

# A Heat Pipe Design for the ARIES.ST Center Post

## Fundamental of Operating Principles

- > **The Heat Pipes Operate On a Closed Two-Phase Cycle.**
- > **The Heat Pipes Utilize the Latent Heat of Vaporization ( As Opposed to Sensible Heat) to Transfer Heat With Very Small Temperature Gradient.**
- > **Heat Pipes Utilize Some Sort of Capillary Wicking Structure to Promote the Flow of Liquid From the Condenser To the Evaporator.**
- > **Heat Pipes can Operate in a Horizontal Orientation, Micro-gravity or Where we Must Pump the Liquid Against Gravity**
- > **The Heat Pipes Operate as a thermal Super conducting Device.**

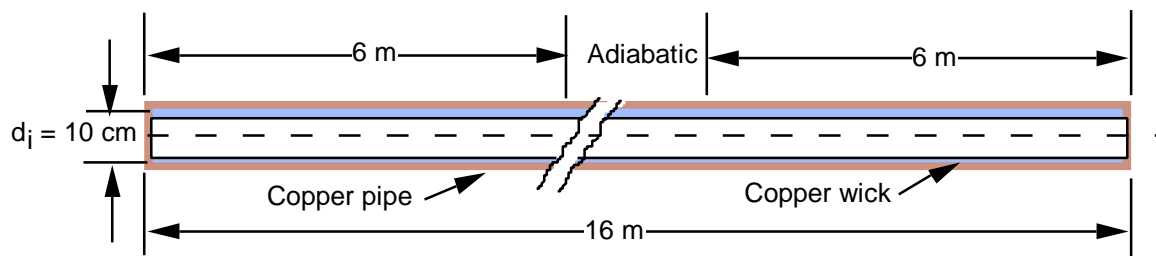


Fig. 1. A Schematic of a heat pipe.

- > As the Wick Thickness Increases the Maximum Heat Transport Due to Capillary Limit Increases. Also, the Maximum Heat Transport Due to Boiling Limit Decreases.
- > Figures. 1 to 5 Show the Variation of different Limits with the Wick Thickness.
- > The Top Part of the Center Post is the Only Immediate Heat Sink in the System.
- > To Run the Heat Pipe Successfully; the Operating temperature of the Heat Pipe must be Less than the surrounding at the Heat Pipe Condenser.
- > An Iterative Scheme must be used to Insure that Heat Pipe Performance is Adequate.

### Heat Pipe Thermal Transport Capacity as a Function of the Operating Temperature

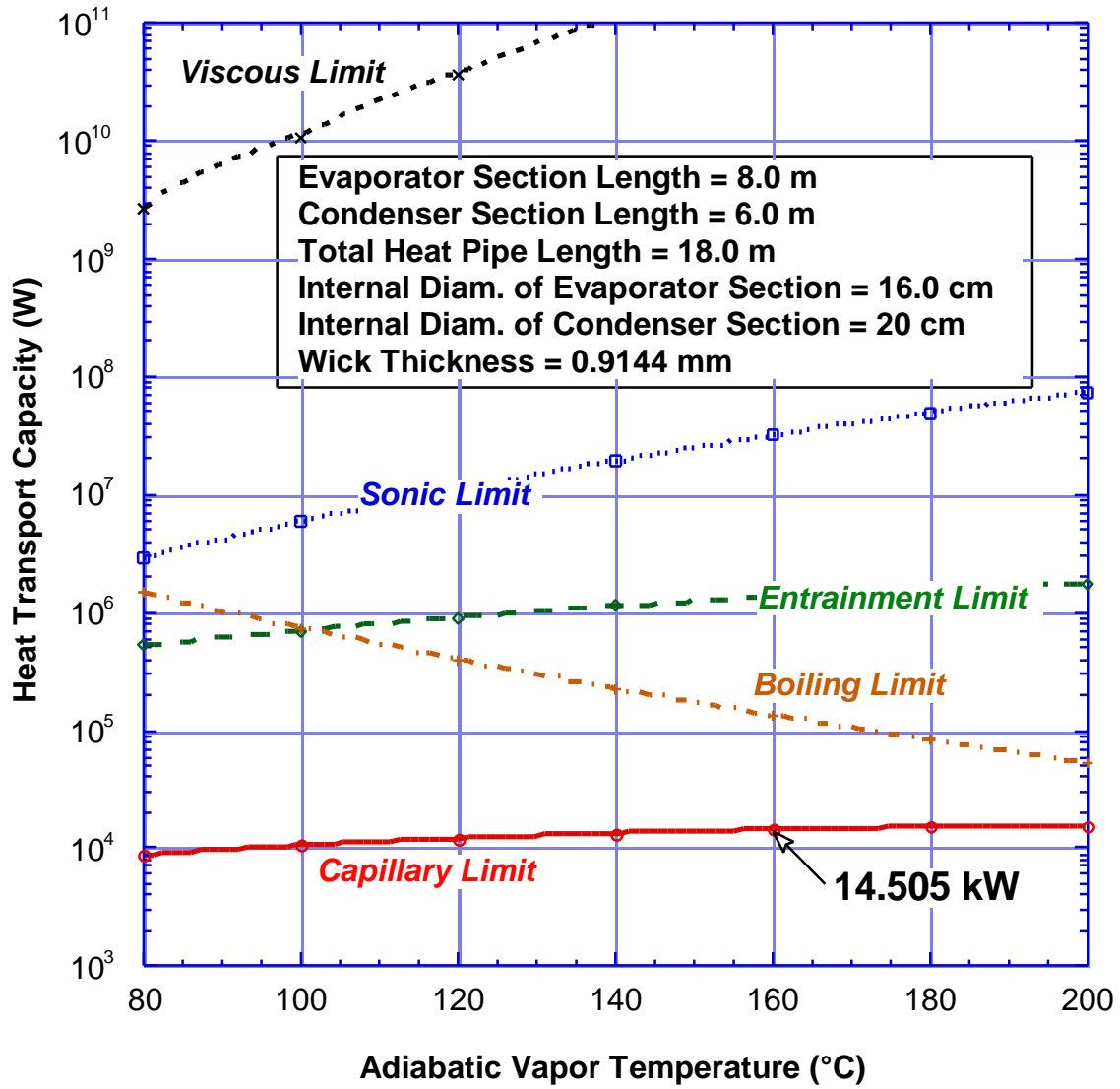


Figure 2.

### Heat Pipe Thermal Transport Capacity as a Function of the Operating Temperature

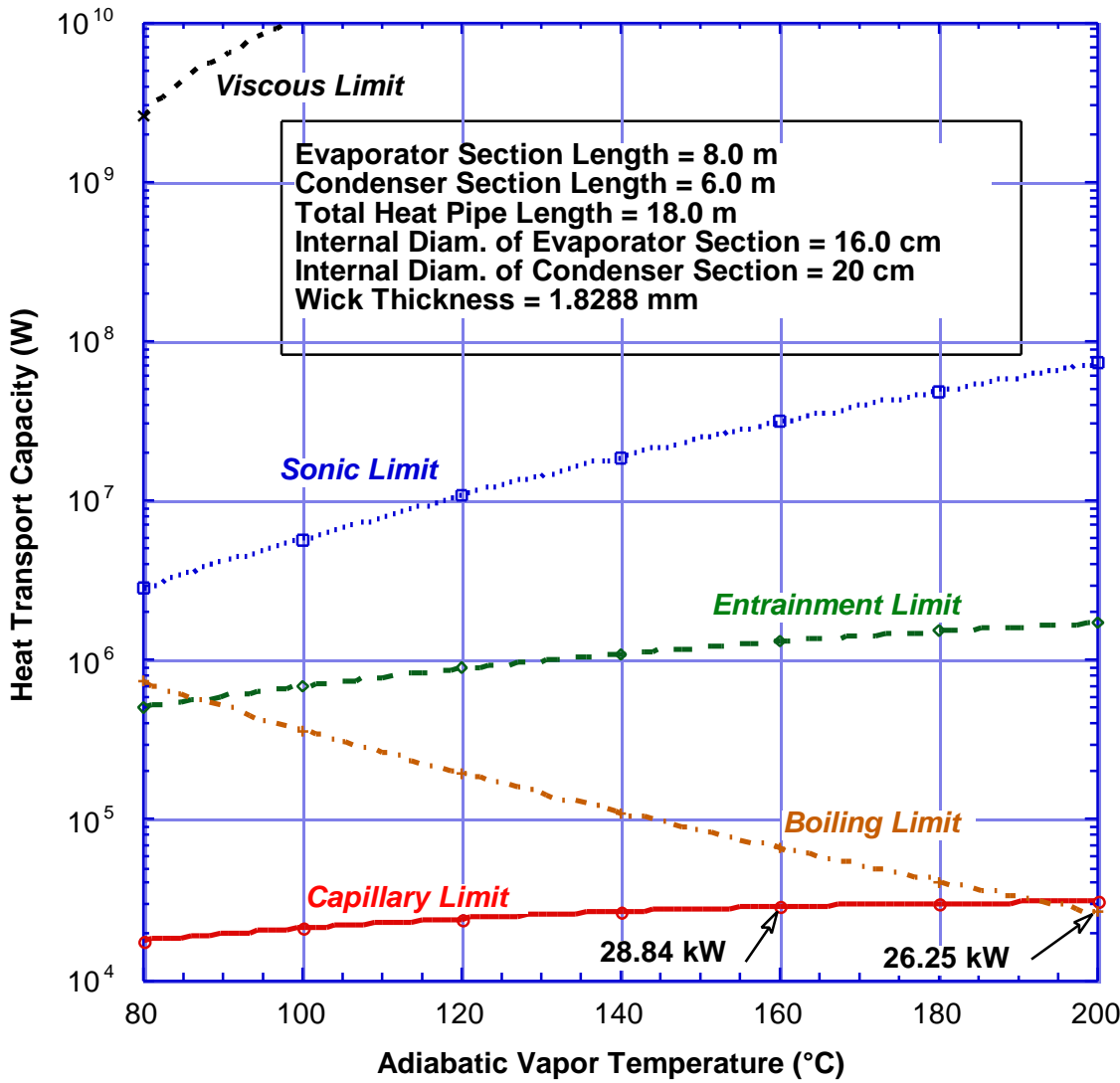


Figure 3.

### Heat Pipe Thermal Transport Capacity as a Function of the Operating Temperature

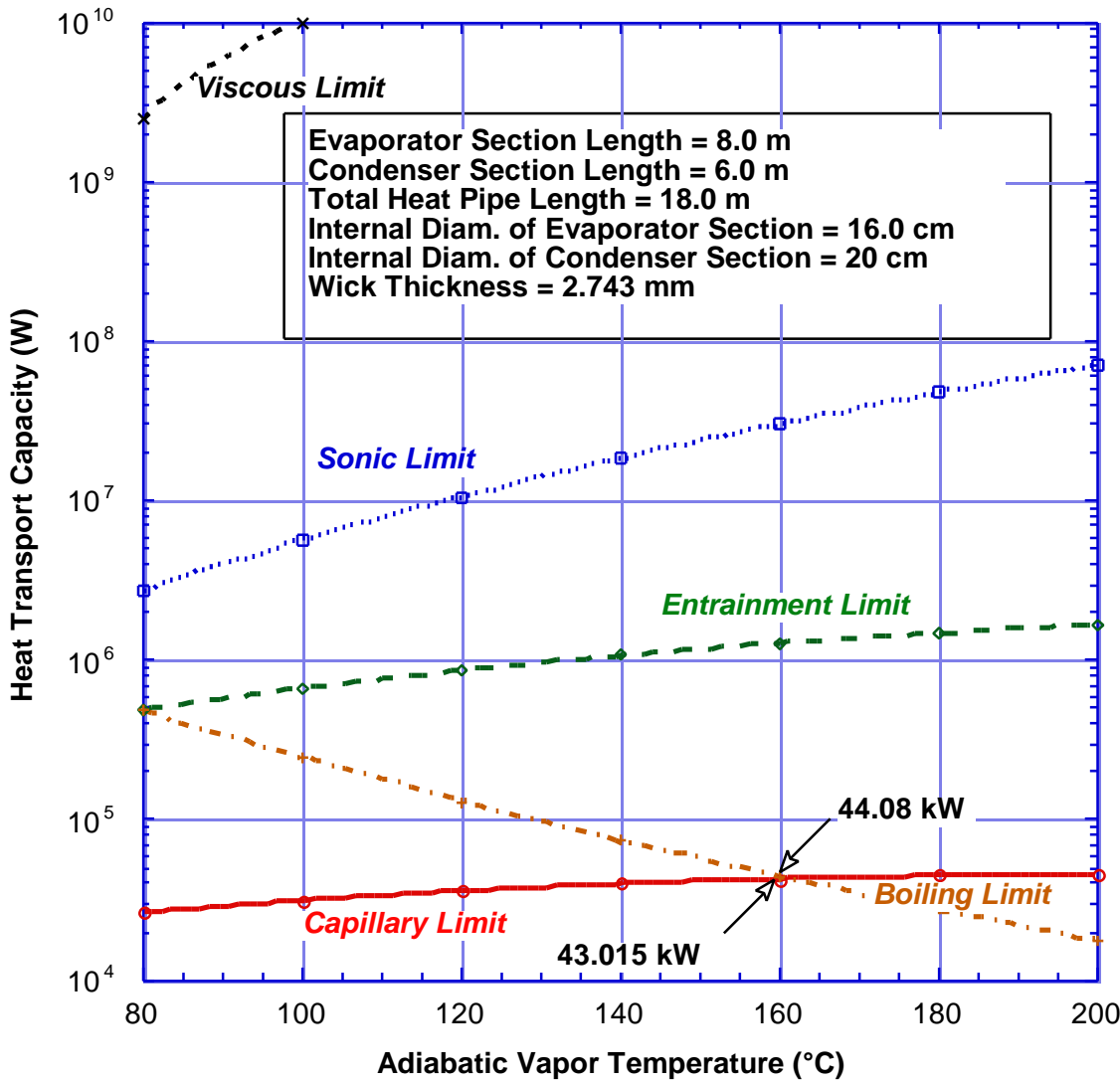


Figure 3.

### Heat Pipe Thermal Transport Capacity as a Function of the Operating Temperature

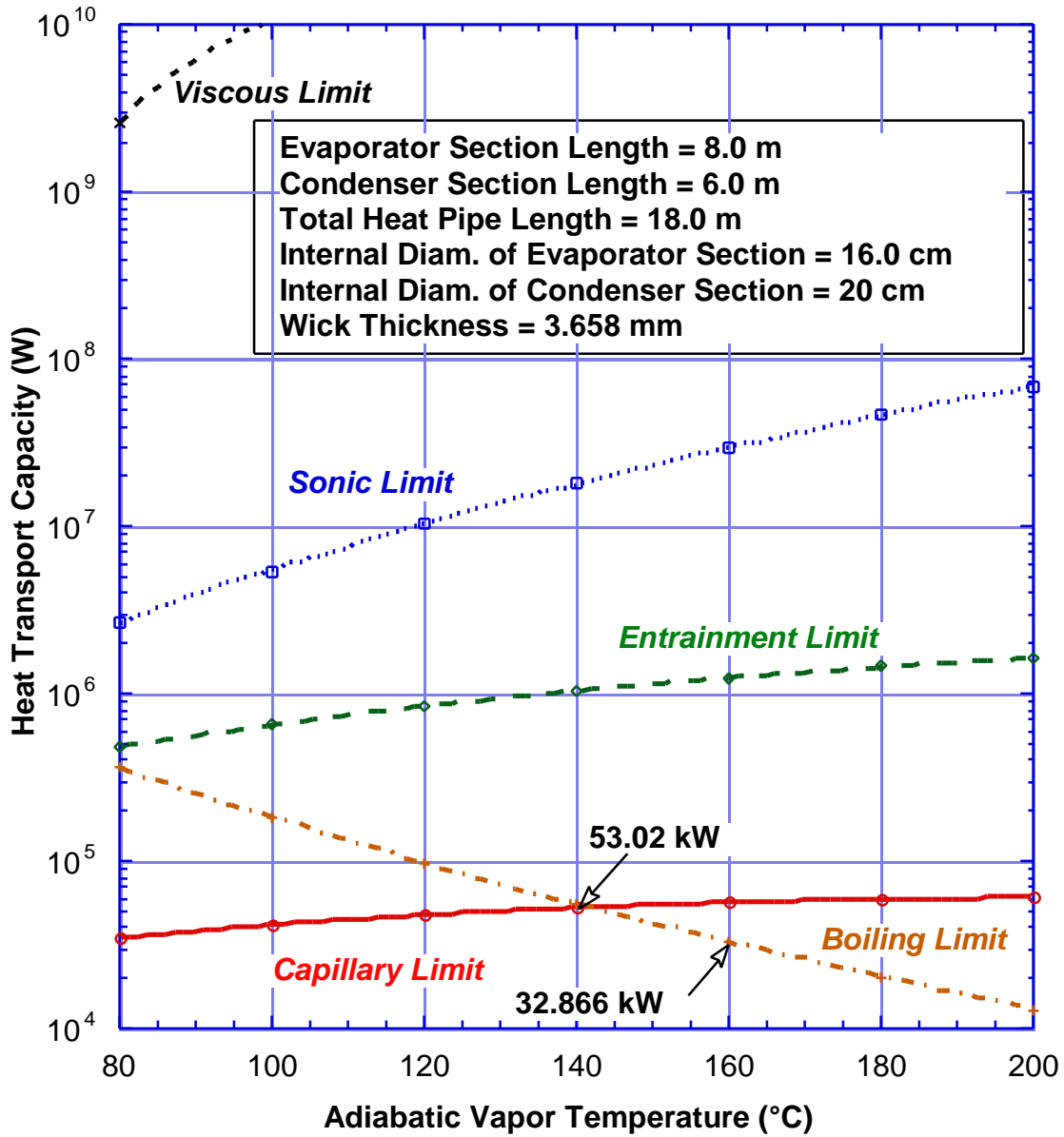


Figure 4.

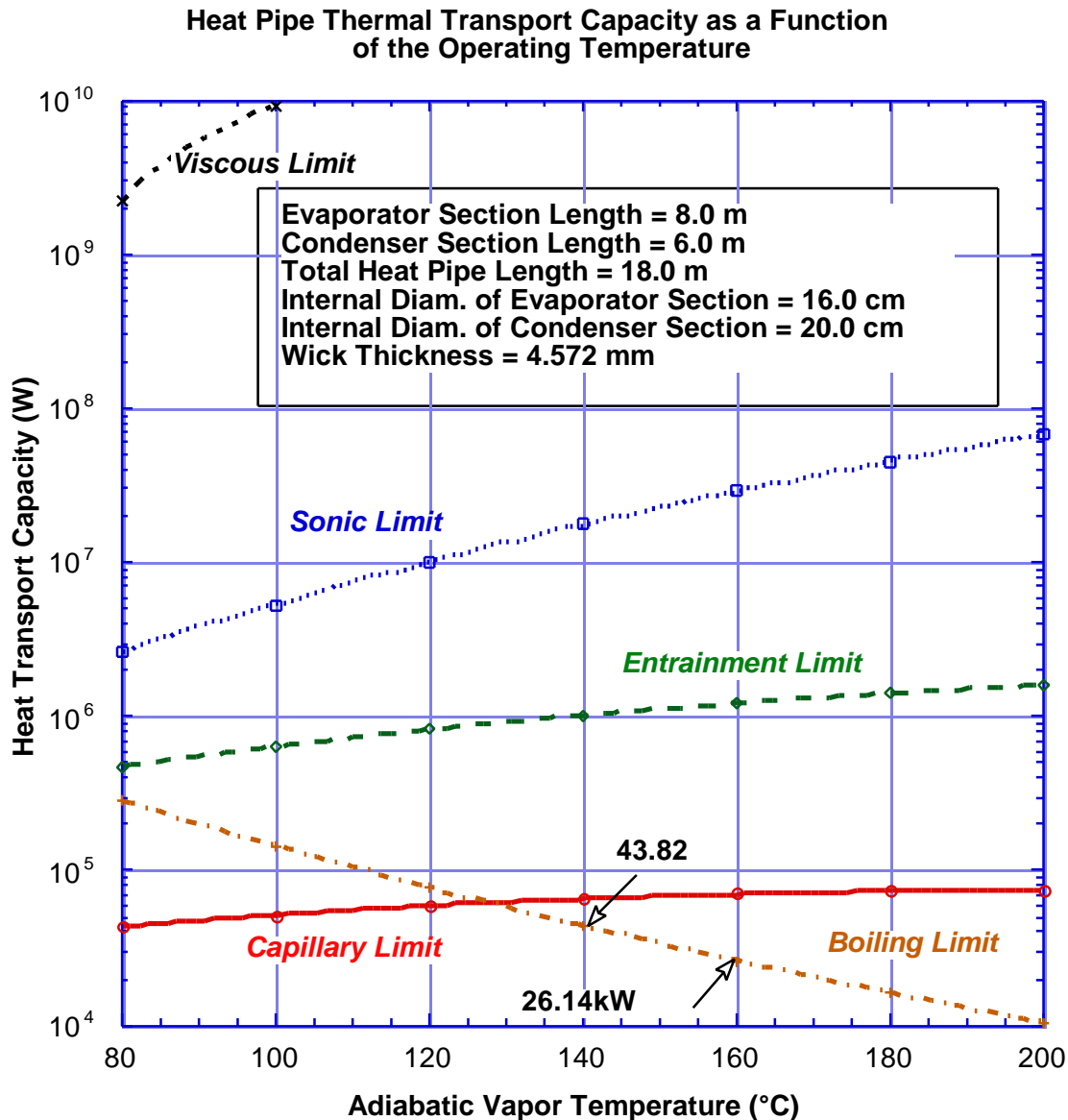


Figure 5.

> From Figure 3. the Heat Pipe Maximum Heat Transport Capacity at a Working Temperature of 160°C is 43 kW.

## *Design Conclusion*

> To Accommodate the Afteheat Generation 35 Heat Pipes (16 cm Diam.) Need to be Arranged And Distributed Uniformly Over the CP Cross Section. the Use of Many Small Heat Pipes Minimizes the Effect of Failure of Some of them During LOCA.