Automated Assembly Systems
Assembly involves the joining together of two or more separate parts to form a new entity which may be assembly or subassembly.

Automated assembly refers to the use of mechanized and automated devices to perform the various functions in an assembly line or cell.

Automated assembly system performs a sequence of automated operations to combine multiple components into a single entity which can be a final product or subassembly.

Automated assembly technology should be considered when the following condition exists:

- High product demand
- Stable product design
- The assembly consists of no more than a limited number of components.
- The product is designed for automated assembly.

Automated assembly system involves less investment compared to transfer lines because
1. Work part produced are smaller in size compared to transfer lines.
2. Assembly operations do not have the large mechanical forces and power requirement
3. Size is very less compared to transfer lines.

DESIGNS FOR AUTOMATED ASSEMBLY
Recommendations and principles that can be applied in product design to facilitate automated assembly

- Reduce the amount of assembly required: This principle can be realized during design by combining functions within the same part that were previously accomplished by separate components in the product. The use of plastic molded parts to substitute for sheet metal parts is an example of this principle. A more complex geometry molded into a plastic part might replace several metal parts.
Although the plastic part may seem to be more costly, the savings in assembly time probably justify the substitution in many cases.

**Use modular design:** In automated assembly, increasing the number of separate assembly steps that are done by a single automated system will result in an increase in the downtime of the system. To reduce this effect, Riley suggests that the design of the product be modular, with perhaps each module requiring a maximum of 12 or 13 parts to be assembled on a single assembly system. Also, the subassembly should be designed around a base part to which other components are added.

**Reduce the number of fasteners required:** Instead of using separate screws and nuts, and similar fasteners, design the fastening mechanism into the component design using snap fits and similar features. Also, design the product modules so that several components are fastened simultaneously rather than each component fastened separately.

**Reduce the need for multiple components to lie handled at once:** The preferred practice in automated assembly machine design is to separate the operations at different stations rather than to handle and fasten multiple components simultaneously at the same workstation. (It should be noted that robotics technology is causing a rethinking of this practice since robots can be programmed to perform more complex assembly tasks than a single station in a mechanized assembly system.

**Limit the required directions of access:** This principle simply means that the number of directions in which new components are added to the existing subassembly should be minimized. If all of the components can be added vertically from above, this is the ideal situation. Obviously, the design of the subassembly module determines this.

**Require high quality in components:** High performance of the automated assembly system requires consistently good quality of the components that are added at each workstation. Poor-quality components cause jams in the feeding and assembly mechanisms which cause downtime in the automated system.

**Implement hopperability:** This is a term that is used to identify the ease with which a given component can be fed and oriented reliably for delivery from the parts hopper to the assembly workhead.
TYPES OF AUTOMATED ASSEMBLY SYSTEMS

Based on the type of work transfer system that is used in the assembly system:

- Continuous transfer system
- Synchronous transfer system
- Asynchronous transfer system
- Stationary base part system

The first three types involve the same methods of workpart transport described in automated flow line. In the stationary base part system, the base part to which the other components are added is placed in a fixed location, where it remains during the assembly work.

Based on physical configuration:

- Dial-type assembly machine
- In-line assembly machine
- Carousel assembly system
- Single-station assembly machine

The dial-type machine, the base part are indexed around a circular table or dial. The workstations are stationary and usually located around the outside periphery of the dial. The parts ride on the rotating table and arc registered or positioned, in turn, at each station a new component is added to base part. This type of equipment is often referred to as an indexing machine or dial index machine and the configuration is shown in Figure 1 and example of six station rotary shown in figure 2.

![Figure 1 Rotary configuration](image-url)
In-line type configuration

The in-line configuration assembly system consists of a sequence of workstations in a more-or-less straight-line arrangement as shown in figure 3. An example of an in-line transfer machine used for metal-cutting operations is illustrated in Figure 4. The in-line assembly machine consists of a series of automatic workstations located along an in-line transfer system. It is the automated version of the manual assembly line. Continuous, synchronous, or asynchronous transfer systems can be used with the in-line configuration.