173
TOTAL PRESSURE DROP, INCHES-H2O                             1.446
EXIT PRESSURE, [LB/IN2] INCHES-H2O       [ 14.648]        405.631
DENSITY RATIO TIMES PRESSURE DROP, INCHES-H20               1.2896

*********************** THERMAL RESISTANCE ************************
THERMAL RESISTANCE FROM INLET FLUID TO COLDPLATE, C/W       0.091
THERMAL RESISTANCE FROM LOCAL FLUID TO COLDPLATE, C/W       0.033

************************** TEMPERATURES ****************************
STATIC INLET FLUID TEMPERATURE, DEG C                      12.8
STAGNATION FLUID TEMP RISE ALONG COLDPLATE, DEG C          84.1
TOTAL STAGNATION FLUID TEMP RISE, DEG C                    84.1
STATIC EXIT FLUID TEMPERATURE, DEG C                       96.9
ISOTHERMAL COLDPLATE TEMPERATURE, DEG C                   104.2
MAXIMUM COLDPLATE TEMPERATURE, DEG C                      130.2
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Comparison of results between Kraus and Bar-Cohen, and COLDPLATE:

	Kraus and Bar-Cohen	COLDPLATE
Isothermal Temp - C	103.6	104.2
Pressure Drop - in H2O	1.46	1.45