

1.02.03 LANDING GEARS



1.02 AIRCRAFT GENERAL KNOWLEDGE

BASIC INFO

Landing gears are used for:

- Provide ability of maneuvering the aircraft on the ground
- Support aircraft on appropriate height above ground
- Absorb kinetic energy on landing touch down
- Provide deceleration on landing roll-out

LANDING GEAR



LAYOUT

LANDING GEAR

There are 2 undercarriage layouts:

- Tail wheel (dragger)
- Tricycle with nose wheel



TAIL WHEEL LAYOUT

Steering is possible only with differential braking system

Landing on cross wind is dangerous of coming off the runway, also because of big angle of attack during landing rollout, on tail wind – danger of nose flipping
Need to perform S-turns while taxi to clear taxi way – picture from real deadly accident happened in US

Disadvantages

- Has complicated steering
- Affected by cross/tail wind
- Risk of nose-over flipping on hard braking
- Bad vision from cockpit while taxi

- Advantages
- Easy and cheap in construction
- Generates less parasite drag in flight

LANDING GEAR



TRICYCLE WITH NOSE WHEEL LAYOUT

LANDING GEAR

There are two versions of tricycle gear layout:

- With nose **steering wheel** (steered by pedals)
- With **self - centered** nose strut (steered by differential braking)

Advantages

- Directionally stable on landing and taxi with nose steering wheel
- Sustainable of nose –over flipping on hard braking (on STOL)
- “Normal” horizontal position of aircraft on ground provides better view from cockpit



MAIN LANDING GEAR

LANDING GEAR

Main landing gear can be:

- Fuselage mounted
- Wing mounted
- Spring or steel leg is usually for main gear as an absorber



MAIN LANDING GEAR

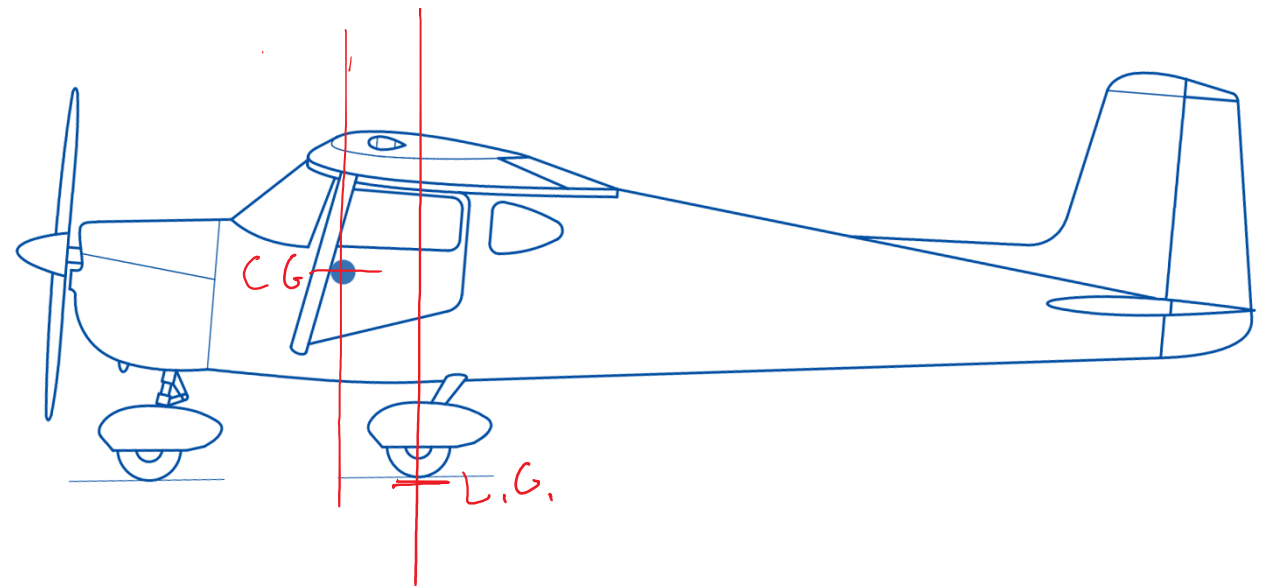
LANDING GEAR

Position of main landing gear is slightly aft of CG.

Main landing gear:

- Takes 90% of load on taxi and touchdown
- Provides braking

On landing touchdown first with main landing gears only



NOSE LANDING GEAR

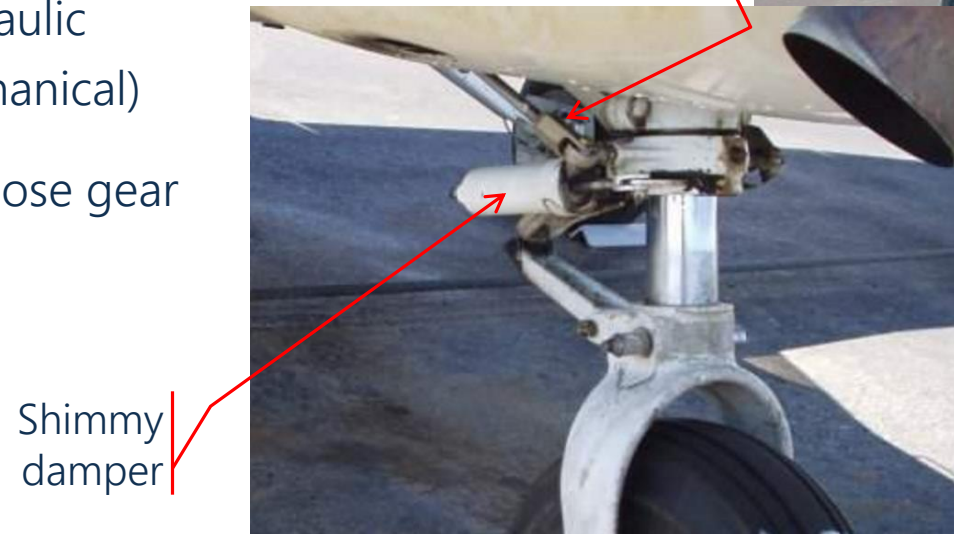
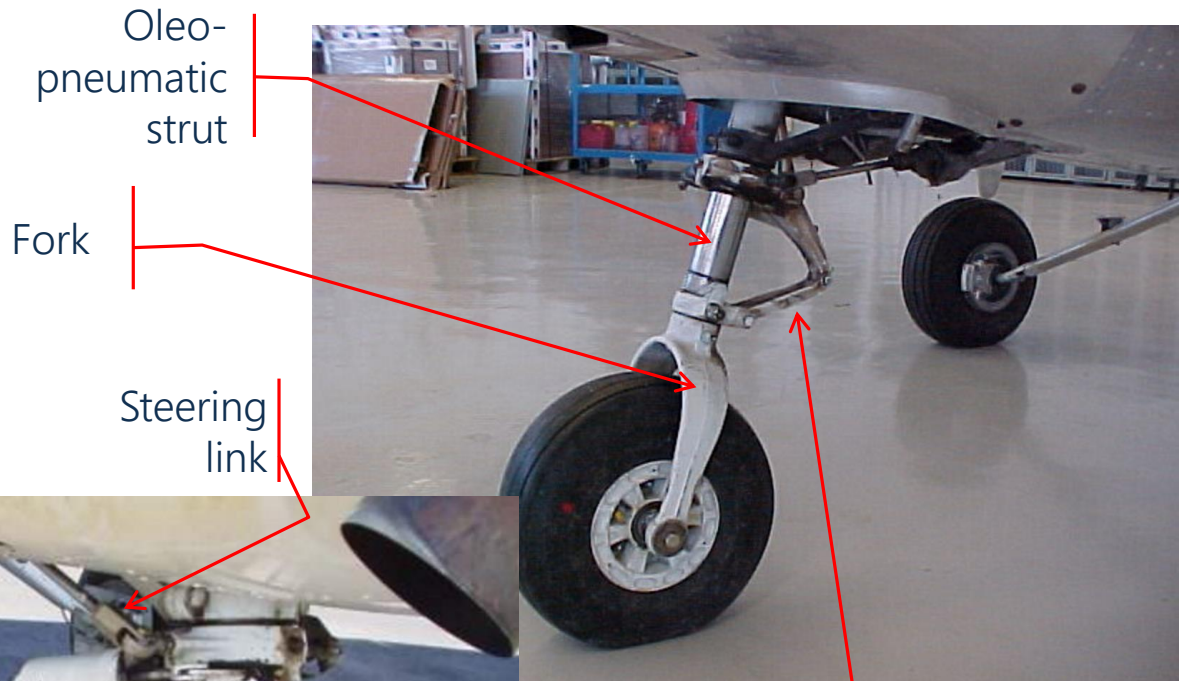
LANDING GEAR

Nose landing gear can have steering strut or self-centering strut. Steering strut is controlled by pedals

- Oleo-pneumatic strut usually is used for nose gear

Steering actuator is used for hydraulic steering system (or lever for mechanical)

Shimmy damper is mounted on nose gear to prevent dangerous directional oscillations of the wheel



SHOCK ABSORBERS

Shock absorbers designed to absorb and damp shock impulses during taxi, takeoff and landing.

Construction of shock absorbers:

- Spring – steel leg
- Oleo-pneumatic strut
- Rubber cord shock absorber
- Rubber pad absorber

Rubber cord is used on old and light, cheap airplanes

Spring steel as part of fixed main landing gears

Oleo-pneumatic strut – for nose landing gear or for all wheels of airplane

LANDING GEAR



FIXED LANDING GEAR

Mounted on fuselage

- Cheap, low cost on maintenance
- Light weight
- High drag - for low speed airplanes
- Sometimes covered by fairings to minimize parasite drag

LANDING GEAR

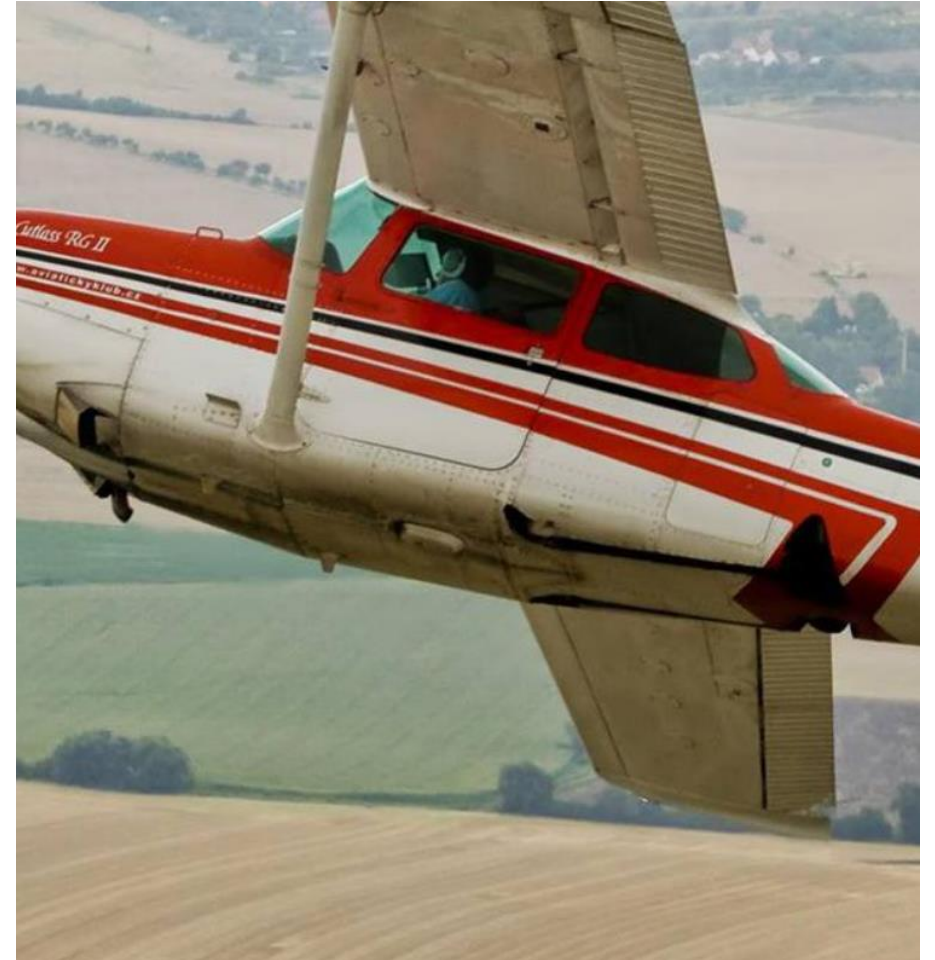


RETRACTABLE LANDING GEAR

LANDING GEAR

Can be retracted into special places in fuselage (gear bays)

- Efficient for high speed airplanes
- Generates less parasite drag
- Heavier than fixed landing gear
- More expensive, more complicated in maintenance
- Has operation limits – can be retracted or extended only on limited airspeed
- Good for emergency landings on soft surfaces



RETRACTION SYSTEMS

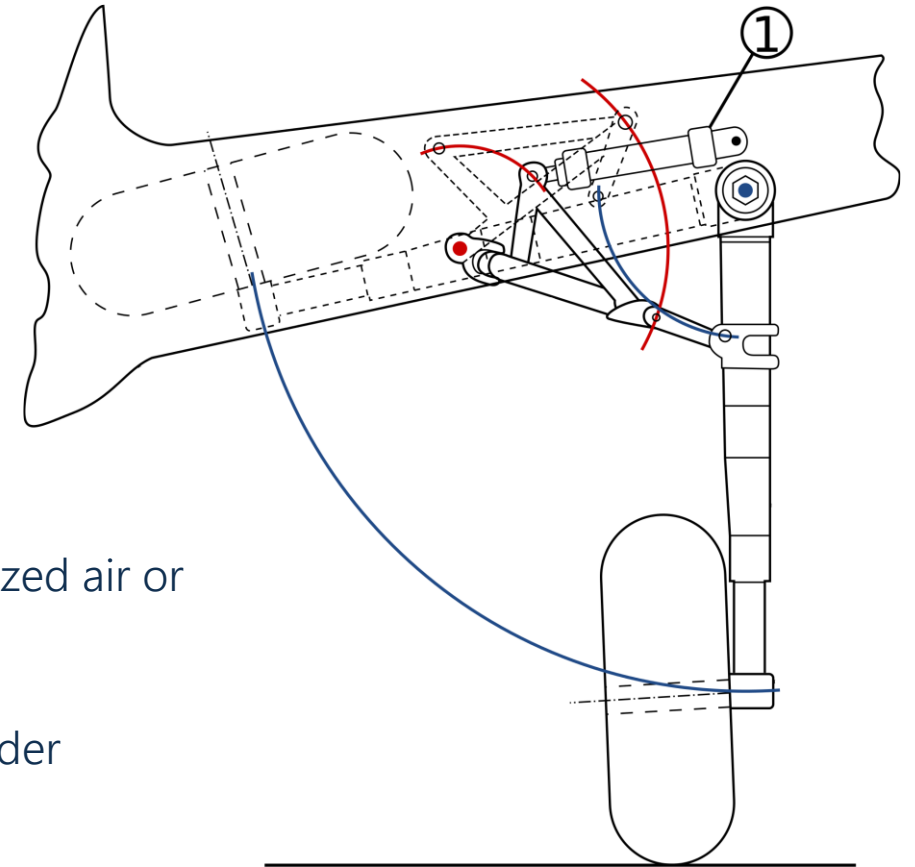
Transition of landing gear position is controlled by means of:

- Pneumatic power
- Hydraulic power
- Electric power

How actuator works:

- Pneumatic actuator is moved by pushing actuators piston by pressurized air or gas
- Hydraulic actuator is moved by pushing actuators piston by liquid under pressure
- Electric actuator is powered by electric motor with screw reduction mechanism

RETRACTABLE LANDING GEAR



CONTROLS

To increase safety gear retraction system is duplicated and has:

- Primary retraction system
- Emergency retraction system

Usually **emergency retraction system** can be:

- With manual unlock and **free gear fall**
- With manual **secondary pump** on small airplanes
- With **secondary pressure system** – on complicated airplanes

RETRACTABLE LANDING GEAR



POSITIONING INDICATOR

In order to be sure in landing gear position during aircraft operation there is a landing gear positioning indicator (three lams):

- Indication of gear locked down – **green light**
- Indication of gear in transit position – **amber**
- Indication of gear locked up – **no lights**

Positioning indicator uses signals from landing gear position sensors. To prevent human mistakes indicator has **lamp test mode**

Some models of aircraft have simple mechanical position lock down indicator

RETRACTABLE LANDING GEAR



OPERATION HIGHLIGHTS

- Follow checklist to be sure to lock gear down on landing
- Control airspeed limits before operating gear retraction system
- Remember emergency check-list
- In rain, slash, wet snow, ice there is risk of freezing landing gear systems during flight. To prevent freezing need to retract – extract, and retract again to drop off slash from the retraction mechanism

RETRACTABLE LANDING GEAR



CONSTRUCTION

Construction of wheels:

- Tube or tubeless tires are used
- Disk (hub) in the center
- Inflation valve
- Bearings

Pneumatic tires are needed to adsorb shocks, transmit braking and provide wearing surface (tires must be changed periodically)

Wheel must be light (disk is made of magnesium or aluminum alloys)

WHEELS AND TIRES



TUBE TIRES

- Don't require tight sealing of tire beds to hub rims
- Is subject to damage as a result of tube creep in case of low pressure in tires

WHEELS AND TIRES



TUBELESS TIRES

WHEELS AND TIRES

- Prevent rapid loss of pressure in case of penetration
- Inflation valve is prevented of damage caused by creep of the tire
- Lighter up to 7% because of lack of the tire

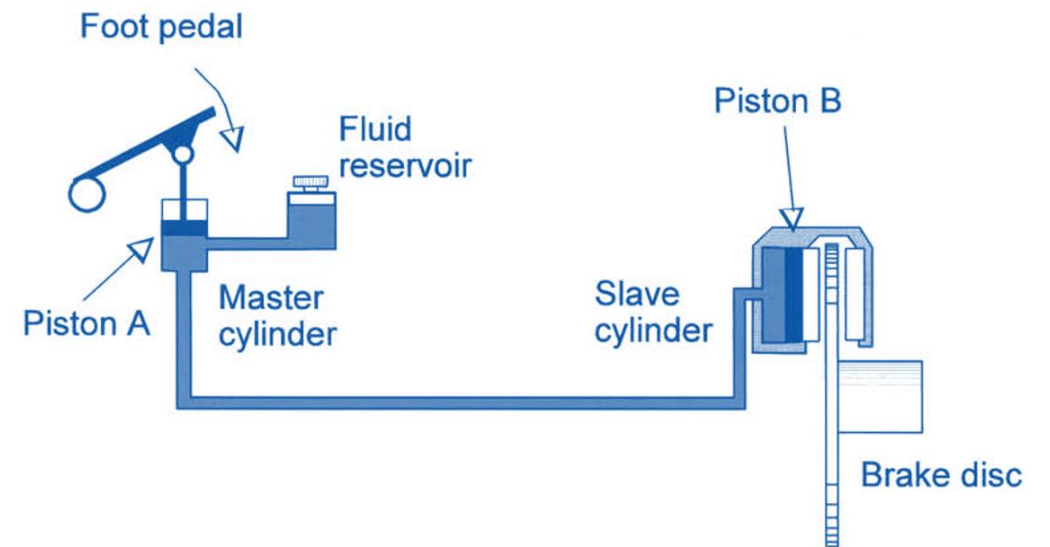


OVERVIEW

Hydraulic braking system is broadly used in aircrafts

- Single plate disk brakes installed for light aircrafts and multiple plate disk for heavy aircrafts
- Pushing pedal and moving piston in master cylinder causes raise of pressure in braking line and liquid pushes brake pads to braking disk causing braking effect

BRAKING SYSTEM



BRAKE CONTROL

- Main landing gear is equipped with brakes
- **Differential brakes** help to steer aircraft on case when aircraft is equipped with centering nose strut)

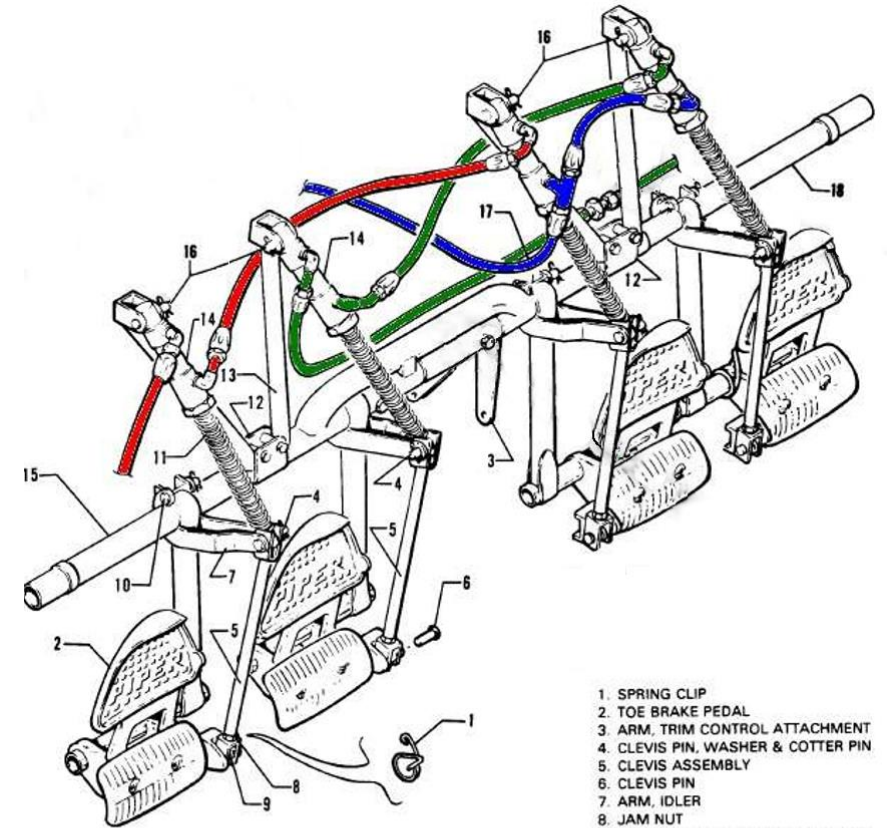
BRAKING SYSTEM



BRAKE CONTROL

- Differential braking is controlled by left and right pedals
- Braking action applied by feet to **toe brake pedals**
- Combined with co-pilot pedals
- Left side (PIC) has priority

BRAKING SYSTEM



1. SPRING CLIP
2. TOE BRAKE PEDAL
3. ARM, TRIM CONTROL ATTACHMENT
4. CLEVIS PIN, WASHER & COTTER PIN
5. CLEVIS ASSEMBLY
6. CLEVIS PIN
7. ARM, IDLER
8. JAM NUT
9. CLEVIS PIN, WASHER & COTTER PIN
10. CLEVIS PIN, WASHER & COTTER PIN
11. SPRING, RETURN
12. BRACKET
13. BRACE ASSEMBLY
14. CYLINDER ASSEMBLY, HYDRAULIC
15. TUBE ASSEMBLY, LEFT
16. CLEVIS PIN & COTTER PIN
17. HOSE ASSEMBLY - FLEXIBLE
18. TUBE ASSEMBLY, RIGHT

Please visit Q/A section to prepare to the theory examination

Thank you!

PPL THEORY

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