Sodick

Sodick REPORT 2020 Summer

Featured

Demonstrates machining, forming, and molding performance to the utmost

Latest Case Studies

Linear Motor Drive Wire-cut EDM
AL series

Linear Motor Drive Ultra High-speed Milling Center
UH series

Metal 3D Printer (Multi-functional additive manufacturing machine)
OPM series / LPM325

V-LINE®
Horizontal & Vertical Injection Molding Machine

New Product

Increased machining speed in all areas of rough, semi and finish machining
Linear Motor Drive High-speed & High Precision Die-sinker EDM
AL40G/AL60G

Realized high quality mixing with improved hygiene and durability
High-capacity Mixer with 2-shaft for Noodles

Completely peels potato skin easily which improves yield
Potato Skin Peeling Device

Successfully improved machining speed by **20% maximum** in all "rough," "semi," and "finish" machining processes!

NEW Linear Motor Drive High-speed & High Precision Die-sinker EDM

AL40G / AL60G

Standardly equipped with machining conditions adviser using the latest electric discharge control & circuit, and artificial intelligence (AI) technology

New Stable Electrical Discharge System
Arc-less 4

The development of the "Arc-less 4" (arc never occurs) which maintains stable electric discharge conditions in all machining environments, greatly improved the performance of die-sinking electric discharge machining including further increased speed of electric discharge machining, suppression of electrode wear to the utmost, and realization of various machining surface qualities in an extensive range from satin to mirror surfaces.

Machining Speed
Cemented Carbide & Steel Materials
20%UP*

Electrodes - Workpiece	Feature Description
Copper - Steel	Enhanced motor control response and the development of the BSN4 finishing circuit increases the machining speed
Copper tungsten - Cemented carbide	The development of the TMM4 circuit increases the machining speed for copper-tungsten/carbide
Copper graphite - Cemented carbide	Improves resolution of arc-less control Added support for copper-graphite (CuGr) as a new material increases the machining speed
Copper - Aluminum	Arc-less control adopted for aluminum to increase the machining speed

* Verified by Sodick test machining evaluation.

LN Pro AI condition advisor uses AI to always provide the optimal machining conditions

The optimal machining conditions and NC program that achieves the desired machining status (machining shape, material, area, machining depth, machining speed, surface roughness, wear, etc.) are intelligently generated based on the built-in discharge fundamentals and the machining conditions.

This allows users from beginners to experts to fully exploit the machining performance.

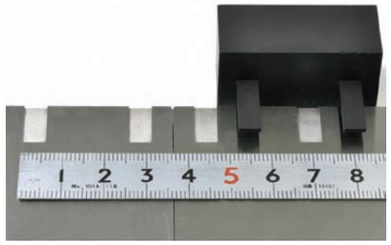
Evolution of machining assist program

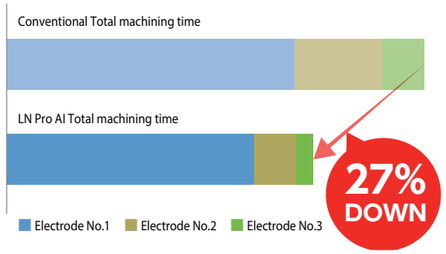
1st generation	Machining conditions corresponding to parameters such as the shape, area and machining depth are collected and stored in a database. Select the closest of these to output the machining conditions.
2nd generation	Machining conditions are generated by interpolating between data in the 1st generation database.
3rd generation	Machining conditions are generated based on the discharge fundamental database.
4th generation	**LN Pro AI** Expanding 3rd generation technology with enhanced AI algorithm.

Latest Machining Cases

LN Pro AI + Arc-less 4

Machining time 27% shorter. Fine Shrinkage Graphite Rib Machining

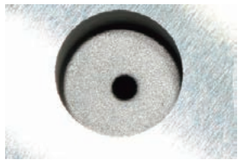


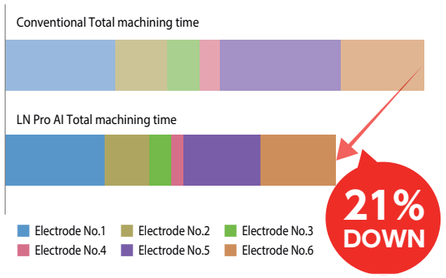


Electrode Material	:	Graphite(TTK-5)
Machining Size	:	1.27 mm x 5.44 mm (3 used)
Undersize	:	0.051 mm/side
Machining Depth	:	12.7 mm
Workpiece Material	:	Steel (SKD-61)
LN Pro AI	:	Installed
Surface Roughness	:	Ra 1.27 µm / Rz 7.9 µm

LN Pro AI + TMM4

Machining time 21% shorter Copper - Cemented carbide

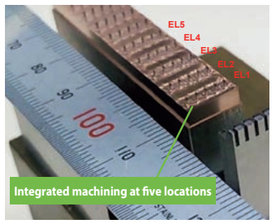


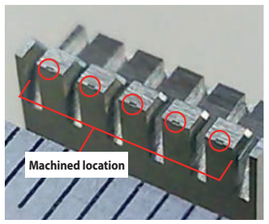


Electrode Material	:	Copper (6 finishing)
Machining Size	:	ϕ 12 mm
Undersize	:	0.15 mm/side
Flushing Pressure	:	0.1 MPa
Pilot Hole	:	ϕ 2 mm
Machining Depth	:	10 mm
Workpiece Material	:	Cemented carbide (G3)
LN Pro AI	:	Installed
Surface Roughness	:	Ra 0.79 µm / Rz 5.6 µm

High-Precision Core Pin Shape

Corner R: 3 µm or less





Electrode Material	:	Copper tungsten
Machining Form	:	0.3 mm x 0.1 mm One-sided
Undersize	:	0.03 mm/side
Machining Depth	:	0.05 mm
Workpiece Material	:	S-STAR
Surface Roughness	:	Ra 0.1 µm / Rz 0.6 µm
Machining Time	:	**32% shorter than previous model**

WEB Exhibition Now Showing !

More detailed information can be seen !

https://www.sodick.co.jp/special/WebExhibition/index_en.html

Case Study

Wire-cut EDM AL series

By developing and manufacturing all the elemental technologies represented by a linear motor, a discharge power supply, a NC device, a motion controller, and ceramics in-house with a development concept of **"Advanced Smart Pulse & Advanced Smart Linear"**, the AL series demonstrates the highest level of performance.

AL400/600 series Latest machining examples

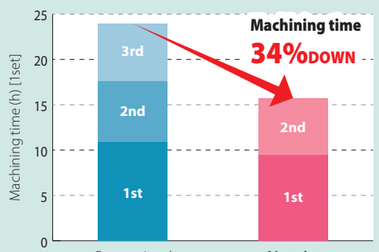
2 cut precision fit machining (150mmT)

Conventionally 3 cuts ⇒ Now 2 cuts

Machining speed increase, Improvement of the accuracy & surface quality

Machining Material : SKD11
Thickness : 150 mm
Machining Accuracy : ±5 µm
Surface Roughness : Ra 1.430 µm (Rz 9.88 µm)
Wire : ϕ 0.25 mm (HAYABUSA WIRE)

Cut portions (1st cut surface)

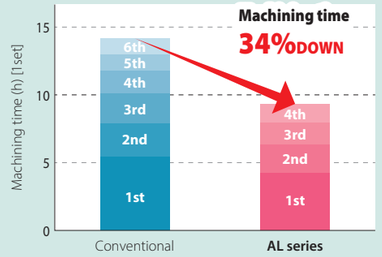


Tapered shape fit machining (200mmT)

Finish machining at a 10°angle

Adopted Digital-PIKA-W
Reduced machining time & number of cuts and improved shape accuracy

Machining Material : SKD11
Thickness : 200 mm
Machining Accuracy : ±5.0 µm
Surface Roughness : Ra 0.328 µm (Rz 2.693 µm)
Wire : ϕ 0.25 mm (HAYABUSA WIRE)

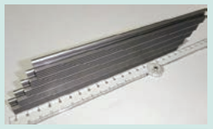


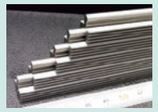
4 cut precision fit machining (200mmT)

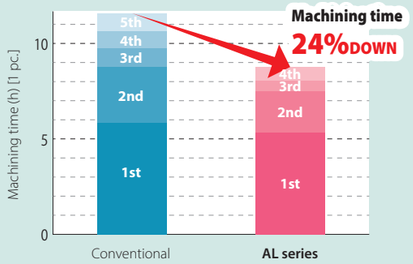
Conventionally 5 cuts ⇒ Now 4 cuts

Adopted Digital-PIKA-W
Machining speed increase,
Improvement of the accuracy & surface quality

Machining Material : STEEL
Thickness : 200 mm
Machining Accuracy : ±5 µm
Surface Roughness : Ra 0.401 µm (Rz 2.83 µm)
Wire : ϕ 0.25 mm (HAYABUSA WIRE)





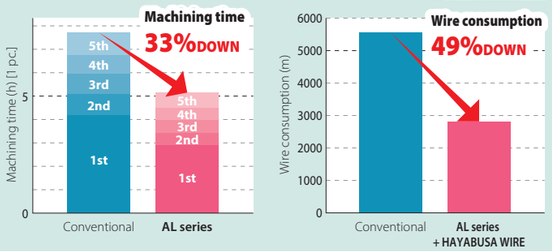


The Fine Parts Cutting on the Step Workpieces (T=20-80mm)

Adopted Digital-PIKA-W
High-speed machining, Improvement of the accuracy & surface quality

- Realized reduction of machining time while greatly reducing wire consumption
  - Ideal energy control which prevents occurrence of dimensional differences and lines
  - 1st cut at high-speed by HAYABUSA WIRE
  - Highly efficient finish machining by Digital-PIKA-W

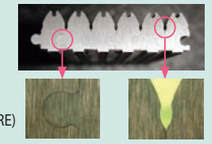
Machining Material : SKD11
Thickness : 20 - 80 mm
Machining Accuracy : ±2.5 µm
Surface Roughness : Ra 0.328 µm (Rz 2.463 µm)
Wire : ϕ 0.20 mm (HAYABUSA WIRE)



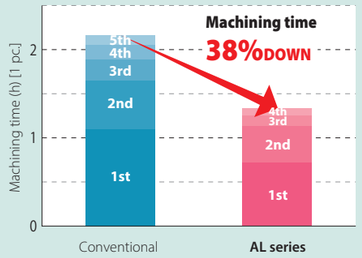
Precision fit machining (Cemented Carbide 80mmT)

Adopted Digital-PIKA-W
Reduced machining time & number of cuts and improved shape accuracy

Machining Material : Cemented carbide (RD30)
Thickness : 80 mm
Machining Accuracy : ±3 µm
Surface Roughness : Ra 0.273 µm (Rz 2.35 µm)
Wire : ϕ 0.20 mm (HAYABUSA WIRE)

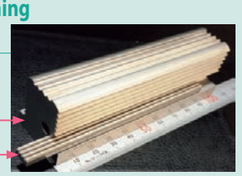


Clearance : 0.008 mm



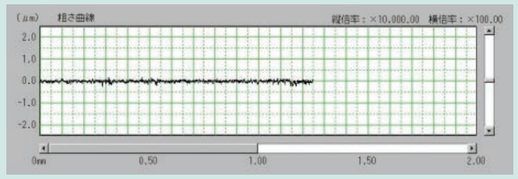
Best surface high accuracy machining (Cemented Carbide 100mmT)

Adopted Digital-PIKA-W Plus
Improvement of the accuracy & surface quality



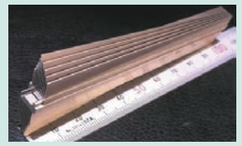
Machining Material : Cemented carbide (G5)
Thickness : 100 mm
Machining Accuracy : ±2.0 µm
Surface Roughness : Ra 0.040 µm (Rz 0.317 µm)
Machining Time : 40 h 30 min (A), 9 h 20 min (B)
Wire : ϕ 0.25 mm (HAYABUSA WIRE)

* ALN400 Q/ALN 600Q excluded



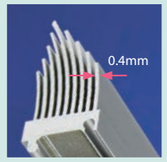
Thin walled fin shape fit machining (100mmT)

Adopted Digital-PIKA-W Plus
5° tip angle, 0.4mm width
High accuracy and high surface finishing machining with fine fin shape



Machining Material : SKD11
Thickness : 100 mm
Machining Accuracy : ±2 µm
Surface Roughness : Ra 0.122 µm (Rz 0.935 µm)
No. of Cuts : 10 Cuts
Machining Time : 9 h 33 min (1piece)
Wire : ϕ 0.20 mm (HAYABUSA WIRE)

* ALN400 Q/ALN 600Q excluded

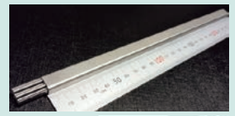


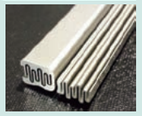
Spring shape precision fit machining (250mmT)

Dynamic straightness with thin wall of 5mm width

Adopted Digital-PIKA-W
Reduced machining time & number of cuts and improved shape accuracy

Machining Material : SKD11
Thickness : 250 mm
Machining Accuracy : ±5.0 µm
Surface Roughness : Ra 0.264 µm (Rz 2.096 µm)
No. of Cuts : 6 Cuts
Machining Time : 38 h 30 min (1set)
Wire : ϕ 0.20 mm (HAYABUSA WIRE)



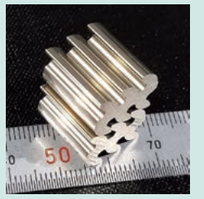


The Best Surface Finish (Cemented Carbide 15mmT)

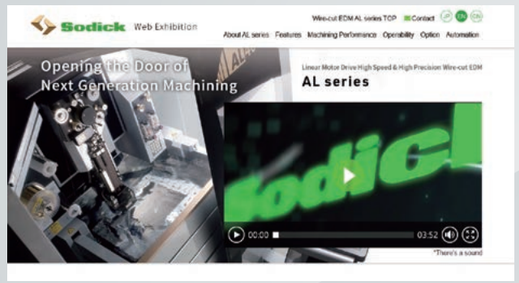
Adopted Digital-PIKA-W Plus
Improvement of the accuracy & surface quality

Machining Material : Cemented carbide (G5)
Thickness : 15 mm
Machining Accuracy : ±2 µm
Surface Roughness : Ra 0.035 µm (Rz 0.298 µm)
No. of Cuts : 12 Cuts
Machining Time : 6 h 29 min (1piece)
Wire : ϕ 0.20 mm (HAYABUSA WIRE)

* ALN400 Q/ALN 600Q excluded



* The machining data indicated here is based on Sodick's specified conditions, machining environment and measurement standards.



WEB Exhibition Now Showing !

More detailed information can be seen !

https://www.sodick.co.jp/special/WebExhibition_wedmAL/index_en.html

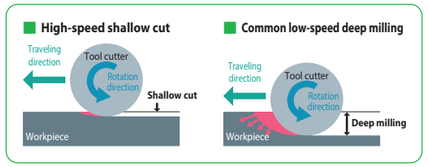
Machining Center UH series

UH Series Precision & Mirror Surface Machining Cases

High-speed milling: High-speed shallow cut

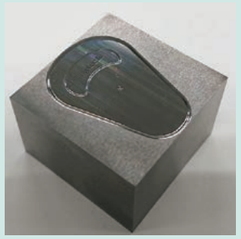
High-speed revolution of tool + shallow cut + high-speed feed milling

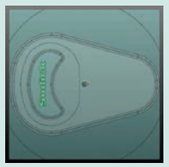
- Reduction of cutting resistance
- Minimization of frictional heat
- Suppression of abnormal tool wear, improvement in tool life
- Uniform machined surface quality



Stay-on Tab

No.1 Mirror surface finish machining by high accuracy and high surface finishing PCD tool Ra 0.0066 µm





Machining Material:
Cemented carbide (G4)<HRA89.0>
30.0 x 30.0 x 20.0 mm

Machining Time:
19 h 02 min
PCD+DCMB Ball end mill tool finishing

Machining Condition:
Spindle Speed(S) 16,000 - 60,000 min^{-1}
Feed Speed(F) 100 - 300 mm/min

Machining Tool:
4 pcs.
PCDRB & DCMB Diamond-coated Ball end mill
R2.0 + R1.0 + R0.5 + R0.3

No.2 Mirror surface finish machining by high accuracy and high surface finishing PCD tool Ra 0.0064 µm

Machining Material:
Cemented carbide (G4)<HRA89.0>
30.0 x 30.0 x 20.0 mm

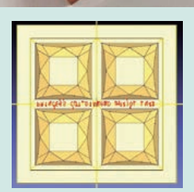
Machining Time:
39 h 15 min
PCD+DCMB Ball end mill tool finishing

Machining Condition:
Spindle Speed(S) 16,000 - 40,000 min^{-1}
Feed Speed(F) 100 - 300 mm/min

Machining Tool:
4 pcs.
PCDRB & DCMB Diamond-coated Ball end mill
R2.0 + R1.0 + R0.5 + R0.3

Princess Cut Diamond

Contrast of 2 types of reflector shapes (hexagon shape & trapezoidal shape) machined with linear motor drive



Machining Material:
Cu 50.0 x 50.0 x 25.0 mm

Notes:
High precision and high surface quality Mirror finishing with Diamond-coated tool Ra 0.02 µm

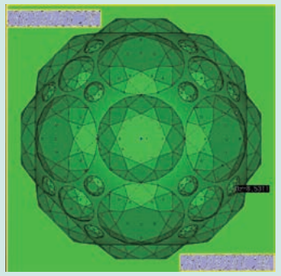
Machining Time:
7 h 52 min
DCRB230 Diamond-coated Ball end mill tool finishing

Machining Condition:
Spindle Speed(S) 16,000 - 60,000 min^{-1}
Feed Speed(F) 100 - 2,500 mm/min

Machining Tool:
4 pcs.
DCRB Diamond-coated Ball end mill
R2.0 + R1.0 + R0.1

137 very fine pins of ϕ0.1 with L/D ratio of 137.5 times on 3D complicated curved surface

Machining of 137 very fine pins of ϕ0.1mm on complicated 3D curved surface



Machining Material:
Cu 50.0 x 50.0 x 25.0 mm

Notes:
6 sided machining, high accuracy and high surface finishing ϕ0.1 pins with L/D ratio of 137.5 times on 3D curved surface

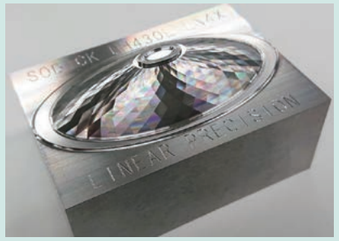
Machining Time:
81 h 50 min

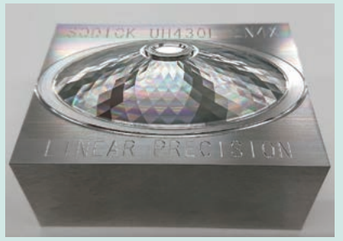
Machining Condition:
Spindle Speed(S) 6,000 - 40,000 min^{-1}
Feed Speed(F) 200 - 2,500 mm/min

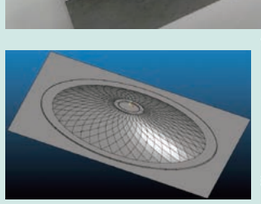
Machining Tool:
3 pcs.
Ball end mill
R1.0 + R0.5 + R0.1

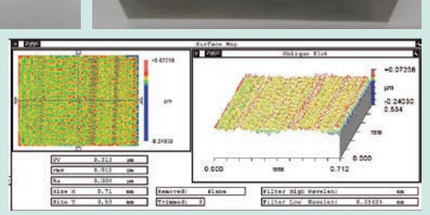
Car Tail Lamp Lens 1

Contrast of 2 types of reflector shapes (hexagon shape & trapezoidal shape) machined with linear motor drive









Machining Material:
STAVAX <HRC52> 70.0 x 50.0 x 40.0 mm

Notes:
High precision and high surface quality Mirror finishing with CBN and PCD tools Ra 0.009 µm

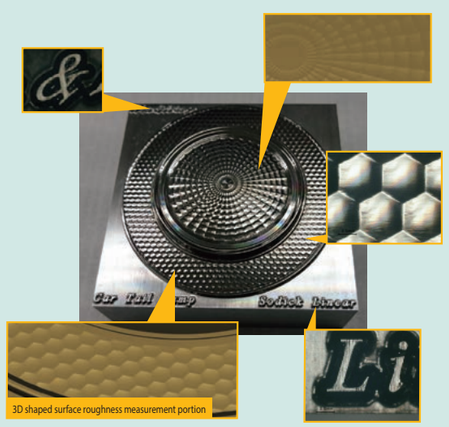
Machining Time:
26 h 11 min

Machining Condition:
Spindle Speed(S) 25,000 - 40,000 min^{-1}
Feed Speed(F) 400 - 2,500 mm/min

Machining Tool:
5 pcs.
Ball end mill … R1.0 + R0.5 + R0.3
CBN+PCD Ball end mill for finishing … R0.5

Car Tail Lamp Lens 2

Contrast of 2 types of reflector shapes (hexagon shape & trapezoidal shape) machined with linear motor drive



Machining Material : STAVAX <HRC52> 50.0 x 50.0 x 20.0 mm

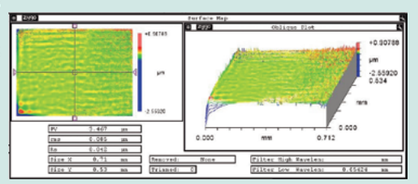
Notes : **High precision and high surface quality Mirror finishing with CBN and PCD tools**

Surface Roughness : **Ra 0.043 µm**

Machining Time : 26 h 11 min

Machining Condition : Spindle Speed(S) 25,000 - 40,000 min^{-1}
Feed Speed(F) 400 - 2,500 mm/min

Machining Tool : 5 pcs.
Ball end mill … R1.0 + R0.5 + R0.3
CBN+PCD Ball end mill
for finishing … R0.5



* The machining data indicated here is based on Sodick's specified conditions, machining environment and measurement standards.

Case Study

Metal 3D Printer

Lineup

* MRS is optional.

Model	OPM350L MRS※
Max. size of object (W x D x H) [mm]	350 x 350 x 350
Machining method	milling
Feature	High-quality molds and components High-speed molding and high-quality finishing
SRT method	○

Model	OPM250L MRS※
Max. size of object (W x D x H) [mm]	250 x 250 x 250
Machining method	milling
Feature	High-quality molds and components High-speed molding and high-quality finishing
SRT method	○

Model	LPM325 MRS※
Max. size of object (W x D x H) [mm]	250 x 250 x 250
Machining method	shaper
Feature	Molds and components High-speed molding and reference surface processing Compatible with a range of metal materials
SRT method	○

What is SRT ?

Technology that balances stress by intentionally expanding thermal contraction in the device during lamination molding

*SRT = Stress Relief Technology

Mechanism

Expansion is actively utilized by martensitic transformation

Warping due to thermal contraction

+

Point

Reduces the risk of cracks and can produce objects with minimal warping and deformation

Reverse warpage due to thermal expansion

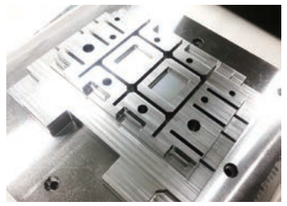
=

Balanced stress reduces warpage

Point of SRT method

Purpose	Quasi-mass production and prototyping are both possible
Aim	**High-cycle** **High-quality molding**
	Process integration
Mold type	Good precision and highly rigid
Production method	Selectable
Molding material	SUS420J2

Examples using SRT



SRT results

- SUS420J2 suitable for plastic molds
- Small objects for which warpage is suppressed can be manufactured
- Deformations due to stress release are small (easy secondary processing)
- Can thin the base plate
- Hard to break even when molding big workpieces
- No model modification required for the stress concentration zone
- Can directly target dimensions by cutting machining (no model correction required)
- Hardness of molded object is about HRC53
- Using the same base materials, common heat treatment conditions can be used.

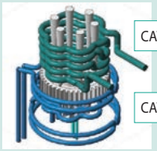
Latest Case of Mold Manufacturing by SRT Method

Cooling effect of gear mold with 3D cooling channel built-in

Incorporating cooling channels into gear molds

- **Improves** concentricity by cooling core pin of **shaft hole**
- **Optimizes cooling of portions** with different gear volume sizes
- **Improves reliability** by improving the straightness of tooth trace

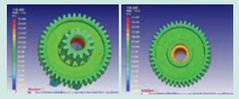
Cooling channel configuration



CAV: ϕ4x1 circuit

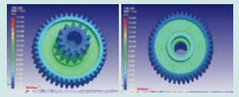
CAV: ϕ3x2 circuit

Without 3D cooling channel



Great cooling effect

With 3D cooling channel



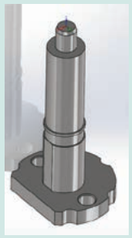
Molded Products

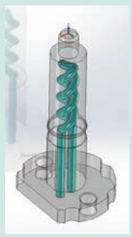
Material: POM
Dimensions: Large teeth ϕ44mm
Small teeth ϕ20mm
Height 28mm

Gear mold with 3D cooling channel built-in - Core Pin

<Gear Core Pin>

Machine : Precision Metal 3D Printer OPM250L
Mold size : ϕ26 x t 53 mm
Material : SUS420J2 HRC52 (57)
Tools : ϕ3.0 Radius end mill

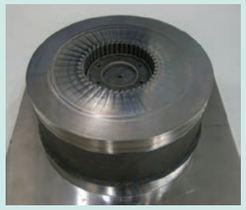


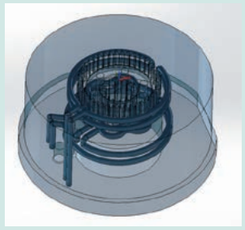


Gear mold with 3D cooling channel built-in - Core

<Gear Core>

Machine : Precision Metal 3D Printer OPM250L
Mold size : ϕ101 x t 53 mm
Material : SUS420J2 HRC52 (57)
Tools : ϕ3.0 Radius end mill

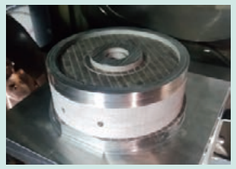


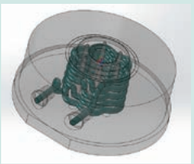


Gear mold with 3D cooling channel built-in - Cavity

<Gear Cavity>

Machine : Precision Metal 3D Printer OPM250L
Mold size : ϕ101 x t 47 mm
Material : SUS420J2 HRC52 (57)
Tools : ϕ3.0 Radius end mill





"Sodick Japan" channel has opened on YouTube[JP]!

Benchmark service

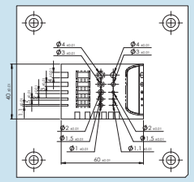
We accept orders for benchmark tests for various materials.

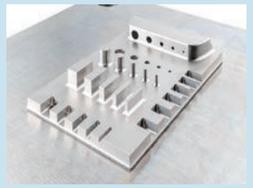
Compatible materials: Al | CoCr | Ti | SUS 420J2 | Inconel® | Maraging Steel

* Inconel® is a registered trademark of Special Metal Corporation.

Test machining for checking accuracy of OPM Series

All shapes satisfied required accuracy of ±1/100mm (Maraging steel)



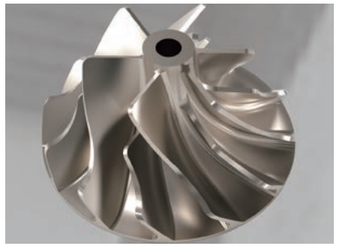


Latest Molding Cases

64 Ti (titanium)

Bracket for jet engine
Use of titanium material 3D Printer reduces weight to 1/3
(1376 g → 427 g)

Inconel® 718



Impeller
Shortens the time of near net shaping when switching from machining by 5-axis cutting to 3D Printer molding

CoCr

Implant
Locking plate for tibial plateau fracture
CoCr, which is excellent in protecting against metal fatigue, cracking and loading, has been found to be useful in the medical field

AlSi10Mg

Suspension link
Examples of molded parts that connect suspension of vehicles
Integration of connected parts
Freedom in design contributes to light weight

Case Study

Injection Molding Machine

All models of Sodick's injection molding machines are equipped with the independently developed V-LINE®.
Precision injection molding demonstrates "high-dimensional stable molding" and "high quality," which contributes to the manufacturing of customers who are pursuing high added-value in extensive fields, such as precision, electronics, optics, automobile, and medical care.

Horizontal Type Standard Injection Model

Electric motor in pursuit of high-cycle and productivity improvement

MS series
eV-LINE Electric Injection Molding Machine

Molding Case

Pre-filled syringe

PP cup
Transparent, thin-walled, and deep material
* High-cycle molding by conformal cooling

Compact hybrid machine which offers both high-cycle molding and precision molding of small items

TR10EH3 / TR20EH3
V-LINE® High-cycle Compact Precision Injection Molding Machine

Molding Case

Connectors for board-to-board (BtoB) for edge terminals, such as smart phones and tablets

Hybrid machine which demonstrates excellent stability for molding engineering plastics & super-engineering plastics

GL series
V-LINE® Injection Molding Machine for High Value-added Products

Molding Case

For automotive parts
Water pump for automobile (EWP)
Rotor core and impeller (PPS resin)
Integral molding

Medium sized hybrid machine which realizes high added-value even for molding of medium size parts

TR series
V-LINE® Injection Molding Machine for Medium Sized High Value-added Products

Molding Case

For automotive parts
Head Up Display (HUD)

Horizontal Type High Response Injection Model

Outstanding injection acceleration/deceleration speed of the high-response hybrid machine also enables highly difficult molding

LP series
V-LINE® High Response Injection Molding Machine for High Value-added Products

Molding Case

Multi-core optical fiber connectors (MT connector)

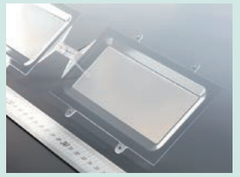
Oil filter with uneven thicknesses by highly difficult molding resin (PEEK)

Horizontal Type High-speed & High-pressure Injection Model

High-speed and high-pressure hybrid machine which responds to molding of thin items that require thinning and upsizing

HSP series
V-LINE® High-Speed, High-Pressure Injection Molding Machine for High Value-added Products

Molding Case Case for 5G smart phones

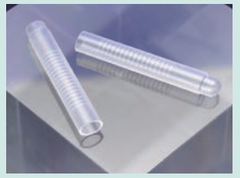


Horizontal Type Thermosetting Model

Burr-less molding which can only be offered by the V-LINE® and direct pressure mold clamping: Horizontal type hybrid machine for thermosetting

LSR series
V-LINE® Injection Molding Machine for Thermosetting

Molding Case Catheter balloon for medical treatment in cardiology or urology



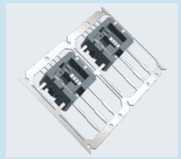
Vertical Type Single-action Standard Injection Model

Vertical type single-action machine which guarantees a high-level of safety by an independently developed counter balance

VT50
V-LINE® Vertical Single-acting Type Injection Molding Machine

Molding Case

For automotive parts
Bus bar parts for automobiles



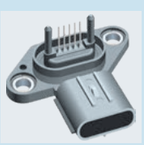
Vertical Type Rotary Standard Injection Model

Vertical type rotary machine in which the injection stability is directly connected to the productivity of insert molding

VRE series
V-LINE® Vertical Rotary Type Injection Molding Machine

Molding Case

↓ For automotive parts
Sensor connector for automobiles



For automotive parts ↑
Connector insert parts for vehicle distance sensors

Vertical Type Thermosetting Model

Burr-less molding which can only be offered by the V-LINE® and direct pressure mold clamping: Vertical type machine for thermosetting

LSR series
V-LINE® Vertical Injection Molding Machine for Thermosetting

* Image shows a single-action model for thermosetting. A lineup of rotary type machines is also available.

Molding Case

↓ Nipples of nursing bottles for infants

Silicone lenses compatible to reflow ↑

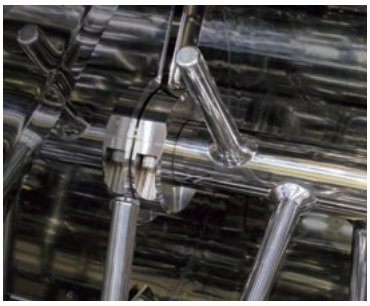
WEB Exhibition Now Showing !

More detailed information can be seen !

https://www.sodick.co.jp/special/WebExhibition_MSseries/index_en.html

NEW
High-capacity Mixer with 2-shaft for Noodles

High-capacity Mixer for producing high end instant noodles and chilled noodles.
Two Mixing-shafts greatly improves mixing performance, hygiene and durability by use of Sodick's unique shaft sealing and air-purge mechanism.



Sodick's unique shaft design and air-purge mechanism

Suitable for high volume production line.

Capable of handling high production capacity. (350kg flour input / batch)

Reduces Maintenance Frequency

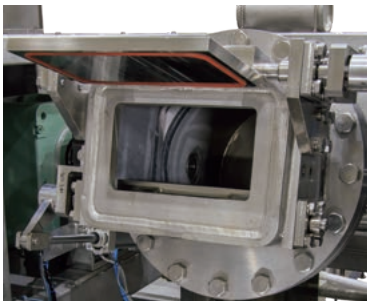
Improved vacuum sustainability in the drump from our conventional models.

Many Operational Options.

Optional designs are available for customers' needs like Vacuum & Non-vacuum, CIP Auto Cleaning, and Heating/ Cooling operations.

NEW
Potato Skin Peeling Device

Great Production-yield Improvement by peeling potato skin cleanly in continuous operation.
Performing Skin-peeling and Surface-sterilization at the same time by high-pressure saturated steam.



Drum supply inlet

Capable of handling High-volume Production Line.

Quick and complete skin peeling (no manual peeling)

Running Cost Saving.

Reduces labor costs and man hours. Improves Material Utilization.

Appicable in many different kinds of production.

Capable of handling many other kinds of food materials like vegetables and fruits.

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TEL : 045-942-3111

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