AGV Wheel for Keyed Polyurethane Bonding

Title	AGV Wheel for Keyed Polyurethane Bonding
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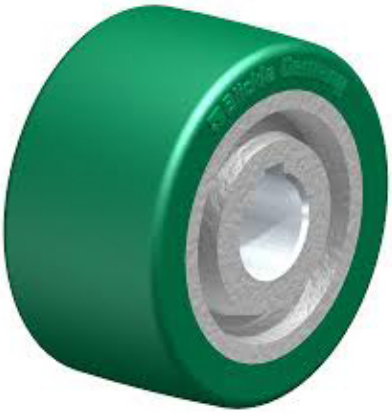
Description

Unlike a standard forklift that moves linearly and stops frequently, modern AGVs present a unique torture test for wheels:

1. Constant Motion: High duty cycles generate significant internal heat (hysteresis) within the polyurethane. Heat is the enemy of adhesion.
2. Zero-Turn Maneuvers: Many AGVs rotate on their axis. This creates immense shear force at the interface between the metal hub and the polyurethane tire.
3. High Load Density: AGVs are becoming smaller but heavier. The load-per-square-inch on the bond line is higher than ever before.

If the bond fails, the polyurethane tire strips off the metal core (debonding), rendering the vehicle useless and potentially damaging the floor or the load.



The Solution: Keyed Bonding and Chemical Adhesion

To ensure a failsafe wheel, manufacturers employ a dual-threat strategy: Mechanical Keying and Chemical Bonding.

1. Mechanical Keying

Keying refers to the machining of the metal hub (usually aluminum or steel). Instead of a smooth surface, the hub is machined with:

Knurling: A diamond-pattern texture that increases surface area.

Slots or Grooves: Deep channels cut horizontally across the rim.

Dovetails: Angled cuts that physically trap the polyurethane as it cures.

When the liquid polyurethane is cast into the mold, it flows into these "keys." Once cured, due to extreme heat, the mechanical key prevents the tire from spinning loosely on the hub.

2. Chemical Bonding

Mechanical keying alone is not enough to prevent micro-movements that generate heat. Chemical bonding is required to fuse the materials.

Surface Prep: The metal core is shot-blasted to remove oxidation and create a microscopic texture.

Degreasing: All oils are removed. Even a fingerprint can cause a bond failure.

The Primer: A specialized bonding agent is applied to the metal. This primer reacts single, fused unit.

The Impact of Bond Failure on ROI

When sourcing wheels for AGVs, the "Keyed" bonding process adds to the manufacturing cost, but the return on investment is clear when analyzing failure modes.

Non-Keyed / Poorly Bonded Wheels: Under high torque (acceleration) or braking, the tire can slip relative to the hub. This leads to positional errors, system faults, and required manual intervention.

Keyed & Chemically Bonded Wheels: The tire and hub move as one. The high-strength adhesive dissipates heat effectively, protecting the bond line even during 24-hour operation cycles.

Conclusion

For AGV manufacturers and warehouse operators, the wheel is not a commodity; it is a reliable solution to handle the torque, load, and duty cycles of modern automation.

By specifying wheels that utilize both mechanical locking (keying) and advanced ensuring that the fleet keeps rolling and the logistics chain remains unbroken.