

Inflation and Deflation of Aircraft's Tire with Intelligent Tire Pressure Regulation System

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Abstract : An aircraft tire is designed to tolerate extremely heavy loads for a short duration. The number of tires increases with the weight of the aircraft, as it is needed to be distributed more evenly. Generally, aircraft tires work at high pressure, up to 200 psi (14 bar; 1,400 kPa) for airliners and higher for business jets. Tire assemblies for most aircraft categories provide a recommendation of compressed nitrogen that supports the aircraft's weight on the ground, including a mechanism for controlling the aircraft during taxi, takeoff; landing; and traction for braking. Accurate tire pressure is a key factor that enables tire assemblies to perform reliably under high static and dynamic loads. Concerning ambient temperature change, considering the condition in which the temperature between the origin and destination airport was different, tire pressure should be adjusted and inflated to the specified operating pressure at the colder airport. This adjustment superseding the normal tire over an inflation limit of 5 percent at constant ambient temperature is required because the inflation pressure remains constant to support the load of a specified aircraft configuration. On the other hand, without this adjustment, a tire assembly would be significantly under/over-inflated at the destination. Due to an increase of human errors in the aviation industry, exorbitant costs are imposed on the airlines for providing consumable parts such as aircraft tires. The existence of an intelligent system to adjust the aircraft tire pressure based on weight, load, temperature, and weather conditions of origin and destination airports, could have a significant effect on reducing the aircraft maintenance costs, aircraft fuel and further improving the environmental issues related to the air pollution. An intelligent tire pressure regulation system (ITPRS) contains a processing computer, a nitrogen bottle with 1800 psi, and distribution lines. Nitrogen bottle's inlet and outlet valves are installed in the main wheel landing gear's area and are connected through nitrogen lines to main wheels and nose wheels assy. Controlling and monitoring of nitrogen will be performed by a computer, which is adjusted according to the calculations of received parameters, including the temperature of origin and destination airport, the weight of cargo loads and passengers, fuel quantity, and wind direction. Correct tire inflation and deflation are essential in assuring that tires can withstand the centrifugal forces and heat of normal operations, with an adequate margin of safety for unusual operating conditions such as rejected takeoff and hard landings. ITPRS will increase the performance of the aircraft in all phases of takeoff, landing, and taxi. Moreover, this system will reduce human errors, consumption materials, and stresses imposed on the aircraft body.

Keywords : avionic system, improve efficiency, ITPRS, human error, reduced cost, tire pressure

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