



# SERVICE LETTER

No. 552

Piper Aircraft Corporation  
 "FAA DOA EA-1 Approved"

Lock Haven, Pennsylvania, U.S.A.  
 May 1, 1970

Subject: Kit - Counter Rotating Powerplant Conversion

Models Affected: All PA-30 Twin Comanche and PA-30 Turbo Twin Comanche Aircraft

Serial Numbers Affected: 30-1 to 30-2000

Purpose: To announce the availability of Counter Rotating Powerplant Conversion Kit for all PA-30 Twin Comanche and PA-30 Turbo Twin Comanche aircraft.

Material Listing: The four (4) primary components of the Counter Rotating Powerplant Conversion Kit are as follows:

- (1) Engine Conversion
- (2) Rudder and Aileron Interconnecting Cable Installation
- (3) Wing Flow Strips Installation
- (4) Propeller Modification.

These four (4) components make up the basic Counter Rotating Powerplant Conversion Kit 760 368, which will be required for all aircraft.

The basic kit and additional required kits for specific model configurations and serial numbers are listed below. Be sure the correct aircraft configuration is selected prior to ordering required material.

SPECIAL NOTE: Material required for accomplishing this conversion on aircraft equipped with propeller and/or wing deicer boots not yet available. Advice as to required material for this aircraft configuration will be submitted in the very near future.

Configuration "A" - PA-30 normally aspirated - Serial Number 30-1 to 30-1716 inclusive, 30-1718 to 30-1744 inclusive.

<u>Kit Number</u>	<u>Quantity per A/C</u>	<u>Nomenclature</u>	<u>Suggested Unit List Price</u>	<u>Estimated Labor Hours</u>
30 368	1 each	Counter Rotating Powerplant Conversion	\$1,825.00 F	
760 374	1 each	Generator Installation	180.00 F	110.0
760 370	1 each	Supplemental Engine Conversion (IO-320-B1A)	72.00 F	
		Total	<u>\$2,077.00 F</u>	

Configuration "B" - PA-30 turbocharged factory installation - Serial Number 30-1 to 30-1716 inclusive, 30-1718 to 30-1744 inclusive.

<u>Kit Number</u>	<u>Quantity per A/C</u>	<u>Nomenclature</u>	<u>Suggested Unit List Price</u>	<u>Estimated Labor Hours</u>
760 368	1 each	Counter Rotating Powerplant Conversion	\$1,825.00 F	
760 374	1 each	Generator Installation	180.00 F	115.0
760 371	1 each	Supplemental Engine Conversion (TIO-320-C1A)	72.00 F	
		Total	\$2,077.00 F	

Configuration "C" - PA-30 Rajay turbocharged field installation - Serial Number 30-1 to 30-1716 inclusive, 30-1718 to 30-1744 inclusive.

<u>Kit Number</u>	<u>Quantity per A/C</u>	<u>Nomenclature</u>	<u>Suggested Unit List Price</u>	<u>Estimated Labor Hours</u>
760 368	1 each	Counter Rotating Powerplant Conversion	\$1,825.00 F	
760 371	1 each	Supplemental Engine Conversion (IO-320-B1A)	72.00 F	
760 374	1 each	Generator Installation	180.00 F	115.0
760 378	1 each	Supplemental Engine Conversion (IO-320-B1A)	305.00 F	
757 351	1 each	Engine Fuel Pump	198.00 F	
		Total	\$2,580.00 F	

Configuration "D" - PA-30 normally aspirated Serial Numbers 30-1717, 30-1745 to 30-2000 inclusive.

<u>Kit Number</u>	<u>Quantity per A/C</u>	<u>Nomenclature</u>	<u>Suggested Unit List Price</u>	<u>Estimated Labor Hours</u>
760 368	1 each	Counter Rotating Powerplant Conversion	\$1,825.00 F	
760 370	1 each	Supplemental Engine Conversion (IO-320-B1A)	72.00 F	106.0
			\$1,897.00 F	

Configuration "E" - PA-30 turbocharged factory installation - Serial Numbers 30-1717, 30-1745 to 30-2000 inclusive.

<u>Kit Number</u>	<u>Quantity per A/C</u>	<u>Nomenclature</u>	<u>Suggested Unit List Price</u>	<u>Estimated Labor Hours</u>
760 368	1 each	Counter Rotating Powerplant Conversion	\$1,825.00 F	
760 371	1 each	Supplemental Engine Conversion (TIO-320-C1A)	72.00 F	112.0
			\$1,897.00 F	

Configuration "F" - PA-30 Rajay turbocharged field installation - Serial Numbers 30-1717, 30-1745 to 30-2000 inclusive.

<u>Kit Number</u>	<u>Quantity per A/C</u>	<u>Nomenclature</u>	<u>Suggested Unit List Price</u>	<u>Estimated Labor Hours</u>
760 368	1 each	Counter Rotating Powerplant Conversion	\$1,825.00F	
760 371	1 each	Supplemental Engine Conversion (IO-320-B1A)	72.00F	
760 378	1 each	Supplemental Engine Conversion (IO-320-B1A)	305.00F	112.0
757 351	1 each	Engine Fuel Pump	198.00F	
Total			\$2,400.00F	

Availability of Parts:

Piper Dealer

Note: Orders are now being accepted and will be shipped as kits become available. Shipments will be filled in the order in which they are received.

When ordering, it will be necessary to furnish the serial number and model of the engine on the aircraft being converted. An engine nameplate stamped with a new serial number will be secured from Lycoming and will be provided with the basic kit, 760 368.

All required modification kits must be installed. Partial installations are not authorized.

SUBJECT: Kit - Counter Rotating Powerplant Conversion

1. The provisions of Purpose I - Service Bulletin No. 310 - (quote) "Airspeed Markings and Revised Operating Practices Recommended by the Manufacturer Placard Installation Kit No. 760 408" (end of quote) are to be disregarded when the Counter Rotating Powerplant Conversion is installed in accordance with instructions contained in Service Letter No. 552. Providing the airplane has already been modified in accordance with Service Bulletin No. 310 and the airplane is then subsequently modified to the counter rotating powerplant configuration, the instructions contained in the counter rotating powerplant conversion kit would apply and would take precedence over Purpose I - Service Bulletin No. 310.
2. Supplementary Information ("A" through "F") - This conversion is approved for installation only on the aircraft configurations appearing under Material Listing of Service Letter No. 552. Aircraft which have been modified in the field (other than those modifications appearing in the letter or field modifications accomplished in accordance with factory approved modification kits) require prior factory approval before this conversion may be accomplished.
3. Reference the aircraft configurations appearing under Material Listing, Service Letter No. 552; add the following kit under Configurations "A", "B" and "C", as follows:

<u>Kit Number</u>	<u>Quantity Per A/C</u>	<u>Nomenclature</u>	<u>Suggested Unit List Price</u>	<u>Estimated Labor Hours</u>
760 448	1 each	Pitch Trim Sensor Relocation Kit	\$4.50 E	One (1) Hour

NOTE

This kit part number 760 448 is required only on PA-30 aircraft serial numbers 30-549 to 30-852 incl., 30-854 to 30-901 incl. with the AltiMatic II automatic Pitch Trim Sensor No. 1D-310-124 (Piper part number 756 198) factory installed, or PA-30 aircraft that have had the Piper AltiMatic II Installation Kit part number 756 843 (with the AltiMatic II automatic Pitch Trim Sensor No. 1D-310-124; Piper part number 756 198) field installed.

This addendum is to be attached to and become a permanent part of Service Letter No. 552.

August 20, 1971

Addendum No. 2

Service Letter No. 552

Subject: Counter Rotating Power Plant Modification Propeller and Wing De-Icing Equipment Information

Purpose: Please refer to the SPECIAL NOTE section on Page 1 of Piper Service Letter No. 552, dated May 1, 1970: This communication announces the availability of propeller and wing de-icing system material that is necessary for accomplishing the Counter Rotating Power Plant Conversion modification on PA-30 aircraft with Wiggins Propeller and/or Wing De-Icing systems previously installed.

Material Required:

1. For PA-30 aircraft with the Wiggins WAP-500A Alcohol Propeller De-Icing Kit previously installed: To install the Counter Rotating Power Plant Conversion kit as explained on Piper Service Letter No. 552, in addition to the Counter Rotating Power Plant Conversion material, the following kit must be installed:

<u>Part Number</u>	<u>Nomenclature</u>	<u>Suggested Retail Unit Price</u>
760 561	Kit-Alcohol Propeller Conversion for right engine only (WAP-500A E.O. #2)	\$140.00E

2. For PA-30 aircraft with the Wiggins Reservoir Type Pneumatic Wing De-Icing Kit previously installed: To install the Counter Rotating Power Plant Conversion Kit as explained on Piper Service Letter No. 552, in addition to the Counter Rotating Power Plant Conversion material, the following kit must be installed:

<u>Part Number</u>	<u>Nomenclature</u>	<u>Suggested Retail Unit Price</u>
760 562	Kit-Rubber Wing Flow Strip Installation (WAP-700A Supplement No. 1)	\$40.00E

This addendum is to be attached to and become an integral part of Service Letter No. 552.

# Piper Aircraft Corporation

Lock Haven, Pennsylvania, U.S.A. 17745

TELEX 841412 AREA CODE 717 748-6711



CABLE ADDRESS: CUB

May 1, 1970

## TO ALL PA-30 OWNERS

Dear Sir:

As a PA-30 owner, you can easily enjoy the tangible benefits of counter-rotating engines by having Piper's conversion kit installed on your present Twin Comanche - reference Service Letter No. 552.

To achieve counter rotation, Lycoming engineers simply reversed the direction of certain components of the right engine and changed the firing order, thus creating a mirror image of the left engine. The two most significant results are elimination of the so-called critical engine and the elimination of directional trim changes normally required with changes in power settings.

Equally good single-engine rate of climb with either engine shut down stems from symmetrical "P" factor characteristics. This system also creates a symmetrical flow of air over the wing and tail surfaces for improved handling -- especially in slow flight and during the landing approach. Handling characteristics are further improved with the installation of flow strips on the leading edge of each wing. A detailed explanation of counter rotation has been enclosed.

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Enclosures

## EXPLANATION OF COUNTER-ROTATING CONCEPT

In order to fully appreciate the benefits gained from the application of the counter-rotating concept, a brief review of some basic aerodynamic facts may prove helpful.

More important perhaps is an understanding of directional control and the forces affecting it--side-wash and direct propeller yawing moment (commonly known as "P" effect). Directional control of an aircraft is maintained by the ability of the rudder to produce adequate yawing moments to counteract these forces.

A much misunderstood and erroneously named factor--"torque"-- is often confused with the forces previously mentioned. When discussing directional control there is a torque force, but it is a negligible factor when compared to the major elements of side-wash and direct propeller yawing moment. For example, the need for right rudder on take-off is caused by "P" effect and side-wash--not "torque."

Side-wash is the swirl or corkscrewing of the propeller slipstream against the fuselage. This swirl might be compared to a large coil spring. At slow speed and high power settings such as on take-off, this spring is compressed; similarly the swirls of air are closer together. This causes the air in the swirl to strike the empennage and the aft fuselage section at such an angle as to require a large amount of right rudder to overcome the left yawing tendency. As aircraft speed is increased the swirl is stretched out and this effectively reduces the angle at which the side-wash strikes the aircraft and less right rudder is required.

The second, and by far the most significant effect on directional control, is the direct propeller yawing moments which result from the difference in thrust being produced by the up-going and down-going propeller blades--depending on the attitude of the aircraft. For example, in a climb attitude the down-going blade would provide more thrust than the up-going blade. Conversely, when an aircraft is in a descent (with a reduced angle of attack) the up-going blade would have more thrust.

Thus, if a single line were drawn representing the resultant thrust of both blades of the propeller, that vector would not directly be aligned with the crankshaft of the engine but would be located toward the blade providing the more thrust. Therefore, at high angles of attack, there exists a need for right rudder when velocity is low and power settings are high to counteract this coupled force of asymmetrical disc loading ("P" factor) and side-wash effect. While at higher speeds (lower angles of attack), side-wash effect is reduced and the "up/down"

(more)

propeller yawing moments are balanced. Also, as a conventional twin-engine aircraft accelerates or decelerates, there are constantly-changing pressures which act upon the airplane and cause corresponding changes in directional trim.

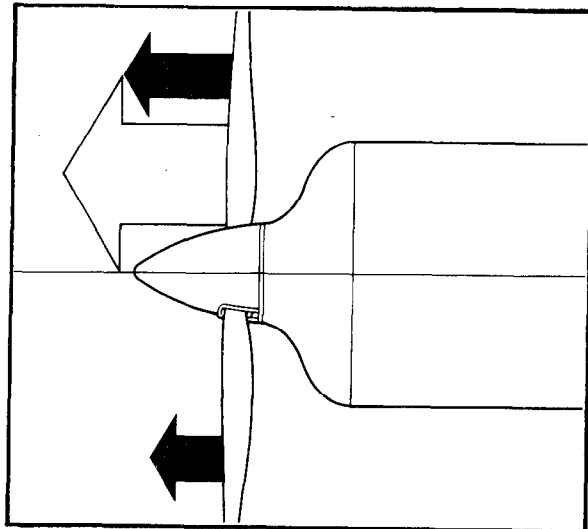
With these airflow factors in mind it is easy to see why the counter-rotating concept minimizes the variety of these aerodynamic situations. Now, with the right-hand engine rotating in the opposite direction (counterclockwise) the airflow is balanced with balanced asymmetrical disc loading. There is symmetrical down-wash on the elevators and equal pressures of slipstream around the rudder. Regardless of the power setting, the rapid changing of power settings or the resulting airspeed, the prop stream vectoring is identical from both engines. Thus both slow flight and landing characteristics are improved and the requirement for directional trim changes during acceleration/deceleration is eliminated.

These desirable characteristics are further amplified by installation of flow strips that induce a controlled separation of the airflow and permit a breakdown of the slipstream causing the wing outer sections to retain lift longer than the inboard portions of the wing.

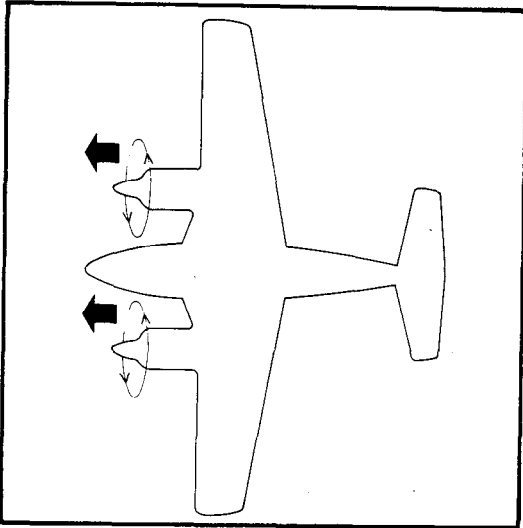
It is also significant that by balancing the propeller thrust vector moments, counter rotation eliminates the "critical engine" because now the thrust vector for each engine is equi-distant from the centerline of the aircraft.



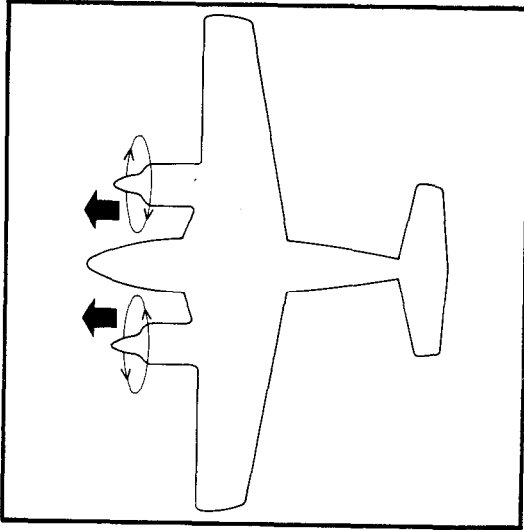
# PIPER TWIN COMANCHE C/R



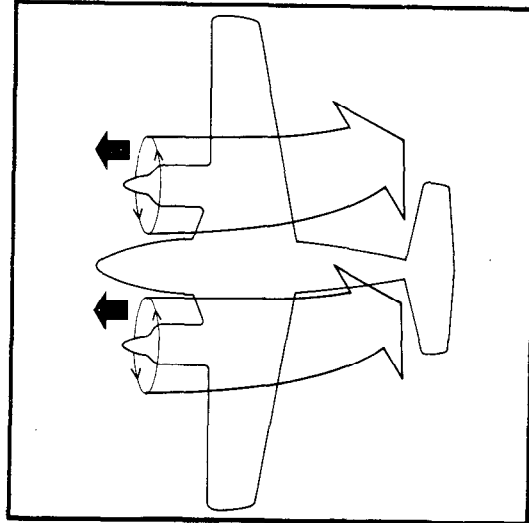
In a climb a propeller blade has more pull, or thrust, on the down swing because it operates at a higher angle of attack than when it rotates upward on the opposite side. Because one blade pulls more than the other the resultant forward thrust vector is offset to one side. This is known as "P" factor.



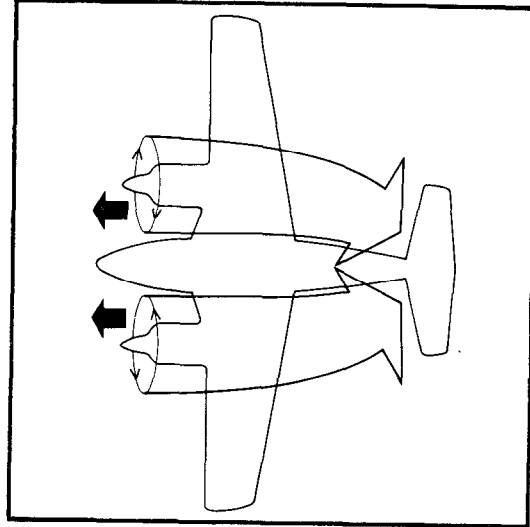
In conventional twins with propellers turning in the same direction, the resultant thrust vector for the left engine is inboard, for the right engine outboard.



In the Twin Comanche C/R with both propellers turning inboard both resultant thrust vectors are inboard.



With the props turning in the same direction, the propeller slip stream and corkscrew effect of the prop wash flows in the same direction.



In the Twin Comanche C/R with the props turning in the opposite direction -- inboard -- the prop slip stream and prop wash are neutralized for balanced symmetrical flow of air along both sides of the fuselage and over the tail.