

FORKLIFT

LOAD STABILITY & SAFE HANDLING PRACTICES



August 2025

Executive Summary

Forklift stability is one of the most critical factors influencing workplace safety and operational efficiency. Every year, thousands of tip-over accidents occur due to improper load management, often resulting in injuries, equipment damage, and costly downtime.

At Machinex we believe that safe operations start with knowledge. This whitepaper explains the fundamentals of forklift load stability, the science behind load distribution, and practical safety measures. It also highlights how Machinex forklifts are engineered with advanced stability features to minimize risks in diverse environments.



1. Key Load Stability Concepts

Understanding a few technical terms helps operators and fleet managers make better decisions:

- **Center of Gravity (CG):** The exact point where an object's weight is concentrated. For a uniform load, it's usually at the midpoint.
- **Fulcrum:** The tipping axis of a forklift, around which the machine can rotate if overloaded or unbalanced.
- **Line of Action:** An imaginary vertical line passing through the load's center of gravity.
- **Load Center:** The horizontal distance from the vertical face of the forks to the load's center of gravity. Standard rating assumes 24 inches.
- **Moment:** The product of weight \times distance from the fulcrum. Higher moments increase the chance of tipping.
- **Stability (Lateral & Longitudinal):** Lateral stability is resistance against side overturns, while longitudinal stability prevents forward/backward tipping.



Machinex Insight

Every Machinex forklift is tested for both lateral and longitudinal stability under real-world conditions, ensuring safer performance in uneven or high-demand environments.

2. The Forklift Stability Triangle

Most counterbalanced forklifts, including four-wheel designs, rest on a three-point suspension system. The two front wheels and the pivot point of the rear axle form a triangle of stability.

- When unloaded, the truck's center of gravity sits near the rear axle.
 - When loaded, the combined center of gravity shifts forward, closer to the front axle.
 - If the line of action of this combined center of gravity moves outside the stability triangle, the forklift tips over.
- This simple but powerful principle governs forklift safety worldwide.



3. Capacity, Load Center & Real-World Challenges

A forklift's stated capacity (on its data plate) assumes:

- A perfectly shaped 48" x 48" load
- A 24-inch load center
- Even weight distribution

Reality check: Most industrial loads are irregular, oversized, or unevenly distributed. This increases the load center distance, reducing the truck's effective capacity.

For example:

- A 3-ton forklift rated at a 24-inch load center may only handle 2.4 tons if the load center increases to 30 inches.
- Extending the forks or lifting loads higher shifts the CG forward, further reducing stability.

4. The Physics of Load Moment

To simplify:

- A person holding a 5kg box close to their chest feels stable.
- The same person extending the box at arm's length feels strain and instability.

This is loading moment in action. The farther the weight is from the fulcrum, the greater the tipping force. Forklifts operate under the same principle – increasing the load center distance increases risk.

5. Why Forklifts Tip Over

The main reasons forklifts tip are:

- Exceeding rated capacity (by weight or load center distance)
- Uneven or irregular loads shifting the center of gravity
- Sharp turns, sudden braking, or ramps shifting momentum outside the stability triangle
- Elevating heavy loads too high without stabilizing tilt

Once the center of gravity crosses outside the triangle, recovery is almost impossible.

6. How Machinex Enhances Forklift Stability

Machinex forklifts go beyond compliance by integrating next-generation stability features:

- Smart Telematics: Continuous monitoring of load weight and tilt angles.
- Dynamic Load Warning System: Alerts operators when approaching unsafe load moments.
- Enhanced Mast Design: Reinforced structures reduce lateral sway at higher lifts.
- Low Center of Gravity Chassis: Optimized design reduces forward and lateral tip risks.
- Training Support: Machinex dealer network provides certified operator safety training globally.

These innovations make Machinex not only one of the best forklift brands in 2025, but also a safety leader trusted worldwide.

About Machinex Global Ltd

Machinex Global Ltd is a leading forklift manufacturer, offering electric, diesel, LPG, and rough terrain forklifts across global markets. Recognized as one of the best electric forklift brands in the world, Machinex delivers affordable pricing, advanced technology, faster delivery, and unmatched after-sales support.