HAZE

POWER TO KEEP YOU ON THE MOVE

Electric Vehicle Gel

ELECTRIC VEHICLE applications are wide and varied with many durability & power demands placed firmly on the batteries shoulders.

HAZE ELECTRIC VEHICLE GEL always delivers when you need it, whatever your DC requirement in extreme situations.

Tough ABS case with INSERT TERMINALS as standard, smaller sizes with FASTON.

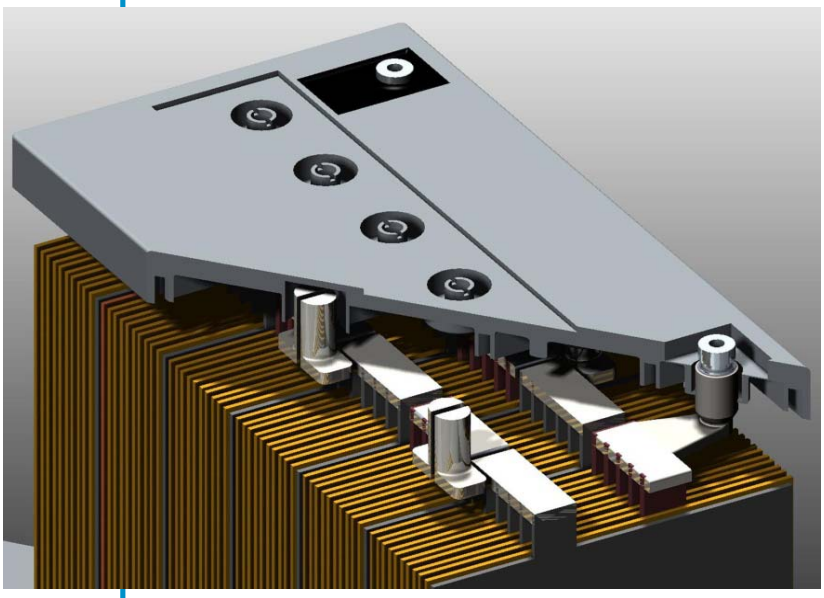
Gel Technology delivers cranking amps, general power and long/deep discharges without the need for immediate recharge. EXTRA LONG CYCLE LIFE and resistance to mechanical stress and the elements all in one battery.

HAZE ELECTRIC VEHICLE GEL delivers maximum capacity within twenty cycles and keeps delivering long after the others are on the scrap heap. HAZE R&D has resulted in SPECIAL CHEMICAL and PROCESS technology to ensure consistency and performance.

CONSTRUCTION - Gel battery construction is as shown in the diagram. The positive and negative grids are cast from a calcium/tin lead alloy to reduce grid growth and corrosion. The active material is manufactured from a high purity lead (99.9999%) to minimize the negative effects of impurities.
Separator is manufactured by a world leader in the field, utilizing the latest German technology. The base material is a microporous duroplastic exhibiting excellent high temperature stability and mechanical strength, resulting in very good resistance to vibration and mechanical shock. The integrity of the battery will be maintained under extreme conditions.

The purpose of the separator is to maintain a constant distance between the positive and negative plates, totally eliminating the possibility of short circuits whilst allowing the active materials to fully react with the gelled electrolyte.

The separator also has an open construction, which allows little resistance to the flow of the electrolyte during filling.
A thin layer (typically 0.4mm) of non-woven glass mat is an integral part of the separator and is placed against the positive plate for improved surface contact.

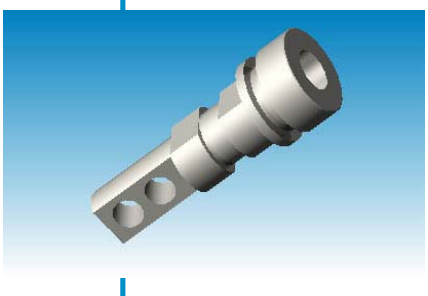


Gel construction with case removed and cover cut away to show internal battery parts.

Typical separator properties are:

Acid displacement -150 ml /sqm
Pore volume - 70%
Average pore size - 0.5 micro m
Maximum pore Diameter - 1 micro m

ELECTROLYTE FILLING - Gelled electrolyte is introduced to the cell by means of custom-built vacuum filling machines it is vitally important that the electrolyte achieves full penetration of the separator and plates therefore; vacuum cycling is utilized after the filling process. To ensure each cell has the correct amount of gel, they are first overfilled, the extra gel is then removed. The battery design and construction negates the need for electrolyte addition and the battery remains maintenance free throughout its design life.



SAFETY RELEASE VALVE- The battery will operate above atmospheric pressure under normal operating conditions, however the maximum pressure is governed by the safety release valve. Open is activated by pressures in excess of approx. 2 psi (14 Kpa), resealing at approx 1.2 psi (8.4 Kpa).

GAS RECOMBINATION - The gasses generated during normal operation of the battery are internally recombined. In fact more than 99% of the gas achieves recombination.

TERMINAL CONSTRUCTION - The contact quality between the insert terminal and the lead post is of vital importance during short duration / high Amp discharges. Elevated terminal temperatures are the result of poor contact, eventually causing seal degradation and electrolyte leaks. Haze design and assembly technique for terminal casting ensures trouble free operation for the design life of the battery.

Gel Vs AGM

Each battery has its advantages and disadvantages, it is therefore important to choose the right battery for the application. Advantages of Gel Batteries:

- Full recovery from deep discharge, even when the battery is not recharged immediately.
- Ideal for repeat cycling daily use.
- Excellent performance over long discharges
- Good tolerance to higher temperature applications
- Suitable where mains power is unstable
- Zero stratification due to immobilized electrolyte
- No equalization charge necessary
- Reduced self-discharge
- Limiting design protects the positive plates to greatly improve cycle life
- Improved charge acceptance due to low internal resistance
- High resistance to water loss with the right charging set up
- Ultra stable polymer separator with glass mat for increased performance
- High resistance to shorting due to superior mechanical strength of the polymer separator
- Increased tolerance to poor charging parameters
- Can be discharged even when full recharge has not been achieved, without loss of battery capacity

Applications

- Float service
- Residential
- Telecommunications
- Refrigeration
- Poor charging applications
- Frequent use applications
- Wind
- Engine Starting
- Higher ambient temperature applications
- Water Pumping
- Road side cabinets
- Cathodic Protection

Many other extreme applications

Capacity temperature correction Factor to be applied to Data at 20 Degrees C

Discharge Time	-30 °C	-20 °C	-10 °C	0 °C	5 °C	10 °C	15 °C	20 °C	25 °C	30 °C	35 °C	40 °C	50 °C
5 minutes to 59 minutes	0.23	0.417	0.605	0.778	0.86	0.91	0.96	1	1.037	1.063	1.085	1.1	1.116
1 Hour to 100 Hours	0.277	0.464	0.647	0.816	0.886	0.93	0.97	1	1.028	1.05	1.063	1.07	1.078

CHEMICAL REACTION- The chemical reaction for the Discharge / Recharge process is represented by the following formula:

PbO_2	+	$2H_2SO_4$	+	Pb	Discharging	$PbSO_4$	+	$2H_2O$
Lead Dioxide		Sulfuric Acid		Sponge Lead	⟶ Charging ⟵	Lead Sulphate Pos & Neg Plates		Water

Under normal float charge conditions the oxygen passes through the separator from the positive to the negative plate where it reacts with the negative active material to form lead oxide.

$$2Pb + O_2 \longrightarrow 2PbO$$

In the acid conditions the lead oxide reacts with the sulfuric acid to form lead sulphate.

$$2PbO + 2H_2SO_4 \longrightarrow 2PbSO_4 + 2H_2O$$

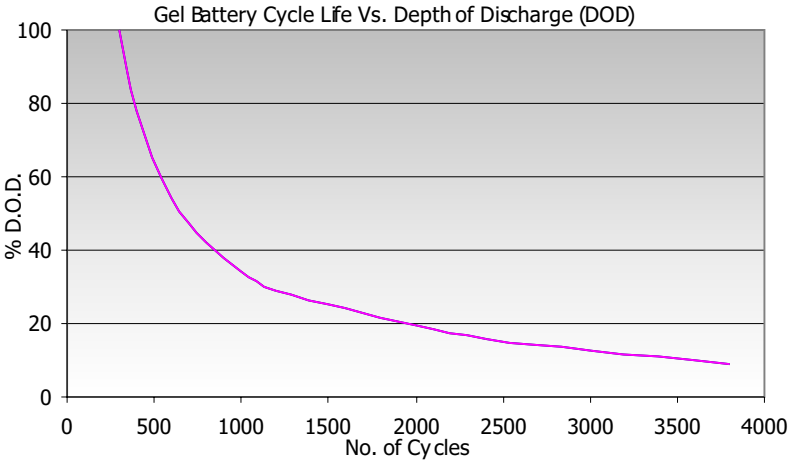
The lead suphate formed on the negative is then reduced to lead and sulfuric acid by the evolving hydrogen.

$$2PbSO_4 + 2H_2 \longrightarrow 2Pb + 2H_2SO_4$$

If the equations are resolved and like terms cancelled out on both sides of the equation the result is:

$$2H_2 + O_2 \longrightarrow 2H_2O$$

This reaction summarises what is meant by GAS RECOMBINATION. The process can never be 100% efficient, normal recombination efficiency is 95 - 99%.



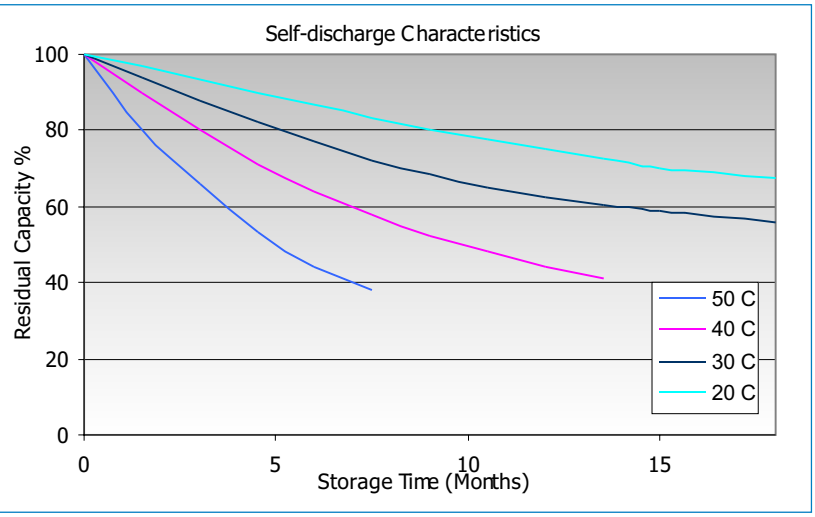
Innovative Features

- Completely maintenance free, sealed
- Construction eliminates the need for watering
- Electrolyte will not stratify, no equalization charge required
- Increased durability and deep cycle ability for heavy demand applications
- Special formation process
- Gelled thixotropic electrolyte
- Spill proof / leak proof
- Valve regulated Max internal pressure 2.5 psi
- Multi-position usage
- Multi-cell container
- ABS Case and cover - V0 on request
- Low self discharge
- Utilising the latest in European technology
- FAA and IATA approved as non-hazardous

Specifications

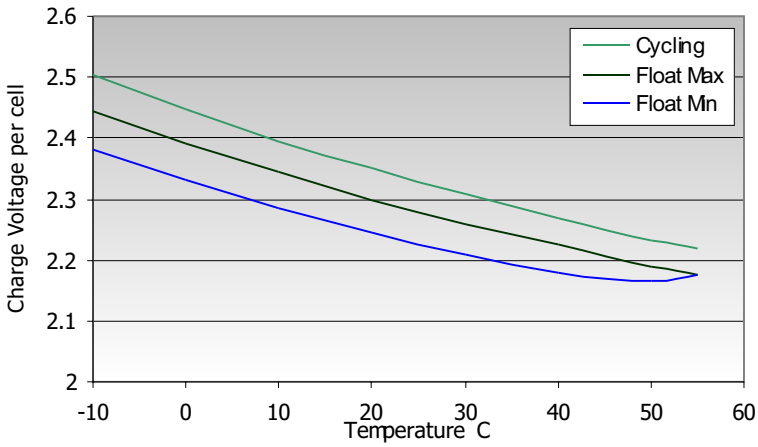
Nominal Voltage	6 & 12 Volts
Design Life	12 Years
Operating Temperature	-20 ˚C to 50 ˚C
Grid alloy	Calcium / Tin lead alloy
Plates	Flat Pasted
Separator	Microporous Duroplastic
Active material	Very high purity lead
Case and cover	ABS (VO on request)
Charge Voltage	Float 2.27 - 2.30 VPC @20 ˚C Cycling 2.4 @20 ˚C Max. 2.4 VPC Max ripple 3.5% Charge V
Electrolyte	Sulphuric acid Analytical grade purity
Venting Valve	EPDM Rubber 1.5 to 2 psi (10.5 - 14 KPa) release pressure. Resealing at 1 psi (7 KPa)
Terminal	Various types Epoxy sealed by extended mechanical paths
Torque setting	The recommended torque value for all types is 5-7 Nm
Cables	Insulated cables / connectors supplied on request.

Haze Battery Company keenly encourages environmental awareness; PLEASE follow guidelines for the recycling /disposal of lead.

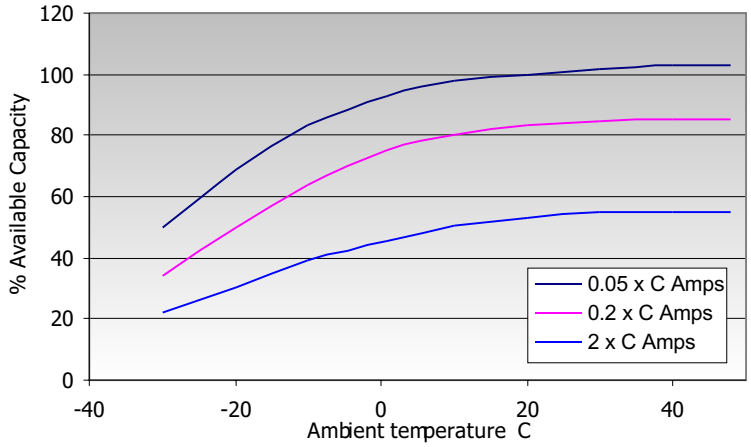


QUALITY ASSURED FIRM ISO 9001 SGS
UKAS QUALITY MANAGEMENT 005
CE
ETS Germany EMC tested
LEAD RETURN RECYCLE
Pb

Relationship Between Charge Voltage and Temperature



Capacity Vs Ambient Temperature



CHARGING CHARACTERISTICS

Floating - The optimum float voltage for a battery is temperature dependant, at 15 - 24°C the recommended value is 2.27 - 2.30V. It is recommended that battery installation sites are temperature controlled, however float voltage can be increased or decreased to compensate for temperature variations. Adjustment is calculated at +/- 3 mV per degree C.

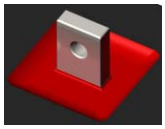
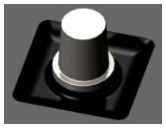
Operating Temperature	Recommended Applied Float Voltage VPC
0-9	2.33 - 2.35
10-14	2.30 - 2.33
15-19	2.27 - 2.30
20-24	2.27 - 2.30
25-29	2.25 - 2.27
30-34	2.23 - 2.25
35-40	2.21 - 2.23

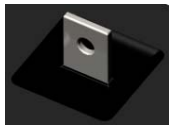
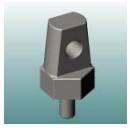
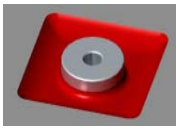
The most suitable charging method for battery life and performance is the constant voltage method with a limited initial current, usually limited to a maximum of $C_{20}/4$.

Terminal Options (left to right)

- Lead Flag
- Automotive
- J Type
- Copper Flag
- J Type Adapter
- Insert

Insert are made from brass with copper, nickel and silver plating giving excellent mechanical, electrical and corrosion resistant properties.

The Quality & Management system governing the manufacture of this product is ISO 9001:2000 and ISO 14001:2004 certified.

Important Note: The capacities and runtimes quoted below are applicable to a battery which has achieved full capacity. Full capacity is achieved after approx. 20 cycles. Initial capacity will be approx. 15 - 20% lower.

Battery Model	Dimensions (mm) & weight (Kg)				Cold Cranking Amps			Volts	Thread size mm	Reserve Capacity - Minutes Discharged					Capacity - Ampere Hour*						
	Length	Width	Height	Weight	20°C (68°F)	0°C (32°F)	-18°C (0°F)			75 Amps	**25 Amps**	20 Amps	15 Amps	8 Amps	100 Hr	48 Hr	**20 Hr**	10 Hr	5 Hr	3 Hr	1 Hr
HZY-EV6-7.5	149	34	94	1.3	-	-	-	6	NA	-	**-**	-	-	-	8.6	8.1	**7.5**	6.9	6.1	5.6	4.6
HZY-EV6-10	151	50	95	1.8	-	-	-	6	NA	-	**-**	-	-	-	11.6	10.9	**10.1**	9.2	8.2	7.6	6.2
HZY-EV6-12	151	50	95	2.0	-	-	-	6	NA	-	**-**	-	-	-	13.8	13.0	**12**	11.0	9.8	9.0	7.4
HZY-EV12-7.5	150	63	95	2.5	-	-	-	12	NA	-	**-**	-	-	-	8.6	8.1	**7.5**	6.9	6.1	5.6	4.6
HZY-EV12-12	152	99	96	4.0	-	-	-	12	NA	-	**-**	-	-	-	13.8	13.0	**12**	11.0	9.8	9.0	7.4
HZY-EV12-18	181	76	167	5.4	204	137	84	12	5	-	**-**	26	44	91	19	18	**17**	15	14	13	10
HZY-EV12-26	168	178	124	8.0	301	217	142	12	5	-	**23**	41	65	141	28	26	**25**	22	20	18	15
HZY-EV12-33	196	131	160	10.4	350	260	172	12	6	6.9	**30**	52	75	170	34	32	**29**	27	24	23	18
HZY-EV12-44	198	167	157	13.0	450	337	220	12	6	12	**54**	78	113	237	44	41	**38**	36	32	29	24
HZY-EV12-55	229	138	213	18.4	569	444	294	12	6	19	**84**	118	165	344	60	56	**52**	48	42	39	32
HZY-EV12-70J	349	168	175	21.0	663	530	367	12	6	27	**115**	156	214	451	77	72	**67**	61	54	50	41
HZY-EV12-65	272	165	188	21.5	708	573	400	12	6	31	**132**	176	246	509	85	79	**74**	67	60	55	45
HZY-EV12-80	260	168	211	25.1	740	600	425	12	8	32	**141**	191	265	549	89	84	**78**	71	65	59	49
HZY-EV12-100	306	168	211	29.3	820	715	520	12	8	44	**171**	225	318	659	108	102	**94**	86	77	71	58
HZY-EV12-110	329	173	209	32.2	854	766	560	12	8	48	**184**	248	356	735	116	110	**102**	94	84	77	63
HZY-EV12-120	409	177	225	36.0	917	835	650	12	8	60	**221**	282	406	847	135	127	**118**	108	96	88	73
HZY-EV12-135	342	173	282	43.7	998	906	762	12	8	82	**270**	361	509	1043	163	153	**142**	130	116	107	88
HZY-EV12-150	483	170	242	45.5	1011	919	784	12	8	86	**282**	376	529	1088	169	159	**147**	135	120	111	91
HZY-EV12-160	530	209	214	53.7	1028	938	811	12	8	93	**312**	406	570	1176	180	169	**157**	143	128	118	97
HZY-EV12-200	522	242	220	63.4	1094	988	909	12	8	139	**429**	553	780	1621	235	222	**210**	192	167	158	129
HZY-EV12-230	521	270	205	69.5	1117	1007	940	12	8	164	**517**	664	897	1910	276	259	**240**	220	195	181	149
HZY-EV6-110	193	168	204	17.1	880	789	577	6	8	52	**205**	263	365	777	126	119	**110**	100	89	83	68
HZY-EV6-160	298	171	226	26.5	1059	966	835	6	8	109	**335**	435	612	1264	192	180	**167**	152	136	125	103
HZY-EV6-180	260	181	246	29.6	1071	972	868	6	8	118	**359**	465	653	1370	203	191	**176**	161	144	133	109
HZY-EV6-200	323	178	226	30.2	1083	978	900	6	8	130	**394**	506	706	1494	219	205	**190**	174	155	143	118
HZY-EV6-225	244	188	275	33.8	1116	1007	927	6	8	144	**453**	590	811	1735	248	233	**216**	197	175	162	133
HZY-EV8-160	260	182	298	34.4	1045	955	829	8	8	101	**323**	423	585	1152	177	166	**154**	141	125	116	95

Battery Charging: Haze recommend the following charging profile to optimise cycle and battery life. Charging Voltage (max) 2.41vpc Charging Current Max 20 Hour Ah / 5 e.g. HZY-EV12 100 = 94/5 = 18.8A. It is recommended that the charging voltage be switch to Float (2.27-2.3vpc) when the battery is fully charged. (The above parameters apply to 20-25 ℃

Cycle Life: To ensure maximum cycle life it is recommended that the battery be fully recharged as soon as possible after use. Cycle life is very dependant on the depth of discharge (DOD). The following is a guide to the number of cycles expected. 100% DOD - 350 cycles, 75% DOD - 420 cycles, 50% DOD - 650 cycles.

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UL Recognised Component MH28512

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