Operators typically purchase twin-aisle airplanes for long-distance flights. However, when market conditions dictate, operators may use some of these airplanes on shorter flights. In such instances, appropriate action by the flight crew can reduce the likelihood of brake overheating and concomitant departure delays.
**FACTORS THAT LEAD TO UNEVEN BRAKE HEATING**

Slowing an airplane requires the dissipation of kinetic energy. Kinetic energy that is not absorbed by the thrust reversers and speed brakes is converted to heat energy by the wheel brakes. The weight and speed of the airplane during landing and taxiing determine how much energy the brake friction (i.e., heat stack) material absorbs.

Factors that lead to uneven brake heating include variation in brake wear, inadvertent asymmetrical braking, and wind conditions.

**Variation in brake wear.** Brakes that are approaching wear limits can become as much as 30 percent hotter than unworn brakes. This variation in temperature simply reflects the difference in the amount of brake friction material.

**Inadvertent asymmetrical braking.** Temperature differences between brakes on the left and right gears often arise from inadvertent asymmetrical braking. When the brakes and rudder pedals are used concurrently to maintain heading and keep speed under control, it is easy for flight crews to inadvertently apply asymmetrical braking inputs that — unknown to them — are being compensated for by the rudder. When the pedal brakes are applied lightly during taxi braking and landings, temperature differences among the brakes on each landing gear can increase quickly.

**Wind conditions.** Brakes cool by convection, and even a moderate breeze can result in temperature differences among brakes that are exposed to wind and those that are sheltered from it.

Given these factors, it is important to remember that temperature differences between the two sides of an airplane do not necessarily mean that a problem exists with the braking system or the brake temperature monitor.

**INTERPRETATION OF THE BRAKE TEMPERATURE INDICATION**

The BRAKE TEMP light illuminates (or a BRAKE OVHT alert displays) when the temperature of a brake rises above a predetermined level and turns off when all the brakes have cooled to a certain level (fig. 1). These levels vary by airplane model and type of brake (table 1).

The BRAKE TEMP light and BRAKE OVHT alert indicate that the radiated and conducted heat from the brake may cause a wheel fuse plug to melt to release air pressure from the tire safely. Whether or not the fuse plug actually melts depends on how far the threshold setting for the brake temperature indication has been exceeded (i.e., the higher the reading on the brake temperature display, the greater the likelihood of the fuse plug melting). The aircraft maintenance manual describes the procedures for checking for deflated tires and hydraulic leaks. (Hydraulic leaks can result from overheated brake systems.)

**FACTORS THAT LEAD TO UNEVEN BRAKE HEATING**

- Slowing an airplane requires the dissipation of kinetic energy.
- Kinetic energy not absorbed by the thrust reversers and speed brakes is converted to heat energy.
- Weight and speed of the airplane during landing and taxiing determine brake energy absorption.
- Factors include variation in brake wear, inadvertent asymmetrical braking, and wind conditions.

**Variation in brake wear**

- Brakes approaching wear limits can be 30% hotter than unworn brakes.

**Inadvertent asymmetrical braking**

- Temperature differences between left and right brakes.
- Brakes used concurrently to maintain heading and speed.

**Wind conditions**

- Brakes cool by convection.
- A moderate breeze can affect temperature differences.
differences between new and worn brakes also will increase with repeated landings. Because of these factors, a BRAKE TEMP or BRAKE OVHT indication will more likely occur toward the end of the day and especially in hot weather.

If landing conditions for an airplane exceed certain maximums listed in the airplane flight manual (AFM) quick-turnaround charts, departure may be delayed for a prescribed period of time to let the brakes cool. The airplane may be allowed to depart before the end of that period if the true brake temperatures, as shown by the brake temperature indication, are lower than those predicted in the AFM.

**FLIGHT CREW ACTION THAT CAN MINIMIZE UNEVEN BRAKE HEATING**

How the flight crew uses the brake system in conjunction with reverse thrust and the spoilers during landing significantly affects the amount of energy transferred to the brake stacks. Flight crews can use several techniques to arrive at the airport gate with cooler brakes.

On long runways, aerodynamic drag and thrust reversers may provide plenty of deceleration at high speed, and braking can be delayed until taxi speeds are reached. If autobrakes are used, the flight crew should choose the lowest deceleration setting commensurate with the available field length, landing long and turning off short should be avoided.

Brake energy balance is improved when the autobrakes are used all the way down to taxi speeds because the same hydraulic pressure is applied to every brake.

On the taxiway, moderate brake applications followed by full pedal release keep the brakes cooler than would a steady application of light brake pressure (i.e., riding the brakes). Using this technique makes it less likely that the BRAKE TEMP or BRAKE OVHT indication will come on because of one disproportionately hot brake. (It should be noted that minimizing the number of brake applications can reduce wear on carbon brakes.)

If the BRAKE TEMP or BRAKE OVHT indication still occurs, published maintenance procedures should be performed.

**SUMMARY**

During short-flight operations, flight crews can take steps to pass on a cooler set of brakes to the next crew. Crews can carefully manage brake energy during landing and taxiing by:

- Maximizing the use of thrust reversers and minimizing the use of brakes.
- Using autobrakes or symmetrical pedal braking.
- Avoiding riding the brakes during taxi.