

AIRCRAFT MAINTENANCE

Aircraft Batteries: Concorde Still Excels

We've put Concorde and Gill batteries, both sealed and flooded, head-to-head for a decade now. Concorde has taken the ribbon every time.

by Kim Santerre

We have tested Concorde and Gill aircraft batteries on multiple occasions looking for the longest battery life and best value. In our view, and in our opinions expressed in our reader polls, Concorde's products are a better bet.

Our gold standard has been the FAA capacity test as the core of that test methodology since it takes each battery's amp-hour rating into consideration during the test, so we are testing apples-to-apples, so to speak.

Per FAR 23.1353(h), we look for 80-percent capacity at the one-hour discharge rate. This simulates the stress of an alternator-out situation where battery power alone keeps the essential electronics bus running for a minimum of 30 minutes.

There is no established standard for the number of cycles a battery must un-

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dergo, and we were only checking to see if the battery passed or failed each test.

Obviously, doing this over and over takes a toll and ultimately as the cycles continued, some of the batteries started to fail the capacity test by reaching the cutoff voltage before they were supposed to—in other words, the capacity dropped below the 80-percent level—at which point we stopped testing that battery.

CONCORDE ON EVERY FRONT

In each of the separate tests conducted a few years apart using three different type testers, we consistently found that Concorde and Gill flooded cells were close in their rated performance. However, Concordes generally have higher rated and actual amp-hour capacity out of the box than Gill. The Concorde flooded batteries also lasted several cycles longer than the Gills before they dropped below their official capacity rating. Two reader surveys returned similar opinions.

The Concorde sealed batteries performed better than their ratings, whereas, Gill sealed batteries just made their lower rating. Ultimately, the Concordes showed better performance throughout the test. So, in this limited quantity of batteries we tested on three separate occasions, it appeared the Concordes have greater cycle endurance before failing the capacity test, as well as greater average amp-hour capacity ratings than their Gill counterpart. The Gills met their lower amp hour specs, but most did not last as many cycles in repetitive capacity testing.

In a final abuse test, we gave the sealed batteries a charge and let them sit for six months. We kept this six-month interval up until the batteries failed a capacity test. The Concorde AGMs finally failed the capacity test at 30 months (but we still use them around the shop). The Gills died at 12 and 18 months and could not be charged.



HOW TO MAKE YOUR BATTERY LAST LONGER

Buy a sealed battery. See, wasn't that simple?

Sealed batteries can sit for much longer periods without discharge, and never need water. If you have a flooded battery, you'll want to keep it charged with a trickle charger if it will be more than a week or two between flights. Don't trickle charge over 13.2/26.4 volts; you'll do more harm than good, unless the charger is on an interval timer. Only use an aviation-rated charger and only use distilled water.

Never, ever leave a battery partially discharged, even overnight. Sulfation starts immediately.

Avoid parasitic losses when possible. These could be from an electric clock, radio memory or anything that draws current when the master switch is off. This includes ground faults. Parasitic draw contributes to the early failure of batteries through sulfation. Concorde also has an advisory out on an easy-to-do parasitic load test for aircraft to find those loads on the battery that drain it while the aircraft is sitting.

Watch your charging system voltage. Match it to the charging profiles in the maker's battery owner manuals, including seasonally adjusted maximum voltages when possible. High air temps need lower voltages. Some voltage regulators automatically change with temperature; others need to be manually adjusted.

Both companies have battery manuals and ICAs on their sites as well, with extensive information on the proper care and

feeding of their batteries.

An improper initial charge of a flooded battery with an auto charger can ruin it. Concorde says the Deltran Battery Tender brand chargers, popular in the automotive markets, should not be used with Concorde AGM batteries as the charging voltage is set too high.

One caution with sealed batteries is charging voltage in excess of the normal 14.4 to 14.7 (28.8 to 29.4) volts. It will damage a sealed battery if prolonged. There are also seasonal variations in acceptable charge voltage. Dedicated aviation profile multistage chargers from VDC Electronics solve this problem with storage charging (Automotive chargers typically are set too high and shorten the life of aircraft sealed batteries). What hasn't been solved is aircraft charging systems that are set too high or improperly maintained.

For those people who don't want to get their systems properly adjusted, they are better off staying with a flooded battery and doing all the associated battery maintenance such as adding water.



Given current battery prices, an owner would be ahead of the game to get that electrical system fixed and get an aircraft-type multistage charger to try to get at least four good years with a viable capacity test, rather than just buy a new battery every two or three years.

Table 1. Recommended Voltage Regulator Settings

Battery Temperature	Voltage Regulator Setting (Volts DC)	
	12V System	24V System
Below 0°C (32°F)	14.5 – 14.75	29.0 – 29.5
0 to 15°C (32 to 59°F)	14.25 – 14.5	28.5 – 29.0
16 to 30°C (60 to 86°F)	14.0 – 14.25	28.0 – 28.5
31 to 45°C (87 to 113°F)	13.75 – 14.0	27.5 – 28.0
Above 45°C (113°F)	13.5 – 13.75	27.0 – 27.5

One area in which we were criticized in testing is that only three to four examples of each brand (12- and 24-volt and both flooded and sealed) were tested on each test. We freely admit this is not a large sample. But the results were repeated three times with three sets of different batteries for a total of over 20 batteries over the 10 years. The Concordes consistently won the match, so we feel confident in our opinion that they are the better value.

USER OPINIONS

Our latest survey of user opinions turned up results consistent with our 2007 one. Sealed batteries are now the majority choice at 59 percent, most of which were Concordes.

"Concorde sealed is the way to go,"

said one reader. "Already because the corrosion repair around the Gill vent cost me \$\$\$." Gill also does not have enough cranking power and does not last." Another told us, "I prefer sealed due to limited maintenance requirements. I have used Gill in the past and have been happier with the reliability of the Concorde. I change the battery every three years." Concorde says their current production is nearly 99 percent of the sealed variety.

The brand usage has reversed from 2007. Then it was 55 percent were Gill and 37 percent for Concorde. Now it's 48 percent for Concorde and 40 percent for Gill. "The Concorde RG-35 batteries are absolutely the best I've ever used. They have performed flawlessly for me with little to no main-

tenance, especially important here in Fairbanks, Alaska." But Gill still had fans: "My Gill G242 is five years old and still going strong! I fly two times a week and use battery on the ground to program flight plans and listen to music." The Gill proponents were limited to flooded-cell type batteries, and a number said they simply replaced what was already installed.

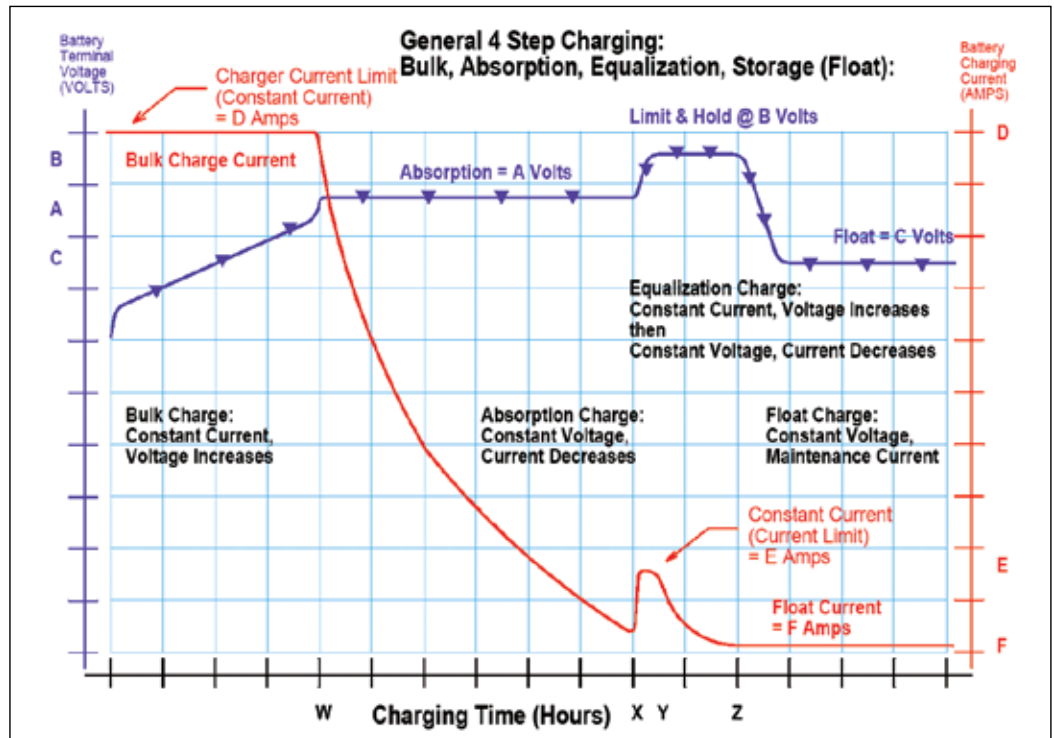
If you were paying attention above, you'll see there was 12 percent unaccounted for. These were homebuilders who have the option to use the other makes such as the Odyssey battery. "The Odyssey battery is far better than either Concorde or Gill that I have used in the past. The cranking power is at least 1/3 greater and it is very small and lightweight."

The VDC charger uses a multistage controller tailored expressly for aviation AGM and flooded cells. You can see how the charging scheme varies with time and existing battery charge.

The respondents as a group seem battery savvy (based on many dozens of insightful comments), and a full 69 percent put their own battery into service, saving themselves a good chunk of change. What is surprising, though, is only 37 percent have ever used a battery charger, and of that group only 19 percent use an aviation-type charger. Case in point for using a charger: "With short flights, my battery sulphated badly and needed encouragement to participate. Now with a VDC Battery Minder connected the day before, the system runs well. The battery has desulphated."

There is lots of room here to improve battery life with an aviation charger between flights if the plane will sit for more than two weeks at a time. Many respondents seem resigned to changing the battery at three-year intervals, but that really doesn't have to be the case with a proper charger in the picture. Some 37 percent claim their battery is over 36 months old, quite a few claimed five years for Concorde sealed or flooded or Gill flooded, and some respondents spoke of 10 years when the battery was well tended.

"I have never had an aircraft battery that didn't last 10 years or longer. The brand is not as important as the maintenance done on the battery. Checking the water level every month or two, never adding anything to the battery except distilled water, and never letting the battery sit in a partially discharged condition will ensure maximum life. I keep the battery topped off with a solar trickle charger [available from VDC Electronics] in the back window that I clip to the battery when not flying. I've had this experience with batteries in my Cessna 172 and later in my Cessna 182. I'm an



electrical engineer, studied lead acid batteries while in college, and have been flying 45 years."

Many respondents indicate they do capacity checks—a good thing. Some wonder if the capacity check shortens the life of the battery. The short answer is, "Yes." But there is currently no better way to test a battery, and the life shortening is relatively low.

In addition, it's probably mandatory. FAR 91.403 says to follow Instructions for Continued Airworthiness

(ICAs), and the ICAs from the battery makers don't exempt any aircraft using their battery from capacity testing if it is used as a starting battery as opposed to emergency or backup use.

FAILURE RATES

Battery failure (defined as death in under 24 months) is still an issue, but both makers improved over the 2007 survey. Sealed batteries were reported as nearly twice as reliable. For Concorde the early failure rate was 7.6 percent. For



Gill it was 30 percent. That may seem like a lot—and it is compared to car batteries—but it's still a big improvement over 2007 when the failure rate was 22 percent for Concorde and 59 percent for Gill.

We did get a repeat finding, which we still find a bit baffling and will use the same rationale for the result, and that is there is a 400 percent higher failure rate for 12-volt batteries than 24-volt types (failure defined as unserviceable in under 24 months).

Since 24-volt batteries have double the number of cells of a 12 volt, there is an inherently greater risk of a bad cell or failing cell, but we can only

conclude the newer aircraft electrical systems (post 1978) take less of a toll on batteries or get more TLC because they are so expensive.

Owner flying hours are holding about the same, but are still low, with 29 percent flying 25-50 hours per year, 38 percent flying 50-100 hours per year and 23 percent over 100 hours per year.

Along those lines, only 12 percent of respondents were satisfied with the warranty service. There were 19 percent unsatisfied and 69 percent were out of warranty or did not pursue it.

As an aside, 29 percent indicated that they will jump a dead battery and press on. This is an inherently danger-

ous practice unless you plan on staying in the pattern since that dead battery is nearly worthless for two to three hours (assuming it was in decent shape) should your alternator system fail. Much of the alternator output is going to servicing electronics, not charging the battery.

THE MARKET SPEAKS

When you're picking a battery, it's important point here is that to judge value, use a dollar cost per amp hour rather than simply the battery price.

Using Aircraft Spruce prices, a Gill G35S sealed, 23 amp-hour battery is \$189. A Concorde 29 amp-hour version is \$198. It looks at first glance like the Gill is the better buy, but in reality you get 26 percent more amp-hour capacity in the Concorde for \$10 more. That's \$8.22 per amp-hour for the Gill and \$6.83 per amp-hour for the Concorde. We think this makes the Concorde the better value in cost. The Concorde ICA requires less frequent testing and has a better warranty, as well.

Our data shows Concorde as number one in sales with a 48-percent market share, followed by Gill at 40 percent and the remainder in the homebuilt market made up mostly of Odyssey sealed batteries. That last option isn't available for many certified aircraft. If we were to go out and buy a new battery today, it would be a sealed Concorde.

Kim Santerre is the editor of our sister publication Light Plane Maintenance.

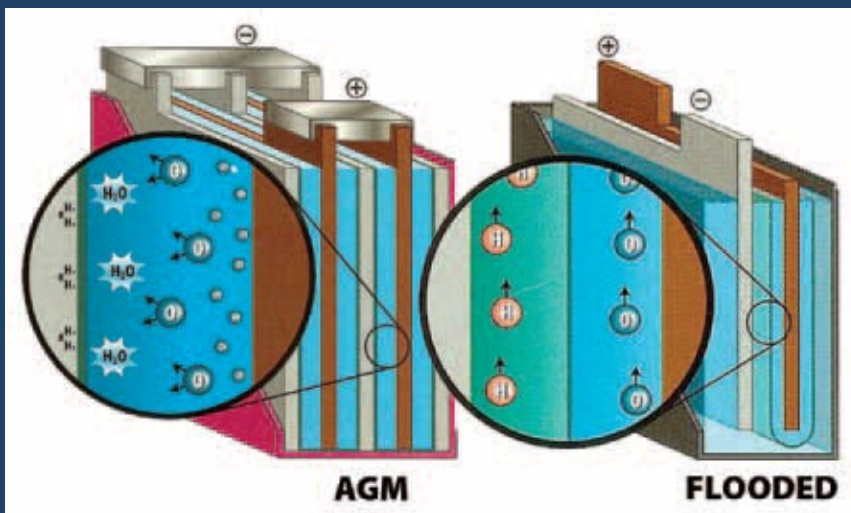
Technical Corner

WHAT'S A SEALED BATTERY?

The term AGM (sealed), recombinant gas (RG) or starved electrolyte battery are the same thing. This technology generally offers greater cranking and faster recharge ability for a given model than a flooded battery due primarily to its extremely low internal resistance and different internal design. (You could drive a spike into an AGM battery and pull it out and the battery would not leak.)

To paraphrase Concorde: The cells are sealed with pressure relief valves that keep gasses within the battery. The plates are sandwiched between layers of fiberglass mat with fibers of different length. The mat is over 90 percent saturated—but no more. The remainder is filled with gas to provide channels by which oxygen travels from positive to negative during charging.

The void spaces allow the freshly generated gasses, which are in their atomic state and highly reactive, to recombine rapidly and safely. Because this design allows much lower internal resistance than flooded battery technology, AGMs have greater starting power and resistance to self-discharge. These are not gel cell batteries; that's a different technology.



CONTACTS

Concorde Battery Corp.
800-757-0303
www.concordebattery.com

Gill Batteries
800-456-0070
www.gillbatteries.com

West Coast Batteries (Odyssey)
888-379-2555
www.odysseybatteries.com

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