

PERFORMANCE ADDITIVES FOR ADVANCED LEAD ACID BATTERIES



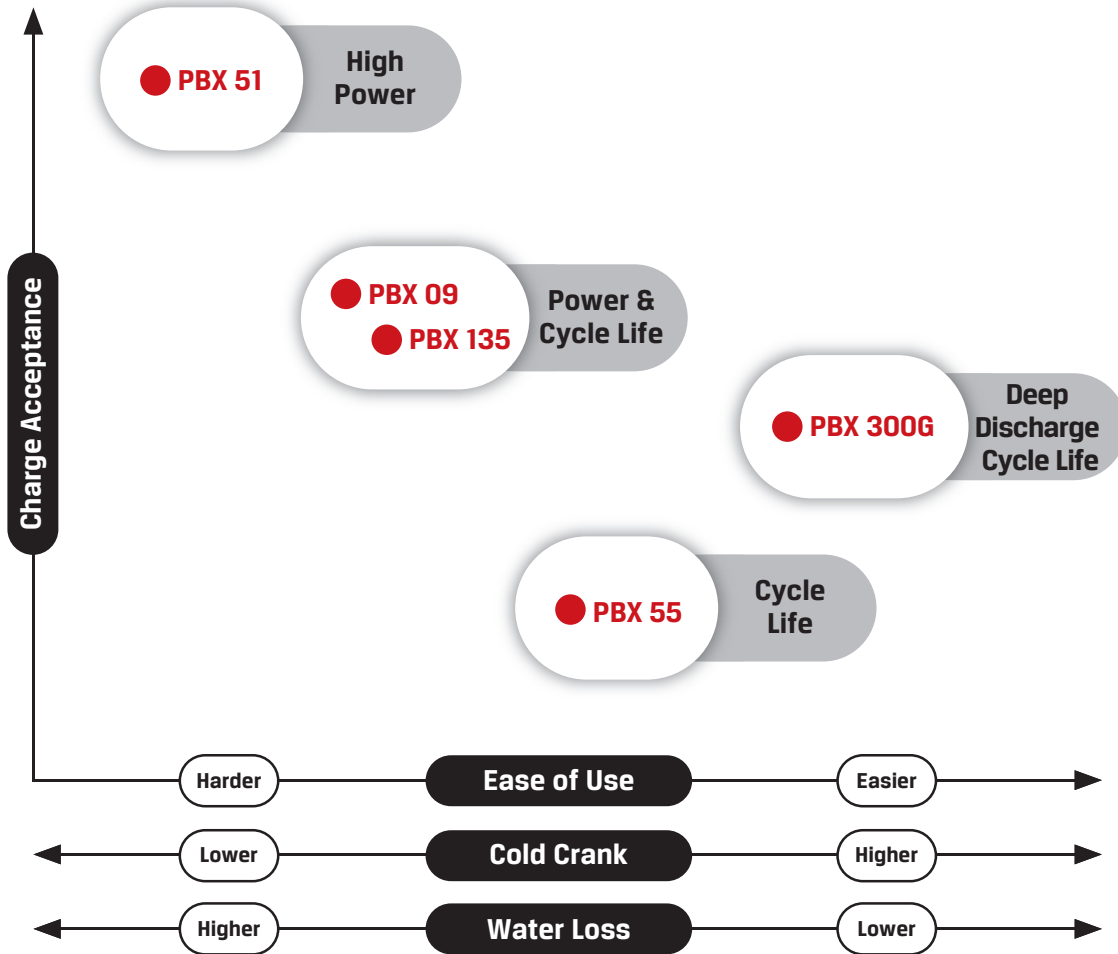
PBX[®] PRODUCT SELECTION GUIDE

CATEGORY	PERFORMANCE REQUIREMENTS	APPLICATION	CABOT CARBON ADDITIVE	CHARGE ACCEPTANCE	CYCLE LIFE	CHARACTERISTICS
HIGH POWER ADDITIVES	Dynamic charge acceptance is the primary requirement	<ul style="list-style-type: none"> ◆ Micro hybrid vehicles ◆ Mild hybrid vehicles ◆ E-bikes ◆ Energy storage systems (ESS) 	PBX 51			<ul style="list-style-type: none"> ◆ Excellent dynamic charge acceptance and cycle life ◆ Suggested loading 0.25-0.5% ◆ For use in both VRLA and flooded batteries
MULTI-PURPOSE ADDITIVES	Charge acceptance and cycle life are equally important	<ul style="list-style-type: none"> ◆ Micro hybrid vehicles ◆ Telecom ◆ Energy storage systems (ESS) 	PBX 09			<ul style="list-style-type: none"> ◆ High charge acceptance and cycle life ◆ Designed primarily for use in valve regulated lead acid (VRLA) batteries
		<ul style="list-style-type: none"> ◆ Micro hybrid vehicles ◆ Motive power 	PBX 135			<ul style="list-style-type: none"> ◆ Excellent cycle life and good charge acceptance ◆ For use in flooded batteries
		<ul style="list-style-type: none"> ◆ E-bikes ◆ Energy storage systems (ESS) 	PBX 300G			<ul style="list-style-type: none"> ◆ Low temperature performance improvement ◆ Excellent cycle life in deep discharge ◆ For use in both VRLA and flooded batteries
CYCLE LIFE ADDITIVES	Cycle life is the primary requirement	<ul style="list-style-type: none"> ◆ Micro hybrid vehicles ◆ High end starting, lighting, ignition (SLI) batteries 	PBX 55			<ul style="list-style-type: none"> ◆ Excellent cycle life ◆ For flooded batteries with minimal charge acceptance requirements

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Additives for lead acid batteries

The primary function of our additives for lead acid batteries is to improve the morphology of negative plates and enable better charge acceptance and cycle life in partial state of charge cycling applications.

- ◆ For applications that require superior dynamic charge acceptance, consider high surface area products such as PBX 51 carbon additive. This product is most suitable for valve regulated lead acid (VRLA) batteries or in applications where water loss and cold crank performance are less important or can be mitigated by battery design.
- ◆ For applications where both high charge acceptance and cycle life are important, consider multi-purpose products such as PBX 09, PBX 135 and PBX 300G carbon additives to meet the requirements for a variety of applications.
- ◆ For applications that primarily require excellent cycle life, with minimal requirements on charge acceptance, consider low surface area products such as PBX 55 carbon additive.

Balancing other requirements

- ◆ We can provide the customer with assistance in selecting the most suitable additive and optimizing expander formulation to achieve the appropriate balance between various performance requirements.
- ◆ We can also provide guidance on techniques on how to disperse and incorporate our additives into the negative plate.

For more information contact: battery.materials@cabotcorp.com or visit: cabotcorp.com/batteries