

Traction Battery

SUPER <LIFTTOP> ECO

For battery forklift



Thai Energy Storage Technology PLC.

Traction Battery SUPER <LIFTTOP> ECO

Battery forklift have replaced conventional forklift (i.e., internal-combustion engine type) as measures for the increasing demand on clean environments in various sites where forklift take an active role, such as factories, distribution centers, warehouses, ports and harbors, airports, etc.

The batteries as a driving source of battery forklift are an outcome of integrating a number of superior technologies based on long-time practices and affluent experiences, and still advancing by inheriting these.

Thai Energy Storage Technology PLC. have adopted the same high-reliable technology that has been successfully equipped to Traction Battery "SUPER <LIFTTOP> ECO" manufactured by Showa Denko KK in Japan. The technology contributes to provide well-balanced battery which can meet various user needs such as using at low and High temperatures. In addition quality control is also fully supported by Showa Denko KK.

We produce all products under the quality management system based on the certificated standard of ISO9001 (Ver.2008).

Also, We acquired the certificate of ISO14001 (Environmental Management standard) in May 2004 to perform manufacturing activities by positioning the harmony with the environment to be an essential theme.

Good discharge characteristics both under the low and high temperatures and life cycle.

Features

The active material density of the positive plate has been optimized by changing the electrode plate structure. The specification of well-balanced battery between capacity and life performance has been realized.

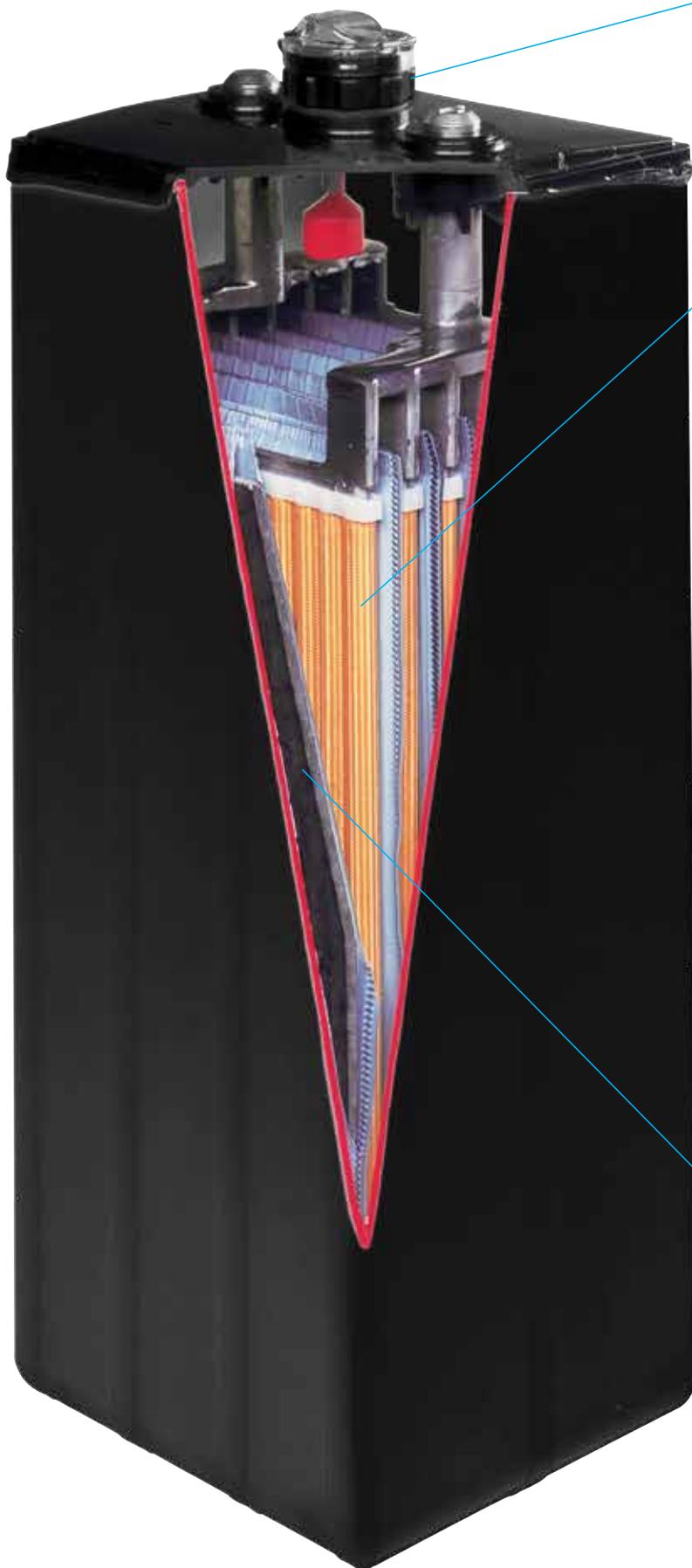
To adopt a glass tube is not only superior in mechanical, but also in chemical and electric characteristics .

Low-temperature characteristics have been improved by adopting new additives, and we can meet more diverse needs.

Characteristics have been enhanced by adopting glass tube same as Showa Denko KK, Japan.

Negative-electrode active materials on SEM photographs

Showa Denko spec.



One example of the battery used for a forklift

As the battery for a forklift, a battery pack of 24 V or 48 V is installed thereon depending of the specification of the forklift.

Battery for reach forklift

The type of battery generally in a high height is used as a driving source of a stand-to-operate type of forklift.



Battery for counterbalanced forklift

The type of battery generally in a low height is used as a driving source of a sit-to-operate type of forklift.

Float mounted water plug

- The large diameter type facilitates water refilling.
- The float enables verification of the water level at a glance.
- Overflow prevention structure offers superior vibration-proof.



Positive plate

Glass tube

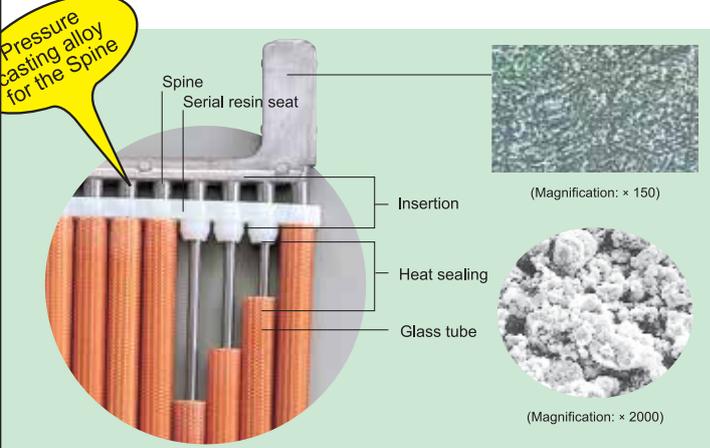
The glass tube used for the positive plate is made of special glass fibers having superior mechanical, electrical, and chemical properties, thereby contributing to the realization of long life.

Spine

The Spine comprising the conductor portion is fabricated by applying the pressure casting method, which we have practiced for a long time. This method enables the crystal architecture denser than that by the gravity casting method, thereby offering the enhanced durability in severe temperature environments.

Active material

Our unique lead powder is adopted for the positive-electrode active material, which takes on a role of accumulation of electricity in the positive plate, thereby contributing to the realization of high capacity and long life.

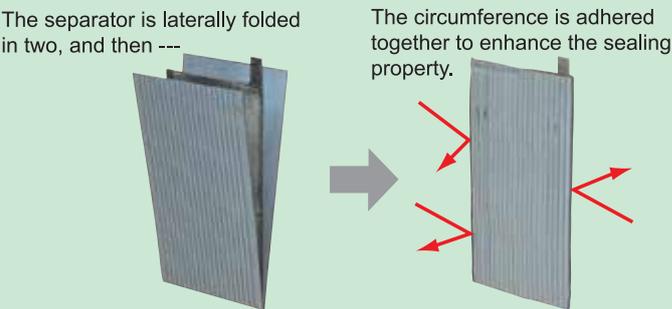


Positive plate active material

The positive plate of high capacity and long life has been realized by adopting our unique lead powder.

Negative plate

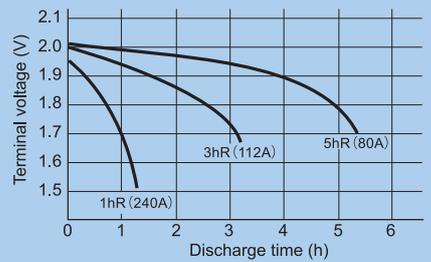
The negative plate is equipped with a clean separator made of polymer polyethylene, which elutes a significantly less amount of oil contained therein and thus results in less contamination of electrolyte.



Standard discharge characteristics (example)

The battery capacity varies depending on the magnitude of discharge current. For example, the capacity at the 1 hour-rate discharge rate is reduced to about 60 to 65% of the 5 hour-rate discharge capacity (rating). In addition, discharge at large current may not only reduce an available quantity of electricity but also shorten the battery life.

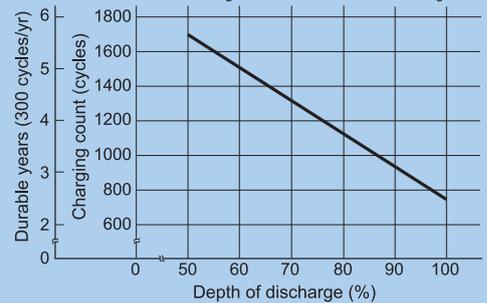
<Initial characteristics>
400Ah/5hR Electrolyte temperature:30°C



Relation of depth of discharge and cycle life (example)

The cycle life of a battery is affected by driving conditions of a vehicle (daily discharge amount), vibration, heat, and the quality of daily maintenance. In particular, the discharge amount significantly affects the life, where repetitive, deep discharge tends to reduce the life.

At 100% discharge: Approx. 750 cycles (2.5 yrs)
At 75% discharge: Approx. 1200 cycles (4 yrs)
Characteristics acquired from a standstill test conducted in a laboratory
Depth of discharge: 75%
Electrolyte temperature: 33 to 45°C
Charge amount: 115 to 125% of discharge amount



How to calculate the electricity rate (approximation)

$$\text{Electricity rate} = \frac{\text{Electric power unit price} \times \text{nominal voltage} \times \text{nominal capacity} \times \text{charge amount}}{\text{Efficiency of a charger} \times 1000}$$

Example: Calculation of electricity rate at 280 Ah/5hR, 48V
Electric power unit price: **US\$/kWh (Ask an electric power company.)
(Assumed unit price)
Nominal capacity: 280Ah/5hR
Nominal voltage: 48V
Charge amount: 120%
Efficiency of a charger: 0.85

Electricity cost of each country

Country	USD Cents /kWh
Singapore	0.189
Philippines	0.18
HongKong	0.159
Indonesia	0.093
Malaysia	0.089
Vietnam	0.056

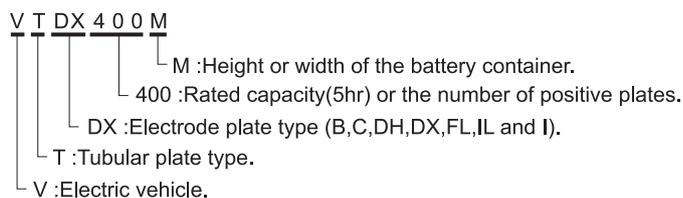
$$\frac{**\text{US}/\text{kwh} \times 280\text{Ah} \times 48\text{V} \times 1.2}{0.85 \times 1000} = **\text{US\$}$$

This information is just reference. This price isn't guaranteed.

Range and specification

Type	Rated capacity (5hR)	External dimensions (mm)				Weight with electrolyte (In approx. kg)	Electrolyte amount (In approx. liter)
		Length (L)	Width (W)	Box height (h)	Total height (H)		
VTB4	160	90	158	320	352	11.4	2.6
VTB4Z	195	90	158	320	352	12.7	2.4
VTB5	200	109	158	320	352	13.8	3.2
VTB6	240	128	158	320	352	16.2	3.8
VTB7	280	148	158	320	352	18.7	4.5
VTB8	320	167	158	320	352	21.1	5.0
VTB400MZ	400	177	158	320	352	24.4	5.0
VTC3M	129	58	158	350	382	8.8	1.7
VTC4	172	90	158	350	382	12.0	2.9
VTC5	215	109	158	350	382	14.5	3.6
VTC6	258	128	158	350	382	17.0	4.2
VTC7	301	148	158	350	382	19.6	4.9
VTC344	344	148	158	350	382	20.9	4.7
*VTC10	430	206	158	350	382	28.3	7.0
*VTC12	516	244	158	350	382	33.3	8.3
VTDH390L	390	148	158	380	412	23.0	5.2
VTDH450L	450	148	158	380	412	24.6	4.8
VTDH480L	480	186	158	380	412	29.3	6.6
VTDH3M	164	58	158	395	427	10.2	1.9
VTDH4N	208	81	158	395	427	13.6	2.8
VTDH160A	160	90	158	395	427	12.5	3.6
VTDH250	250	90	158	395	427	15.8	2.9
VTDH480M	480	161	158	395	427	27.7	5.6
VTDH9	490	186	158	395	427	29.7	7.0
VTDH560	560	186	158	395	427	33.0	6.3
VTDX330	330	128	158	395	427	20.9	4.6
VTDX360	360	128	158	395	427	22.6	4.2
VTDX330M	330	144	158	395	427	22.2	5.5
VTDX400M	400	144	158	395	427	24.0	5.2
VTDX470M	470	144	158	395	427	25.7	4.8
VTDX450M	450	161	158	395	427	26.9	5.7
VTDX540M	540	161	158	395	427	28.7	5.4
VTDX560M	560	177	158	395	427	30.1	6.4
VTDX620	620	186	158	395	427	34.6	6.5
*VTDX690	690	206	158	395	427	37.8	6.9
VTDX165MH	165	58	158	410	442	10.8	1.9
VTDX485MH	485	144	158	410	442	26.0	5.1
VTDX545MH	545	161	158	410	442	29.2	5.7
VTDX565MH	565	177	158	410	442	30.5	6.6
VTDX600MH	600	177	158	410	442	32.2	6.3
*VTDX700H	700	206	158	410	442	38.1	7.3

Notes 1. Symbols and a numeric numbers of the "Type" have the following meanings.



Notes 2. Marking of "*" indicates a double pole.

Notes 3. Some of the designs and specifications are subject to change without prior notice.

Notes 4. The normal voltage of single battery is 2V.

Range and specification

Type	Rated capacity (5hR)	External dimensions (mm)				Weight with electrolyte (In approx. kg)	Electrolyte amount (In approx. liter)
		Length (L)	Width (W)	Box height (h)	Total height (H)		
VTFL201M	201	58	158	490	522	12.6	2.3
VTFL268M	268	75	158	490	522	16.3	3.2
VTFL210A	210	90	158	490	522	15.6	4.6
VTFL280	280	90	158	490	522	17.6	4.2
VTFL320	320	90	158	490	522	19.7	3.8
VTFL5	335	109	158	490	522	21.2	5.0
VTFL390	390	109	158	490	522	23.5	4.8
VTFL6	402	128	158	490	522	25.0	6.0
VTFL545	545	148	158	490	522	30.8	6.6
*VTFL9ZD	670	186	158	490	522	39.2	8.5
*VTFL10	670	206	158	490	522	41.0	9.8
*VTFL11	737	225	158	490	522	44.7	10.7
*VTFL858	858	225	158	490	522	48.7	10.0
VTIL220ML	220	58	158	490	522	13.2	2.2
VTIL445L	445	109	158	490	522	24.3	4.4
VTIL515L	515	128	158	490	522	28.2	5.3
VTIL545ML	545	144	158	490	522	31.9	5.9
VTIL730ML	730	177	158	490	522	39.5	7.3
*VTIL865L	865	206	158	490	522	47.1	8.5
*VTIL935L	935	225	158	490	522	51.0	9.4
VTIL225M	225	58	158	520	552	13.6	2.4
VTIL288M	288	75	158	520	552	17.5	3.2
VTIL4	312	90	158	520	552	19.1	4.4
VTIL370	370	90	158	520	552	21.3	4.0
VTIL435	435	109	158	520	552	25.1	4.8
VTIL6	468	128	158	520	552	27.0	6.3
VTIL510	510	128	158	520	552	29.2	5.8
VTIL7	536	148	158	520	552	31.1	7.3
VTIL580	580	148	158	520	552	33.3	6.8
VTIL8	612	167	158	520	552	35.0	8.2
VTIL9	702	186	158	520	552	39.4	9.2
*VTIL10	780	206	158	520	552	44.2	10.2
*VTIL11	858	225	158	520	552	48.2	11.2
*VTIL12	936	244	158	520	552	52.3	12.2
VTI240M	240	58	158	520	552	14.2	2.3
VTI470	470	109	158	520	552	25.8	4.7
VTI565	565	128	158	520	552	30.1	5.8
VTI645	645	148	158	520	552	34.2	6.6
VTI725M	725	161	158	520	552	37.9	7.1
*VTI845	845	186	158	520	552	46.1	8.3
*VTI925	925	206	158	520	552	49.3	9.1
*VTI1080	1080	244	158	520	552	57.6	10.9

Traction Battery SUPER <LIFTTOP> ECO



Improved efficiency of water refilling operation. New Water Filling System 〈NEW QUICK FILLER〉

Only need to turn the couplings and stop water automatically.



Water sealing structure for induced explosion prevention

A water sealing portion is provided for preventing entry of gas produced during charging into the water refilling hose in order to eliminate the hazard of induced explosion.

Automatic water stopping structure

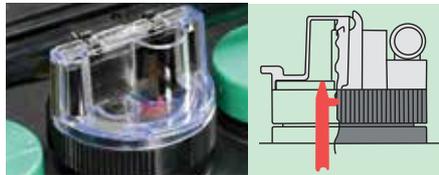
The water shutoff valve rises when water reaches the specified level, and stops water refilling automatically.

Opening/closing the cap is unnecessary during water refilling operation

The user only needs to snap-connect the couplings of the hoses on the tank and battery sides and open the faucet. Water is fed into all cells.

The liquid level is easily visible. Maintenance is also easy.

The liquid level is identifiable at a glance, thanks to the large level display. In addition, the large hole for measuring the specific gravity enables quick measurement of the specific gravity.



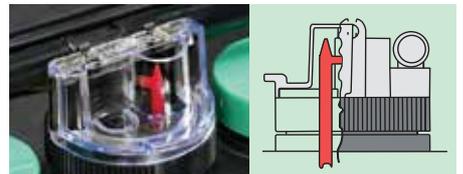
Liquid level checking: The fallen liquid level indicator bar (red color) indicates that water must be refilled.



Refilling preparation: Snap-connect the couplings of the hoses on the tank and battery sides and open the faucet.



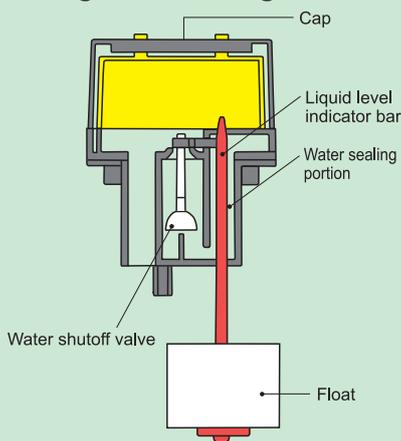
Start of water refilling: Opening the faucet automatically starts refilling water into all batteries (be sure to open the faucet fully).



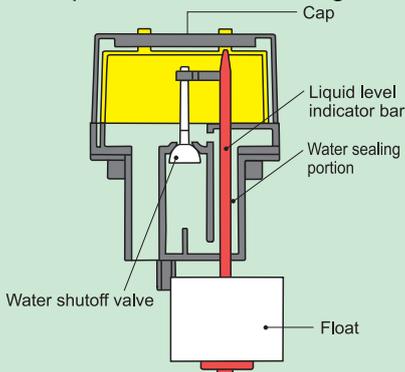
Completion of water refilling: Refilling water is complete when the liquid level indicator bar rises to the upper limit. Close the faucet and disconnect the coupling.

■ Structural diagram

During water refilling



Completion of water refilling



Please read the instructions carefully when handling.

Float mounted water plug

Easy water filling

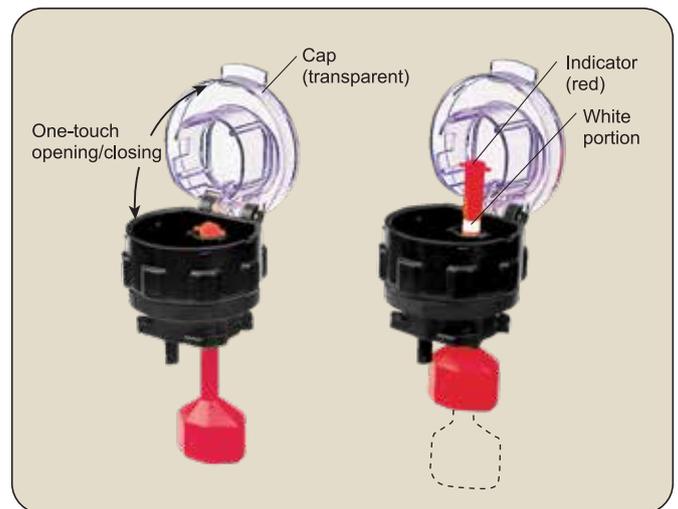
The spout wide and it is easy to fill water.

Excessive refilling prevented

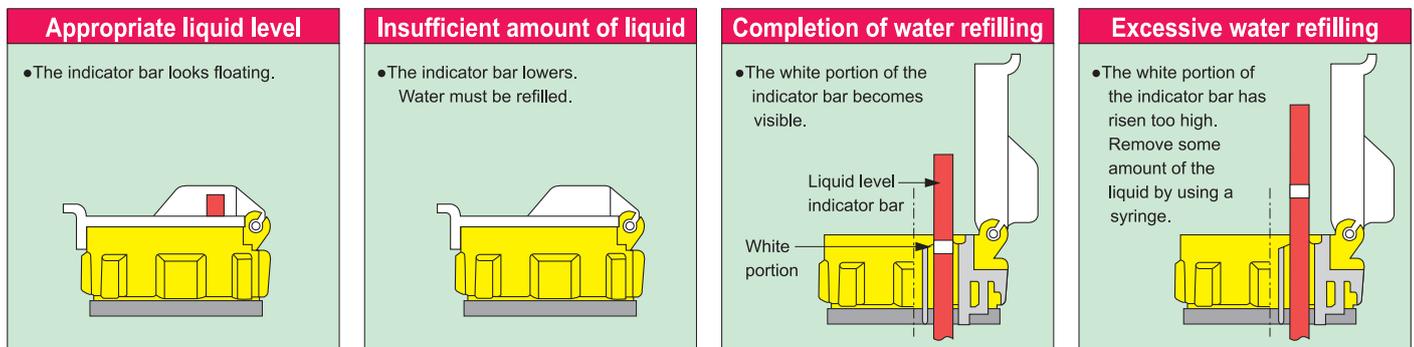
As the appropriate liquid level is displayed as an indicator band, an appropriate amount of liquid is understood at a glance, thereby preventing excessive refilling.

Easy replacement

Installation and removal of the float mounted plug is easy, thanks to the use of the quarter turn method.



The liquid level is obvious at a glance, so the level can be accurately managed.



- When insufficient amount of liquid is observed, refill water to the level equivalent to the completion of water refilling.
- Care should be taken that the water refill cap might be damaged in case a person steps on or an object drops thereon

Liquid level meter <SUPER DELSIGN>

Easy-to-see warning display

The green lamp is normally lit. The red lamp goes on to alert the timing of water refilling.

One-touch mounting on the side surface of the iron box

Adhesive is provided on the backside of the panel. Tear off the seal to mount the level meter with ease.

Mounting the sensor and the power source is also easy.

Simply mount the sensor provided inside the water refill faucet. Solder the power source on the lead connector.

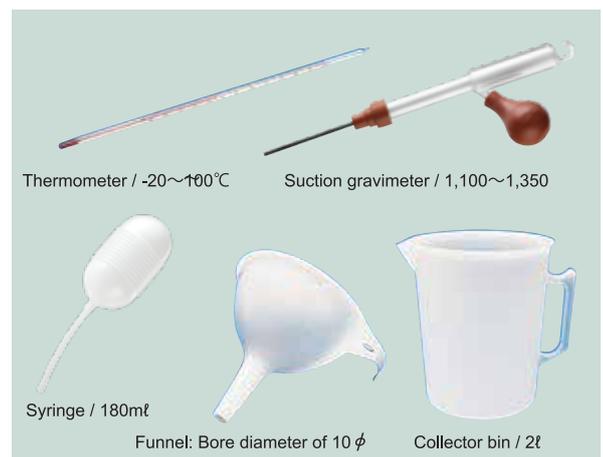


Float mounted type water addition plug with sensor



Note: The liquid level sensor detects the level of only one cell and does not indicate the liquid level of the entire assembled batteries.

Products for maintenance



Battery connector



Outside dimensions

SB350.6320 --- Length 108.0 × Width 70 × Height 33 (mm)
 SB175.6325 --- Length 79.4 × Width 55 × Height 26 (mm)

Precautions on Maintenance and Handling

Classification of harm and damage

 Danger	The degree of harm that erroneous handling might cause death or severe injury of the user and besides the degree of urgency is high
 Warning	The degree of harm that erroneous handling might cause death or severe injury of the user; cases that frequent occurrence of minor injury or physical damage is assumed
 Caution	The degree of harm or damage that erroneous handling might cause injury of the user or physical damage

Symbols and their meanings

 Caution - inflammable	Do not bring fire closely to the battery or generate a short circuit or sparks. Otherwise, inflammation explosion might be caused.	 Caution - no child	Any person who does not understand well the handling method or hazard of the battery (e.g., child) should not be allowed to touch the battery
 Caution - explosive	Erroneous handling might cause inflammation explosion due to hydrogen gas produced by the battery.	 Caution - sulfuric acid	Attaching of diluted sulfuric acid, which is used for batteries, to eyes or skin might cause sight loss or burn injury.
 Caution - electric shock	Electric shock might be caused in case a human body directly contacts a conductive part at a voltage of 42 V or higher.	 Read manual	Thoroughly read the manual for properly using the battery prior to its handling.
 Wear glasses	To protect the human body against accidental explosion and/or diluted sulfuric acid, wear protective glasses and rubber gloves when handling the battery.		

Danger

 Caution - explosive	<ul style="list-style-type: none"> Do not use or charge the battery in a confined area or an ambience with bad ventilation. Otherwise, a hazard of inflammation explosion is caused due to hydrogen gas produced by the battery. Do not bring fire closely to the battery. Otherwise, inflammation explosion might be caused due to short circuit, spark, or cigarette fire interacting with hydrogen gas produced by the battery. Do not install the battery near heat generators (e.g., transformer) or objects that produce sparks (e.g., welder, grinder, switch, and fuse). Otherwise, inflammation explosion might be caused due to hydrogen gas produced by the battery. Do not form a short circuit across the battery terminals by using a tool such as the one used for tightening/loosening bolts and nuts. Otherwise, burn injury or inflammation explosion might be caused due to the occurrence of sparks. Do not use the battery (or forklift truck) with the liquid being at the lowest level allowed or below. Otherwise, explosion might be caused due to excessively hot battery or a short circuit formed internally by deteriorated internal parts. Do not clean the surfaces and connections of the battery with a dry cloth or duster. Otherwise, inflammation explosion might be caused due to generation of static electricity that interacts with hydrogen gas produced by the battery. Use a cloth wetted with water, for example, for cleaning the top surface of the battery.
 Caution - inflammable	
 Caution - sulfuric acid	<ul style="list-style-type: none"> In case of entry of electrolyte into eyes, immediately wash them with abundant tap water and receive an examination of an eye doctor. Otherwise, sight loss might be caused.

Warning

- When the battery is not used for a long time, do not store it in a place badly ventilated or present with fire. Otherwise, explosion might be caused due to the accumulation of hydrogen gas.
- Only use the dedicated charger or a charger meeting the rated capacity and voltage of the battery. Using chargers other than those might cause insufficient charging of the battery, leak of liquid, heat generation, or earth leakage.
- Personnel not familiar with the handling method and hazards of the battery should not mount or install the battery. Otherwise, injury or battery damage might be caused.
- Do not allow any person who is unfamiliar with the battery handling (such as child) to touch the battery. Otherwise, sight loss, burn injury, or electric shock might be caused by the electrolyte (diluted sulfuric acid) filled in the battery.
- Do not heat the battery or throw it into fire. Otherwise, liquid leakage, smoke generation, or rupture might be caused.
- Do not reversely connect the positive and negative terminals of the battery. Otherwise, heat generation, ignition, smoke generation, or inflammation explosion might be caused.
- Do not discharge the battery at a current equivalent to twice the rated capacity, or 0.5 times the rated capacity continuously. Otherwise, the internals melt down to cause explosion.
- Before starting checkup or cleaning of the battery, remove static electricity from your body by such as touching a metallic member in a place away from the battery. Touching the battery with electrostatically charged body might cause inflammation explosion due to spark generation.
- Do not use or leave the battery with its surfaces or connections attached by dirt or foreign matter. Otherwise, inflammation explosion or fire might be caused due to earth leakage. Keep the battery clean and dry at all times by cleaning off dirt and foreign matter with a moisture-containing cloth and the like.
- In case the battery electrolyte (diluted sulfuric acid) attaches to skin, other portions of the body, or clothes, immediately wash it off with abundant water and then sufficient amount of soap. Otherwise, burn injury might be caused.
- In case the electrolyte (diluted sulfuric acid) enters into your mouth or you swallow it, gargle with abundant drinking water immediately and repetitively and then drink abundant drinking water or cow milk. After that, seek medical treatment from a medical doctor as promptly as possible. Otherwise, the inside of the mouth might be burnt.
- Do not disassemble or repair the battery. Otherwise, inflammation explosion or injury might be caused.

Caution

- Handle the Filling device for plural cells and the liquid surface alarm device in accordance with the device manufacturers' operation manuals.
- Do not wet the battery with rainwater or seawater. Otherwise, damage to the battery or fire might be caused.
- When charging is conducted, do not exceed the charging conditions described in the operation manual of the specified charger. Otherwise, heat generation or liquid leakage might be caused.
- Checkup and handling of the battery is allowed only by a person qualified for checking and maintenance, experienced person, professional, or clerk of the service shop. Otherwise, electric shock or injury might be caused.
- Regarding the used battery, we are working on ensuring effective utilization, maintenance, and conservation of resources by recycling the materials (reuse of lead, plastics, and so on as raw materials). In order to dispose of the battery, request it from a disposal company in accordance with laws pertaining to treatment and cleaning of disposals and environment-related laws. For any question, contact the sales company or us.

When placing an order:

Please kindly inform us the following when you place a purchasing order:

- About the battery forklift or battery carrier
 - (1) Manufacturer name, (2) Model, and (3) Weight (tonnage)
- About the battery (if you currently use one)
 - (1) Manufacturer name, (2) Model, (3) Capacity, (4) Voltage, and (5) Battery product No. (the number shown on the nameplate)

- The data shown in this catalog are as of November 2018.
- The contents of this catalog are based on tests we performed with meticulous care; however, they do not guarantee actual on-site results.
- Product use examples shown in photographs and illustrations may be different from current use situations.
- It is not guaranteed that methods to use this product, and parts or equipment using this product do not infringe industrial properties possessed by third parties.
- Please note that specifications and appearance of the product are subject to change without prior notice.
- Please note that the colored design appearing in product photographs may be different from the actual one more or less due to printing conditions.
- Be sure to read the operation manual prior to use of the product.

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