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THE EXPERIENCE OF FIAMM AT THE SERVICE OF THE ENVIRONMENT

Nowadays, the energy requirements of modern vehicles require batteries capable of maintaining their performance for a long time. In particular, in a quest to reduce CO₂ emissions and comply with EU regulations, car manufacturers have developed micro hybrid models equipped with devices, such as Start & Stop and Brake Energy Regeneration, which require a much more intense battery use.

The new range of ecoFORCE batteries for micro hybrid cars provides a response to this need.

EMISSIONS

EUROPEAN DIRECTIVE ON THE REDUCTION OF CO₂ EMISSIONS

Altogether, cars and light commercial vehicles account for approximately 15% of all CO₂ emissions in the European Union, including those from fuel procurement. The objectives fixed by the European Commission will lead to the reduction of the average CO₂ emissions of new cars from 135.7 g/km (in 2011) to 95 g of CO₂ per kilometre in 2020, whereby improving the previous goal, which was to reach 130 g/km by 2015. This challenge for auto makers is the beginning of a new era which will determine considerable changes in vehicle manufacturing and will also influence the automotive component sector in a major manner.

The battery will become the beating heart of the car even more than it is today and will be expected to provide increasingly more frequent starts and unprecedented storage capacity.



THE EU2020 TARGET

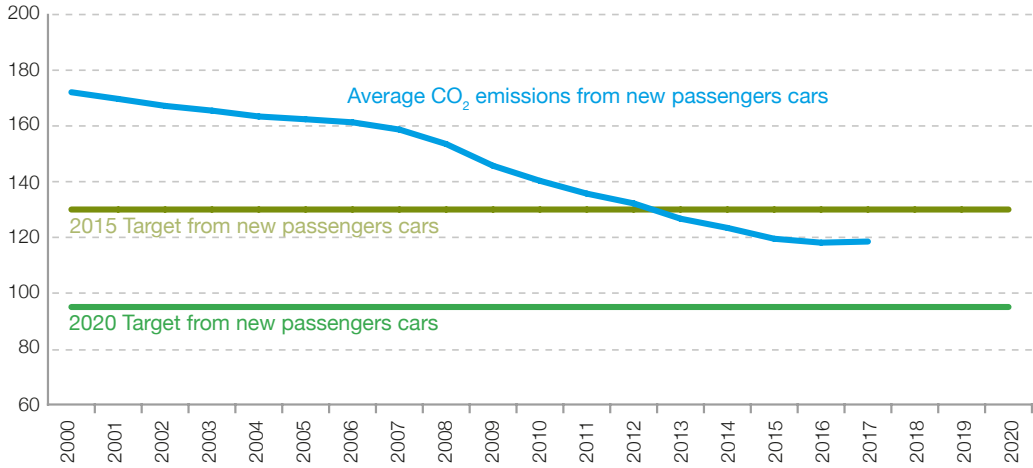
The European Parliament has approved new standards governing CO₂ emissions of new generation cars which starting **from 2020** must not exceed the maximum limit of **95 g/km**. This restriction will apply to manufacturers that make more than 1000 cars per year.

The reform includes a transition phase, limited to one year only (2020), and a "supercredit" system, applicable from 2020 to 2022, in which cars which emit less than 50 g/km of CO₂ will count double in the manufacturer's average.

It is estimated that the target of 95 g/km of CO₂ will allow 15 tons lower CO₂ emissions and better fuel efficiency equal to € 4000 for the entire lifecycle of the vehicle.



UE 27 - AVERAGE CO₂ EMISSIONS OF NEW CARS SOLD (g/km)



ENFORCEMENT DATE OF EN 50342-1: 2015-11

The new edition of EN 50342-1 came into force on 5 October 2018.

EN 50342-1: Lead-acid starter batteries - Part 1: General requirements and methods of test. This standard governs measurement of the electrical and mechanical properties of lead-acid batteries for automotive applications. One of the innovations of the 2015 edition of EN 50342-1 is the classification of some battery performances levels.

THE PERFORMANCE TO BE CLASSIFIED AND THE RESPECTIVE LEVELS ARE:	EN 50432-1: 2015	MIN	MAX
	Water consumption	W1	W5
	Charge storage	C1	C2
	Resistance to vibrations	V1	V4
	Cycle duration	E1	E4

Example of specifications stated on label:

12 V 180 Ah 1100 A EN
EN 50342-1: W3-C2-V1-E1



MICRO HEV

START & STOP SYSTEM - BRAKE ENERGY REGENERATION

Cars in the Micro HEV (Hybrid Electric Vehicle) category have a Start & Stop function which switches off the engine when the car stops and starts it again when the driver presses the clutch pedal or the throttle.

All electrical devices are powered exclusively by the battery when the vehicle is at a standstill. According to NEDC (New European Driving Cycle - used by all manufacturers to calculate fuel consumption), the Start & Stop function can decrease CO₂ emissions by 3-6%.

Micro HEV cars also fit a braking energy recovery device capable of reducing consumption by up to 8% with respect to a conventional vehicle. The Brake Energy Regeneration recovers the energy developed during deceleration or braking. The energy produced by the movement of the vehicle is collected and stored in the battery.

This reduces the work of the thermal engine and increases fuel efficiency. During acceleration, all the devices which are not actually needed are disconnected from the driveline, to make all the engine power available for propelling the car and save fuel at the same time.



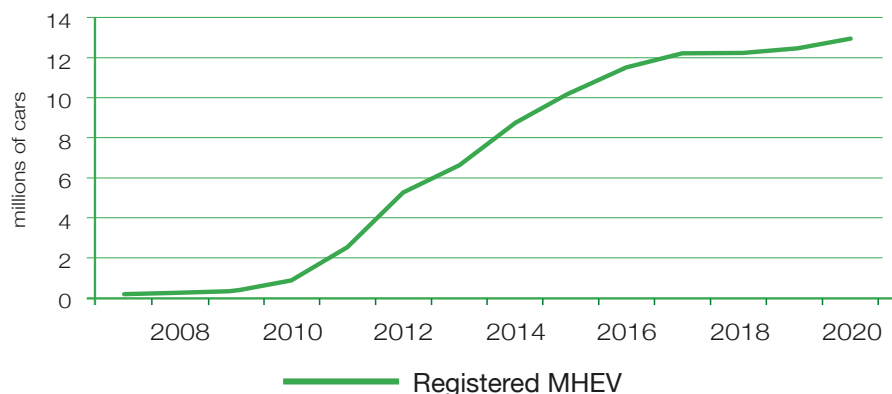
These devices require the use of a battery capable of withstanding continuous and numerous cranking, charging and discharging cycles.

- › **ecoFORCE AFB** batteries are generally suited for cars with Start & Stop system.
- › **AGM ecoFORCE** batteries are indispensable for the cars which combine various fuel saving devices to the Start & Stop system.

INSTRUMENTS TO REDUCE CONSUMPTION

- › Gear shift indicators
- › Smart alternator
- › Dual clutch transmissions
- › Solutions for electronic management of frictions and fluids
- › Steering by wire and braking by wire systems

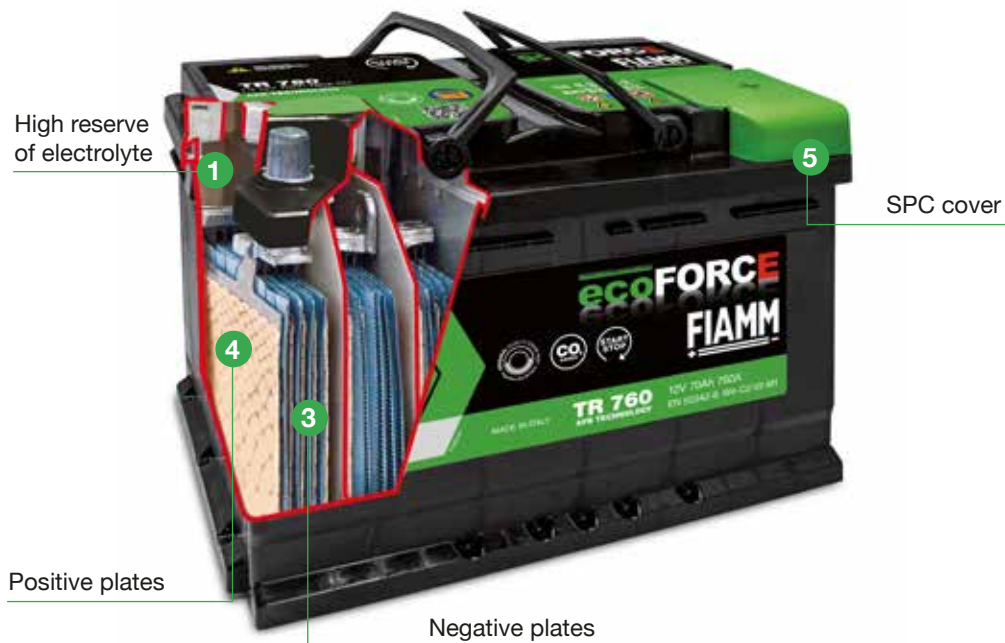
EUROPEAN MARKET



ecoFORCE AFB

ecoFORCE AFB (Advanced Flooded Battery) is an evolution of conventional lead batteries. ecoFORCE AFB is the best solution for vehicles equipped with Start&Stop system which require a higher energy support than that offered by conventional SLI batteries.

In this case, the battery is characterised by a cycling resistance two times greater than that of a conventional battery. In queues or at traffic lights, ecoFORCE AFB powers all the electrical components when the engine is off and ensures reliable restarting as soon as the clutch is engaged.



AFB TECHNOLOGY

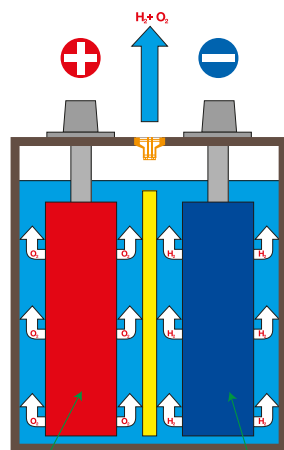
The main differences of an AFB battery with respect to a conventional free-acid battery are:

- 1 more electrolyte reserve;
- 2 large electrolyte exchange surface;
- 3 negative plates characterised by:
 - a. special PbCaSn (Lead-Calcium-Tin) alloy grids;
 - b. negative active mass composition with more carbon;
 - c. expander compound specifically designed to withstand Start & Stop cycles;
 - d. organic fibre layer to contain expansion of active mass during cycling;
- 4 positive plates characterised by:
 - a. special PbCaSn (Lead-Calcium-Tin) alloy grids;
 - b. grid specially studied to withstand corrosion and high temperatures (SAEJ2801);
 - c. layer to contain expansion of active mass during cycling;
- 5 electrode flags protected against corrosion and situations of potential danger.

CAUTION

The use of conventional free-acid batteries on micro hybrid cars is absolutely not recommended and dangerous. **FIAMM** recommends installing **AFB/AGM** batteries on these models. In case of replacement, always comply with the technology of the original battery.

BATTERY OPERATION FLOODED HEAVY DUTY WHILE RECHARGING



Development of oxygen

Development of hydrogen



THE MAIN ADVANTAGES

- › OE technology and quality
- › High resistance to the charging and discharging cycles (cycling resistance greater than conventional Pb-Ca batteries)
- › The composition of the active mass negative specially designed to support the typical Start & Stop cycles
- › Excellent starting power
- › Longer lifecycle than conventional lead-calcium batteries (measured in terms of energy output)
- › Maintenance-free

TECHNICAL SPECIFICATIONS

REFERENCE	PERFORMANCE		DIMENSIONS				SPECIFICATIONS			EN 50342-1:2015 EN 50342-6:2015			
	CAP. AH	CCA A (EN)	BOX	L (mm)	LA (mm)	A (mm)	LAY-OUT	TERMINAL	HOLD-DOWN	Water Consumption	Charge Retention	Resistance to Vibrations	Endurance Micro Cycle
TRM40	40	420	B20	197	129	227	0	3	B00	W3	C2	V2	M1
TRM40X	40	420	B20	197	129	227	1	3	B00	W3	C2	V2	M1
TRN50	50	500	B24	238	129	227	0	3	B00	W3	C2	V2	M1
TR540	50	540	L1	207	175	190	0	1	B13	W3	C2	V2	M1
TR600	60	600	L2	242	175	190	0	1	B13	W3	C2	V2	M1
TRQ65	65	650	D23	232	173	225	0	1	B00	W3	C2	V2	M1
TR650	65	650	L3B	278	175	175	0	1	B13	W3	C2	V2	M1
TR760	70	760	L3	278	175	190	0	1	B13	W3	C2	V2	M1
TRS75	75	640	D26	260	173	225	0	1	B00	W3	C2	V2	M1
TR730	75	730	L4B	315	175	175	0	1	B13	W3	C2	V2	M1
TR740	80	740	L4	315	175	190	0	1	B13	W3	C2	V2	M1
TRT95	95	760	D31	302	172	220	0	1	B00	W3	C2	V2	M1
TR850	95	850	L5	353	175	190	0	1	B13	W3	C2	V2	M1

ecoFORCE AGM

ecoFORCE AGM (Absorbent Glass Material) is the ideal battery for micro hybrid cars with Start& Stop, Brake Energy Regeneration and other fuel saving technologies.

The operation of all these instruments depends on the presence of a battery which provides optimum efficiency operating mainly in extreme cycling conditions.



AGM TECHNOLOGY

The main feature which differentiates an ecoFORCE AGM battery from a conventional one is gas recombination technology.

Water dissociates into hydrogen and oxygen in a conventional flooded lead battery when it is recharged. The two gases are released through the caps and the level of electrolyte decreases in the battery. ecoFORCE, instead, exploits the recombination principle. By using a special, very fine separator (Absorbent Glass Material) seeped in a controlled amount of electrolyte, the oxygen released from the positive plate due to

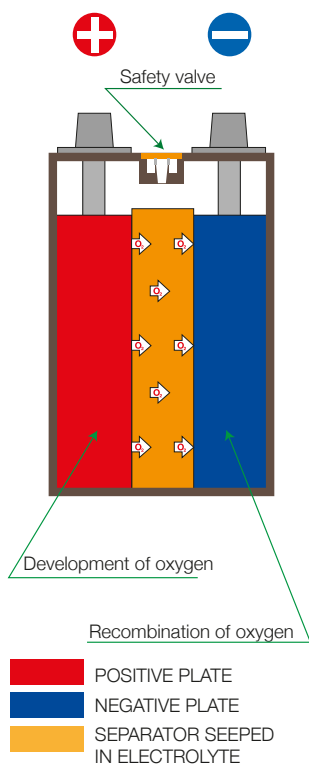
the dissociation of water during recharging can migrate to the negative plate where it is fixed to then recombine with hydrogen and form water again. In principle, this establishes a closed electrochemical cycle without gas emissions outside and without consuming water. It is a simple system that requires high constructive accuracy and careful selection of components in order to work perfectly. Crucial are the plate-mat system compression and the purity of components.

CAUTION

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ecoFORCE SEALED GAS-RECOMBINATION BATTERY OPERATION



THE MAIN ADVANTAGES

- › OE technology and quality
- › Breakaway current
- › Extreme resistance to the charging and discharging cycles (three times more resistant than conventional lead-calcium batteries)
- › Low self-discharge
- › Vibration resistance higher than conventional batteries
- › Maintenance-free
- › No leakage of liquid and gas

TECHNICAL SPECIFICATIONS

REFERENCE	PERFORMANCE		DIMENSIONS			SPECIFICATIONS			EN 50342-1:2015 EN 50342-6:2015				
	CAP. AH	CCA A (EN)	BOX	L (mm)	LA (mm)	A (mm)	LAY-OUT	TERMINALS	HOLD-DOWN	Water Consumption	Charge Retention	Resistance to Vibrations	Endurance Mycro Cycle
VR170	10	170	BTX 12	150	87	130	1	-	B00	W5	C2	V2	E4
VR200	12	200	BTX 14	150	87	145	1	-	B00	W5	C2	V2	E4
VR370	45	370	B24	236	127	224	1	3	B00	W5	C2	V2	E4
VR680	60	680	L2	242	176	190	0	1	B13	W5	C2	V2	M3
VR760	70	760	L3	278	176	190	0	1	B13	W5	C2	V2	M3
VR800	80	800	L4	315	175	190	0	1	B13	W5	C2	V2	M3
VR850	95	850	L5	353	175	190	0	1	B13	W5	C2	V2	M3
VR950	105	950	L6	394	175	190	0	1	B13	W5	C2	V2	M3

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