

# Improvement of Production Efficiency

A case study that reduced the running costs by \$262,700\* over 3 years by changing to electric actuators

\*Exchange rate: 90 yen = \$1

## Environment surrounding customers

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



### ● Issues of production facilities

Multiple varieties, varying volumes  
(Reduction of labor cost)

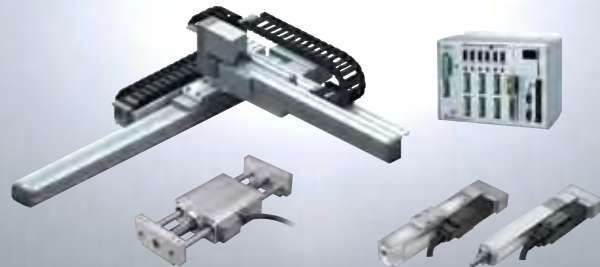
Improvement of production efficiency

+ Energy-saving



Improvement is needed to solve these issues. There are largely three causes.

**100% motorization is the solution!**



# Overview of Improved System (System Using Air Cylinders)

## Onboard sensor performance tester

### Overview of system

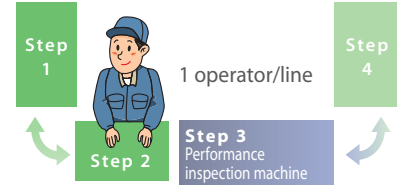
The system we worked on is a simple semi-automatic system that assembles onboard sensors and conducts an electrical continuity test on sensor assemblies. The operator sets the work part and presses the start switch, then the work part setting table moves toward the back of the system to perform assembly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

### System specifications

- Number of air cylinders = 8 units
- Product types supported = 10 types (25 types can be supported with 3 lines.)
- Setup hours = 10 hours/year
- Cycle time = 10.5 seconds

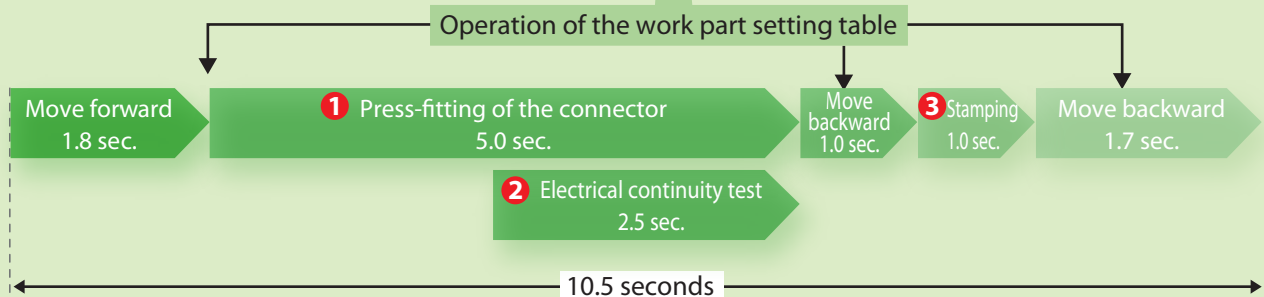
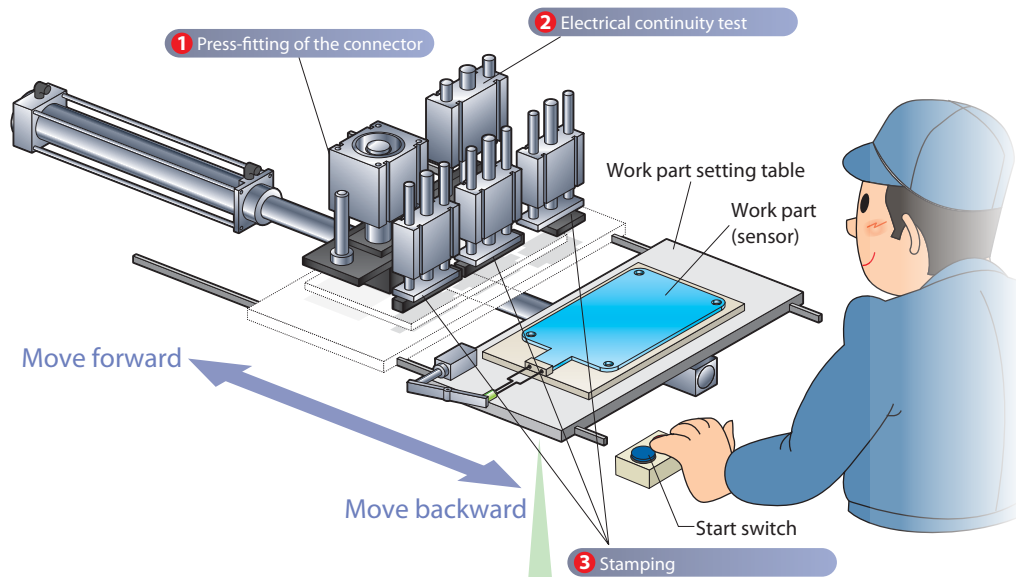
### Positioning of the system in the line

#### Onboard sensor assembly line



- Improvements made
- 1 Press-fitting of the connector
  - 2 Electrical continuity test
  - 3 Stamping

Onboard sensor performance inspection machine (using air cylinders)



Improve 1

Improve 2

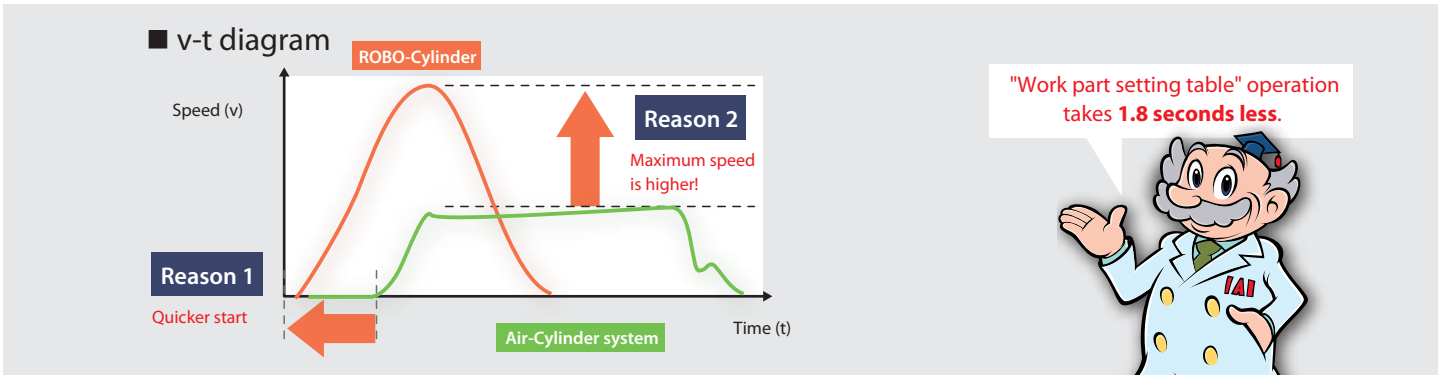
Improve 3

# Significant Improvement of Production Efficiency through Motorization



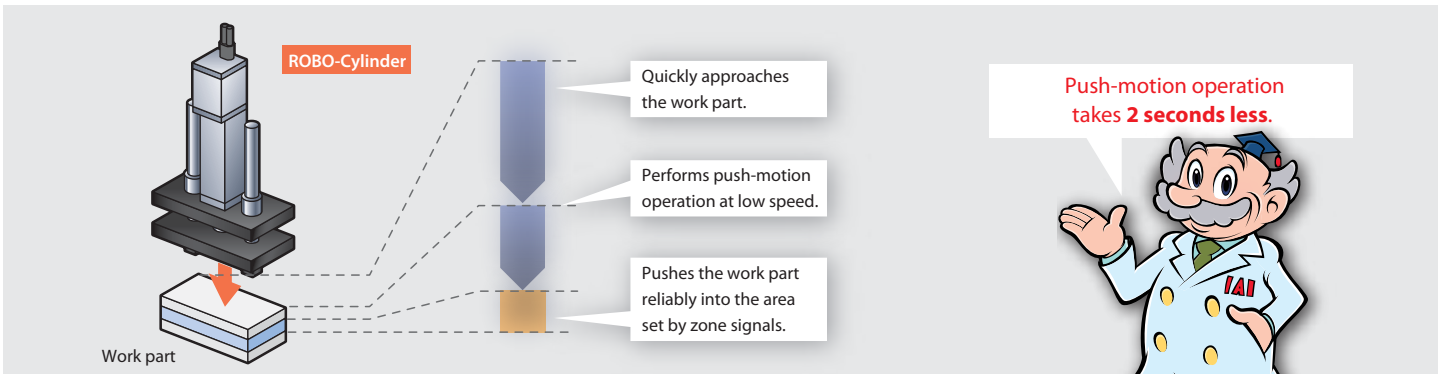
## Cycle time reduction for "work part setting table" operation

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.



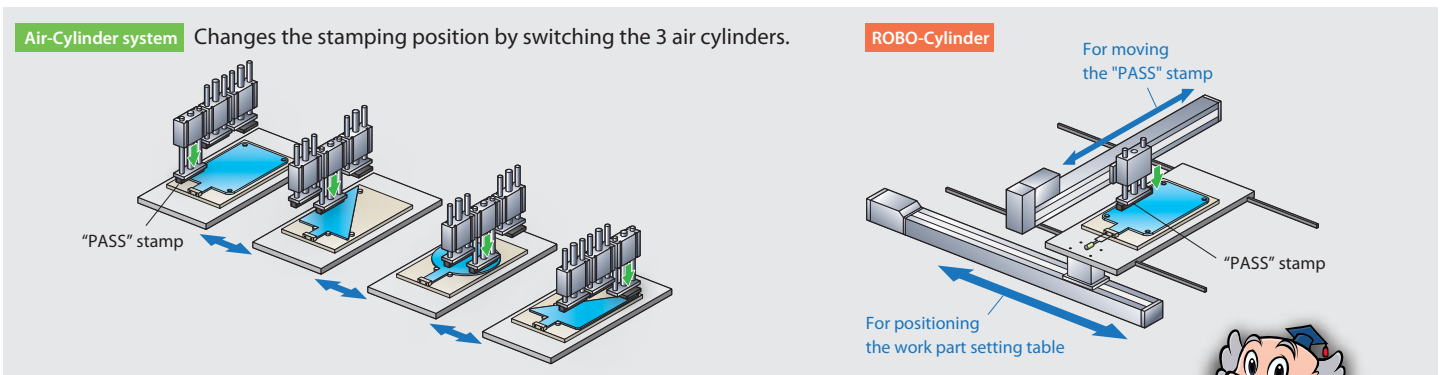
## Cycle time reduction for "connector press-fitting" operation

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

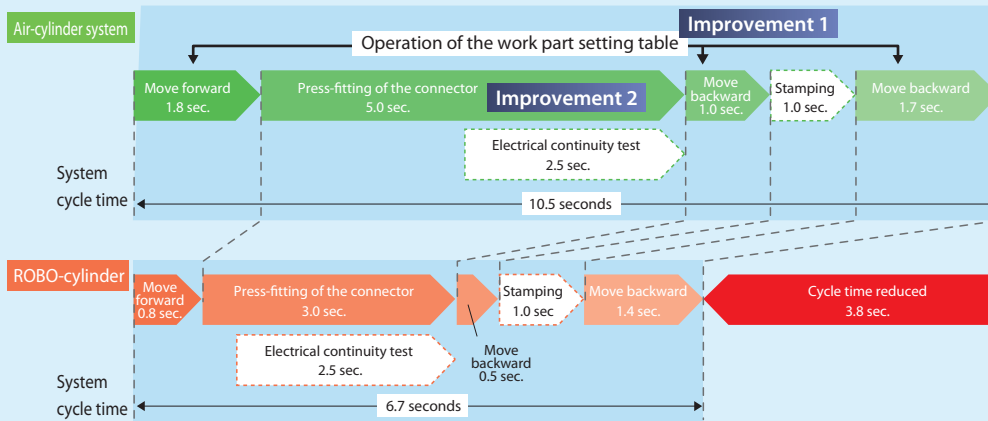
With the air-cylinder system, multiple product types (10 types) were supported by switching the three air cylinders at the stamping location of the work part inspection "PASS" stamp. By motorizing the system, 25 product types are now supported. With the motorization of the "connector press-fitting" and "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.)



Setup time = 0 seconds    Number of product types supported: 10 → 25 types



**Improvement 1 & Improvement 2 led to reduce the cycle time by 3.8 seconds.**



Cycle time improved by 36%



**Summary**

		Air-cylinder equipment	ROBO-cylinder equipment
Improvement of production efficiency		1 line: 1,918 pcs/day 3 lines: 5,754 pcs/day =1,403,976 pcs/year (244 days)	1 line: 2,647 pcs/day (38% improved) 2 lines: 5,294 pcs/day =1,291,736 pcs/year (244 days)
Number of production lines required		3 lines	2 lines
Number of product types supported		10 types (Requires 3 lines to support 25 types)	25 types + α (1 line supports 25 types or more)
Step 3: Performance inspection machine	Cost of equipment	\$55,600	\$61,100
	Electric power consumption (a)/system	142.51 kWh/year	429.32 kWh/year
	Air compressor power consumption (b)/system	1,113.15 kWh/year	0 kWh/year
	Total power consumption (a+b)/system	1,255.67 kWh/year	429.32 kWh/year
	Step 3 total power consumption	1,255.67 kWh x 3 lines = 3,767.0 kWh/year	429.32 kWh x 2 lines = 858.6 kWh/year
	Step 3 total power cost (\$0.17/kWh)	\$600/year	\$100/year
Step 3 power consumption/piece		3,767.0 kWh ÷ 1,403,976 pcs = 2.683 Wh	858.6 kWh ÷ 1,291,736 pcs = 0.6647 Wh < Electric power consumption 75% decreased >

**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

	① Air-cylinder equipment	② ROBO cylinder equipment	Difference (② - ①)
Equipment cost	\$55,600 x 3 lines = \$166,800	\$61,100 x 2 lines = \$122,200	-\$44,600
Labor cost	\$72,200 x 3 operators x 3 years = \$649,800	\$72,200 x 2 operators x 3 years = \$433,200	-\$216,600
Electric bill	\$600 x 3 years = \$1,800	\$100 x 3 years = \$300	-\$1,500
Total	\$818,400	\$555,700	-\$262,700

Exchange rate: 90 yen = \$1, Dollar amounts rounded to the nearest \$100

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