

Flexible Heat Pipe and Flexible Heat Pipe Cold Plate

For improved aerospace thermal control with a need for freedom of movement, minimum weight and maximum reliability, Aavid, Thermal Division of Boyd Corporation's custom flexible heat pipes (Figure 1) are an advanced heat pipe technology that provides an ideal solution.

These flexible heat pipes give design engineers the freedom to:

- ▶ Specify moving actuators, and remote terminals.
- ▶ Maintain thermal controls in rugged and demanding environments.
- ▶ Use as building blocks for innovative systems to meet emerging aerospace challenges.
- ▶ Vibration and isolation tested

Flexible heat pipes have been qualified for use in military aircraft — specifically, for cooling electronics on the **More Electric Aircraft**, and the **All Electric Aircraft**.

Flexible Heat Pipe Cold Plate (FHPCP)

Flexible Heat Pipe Cold Plate (FHPCP) (Figure 2), available in four configurations, solves cooling problems with a cold plate that transfers electronic heat to the most convenient heat sink via a flexible heat pipe. The flexibility allows relative motion between the heat sink and the component to be cooled — increasing durability and mean time between failures.

Key Features and Benefits

- ▶ Aircraft Level Vibration Tested: Met shock and acoustic noise design requirements, and test procedures for the aircraft equipment
- ▶ Thermal-Cycled Tested: Freeze/Thaw from -55°C to 135°C
- ▶ Bellows Flex Fatigue Tested to Over 5 million cycles with No Signs of Failure
- ▶ Shock Tested for Cooling Missile Avionics

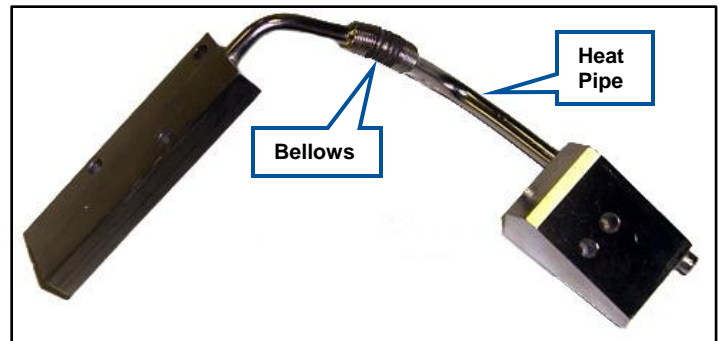


Figure 1 – Flexible Heat Pipe



Figure 2 – Flexible Heat Pipe Cold Plate

Critical Need Application

- ▶ Vibration Isolated Heat Sources
 - » Optical Sensors
 - » Radar Amplifiers
- ▶ Assemblies that Require Relative Motion
 - » Deployable Radiators
 - » Electro-Mechanical Actuators
 - » Molding/Tooling
- ▶ Challenging “Fit-Up” with Tolerance Stack-Up Issues
 - » Complex, Multiple-Part Assemblies
 - » Difficult to Assemble, Constrained Spaces

How Can Heat Pipes Be Made Flexible?

Heat pipes are made flexible by inserting a bellows section between the evaporator heat input section, and the condenser heat output section. Flexible heat pipes are made from a wide range of metal materials, and use a variety of working fluids, depending on the application.

Flexible heat pipes can be installed in either gravity-aiding, or against-gravity orientations. The against-gravity orientation is possible because of Aavid's proprietary flexible wick structures, which are used to return the working fluid to the evaporator section. The cold plate portion attaches to the surface to be cooled, and the other end attaches to the heat sink. The flexible section allows for ease of installation, and it accommodates any relative motion between the heat source and the heat sink. The condenser region can be cooled by air cooled fins, like many other Aavid's products.

Specifications – Flexible Heat Pipe Cold Plate	
Length	Up to 30 in.
Design Power	Up to 150 Watts
Weight	Typically less than 2 lbs.
Cold Plate Size	Up to 5" x 8" x 3/16" Solid Al
Heat Sink Attachment	Customer Specified
Working Fluid	Water
ΔT at 150 Watts	Typically Less Than 4 °C