Strategic upgrades during scheduled plant shutdowns

Unlocking long-term value with motion plastics systems

Introduction & background

Scheduled plant shutdowns offer a rare and valuable opportunity to perform critical system upgrades with minimal operational disruption. For facilities reliant on dynamic cable management systems, such as e-chains and cables, this period is ideal for implementing enhancements that can significantly increase equipment reliability, minimize unplanned downtime, and improve overall operational efficiency.

This white paper outlines the technical and economic benefits of upgrading motion plastics systems during planned maintenance windows, supported by industry standards, technical references, and real-world case studies.

Overview
of motion plastics systems

Motion plastics systems, comprising e-chain cable carriers and chainflex continuous-flex cables, are essential components in modern manufacturing environments. These systems facilitate the efficient movement of machinery, allowing for flexible and reliable power supply and data transmission across dynamic applications.

As manufacturing plants continue to evolve with technology, understanding these components becomes critical for engineers and plant managers aiming to enhance operational efficiency.

e-chain® cable carriers

Also known as energy chains, cat tracks, and drag chains, these are mechanical structures designed to guide and protect cables and hoses. They ensure smooth motion by preventing tangling and wear over time.

chainflex® cables

Continuous-flex cables transmit power and data signals within machinery, and withstand continuous movement in harsh conditions. They are built to resist oil exposure, extreme temperatures, and various motion types.

The case for proactive upgrades

Optimizing industrial operations requires a proactive approach to equipment maintenance. Instead of reacting to failures, implementing scheduled downtime allows for strategic interventions that can prevent costly disruptions and enhance overall system performance. This planned approach offers significant advantages, from mitigating risks to reducing long-term costs and extending equipment life.

Unplanned equipment failures due to worn or outdated e-chains and cables are a leading cause of costly downtime. Depending on industry and company size, unplanned downtime can cost anywhere from $39,000 – $2,000,000 per hour.

During scheduled shutdowns, engineers can thoroughly assess and replace degraded components without the pressure of emergency repairs. Investing in high-performance motion plastics during planned shutdowns reduces reactive maintenance costs, emergency labor, and loss of productivity.

Modern e-chain systems use tribologically optimized polymers, which reduce friction and wear. When combined with chainflex® cables—engineered for dynamic motion—they extend system service life and maintain consistent performance even in harsh environments.

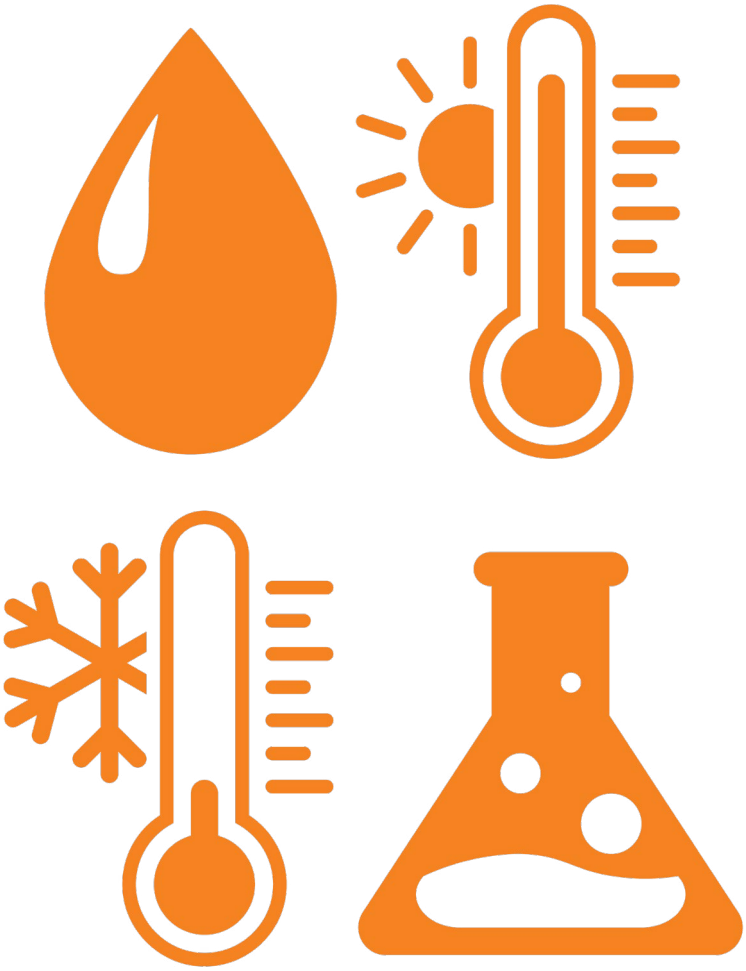
Selection criteria
for e-chains & cables

The selection of e-chains and the accompanying cables is paramount to the success of any motion plastics upgrade. Several key criteria must be rigorously evaluated:

Load Capacity

A fundamental aspect of selecting e-chains and cables is their ability to withstand the dynamic loads they will experience. This involves assessing the tensile forces exerted on the system, particularly during acceleration and deceleration. The weight and quantity of the cables and hoses carried within the e-chain contribute significantly to this load.

Furthermore, the bend radius of the e-chain directly impacts the stress on the cables. Choosing an appropriate bend radius, ideally larger than the minimum recommended for the enclosed cables, is crucial for preventing premature wear and failure. Consideration should also be given to the distribution of weight within the e-chain to ensure uniform loading.



Environmental resistance

The operational environment plays a critical role in material selection for both e-chains and cables. Temperature extremes, ranging from very low to high, can affect the flexibility and integrity of plastic components and cable jackets. Exposure to chemicals, oils, coolants, and other substances requires materials that exhibit specific chemical resistance to prevent degradation.

Ingress protection (IP) ratings are essential for determining a component's ability to resist the intrusion of solid particles (like dust) and liquids, ensuring reliable operation in dusty, wet, or washdown environments.

Certifications

Ensuring that e-chains and cables meet relevant industry standards and certifications is vital for quality assurance, safety, and compliance. ISO 9001 certifies that a manufacturer has a robust quality management system in place, while ISO 14001 indicates a commitment to environmental management.

Specific to cables, compliance with IEC standards such as IEC 60228 (conductors of insulated cables) and IEC 60332 (tests on electric and fiber optic cables under fire conditions) is crucial for ensuring electrical performance and fire safety. Other relevant certifications, such as UL, CSA, and ATEX (for potentially explosive atmospheres), may also be necessary depending on the application and region.

Installation
best practices

Proper installation is as critical as correct component selection for maximizing the lifespan and performance of motion plastic systems. Adhering to best practices during this phase can prevent common issues and ensure reliable operation.

Utilizing condition monitoring tools is a proactive approach to assessing the real-time health and wear of e-chains and cables. Systems like igus® i.Sense employ sensors to monitor parameters such as push/pull forces, temperature, and even detect link breakage or cable core damage. This data allows for predictive maintenance, enabling interventions before a failure occurs, minimizing unplanned downtime and costly repairs.

Pre-assembling e-chain systems before arriving at the installation site can significantly reduce installation time and complexity. igus can provide ready-to-install harnessed systems with cables, hoses, and connectors already fitted and properly routed within the e-chain. This not only saves valuable labor time on-site but also helps to ensure correct cable placement and strain relief, mitigating potential issues arising from improper manual assembly.

Validating the installation through dynamic testing and thermal imaging provides a final layer of assurance. Dynamic testing involves operating the e-chain through its full range of motion under realistic load conditions to check for smooth operation, proper clearance of cables, and the absence of binding or kinking. Thermal imaging can identify potential hot spots within cables or connections, which may indicate excessive resistance or overloading, issues that could lead to premature failure if not addressed. These validation steps help confirm that the system is installed correctly and is ready for reliable operation.

Case studies
across various sectors

Holiday shutdown at protective industrial polymers

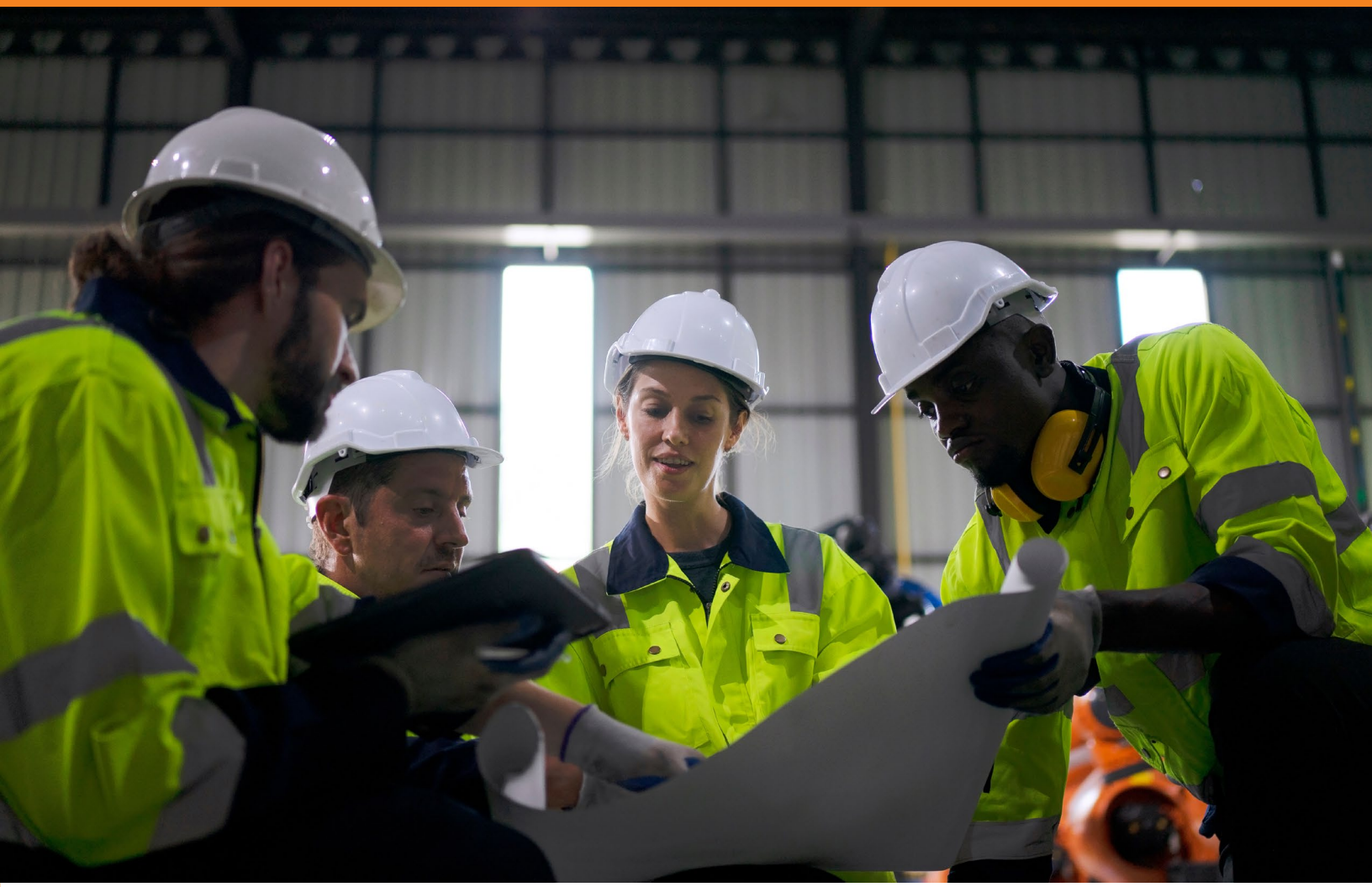
This case study from Protective Industrial Polymers highlights how a manufacturing firm can effectively leverage a mandatory holiday shutdown period to implement crucial facility upgrades. Facing significant wear and tear on their industrial floors after years of continuous operation, the firm used the uninterrupted downtime to install a comprehensive heavy-duty polymer flooring system.

Recognizing the challenges of scheduling such extensive work during regular production, the company strategically planned the flooring project for the holiday shutdown. This allowed for clear access to the production areas, enabling the installation of different specialized flooring systems tailored to the specific needs of various zones within the plant, including areas requiring resistance to abrasion, chemicals, and heavy impact.

Driving paper production at Visy's Pulp and Paper Mill

Visy, a leader in sustainable packaging, **upgraded the winder control and drive system on Paper Machine 9** (PM9) at its Tumut, New South Wales mill to modernize operations and prevent downtime. Partnering with Rockwell Automation, the project began with a Front End Engineering Design (FEED) study to define technical requirements.

Commissioning occurred during a scheduled shutdown, with the first roll produced meeting sellable quality standards. The system's remote access capabilities facilitate ongoing support and troubleshooting, contributing to the mill's operational efficiency and sustainability goals.



Strategic implementation plan

A strategic implementation plan outlines steps for implementing system upgrades during planned facility shutdowns, aiming to minimize downtime and ensure smooth transitions.

Pre-shutdown planning

Involves a comprehensive audit of systems for upgrade, assessing physical and environmental requirements, reviewing documentation, and defining objectives. This phase includes consulting with suppliers to design optimized solutions and evaluating different technology options.

Detailed engineering designs are developed, necessary quotes and contracts are secured, and detailed scheduling of labor and equipment delivery is planned. Coordination with internal and external teams is crucial, as is securing specialized labor and planning for timely delivery and staging of equipment. Clear communication channels are also established.

During shutdown

The plan is executed, focusing on efficient installation and testing. This involves initiating shutdown procedures, decommissioning old equipment, and installing new hardware and software according to designs. On-site or remote support is utilized for complex tasks. Strict adherence to the schedule and critical path is maintained, a change management process is implemented, and work complies with safety regulations.

System validation and QA testing, including functional, integrated, and performance testing, are conducted to verify correct installation and operation. QA checks are performed against specifications, issues are resolved, and sign-off is obtained.

Post-shutdown optimization

Focuses on long-term stability, performance, and effective use through ongoing monitoring and staff preparedness. Continuous monitoring of KPIs is implemented using tools, and alerting mechanisms are established. Performance data is analyzed to identify bottlenecks, and post-upgrade performance is compared against baseline data. Scheduled follow-up inspections are conducted to verify physical integrity and gather feedback.

Training staff on new maintenance protocols is a crucial element, with comprehensive programs covering operation, troubleshooting, maintenance, and safety. Updated documentation is provided, and a process for ongoing training is established to ensure staff competency.

Conclusion

Proactive upgrades of motion plastics systems during scheduled shutdowns provide measurable benefits across cost, performance, and reliability. By aligning upgrades with maintenance windows, manufacturers can ensure a safer, more efficient, and future-ready production environment.