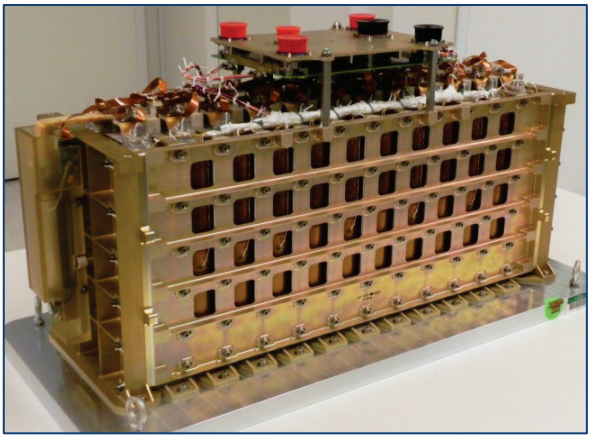
MA190 Modular Lithium Ion Battery For Satellites

The MA190 module is a scalable and configurable cell pack based on GS Yuasa's LSE190 Generation III lithium ion cell.
With a nameplate capacity of 190Ah, the LSE190 cell has significant spaceflight heritage supporting both human rated LEO missions as well as commercial GEO satellites.

MA190 modules may each contain between 6 and 12 LSE190 cells. The cells in a module may be electrically connected in a simple series arrangement, yielding a module rated for 190Ah. Alternatively, two or three cells may be connected first in parallel and then in series yielding 380Ah or 570Ah modules.

The GS Yuasa LSE190 Li-ion Cell



MA190-112 Qualification Model

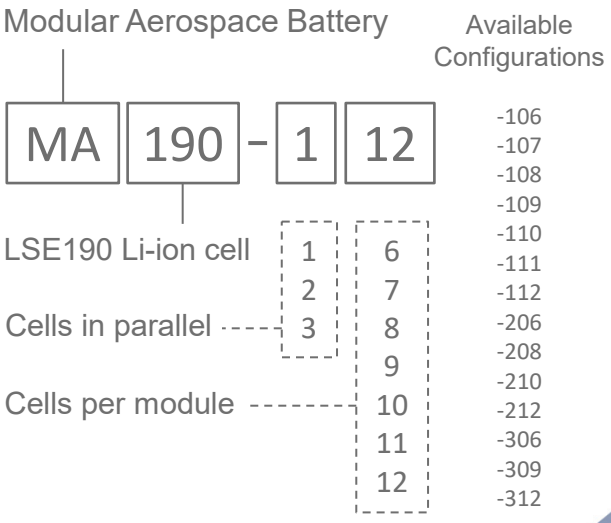
LSE190 Cell Safety Tests (JSC 20793)

- Over-charge
- Over-discharge (forced reversal)
- External short circuit (2 & 5 milliohm)
- Crush (fresh & seasoned cells)
- Heat to vent
- Three orientation drop
- Vent and burst pressure

MA190 Module Qualification Tests

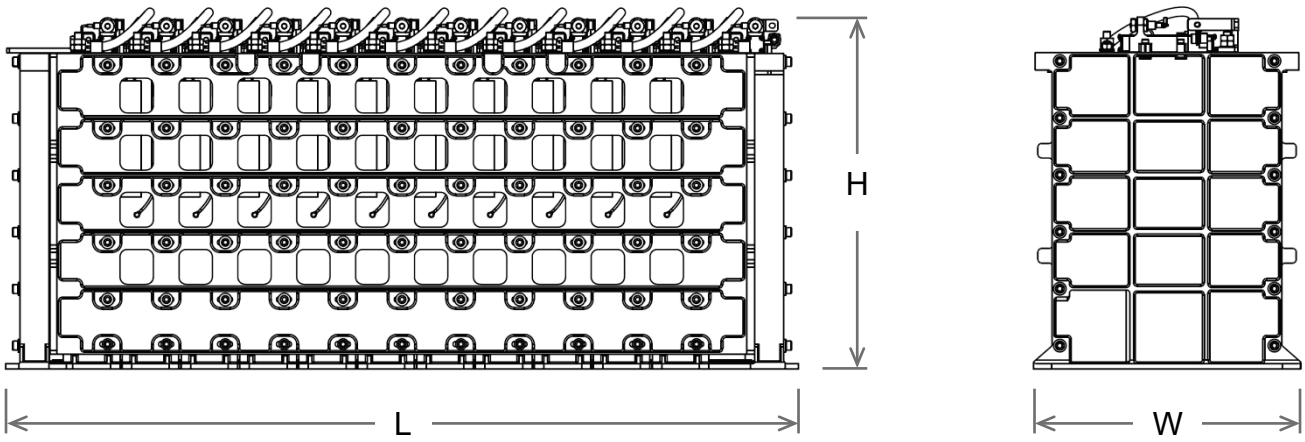
- Sine vibration
- Random Vibration
- Shock
- Thermal vacuum

MA190 Module Configuration Numbering



MA190 Module Configurations

Vehicle battery systems consist of one or more MA190 modules connected in series and/or parallel. The table below provides nominal mass, dimensions and key electrical performance attributes for select module configurations. Please contact GS Yuasa Lithium Power for information on other configurations.



							GEO.....			LEO.....		
Module	Config.	Wh_1	Mass (lb.)$_2$	L (in.)	W (in.)	H (in.)	Power (w)$_3$	$EOCV_4$	$EODV_5$	Power (w)$_6$	$EOCV_7$	$EODV_8$
MA190-106	1p6s	4286	80.8	15.2	9.2	13.2	2574	25.2	21.8	2531	24.3	21.6
MA190-107	1p7s	5001	92.9	17.2	9.2	13.2	3003	29.4	25.4	2953	28.4	25.2
MA190-108	1p8s	5715	105.1	19.2	9.2	13.2	3432	33.6	29.1	3374	32.4	28.8
MA190-109	1p9s	6430	117.3	21.3	9.2	13.2	3861	37.8	32.7	3796	36.5	32.4
MA190-110	1p10s	7144	129.5	23.3	9.2	13.2	4290	42.0	36.3	4218	40.5	36.0
MA190-111	1p11s	7858	141.7	25.3	9.2	13.2	4719	46.2	40.0	4640	44.6	39.6
MA190-112	1p12s	8573	153.9	27.3	9.2	13.2	5148	50.4	43.6	5062	48.6	43.2
MA190-206	2p3s	4286	78.8	15.2	9.2	13.2	2574	12.6	10.9	2531	12.2	10.8
MA190-208	2p4s	5715	102.5	19.2	9.2	13.2	3432	16.8	14.5	3374	16.2	14.4
MA190-210	2p5s	7144	126.2	23.3	9.2	13.2	4290	21.0	18.2	4218	20.3	18.0
MA190-212	2p6s	8573	149.9	27.3	9.2	13.2	5148	50.4	21.8	5062	24.3	21.6
MA190-306	3p2s	4286	78.1	15.2	9.2	13.0	2574	8.4	7.3	2531	8.1	7.2
MA190-309	3p3s	6430	113.4	21.3	9.2	13.0	3861	12.6	10.9	3796	12.2	10.8
MA190-312	3p4s	8573	148.6	27.3	9.2	13.0	5148	16.8	14.5	5062	16.2	14.4

[1]at acceptance, C/2 discharge, 4.10V to 2.75V

[2]includes cell pack, bus bars, bypass switches, wire harness, heaters

[3]18 year GEO mission, 80% actual DOD max, no bypassed cells

[4]based on 4.20V per cell EOM condition

[5]EOM, based on 18 year GEO mission at rated power

[6]15 year LEO mission, 30% DOD (Ah nameplate), no bypassed cells

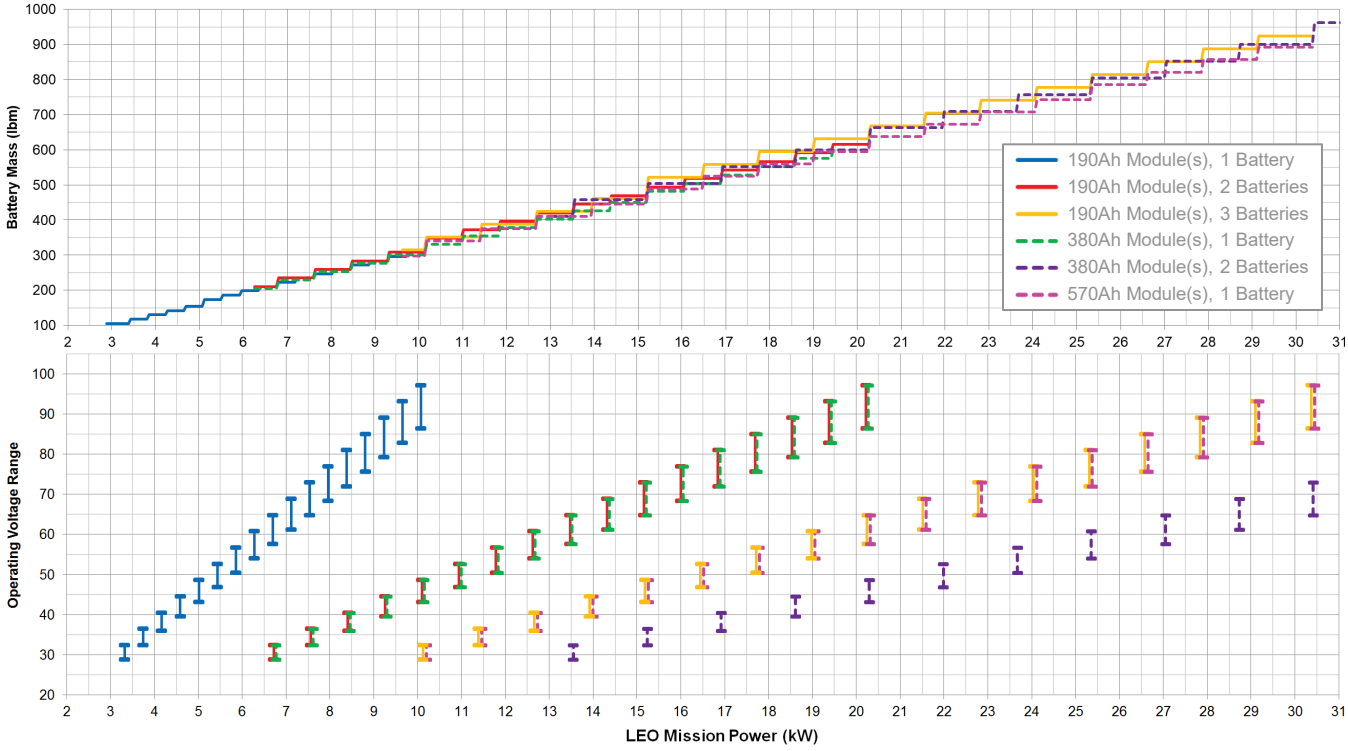
[7]based on 4.05V per cell EOM condition

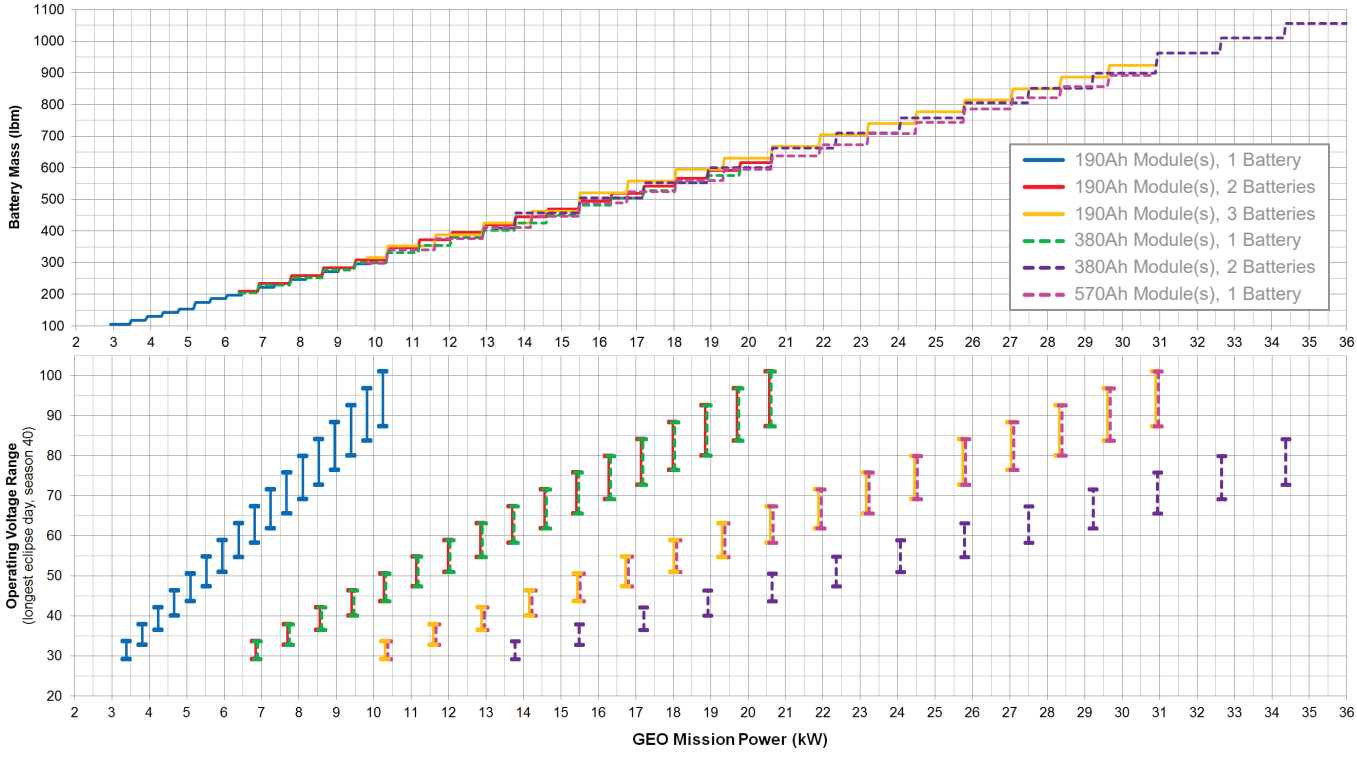
[8]end of year 15

MA190 Battery Systems

Key Attributes of Notional Configurations

The charts below provide battery system mass and operating voltage range as a function of required LEO or GEO eclipse power. Battery systems described are comprised of one or more MA190 module(s) connected in series to form a single battery. A vehicle battery system may consist of one or more batteries.

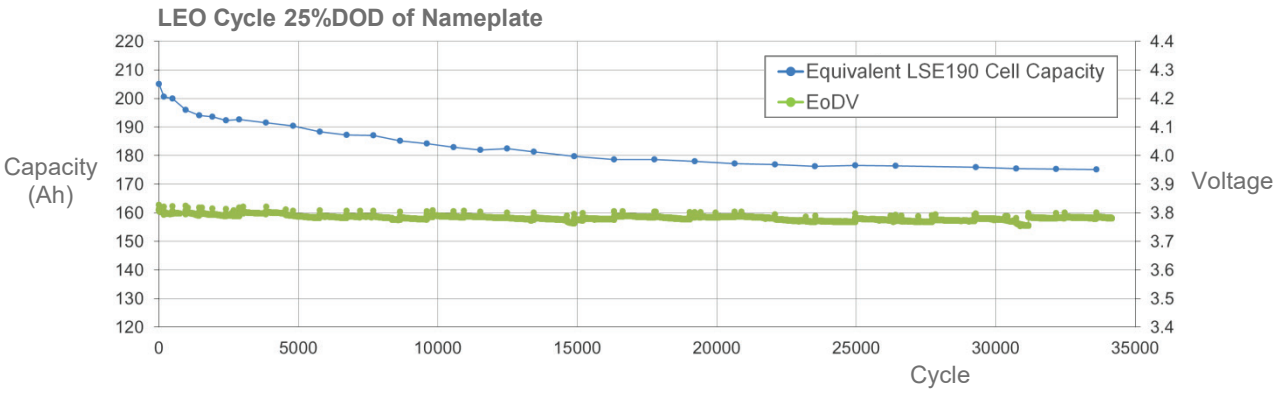


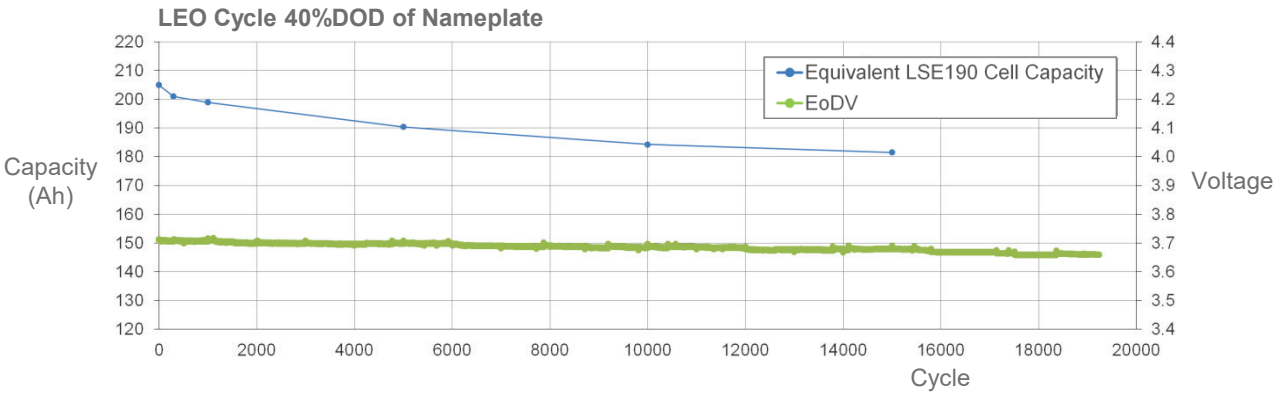


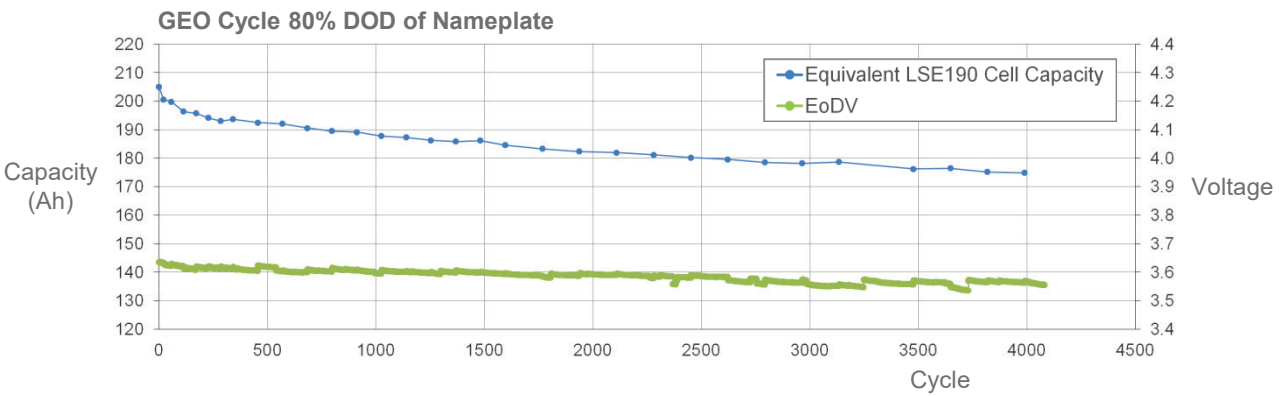
In these examples, the LEO mission is 15 years and the GEO mission is 18 years. Higher eclipse power may be supported for shorter design lives. These charts assume no cells are bypassed. Please contact GS Yuasa Lithium Power (GYLP) for consideration of your specific requirements.

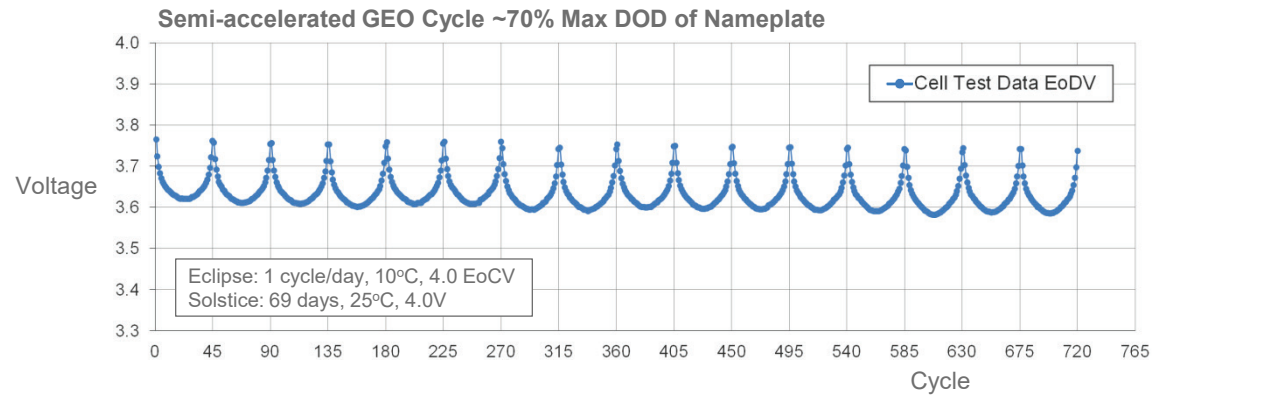
United States Department of Defense: For classified missions, GYLP is able to provide software tools to assist with battery system configuration and predictive life and performance modeling.

Generation III Energy Type LSE Cell Test Data









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