

# MATRICES Ni-Cd BATTERY

## MASS TRANSIT & RAIL INTEGRATED COMPACT SYSTEM



S A F T

## MATRICES: TARGETED PERFORMANCE FOR ON-BOARD RAIL APPLICATIONS

***Matrics is Saft's cutting-edge design of compact nickel-cadmium block battery, embodying optimum performance and low life cycle cost. It is engineered specifically for mobile on-board applications for today's clean, safe and efficient LRV, metro, EMU, electric locomotive and high speed rail systems.***

MATRICES provides a new solution to the overall performance demands of mass transit rail systems. Saft has over 15 years experience in developing highly efficient sintered/pbe technology, and MATRICES utilises this expertise to great advantage.

Emergency lighting, air conditioning, computing systems, door opening controls and totally reliable back-up energy for electric traction make MATRICES ideal for your mass transit system.

### **Specifically for rail systems**

Saft pro-actively respond to customers' wishes for smaller, lighter battery systems, optimised for reduced maintenance and low life cycle cost. Engineers can now rethink the wisdom of building-in conventional battery compartments for, with MATRICES, vehicle design and construction can be rationalised.

Lighter-weight MATRICES integrates a complete, compact system tailored to individual requirements, using less energy and costing less to carry, leading to increased passenger comfort and greater profitability.

### **A new concept with a long track record**

Saft build MATRICES to tolerate heavy vibration, wide fluctuations in operating temperature, and physical and electrical abuses that frequently destroy lead acid batteries in service. The battery retains its excellent performance and capacity when using its rapid charge/discharge capability, even after several years in service.



## MATRICES

### Ni-Cd excellence – smaller and lighter

Competitive rail markets know that every kilogram and cubic centimetre saved leads to increased efficiency. In response, MATRICS offers significant weight and volume advantages by marrying sintered/pbe and wrapped plate stack technologies with membrane separators of the type specified in Saft aviation batteries.

Additionally, the advantages of MATRICS' block construction combined with integrated water filling system and tailored tray design retain all the advantages of Ni-Cd in a slim, lighter-weight package. MATRICS shows a 40% size and volume advantage over conventional NiCd products and double that of lead acid batteries.

### With you all the way

When Saft engineers collaborate with your engineering team to develop your optimum battery specification, the size and performance characteristics of MATRICS are carefully integrated into a complete solution to suit individual applications.

### Keeping down life cycle costs

By considering all aspects of the battery's operation, and finding the optimum specification, Saft engineers will maximise cost savings and offer a truly low life-cycle cost solution.

With minimal maintenance, a higher quality output per initial outlay, and enhanced passenger comfort and safety, MATRICS clearly represents the most cost-efficient choice.

Reduced volume  
Reduced footprint  
Reduced weight



### Designed-in reliability

No better insurance exists against unexpected power loss, or to guarantee smooth on-board systems operation than the total reliability of Saft Ni-Cd batteries.

MATRICES is your guarantee. It cannot suffer from sudden death, even in extreme temperatures from  $-40^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ . Robust construction, engineered electrolyte and reliable dimensional stability ensure a marked difference in reliability over other batteries.



# LOWER LIFE COST FOR OPTIMISED PERFORMANCE

The acquisition of a railway battery is a long-term investment. With lead acid batteries, running costs include not only the acquisition cost, but also significant on-going maintenance and expensive replacements over 15+ years. Compromises in vehicle design, and higher energy requirement for transportation of heavy equipment are additions 'hidden' in overall operating expenditure.

## MATRICS is different

A MATRICS system optimised to your application will generate substantial savings over the life of the battery. Each component is precisely specified for your particular requirement to optimise life cycle cost for a quality product with a 15+ years trouble-free life.

With MATRICS, opportunities arise for designers to rationalise overall costs by reducing vehicle weight, expand passenger compartments, improve comfort and safety factors, minimise personnel costs and maintenance, and enjoy peace of mind with the installation of a completely reliable electrical system.

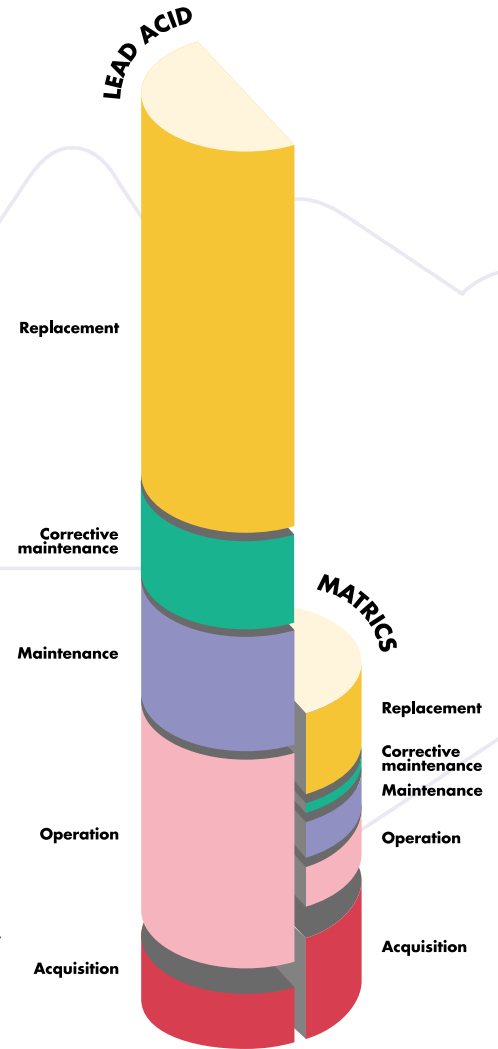
## Advantages all round

After 5 years MATRICS begins to show clear cost advantages over lead acid. After 30 years in operation, MATRICS will have provided total reliability at around 30% of the cost for a lead acid battery and its replacements.

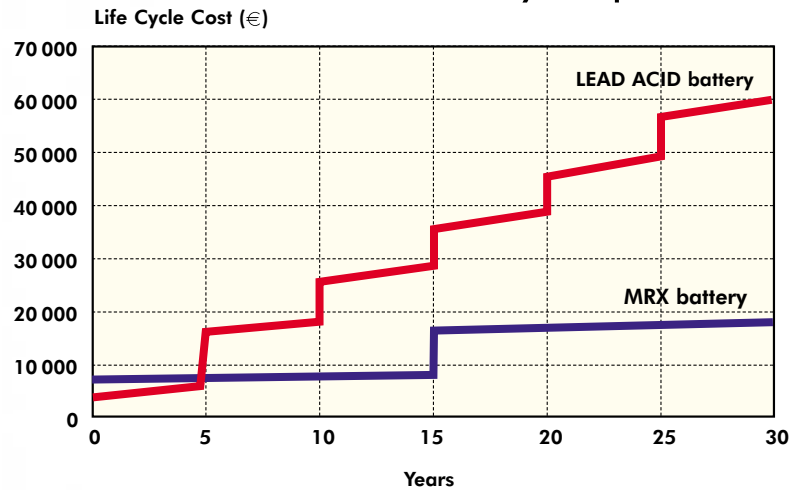
Lead acid technology suffers from material degradation throughout its life. Critically, performance is radically reduced and degradation increased still further in extreme operating conditions. The serious consequences of power loss and sudden death cannot be risked in passenger transport.

MATRICS' sintered/pbe technology is inherently safe with no possibility of material degradation. It provides an optimum performance even at extreme temperatures.

MATRICS' key features of smaller footprint, reduced weight and size, integral water-filling system, integrated tray design, total reliability and minimal maintenance aggregate to optimise initial acquisition cost, and to control operational costs for the long life of the equipment.



Life cycle costing comparison after 30 years' operation



# MATRICS Ni-Cd – A NEW BENCHMARK



## Quality without compromise

MATRICS is built around sintered/pbe, the technology that is perfectly tailored to railway operating conditions. Reliability, performance, extended life, low maintenance – all the best features of Ni-Cd are now designed into the MATRICS compact battery.

## Many years in service

MATRICS is designed to be a reliable component in your rail system for many years. It will provide up to 15 years of low maintenance service.

## Outstanding chargeability

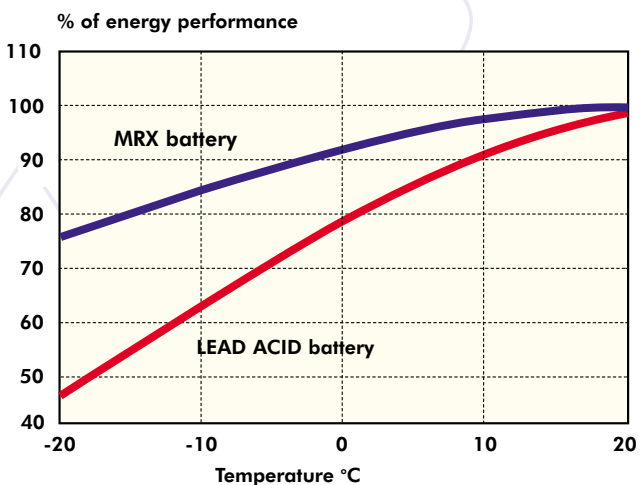
MATRICS displays an excellent charging capability within a constrained voltage window. After 5 hours at low charging voltage (1.45 V/cell), over 90% capacity is available. By using a smaller derating factor for the charge, a smaller battery can be specified and oversizing becomes less necessary. Water consumption is further minimised due to reduced overcharging.

## Long maintenance intervals

Owing to its robust construction, reliable technology and design optimised for individual applications, MATRICS requires minimal maintenance – on average, only around every 2 years. Uniquely, sintered/pbe benefits from extremely low water consumption, and when topping-up is required it is carried out simply and reliably through the water-filling apparatus integrated into the MATRICS system.

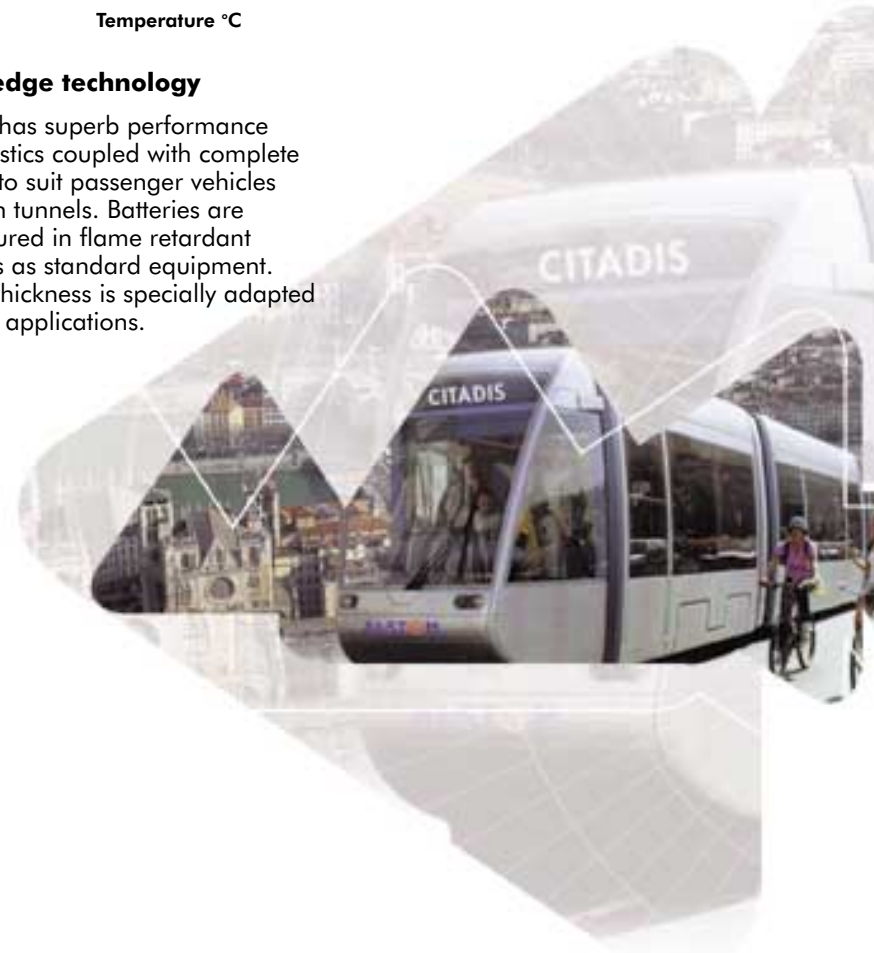
## Wide temperature performance

For medium discharge duties MATRICS performs at a level far superior to lead acid, particularly at the extremes of a wide operating temperature range.



## Cutting edge technology

MATRICS has superb performance characteristics coupled with complete reliability to suit passenger vehicles working in tunnels. Batteries are manufactured in flame retardant containers as standard equipment. Cell wall thickness is specially adapted to railway applications.

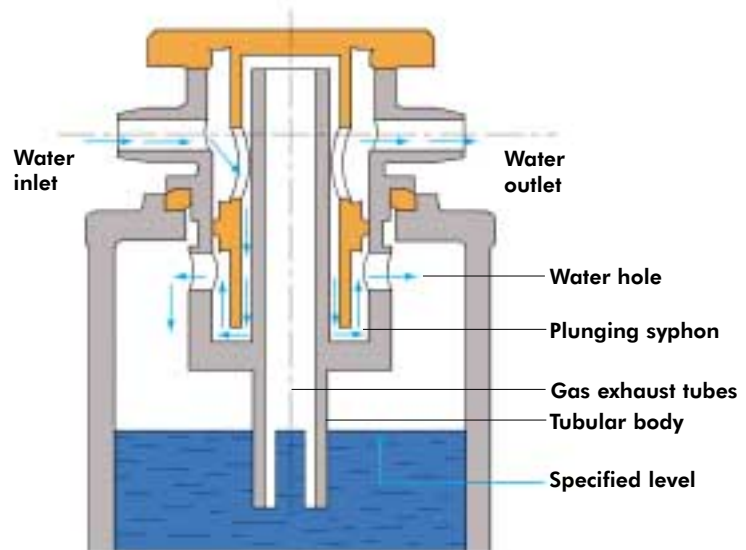


## FULLY INTEGRATED MATRICS – NOT JUST A BATTERY

### Integrated water filling system minimises maintenance

MATRICES' maintenance requirements are substantially reduced with Saft's centralised water filling system. Integrated into the block, it channels gases through the system where they are exhausted. The system tops-up cells quickly, safely and accurately, maximising the battery's useful life.

- All cells fill from one central tank
- Sealed vents have no moving parts, giving totally reliable performance
- Quick, accurate, cost-saving system
- Simple to operate and easy to disconnect for servicing

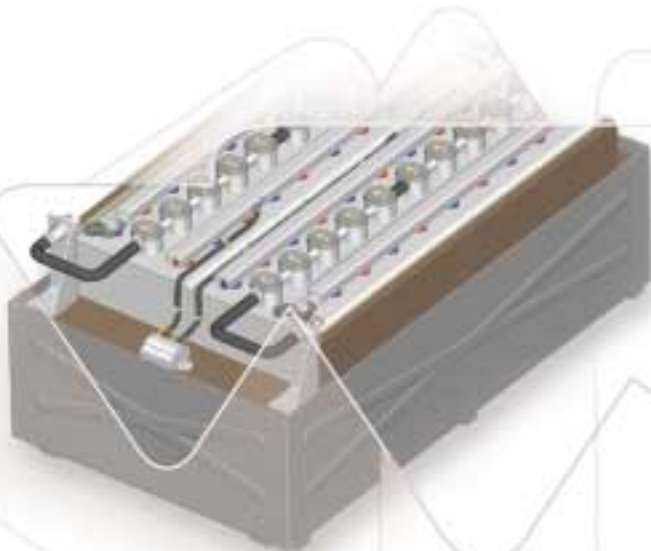


### Integrated tray design

Saft designers will optimise your battery system, specifying electrical, mechanical and control functions, including tailored tray design, as a turnkey project. Typical solutions will include detailed specification of

- construction materials
- locking systems
- mechanical and electrical interfaces
- cell restraints
- physical characteristics
- calculated to GMTT 01/79 and Eurocode 3
- vibration and shock tested to RIA20 or IEC 77

Saft's integrated trays are designed around individual application requirements and enhance the compact size and weight advantages of MATRICS batteries.



## SAFT SUPPORT, RIGHT FROM THE START

### **Working as part of your team**

Saft offer a turnkey solution based upon a thorough understanding of the rail industry, professional planning, scheduling, and accurate life-cycle costing with reliable quality of service.

From initial engineering design, through sizing and testing to manufacture and implementation, Saft respect your own processes and quality standards to engineer the best all round solution as though it was a single integrated assembly.

### **ISO quality standard**

MATRICS is manufactured at Saft's facility in Bordeaux, France. Here they meet the very stringent ISO 9001 standard. Saft fully appreciate demands for quality products, efficient back-up and professional on-going support. Strategic product development and close integration in the rail industry mean Saft will work in collaboration with its customers to help them to maintain their leading market position for future generations.

### **Care for the environment**

Saft takes a responsible approach to safeguarding the environment. More than 99% of each nickel-cadmium battery will be recycled, and Saft will assure this important service for its customers at one of several sites worldwide.



## Compact block construction

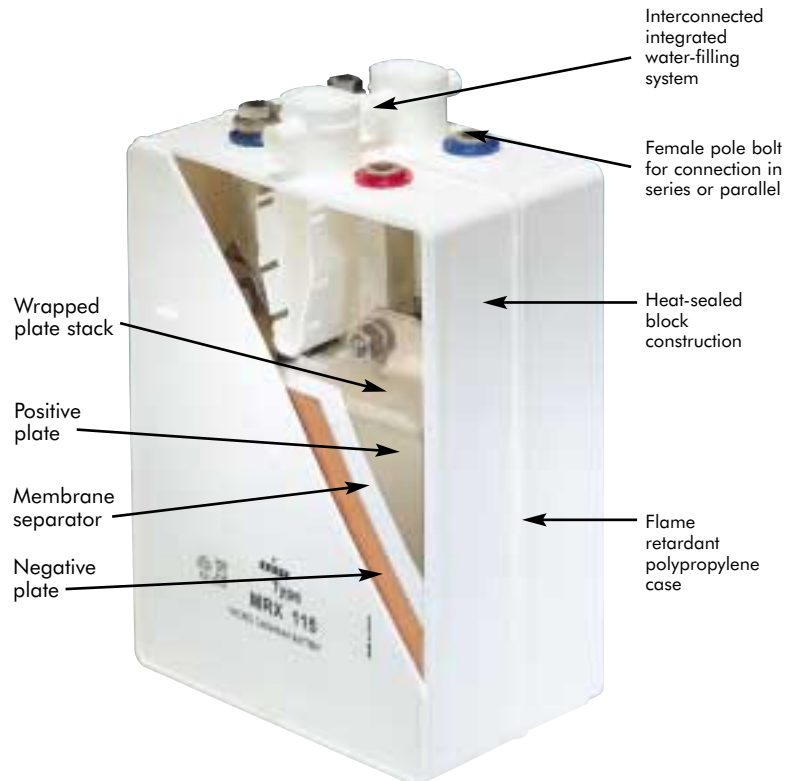
MATRICS' rigid welded block construction minimises casing material and is a factor in the battery's overall compact size advantage. This method of construction also saves volume, optimising the battery's output and improving life cycle cost.

The positive plate is a structure produced by sintering nickel powder onto a thin, perforated nickel strip, which is then impregnated with nickel hydroxide.

Negative electrodes are plastic-bonded cadmium units, produced by a continuous process culminating in the coated material being trimmed to precise dimensions. The completed plates are connected to the cell's internal steel structure, and housed in tough polypropylene cases.

The MATRICS block, comprising 3-10 cells running in parallel or in series with integrated water filling system, is tailored to your particular specification using Saft's proven heat-sealing method.

Saft has gained many years' experience in production of separators. In MATRICS, this technology not only maintains optimum operating efficiency, but, together with wrapped plate stack concept, also contributes to its compact size and lighter weight.



## Meeting recognised standards

MATRICS meets, and often exceeds, the specifications of all major international shock, vibration and electrical standards : IEC 60623, IEC 61343, EN 50155, NFF 60 022, CEI 77, GM/TTO 179. The system measures up to the very exacting standards laid down for all materials used in rail vehicles, including NFF fire and smoke criteria, and BS standards for gas toxicity.

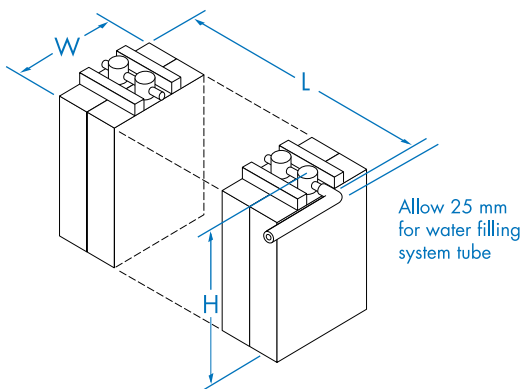
Additionally, MATRICS exceeds by more than 6 times the requirements of the UIC 854 railway specifications minimum.

# MATRICES COMPACT POWER FOR YOUR RAIL APPLICATIONS

## Mechanical characteristics of the MATRICES range

Cell type	Rated capacity Ah	Reserve cm <sup>3</sup>	H (mm)	Dimensions				Weight				
				W (mm)	L (3 cells) (mm)*	L (4 cells) (mm)*	L (5 cells) (mm)*	L (10 cells) (mm)*	(3 cells) (kg)	(4 cells) (kg)	(5 cells) (kg)	(10 cells) (kg)
<b>MRX 70</b>	70	375	305	169		158	196	384		13	16	32
<b>MRX 80</b>	80	375	305	169		158	196	384		13	16	33
<b>MRX 90</b>	90	370	305	169		158	196	384		14	17	34
<b>MRX 100</b>	100	465	305	169		188	234			16	20	
<b>MRX 115</b>	115	460	305	169		188	234			17	21	
<b>MRX 130</b>	130	520	305	169		209	259			18	23	
<b>MRX 145</b>	145	750	305	169		309	384			26	32	
<b>MRX 160</b>	160	750	305	169		309	384			26	33	
<b>MRX 180</b>	180	740	305	169		309	384			28	35	
<b>MRX 200</b>	200	930	305	169	279	369			23	31		
<b>MRX 230</b>	230	920	305	169	279	369			25	33		
<b>MRX 260</b>	260	1040	305	169	310	410			27	36		

\* The block length and weight are determined by the number of cells in the block.



# MATRICES CELL PERFORMANCE

Available amperes at 20°C

End voltage - 1.00 V/cell

Cell type	C <sub>5</sub> Ah	Hours			Mins				
		5	3	2	90	60	45	30	15
<b>MRX 70</b>	70	14.0	24.3	36.3	47.9	70.8	91.0	128	213
<b>MRX 80</b>	80	16.0	27.0	40.3	53.2	78.6	101	142	237
<b>MRX 90</b>	90	18.0	31.5	47.1	62.2	91.8	118	166	277
<b>MRX 100</b>	100	20.0	34.2	51.0	67.4	99.5	128	180	300
<b>MRX 115</b>	115	23.0	39.5	59.0	78.0	115	148	208	347
<b>MRX 130</b>	130	26.0	44.9	66.9	88.5	131	168	236	393
<b>MRX 145</b>	145	29.0	48.6	72.5	95.9	142	182	255	426
<b>MRX 160</b>	160	32.0	54.0	80.5	106	157	202	284	473
<b>MRX 180</b>	180	36.0	63.1	94.1	124	184	236	331	553
<b>MRX 200</b>	200	40.0	68.3	102	135	199	256	359	599
<b>MRX 230</b>	230	46.0	79.1	118	156	230	296	416	693
<b>MRX 260</b>	260	52.0	89.7	134	177	261	336	471	787

Available amperes at 20°C

End voltage - 1.05 V/cell

Cell type	C <sub>5</sub> Ah	Hours			Mins				
		5	3	2	90	60	45	30	15
<b>MRX 70</b>	70	14.0	24.2	36.5	47.2	68.2	87.0	118	172
<b>MRX 80</b>	80	16.0	26.9	40.5	52.4	75.8	96.7	131	191
<b>MRX 90</b>	90	18.0	31.4	47.3	61.3	88.5	113	153	223
<b>MRX 100</b>	100	20.0	34.1	51.3	66.4	95.9	122	166	242
<b>MRX 115</b>	115	23.0	39.4	59.4	76.8	111	142	192	280
<b>MRX 130</b>	130	26.0	44.7	67.4	87.2	126	161	218	318
<b>MRX 145</b>	145	29.0	48.4	73.0	94.4	136	174	236	344
<b>MRX 160</b>	160	32.0	53.8	81.0	105	152	193	263	382
<b>MRX 180</b>	180	36.0	62.9	94.7	123	177	226	307	447
<b>MRX 200</b>	200	40.0	68.1	103	133	192	245	332	484
<b>MRX 230</b>	230	46.0	78.8	119	154	222	283	385	560
<b>MRX 260</b>	260	52.0	89.4	135	174	252	321	436	636

# MATRICES CELL PERFORMANCE

Available amperes at 20°C

End voltage - 1.10 V/cell

Cell type	C <sub>5</sub> Ah	Hours			Mins				
		5	3	2	90	60	45	30	15
MRX 70	70	14.0	23.9	35.2	45.7	64.9	80.3	104	137
MRX 80	80	16.0	26.6	39.1	50.8	72.1	89.1	116	152
MRX 90	90	18.0	31.1	45.6	59.4	84.3	104	135	178
MRX 100	100	20.0	33.7	49.5	64.3	91.3	113	147	193
MRX 115	115	23.0	38.9	57.2	74.4	106	131	170	223
MRX 130	130	26.0	44.2	64.9	84.5	120	148	193	253
MRX 145	145	29.0	47.9	70.3	91.5	130	161	209	274
MRX 160	160	32.0	53.2	78.1	102	144	178	232	305
MRX 180	180	36.0	62.1	91.3	119	169	208	271	356
MRX 200	200	40.0	67.3	98.9	129	183	226	293	386
MRX 230	230	46.0	77.9	114	149	211	261	340	446
MRX 260	260	52.0	88.4	130	169	240	296	385	506

Available amperes at -20°C

End voltage - 1.00 V/cell

Cell type	C <sub>5</sub> Ah	Hours			Mins		
		5	3	2	90	60	45
MRX 70	70	13.1	21.4	31.4	40.9	58.4	73.9
MRX 80	80	14.6	23.7	34.8	45.4	64.8	82.1
MRX 90	90	17.0	27.7	40.7	53.0	75.7	95.9
MRX 100	100	18.5	30.1	44.1	57.5	82.1	104
MRX 115	115	21.4	34.8	51.0	66.5	95.0	120
MRX 130	130	24.2	39.5	57.9	75.4	108	136
MRX 145	145	26.3	42.8	62.7	81.7	117	148
MRX 160	160	29.2	47.5	69.7	90.7	130	164
MRX 180	180	34.1	55.5	81.4	106	151	192
MRX 200	200	36.9	60.1	88.2	115	164	208
MRX 230	230	42.7	69.6	102	133	190	241
MRX 260	260	48.5	78.9	116	151	216	273

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