CHAPTER-4
DESIGN CALCULATIONS

4.1 Dimensions of Heatpipe:

Length of Heat pipe = 290 mm

Width of loop = 40 mm

Outer diameter of the heat pipe = 10 mm

Inner diameter of the heat pipe = 9 mm

Inner wick thickness = 1 mm

Internal fluid chamber diameter = 8 mm

Length of heatpipe evaporator region = 66.5 mm

Length of heatpipe adiabatic region = 58 mm

Length of heatpipe condensing region = 165.5 mm

4.2 Dimensions of Heatpipe Holder (Heat Exchanger):

Total length of the heat exchanger = 250 mm

Length of heatpipe holding portion = 50 mm

Width of heatpipe holding portion = 100 mm

Length of refrigerant flowing pipe = 250 mm

Number of heat pipes inserted in holder = 7 no's

4.3 Dimensions of Fins:

Length of fin = 200 mm

Width of fin = 150 mm

Thickness of the fin = 1 mm

The total number of Fins used of heat transfer is 7

4.4 Formulae Used for Calculation of COP:

Net work done in refrigeration unit (Wnet) = Wc - We

Where

Wc = work done by the condenser

We = work done by the evaporator

As the work done in the condenser and evaporator is due to heat transfer we can rewrite the equation as

$$Wnet = Qc – Qe$$

Where

Qc = heat transferred through condenser

Qe = heat transferred through evaporator

Generally the COP of refrigeration system is given as ratio of the heat transferred from evaporator to the net work done

$$COP = (Qe / Wnet)$$

$$= Qe/(Qc-Qe)$$

Here in this analysis the Qc value is reduced to Qc* this is due to reduction in the condenser out let temperature from

Qc= Tc (S2 — S3) (Here Tc=Temperature after leaving the condenser

Te=Temperature before entering evaporator

Qe = Te (S1 - S4)

From Refrigeration Circuit Process :

1-2 Compressor stage

2-3 Condenser stage

3-4 Expansion valve stage

4-1 Evaporator stage

Here the Te which is the temperature of the refrigerant before entering the condenser is reduced to Tc*

$$Tc^* < Tc$$

By introducing the inter cooler between compressor and condenser units the Tc is reduced to Tc* this is because of intercooling of refrigerent before entering the condenser now the new COP will be as

$$COP^* = Qe/(Qc^* — Qe)$$

As the Qc is reduced to Qc* because of this the denominator value is reduced due to decrease in the denominator value the COP value increases

4.5 CATIA DESIGN :

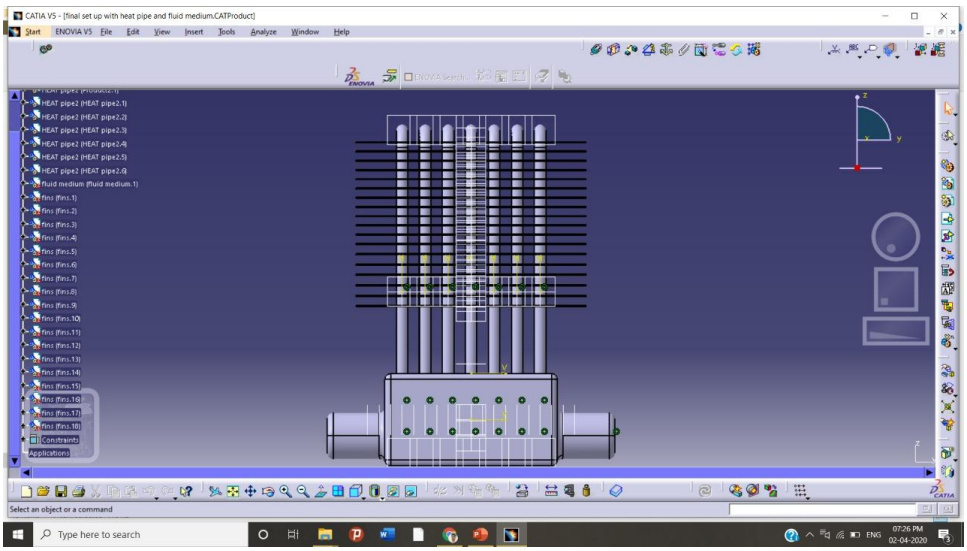

FIGURE 4.1 TOP VIEW OF HEAT PIPE

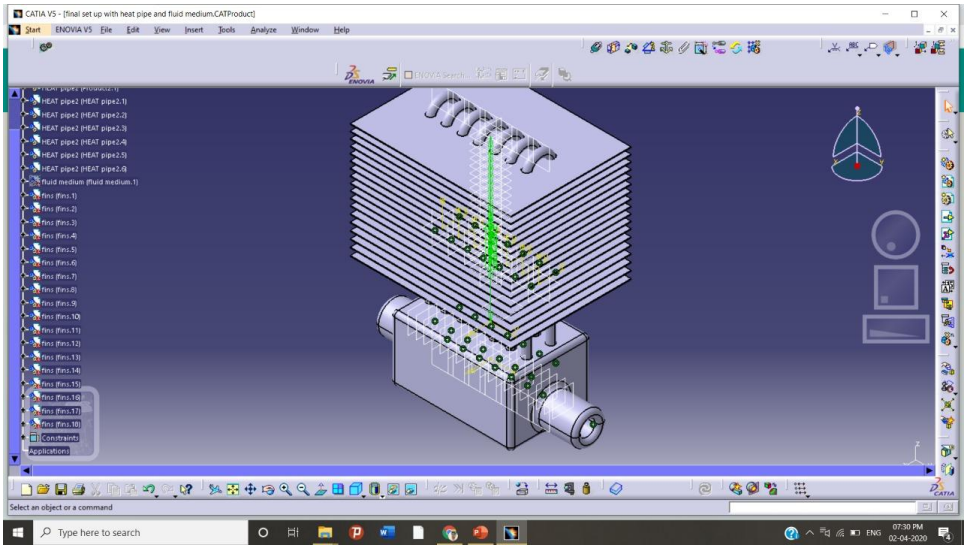

FIGURE 4.2 CATIA MODEL HEAT PIPE