

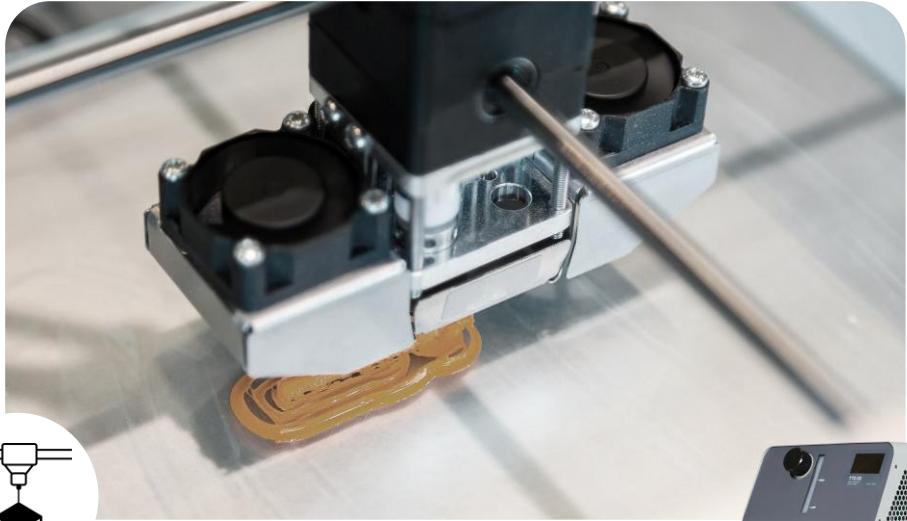


**Precise Thermal  
Management for  
Additive Manufacturing**

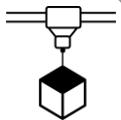
# Introduction

Additive Manufacturing enable:

- Rapid prototyping
- Workflow digitization
- Manufacturing of final products



Thermal management is required to



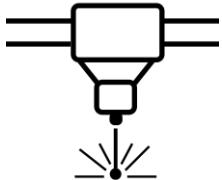
Cool laser and electronic beam optics

Cool power source

Control viscosity of liquid powder



# Application Overview



A Laser beam, electron beam, or a thermal heated printhead are used to melt material together and create a 3D object

## 3D Technology Applications

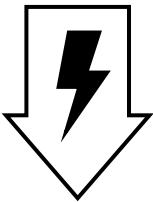
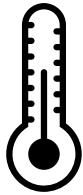
- Medical – casts, prostheses etc.
- Aerospace and automotive - light weighted parts
- Consumer goods

**\$36.6 Billion**

Expected additive manufacturing market by 2025 (up from USD 8.4 billion 2019)



# Application Challenges



## TEMPERATURE CONTROL

Require stable operating temperature of  $20^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$

## POWER CONSUMPTION

Maximizing performance while reducing power consumption

## VIBRATION AND NOISE

Loud, vibrating machines create dangerous work environment

## ECO-FRIENDLY

Governments phase out refrigerants with high global warming potential (GWP)

# Comparing Cooling Technologies

## Compressor-Based Refrigeration Systems

- High Coefficient of Performance (COP)



## Ambient Liquid Loop Systems utilizing Thermoelectric Coolers



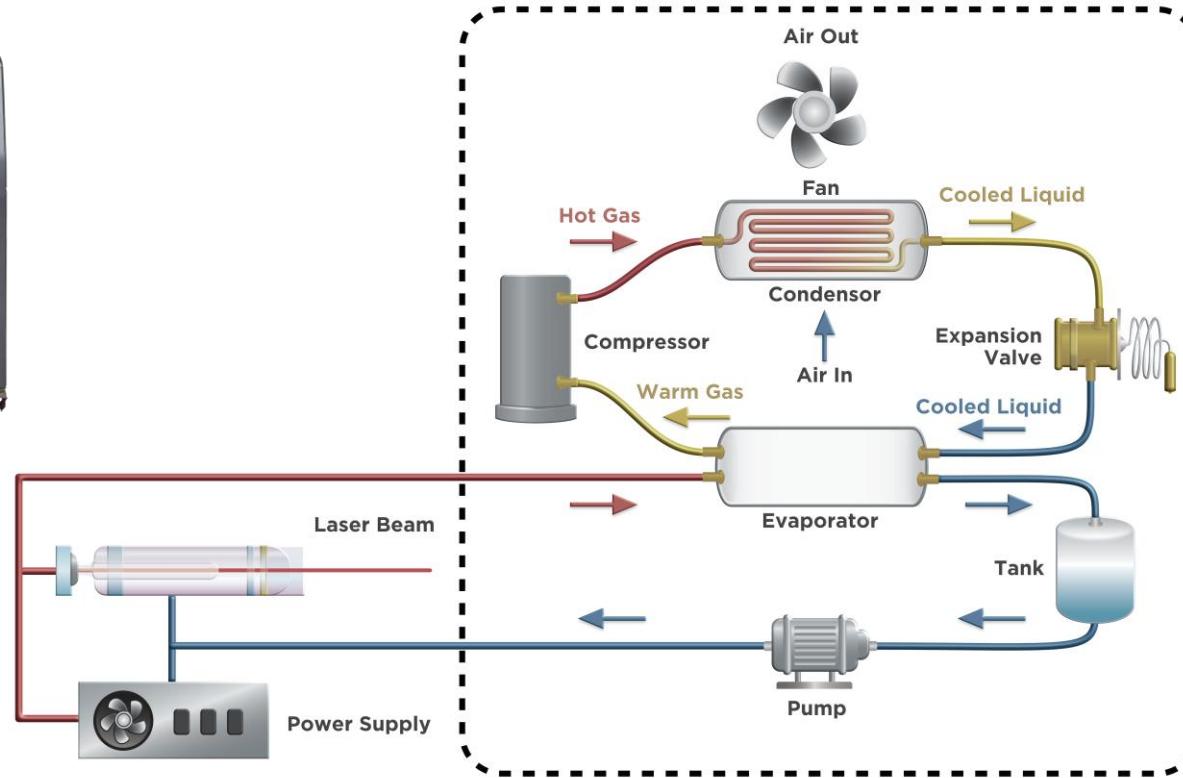
- Spot cooling of system components

Ability to cool to well below ambient temperatures



# Thermoelectrics in 3D Printers

Recirculating Chillers efficiently cool Additive Manufacturing systems



# VRC Chiller Series

The VRC Value Chillers offer OEMs a cost-effective and reliable thermal management solution that keeps sensitive electronics in industrial and analytical equipment at the optimum temperature.



The VRC Chiller is available in 1200 2700 and 4800 Watts

- **Precise Control** – Temperature stability to within  $\pm 0.5^{\circ}\text{C}$
- **High COP** – Achieves high COP to minimize power consumption
- **Low GWP** – Half the GWP compared to traditional hydrofluorocarbons (HFC) refrigerants
- **User-friendly** – LCD touchscreen display
- **High uptime** – Maintenance can be scheduled at any time

# UltraTEC™ UTX Series

## Premium thermoelectric coolers

- Precise Temperature Control**

Spot cooling allow for precise temperature control

- 296 Watts Heat Pumping Capacity**

Advanced thermoelectric materials for higher heat pumping capacity

- (ΔT) up to 72°C**

Improved temperature differential with higher thermal insulating barrier

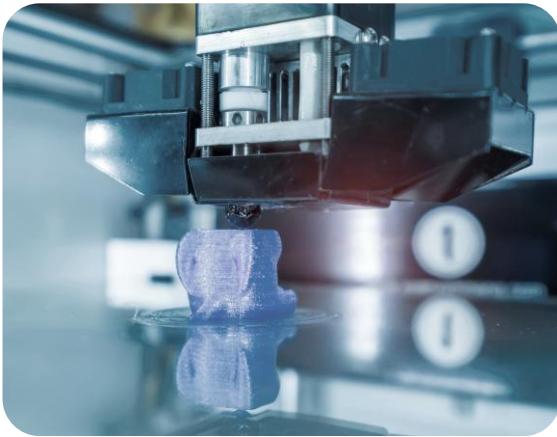
- Reliable Solid-State**

No moving parts, solid-state Peltier coolers significantly reduce maintenance and total ownership costs.



The UltraTEC™ UTX Series is offered in 13 models.

# Conclusion



## 3D PRINTING MACHINES REQUIRE ACTIVE COOLING

Ensures **maximum performance**  
and  
**long operating life**

## THERMOELECTRICS PROVIDE SPOT COOLING

**Reliable** and **cost-effective**  
cooling of components.

3D Printers require thermal management solutions for maximum performance

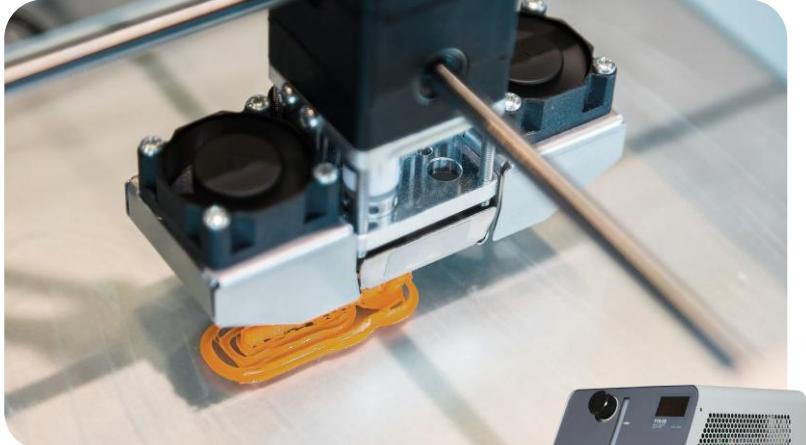
## THERMAL MANAGEMENT DESIGN CHALLENGES

Demands for **high performance**,  
**reduced energy consumption**,  
**environmentally friendly refrigerants**

## VRC CHILLERS OFFER HIGHER COP

For precise temperature control of  
additive manufacturing applications

# For more Information



Learn more about our products

[VRC Recirculating Chillers](#)

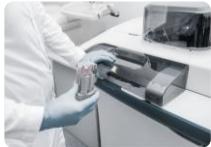
[UltraTEC UTX Series](#)

Read more about precise thermal management for additive manufacturing in our application note

[tark-solutions.com/thermal-technical-library/application-notes/precise-thermal-management-additive-manufacturing](https://tark-solutions.com/thermal-technical-library/application-notes/precise-thermal-management-additive-manufacturing)

# About Tark Thermal Solutions

Tark Thermal Solutions develops thermal management solutions for demanding applications



Medical



Analytical



Industrial



Transportation



Telecom

## DIVERSE PRODUCT PORTFOLIO

Thermoelectric Coolers, Thermoelectric Cooler Assemblies, Temperature controllers and Liquid Cooling Systems

## SOLVING COMPLEX ISSUES

Our engineers use advanced thermal modeling and management techniques to solve complex heat and temperature control problems

## ACCELERATING TIME-TO-MARKET

We partner closely with our customers across the entire product development lifecycle.

## MAXIMIZING PERFORMANCE

Our global manufacturing and support resources help customers maximize productivity, uptime, performance and product quality



Visit our website and full service hub under [tark-solutions.com](http://tark-solutions.com)



Visit our website and full service hub under **tark-solutions.com**



**Chat** directly with our service-team via the Tool on our Website



Contact us for a personal consultation at:  
**sales@tark-solutions.com**

**Tark Thermal Solutions  
is the optimum choice  
for standard or custom  
thermal systems**