

## Safety Precautions

- Carefully read the operation manual before using the battery.

### **Danger**

- The room where the battery is installed must be ventilated so that the maximum hydrogen concentration is not more than 0.8%. Storage batteries generate hydrogen gas which may cause explosions.
- Do not install the battery near flames or in areas with poor ventilation where hydrogen concentration is 0.8% or higher. Otherwise, it may result in explosions and fire.

### **Caution**

- The temperature range for using the battery is -15°C to 45°C. Using the battery out of this temperature range may cause deterioration to, or damage the battery by freezing or overheating.
- Do not use the battery under direct sunlight. It may damage battery components.
- Do not allow water to contact the battery. It may damage the battery, cause fire, or corrode the battery terminals and connector plate.
- Do not use the battery near sources of heat. It may damage the battery or shorten its life.
- Do not use the battery in dusty areas. It may cause the battery to short-circuit.
- Charge the battery under the charging conditions specified by Furukawa Battery. Charging the battery under other conditions may prevent full charge; cause the battery to leak, become hot, or explode; or lower performance and shorten the life of the battery.
- Do not install the battery so that it leans from the upright position with the terminals on top. It may cause leakage of the electrolyte.
- Keep the discharge current the battery to the values shown in the table below, or the battery may be damaged.

Type	1 minute or less	5 seconds or less
CS, PS	1.5 CA	3 CA
HS	3 CA	6 CA

Note: C suggests the capacity value.

- The battery should be checked regularly, in accordance with legal obligation or governmental regulations required locally. If it is found that battery parameters are out of the ranges specified in the operation manual, solve the problem according to the steps presented in the manual. The usage beyond range specified in the operation manual may damage or burn the battery.



ISO9001 Certified  
JQA-1395



ISO14001 Certified  
JQA-EM0461

For More Information, please contact.

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The Furukawa Battery Co., Ltd. reserves this right to change the data and specification in this brochure without prior notice.

For further details, do not hesitate to contact us at the address above.

TP-9908-5D-03

## STATIONARY LEAD-ACID STORAGE BATTERIES

# CS·HS·PS Type

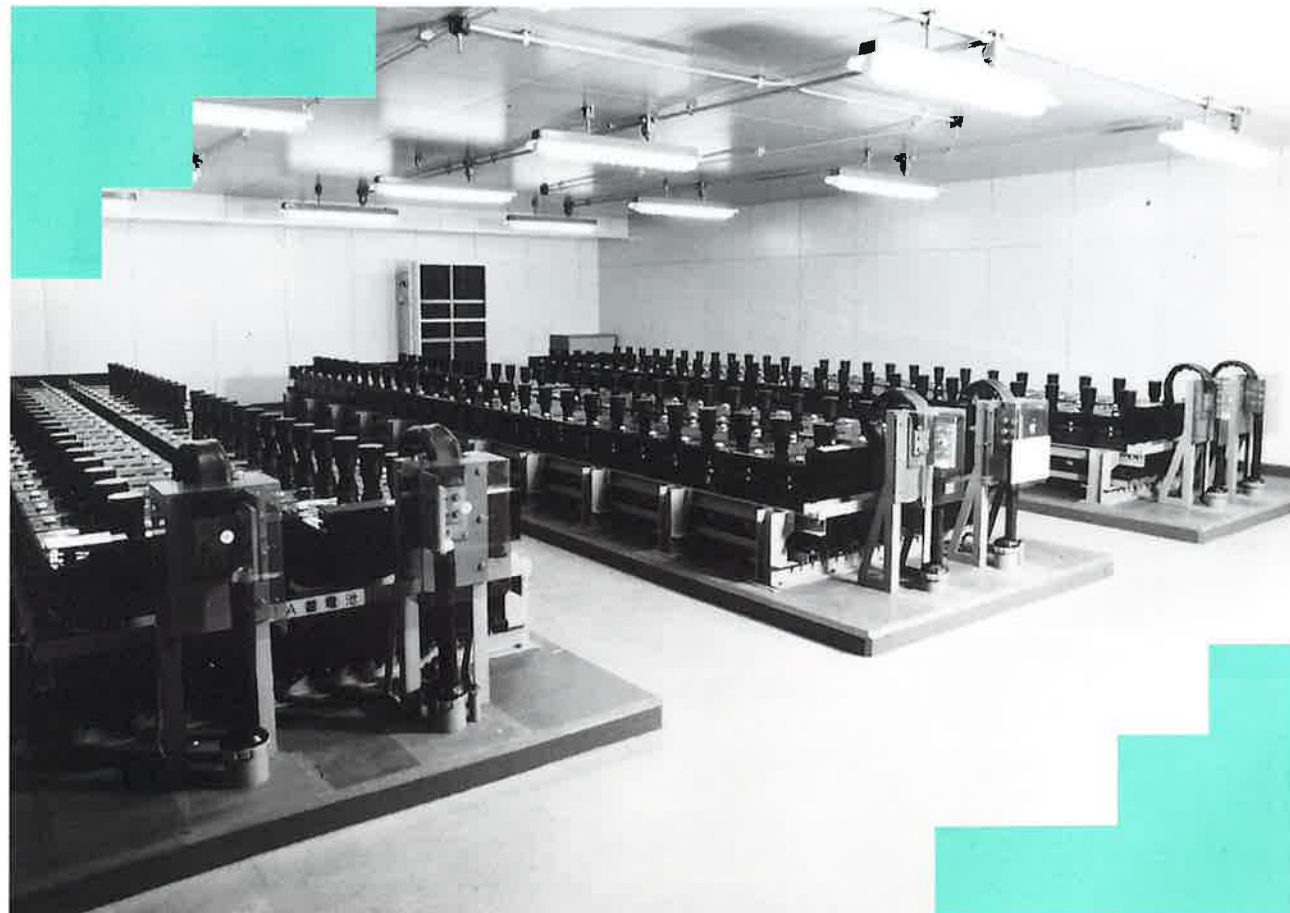


## **FB THE FURUKAWA BATTERY CO., LTD.**

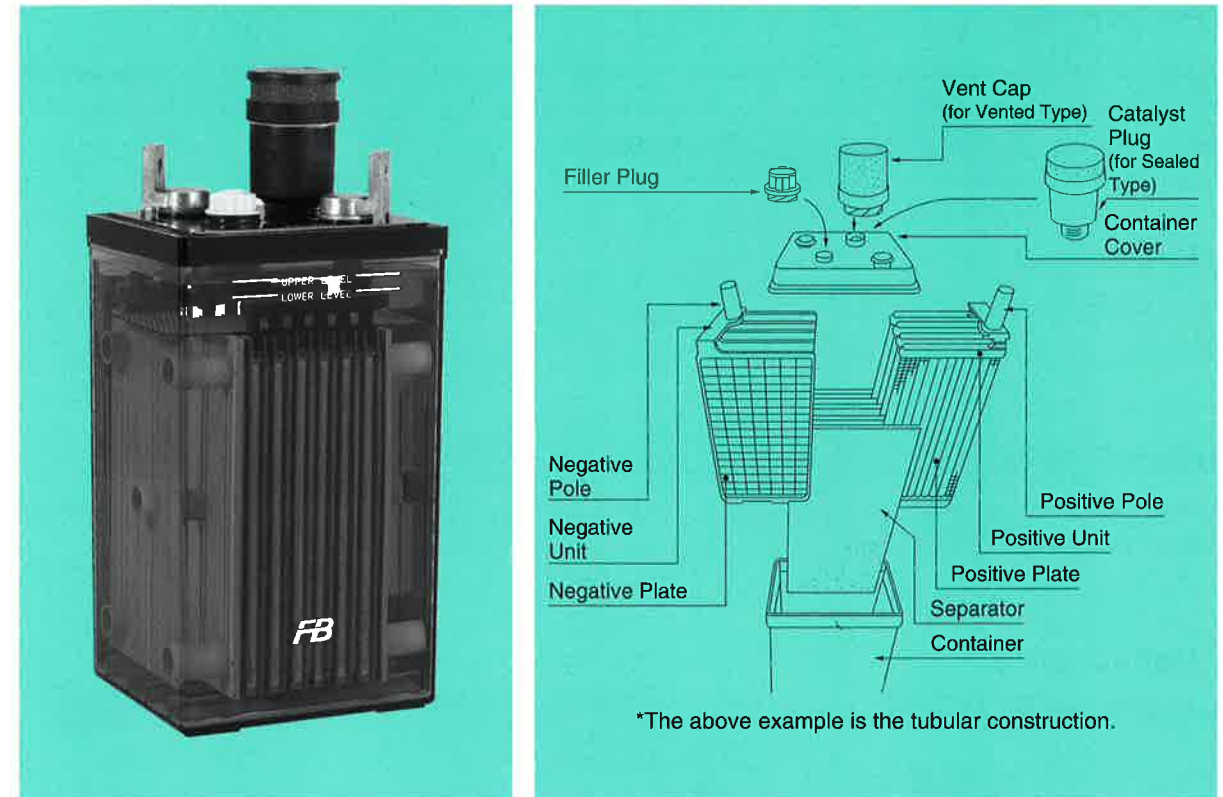
# Stationary lead-acid battery

CS·HS·PS Type

**FB** stationary lead-acid batteries have found increasingly varied uses in the last decade. Furukawa offers a wide range of products to handle all these applications. All of them are high performance and extremely reliable. Our customers regard us quite highly, but that does not stop us from constantly trying to improve product quality and perfect our products through tireless research so that we can confidently offer you the best there is.



## Construction



### ■ Main parts of a stationary lead-acid battery

	Clad types	Pasted types
Charge storing type	CS (EF)	HS, PS (EP)
Positive Plate	A lead alloy spine passes through the center of a strong tube of braided glass fiber, and the space between the two is filled with the active material. Several of these tubes are then combined to create a positive plate.	A lead alloy grid is filled with an active material in paste form. The general-purpose models (PS and EP) have relatively thick plates, while the high-discharge models (HS) have thin plates.
Negative Plate	These are pasted plates in which a lead alloy grid is filled with an active material in paste form. They are designed for long life span and capacity that matches the positive plate.	
Separator	These use separator plates made of microporous rubber that has excellent acid and oxidation resistance. Paste models also use a glass mat with the separator.	
Container	These use containers made of plastic that has excellent acid and shock resistance. For small capacity batteries, a 6 V monoblock construction in which three cells are joined in a set is also available.	
Cover	The plastic cover is sealed to the container with a sealer.	
An explosion-proof and anti-splash device (for vented type)	Has a porous aluminum filter that is mounted on the container cover to both prevent acid mist from escaping and prevent the gas inside from sympathetically detonating when the battery approaches the flash point.	
Catalyst plug (for sealed type)	By adding a catalyst, this device can promote chemical reactions between oxygen and hydrogen gases produced during charging, recombining them into water and refluxing into the battery.	



# Features

## High Performance

We combined plate active material created using manufacturing methods developed through long years of research with a stringently selected separator with low ohmic resistance to achieve a wide range of capacities and excellent discharge voltage characteristics.

## Long Life Span

We use a highly corrosion-resistant alloy in the plate grid for stable performance over long periods.

## Explosion-Proof Construction

We have adopted a construction that includes an explosion-proof filter in the vent cap. This lessens the chance of catching fire within the battery if the battery should approach the flash point.

## Easy Maintenance

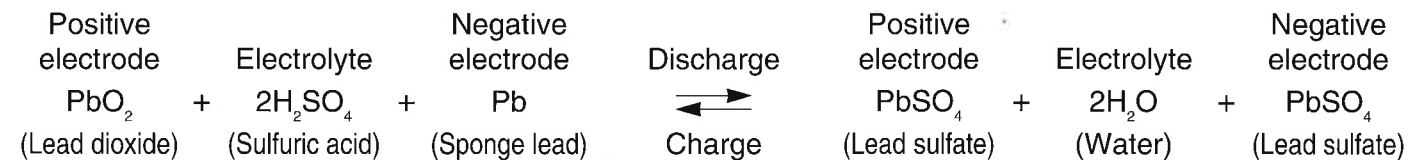
We have lengthened the water replenishment period for sealed batteries by using a catalyst plug.

## Full Model Line-Up

Our model line-up offers many different capacities from 15 Ah to 8000 Ah. We also produce both general-purpose load and high-factor discharge batteries, so you can economically select the most suitable battery for a wide range of load conditions.

# How Batteries Operate

The reactions of charging and discharging in a lead battery are expressed by the following chemical equation:



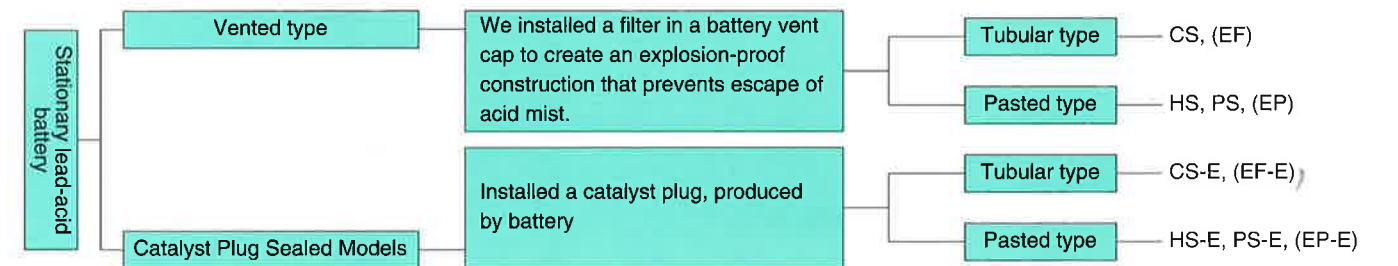
In other words, during charging, the positive pole active material is lead dioxide ( $PbO_2$ ) and the negative active material is sponge lead ( $Pb$ ), but when they discharge electricity, both change into lead sulfate ( $PbSO_4$ ) by reacting with the sulfuric acid in the electrolyte. The sulfuric acid concentration in the electrolyte declines as the reaction progresses. When a discharged battery is charged, the inverse reaction occurs, returning it to its original state.

# Type of lead-acid battery

Tubular type (sealed)



Pasted type (vented)

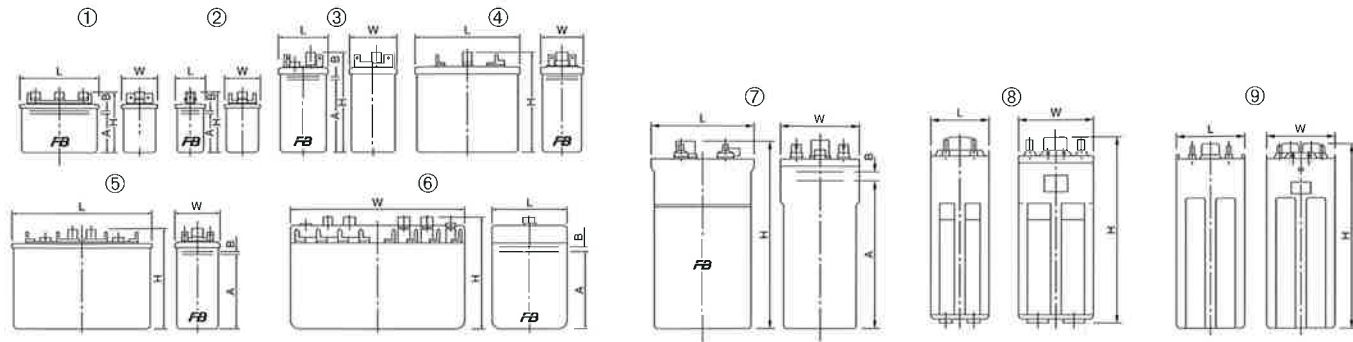


Type of plate	Type	Tubular type			Pasted type		
		CS(E)	CS-H(E)	CS(EF)(E)	HS(E)	PS(E)	PS(EP)(E)
Main construction	Positive plate	Tubular type (PbO <sub>2</sub> )			Pasted type (PbO <sub>2</sub> )		
	Negative plate	Pasted type (sponge lead)					
	Separator	Microporous rubber			Microporous rubber and glass mat		
	Container	Transparent plastic (clear)	Transparent plastic (opaque)	Transparent plastic (clear)	Transparent plastic (opaque)	Transparent plastic (clear)	Transparent plastic (opaque)
	Electrolyte	Diluted sulfuric acid					
Capacity (Ah)	Specific gravity of electrolyte (20°C)	1.215			1.240	1.215 (PS-190,340 = 1.240)	
	Range	15-2400	900-1250 (1800-2500)	2500-8000	18-1500 (30-2500)	190-1980	2860,4400
	Discharge rate (HR)	10	1(10)	10	1(10)	10	
Voltage (V/cell)	Nominal	2					
	Floating	2.15			2.18	2.15 (PS-190,340 = 2.18)	
	Equalized	2.30					
Installation system and capacity range (Ah)	Cubicle (built-in)	15-290	—	—	30-400	190,340	—
	Cubicle (separate)	15-600	—	—	30-900	190-600	—
	Rack	15-2400	1800-2500	2500-8000	30-2500	190-1980	2860,4400
Discharge maximum current (A)	1.5C within 1 min*1 3C within 5 sec			3C within 1 min 6C min 5 sec	1.5C within 1 min 3C within 5 sec		
Recommended load time	30 min or more			60 min or less	30 min or more		
Applicable standards	JIS C 8704			JIS C 8704			
Battery Equipment Approval Committee, type approval No.	Type	CS/CS-E	CS-H/CS-HE	CS/CS-E	HS/HS-E	—	—
	General approval No.	††□C114	††□C143	††□C114	††□C123	—	—
	Sealed type	††□C114E	††□C143E	††□C114E	††□C123E	—	—
Anticipated life cycle	10 to 14 years			5 to 7 years	7 to 12 years		
Main applications	Low-rate discharge For power plant, substation For communications For device operations			High-rate discharge For inverter For instrumentation For engine starting	Low-rate discharge For communications For device operations		

\*1:C represents the rated capacity. \*2: in front of the approval number indicates the year in which the approval was granted.



# Cell specification



## CS type (tubular type)

Type	Nominal voltage (V)	Capacity (Ah)		External appearance diagram	External dimensions (approx. in mm)				Level line height (mm)		Weight (including electrolyte, approx. in kg)	Quantity of electrolyte (approx. in l)
		10-hour rate	5-hour rate		W	L	H		A	B		
							Vented type	Sealed type				
CS-15-6(E)	6	15	12	①	132	149※200	230	260	150	10	7※8.5	1.8※3
CS-30-6(E)	6	30	24	①	132	200	230	260	150	10	10	2.7
CS-45-6(E)	6	45	36	①	132	252	230	260	150	10	13	3.4
CS-60-6(E)	6	60	48	①	132	303	230	260	150	10	18	3.8
CS-90-6(E)	6	90	72	①	132	472	230	260	150	10	24	6.6
CS-15(E)	2	15	12	②	132	67	230	260	150	10	3	1
CS-30(E)	2	30	24	②	132	67	230	260	150	10	3.5	0.9
CS-45(E)	2	45	36	②	132	102	230	260	150	10	5	1.5
CS-60(E)	2	60	48	②	132	102	230	260	150	10	6	1.4
CS-90(E)	2	90	72	②	133	154	230	260	150	10	8	2.2
CS-130(E)	2	130	104	③	170	120	380	420	285	10	13.5	3.9
CS-170(E)	2	170	136	③	170	120	380	420	285	10	15	3.6
CS-210(E)	2	210	168	③	170	195	380	430	285	10	21.5	6.6
CS-250(E)	2	250	200	③	170	195	380	430	285	10	23	6.4
CS-290(E)	2	290	232	③	170	195	380	430	285	10	25	6.2
CS-400(E)	2	400	320	④	170	285	380	430	285	10	34.5	10
CS-500(E)	2	500	400	④	170	390	380	430	285	10	46	13.5
CS-600(E)	2	600	480	④	170	390	380	430	285	10	49	13
CS-700(E)	2	700	560	⑤	170	515	380	430	285	10	59.5	17.5
CS-800(E)	2	800	640	⑤	170	515	380	430	285	10	63	17
CS-900(E)	2	900	720	⑤	170	515	380	430	285	10	70	16.5
CS-1000(E)	2	1000	800	⑦	300	280	720	780	580	20	107	34
CS-1200(E)	2	1200	960	⑦	300	280	720	780	580	20	116	32
CS-1400(E)	2	1400	1120	⑦	300	280	720	780	580	20	126	30
CS-1600(E)	2	1600	1280	⑦	300	390	720	780	580	20	150	45
CS-1800(E)	2	1800	1440	⑦	300	390	720	780	580	20	159	43
CS-2000(E)	2	2000	1600	⑦	300	390	720	780	580	20	168	41
CS-2200(E)	2	2200	1760	⑦	300	390	720	780	580	20	175	40
CS-2400(E)	2	2400	1920	⑦	300	390	720	780	580	20	181	40

Note: ※ indicates values applicable to the sealed type only.

## CS-H(E) type (tubular type)

Type	Nominal voltage (V)	Capacity (Ah)		External appearance diagram	External dimensions (approx. in mm)				Level line height (mm)		Weight (including electrolyte, approx. in kg)	Quantity of electrolyte (approx. in l)
		1-hour rate	10-hour rate		W	L	H		A	B		
							Vented type	Sealed type				
CS-1800H(E)	2	900	1800	⑥	653	280	425	560	293	10	155	34
CS-2000H(E)	2	1000	2000	⑥	653	280	425	560	293	10	159	33
CS-2200H(E)	2	1100	2200	⑥	653	280	425	560	293	10	162	32
CS-2500H(E)	2	1250	2500	⑥	653	280	425	560	293	10	170	30

Note:

## PS type (pasted type)

Type	Nominal voltage (V)	Capacity (Ah)		External appearance diagram	Level line height (mm)				Weight (including electrolyte, approx. in kg)	Quantity of electrolyte (approx. in l)		
		10-hour rate	5-hour rate		W	L	H					
							Vented type	Sealed type				
PS-190(E)	2	190	152	③	170	120	380	430	285	10	16	3.4
PS-340(E)	2	340	272	③	170	195	380	430	285	10	25	5.6
PS-450(E)	2	450	360	④	170	285	380	430	285	10	38	9
PS-600(E)	2	600	480	④	170	390	380	430	285	10	54.5	12
PS-840(E)	2	840	672	⑤	170	515	380	430	285	10	70	16
PS-1320(E)	2	1320	1056	⑦	300	280	720	780	580	20	133	28
PS-1980(E)	2	1980	1584	⑦	300	390	720	780	580	20	179	40

## PS(EP) type (pasted type)

Type	Nominal voltage (V)	Capacity (Ah)		External appearance diagram	Level line height (mm)				Weight (including electrolyte, approx. in kg)	Quantity of electrolyte (approx. in l)
		10-hour rate	5-hour rate		W	L	H			
							Vented type	Sealed type		
PS-2860(E) [EP-2860(E)]	2	2860	2288	⑧	430	325	996	1106	305	66
PS-4400(E) [EP-4400(E)]	2	4400	3520	⑧	430	460	996	1106	425	96

## CS(EF) type (tubular type)

Type	Nominal voltage (V)	Capacity (Ah)		External appearance diagram	Level line height (mm)				Weight (including electrolyte, approx. in kg)	Quantity of electrolyte (approx. in l)
		10-hour rate	5-hour rate		W	L	H			
							Vented type	Sealed type		
CS-2500(E) [EF-2500(E)]	2	2500	1875	⑧	430	325	996	1106	270	69
CS-3000(E) [EF-3000(E)]	2	3000	2250	⑧	430	325	996	1106	300	66
CS-3500(E) [EF-3500(E)]	2	3500	2625	⑧	430	460	996	1106	390	101
CS-4000(E) [EF-4000(E)]	2	4000	3000	⑧	430	460	996	1106	410	98
CS-4500(E) [EF-4500(E)]	2	4500	3375	⑧	430	460	996	1106	430	95
CS-5000(E) [EF-5000(E)]	2	5000	3750	⑨	500	410	1245	1355	550	123
CS-6000(E) [EF-6000(E)]	2	6000	4500	⑨	500	410	1245	1355	600	118
CS-7000(E) [EF-7000(E)]	2	7000	5250	⑨	500	410	1245	1355	643	113
CS-8000(E) [EF-8000(E)]	2	8000	6000	⑨	500	496	1245	1355	750	138

## HS type (pasted type for high-rate discharge)

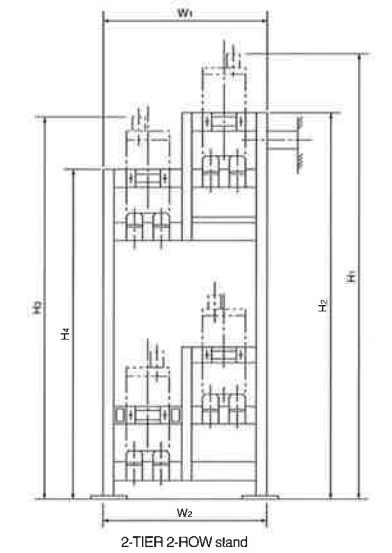
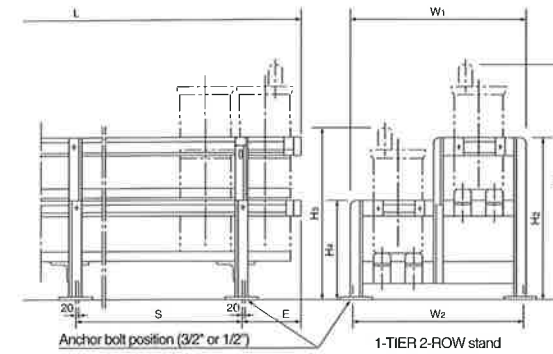
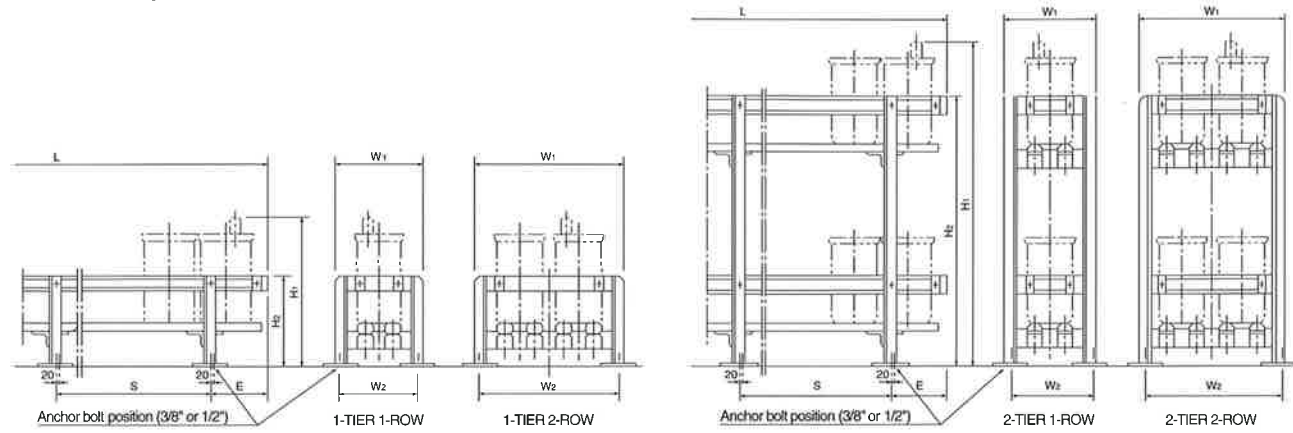
Type	Nominal voltage (V)	Capacity (Ah)		External appearance diagram	Level line height (mm)				Weight (including electrolyte, approx. in kg)	Quantity of electrolyte (approx. in l)		
		1-hour rate	10-hour rate		W	L	H					
							Vented type	Sealed type				
HS-30-6(E)	6	18	30	①	132	200	230	260	150	10	9	2.6
HS-40-6(E)	6	24	40	①	132	200	230	260	150	10	10	2.4
HS-50-6(E)	6	30	50	①	132	200(252)	230	260	150	10	11 (12)	2.3(3)
HS-60-6(E)	6	36	60	①	132	252(303)	230	260	150	10	13.5(15)	3(3.5)
HS-80-6(E)	6	48	80	①	132(133)	303(472)	230	260	150	10	16.5(18)	3.6(6)
HS-100-6(E)	6	60	100	①	133	472	230	260	150	10	23	5.8
HS-120-6(E)	6	72	120	①	133	472	230	260	150	10	24.5	5.6
HS-30(E)	2	18	30	②	131	67	230	260	150	10	3	0.9
HS-40(E)	2	24	40	②	131	67	230	260	150	10	3.5	0.8
HS-50(E)	2	30	50	②	131	67(102)	230	260	150	10	4	0.8
HS-60(E)	2	36	60	②	132	102	230	260	150	10	5	1.2
HS-80(E)	2	48	80	②	132	102(154)	230	260	150	10	6	1.2
HS-100(E)	2	60	100	②	133	154	230	260	150	10	7.5	1.9
HS-120(E)	2	72	120	②	133	154	230	260	150	10	8.5	1.9
HS-150(E)	2	90	150	③	170	120	380	420	285	10	13.5	3.8
HS-200(E)	2	120	200	③	170	120	380	430	285	10	15	3.6
HS-250(E)	2	150	250	③	170	120	380	430	285	10	16.5	3.5
HS-300(E)	2	180	300	③	170	195	380	430	285	10	23	6.5
HS-400(E)	2	240	400	③	170	195	380	430	285	10	26	6
HS-500(E)	2	300	500	④	170	285	380	430	285	10	35.5	9
HS-600(E)	2	360	600	④	170	285	380	430	285	10	38.5	8.5
HS-700(E)	2	420	700	④	170	390	380	430	285	10	49	13
HS-800(E)	2	480	800	④	170	390	380	430	285	10	52.5	12.5
HS-900(E)	2	540	900	④	170	390	380	430	285	10	55	12
HS-1000(E)	2	600	1000	⑤	170	515	380	430	285	10	68	16
HS-1200(E)	2	720	1200	⑤	170	515	380	430	285	10	74	15.5
HS-1500(E)	2	900	1500	⑥	653	280	425	560	293	10	125	39
HS-2000(E)	2	1200	2000	⑥	653	280	425	560	293	10	141	36
HS-2500(E)	2	1500	2500	⑥	653	280	425	560	293	10	157	34

Note: Values in parentheses ( ) are applicable when an automatic hydrometer is attached.



# Rack

Material: Steel (Ss41)  
 Paint: Munsell symbol 7.5BG6/1.5, acidproof



Dimensions are in mm.

Battery type			1-TIER				2-TIER				1-TIER 1-ROW stand				2-TIER 2-ROW stand												
CS	PS	HS	H <sub>1</sub>	H <sub>2</sub>	1-ROW W <sub>1</sub>	2-ROW W <sub>2</sub>	H <sub>1</sub>	H <sub>2</sub>	1-ROW W <sub>1</sub>	2-ROW W <sub>2</sub>	H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>	H <sub>4</sub>	W <sub>1</sub>	W <sub>2</sub>	H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>	H <sub>4</sub>	W <sub>1</sub>	W <sub>2</sub>					
CS-130(E) CS-170(E)	PS-190(E)	HS-150(E) HS-200(E) HS-250(E)	543 (583)	333	316	316	552	552	1231 (1271)	1021	316	316	552	552	753 (793)	543 (583)	333	592	592	1637 (1677)	1427 (1474)	1434 (1474)	1224	592	592		
CS-210(E) CS-250(E) CS-290(E)	PS-340(E)	HS-300(E) HS-400(E)	543 (593)						1231 (1281)						753 (803)	543 (593)				1637 (1687)	37	1434 (1484)					
CS-400(E)	PS-450(E)	HS-500(E) HS-600(E)	558 (608)	348	431	431	782	782	1261 (1311)	1051	451	441	802	792	768 (818)	558 (608)	558	348	822	822	1697 (1747)	1487 (1529)	1479	1269	852	842	
CS-500(E) CS-600(E)	PS-600(E)	HS-700(E) HS-800(E) HS-900(E)	558 (608)	348	556	546	1012	1002	1261 (1311)	1051	556	546	1012	1002	768 (818)	558 (608)	558	348	1062	1052	1505 (1555)	1295 (1405)	1355 (1405)	1145	1062	1037	
CS-700(E) CS-800(E) CS-900(E)	PS-840(E)	HS-1000(E) HS-1200(E)	558 (608)	348	681	671	1262	1252	1261 (1311)	1051	681	671	1262	1252	768 (818)	558 (608)	558	348	1312	1302							
CS-1800H(E) CS-2000H(E) CS-2200H(E) CS-2500H(E)		HS-1500(E) HS-2000(E) HS-2500(E)	603 (738)	348	869	834	1609	1574	1495 (1630)	1250	869	834	1665	1630													
CS-1000(E) CS-1200(E) CS-1400(E)	PS-1320(E)		898 (958)	578	476	451	822	797							1148 (1208)	828 (898)	898 (958)	578	887	862							
CS-1600(E) CS-1800(E) CS-2000(E) CS-2200(E) CS-2400(E)	PS-1980(E)		898 (958)	578	586	561	1042	1017							1148 (1208)	828 (898)	898 (958)	578	1107	1082							

Notes 1) The e dimension of a rack indicated by  $\Delta$  is 150. 2) Dimensions in parentheses ( ) are for the sealed type.

Number of cells per ROW													E
5	6	7	8	9	10	11	12	13	14	15	16		
L	L	L	L	L	L	L	L	L	L	L	L	L	
$\Delta$ 650 350x1	$\Delta$ 825 525x1	$\Delta$ 950 650x1	$\Delta$ 1075 775x1	$\Delta$ 1200 900x1	1325 895x1	1450 1020x1	1575 572.5x2	1700 635x2	1825 697.5x2	1950 760x2	2075 822.5x2	215 $\Delta$ 150	
$\Delta$ 1075 775x1	$\Delta$ 1275 975x1	1475 1045x1	1675 622.5x2	1875 722.5x2	2075 822.5x2	2275 922.5x2	2475 1022.5x2	2675 748.3x3	2875 815x3	3075 881.6x3	3275 948.3x3	215 $\Delta$ 150	
950 520x1	1125 695x1	1300 870x1	1475 522.5x2	1650 610x2	1825 697.5x2	2000 785x2	2175 872.5x2	2350 960x2	2525 698.3x3	2700 756.6x3	2875 815x3	215	
950 520x1	1125 695x1	1300 870x1	1475 522.5x2	1650 610x2	1825 697.5x2	2000 785x2	2175 872.5x2	2350 960x2	2525 698.3x3	2700 756.6x3	2875 815x3	215	
1500 1070x1	1785 677.5x2	2070 820x2	2355 962.5x2	2640 736.7x3	2625 831.7x3	3210 926.7x3	3495 766.3x4	3780 837.5x4	4065 908.8x4	4350 784x5	4635 841x5	215	
1600 580x2	1905 732.5x2	2210 885x2	2515 691.7x3	2820 793.3x3	3125 895x3	3430 996.6x3	3735 823.8x4	4040 900x4	4345 976.3x4	4650 842x5	4955 903x5	220	
1600 580x2	1905 732.5x2	2210 885x2	2515 691.7x3	2820 793.3x3	3125 895x3	3430 996.6x3	3735 823.8x4	4040 900x4	4345 976.3x4	4650 842x5	4955 903x5	220	

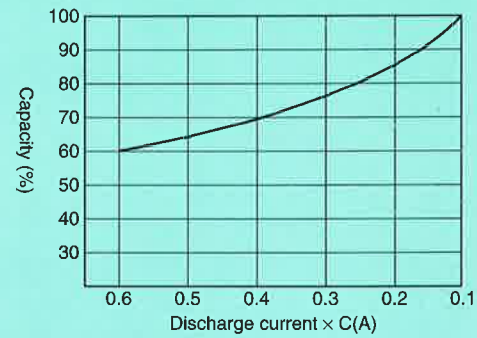
3) Only one shape of rack is shown in the example. 4) Standard color: 5Y7/ Semi-Lustrous 5) Antiseismic strength: 1G

# Characteristics

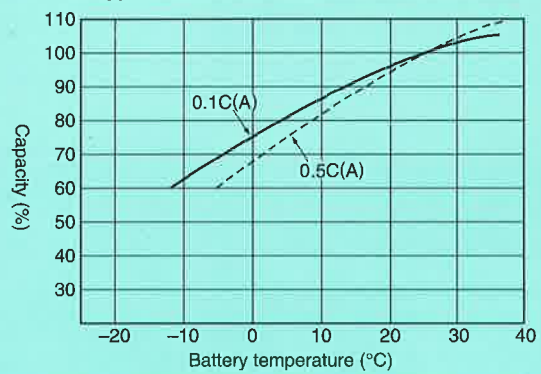
CS type discharge current-capacity characteristics



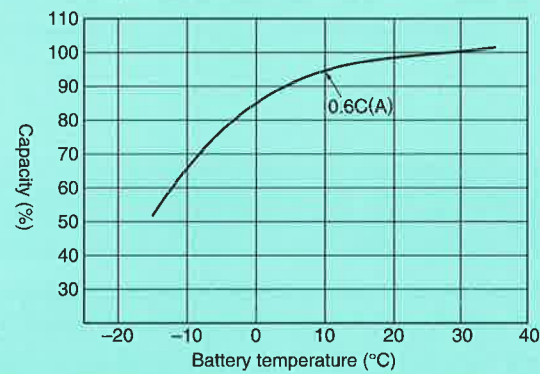
HS type discharge current-capacity characteristics



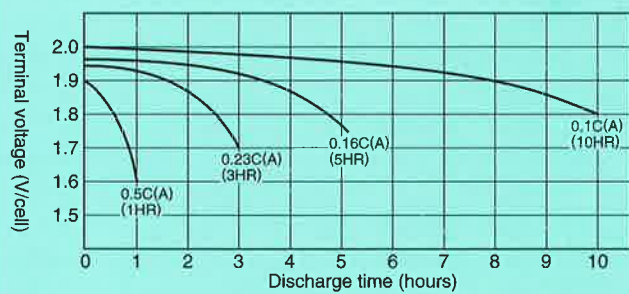
CS type temperature-capacity characteristics



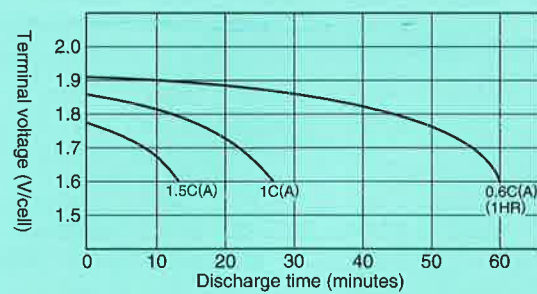
HS type temperature-capacity characteristics



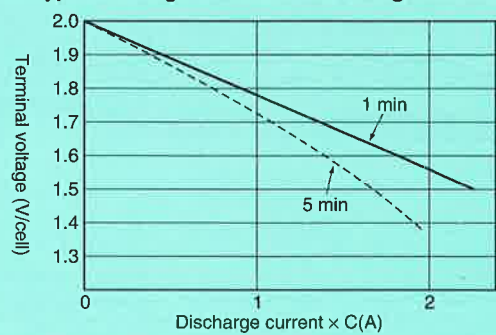
CS type voltage-time curves



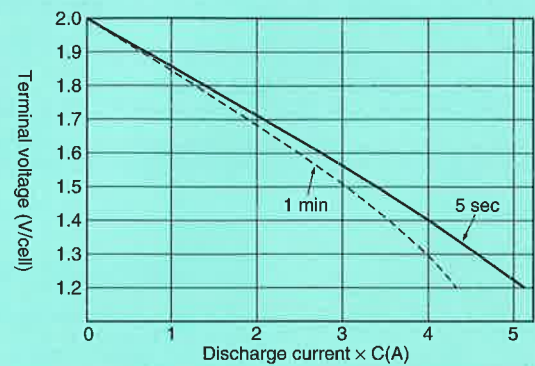
HS type voltage-time curves



CS type discharge current-initial voltage Characteristics



HS type discharge current-initial voltage characteristics



Note: C: Rated capacity value.

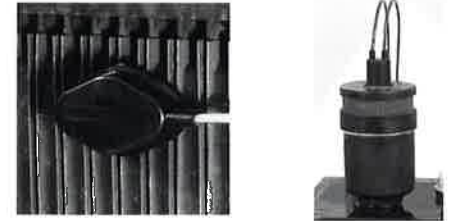
# Accessories

●Low Fluid Warning

A low fluid warning device displays an alarm when the surface of the electrolyte in the battery approaches the minimum fluid surface line. Their use is mandatory in vented batteries used in loads, and is covered by the Fire Services Act and the Building Standards Act.

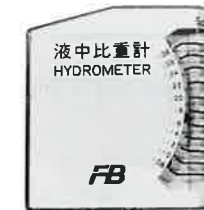
●Temperature Alarm

Temperature is the environmental condition that affects batteries the most. High temperatures can be dangerous and harm safety. Therefore, for greater safety, a temperature alarm can be installed on the battery if usage conditions dictate, and an alarm can be given in case of accidents.



●Hydrometer

The hydrometer is inserted into the lead battery so that specific gravity can be measured from outside without touching the electrolyte.



●Bimetal Thermometer

The battery temperature can be measured constantly by attaching a thermometer to the battery container.



# Maintenance tools (optional)

●Thermometer

Indicator range  
-10 to 50°C  
-20 to 100°C



●Syringe Hydrometer

Graduation range:  
1.12-1.24  
1.18-1.23  
1.10-1.30



●Syringe

80 cc  
180 cc



●Purified Water



●Funnel  
Polyethylene



●Measuring Jug

Polyethylene  
2 l



●Maintenance Tool Box

Plastic



●Voltmetre (option)



# Catalytic Plug

Catalytic Plug 1CP



Catalytic Plug 2CP



Catalytic Plug 3CP

