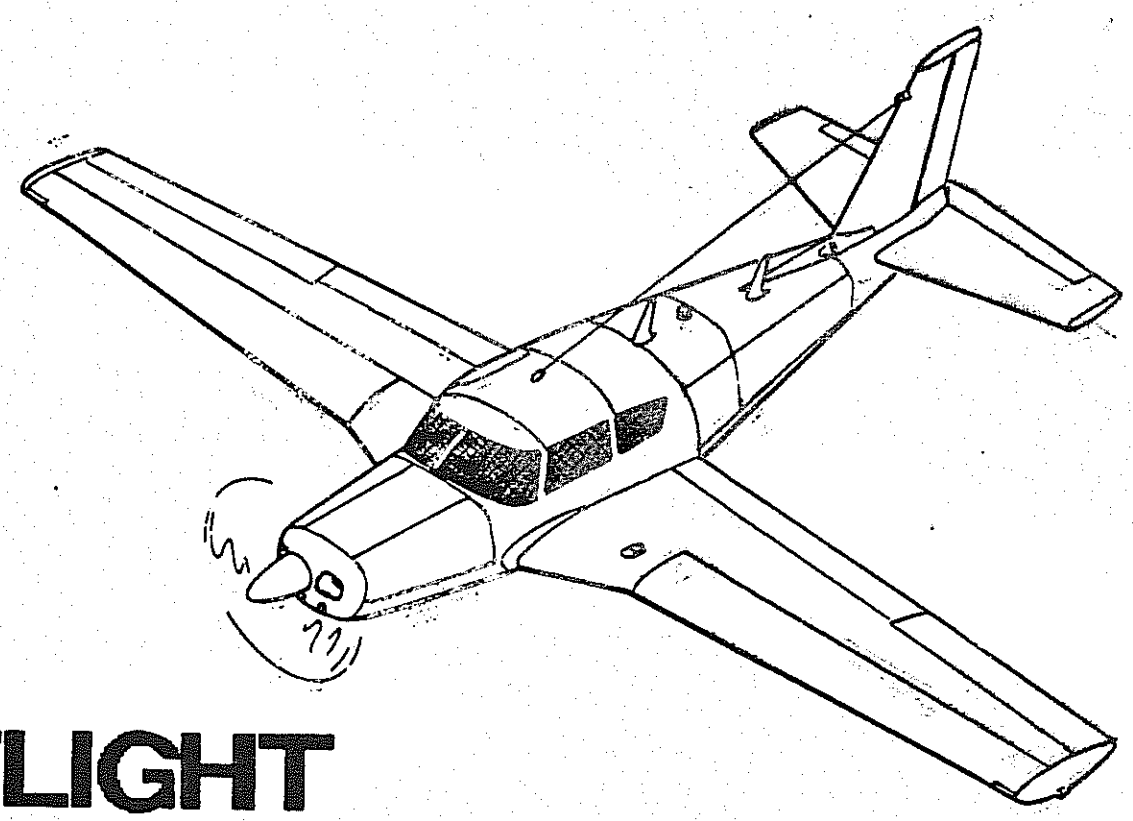
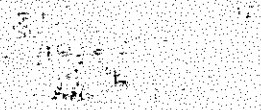
# Comanche



# FLIGHT TRAINING MANUAL



# Comanche

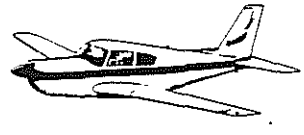
## NOTICE

The subject matter contained in this flight training manual was derived on information obtained from the Pilot's Operating Handbook and Maintenance/ Service Manuals for the PA-24 Comanche and the Textron Lycoming Flyer.

Additional information was obtained from The Piper Indians, Bill Clarke, Tab Books, Inc., 1988 and Piper Aircraft and Their Forerunners, Roger W. Peperell & Colin M. Smith, Air-Britain (Historians) Limited, 1987.

The material presented in this publication is to be used for training purposes and aircraft familiarization only.

The Piper Training Center welcomes suggestions for improvements in this manual and the academic presentations.



**TRAINING PURPOSES ONLY**

# Comanche

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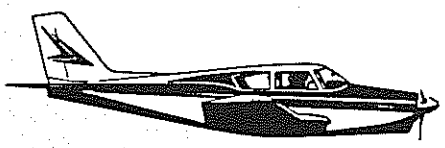
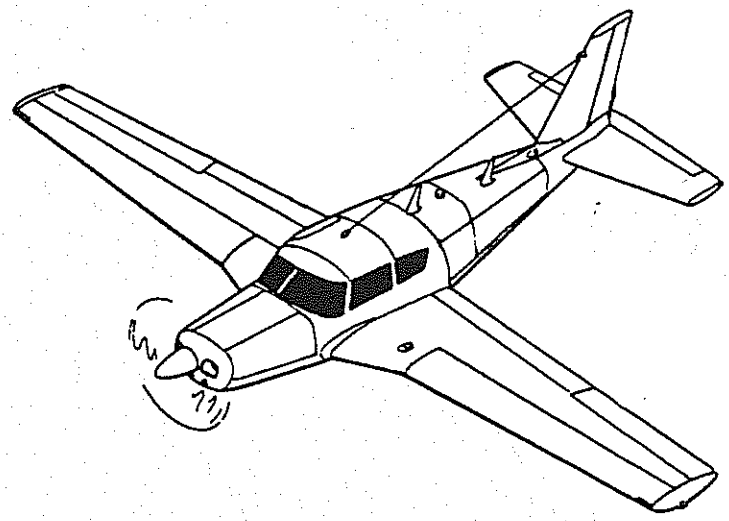


# Comanche

## CHAPTER 1

# AIRCRAFT FAMILIARIZATION



Comanche

# PA-24 COMANCHE

## AIRCRAFT FAMILIARIZATION

## Chapter 1

## CONTENTS



## ILLUSTRATIONS



# PA-24 COMANCHE

## CHAPTER 1

## AIRCRAFT FAMILIARIZATION

### INTRODUCTION

The mere words "Piper Cub" are often used in reference to any small airplane. Perhaps this is because there is no other name more associated with small airplanes than Piper.

### EARLY HISTORY

The Piper Aircraft Corporation began life as the Taylor Brothers Aircraft Corporation, formed by C. G. Taylor. William T. Piper bought a few shares of the fledgling Taylor company as an investment when Taylor first moved his company to Bradford,. Pennsylvania. Piper was not involved with the airplane manufacturing business at that time.

When the Taylor Brothers Aircraft Corporation failed - as many small companies did during the depression era - Piper bought the remaining assets for $600. He then formed the Taylor Aircraft Corporation and promptly gave half of the assets back to C.G. Taylor. (Never let it be said that Piper was a selfish man.)

About this time, Taylor designed a small two-place trainer called the Cub. The Cub was intended to be a cheaper, less complex trainer than was currently on the market. The only similar aircraft at that time was the Aeronca.

All these business dealings took place during the Depression years. This was a time when, for most people, money was scarce for food and shelter. Jobs were scarce. Flying was for the rich. Life for a fledgling aircraft company was difficult at best.

The financial times were so hard that, at one point, airplane engines were available to Piper only on a cash-and-carry basis. When a customer arrived at the factory to purchase a new airplane, a Piper employee made a quick trip to the railroad express office to pick up an engine. All new engines were stored at the express office until paid for in cash. After the cash was paid, the engine was taken to the factory where it was installed on the new airplane. All this took place while the customer waited.

PA-24 COMANCHE

AIRCRAFT FAMILIARIZATION

In 1935 the partnership with Taylor was dissolved. Taylor went to alliance, Ohio and formed the Taylorcraft Aviation Company. In 1937 the original Bradford airplane factory was destroyed by fire. After the fire, the factory was relocaated to Lock Haven, Pennsylvania, and the name changed to Piper Aircraft Corporation.

Not long after Piper inaugurated business in Lock Haven, the clouds of World War II began forming. It was a recognized fact that the war would be a test of air superiority. The United States government, seeing the air race coming, shouted a mighty call for pilots. As a result, Piper Aircraft began producing large numbers of small trainer airplanes. They were called Piper Cubs.

Piper prpduced the L-4, a military version of the J-3 Cub, during the war. These planes were used for light transport.

After the war, Piper Aircraft, like all other airplane builders, produced large numbers of small planes to quench the postwar flying thirst. Unfortunately, in 1947 the sales boom went bust.

By late 1947, Piper was pared to 157 employees, down from 1,738. Recovery was slow, and only done with the most careful of planning and the introduction of practical airplanes.

By 1951, Piper had seen the introduction of the Vagabond (a "poor man's airplane), the four-place Pacer, and the Tri-Pacer. Billed as easy to fly, the Tri-Pacer's sales took off.

In 1954 the first Piper twin-engined airplane, the Apache, was introduced. Profits from the Apache gave Piper the necessary funds to expand.

In the 1960s a new production plant was built for Piper in Vero Beach, Florida. In addition to aircraft production, considerable research was conducted at the new Florida facility - no doubt due to the better year-round flying conditions than those provided by the long and cold Pennsylvania winters.

PA-24 COMANCHE

AIRCRAFT FAMILIARIZATION

Additional fabrication plants were built in Pennsylvania, but it was in Florida that Piper designed and built the larger Indian models that now serve the commuter airlines and corporate users. The Lock Haven plant is part of Piper history now, as are the planes once produced there. (except Super Cubs and watch LoPresti Piper with the Comanche)

History sometimes produces strange turns of events. One such point of interest is that Taylorcraft airplanes, of C.G. Taylor design, were being built until early 1987 in the old Piper plant at Lock Haven - the very plant that once produced the Piper Cub.

It's interesting that William T. Piper did not start his aviation career until he was nearly 50 years of age. Mr. Piper died in 1970, at the age of 89.

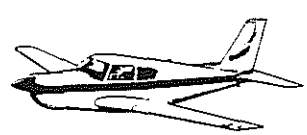
Piper Aircraft later became a division of Lear Siegler, Inc., a diversified manufacturer with operations in numerous fields including aerospace, electronics, automotive, agricultural, and recreation.

In 1987, Piper was sold to M. Stuart Millar, a private businessman.

CHRONOLOGY OF PIPER CLASSICS

The most famous word associated with Piper airplanes is "Cub". Cub actually was the name applied to several models of Taylor/Piper airplanes. The first Cub of Piper manufacture was the model J-3. A simpler flying machine has never been made.

A pre-World War II design airplane, the J-3 Cub was introduced in 1938. Civilian production was halted during the war years; however, the J-3 went to war as the Army L-4. The L-4 was used for liaison, VIP transportation, and tactical observation. Among the VIPs who rode in the L-4 were George Patton, Omar Bradley, Dwight Eisenhower, and Winston Churchill. At one time, J-3s were coming out of the factory door at the rate of one every 10 minutes.



PA-24 COMANCHE

AIRCRAFT FAMILIARIZATION

Civilian production was restarted in 1945, and continued through 1947. A total of 14,125 J-3s were built. The J-3 was the basis for many other Piper models through the Super Cub.

The J-4 Cub Coupe was built before the war, from 1939 to 1941. The Coupe used many J-3 parts, which kept costs of design and production to a minimum. No J-4s were built after the war. They seated two, side-by-side, and were powered with a 65-hp engine.

The J-5 Cub Cruiser was introduced just before the war, in 1941, and seated three persons. The pilot sat up front in a single bucket seat and there was a bench for two to sit - very cozily - in the rear. Like the J-4, it shared many J-3 parts. After the war the J-5C, an improved version of the J-5, was brought out as the Super Cruiser. Improvement, in aviation, ofter means the same old airframe with a larger engine. The J-5C was powered with a 100-hp engine.

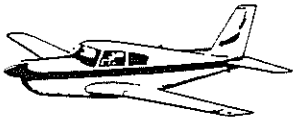
The J in the early Piper model numbers was for Walter C. Jamouneau, Pipers's Chief Engineer. Later the PA designator (for Piper Aircraft) replaced the J.

The PA-11 Cub Special was introduced in 1947 as a modernized version of the J-3. The improvements allowed for solo flight from the front seat and a fully cowled engine, available in either 65 hp or 90 hp. 1,428 Specials were built before production ceased in 1949.

The PA-12 Cruiser was an updated J-5. It still had the three-seat configuration, but added a slightly larger engine.

The first Piper production model of a four-place airplane was the PA-14 Family Cruiser. First built in 1948, the PA-14 is really a modified PA-12, with an extra seat up front. The family 'Cruiser was small and underpowered. Only 237 were manufactured. The price for a new PA-14 was $3,285.

The PA-15 was introduced as the Vagabond in 1948. A very basic airplane, it had a Lycoming O-145 engine rated at 65 hp, and seated two side-by-side. The main landing gear were solid, with the only shock-absorbing action coming from the tires and the finesse of the pilot at landing time.



# Comanche

## PA-24 COMANCHE

## AIRCRAFT FAMILIARIZATION

The PA-16 Clipper was introduced in 1949 as an update to the PA-14. The Clipper had shorter wings and fuselage than the PA-14, and was really the first of the "short wing" Pipers. The PA-14 and the PA-16 are unique from the standpoint of controls. They have sticks, rather than the control wheels usually associated with four-place airplanes.

A new, improved Vagabond came off the assembly line later in 1948. The new PA-17 Vagabond was a plushier airplane than the Pa-15. It had bungee-type landing gear, floor mats, and a Continental A-65 engine. The Continental engine had more "punch" than the Lycoming, yet both were rated at 65 hp.

The Super Cub, PA-18, is basically an airplane whose roots can be traced back to the J-3. Although built with a completely redesigned airframe, the PA-18 looks like a J-3. First built in 1949, it's a fun plane to fly; however, it's usually found working for its keep. Super Cubs are utilized in photography, mapping, fish spotting, spraying, glider towing, bush flying, and etc.

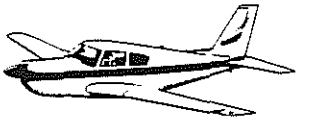
In 1950, the PA-20 Pacer series was begun, as an updated four-place plane. Like the PA-14s and -16s, the PA-20s were of tube-and fabric construction and conventional gear design. A total of 1,120 Pacers were built. Evolution of the Pacer saw the eventual addition of a nosewheel, the latter resulting in the PA-22 Tri-Pacer.

Billed as an "anyone can fly it" airplane due to the tri-gear, the PA-22 was first sold as an option to the PA-20 Pacer. Sales of the nosewheeled Tri-Pacer soared, while those of the conventional-geared Pacer fell. As a result, the Pacer was removed from production in 1954.

The PA-22s were built from 1951 until 1960 and can be found with 125-, 135-, 150- and 160-hp engines. A total of 7,670 Tri-Pacers were built before Piper moved on to all-metal four-place airplanes.

Piper's last tube-and-fabric airplane was the PA-22-108 Colt, a trainer. It was really a two-seat, flapless version of the Tri-Pacer. The Colt was powered with a 108-hp Lycoming engine; 1,820 were built between 1961 and 1963.

(Of course, the above paragraph will have to be rewritten when the present Super-Cub line is discontinued.)



# Comanche

## PA-24 COMANCHE

## AIRCRAFT FAMILIARIZATION

### CHRONOLOGY OF THE INDIANS

When Piper Aircraft introduced its first all-metal airplane, the tradition of utilizing American Indian tribal and weapon names for different aircraft models was adopted.

**Apache:** A nomadic North American Indian Tribe found in the southwestern area of the United States. Piper's first airplane named for an American Indian tribe was a light twin called the Apache. First introduced in 1954, the PA-23 saw many changes over the years, eventually evolving into the Aztec. The last year of Apache production was 1963.

**Comanche:** A tribe of North American Indians that once roamed the south plains. In 1958 the Comanche, powered by a Lycoming 180 hp engine, was introduced as an all-metal, single -engine, retractable-geared airplane. The "180" was quickly followed by the Comanche 250 powered by a Lycoming O-540 engine producing 250 hp. 260's appeared in 1965 and in 1966, the Comanche B appeared with a third side window and a fifth and sixth seat option. In the meantime, the "400" was introduced in 1964 powered by a Lycoming IO-720 engine producing 400 hp. Needless to say, it was the fastest of the Comanches. The Comanche C and Turbo Comanche C were introduced in 1969 with the Tiger Shark Cowling and a throttle quadrant. In addition, the now familiar "T" instrument arrangement was introduced in the "C"

Comanche production was halted by Hurricane Agnes in 1972. It remains to be seen if the work being done at LoPresti Piper will bring back the Comanche.

In 1963 Piper brought out a new light twin, the PA-30 Twin Comanche. Powered with two Lycoming 160 hp engines, it sits low to the ground, and is very docile to fly. Production of the Twin Comanche ended in 1972 also with Hurricane Agnes. In 1970, Piper improved the handling of the Twin Comanche by adding counter-rotating engines, thus eliminating the critical engine effect. At this time the model number was changed to PA-39, but the Twin Comanche name remained.



## PA-24 COMANCHE

## AIRCRAFT FAMILIARIZATION

**Aztec:** Central American Indians noted for the highly advanced civilization. In 1960, the first sales of the Aztec PA-23 were made. It was powered with twin 250-hp Lycoming engines, and seated five. After 1961, all Aztec models had six seats. The Aztec shares the PA-23 model number with the Apache.

**Cherokee:** A tribe of North American Indians that once dwelled in the North Carolina and Tennessee area. In 1961 Piper launched the PA-28 Cherokee series. The PA-28 series was destined to be the backbone of all Piper single-engine airplanes.

Improvements would come in the form of larger engines, modified wings, stretched cabins, and retractable landing gear.

Initially, the PA-28 was powered with a 150 hp Lycoming engine. It was call the PA-28-150. An optional version, the PA-28-160 with a 160 hp engine, was also available.

The Cherokee 140 was introduced in 1964 as a two-to-four place trainer. This was the first training aircraft Piper produced since the end of Colt production In reality, the 140 was a standard PA-28 without the rear seat: otherwise it was the same airframe as a four-place PA-28.

1965 saw the introduction of a much larger Cherokee, the PA-32. Called the Cherokee Six, it was available with 260-hp or 300-hp engines. Equipped with removable seats, this craft can carry cargo, a stretcher or even livestock.

**Arrow:** A straight, thin shaft, shot from a bow, known for its speed and accuracy. In 1967, the PA-28R Arrow, with retractable landing gear, was ushered in. Simplicity is the key to the operation of the Arrow. Even the responsibility of controlling the landing gear was removed from the pilot - it's automatic!

**Seneca:** A tribe of North American Indians once found in the Finger Lakes region of western New York. In 1971, Piper introduced a new light twin called the Seneca. It was basically a Cherokee Six made twin. Called the PA-34, the Seneca is a very roomy light twin.

# Comanche

## PA-24 COMANCHE

## AIRCRAFT FAMILIARIZATION

**Warrior:** An Indian experienced in battle. In 1974, the Warrior series was brought out. The Warriors were the PA-28 with longer, redesigned wings and a stretched fuselage. Piper claimed, "The Warriors are a logical progression of the PA-28 series".

Performance changes resulted in expanded carrying abilities and extremely gentle stall characteristics. The new wing, often called the "Warrior wing", was later added to all PA-28 series airplanes.

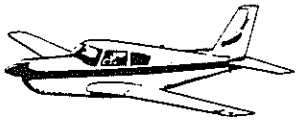
**Tomahawk:** A light axe used as a weapon or tool by many North American Indians. In 1978, the PA-38 Tomahawk was introduced as a trainer. The Tomahawk, an all-metal low-wing airplane, bears no resemblance to the earlier tube-and-fabric Piper trainers. It was the first true two-place trainer built by Piper since Colt production was halted in 1963.

**Seminole:** A tribe of American Indians living in the southern regions in the State of Florida. Piper announced the PA-44-180 Seminole in March, 1978. In 1979, Piper developed the PA-44-180T Turbo Seminole with weather radar, propeller de-icing, optional oxygen systems with a 180 hp turbo charged engine. Production of the normally aspirated Seminole stopped in November 1981 and production was stopped on the Turbo Seminole in October, 1982.

**Malibu:** A tribe of American Indians. T! PA-46-310 received FAA certification in September, 1983. The Malibu is a six place, pressurized, high altitude single engine, high performance airplane that leads the way in the industry. It was powered by a Continental IO-520 Turbo-charged engine capable of delivering 310-hp and can cruise well over 200 knots. A new model, The PA-46-350 Malibu Mirage was introduced in November 1988. It is powered with a Lycoming Turbo-charged IO-540 capable of 350 hp. First deliveries were made in January 1989.

Members of the Piper tribe used for corporate and commuter-airline operations are the Aerostar, Mojave, Navajo Chieftain and Cheyenne. The Pawnee and Pawnee Brave are used for chemical application. (crop dusting)

**Super Cub:** The PA-18 Super Cub is back in production as a completed airplane and also as a kit.



# Comanche

## SPECIFICATIONS

## PA-24-180

## COMANCHE

| | |
|---|---|
| SPEED | |
| Top Speed at Sea Level: | 167 mph |
| Cruise: | 160 mph |
| Stall (w/flaps) | 61 mph |
| TRANSITIONS | |
| Takeoff over 50' obstacle: | 2240 ft |
| Ground run: | 750 ft |
| Landing over 50' obstacle: | 1340 ft |
| Ground roll: | 460 ft |
| RATE OF CLIMB AT SEA LEVEL: | 910 fpm |
| SERVICE CEILING: | 18.500 ft |
| FUEL CAPACITY | |
| Standard | 50 gal |
| With reserve | 60 gal |
| ENGINE: | Lycoming O-360-A1D |
| TBO: | 2000 hrs* |
| Power: | 180 hp |
| DIMENSIONS | |
| Wingspan: | 36 ft 0 in |
| Length: | 24 ft 11 in |
| Height: | 7 ft 4 in |
| WEIGHTS | |
| Gross Weight: | 2550 lbs |
| Empty Weight | 1455 lbs |
| Useful Load: | 1090 lbs |
| Baggage Allowance: | 200 lbs |

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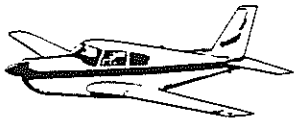
* with 1/2 inch valves



# Comanche

## SPECIFICATIONS

## PA-24-250

## COMANCHE 250

| | |
|---|---|
| SPEED | |
| Top Speed at Sea Level: | 190 mph |
| Cruise: | 181 mph |
| Stall (w/flaps) | 61 mph |
| TRANSITIONS | |
| Takeoff over 50' obstacle: | 1675 ft |
| Ground run: | 1180 ft |
| Landing over 50' obstacle: | 1420 ft |
| Ground roll: | 920 ft |
| RATE OF CLIMB AT SEA LEVEL: | 1350 fpm |
| SERVICE CEILING: | 20.000 ft |
| FUEL CAPACITY | |
| Standard | 60 gal |
| With reserve | 90 gal |
| ENGINE: | Lycoming O-540-A1A5 |
| TBO: | 2000 hrs* |
| Power: | 250 hp |
| DIMENSIONS | |
| Wingspan: | 36 ft 0 in |
| Length: | 24 ft 11 in |
| Height: | 7 ft 4 in |
| WEIGHTS | |
| Gross Weight: | 2900 lbs |
| Empty Weight | 1690 lbs |
| Useful Load: | 1210 lbs |
| Baggage Allowance: | 200 lbs |

==========

* with 1/2 inch valves



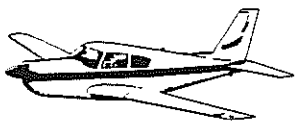
# SPECIFICATIONS

## PA-24-260

## COMANCHE 260

| | | |
|---|---|---|
| SPEED | | |
| Top Speed at Sea Level: | | 195 mph |
| Cruise: | | 185 mph |
| Stall (w/flaps) | | 67 mph |
| TRANSITIONS | | |
| Takeoff over 50' obstacle: | | 1400 ft |
| Ground run: | | 760 ft |
| Landing over 50' obstacle: | | 1290 ft |
| Ground roll: | | 655 ft |
| RATE OF CLIMB AT SEA LEVEL: | | 1500 fpm |
| SERVICE CEILING: | | 20,600 ft |
| FUEL CAPACITY | | |
| Standard | | 60 gal |
| With reserve | | 90 gal |
| ENGINE: | Lycoming O-540-E or IO-540-D | |
| TBO: | | 2000 hrs* |
| Power: | | 260 hp |
| DIMENSIONS | | |
| Wingspan: | | 36 ft 0 in |
| Length: | | 24 ft 11 in |
| Height: | | 7 ft 4 in |
| WEIGHTS | | |
| Gross Weight: | | 2900 lbs |
| Empty Weight | | 1700 lbs |
| Useful Load: | | 1210 lbs |
| Baggage Allowance: | | 200 lbs |

* with 1/2 inch valves



# Comanche

SPECIFICATIONS

PA-24-260B

COMANCHE 260B

| | |
|---|---|
| SPEED | |
| Top Speed at Sea Level: | 194 mph |
| Cruise: | 182 mph |
| Stall (w/flaps) | 67 mph |
| TRANSITIONS | |
| Takeoff over 50' obstacle: | 1725 ft |
| Ground run: | 760 ft |
| Landing over 50' obstacle: | 1435 ft |
| Ground roll: | 655 ft |
| RATE OF CLIMB AT SEA LEVEL: | 1370 fpm |
| SERVICE CEILING: | 20,000 ft |
| FUEL CAPACITY | |
| Standard | 60 gal |
| With reserve | 90 gal |
| ENGINE: | Lycoming O-540-E or IO-540-D |
| TBO: | 2000 hrs* |
| Power: | 260 hp |
| DIMENSIONS | |
| Wingspan: | 36 ft 0 in |
| Length: | 25 ft 4 in |
| Height: | 7 ft 6 in |
| WEIGHTS | |
| Gross Weight: | 3100 lbs |
| Empty Weight | 1728 lbs |
| Useful Load: | 1372 lbs |
| Baggage Allowance: | 250 lbs |
| Maximum Landing Weight | 2945 lbs |

* with 1/2 inch valves



## SPECIFICATIONS

## PA-24-260C

## COMANCHE 260C

| | |
|---|---|
| SPEED | |
| Top Speed at Sea Level: | 195 mph |
| Cruise: | 185 mph |
| Stall (w/flaps) | 61 mph |
| TRANSITIONS | |
| Takeoff over 50' obstacle: | 1400 ft |
| Ground run: | 820 ft |
| Landing over 50' obstacle: | 1320 ft |
| Ground roll: | 690 ft |
| RATE OF CLIMB AT SEA LEVEL: | 1320 fpm |
| SERVICE CEILING: | 19,500 ft |
| FUEL CAPACITY | |
| Standard | 60 gal |
| With reserve | 90 gal |
| ENGINE: | Lycoming IO-540-N1A5 |
| TBO: | 2000 hrs* |
| Power: | 260 hp |
| DIMENSIONS | |
| Wingspan: | 36 ft 0 in |
| Length: | 25 ft 11 in |
| Height: | 7 ft 6 in |
| WEIGHTS | |
| Gross Weight: | 3200 lbs |
| Empty Weight | 1773 lbs |
| Useful Load: | 1427 lbs |
| Baggage Allowance: | 250 lbs |
| Maximum Landing Weight | 3040 lbs |

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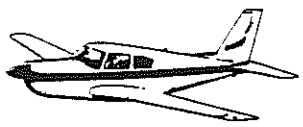
* with 1/2 inch valves



## SPECIFICATIONS

## PA-24-400

## COMANCHE 400

| | |
|---|---|
| SPEED | |
| Top Speed at Sea Level: | 223 mph |
| Cruise: | 213 mph |
| Stall (w/flaps) | 68 mph |
| TRANSITIONS | |
| Takeoff over 50' obstacle: | 1500 ft |
| Ground run: | 980 ft |
| Landing over 50' obstacle: | 1820 ft |
| Ground roll: | 1180 ft |
| RATE OF CLIMB AT SEA LEVEL: | 1600 fpm |
| SERVICE CEILING: | 19,500 ft |
| FUEL CAPACITY | |
| Standard | 100 gal |
| With reserve | 130 gal |
| ENGINE: | Lycoming IO-720-A1A |
| TBO: | 1800 hrs* |
| Power: | 400 hp |
| DIMENSIONS | |
| Wingspan: | 36 ft 0 in |
| Length: | 25 ft 8 in |
| Height: | 7 ft 10 in |
| WEIGHTS | |
| Gross Weight: | 3600 lbs |
| Empty Weight | 2110 lbs |
| Useful Load: | 1490 lbs |
| Baggage Allowance: | 200 lbs |

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* with 1/2 inch valves



# Comanche

## SPECIFICATIONS

## PA-24-260C TURBO

## COMANCHE 260C TURBO

| | |
|---|---|
| SPEED | |
| Top Speed at 20,000 ft. | 233 mph |
| Cruise 25,000 ft. | 224 mph |
| Economy Cruise 25.000 ft. | 209 mph |
| Stall (w/flaps) | 67 mph |
| TRANSITIONS | |
| Takeoff over 50' obstacle: | 1400 ft |
| Ground run: | 820 ft |
| Landing over 50' obstacle: | 1465 ft |
| Ground roll: | 690 ft |
| RATE OF CLIMB AT SEA LEVEL: | 1320 fpm |
| SERVICE CEILING: | 25,000 ft |
| FUEL CAPACITY | |
| Standard | 60 gal |
| With reserve | 90 gal |
| ENGINE: | Lycoming IO-540-R1A5 |
| TBO: | 1800 hrs* |
| Power: | 260 hp |
| DIMENSIONS | |
| Wingspan: | 36 ft 0 in |
| Length: | 25 ft 7 in |
| Height: | 7 ft 6 in |
| WEIGHTS | |
| Gross Weight: | 3200 lbs |
| Empty Weight | 1894 lbs |
| Useful Load: | 1306 lbs |
| Baggage Allowance: | 250 lbs |
| Maximum Landing Weight | 3040 lbs |

==========

* with 1/2 inch valves

PA-24 COMANCHE

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Production Figures and Serial Numbers
Model PA-24-180/250

The following list shows the production years and total number of PA-24-180/250 airplanes that were built, along with serial numbers.

| Production Year | Total Aircraft Produced | Serial Numbers Beginning | Ending |
|---|---|---|---|
| 1958 | 333 | 24-3 | 24-336 |
| 1959 | 1139 | 24-337 | 24-1476 |
| 1960 | 821 | 24-1477 | 24-2298 |
| 1961 | 544 | 24-2299 | 24-2843 |
| 1962 | 440 | 24-2844 | 24-3284 |
| 1963 | 272 | 24-3285 | 24-3557 |
| 1964 | 129 | 24-3558 | 24-3687 |

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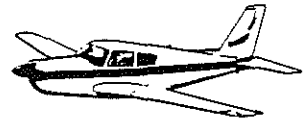

PA-24 COMANCHE

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Production Figures and Serial Numbers
Model PA-24-260

The following list shows the production years and total number of PA-24-260 airplanes that were built, along with serial numbers.

| Production Year | Total Aircraft Produced | Serial Numbers Beginning | Ending |
|---|---|---|---|
| 1965 | 299 | 24-4000 | 24-4299 |

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PA-24 COMANCHE

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Production Figures and Serial Numbers
Model PA-24-260B

The following list shows the production years and total number of PA-24-260B airplanes that were built, along with serial numbers.

| Production Year | Total Aircraft Produced | Serial Numbers Beginning | Ending |
|---|---|---|---|
| 1966 | 360 | 24-4300 | 24-4660 |
| 1967 | 90 | 24-4661 | 24-4751 |
| 1968 | 51 | 24-4752 | 24-4803 |

==========



PA-24 COMANCHE

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Production Figures and Serial Numbers
Model PA-24-260C and 260C Turbo

The following list shows the production years and total number of PA-24-260C aircraft that were built, along with serial numbers.

| Production Year | Total Aircraft Produced | Serial Numbers Beginning | Ending |
|---|---|---|---|
| 1969 | 96 | 24-4804 | 24-4900 |
| 1970 | 50 | 24-4901 | 24-4950 |
| 1971 | 50 | 24-4951 | 24-5000 |
| 1972 | 27 | 24-5001 | 24-5028 |

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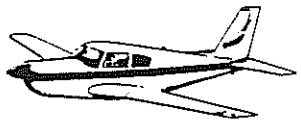

PA-24 COMANCHE

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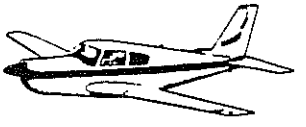
Production Figures and Serial Numbers
Model PA-24-400

The following list shows the production years and total number of PA-24-260C aircraft that were built, along with serial numbers.

| Production Year | Total Aircraft Produced | Serial Numbers Beginning | Ending |
|---|---|---|---|
| 1964 | 146* | 26-3 | 26-148 |

==========



# PA-24 COMANCHE

## AIRCRAFT FAMILIARIZATION

### COMANCHE DESCRIPTION

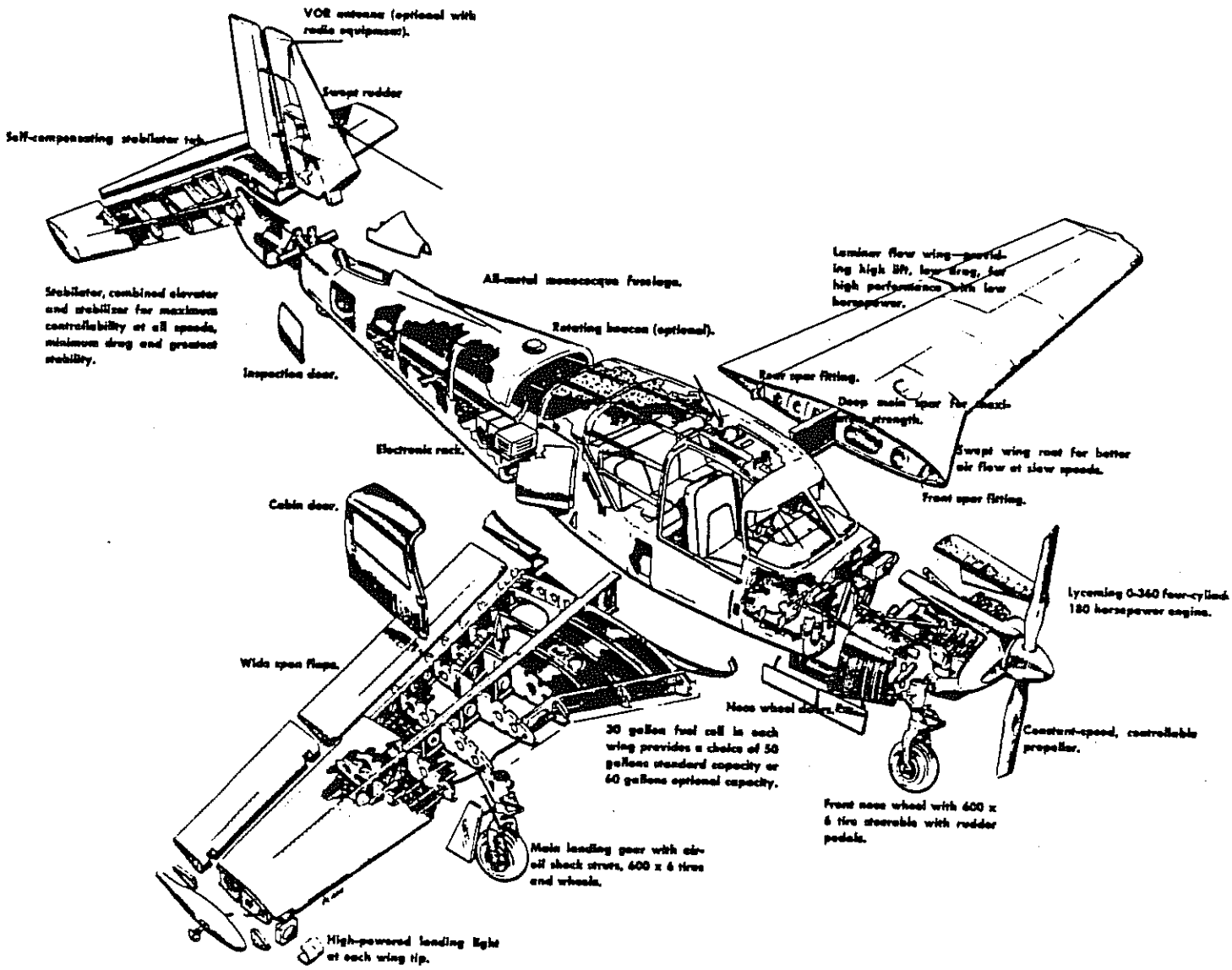
The Piper PA-24 Comanche is a four place, (optional 5th and 6th seats are available in the PA-24-260, Serial Nos. 24-4300 and up) single engine, low-wing monoplane of all metal construction.

Wing - The laminar flow wing is an all-metal stressed skin, full-cantilever, low-wing design, consisting of two wing panels bolted together at the center of the fuselage. The wing tips are removable. The ailerons are cable and push rod controlled and are statically and dynamically balanced. The trailing edge wing flaps are manually or electrically operated. Wing airfoil section is a laminar flow type, NACA-64 A215, modified with maximum thickness about 40% aft of the leading edge.

Fuselage - The fuselage consists of three basic units: The engine section, the cabin section and the sheet-metal tail cone.

Empennage - The empennage consists of the fin, stabilator and stabilator trim tab. The rudder and stabilator are dynamically and statically balanced.

All structure parts are finished with zinc chromate prior to assembly to prevent corrosion.

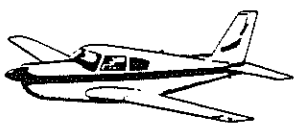


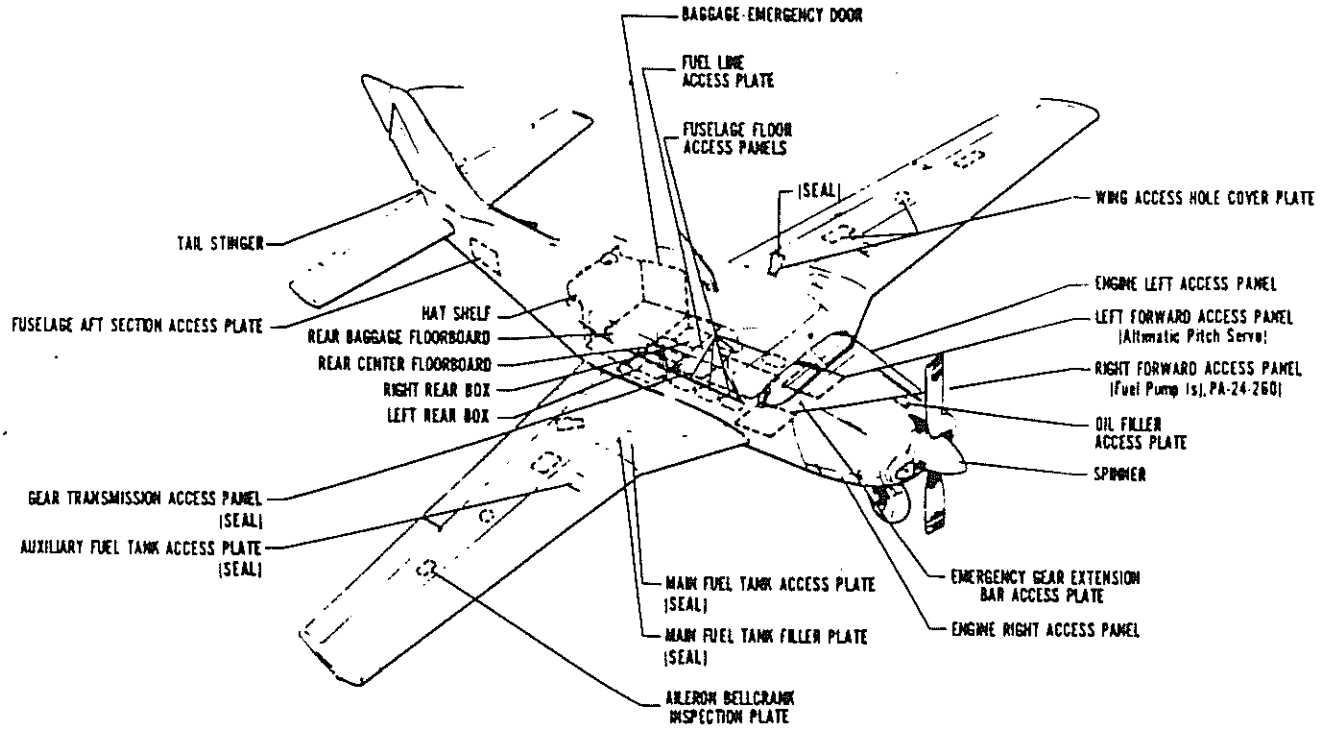

**CONSTRUCTION DETAILS OF THE PIPER**

*Comanche*

FIGURE 1-1



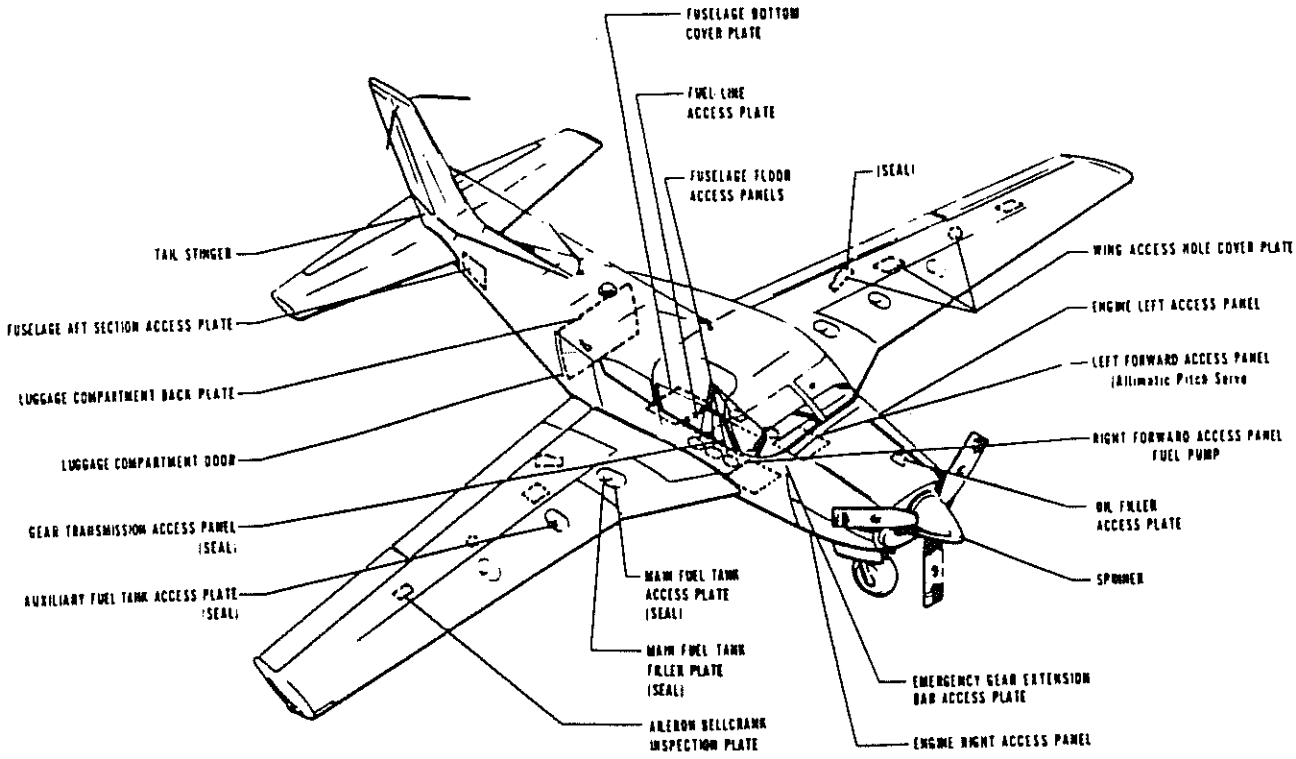





ACCESS PANELS

PA-24-260 S/N 24-4300 AND UP

FIGURE 1-2

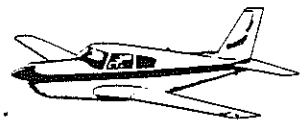



ACCESS PANELS

PA-24-400

FIGURE 1-3

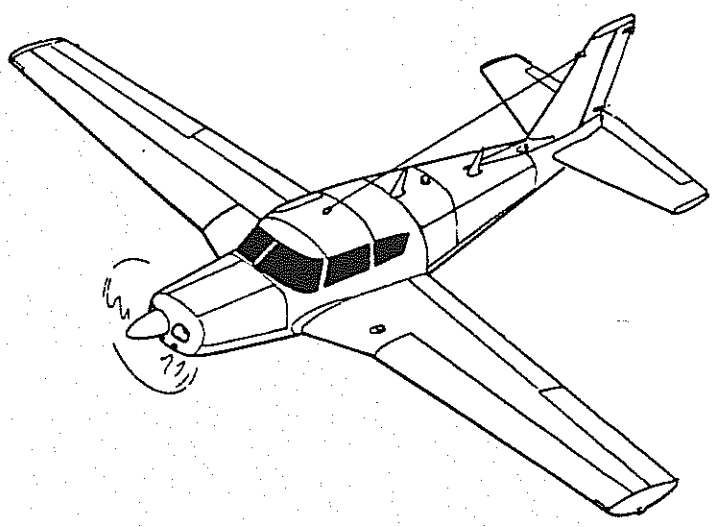




Comanche

## CHAPTER 2

# LANDING GEAR AND BRAKE SYSTEM



Comanche

# PA-24 COMANCHE

## Chapter 2

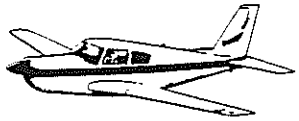
## LANDING GEAR AND BRAKE SYSTEM

### Contents



### ILLUSTRATIONS





# PA-24 COMANCHE

## LANDING GEAR AND BRAKE SYSTEM

## Chapter 2

### LANDING GEAR

All Comanche models are equipped with a steerable nose wheel operated by the rudder pedals that can rotate 20 degrees either side of center to allow a very small turn radius with minimum use of brakes. In addition, the nose wheel is equipped with a shimmy dampener. The mechanical steering is automatically disengaged when the wheels are retracted to reduce rudder pedal loads in flight.

Early Comanche models have a hand operated brake while toe brakes were optional on the pilots side. Left side toe brakes later became standard and optionally, right side toe brakes were available.

The brake fluid reservoir is located on the left hand side of the firewall in the engine compartment. The correct fluid is MIL 5606.

All three landing gear are equipped with air/oil struts with a normal (full static load) extension of 2.75 inches. The 400 is 2.5 inches. Proper inflation of struts and tires are necessary to insure landing loads do not carry through to the airframe.

**CAUTION:** Never fly your aircraft with a flat strut. The struts must extend to allow the wheels to enter the wheel wells during the retraction cycle.

The landing gear on all Comanche models is retracted through an electro/mechanical system operated by an electric motor mounted under the floor between the two front seats. Emergency extension (due to motor failure) requires that the motor arm is manually disengaged from the worm drive (after properly slowing the aircraft) allowing gravity to extend the gear. Correct procedures are contained on a placard in your aircraft. Early models contained a telescoping handle above the floor to manually extend the gear while on PA-24-260C aircraft, the emergency extension handle is stowed under a access plate between the front seats.

## PA-24 COMANCHE

## LANDING GEAR AND BRAKE SYSTEM

All three wheels are held down by an over-center mechanism assisted by various springs and bungees. Main gear bungees must be replaced every 500 hours or 3 years, whichever comes first. Reference A.D. 77-13-21 and Piper Service Letter No. 782B. A bungee replacement tool as described in the International Comanche Society (I.C.S.) Tips Special makes what can be a very difficult job a simple task.

A gear warning horn located on the cabin side of the firewall sounds under the following conditions:

a) The gear is up and the manifold pressure is reduced to approximately 12-14 inches.

b) The gear selector is placed in the "UP" position while the airplane is on the ground and the master switch is "ON".

As a final safety feature, a squat switch on the left main gear prevents activation of the landing gear motor until the strut reaches near full extension as on takeoff.

A "GEAR UP" and "GEAR DOWN" light are located on the instrument panel and on later models, a "gear in transit" light is also available. The gear down light requires that all three gear are in the down and locked position prior to its activation.

The landing gear can be lowered at speeds up to 150 mph, but reducing speed to 125 mph or below is recommended.

### BRAKE SYSTEM

All three landing gear on the PA-24 models, with the exception of the first 129 Comanche 400's, are equipped with Cleveland 6.00 X 6 wheels. The main wheels are provided with Cleveland disc hydraulic brake assemblies. Two piston brakes are standard and either organic or sintered iron linings are used depending on the aircraft model.

## PA-24 COMANCHE

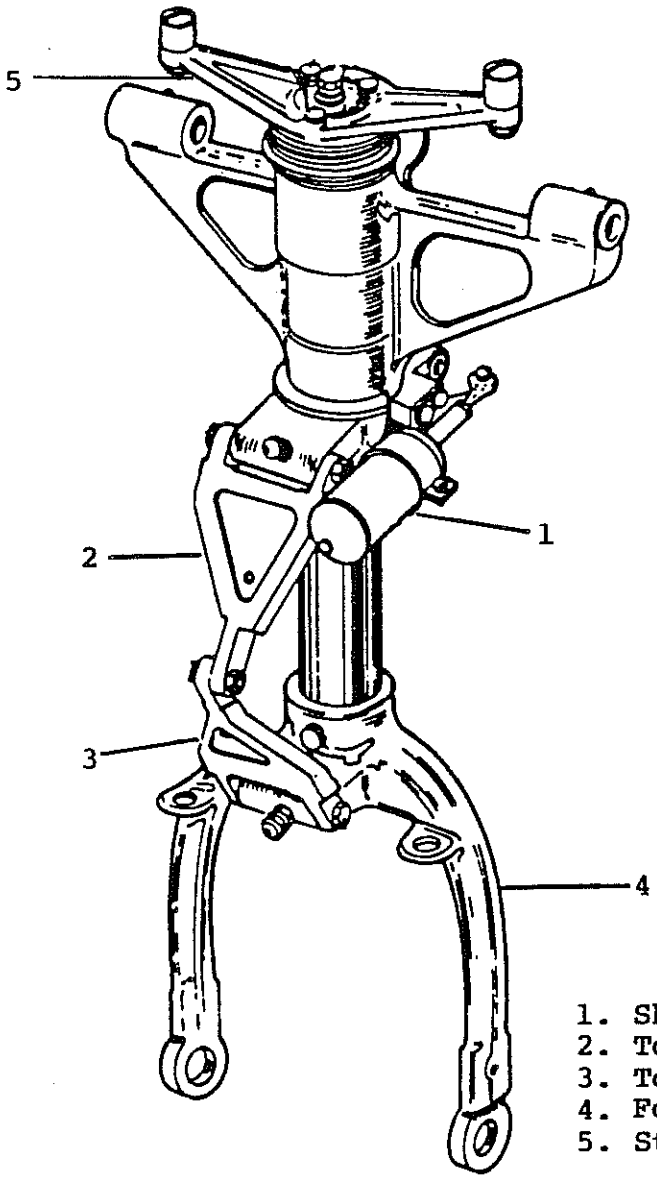
## LANDING GEAR AND BRAKE SYSTEM

The correct method of breaking in a new set of linings is as follows:

Organic-perform a minimum of six light pedal effort braking applications from 25 to 40 mph. Allow the brake discs to partially cool between stops.

Sintered Iron-perform three successive hard braking applications from 45 to 50 mph. Do not allow the brake discs to cool between applications.

The above break-in procedure will greatly increase brake life and will ensure optimum braking is available on your Comanche if required.

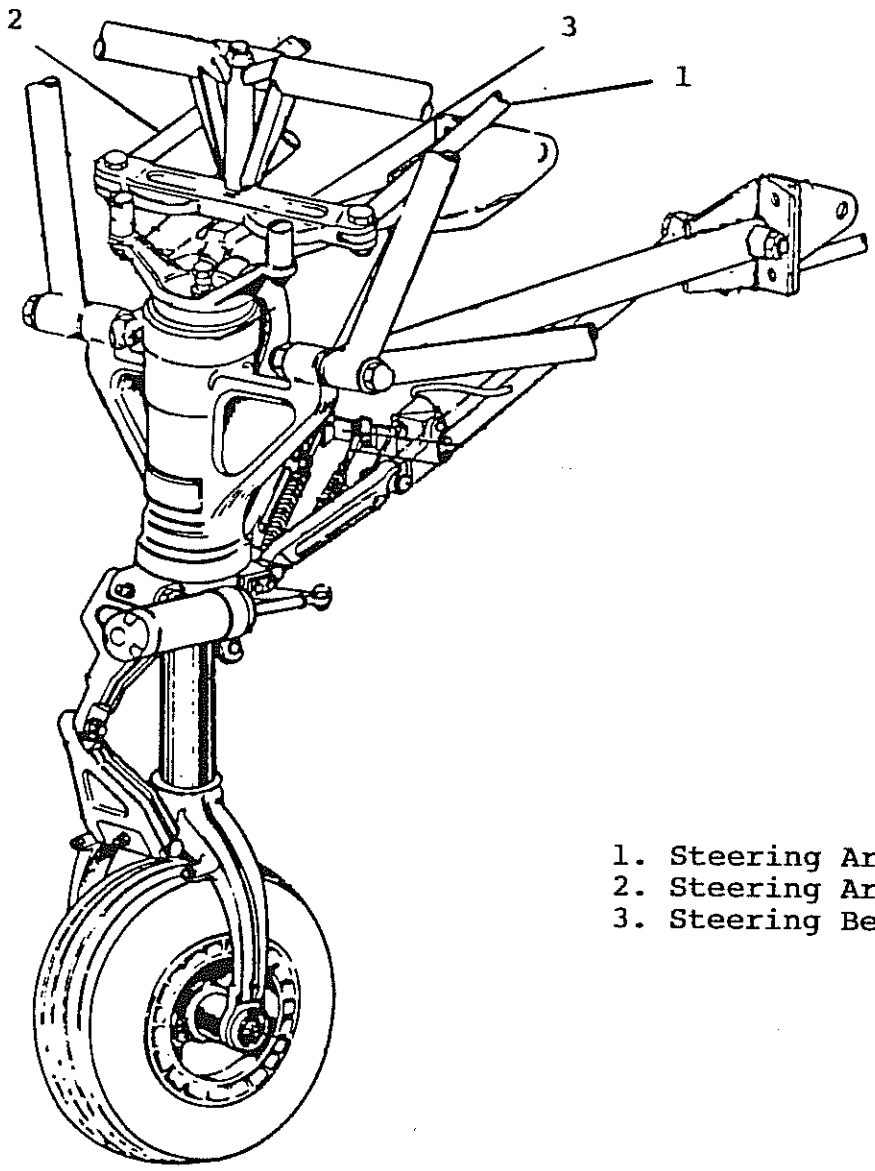



1. Shimmy Dampener
2. Torque Link, Upper
3. Torque Link, Lower
4. Fork Assembly
5. Steering Arm

NOSE GEAR STRUT

FIGURE 2-1

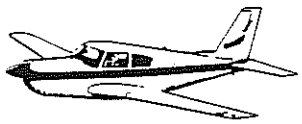


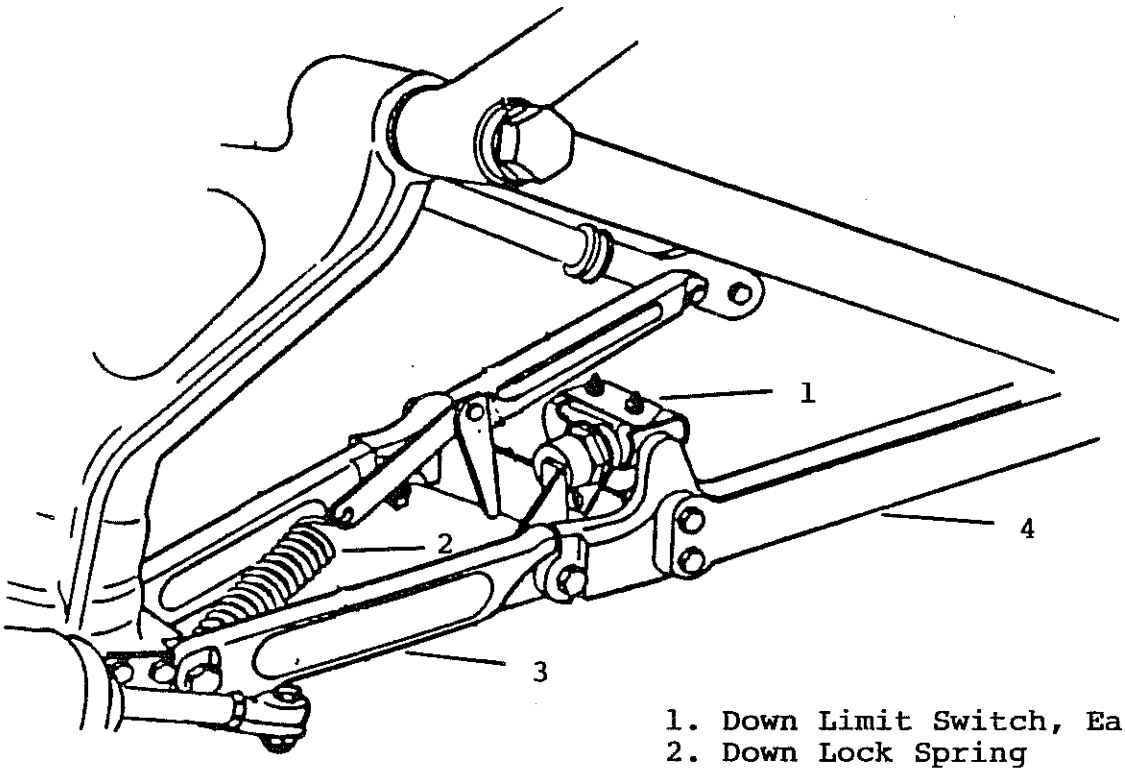



1. Steering Arm, Left
2. Steering Arm, Right
3. Steering Bellcrank

NOSE GEAR INSTALLATION

FIGURE 2-2



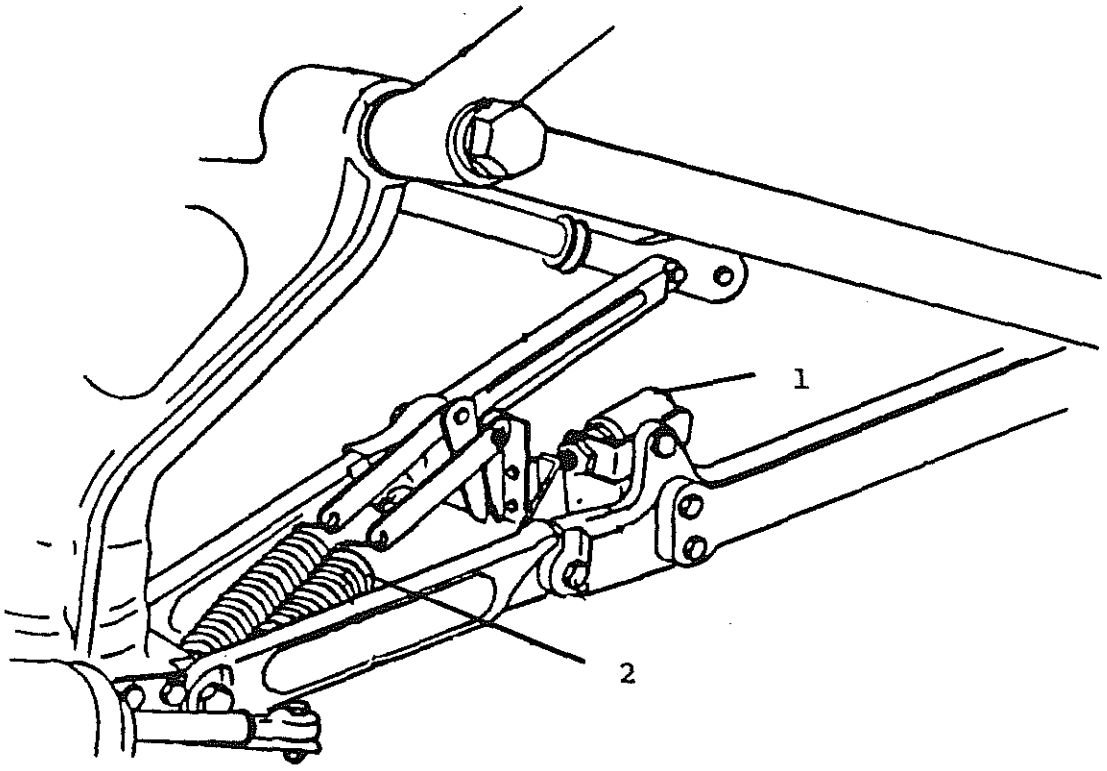



1. Down Limit Switch, Early
2. Down Lock Spring
3. Lower Drag Line, Left
4. Upper Drag Line, Left

NOSE GEAR LOCKING MECHANISM

ORIGINAL INSTALLATION

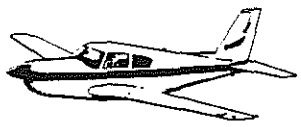
FIGURE 2-3

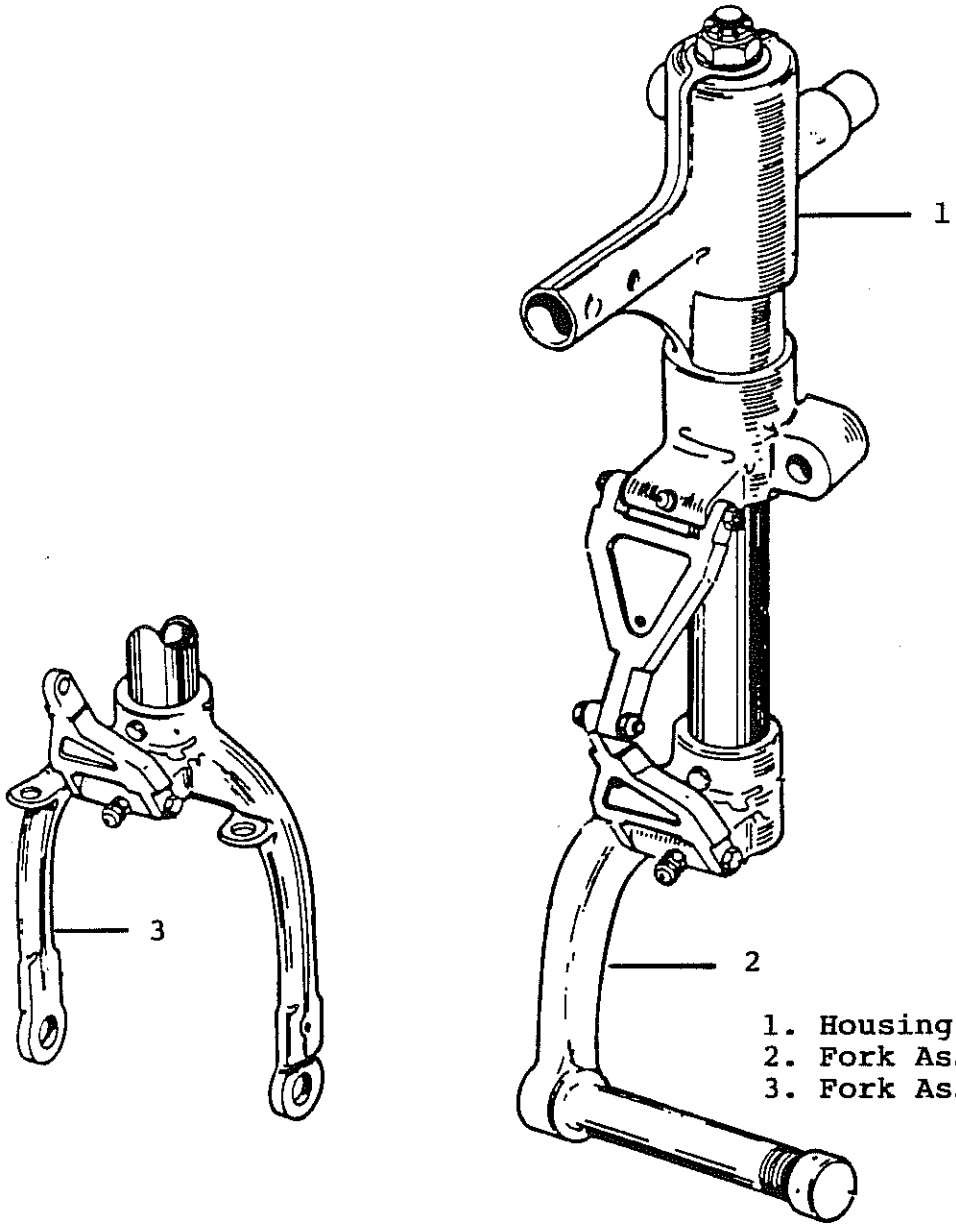



1. Down Limit Switch, Late
2. Down Lock Springs

NOSE GEAR LOCKING MECHANISM
DUAL SPRING INSTALLATION
PIPER KIT 761 082

FIGURE 2-4

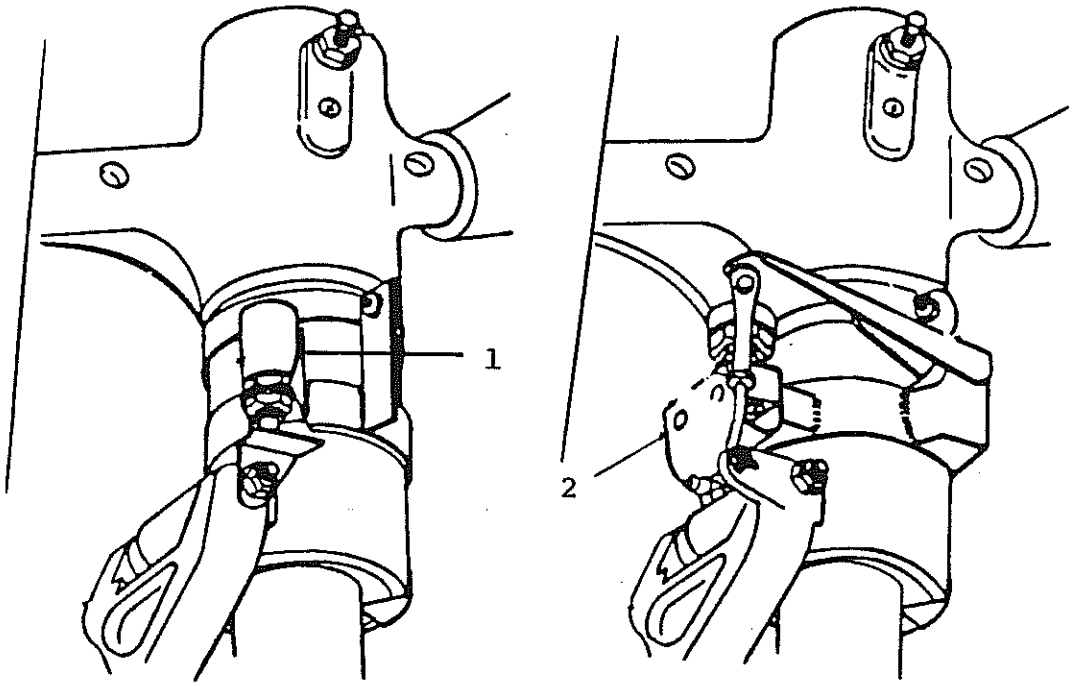





1. Housing, Oleo Strut
2. Fork Assembly, Late
3. Fork Assembly, Early

MAIN GEAR STRUT

FIGURE 2-5

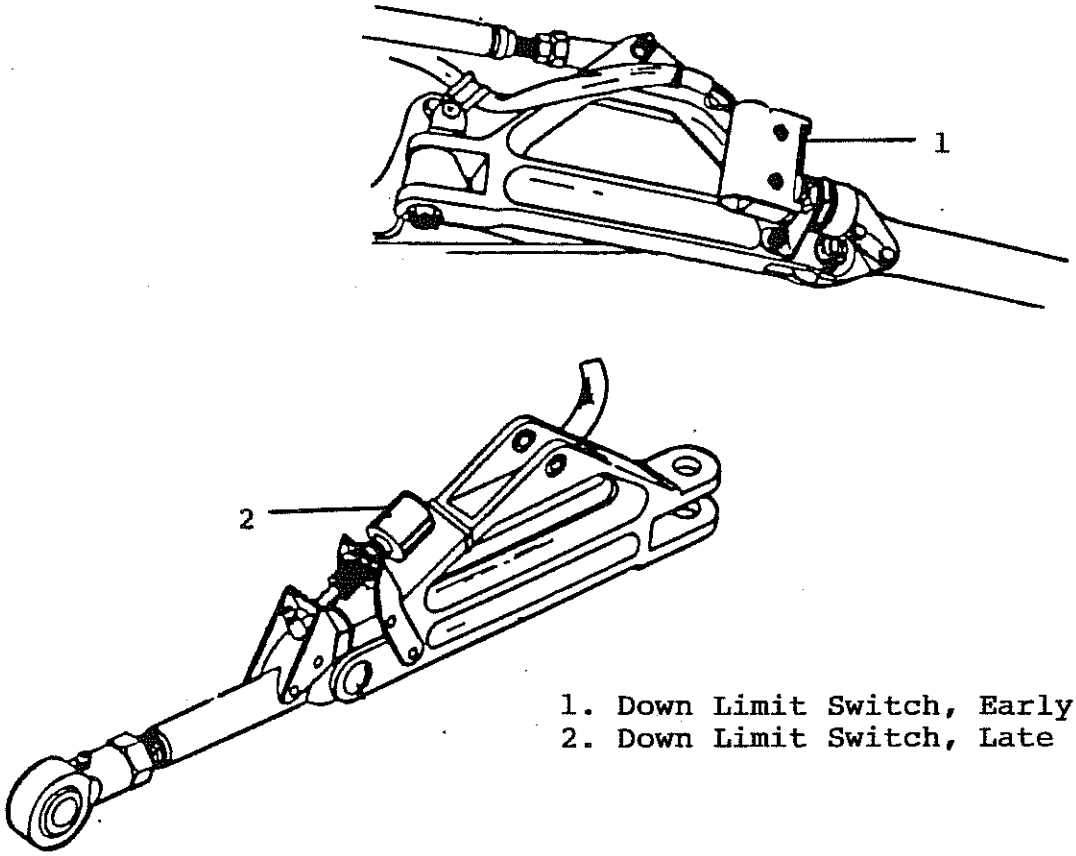



1. Safety Switch, Late
2. Safety Switch, Early

MAIN GEAR INSTALLATION

SQUAT SWITCH

FIGURE 2-6

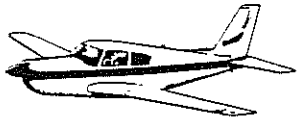


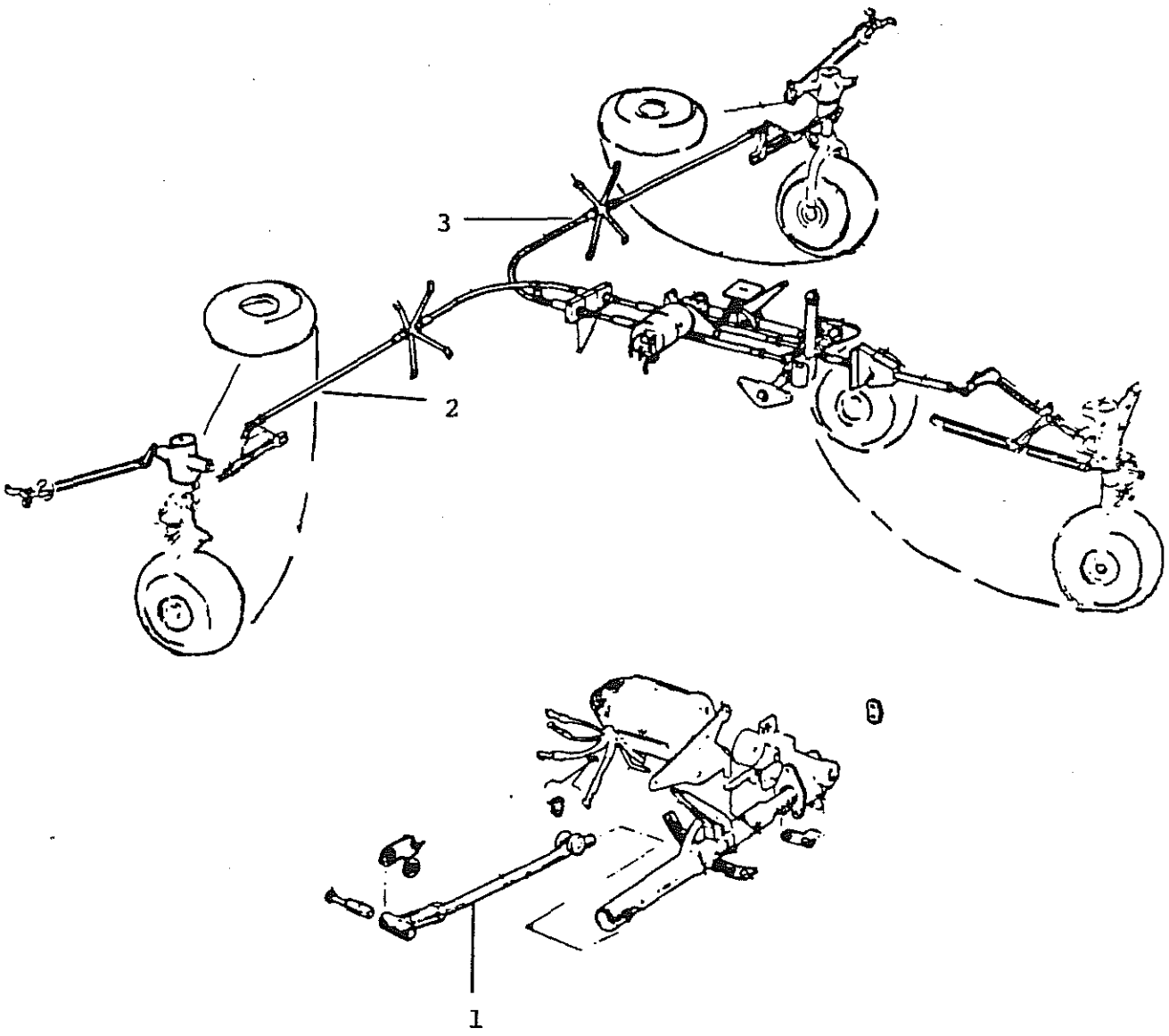

1. Down Limit Switch, Early
2. Down Limit Switch, Late

MAIN GEAR INSTALLATION

FIGURE 2-7



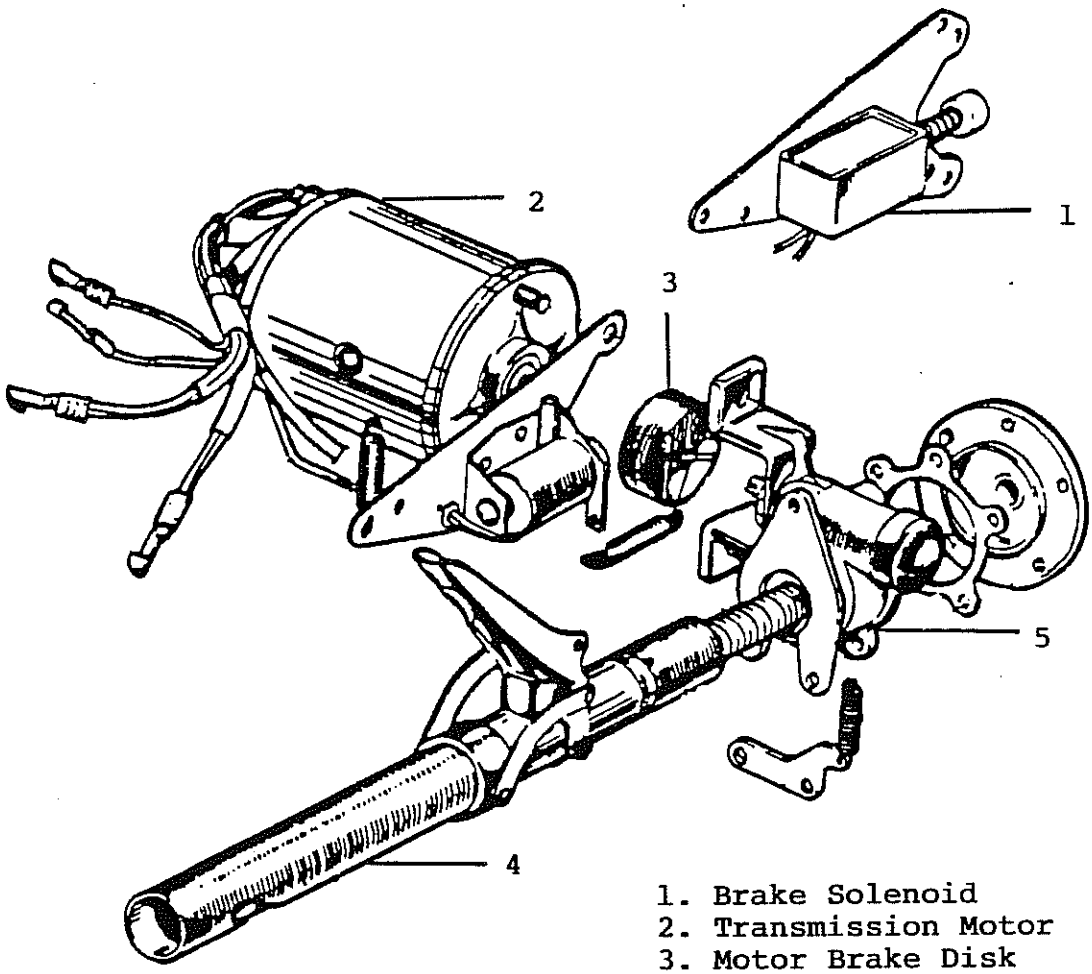





1. Lock Assembly - Landing Gear Safety
2. Push-Pull Cable - Right
3. Push-Pull Cable - Left

LANDING GEAR RETRACTION MECHANISM

FIGURE 2-8

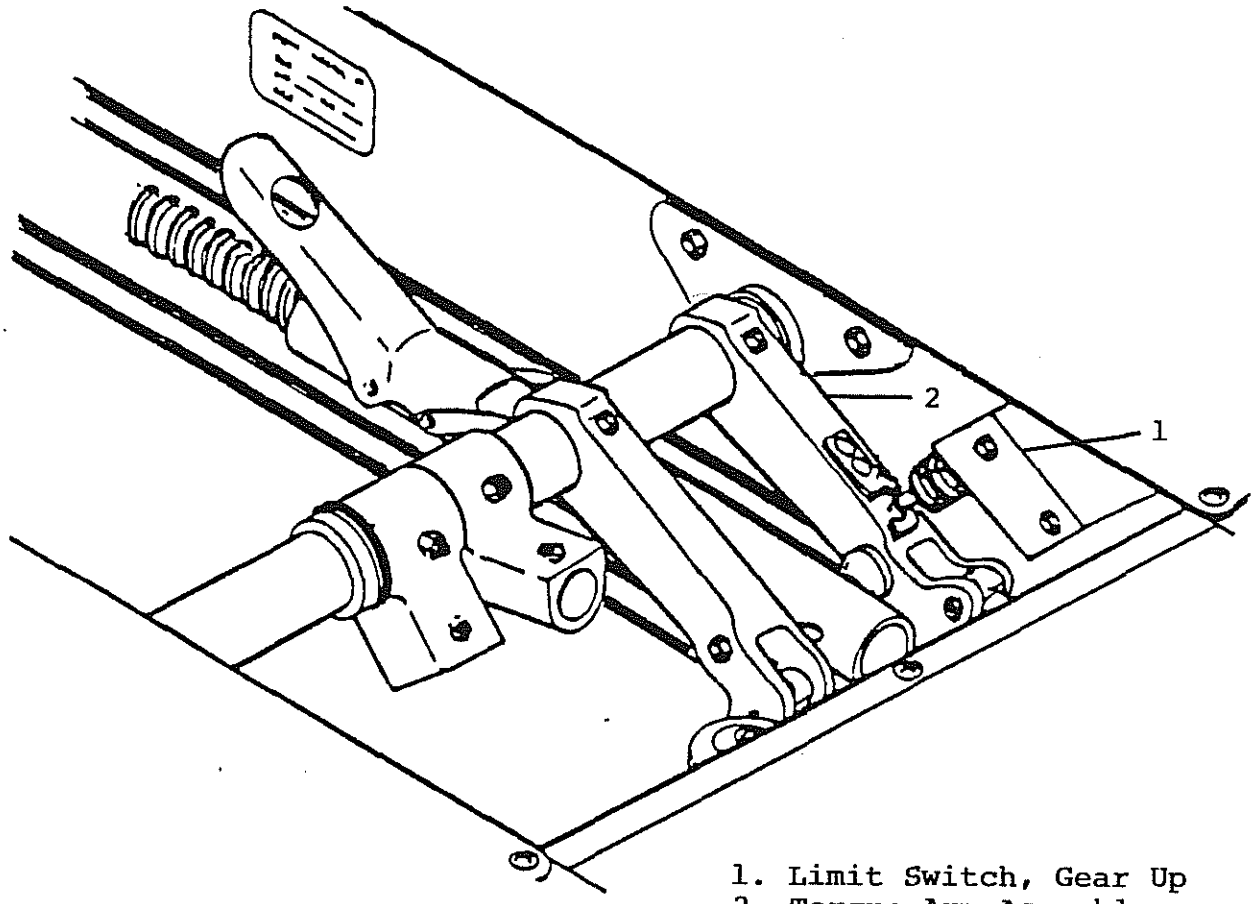



1. Brake Solenoid
2. Transmission Motor
3. Motor Brake Disk
4. Release Tube
5. Transmission

LANDING GEAR RETRACTION

TRANSMISSION ASSEMBLY

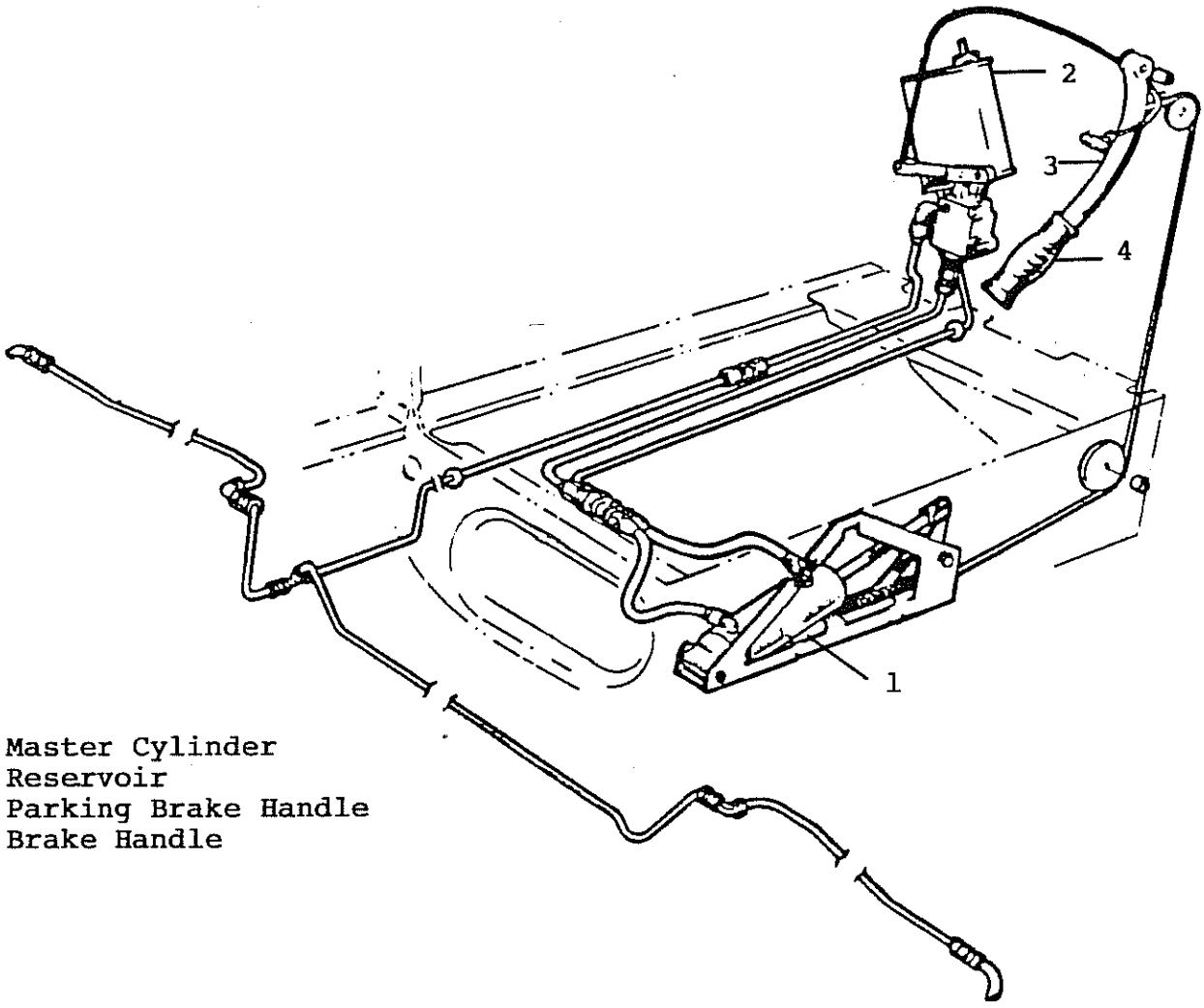
FIGURE 2-9




1. Limit Switch, Gear Up
2. Torque Arm Assembly

LANDING GEAR UP LIMIT SWITCH

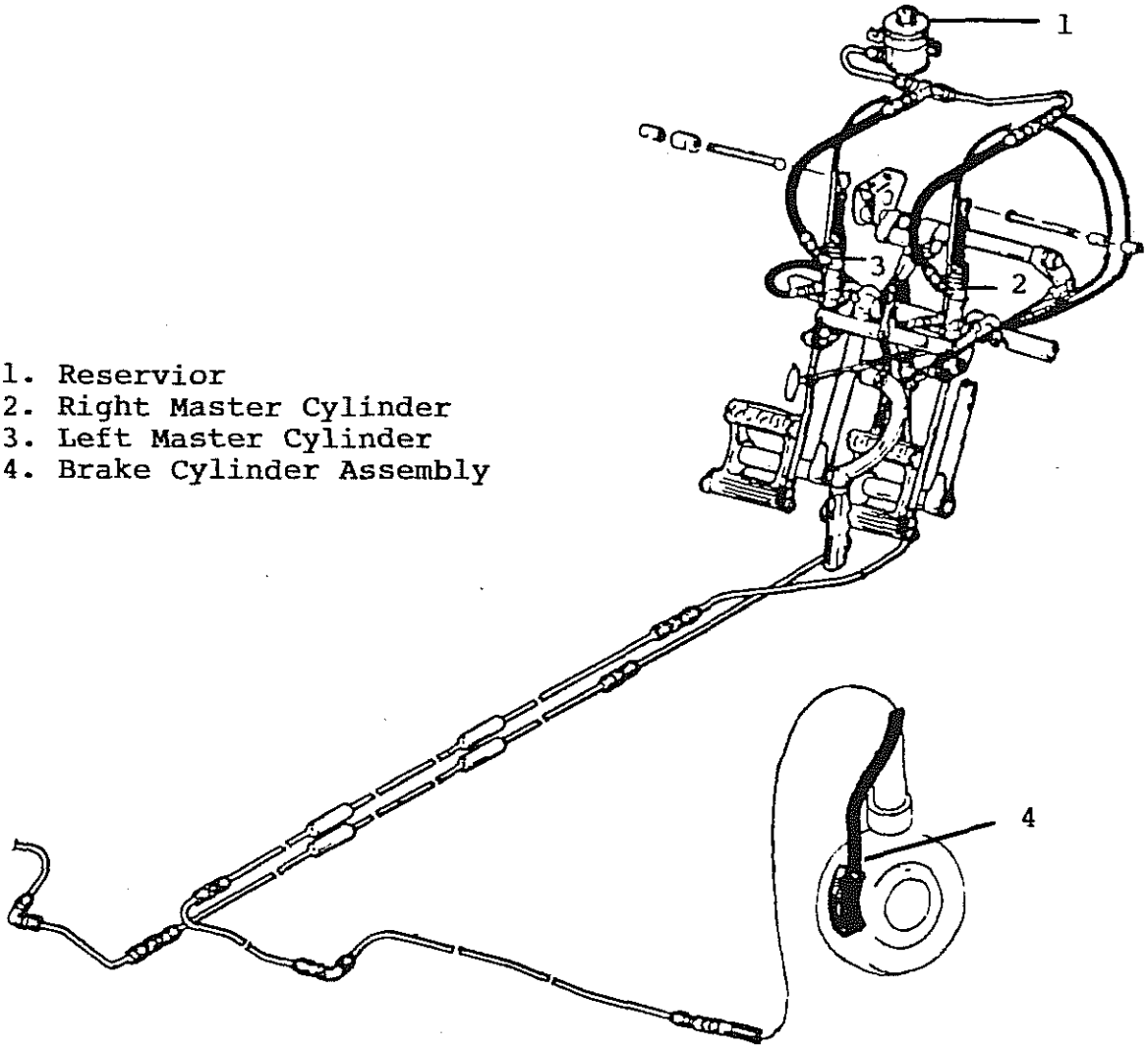
FIGURE 2-10




1. Master Cylinder
2. Reservoir
3. Parking Brake Handle
4. Brake Handle

BRAKE SYSTEM INSTALLATION PA-24-180 and PA-24 250
Serial #'s 24-1 to 24-2174 incl., 24-2176 to 24-2298 incl.

FIGURE 2-11




1. Reservior
2. Right Master Cylinder
3. Left Master Cylinder
4. Brake Cylinder Assembly

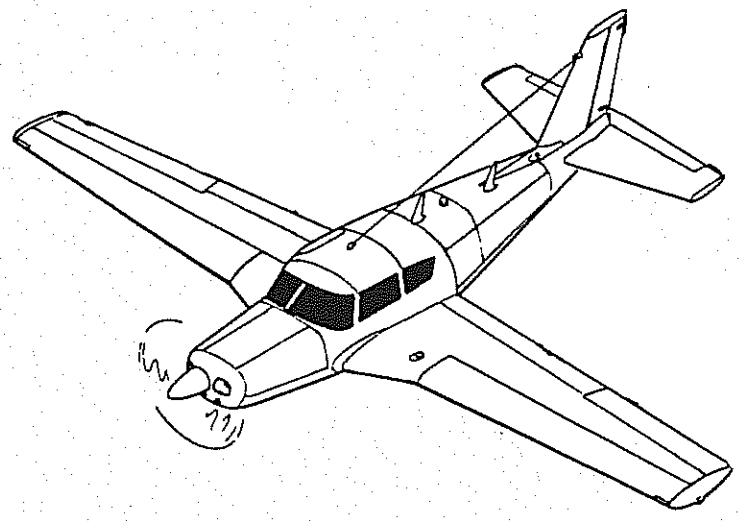
BRAKE SYSTEM INSTALLATION PA-24-180 and PA-24-250
Serial #'s 24-2175, 24-2298 and up, PA-24-260 and PA-24-400

FIGURE 2-12

Comanche

## CHAPTER 3

# FLIGHT CONTROLS



# PA-24 COMANCHE

## FLIGHT CONTROLS

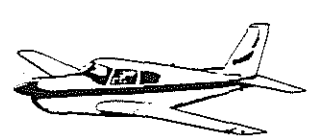
## Chapter 3

## CONTENTS



## ILLUSTRATIONS





# PA-24 COMANCHE

## Chapter 3

## FLIGHT CONTROLS

### INTRODUCTION

The flight controls in the PA-24 Comanche are conventional, consisting of dual control wheels which operate the ailerons and stabilator, and dual pedals that operate the rudder.

### GENERAL

The aircraft is controlled in flight by the use of three standard primary control surfaces, consisting of the ailerons, stabilator and rudder. Operation of these controls is through the movement of the dual control columns and dual rudder pedals. The individual surfaces are connected to their control components through the use of cables and push-pull tubes. Provisions for directional and longitudinal trim control is provided by an adjustable trim mechanism for the rudder and stabilator.

The aileron controls consist of two-control wheels connected by torque tubes to sprockets on each end of the horizontal control column. A chain is wrapped around the sprockets and around a double sprocket on the left control tube. The chain is connected to the primary aileron control cable which is routed under the left floor of the fuselage to the main spar and out through the wings to a bellcrank in each wing. A balance cable is also connected to the bellcrank. As the control wheels are moved, the control cables move the bell cranks and actuate push-pull rods to move the ailerons.

The stabilator controls are also connected to the control column. From the connecting point, cables are routed around a series of pulleys down under the floor and aft to the tail section of the airplane. The aft end of the cables connect to the stabilator balance arm which in turn is connected to the stabilator. When the control wheels are moved forward or aft, the cables move the balance arm on the stabilator up and down, rotating the stabilator at its hinge points.

PA-24 COMANCHE

FLIGHT CONTROLS

The rudder is controlled by the pilot's and co-pilot's rudder pedals. Cables are connected to both sides of the rudder pedal assembly and are routed aft through the bottom of the fuselage to the rudder horn. When one rudder pedal is pushed, the cables move in opposite directions turning the rudder horn and rudder.

On some later models, the rudder and ailerons are interconnected by a cable-spring system for co-ordinated control action.

## FLAPS

Manually controlled flaps are provided on the PA-24-180. The flaps are balanced and spring loaded to return to the retracted (up) position. A control handle, which is located between the two front seats extends the flaps by the use of a control cable. To extend the flaps, the handle is pulled up to the desired flap setting of 9, 18 or 27 degrees. To retract, depress the button on the end of the handle and lower the control. When extending or retracting flaps, there is a pitch change in the airplane. This pitch change can be corrected either by stabilator trim or increased control wheel force. When the flaps are in the retracted (up) position, locks on the inboard ends of the flaps, hold them in the up position so the right flap may be used as a step.

NOTE

The right flap will support a load only in the fully retracted (up) position. When the flap is to be used as a step, make sure the flaps are in the retracted (up) position.

The Comanche 250, 260 and 400 are equipped with electrically operated Max-Lift flaps that can be used in any position up to the maximum of 32 degrees. A second up lock is provided so that if someone steps on the right flap without it being locked, it will not go to the full 32 degree position.

PA-24 COMANCHE

FLIGHT CONTROLS

Flaps may be lowered at speeds up to 125 mph, but slowing to 100 mph will reduce the air loads during operation.

## STABILATOR TRIM

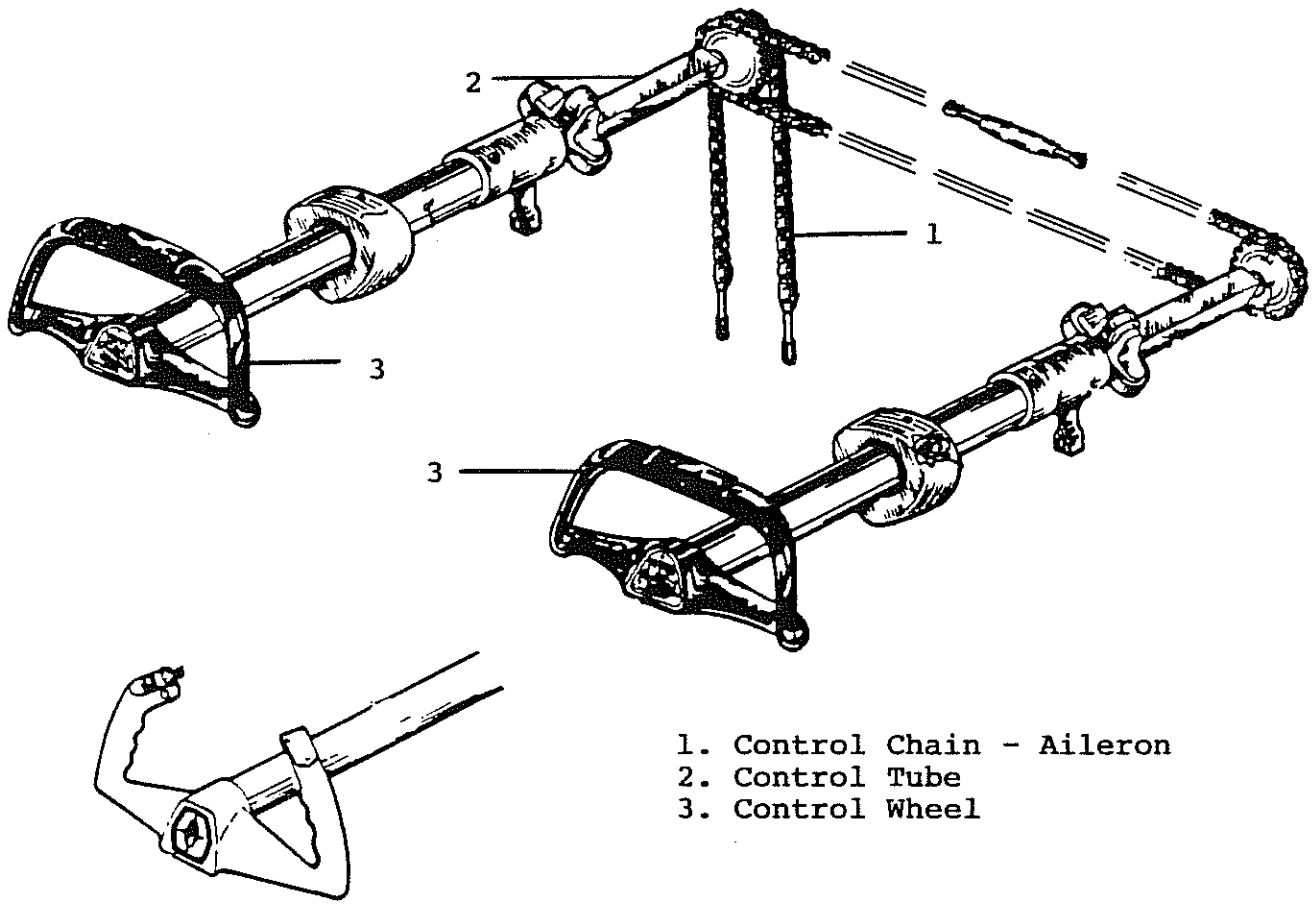
An overhead crank located between the two front seats operates the stabilator trim/anti-servo tab to longitudinally trim the airplane. Electric trim via a switch on the pilots control wheel is available on later models.

## RUDDER TRIM

Rudder trim is accomplished through a knob located on the right side of the nose wheel well and can be used to maintain a centered ball throughout the speed/power envelope on the Comanche. The control actually moves the steering arm which repositions the rudder and rudder pedals.

## AILERON TRIM

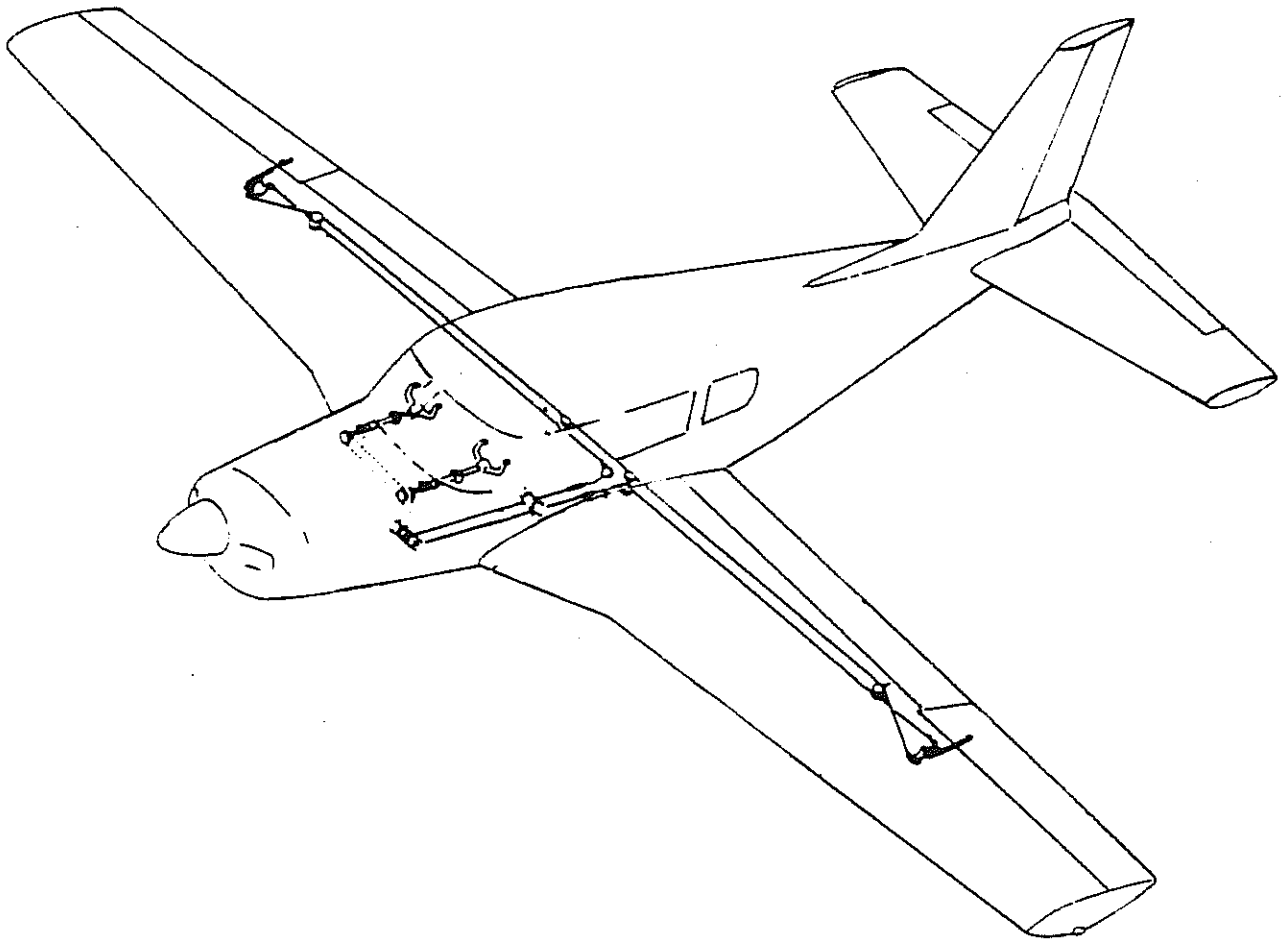
Aileron trim is accomplished through a ground adjustable tab on the left aileron.




1. Control Chain - Aileron
2. Control Tube
3. Control Wheel

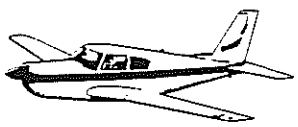
CONTROL WHEEL INSTALLATION

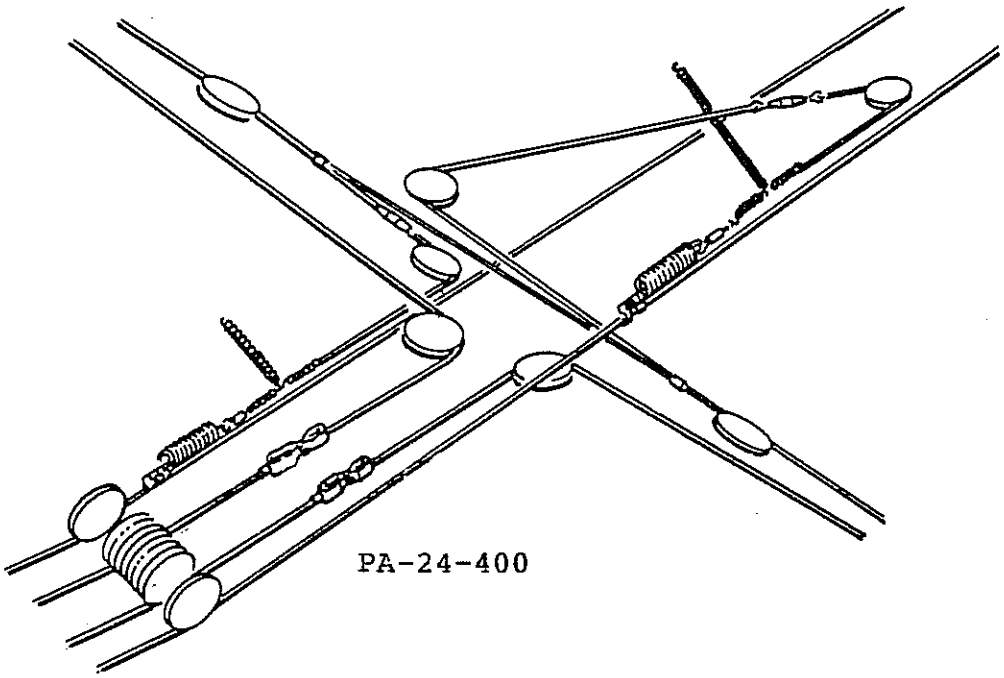
FIGURE 3-1



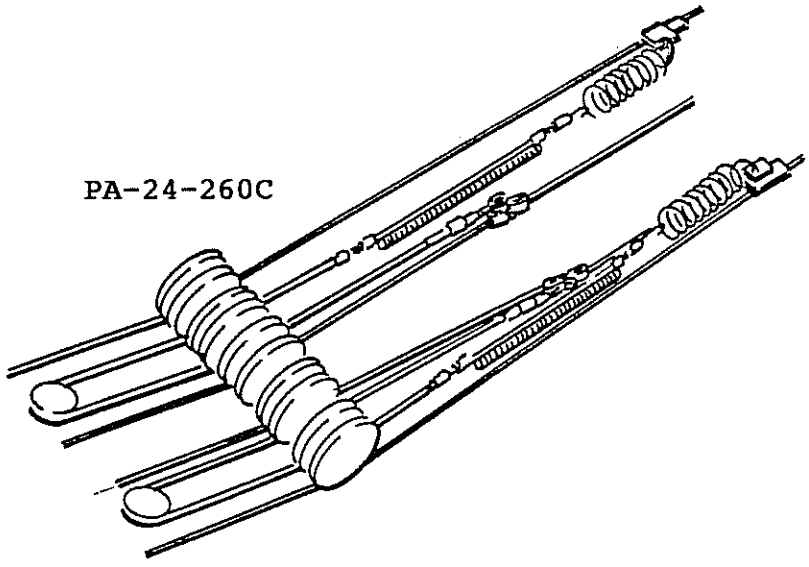
AILERON CONTROLS

FIGURE 3-2





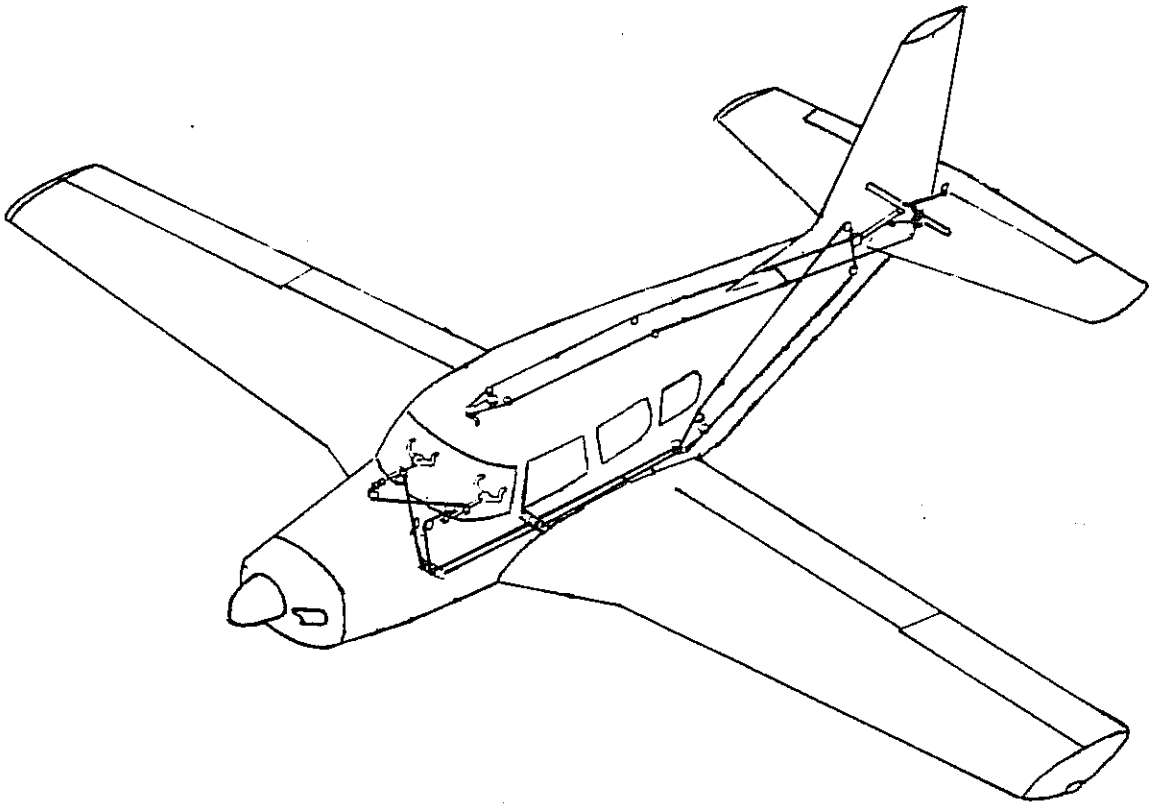
PA-24-400



PA-24-260C

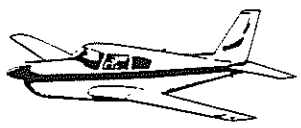
RUDDER/AILERON INTERCONNECT

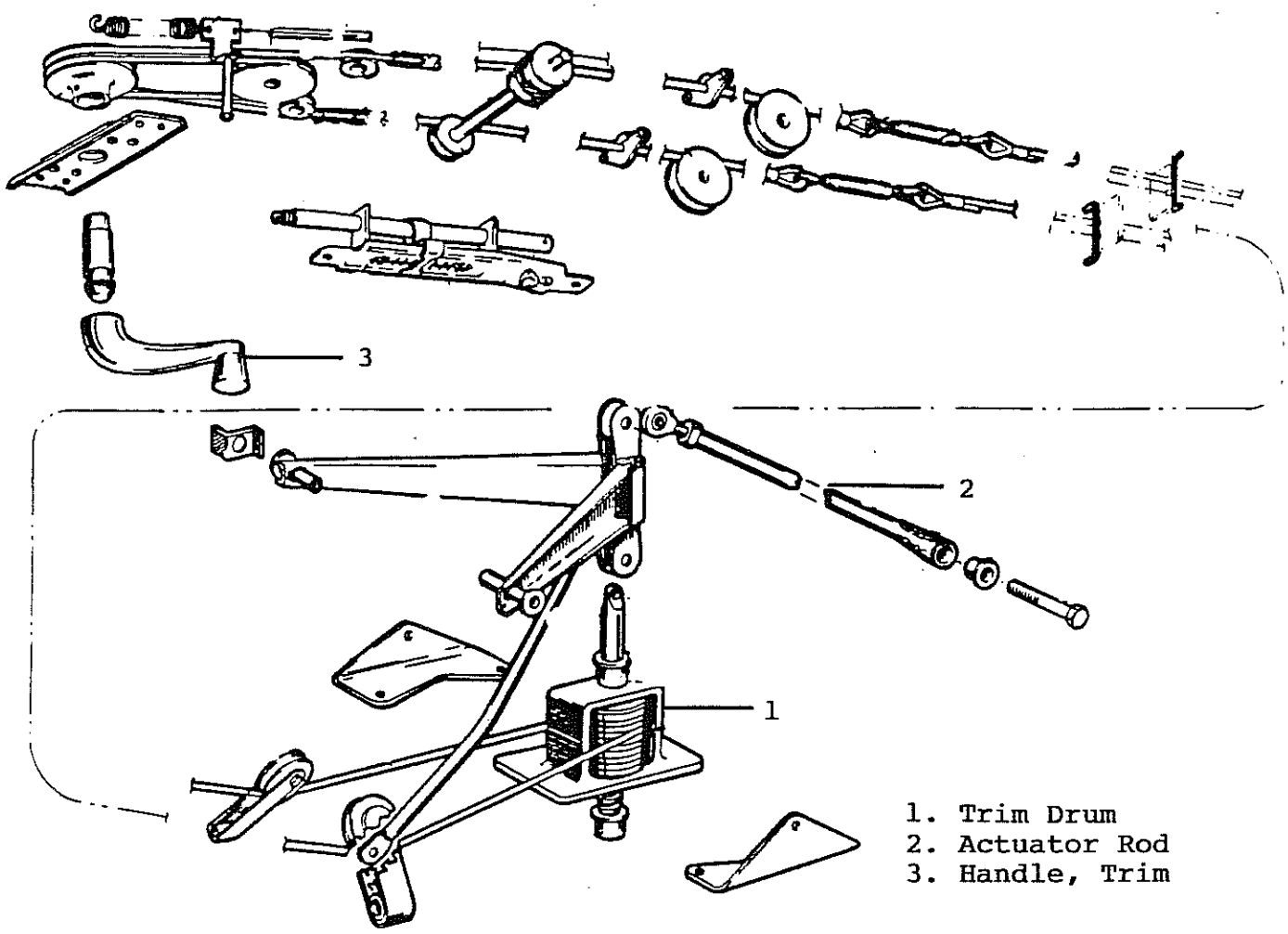
FIGURE 3-3



STABILATOR AND TRIM CONTROLS

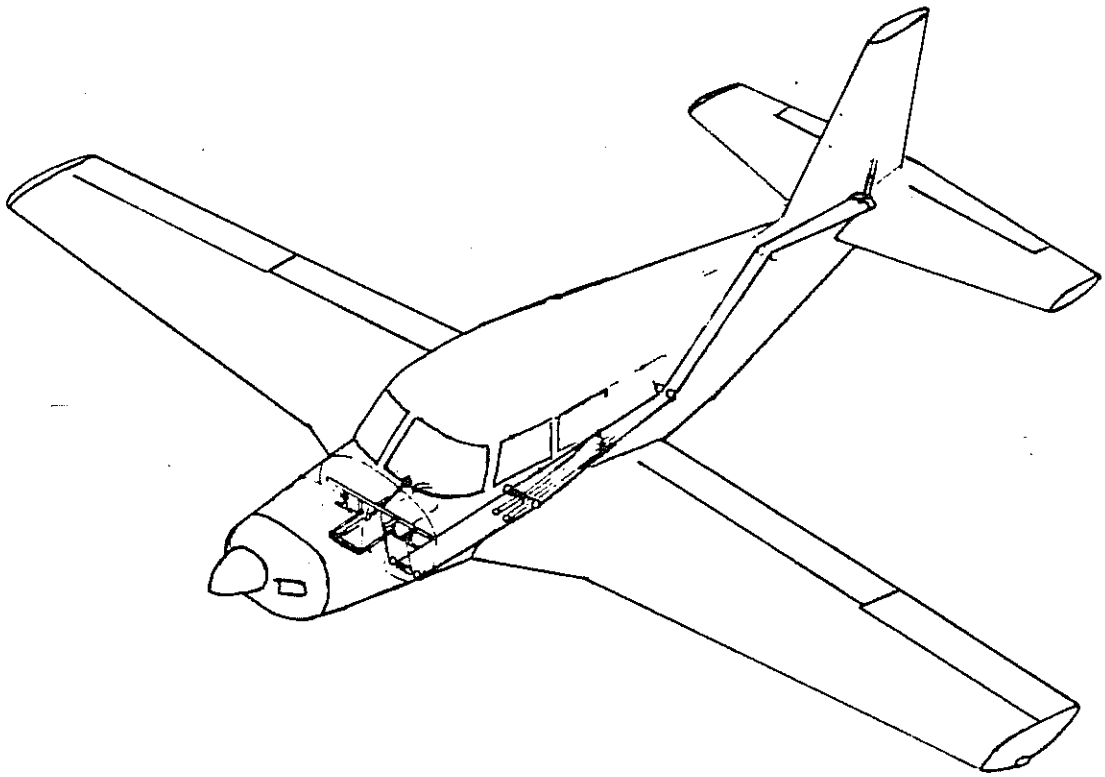
FIGURE 3-4





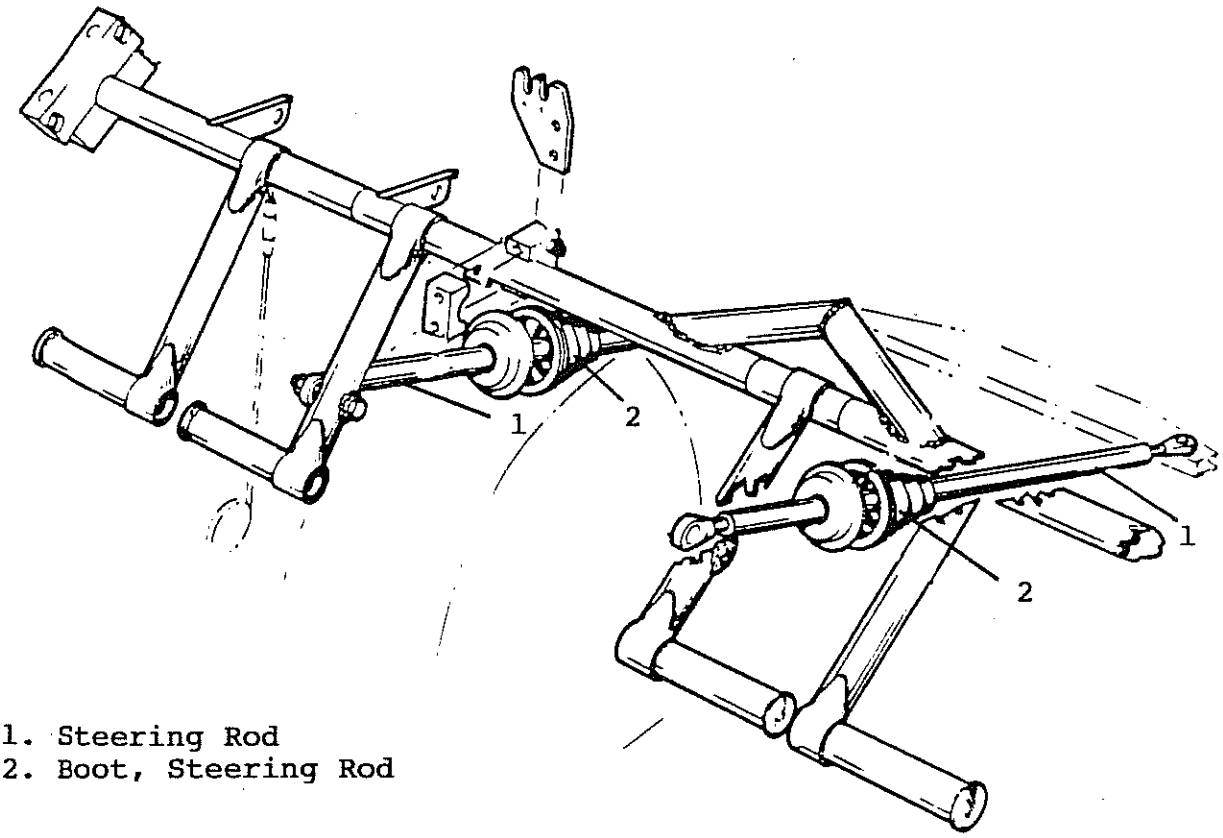

STABILATOR TRIM

FIGURE 3-5



RUDDER CONTROL CABLES

FIGURE 3-6

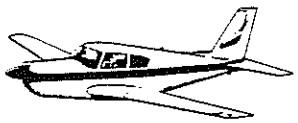


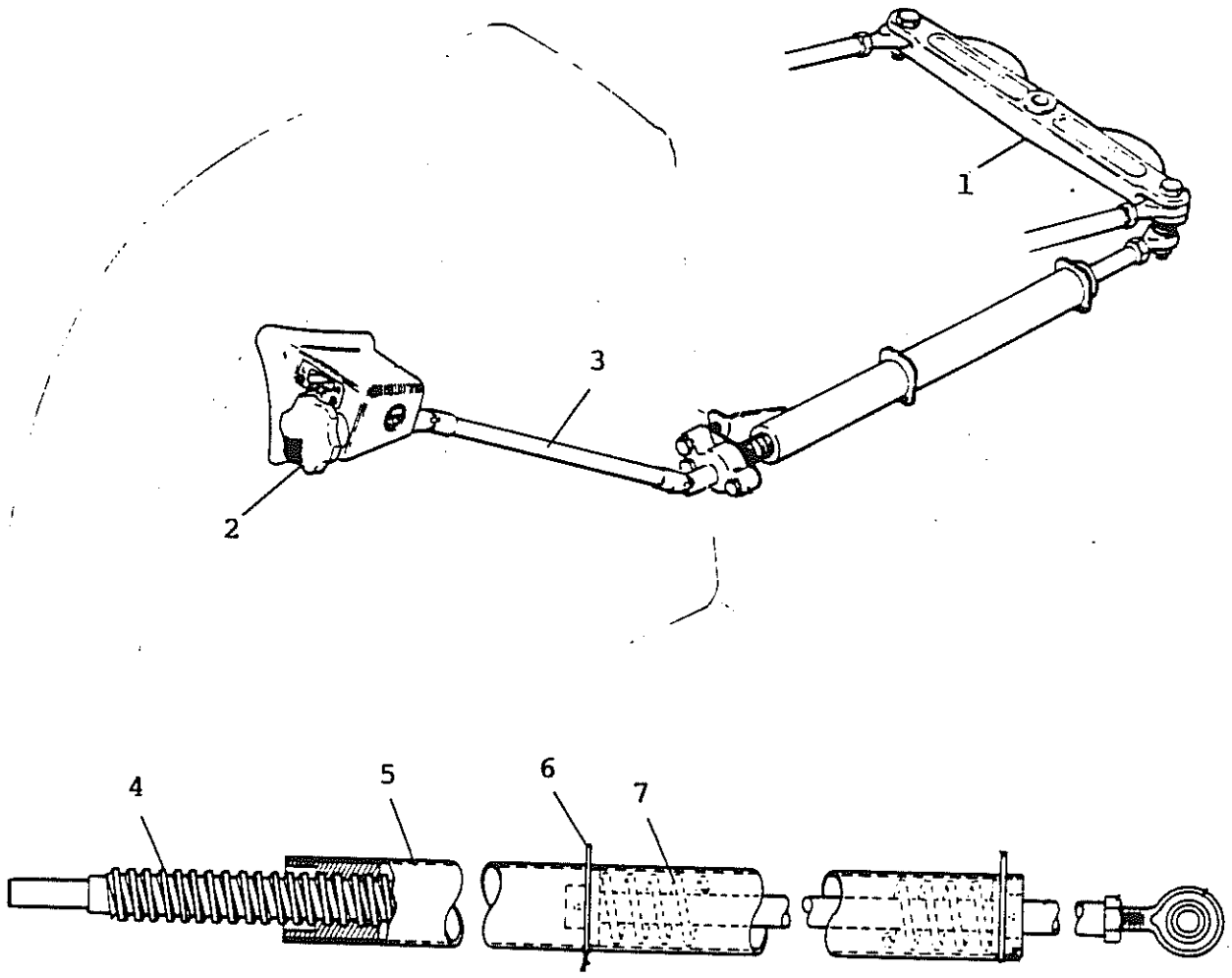

1. Steering Rod
2. Boot, Steering Rod

RUDDER PEDAL INSTALLATION

FIGURE 3-7



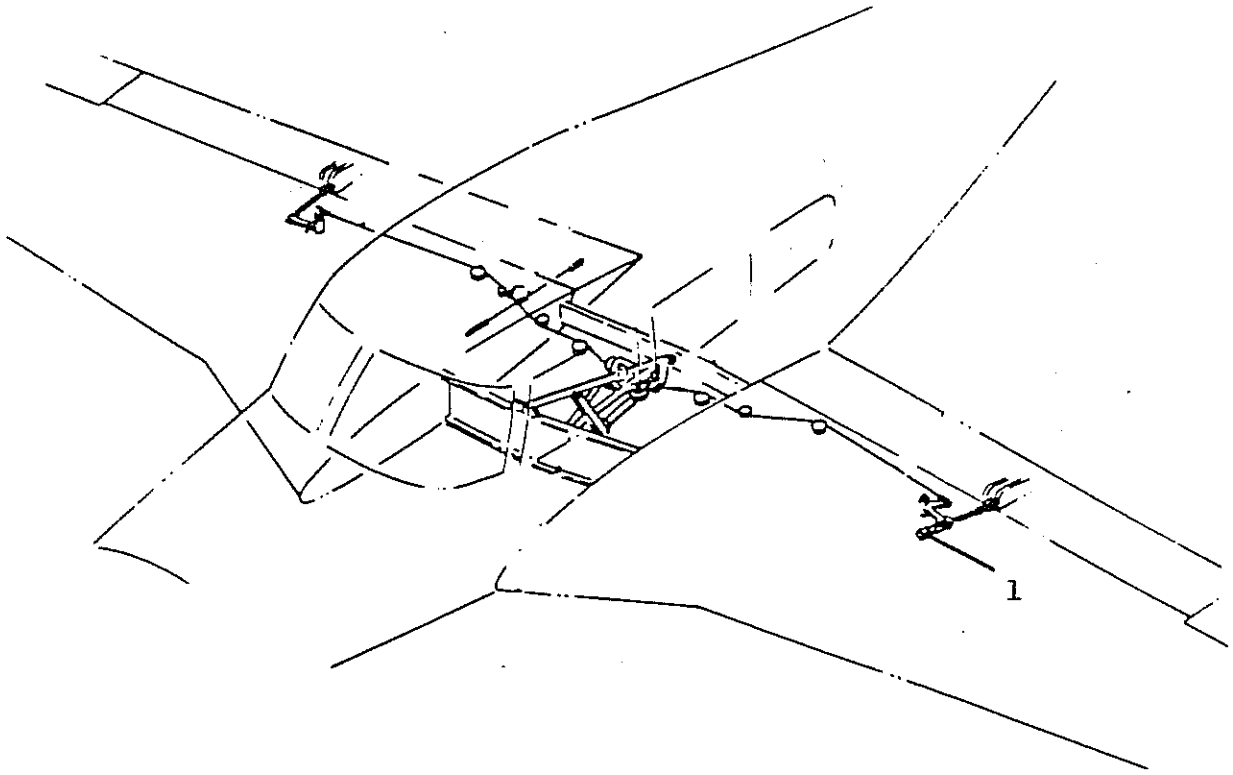





1. Nose Gear Steering Arm
2. Control Knob
3. Tube
4. Actuator Screw, Trim Bungee
5. Tube, Trim Bungee
6. Clip
7. Spring

RUDDER TRIM

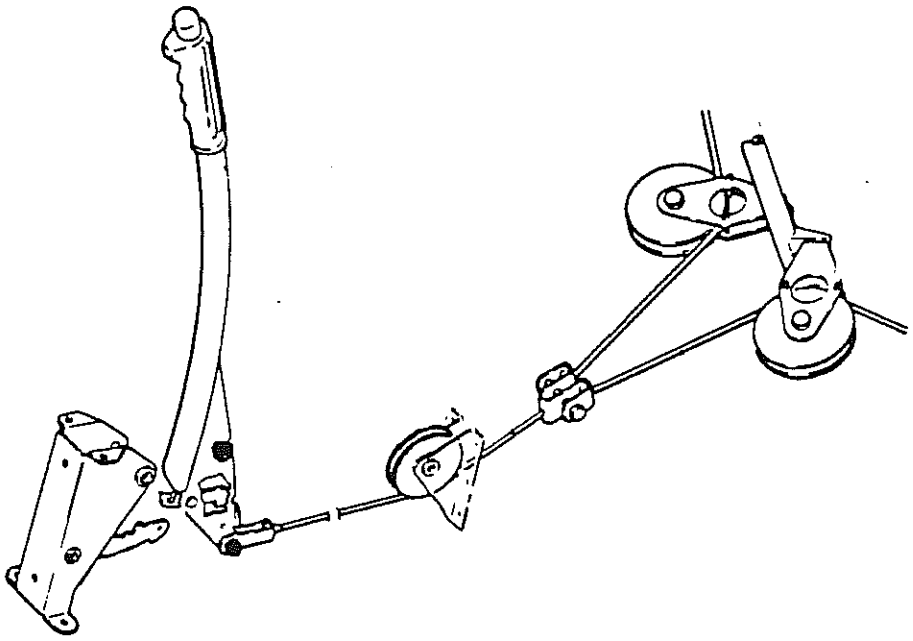
FIGURE 3-8




1. Spring

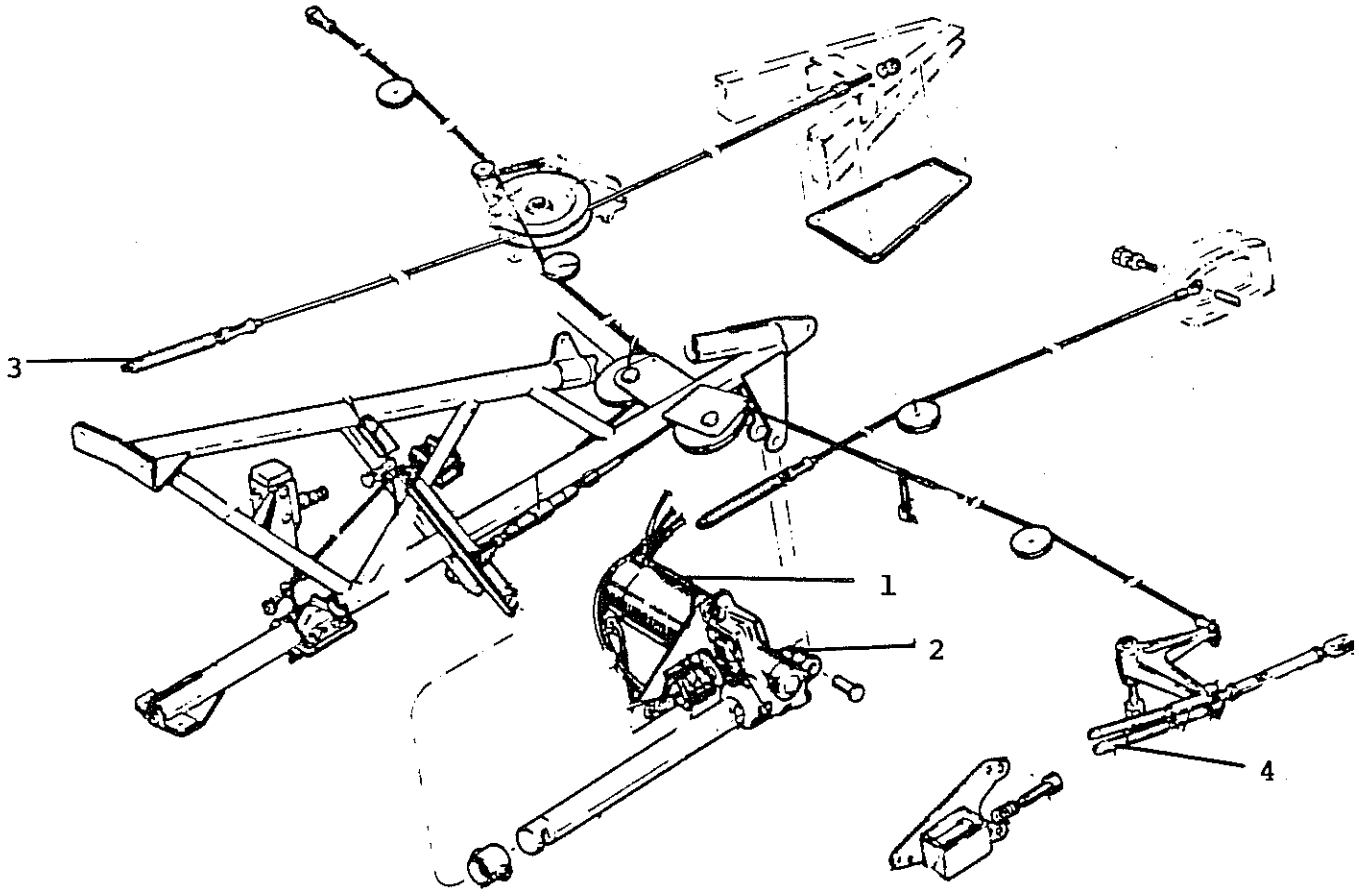
FLAP CONTROLS

Figure 3-9



MANUAL FLAP CONTROL

FIGURE 3-10

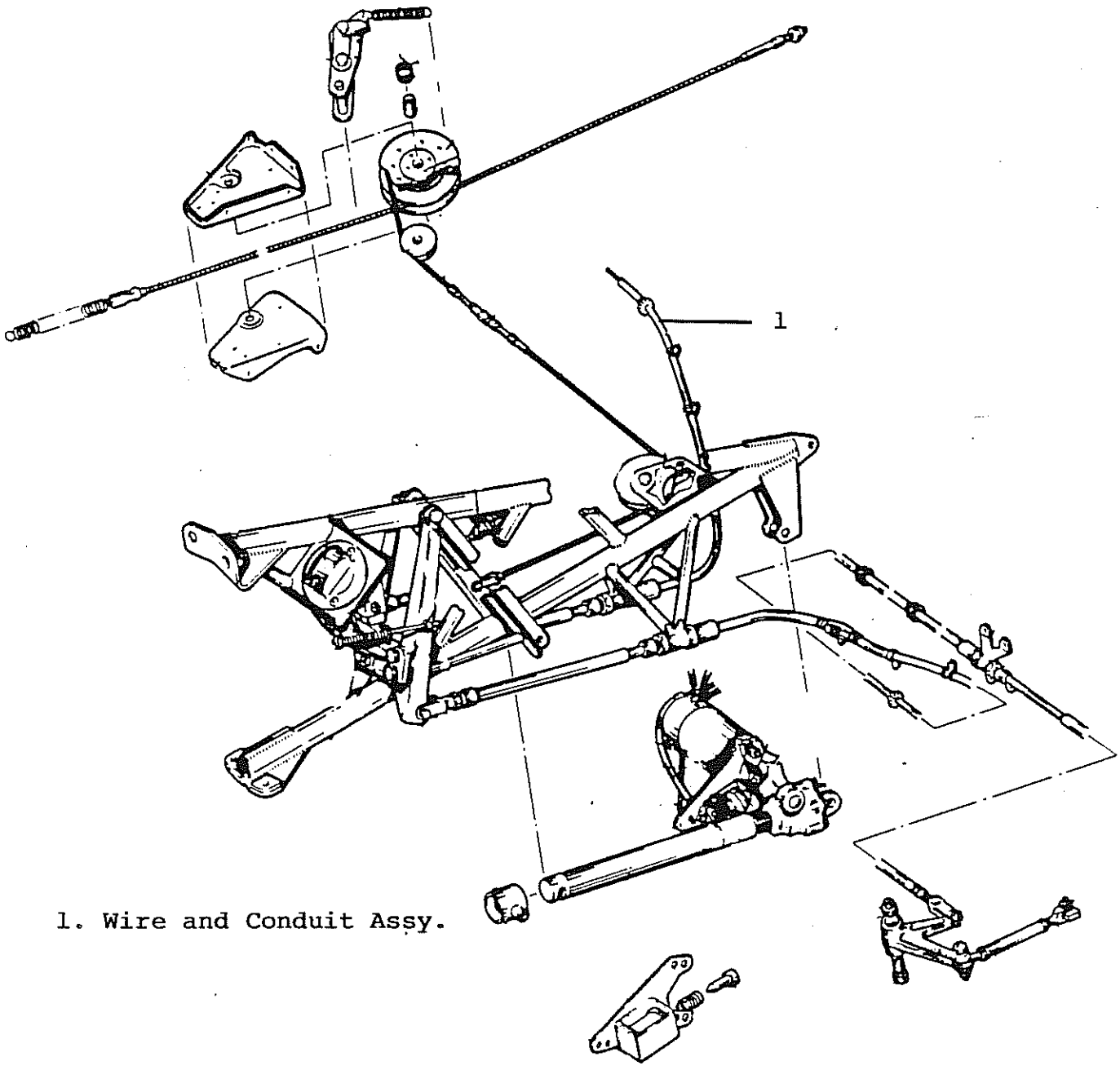



1. Motor Assembly, Flap
2. Transmission
3. Spring
4. Spring

PA-24-250/260 ELECTRIC FLAPS

FIGURE 3-11






1. Wire and Conduit Assy.

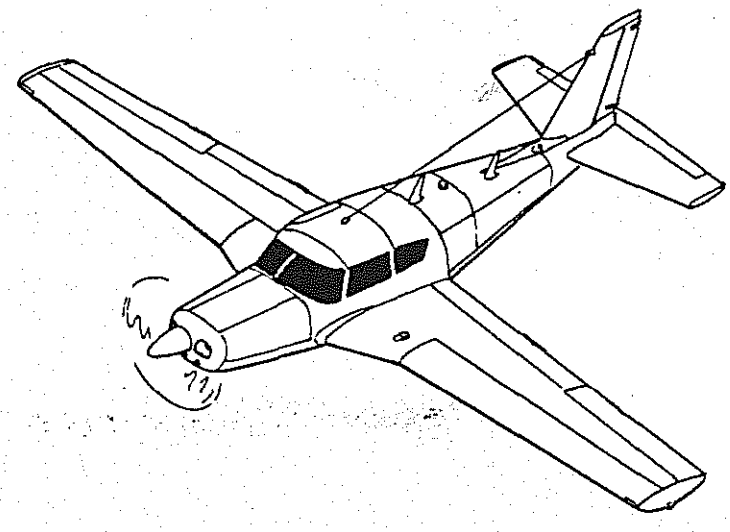
PA-24-400 ELECTRIC FLAPS

FIGURE 3-12

# Comanche

## CHAPTER 4

# FUEL SYSTEM



# PA-24 COMANCHE

## CHAPTER 4

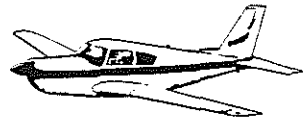
## FUEL SYSTEM

### Contents



### ILLUSTRATIONS





# PA-24 COMANCHE

# CHAPTER 4

# FUEL SYSTEM

## FUEL SYSTEM - PA-24-180/250/260

The fuel for the Comanche is carried in two rubber-like fuel cells located in the inboard leading edge sections of the wings. Capacity of these cells, which are classified as the main fuel cells, are 30 gallons each. On the 180 Comanche 50 gallons of fuel is called out as the standard fuel capacity. To obtain this amount of fuel it is necessary to fill the cells only to the bottom of the filler neck. To obtain the standard fuel load plus reserve quantity the cells are filled to the top of the filler neck. This system provides a reserve fuel capacity for the 180 Comanche without the necessity for extra cells. On the 250 Comanche 60 gallons is the standard fuel capacity of which 56 gallons is usable: however, if auxiliary fuel cells are installed the fuel capacity is increased to 90 gallons of which 86 gallons is usable.

As optional equipment for the Comanche 250 only, a 30 gallon auxiliary fuel system is available. The system consists of two 15 gallon fuel cells installed in the wings just outboard of the main fuel cells. Use auxiliary fuel in level flight only.

The cells should be kept full of fuel during storage of the airplane to prevent accumulation of moisture and deterioration of the cells. For long term storage without fuel, the cells should be coated with light engine oil to keep the rubber from drying out.

During normal operation the fuel is drawn to the engine from the cells by a mechanically operated fuel pump located on the engine accessory section. In the event the engine driven fuel pump fails an electric auxiliary fuel pump is provided. This pump is operated during starting, take-offs and landing. Two auxiliary pumps are used on the Comanche 250.

## PA-24 COMANCHE

## FUEL SYSTEM

The fuel strainer unit for the system is located under the floorboard in the center section of the fuselage. Daily draining of the strainer is accomplished through an access panel located on the bottom of the airplane on early models. Later models can be drained from the cockpit by opening the hinged access door located in the floorboard just aft of the fuel selector valve and moving the quick drain valve handle to the full aft position. The general procedure for draining the fuel system is to open the strainer quick drain for a few seconds with the fuel cell selector on one cell, then change the fuel selector to the opposite cell and repeat the process. The same process applies to the auxiliary fuel system when installed. Allow enough fuel to flow to clear the lines as well as the strainer. Positive fuel flow shut-off can be observed through the clear plastic tube which carries the fuel overboard.

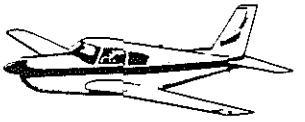
Fuel quantity is indicated by an electric gauge located in the instrument cluster. The instrument is connected to a transmitter unit located in the fuel cell. On the 180 Comanche, two individual indicating systems are used, one for each main cell. The Comanche 250 incorporates only one fuel quantity gauge. This gauge will indicate the amount of fuel in the cell that is selected.

An over-ride system is incorporated so that it is possible to check the amount of fuel available in the remaining cells without moving the selector handle to that cell position. This is accomplished by depressing the red button (located on the fuel selector plate) under the desired fuel cell position. The fuel gauge will indicate the amount of fuel available in that cell. When the red button is released the indicating system will return to its normal operation.

Several fuel cell venting changes have been made since the first Comanche. The NACA vent kits became standard on S/N 24-3530.

All non-fuel injected models contain a primer located in the cockpit to aid in starting.

Later models of the 250 and 260 were fuel injected but the basic fuel system was the same.

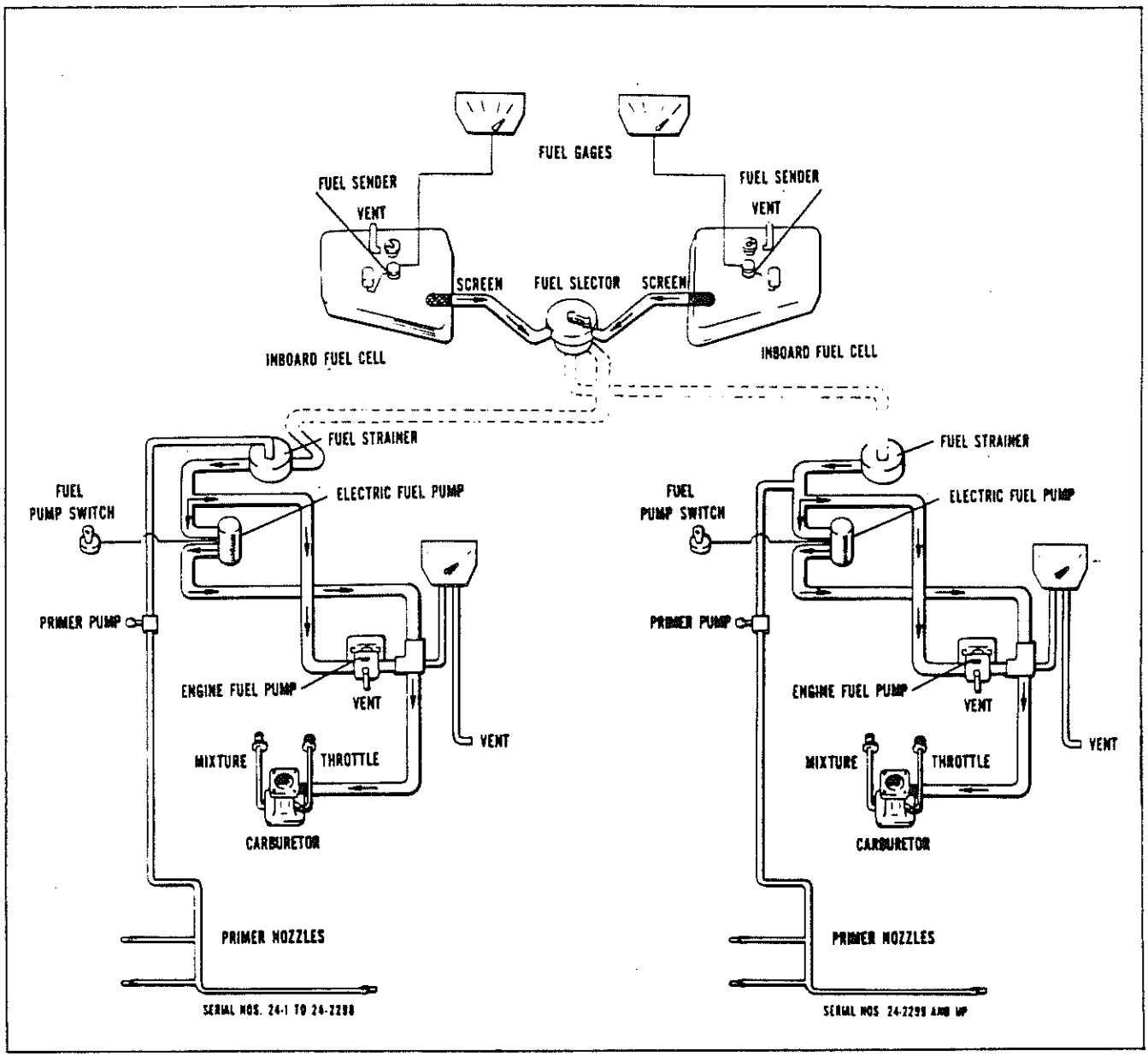


PA-24 COMANCHE

FUEL SYSTEM

## FUEL SYSTEM COMANCHE 400

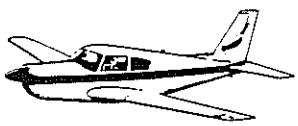
The Comanche 400 fuel system is basically the same as the other models with the exception that the auxiliary tanks contain 35 gallons each giving a total fuel capacity of 130 gallons. Of that amount, 124 gallons are usable.

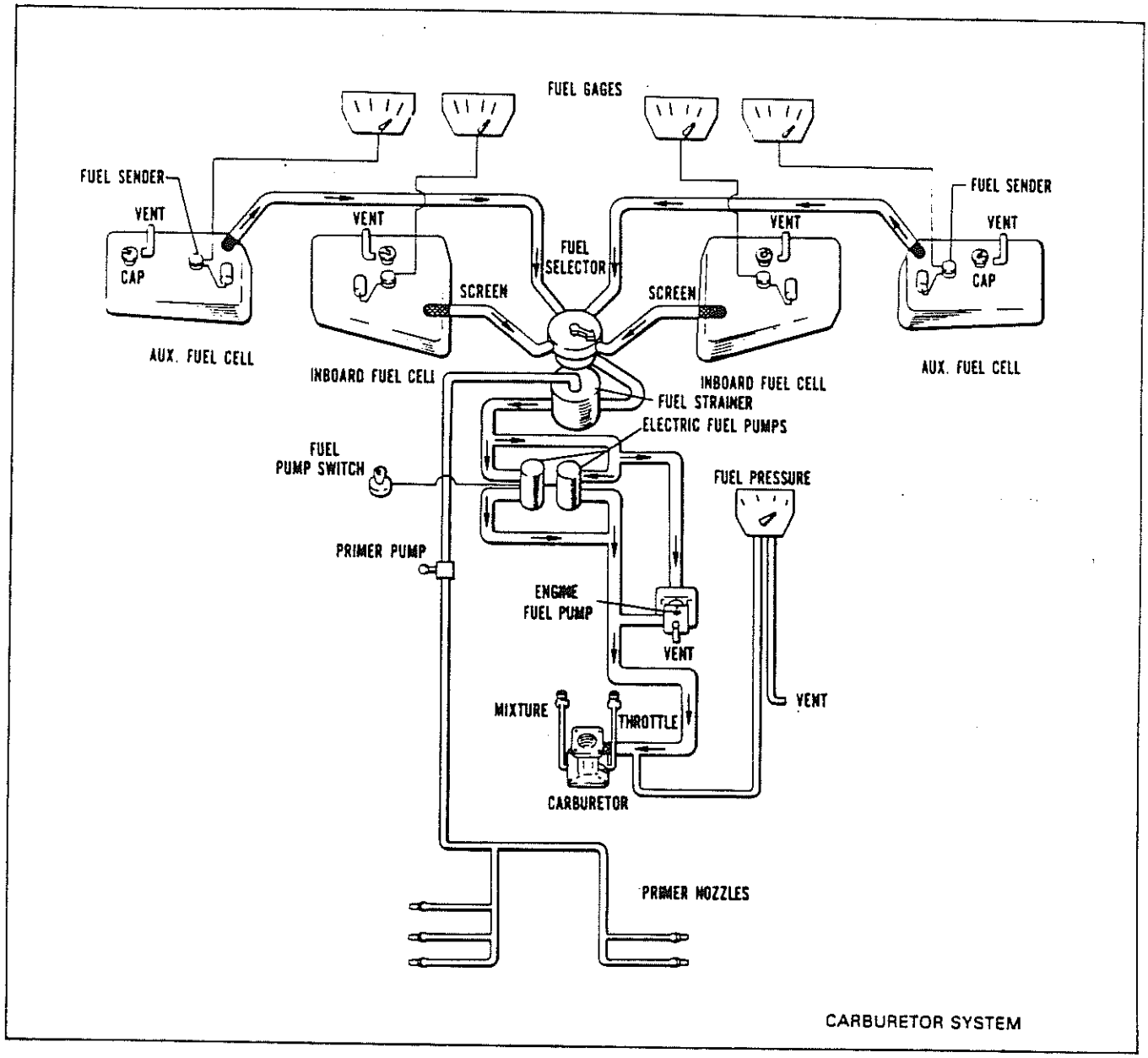



**FUEL SYSTEM SCHEMATIC**
**PA-24-180**

FIGURE 4-1





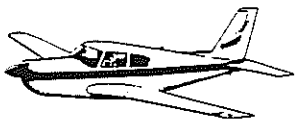


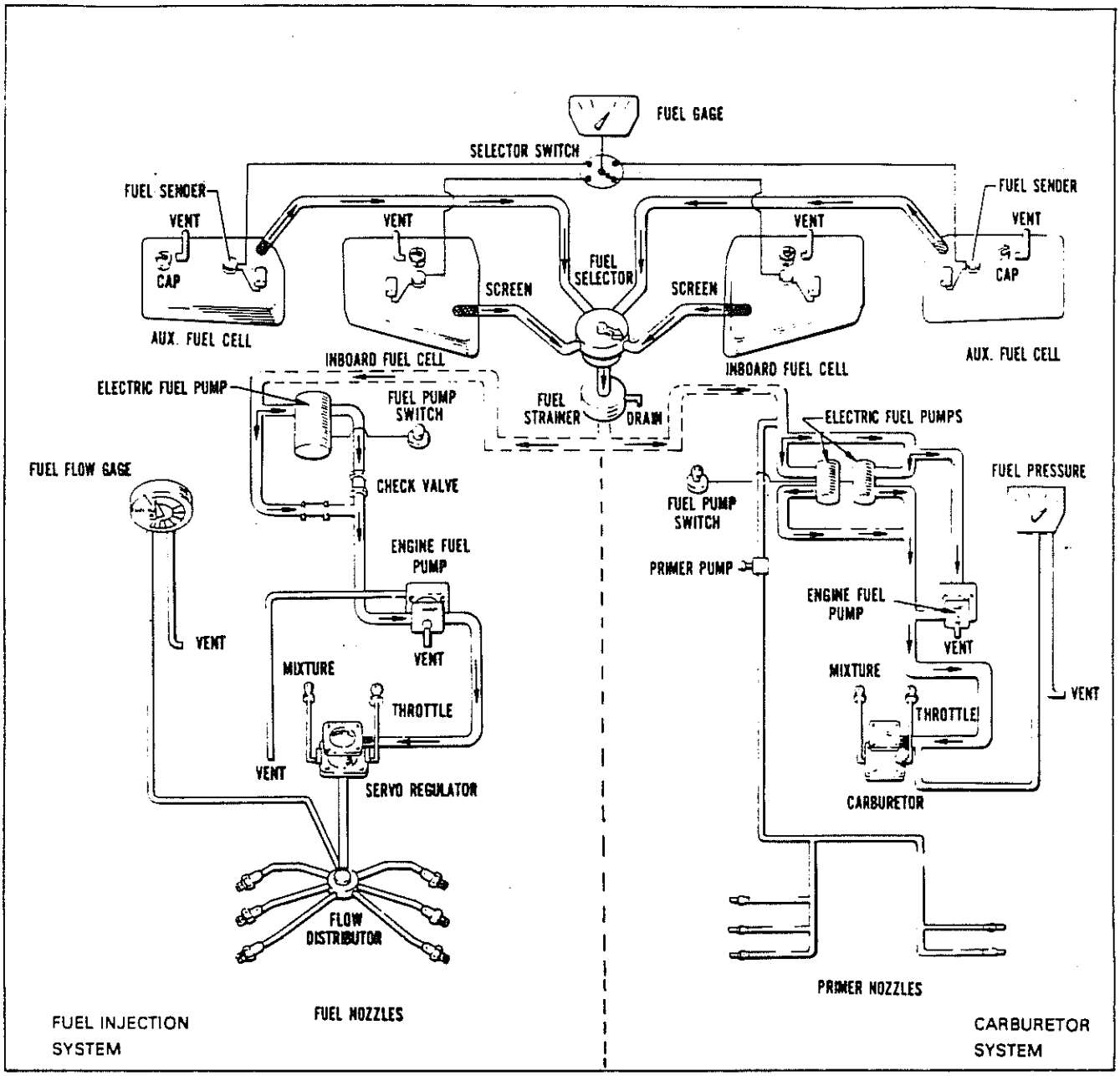

**FUEL SYSTEM SCHEMATIC**

**PA-24-250, Serial Nos. 24-105 to 24-2298**

FIGURE 4-2





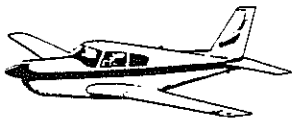


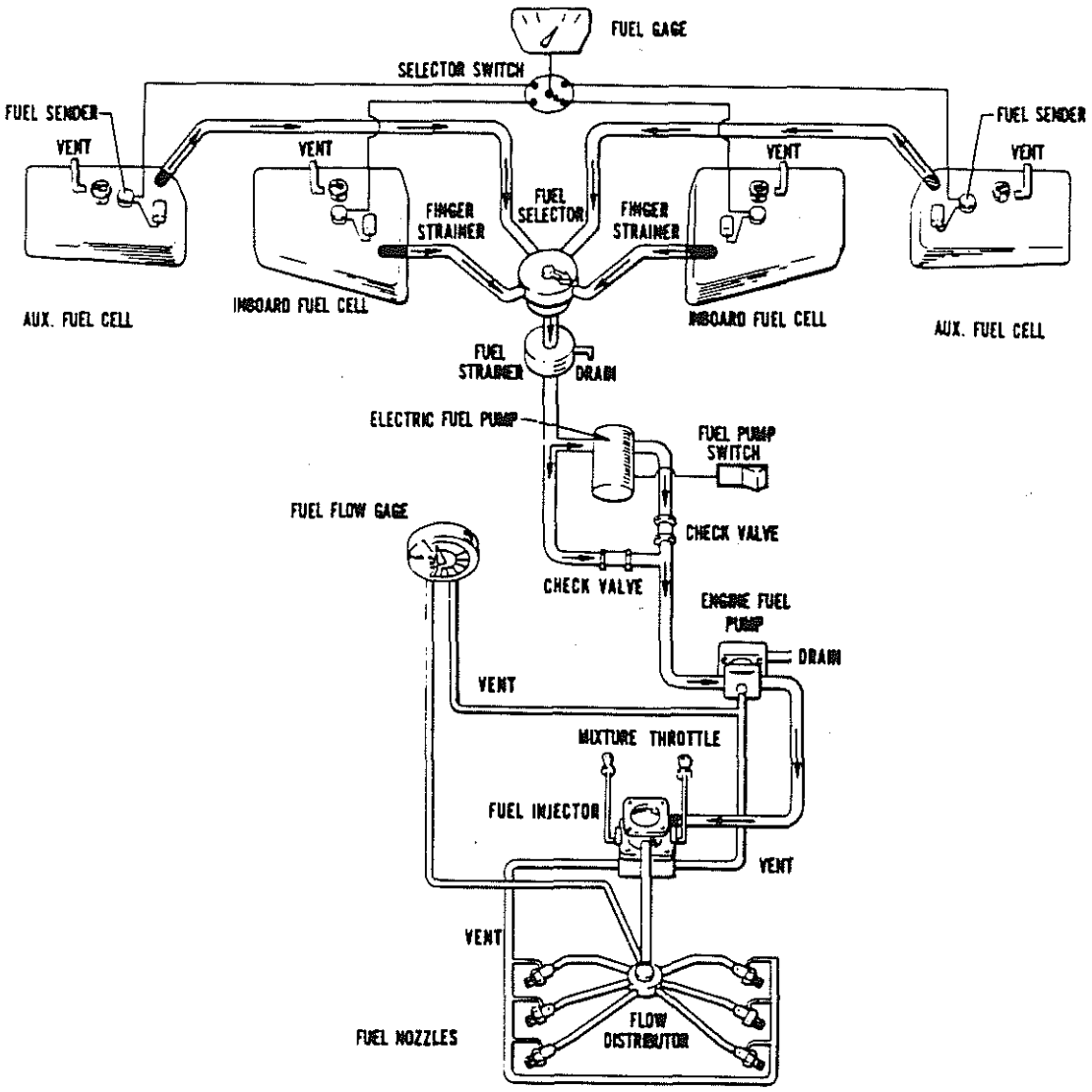

**FUEL SYSTEM SCHEMATIC**

**PA-24-250, Serial Nos. 24-2299 and up and PA-24-260**

FIGURE 4-3





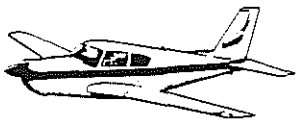


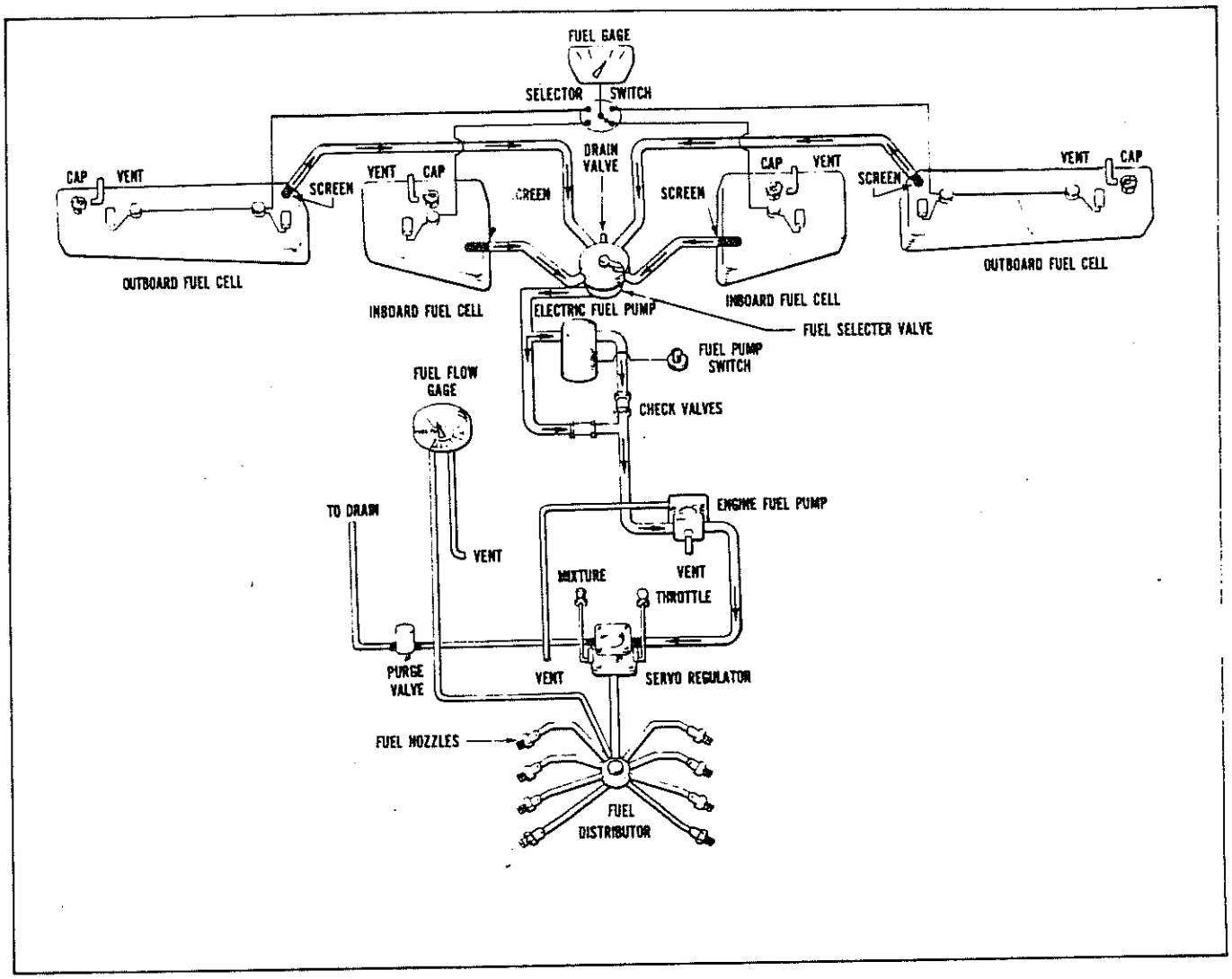

FUEL SYSTEM SCHEMATIC

PA-24-260 (TURBO)

FIGURE 4-4





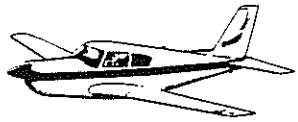



FUEL SYSTEM SCHEMATIC

PA-24-400

FIGURE 4-5

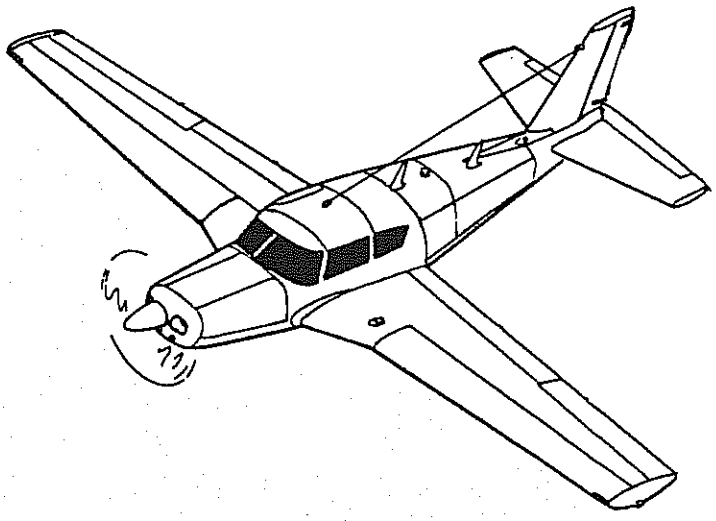




Comanche

## CHAPTER 5

# POWERPLANT



# PA-24 COMANCHE

## POWERPLANT

## CHAPTER 5

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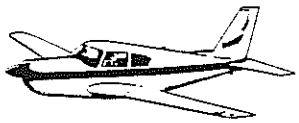
## ILLUSTRATIONS





# PA-24 COMANCHE

# POWERPLANT

# CHAPTER 5

## INTRODUCTION

The PA-24 Comanche aircraft all utilize Textron Lycoming engines, of various displacements and rated horsepower, for all models.

## ENGINE CONTROLS

The engine controls of the PA-24 Comanche aircraft consist of a throttle, propeller control. and a mixture control. These controls are located on the control quadrant on the lower center of the instrument panel where they are accessible to both the pilot and the copilot on the "C" models. Earlier models utilize push/pull controls and many cases have a vernier adjustment.

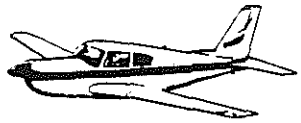
The throttle lever is used to adjust the manifold pressure. It incorporates a landing gear up warning horn switch which is activated when manifold pressure decreases to approximately 14 inches. (varies with switch adjustment and altitude) If the landing gear is not down, the horn will sound until it is either down and locked or the throttle is advanced to increase power. This is a safety feature to prevent a gear up landing.

The propeller control lever is used to adjust the propeller pitch for low or high RPM.

The mixture control lever is used to adjust the air to fuel ratio. The engine is shut down by the placing of the mixture lever in the full lean or idle cut off position.

A friction adjustment lever is located on the right side of the control quadrant on the "C" models and may be used to increase or decrease the friction holding the throttle, propeller and mixture controls in a selected position.

The alternate air or carburetor heat control is located to the right of the engine controls. When alternate air or carburetor heat is in the off or closed position, the engine is operating on filtered air; when the controls are activated, the engine is operating on unfiltered, heated air.



## PA-24 COMANCHE

## POWERPLANT

### TEXTRON LYCOMING NORMAL ASPIRATED ENGINE MODELS

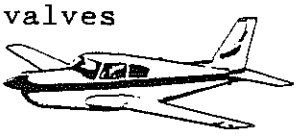
Listed below are the types of aircraft, engine models and rated horsepower for all normal aspirated models.

| | AIRCRAFT | ENGINE | HORSEPOWER |
|---|---|---|---|
| a. | 180 Carburetor | O-360-A1A/A1D | 180 |
| B. | 250 Carburetor | O-540-A1A5/A1B5/A1C5/A1D5 | 250 |
| c. | 250 Fuel Injected | IO-540-C1B5 | 250 |
| d. | 260 Carburetor | O-540-E4A5 | 260 |
| e. | 260 Fuel Injected s/n 24-4783,4804 and up | IO-540-N1A5 | 260 |
| f. | 260 Fuel Injected s/n 24-4000 to 4782 | IO-540-D4A5 | 260 |
| g. | 400 Fuel Injected | IO-720-A1A | 400 |

The normal aspirated engines are either 4 or 6 cylinder, direct drive and horizontally opposed. They are furnished with a starter, 35/50 ampere 12 volt generators, shielded ignition, vacuum pump drive, fuel pump, propeller governor and an induction air filter. Later models are equipped with alternators. Recommended overhaul period of 1800/2000* hours is based on Textron Lycoming service experience. Operation beyond the recommended time is the decision of the operator. Since Textron Lycoming from time to time revises the recommended overhaul period, the owner should check their latest Service Instruction at his/her Piper dealer for the latest recommendation and other service information.

All Comanches are equipped with a constant speed, controllable pitch propeller. All except the "400" have two blades while the "400" is equipped with a three bladed propeller. The pilot can control the RPM at various power settings by adjusting the propeller control in the cockpit.

* with 1/2 inch exhaust valves



PA-24 COMANCHE

POWERPLANT

The exhaust system is a crossover type, which reduces back pressure and improves performance. It is constructed entirely of stainless steel and is equipped with single or dual mufflers. Cabin heat and windshield defrosting are provided by a heater shroud around the muffler.

An oil cooler is used on all models and is mounted in various locations on the different models.

## INDUCTION SYSTEM

The induction system on the carbureted engines utilizes a Marvel-Schebler MA-4-5 carburetor. Manual leaning is provided for optimum performance.

The induction system on all fuel injected engines except for the "400" is a Bendix RSA-5AD1 fuel injector. The system is based on the principle of measuring airflow and using the airflow signals to operate a servo valve. The accurately regulated fuel pressure established by the servo valve, when applied across a fuel control (jetting system), makes fuel flow proportional to airflow.

Fuel pressure regulation, by means of the servo valve, necessitates only a minimum fuel pressure drop through the entire metering system. An inherent feature of the servo system is self-purging which eliminates any possibility of vapor lock and associated problems of difficult starting.

The injection system consists of a Servo Regulator, which meters fuel flow in proportion to airflow to the engine, giving proper fuel air mixture at all engine speeds, and a Flow Divider, which receives the metered fuel and accurately divides fuel flow to each cylinder fuel nozzle.

Installed in the instrument panel is a fuel flow indicator. This instrument is connected to the flow divider and monitors fuel pressure. The instrument converts fuel pressure to an accurate indication of fuel flow in gallons per hour.

NOTE

An increasing or abnormally high fuel flow indication is a possible symptom of restricted injector lines or nozzles.

## PA-24 COMANCHE

## POWERPLANT

Induction air for the engines enters through various means on the different models. It is directed through a filter and on to the injector/carburetor. An alternate air source is incorporated to provide airflow to the engine in case the normal flow through the filter is restricted. The alternate air door is spring loaded, and will remain closed during normal operation. The alternate air door will operate automatically, if the normal induction airflow thorough the filter is restricted, or when the push-pull control, located on the instrument pane., is placed in the FULL ON position. The control should be placed in the FULL ON position if icing conditions are suspected.

### TEXTRON LYCOMING TURBO CHARGED ENGINE MODEL

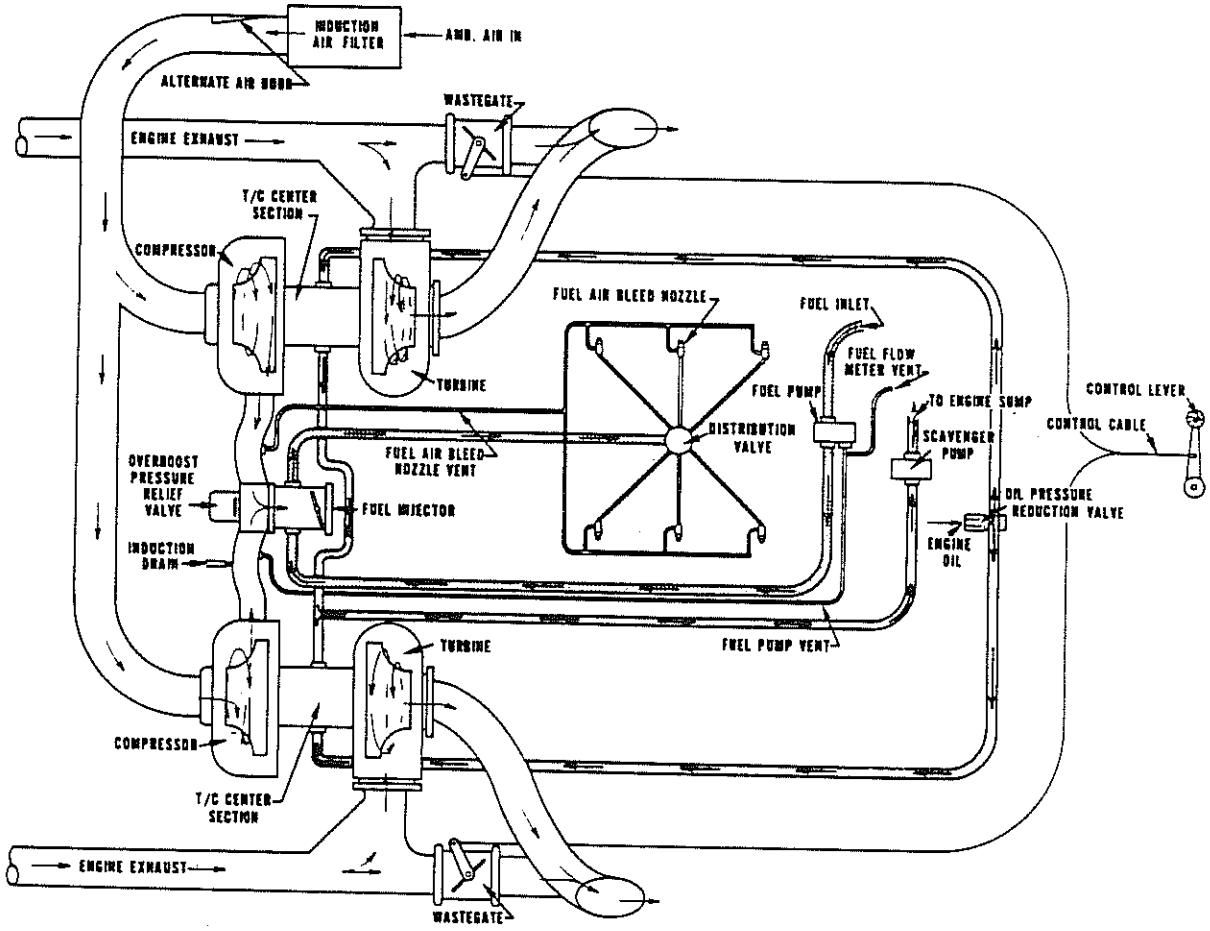
Listed below is the aircraft type, engine model and rated horsepower for the turbo charged model.

| | AIRCRAFT | ENGINE | HORSEPOWER |
|---|---|---|---|
| a. | PA-24-260 Turbo | IO-540-R1A5 | 260 |

The turbocharged Textron Lycoming IO-540-R1A5 engine is a six cylinder, horizontally opposed, fuel injected engine rated at 260 horsepower at 2700 RPM and 29 inches of MP. It is equipped with basically the same accessories as the normal aspirated models with the exception of the turbocharger and its controller. The turbocharger system is controlled by a manually operated lever in the cockpit which closes the waste gates as required to maintain a MP of 29 inches. Normal operation requires that the engine throttle is used as long as possible to maintain 29 inches, and then the Turbo Control is used to maintain 29 inches as the airplane climbs. The system is capable of maintaining 25 inches of manifold pressure at 25,000 feet.

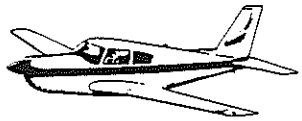
### INDUCTION SYSTEM

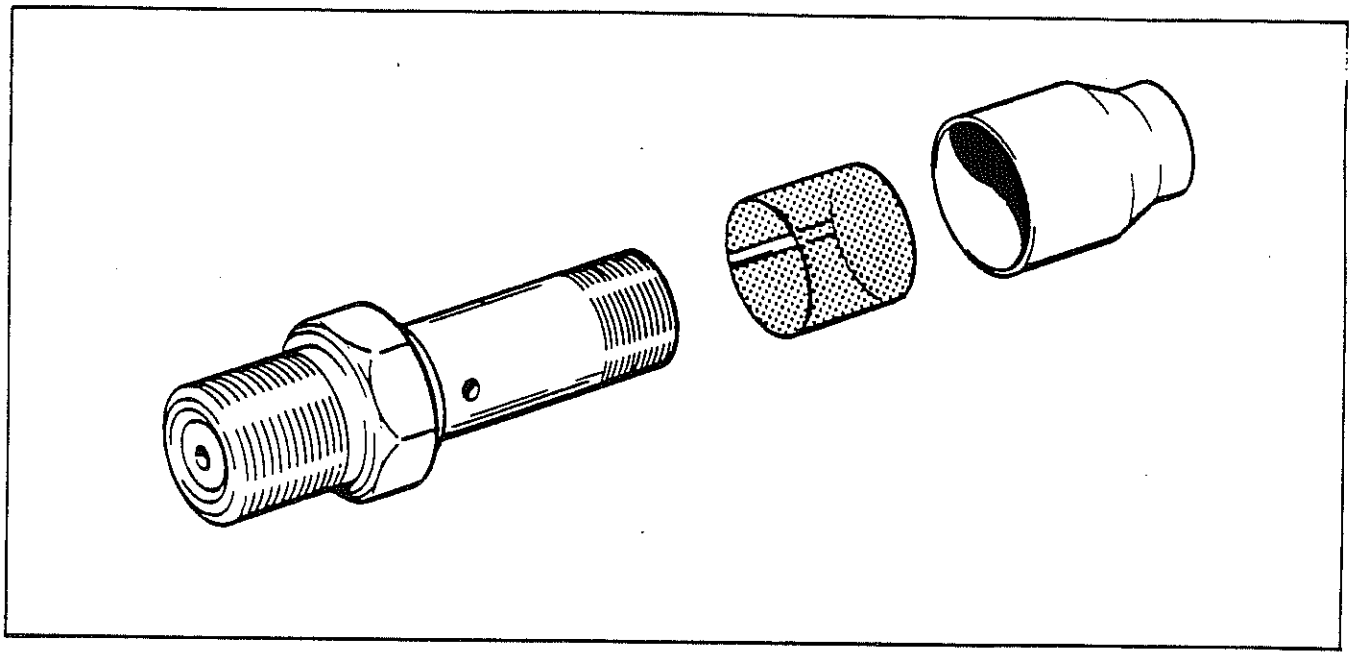
The same Bendix RSA-5AD-1 fuel injection system as used on the fuel injected normally aspirated engines is utilized on the 260 Turbocharged model. The injector nozzles and the flow divider are referenced to deck pressure instead of the atmosphere to maintain correct reference.




TURBOCHARGER SYSTEM

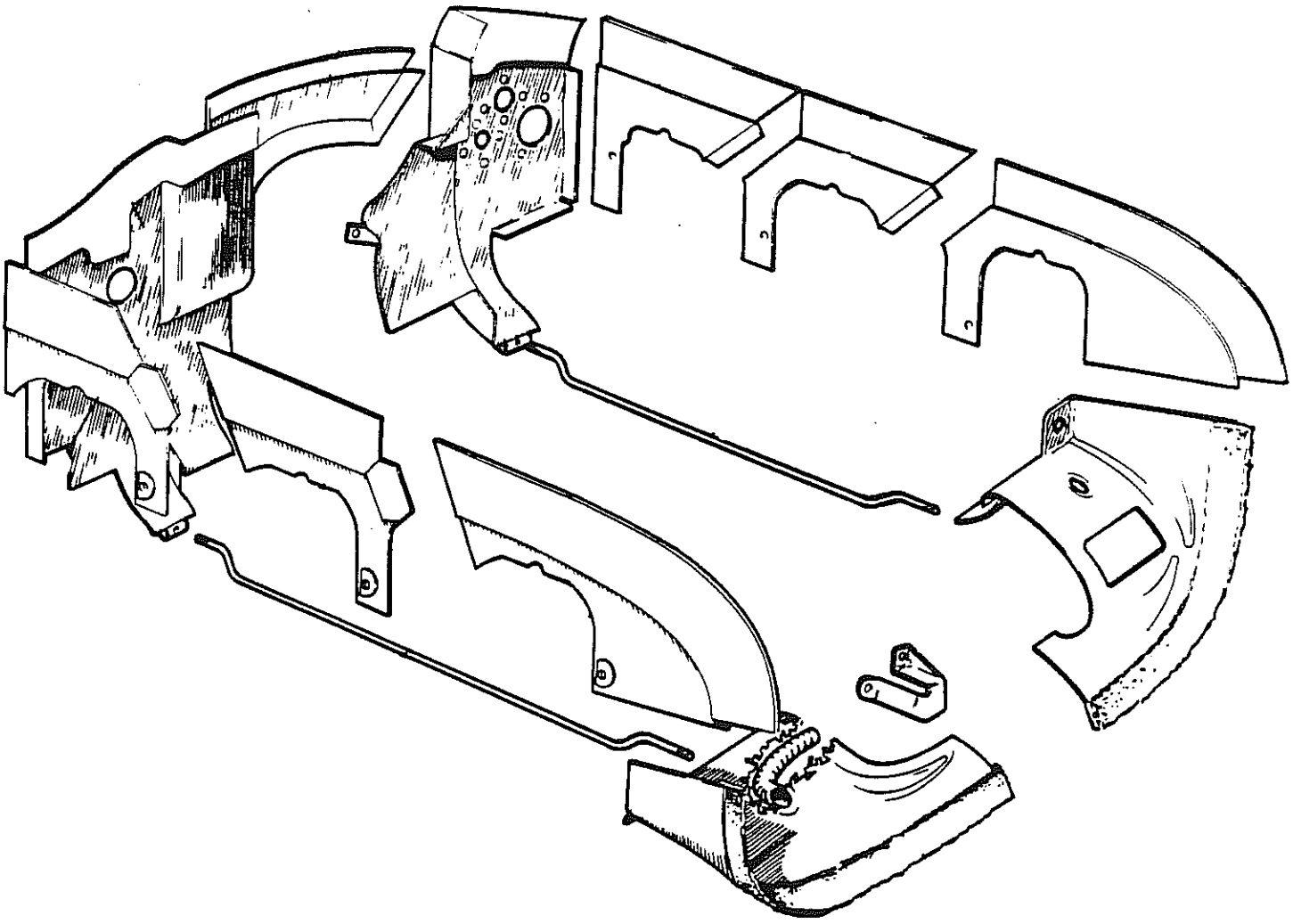
FIGURE 5-1





FUEL AIR BLEED NOZZLE

FIGURE 5-2



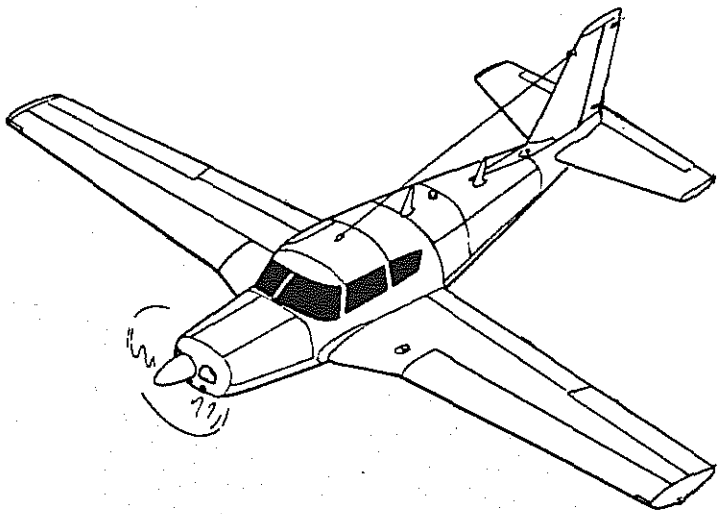
ENGINE BAFFLE INSTALLATION

FIGURE 5-3

# Comanche

## CHAPTER 6

# ELECTRICAL



# PA-24 COMANCHE

## ELECTRICAL SYSTEM

## CHAPTER 6

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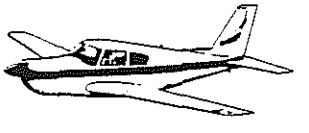


# PA-24 COMANCHE

# ELECTRICAL SYSTEM

# CHAPTER 6

## INTRODUCTION

Electrical power for the Comanche is supplied by a 12-volt, direct current, single wire, negative ground electrical system. A 12-volt battery is incorporated in the system to furnish power for starting and a reserve power source in case of generator or alternator failure. An external power receptacle can be provided as optional equipment in the fuselage to permit the use of an external power source for cold weather starting.

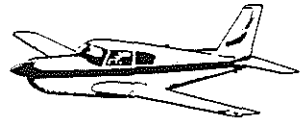
## ELECTRICAL SYSTEMS

On the PA-24-180 and Pa-24-250 models, a 35-ampere or 50-ampere generator is installed. With the generator is a regulator assembly, composed of a voltage regulator and current regulator to prevent overloading of the battery electrical circuits. Also, with the regulator is a reverse current cutout to prevent the generator from being motorized by the battery when the generator output drops below the battery voltage.

On the PA-24-260 and PA-24-400 models, a 70 ampere alternator is installed. It is controlled by a voltage regulator within the field circuit to control field voltage. Also, in the field circuit is a 5-ampere thermal circuit breaker, master switch, radio noise filter and an over-voltage relay.

The generator or alternator is located on the front lower right side of the engine and utilizes a belt drive from the engine crankshaft. The generator voltage regulator is located on the engine firewall and the alternator voltage regulator and relay is located within the aft section of the fuselage.

Electrical switches are located on the left lower side of the instrument panel. Circuit breakers for the individual circuits are mounted in a cluster below the left side of the instrument panel.



PA-24 COMANCHE

ELECTRICAL SYSTEM

CAUTION

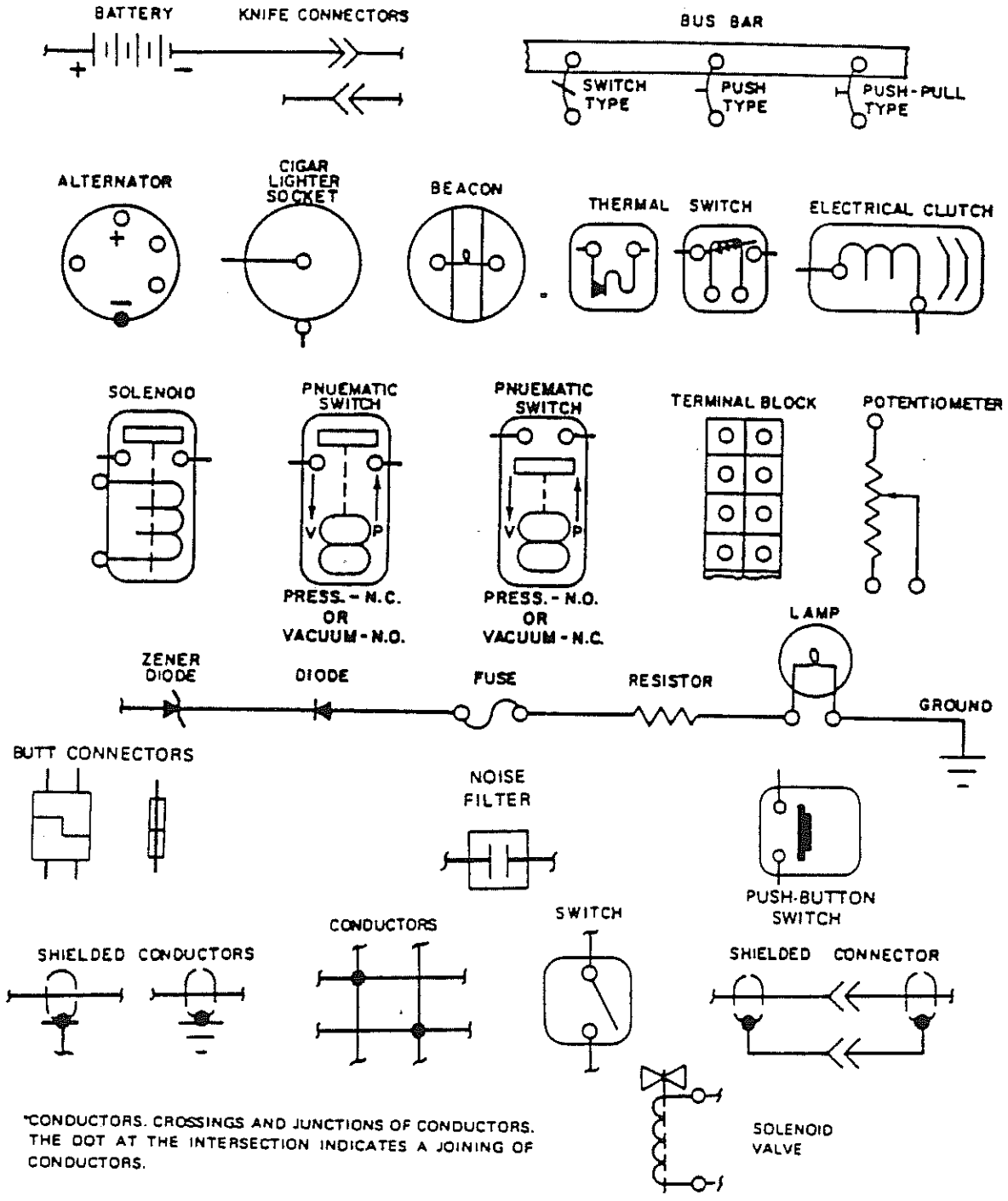
The alternator circuit breaker should not be opened under any circumstances, other than an emergency, while the engine is running.

Standard lighting on the Comanche are navigation lights, landing lights, cockpit light and instrument lighting. As optional equipment, a rotating beacon and individual instrument lights are available.

CAUTION

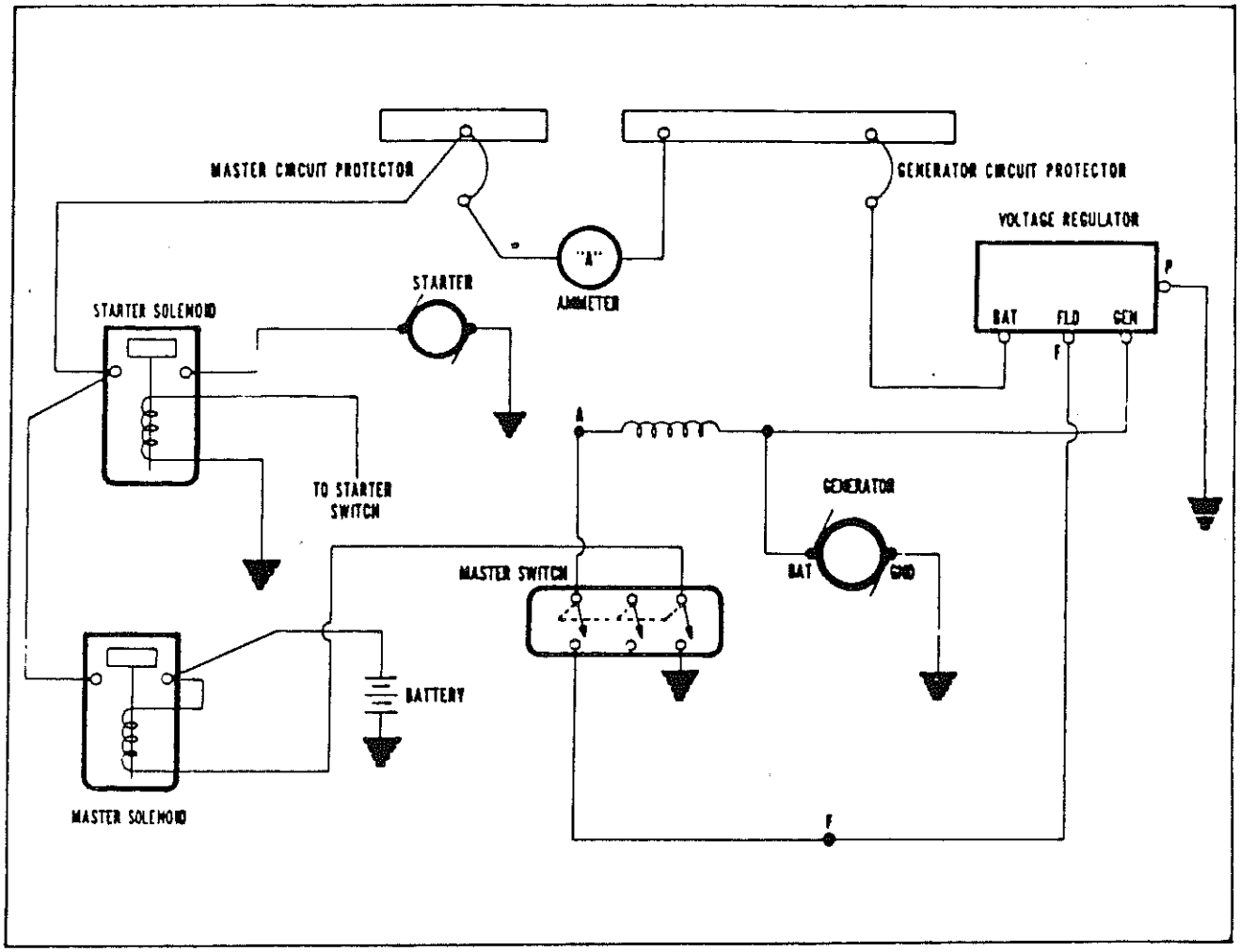
The landing gear position indicating lights are dimmed when the navigation lights are on.

An ammeter is installed on the instrument panel to indicate battery charge/discharge current.




ELECTRICAL SYMBOLS

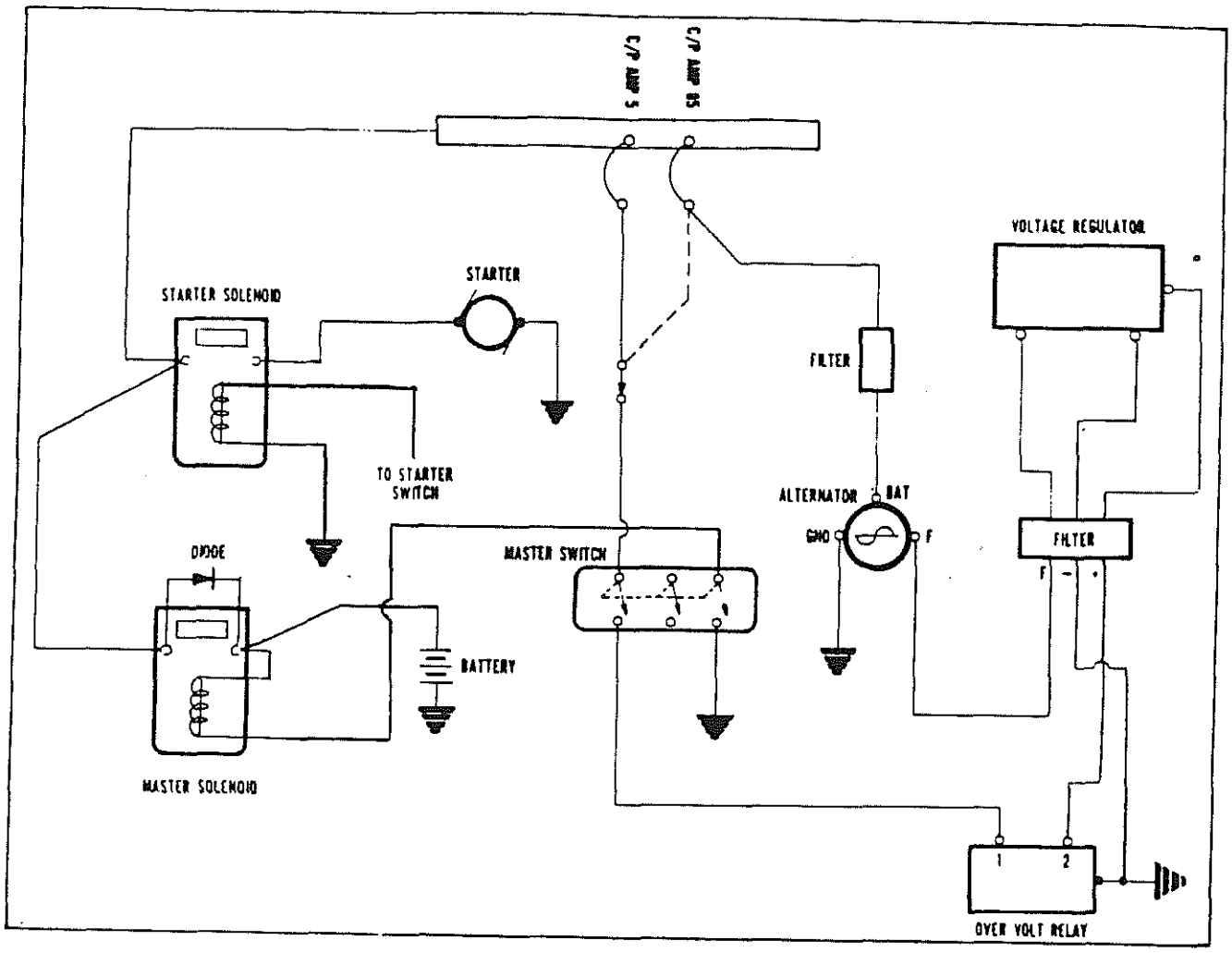
FIGURE 6-1




GENERATOR AND STARTER WIRING SYSTEM

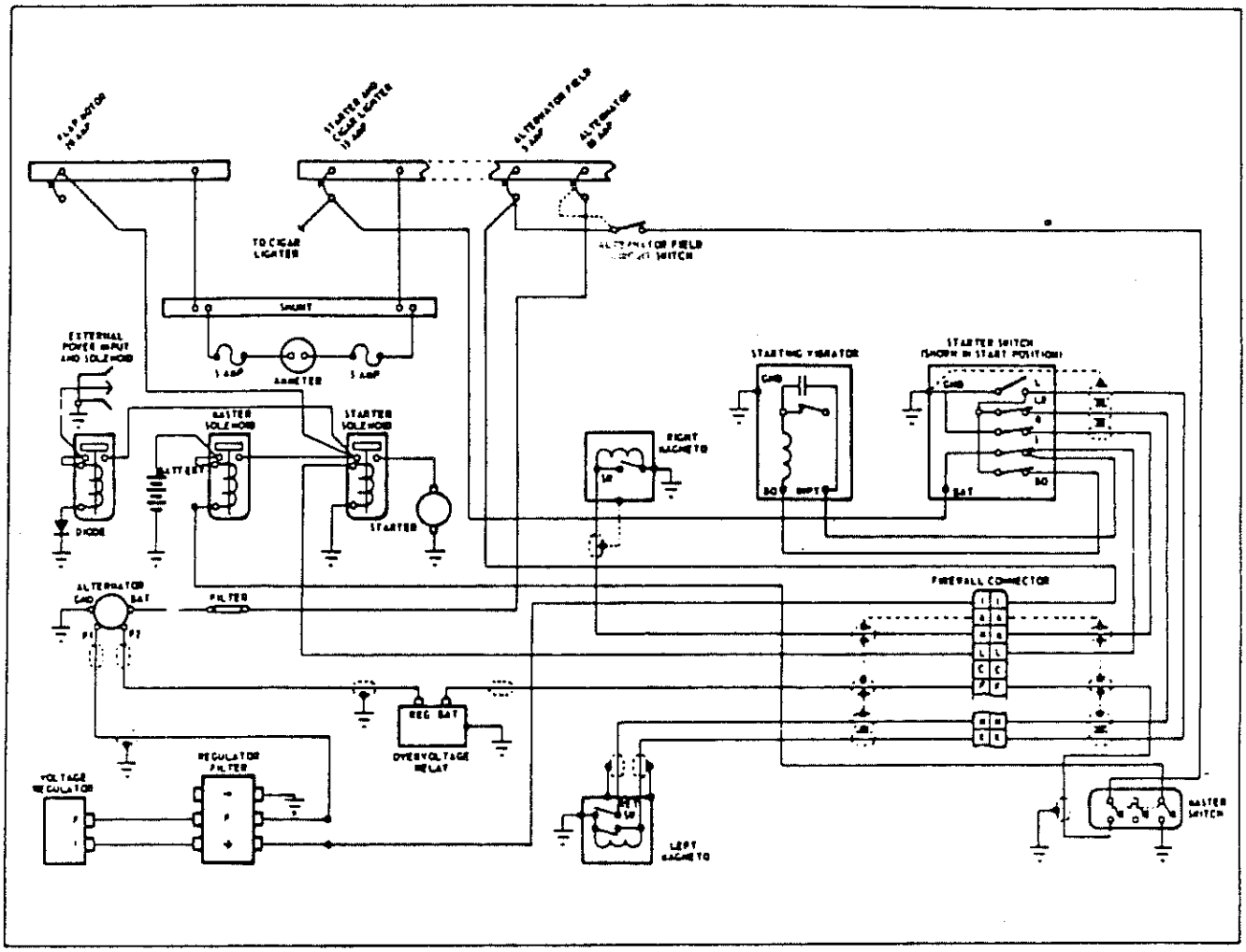
FIGURE 6-2






ALTERNATOR AND STARTER WIRING SYSTEM
DELCO-REMY

FIGURE 6-3




ALTERNATOR AND STARTER WIRING SYSTEM

PRESTOLITE

FIGURE 6-4

| HYDROMETER READINGS | PERCENT OF CHARGE |
|---|---|
| 1280 | 100 |
| 1250 | 75 |
| 1220 | 50 |
| 1190 | 25 |
| 1160 | Very Little Useful Capacity |
| 1130 or Below | Discharged |

HYDROMETER READING AND BATTERY DISCHARGE PERCENT

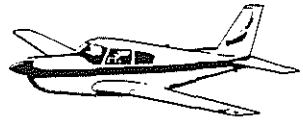
FIGURE 6-5

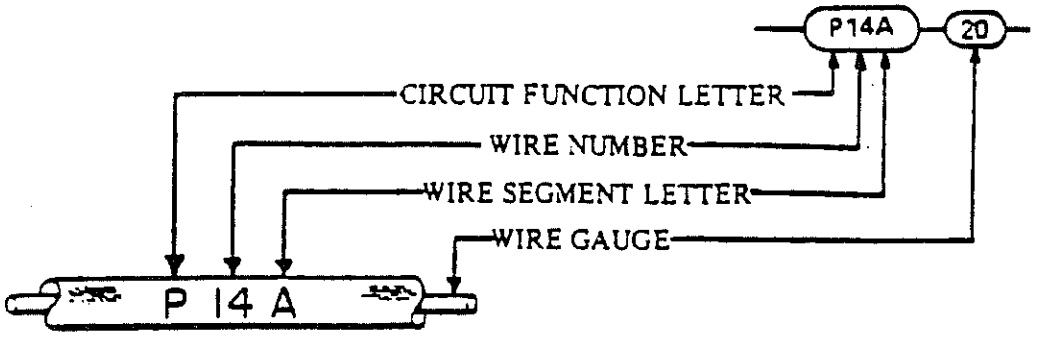
---

| WIDTH OF BELT | CONDITION | TORQUE INDICATED AT GENERATOR/ALTERNATOR PULLY |
|---|---|---|
| 3/8 Inch | New | 11 to 13 ft. lbs. |
| 3/8 Inch | Used | 7 to 9 ft. lbs. |
| 1/2 Inch | New | 13 to 15 ft. lbs. |
| 1/2 Inch | Used | 9 to 11 ft. lbs. |

GENERATOR/ALTERNATOR BELT TENSION

FIGURE 6-6

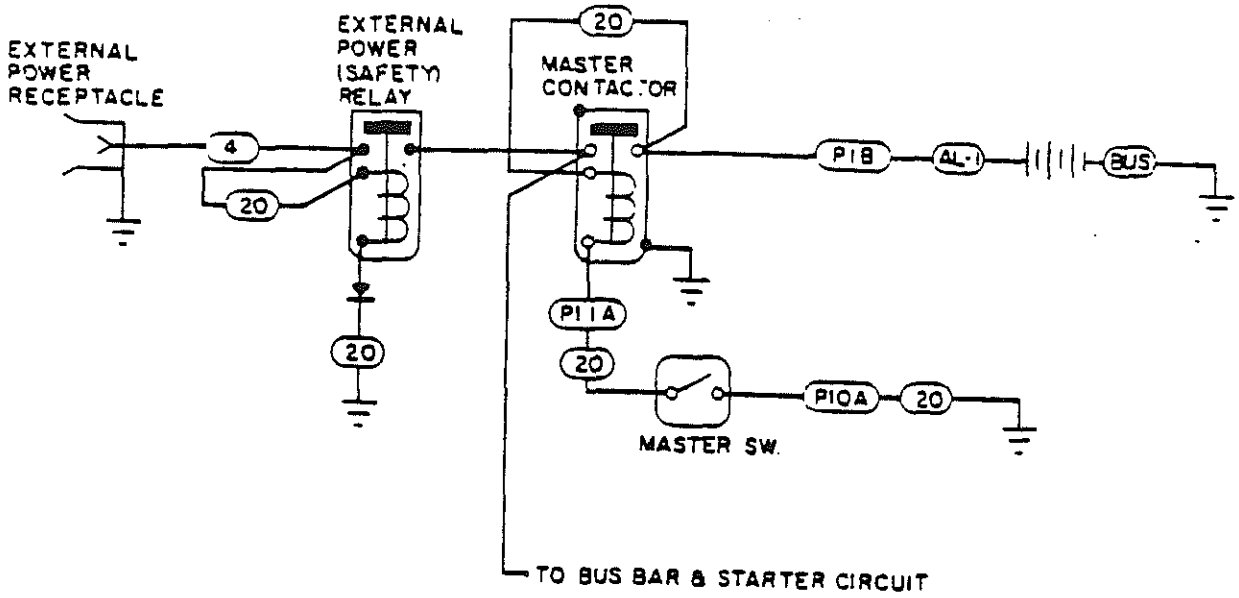





| CIRCUIT IDENTIFICATION | CIRCUITS |
|---|---|
| A | AUTOMATIC CONTROLS |
| C | CONTROL SURFACE |
| E | ENGINE INSTRUMENT |
| F | FLIGHT INSTRUMENTS |
| G | LANDING GEAR SYSTEM |
| H | HEATER, VENTILATING |
| J | IGNITION SYSTEM |
| L | LIGHTING SYSTEM |
| M | CIGAR LIGHTER |
| P | PRIMARY POWER |
| PF | ALTERNATOR FIELD |
| Q | FUEL AND OIL |
| RG | RADIO GROUND |
| RP | RADIO POWER |
| RZ | RADIO AUDIO AND INTERPHONE |

ELECTRICAL WIRE CODING

FIGURE 6-7



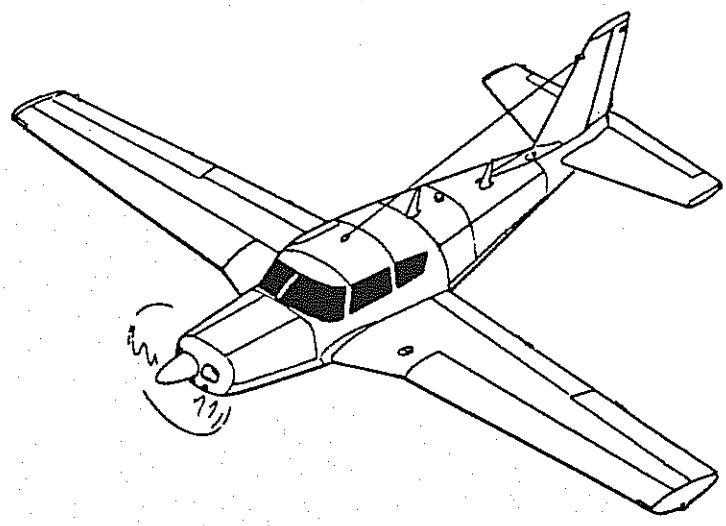

EXTERNAL POWER SUPPLY SCHEMATIC

FIGURE 6-8

Comanche

## CHAPTER 7

# PITOT/STATIC AND VACUUM SYSTEM



# PA-24 COMANCHE

## PITOT/STATIC - VACUUM SYSTEMS

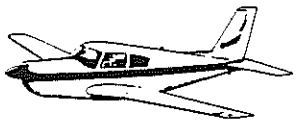
## CHAPTER 7

## CONTENTS



## ILLUSTRATIONS





PA-24 COMANCHE

PITOT/STATIC - VACUUM SYSTEMS

CHAPTER 7

## PITOT/STATIC SYSTEM

The system supplies both pitot and static pressure for the airspeed indicator, altimeter, and the vertical speed indicator.

Pitot pressure is picked up by the pitot tube installed on the bottom of the left wing and carried through lines within the wing and fuselage to the airspeed indicator on the instrument panel.

The static air is supplied from a port on both sides of the aft fuselage, connected through a "T" arrangement, to the airspeed, altimeter and rate of climb instruments on the instrument panel. The "T" arrangement minimizes any erroneous readings when the aircraft is in un-coordinated flight.

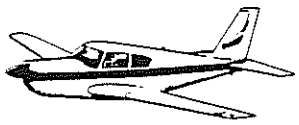
An alternate static source is available as optional equipment. When installed, the control valve is located below the left side of the instrument panel. When the valve is set in the alternate position, the altimeter, vertical speed indicator and airspeed indicator will be using cabin air for static pressure. Normally, airspeed and altitude will read higher when using alternate air.

A heated pitot tube, which alleviates problems with icing and heavy rain, is available as optional equipment. The switch for pitot heat is located on the electrical switch panel in front of the pilot.

To prevent bugs and/or water from entering the pitot tube, a cover should be placed over the tube when the aircraft is parked. A partially or completely blocked pitot tube will give erratic or zero readings on the airspeed indicator.

**NOTE**

DURING PREFLIGHT, BE SURE THE PITOT COVER IS REMOVED.



# PA-24 COMANCHE

## PITOT/STATIC - VACUUM SYSTEMS

### VACUUM SYSTEM

The vacuum system operates the air driver gyro instruments. This system consists of an engine-driven vacuum pump, a vacuum regulator, a filter, a vacuum gauge, the necessary plumbing and when installed, the directional and attitude indicator instruments.

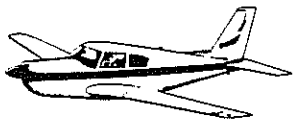
The vacuum pump on early Comanches is the wet type while later models use the dry type pump. A shear drive protects the engine from damage when the dry pump is used in case of pump failure. The gyros also become inoperative when the pump fails.

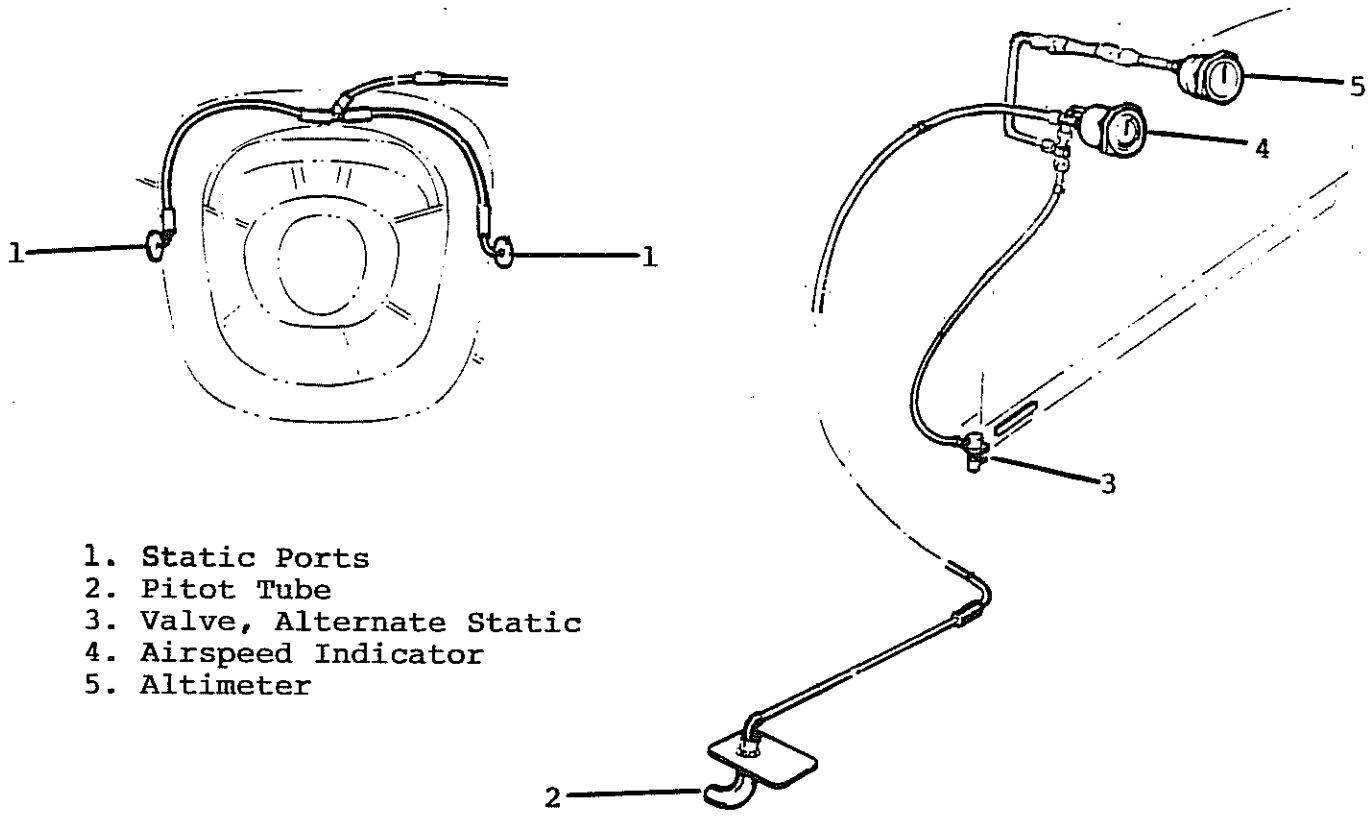
The vacuum gauge, mounted on the instrument panel provides valuable information to the pilot about the operation of the vacuum system. A decrease in pressure in a system that has remained constant over an extended period may indicate a dirty filter, dirty screens, possible a sticking vacuum regulator or leak in the system. Zero pressure would indicate a sheared pump drive, defective pump, possible a defective gauge or collapsed line. In the event of any gauge variation from the norm, the pilot should have a mechanic check the system to prevent possible damage to the system components or eventual failure of the system.

A vacuum regulator is provided in the system to protect the gyros. The valve is set so the normal vacuum reads 4.2 to 4.7 inches of mercury, a setting which provides sufficient vacuum to operate all the gyros at their rated RPM. Units with a central air filter system should be adjusted to indicate between 4.8 and 5.1 inches of mercury. Higher settings will damage the gyros, and with a low setting the gyros will be unreliable. The regulator is located in the engine compartment.

A kit (754356) is available to convert any wet vacuum system to a dry system.



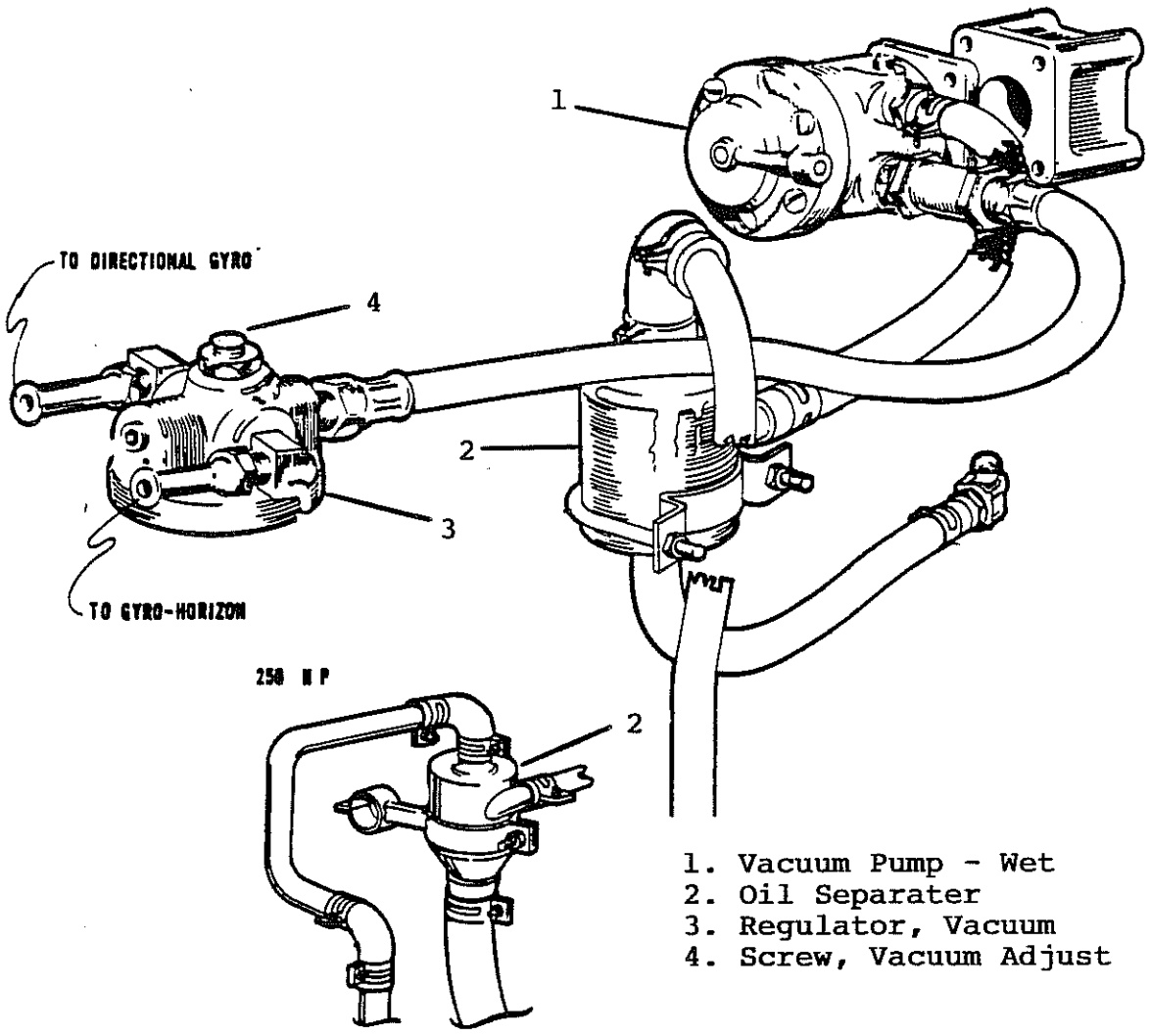





1. Static Ports
2. Pitot Tube
3. Valve, Alternate Static
4. Airspeed Indicator
5. Altimeter

PITOT/STATIC SYSTEM PA-24

FIGURE 7-1

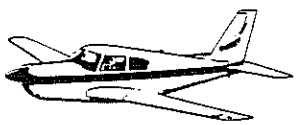


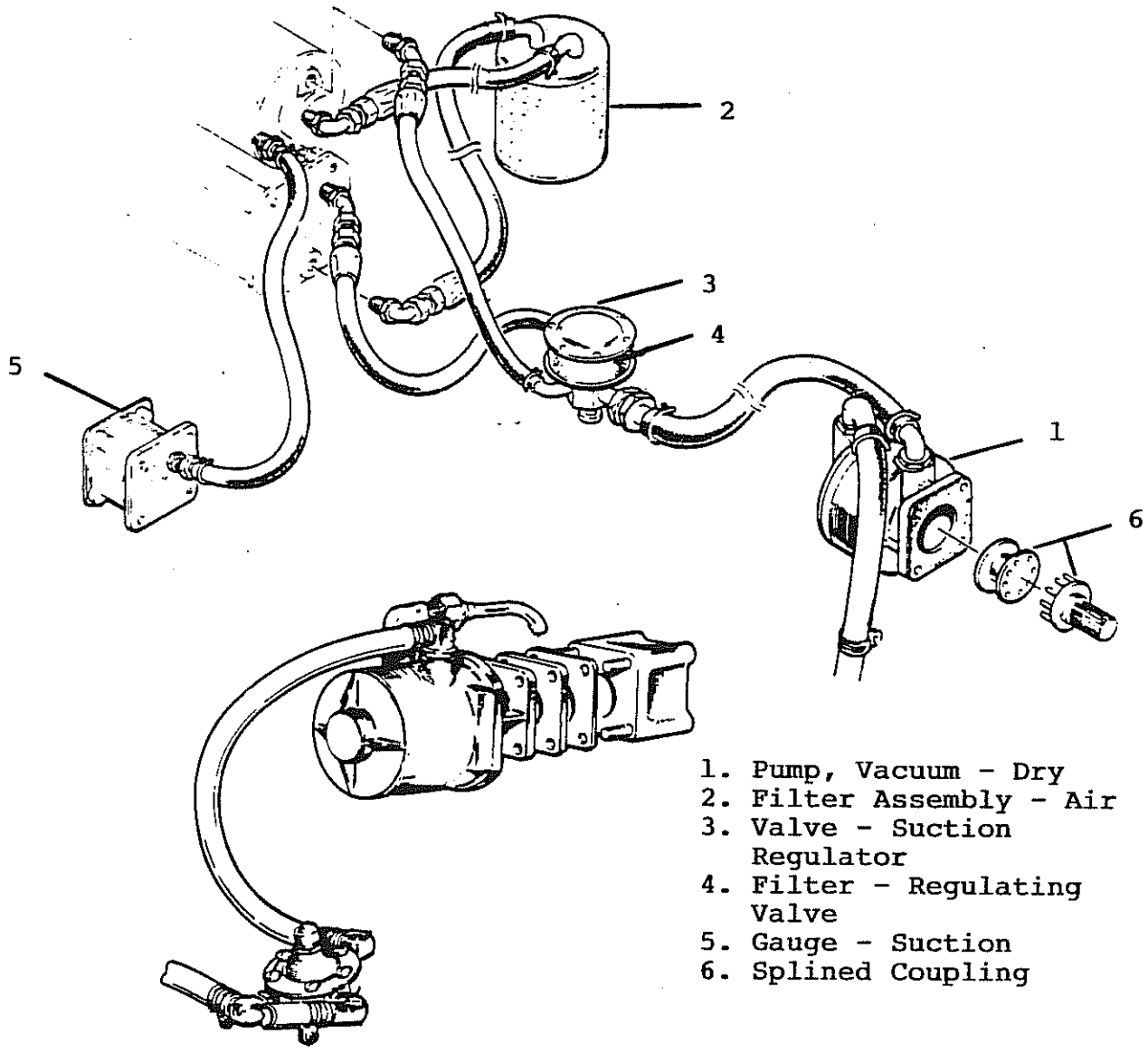

1. Vacuum Pump - Wet
2. Oil Separater
3. Regulator, Vacuum
4. Screw, Vacuum Adjust

GYRO VACUUM SYSTEM - WET

FIGURE 7-2








1. Pump, Vacuum - Dry
2. Filter Assembly - Air
3. Valve - Suction Regulator
4. Filter - Regulating Valve
5. Gauge - Suction
6. Splined Coupling

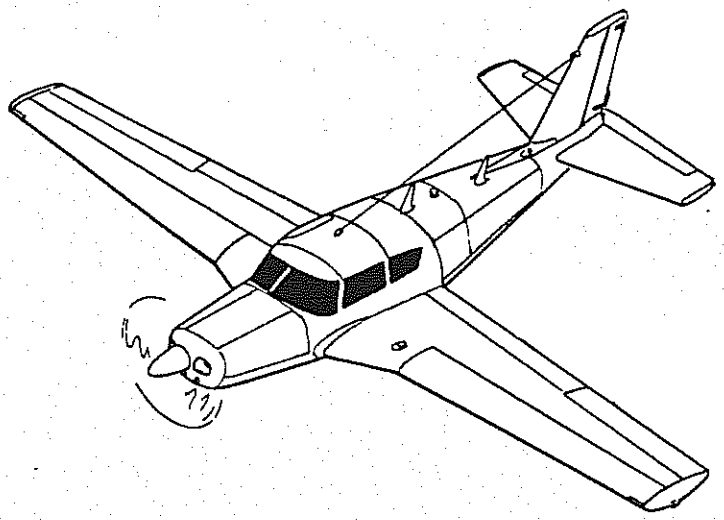
GYRO VACUUM SYSTEM - DRY

FIGURE 7-3

Comanche

# CHAPTER 8

# ENVIRONMENTAL SYSTEM



# PA-24 COMANCHE

## ENVIRONMENTAL SYSTEMS

## CHAPTER 8

## CONTENTS



## ILLUSTRATIONS



# PA-24 COMANCHE

## ENVIRONMENTAL SYSTEMS

## CHAPTER 8

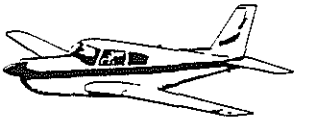
### HEATING SYSTEM

Heat for the cabin of the Comanche is provided by a hot air exchanger installed on the exhaust muffler. On the PA-24-180 and PA-24-250, fresh air enters the engine compartment through the upper portion of the nose cowling, passes over the engine and is vented to the heater muff through a flexible hose located on the baffling at the rear of the engine. On the PA-24-260 and PA-24-400, air enters through the lower portion of the nose cowl and is directed through flexible hoses to the muffler shroud. The air is then heated and vented into the cabin area through a valve which can be controlled from the instrument panel. When the valve is completely closed off, the heated air is vented back into the engine compartment. The heater outlet in the cabin is located at the top of the nose wheel housing on early PA-24-180 and PA-24-250 models and along each side of the fuselage on late PA-24-180 and PA-24-250 as well as all PA-24-260 and Pa-24-400 aircraft. Control for the heater system is located on the right panel, below the instruments. The windshield is kept clear of frost, ice and etc. by a defroster system which operates from the heater muff, but has an individual control.

### VENTILATING SYSTEM

Fresh air for early PA-24-180 and PA-24-250 models is supplied to the cabin by adjustable ventilators located beside each seat, and one larger ventilator located under the instrument panel on the left side of the cabin.

For the late PA-24-180 and PA-24-250 aircraft, fresh air is supplied by ventilators located beside each seat and an air intake located at the top of the fuselage directing air through individual overhead outlets.



PA-24 COMANCHE

ENVIRONMENTAL SYSTEMS

VENTILATING SYSTEM (Continued)

On the PA-24-260 and PA-24-400 , fresh air for the cabin interior is picked up from two air inlets in the leading edge of each wing. The air passes through the wings to the wing root area and is discharged into the cabin near the floor just forward of the front seats. In addition, two fresh air scoops are located on the dorsal fin. These provide air for two overhead ventilators in the rear seat area and two front seat ventilators located between the windshield posts and the instrument panel.

HEATER MAINTENANCE

If a crack or other defect should occur in the exhaust muffler, carbon monoxide fumes may be discharged into the cabin area. Make sure that your exhaust and heater system is properly maintained.

CAUTION

If any exhaust gases are smelled in the cabin, turn off all heat and open fresh air vents to insure proper ventilation.

OXYGEN SYSTEM

A fixed oxygen system to provide supplementary oxygen for the pilot and passengers during high altitude flights (above 10,000 feet is recommended) was available as optional equipment. The major components of the system are a 63 cubic foot, 3AA 1800 oxygen cylinder, an oxygen pressure gauge, an ON-OFF flow control knob, a pressure regulator and four or six plug-in receptacles and oxygen masks.

WARNING

Positively **NO SMOKING** while oxygen is being used by anyone in the aircraft.

PA-24 COMANCHE

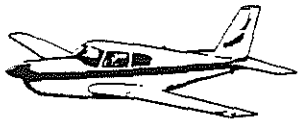
ENVIRONMENTAL SYSTEMS

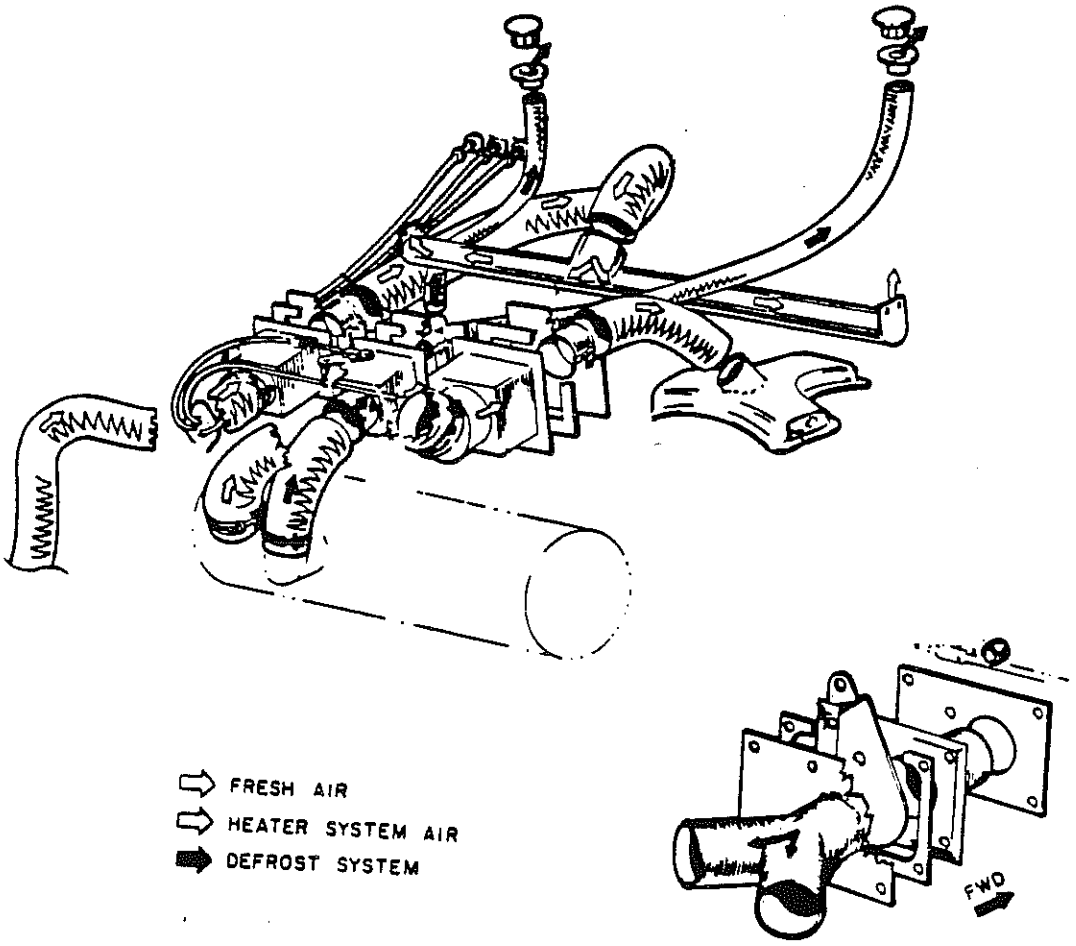
To use the oxygen system, masks should be plugged into their respective outlets, the OXYGEN control should be pulled and the masks placed over the face. The red flow indicator should disappear in each mask supply hose. This indicates that oxygen is flowing to the individual mask.

To stop the system, the OXYGEN control should be pushed in. Leave the mask supply hoses connected for approximately three minutes to purge the system.

To preclude the possibility of fire during oxygen use, oil, grease, paint, hydraulic fluid, lipstick or any other flammable material should be kept away from oxygen equipment.

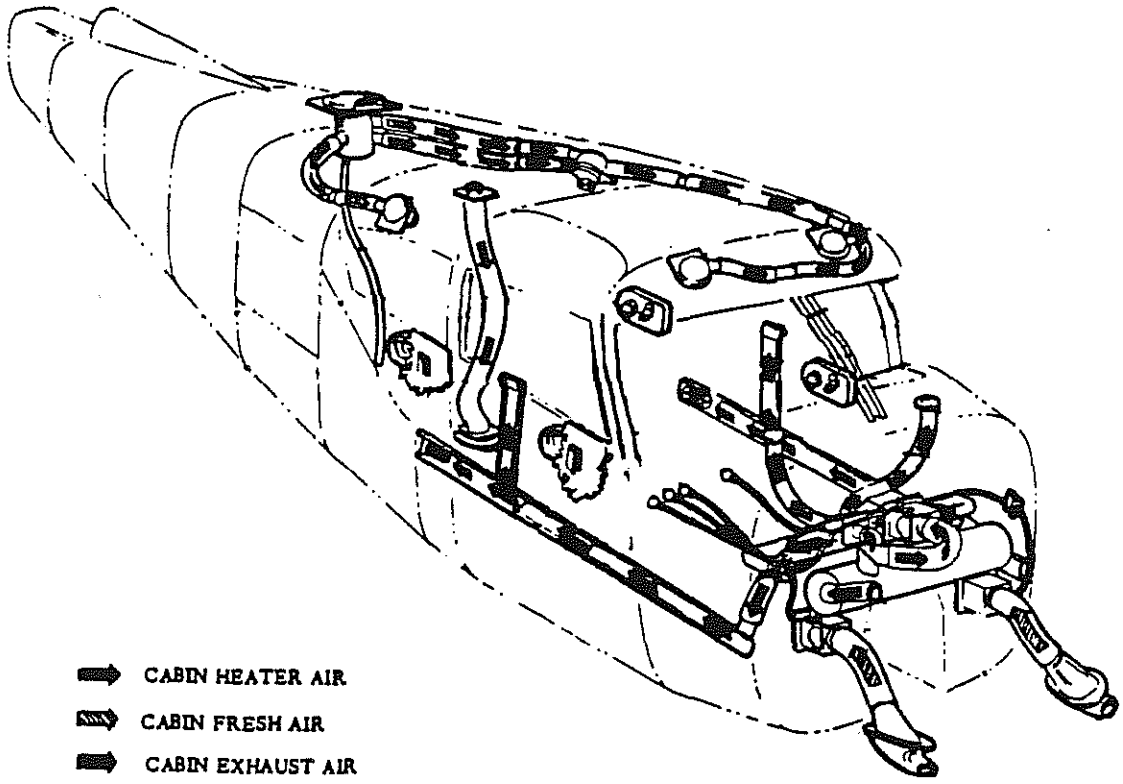
Oxygen cylinders must be hydrostatically tested at the end of each five year period and only oxygen approved for aviation use should be used.





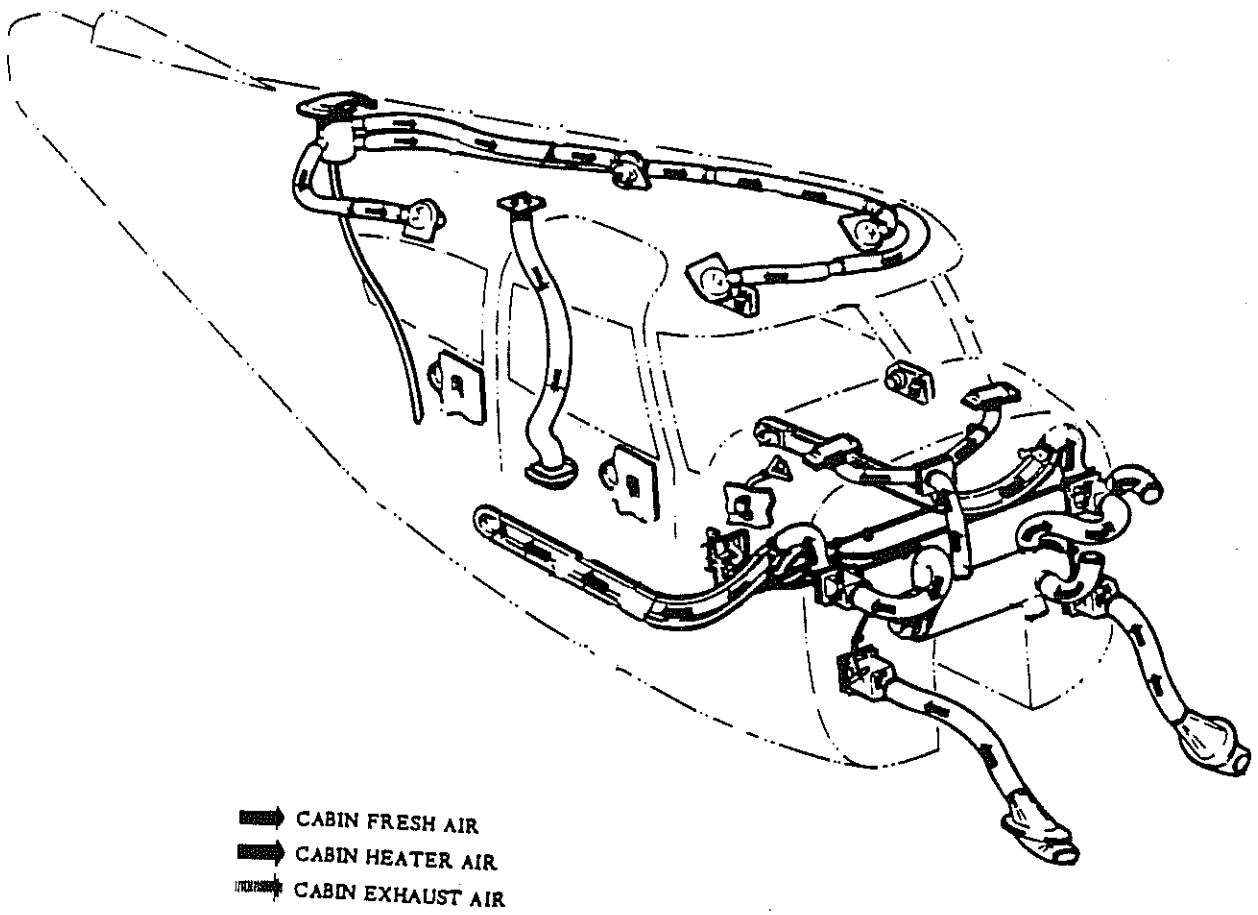

CHABIN HEAT, DEFROSTER AND FRESH AIR
PA-24-1 THROUGH PA-24-1251

FIGURE 8-1



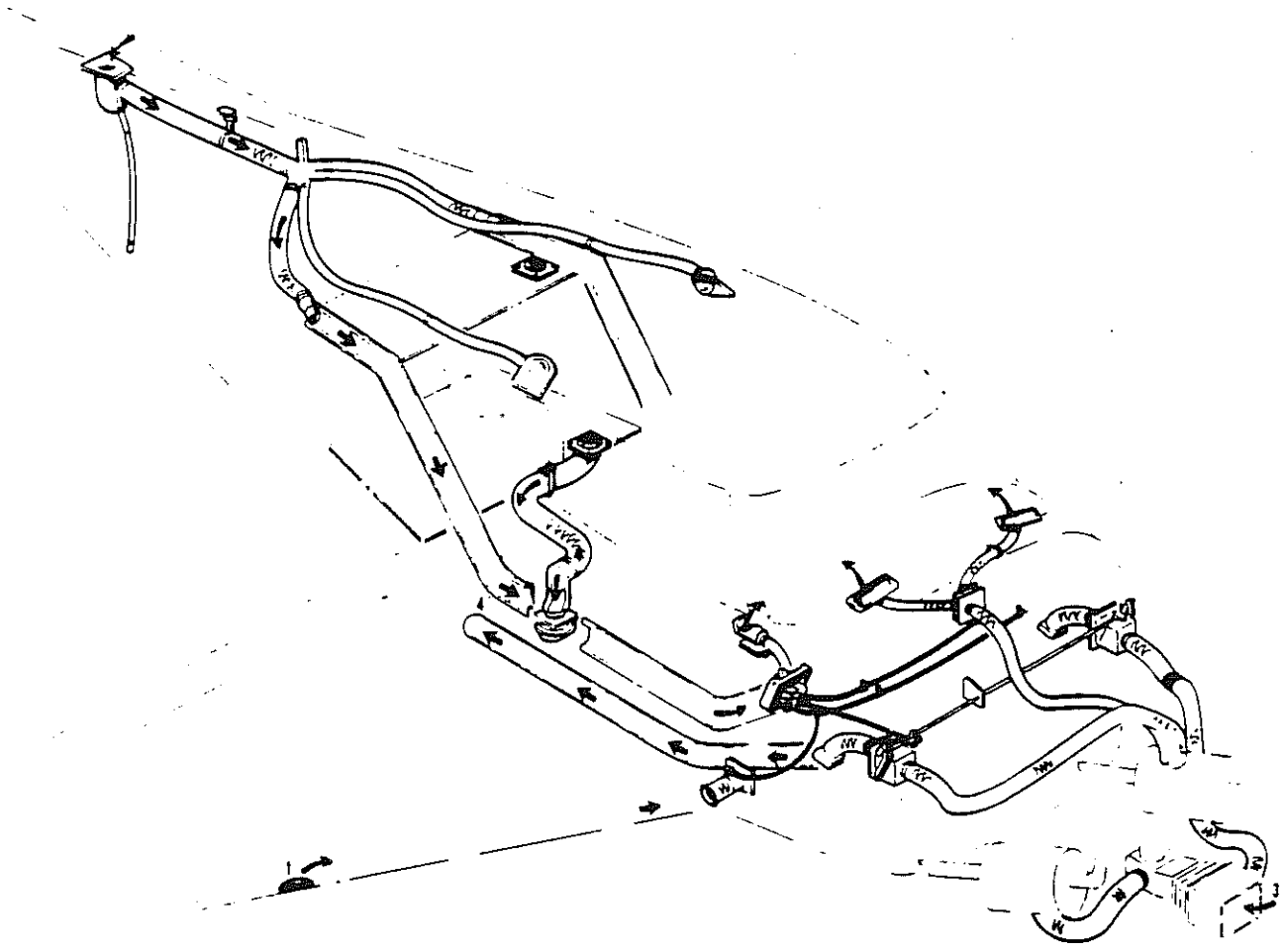

CABIN HEATER, DEFROSTER AND FRESH AIR SYSTEM
PA-24-1252 THROUGH PA-24-2298

FIGURE 8-2



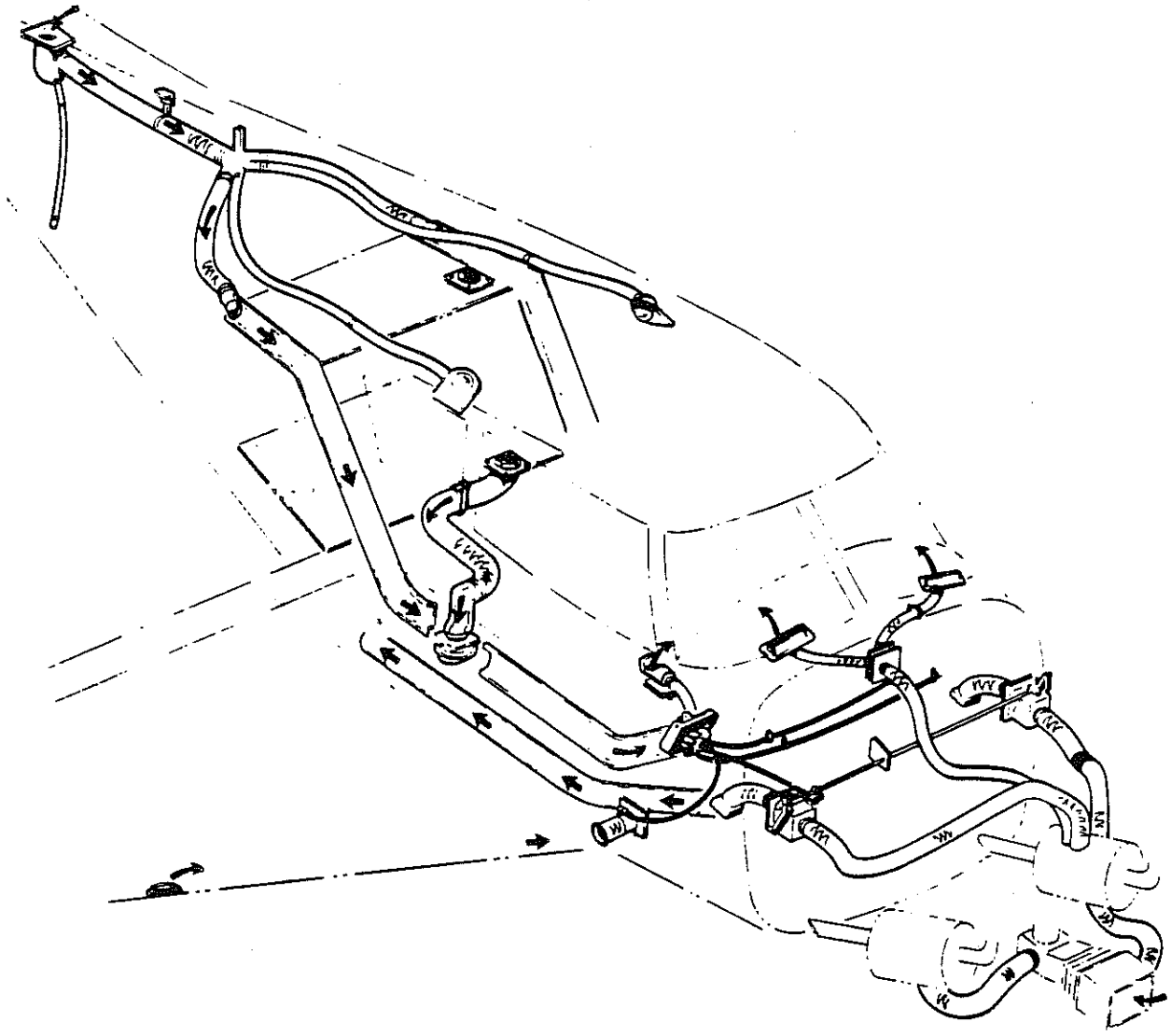

CABIN HEATER, DEFROSTER AND FRESH AIR SYSTEM
PA-24-180 AND 250, SERIAL NUMBERS PA-24-2299 AND UP

FIGURE 8-3



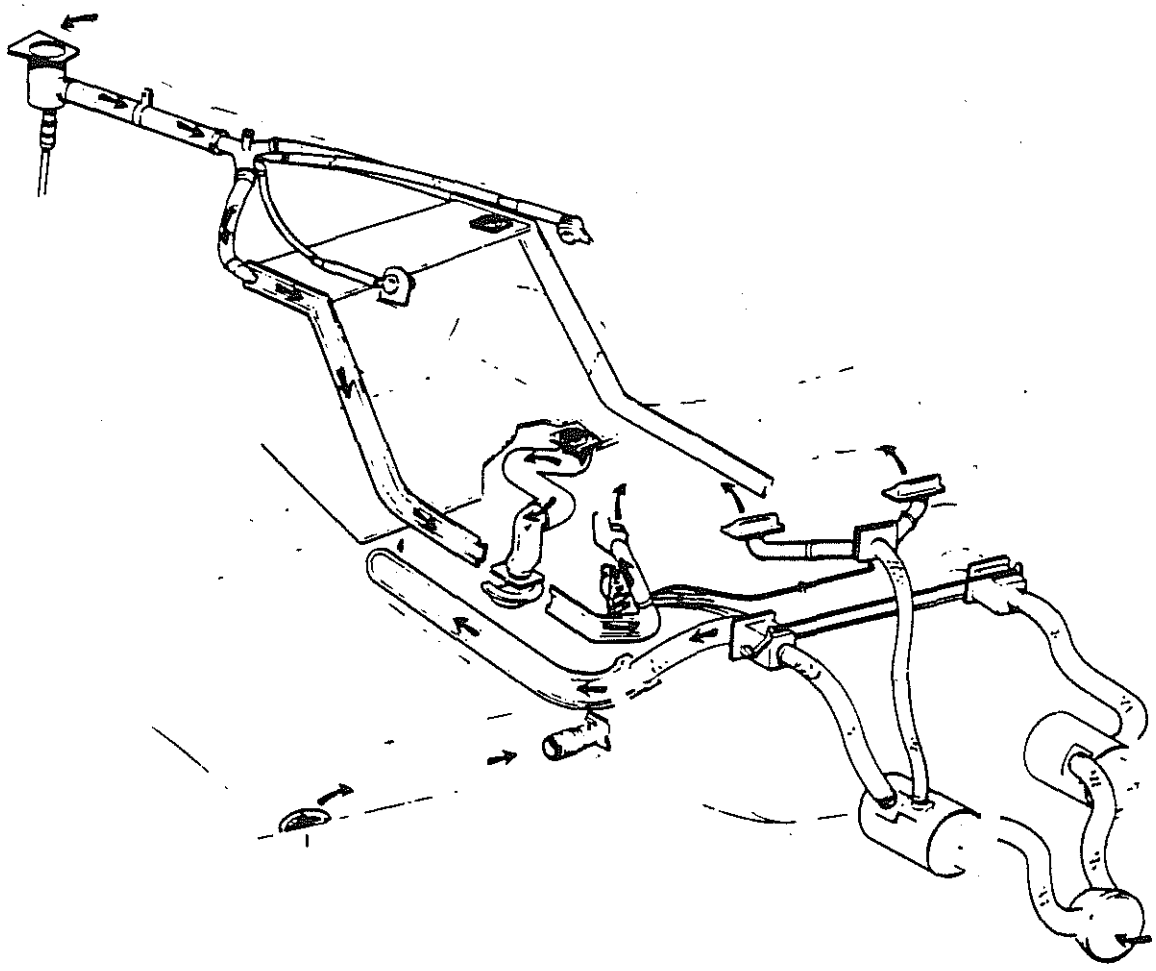
CABIN HEATER, DEFROSTER AND FRESH AIR SYSTEM
PA-24-260, 24-4000 TO 24-4246, 24-4248 TO 4299

FIGURE 8-4



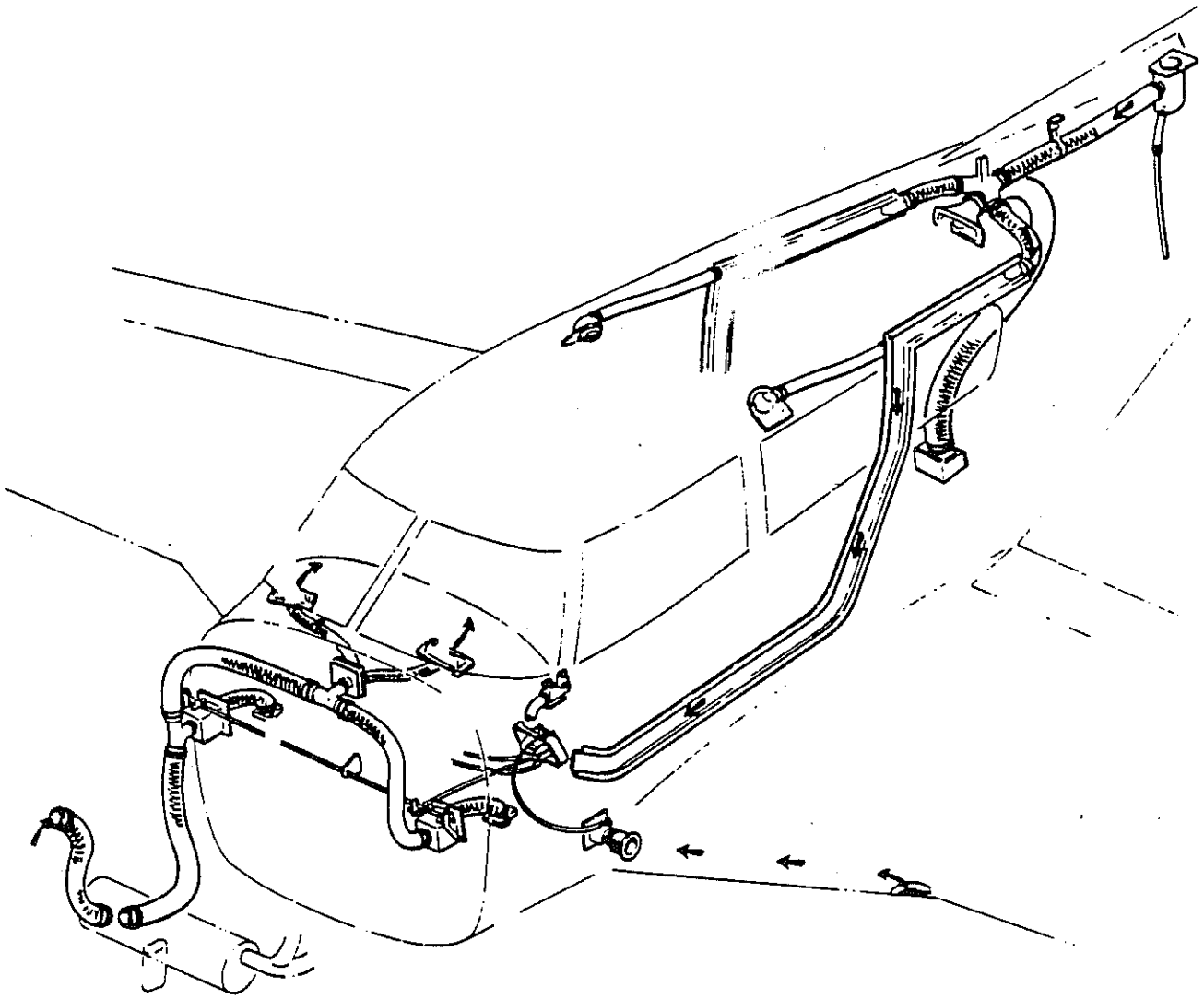
CABIN HEATER, DEFROSTER AND FRESH AIR SYSTEM
PA-24-260, 24-4247, 24-4300 TO 24-4782 AND
24-4784 TO 24-4803 INCLUSIVE

FIGURE 8-5



CABIN HEATER, DEFROSTER AND FRESH AIR SYSTEM
PA-24-400

FIGURE 8-6



CABIN HEATER, DEFROSTER AND FRESH AIR SYSTEM
PA-24-260 24-4783, 24-4804 AND UP

FIGURE 8-7

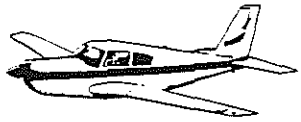
INDICATED OXYGEN CYLINDER PRESSURES

FOR GIVEN AMBIENT TEMPERATURES

| TEMPERATURE °F | INDICATED CYLINDER PRESS. PSI |
|---|---|
| 110 | 1980 |
| 100 | 1935 |
| 90 | 1890 |
| 80 | 1845 |
| 70 | 1800 |
| 60 | 1755 |
| 50 | 1710 |
| 40 | 1665 |

OXYGEN FILL PRESSURES

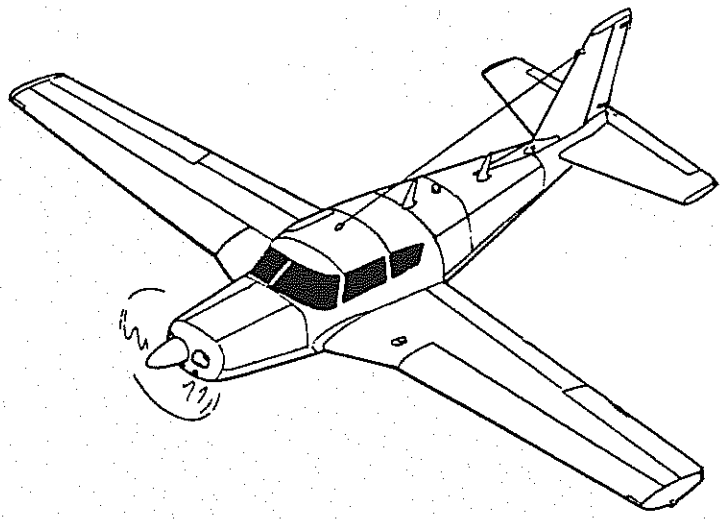
FIGURE 8-8



# Comanche

## CHAPTER 9

# WEIGHT & BALANCE



Comanche

# PA-24 COMANCHE

## WEIGHT AND BALANCE

## CHAPTER 9

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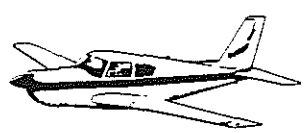
## ILLUSTRATIONS





# PA-24 COMANCHE

# WEIGHT AND BALANCE

# CHAPTER 9

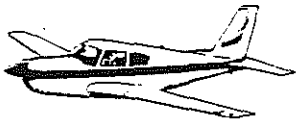
## INTRODUCTION

In order to achieve the performance and flying characteristics which are designed into the airplane, it must be flown with the weight and center of gravity (C.G.) within the approved operating range (envelope). Although the airplane offers a flexibility of loading, it cannot be flown with the maximum number of adult passengers, full fuel tanks and maximum baggage. With this loading flexibility comes responsibility. The pilot must insure that the airplane is loaded within the loading envelope before takeoff.

Misloading carries consequences for any aircraft. An overloaded airplane will not take off, climb or cruise as well as a properly loaded one. The heavier the airplane is loaded, the less climb performance it will have, and the higher the stall speed.

Center of gravity is a determining factor in flight characteristics. If the C.G. is too far forward in any airplane, it may be difficult to rotate for takeoff or landing. If the C.G. is too far aft, the airplane may rotate prematurely on takeoff or tend to pitch up during climb. Longitudinal stability will be reduced. This can lead to inadvertent stalls and even spins; and spin recovery becomes more difficult or impossible as the center of gravity moves aft of the approved limit. An aft C.G. (within limits) will generally mean a less stable, but faster airplane.

A properly loaded airplane, however, will perform as intended. Before the airplane is licensed, it is weighed, and a basic empty weight and C.G. location is computed (basic empty weight consists of the standard empty weight of the airplane plus the optional equipment). Using the basic empty weight and C.G. location, the pilot can easily determine the weight and C.G. position for the loaded airplane by computing the total weight and movement and then determining whether they are within the approved envelope.



## PA-24 COMANCHE

## WEIGHT AND BALANCE

The basic empty weight and C.G. location are recorded in the Weight and Balance Data Form and the Weight and Balance Record. The current values should always be used. Whenever new equipment is added or any modification work is done, the mechanic responsible for the work is required to compute a new basic empty weight and C.G. position and to write these in the Aircraft Log Book and the Weight and Balance Record. The owner should make sure that it is done.

A weight and balance calculation is necessary in determining how much fuel or baggage can be loaded so as to keep within allowable limits. Check calculations prior to adding fuel to insure against improper loading.

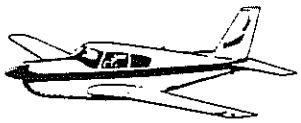
NOTE

The useful load includes usable fuel, oil, baggage, cargo and passengers. Following this is the method for computing takeoff weight and C.G.

### WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

(a) Add the weight of all items to be loaded to the basic empty weight.
(b) Use the arm as listed in weight and balance data to determine the moment of all items to be carried in the airplane.
(c) Add the moment of all items to be loaded to the basic empty weight moment.
(d) Divide the total moment by the total weight to determine the C.G. location.
(e) By using the figures in item (a) and item (d) above, locate a point of the C.G. range and weight graph. If the point falls within the C.G. envelope, the loading meets the weight and balance requirements for takeoff.





PA-24 COMANCHE

WEIGHT AND BALANCE

(f) Then estimate your fuel burn for the intended flight. Subtract the weight and moment to determine your landing C.G. and weight. If the C.G. is still within the C.G. envelope and your weight is less than 3,040 pounds, the aircraft meets all weight and balance requirements for the intended flight.

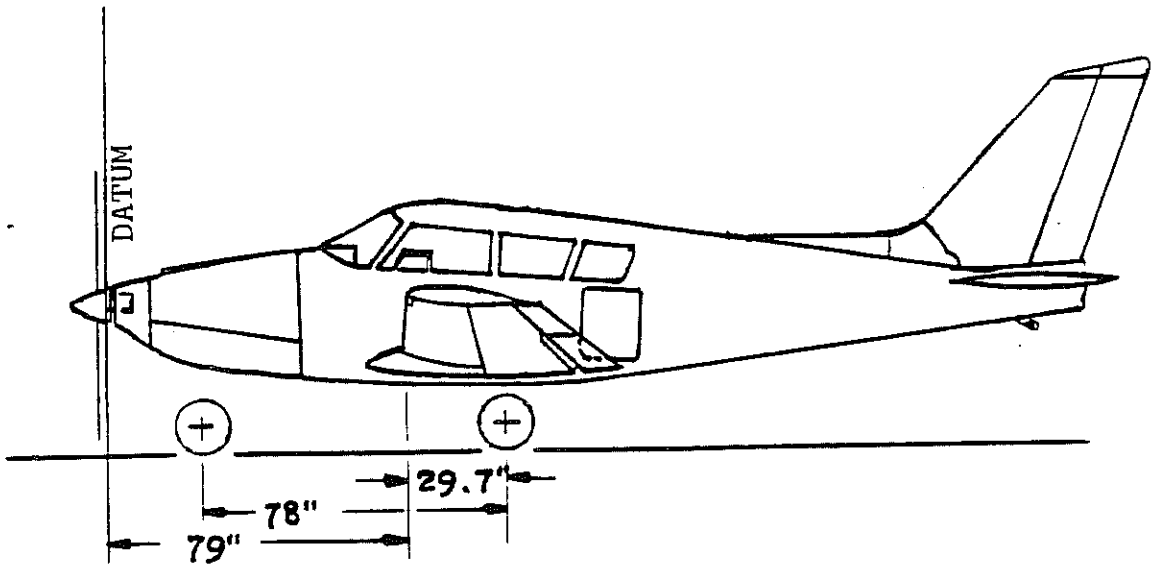
NOTE

It is the responsibility of the pilot and aircraft owner to insure that the airplane is loaded properly at all times.

ACTUAL WEIGHT AND BALANCE

MODEL PA-24-260

SERIAL NO. 24- IDENTIFICATION NO. N DATE:




Empty Weight as Weighed (Includes Items checked on Equipment List)

| | |
|---|---|
| Left Wheel | 765 |
| Right Wheel | 761 |
| Nose Wheel (N) | 463 |
| TOTAL (T) | 1989 |

LEVELING DIAGRAM

FIGURE 9-1

PA-24-260C

| | Weight (Lbs) | Arm Aft Datum (Inches) | Moment (In-Lbs) |
|---|---|---|---|
| Empty Weight | 1989 | 83.4 | 165883 |
| Pilot and Passenger (F seat) | | 84.8 | |
| Passenger/s 3rd and 4th Seat | | 120.5 | |
| Passenger/s - 5th and 6th Seat (Max 235 lbs) | | 148.0 | |
| Fuel (Inboard Tanks) 56 Gal | | 90.0 | |
| Fuel (Outboard Tanks) 30 Gal | | 95.0 | |
| Oil (3 Gal) | 23 | 28.0 | 644 |
| Baggage (Max 250 Lbs) | | 142.0 | |
| | | | |
| Takeoff Weight (3200 Lbs Max) | | | |

The center of gravity (C.G.) for the take-off weight of this sample loading problem is at inches aft of the datum line. Locate this point ( ) on the C.G. range and weight graph. If this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

| | | | |
|---|---|---|---|
| Takeoff Weight | | | |
| - Fuel Burn (Inboard) | | 90.0 | |
| - Fuel Burn (Outboard) | | 95.0 | |
| Landing Weight (3040 Max) | | | |

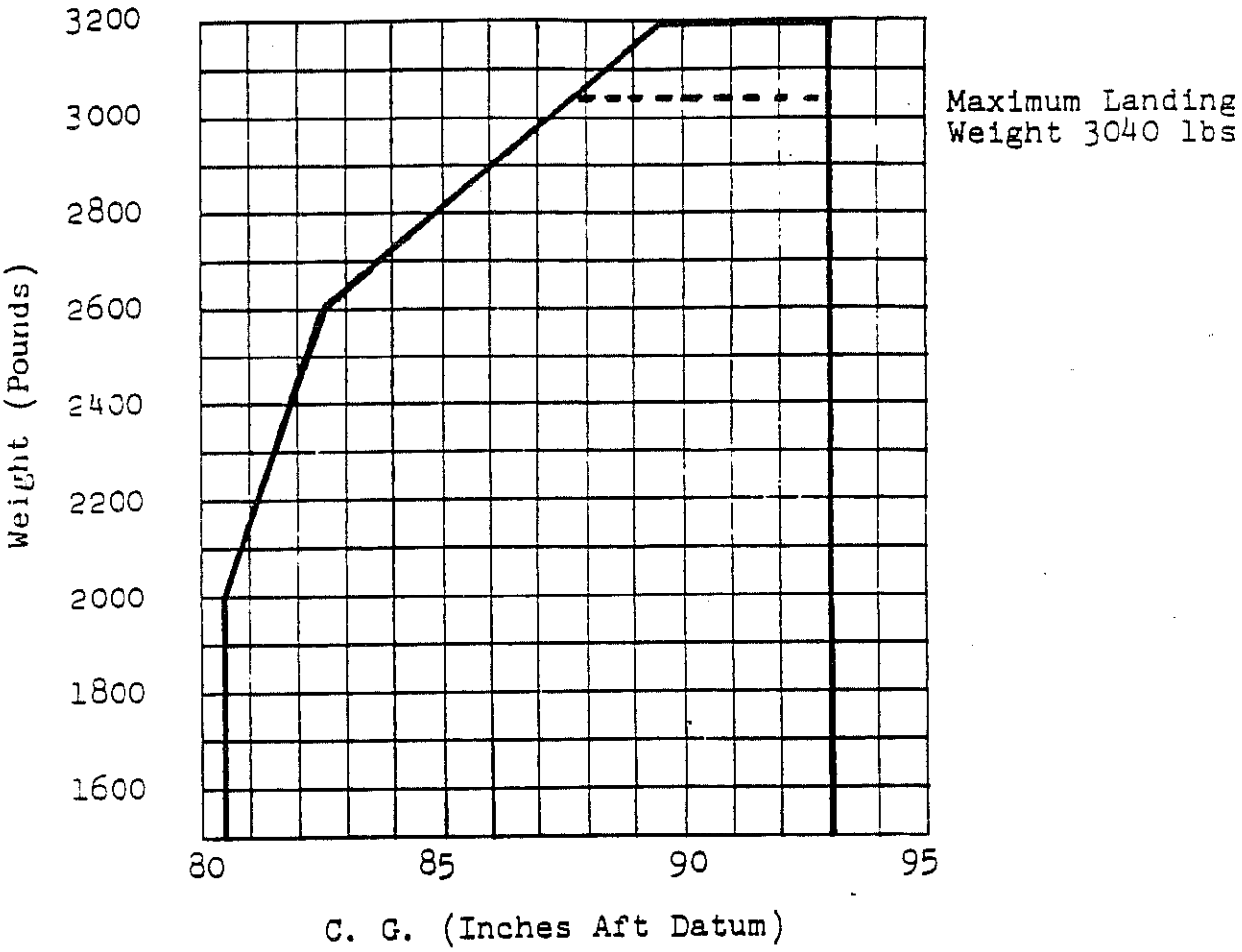
Locate the center of gravity of the landing weight on the C.G. range and weight graph. If this point falls within the weight - C.G. envelope, the loading may be assumed acceptable for landing.

IT IS THE RESPONSIBILITY OF THE PILOT AND AIRCRAFT OWNER TO INSURE THAT THE AIRPLANE IS LOADED PROPERLY AT ALL TIMES.

**WEIGHT AND BALANCE LOADING FORM**

FIGURE 9-2

APPROVED C. G. RANGE AND WEIGHT




Moment Due to Retracting Landing Gear = 1266 Inch Pounds

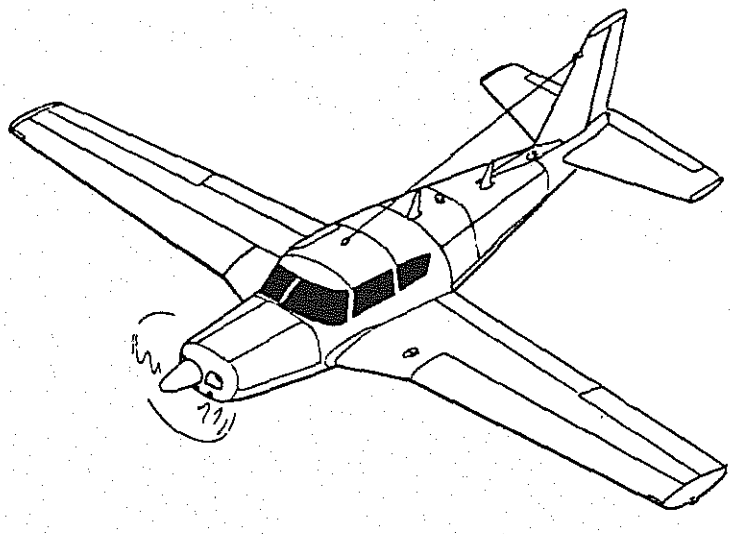
FIGURE 9-3



# Comanche

## CHAPTER 10

# PERFORMANCE AND FLIGHT PROFILE



# PA-24 COMANCHE

## PERFORMANCE/FLIGHT PROFILE

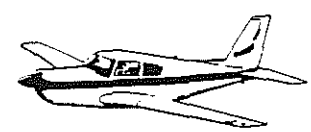
## CHAPTER 10

## CONTENTS



## ILLUSTRATIONS





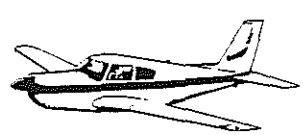
PA-24 COMANCHE

PERFORMANCE/FLIGHT PROFILE

CHAPTER 10

ILLUSTRATIONS (CONTINUED)





PA-24 COMANCHE

PERFORMANCE

CHAPTER 10

## PERFORMANCE AND FLIGHT PLANNING

The performance information presented in this section is taken from the owners' handbooks of various Comanche models. It is not intended to substitute for any handbook, but rather to present data in the various forms utilized in Comanche owner handbooks during Comanche production.

Remember, performance charts are based on new aircraft, flown by very proficient pilots. You may not achieve the same performance with your airplane. However, if you want to achieve chart performance, or come as close as possible, you must use the chart procedures.

Effects of conditions not considered on the charts must be evaluated by the pilot, such as the effect of soft or grass runway surface on takeoff and landing performance, or the effect of winds/temperatures aloft on cruise and range performance. Endurance can be grossly affected by improper leaning procedures, and inflight fuel flow and quantity checks are recommended.

**WARNING**

Performance information derived by extrapolation beyond the limits shown should not be used for flight planning purposes.

# PA -24 -260
# COMANCHE

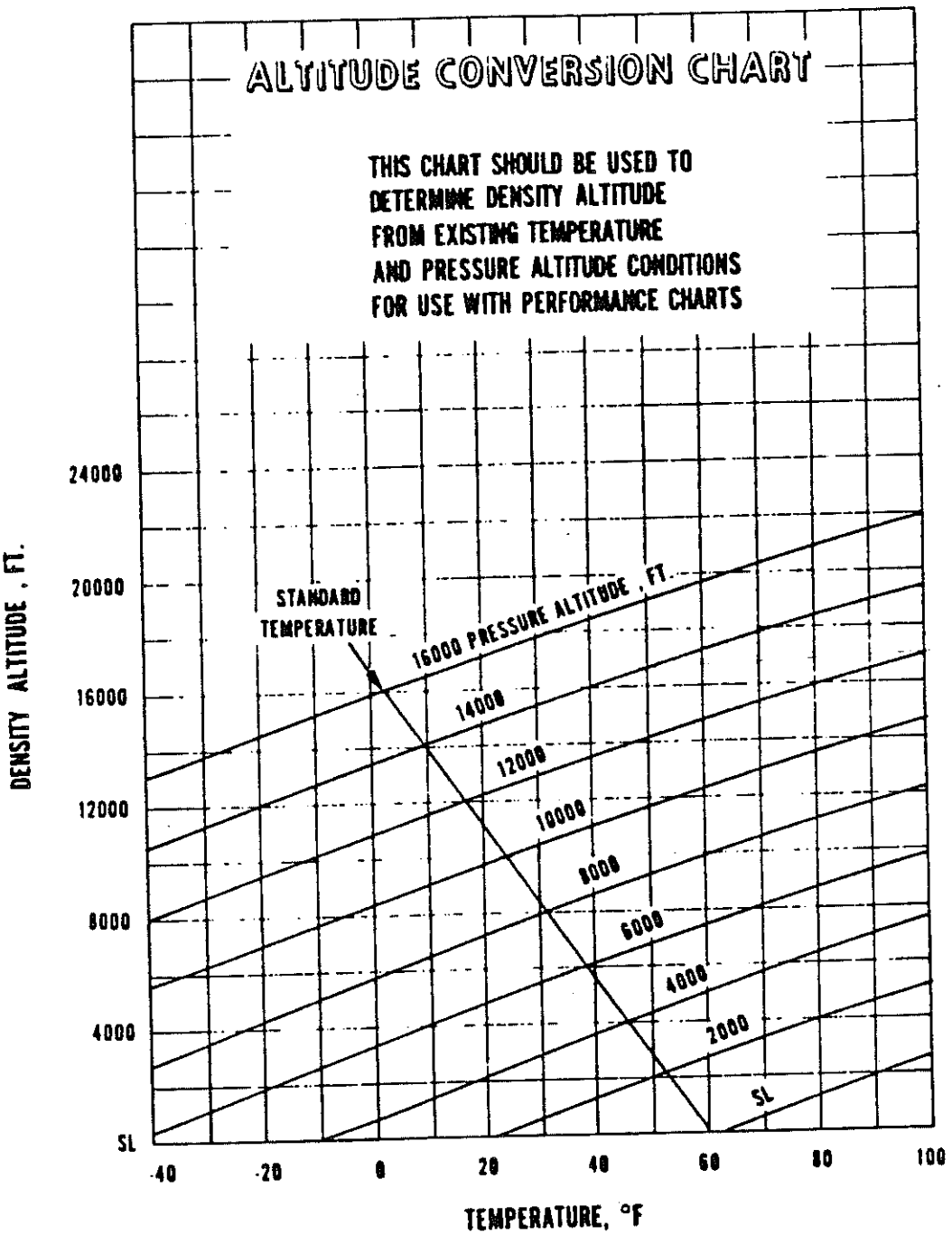



FIGURE 10-1

# TURBO COMANCHE C

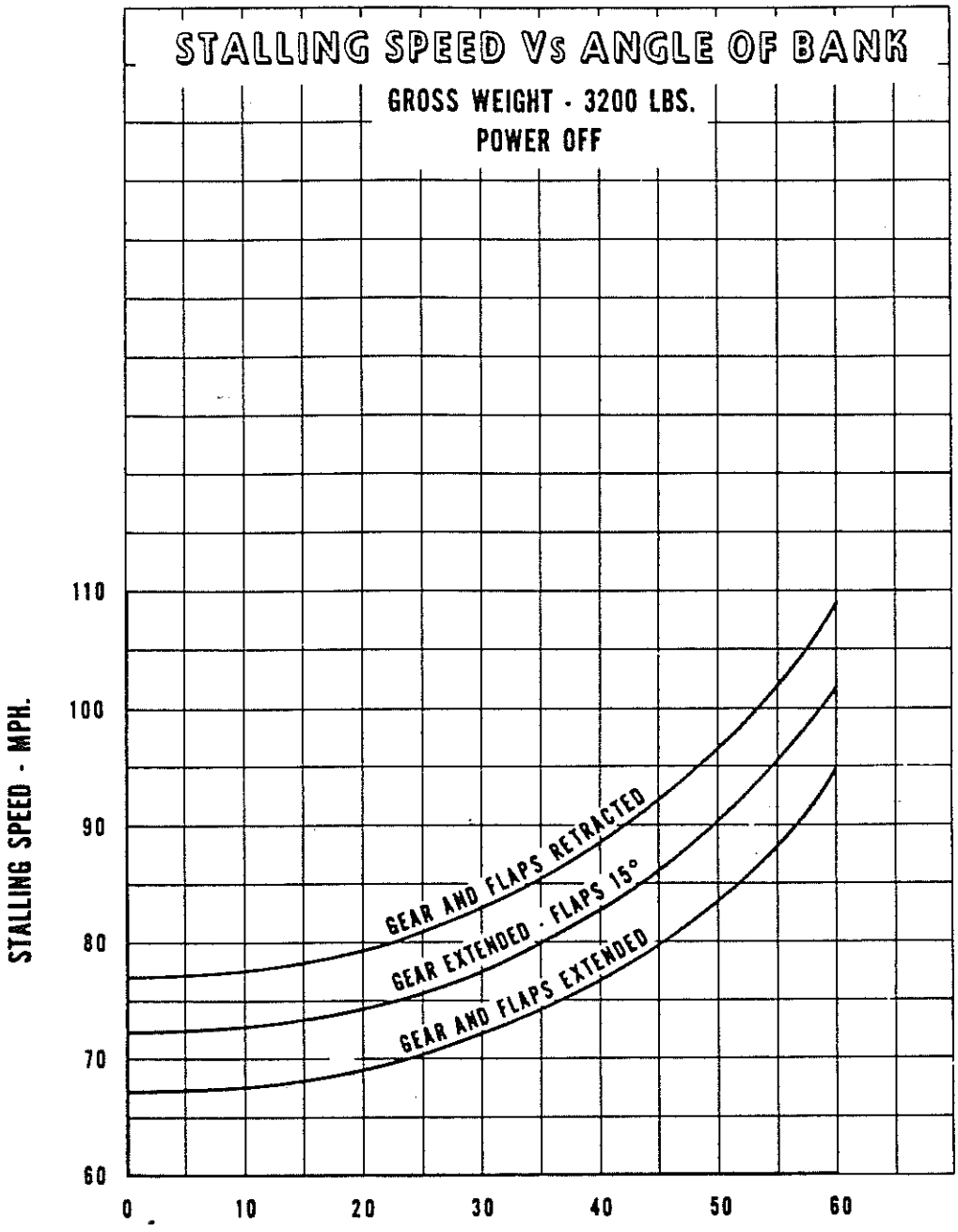
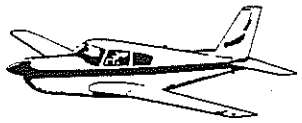



FIGURE 10-2





# TURBO COMANCHE C

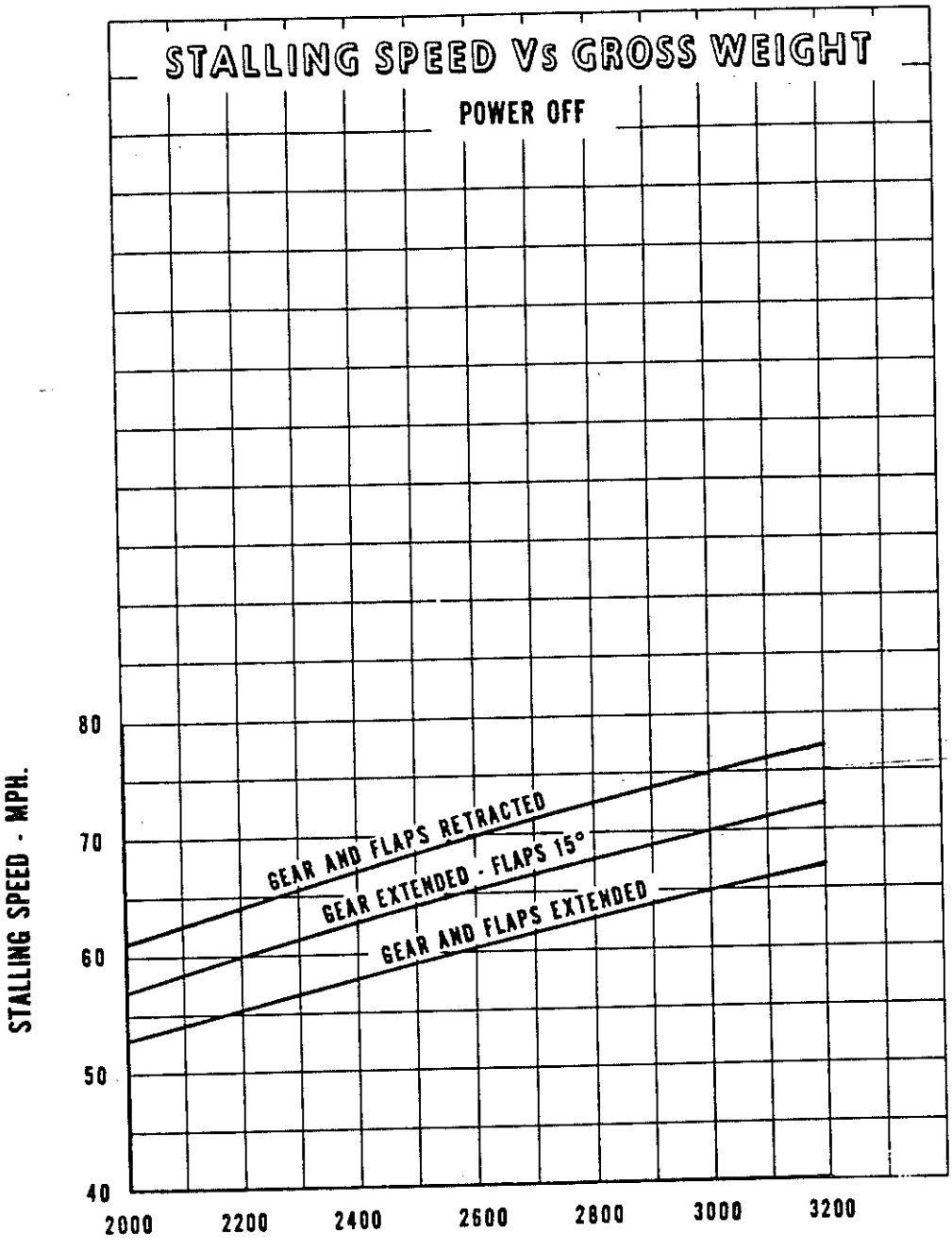



FIGURE 10-3



# PA-24-260
# COMANCHE

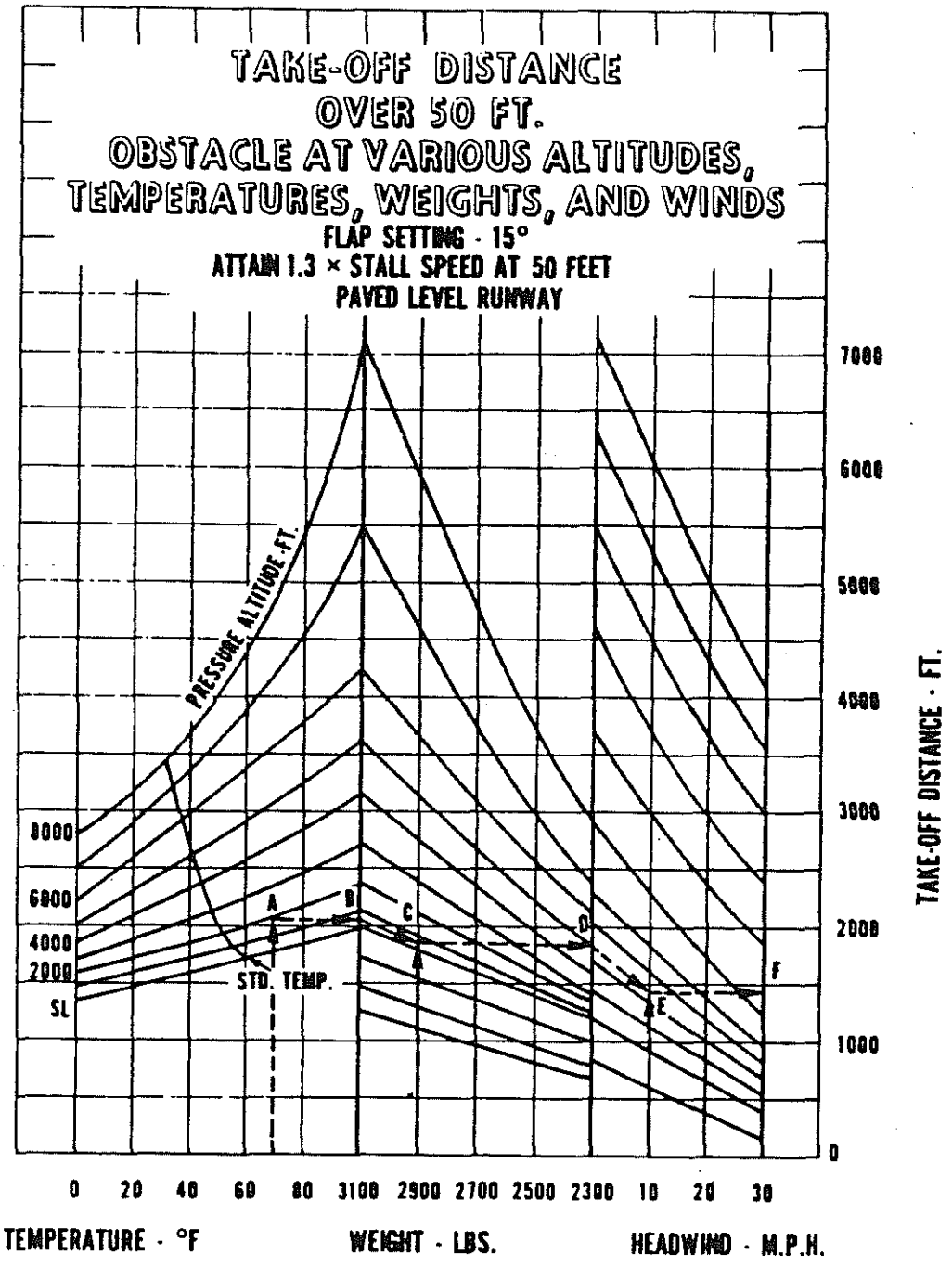
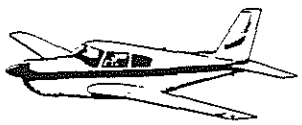



FIGURE 10-4





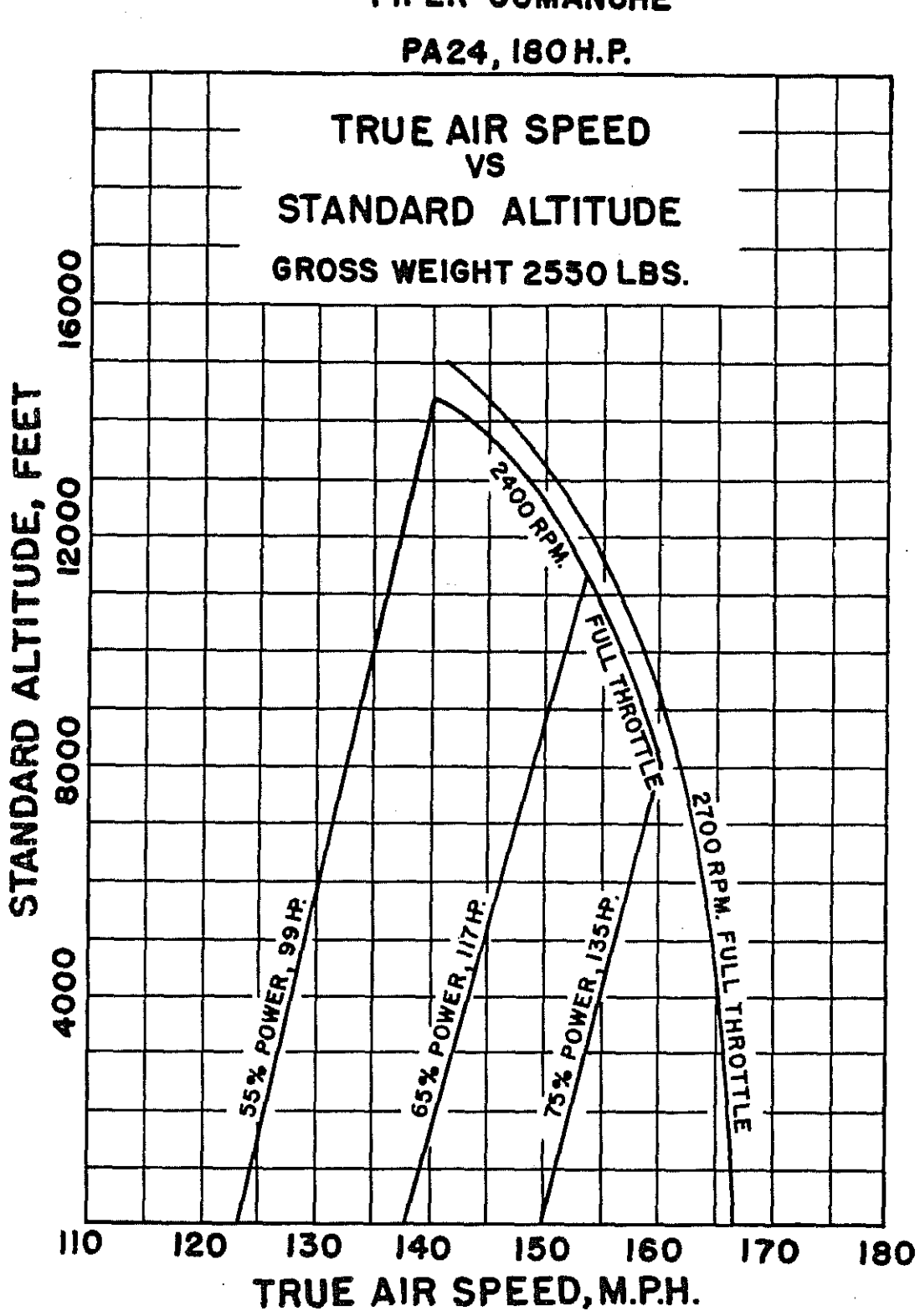
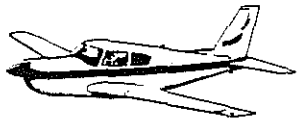

PIPER COMANCHE
PA24, 180 H.P.
TRUE AIR SPEED
VS
STANDARD ALTITUDE
GROSS WEIGHT 2550 LBS.
STANDARD ALTITUDE, FEET
4000
8000
12000
16000
2400 RPM. FULL THROTTLE
2700 RPM. FULL THROTTLE
55% POWER, 99 HP.
65% POWER, 117 HP.
75% POWER, 135 HP.
110
120
130
140
150
160
170
180
TRUE AIR SPEED, M.P.H.

FIGURE 10-5





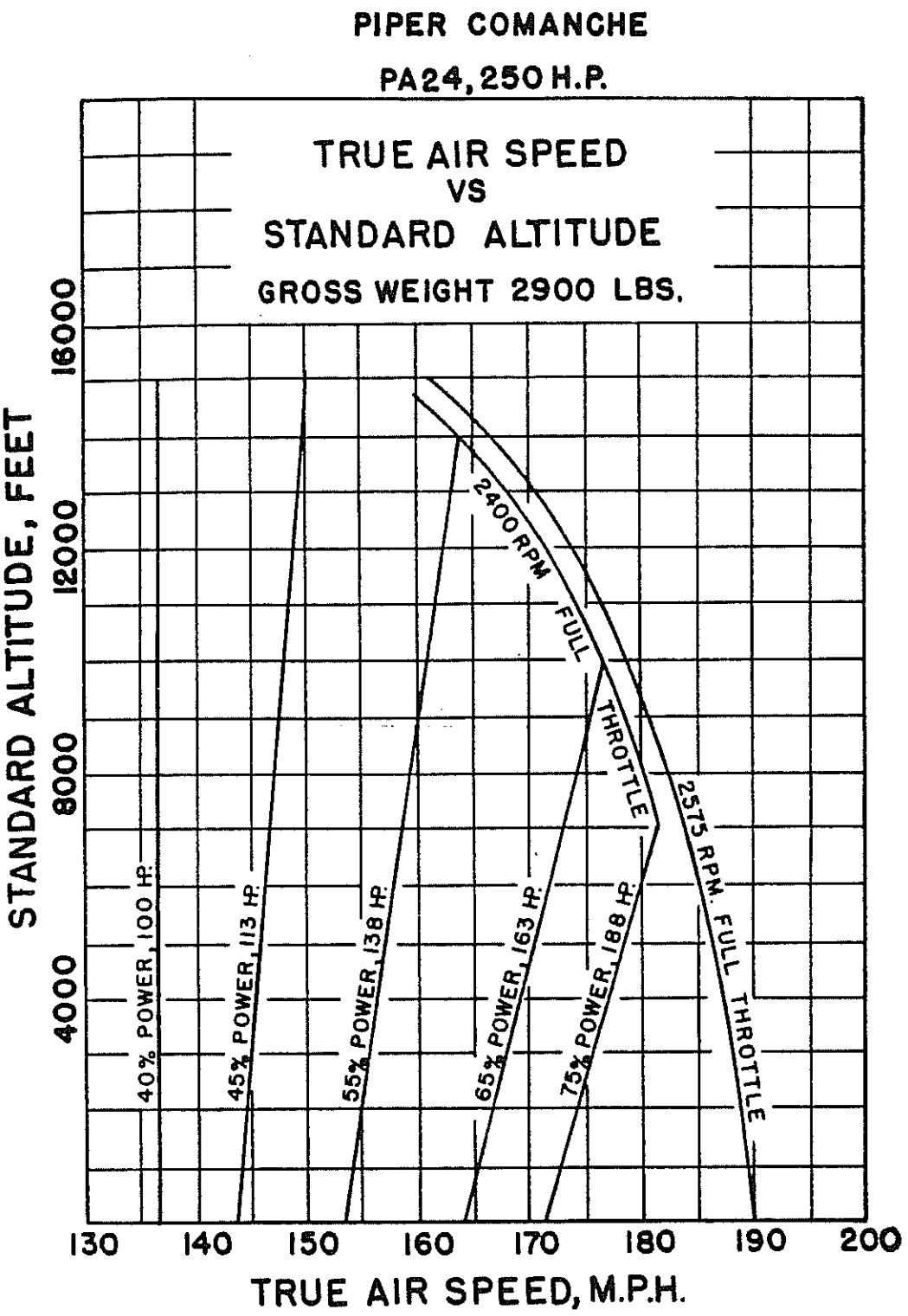
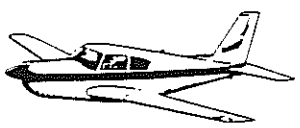



FIGURE 10-6





# PA-24-400
# COMANCHE

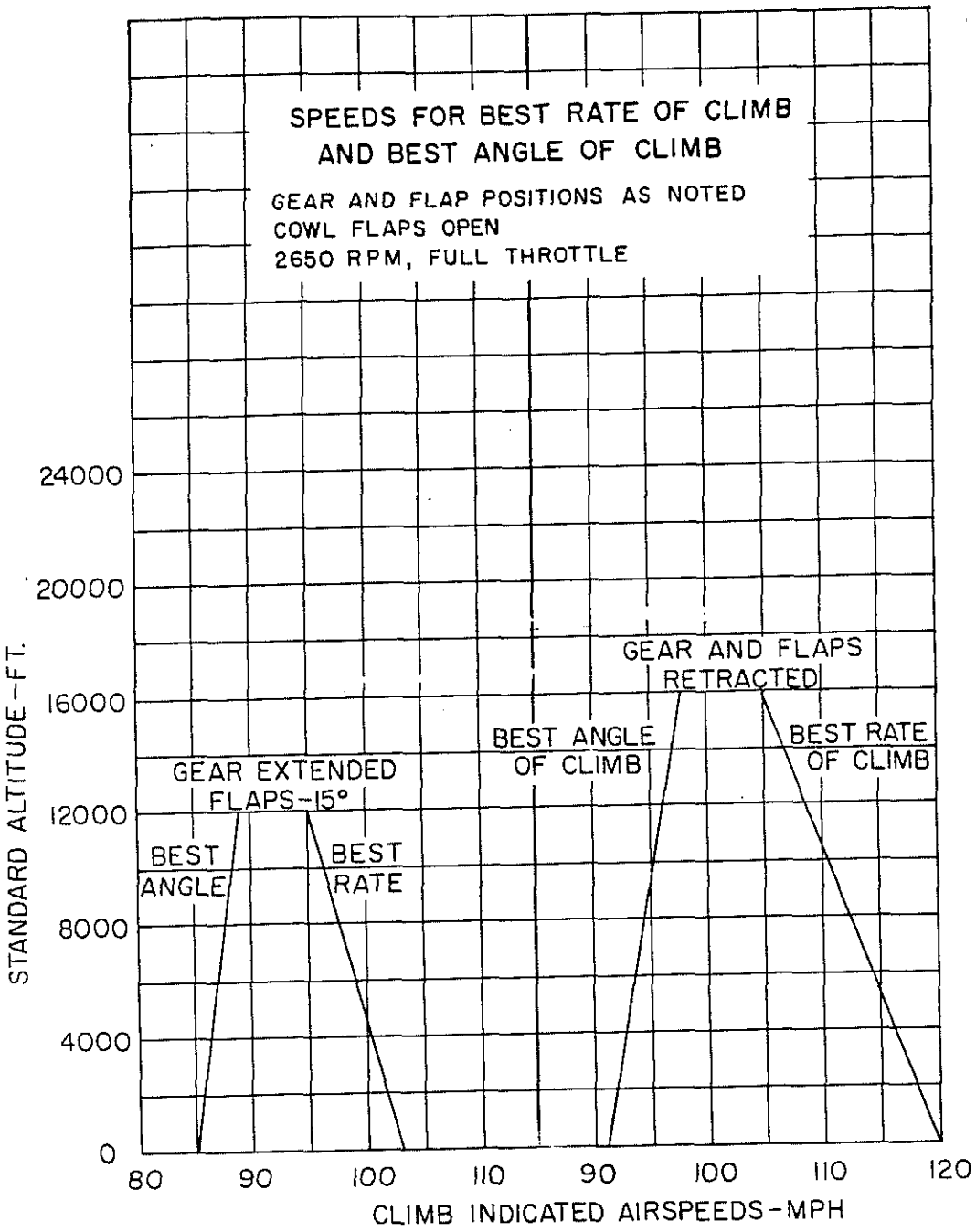



FIGURE 10-7



# TURBO COMANCHE C

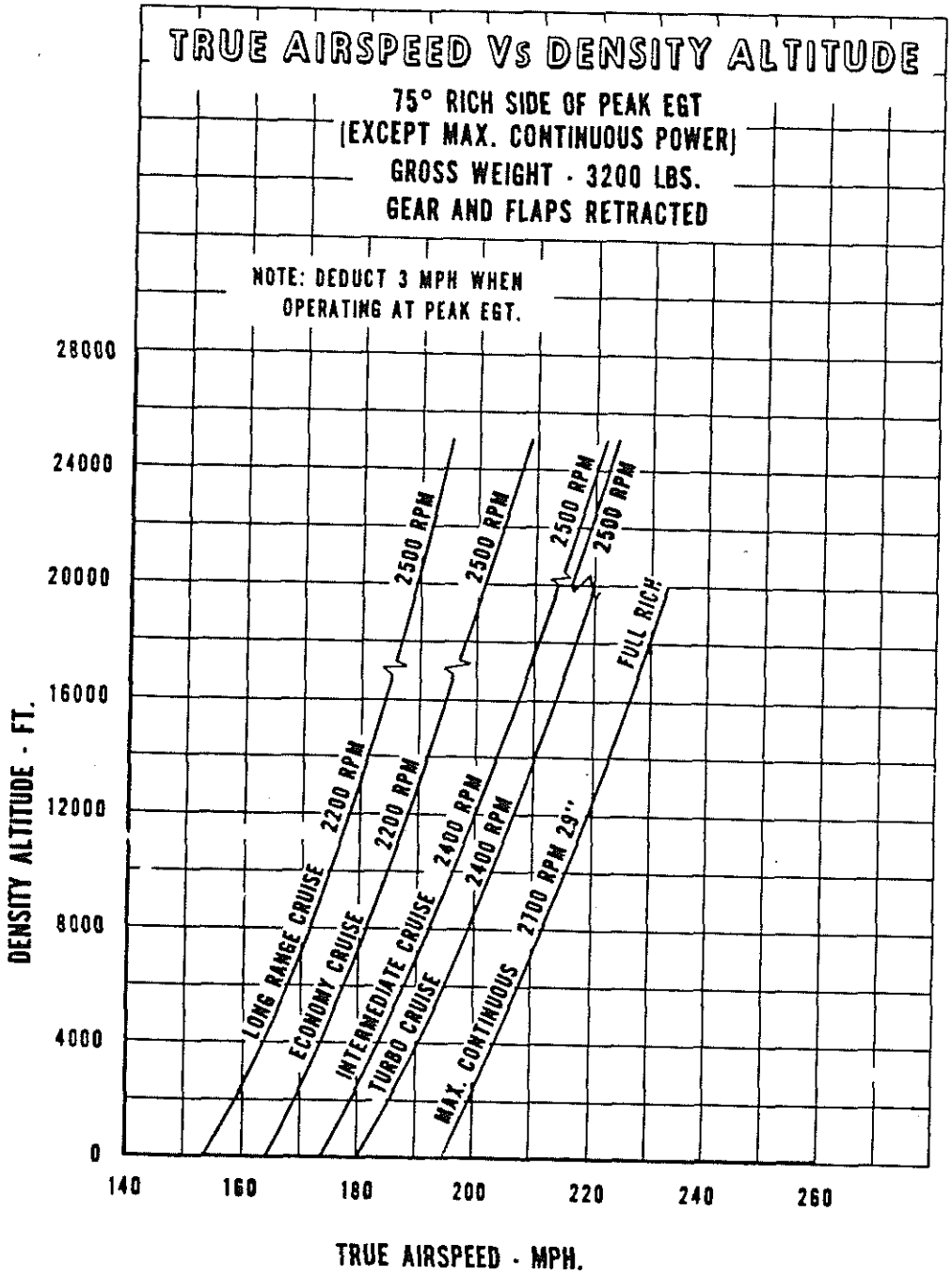
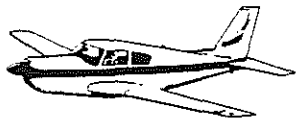
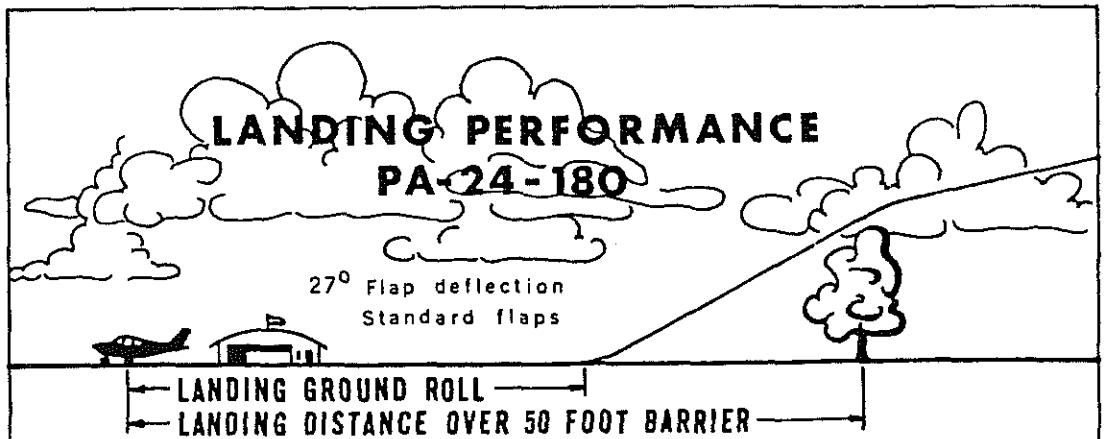



FIGURE 10-8







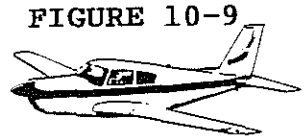

## LANDING DISTANCE UNDER VARIED CONDITIONS

| Weight | Altitude | Air Temp. | Landing roll - max. braking effort 0 mph. | 10 mph. | 20 mph. | Total distance at wind velocity 0 mph. | 10 mph. | 20 mph. |
|---|---|---|---|---|---|---|---|---|
| 2100 | SEA LEVEL | 40 | 350 | 240 | 130 | 1230 | 1060 | 810 |
| 2550 | | 40 | 440 | 310 | 180 | 1320 | 1140 | 900 |
| 2100 | | 60 | 370 | 250 | 140 | 1260 | 1090 | 840 |
| 2550 | | 60 | 460 | 330 | 200 | 1340 | 1150 | 910 |
| 2100 | | 80 | 390 | 260 | 150 | 1290 | 1120 | 870 |
| 2550 | | 80 | 480 | 350 | 220 | 1360 | 1160 | 920 |
| 2100 | 2000 FEET | 30 | 380 | 250 | 140 | 1280 | 1110 | 860 |
| 2550 | | 30 | 470 | 330 | 200 | 1350 | 1180 | 910 |
| 2100 | | 50 | 400 | 270 | 150 | 1300 | 1120 | 870 |
| 2550 | | 50 | 490 | 340 | 210 | 1370 | 1190 | 920 |
| 2100 | | 70 | 420 | 290 | 160 | 1320 | 1130 | 880 |
| 2550 | | 70 | 510 | 350 | 220 | 1390 | 1200 | 930 |
| 2100 | 4000 FEET | 20 | 400 | 270 | 150 | 1310 | 1130 | 870 |
| 2550 | | 20 | 490 | 340 | 200 | 1390 | 1200 | 930 |
| 2100 | | 40 | 420 | 290 | 160 | 1340 | 1160 | 900 |
| 2550 | | 40 | 510 | 360 | 220 | 1410 | 1220 | 950 |
| 2100 | | 60 | 440 | 310 | 170 | 1370 | 1190 | 930 |
| 2550 | | 60 | 530 | 380 | 240 | 1430 | 1240 | 970 |

Example shown in shaded areas:
Airplane weight 2550 lbs., airport altitude 2000 ft., air temperature 70° F., wind velocity 10 mph.- stopping distance with maximum braking effort 350 ft., total landing distance from over 50 ft. barrier 1200 ft. Also see Landing Performance Chart

FIGURE 10-9





# PA-24-260
# COMANCHE

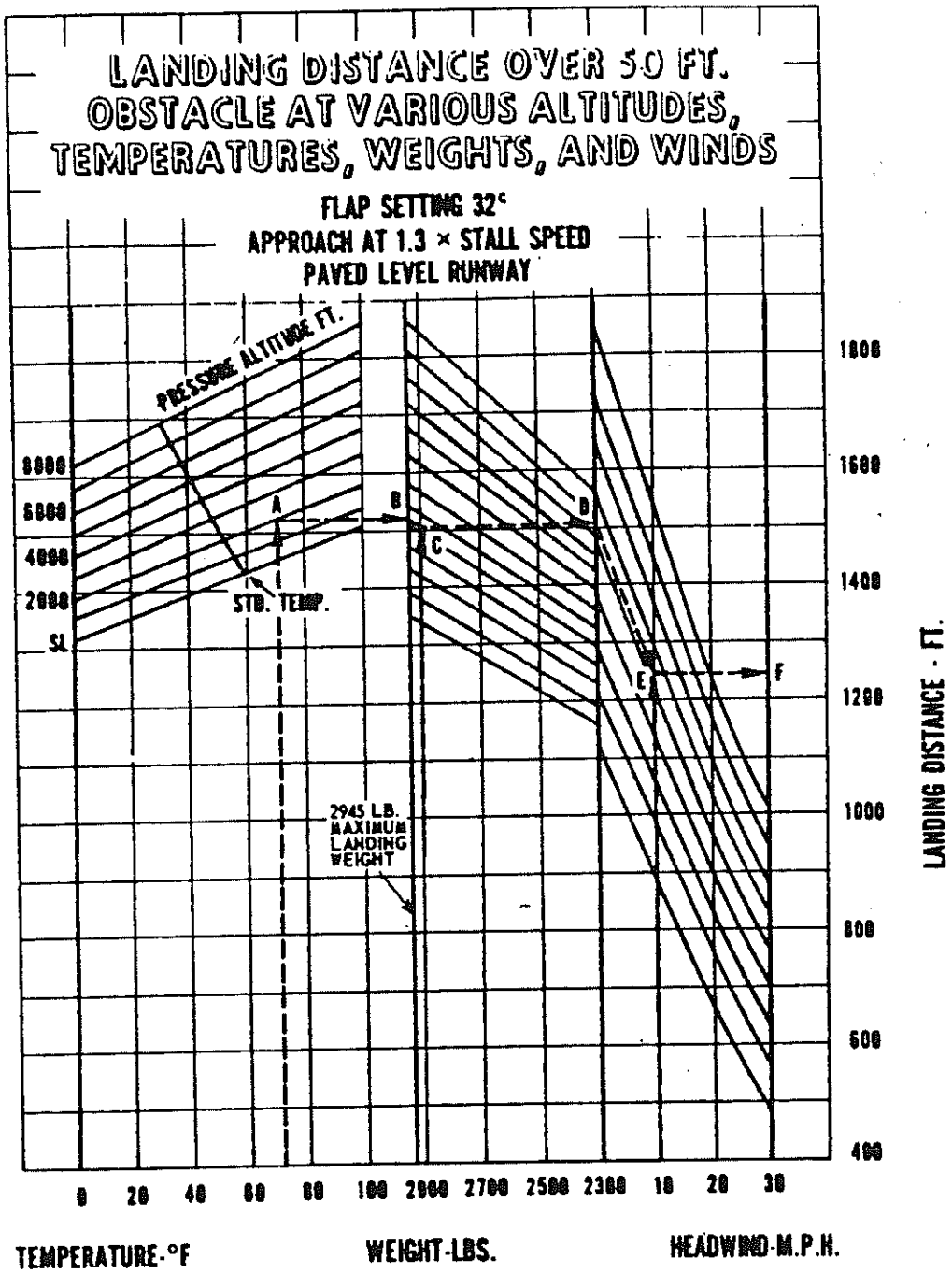
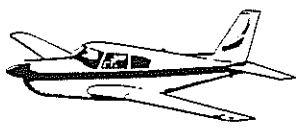



FIGURE 10-10





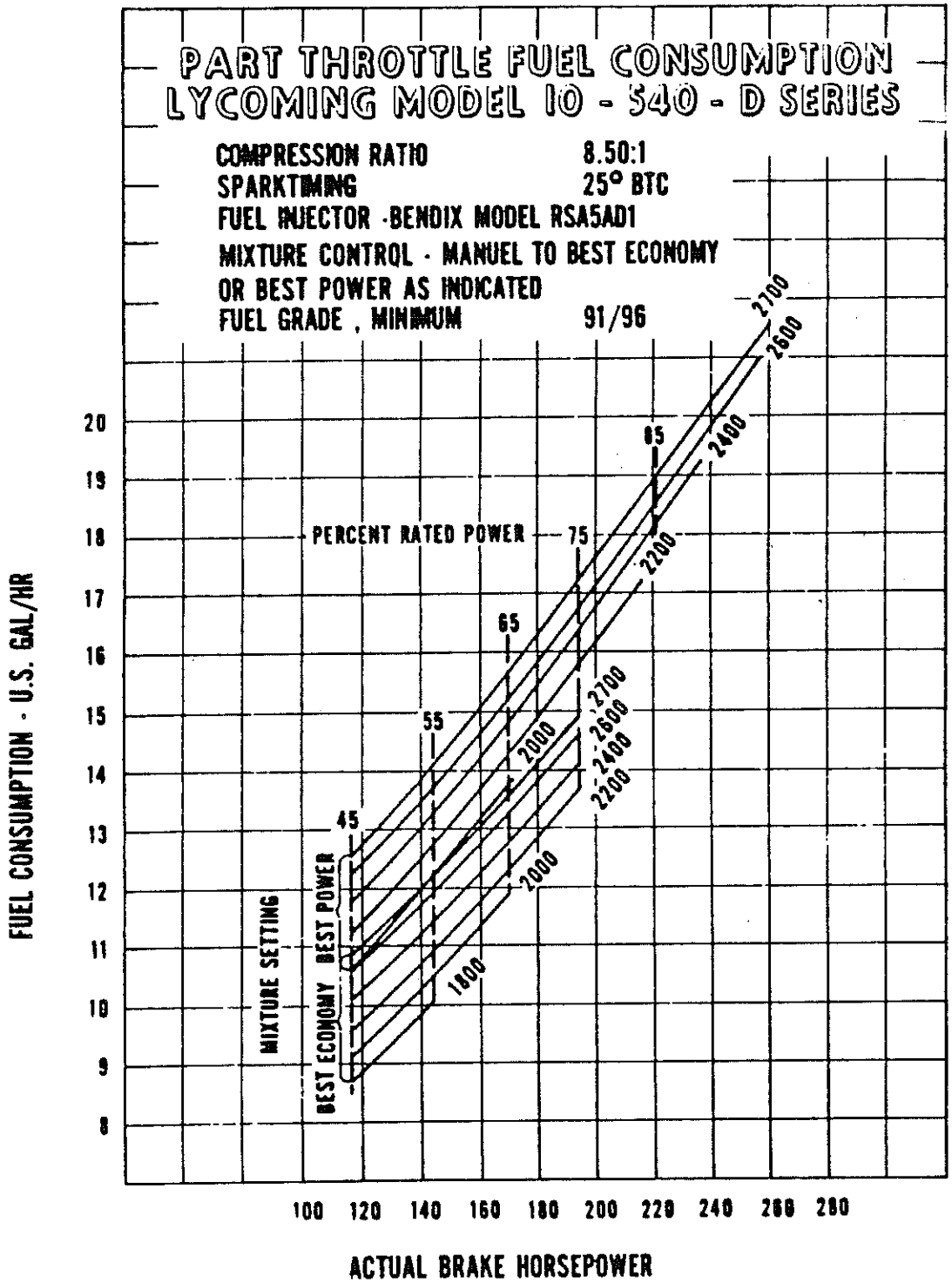

PART THROTTLE FUEL CONSUMPTION
LYCOMING MODEL IO - 540 - D SERIES
COMPRESSION RATIO 8.50:1
SPARKTIMING 25° BTC
FUEL INJECTOR - BENDIX MODEL RSA5AD1
MIXTURE CONTROL - MANUEL TO BEST ECONOMY OR BEST POWER AS INDICATED
FUEL GRADE , MINIMUM 91/96
PERCENT RATED POWER
65
75
85
55
45
2700
2600
2400
2200
2000
1800
MIXTURE SETTING
BEST ECONOMY
BEST POWER
FUEL CONSUMPTION - U.S. GAL/HR
ACTUAL BRAKE HORSEPOWER

FIGURE 10-11



# TURBO COMANCHE C

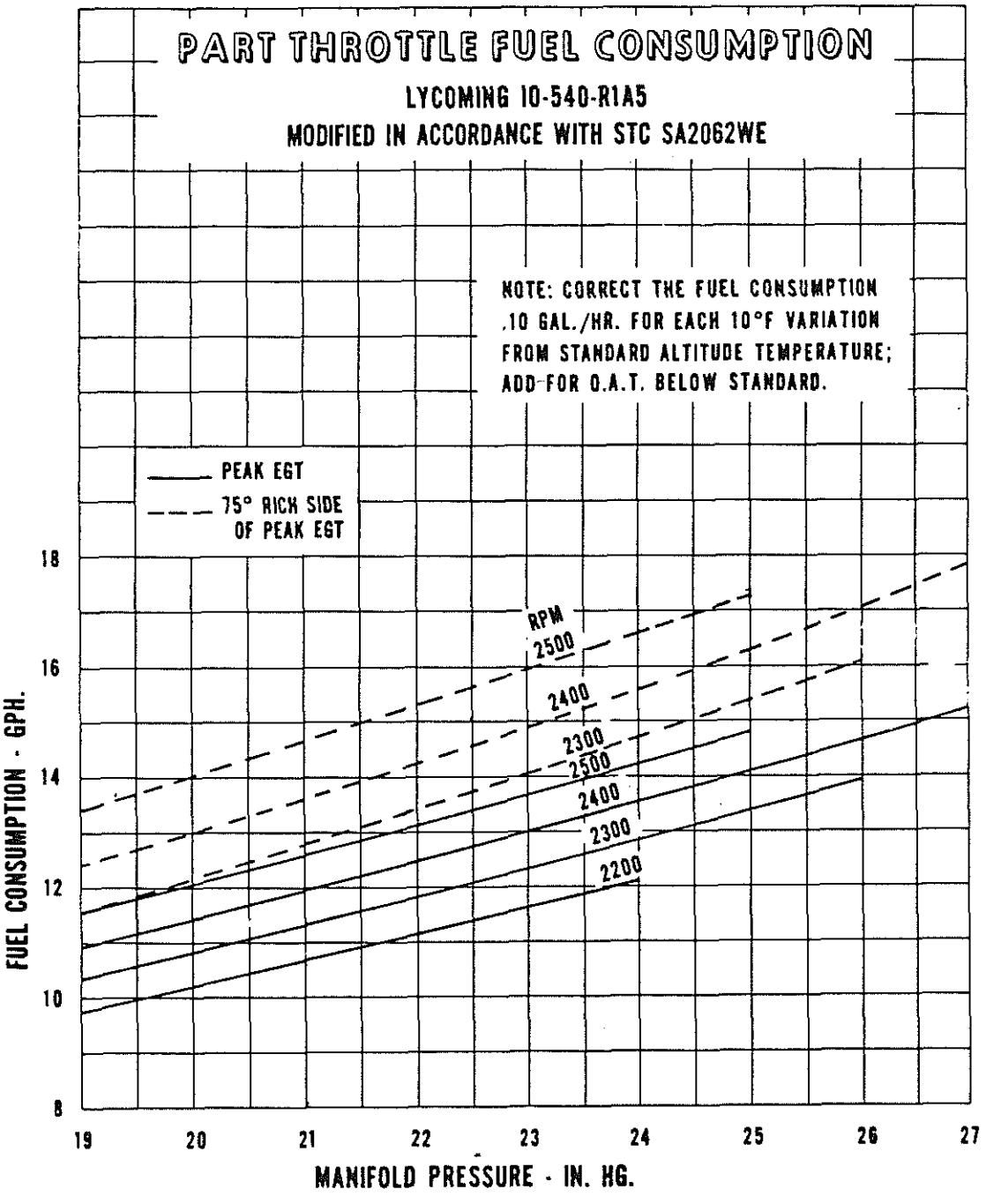
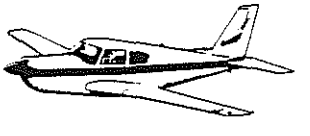



FIGURE 10-12





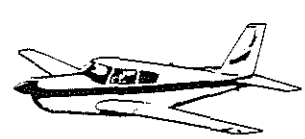
## Power Setting Table (Cruise) - Rajay Turbocharged Lycoming IO-540-R1A5

| Turbo Cruise | | Intermediate Cruise | | Economy Cruise | | Long Range Cruise | |
|---|---|---|---|---|---|---|---|
| RPM | M.P. | RPM | M.P. | RPM | M.P. | RPM | M.P. |
| 2500 | 25.0 | 2500 | 26.0 | 2200 | 24.0 | 2200 | 22.0 |
| 2400 | 27.0 | 2400 | 25.0 | 2300 | 23.0 | 2300 | 21.1 |
| | | 2500 | 24.2 | 2400 | 22.1 | 2400 | 20.4 |
| | | | | 2500 | 21.4 | 2500 | 19.7 |

1. To maintain constant power, correct manifold pressure approximately 0.17" Hg. for each 10°F variation in induction air temperature from standard altitude temperature. Add manifold pressure for air temperature above standard; subtract for temperatures below standard.
2. Do not exceed 27.0" M.P. when manually leaning.
3. To determine fuel consumption for these power settings, refer to the Fuel Consumption Chart.
4. At higher altitudes, engine roughness or loss of power may result from low RPM settings. In such a case use higher RPM power setting.
5. The recommended engine speeds for various altitude ranges are as follows:
   Sea Level to 17,000 feet 2200 RPM or above
   17,000 to 20,000 feet 2400 RPM or above
   20,000 to 25,000 feet 2500 RPM or above

FIGURE 10-13



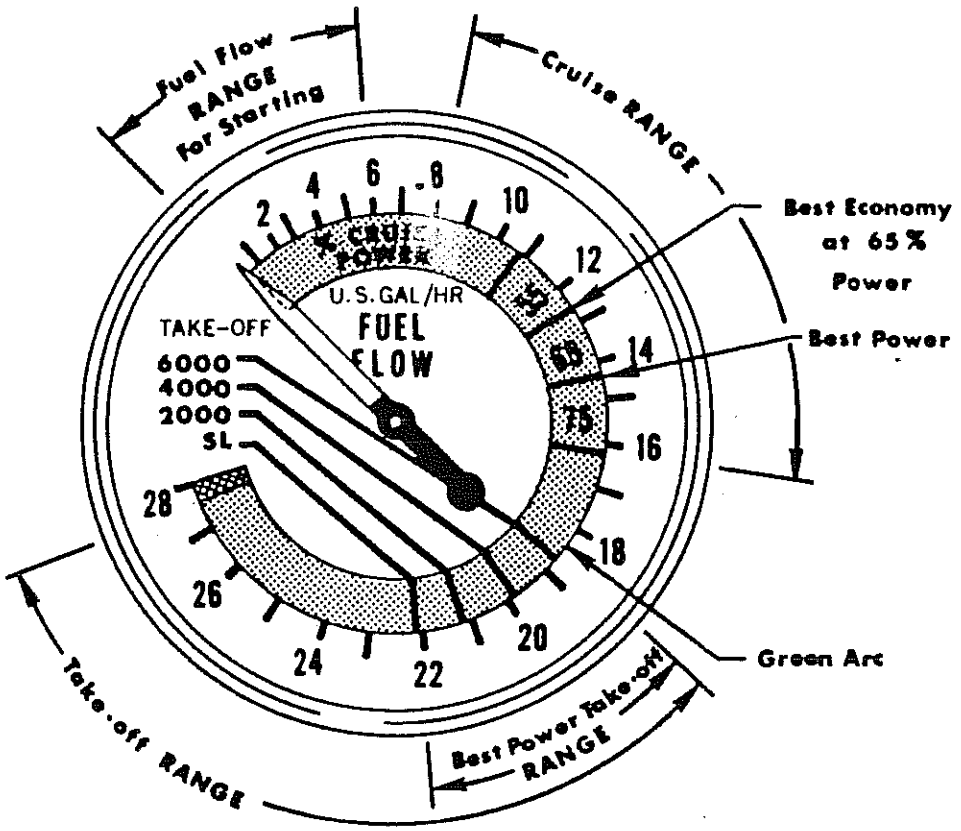


## Power Setting Table — Lycoming Model O-540-A, 250 HP Engine

| Press. Alt. 1000 Feet | Std. Alt. Temp. °F | 138 HP — 55% Rated Approx. Fuel 10.3 Gal./Hr. RPM AND MAN. PRESS. | | | | 163 HP — 65% Rated Approx. Fuel 12.3 Gal./Hr. RPM AND MAN. PRESS. | | | | 188 HP — 75% Rated Approx. Fuel 14.0 Gal./Hr. RPM AND MAN. PRESS. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2100 | 2200 | 2300 | 2400 | 2100 | 2200 | 2300 | 2400 | 2200 | 2300 | 2400 |
| SL | 59 | 21.6 | 20.8 | 20.2 | 19.6 | 24.2 | 23.3 | 22.6 | 22.0 | 25.8 | 25.1 | 24.3 |
| 1 | 55 | 21.4 | 20.6 | 20.0 | 19.3 | 23.9 | 23.0 | 22.4 | 21.8 | 25.5 | 24.8 | 24.1 |
| 2 | 52 | 21.1 | 20.4 | 19.7 | 19.1 | 23.7 | 22.8 | 22.2 | 21.5 | 25.3 | 24.6 | 23.8 |
| 3 | 48 | 20.9 | 20.1 | 19.5 | 18.9 | 23.4 | 22.5 | 21.9 | 21.3 | 25.0 | 24.3 | 23.6 |
| 4 | 45 | 20.6 | 19.9 | 19.3 | 18.7 | 23.1 | 22.3 | 21.7 | 21.0 | 24.8 | 24.1 | 23.3 |
| 5 | 41 | 20.4 | 19.7 | 19.1 | 18.5 | 22.9 | 22.0 | 21.4 | 20.8 | — | 23.8 | 23.0 |
| 6 | 38 | 20.1 | 19.5 | 18.9 | 18.3 | 22.6 | 21.8 | 21.2 | 20.6 | — | — | 22.8 |
| 7 | 34 | 19.9 | 19.2 | 18.6 | 18.0 | 22.3 | 21.5 | 21.0 | 20.4 | — | — | — |
| 8 | 31 | 19.6 | 19.0 | 18.4 | 17.8 | — | 21.3 | 20.7 | 20.1 | | | |
| 9 | 27 | 19.4 | 18.8 | 18.2 | 17.6 | — | — | 20.5 | 19.9 | | | |
| 10 | 23 | 19.1 | 18.6 | 18.0 | 17.4 | — | — | — | 19.6 | | | |
| 11 | 19 | 18.9 | 18.3 | 17.8 | 17.2 | — | — | — | — | | | |
| 12 | 16 | 18.6 | 18.1 | 17.5 | 17.0 | — | — | — | — | | | |
| 13 | 12 | — | 17.9 | 17.3 | 16.8 | | | | | | | |
| 14 | 9 | — | — | 17.1 | 16.5 | | | | | | | |
| 15 | 5 | — | — | — | 16.3 | | | | | | | |

To maintain constant power, correct manifold pressure approximately 0.17" Hg for each 10° F. variation in carburetor air temperature from standard altitude temperature. Add manifold pressure for air temperatures above standard; subtract for temperatures below standard.

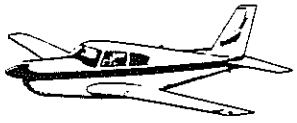
FIGURE 10-14




## READING THE
# FUEL FLOW INDICATOR
## PA-24-260

FIGURE 10-15

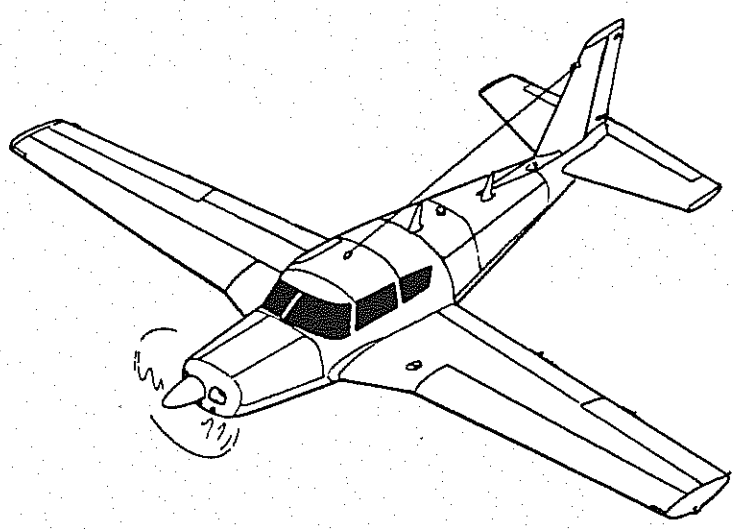




# Comanche

## CHAPTER 11

# EMERGENCY PROCEDURES



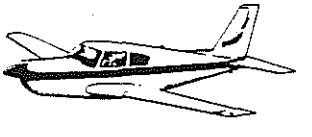
# PA-24 COMANCHE

## EMERGENCY PROCEDURES

## CHAPTER 11

## CONTENTS





# PA-24 COMANCHE

# EMERGENCY PROCEDURES

## CHAPTER 11

## GENERAL INFORMATION

The following recommended procedures are for a PA-24-260 Turbo Comanche "C" for use in coping with various types of emergencies and critical situations. All of the required (FAA regulations) emergency procedures and those necessary for the safe operation of the aircraft as determined by the operating and design features of the airplane are presented.

These procedures are suggested as the best course of action for coping with the particular condition described, but are not a substitute for sound judgement and common sense. Since emergencies rarely happen in modern aircraft, their occurrence is usually unexpected and the best corrective action may not always be obvious. Pilots should familiarize themselves with the procedures given in this section and be prepared to take appropriate action should an emergency arise.

Most basic emergency procedures, such as power off landings, are a normal part of pilot training. Although these emergencies are discussed here, this information is not intended to replace such training, but only to provide a source of reference and review, and to provide information on procedures which are not the same for all aircraft. It is suggested that the pilot review standard emergency procedures periodically to remain proficient in them.

# PA-24 COMANCHE

## EMERGENCY PROCEDURES

### PA-24-260 COMANCHE "C" - EMERGENCY PROCEDURES CHECKLIST

**ENGINE FIRE DURING START**

Starter ..... crank engine
Mixture ..... idle cut-off
Throttle ..... open
Fuel selector ..... OFF
Abandon if fire continues.

**ENGINE POWER LOSS DURING TAKEOFF**

If sufficient runway remains for a normal landing, leave gear down and land straight ahead.

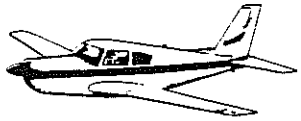
If area ahead is rough, or if it is necessary to clear obstructions:
Gear selector switch ..... UP

If sufficient altitude has been gained to attempt a restart:
Maintain safe airspeed.
Fuel selector ..... switch to tank containing fuel
Electric fuel pump ..... ON
Mixture ..... check RICH
Alternate air ..... OPEN
If power is not regained, proceed with power off landing.

**ENGINE POWER LOSS IN FLIGHT**

Fuel selector ..... switch to tank containing fuel
Electric fuel pump ..... ON
Mixture ..... RICH
Alternate air ..... OPEN
Magnetos ..... left/right/both if no change
Engine gauges ..... check for indication of cause of power loss
If no fuel pressure is indicated, check tank selector position to be sure it is on a tank containing fuel.





PA-24 COMANCHE

EMERGENCY PROCEDURES

When power is restored:
Alternate air ..... CLOSED
Electric fuel pump ..... OFF
If power is not restored, prepare for power off landing.
Trim for 97 MPH.

## POWER OFF LANDING

Trim for 97 MPH.
Locate suitable field.
Establish a spiral pattern.
1000 ft. above field at downwind position for normal landing approach. When field can be easily reached, extend gear, flaps and slow to 87 MPH for shortest landing.

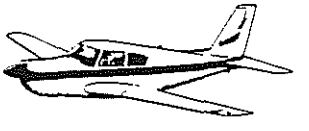
## GEAR DOWN EMERGENCY LANDING

Touchdowns should normally be made at lowest possible airspeed with full flaps.

When committed to landing:
Landing gear selector ..... down
Throttle ..... close
Mixture ..... idle cut-off
Ignition ..... OFF
Master switch ..... OFF
Fuel selector ..... OFF
Seat belt and harness ..... tight

## GEAR UP EMERGENCY LANDING

In the event a gear up landing is required, proceed as follows:
Flaps ..... as desired
Throttle ..... close
Mixture ..... idle cut-off
Ignition switch ..... OFF
Master switch ..... OFF
Fuel selector ..... OFF
Seat belt and harness ..... tight
Contact surface at minimum possible airspeed.



PA-24 COMANCHE

EMERGENCY PROCEDURES

## FIRE IN FLIGHT

Source of fire ..... check

Electrical fire (smoke in cabin):
Master switch ..... OFF
Vents ..... open
Cabin heat ..... OFF
Land as soon as practicable.

Engine fire:
Fuel selector ..... OFF
Throttle ..... CLOSED
Mixture ..... idle cut-off
Electric fuel pump ..... check OFF
Heater and defroster ..... OFF
Proceed with power off landing procedure.

## LOSS OF OIL PRESSURE

Land as soon as possible and investigate cause.
Prepare for power off landing.

## LOSS OF FUEL FLOW

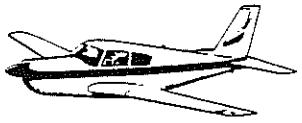
Electric fuel pump ..... ON
Fuel selector ..... check on full tank
Note: See CAUTION below.

## ENGINE DRIVEN FUEL PUMP FAILURE

Throttle ..... as required
Electric fuel pump ..... ON
Note: See CAUTION below.

CAUTION

If normal engine operation and fuel flow is not immediately re-established, the electric fuel pump should be turned off. The lack of a fuel flow indication while in the ON position could indicate a leak in the fuel system, or fuel exhaustion



PA-24 COMANCHE

EMERGENCY PROCEDURES

## HIGH OIL TEMPERATURE

Land at nearest airport and investigate the problem.
Prepare for power off landing.

## ELECTRICAL FAILURES

Ammeter ..... Discharge

Reduce electrical loads to minimum
ALT field circuit breaker ..... check and reset as required
Main ALT circuit breaker ..... ON

If power is not restored
Master switch ..... OFF
(for 6 seconds) to reset overvoltage relay, then ON

If either the alternator field circuit breaker or the main alternator circuit breaker opens when the master switch is turned back on, continue with reduced electrical load and land as soon as practical.

Emergency landing gear extension procedures may be required if the battery is depleted. Use electric flaps with caution as sufficient power may not be available to retract them in case a go-around is required.

The battery may power a reduced electrical load system for 25 to 45 minutes if the failure is noticed within 5 minutes.

**NOTE**

If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative.

## PA-24 COMANCHE

## EMERGENCY PROCEDURES

### PROPELLER OVERSPEED

| | |
|---|---|
| Throttle | retard |
| Oil pressure | check |
| Prop control | full DECREASE rpm, then set if any control available |
| Airspeed | reduce |
| Throttle | as required to remain below red line |

### EMERGENCY LANDING GEAR EXTENSION (Discussion Only)

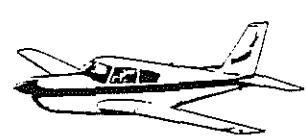
Prior to emergency extension procedure:

| | |
|---|---|
| Master switch | check ON |
| Circuit breakers | check |
| Instrument lights | OFF (in daytime) |
| Gear indicator bulbs | check |

To extend the gear, remove the plate covering the emergency disengage control and proceed in these steps as listed:

a. Reduce power - airspeed 100 MPH or below.
b. Gear selector "down locked" position
c. Disengage motor - raise motor release arm and push forward through full travel.
d. Remove gear extension handle from storage. If left socket is not in clear position, place handle in right socket. Engage slot and twist clockwise to secure handle. Extend handle and rotate forward until left socket is in clear position. Remove handle and place in left socket and secure. Extend handle. Rotate handle **FULL FORWARD** to extend landing gear and engage emergency safety lock. Pull aft on the handle to check that the safety lock is engaged.
e. **HANDLE LOCKED** in full forward position indicates landing gear is down and emergency safety lock engaged. Gear "down locked" indicator light should be **ON**. If the gear selector switch is moved to the up position with the emergency safety lock engaged, the white light will indicate that the gear is in transit although the gear will remain down and locked as indicated by the green light.





PA-24 COMANCHE

EMERGENCY PROCEDURES

NOTE

Reducing power and rocking gear extension handle will aid in manually extending the gear. DO NOT RETRACT WITH HANDLE IN SOCKET. DO NOT RE-ENGAGE MOTOR IN FLIGHT.

SPIN RECOVERY (INTENTIONAL SPINS ARE PROHIBITED)

Throttle ..... idle
Rudder ..... full opposite to direction of rotation
Control wheel ..... full forward until spin stops
(When nose bobs down rapidly, the stall is broken.)
Rudder ..... neutral (when rotation stops)
Control wheel ..... steady back pressure as required to smoothly regain level flight attitude.

If buffeting is felt during recovery, release the back pressure slightly. The spin recovery may be expedited by using aileron opposite the direction of rotation.

OPEN DOOR

If the latch opens, the door will trail slightly open and airspeeds will be reduced slightly. Fly the airplane and return to land.

EMERGENCY DESCENT

A malfunction of the oxygen system requires an immediate descent to an altitude at or below 12,500 feet.

## PA-24 COMANCHE

## EMERGENCY PROCEDURES

### NOTE

Time of useful consciousness at 20,000 ft. is approximately 10 minutes.

The following procedure is recommended if a rapid descent is necessary for any reason.

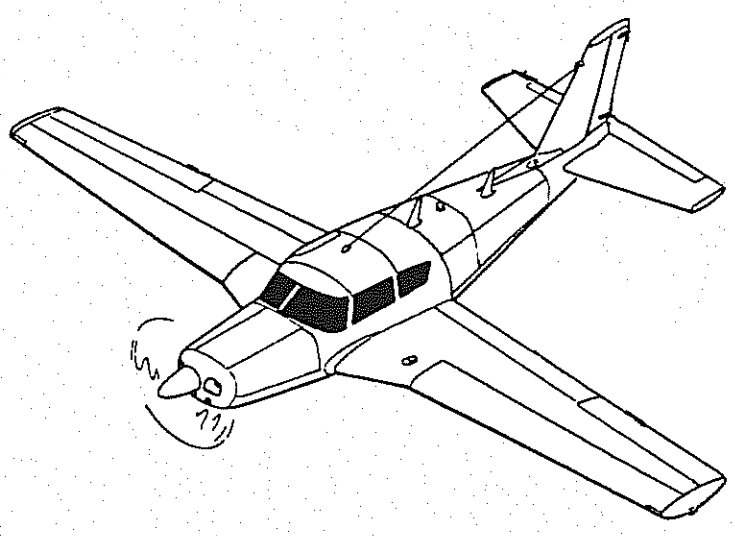
a. Power - idle
b. Landing gear - extend
c. Airspeed - 150 MPH



Comanche

# CHAPTER 12

# PREFLIGHT



# PA-24 COMANCHE

## PREFLIGHT

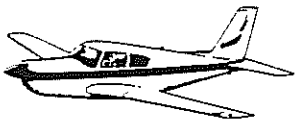
## CHAPTER 12

## CONTENTS



## ILLUSTRATIONS





# PA-24 COMANCHE

## PREFLIGHT

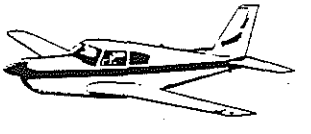
## CHAPTER 12

### I. PREFLIGHT - DAY

The following safety procedure instructions must become an integral part of the pilot's operational routine and preflight inspection.

Use figure 12.1 as a guide and follow the preflight outline below:

1. a. Ignition and master switches **OFF**
   b. Drain fuel strainer
2. a. Check for external damage or operational interference to the control surfaces, wings or fuselage
   b. Check and remove any snow, ice or frost on wings and control surfaces
3. a. Check fuel supply
   b. Check fuel cell caps and covers for security (adjust caps to maintain a tight seal)
   c. Fuel system vents open
   d. Remove pitot tube cover (if used)
4. a. Landing gear shock struts properly inflated. 2.75 inches
   b. Tires properly inflated and not excessively worn
   c. Cowling, landing gear doors and inspection covers properly attached and secured.
   d. Propeller free of detrimental nicks
   e. No obvious fuel or oil leaks
   f. Engine oil at proper level and dipstick properly seated
5. a. Windshield clean and free of defects
6. a. Tow-bar and control locks detached and stowed. Check that baggage - emergency door is secured.
7. a. Upon entering the airplane, check that all controls operate normally
   b. Check that landing gear selector and other controls are in their proper position.
   c. Check that required documents are in order and in the airplane.
8. a. Oxygen supply (if high altitude flight is planned)



PA-24 COMANCHE

PREFLIGHT

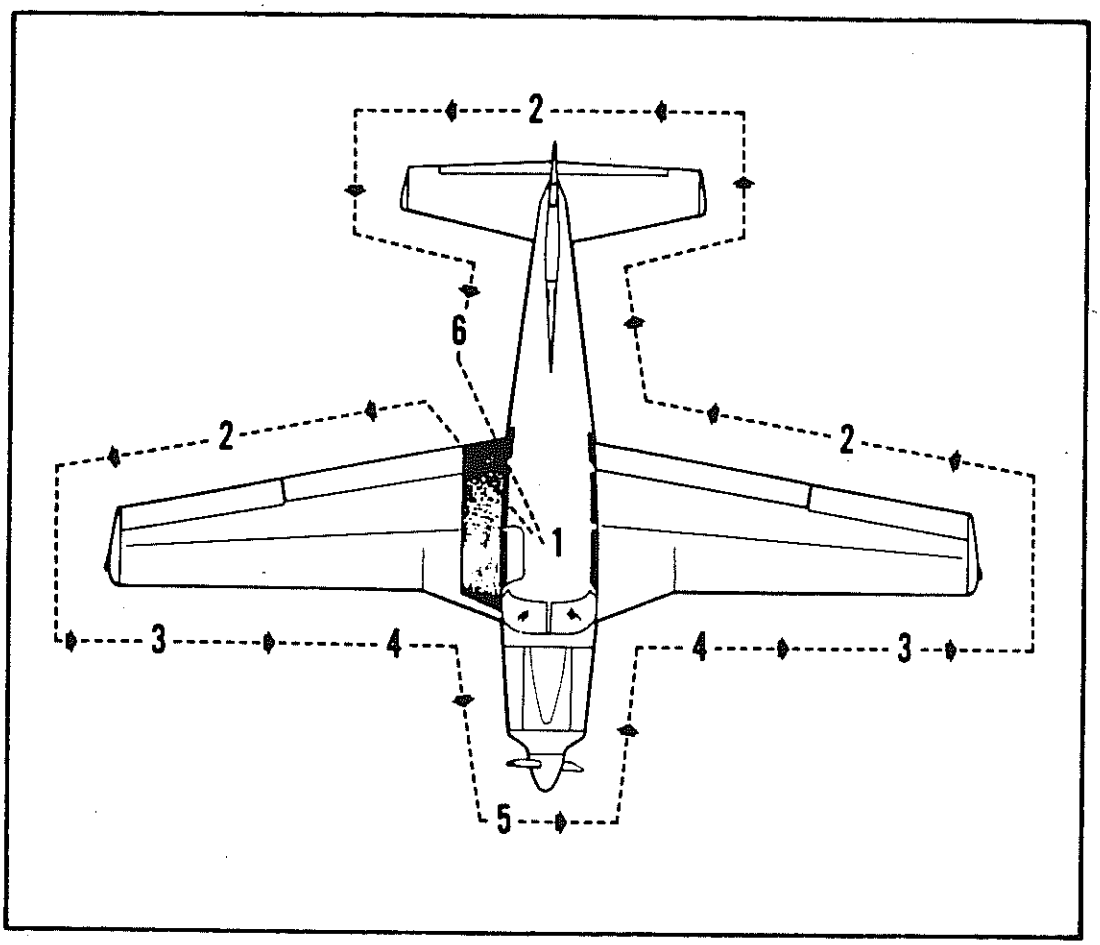
II. **PREFLIGHT - NIGHT**

a. Interior lights
b. Exterior lights
c. Oxygen is recommended if flight above 5000 feet is planned
d. Flashlight available and working

III. **PREFLIGHT - IFR**

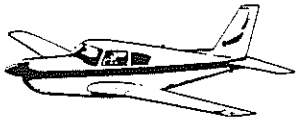
a. Pitot heat operational






PA-24 TOP VIEW

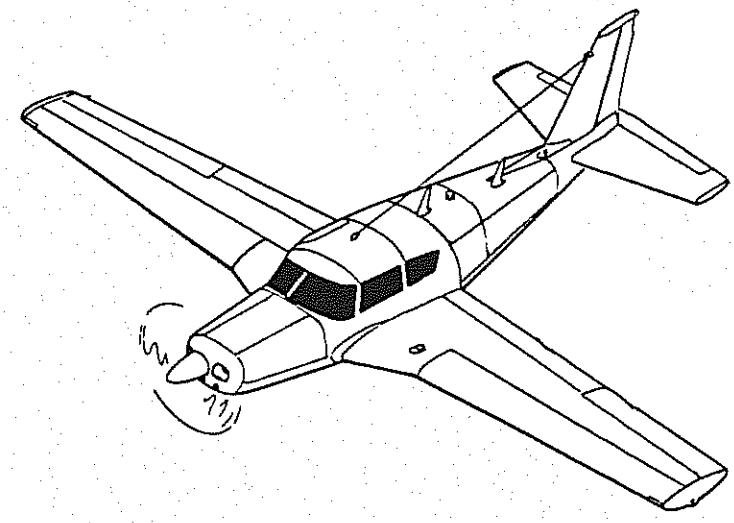
FIGURE 12-1



Comanche

## CHAPTER 13

# MINOR SERVICE AND MAINTENANCE



# PA-24 COMANCHE

## MINOR SERVICE AND MAINTENANCE

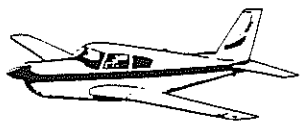
## CHAPTER 13

## CONTENTS



## ILLUSTRATIONS





# PA-24 COMANCHE

## MINOR SERVICE AND MAINTENANCE

## CHAPTER 13

### INTRODUCTION

Piper Aircraft Corporation takes a continuing interest in having the owner get the most efficient use from his aircraft and keeping it in the best mechanical condition. Consequently, Piper Aircraft from time to time issues Service Bulletins, Service Letters and Service Spares Letters relating to the aircraft.

Service Bulletins are of special importance and should be complied with promptly. These are sent to the latest registered owners, distributors and dealers. Depending on the nature of the bulletin, material and labor allowances may apply, and will be addressed in the body of the Bulletin.

Service Letters deal with product improvements and service hints pertaining to the aircraft. They are sent to dealers, distributors and occasionally (at the factory's discretion) to latest registered owners, so they can properly service the aircraft and keep it up to date with the latest changes. Owners should give careful attention to the Service Letter information.

Service Spares Letters offer improved parts, kits and optional equipment which were not available originally and which may be of interest to the owner.

If an owner is not having his aircraft serviced by an Authorized Piper Service Center, he should periodically check with a Piper dealer or distributor to find out the latest information to keep his aircraft up to date.

Piper Aircraft Corporation has a Subscription Service for the Service Bulletins, Service Letters and Service Spares Letters. This service is offered to interested persons such as owners, pilots and mechanics at a nominal fee, and may be obtained through Piper dealers and distributors.

A service manual, parts catalog, and revisions to both, are available from your Piper dealer or distributor. Any correspondence regarding the airplane should include the airplane model and serial number to insure proper response.

PA-24 COMANCHE

MINOR SERVICE AND MAINTENANCE

## AIRPLANE INSPECTION PERIODS

The Federal Aviation Administration (FAA) occasionally publishes Airworthiness Directives (ADs) that apply to specific groups of aircraft. They are mandatory changes and are to be complied with within a time limit set by the FAA. When an AD is issued, it is sent by the FAA to the latest registered owner of the affected aircraft and also to subscribers of their service. The owner should periodically check with his Piper dealer or A & P mechanic to see whether he has the latest issued AD against his aircraft.

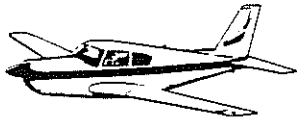
One hundred hour inspections are required by law if the aircraft is used commercially. Otherwise this inspection is left to the discretion of the owner. This inspection is a complete check of the aircraft and its systems, and should be accomplished by a Piper Authorized Service Center or by a qualified aircraft and power plant mechanic who owns or works for a reputable repair shop. The inspection is listed, in detail, in the inspection report of the appropriate Service Manual.

An annual inspection is required once a year to keep the Airworthiness Certificate in effect. It is the same as a 100-hour inspection except that it must be signed by an Inspection Authorized (IA) mechanic or General Aviation District Office (GADO) representative. This inspection is required whether the aircraft is operated commercially or for pleasure.

A spectographic analysis of the oil is available from several sources. This system, if used intelligently, provides a good check of the internal condition of the engine. for this system to be accurate, oil samples must be sent in at regular intervals, and induction air filters must be cleaned or changed regularly.

## PREVENTIVE MAINTENANCE

The holder of a Pilot Certificate issued under FAR Part 61 may perform certain preventive maintenance described in FAR Part 43. This maintenance may be performed only on an aircraft which the pilot owns or operates and which is not



PA-24 COMANCHE

MINOR SERVICE AND MAINTENANCE

used to carry persons or property for hire, except as provided in applicable FAR's. Although such maintenance is allowed by law, each individual should make a self-analysis as to whether he has the ability to perform the work.

All other maintenance required on the airplane should be accomplished by appropriately licensed personnel.

If maintenance is accomplished, an entry must be made in the appropriate logbook. The entry should contain:

a. The date the work was accomplished.
b. Description of the work.
c. Number of hours on the aircraft.
d. The certificate number of pilot performing the work.
e. Signature of the individual doing the work.
f. Approval for return to service.

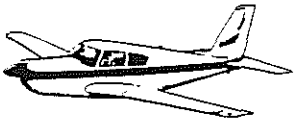
## AIRPLANE ALTERATIONS

If the owner desires to have his aircraft modified, he must obtain FAA approval for the alteration. Major alterations accomplished in accordance with Advisory Circular 43.13-2, when performed by an A & P mechanic, may be approved by the local FAA office. Major alterations to the basic airframe or systems not covered by AC43.13-2 require a Supplemental Type Certificate.

The owner or pilot is required to ascertain that the following Aircraft Papers are in order and in the aircraft.

a. To be displayed in the aircraft at all times:
   1. Aircraft Airworthiness Certificate Form FAA-8100-2
   2. Aircraft Registration Certificate Form FAA-8050-3
   3. Aircraft Radio Station License if transmitters are installed.

b. To be carried in the aircraft at all times:
   1. Pilot's Operating Handbook
   2. Weight and Balance data plus a copy of the latest Repair and Alteration Form FAA-337, if applicable

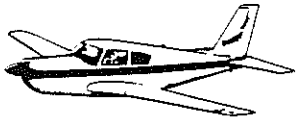


PA-24 COMANCHE

MINOR SERVICE AND MAINTENANCE

Although the aircraft and engine logbooks are not required to be in the aircraft, they should be made available upon request. Logbooks should be complete and up to date. Good records will reduce maintenance cost by giving the mechanic information about what has or has not been accomplished.

Section V of your Owner's Handbook contains additional minor maintenance information about your airplane. Recognizing the need for minor maintenance and making sure it is completed can often prevent expensive, time consuming maintenance problems at a later date.

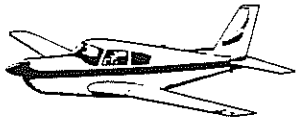


| Nature of Inspection | Inspection Time (hrs) | | | |
|---|---|---|---|---|
| | 50 | 100 | 500 | 1000 |
| **A. PROPELLER GROUP** | | | | |
| 1. Inspect spinner and back plate for cracks | O | O | O | O |
| 2. Inspect blades for nicks and cracks | O | O | O | O |
| 3. Inspect for grease and oil leaks | O | O | O | O |
| 4. Lubricate per lubrication chart in service manual | | O | O | O |
| 5. Inspect spinner mounting brackets for cracks | | O | O | O |
| 6. Inspect propeller mounting bolts and safety (check torque if safety is broken) | | O | O | O |
| 7. Inspect pitch actuating arms and bolts | | O | O | O |
| 8. Inspect hub parts for cracks and corrosion | | O | O | O |
| 9. Rotate blades and check for tightness in hub pilot tube | | O | O | O |
| 10. Remove propeller; remove sludge from propeller and crankshaft | | | O | O |
| 11. Overhaul propeller (see latest revision Hartzell Service Letter 61) | | | | O |
| **B. ENGINE GROUP** | | | | |
| WARNING: Ground magneto primary circuit before working on engine. | | | | |
| NOTE: Read notes 8 and 19 prior to completing this inspection group. | | | | |
| 1. Remove the engine cowl | | O | O | O |
| 2. Clean and check cowling for cracks, distortion and loose or missing fasteners | | O | O | O |
| 3. Drain oil sump (see note 5) | O | O | O | O |
| 4. Clean suction oil strainer at oil change (inspect strainer for foreign particles) | O | O | O | O |
| 5. Clean pressure oil strainer or change full flow (cartridge type) oil filter element (inspect strainer or element for foreign particles) | O | O | O | O |
| 6. Inspect oil temperature sender unit for leaks and security | | O | O | O |

INSPECTION REPORT

FIGURE 13-1

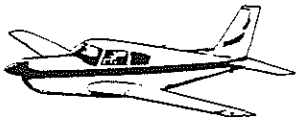




| Nature of Inspection | Inspection Time (hrs.) | | | |
|---|---|---|---|---|
| | 50 | 100 | 500 | 1000 |
| **B. ENGINE GROUP (cont.)** | | | | |
| 7. Inspect oil lines and fittings for leaks, security, chafing, dents and cracks (See Notes 7 and 17) | | O | O | O |
| 8. Clean and inspect oil radiator cooling fins | | O | O | O |
| 9. Remove and flush oil radiator | | | O | O |
| 10. Inspect rocket box covers for evidence of oil leaks. If found, replace gasket; torque cover screws 50 inch-pounds (See Note 9) | O | O | O | O |
| NOTE: Lycoming requires a Valve Inspection be made after every 400 hours of operation (See Note 10.) | | | | |
| 11. Inspect wiring to engine and accessories. Replace damaged wires and clamps. Inspect terminals for security and cleanliness | | O | O | O |
| 12. Inspect spark plug cable leads and ceramics for corrosion and deposits | O | O | O | O |
| 13. Check cylinder compression (Ref: AC 43.13-1A) | | O | O | O |
| 14. Inspect cylinders for cracked or broken fins | | O | O | O |
| 15. Fill engine with oil as per lubrication chart | O | O | O | O |
| 16. Clean engine | | O | O | O |
| 17. Inspect condition of spark plugs (Clean and adjust gap as required. 0.015 to 0.018 or 0.018 to 0.022, as per latest revision of Lycoming Service Instruction No. 1042) | | O | O | O |
| NOTE: If fouling of spark plugs has been apparent, rotate bottom plugs to upper plugs. | | | | |
| 18. Inspect ignition harnesses and insulators (High tension leakage and continuity) | | O | O | O |
| 19. Check magneto main points for clearance - Maintain clearance at 0.018 ± 0.006 | | O | O | O |
| 20. Inspect magneto for oil seal leakage | | O | O | O |
| 21. Inspect breaker felts for proper lubrication | | O | O | O |
| 22. Inspect distributor block for cracks, burned areas, and corrosion and height of contact springs | | O | O | O |
| 23. Check magnetos to engine timing | | O | O | O |
| 24. Overhaul or replace magnetos (See Note 6) | | | | O |
| 25. Remove air cleaner screen and clean (Refer to Piper Service Manual) | O | O | O | O |
| 26. Drain carburetor and remove and clean carburetor inlet screen or remove and clean fuel injector inlet screen. (Clean injector nozzles as required) (Clean with acetone only) | O | O | O | O |
| 27. Inspect condition of carburetor heat or alternate air door and box | O | O | O | O |

| Nature of Inspection | Inspection Time (hrs.) | | | |
|---|---|---|---|---|
| | 50 | 100 | 500 | 1000 |
| **B. ENGINE GROUP (cont.)** | | | | |
| 28. Inspect intake seals for leaks and clamps for tightness | | O | O | O |
| 29. Inspect condition of flexible fuel lines (See Note 17) | | O | O | O |
| 30. Replace flexible fuel lines (See Note 17) | | | | O |
| 31. Inspect fuel system for leaks | | O | O | O |
| 32. Inspect and lubricate fuel selector valve (PA-24-180 and 250 per latest Piper Service Bulletin No. 354) (See Note 13 & 15) | | O | O | O |
| 33. Clean screens in electric fuel pump(s) (Plunger type pump) | O | O | O | O |
| 34. Check fuel pumps for operation (Engine driven and electric) | | O | O | O |
| 35. Overhaul or replace fuel pumps (Engine driven and electric) (See Note 6) | | O | O | O |
| 36. Inspect vacuum pumps and lines | | O | O | O |
| 37. Overhaul or replace vacuum pumps (See Note 6) | | | | O |
| 38. Inspect throttle, carburetor heat or alternate air, mixture and propeller governor controls for travel and operating condition | | O | O | O |
| 39. Inspect exhaust stacks, connections and gaskets (Refer to PA-24 Service Manual, Section III) (Replace gaskets as required) | O | O | O | O |
| 40. Inspect muffler, heat exchanger and baffles (Refer to PA-24 Service Manual, Section III) | | O | O | O |
| 41. Inspect breather tube for obstructions and security | | O | O | O |
| 42. Inspect crankcase for cracks, leaks and security of seam bolts | | O | O | O |
| 43. Inspect engine mounts for cracks and loose mounting | | O | O | O |
| 44. Inspect rubber engine mount bushings for deterioration (Replace every 500 hours) | | O | O | O |
| 45. Inspect all engine baffles for cracks | | O | O | O |
| 46. Inspect firewall for cracks | | O | O | O |
| 47. Inspect condition of firewall seals | | O | O | O |
| 48. Inspect condition and tension of generator or alternator drive belt | | O | O | O |
| 49. Inspect condition of generator or alternator and starter | | O | O | O |
| 50. Lubricate all controls per lubrication chart in Service Manual | | O | O | O |
| 51. Overhaul or replace propeller governor (Refer to latest revision Hartzell Service Letter No. 61) | | | | O |
| 52. Complete overhaul of engine or replace with factory rebuilt (See Note 6) | | | | O |
| 53. Reinstall engine cowl | | O | O | O |



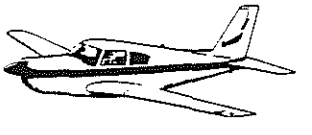


| Nature of Inspection | Inspection Time (hrs.) | | | |
|---|---|---|---|---|
| | 50 | 100 | 500 | 1000 |
| **C. TURBOCHARGER GROUP** | | | | |
| 1. Inspect all air inlet ducting and compressor discharge ducting for worn spots, loose clamps or leaks | O | O | O | O |
| 2. Inspect engine air inlet assembly for cracks, loose clamps and screws | O | O | O | O |
| 3. Inspect waste gate housing, exhaust ducting, and exhaust stacks for signs of leaks or cracks | O | O | O | O |
| 4. Carefully inspect all turbo support brackets, struts, etc., for breakage, sagging or wear | O | O | O | O |
| 5. Inspect all oil lines, fuel lines, and fittings for wear, leakage, heat damage or fatigue (See Note 17) | O | O | O | O |
| 6. Actuate waste gate control; check spring pre-load and examine control for any pending sign of breakage | O | O | O | O |
| 7. Remove inlet hose to compressor and visually inspect compressor wheel | | O | O | O |
| 8. Inspect the compressor wheel for nicks, cracks or broken blades | | O | O | O |
| 9. Inspect for excess bearing drag or wheel rubbing against housing | | O | O | O |
| 10. Inspect induction and exhaust components for worn or damaged areas, loose clamps, cracks and leaks | | O | O | O |
| 11. Inspect turbine wheel for broken blades or signs of rubbing | | O | O | O |
| 12. Inspect turbine heat blanket for condition and security | | O | O | O |
| 13. Inspect rigging of exhaust waste gates | | O | O | O |
| 14. Inspect rigging of alternate air control | | O | O | O |
| 15. Run up engine, check instruments for smooth, steady response | O | O | O | O |
| 16. Remove all Turbocharger components from the engine. Inspect and repair or replace as necessary | | | | O |
| **D. CABIN GROUP** | | | | |
| 1. Inspect cabin entrance door, baggage compartment door and windows for damage, operation and security | | O | O | O |
| 2. Inspect upholstery for tears | | O | O | O |
| 3. Inspect seats, seat belts, securing brackets and bolts | | O | O | O |
| 4. Inspect trim operation | | O | O | O |
| 5. Inspect rudder pedals, brake pedals, and cylinders for operation and leaks | | O | O | O |
| 6. Inspect parking brake | | O | O | O |



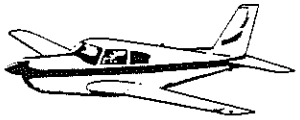
| Nature of Inspection | Inspection Time (hrs.) | | | |
|---|---|---|---|---|
| | 50 | 100 | 500 | 1000 |
| **D. CABIN GROUP (cont.)** | | | | |
| 7. Inspect control wheels, column, pulleys and cables | | O | O | O |
| 8. Check landing, navigation, cabin and instrument lights | | O | O | O |
| 9. Inspect instruments, lines and attachments | | O | O | O |
| 10. Inspect instruments, central air filter lines and replace filter | | O | O | O |
| 11. Inspect condition of vacuum operated instruments and operation of electric turn and bank (Overhaul or replace as required) | | O | O | O |
| 12. Replace vacuum regulator filter | | O | O | O |
| 13. Replace filters, if equipped, in gyro horizon and directional gyro | | | O | O |
| 14. Inspect altimeter (Calibrate altimeter system in accordance with FAR 91.170, if appropriate) | | O | O | O |
| 15. Inspect operation of fuel selector valve (See Note 14) | | O | O | O |
| 16. Inspect oxygen outlets for defects and corrosion | | O | O | O |
| 17. Inspect oxygen system operation and components | | O | O | O |
| **E. FUSELAGE AND EMPENNAGE GROUP** | | | | |
| 1. Remove inspection panels and plates | | O | O | O |
| 2. Check fluid in brake reservoir (Fill as required) | O | O | O | O |
| 3. Inspect battery, box and cables (Check at least every 30 days. Flush box as required and fill battery per instructions in Service Manual) | O | O | O | O |
| 4. Inspect electronic installations | | O | O | O |
| 5. Inspect bulkheads and stringers for damage | | O | O | O |
| 6. Inspect loop and loop mount, antenna mount and electric wiring | | O | O | O |
| 7. Inspect E.L.T. installation and condition of battery and antenna (See latest revision Piper S/L No. 820) | | O | O | O |
| 8. Remove, drain, and clean fuel filter bowl and screen (Drain and clean at least every 90 days) | O | O | O | O |
| 9. Inspect fuel lines, valves and gauges for damage and operation (See Note 13) | | O | O | O |
| 10. Inspect security of all lines | | O | O | O |
| 11. Inspect stabilator and stabilator trim tabs for security of mounting, free play of components and ease of operation (Refer to Service Manual) | | O | O | O |
| 12. Inspect stabilator bearings, bungee, and stabilator trim horns control rod and trim mechanism for security of installation, damage and operation (Refer to latest Piper Service Bulletin No. 464) | | O | O | O |
| 13. Inspect stabilator tip balance weight arm for cracks | | O | O | O |





| Nature of Inspection | Inspection Time (hrs.) | | | |
|---|---|---|---|---|
| | 50 | 100 | 500 | 1000 |
| **E. FUSELAGE AND EMPENNAGE GROUP (cont.)** | | | | |
| 14. Inspect fin front spar to fuselage attachment, per latest revision of Piper Service Letter No. 751 and AD No. 75-12-06 | | O | O | O |
| 15. Inspect fin, rudder and stabilator surfaces for damages | | O | O | O |
| 16. Inspect rudder and rudder tab hinges, horns and attachments for security, damage and operation | | O | O | O |
| 17. Inspect rudder trim mechanism operation | | O | O | O |
| 18. Inspect all control cables and trim cables for correct cable tension, and turnbuckles, guides, and pulleys for damage, operation and safeties | | O | O | O |
| 19. Replace rudder hinge bolts | | | O | O |
| 20. Inspect rotating beacon for wear, etc. | | O | O | O |
| 21. Lubricate per lubrication chart in Service Manual | | O | O | O |
| 22. Inspect security and condition of Autopilot bridle cables and clamps | | O | O | O |
| 23. Reinstall inspection panels and plates | | O | O | O |
| **F. WING GROUP** | | | | |
| 1. Remove inspection plates and fairings | | O | O | O |
| 2. Inspect wing, aileron and flap surfaces for damage and loose rivets, and condition of wing tips | | O | O | O |
| 3. Inspect condition of walkway | | O | O | O |
| 4. Inspect aileron attachments and hinges for damage, looseness and operation | | O | O | O |
| 5. Inspect aileron balance weight and arm for security and condition | | O | O | O |
| 6. Replace outboard aileron hinges with Aileron Outboard Hinge Bracket Kit No. 760 914 | | | | O |
| 7. Inspect aileron cables for correct tension, pulleys, bellcranks and control rods for corrosion, damage and operation | | O | O | O |
| 8. Inspect flap attachments and hinges, or tracks and rollers for damage, looseness and operation. Clean tracks and rollers | O | O | O | O |
| 9. Inspect flap cables, pulleys, step lock, bellcranks and rods for corrosion, damage and operation | | O | O | O |
| 10. Replace pins and or bolts used with aileron hinges and flap hinges or tracks | | | | O |
| 11. Lubricate per lubrication chart in Service Manual | O | O | O | O |
| 12. Inspect wing attachment bolts and brackets (See Note 18) | | O | O | O |





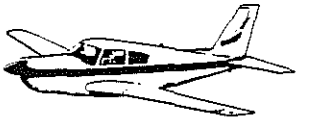
| Nature of Inspection | Inspection Time (hrs.) | | | |
|---|---|---|---|---|
| | 50 | 100 | 500 | 1000 |
| **F. WING GROUP (cont.)** | | | | |
| 13. Inspect fuel tanks and lines for leaks and water | | O | O | O |
| 14. Fuel tanks marked for capacity | | O | O | O |
| 15. Fuel tanks marked for minimum octane rating | | O | O | O |
| 16. Inspect switches to indicators registering fuel tank quantity | | O | O | O |
| 17. Inspect fuel cell vents | | O | O | O |
| 18. Inspect thermos type fuel cap rubber seals for brittleness, deterioration | | O | O | O |
| 19. Reinstall inspection plates and fairings | | O | O | O |
| **G. LANDING GEAR GROUP** | | | | |
| 1. Inspect oleo struts for proper extension. (Inspect for proper fluid level as required) | | O | O | O |
| 2. Inspect nose gear steering control | | O | O | O |
| 3. Inspect wheels for alignment | | O | O | O |
| 4. Put airplane on jacks | | O | O | O |
| 5. Inspect tires for cuts, uneven or excessive wear and slippage | | O | O | O |
| 6. Remove wheels, clean, inspect and repack bearings | | O | O | O |
| 7. Inspect wheels for cracks, corrosion and broken bolts | | O | O | O |
| 8. Check tire pressure (Refer to Service Manual) | O | O | O | O |
| 9. Inspect brake lining and disc for wear and cracks | | O | O | O |
| 10. Inspect brake backing plates for cracks | | O | O | O |
| 11. Inspect condition of brake lines | | O | O | O |
| 12. Inspect condition of shimmy dampener | | O | O | O |
| 13. Inspect gear forks for damage | | O | O | O |
| 14. Inspect oleo struts for fluid leaks and scoring | | O | O | O |
| 15. Inspect gears struts, attachments, torque links, retraction links and bolts for operation (See Note 11) | | O | O | O |
| 16. Inspect torque link bolts and bushings (Rebush as required) | | | O | O |
| 17. Inspect drag link bolts (Replace as required) | | | O | O |
| 18. Inspect gear doors and attachments | | O | O | O |
| 19. Inspect warning horn and light for operation | | O | O | O |
| 20. Retract gear - Check operation | | O | O | O |
| 21. Retract gear - Check doors for clearance and operation | | O | O | O |
| 22. Inspect emergency operation of gear (See latest revision Piper S. L 782) | | O | O | O |
| 23. Inspect landing gear motor, transmission and attachments | | O | O | O |
| 24. Inspect anti-retraction system | | O | O | O |
| 25. Inspect position indicating switches and electrical leads for security | | O | O | O |



| Nature of Inspection | Inspection Time (hrs.) | | | |
|---|---|---|---|---|
| | 50 | 100 | 500 | 1000 |
| **G. LANDING GEAR GROUP (cont.)** | | | | |
| 26. Inspect rubber assist bungee cords and check bungee arms for wear, cracks and/or deformation. (See Note 12) | | O | O | O |
| 27. Lubricate per lubrication chart in Service Manual | | O | O | O |
| 28. Remove airplane from jacks | | O | O | O |
| **H. OPERATIONAL INSPECTION** | | | | |
| 1. Check fuel pump and fuel tank selector operation | O | O | O | O |
| 2. Check indication of fuel quantity and pressure or flow gauges | O | O | O | O |
| 3. Check oil pressure and temperature indications | O | O | O | O |
| 4. Check generator or alternator output | O | O | O | O |
| 5. Check manifold pressure indications | O | O | O | O |
| 6. Check operation of carburetor heat or alternate air | O | O | O | O |
| 7. Check operation of brakes and parking brake | O | O | O | O |
| 8. Check operation of vacuum gauge | O | O | O | O |
| 9. Check gyros for noise and roughness | O | O | O | O |
| 10. Check cabin heat operation | O | O | O | O |
| 11. Check magneto switch operation | O | O | O | O |
| 12. Check magneto RPM variation | O | O | O | O |
| 13. Check throttle and mixture operation | O | O | O | O |
| 14. Check engine idle | O | O | O | O |
| 15. Check propeller smoothness | O | O | O | O |
| 16. Check propeller governor action | O | O | O | O |
| 17. Check electronic equipment operation | O | O | O | O |
| 18. Check operation of controls | O | O | O | O |
| 19. Check operation of flaps | O | O | O | O |
| 20. Check operation of Autopilot, including automatic pitch trim, and Manual Electric Trim (See Note 16) | O | O | O | O |
| **I. GENERAL** | | | | |
| 1. Aircraft conforms to FAA Specifications | O | O | O | O |
| 2. All FAA Airworthiness Directive complied with | O | O | O | O |
| 3. All Manufacturers Service Letters and Bulletins complied with | O | O | O | O |
| 4. Check for proper Flight Manual | O | O | O | O |
| 5. Aircraft papers in proper order | O | O | O | O |

INSPECTION REPORT





PA-24 COMANCHE

MINOR SERVICE AND MAINTENANCE

INSPECTION REPORT ADDENDUMS

1. Refer to the last card of the Piper Parts Price List - Aerofiche, for a checklist of current revision dates to Piper inspection reports and manuals.

2. All inspections or operations are required at each of the inspection intervals as indicated by a (O). Both the annual and 100 hour inspections are complete inspections of the airplane, identical in scope, while both the 500 and 1000 hour inspections are extensions of the annual or 100 hour inspection, which require a more detailed examination of the airplane, and overhaul or replacement of some major components. Inspections must be accomplished by persons authorized by the FAA.

3. Piper service bulletins are of special importance and Piper considers compliance mandatory.

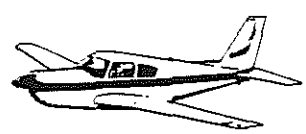
4. Piper service letters are product improvements and service hints pertaining to servicing the airplane and should be given careful attention.

5. Intervals between oil changes can be increased as much as 100% on engines equipped with full flow (cartridge type) oil filters, provided the element is replaced each 50 50 hours of operation.

6. Replace or overhaul as required or at engine overhaul (for engine overhaul, refer to latest revision of Lycoming Service Letter L201).

7. Replace flexible oil lines at engine TBO per latest revision of Lycoming Service Bulletin 240.

8. Inspections given for power plant are based on the engine manufacturer's operator's manual (Lycoming Part No. 60297-19). Any changes issued to the engine manufacturer's operator's manual supersede or supplement the instructions outlined in this report. Occasionally, service bulletins or service instructions are issued by



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MINOR SERVICE AND MAINTENANCE

Avco Lycoming Division that require inspection procedures that are not listed in this manual. Such publications usually are limited to specific models and become obsolete after corrective steps have been accomplished. All such publications are available from Avco Lycoming distributors, or from the factory by subscription. Consult latest revision of Lycoming Service Letter L114 for subscription information. Maintenance facilities should have an up-to-date file of these publications available at all times.

9. Check cylinders for evidence of excessive heat indicated by burned paint on the cylinders. This condition is indicative of internal damage to the cylinder and, if found, its cause must be determined and corrected before the aircraft is returned to service.

   Heavy discoloration and appearance of seepage at the cylinder head and barrel attachment area is usually due to emission of thread lubricant used during assembly of the barrel at the factory, or by slight gas leakage which stops after the cylinder has been in service for awhile. This condition is neither harmful or detrimental to engine performance and operation. If it can be proven that leakage exceeds these conditions, the cylinder should be replaced.

10. At every 400 hours of engine operation, remove the rocker box covers and check for freedom of valve rockers when valves are closed. Look for evidence of abnormal wear or broken parts in the area of the valve tips, valve keeper, springs and spring seat. If any indications are found, the cylinder and all of its components should be removed (including the piston and connecting rod assembly) and inspected for further damage. Replace any parts that do not conform with limits shown in the latest revision for Service Table of Limits SSP 1776.

11. Refer to Section VI of PA-24 Service Manual for proper inspection and wear limits.



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MINOR SERVICE AND MAINTENANCE

12. Replace bungee cords every 500 hours in service or every three years, whichever occurs first.

13. For PA-24-400, refer to latest Piper Service Letter 851.

14. Refer to latest revision of Piper Service Bulletin 354.

15. If the fuel selector valve has 400 hours or more total time in service, inspect valve within the next 100 hours of aircraft operation and every 400 hours thereafter. Inspect the valve in accordance with instructions in Section VIII of the service manual and lubricate per lubrication chart in Section II.

16. Refer to flight manual supplement for preflight and flight check, for intended function in all modes.

17. Replace all Rajay turbo air, fuel and oil hoses upon condition or every five years.

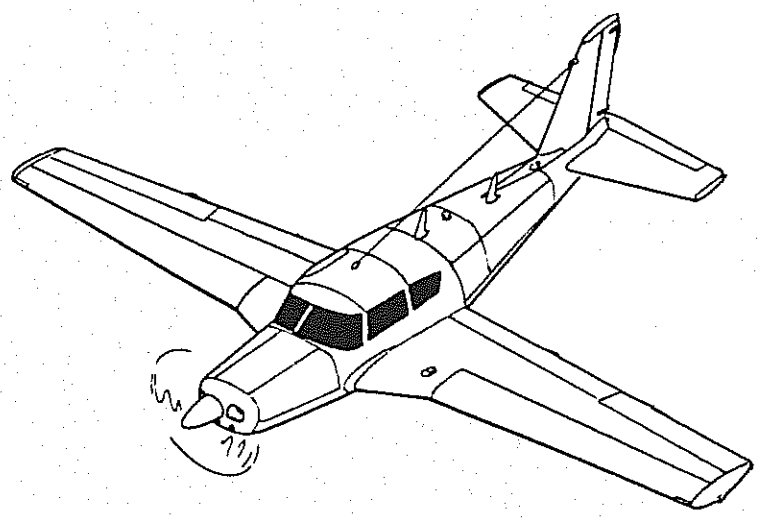
18. Refer to and comply with Airworthiness Directive 82-19-01.

19. Refer to VSP 69.

Comanche

# CHAPTER 14

# OPERATING TIPS



Comanche

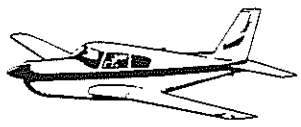
PA-24 COMANCHE

OPERATING TIPS

CHAPTER 14

CONTENTS





PA-24 COMANCHE

OPERATING TIPS

CHAPTER 14

## GENERAL INFORMATION

In the operation of Comanches, as in any other aircraft, there are a few points of technique that apply. The following operating tips may be helpful.

1. Remember that when the instrument or navigation lights are on, the gear position lights are very dim. (Model dependent.)

2. Learn to trim the airplane for take-off with varying loads so only a very slight back pressure on the wheel is required to rotate the airplane from the ground..

3. On take-off, do not retract the gear prematurely. The aircraft may settle and make contact with the ground because of lack of flying speed, atmospheric conditions or rolling terrain.

4. The best speed for take-off on the various models is listed below. Trying to pull the airplane off the ground at too low an airspeed will increase rather than decrease the take-off roll.

| | |
|---|---|
| PA-24-180 | 65 MPH |
| PA-24-250 | 65 MPH |
| PA-24-260 | 65 MPH |
| PA-24-260 Turbo | 70 MPH |
| PA-24-400 | 80 MPH |

5. Although it is permissible to extend the landing gear at speeds up to 150 MPH, the loads on the landing gear extension motor and on the gear doors are much lower if slower speeds are used.

6. The flaps can be lowered at airspeeds up to 125 MPH. To reduce flap operating loads, however, it is desirable to slow the airplane to 100 MPH or less before extending the flaps.

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OPERATING TIPS

7. If the flaps actuating mechanism is not properly maintained, it is possible for one or both flaps to remain down. Therefore, in extending or retracting the flaps, it is recommended to do so in steps to avoid undesirable roll due to asymmetric flaps. If one flap sticks down, the other can usually be controlled so that the pilot can achieve symmetric positions.

8. Before attempting to reset any circuit breaker, allow a two to five minute cooling off period.

9. During gear operation, keep the floor area under the emergency gear lever clear. Restriction to movement of the lever will cause the gear motor circuit breaker to open. (Models with the emergency gear lever above the floor.)

10. If, under unusual circumstances, the landing gear motor is apparently being overloaded and the circuit breaker opens repeatedly, the electric motor can be assisted by applying light hand pressure to the emergency gear lever. (Models with the emergency gear lever above the floor.)

11. When landing and upon making contact with the main wheels, neutralize the rudder pedals, apply additional back pressure to the control wheel. If a short field landing is desired, retract the flaps as soon as the airplane is on the ground. This gives best directional control on the ground and provides for full effectiveness of the brakes during the landing roll.