Don’t move your aircraft by the prop!!!

"Don't use prop blades as handles...it can do really jumbo-sized harm to a propeller if you use the prop blades as convenient handles for maneuvering the plane on the ground."
--McCauley Textron Co.

"Avoid pulling the airplane around by the prop. Yes, this seems the perfect solution to a vexing problem of how to change the airplane’s position without having to walk around and get the tow bar, but it’s worthwhile to make the extra effort. Neither the engine nor the prop particularly benefit from the loads imposed by horsing the whole airplane around."
--AOPA safety training, sponsored by Hartzell Propeller inc.

"... never push or pull on the prop blades. Forget what anyone has told you about pulling near the hub or the strength of the propeller. Aluminum blades can bend, and it doesn’t take much to put the blades out of track with one another."
--"Propeller Care" by Jeff Simon, A&P, author "The Educated Owner"

I've seen cowlings damaged, spinners damaged (and that subsequently failed), and propellers damaged from pushing and pulling on the propeller, and I know two individuals who suffered head injuries when struck by a prop after moving it.

I've seen a lot of people push on the spinner, on the assumption that rather than apply asymmetric forces on the propeller by pushing on one blade, pressure on the spinner is along the thrust line of the engine. The spinner is decorative in many cases, in many others it's important for engine cooling and part of the design for the pressure cowl. Regardless, it's easy to get out of balance, to damage a backing plate, or to misalign the spinner or deform it by pushing, and it's a way to start cracks, too. I've seen each.

When I install a spinner, I use a torque screwdriver and take pains to ensure it's aligned, and check it in operation; imbalance or misalignment can cause failure, which can lead to propeller and aircraft damage. Pushing on it can be part of that.

I don't know any propeller manufacturers that recommend pushing or pulling the aircraft by the propeller, and I'm not aware of any engine manufacturers that make that recommendation, either. I'm aware of a number of warnings and cautions by different manufacturers against moving the aircraft using the propeller.

In small aircraft that are easily maneuvered, it may or may not present a hazard to the prop, crankshaft, prop flange, seals, and bearings, but then again, it may. It's always a good idea to avoid handling the propeller any more than necessary, regardless of the mag status. One needn't be afraid of the prop, but it should be respected.

I've seen more than a few people grab the prop tips to push or pull; definitely a bad idea.

Some have said that one can't apply as much force to a propeller by pushing or pulling as is applied in operation, but that's not an accurate statement. The force applied to a propeller when static is not at all the same as applied to the prop during operation. When pushing or pulling on a static prop, a direct moment is placed on the blade and shank on a specific direction, with no centripetal force acting on the blade. The actions on the propeller, shank, hub, and seals are quite different when the propeller is "pulling" outward as the prop spins. The rigidity of the propeller and the stress it experiences are quite different in operation, than when static. Is it going to break off in your hand? No, but that's irrelevant.

The strength and characteristics of a propeller in a static state are different than when it is in motion, and the lack of centripetal force on each blade when the push/pull is applied by hand does not mirror the force acting on the blade when the prop arc is developing thrust in operation. It's best not to compare or confuse the two.

Geared engines add additional possible problems when the aircraft is pulled or pushed no matter where one grabs the blades. The Rotax engine is perhaps one of the most popular and is a good example for discussion.

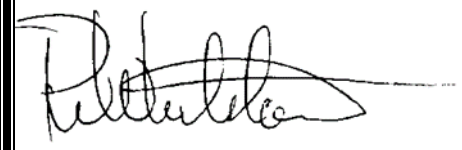
The Rotax engine has a special gear on the end of the crankshaft which is serial number matched to another, larger gear which is on a separate shaft called the prop shaft. This is where we get out efficiency. At roughly 5800 engine rpm, the prop is turning about 2000 rpm. Virtually all propellers lose efficiency above 2000 rpm. Virtually all piston engines loose efficiency below 3500 rpm. Most conventional aircraft just put up with the losses and bolt the prop directly on the crank so they are both not running at peak efficiency but to avoid the gearing, it is acceptable. That is virtually the only difference between a Cessna 414 (TSIO520 Continentals) and the flagship Cessna 421 (GTSIO520 Continentals). Direct coupling on the 414, a gearbox on the 421 that allows the prop to turn 2000 and the engine to run 3600 or so depending on tuning. Of course these aircraft are too big to jerk around by hand but the concept is the same.

Back to the Rotax and why it can develop 135 hp and more (915 iS) and only weigh about half of an older, conventional engine. I've seen 2-place Rotax powered aircraft go over 200 knots. But if one pulls or pushes on the prop, the forces go to the blades, hub, and small prop shaft than turn into a sliding motion (while no oil is moving) between the very expensive, matched crank shaft and prop shaft gearing. None of this is good.

And it's even worse when the prop is a composite prop. They just don't have the same strength around the hub, especially when they are not turning, They can and will warp and bend and go out of track. The first thing we do before we touch a Rotax prop is to perform a blade tracking, right out of AC 43.13 and most that have been pulled around are out of track. Sometimes this can be fixed by rotating the root, but if it is more than 1/16" out, it is out of spec and will cause harmful vibrations that you feel and that harm engine components, sensors and instrumentation.

Lastly, Rotax recommends dynamically balancing the prop anytime it is removed and reinstalled, retorqued or basically altered in any way including fixing chips. We use the very good DynaVibe GT3X and it clearly states that if the blade track is more than 1/16", the prop can not be successfully dynamically balanced.

So…… It can get expensive if one moves these small aircraft around by their composite props. It's your money but several thousand dollars to the prop, more with sensors and instrumentation can be spent fixing vibration related issues, caveat emptor.



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