

GAZ[®]

tomain[™]

NEXT GENERATION
OF BATTERIES

KGM...P

KGL...P

Battery Installation,
Operation and
Maintenance Instructions

EnerSys[®]

Power/Full Solutions

Visit us at www.enersys.com

Warning!

The gases emitted during charging are explosive. The electrolyte (potassium hydroxide, KOH) is highly corrosive. Exposed metal parts of the battery always conduct a voltage and are electrically active parts. Precautions in accordance with IEC 62485-2:2010 must be observed.



Observe the instructions for use and place them visibly close to the battery! Work only on batteries after receiving instruction from qualified personnel!



When working on batteries wear safety glasses and protective clothing. All metallic personal objects, such as rings, watches, bracelets etc. shall be removed before starting work on the battery! Only use insulated tools! Comply strictly with the accident prevention regulations and your national Health and Safety standards as well as IEC 62485-1:2010



Electrolyte is harmful to skin and eyes. Therefore, after an accidental contact with the electrolyte flood the eyes immediately with large quantities of clean water for an extended period of time of at least 15 minutes. In all cases, consult a doctor immediately! Clothing contaminated with electrolyte should be washed in water immediately!



Warning: Risk of fire, explosion, or burns! Avoid any short circuit! Metallic parts of the battery are always under voltage on the battery, do not place tools or items on top of the battery!



Electrolyte is highly corrosive!



Cells are heavy! Make sure they are safely installed! Only use suitable transport equipment!



No smoking! Do not allow naked flames, embers or sparks near the battery due to the risk of explosion or fire!

The Installation, Operation and Maintenance Instructions must be strictly observed.

Non-compliance with the Installation, Operation and Maintenance Instructions, use of nongenuine spares and the usage of other than by EnerSys/GAZ specified parts, use of additives to the electrolyte and unauthorised tampering will invalidate any entitlement to warranty.

Used batteries with this symbol are recyclable products and have to be put into a recycling system. Used batteries must be disposed of as special waste in accordance with all standards.



WARNING!

Never use sulphuric acid or acidic water.
Acid will damage the battery!

1. Receiving the battery

Cells must not be stored in their packaging, therefore, unpack the battery immediately upon receipt. Do not tilt the package or turn it upside down. The battery cells are equipped with a blue plastic transport plug. *lomain*[™] battery cells will be delivered **filled and charged**. The battery is ready for installation. Replace the transport plug with the red vent cap included in the accessories just before use (see section 7).

The battery must not be charged with the transport plug installed as this can damage the battery.

2. Storage

The rooms provided for storing the batteries must be clean, dry, cool (+10°C to +30°C) and well ventilated. Cells must not be stored in the transport packaging and must not be exposed to direct sunlight or UV-radiation.

If the cells are delivered in plywood boxes, open the boxes before storage and remove the packing material on the top of the cells. If the cells are delivered on pallets, remove the packing material on the top of the cells.

Filled *lomain*[™] cells can be stored up to 12 months from the day of delivery.

Storage of filled cells at a temperature above +30°C will result in a loss of capacity of approximately 5% per 10 degrees per year. It is very important that the cells are sealed with the plastic transport plugs tightly in place. This is to be checked after receiving the goods. In case of electrolyte loss during transport, refill the cell up to the "MAX" mark with genuine electrolyte before storage.

3. Installation

The installation should be carried out in accordance with the requirements of IEC 62485-2:2010, Part 2 "Safety Requirements for secondary batteries and battery installations – Part 2: Stationary batteries". For non-stationary installations, specific standards may also apply.

3.1 Location

Install the battery in a dry and clean room. Avoid exposure to direct sunlight and heat. The battery will give the optimal performance and maximum service life if the ambient temperature range is between +10°C and +30°C.

3.2 Ventilation

During the last phase of charging, battery gases are released (a mixture of oxygen and hydrogen). Ventilation is necessary, even if the generation of gas is very low during float charging.

Compliance with local regulations as to ventilation may be necessary for certain applications. If there are no special regulations, standard IEC 62485-2:2010, Part 2 must be met.

3.3 Setting up

Always follow the assembly drawings, circuit diagrams and other separate instructions. In the case of parallel string connection only use battery cells of the same capacity, design and age up to a maximum of two parallel strings. For parallel connection of more than two strings, please contact the manufacturer for technical approval. Use nickel-plated cable lugs for cable connections.

The transport plugs must be replaced with the red vent caps included in the accessories.

Tighten the terminal screws with corresponding tightening torque as per table 1.

It is recommended to use a calibrated torque wrench.

Table 1: Torque loading for terminal screws:

Male terminal	Female terminal
M10 : 8 Nm	M8 : 20-25 Nm M10 : 25-30 Nm

Connectors and terminals should be protected by a thin layer coating of anti-corrosion grease.

3.4 Electrolyte

The electrolyte for *lomain*TM NiCd batteries consists of a diluted potassium hydroxide (KOH) solution (specific gravity 1.20 kg/litre +/-0.01 kg/litre) with a lithium hydroxide component, in accordance with IEC 60993:1989. The potassium hydroxide solution is prepared in accordance with factory regulations. The specific gravity of the electrolyte does not indicate the state of charge of the battery. The specific gravity changes very little during charging and discharging, and has limited relationship to the temperature.

When checking the electrolyte levels, a variation in level between cells is not unusual and is due to the different quantity of gas held in the separators of each cell. Before the battery is put into service for the first time, check that the electrolyte level is not lower than 10mm below the "MAX" mark. There is usually no need to adjust it.

If the electrolyte level is lower than the "MIN" level during service, the battery should not be disconnected from the charger for a time longer than 12 hours.

If visual inspection is not possible, due to restricted view, use an electrolyte level testing tube to check the electrolyte level. For further instructions, please contact your GAZ/EnerSys representative.

GAZ *lomain*TM cells fulfil the requirements of IEC 62259:2003, para 7.9 for gas recombination efficiency.

3.5 Commissioning

The following instructions are valid for commissioning between +20°C and +30°C. For different conditions please contact GAZ. Charging with constant current is the preferred method.

If a site test is requested, it must be carried out in accordance with IEC 62259:2003.

According to IEC 62259:2003, 0.1 C₅ A is also expressed as 0.1 I_t A. The reference test current I_t is expressed as:

$$I_t A = \frac{C_n Ah}{1h}$$

Example:

0.1 I_t A means:
10 A for a 100 Ah battery or
50 A for a 500 Ah battery

3.5.1 Commissioning with constant current

***lomain*TM cells stored up to 6 months:**

A commissioning charge is normally not required and the cells are ready for service. If full performance is necessary immediately, a commissioning charge of 10 hours at 0.1 I_t A is recommended. This procedure is carried out without the red low-pressure vents installed.

During the charge the temperature should be checked (see section 5).

***lomain*TM cells stored for more than 6 months up to 1 year:**

A commissioning charge of 15 hours at 0.1 I_t A is necessary. This procedure is carried out without the red low-pressure vents installed.

During the charge the temperature should be checked (see section 5).

3.5.2 Commissioning with constant voltage

A commissioning charge is normally not required and the cells are ready for service. If the charger's maximum voltage setting is too low to supply constant current charging, divide the battery into two parts and charge them individually.

***lomain*TM cells stored up to 6 months:**

A commissioning charge is normally not required and the cells are ready for service. If full performance is necessary immediately, a commissioning charge of 20 hours at 1.65 V/cell with current limited to 0.1 I_t A is recommended.

This procedure is carried out without the red low-pressure vents installed.

During the charge the temperature should be checked (see section 5).

***lomain*TM cells stored more than 6 months and up to 1 year:**

A commissioning charge of 30 hours at 1.65 V/cell with current limited to 0.1 I_t A is necessary.

This procedure is carried out without the red low-pressure vents installed.

During the charge the temperature should be checked (see section 5).

In the case of variable charging conditions, please consult your GAZ[®] representative.

3.5.3 Commissioning at ambient temperature above +30°C

Constant current charging is the only appropriate method for commissioning under such temperature conditions. During the whole process the electrolyte temperature must be monitored. The electrolyte temperature should never exceed +45°C. On exceeding +45°C the charging should be temporarily interrupted until the electrolyte temperature drops to +40°C.

Duration: 20 hours

Charging current: 0.1 I_t A

In case of any interruption during the commissioning process, the total charge time must be extended by the duration of the downtime.

4. Charging in operation

Do not open or remove the low pressure vent caps during operation. The charging current limit should be 0.1 I_t A maximum in general.

In order to reduce the water consumption it is recommended, but not obligatory to adjust the charge voltage.

Operation in high temperature area (>35°C): Temperature coefficient of -2 mV/K

Operation in low temperature areas (<20°C): Temperature coefficient of -3mV/K

Recommended charging voltages for ambient temperatures from +20°C to +35°C are:

Two step charge

Float charge: 1.40-1.42 V/cell
Boost charge: 1.45-1.46 V/cell
Current limitation: 0.1 I_t A

Single step charge

Charging voltage: 1.42-1.44 V/cell
Current limitation: 0.1 I_t A

5. Periodic maintenance

GAZ[®] *lomain*TM cells require a minimum amount of maintenance. In order to maintain maximum performance, the following is recommend:

Standard service inspection:

In a regular twelve month period, carry out a check-up under normal float conditions. Depending on site location, local regulations, or special application requests, these check-ups can vary in frequency or period.

When performing the standard service inspections please be sure to carry out the following:

- General appearance and cleanliness of all the batteries and the battery room.

The battery must be kept clean using only water. Do not use a wire brush or solvents/additives of any kind. Ventilation must fulfill the requirements of section 3.2.

- Electrolyte level

Visually check the electrolyte level. Refilling is recommended when the electrolyte level reaches the "MIN" mark. However it must never drop below the "WARNING LEVEL" mark. Adjust the electrolyte level only in fully charged conditions. Only use distilled or deionized water to top-up the cells in accordance with IEC 60993:1989.

NOTE: Once the battery has been filled with the correct electrolyte at the factory, there is no need to regularly check the electrolyte density. Interpretation of density measurements is difficult and could lead to misunderstandings.

- Electrical parameters

Check the float voltage measurements of every single cell and the battery charging current.

It is important that the recommended charging voltage remains unchanged. High water consumption of the battery is usually caused by improper voltage settings of the charger. If a single-cell voltage of below 1.35V is detected during float charging, it is recommended to charge the cell(s) separately in accordance to section 3.5.1 Commissioning with constant current

If a battery is connected in parallel, the charging current in the strings should also be checked to ensure equality.

- Electrolyte temperature:

Check the electrolyte temperature from one of the cells in the middle of the battery from time to time. The temperature of the electrolyte should never exceed +45°C, as higher temperatures have a detrimental effect on the performance and lifetime of the cells. During charging, the electrolyte temperature should be ≤35°C. In the case of the temperature exceeding +45°C, the charging should be temporarily interrupted until the electrolyte temperature has dropped to +35°C. In the case of low ambient temperatures or electrolyte temperatures that reduce to -25°C, this does not have a detrimental effect on the battery, and only causes a temporary reduction of capacity.

Extended service inspection:

Regular check every 24 months

In addition to the standard service inspection the following measures are required:

- Connector torque and corrosion protection:

Check that all connectors, nuts and screws are correctly torqued. All metal parts of the battery should be coated with a thin layer of anti-corrosion grease supplied by GAZ. Do not coat any plastic parts of the battery, for example cell cases.

Measurement readings - battery log book:

It is recommended to utilize a battery log book. This log book should record all significant events such as power cuts, service activities, inspections, discharge tests, equalizing charges, topping

6. Additional warning notes

Lead-acid and NiCd batteries shall preferably be accommodated in separate rooms. Where both battery types are located in the same room, the charging gases from the lead-acid batteries must be kept away from the NiCd batteries. Tools for lead-acid batteries must not be used for NiCd batteries.

Risk of short circuit and fire:

Do not place electrically conductive objects such as tools etc. on top of the battery!

Risk of injury:

No rings or metal bracelets should be worn during the assembly of the battery.

Risk of explosion:

Open the doors of the battery cabinet during charging so that the charging gases can escape.

The charging gases from batteries are explosive. Do not allow naked flames, sparks or other sources of ignition in the vicinity of the battery!

Caution – potassium hydroxide solution is corrosive!

A potassium hydroxide solution is used as electrolyte. It is a highly corrosive liquid which can cause severe damage to health if it comes into contact with eyes or skin (risk of blinding). Even swallowing a small quantity may cause internal injuries.

When working with the electrolyte, and on the cells or batteries, rubber gloves, safety glasses with side guards, and protective clothing must always be worn!

Contact with the eyes:

Flood eyes immediately with large quantities of water for 10 to 15 minutes. Consult a doctor immediately.

Contact with the skin:

Remove contaminated clothing immediately and wash the affected skin areas with large quantities of water. In case of discomfort seek medical advice.

Swallowing:

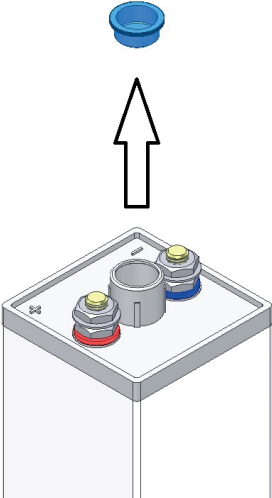
Rinse the mouth immediately with large quantities of water and keep drinking large amounts of water. Do not provoke vomiting. Call an emergency doctor immediately.

In the event of injuries:

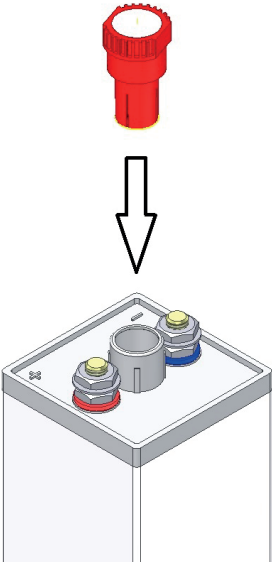
Rinse thoroughly for a long time under running water. Consult a doctor immediately.

7. Removal of the Transportation Plugs and Fitting of Vent Caps

KGL 12-440 P
KGM 11-400 P

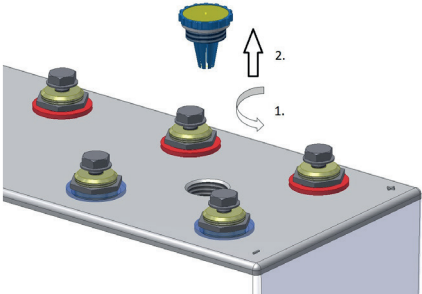


Step 1
(before commissioning charge)

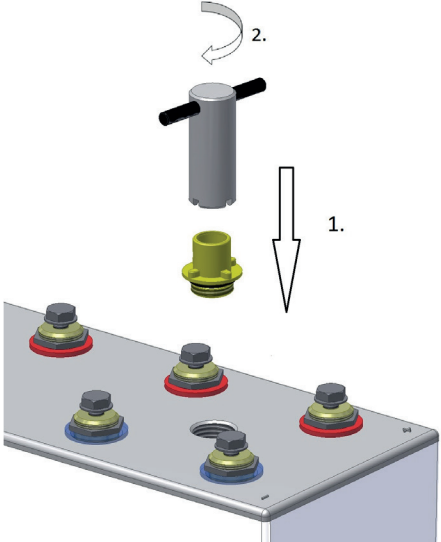


Step 2
(after commissioning charge)

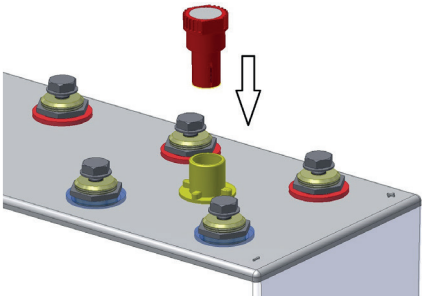
KGL 500-1570 P
KGM 450-1560 P



Step 1
(before commissioning charge)



Step 2

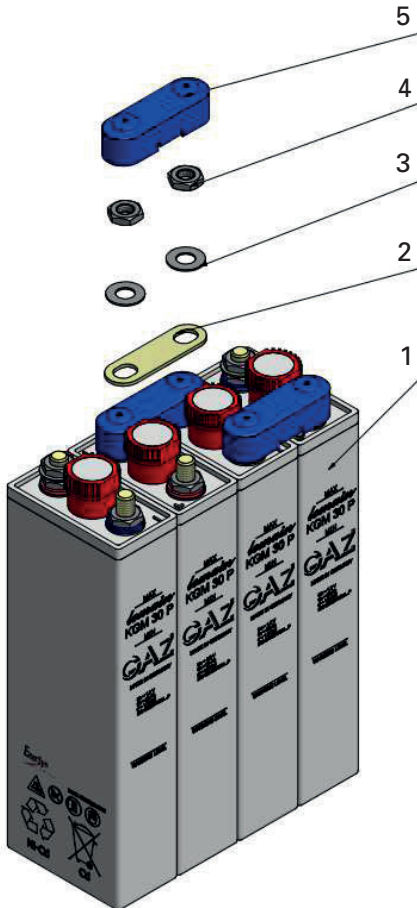


Step 3
(after commissioning charge)

8. Layout details: inter-cell connection

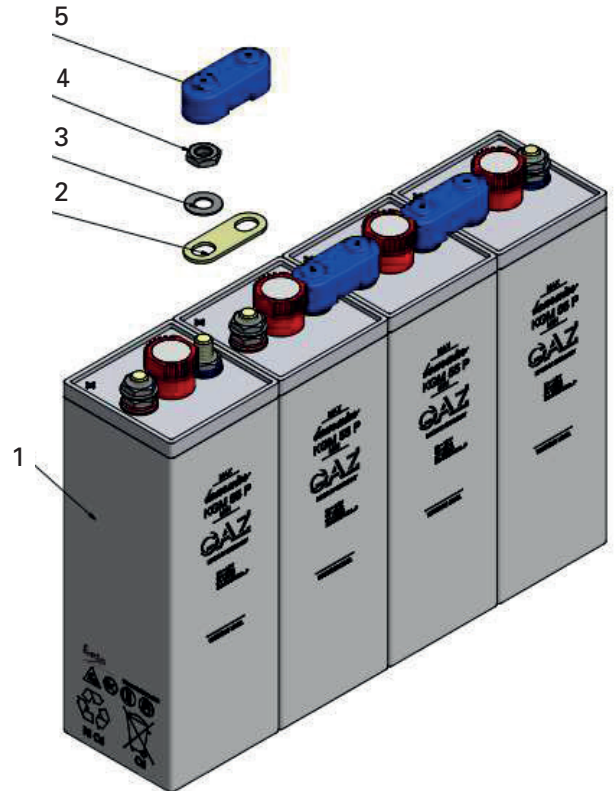
KGL 12-35 P
KGM 11-30 P

- 1 Cell
- 2 Cell connector
- 3 Spring washer
- 4 Nut
- 5 Connector cover



KGL 45-60 P
KGM 40-55 P

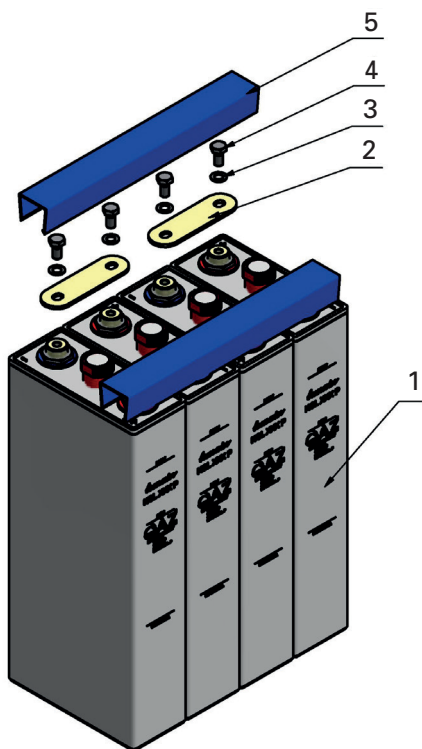
- 1 Cell
- 2 Cell connector
- 3 Spring washer
- 4 Nut
- 5 Connector cover



Note, typical layout only. Refer to section 9 for details

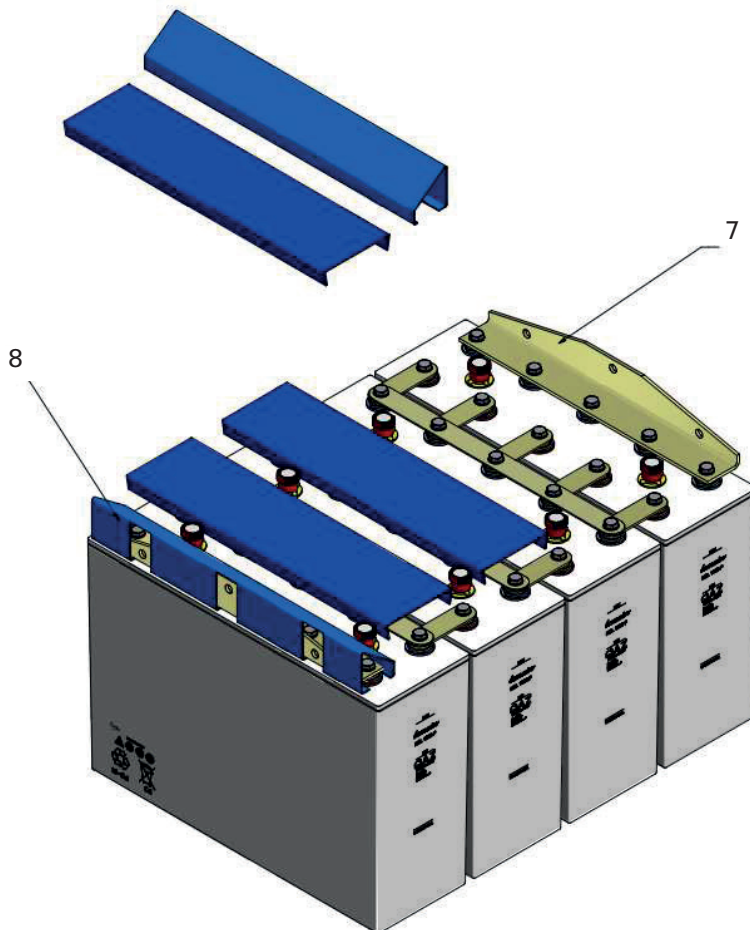
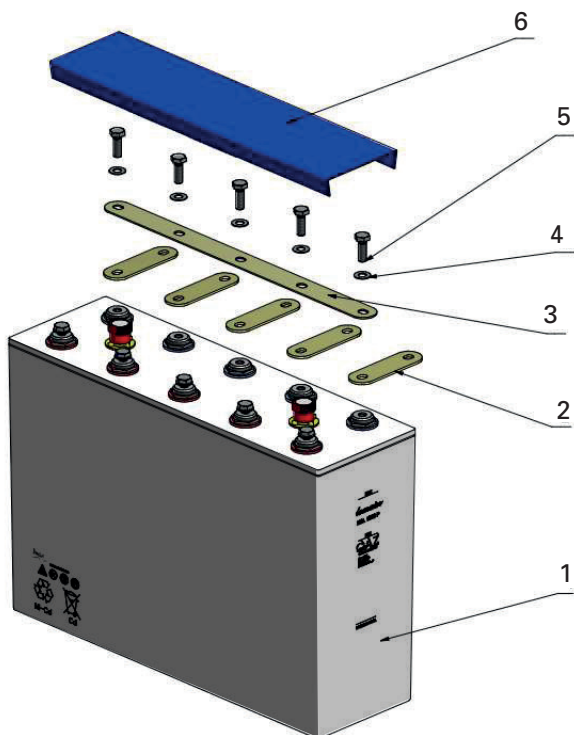
KGL 70-440 P
KGM 65-400 P

- 1 Cell
- 2 Cell connector
- 3 Spring washer
- 4 Screw
- 5 Connector cover



KGL 500-1570 P
KGM 450-1350 P

- 1 Cell
- 2 Cell connector
- 3 Terminal connector
- 4 Spring washer
- 5 Screw
- 6 Connector cover
- 7 End terminal connector
- 8 Cover end terminal connector

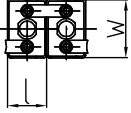


Note, typical layout only. Refer to section 9 for details

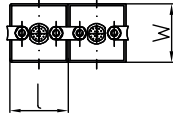
9. Cell Layout

KGL...P

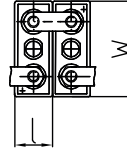
KGL 12 P - KGL 35 P
(Male thread M10)



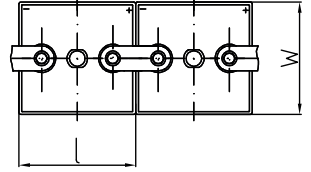
KGL 45 P - KGL 60 P
(Male thread M10)



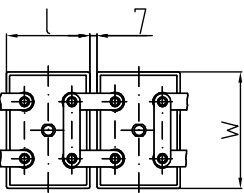
KGL 70 P - KGL 275 P
(Female thread M8)



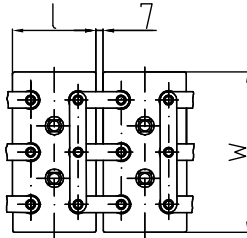
KGL 300 P - KGL 440 P
(Female thread M10)



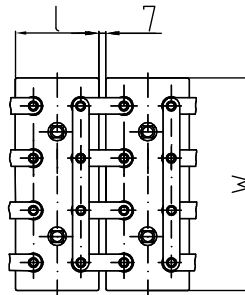
KGL 500 P - KGL 645 P
(Female thread M10)



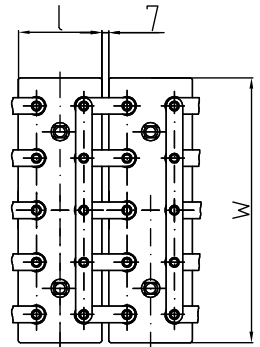
KGL 665 P - KGL 835 P
(Female thread M10)



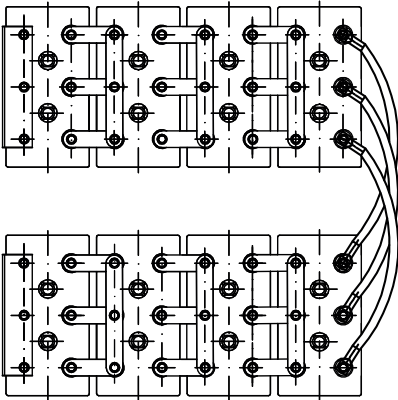
KGL 890 P - KGL 1110 P
(Female thread M10)



KGL 1260 P - KGL 1570 P
(Female thread M10)

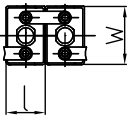


Cells assembled in a 2 row configuration

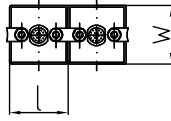


KGL...M

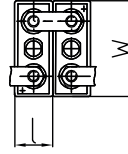
KGM 11 P - KGM 30 P
(Male thread M10)



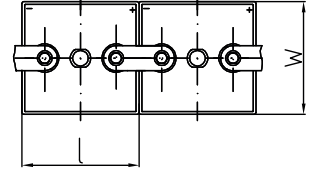
KGM 40 P - KGM 55 P
(Male thread M10)



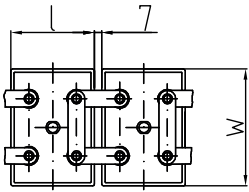
KGM 65 P - KGM 250 P
(Female thread M8)



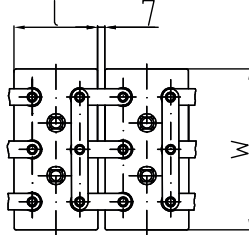
KGM 270 P - KGM 400 P
(Female thread M10)



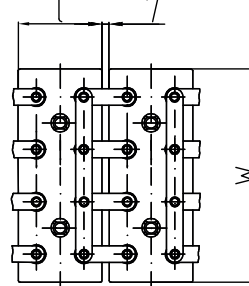
KGM 450 P - KGM 570 P
(Female thread M10)



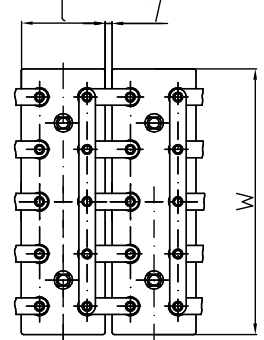
KGM 600 P - KGM770 P
(Female thread M10)



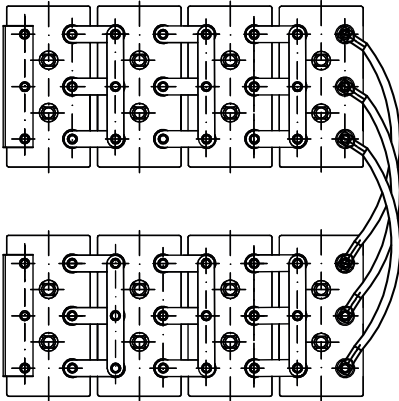
KGM 800 P - KGM 1130 P
(Female thread M10)



KGM 1250 P - KGM 1350 P
(Female thread M10)



Cells assembled in a 2 row configuration





Power/Full Solutions

EnerSys World Headquarters
2366 Bernville Road, Reading
PA 19605, USA
Tel: +1-610-208-1991 /
+1-800-538-3627

EnerSys EMEA
EH Europe GmbH
Baarerstrasse 18
6300 Zug, Switzerland

EnerSys Asia
152 Beach Road
Gateway East Building #11-03
Singapore 189721
Tel: +65 6508 1780

Contact