

SFC Energy Products for Industrial Applications

Fuel Cell Generators
Energy Solutions
Power Supplies





SFC Energy Group

SFC Energy is technology and market leader in portable, mobile and stationary off-grid and grid-based power generation and distribution in the markets consumer, industrial and defense & security. While you are reading this, power solutions from SFC are supplying electrical energy all over the world - from Japan to Antarctica - for measurement and early warning stations, defense applications, traffic monitoring systems, motor homes, yachts and much more.

With thousands of fuel cell generators sold, the company has successfully established its fully commercialized and multi-award-winning products on the global market for a number of years. The company also develops, produces and markets with equal success high-performance electronics components such as voltage transformers and switching power supplies on an international basis for the industry sector in particular. Its products are increasingly being supplied as system solutions for power supplies in accordance with customers' needs.

All of the SFC Energy Group's products are primarily developed and manufactured in Europe. SFC fuel cell generators and fuel cartridges are "Made in Germany". They are developed and manufactured at SFC's

headquarters in Brunnthal, near Munich. PBF high-performance electronics are developed and produced at our sites in the Netherlands and Romania. This enables us to ensure that new developments are implemented straight away into innovative products and are available for you and the reasons you need them. Thanks to the SFC Energy Group's international network of trading partners, along with our locations in Germany, the Netherlands, Romania and the USA, our products are now available worldwide. SFC customers profit from our service: worldwide guarantee.

SFC is certified to DIN ISO 9001. SFC Energy AG is listed in the Prime Standard of the German stock exchange (WKN: 756857 ISIN: DE0007568578).

Consumer

In caravans (RVs), in cabins or on a boat, EFOY fuel cell generators charge your batteries fully automatically and are available around the clock, without any user interference – just like a mobile power socket.

Industrial

In the industrial market SFC Energy is focused on three fields of application: off-grid power supply with EFOY Pro fuel cell generators, PBF power electronics, and complete energy solutions geared to the needs of the customer.

Defense & Security

SFC Energy develops, produces and distributes portable, mobile and vehicle-based power generation and power management devices for defense and security organizations.



Off-grid Power Supply



PBF Power Solutions



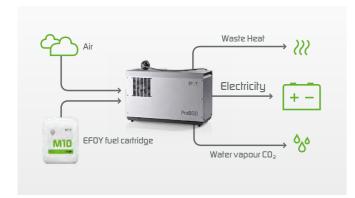
PBF - SFC ENERGY GR

Shaping the future with new ideas

With its pioneering technologies, the SFC Energy Group is always breaking new ground and setting trends as it does so. This success is based on the dedication and passion of each individual member of staff at SFC. With a wealth of ideas and foresightedness, we develop solutions that will still inspire generations to come.

SFC Fuel Cell Generator Technology

All of SFC's fuel cell generators are based on DMFC (Direct Methanol Fuel Cell) technology. They use an eco-friendly catalytic process to convert methanol (methyl alcohol) into electricity in a direct and efficient process without intermediate steps. This makes this technology one of the cleanest ways of generating electricity.



DMFC fuel cell generators are the ideal energy solution for off-grid and mobile applications.

Connect - switch on - forget

SFC fuel cell generators are smart energy producers that can be used to continuously and fully automatically recharge batteries. To do this, the fuel cell generator is connected directly to the battery that supplies consumers and monitors its charge level. Depending on the demand, the fuel cell generator turns on completely automatically, recharges the battery and then switches to standby - without any need for maintenance or intervention on the part of the user.

More power than solar

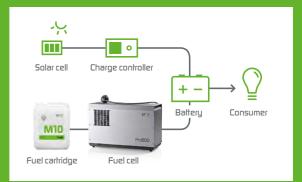
The EFOY Pro fuel cell generator supplies electricity at any time of the year or day, making it completely independent of the weather. The EFOY Pro supplies 3 to 10 times as much energy as a solar power system with the same output throughout the year. This is because, to produce as much energy as an EFOY Pro 800, you would need a solar power system with an output of up to 1600 Wp, depending on the country and time of year.

Longer autonomy than batteries

Batteries have a very limited autonomy. Whether it be in vehicles, on building sites or in a switching cabinet, when an application is only powered by batteries, frequent battery changes, and therefore the costs required to keep the application running, are extremely high. With an EFOY Pro fuel cell generator, downtimes and maintenance intervals are reduced, deep-discharging of batteries is avoided and the battery's autonomy is increased many times over.

More eco-friendly than conventional generators

Regular generators are noisy, dirty and frequently need to be filled up with fuel and have their oil changed regularly. EFOY Pro fuel cell generators, on the other hand, are quiet, producing only small quantities of pure CO_2 , and guarantee a long autonomy - without any need for maintenance. EFOY Pro fuel cell generators can be operated without hesitation in vehicles, in nature conservation areas and generally in closed spaces - could you say the same thing about a regular generator?



TIP

Supplement your standalone solar power system with an EFOY Pro fuel cell generator

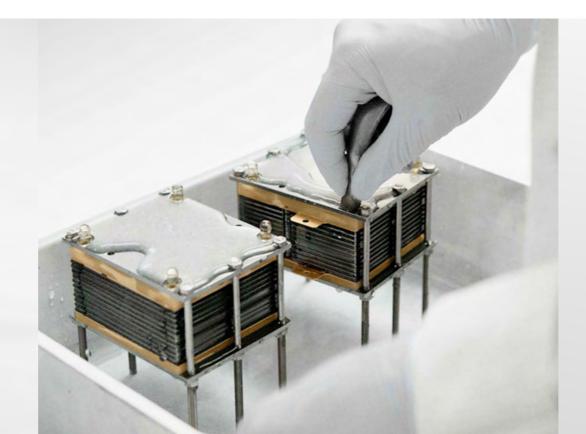
The perfect solution for ensuring 100% availability with minimum fuel consumption is the use of an EFOY Pro fuel cell generator as a hybrid energy supply or as a back-up for a solar power system. When the solar system is unable to deliver enough power, the fuel cell generator automatically switches on and compensates the shortfall in energy. Complex designs for large solar power systems can therefore be avoided and the reliability of the system significantly increased.



Further Information

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EFOY Pro Fuel Cell Generators



EFOY Pro fuel cell generators are SFC Energy's industrial product line and have been adapted specifically to the needs of professional users. Fuel cell generators from SFC for industrial applications are now available in a second generation. The experience and requirements of our customers have been factored into this

second generation and the technology behind EFOY Pro has been developed and improved as a result.

Technical data

EFOY Pro	800	800 Duo	2400	2400 Duo
Max. nominal power*	45 W		110 W	
Min. nominal power*	25 W		80 W	
Nominal Voltage	12 V / 24 V		12 V / 24 V	
Min. charging current at 12 V/24 V	2.1 A / 1.05 A		6.7 A / 3.3 A	
Weight	8.0 kg (17.6 lbs)	8.3 kg (18.3 lbs)	9.0 kg (19.8 lbs)	9.3 kg (20.5 lbs)
Connectable fuel cartridges (with DCS1)	1 (2)	2 (4)	1 (2)	2 (4)
Operating temperature	-20 °C to +50 °C (-4°F to +122°F)			
Nominal consumption	0.9 l/kWh (0.24 gallons/kWh)			
Dimensions L x W x H	433 x 188 x 278 mm (17 x 8 x 11 in)			

^{*} Nominal power decreases with the operation hours. Specification valid within warranty period.

Performance classes

EFOY Pro fuel cell generators are available in two performance classes - with a maximum output of 45 and 110 W. This is not, however, the maximum amount of power which an application can deliver. With a cluster controller, up to 5 EFOY Pro fuel cell generators can be connected to each other in parallel to deliver a maximum output of up to 550 W.





EFOY Pro 800 and EFOY Pro 2400

EFOY Pro fuel cell generators, with their compact design, store a lot of energy in a small package. Due to length of the fuel cartridge connection hose EFOY Pro fuel cell generators are extremely flexible in terms of their installation requirements. The fuel cartridges can be intuitively replaced quickly and easily, even by untrained personnel. The EFOY Pro 800 produces a maximum output of 45 W. It is suitable for applications with low energy requirements, the operation of various types of sensor, for example. The EFOY Pro 2400 delivers a maximum output of 110 W. It is most suitable for applications such as on-board power supplies in vehicles, video surveillance systems, speed monitoring and wind measuring equipment.

EFOY Pro 800 Duo and 2400 Duo

In order to achieve even longer lasting autonomy without the need for the user to replace fuel cartridges, a device with two fuel cartridge connectors has been developed for both performance classes of the EFOY Pro fuel cell generator. This means that two and, with two optional DuoCartSwitches, up to 4 fuel cartridges can be connected to a single fuel cell generator. The result is a very long lasting autonomous power supply for offgrid systems such as measuring stations located in the mountains, wind measuring equipment for the planning process of wind farms or cameras for monitoring pipelines.



Control panel

The control panel for controlling the EFOY Pro fuel cell generator has an user-friendly surface. On it, you will find all the key information clearly arranged.

The benefits at a glance



100% reliability and operational safety



Long periods of autonomy, maintenance-free



Remote monitoring



Lightweight and compact



Quiet and emission-free



For detailed technical data, please visit www.efoy-pro.com



An example of an application with cont. 25 W:

EFOY Pro	800	800 Duo	800 Duo with 2 DuoCartSwitch
Connected fuel cartridge(s)	1x M28	2x M28	4x M28
Autonomy (in days)	51 days	103 days	207 days



Advantages of EFOY Fuel Cartridges



Extremely high energy density

10 l of methanol have a capacity of 11.1 kWh of energy and weighs just 8.4 kg. Approximately 280 kg of lead gel batteries would be required to provide the same amount of energy.



Safety tested

EFOY fuel cartridges have been designed to comply with the strictest safety requirements and bear the TÜV GS seal of quality by way of confirmation, along with the UN approval for transport by sea, road or air. Their design ensures that users never come into contact with their content.



Global fuel cartridge logistics

SFC has established a worldwide logistics network for the sale of EFOY fuel cartridges. As a result, SFC fuel cartridges are available at over 2,000 sales points worldwide. EFOY fuel cartridges can also be transported on pallets by land, sea and air.

EFOY Fuel Cartridges

EFOY Pro fuel cell generators are direct methanol fuel cells that are operated with methanol. Methanol is filled into specially-developed EFOY fuel cartridges. EFOY fuel cartridges are available in sizes of 5, 10 and 28 liter. High-purity and clean methanol is required for the reliable operation of EFOY Pro fuel cell generators. SFC's ISO 9001 certified quality management system controls the methanol fuel cartridge production to ensure highest safety and performance standards. Only the use of original EFOY fuel cartridges can ensure the maximum service life of EFOY fuel cell generators.

Fuel cartridges	M5	M10	M28
Volume	5 l (1.32 gallons)	10 l (2.64 gallons)	28 l (7.4 gallons)
Weight	4.3 kg (9.5 lbs)	8.4 kg (18.5 lbs)	22 kg (48.5 lbs)
Nominal Capacity	5.5 kWh	11.1 kWh	31.1 kWh
Size L x W x H	190 x 145 x 283 mm (7.5 x 5.7 x 11.1 in)	230 x 193 x 318 mm (9.1 x 7.6 x 12.5 in)	420 x 280 x 360 mm (16.5 x 11.0 x 14.2 in)
Autonomy @ 20 W cont.	11.5 days	23 days	65 days

Certified safety



Optional Extras

Remote application monitoring

SFC offers an impressive selection of accessories for the remote monitoring of your system. A communication interface can be set up which will allow the EFOY Pro fuel cell generator to be monitored and controlled remotely. This means that the fuel cell generator can be read, monitored and controlled from a distance.

It is also possible to connect a fuel cartridge sensor. With a sensor connected to the fuel cartridge, you will be automatically alerted by text message or e-mail when the cartridge's fill level falls below a certain value. This will give you sufficient time to take a new fuel cartridge to the system and avoid downtimes.

Longer autonomy

A DuoCartSwitch allows the number of fuel cartridges connected to a single EFOY Pro to be doubled. This means that, in ideal scenarios, up to 4 fuel cartridges can be connected to a single fuel cell generator, extending the autonomy of the application many times over. The EFOY Pro recognizes when a fuel cartridge is empty and automatically switches to the next one.

More performance

EFOY Pro fuel cell generators are available in two power ratings - with a maximum output of 45 and 110 W. This is not, however, the maximum amount of power they can deliver. With a cluster controller, up to 5 EFOY Pro fuel cell generators can be connected in parallel to deliver a maximum output of up to 550 W.



Further information about extras on www.efoy-pro.com

TIP

Take advantage of further developments

We are continuously working on improving our fuel cell generators. Take advantage of the most recent developments and keep your fuel cell generator up to date with our free firmware update.

Complete Energy Solutions



As a system solutions provider, SFC Energy is constantly working on the development of complete solutions for different demands. EFOY Pro energy solutions ideally combine the EFOY Pro fuel cell generator with a battery contained in a box or cabinet. EFOY Pro fuel cell generators and power storage through batteries in a single, suitable housing. And, there is still enough space to accommodate customer-

specific adaptations. All complete energy solutions for EFOY Pro fuel cell generators can be found at www.efoy-pro.com. Please contact us for customized solutions.



EFOY ProCabinet

Stationary Power Supply

EFOY ProCabinet is an outdoor, complete energy solution for autonomous, stationary power supplies with EFOY Pro fuel cell generators - without connection to the grid. The EFOY ProCabinet comprises of a 19" control cabinet which offers space for several EFOY Pro fuel cell generators, M28 fuel cartridges and batteries. The EFOY ProCabinet can be designed in line with individual requirements, and therefore offers sufficient space for customer-specific installations. For example, an optional GSM modem can also be installed for remote system monitoring, as can an inverter or a voltage transformer for voltage adaptations.

The EFOY ProCabinet is ideal for standalone operation or as a back-up for an uninterruptible power supply (UPS).



EFOY ProCube

Mobile Energy Solution

The EFOY ProCube is a complete mobile, maintenance-free solution for off-grid power supplies - ready for use anytime and anywhere. The EFOY ProCube is an outdoor box containing the fuel cell generator, fuel cartridge and battery integrated into it. The EFOY ProCube can be used temporarily, for example on construction sites, or permanently in hard-to-access locations.

- The EFOY ProCube is pre-configured and can be adapted to the customer's wishes based on the choice of EFOY Pro, fuel cartridge and battery size.
- Ideal for outdoor or concealed applications.
- Compatible with hybrid operation e.g. as a back-up or add-on to solar power systems.



EFOY ProEnergyBox

for extreme weather conditions

The EFOY ProEnergyBox has been developed especially for use in extreme weather conditions at temperatures from -40 °C to +50 °C (- 40 °F to + 122 °F). The box contains an EFOY Pro fuel cell generator, a battery and EFOY fuel cartridges. Thanks to effective temperature regulation, the heat given off by the EFOY Pro fuel cell generator can be used in sub-zero temperatures to keep the energy solution warm and also prevent the battery and the electronics inside from freezing. An effective heat conduction system has been implemented for high ambient temperature environments in order to protect the components inside the box from heat. There is also space for customer-specific installations so that these too can be protected against external weather conditions and operated in a more temperate environment.



EFOY Pro Reference Applications



Reliable data capture and transfer from measuring stations

Power requirement: 8 to 100 W

Energy requirement: 200 to 2400 Wh/day

SFC solution: An EFOY Pro 800 Duo or EFOY Pro 2400 Duo (depending on performance requirements) integrated into an EFOY ProCabinet, including DuoCartSwitch with 4 connected M28 fuel cartridges. It can also be combined with solar - allowing the solar panel to be made smaller.

Applications in the field of measuring technology: measurement of water levels, documentation of weather and climate data, seismic movements or gas and radiation levels



100% autonomous and reliable power supplies for SCADA applications

Power requirement: 5 to 20 W

Energy requirement: 120 to 480 Wh/day

Autonomy requirement: at least 4 months (especially during winter)

SFC solution: An EFOY Pro 800 Duo with DuoCartSwitch allows four M28 fuel cartridges to be connected. Integrated into an insulated control cabinet, the SFC solution provides 7 months of reliable, maintenance-free electricity based on a 25 W application. If necessary, the application can also be combined with solar power.

Other areas of application in the oil and gas sector: e.g. chemical injection pumps, air compressors, surveillance



Covert surveillance without intervention by the user

Power requirement: 15 to 100 W

Energy requirement: 360 to 2400 Wh/day

Autonomy requirement: up to 12 weeks

SFC solution: An EFOY Pro 800 or EFOY Pro 2400 (depending on performance requirements) with a DuoCartSwitch and two connected M28 fuel cartridges in order to guarantee an operating period of up to 130 days. Power supplies with the EFOY Pro are quiet, generate no heat and guarantee long periods of operation without any intervention by

Applications for covert surveillance: e.g. covert investigations, border protection



On-board power supply for enforcement vehicles

Power requirement: 50 to 100 W

Energy requirement: 1200 to 2400 Wh/day

SFC solution: An EFOY Pro 2400 is integrated into the vehicle and connected to the on-board or secondary battery. A 10-litre fuel cartridge will give up to 4 weeks of autonomy without a single fuel cartridge change.

Applications in vehicles: e.g. official cars and measurement vehicles



The best energy solution for wind measurements

Power requirement: 7 to 100 W

Energy requirement: 600 to 2400 Wh/day

SFC solution: An EFOY Pro 800 Duo or 2400 Duo (depending on performance requirements) integrated into an EFOY ProCube or the EFOY ProCabinet.

Other areas of application in the wind industry: operation of pumps, off-grid operation of obstruction lights



Reliable, off-grid electricity for radar cameras

Power requirement: 20 to 100 W, 400 W peak power

Energy requirement: 1200 Wh to 3000 Wh/day

SFC solution: An EFOY Pro 2400 integrated into an EFOY ProCube for the temporary use of radar cameras. The integration of an EFOY Pro 2400 Duo into the EFOY ProCabinet is ideal for the stationary setup of a radar camera in a location without a power connection. The fuel cell generators cover the basic demands for electricity, while the battery provides the current for the brief peaks in output.

Other applications in traffic management: e.g. road weather stations, enforcement vehicles, traffic cameras and counters



Stationary monitoring of critical infrastructures

Continuous power requirement: 10 to 20 W

Energy requirement: 300 to 400 Wh/day

SFC solution: An EFOY ProCabinet energy solution including an EFOY Pro 800 Duo with four connected M28 fuel cartridges, two DuoCartSwitches and accumulators for high currents. With this energy solution in use, autonomy of up to a year can be achieved without any costly servicing. Solar panels can be connected as an option.

Applications for stationary monitoring: event safety, monitoring of animals and plants in the wild, pipeline monitoring, off-grid applications such as points and signalling technology with multiple short power peaks per day.

PBF Power Supplies and Coils



The PBF Group B.V. develops and produces high-quality and reliable, customized power supply systems. Our customers include well-known OEMs and systems suppliers in all over the world. PBF works intensively with its customers to develop customized solutions such as switching power supplies,

external transformer units, system control cabinets and also special coils.

Our product portfolio ranges from relatively simple Open Frame to the highly complex and powerful Power Cabinet, in small to medium-sized series volumes that can be anything from a few to several tens of thousand in number each year. For production, PBF has a cost effective state-of-the-art supply chain for small series in Europe and mass production in China. As a result, PBF offers customized design, international certifications and inetiggent supply chain resulting to short lead times. PBF offeres low development cost for high quality and power supplies to satisfy customers' requirements.

Thanks to its unerringly strong commitment to research and development, the PBF Group is able to develop and produce power supply systems that combine superlative efficiency with excellent reliability and a long service life. This tremendous efficiency also satisfies governmental energy-saving requirements. The limited heat generation also leads to reduced thermal stress on components, which in turn means that a smaller installation space is required for the power supply.

Benefits at a glance



High efficiency



High power density



High reliability



Long lifetime



Customized

Another important element of the company's expertise in the field of research and development is its simulation models, which PBF uses to carry out simulations on development concepts that show clients even in the offer phase whether the desired specification can be achieved with what they are proposing. PBF doesn't just collaborate closely with the client during a solution's development process, but rather across the entire production process and most importantly in the after-sales service. PBF offers product lifecycle management from a single source.

Portfolio of PBF

- Standard switching power supplies and DC/DC converters
- AC/DC and DC/DC power supply systems as well as pulsed current systems
- Power range from < 20 W to 150 kW and beyond
- Customer-specific power supply systems and performance electronics (design-in, design-to-cost)
- Mains transformers (5 to 60 kVA)



Further Information

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PBF Reference Applications



Reliable and maintenance-free AC/DC power supply units for LED backlight display systems

Power requirement

AC/DC switching power supply with power outputs of 100 W and 280 W

Important characteristics

- Products for continuous, always-on operation (24/7) without maintenance intervals
- Requirement of maximum reliability

PBF solution

Customer-specific switching power supplies with power outputs of 100 and 280 W for use in the back panel of the LED backlight system. The products were developed based on the mechanical and electrical requirements and optimized in collaboration with the customer to match up to the constantly changing system requirements.

The individual voltage outputs and power drains of the power supply units were developed for the specific LED backlight system requirements. The efficiency was optimized for maintenance-free, permanent operation.

Other applications for power supply systems used in monitor systems

Switching power supply for use in the monitor's air-tight, enclosed equipment housing, for example.



Reliable AC power supply units for professional use in security alarm systems and transfer systems

Power requirement

Various AC/DC switching power supply units with power outputs of 150 W to 750 W $\,$

Important characteristics

- Customer-specific voltage outputs and power outputs
- Special construction shapes for integration into customer system components

PBF solution

- Development of various customer-specific switching power supply units for individual use in customer system components.
- Voltage outputs of e.g. 4 x 39 V / 26 V and 58 V for the different system components and areas of application.
- The applicable power supplies were developed for the individual demands of the required system components and were also designed as a perfect fit for the specific mechanical requirements of the individual device types.

Other applications for power supplies in the audio sector

Switching power supply units for the use of professional public address systems, for example.



Reliable power supply for a UPS system

Power requirement

3-phase AC input with power outputs of 500 A pulsed

Important characteristics

The efficiency must be extremely high at outputs of up to 500 A pulsed current.

PBF solution

Together with the client, highly intensive development research was carried out and equipment reliability of over 99% was achieved.



Further Information

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PBF Reference Applications



AC/DC power supply unit for traffic surveillance measuring equipment

Power requirement

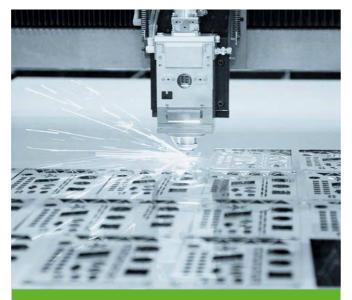
AC/DC switching power supply unit with a power output of 300 W to supply the surveillance system and flash equipment.

Important characteristics

Due to the specific, small housing dimensions and requirement for the system to be water tight, the power supply unit must be able to function reliably even at high operating temperatures. Another parameter is the satisfaction of the requirements for the use of special LED technologies.

PBF solution

Development of an AC/DC switching power supply unit that allows the surveillance system - thanks to the use of technology developed especially for this measuring process - to detect the traffic light changing cycles and control the flash equipment with pinpoint accuracy.



AC power supply unit for use on material processing laser systems

Power requirements

- High-performance 3-phase AC power supply unit
- Scalable power output from 10 kW to 80 kW

Important characteristics

- Adaptation to the laser system's existing characteristics
- Cooling of the power supply using the laser system's existing water cooling circuit
- Power outputs are modular and scalable for various laser powers

PBF solution

Development of a modularly-designed power supply in a 19" rack. The power supply was cooled through adaptation and integration into the laser system's cooling water circuit. The required power levels in steps of 10 kW, 20 kW, 40 kW and up to 80 kW were made possible through the modular construction of 19" plug-in units with power outputs of 10 kW or 20 kW each. This gave the client the option of using standardised power supply systems in different laser systems.



Coils and power supply units for electron microscopy

Power requirement

Customer-specific coils and power supply units for high-end microscopes

Important characteristics

- AC/DC power supply unit with ultra-low ripple at the output in order to avoid influences to the electron stream on the microscope.
- High efficiency, resulting in a long service life for the microscope.
- Customer-specific deflection coils that were developed in collaboration with the client especially for the individual device properties in order to achieve optimum performance.

PBF solution

Development of an AC/DC power supply unit with an efficiency of over 95% and a ripple & noise level of < 10 mVpp at the voltage output.



Development of a high-voltage power supply unit for use in a laser system

Power requirement

- Generation of 26,000 V of system pulsed voltage
- Integration of the control interfaces of the existing laser system

Important characteristics

Customer-specific high-voltage power supply unit that was adapted to the pre-specified equipment details and communication interfaces.

PBF solution

- Development of a customer-specific power supply component. Generation of a pulsed voltage of 26,000 V to supply a laser system.
- Individual adaptation of the power supply unit control and controller unit to the customer-specific system components.



Further Information

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