MASTERVOLT

THE POWER TO BE INDEPENDENT

2 VOLT GEL CELLS

MVSV series

USER AND INSTALLATION MANUAL

10000010113/06

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CONTENTS

1 SAFETY GUIDELINES AND MEASURES

Observe these instructions and keep them located near the battery for future reference.

Work on the battery should be carried out by qualified personnel only.

Do not smoke!

Do not use any naked flame or other sources of ignition.

Risk of explosion and fire.

While working on batteries wear protective eye-glasses and clothing.

Observe the accident prevention rules as well as EN 50 272-2, VDE 0105 Part 1.

Any acid splashes on the skin or in the eyes must be flushed with plenty of clean water immediately. Then seek medical assistance. Spillages on clothing should be rinsed out with water.

Explosion and fire hazard. Avoid short circuits, use insulated tools. Do not place tools or other items on the battery. Do not wear any metallic items such as watches, bracelets etcetera.

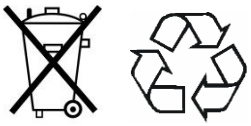
Electrolyte is very corrosive. In normal working conditions contact with the electrolyte is impossible. If the battery container is damaged, do not touch the exposed electrolyte because it is corrosive.

Batteries are heavy. If involved in an accident, they can become a projectile! Ensure adequate and secure mounting and always use suitable handling equipment for transportation. Handle with care because batteries are sensitive to mechanical shock.

Caution! Metal parts of the battery are always alive; therefore do not place items or tools on the battery.

Keep children away from batteries.

Non-compliance with operating instructions, repairs made with other than original parts, or repairs made without authorization (e.g. opening of valves) render the guarantee void.



Disposal of batteries

Spent batteries are harmful to health and environment. Therefore batteries may not be mixed with domestic or industrial waste but must be collected and recycled separately. Contact your supplier for recollection and recycling of batteries or contact an authorized waste management company.

2 GENERAL INFORMATION

2.1 USE OF THIS MANUAL

This manual serves as a guideline for the safe and effective installation, operation and maintenance of the Mastervolt MVSV gel batteries, further mentioned as “cell(s)” or “battery” / “batteries”

It is obligatory that every person who works on or with the batteries must be completely familiar with the contents of this manual, and that he/she carefully follows the instructions contained herein.

Installation of, and work on the batteries, may be carried out only by qualified, authorized and trained personnel, consistent with the locally applicable standards and taking into consideration the safety guidelines and measures (chapter 1 of this manual).

Keep this manual at a secure place!

2.2 VALIDITY OF THIS MANUAL

All of the specifications, provisions and instructions contained in this manual apply solely to standard versions of the Mastervolt MVSV gel batteries that were delivered by Mastervolt from 1 July 2006 on.

2.3 DISCLAIMER

Our products are subject to continual development and improvement. Therefore, additions or modifications to the products may cause changes to the technical data and functional specifications. No rights can be derived from this document. Please consult our most current Terms & Conditions of Sale.

2.4 GUARANTEE SPECIFICATIONS

Mastervolt guarantees that the Mastervolt MVSV gel batteries have been built according to the legally applicable standards and specifications. Should work take place, which is not in accordance with the guidelines, instructions and specifications contained in this user manual, then damage may occur and/or the batteries may not fulfil their specifications. All of these matters can mean that the guarantee becomes invalid.

The guarantee is limited to the costs of repair and/or replacement of the product. Costs for installation labor or shipping of the defective parts are not covered by this guarantee.

The period and conditions of this guarantee are laid down in the general conditions of delivery as registered with the Chamber of Commerce and Industries in Amsterdam number 33279951 and are available on request.

2.5 LIABILITY

Mastervolt can accept no liability for:

- consequential damage due to use of the batteries;
- possible errors in the manuals and the results thereof.

2.6 IMPORTANT TO KNOW

Stationary valve-regulated lead acid batteries do not require topping up water. Never open the battery. Do not add acid or distilled water. Pressure valves are used for sealing and cannot be opened without destruction.

For the installation and operation of stationary batteries EN 50 272-2 is mandatory.

3 INSTALLATION

3.1 BEFORE YOU START

- Installation, connection and protection must be executed in accordance with the locally applicable regulations.
- Check the contents of the delivery. See section 6.1 on page 13 for an overview of components that are standard included with the delivery.
- After unpacking, check each battery for mechanical damage. Do not use the product if it is damaged. If in doubt, contact your supplier.
- Check the batteries for correct polarity:

Terminal colour	Indication on battery	Meaning
Red	+	Positive
Blue	–	Negative

- Check each cell separately by measuring the open circuit voltage. U ≥ 2.07V.
- Control of insulation resistance: New batteries: > 1MΩ Used batteries: > 100 Ω/Volt.

3.2 LOCATION TO INSTALL

3.2.1 General

Standards referring to installation, cabinets, equipment or battery rooms are: EN 50091-1-2, IEC 896-2 (/3/) (draft IEC 60896-21 (/4/)) and EN 50272-2 (/1/).

Obey the following stipulations when choosing a location to install the batteries:

- Keep batteries away from heat sources. Allowed operating temperature: –20 to 45ºC / –4 to 113ºF. Nominal operating temperature: 10 to 30ºC / 50 to 86ºF. Recommended at 20ºC / 68ºF. The battery life is halved for every 10ºC of rise in temperature. Lower temperatures will reduce the available capacity.
- Battery installation should be made such that temperature differences between individual units do not exceed 3ºC / 5ºF.
- Keep at least 1cm / 0.5 inch space between the batteries. Mastervolt can supply dedicated cooling plates for this purpose (Part No. 67909014).
- All models of the MVSV range are suitable for both horizontal and vertical mounting. All cells should be mounted either vertically or horizontally.
- Please note that models MVSV 2000 (67162000) and MVSV 2500 (67202500) which were delivered before January 1st 2006 are only allowed to be installed in upright (vertical) position. See also chapter 2.2. If in doubt, contact your supplier.

3.2.2 Ventilation

DO NOT install the batteries in airtight enclosures. Under overcharging conditions, lead acid batteries can vent an explosive mixture of hydrogen gas.

The ventilation of battery rooms and cabinets must be carried out according to EN 50272-2. Under normal conditions the minimum air flow rate for ventilation of a battery location or compartment for Mastervolt MVSV gel batteries shall be calculated by the following formula (up to 40° C operating temperature).

$$Q = 0.05 \times n \times C_{nom} \times 10^{-3} \ [m^3/h]$$

Where

n = number of cells

C_{nom} = Nominal capacity (see Specifications)

With natural ventilation (air convection) the minimum inlet and outlet area (A) is calculated as follows (Air convection speed = 0.1 m/s):

$$A = 28 \times Q \ [cm^2]$$

Example:

Given: 24V battery bank consisting of 12 pieces Mastervolt MVSV 800 gel batteries, C_{nom} = 998 Ah,

Calculation of fresh air necessary:

$$Q = 0.05 \times n \times C_{nom} \times 10^{-3} \ [m^3/h]$$
$$= 0.05 \times 12 \times 998 \text{ Ah} \times 10^{-3} \ [m^3/h]$$
$$= 0.5988 \ [m^3/h]$$
$$A = 28 \times Q \ [cm^2]$$
$$= 28 \times 0.5988 \ [cm^2]$$
$$= \text{approx. } 16.8 \ [cm^2]$$

Potential sources of ignition must have a safety distance to the pressure valves of the batteries as specified in EN 50272-2.

3.2.3 Use of battery racks

When batteries are installed horizontally, use of a battery rack is obligatory. Obey the following recommendations:

- Each cell should be supported separately by the rack over its full length. Never stack a battery on another battery.
- Check that the battery racks are stable and horizontal. For the shelf assemblies with 4 levels of 2 rows or 5 levels of 3 rows, the assembly should anchored to the floor.
- Precautions must be taken if batteries are being installed in metallic cabinets or on racks. Keep an air safety distance of at least 10mm / 0.5inch between insulated cables and electrically conductive parts, or use additional insulation.

- The use of metal clamps on the cells is not recommended. A system made of insulating material should be used.
- Racks and cabinets shall have a distance of at least 100mm to the wall for a better placement of connections and better access for cleaning.

3.3 CONNECTION

- To avoid corrosion of the battery poles Mastervolt recommends lubricating the inserts and connections moderately using a small quantity of battery terminal grease.
- Use properly sized and reliable cables, cable lugs and battery terminals. Tighten all connections firmly. The following torque values apply for screw connectors: M8 (20±1) Nm / 175±10 Inlbs.
- Rubber covers shall be fitted to both ends of the connector cables (pole covers) before installation.
- Batteries in series or parallel must be of the same brand, type, capacity and state of charge. Do not mix old and new batteries.

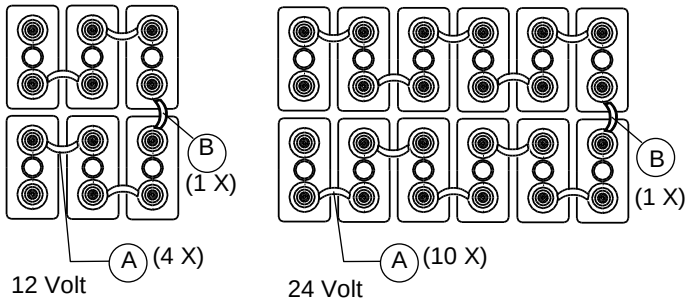
If a battery temperature sensor is used, it should be located on top or on one side of the cell which is located in the centre of the battery bank.

Connect the battery with the correct polarity to the charger (positive pole to positive terminal). Note that the position of the battery poles may differ from previous installed batteries! The charger may not be switched on during this process and the load must not be connected. Connect the minus cable last of all.

Check if all connections are firmly seated. Then switch on charger and start charging following chapter 4.2.

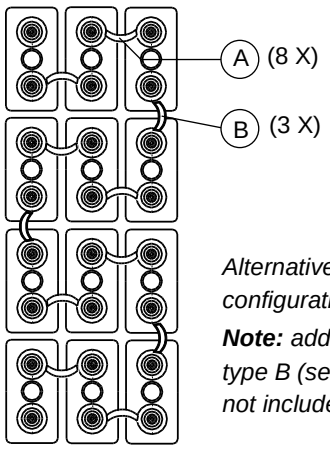
3.4 CONFIGURATIONS

3.4.1 Models MVSV 280, MVSV 420, MVSV 500, MVSV 580 and MVSV 750



Standard configuration.

All required parts are included in the delivery.

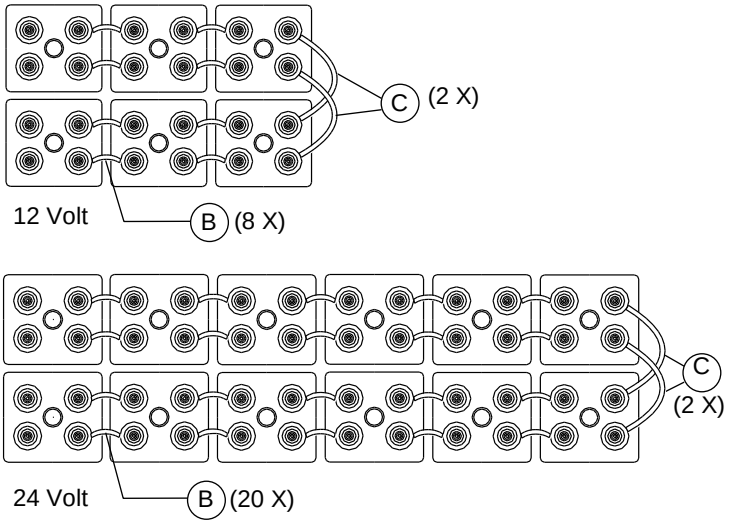


Alternative 24V configuration.

***Note:** additional 2 pcs. cable type B (see following table) not included.*

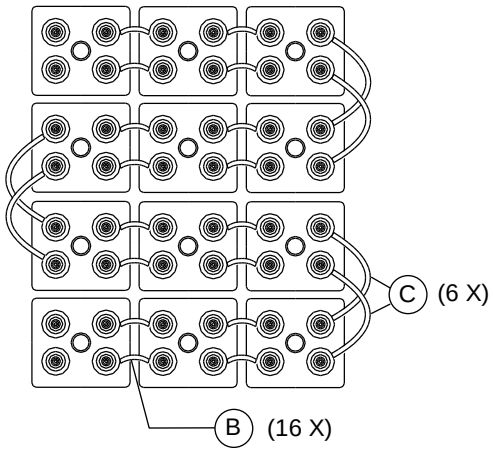
Battery Cable	Cable type	6 x MVSV 280/420	12 x MVSV 280/420	6 x MVSV 500	12 x MVSV 500	6 x MVSV 580	12 x MVSV 580	6 x MVSV 750	12 x MVSV 750
70mm^2, l = 135 mm	A	4	10						
70mm^2, l = 155 mm	A			4	10				
70mm^2, l = 165 mm	B	1	1	1	1				
70mm^2, l = 175 mm	A					4	10		
70mm^2, l = 230 mm	B					1	1		
95mm^2, l = 155 mm	A							4	10
95mm^2, l = 190 mm	B							1	1

3.4.2 Models MVSV 1000, MVSV 1250, MVSV 1500 and MVSV 1650



Standard configuration.

All required parts are included in the delivery

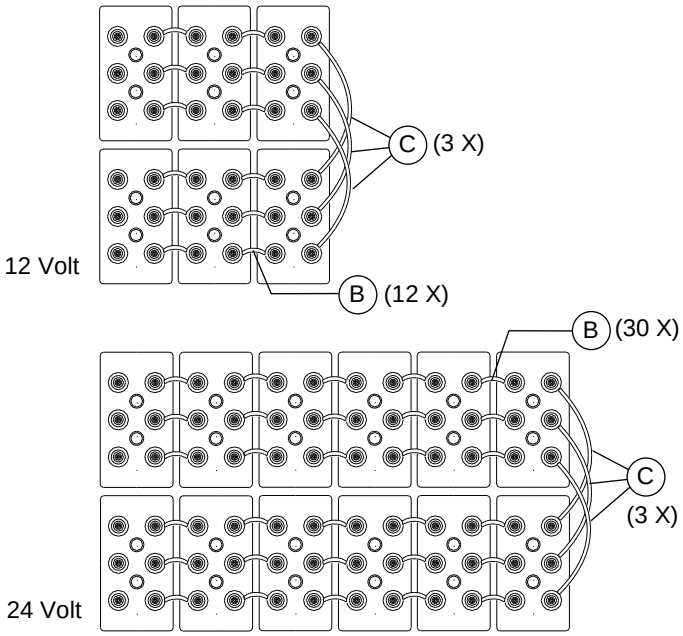


Alternative 24V configuration.

***Note:** additional 4 pcs. cable type C (see following table) not included.*

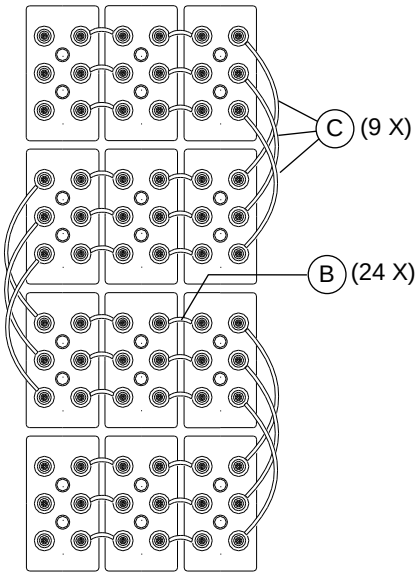
Battery Cable	Cable type	6 x MVSV 1000/1250	12 x MVSV 1000/1250	6 x MVSV 1500/1650	12 x MVSV 1500/1650
70mm^2, l = 165 mm	B	8	20		
95mm^2, l = 190 mm	B			8	20
70mm^2, l = 330 mm	C	2	2		
95mm^2, l = 400 mm	C			2	2

3.4.3 Model MVSV 2200



Standard configuration.

All required parts are included in the delivery.

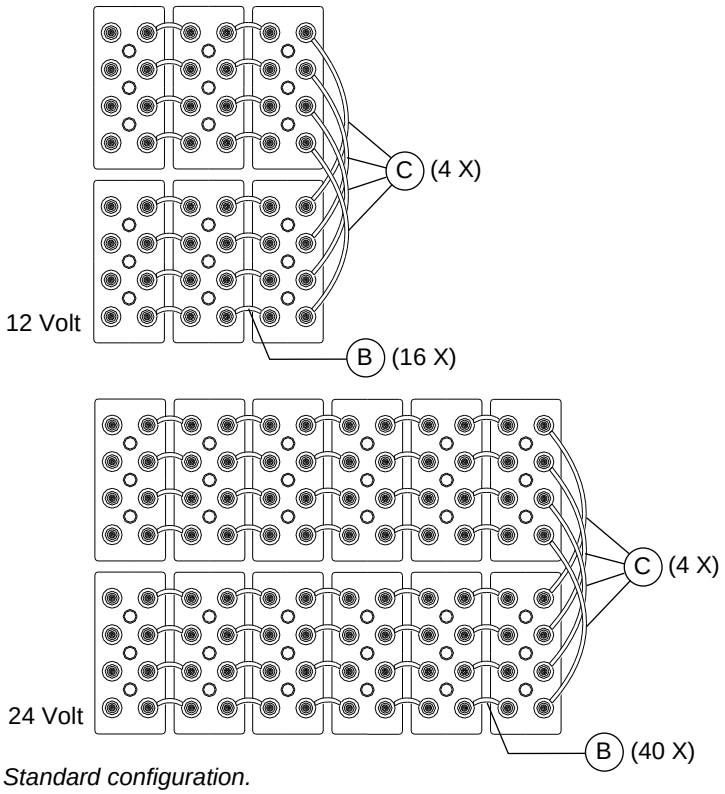


Alternative 24V configuration.

***Note:** Additional 6 pcs. cable type C (see following table) not included.*

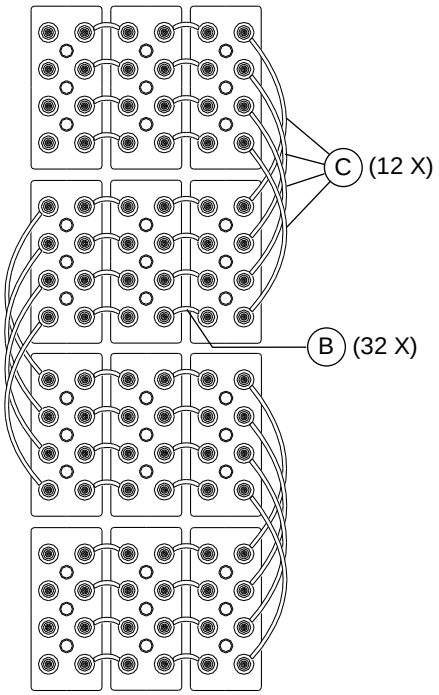
Battery Cable	Cable type	6 x MVSV 2200	12 x MVSV 2200
95mm^2, l = 115 mm	B	12	30
95mm^2, l = 580 mm	C	3	3

3.4.4 Model MVSV 2700



Standard configuration.

All required parts are included in the delivery.



Alternative 24V configuration.

***Note:** additional 8 pcs. cable type C (see section following table) not included.*

Battery Cable	Cable type	6 x MVSV 2700	12 x MVSV 2700
95mm^2, l = 115 mm	B	16	40
95mm^2, l = 580 mm	C	4	4

4 OPERATION

4.1 DISCHARGE

- Avoid deep discharges. Regular discharges beyond 60% of the nominal capacity are not recommended as they might shorten the lifetime of the battery.
- Recharge the battery immediately after a discharge.
- Never discharge below the final discharge voltage. The final discharge voltage is related to the discharge current. See section 6.3.3 on page 15.

4.2 CHARGING

Recommended charging method: three step battery charger with IUoUo characteristic. Voltage settings (@ 25ºC / 77ºF):

Nominal voltage	Float	Absorption*
2V (one cell)	2.30V	2.38V
12V (6 cells)	13.8V	14.25V
24V (12 cells)	27.6V	28.5V
48V (24 cells)	55.2V	57.0V

*max 5 hrs

Regularly, at least every month, fully charge the batteries.

4.3 ALTERNATING CURRENTS

When using old-style charging equipment or battery chargers of inferior quality, alternating currents may flow through the battery, superimposing onto the direct current during charge operation. Alternating currents and the reaction from the loads may lead to an additional temperature increase of the battery, and strain the electrodes with possible damages, which can shorten the battery life. Such damages can be avoided by using Mastervolt battery chargers.

When recharging up to 2.38V/cell under normal operation, the actual value of the alternating current is occasionally permitted to reach 10A (RMS)/100Ah nominal capacity. In a fully charged state during float charge or standby parallel operation the actual value of the alternating current must not exceed 5A (RMS)/100Ah nominal capacity.

4.4 CHARGING CURRENTS

The charging current should range between 10A to 50A / 100Ah nominal capacity (guide values). When selecting a battery charger keep in mind that the battery charger must be capable of supplying both the current of the connected load and the battery charging current.

Contact your Mastervolt representative for advice if the charger current exceeds 50A/100Ah nominal capacity.

4.5 TEMPERATURE

The recommended operation temperature range for Mastervolt MVSV batteries is 10°C to 30°C, best at 20°C (50°F to 86°F, best at 68°F). Higher temperatures will seriously reduce service life. lower temperatures reduce the available capacity. The absolute maximum temperature is 55°C (131°F) and should not exceed 45°C (113°F) in service.

4.6 TEMPERATURE RELATED CHARGE VOLTAGE

Temperature compensated charging is recommended according to the table below:

Nominal voltage	Temperature compensation	
2V (one cell)	–5mV/ºC	–2.8mV/ºF
12V (6 cells)	–30mV/ºC	–17 mV/ºF
24V (12 cells)	–60mV/ºC	–33 mV/ºF
48V (24 cells)	–120mV/ºC	–67 mV/ºF

Mastervolt battery chargers are standard provided with a battery temperature sensor for automatic adjustment of the charge voltage.

4.7 ELECTROLYTE

The electrolyte is diluted sulphuric acid and fixed in a gel.

5 MAINTENANCE

5.1 BATTERY MAINTENANCE AND CONTROL

Keep the battery clean and dry to avoid leakage currents. Plastic parts of the battery, especially the containers, must be cleaned with pure water. Never use any additives, acids and/or scourers.

Check batteries and connections on a regular base. Defects such as loose or corroded connections must be corrected immediately.

At least every 6 month measure and record:

- Overall voltage the batteries
- Voltages of several cells
- Surface temperature of several cells
- Battery-room temperature

If the cell voltages differs from the average float charge voltage by more than +0.2V respectively -0.1V or if the surface temperature difference between cells exceeds 5ºC, a Mastervolt service representative should be contacted.

Check and record at least every year:

- Voltage of each cell
- Surface temperature of each cell
- Battery-room temperature
- Screw connections
- Screw connections without locking devices have to be checked for tightness
- Battery installation and arrangement
- Ventilation

5.2 TESTS

Tests have to be carried out according to IEC 60896-22, DIN 43539 part 1. Special instructions like DIN VDE 0107 and DIN VDE 0108 have to be observed.

5.3 FAULTS

Call a Mastervolt service representative immediately if faults in the battery or the battery charger are found. Recorded data as described in chapter 5.1. must be made available to the service representative. It is recommended that a service contract is taken out with your agent.

5.4 STORAGE AND TAKING OUT OF OPERATION

To store or decommission cells for a longer period of time they should be fully charged and stored in a dry and cold but frost-free room, away from direct sun light.

The rate of self-discharge is approximately 2% per month @ 20ºC/68°F. Elevated environmental temperatures increase the self-discharge rate of the batteries. Therefore batteries need supplementary charge according to the table below to keep its capacity.

Storage temperature	Maximum charging interval
< 20ºC / < 68ºF	Every 24 months
20 to 30ºC / 68 to 86ºF	Every 12 months
30 to 40ºC / 86 to 104ºF	Every 6 months
40 to 50ºC / 104 to 122ºF	Every 3 months

5.5 TRANSPORT

The batteries must be transported in an upright position. Never lift the batteries at the terminals. Use soft slings to avoid damage. Do no stand below the batteries. Batteries without any visible damage are not defined as dangerous goods under the regulations for transport of dangerous goods by road (ADR) or by railway (RID). They must be protected against short circuits, slipping, upsetting or damaging. Cells may be suitable stacked and secured on pallets (ADR and RID, special provision 598). It is prohibited to stack pallets.

No dangerous traces of acid shall be found on the exteriors of the packing unit. Cells whose containers leak or are damaged must be packed and transported as class 8 dangerous goods under UN no. 2794.

6 SPECIFICATIONS

6.1 WHAT'S IN THE BOX

The following parts are included in the delivery:

Description	Part No.*	6 x MVSV 280	12 x MVSV 280	6 x MVSV 420	12 x MVSV 420	6 x MVSV 500	12 x MVSV 500	6 x MVSV 580	12 x MVSV 580	6 x MVSV 750	12 x MVSV 750	6 x MVSV 1000	12 x MVSV 1000	6 x MVSV 1250	12 x MVSV 1250	6 x MVSV 1500	12 x MVSV 1500	6 x MVSV 1650	12 x MVSV 1650	6 x MVSV 2200	12 x MVSV 2200	6 x MVSV 2700	12 x MVSV 2700
Battery Cable 70mm^2, l=135mm	67909016	4	10	4	10																		
Battery Cable 70mm^2, l=155mm	67909017					4	10																
Battery Cable 70mm^2, l=165mm	67909025	1	1	1	1	1	1					8	20	8	20								
Battery Cable 70mm^2, l=175mm	67909024							4	10														
Battery Cable 70mm^2, l=230mm	67909023							1	1														
Battery Cable 70mm^2, l=330mm	67909026											2	2	2	2								
Battery Cable 95mm^2, l=115mm	67909027																			12	30	16	40
Battery Cable 95mm^2, l=155mm	67909021									4	10												
Battery Cable 95mm^2, l=190mm	67909018									1	1					8	20	8	20				
Battery Cable 95mm^2, l=400mm	67909028															2	2	2	2				
Battery Cable 95mm^2, l=580mm	67909019																			3	3	4	4
Cover for connector positive	67909100	5	11	5	11	5	11	5	11	5	11	10	22	10	22	10	22	10	22	30	33	20	44
Cover for connector negative, with hole	67909102	5	11	5	11	5	11	5	11	5	11	10	22	10	22	10	22	10	22	30	33	20	44
Screw M8 x 18 for connector	67909104	12	24	12	24	12	24	12	24	12	24	24	48	24	48	24	48	24	48	36	72	48	96
Spring washer B8 for connector	67909105	12	24	12	24	12	24	12	24	12	24	24	48	24	48	24	48	24	48	36	72	48	96
Angle for end connector	67909106											4	4	4	4	4	4	4	4	6	6	8	8
Cover for angle rubber	67909107											4	4	4	4	4	4	4	4	6	6	8	8
Plate for end connector 50x5x80mm	67909206											2	2										
Plate for end connector 50x5x110mm	67909201													2	2								
Plate for end connector 50x5x140mm	67909202															2	2	2	2				
Plate for end connector 50x5x220mm	67909208																			2	2		
Plate for end connector 50x5x330mm	67909209																					2	2
Screw M8x25 for connector	67909104											4	4	4	4	4	4	4	4	6	6	8	8
Hex nut M8 for end connector	67909108											4	4	4	4	4	4	4	4	6	6	8	8
Washer B 8, 4 for end connector	67909109											4	4	4	4	4	4	4	4	6	6	8	8
Spring Washer B8 for connector	67909110											4	4	4	4	4	4	4	4	6	6	8	8
Insulation for end connector - transparent plastic	67909112											2	2	2	2	2	2	2	2	2	2	2	2

*) Note that these numbers are for reference purposes only. Contents of the delivery may differ due to special agreements.

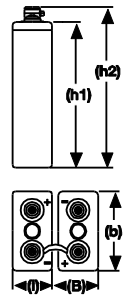
6.2 PHYSICAL SPECIFICATIONS

General

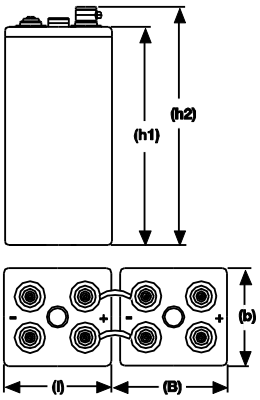
Operating temperature:	–20ºC to 45ºC (–4ºF to 113ºF)
Nominal operating temperature:	10ºC to 30ºC (50 ºF to 86ºF), recommended at 20ºC (68ºF)
Storage temperature:	–40°C to 55°C (–40°F to 131ºF)
Material of the battery container:	Styrene-acrylonitrile copolymer (SAN), Ul classification 94 HB

Dimensions and weights

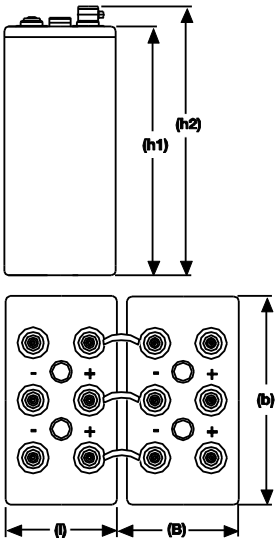
Model	length (l) Max mm	Width (b) Max mm	Height (h1) Max mm	Height (h2) Max mm	Installed length (B) Max mm	Weight (approx.)	Terminal
MVSV 280	126	208	357	399	135	23 kg	F-M8
MVSV 420	126	208	473	515	135	30 kg	F-M8
MVSV 500	147	208	473	515	156	35 kg	F-M8
MVSV 580	168	208	473	515	177	39 kg	F-M8
MVSV 750	147	208	648	690	156	49 kg	F-M8
MVSV 1000	212	193	648	690	221	66 kg	F-M8
MVSV 1250	212	235	648	690	221	80 kg	F-M8
MVSV 1500	212	277	648	690	221	95 kg	F-M8
MVSV 1650	212	277	717	759	221	115 kg	F-M8
MVSV 2200	216	400	775	816	225	160 kg	F-M8
MVSV 2700	214	489	774	816	223	198 kg	F-M8



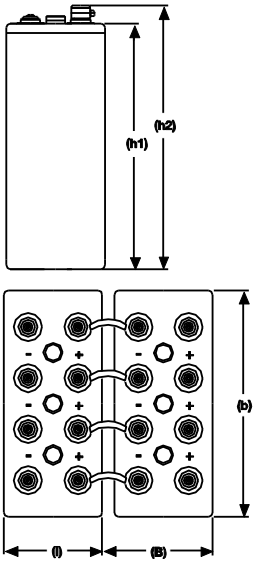
MVSV 280
MVSV 420
MVSV 500
MVSV 580
MVSV 750



MVSV 1000
MVSV 1250
MVSV 1500
MVSV 1650



MVSV 2200



MVSV 2700

Drawings with terminal position not to scale!

6.3 ELECTRICAL SPECIFICATIONS

6.3.1 General

Model	Part number	Nominal voltage	Nominal capacity*	Discharge current I_{10}*	Pole pairs	Internal resistance**	Short circuit current**
MVSV 280	68000280	2V	280Ah	28.0A	1	0.79mΩ	2700A
MVSV 420	68000420	2V	416Ah	41.6A	1	0.62mΩ	3300A
MVSV 500	68000500	2V	499Ah	49.9A	1	0.53mΩ	3950A
MVSV 580	68000580	2V	582Ah	58.2A	1	0.47mΩ	4400A
MVSV 750	68000750	2V	748Ah	74.8A	1	0.48mΩ	4300A
MVSV 1000	68001000	2V	998Ah	99.8A	2	0.38mΩ	4850A
MVSV 1250	68001250	2V	1248Ah	125A	2	0.33mΩ	6250A
MVSV 1500	68001500	2V	1497Ah	150A	2	0.29mΩ	7850A
MVSV 1650	68001650	2V	1643Ah	164A	2	0.23mΩ	9000A
MVSV 2200	68002200	2V	2190Ah	219A	3	0.19mΩ	10750A
MVSV 2700	68002700	2V	2738Ah	274A	4	0.16mΩ	13400A

* Nominal capacity C_{10}: 1.8V/cell @ 20°C (68°F)

** According to IEC60896-22

6.3.2 Charge voltage settings for three step battery chargers

Float:	2.30V/cell @ 25ºC / 77ºF
Absorption:	2.38V/cell @ 25ºC / 77ºF (max 5 hrs)
Temperature compensation:	-5mV/ºC/cell or -2.8mV/ºF/cell

6.3.3 Final discharge voltage

Model	Part number	Discharge current			
		C_1	C_3	C_5	C_{10}
MVSV 280	68000280	154A	76.0A	49.8A	28.0A
MVSV 420	68000420	238A	111A	76.6A	41.6A
MVSV 500	68000500	286A	133A	91.9A	49.9A
MVSV 580	68000580	333A	155A	107A	58.2A
MVSV 750	68000750	429A	195A	135A	74.8A
MVSV 1000	68001000	572A	260A	180A	99.8A
MVSV 1250	68001250	715A	325A	225A	125A
MVSV 1500	68001500	858A	390A	269A	150A
MVSV 1650	68001650	992A	479A	309A	164A
MVSV 2200	68002200	1267A	580A	397A	219A
MVSV 2700	68002700	1583A	725A	496A	274A
Final discharge voltage		**1.60V**	**1.70V**	**1.75V**	**1.80V**

All data refer to 20°C (68°F)

6.3.4 Open circuit voltage versus remaining capacity

Open circuit voltage	1.92V	1.98V	2.03V	2.08V	2.13V	2.16V
Approximate state of charge (± 20%)	0%	20%	40%	60%	80%	100%

Open circuit voltage is measured after the battery was disconnected from any load or power source for at least 24hrs.

6.4 CONSTANT CURRENT DISCHARGE

1.90V/cell – Discharge in A @ 20°C (68°F)

Model	Part number	10min	15min	30min	1h	2h	3h	5h	8h	10h
MVSV 280	68000280	180	158	134	95.3	74.5	57.1	39.0	26.8	22.9
MVSV 420	68000420	244	231	187	143	112	90.0	65.3	44.8	36.7
MVSV 500	68000500	293	277	224	172	134	108	78.4	53.8	44.0
MVSV 580	68000580	342	323	262	200	157	126	91.4	62.7	51.4
MVSV 750	68000750	270	258	243	214	167	138	102	71.9	60.3
MVSV 1000	68001000	360	344	324	285	223	184	136	95.9	80.4
MVSV 1250	68001250	450	430	405	357	278	230	171	120	101
MVSV 1500	68001500	517	516	486	428	334	276	205	144	121
MVSV 1650	68001650	518	518	507	420	312	261	205	155	129
MVSV 2200	68002200	691	669	639	581	469	381	284	207	172
MVSV 2700	68002700	863	837	798	727	587	477	355	259	216

1.87V/cell – Discharge in A @ 20°C (68°F)

Model	Part number	10min	15min	30min	1h	2h	3h	5h	8h	10h
MVSV 280	68000280	216	195	155	105	80.9	61.9	43.4	30.3	25.6
MVSV 420	68000420	308	284	223	163	119	96.6	69.4	47.8	39.6
MVSV 500	68000500	370	341	268	196	143	116	83.3	57.4	47.5
MVSV 580	68000580	431	398	313	228	167	135	97.2	66.9	55.4
MVSV 750	68000750	340	327	305	248	190	154	113	78.0	64.5
MVSV 1000	68001000	453	436	407	331	253	205	150	104	86.0
MVSV 1250	68001250	567	545	508	413	317	257	188	130	108
MVSV 1500	68001500	623	623	610	496	380	308	226	156	129
MVSV 1650	68001650	624	624	615	548	380	319	227	167	139
MVSV 2200	68002200	832	817	793	632	520	437	313	223	185
MVSV 2700	68002700	1040	1022	992	790	650	547	391	278	231

1.85V/cell – Discharge in A @ 20°C (68°F)

Model	Part number	10min	15min	30min	1h	2h	3h	5h	8h	10h
MVSV 280	68000280	243	214	171	113	85.1	65.0	45.4	31.5	26.6
MVSV 420	68000420	332	308	249	176	124	101	71.3	49.1	40.0
MVSV 500	68000500	398	370	299	211	149	121	85.6	58.9	48.5
MVSV 580	68000580	465	431	349	246	174	141	100	68.7	56.6
MVSV 750	68000750	389	368	336	269	202	165	119	82.1	67.6
MVSV 1000	68001000	519	491	448	359	269	220	159	109	90.1
MVSV 1250	68001250	648	613	560	448	337	275	199	137	113
MVSV 1500	68001500	701	701	672	538	404	330	238	164	135
MVSV 1650	68001650	702	702	683	597	431	339	252	181	150
MVSV 2200	68002200	1031	972	864	680	555	463	335	241	200
MVSV 2700	68002700	1288	1215	1080	850	693	578	419	302	249

1.83V/cell – Discharge in A @ 20°C (68°F)

Model	Part number	10min	15min	30min	1h	2h	3h	5h	8h	10h
MVSV 280	68000280	261	228	185	122	89.3	68.6	47.5	32.8	27.5
MVSV 420	68000420	350	337	265	187	130	104	72.9	49.8	40,9
MVSV 500	68000500	420	404	318	224	156	125	87.5	59.8	49.1
MVSV 580	68000580	490	472	371	262	182	146	102	69.7	57.3
MVSV 750	68000750	421	404	365	290	216	175	125	86.3	70.4
MVSV 1000	68001000	561	539	487	387	288	233	167	115	93.9
MVSV 1250	68001250	702	673	608	483	360	292	208	144	117
MVSV 1500	68001500	755	755	716	580	432	350	250	173	141
MVSV 1650	68001650	756	756	717	645	480	374	268	190	157
MVSV 2200	68002200	1123	1077	944	733	589	497	358	254	210
MVSV 2700	68002700	1403	1347	1180	917	737	622	447	317	262

1.80V/cell – Discharge in A @ 20°C (68°F)

Model	Part number	10min	15min	30min	1h	2h	3h	5h	8h	10h
MVSV 280	68000280	290	245	203	133	94.5	72.5	49.0	33.3	28.0
MVSV 420	68000420	397	364	280	201	135	107	75.1	50.8	41.6
MVSV 500	68000500	476	437	336	241	162	128	90.1	61.0	49.9
MVSV 580	68000580	556	510	392	281	189	149	105	71.1	58.2
MVSV 750	68000750	478	458	388	314	228	182	131	90.5	74.8
MVSV 1000	68001000	637	611	517	419	304	243	175	121	99.8
MVSV 1250	68001250	797	763	647	523	380	303	218	151	125
MVSV 1500	68001500	858	858	776	628	456	364	262	181	150
MVSV 1650	68001650	859	859	808	694	526	410	287	199	164
MVSV 2200	68002200	1279	1197	1076	863	657	531	378	266	219
MVSV 2700	68002700	1598	1497	1345	1078	822	663	473	332	274

1.75V/cell – Discharge in A @ 20°C (68°F)

Model	Part number	10min	15min	30min	1h	2h	3h	5h	8h	10h
MVSV 280	68000280	331	286	228	144	100	75.4	49.8	33.8	28.3
MVSV 420	68000420	423	389	300	215	139	109	76.6	51.8	42.6
MVSV 500	68000500	508	467	360	258	167	131	91.9	62.2	51.1
MVSV 580	68000580	592	545	420	301	195	153	107	72.5	59.6
MVSV 750	68000750	561	534	463	354	240	190	135	92.2	75.9
MVSV 1000	68001000	748	712	617	472	320	253	180	123	101
MVSV 1250	68001250	935	890	772	590	400	317	225	154	127
MVSV 1500	68001500	1048	1048	926	708	480	380	269	184	152
MVSV 1650	68001650	1049	1049	982	777	585	452	309	209	172
MVSV 2200	68002200	1356	1313	1237	1012	712	567	397	278	229
MVSV 2700	68002700	1695	1642	1547	1265	890	708	496	348	287

1.70V/cell – Discharge in A @ 20°C (68°F)

Model	Part number	10min	15min	30min	1h	2h	3h	5h	8h	10h
MVSV 280	68000280	363	323	251	150	102	76.0	50.3	34.1	28.4
MVSV 420	68000420	468	425	334	220	142	111	78.2	52.4	43.0
MVSV 500	68000500	562	510	401	264	170	133	93.8	62.9	51.6
MVSV 580	68000580	655	595	468	308	199	155	109	73.4	60.2
MVSV 750	68000750	639	615	527	388	252	195	136	92.7	76.4
MVSV 1000	68001000	852	820	703	517	336	260	181	124	102
MVSV 1250	68001250	1065	1025	878	647	420	325	226	155	127
MVSV 1500	68001500	1267	1230	1054	776	504	390	271	185	153
MVSV 1650	68001650	1268	1260	1135	903	623	479	322	222	176
MVSV 2200	68002200	1557	1480	1365	1140	753	580	406	285	234
MVSV 2700	68002700	1947	1850	1707	1425	942	725	507	356	293

1.65V/cell – Discharge in A @ 20°C (68°F)

Model	Part number	10min	15min	30min	1h	2h	3h	5h	8h	10h
MVSV 280	68000280	393	348	265	153	103	76.3	50.5	34.4	28.5
MVSV 420	68000420	488	458	354	230	144	112	79.3	52.8	43.4
MVSV 500	68000500	586	550	425	276	173	134	95.2	63.4	52.1
MVSV 580	68000580	683	641	496	322	202	157	111	73.9	60.8
MVSV 750	68000750	715	696	583	411	255	197	136	93.2	76.8
MVSV 1000	68001000	953	928	777	548	340	262	182	124	102
MVSV 1250	68001250	1192	1160	972	685	425	328	227	155	128
MVSV 1500	68001500	1430	1392	1166	822	510	394	272	186	154
MVSV 1650	68001650	1463	1446	1249	960	645	491	328	225	178
MVSV 2200	68002200	1760	1608	1476	1208	777	596	413	289	238
MVSV 2700	68002700	2200	2010	1845	1510	972	745	516	361	297

1.60V/cell – Discharge in A @ 20°C (68°F)

Model	Part number	10min	15min	30min	1h	2h	3h	5h	8h	10h
MVSV 280	68000280	408	375	278	154	104	76.5	50.8	34.5	28.6
MVSV 420	68000420	500	478	382	238	146	113	80.2	53.2	43.8
MVSV 500	68000500	600	574	458	286	175	136	96.2	63.8	52.6
MVSV 580	68000580	700	669	535	333	204	158	112	74.5	61.3
MVSV 750	68000750	786	767	632	429	260	198	137	93.6	77.2
MVSV 1000	68001000	1048	1023	843	572	347	264	182	125	103
MVSV 1250	68001250	1310	1278	1053	715	433	330	228	156	129
MVSV 1500	68001500	1572	1534	1264	858	520	396	273	187	154
MVSV 1650	68001650	1604	1480	1295	992	662	497	332	226	180
MVSV 2200	68002200	2059	1872	1664	1267	807	607	417	292	240
MVSV 2700	68002700	2573	2340	2080	1583	1008	758	522	365	300

MASTERVOLT
THE POWER TO BE INDEPENDENT

EMEA

Snijdersbergweg 93
1105 AN AMSTERDAM
The Netherlands

+31 (0)20 34 22 100
info@mastervolt.com

NORTH AMERICA

N86 W12500 Westbrook Crossing
Menomonee Falls, WISCONSIN 53051
USA

+1 800 307 6702, Option 1
technical@marinco.com

ASIA/PACIFIC

42 Apollo Drive, Rosedale
AUCKLAND 0632
New Zealand

+ 64 9 415 7261
enquiries@bepmarine.com