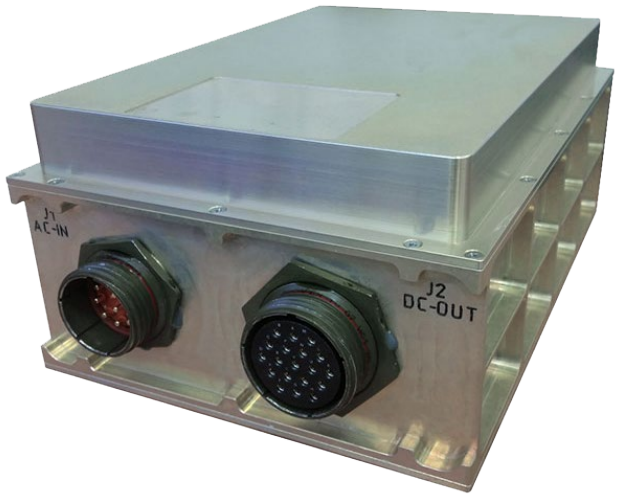
ENERCON
TECHNOLOGIES LTD

FIELD-PROVEN COTS, MOTS AND CUSTOM MILITARY POWER SOLUTIONS

M2781 SERIES

3-PHASE AC/DC GENERATOR CONTROL UNIT



PRODUCT HIGHLIGHTS

- **2.8kW 3-PHASE AC/DC GCU**
- **WIDE INPUT RANGE**
- **HIGH EFFICIENCY SWITCHING REGULATOR**
- **PARALLEL CAPABILITIES**
- **OVER VOLTAGE PROTECTION**
- **TEMPERATURE PROTECTION**
- **88% EFFICIENCY AT FULL LOAD**
- **COMPLIES WITH: CS114, CS115, CS116 of MIL-STD-461F and with RE102 and RS103 of MIL-STD-461F**

NON ITAR

AS9100D CERTIFIED ISO 9001

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1. General

1.1. General description

The M2781-6 is a 2.8 kW AC to DC power supply that when fed from the 3-phase, variable- voltage and frequency output of a suitable PMG provides a regulated, filtered and protected 28 V_{DC} output. The M2781-6 is composed of a 3-phase input Bridge-rectifier followed by a wide input-range, high-efficiency switching regulator. The 28VDC Output of the M2781-6 is normally off and turns only when the Enable input signal is active (High).

1.2. Applicable Documents

The following documents form part of this Specification to the extent specified herein.

MIL-STD-704D	Aircraft Electrical Power Characteristics.
MIL-STD-461F	Requirements for the Control of Electromagnetic Characteristics of Subsystems and Equipment.
MIL-STD-810F	Environmental Engineering Considerations and Laboratory Tests.
M2781006	Outline Dimensions Drawing

2. Performance

2.1. Input Power

The AC voltage waveforms of the PMG, when fully loaded by the M2781-6, will be highly distorted with a crest factor considerably lower than the theoretical 1.414. This is due to the relatively high winding inductance, as is typical of a PMG. Therefore, in order to avoid ambiguities, the input voltage of the M2781-6 is specified herein in terms of the rectified voltage that the PMG provides when measured on the DC terminals of a 3-phase bridge rectifier loaded by a resistive-capacitive load.

2.1.1. Absolute Maximum Voltage

The peak rectified voltage should not exceed 190 V_{DC}. The M2781-6 will not suffer any damage and will remain safe with any input voltage between 0 to 190 V_{DC}. However, exceeding 190 V_{DC}, even momentarily, may damage the unit.

2.1.2. Operating Input Voltage

The M2781-6 provides full performances when the input (rectified) voltage is between $39V_{DC}$ to $170V_{DC}$. When the input voltage is below $39V_{DC}$ but above $32V_{DC}$ the M2781-6 will provide at least $22V_{DC}$ when loaded by 500W (see Figure 1).

2.2. Output Power

2.2.1. Power Rating

The M2781-6 provides full performances for any load between no-load to 2.8 kW. For Base plate temperature above 75 °C the maximum load should be derated linearly to 1,500 W at 85 °C (130 W/°C).

2.2.2. Output Voltage

In order to facilitate power sharing when connecting two M2781-6 units in parallel, the M2781-6 output exhibits a controlled voltage-droop (see Figure 2). The steady- state output voltage for any load between no-load to 2.8 kW, at any input voltage between 39 V_{DC} to 170 V_{DC} will be within the range of 28.0 +1.0/-2.0 V_{DC} for the entire operating temperature range. Tighter regulation (without droop) is available upon request.

2.2.3. Output Ripple

The AC ripple on the M2781-6 output voltage when measured on a resistive load with load capacitance of 10 µF or higher, will not exceed 0.3 V_{rms}.

2.3. Protections

2.3.1. Overload and Short Circuit Protection

The M2781-6 is protected from overload up to a full short on its output for an unlimited duration. The M2781-6 actively limits it output current to below 130 A. If a load attempts to exceed the current limit, the M2781-6 will reduce its output voltage such that the current limit will not be exceeded. Upon removal of the overload condition the output will automatically recover to full performances.

2.3.2. Overvoltage Protection

The M2781-6 employs a crow-bar overvoltage protection circuit on its output. The protection is set to trip at 35 ± 1 V_{DC}. Once the overvoltage protection trips it will latch and short circuit the output voltage. It will reset only when power is removed from the M2781-6 input. The overvoltage protection will not trip by input voltage transients (as long as they do not exceed 190 V) or by load transients (including load-removal). The over-voltage protection is intended to protect the user from a failed M2781-6. Any attempt to trigger the overvoltage protection by connecting an external power source to its output, may damage the M2781-6.

2.3.3. Over Temperature Protection

The M2781-6 contains an Over Temperature Protection (O.T.P.) that in case of a cooling failure (namely baseplate temperature exceeding +85 °C) turns the M2781-6 off. Once tripped, the O.T.P. will reset (automatically) when the baseplate temperature drops to below +75 °C.

2.4. Isolation

The input and output of the M2781-6 are isolated from the chassis ground (>10 MΩ @ 500 V_{DC}) but not from each other. Any circuit connected to the same AC source (the PMG winding) that the M2781-6 is connected to, must be galvanically isolated from chassis ground and from the DC output of the M2781-6. **Failure to maintain this isolation may damage the load and/or the M2781-6.**

2.5. Efficiency and Power Dissipation

The efficiency of the M2781-6 at full load is higher than 88% (dissipating less than 382 W). The power dissipation of the M2781-6 for any operating conditions (including overload) does not exceed 500 W.

2.6. Input Power Application

The M2781-6 is designed to operate from the output of a PMG that is permanently connected to it and gradually rises from zero to the full rated AC voltage as the rotational speed of the PMG's is rising. The rate-of-change of the input voltage should not exceed 10 V_{rms}/ms. Abrupt connection of the M2781-6 inputs to an operating DC source (as by a switch) my damage the M2781-6.

2.7. Enable input

The Enable signal is a 28V discrete signal, referenced to the Output RTN line. When High, the 28VDC Output is enabled and will provide power within 100mS, pending that the rectified Input voltage is higher than 32V_{DC} for at least 500mS. When the Enable is Low the 28VDC Output is disabled. High is when the Enable signal is above 12V. Low is when it is Open (I<0.1mA, or V<6V). The load that the Enable input presents to the signal source is: I = (V-7)/3.6KΩ when I is in mA and V in volts. The absolute maximum voltage of the Enable signal is 33VDC (50V for up to 100mS).

2.8. Parallel Operation

The output of two M2781-6 units can be connected in parallel. If the two GCUs are connected to a common load with identical harness and are fed from identical input voltage they will equally share the load between them to within ±15 A. When connecting the M2781-6 output in parallel with a high-current DC Source, other than another M2781- 6 GCU (for example; a 28 V_{DC} battery), the connection should be done via an external reverse-blocking diode in series with the M2781-6 output.

2.9. Mean Time Between Failure (MTBF)

The MTBF of the M2781-6 (MIL-HDBK-217F Ground Fixed) at 100 V_{DC} input, 2.8 kW Load and 25 °C is higher than 50,000 hours.

2.10. Electro Magnetic Compatibility (EMC)

The M2781-6 complies with CS114, CS115, CS116 of MIL-STD-461F and with RE102 and RS103 of MIL-STD-461F when the load and cables are properly shielded.

The M2781-6 is not designed to meet CE101 or CE102. The M2781-6 and the PMG that feeds it are considered as parts of the same EUT (Equipment Under Tests) and in accordance with MIL-STD- 461F, these tests are applicable only to power lines "which obtain power from other sources not part of the EUT", hence not applicable to the M2781-6.

2.11. Environmental Conditions

2.11.1. Ambient Temperature

Non-operating: -55 °C to +80 °C
Operating: -40 °C to +72 °C (See paragraph 03.2 for cooling requirements).

2.11.2. Altitude

Up to 36,000 feet above MSL.

2.11.3. Acceleration

The M2781-6 will not be damaged and will provide full performance during and after exposure to 10 g load in any direction.

2.11.4. Mechanical Shock

The M2781-6will not be damaged and provides full performances during and after exposure to 18 shocks (3 in each direction) of 15 g / 11 ms. The M2781-6 will not be damaged by Maintenance Bench Drop per MIL-STD-810F.

2.11.5. Vibration

The M2781-6 is able to sustain without damage or deterioration, and provides full performance during and after exposure to the “General Minimum Integrity Exposure” vibration level of MIL-STD-810F, Figure 514.5C-17.

2.11.6. Moisture

The M2781-6 is protected from humidity up to RH of 100%. It will not be damaged and will provide full performances when subjected to the 240 hours humidity test of MIL- STD-810F, method 507.4. The M2781-6 is protected from dripping water. It will not be damaged and provides full performance when subjected to the drip test of MIL-STD- 810F, method 506.4, procedure III.

2.11.7. Fungus

The M2781-6 does not contain materials that support fungal growth.

3. Physical Characteristics

3.1. Weight and size

The M2781-6 outline dimensions are in accordance with drawing M2781006 (does not exceed 180 by 250 by 110 mm, excluding the I/O connectors). The M2781-6 weight does not exceed 4.9 kg.

3.2. Cooling

The M2781-6 is a Baseplate cooled unit. It is the user responsibility to maintain the 180 by 250 mm Baseplate of the M2781-6 below 85 °C by thermally attaching it to a suitable heatsink using the 6 mounting threaded holes on the baseplate (see DWG M2781006). When the Baseplate temperature of the M2781-6 exceeds +75 °C, the rated output power is derated linearly by 130 W/°C, to 1.5 kW at 85 °C.

3.3. I/O Connectors

3.3.1. Input Connector

D38999/20WG11PN (Male, 11 pins AWG #12).

Phase A: Pins A, B and C.
Phase B: Pins D, E and F.
Phase C: Pins G, H and J.
Not Used: Pins K and L.

3.3.2. Output connector

D38999/20WJ19SN (Female, 19 pins AWG #12).

Output: Pins G, H, J, K, L, U and T. **Output RTN:** Pins C, D, E, F, P, R, S and V. **Enable:** Pin A.
Reserved: Pins B, M and N.

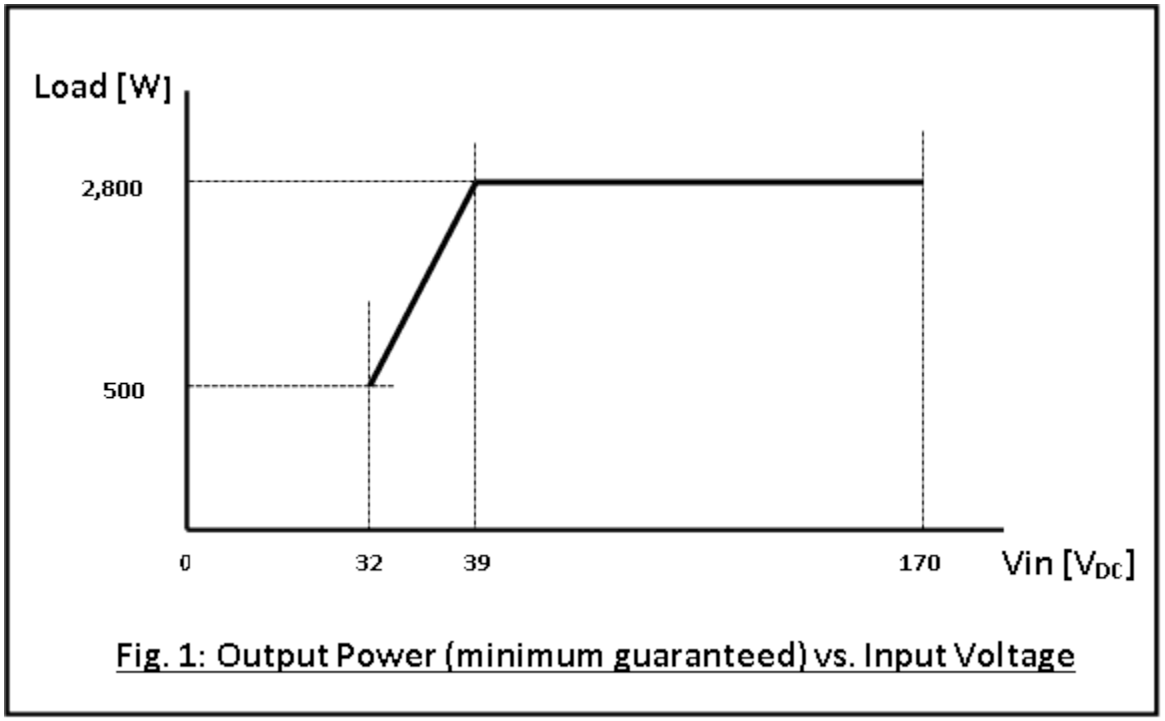

Fig. 1: Output Power (minimum guaranteed) vs. Input Voltage

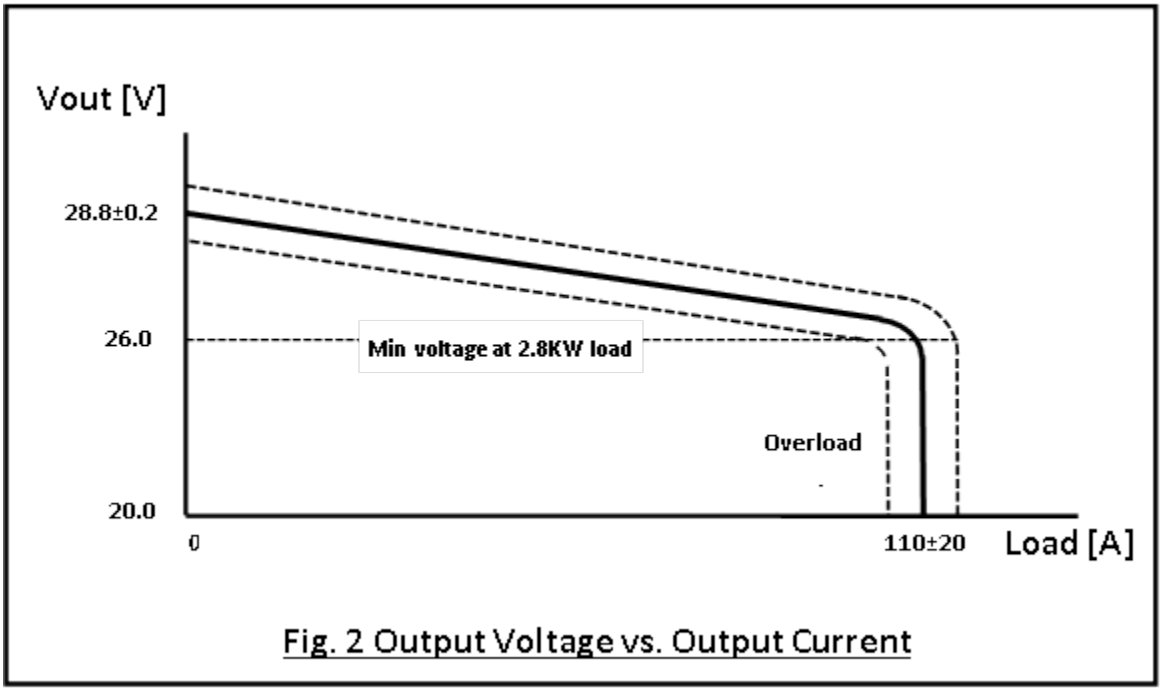

Fig. 2 Output Voltage vs. Output Current

Note: Specifications are subject to change without prior notice by the manufacturer