Generator Cranking Supercapacitor (GCS – Series)

24 Volt Modules

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www.supercapacitor.in
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Introduction: When starting a diesel engine, it is necessary to overcome the compressed gas resistance in the cylinder, as well as the friction and inertia force generated by the engine. At present, the diesel engine uses lead-acid battery as the startup power source. However, in the condition of severe temperature and humidity changes, the discharge capacity of the battery is reduced, which makes the diesel engine cannot be normally started. In addition, the battery charging time is very long, working life is low, and when it is laid static for a long time affect the reliability of diesel engine.

Supercapacitor based Genset starting system can resolve these problems. SPEL GCS series module provides more cranking cycles in a shorter period than the lead acid battery. Due to the low equivalent series resistance more current can be released instantaneously in a shorter period to ensure the success rate each time you start. It takes only minutes to recharge the SPEL GCS series from the available source.

To ensure reliable and safe operation of the Genset starting systems, SPEL-GCS Series provides the necessary power to start the diesel engine

Advantage of using SPEL-GCS series instead of Batteries for Cranking.

Supercapacitors are highly efficient technology reliable and safe. It has large capacitance and excellent charge-discharge performance with higher power density and the longer useful life and more advantages as maintenance free, high reliability. Supercapacitors has unique features like short charge-time, long service life, good temperature characteristics, energy conservation, and green environmental protection as compared to the batteries. The most significant advantage of supercapacitors over batteries is their ability to be charged and discharged continuously without degrading like batteries do. In cold weather the higher power capability of supercapacitors compared to batteries translates to faster response time for similarly designed systems. Moreover, they have almost negligible losses and long lifespan. They can process a large number of charge and discharge cycles (several hundred thousand cycles) compared to only a few thousand cycles for lead-acid batteries, and can supply much higher current than batteries which is highly useful for starting purpose.

GCS series *for DG Cranking Application*

Dimensions: 330mm x 173mm x 240mm (*Tol. +/- 0.5mm***)**

Basic Specifications

Capacitance	Capacitance Tolerance	Working Voltage DC	Surge Voltage DC	Termination	Balancing	Typical Mass	Operating Temperature Range	Typical Cycle Life (25 °C)
300.0 F	0% to 20%	24.0V	28.0V	Brass	Resistor	8.0 Kg	-40~ 75 °C	100,000 cycles

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Electrical Specifications

Module Rated Capacitance [1]	300.0 Farads
Number of Terminals	2
Rated Voltage/ Nominal Starter Voltage	24.0 VDC
Absolute Maximum Voltage [2]	28.0 VDC
Operating Voltage Range	14.0 VDC to 28.0 VDC
Cold Cranking Current	900.0 Amps
Initial Maximum ESR (DC) [3]	4.0 milli-ohms
Maximum Leakage Current [4]	112 mA
Peak Power [5]	49.0 KW
Total Energy [5]	32.7 Wh
Maximum Shelf Life	4 Years
Operating Temperature Range	-40°C to 65°C
Storage Temperature Range	-40°C to 70°C

Note: *Capacitance, ESR and Leakage current are all measured according to IEC 62391-1*

* *If required then Leakage current can be altered/changed by Balancing Method.*

\+ *Results may vary. Additional terms & Conditions including limited warranty apply at the time of purchase.*

++ *Product dimensions are for reference only unless otherwise identified, Product dimensions & Specifications may change without Notice.*

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Physical Specifications

Physical Dimension (L x B x H) in mm +/- 0.5mm	330 x 173 x 240
Approximate Mass of Module	8.0 Kg.
Connection Terminals	Standard Battery Type
Recommended Torque - Terminal	4 Nm
Environmental Protection	IP54
Insulation Coordination	IEC 61287-1 (Category: OV II) Rated insulation voltage: 1kV DC or 2.8kV AC (at 50Hz, 10 sec) Rated impulse withstand voltage: 6kV DC
Vibration Specification	IEC60068-2-6
Shock Specification	IEC60068-2-2,-29
Cooling	Natural Convection
Package Quantity	Single

Monitoring/Cell Management

Internal Temperature Sensor	N/A
Temperature Interface	Available on request
Cell Voltage Management	Passive/Active
Cell Voltage Monitoring	Available on request
Connector	N/A

Safety

Maximum Current, Non-repetitive (I_{max}) [6]	1800.0 Amps
Short Circuit Current (Typical)	2000 Amps**
High Potential Capability	5600VDC for 60 seconds
Max Stored Energy [5]	30.4.0 Wh****

CAUTION: *Please do not discharge Capacitor directly.* *Please do not Reverse Polarity*

IMPORTANT: Charger not to exceed maximum voltage limits 28.0 Volts

Note:

** *Current possible with short circuit from rated voltage. It should not be mistaken for operating current.*

**** *As per United Nations material classification UN3499 device should have less than 10Wh capacity to meet the Requirement of Special Provisions 361 for transporting without being treated as dangerous goods (hazardous material) Under Transport Regulations. So this product has to be shipped with zero initial charge.*

Life

Endurance (at V_R and 65 °C) [7] [8]	1500 Hrs.
Room Temperature (at V_R and 25 °C) [7]	10 Years
Cycle Life (at 25 °C) [7]	1,000,000 cycles (Estimated value when cycled from V_R to ½ V_R using constant current of 7 Amps with 10 second rest between charge and discharge steps)
Shelf Life	4 Years (Stored Uncharged at 25°C) 2 Years (Stored Uncharged at 70°C & under 40% RH)

Thermal Characteristics

Typical Thermal Resistance, R_{th} (Housing)	1.7 °C/W
Maximum Continuous Current ΔT = 30 °C [9]	60 A_{RMS}
Maximum Continuous Current ΔT = 45 °C [9]	80 A_{RMS}

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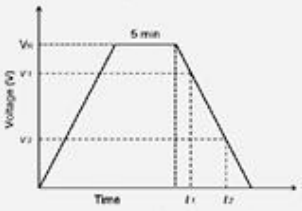
Notes

1 **Rated Capacitance**

> Constant Current charge with 10mA/F to VR
> Constant Voltage charge at VR for 5 minutes.
> Constant Current discharge with 10mA/F to 0.1V



$$C = \frac{I \times (t_2 - t_1)}{v_1 - v_2}$$

Where

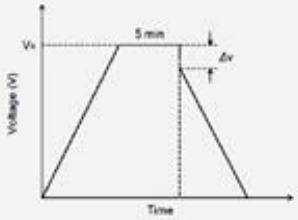
v_1 is the measurement starting voltage 0.8 x VR (V);
v_2 is the measurement end voltage 0.4 x VR (V);
t_1 is the time from discharge start to reach v_1 (s);
t_2 is the time from discharge start to reach v_2 (s);
I is the absolute value of the discharging current (A);

2 **Surge Voltage / Absolute Maximum Voltage**

> Absolute maximum voltage, not repeated and for no longer than 1 second.

3 **ESR** *(Equivalent Series Resistance)*

> ESR_{DC}
- Constant current charge to VR
- Constant voltage charge at VR for 5min
- Constant current discharge to 0.1V



$$R_d = \frac{\Delta v}{I}$$

Where

R_d is the ESR_{DC} (Ω);
Δv is the voltage drop for 10ms (V);
I is the discharge current (A).

4 **Leakage Current**

> The capacitor is charged to the rated voltage at 25°C.
> Leakage current is the current at 72 hours that is required to keep the capacitor charged at the rated voltage

5 **Energy & Power**

> Max. Stored Energy at V_R = $\frac{½CV_R^2}{3600}$

Where C is the Capacitance (F);
V_R is the rated voltage (V).

> Peak Power = (V_{max} x V_{max}) / (4 x ESR)

> Cold Cranking Current = C x (V_{max} – V_{min}) / (T+C x ESR)

Where T = 3 Seconds

> Gravimetric Specific Energy (Wh/kg) = $\frac{E_{Max.}}{Weight}$

6 **Max. Current**

> Current for 1sec discharging from rated voltage to half Rated voltage under constant current discharging mode.

$$I_{Max.}\,(A) = \frac{½V_R}{\Delta t / C + R_d}$$

Where

Δt is the discharge time (sec) and Δt is 1 sec in this case;
C is the capacitance (F);
R_d is the ESR_{DC} (Ω);
VR is the rated voltage (V)

7 **Lifetime**

> End-of-Life Conditions
- Capacitance: -20% from rated min. value
- ESR: +100% from max. ESR value

8 **Endurance**

> Conditions
- Temperature: 65 ± 2°C
- Test duration : 1500 (+48/-0) h
- Applied voltage: V_R ± 0.02V
- Capacitance and ESR measurement are made at 25°C

9 $\Delta T = I_{RMS}.I_{RMS}.ESR.R_{th}$

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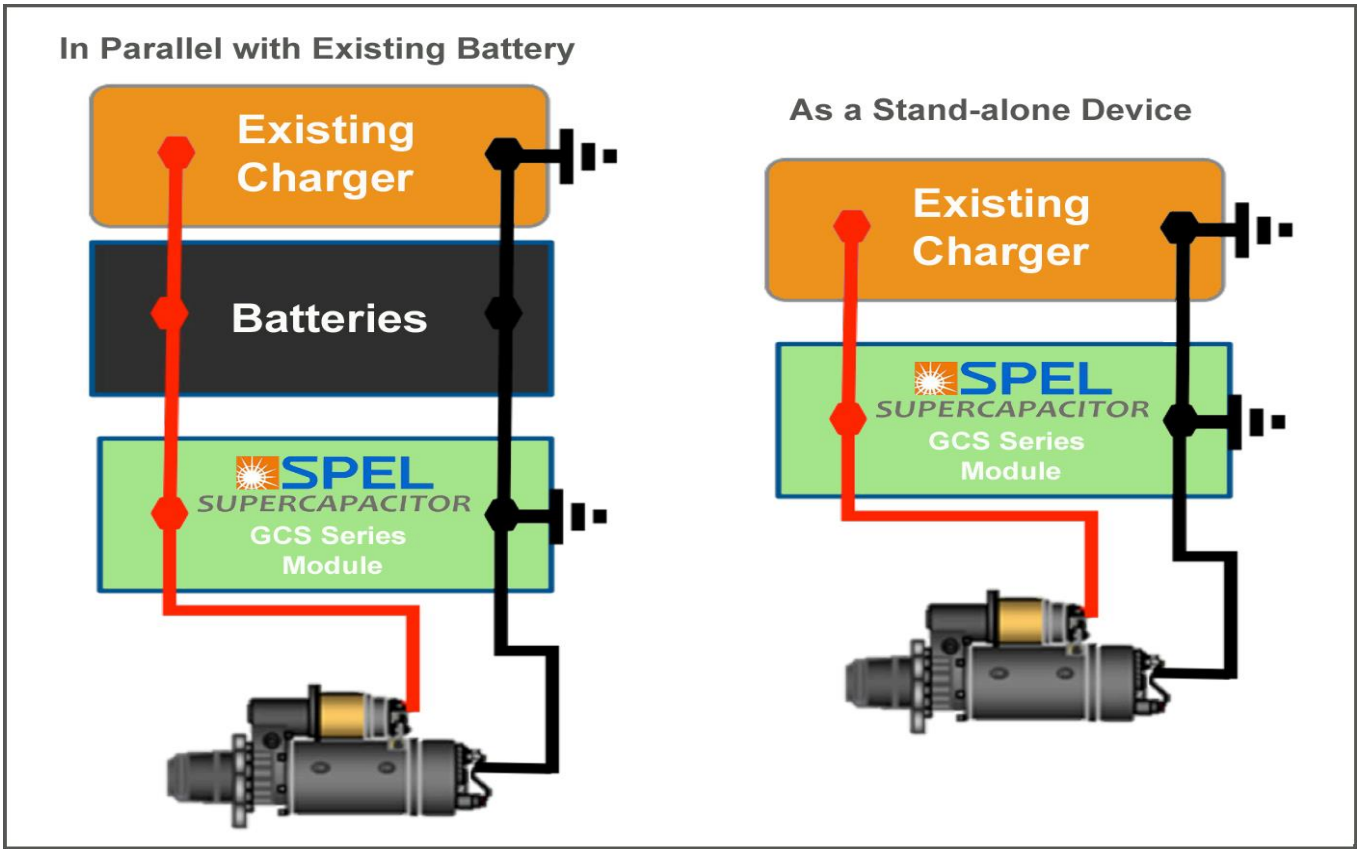
Connection/ Mounting Notes/ Instructions



Mounting Recommendations
Use compatible mounting Clamps. Maximum allowable torque on Mounting Clamp Nuts not to exceed 4Nm. Use dual mounting clamp to meet vibration specifications.
Markings
Products are marked with the following information: Capacitance (F), Nominal Working Voltage (V), Series Code (or part No.), Polarity, Serial Number and name of Manufacturer.
Packaging information
Each Module of GCS series is packed individually in a box.

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