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Liquid-Cooled AC-DC Converters Deliver High Power In Harsh Environments

[Bel Fuse's](#) TLP5000 series liquid-cooled, high-power three-phase ac-dc converters are designed to meet the growing demands of industrial systems operating in extreme conditions. Built for applications such as high-power laser cutting, winding machines, and spinning mills, the platform delivers the reliability and robustness engineers need in demanding environments, says the vendor (see the figure).

"The shift to liquid cooling is enabling a new class of high-power systems to operate reliably in environments where conventional solutions fall short," said Fabio Luconi, business development manager industrial & medical. "With the TLP5000 series, we're simplifying integration while giving engineers the scalability and control they need for next-generation industrial applications."

The rugged ac-dc converter integrates a liquid cooling system with a built-in cooling plate, which eliminates the need for fans and significantly improves reliability, thermal efficiency, and product lifespan. The TLP5000 series is a robust solution that can operate effectively in polluted environments, making it well suited for defense, industrial automation, and other harsh-condition deployments.

The converter's adjustable output voltage provides added design flexibility, allowing engineers to implement it across a wide range of high-power use cases and withstand continuous high-performance for a long lifetime. The TLP5000 series also supports parallel operation of up to 12 units with active current sharing, enabling scalable configurations up to 60 kW.

Key electrical specifications include:

- three-phase input voltage range (400 to 480 Vac L-L)
- >0.94 power factor
- 21.4-W/in³ power density
- >94% typical efficiency
- 48-Vdc nominal output voltage
- 39- to 57-Vdc adjustable output voltage
- Operating temperature range of 0°C to 40°C coolant temperature and 0°C to 70°C ambient air temperature

To support modern industrial architectures, the series includes CAN bus communication for real-time monitoring, control, and diagnostics. Hot-plug connectors further enhance system uptime by allowing maintenance or replacement without requiring a full system shutdown, which is essential for automated environments and smart infrastructure where continuous operation is critical.

For more information, see the TLP5000 series [page](#).



Figure. The TLP5000-1048 is a 5-kW, three-phase ac-dc converter with adjustable dc output. Liquid cooling (no fan) makes this power supply suitable for a wide variety of high power industrial applications. This power supply has been designed with emphasis on reliability and long life. Parallel operation is possible for up to 12 units (up to 60 kW).