

Engine Specifications					
	Metric		Imperial		
Engine Displacement :	6.997	L	427	cu.inch	
Maximum Engine Speed :	8000	rpm			
Engine Free Airflow at Atmospheric Pressure :	0.466	m ³ /sec	988	cfm	
Peak Boost Pressure :	275.790	kPa	40	psi	
Engine Free Airflow at Peak Boost Pressure :	1.736	m ³ /sec	3679	cfm	
Inlet Air Heat Load Analysis					
Intake Air Temperature @ Air Cleaner :	35.0	°C	=	308.15	°K
Intake Air Temperature @ I.C. Inlet :	230.0	°C	=	503.15	°K
Intake Air Temperature @ I.C. Outlet :	25.0	°C	=	298.15	°K
Intake Air Flowrate :	104.2	m ³ /min	=	1.73618	m ³ /sec
Atmospheric Air Pressure :	101.325	kPa	=	14.696	psi
Intake Air Density :	0.87283	m ³ /kg			
Intake Air Mass Flowrate :	1.98915	kg/sec			
Intake Air Enthalpy @ I.C. Inlet :	504.911	kJ/kg			
Intake Air Enthalpy @ I.C. Outlet :	299.194	kJ/kg			
Required Heat Transfer to I.C. Water :	409.203	kW	=	548.530	hp
Constant Pressure Specific Heat of Air :	1.0035	kJ/(kg.K)			
Atmospheric Pressure :	101.325	kPa			

Intercooler Structure Design							
Tube Data							
Tube Width (a) :	90.500	mm					
Tube Depth (b) :	4.500	mm					
Tube Cross-sectional Area :		mm ²					
Tube Surface Area per Lineal Metre :		mm ²					
Fin Data							
Fin Thickness (c) :	0.370	mm					
Fin Spacing (d) :		fpi					
Fin Pitch (e) :		mm					
Intercooler Structure Size							
Number of Intercooler Assemblies :	2						
Inlet Tank Width (f) :	178	mm					
Inlet Tank Length (g) :	280	mm					
Intercooler Core Assembly Depth (h) :	424	mm					
Number of Tubes per Core :							
Number of Cores :	4						
Total Cross-sectional Area for Cooling Water Flow :	0.021665	m ²			Equivalent Diameter :	166.1	mm
Total Tube Surface Area for Cooling Water Contact :	11.438623	m ²					
Number of Fins per Length of Tube :							
Fin Length :		mm					
I.C. Core Fin Gap Cross-sectional Area :		mm ²					
I.C. Core Airflow Cross-sectional Area :		mm ²					

I.C. Plumbing Air Speed					
Intercooler Plumbing Pipe Diameter :	3.0	inches	76.2	mm	
Pipe Wall Thickness :	2.0	mm			
Number of Inlet Pipes :	2				
Total Pipe Cross-sectional Area :	8188.3	mm ²		0.008188	m ²
Air Temperature (Post Turbo) :	230.0	°C		503.15	°K
Air Flowrate (Post Turbo) :	0.466	m ³ /sec		466.49	L/sec
Air Velocity (Post Turbo) :	56.970	m/sec		205.09	km/hr
Reynold's Number :	101742	Turbulent			
Tube Surface Roughness, E :	0.0015	mm			
Inlet Pipe Length :	1300	mm			
Friction Factor, f :	0.018	0.018			
Head Loss :	50.571	m.N/N			
Pressure Drop :	2171.736	Pa			
Total Pressure Drop :	0.315	psi			
Inlet Pipe to I.C. Core Cross-sectional Area Ratio :	6.903				
Air Velocity Through I.C. Core :	8.252	m/sec		29.71	km/hr
Time one molecule takes to travel through core only:	0.051	/ second			

Heat Transfer in a Rough Tube					
Tube Length :	0.280	m			
Tube Cross-sectional Area :		m ²			
Equivalent Tube Diameter :		mm			
Fin Height :		mm			
Relative Roughness :		mm			
Constant Tube Wall Temperature :	240	°C	=	513.15	K
Water Inlet Temperature :	12	°C	=	285.15	K
Outlet Temperature :	103.558	°C	=	376.71	K
Heat Transfer :	11.867	kW			
Core 1 Heat Transfer					
Heat Removed per Tube:	11.039	kW			
Heat Removed per Core :	154.546	kW			
Air Temperature Into Core :	230	°C	=	503.15	K
Air Temperature Out Of Core :	79.153	°C	=	352.30	K
Core 2 Heat Transfer					
Heat Removed per Tube:	2.162	kW			
Heat Removed per Core :	30.268	kW			
Air Temperature Into Core :	79	°C	=	352.30	K
Air Temperature Out Of Core :	48.999	°C	=	322.15	K
Core 3 Heat Transfer					
Heat Removed per Tube:	1.069	kW			
Heat Removed per Core :	14.966	kW			
Air Temperature Into Core :	49	°C	=	322.15	K
Air Temperature Out Of Core :	34.058	°C	=	307.21	K
Core 4 Heat Transfer					
Heat Removed per Tube:	0.598	kW			
Heat Removed per Core :	8.372	kW			
Air Temperature Into Core :	34	°C	=	307.21	K
Air Temperature Out Of Core :	25.692	°C	=	298.84	K

Ice Mass Analysis

Ice Initial Temperature :	-1.0	°C		272.15
Water Final Temperature :	7.0	°C		280.15
Heat Flow per Second :		J		
Mass of Ice :	1.130	kg	=	1.13
Heat Load Duration :	10.0	sec		
Total Mass of Ice Required :	11.296	kg		

Calculated at 50°C

Percentage		Specific Heat <i>kJ/(kg.K)</i>	Heat Capacity to Water <i>(%)</i>
Water <i>(%)</i>	Ethylene Glycol <i>(%)</i>		
100	0	4.1950	100.00
95	5	4.1090	97.95
90	10	4.0229	95.90
85	15	3.9369	93.85
80	20	3.8508	91.79
75	25	3.7648	89.74
70	30	3.6787	87.69
65	35	3.5927	85.64
60	40	3.5066	83.59
55	45	3.4206	81.54
50	50	3.3345	79.49
45	55	3.2485	77.44
40	60	3.1624	75.38
35	65	3.0764	73.33
30	70	2.9903	71.28
25	75	2.9043	69.23
20	80	2.8182	67.18
15	85	2.7322	65.13
10	90	2.6461	63.08
5	95	2.5601	61.03
0	100	2.4740	58.97

Specific Heat of Water : 4.1950 kJ/(kg.K)
 Specific Heat of Ethylene Glycol : 2.4740 kJ/(kg.K)