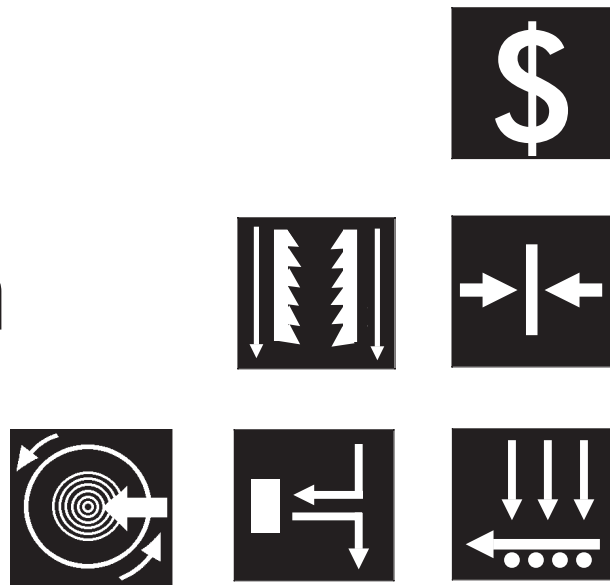


Your Guide to Cost Reduction through Pneumatics Automation



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.

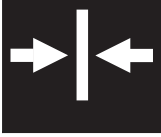
The applications and components described here are representative — pneumatics automation can be effectively utilized in countless automation processes, and pneumatic components are available in many different sizes and configurations. NFPA's manufacturers invite you to contact them for additional information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

The applications and components described or pictured here are illustrative only. Depiction or description of any product or component does not constitute, indicate or imply a recommendation or endorsement of any sort with respect to any system, products or components. Information and illustrations contained in this booklet do not constitute or indicate a warranty, express or implied, including but not limited to a warranty or representation as to quality, merchantability, or fitness for a particular use or purpose of any system, product or component.

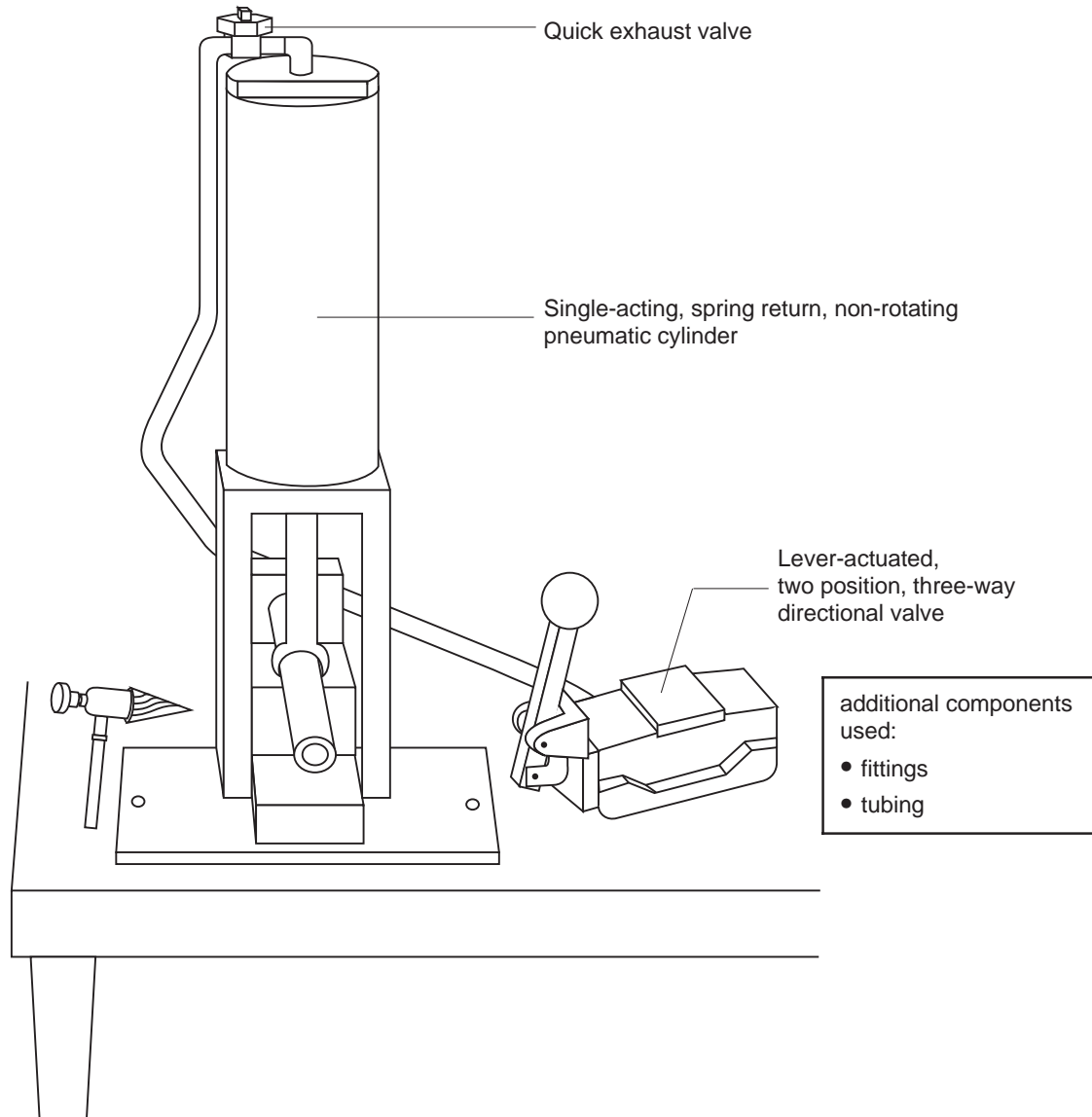


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Pneumatics Automation at Work – Clamping

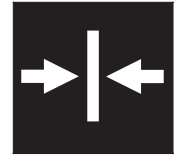


The Problem and Its Solution

A furniture manufacturer produced a specialized tubular steel utility cart made to carry an electronic medical diagnostic instrument. The product was produced infrequently and at such low quantities that dedicated machinery to cut and deburr the support tubing was not cost-effective. Consequently, each section of tube was cut and deburred manually. This operation required placing leather belting around the tube and inserting it into a combination vise for measuring, cutting and deburring.

The deburring was done with a hand-held ratcheting type reamer.

To increase production speed, a vertically-mounted pneumatic cylinder was used to hold the work in a predetermined position. This eliminated the need to manually clamp the tubular steel in a vise and mark it every time a cut was made.



The Design and Construction Process

- 1) First, the approximate amount of twisting force generated by the action of the hand reamer was determined, in this case by attaching a common torque wrench to a piece of tubing which was being reamed.
- 2) Next, the coefficient of friction was determined for leather against steel. This is the ratio between the normal force (or clamping force) and the amount of force it takes to begin sliding one of these surfaces against the other. This was determined by consulting a machinery text.
- 3) The torque, which represents the turning force, was divided by the coefficient of friction to determine the necessary clamping force. An appropriate pneumatic cylinder was then selected from the manufacturer's sizing tables. The cylinder was a single-acting spring return configuration. It was of the non-rotating type to ensure that its center rod would be in the same position each time its end tooling contacted the tubing.
- 4) A yoke clamp was mounted to the cylinder's center rod which was shaped to conform to the surface of the tubular steel. A corresponding channel was cut into an opposing clamp block which held the tube and formed the base of the frame. A stop block and reference line were also attached to this base to eliminate the need to individually measure and mark the tubes for cutting. The yoke clamp and clamp block were lined with leather to resist scuffing.
- 5) Measurements were made and the cylinder frame was welded together, and in turn welded to the channeled clamp block. A stop was welded to the rear of the channeled clamp block, and a mark where the saw cut was to be made was placed near the channeled clamp block's front.
- 6) The yoke clamp tooling was formed and bolted to the cylinder's piston rod. The cylinder was then mounted to the cylinder frame. A lever-actuated, two-position, three-way control valve was attached to a quick exhaust valve. This valve was mounted to the cylinder's only port. The lever-actuated control valve was then connected to a compressed air source.

Payback: Manual vs. Automated Processes*

Time Savings Per Unit

45 seconds (manual) - 38 seconds (automated)
= 7 seconds

Labor Savings Per Month

.002 hour (7 seconds) x \$10 per hour (average hourly rate) x 11,760 units per month = \$235

Number of Months to Payback Investment

\$200 component cost / \$235 monthly labor savings
= .9

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

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