Some useful information extracted from Rich Stowell's book: Stall/Spin Awareness.

<u>The AA-1X</u>: The unmodified wing of this airplane had a critical angle of attack of about ten degrees.

…

The slope of the wing's lift curve was favorable to spin entry at around fourteen degrees angle of attack. The airplane had both recoverable and unrecoverable spin modes.

...

The AA-1X team also extensively explored intertially locke din (i.e. unrecoverable) flat spins. After several turns in the flat spins, the engine always quit and the propelelr stopped rotating. The measured rate of rotation often exceeded 200 degrees per second. All of the flat spins were unrecoverable regardless of the recovery actions attempted.

…

The test pilot would then apply Normal Recovery Controls followed by pumping the elevator control fore and aft. This induced roll and pitch oscilaltions that *occasionally* upset spin dynamics and recovered the airplane from the spin.

…

Even NASA's AA-1X airplane displayed two distinct spin modes with one of the tail configurations tested: a moderately flat spin mode with 51 degrees AOA and 157 degrees per second rate of rotation and a flat spin mode with 68 degrees AOA and 209 degrees per second rate of rotation (33 percent faster than the moderately flat spin mode).

…

The de Havilland Chipmunk, for example, has three separate, distinct spin modes:

1. A steady spin (called "comfortable" in the Chipmunk literature) duuring which the rotation rate is about 120 degrees per second, the nsoe-down attitude is 50-60 degrees, and the altituder loss is 300 or feet per turn;
2. An oscillatory spin (called a "less comfortable, pitching spin") during which the nose regularly rises and falls through an angle of about 15-20 degrees;
3. A hesitant spin (called "uncomfortable") during which the airplane snaps back and forth between spiralling and spinning.

…

In airplanes with clockwise turning propellers (viewed from the cockpit), adding power during the normal upright spin to the right typically increases the rate of rotation without an appreciable change in pitch attitude. Adding power during a normal upright spin to the left, on the other hand, speeds up the spin and can flatten the pitch attitude.

Applying right aileron in a normal upright spin to the left tends to level the wings and flatten the pitch attitude, and tends to reduce oscilaltions. Applying left aileron instead tends to steepen both the bank and the ptich attitude of the spin, and tends to increase oscilaltions.

The pilot can induse a flat spin by adding power and by applying aileron opposite to the direction of roll in a spin …

…

Some airplanes will flat spin inherently, withourt provocation by the pilot.

…

Pushing the elevator forward while maintaining pro-spin rudder during an otherwise normal upright spin speeds up the rotation.

…

Spins so aggravated by moving the elevator control are called accelerated spins. (The accelerating effect associated with elevator movement may also be observed briefly as part of the normal spin recovery process.)

…

Fuselage Design:

…

Airplanes with high damping (larger side surface area) tend to spin slower. Airplanes with low damping (smaller side surface area) tend to spin faster and flatter.

…

Tail design:

…

Rudder applied fully against a spin directly opposes the yaw/roll couple. It's the most effective anti-spin input available in our light, single-engine airplanes. Even though anti-spin gyroscopic effects from elevator and aileron inputs may take on more importance in wing- and fuselage-heavy designs, the effect of ull opposite rudder against rotation remains crucial to successful spin recovery.

…

The amount of rudder shieleded during a spin is an important factor in tail design, too.The horizontal stabilizer on a conventional tail configuration, for instance, prevents airflow from reaching the upper part of the evrtical stabilizer/rudder during upright spins. Hence, much of this area may be rendered useless for spin recovery. The blanketing effect can also be exacerbated by deflecting the elevator downward during an upright spin, further reducing rudder power and decreasing the damping effect of the tail.

…

Center of gravity definitely influences stall and spin behaviour. Attaining the high angles of attack necessary for Autorotation tends to be more difficult with a forward center of gravity. As a result, airplanes so loaded tend to be more spin resistant.

…

Sliding the center of gravity aft, by comparison ..

It's also easier to achieve higher angles of attack and depper stalls – and thereby generate stronger pro-spin forces and moments – at aft centers of gravity. Moreover, aft centers of gravity promote flatetr spin attitudes. Although unrecoverable spins may be possible at any center of gravity position, they become increasingly more likely as c.g. moves aft.

…

Nonetheless, the flat spin typically is the most dangerous because it's unrecoverable in most airplanes.

…

The lesson here should be obvious: if you don't want to contribute to flattening and accelerating a spin, don't add power, don't try to raise the lower wing with opposite aileron, and don't push the elevator forward prematurely.

…

Case Study – American Champion/Bellanca 8KCAB Series

…

Not only does the FAA-approved AFM still conflict with itself, but the newer, non-FAA-approved POM is in conflict with itself now as well. All of the Decathlon materials contain the essence of standard spin recovery information, But the exact sequencing of the critical rudder and elevator actions is left open to interpretation. The best course of action here is to follow standard spin recovery protocol applied in the proper order as assured by the PARE© checklist.

Finally, a bit of information from Bill Kershner's book “The Basic Aerobatic Manual” which specifically addresses the Cessna Aerobat only.

...

Note that for this airplane the higher the pitch attitude, the slower the rate of rotation … the reactions of a particular airplane.

…

Notice that for this particular airplane the rotation rates for the left spins do not increase so rapidly or attain as high a value as for the right spins.

…

During the recovery from a flatter mode, pilots may be disturbed by the nose dropping and the rotation rate apparently increasing. Actually, it is normally a good sign; the airplane is going back through the steep mode as it moves toward recovery.