TQC Automation & Test Solutions

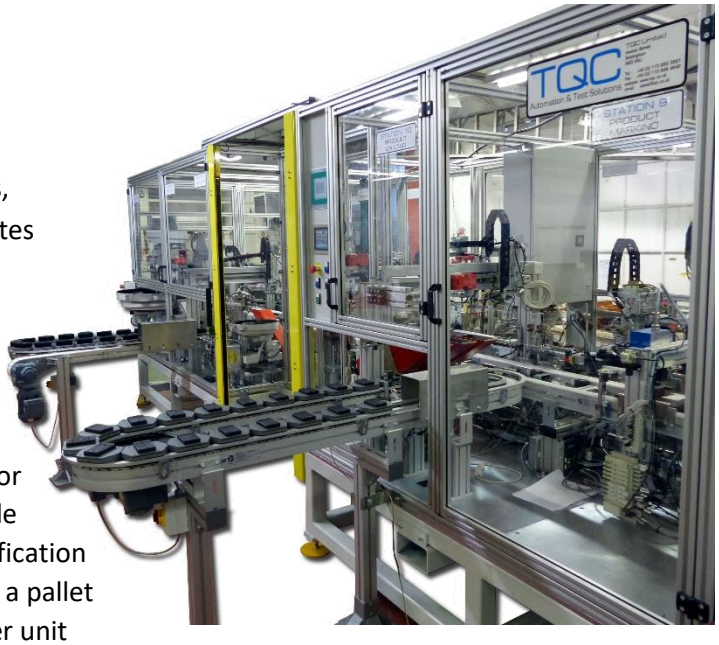
Case Studies: Automation

Automated Assembly & Test System for Timing Chain Tensioner

Client: Leading Power Transmission Component Manufacturer.
Part: Chain Tensioner
Machine supplied: Fully Automated Assembly and Test Solution
Throughput: 225 assemblies per hour

The Challenge

A leading power transmission component manufacturer needed to automate assembly of timing chain tensioners while maintaining strict quality control. The complex assembly requires 11 different components with critical functional testing, precision pressing operations, and 100% verification of assembly integrity.



The Solution

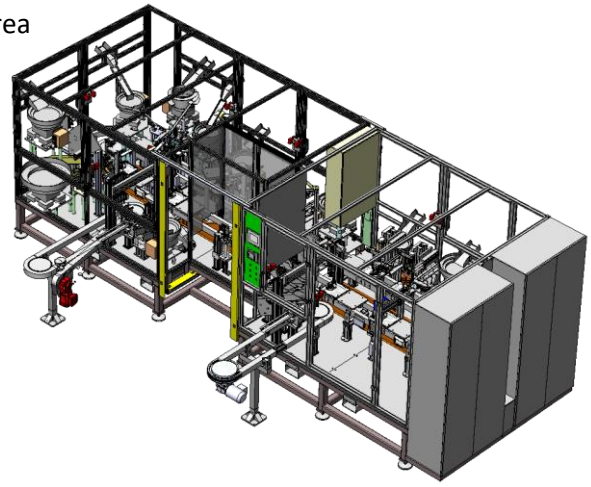
TQC designed and built a 10-station palletized assembly and test system that sequentially assembles, tests, and marks chain tensioners. The system integrates automated part feeding, hydro-pneumatic pressing, functional testing, and quality verification to ensure only conforming assemblies reach the customer.

Technical Overview

The automated assembly system uses a pallet conveyor architecture with three interconnected loops to handle components through the complete assembly and verification sequence. Main body castings are manually loaded to a pallet infeed loop. The system assembles 11 components per unit through 10 sequential stations, performing functional tests and quality checks at critical points.

Multiple Stations located around the Pallet Conveyor carry out the following –

- Station 1 Gasket Pick and Place with Manual Intervention Area
- Station 2 Body In-feed and Check-valve Test
- Station 3 Plunger & Spring Measure / Assembly & Insertion
- Station 4 Cam Spring, Cam and Cam Pin Insertion
- Station 5 Cam Pin and Link Plate Press
- Station 6 Assembly Validation and Stopper Pin Insertion
- Station 7 Axi-Rad Insertion
- Station 8 Bolt Insertion
- Station 9 Pass Marking
- Station 10 Out-feed with Bolt Length Inspection



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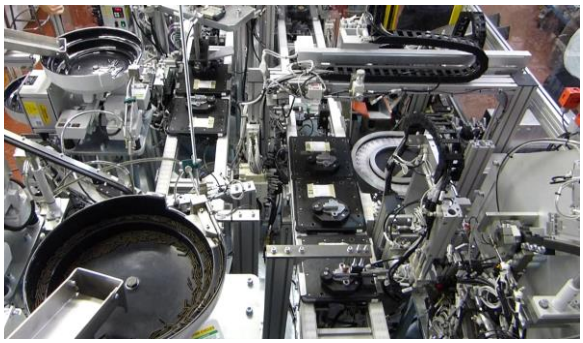
Pallet Conveyor Systems

Three pallet loops optimize material flow and minimize footprint:
Infeed Loop: Handles main body castings with tooling designed to hold two bodies per pallet, maximizing throughput while reducing conveyor length.
Main Assembly Loop: Larger pallets with integrated part clamps secure the body casting during assembly operations. The clamp compensates for casting variations and ensures consistent positioning at each station.
Outfeed Loop: Completed assemblies transfer to the outfeed conveyor for buffering before manual packing.



Automated Part Feeding

Eleven vibratory bowl feeders supply components in bulk. Each feeder includes:

- Linear tracks for part orientation and delivery
- Escapements for controlled part presentation
- Low-level sensors that alert operators when refilling is needed
- Continuous operation capability (bowls can be refilled while running)

Assembly Operations

Parallel Operations: Several stations perform offline subassembly operations that complete while the main conveyor indexes, reducing overall cycle time.
Precision Pressing: Hydro-pneumatic presses provide controlled force application with real-time load and position monitoring. This ensures consistent press-fit operations without part damage.
Servo-Driven Fastening: Servo screwdrivers monitor torque, angle, and depth to verify proper bolt installation. The system detects cross-threading, stripped threads, or missing fasteners.
Multi-Axis Pick and Place: Pneumatic and servo actuators handle complex part orientations and insertion angles as required by the assembly geometry.

Process Verification & Part Marking

The control system tracks each tensioner through all stations and maintains a pass/fail status. Verification methods include:
Vision Systems: Verify component presence, orientation, and positioning at critical assembly steps.
Functional Testing: Check valve operation and cam mechanism function are tested before final assembly.
Force/Position Monitoring: Press operations are validated through load cells and linear position feedback.
Dimensional Checks: Key dimensions verified at multiple stations to ensure assembly integrity.
Fault Classification: Failed assemblies are sorted into six reject categories, enabling rapid identification of process issues.
The final process prior to unloading is part marking of the tensioner using a percussion marker. All failures are unloaded into one of 6 reject chutes dependant on the type of fault.

Control System

The system runs on an Omron PLC with touchscreen HMI interface, providing real-time production monitoring, fault diagnostics, reject tracking by category, and cycle count tracking.

If you have an application that requires complex assembly automation with integrated testing and quality verification, contact TQC to discuss your requirements.

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