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VERSION	EFFECTIVE DATE	DESCRIPTION OF REVISION(S)
001	2015.01	Module creation and release.
002	2024.06	Regulatory update for EASA 2023-989 Compliance.
002.1	2025.01	Page 3.16 - Corrected term thermoplastics to thermoset polymers. Page 9.5 - Corrected the orientation of left side checknut Figure 9-11. Page 12.13 - Replaced to improve Figure 12-22.

Module was reorganized based upon the EASA 2023-989 subject criteria. Enhancements included in this version 002.1 are:

11.1.2 *High Speed Flight* - topic moved to Module 8 Basic Aerodynamics.
11.3.1 *Airborne Towing Devices* - topic added.
11.5.2 *Avionics Test Equipment* - topic added.
11.10 *Inert Gas Systems* - topic added.
11.11 *Tail Protection* - topic added.
11.16 *Pneumatic Pumps* - topic added.
Question and Answer updates for all Submodules.

be mounted far enough away so that the hot engine and exhaust gasses do not damage it, and to safeguard the airframe in the event of an engine explosion or breakup. [**Figure 3-40**]

The four functions of pylons are to:
1. Support the engine.
2. Transmit the engine thrust to the airframe.
3. Enable the attachment of engine accessories such as electrical wiring, hydraulic lines, bleed air and fuel lines.
4. Serve as fire barrier between engine and airframe.

Pylon structures are divided into primary and secondary sections. As the primary structure carries all the loads and serves as the firewall, it is normally built with titanium and steel alloys. Secondary sections which are not part of the firewall are typically made with composite panels.

FIREWALLS
Engines and their pylons are divided into fireproof zones by bulkheads made of stainless steel, titanium or thermoset polymers. These zones divide the spaces between the engine and nacelle into compartments to limit the spread of fire. Normally the hinged nacelle doors are also part of the firewall, surrounding the engine with airtight fireproof seals.[**Figure 3-41**]

Figure 3-38. The bottom of the up aileron pivots into the airstream creating drag and helping to prevent flutter.

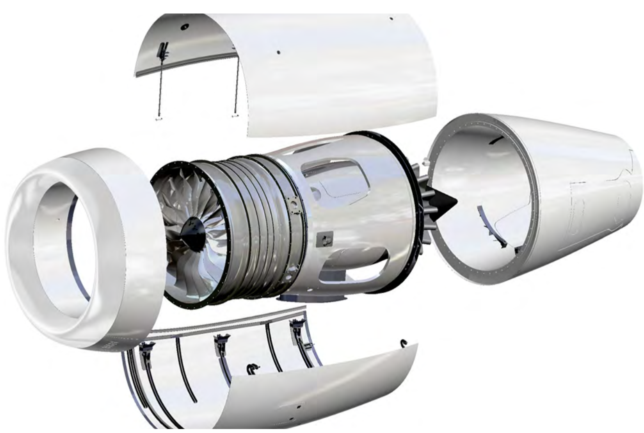

Figure 3-39. The various sections of a turbine engine nacelle.

ENGINE MOUNTS
The engine mounts on turbine engines perform the basic functions of supporting the engine and transmitting the loads imposed by the engine to the aircraft structure. Turbine engine mounts are typically constructed from chrome/nickel/molybdenum assemblies in larger aircraft. Some engine mounting systems use two mounts to support the forward end of the engine and a single mount at the rear end.

Vibration isolator engine mounts additionally isolate the airplane structure from adverse engine vibrations. Vibration isolators consist of a resilient material permanently enclosed in a metal case. As an engine vibrates, the resilient material deforms slightly, thereby dampening the vibrations before they reach the airplane structure. [**Figure 3-41**]

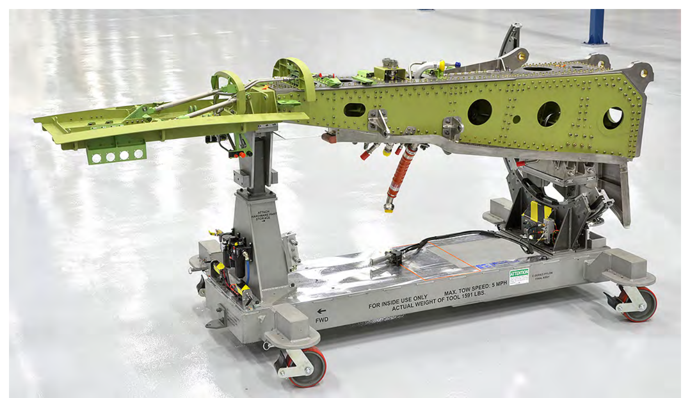

Figure 3-40. Spirit Aerospace pylon from a Bombardier C series.

Figure 3-41. A turboprop engine mount with vibration isolation, in front of a stainless steel firewall.

PUSH-PULL TUBES

Where cables only have strength when they are place under tension, or pulled, push-pull rods are able to transmit force in either direction. Push-pull rods may be solid or hollow. The ends attached to the push-pull rods may be fixed or adjustable. Technicians must ensure that adjustable ends have adequate thread engagement with the push-pull rod. Inadequate thread engagement may lead to part failure and loss of control. Witness holes are used to verify sufficient thread engagement. [**Figure 9-11 and 9-12**]

BELLCRANKS AND LEVERS

Bellcranks are constructed so that a series of levers are able to receive an input signal and deliver an output. The output from a lever or bellcrank may amplify the input or vice-versa. Frequently, bellcranks change the direction of movement. The input signal may come from a lateral direction and the output motion made in a longitudinal direction and vice-versa. [**Figure 9-13 and 9-14**]

JACKSCREWS

Jackscrews are commonly used for moving surfaces that experience extreme aerodynamic loads, such as horizontal stabilizers and flaps. Jackscrews are threaded units that convert rotary motion

Figure 9-8. Outboard Trailing Edge Flaps and Slats Extended. Note how the extension of the flaps and slats increase the surface area of the wing in addition to altering the shape of the wing to enhance low-speed performance and lift production.

Figure 9-9. Leading edge and trailing edge inboard flaps extended. In addition to the outboard trailing edge flaps and slats shown in the previous illustration, leading edge flaps and inboard trailing edge flaps, seen behind the landing gear, are extended to further enhance low-speed performance.

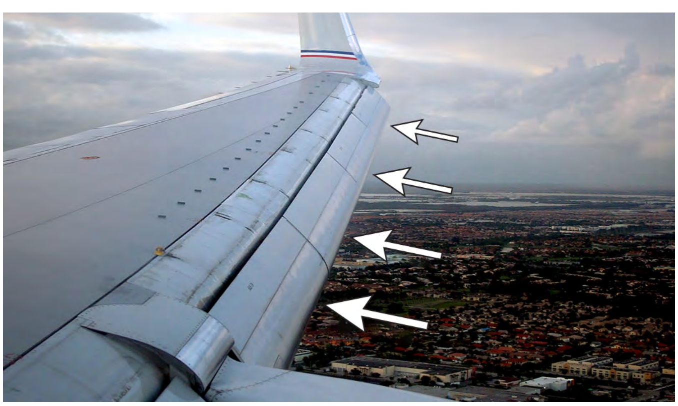

Figure 9-10. Leading edge slats deployed in low speed takeoff and landing position.

Figure 9-12. Witness hole in push-pull tube. When the terminal end is adequately threaded into the tube, the threads will block the witness hole.

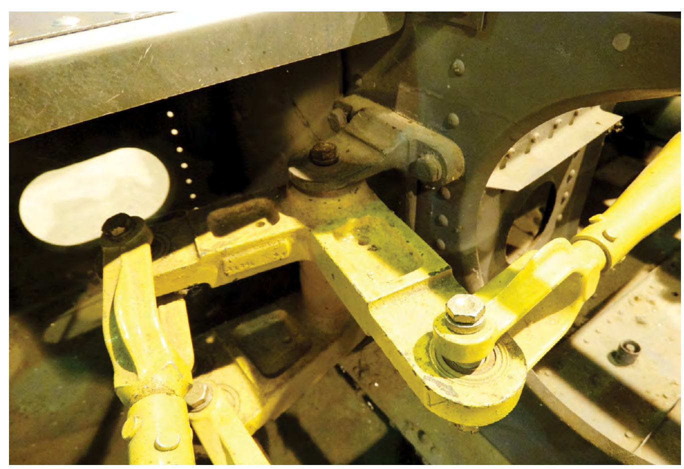

Figure 9-13. Bell crank with push-pull tubes.

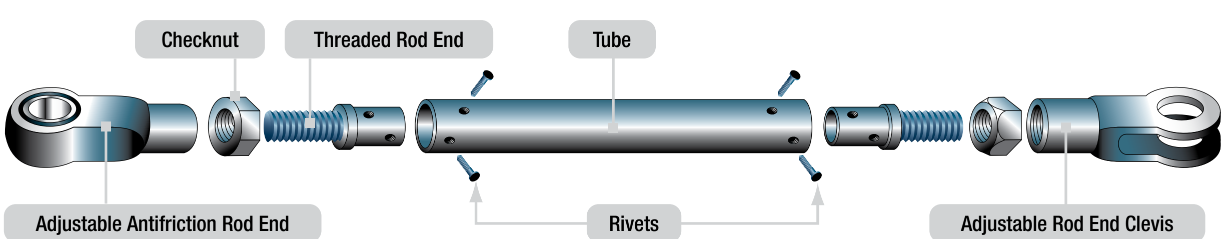

Figure 9-11. Exploded view of push-pull rod.

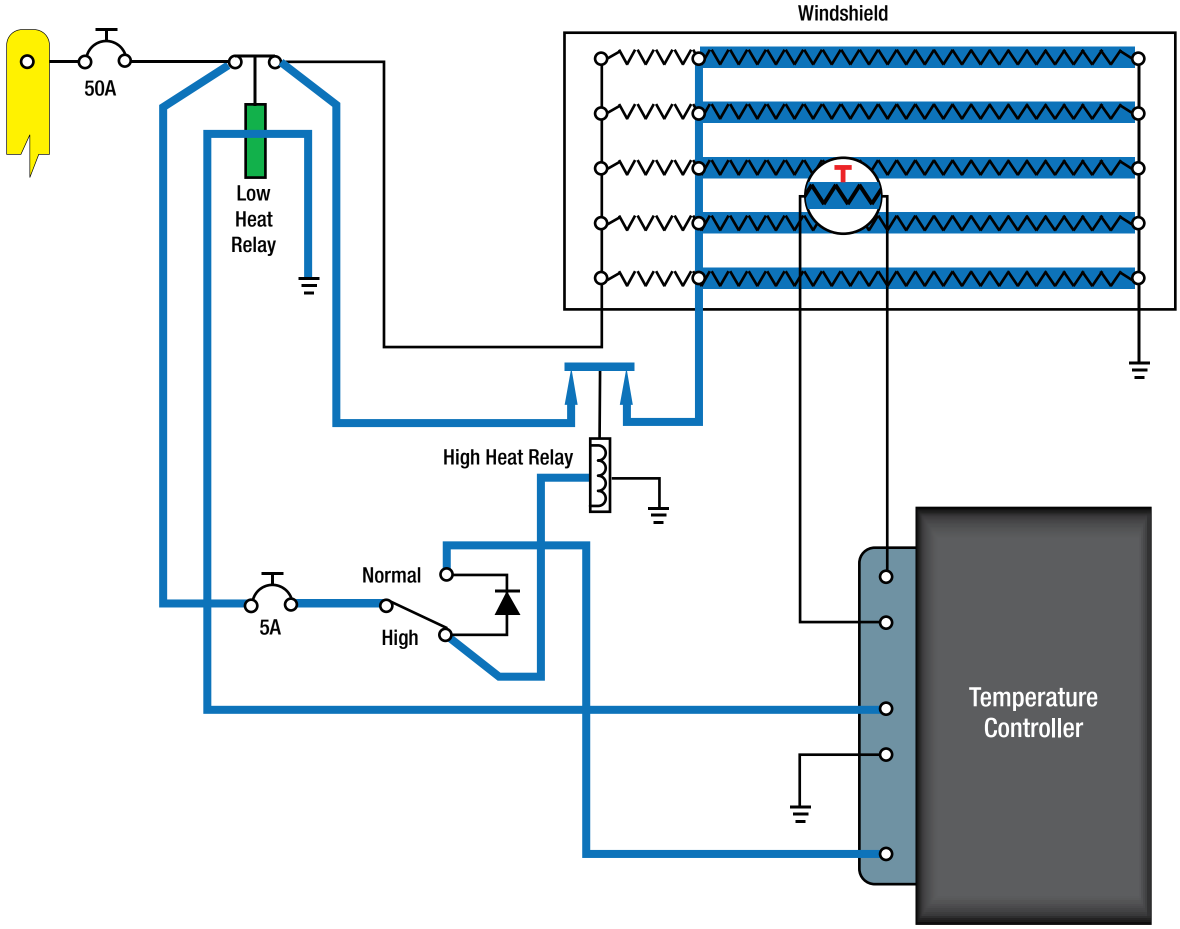

Figure 12-21. Electric windshield heat schematic.

PROPELLER ANTI-ICE

Many propellers use thermal electric boots to remove any ice that forms on the blades (de-ice). However some aircraft permit operation of the electric heating element boots to prevent ice from forming. In this case, the boots perform an anti-icing function.

THERMAL PNEUMATIC ANTI-ICE

Thermal pneumatic systems used for the purpose of preventing the formation of ice on airfoil leading edges usually use heated air ducted span-wise along the inside of the leading edge of the airfoil and distributed around its inner surface. These thermal pneumatic anti-icing systems are used for wings, leading edge slats, horizontal and vertical stabilizers, engine inlets, and more. As stated, the most common source of the heated air is the turbine engine compressor bleed air.

WING ANTI-ICE SYSTEMS (WAI)

Thermal wing anti-ice (WAI or TAI) systems for business jet and large-transport category aircraft take advantage of the relatively large amounts of very hot air that can be bled off of turbine engine compressors to provide a satisfactory source of anti-icing heat. The hot air is routed through ducting, manifolds, and valves to the leading edges of the wings. [**Figure 12-22**]

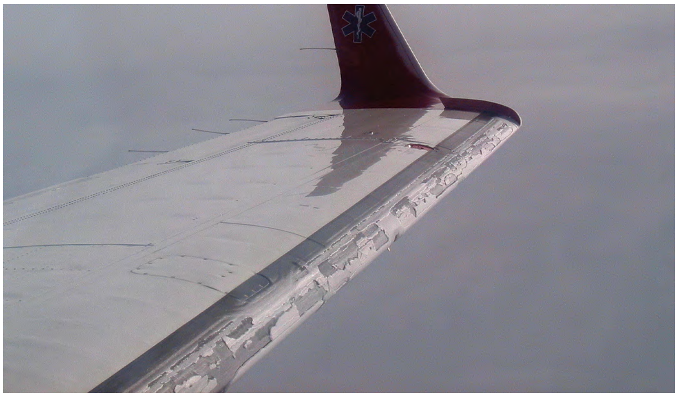

Figure 12-22. Aircraft with thermal WAI system.

Figure 12-23 shows a typical WAI system schematic for a business jet. The bleed air is routed to each wing leading edge by an ejector in each wing inboard area. The ejector discharges the bleed air into piccolo tubes for distribution along the leading edge. Fresh ambient air is introduced into the wing leading edge by two flush-mounted ram air scoops in each wing leading edge, one at the wing root and one near the wingtip. The ejectors entrain ambient air, reduce the temperature of the bleed air, and increase the mass airflow in the piccolo tubes. The wing leading edge is constructed of two skin layers separated by a narrow passageway. [**Figure 12-24**]

The air directed against the leading edge can only escape through the passageway, after which it is vented overboard through a vent in the bottom of the wingtip. When the WAI switch is turned on, the pressure regulator is energized and the shutoff valve opens. When the wing leading edge temperature reaches approximately