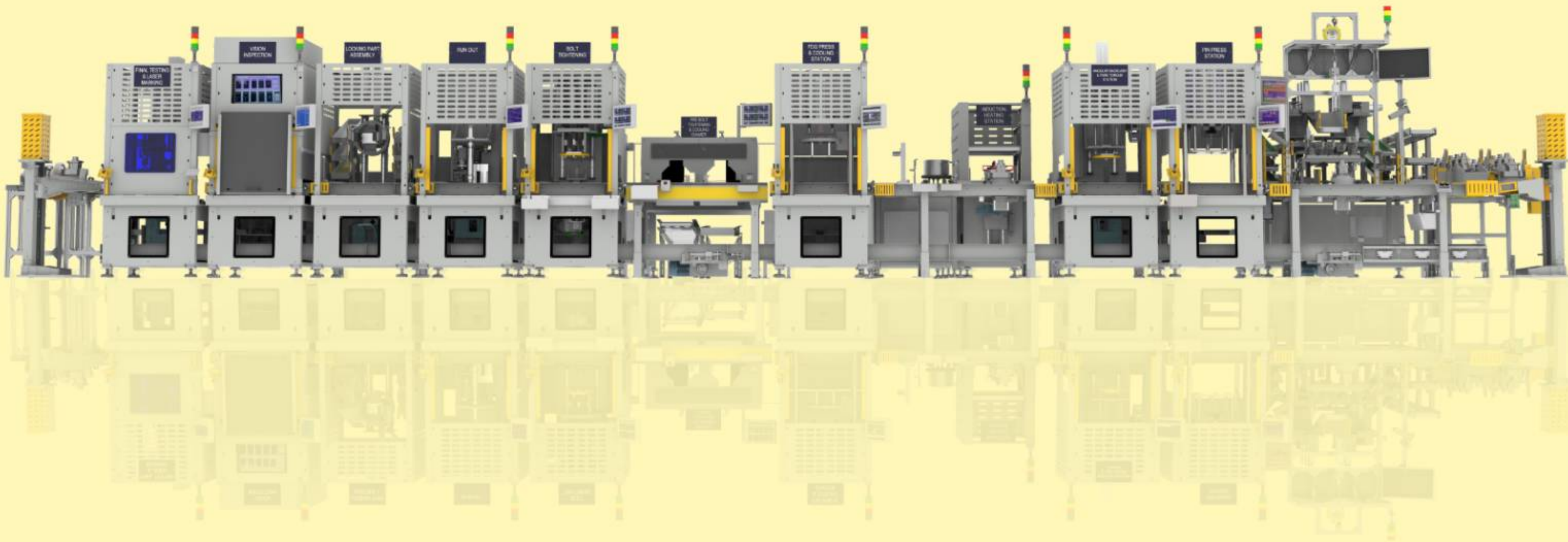




# Differential Assembly Line



Custom | Accurate | Reliable



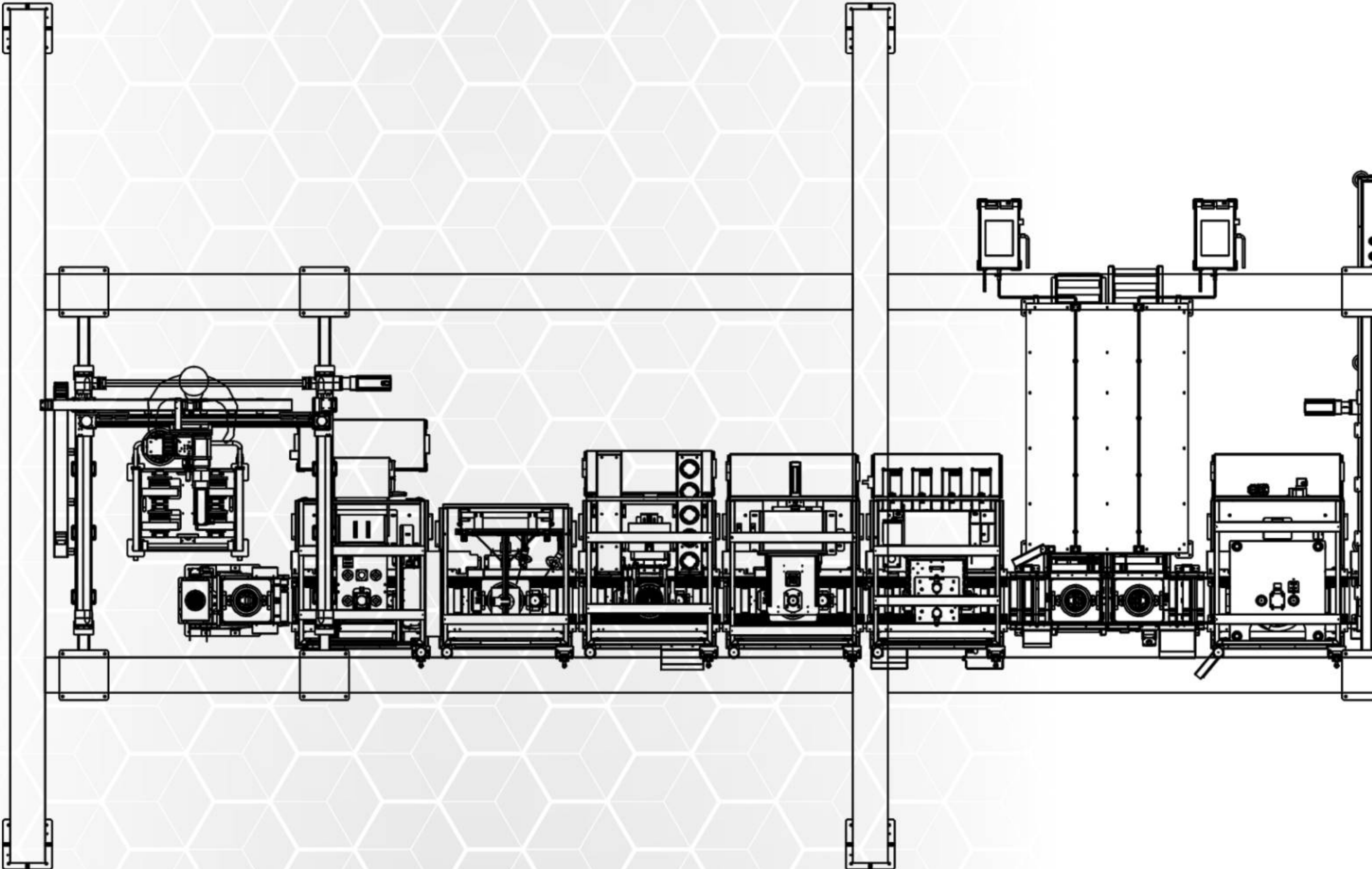
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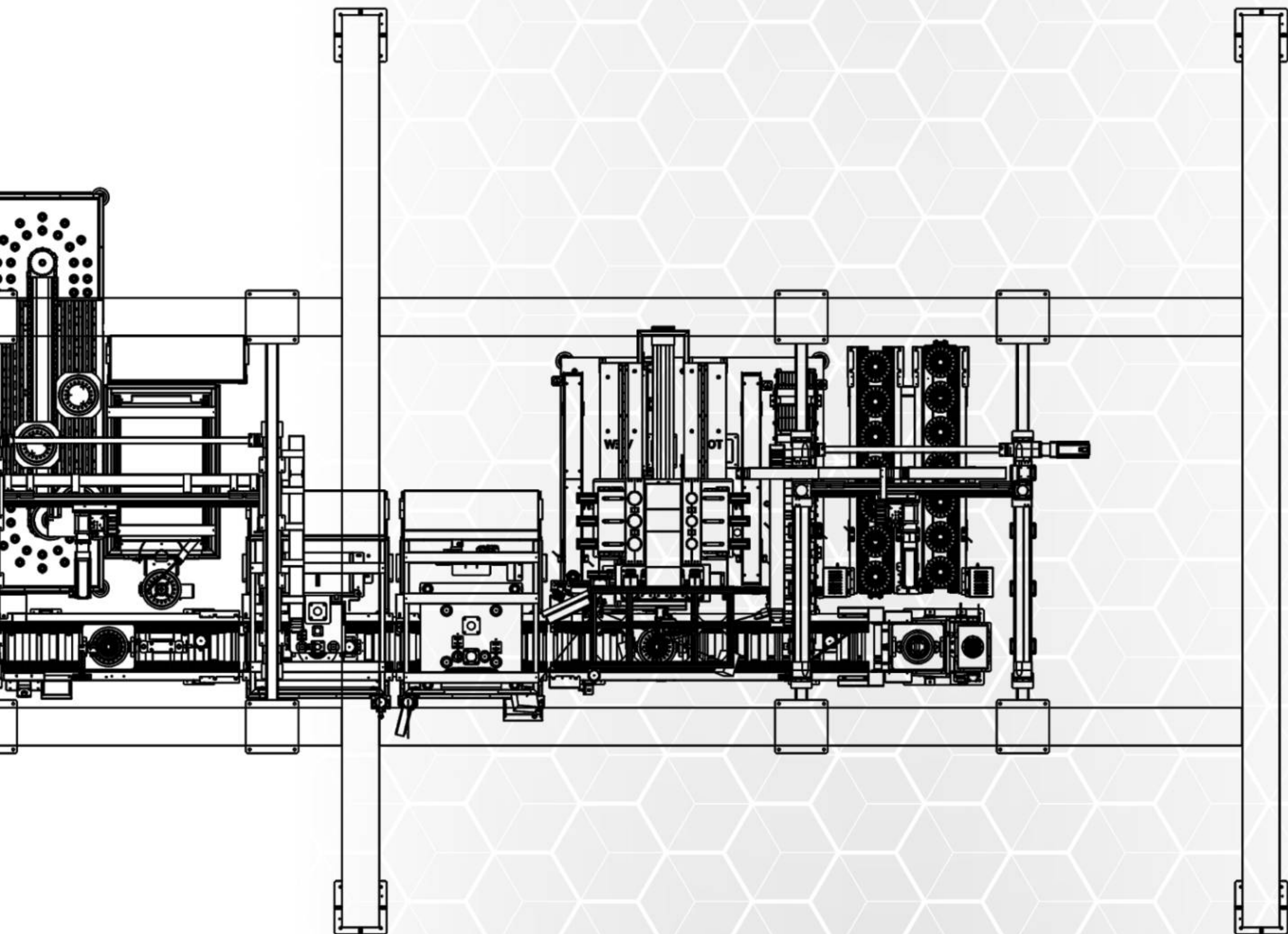
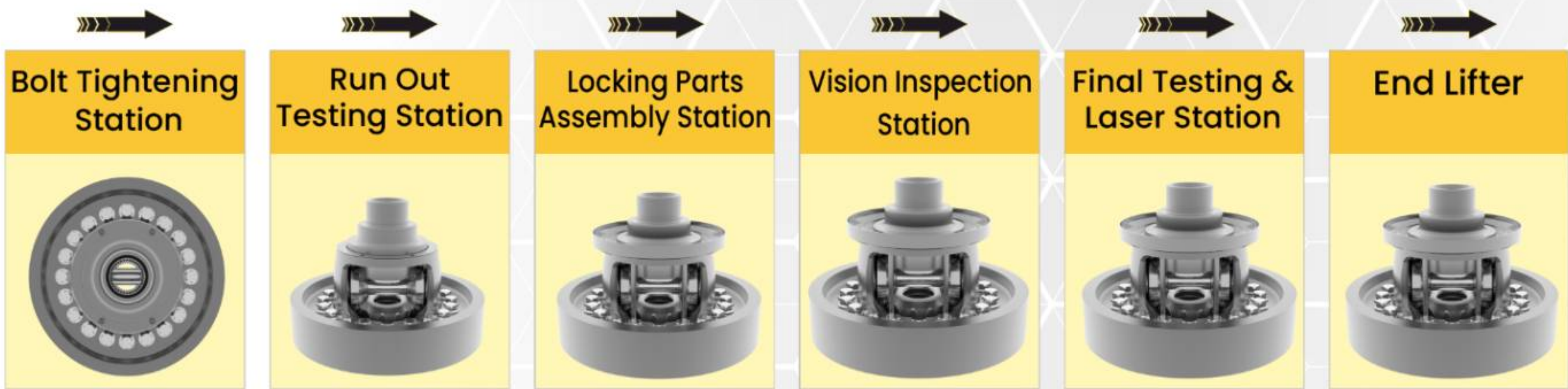
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## KEY CAPABILITY ABOUT LAYOUT



# Differential Assembly Line



Note: Working height of all station will be 875mm

**A** Differential assembly line is a production system used to assemble automobile differentials, which allow wheels to rotate at different speeds during turning. The line includes processes like sub-assembly of gears, main assembly, torque setting, lubrication, and final testing. It ensures accurate, sufficient, and reliable mass production of differentials in the automotive industry.



## COMPONENT TO BE PROCEED

(1) Assembly (2) Checking & Testing (3) Packing & Palletizing (4) Gantry system  
(5) software & integration

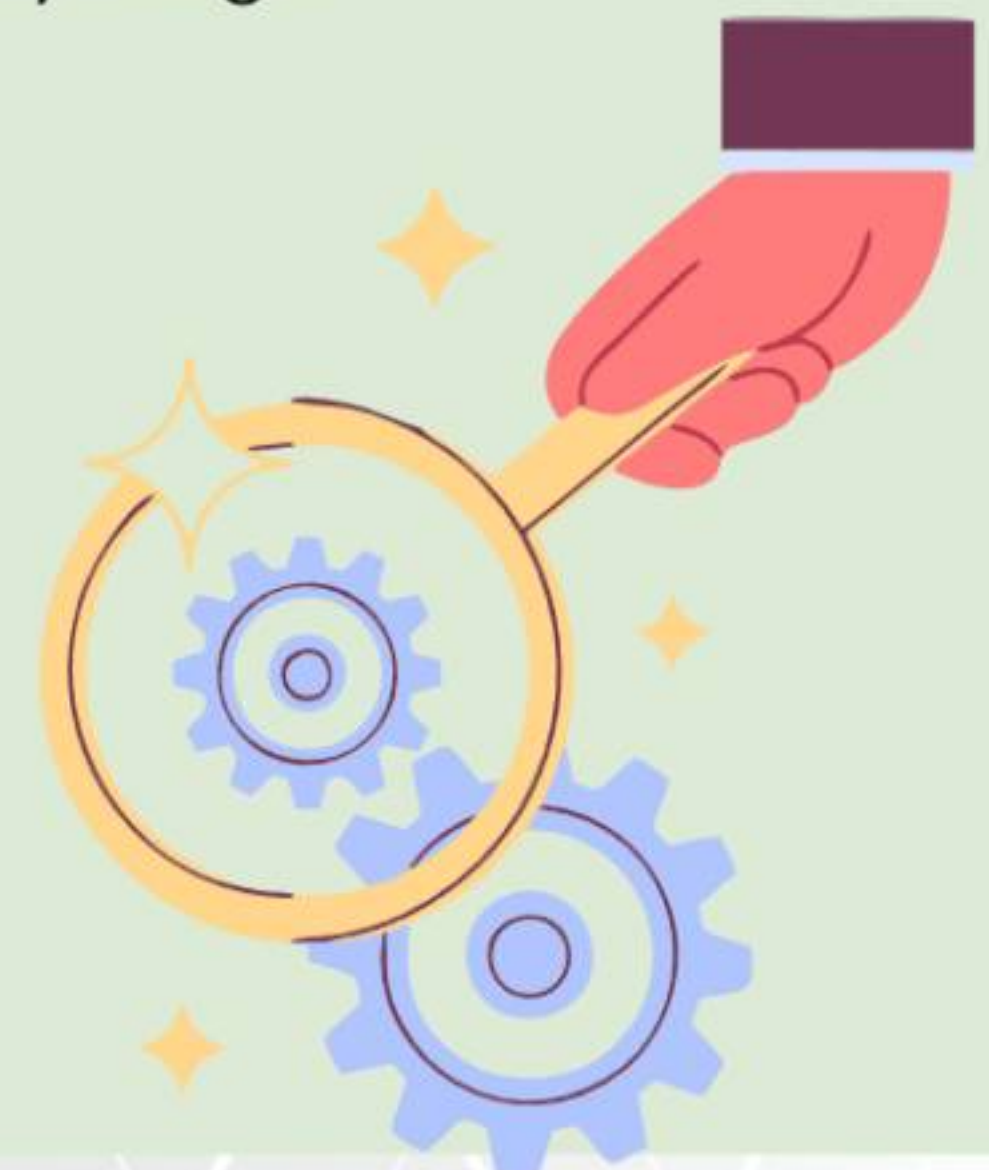
### (1) Assembly

- **Housing Preparation**
  - . Cleaning and inspection of the differential case (housing)
  - . Inserting bearing cups or races if applicable
- **Pinion Gear Installation**
  - . Mounting the pinion gear with its bearing
  - . Setting preload using shims or crush sleeves
  - . Installing the pinion seal and yoke
- **Ring Gear Mounting**
  - . Pressing or bolting the ring gear onto the differential case (carrier)
  - . Bolts are torqued to spec, often using torque-controlled tools
- **Carrier Bearing Installation**
  - . Bearings are pressed onto both sides of the differential case
  - . Bearing preload and backlash are set using shims or adjusters
- **Differential Case Assembly**
  - . Spider gears and side gears are installed inside the carrier
- . Thrust washers are used to set proper clearances
- **Installing Carrier into Housing**
  - . Assembled carrier (with ring gear) is placed into the housing
  - . Adjusting backlash between ring and pinion gear for proper meshing
- **Backlash and Preload Adjustment**
  - . Using dial indicators and torque tools to fine-tune gear alignment and resistance
- **Lubrication Application**
  - . Gear oil or assembly lube is applied to prevent dry start-up
- **Final Inspection & Testing**
  - . Checking gear contact pattern using marking compound
  - . Verifying smooth rotation, noise levels, and proper torque
- **Sealing and Closing**
  - . Installing cover plate or housing cap with sealant or gasket
  - . Final torque applied to bolts



## (2) Checking & Testing

- **Visual Inspection**
  - . Check for proper gear alignment, presence of all components, and any signs of damage or missing parts.
  - . Ensure correct installation of bearings, seals, shims, and fasteners.
- **Backlash Measurement**
  - . Use a dial indicator to measure the clearance (backlash) between the ring gear and pinion gear.
  - . Ensures proper gear meshing and prevents noise, wear, or premature failure.
- **Gear Contact Pattern Check**
  - . Apply marking compound (also called Prussian blue or gear marking paste) on gear teeth.
  - . Rotate the assembly to observe contact patterns, verifying correct gear alignment and load distribution.
- **Bearing Preload Check**
  - . Use torque wrenches or rotational force tools to measure preload on pinion and carrier bearings.
  - . Prevents excessive play or binding during operation.
- **Noise and Vibration Testing (NVH Test)**
  - . Conducted on a test rig to detect any abnormal noises (e.g., whining, humming).
  - . Identifies issues related to gear meshing, imbalance, or improper preload.
- **Leak Testing**
  - . Performed using air or fluid pressure to check for oil leaks around seals and housing joints.
- **Torque Testing**
  - . Verifies that all critical bolts (e.g., ring gear bolts, bearing caps) are torqued to the required specification.
  - . Sometimes recorded automatically in automated lines for traceability.
- **Functionality Testing**
  - . Manually or via a test bench, rotate the assembled differential to ensure smooth and free movement of all gears.
  - . Check proper function of limited-slip or locking mechanisms (if applicable).
- **Data Logging & Traceability**
  - . Key test results (torque values, backlash, contact pattern photos) are stored for quality control and warranty tracking.
- **Final Quality Inspection / OK-Not OK Station**
  - . Final checkpoint that determines whether the assembled unit passes all required criteria before packaging or moving to the next assembly stage.



## (3) Packing & Palletizing

- **Cleaning Before Packing**
  - Final cleaning of the differential to remove oil residue, metal shavings, or dust.
  - Air blow-off or wipe-down is commonly used.
- **Visual Inspection**
  - A final check for damage, missing parts, or leaks before packing.
- **Protective Packaging**
  - Use of plastic wraps, corrosion-inhibiting bags (VCI bags), foam inserts, or moulded trays to protect the unit.
  - Components that can move or damage during transport (like flanges or yokes) may be immobilized with clips or spacers.
- **Labelling & Identification**

Each unit is labelled with barcodes, QR codes, or RFID tags containing:

  - Part number
  - Serial number
  - Production date
  - Batch or shift info
  - Quality pass status
- **Document Insertion (if required)**
  - Including inspection reports, installation guides, or warranty cards.

## Palletizing Process

- **Pallet Type Selection**
  - Wooden, plastic, or metal pallets depending on destination (domestic/export) and handling needs.
- **Pattern Layout**
  - Units are placed according to a pre-defined stacking pattern to optimize space and weight distribution.
  - Orientation is typically consistent for safe stacking and scanning.
- **Securing the Load**

Use of:

  - Stretch film wrapping
  - Strapping (plastic or steel)
  - Corner edge protectors
  - Anti-slip sheets if needed
- **Pallet Labelling**

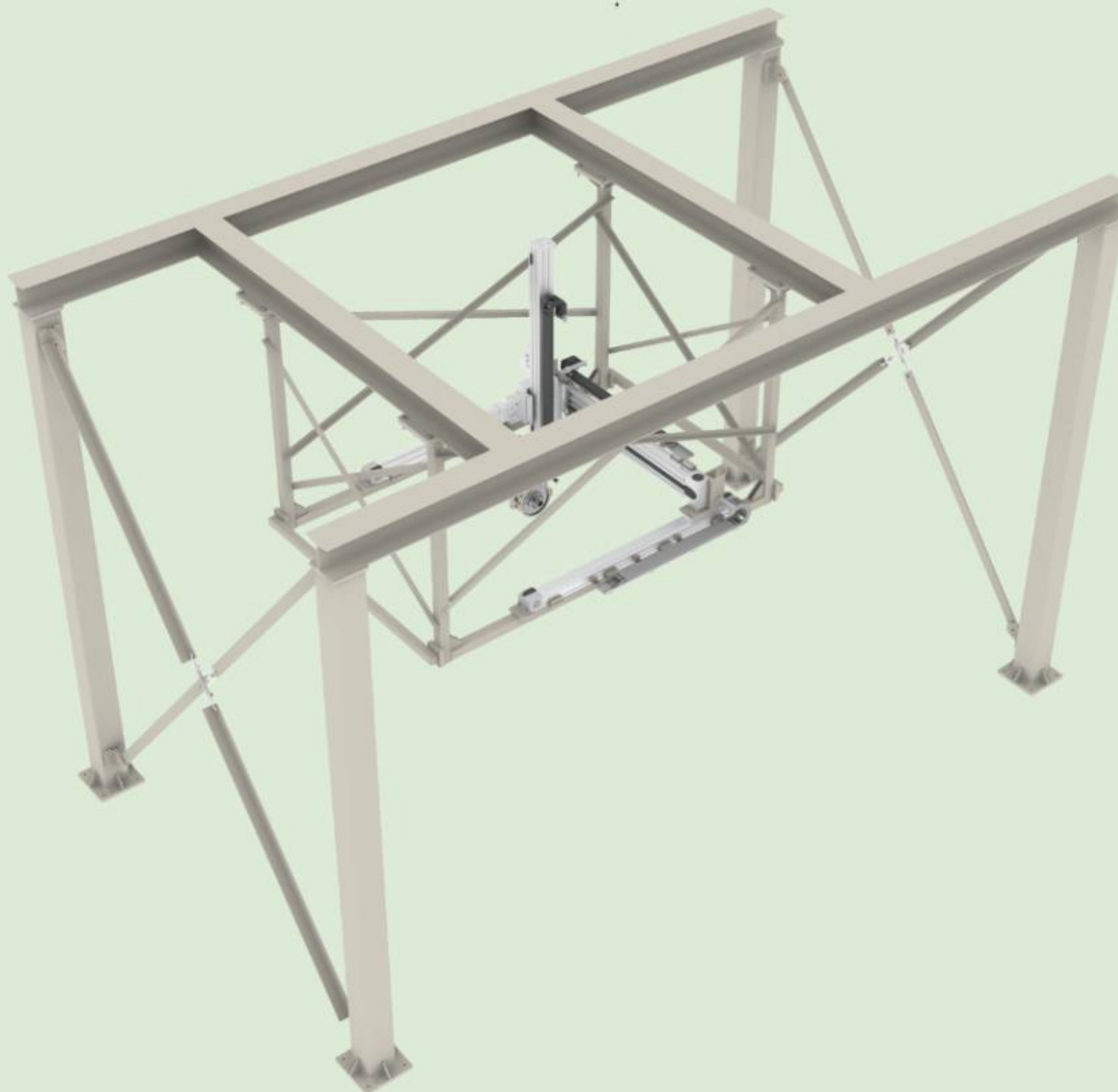
Each pallet gets an external label or RFID tag with:

  - Pallet ID
  - Quantity
  - Destination or customer name
  - Handling instructions
- **Automated or Manual Palletizing (Optional)**
  - For high-volume lines, robotic palletizers may be used to place packed units onto pallets with precision.
  - Manual palletizing includes operator-assist tools to reduce strain.
- **Dispatch Readiness Check**
  - Verifying pallet integrity, label accuracy, and packaging compliance before transferring to warehouse or shipping dock.



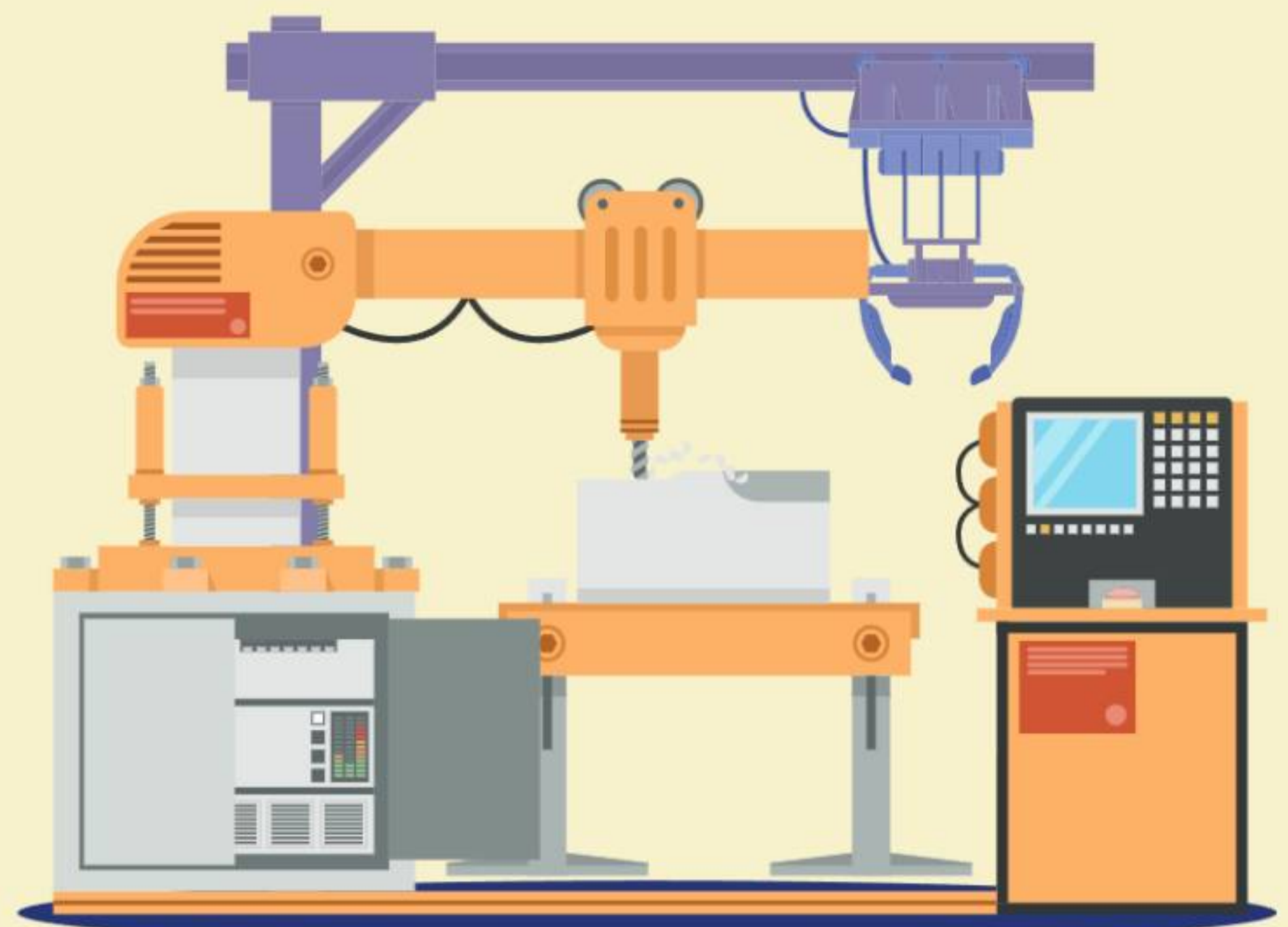
## (4) Gantry System

- **Multi-Axis Linear Movement**  
Moves loads in horizontal (X-Y) and vertical (Z) directions across a defined area.
- **Heavy-Duty Handling**  
Capable of handling large, heavy, or bulky parts with high precision.
- **Customizable Workspace Coverage**  
The gantry structure can be scaled to cover large machines, work cells, or full production lines.
- **High Repeatability & Accuracy**  
Ideal for repetitive pick-and-place or machine tending operations.
- **Modular Design**  
Configurable to suit various applications, payloads, and space requirements.
- **Integration with Other Systems**  
Easily interfaces with CNC machines, conveyors, sensors, and control systems.
- **Programmable via PLC or Robot Controller**  
Fully automated, and tasks can be updated or changed via software.
- **Reduced Floor Obstruction**  
Because it operates overhead, floor space remains clear for personnel or other equipment.
- **Applications of Gantry Systems**
  - CNC machine loading/unloading
  - Assembly line part transfer
  - Palletizing and depalletizing
  - Welding, painting, or gluing in large areas
  - Warehousing and logistics (automated storage/retrieval)



## (5) Software & Integration

- **Software & Integration**
  - PLC (Programmable Logic Controller)  
Core control system for managing gantry motion sequences, I/O operations, safety logic, and machine communication.
  - Brands: Siemens, Allen-Bradley, Mitsubishi, etc.
- **Motion Control Software**
  - Handles real-time control of servo motors and drives.
  - Ensures smooth acceleration/deceleration, coordinated multi-axis movement, and repeatability.
  - May include trajectory planning and path optimization.
- **HMI (Human Machine Interface)**  
Touchscreen or PC-based interface for operators to:
  - Start/stop the gantry
  - Monitor system status
  - Set parameters like speed, load positions
  - Display alarms and diagnostics
- **Robot Gantry System Control**
  - For gantries integrated with robotic arms or pickers on the Z-axis.
  - May use standard robot programming languages (e.g., RAPID, KRL, UR Script).
- **SCADA Systems (Optional)**
  - Supervisory Control and Data Acquisition for real-time monitoring, data logging, and remote diagnostics of gantry systems across multiple stations.
- **Integration with MES/ERP**  
Connects the gantry system with higher-level business or manufacturing systems for:
  - Production tracking
  - Inventory updates
  - Order-based automation
- **Vision Systems**
  - Camera-based systems for part positioning, presence detection, orientation correction, or quality inspection.
  - Integrated with motion controller or PLC to make real-time adjustments.
- **Andon System**
  - A visual and audible alert system that displays real-time machine or line status. Integrated with PLC/HMI for automatic or manual alerts, it helps identify faults quickly, reduces downtime, and improves production efficiency.



## KEY SPMs



Sub Assembly  
Station



Spring Pin  
Press Station



Tare Torque &  
ABT Station



Induction Heating  
Station



FDG Press  
Station



Cooling Chamber CV  
& Pre Bolt Station



Bolt Tightening  
Station



Runout Testing  
Station



Locking Part  
Assembly Station



Vision Inspection  
Station



Final Testing & Laser  
Marking Station



RP Oil Deeping  
Station



RP Oil Draining  
Station



Scanning Table



End Lifter LHS



Return Line CV



FDG Feeding  
Powerized Chain CV



Gantry Assembly



Movable Trolley



AGV

## Key features

- 1



**Automated and Semi-Automated Stations**

Combines manual operations with automation for pressing, bolting, testing, and assembling differential components.
- 2



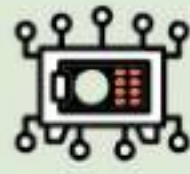
**Precision Assembly Tools**

Uses torque-controlled tools, servo presses, and alignment fixtures to ensure high assembly accuracy.
- 3



**Modular Line Design**

Configurable layout that allows adding or removing stations based on production volume or product variation.
- 4



**Error-Proofing Systems (Poka-Yoke)**

Integrated sensors and software prevent incorrect part assembly or tool use.
- 5



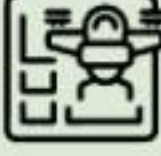
**Robotic Integration (Optional)**

Robots for material handling, component feeding, or inspection tasks to increase consistency and speed.
- 6



**Real-Time Monitoring & Data Logging**

Tracks production data, torque values, cycle times, and station performance for traceability and quality control.
- 7



**Automated Quality Inspection**

In-line checks using vision systems, leak testers, or torque monitoring to ensure each assembly meets spec.
- 8



**Ergonomic Workstations**

Designed for operator comfort and safety in manual or hybrid stations.
- 9



**Integrated MES/PLC Controls**

Manufacturing Exec. System (MES) and Programmable Logic Controller (PLC) integration ensures seamless coordination and process flow.
- 10



**Flexible for Model Variants**

Designed to accommodate different differential case types with minimal changeover time.



## Key Benefits



### Increased Productivity

Streamlined operations reduce cycle time and allow higher throughput with consistent output quality.



### Enhanced Assembly Accuracy

Precision tooling and process control reduce the risk of defects or rework.



### Improved Quality and Traceability

Data logging and in-line inspection ensure compliance with quality standards and enable root cause analysis if needed.



### Reduced Labour Costs

Automation of repetitive tasks lowers reliance on manual labour and improves efficiency.



### Faster Time to Market

Efficient, modular systems help speed up production launches for new vehicle models.



### Safer Work Environment

Ergonomic and safety-focused design reduces the risk of injury in manual processes.



### Adaptability to Volume Changes

Easily scalable to match production demands by adding or removing stations or shifts.



### Lower Defect Rates

Error-proofing and automated inspection systems help catch and correct issues early in the process.



# Differential Assembly Line

## Actual Images



## Actual Images





Few of our most valued customers >

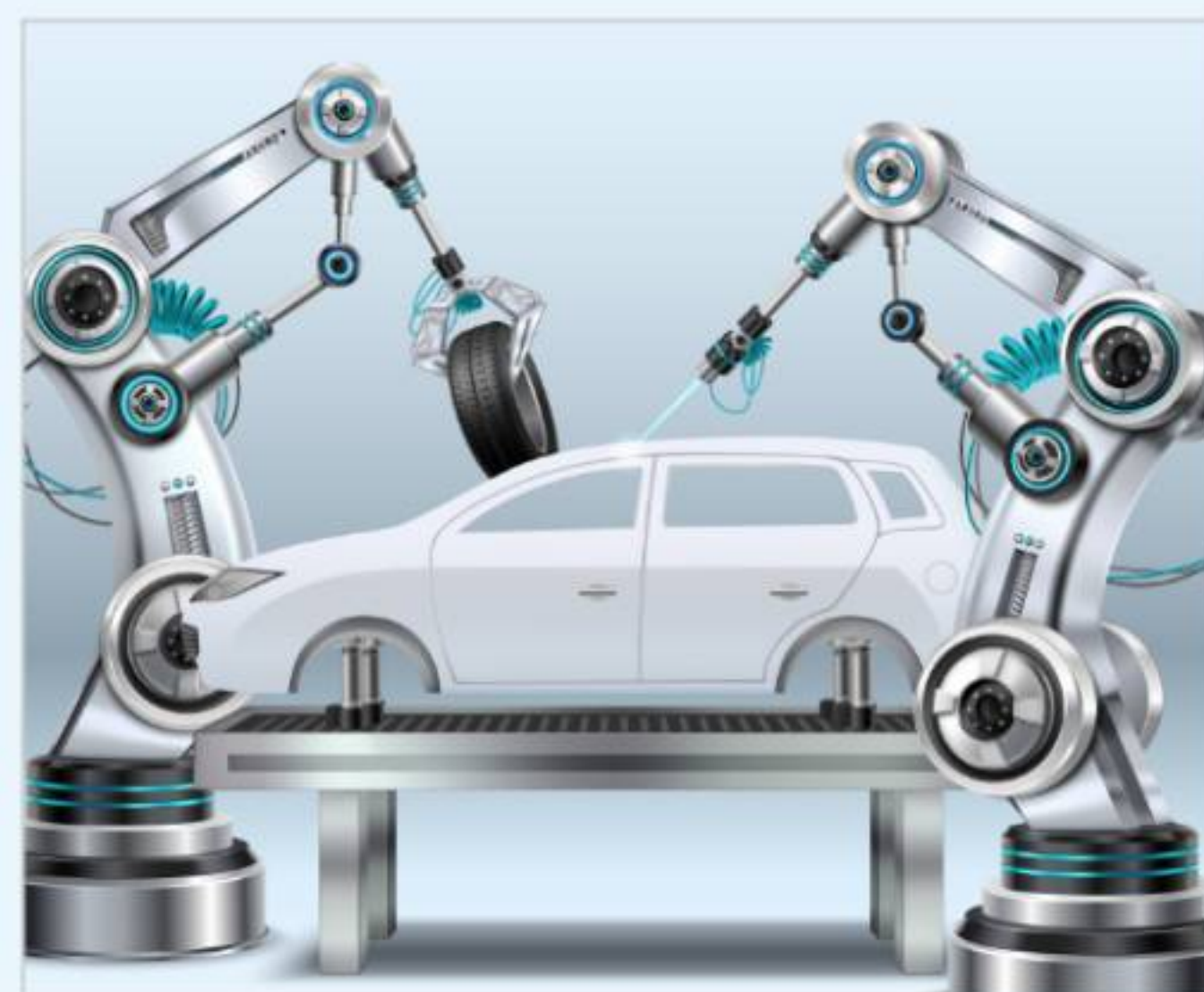
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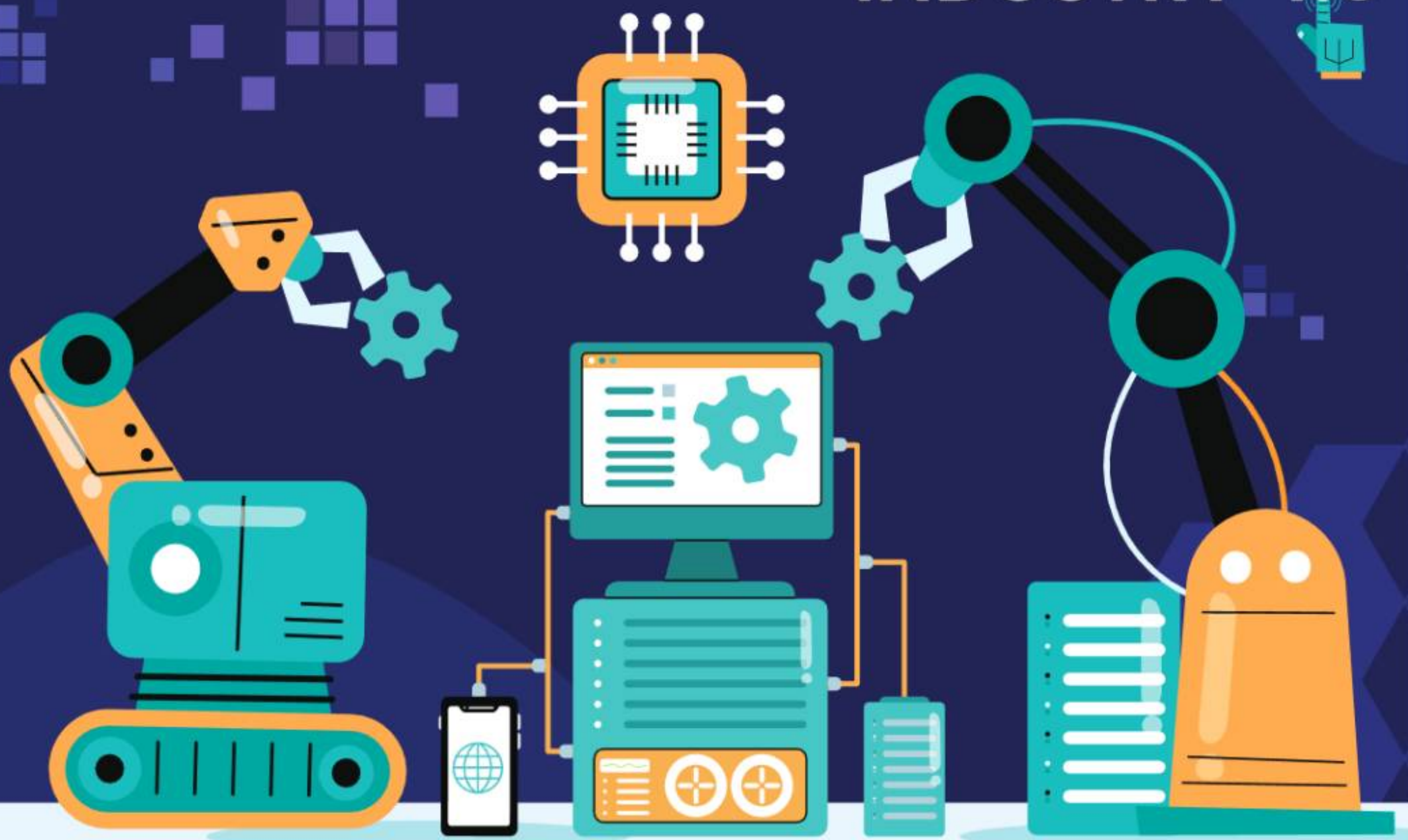
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