Summary

<table>
<thead>
<tr>
<th></th>
<th>Air cylinder equipment</th>
<th>ROBO cylinder equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement of production efficiency</td>
<td>1 line: 1,918 pcs/day</td>
<td>1 line: 2,647 pcs/day (38% improved)</td>
</tr>
<tr>
<td>Number of production lines required</td>
<td>3 lines</td>
<td>2 lines</td>
</tr>
<tr>
<td>Number of product types supported</td>
<td>10 types</td>
<td>25 types + α</td>
</tr>
<tr>
<td>Step 3: Performance improvement machine</td>
<td>(Requires 3 lines to support 25 types)</td>
<td>(1 line supports 25 types or more)</td>
</tr>
<tr>
<td>Cost of equipment</td>
<td>$50,000</td>
<td>$55,000</td>
</tr>
<tr>
<td>Electric power consumption (a)/system</td>
<td>142.51 kwh/year</td>
<td>429.32 kwh/year</td>
</tr>
<tr>
<td>Air compressor power consumption (b)/system</td>
<td>1,113.15 kwh/year</td>
<td>429.52 kwh/year</td>
</tr>
<tr>
<td>Total power consumption (a+b)/system</td>
<td>1,255.67 kwh/year</td>
<td>858.6 kwh/year</td>
</tr>
<tr>
<td>Step 5: Total power consumption</td>
<td>1,255.67 kwh x 1 line = 1,255.67 kwh/year</td>
<td>858.6 kwh x 2 lines = 858.6 kwh/year</td>
</tr>
<tr>
<td>Step 5: Total power cost ($0.17/kwh)</td>
<td>$390,000</td>
<td>$129,000</td>
</tr>
<tr>
<td>Step 5: Power consumption/piece</td>
<td>3,767.0 kwh/1,403,976 pcs = 2.683 wh</td>
<td>858.6 kwh/1,291,736 pcs = 0.6647 wh</td>
</tr>
</tbody>
</table>

Production capability:
Air-cylinder equipment x 3 lines is equivalent to ROBO-cylinder equipment x 2 lines

Cost saved in 3 years after switching to ROBO-cylinder equipment at Step 3

- Equipment cost: $50,000 x 3 lines = $150,000
- Labor cost: $65,000 x 3 years = $195,000
- Electric bill: $55,000 x 2 lines x 3 years = $330,000

Difference:
- $40,000
- $51,000
- $104,000

Total cost:
- $236,300

Environment surrounding customers

- Supporting multi-variety, variable-volume production
- Improvement of production efficiency is urgently needed

ROBO Cylinder
Production capability:
Air-cylinder equipment x 3 lines is equivalent to ROBO-cylinder equipment x 2 lines

- Cycle time reduced by 3.8 seconds.
- Cycle Time Improved by 36%

Improvement of Production Efficiency

A case study that reduced the running costs by $236,300* over 3 years by changing to electric actuators

**Exchange rate: ¥100 = $1**

Issues of production facilities
- Multiple varieties, varying volumes
- Reduction of labor cost
- Improvement of production efficiency
+ Energy-saving

100% motorization is the solution!

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Overview of Improved System
(System Using Air Cylinders)

The system we worked on is a simple semi-automatic system that assembles onboard sensors and conducts an electrical continuity test on sensor assemblies. The operator sets the work part and presses the start switch, then the work part setting table moves toward the back of the system to perform assembly (press-fitting of the connector) and inspect the assembled work part, after which the table returns to the forward position.

- Number of air cylinders = 8 units
- Product types supported = 10 types
- Setup hours = 10 hours/year
- Cycle time = 10.5 seconds

Significant Improvement of Production Efficiency through Motorization

Cycle time reduction for "work part setting table" operation

-with the air cylinder system, the "work part setting table" could not be operated faster because it would have increased the shock upon stopping. With the ROBO Cylinder system, on the other hand, the maximum speed can be increased because the actuator stops without generating shock. In addition, the ROBO Cylinder system starts quicker than the air cylinder system, which enabled significant reduction of the cycle time.

Cycle time reduction for "connector press-fitting" operation

-with the air cylinder system, an automatic switch was used to determine whether the work part had been pressed to the specified position, which made the operation unstable and required 4 seconds for the press-fitting action to ensure quality. With the ROBO Cylinder system, on the other hand, push-motion operation can be performed using the zone function and consequently the press-fitting time was successfully reduced by 2 seconds.

Supporting more product types

-with the air cylinder system, multiple product types (10 types) were supported by switching the three air cylinders at the stamping location of the work part inspection "PASS" stamp. By motorizing the system, 25 product types are now supported. With the motorization of the "connector press-fitting" and "electrical continuity test," these steps can now support 25 product types, as well. (The time spent on setup went down from 150 seconds per day to 0 seconds.)