Evaluation Report

Air Consumption Reduction Technology (Energy Saving Effect Evaluation using Mecha Swing Nozzle)

Provided by Company P
(CO2 Reduction Promotion Section,
Environmental Promotion Group)

Contents

1. Introduction

2. Mecha Swing Nozzle

1. Introduction

Purpose

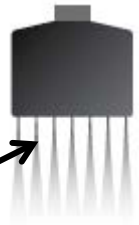
To reduce the amount of compressed air used in “Air Blow”, a device called “Mecha Swing Nozzle” was manufactured by GA-REW.

This examination will help us to evaluate these technologies and spread them within the company.

Mecha Swing Nozzle

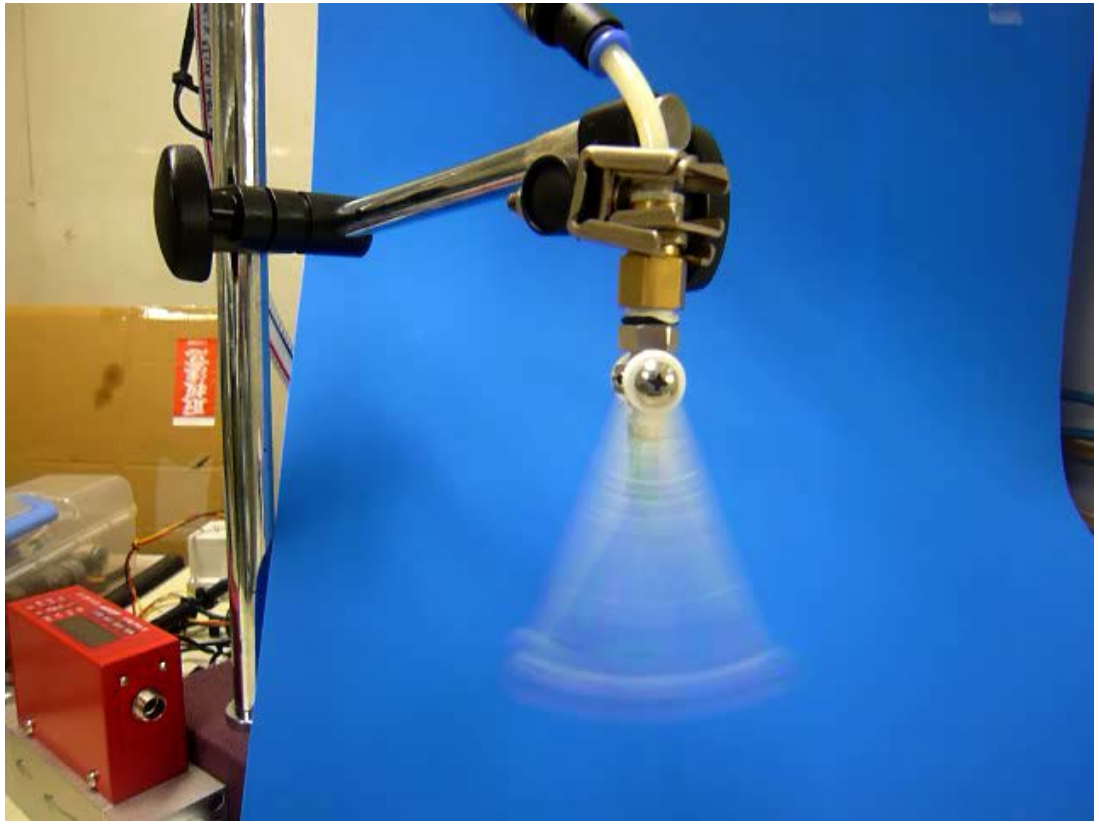
2. Movement of the Mecha Swing Nozzle

What is the Mecha Swing Nozzle?



Img.1. Flat Nozzle

Img.2. Mecha Swing Nozzle



Pic.1. Movement of the Mecha Swing Nozzle (at Air Pressure : 0.4 MPa)

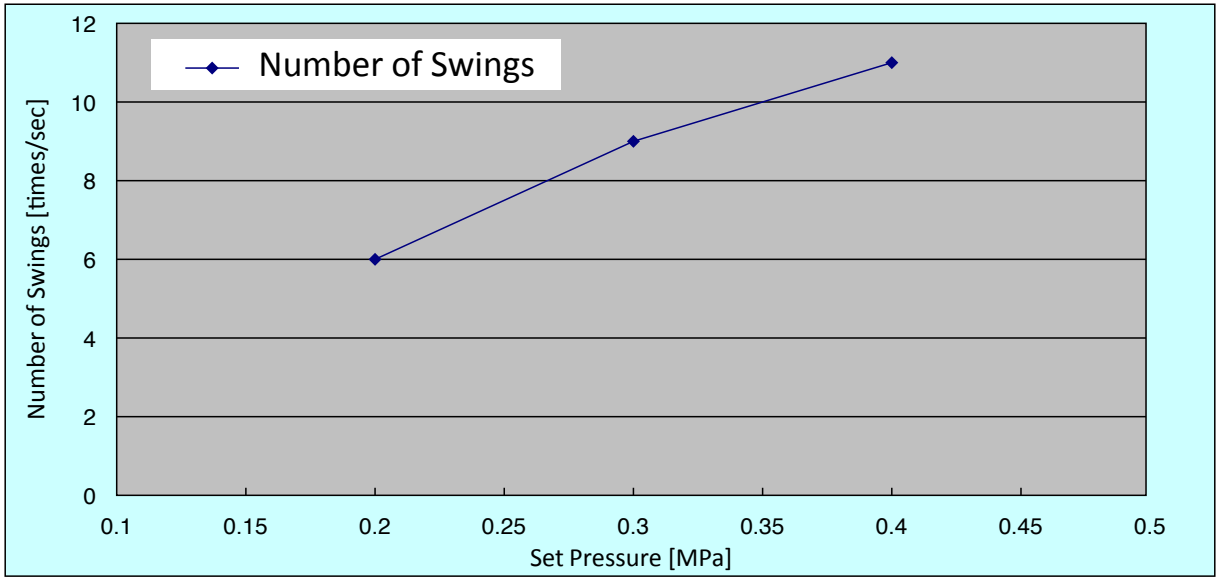
2. Movement Analysis of the Mecha Swing Nozzle

- Evaluation of the set pressure and the number of swings persecond of the Mecha Swing Nozzle (measured by a high speed camera)

Table 1. Number of Swings

Pressure [MPa]	Number of Swings [times/sec]
0.2	6
0.3	9
0.4	11

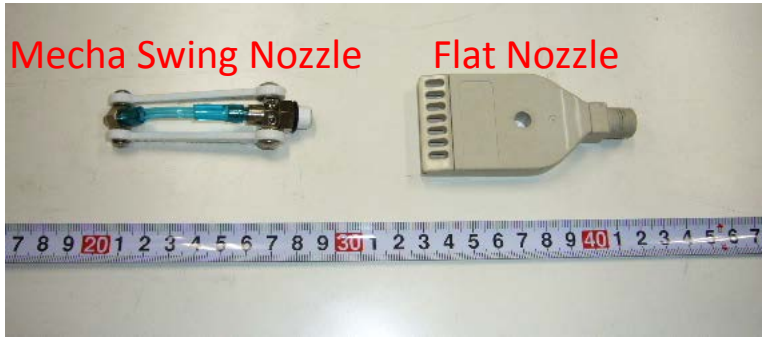
Pic.2. High Speed Camera



Graph 1. Evaluation results of the set pressure and the number of swings of the Mecha Swing Nozzle

2. Air Consumption of the Mecha Swing Nozzle

Devices used for the test

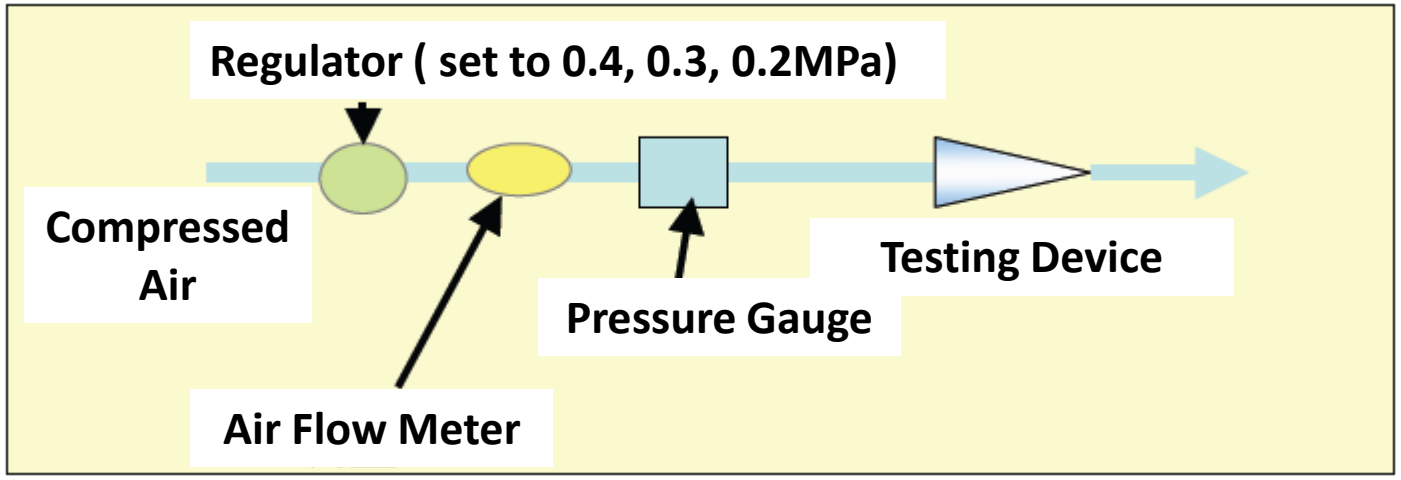


Pic.3. Testing Devices

Mecha Swing Nozzle
Model : MS-70 by GA-REW Co., Ltd.
Nozzle diameter : 2mm (Single hole)
Flat Nozzle
(manufactured by company A)

Evaluation Method of Air Pressure and Air Flow Rate

(Air Pressure is controlled by a Regulator)



Img.3. Schematic Diagram of the Evaluation Test

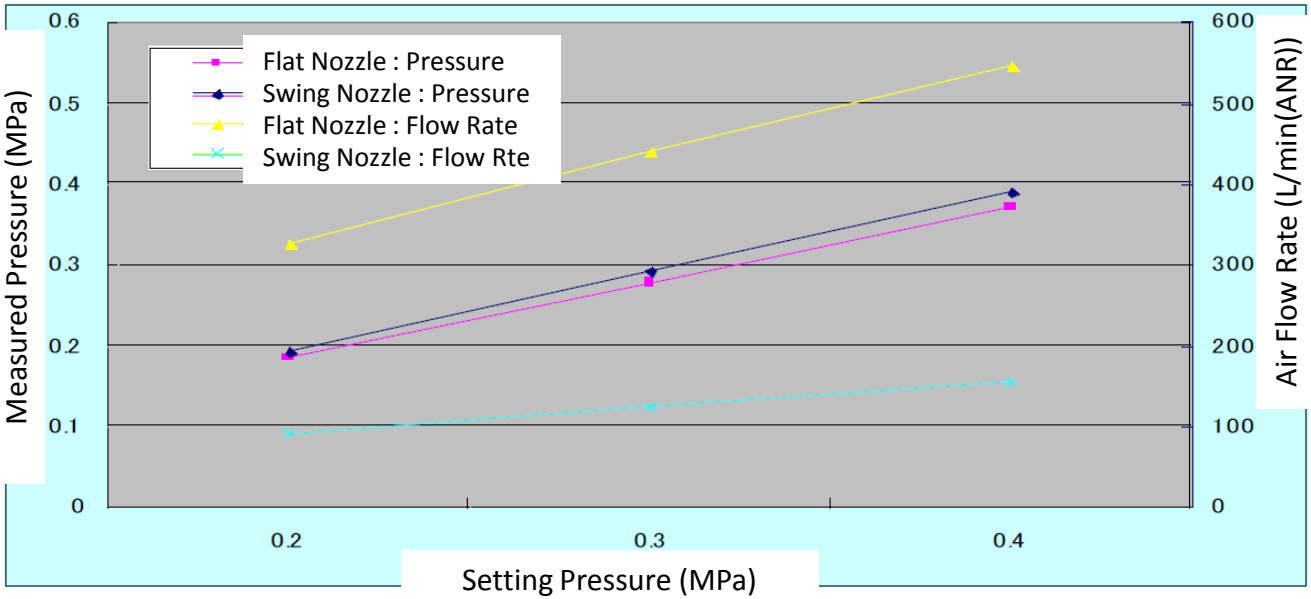
2. Evaluation of the Mecha Swing Nozzle

Table 2. Air Pressure and Air Flow Rate

Nozzle Type	Setting Pressure (MPa)	Measured Pressure (MPa)	Flow Rate (L/min(ANR))
Flat Nozzle	0.2	0.185	326
	0.3	0.277	438
	0.4	0.371	544
Mech Swing Nozzle	0.2	0.192	92
	0.3	0.292	123
	0.4	0.390	154

Table 3. Difference of Air Flow Rate

Setting Pressure (MPa)	Air Flow Rate (L/min(ANR))			Mecha Swing Nozzle / Flat Nozzle
	Flat Nozzle	Mecha Swing Nozzle	Difference	
0.2	326	92	234	0.28
0.3	438	123	315	0.28
0.4	544	154	390	0.28



Graph 2. Relation between Air Pressure and Air Flow Rate

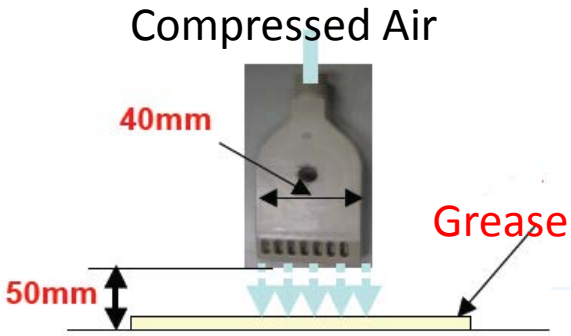
Result:

The Mecha Swing Nozzle uses only 30% of what's used in the flat nozzle.

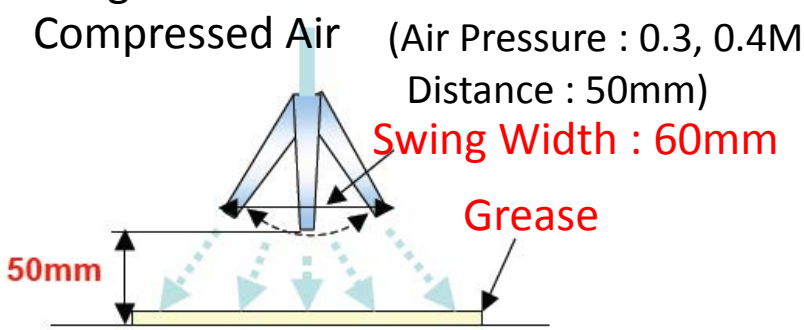
2. Evaluation of the Mecha Swing Nozzle (cont.)

Evaluation Method of Air Blow Capacity (Operating Time and Effective Range)

Air is injected to the surface which has been coated with grease for a certain time.
After that, measure the surface area where the grease has been removed.

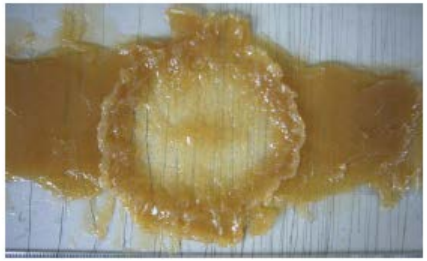


Img.4. Flat Nozzle



Img.5. Mecha Swing Nozzle

Before



After

Pic.4. Before and After the Blow
(Flat Nozzle)

Before

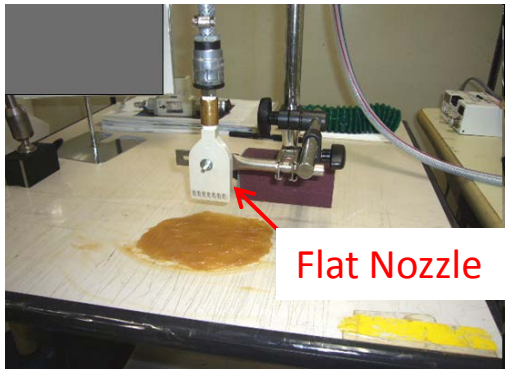
After

Pic.5. Before and After the Blow
(Mecha Swing Nozzle)

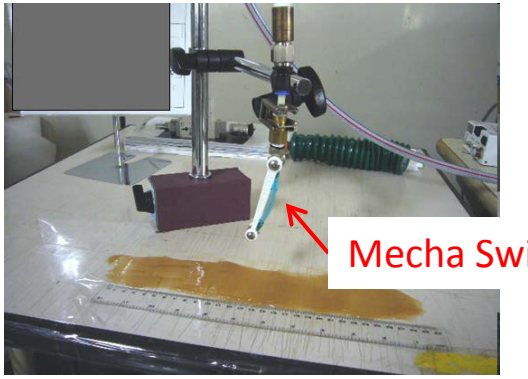
2. Evaluation of the Mecha Swing Nozzle (cont.)

Evaluation Method of Air Blow Capacity (Operating Time and Effective Range)

Photos taken during the experiment



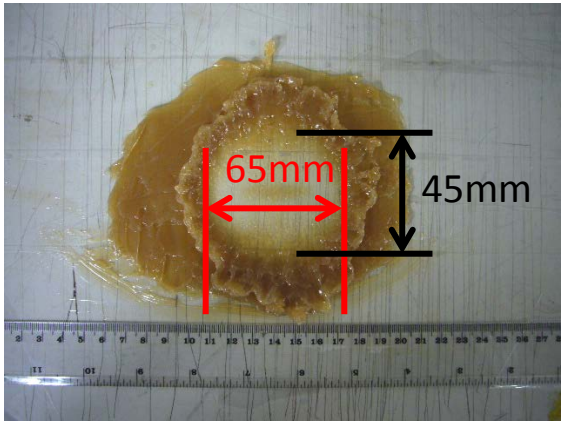
Pic.6. Flat Nozzle



Pic.7. Mecha Swing Nozzle

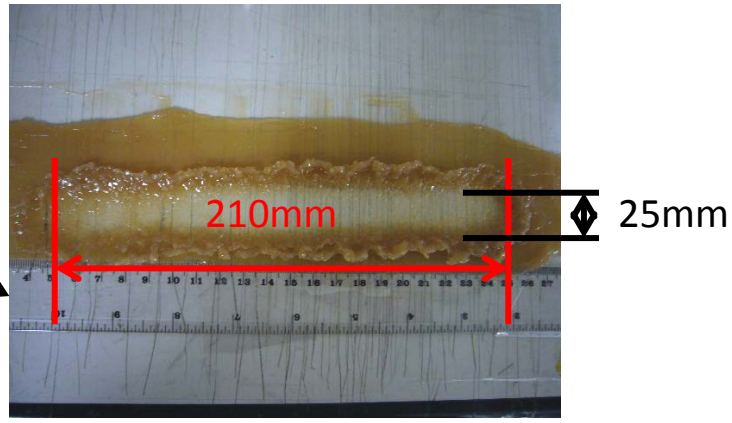
Evaluation Method

After using the devices, measure the grease that was removed as shown below.



Pic.8. Result (Flat Nozzle)

Scale



Pic.9. Result (Mecha Swing Nozzle)

2. Evaluation of the Mecha Swing Nozzle

Evaluation results of the Operating Time and the Air Trace Width.

Table 4. Results at Distance : 50mm , Pressure : 0.3MPa

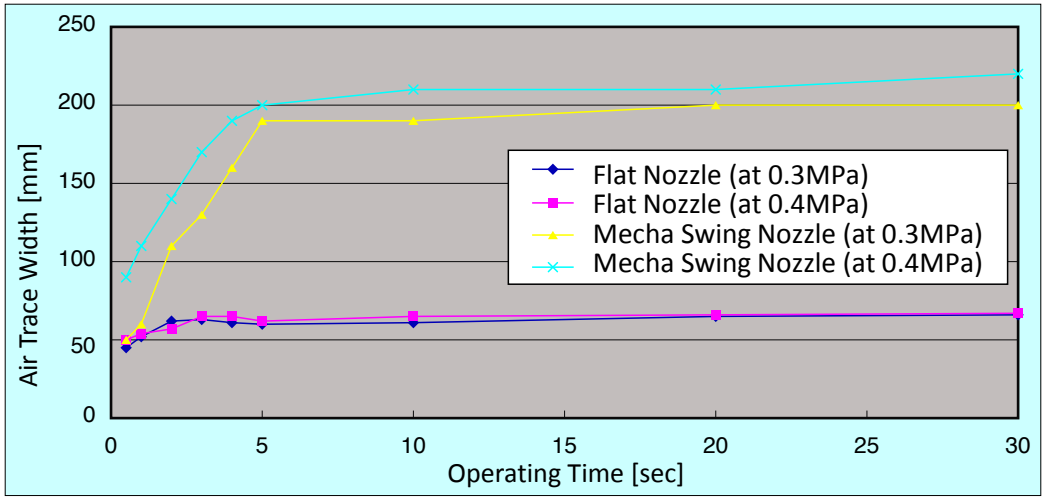
Unit : [mm]

Nozzle Type	Operating Time (sec)								
	0.5	1	2	3	4	5	10	20	30
Flat Nozzle	45	52	62	63	61	60	61	65	66
Mecha Swing Nozzle	50	60	110	130	160	190	190	200	200

Table 5. Results at Distance : 50mm , Pressure : 0.4MPa

Unit : [mm]

Nozzle Type	Operating Time (sec)								
	0.5	1	2	3	4	5	10	20	30
Flat Nozzle	50	54	57	65	65	62	65	66	67
Mecha Swing Nozzle	90	110	140	170	190	200	210	210	220



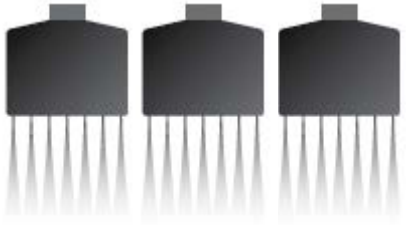
Graph 3. Relation between Operating Time and Air Trace Width

Result : The effective range of the Mecha Swing Nozzle is three times wider than the flat nozzle.

2. Air Saving Technique using the Mecha Swing Nozzle

Air Saving Effect using the Mecha Swing Nozzle

From the test results, we found out that using “one” Mecha Swing Nozzle is equivalent to using “three” Flat Nozzles.



Img.6. Three conventional Flat Nozzle

Img.7. One Mecha Swing Nozzle

Table 6. Air Saving Effect with the Mecha Swing Nozzle

(In case of Three Flat Nozzle and One Mecha Swing Nozzle)

Setting Pressure (MPa)	Air Consumption (Flow Rate : L/min (ANR))			Air Saving Rate
	Flat Nozzle	Mecha Swing Nozzle	Saving Air Quantity	
0.3	1314	123	1191	90.6%
0.4	1632	154	1478	90.6%

Result:

It’s a proven fact that you can reduce up to 90% of the air used by three flat nozzles with just one Mecha Swing Nozzle.

2. Conclusion

Conclusion of the test results of the Mecha Swing Nozzle

Air Saving Effect : Reduce up to 90% of Air used

Air Saving Effect is confirmed
from the test results in our group.

Product Durability

Durability Test in progress

Pic.10. Durability Test (setting pressure : 0.6MPa)

Supplement

▪ Cost

Table 7. Initial (introduction) cost

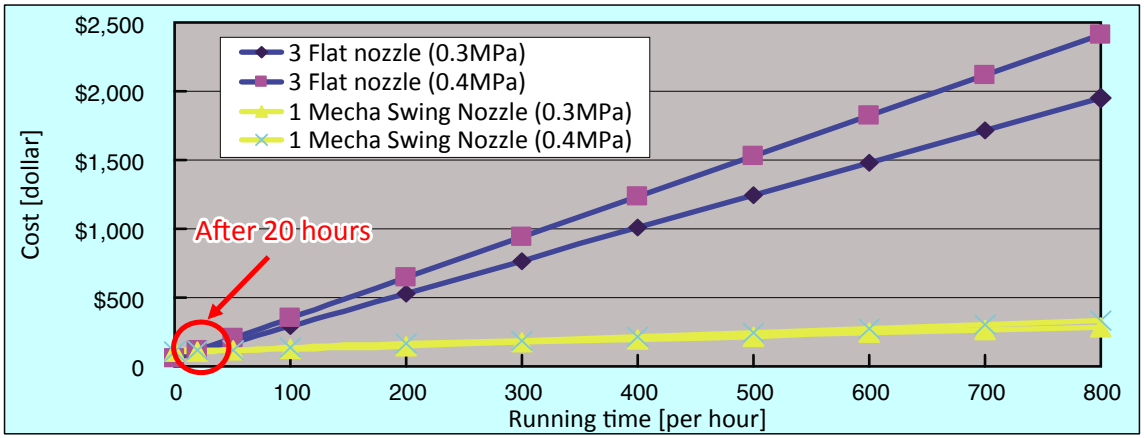
Name of nozzle	Initial (introduction) cost		
	1 unit	3 units	Total
Flat Nozzle	$20	$60	$60
Mecha Swing Nozzle	$107.5	-	$107.5

Table 8. Flow rates of using 3 Flat nozzles and using 1 Mecha Swing Nozzle

Set Pressure (MPa)	Air Consumption (Flow Rate : L/min (ANR))	
	3 Flat Nozzles	1 Mecha Swing Nozzle
0.3	1314	123
0.4	1632	154

Table 9. Initial & running cost (calcurated at 3cents per 1m^3 of air)

Name of nozzle	Set Pressure (MPa)	Running cost (operating time US$)										
		0 (at introduction time)	20	50	100	200	300	400	500	600	700	800
3 Flat Nozzles	0.3	$60	$107.30	$178.26	$296.52	$533.04	$769.56	$1,006.08	$1,242.60	$1,479.12	$1,715.64	$1,952.16
	0.4	$60	$118.75	$206.88	$353.76	$647.52	$941.28	$1,235.04	$1,528.80	$1,822.56	$2,116.32	$2,410.08
1 Mecha Swing Nozzle	0.3	$107.50	$111.93	$118.57	$129.64	$151.78	$173.92	$196.06	$218.20	$240.34	$262.48	$284.62
	0.3	$107.50	$113.04	$121.36	$135.22	$162.94	$190.66	$218.38	$246.10	$273.82	$301.54	$329.26



Graph 4. Transition of Initial & running cost

Result

<u>After using about 20 hours</u>, the running cost of the Mecha Swing Nozzle would be reduced than the cost of the flat nozzles.

Note: Losses such as service life or exchange time are not included in this trial calculation. It is a trial calculation of the introduction and running cost.