PMI

Power Management Instruments

NiCd RANGE

NICKEL CADMIUM INDUSTRIAL BATTERY SOLUTIONS

Capacity: 10 Ah to 1200 Ah

IEC-EN 60623

NICKEL CADMIUM BATTERIES SINTERED / POCKET PLATES

5 AH to 1200AH / 20 years long life

PMI Nickel Cadmium industrial cells using advanced sintered plate / pocket plate technology have been used successfully in industrial battery applications for long years. With a design life of 20 years, they have proved to be a very reliable DC power source in float service or cyclic applications in harsh conditions with temperatures up to 50° C.

KPX Series (Ultra High Discharge Rate Cells)

KPX Series Ultra High Discharge Rate nickel cadmium battery is made of sintered plate, characterized by compact construction, low internal resistance, high reliability, high capacity, long service life and excellent low temperature performance. The battery is suitable for ultra high rate discharging such as AGV, engine starting, switch tripping and closing and any special purpose.

KPH Series (High Discharge Rate Cells)

KPH Series High Discharge Rate nickel cadmium battery is made of pocket plate with the characteristics of thin plate, high porosity and low internal resistance. The battery is particularly suitable for short discharge periods such as switchgear tripping and closing, UPS, etc.

KPM Series (Medium Discharge Rate Cells)

KPM Series Medium Discharge Rate nickel cadmium battery is made of pocket plate. The battery is suitable for medium discharge periods between 30 minutes and 5 hours such as standby for UPS, gas turbine control, etc.

KPL Series (Low Discharge Rate Cells)

KPL Series Low Discharge Rate nickel cadmium battery is made of pocket plate. The battery is designed for general purpose and standby applications such as lighting on train and operation of circuit breaker, etc.




Battery Model	Discharge Performance	Plate Type	Aplications
KPX Series	Ultra High Discharge Rate	Sintered Plate	AGV, gas turbine generation, engine starting, operating / control of computer systems, transportation networks, airport, etc.
KPH Series	High Discharge Rate	Pocket Plate	Engine starting, UPS (up to 30 minutes), operation and control of DC motor, water treatment plants, etc.
KPM Series	Medium Discharge Rate	Pocket Plate	UPS (over 30 minutes), railway DC power sources, auxiliary power sources for power stations, chemical plants, oil refineries, iron works, etc.
KPL Series	Low Discharge Rate	Pocket Plate	Emergency lighting, telecommunications, operation of communication equipment on a ship lighting, air conditioner control on a train, etc.

Connector covers
Material : plastic.

Flame arresting vents
Material : polypropylene

Cell container
Mateial : translucent polypropylene

Plate tab
Spot-welded both to the plate side frames and to the upper edge of the pocket plate

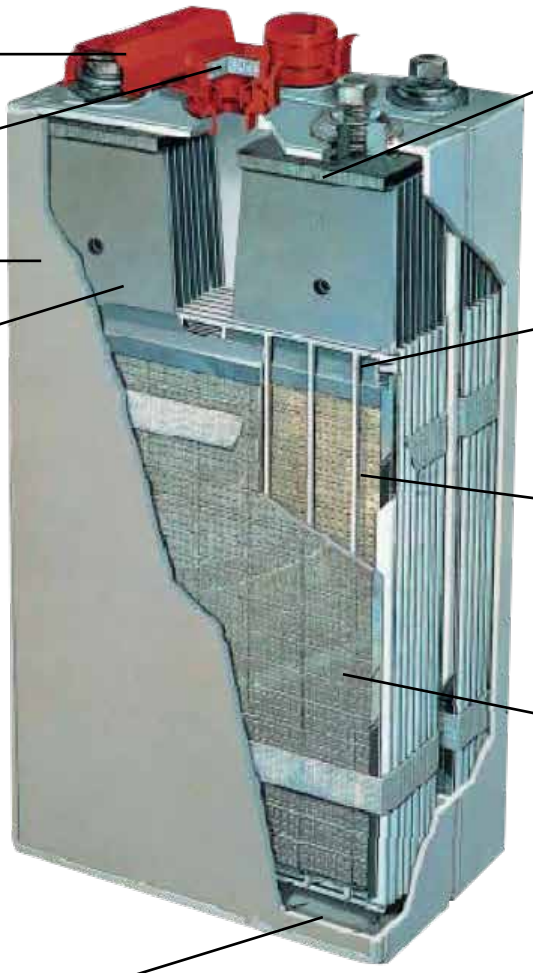


Plate group bus
Connects the plate tabs with the terminal post. Plate tabs and terminal post are projection welded to the plate group bus.

Separating grids
Seperate the plates and insulate the plate frames from each other. The grids allow free circulation of electrolyte between the plates.

Plate frame
Seals the plate pockets and serves as a current collector.

Plate
Horizontal pockets of double-perforated steel strips.

Electrolyte
An alkaline solution of potassium hydroxide (KOH) which does not corrode steel.

Battery Charging:

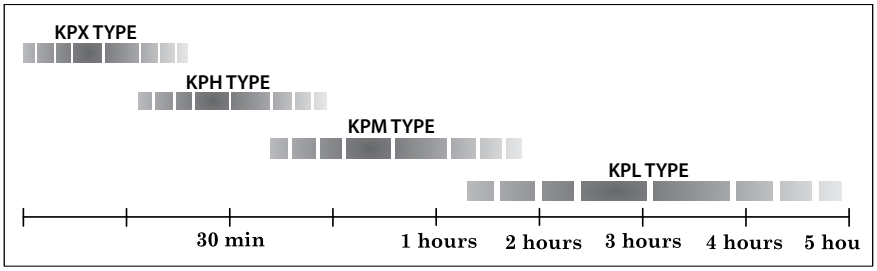
It is recommended to use Constant Voltage method of charging for Nickel Cadmium Batteries, usually with current limitation to C /5 o r C /10. Charging voltages must be regularly checked. To optimize the battery performance, it is necessary to ensure that the voltage is kept within the following limits:

Recommended Charging Voltage Per Cell

IEC Type	Floating Charge	Equalizing Charge
KPX	1.38~1.40	1.46~1.49
KPH	1.42~1.45	1.55~1.60
KPM	1.42~1.45	1.55~1.60
KPL	1.45~1.50	1.55~1.60

Recommended Type Selection

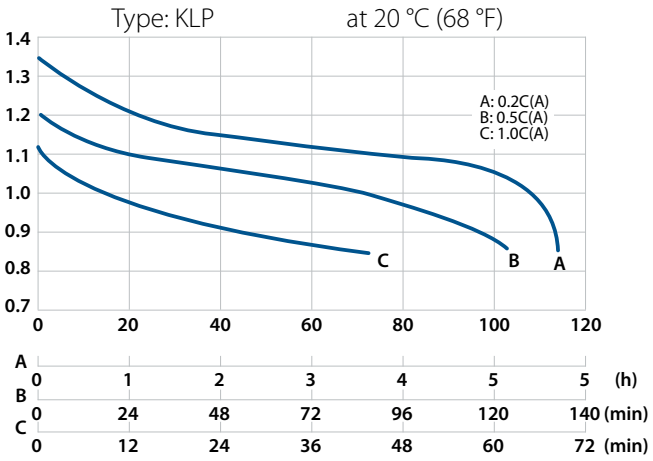
According to backup time required by application:

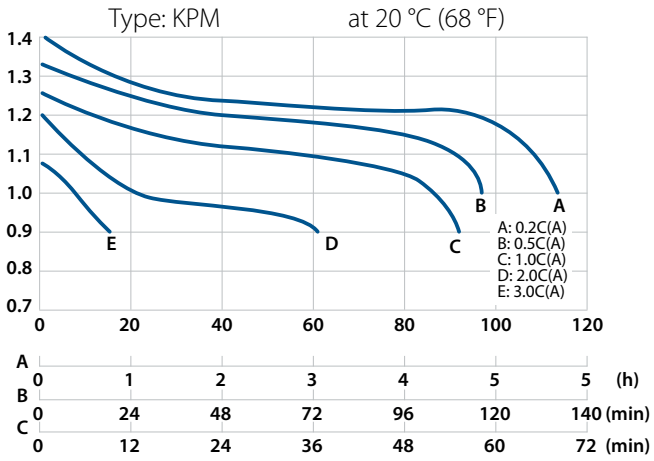


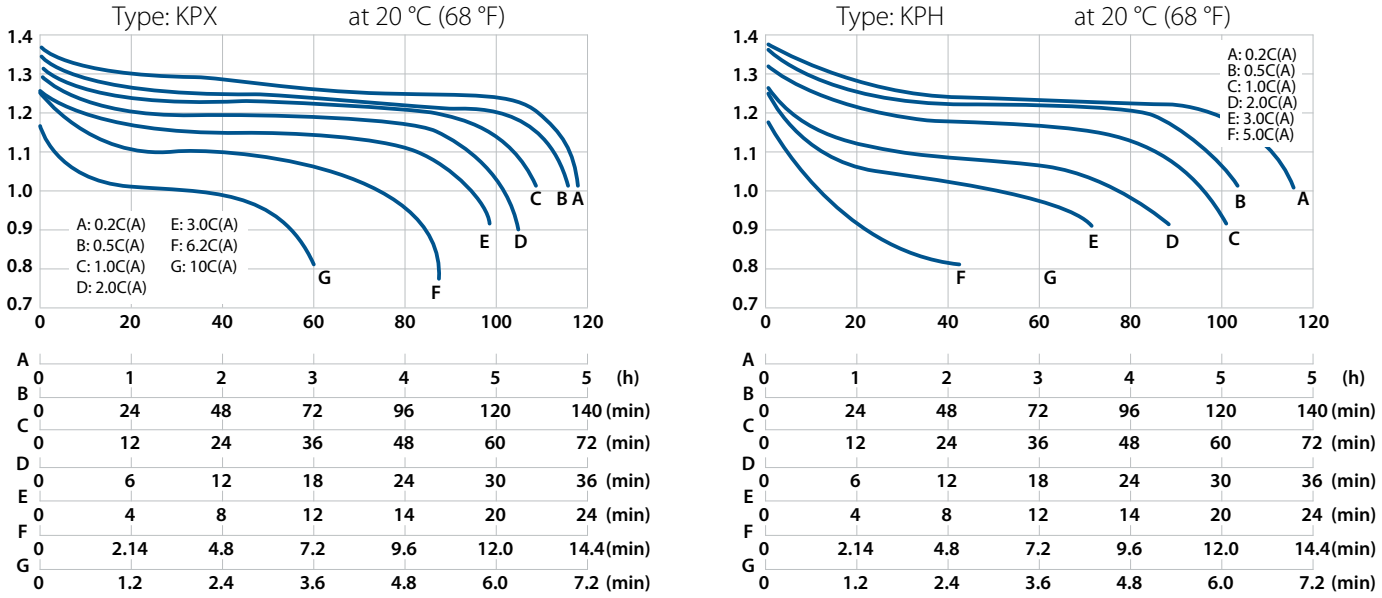
Initial Charging:

The whole charge should preferably be carried out at constant current. The charging time is inversely proportional to the current which is set by the current limit of the charging equipment. Recommended rates for the first charging:
0.2 C 5A for 10 hours
0.1 C 5A for 20 hours

Discharge Curves at 20C (68F)







These curves are only for demonstration purposes. They should not be used for detailed sizing

Discharge:

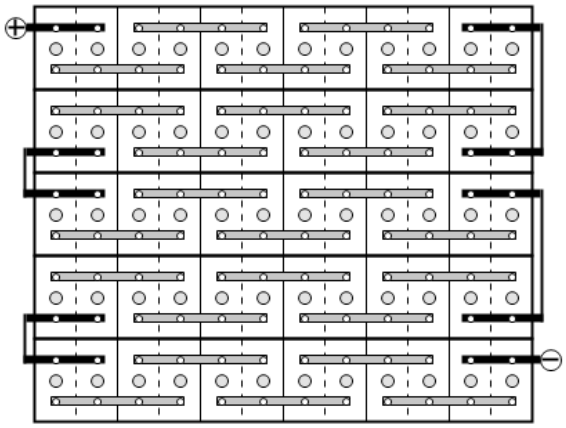
The low rate battery can be discharged at the current of 0.1 C5 A ~0.5C5 A (1C5 A is for the short time discharge). The medium rate battery can be discharged at 0.2C5A~3.5C5A. During discharge, the temperature of electrolyte should not exceed45C°.If exceeded, the discharge current must be reduced or cooling measures be taken immediately. The battery discharge regime is shown as follow:

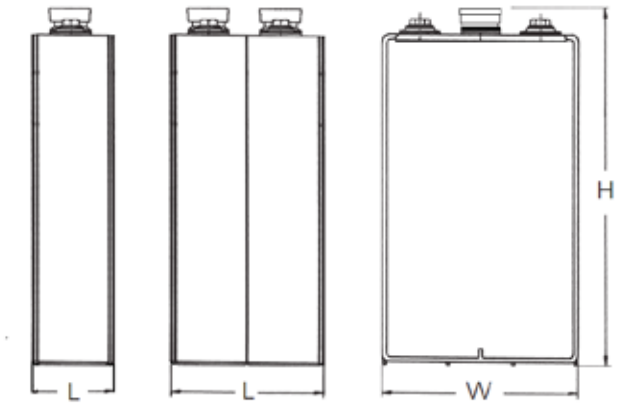
Constant discharge(A)	Discharge end-voltage(V)	Discharge duration	remarks
$0.1C_5$	≥1.10	About 10h	
$0.2C_5$	≥1.10	About 5h	
$0.33C_5$	≥1.10	About 3h	Final discharge voltage is 0.9V/cell for low rate cell
$0.5C_5$	≥0.9	About 2h	Final discharge voltage is 0.7V/cell for low rate cell
$1C_5$	≥0.9	About 40min	Only for medium rate cell
$2C_5$	≥0.8	About 10min	Only for starting application of the medium rate cell

Features:

- Long service life more than 20 years
- Excellent charging efficiency and smooth discharge voltage
- High resistance to mechanical and electrical abuse
- Reduced maintenance and replacement cost
- High cycling capability
- Exceptionally better life cycle cost
- Wide operating temperature range from -20 °C to 50°C
- No electrolyte stratification
- No plate corrosion
- Low internal resistance
- Reduced loss of capacity at deep temperature
- No ice formation at temperatures below 0 °C
- Exceptional lifetime at high temperatures
- 20 years in stationary cycling applications
- Suitable for deep discharge conditions
- Long shelf life, up to several years in a discharged state under correct conditions
- Recognized by CE/IEC60623/ISO9001

Battery Layout (Lenght to Lenght Connection)





Capacity and Dimensions : TYPE KPL (IEC-EN 60623)

POCKET PLATE NI-CD BATTERY

LOW RATE OF DISCHARGE

CELL TYPE	NOMINAL VOLTAGE (V)	RATED CAPACITY (AH)	DIMENSION (MM) L	W	H	THREAD OF POLE	WEIGHT (FILLED) (KG)	ELECTROLYTE VOLUME (L)	CONTAINER MATERIAL
KPL 10	1.2	10	85	39	156	1.0	0.5	PP	M10
KPL 20	1.2	20	114	52	266	2	0.6	MBS / ABS	M10
KPL 20-(2)	1.2	20	82	43	258	1.3	0.3	MBS / ABS	M10
KPL 20-(3)	1.2	20	135	54	265	1.8	0.58	MBS / PP	M10
KPL 22	1.2	22	112	31	220	1.2	0.3	MBS / ABS	M8
KPL 30	1.2	30	114	52	266	2.2	0.5	MBS / ABS	M10
KPL 30-(2)	1.2	30	135	54	265	2	0.5	MBS / PP	M10
KPL 40	1.2	40	114	52	266	2.3	0.42	MBS / ABS	M10
KPL 40-(2)	1.2	40	135	54	265	2.4	0.5	MBS / PP	M10
KPL 40-(3)	1.2	40	141	66	226	2.6	0.5	PP	M10
KPL 45	1.2	45	138	61	266	3	0.85	MBS / ABS	M10
KPL 45-(2)	1.2	45	141	66	226	2.8	0.7	PP	M10
KPL 50	1.2	50	138	61	266	3.2	0.7	MBS / ABS	M10
KPL 50-(2)	1.2	50	141	71	295	3.5	0.9	PP	M10
KPL 60	1.2	60	143	76	275	4	1.1	MBS / ABS	M10
KPL 60-(2)	1.2	60	135	53	370	3.9	1.0	PP	M10
KPL 60-(3)	1.2	60	141	71	295	4	0.9	PP	M10
KPL 60-(4)	1.2	60	139	79	295	4.3	1.13	MBS / ABS	M10
KPL 65	1.2	65	143	76	295	4.7	1.1	MBS / ABS	M10
KPL 70	1.2	70	139	79	295	4.4	1	MBS / ABS	M10
KPL 70-(2)	1.2	70	141	71	295	4.3	0.8	PP	M10

CELL TYPE	NOMINAL VOLTAGE (V)	RATED CAPACITY (AH)	DIMENSION (MM) L	W	H	THREAD OF POLE	WEIGHT (FILLED) (KG)	ELECTROLYTE VOLUME (L)	CONTAINER MATERIAL
KPL 70-(3)	1.2	70	143	76	275	4.3	1.	MBS / ABS	M10
2KPL 70	1.2	70	195	79	331	8.3	2.5	PP	M8
KPL 80	1.2	80	143	76	275	4.7	0.95	MBS / ABS	M10
KPL 80-(1)	1.2	80	141	71	295	4.6	0.9	PP	M10
KPL 80-(2)	1.2	80	139	79	295	4.7	1	MBS / ABS	M10
KPL 90	1.2	90	139	79	362	5.9	1.4	MBS / PP	M10
KPL 100	1.2	100	139	79	362	6	1.4	MBS / PP	M10
KPL 100-(2)	1.2	100	143	100	280	6	1.4	MBS	M10
KPL 110	1.2	110	139	79	362	6	1.4	MBS / PP	M10
KPL 110-(2)	1.2	110	143	100	280	6	1.4	MBS	M10
KPL 120	1.2	120	139	79	362	6.2	1.3	ABS/MBS/PP	M10
KPL 120-(2)	1.2	120	143	100	280	6.2	1.3	MBS / ABS	M10
KPL 125	1.2	125	139	79	362	6.4	1.17	MBS / PP	M10
KPL 150	1.2	150	167	162	345	12	3	MBS	M10
KPL 150-(2)	1.2	150	164	104	345	9.3	2	MBS / PP	M20x1.5
KPL 200	1.2	200	167	162	345	14	3.3	MBS	M20x1.5
KPL 200-(2)	1.2	200	164	104	348	1.5	3.5	ABS / MBS	M20x1.5
KPL 250	1.2	250	167	162	345	14	3.4	MBS	M20x1.5
KPL 300	1.2	300	282	170	348	22.5	5	MBS	M20x1.5
KPL 300-(2)	1.2	300	176	161	540	22	5.3	MBS	M16/20
KPL 300-(3)	1.2	300	277	145	450	21	5.2	PP	M20x1.5
KPL 400	1.2	400	282	170	348	24	4.5	MBS	M20x1.5
KPL 500	1.2	500	285	172	490	33.6	7.8	MBS	M20x1.5
KPL 600	1.2	600	285	172	490	34	7.5	MBS	M20x1.5
KPL 700	1.2	700	285	172	490	40	9	MBS	M20x1.5
KPL 800	1.2	800	395	185	560	57.5	15.5	MBS	M20x1.5
KPL 900	1.2	900	395	185	560	63.5	17	MBS	M20x1.5
KPL 1000	1.2	1000	395	185	560	70	18.5	MBS	M20x1.5
KPL 1100	1.2	1100	395	185	560	76	20	MBS	M20x1.5
KPL 1200	1.2	1100	395	185	560	82	21.5	MBS	M20x1.5

Capacity and Dimensions : TYPE KPM (IEC-EN 60623)

POCKET PLATE NI-CD BATTERY

MEDIUM RATE OF DISCHARGE

CELL TYPE	NOMINAL VOLTAGE (V)	RATED CAPACITY (AH)	DIMENSION (MM) L	W	H	THREAD OF POLE	WEIGHT (FILLED) (KG)	ELECTROLYTE VOLUME (L)	CONTAINER MATERIAL
KPM 10	1.2	10	82	43	258	1	0.5	MBS	M10
KPM 20	1.2	20	135	54	265	1.9	0.6	MBS / PP	M10
KPM 20-(2)	1.2	20	114	52	266	2	0.6	MBS	M10
KPM 30	1.2	30	135	54	265	2.4	0.6	MBS / PP	M10
KPM 40	1.2	40	141	71	295	3.6	1.0	PP	M10
KPM 40-(2)	1.2	40	143	76	275	3.4	0.9	MBS / ABS	M10
KPM 45	1.2	45	86	86	273	3.2	0.7	PP	M10
KPM 50	1.2	50	139	79	295	5	1.3	MBS / ABS	M10
KPM 50-(2)	1.2	50	143	76	275	4.3	0.9	PP	M10
KPM 50-(3)	1.2	50	141	71	295	5	1.3	MBS / ABS	M10
KPM 60	1.2	60	139	79	295	5.3	1.2	MBS / ABS	M10
KPM 60-(2)	1.2	60	141	71	295	4.4	1.0	PP	M10
KPM 60-(3)	1.2	60	143	76	275	4.6	1.1	MBS / ABS	M10
KPM 70	1.2	70	139	79	295	4.5	1.2	MBS / ABS	M10
KPM 70-(2)	1.2	70	143	76	275	4.9	1.0	MBS / ABS	M10
KPM 75	1.2	75	139	79	362	6.5	1.7	MBS / PP	M16
KPM 80	1.2	80	139	79	362	6.8	1.8	MBS / PP	M16
KPM 80-(2)	1.2	80	143	100	280	5.8	1.5	MBS	M10
KPM 90	1.2	90	164	104	345	8.2	1.62	MBS / PP	M20
KPM 90-(2)	1.2	90	139	79	362	6.5	1.3	MBS / PP	M16
KPM 100	1.2	100	164	104	345	9.3	1.8	MBS / PP	M20x1.5
KPM 120	1.2	120	164	104	345	11.2	2.4	MBS/PP/ABS	M20x1.5
KPM 120-(2)	1.2	120	139	89	362	7.5	1.5	PP	M16
KPM 150	1.2	150	167	162	345	12.5	2.7	MBS / ABS	M20x1.5
KPM 160	1.2	160	167	162	345	12.8	2.99	MBS / ABS	M20
KPM 200	1.2	200	167	162	345	13.5	2.7	MBS / ABS	M20x1.5
KPM 250	1.2	250	282	170	348	17.8	3.6	MBS / ABS	M20x1.5
KPM 250-(2)	1.2	250	176	161	540	20.6	4.5	MBS / ABS	M16
KPM 300	1.2	300	282	170	348	26	6.0	MBS / ABS	M10
KPM 300-(2)	1.2	300	176	161	540	22.6	5.0	MBS / ABS	M20x1.5
KPM 400	1.2	400	285	172	490	34	8.0	MBS / ABS	M20x1.5
KPM 500	1.2	500	285	172	490	36.5	8.5	MBS / ABS	M20x1.5
KPM 600	1.2	600	285	172	490	45	9.7	MBS / ABS	M20x1.5
KPM 700	1.2	700	395	185	560	55	11.5	MBS / ABS	M20x1.5
KPM 800	1.2	800	395	185	560	66	15.0	MBS / ABS	M20x1.5
KPM 900	1.2	900	395	185	560	66	15.0	MBS / ABS	M20x1.5
KPM 1100	1.2	1100	395	185	560	68	12.5	MBS / ABS	M20x1.5

Capacity and Dimensions : TYPE KPX (IEC-EN 60623)

SINTERED PLATE NI-CD BATTERY

CELL TYPE	NOMINAL VOLTAGE (V)	RATED CAPACITY (AH)	DIMENSION (MM) L	W	H	THREAD OF POLE	WEIGHT (FILLED) (KG)	ELECTROLYTE VOLUME (L)	CONTAINER MATERIAL
KPX 5	1.2	5	81	26	163	0.51	0.031	MBS	M8
KPX 10	1.2	10	81	26	163	0.62	0.06	MBS	M8
KPX 10-(2)	1.2	10	81	34	245	1.07	0.13	MBS	M8
KPX 10-(3)	1.2	10	81	26	163	0.6	0.06	MBS	M8
KPX 20	1.2	20	81	34	245	1.25	0.12	MBS	M10
KPX 20-(2)	1.2	20	81	34	245	1.25	0.12	MBS	M10
KPX 20-(3)	1.2	20	81	34	245	1.25	0.12	MBS	M10
KPX 20-(4)	1.2	20	138	61	266	2.8	0.5	MBS	M10
KPX 20-(5)	1.2	20	81	43	266	1.7	0.17	MBS	M10
KPX 20-(6)	1.2	20	138	61	266	2.75	0.53	MBS	M10
KPX 30	1.2	30	81	43	266	1.75	0.21	MBS	M10
KPX 40	1.2	40	81	43	266	1.85	0.2	PP	M10
KPX 40-(2)	1.2	40	80	35	235	1.5	0.16	Nylon	M5
KPX 40-(3)	1.2	40	81	43	266	1.85	0.2	MBS	M10
KPX 40-(4)	1.2	40	138	61	266	3.3	0.5	MBS	M10
KPX 40-(5)	1.2	40	100	85	138	1.6	0.2	MBS	M10
KPX 40-(6)	1.2	40	81	43	266	1.86	0.18	MBS	M10
KPX 40-(7)	1.2	40	138	61	266	3.25	0.55	MBS	M10
KPX 50	1.2	50	81	50	266	2.14	0.25	MBS	M10
KPX 50-(2)	1.2	50	138	61	266	3.5	0.53	MBS	M10
KPX 60	1.2	60	81	50	266	2.2	0.24	MBS	M10
KPX 60-(2)	1.2	60	138	61	266	3.8	0.5	MBS	M16
KPX 70	1.2	70	138	61	266	4.	0.4	MBS	M16
KPX 80	1.2	80	138	61	266	4.2	0.35	MBS	M16
KPX 80-(2)	1.2	80	86	86	276	3.6	0.45	PP	M10
KPX 80-(3)	1.2	80	86	86	305	3.8	0.6	PP	M10
KPX 90	1.2	90	138	61	266	4.3	0.33	MBS	M16
KPX 100	1.2	100	138	61	266	4.3	0.31	MBS	M16
KPX 100-(S)	1.2	100	147	78	190	4.3	0.25	MBS	M16
KPX 100-(2)	1.2	100	139	79	291	5.5	1.4	MBS	M16
KPX 110	1.2	110	138	61	266	4.5	0.305	MBS	M16
KPX 110-(2)	1.2	110	139	79	291	5.5	1.4	MBS	M16
KPX 120	1.2	120	138	61	266	4.6	0.25	MBS	M16
KPX 120-(2)	1.2	120	139	79	291	5.5	1.4	MBS	M16
KPX 130-(3)	1.2	130	139	79	291	5.6	1.4	MBS	M16

CELL TYPE	NOMINAL VOLTAGE (V)	RATED CAPACITY (AH)	DIMENSION (MM) L	W	H	THREAD OF POLE	WEIGHT (FILLED) (KG)	ELECTROLYTE VOLUME (L)	CONTAINER MATERIAL
KPX 140	1.2	140	165	105	350	9.5	1.9	MBS	M20
KPX 140-(2)	1.2	140	139	79	362	9	1.85	MBS	M16
KPX 140-(3)	1.2	140	139	79	291	9.2	1.8	MBS	M16
KPX 150	1.2	150	165	105	350	9.5	1.9	MBS	M20
KPX 150-(2)	1.2	150	139	79	362	9.3	1.85	MBS	M16
KPX 150-(3)	1.2	150	139	79	291	9	1.8	MBS	M16
KPX 160	1.2	160	165	105	350	9.5	1.9	MBS	M20
KPX 160-(2)	1.2	160	139	79	362	9.5	1.85	MBS	M16
KPX 170	1.2	170	165	105	350	9.5	1.9	MBS	M20
KPX 170-(2)	1.2	170	139	79	362	10	1.95	MBS	M16
KPX 170-(3)	1.2	170	139	79	362	9.8	1.95	MBS	M16
KPX 190	1.2	190	165	105	350	9.9	1.95	MBS	M20
KPX 210	1.2	210	165	105	350	10.5	1.9	MBS	M20
KPX 230	1.2	230	167	162	343	13	3	MBS	M16
KPX 250	1.2	250	167	162	343	13	2.8	MBS	M16

CAPACITY AND DIMENSIONS : TYPE KPH (IEC-EN 60623)

POCKET PLATE NI-CD BATTERY

HIGH RATE OF DISCHARGE

CELL TYPE	NOMINAL VOLTAGE (V)	RATED CAPACITY (AH)	DIMENSION (MM) L	W	H	THREAD OF POLE	WEIGHT (FILLED) (KG)	ELECTROLYTE VOLUME (L)	CONTAINER MATERIAL
KPH 10	1.2	10	135	54	266	1.2	0.85	MBS	M10
KPH 20	1.2	20	135	54	266	2.8	1	MBS	M10
KPH 30	1.2	30	143	76	275	4.3	1.25	MBS	M10
KPH 40	1.2	40	139	79	362	6	1.5	MBS	M10
KPH 50	1.2	50	139	79	362	7.5	1.8	MBS	M16
KPH 60	1.2	60	139	89	362	9	2	MBS	M16
KPH 70	1.2	70	164	104	345	10.5	2.25	MBS	M20x1.5
KPH 80	1.2	80	164	104	345	12	2.5	MBS	M20x1.5
KPH 90	1.2	90	167	162	345	13.2	2.8	MBS	M20x1.5
KPH 100	1.2	100	167	162	345	15	3	MBS	M20x1.5
KPH 150	1.2	150	282	170	348	21.8	4.8	MBS	M20x1.5
KPH 200	1.2	200	282	170	348	25.6	5.5	MBS	M20x1.5
KPH 250	1.2	250	282	170	348	27	6	MBS	M20x1.5
KPH 300	1.2	300	285	170	490	34.5	7.5	MBS	M20x1.5
KPH 400	1.2	400	395	185	560	51	10	MBS	M20x1.5

Calculation Methods

Information required for battery capacity calculation

The following informat on needed fbr a precise battery capacity calculation:

-Nominal voltage of the system	-Load current required	-Backup time required
-Maximum voltage (for charging)	-Minimum voltage	-Temperature range
-Battery layout and available space	-Physical condition	

Float Voltage Operation

In these conditions the float voltage, being the voltage at which the general load circuit will operate, then a decision will have to be reached on the cell float voltage needed to maintain the battery in the required condition.

$$\text{Number of cells required} = \frac{\text{Circuit voltage}}{\text{Cell Float voltage}} \qquad \text{Minimum cell voltage} = \frac{\text{Minimum DC voltage}}{\text{Number of cells}}$$

The most commonly used float voltages are 1.40-1.48 voltage per cell, but the exact figure has to be related carefully to circumstances.

For Example

An PMI Nickel Cadmium battery is required to maintain an inverter load of 50KVA at 0.8 power factor for a backup time of 30 minutes, at 20~25°C temperature. The DC voltage to the inverter operates within the limit of 265 volts with the battery on float charge to a minimum of 202 volts at end of back up time. The inverter has an 85% efficiency rate.

-Number of Cells (at recommended float of 1.44VPC) = 265/1.44≈184cells
-Minimum Cell Voltage = 202/184≈1.10 volts per cell
-Maximum Battery Current

$$= \frac{\text{Inverter load in KVA x Power factor}}{\text{Min. cell voltage x Number of cells x Inverter efficiency}}$$

$$= \frac{50\text{KVA} \times 0.80}{1.10 \times 184 \times 0.85} = 232.5 \text{ Amps}$$

We shall choose the battery with capacity equal or just above 232.5Amps.
To meet the 30 minutes backup time requirement, we determine to choose the battery size from KPM Range.
From our catalogue data, the cell type is KPM300.
Battery shall comprise 184 cells of PMI Nickel Cadmium type KPM300.

System Voltage	Number of Cells	Spread Range Number of Cells
24	20	18～21
36	30	27～31
48	40	36～41
110	92	88～93
220	184	180～186

The number of cells in a battery may be determined by simply dividing the nominal voltage of the system by the nominal voltage of a cell (1.2 Volts).

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