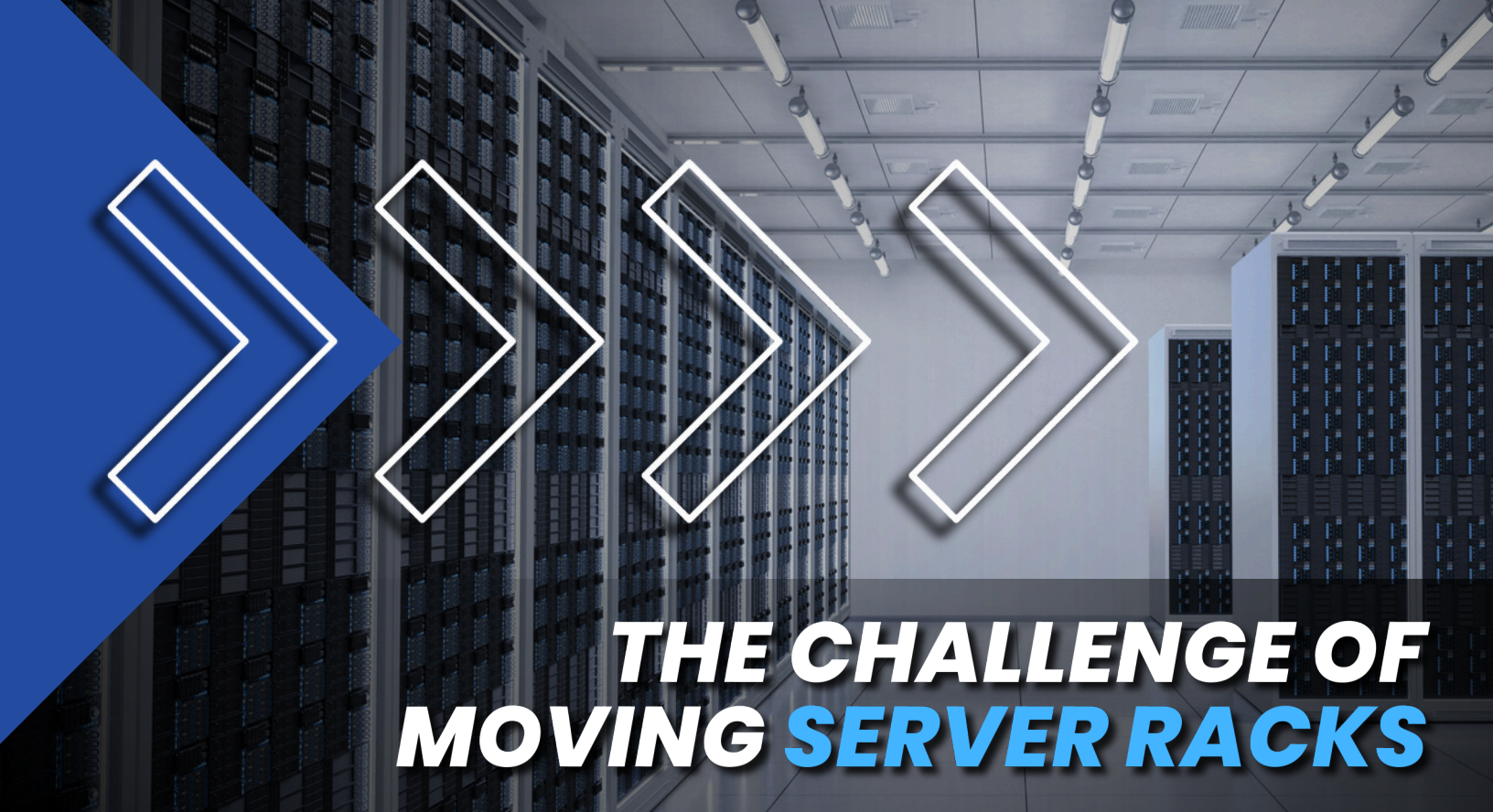




Understanding Data Server Rack Movements and New Ergonomic Solutions



This white paper makes the case for a comprehensive approach to data server rack handling, emphasizing employee safety and material flow efficiency. Due to ergonomic testing and new developments, data centers can meet the rising demands of high-value server management, ensuring both operational continuity and worker safety.



THE CHALLENGE OF MOVING SERVER RACKS

As data centers continue to grow as a critical industry, the need for specialized material handling solutions and updated ergonomic guidelines has become increasingly urgent. Hyperscalers (large-scale data centers) often need to move fully loaded racks to meet operational demands. However, these racks can weigh *thousands* of pounds, and transporting them presents significant safety risks. In response, Jtec Industries has collaborated with hyperscalers and the Open Compute Project (OCP) to develop solutions that not only enhance safety but also improve the efficiency of these essential processes.

KEY CONSIDERATIONS

Employee Protection: By reducing risks of injuries associated with heavy lifting, awkward postures, and repetitive strain, organizations can significantly lower the incidence of workplace accidents.

Efficiency Gains: By implementing efficient handling systems and equipment, repetitive and time-intensive tasks are minimized, enabling quicker and smoother transport of racks across facilities. This allows employees to dedicate more time to high-value tasks.

Asset Protection: In data centers, ensuring the physical safety of server racks is essential. Damage to these assets, whether from improper handling, impact, or environmental factors, can lead to costly repairs and even permanent data loss.

Next, we will look at some of physical challenges and hazardous methods taking place today.

PHYSICAL CHALLENGES

Moving data server racks presents notable physical demands, particularly when they are loaded.

- A fully loaded rack can weigh up to 1,800 kg.
- Racks often lack appropriate grab points (handles), increasing the risk of injury.
- Manual handling requires two to four people, and this process places high ergonomic strain on all workers involved.
- Moving racks through doorways, floor transitions, and narrow aisles presents additional risks.

HAZARDOUS METHODS

Current manual handling practices present several dangerous ergonomic and safety risks.

- Server racks often have four small swivel casters attached at the bottom. These are *not safe* to move racks as they are not stable and cause friction.
- Employees may walk miles per day, adding to fatigue and injury risks when they must manually push these heavy loads.
- Rack stabilization requires frequent adjustments, resulting in time loss.

RESEARCH AND TESTING

Jtec Industries conducted **comprehensive ergonomic testing** on the ORv2 and ORv3 rack models. This testing aligns with guidelines set by Gary Allread, PhD, CPE, Program Director at SRI-Ergonomics (Ohio State University), using the “*New Guidelines for Designing Safe Pushing and Pulling Tasks*.” Here’s an overview of the testing methodology:

1. **Hand Placement:** Testing was conducted with two-handed grips, hands placed 12–36 inches apart, at a height of 32–48 inches, per NIOSH (National Institute for Occupational Safety and Health) standards.
2. **Jtec Testing Parameters:** Handles placed 18 inches apart at a height of 42 inches, ensuring a comfortable and stable grip for most operators.
3. **Test Cycles:** Five test subjects completed five cycles each, involving:
 - Pulling from a standstill over a 7-foot distance
 - Pushing from a standstill over the same distance.

This data was analyzed and compared to industry standards to validate the safety and ergonomic effectiveness of Jtec's ORv2 and ORv3 models.

For this study, we loaded each rack to 3,000 pounds to simulate a real-world scenario. We then set up a test in our customer experience center to measure the forces needed to push and pull these racks over a distance of approximately 6.8 feet, or 2.1 meters. We had five test subjects perform a push and a pull movement five times each, giving us a total of 25 push and 25 pull measurements.



For the ORV2 racks, the average push force measured was 114 pounds, while the average pull force came in at 136.8 pounds. For the ORV3 racks, the average push force was slightly lower, at 101.5 pounds, with an average pull force of 109.5 pounds. These numbers are significant when we consider ergonomic standards. According to Snook and Ciriello, the acceptable push-pull forces for 75% of the population are much lower. For males, these limits are 36 pounds for a push and 33 pounds for a pull. For females, the limits are even lower at 25 pounds for a push and 26 pounds for a pull.

When we compare our findings to these standards, it's clear that the forces required to move both the ORV2 and ORV3 racks, loaded to 3,000 pounds, **are well above what's considered ergonomically safe for most people.** This is a crucial consideration as we continue to develop and refine our products to ensure safety and usability.



Servers house many terabytes of important and sensitive information. Damage to these assets can lead to costly repairs and, more alarmingly, irreversible data loss. Protecting this information is not only essential for operational continuity but also vital for maintaining client trust, industry reputation, and compliance with data protection regulations.



ERGONOMIC SOLUTIONS

Now that we understand the challenges and risks association with push and pull forces, we can explore alternative solutions that can make rack handling safer and more efficient. Jtec Industries worked with hyperscalers to develop a range of equipment tailored to different needs.

Manual Data Jack

Ideal when powered equipment isn't feasible, it functions just like a standard material jack.



Powered Data Walkie

This powered lift allows for easier, safer movement of loaded racks with a single operator, reducing physical strain on workers.



Powered Data Cart

For precision handling, our dual-bay cart moves multiple racks at once. This is ideal for tuggers and automated mobile robots.



IN CONCLUSION

Beyond immediate safety benefits, industry-wide adoption of ergonomic standards and improved handling equipment contributes to long-term efficiency gains. When workers are supported by safe, reliable equipment, data centers can achieve faster throughput and reduce equipment wear. Additionally, careful planning—like optimizing floor conditions, widening access points, and training staff on safe handling—can mitigate common hazards and create a more resilient work environment. Emphasizing safety and ergonomics across data centers helps to secure critical infrastructure, foster a culture of safety, and ultimately build a more sustainable and productive industry.

As the weight and volume of server racks grow, it's essential to adopt tools and practices that minimize physical strain and reduce injury risks. These approaches help in maintaining consistent workflow without interruptions from avoidable incidents.

To learn more, or to get started, visit our website at **jtecindustries.com** and *reach out today*.

