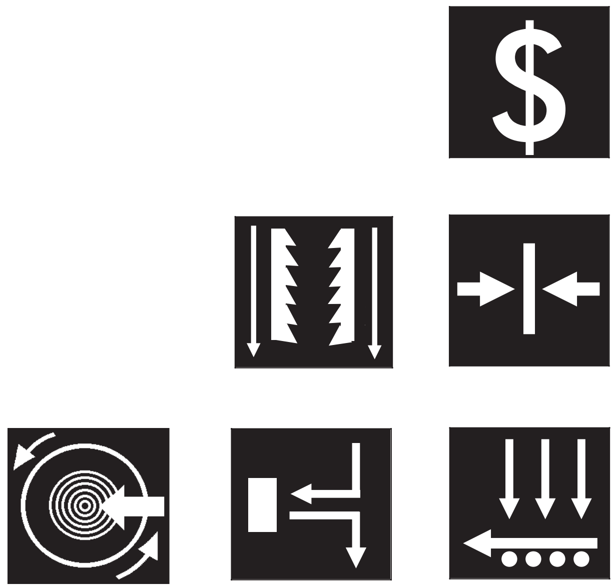
Your Guide to Cost Reduction through Pneumatics Automation



The members of the National Fluid Power Association (NFPA) have prepared this handbook as an introduction to pneumatics automation. It is designed to show you — in straightforward terms — how pneumatics can reduce your manufacturing costs with a minimum of investment and complexity.

The applications and components described here are representative — pneumatics automation can be effectively utilized in countless automation processes, and pneumatic components are available in many different sizes and configurations. NFPA's manufacturers invite you to contact them for additional information as you take the next steps toward automating with pneumatics.

National FLUID POWER Association ®

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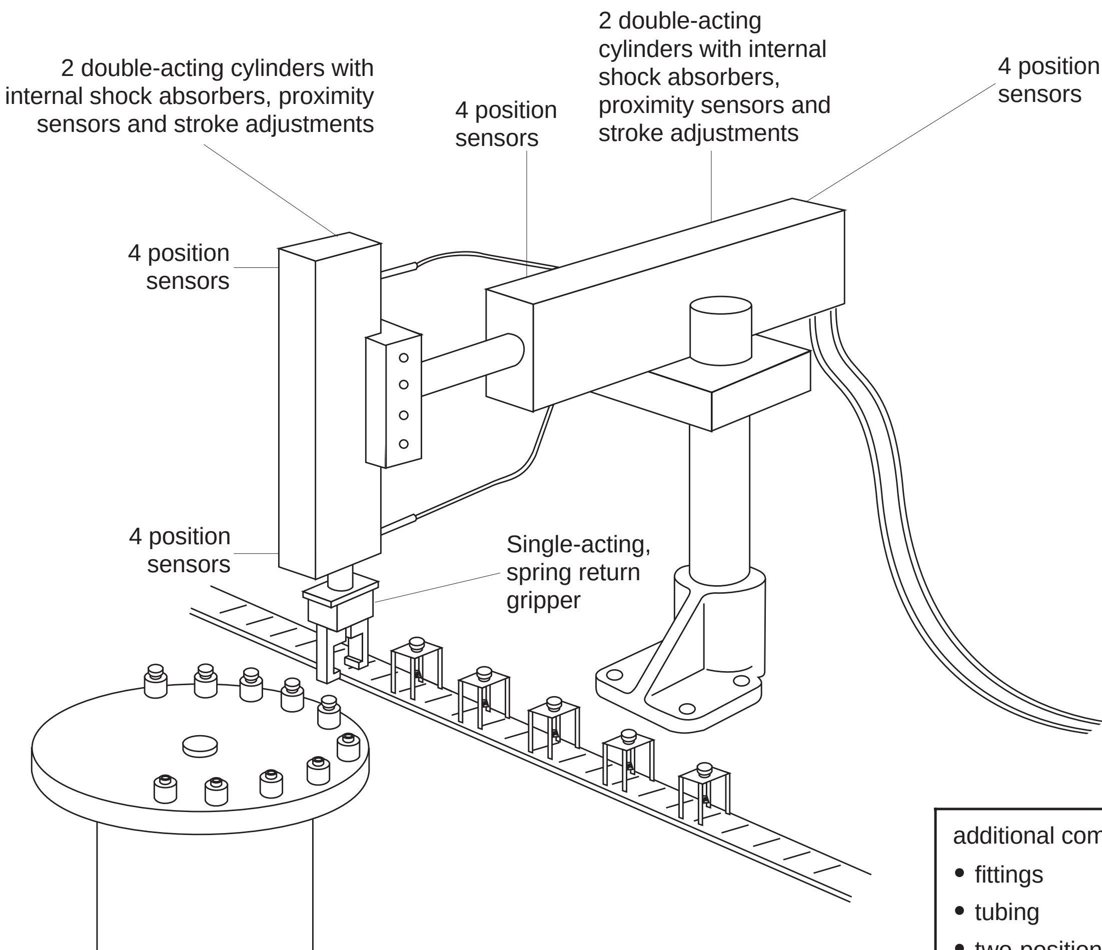
Pneumatics Automation at Work – Assembly



additional components used:

- fittings
- tubing
- two-position, three-way solenoid-actuated directional valve (located off station)
- 2 three-position, five-way solenoid-actuated directional valves (located off-station)

The Problem and its Solution

A cosmetic manufacturer had been manually inserting a brush assembly into nail polish bottles. The process required a worker to pick up each brush individually and insert it into the open nail polish bottle. The bottles were transported to and from the assembly area via a conveyor system. The bottle caps were seated and twisted onto the bottles at a later assembly station. In addition to being labor intensive, the process required a high degree of individual accuracy in order to fit the brush tips into the comparatively small hole in the nail polish bottle. This greatly limited production line speeds.

It was decided to automate this brush assembly process. A gripper was used to grasp the brush. Two pneumatic cylinders then raised the gripper holding the brush, moved it over the open nail polish bottle, lowered the brush into the bottle and released it. The caps were again put on and tightened at a later station. The pneumatic cylinders employed adjustable internal stops so that different sizes of bottles and brushes could be used on the same assembly line. An indexing table, instead of a conveyor system, was used to transport the bottle to the next station.

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The Design and Construction Process

1) A study was made to decide what motions would be required. The number of cycles the machinery would need to withstand during its lifetime was determined along with the minimum cycle time for this particular operation. Other factors such as maximum allowable "down time" due to component wear and reliability were also examined. In this case, it was decided to use components rated for maximum life, since machine "down time" needed to be kept at an absolute minimum.

2) Components were selected. A low-force gripper, with less then 10 pounds of force, was selected to pick up the brush. This was to ensure that the tubes forming the brush's body would not be crushed during the pick up operation. Special tooling was constructed for the gripper's fingers in order to grasp the brush's body. The weight of the gripper and tooling were used as a means to select the pneumatic cylinder which would provide the vertical or x-axis movement. The weight of this cylinder and the gripper were then used to select the pneumatic cylinders providing the horizontal or y-axis movement of the process. It was decided to use internally supported, non-rotating pneumatic cylinders in order to provide more lateral strength and accuracy. These cylinders included internal stroke adjustments, allowing their use with varying height bottles.

3) Directional valves to control the pneumatic cylinder and the gripper jaws were selected. It was decided to employ three-position solenoid actuated directional valves to control the pneumatic cylinders in order to positively shut off air flow when the assembly station was to be serviced.

4) Measurements were made for locating the entire assembly at the correct point on the assembly line. The mounting kit provided by the pneumatic cylinder manufacturer was selected because it allowed the components to be adjusted after assembly.

5) Pneumatic and electrical connections were made between the compressed air source, valves, pneumatic cylinders, gripper and an existing programmable controller. The controller's internal program was adapted to sequence the assembly station, receiving inputs from sensors located at the ends of the pneumatic cylinders and in the gripper. These sensors indicated whether a particular operation had taken place. Flow controls, connected to the pneumatic cylinders, were adjusted to attain the proper cycling speeds.

Payback: Manual vs. Automated Processes*

Time Savings Per Unit:
1.7 seconds (manual) – 1.2 seconds (automated) = .5

Labor Savings Per Month:
.00014 hour (.5 seconds) x $10 per hour (average hourly rate) x 311,294 units per month = $436

Number of Months to Payback Investment:
$2,700 component cost / $436 monthly labor savings = 6.2

***NOTE:** Supplied figures for all applications in this guide are based upon 21 work days per month with one 7-hour shift operating and an average hourly rate including benefits but not including operating overhead. The component costs listed do not include the tooling or labor required to build the application. For an estimate of total application costs, double the total component cost. Final application costs will vary based upon individual labor costs, skill levels and final application design.

Components Used in Pneumatic Applications*:

- Actuators
- After Coolers
- Air Compressors
- Air Dryers
- Air Line Lubricators
- Controls (electronic) and Software
- Cylinders
- Filters
- Filters/Regulators
- FRLs
- Fittings
- Gauges
- Grippers
- Hose
- Manifolds
- Motors
- Mufflers
- Regulators
- Rotary Actuators
- Seals
- Shock Absorbers
- Slides
- Switches
- Tubing
- Vacuum Products
- Valves

***Click here to access the NFPA Fluid Power Product Locator, which includes information about and links to NFPA member companies.**