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Eco-Friendly Casting Production

January 24, 2024

SINTOKOGIO, LTD.

Today's Subject:

Introduction of the latest technology for eco-friendly casting production from the perspective of energy saving, recycling and working environment Improvement.

I. Energy Saving

Direct reduce of energy usage and defect elimination in terms of indirect energy saving

II. Recycling

Reduce environmental burden and cost saving by reusing the waste from casting production

III. Working Environment Improvement

Protect the people working in the foundry and the surrounding environment by removing harmful substances

I. Energy Saving

Direct reduce of energy usage and defect elimination in terms of indirect energy saving

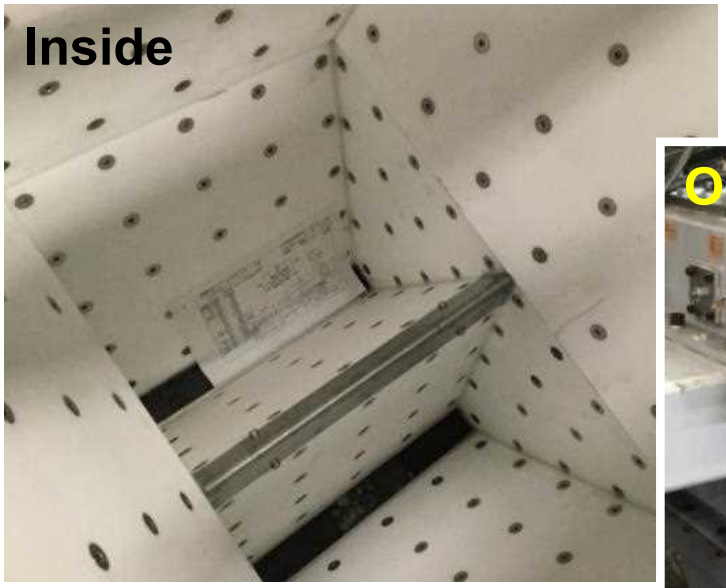
- **Aeration Sand Filling**
- **Servo Cylinder**
- **Hybrid Hydraulic System**
- **Data Analysis**

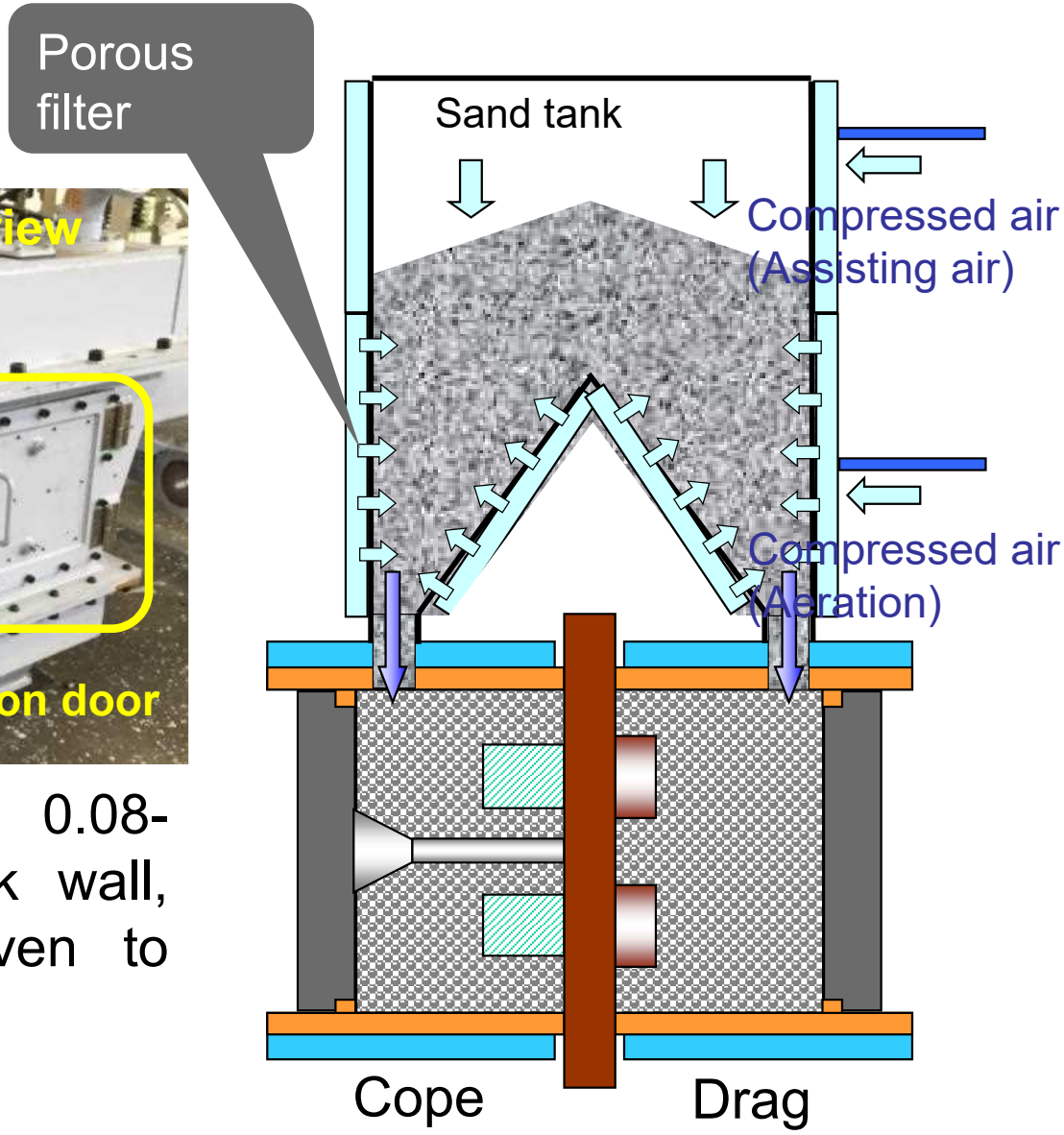
I. Energy Saving

- Aeration Sand Filling

Advanced and unique technology equipped on Sinto's Molding Machines for better quality mold production

Aeration sand filling





By introducing aeration air (at 0.08-0.18MPa) from full area of tank wall, fluidized sand can be filled even to narrow pockets uniformly.

★Excellent sand filling performance
★Reduced compressed air consumption; ½ compared to conventional machine.

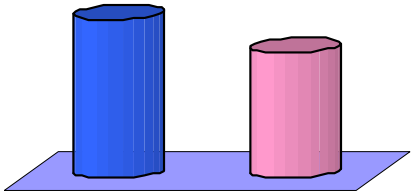
Aeration changes mold

Advantages of Aeration

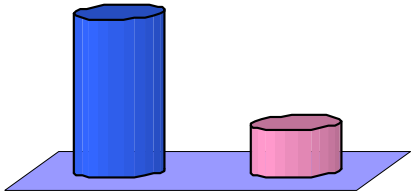
- Uniform sand packing density
- Large reduction of air consumption compared to blow method
- Low noise of 75 dB(A)
- Wide range of applicability of sand property

Video

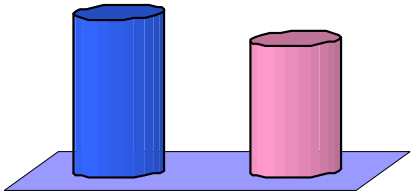
Reduction of casting product weight



Reduction of compressed air consumption by 70%



Reduction of amount of sand used by 2.5%

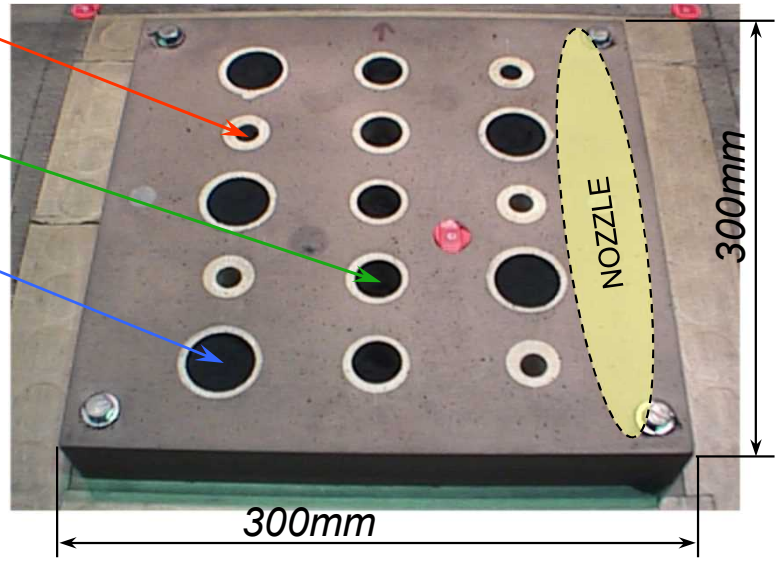


Aeration sand filling achieves uniform and high filling performance

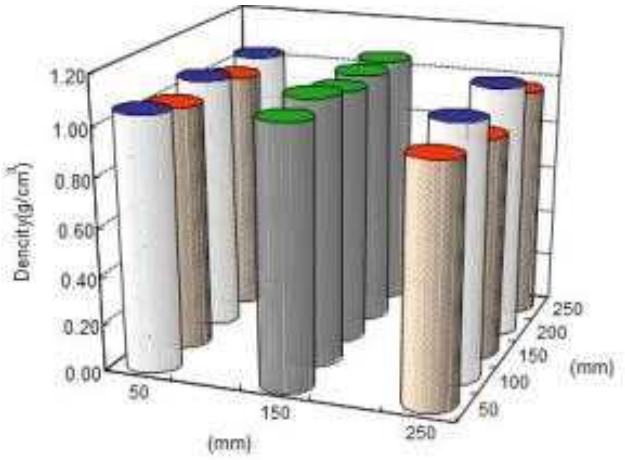
φ10 × 50

φ20 × 50

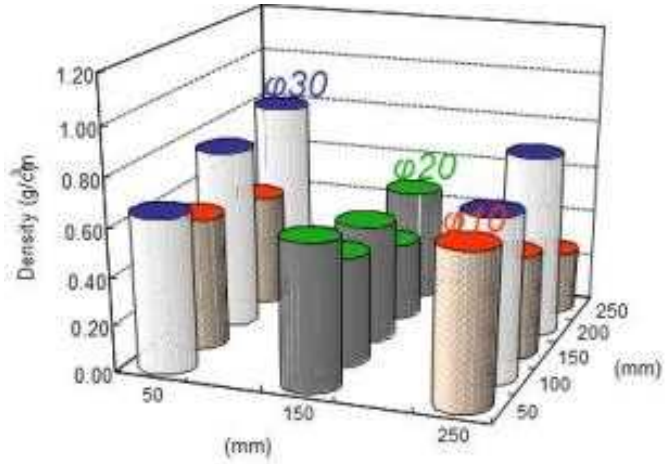
φ30 × 50



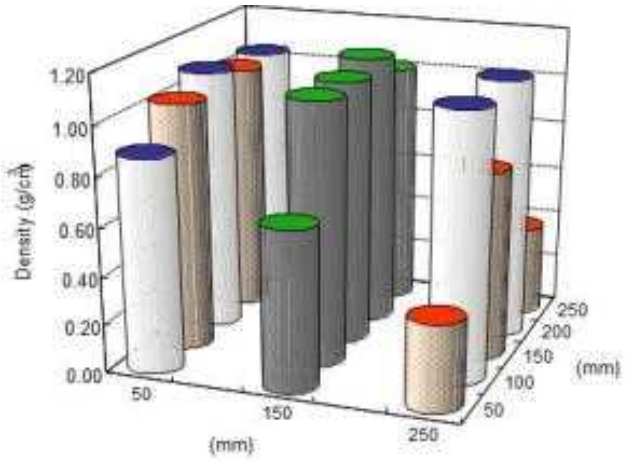
Aeration (Pressure=0.1MPa)



Gravity sand fill



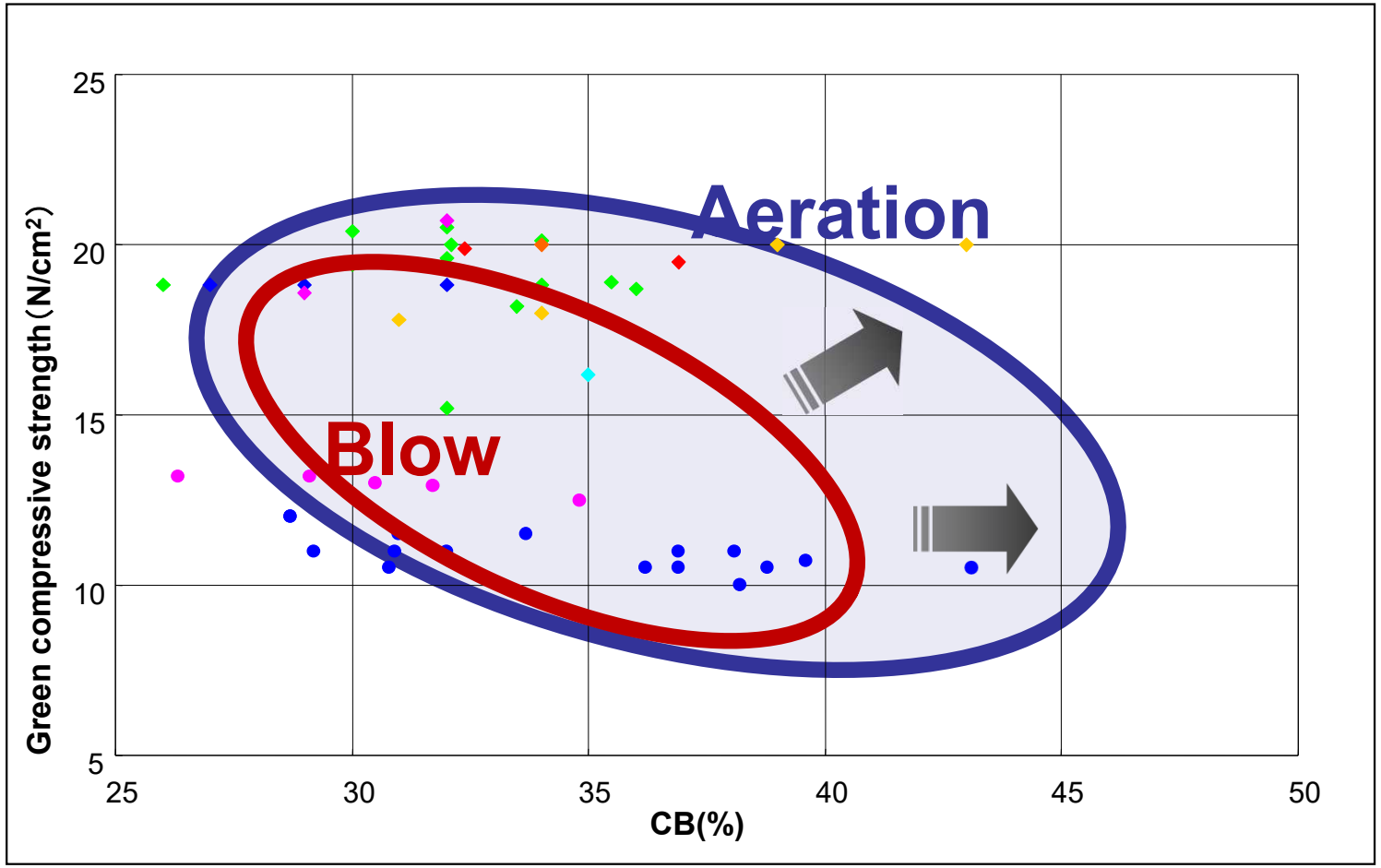
Blowing (Pressure=0.3MPa)



Good mold cannot be made even after strong squeeze if sand is not well filled.

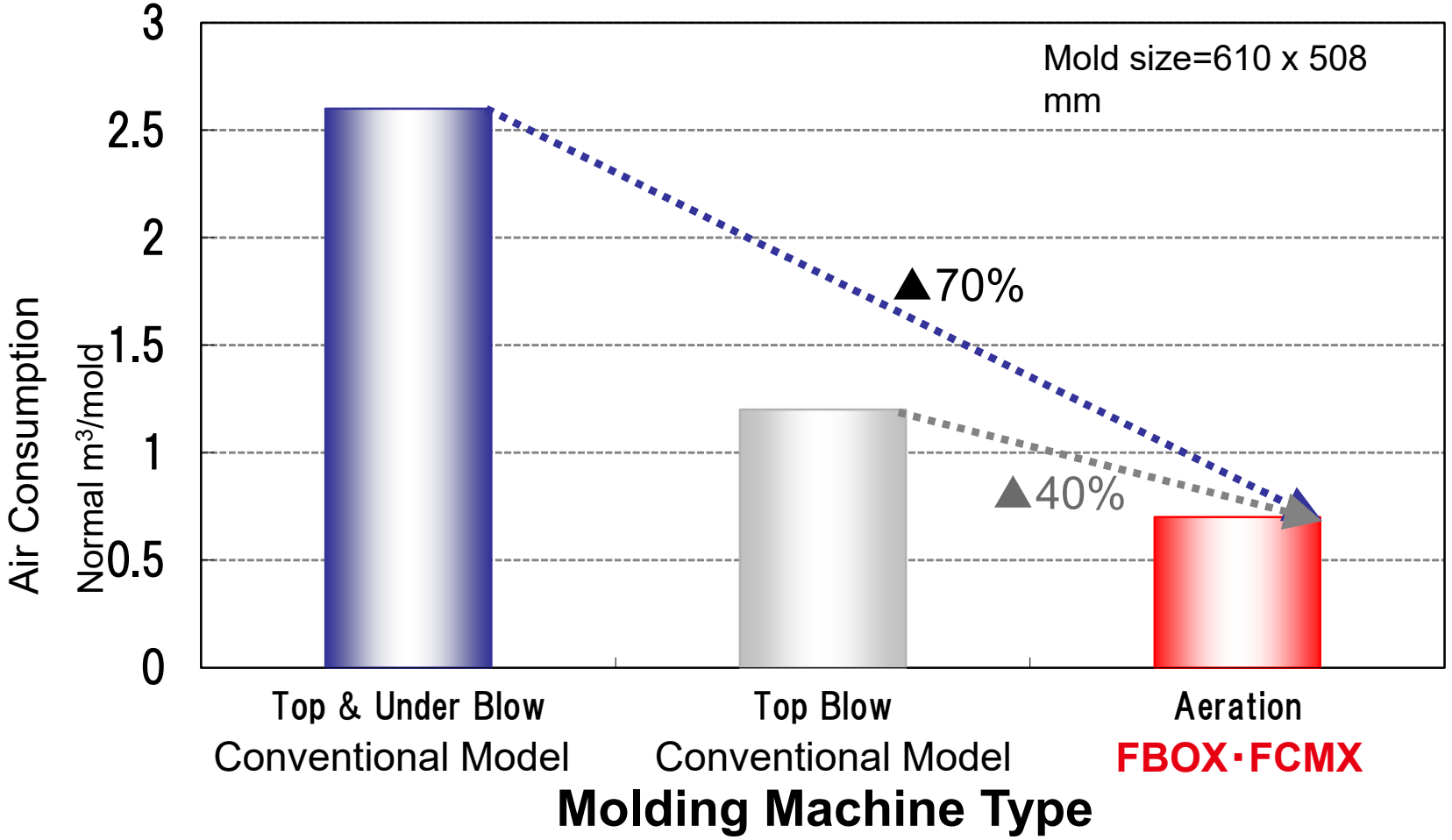
Wider range of sand can be used for Aeration filling

Sample of molding sand properties distribution (from customers and test data)



Compared to blowing method, far wider range of sand is allowed, accepting sand from existing sand system.

Improved energy consumption



Aeration is an environmentally-friendly molding process to reduce CO2 gas

Aeration Molding machine series

Flaskless molding machine

FCMX

FBOX

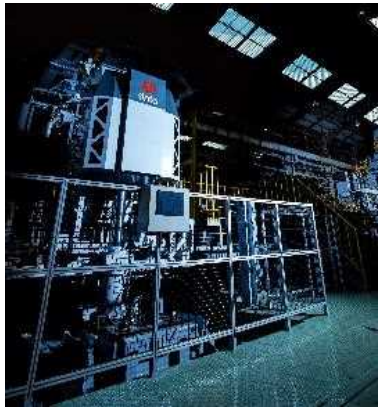
FBON

FBMX

FDNX

Tight-flask Molding machine

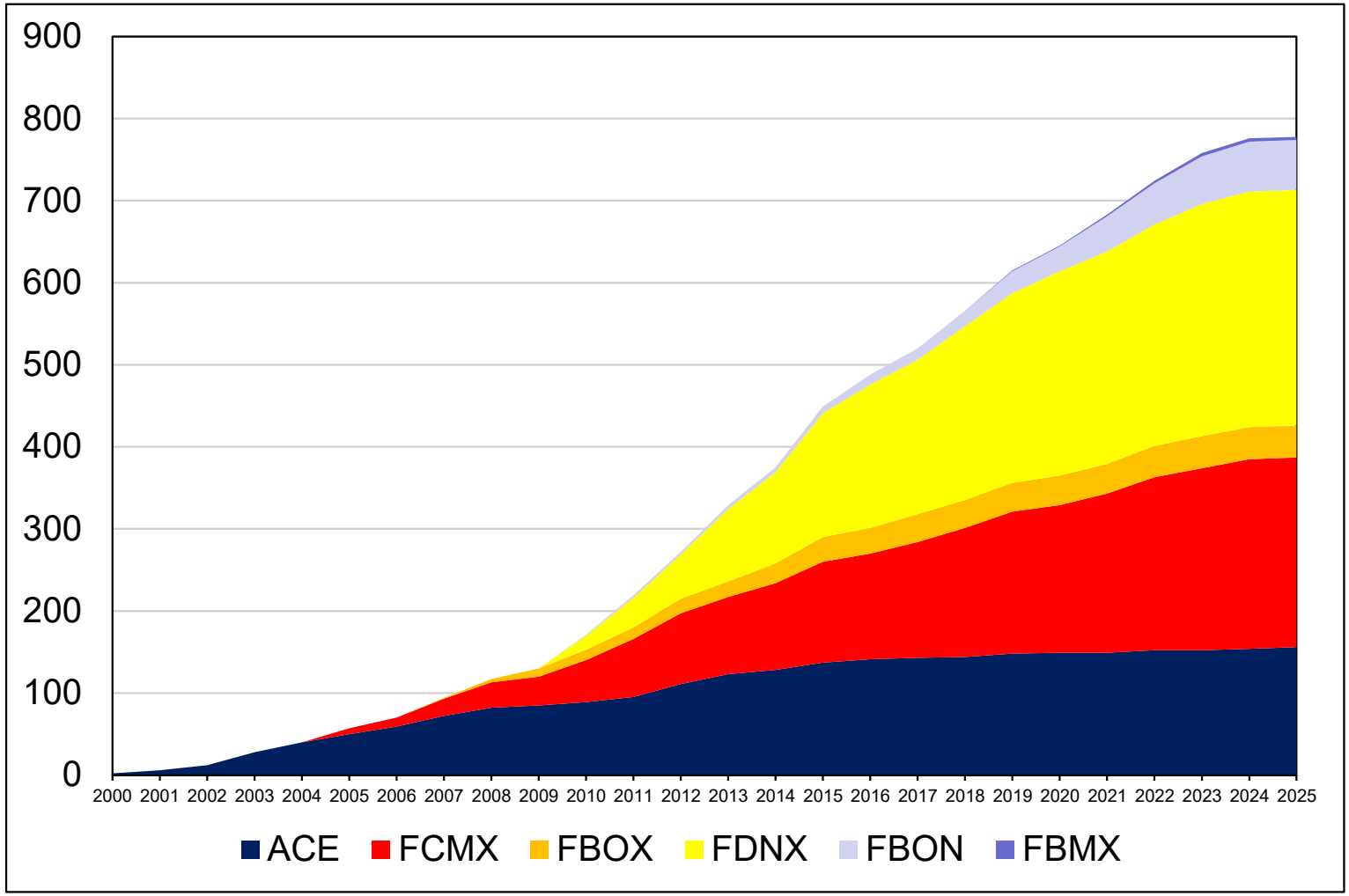
ACE



ACEX

Number of installations of Aeration molding machine

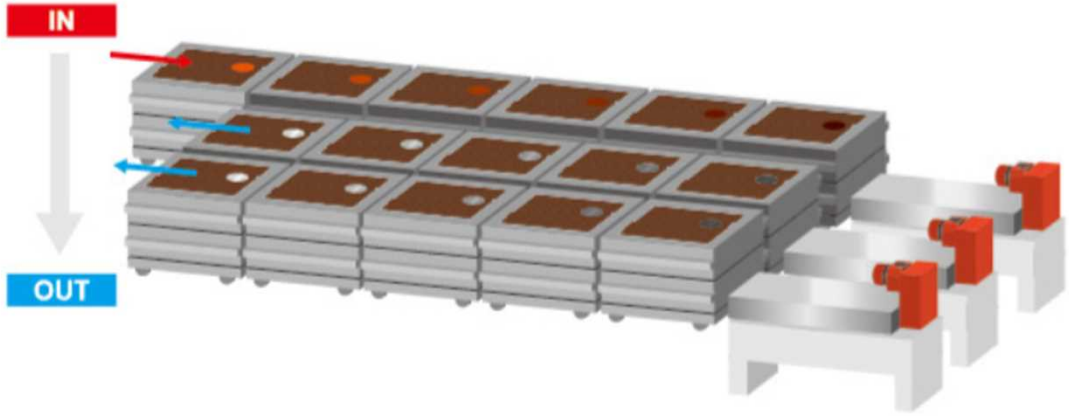
Over 700



I. Energy Saving

- Servo Cylinder

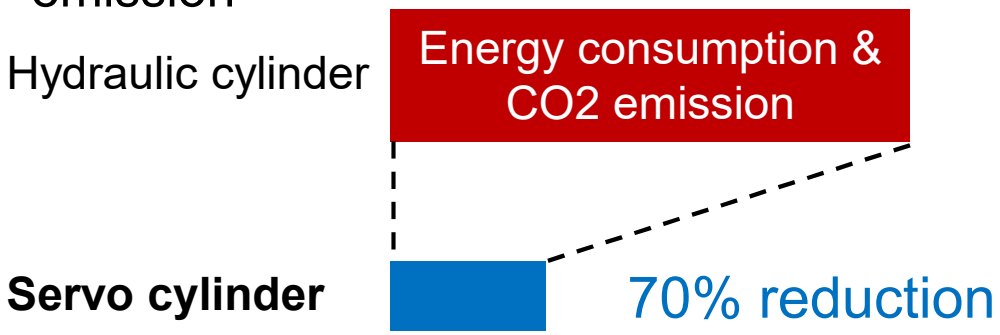
An innovative drive method that not only saves energy but also solves the problems of hydraulic and pneumatic driving in conventional molding lines



Switching Hydraulically Driven Devices to Electrically Driven Devices

Adoption of servo cylinder

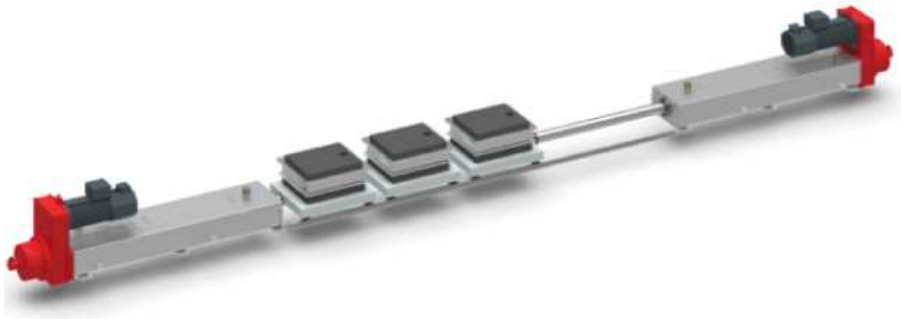
1) Reduction of Power consumption & CO2 emission



2) Elimination of risk fire by oil leakage
3) Maintenance cost saving: by 67%
4) Noise reduction (dB): by 20%
5) Simple piping and wiring
6) Less influence by temperature

Electric power:
6,200Kwh/year
(≒100,000 J. Yen)
CO2: 3,000kg/year

Electric power:
1,800Kwh/year
(≒28,000 J. Yen)
CO2: 850kg/year

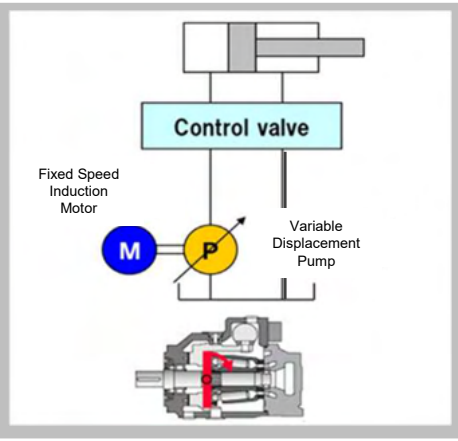
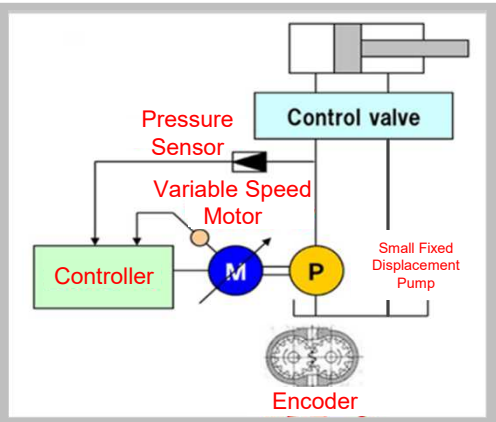
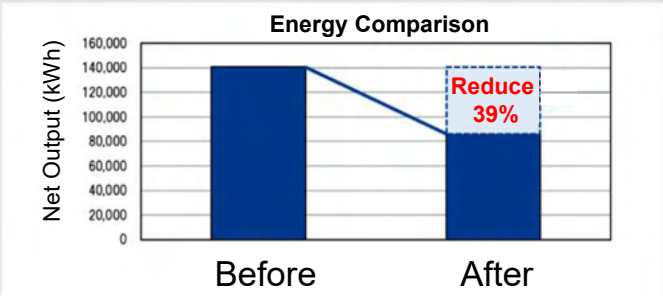


I. Energy Saving

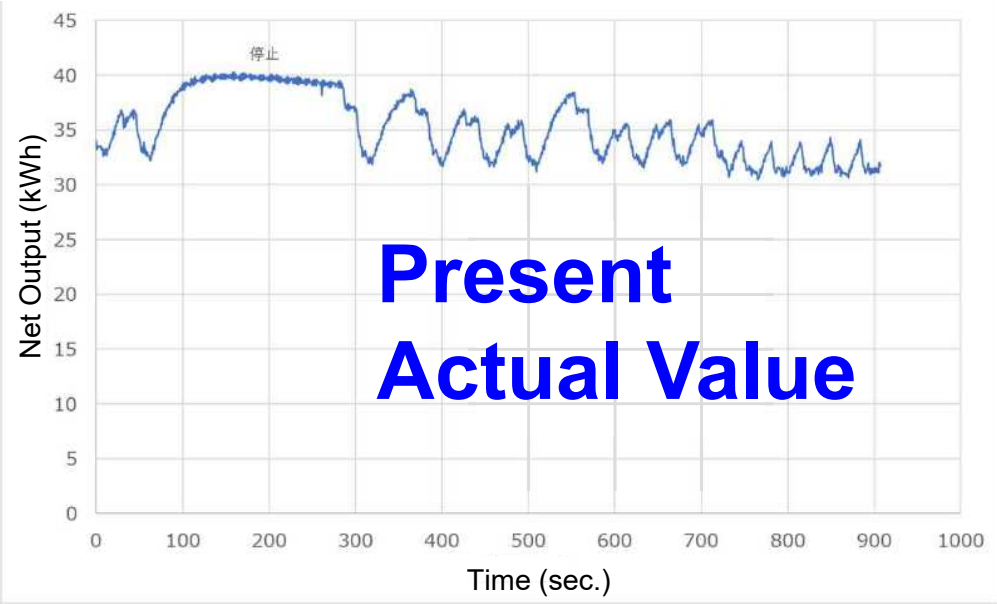
- Hybrid Hydraulic System

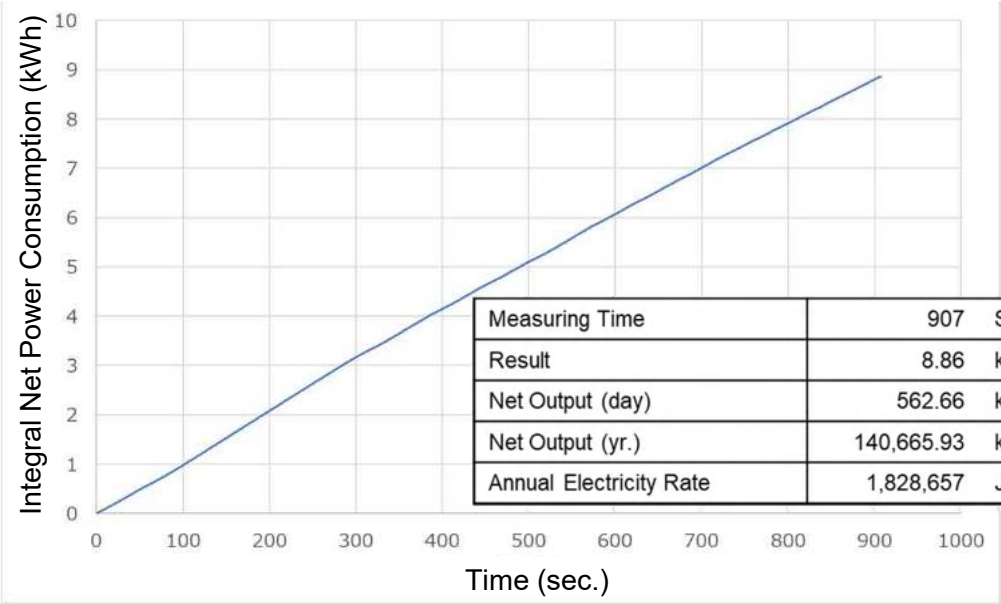
The combination of variable speed motor and pressure sensor reduces unnecessary power consumption during standby.

Hybrid Hydraulic System

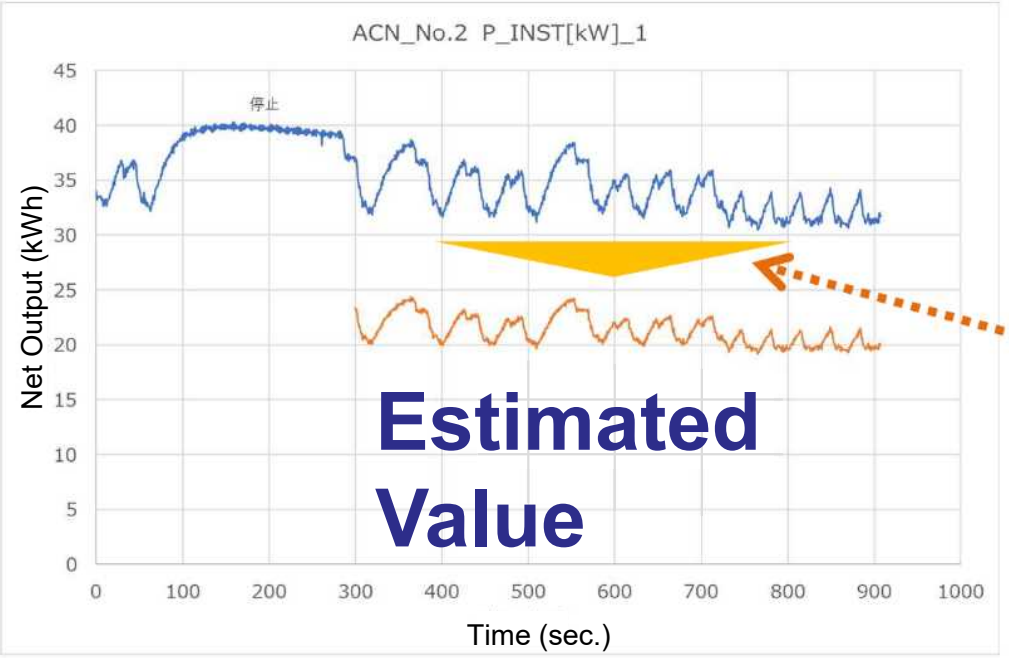
	Conventional System	Hybrid System
Outline		
Motor	Fixed speed induction motor	Variable speed motor
Discharge Volume	Piston pump : Change by pump Vane pump : Constant volume	Motor revolution control by encoder
Pressure	Setting by pump	Multi-step setting by detecting pressure load
Feature	*Volume and pressure given to the actuator only when needed*	
Usage Example (Japan)		

Energy Saving with Hybrid Hydraulic System





Measuring Time	907	Sec.
Result	8.86	kWh
Net Output (day)	562.66	kWh/day
Net Output (yr.)	140,665.93	kWh/yr.
Annual Electricity Rate	1,828,657	JPY/yr.



<Prerequisite>

- Less 10% during operation
- Less 90% for pressure keeping
- Filling accumulator with 20% of 40kWh energy consumption

Pump:PV2R4
Motor:45kW-6P

◆Effect of Energy Saving

Less39% JPY720K

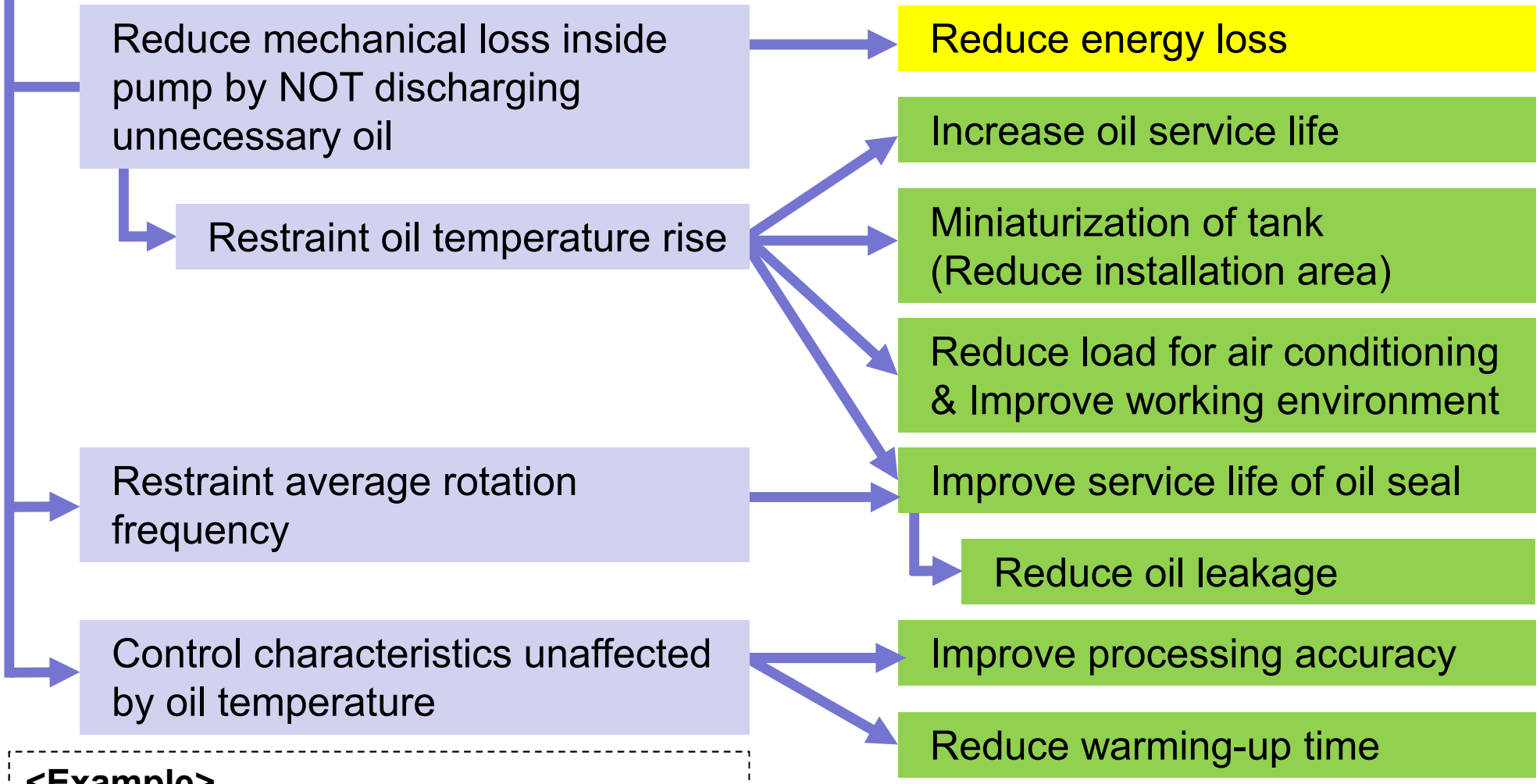
◇Assuming 10% of operating hour for set-up change (= pressure keeping)

Less45% JPY830K

Terms of Estimation:
JPY13/kWh, 16hr./day. 250day/yr.

Reduce Various Kinds of Loss

Flow volume control by pump motor rotation frequency



<Example>

i) Noise: Operation 82-85dB ⇒ 75-80dB
Standby 75-80dB ⇒ 60-63dB

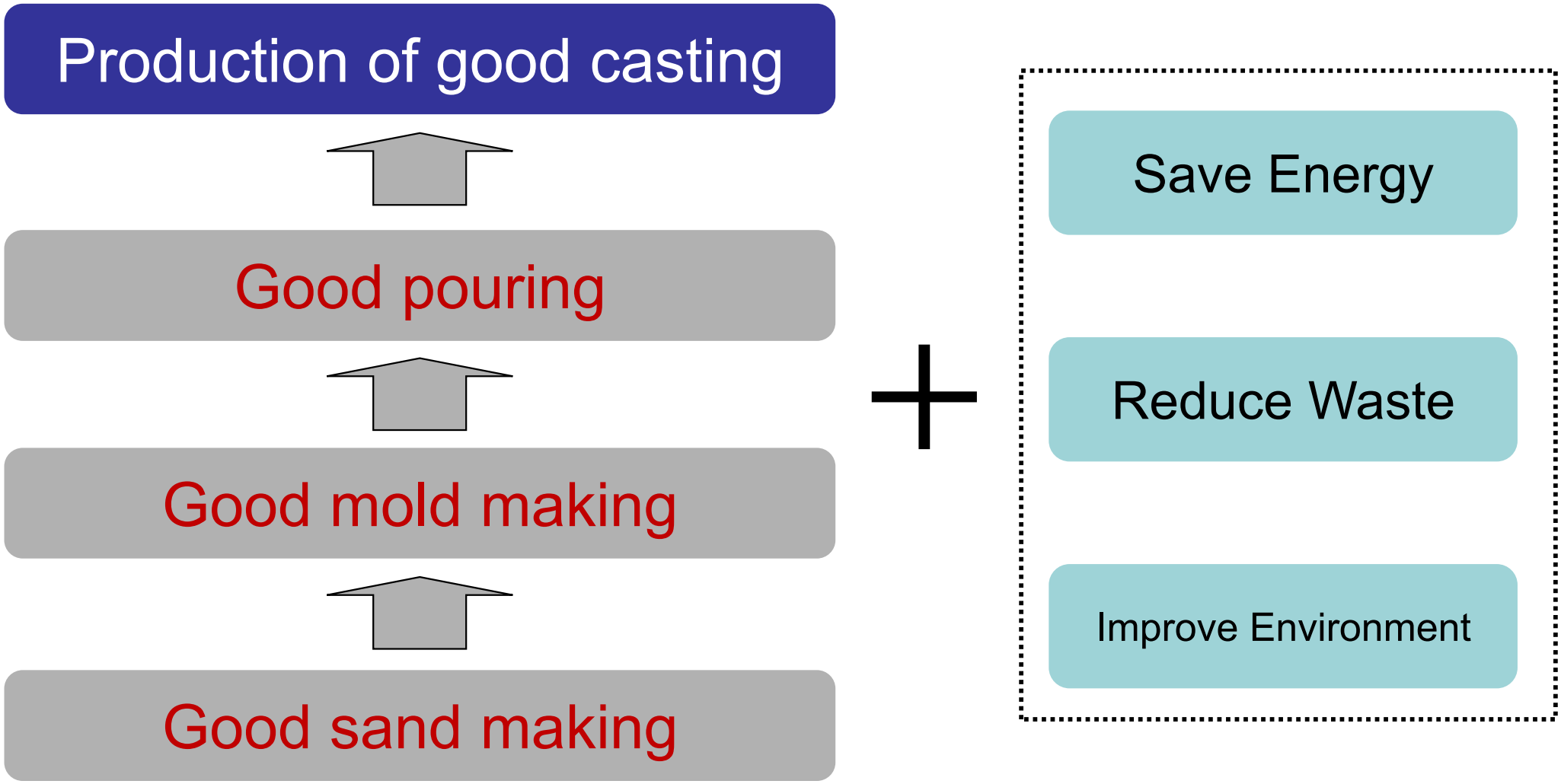
ii) Oil Temp.: September 47℃ ⇒ 40℃

I. Energy Saving

- Data Analysis

Reduce defects by analyzing and optimizing various parameters of casting production

For good casting production



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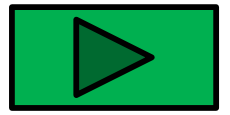


Video

II. Recycling

Reduce environmental burden and cost saving by reusing the waste from casting production

- **Sand Reclamation**

Sand Reclaimer

Reduction of waste sand

Energy saving

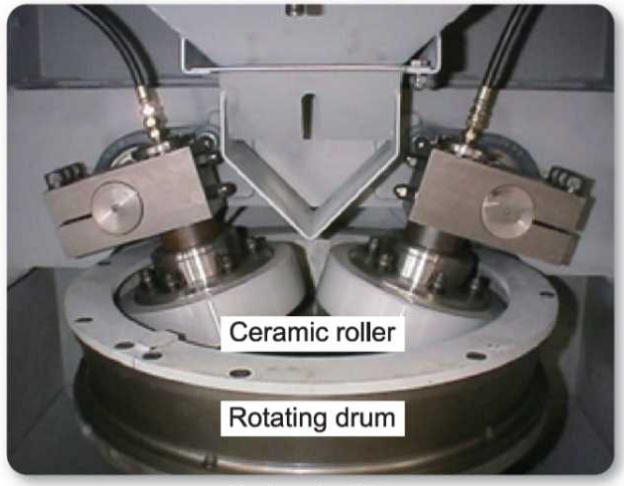
Quality improvement

Video

Sand Reclaimer

Powerful reclamation by pressurizing mechanism

- Ceramic rollers are pressed against rotating drum where sand is scrubbed to remove adhered materials, achieving high energy saving effect. By different setting of pressurizing mechanism, USR can handle various kinds of sand and processes. Optimum pressure realizes high yeild.



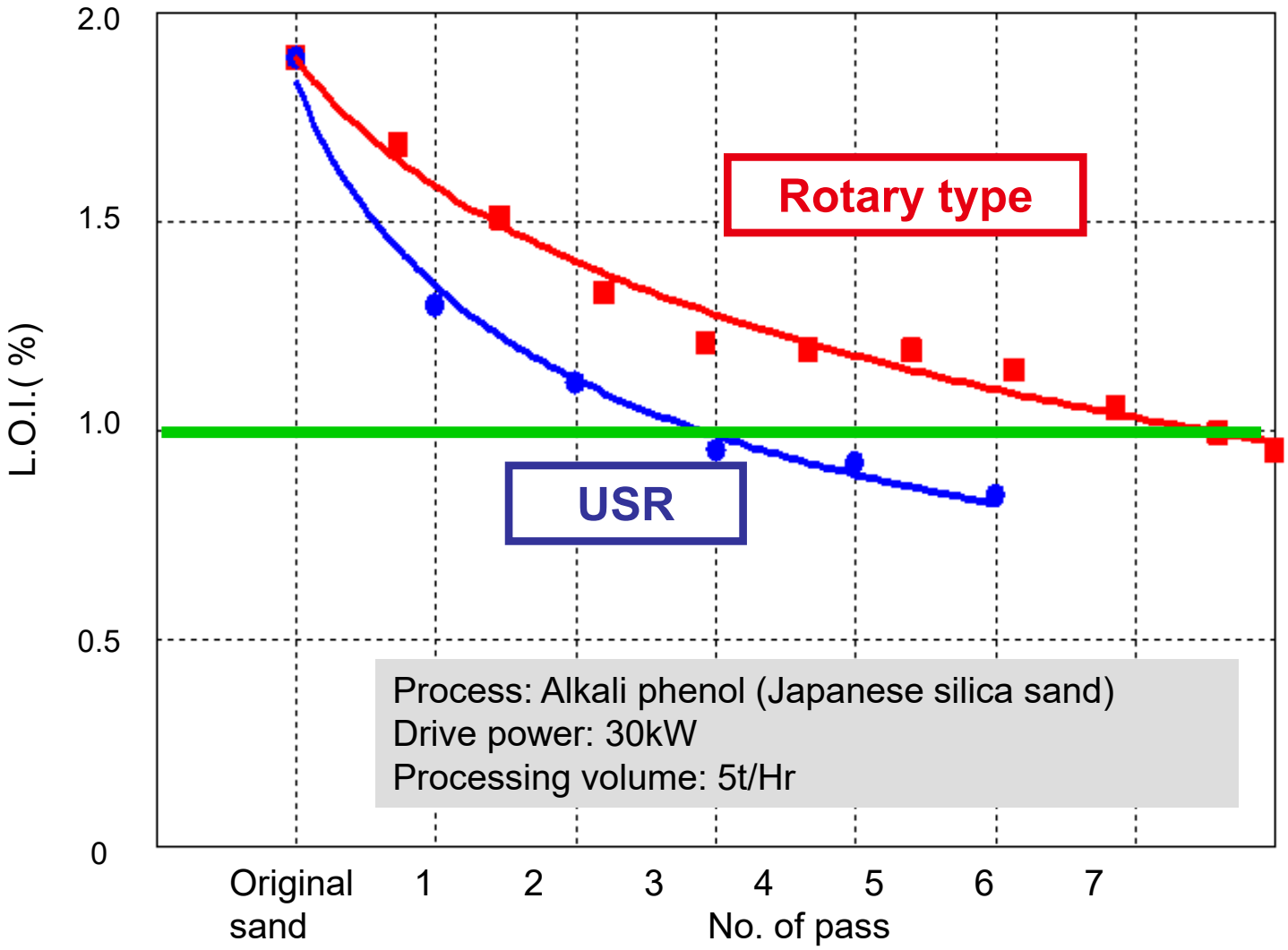
Reclamation Unit

Highly efficient dust removal

- Compact structure removes and separates particles and dust efficiently.


Inside of Fine Particle Extractor

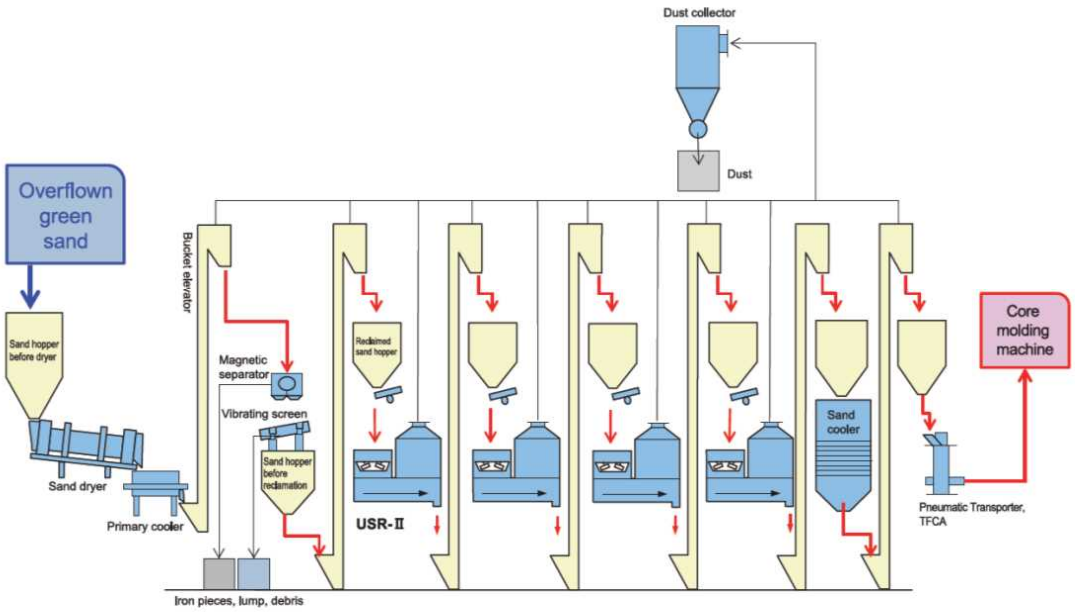
Comparison with rotary type reclaimer



Same LOI removal effect is obtained by about ½ number of pass and power of rotary type reclaimer.

Green Sand Reclamation System

Sample Layout (Company A), Processing volume: 3T/hr



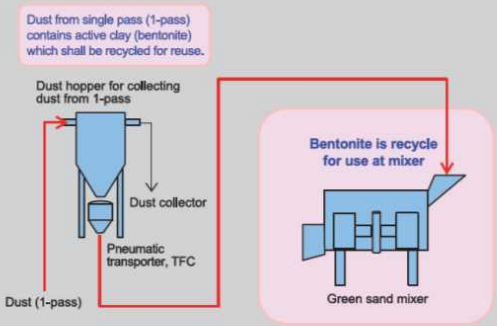
Sand Reclaimer, USR series

Sand reclamation is processed mechanically without roasting sand

Option

Reuse of active clay

Consumption volume and purchasing cost for bentonite are reduced by recycled and collected active clay (bentonite) during reclamation process



Reuse of active clay (Combined with ultrasonic cleaning)

By combination with water wash by ultrasonic cleaning, collection volume of active clay can be increased.

Green Sand Reclamation System

Cost reduction

- Cost for disposal of used sand purchase of new sand is reduced by re-used of reclaimed sand

Environmental protection

- Contributes protection of protection by reducing volume of disposed sand

III. Working Environment Improvement

Protect the people working in the foundry
and the surrounding environment by
removing harmful substances

- **Dust Collection System**

We protect different environments

Factory environment

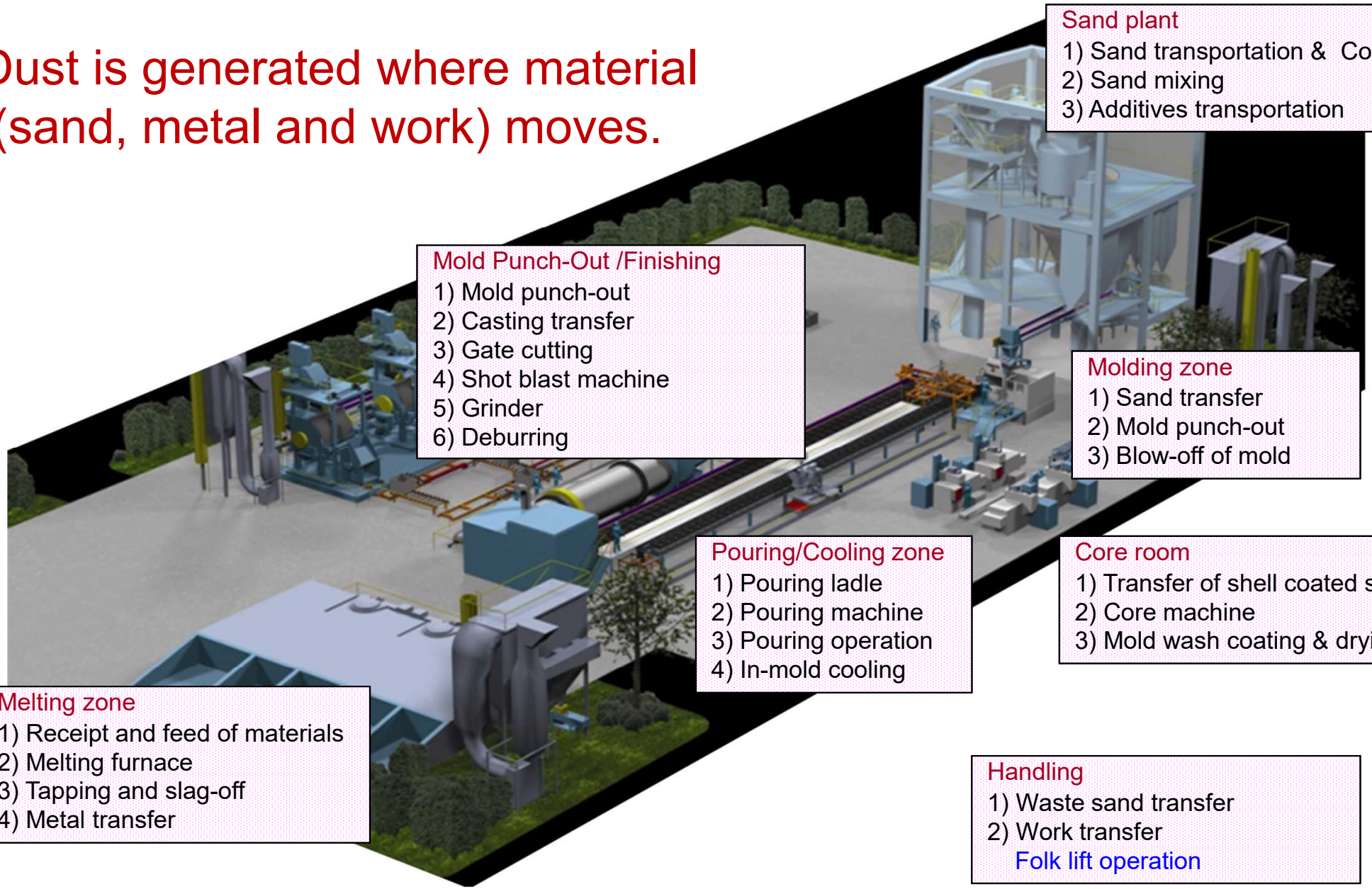
Environment surrounding the plant

Work environment

Worker's environment

Contamination locations in each zone in foundry

Dust is generated where material (sand, metal and work) moves.



Sand plant
1) Sand transportation & Cooling
2) Sand mixing
3) Additives transportation

Mold Punch-Out /Finishing
1) Mold punch-out
2) Casting transfer
3) Gate cutting
4) Shot blast machine
5) Grinder
6) Deburring

Molding zone
1) Sand transfer
2) Mold punch-out
3) Blow-off of mold

Pouring/Cooling zone
1) Pouring ladle
2) Pouring machine
3) Pouring operation
4) In-mold cooling

Core room
1) Transfer of shell coated sand
2) Core machine
3) Mold wash coating & drying

Melting zone
1) Receipt and feed of materials
2) Melting furnace
3) Tapping and slag-off
4) Metal transfer

Handling
1) Waste sand transfer
2) Work transfer
Folk lift operation

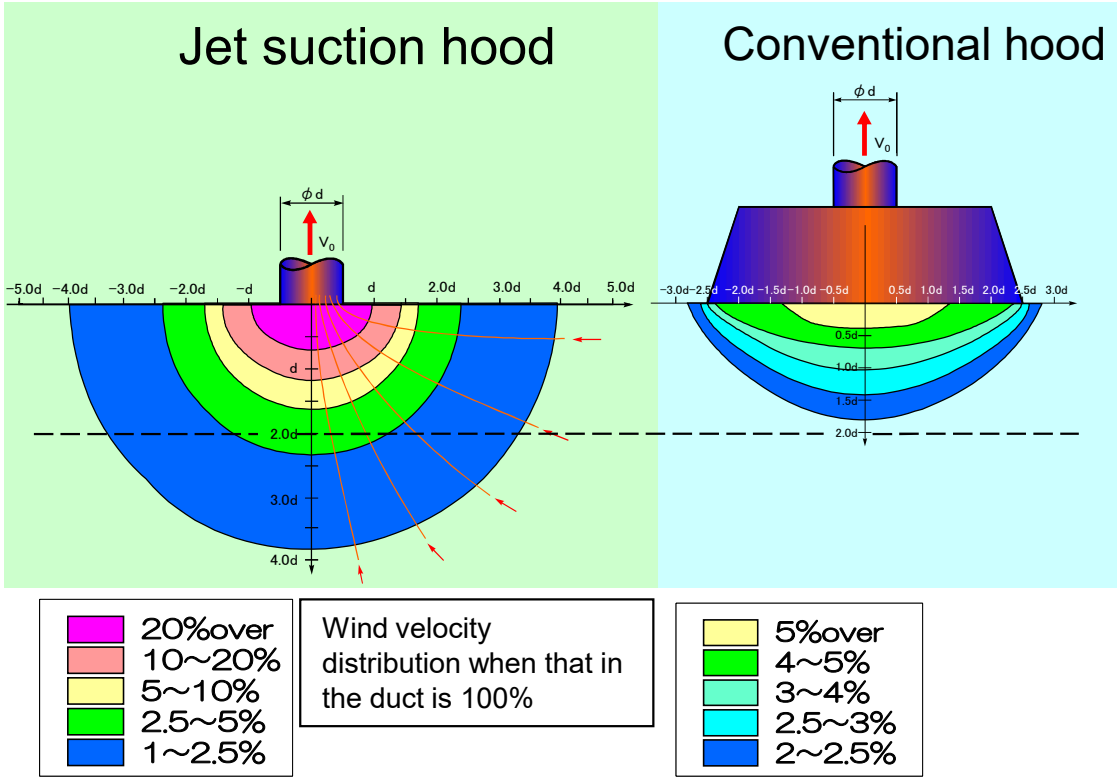
Fume capture from melting shop

Electric furnace Ring hood for tapping

Video

Fume capture from melting shop

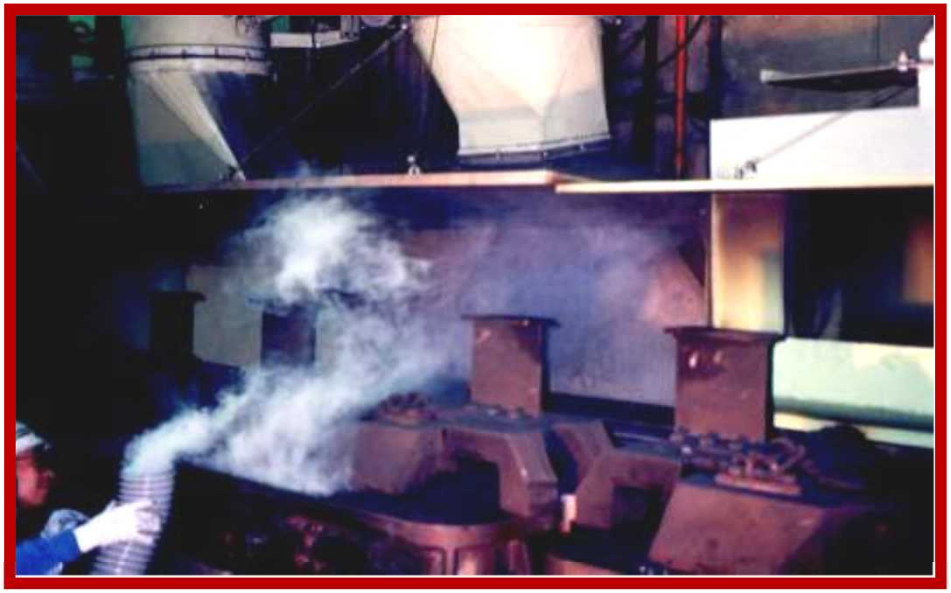
Jet suction hood



Fume capture from melting shop

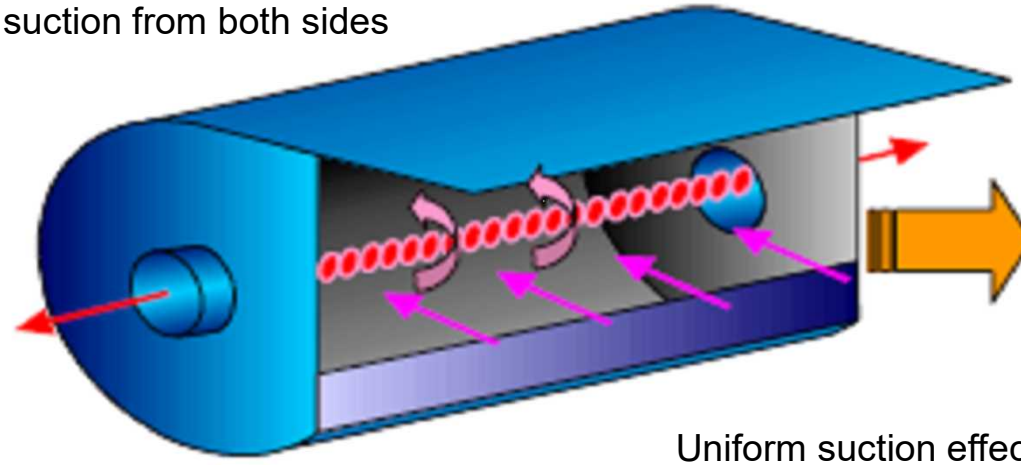
Tornado hood

Conventional: fume escapes



Tornado hood: No fume escape

Air suction from both sides



View of sucked fume in swirling condition

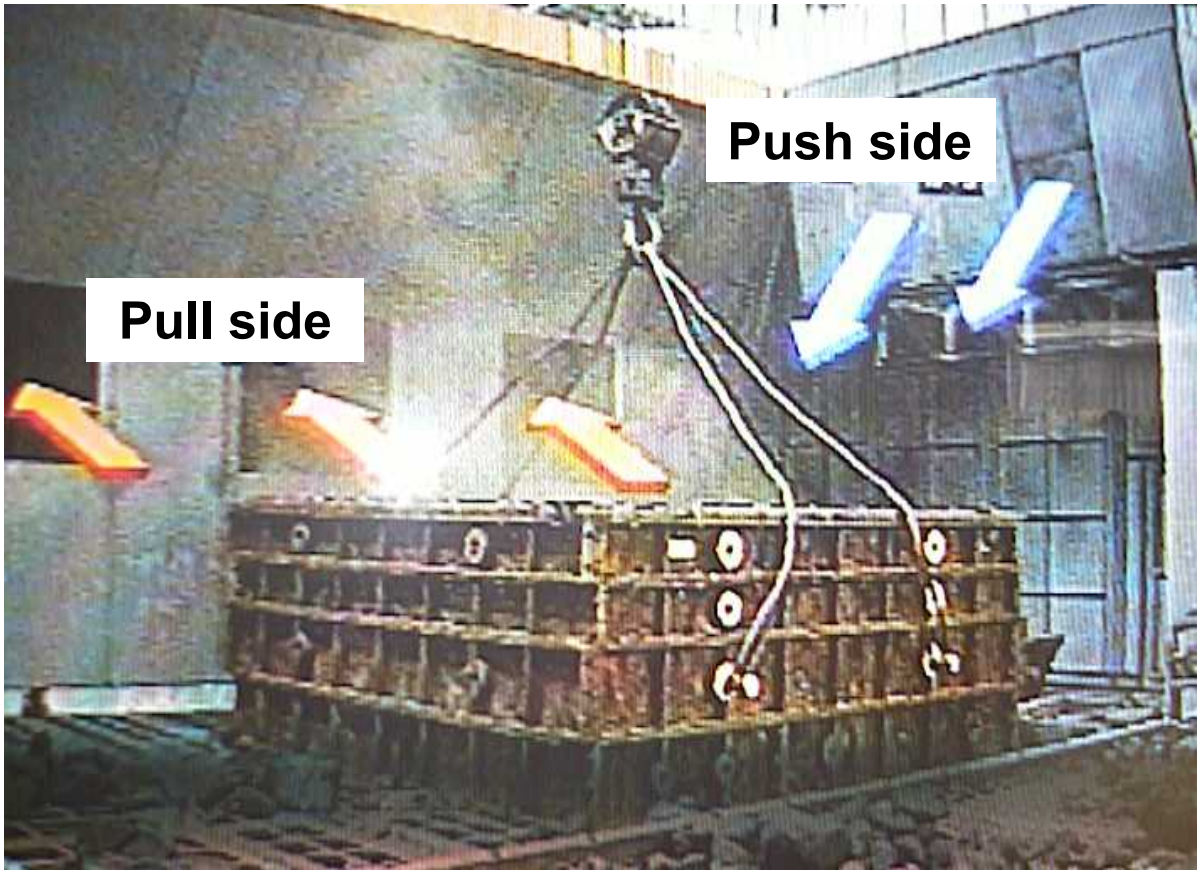
Uniform suction effect throughout whole opening

Measures against Dust by Push and Pull Hoods in Disassembly Section

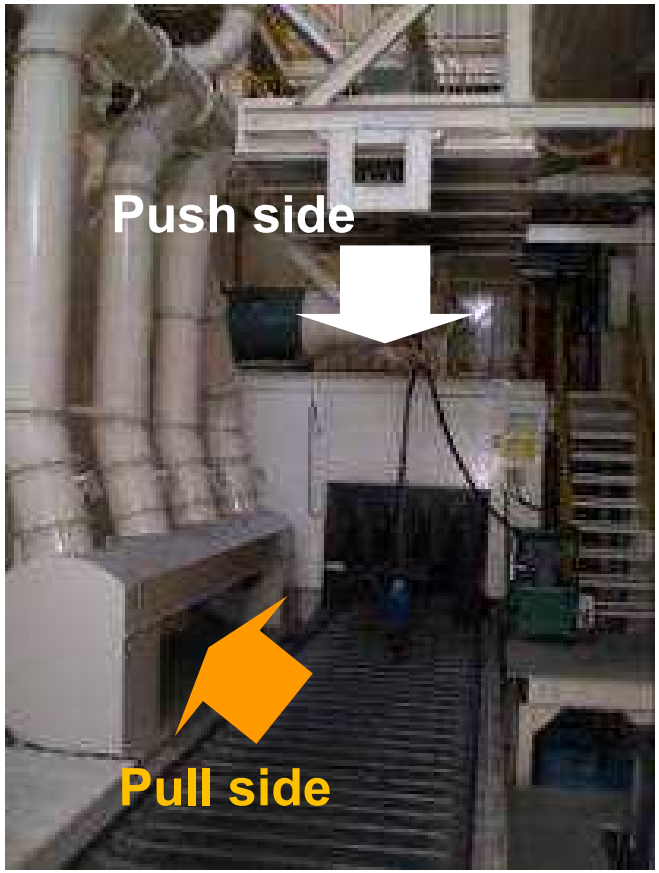
Push-Pull system

Video

Example of implementation in self-hardening flask disassembly process



Example of setup at apron conveyor



As this is an open-type dust collection method unlike the complete hood enclosing method, it is excellent in workability (carrying-in and carrying-out of metallic flasks and products) and maintainability.

Thank You for Your Attention