TOYO

TOYO MACHINERY & METAL CO., LTD.

Fully Electric Injection Molding Machine Si-6

Si-6 series

Small-size models

Si-50-6	Si-80-6	Si-100-6
Si-130-6	Si-180-6	Si-230-6

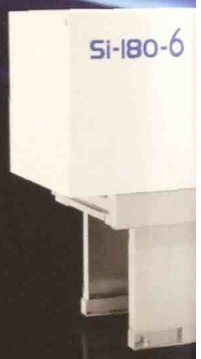
Customer's Value Up

SMART MOLDING

Powerful yet Simple Process Control

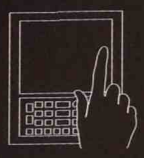
Si-6series

Based on TOYO's accumulated molding expertise and technical know-how, small models in Si-6 series offer strengthened base performance for value-up of customer's products.



▪ New control SYSTEM 600

Easy-to-operate control system including an easy-to-see 15-inch LCD touch panel, high precision mold protection, and versatile trouble diagnosing function.

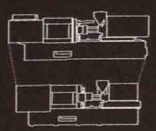


▪ Easy maintenance

Much easier servicing work thanks to one-touch connection of nozzle heater and thermocouple, light toggle cover, and fewer cover-fixing bolts.

▪ Space-efficient design

Easy factory floor layout or machine replacement thanks to small footprint of the machine.



▪ Environmental friendliness

Reduced and digitally visualized power consumption boosts energy saving activity and evokes eco-consciousness.

Small type

[Small-size models]

Si-50-6 **Si-80-6** **Si-100-6**
Si-130-6 **Si-180-6** **Si-230-6**

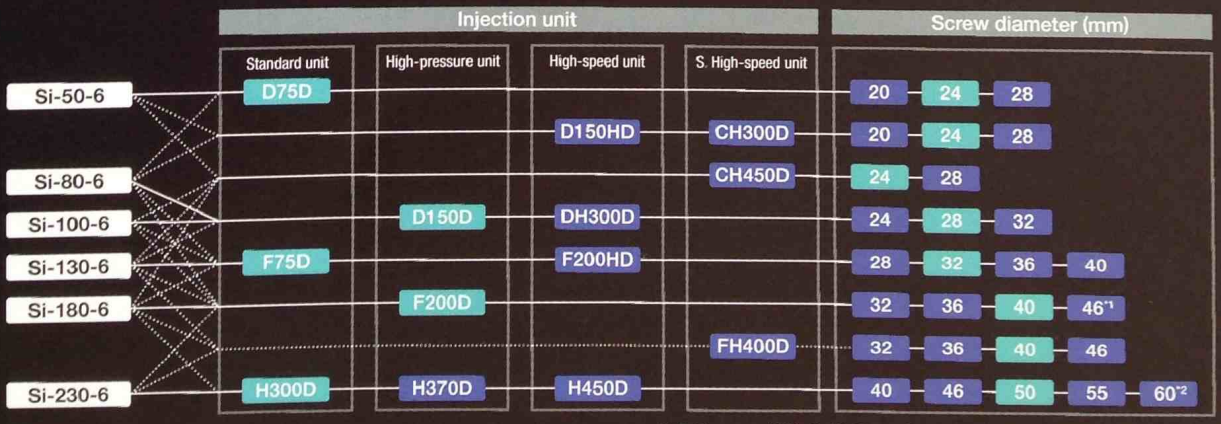
Globally-uniformed specifications

Standardized multi-language screen and common safety specifications covering all the destinations of the machine.

Japan (K1001: The Japan Society of Industrial Machinery Manufacturers)
China (GB22530: National Standard)
Europe (CE Mark)
North America (ANSI/SPI)
South Korea (KC Mark)
Brazil (NR-12)

Safety specifications are available to meet the safety standards for each country.

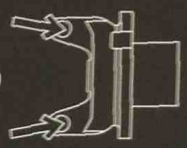
Wide selection of injection units for your specific needs



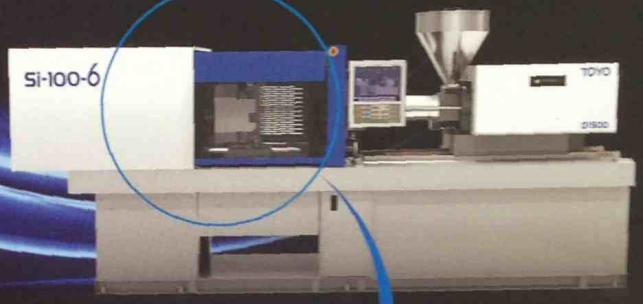
*1 Φ46: non-available for Si-80-6 or Si-100-6. *2 Φ60: non-available for Si-180-6.

Standard injection units and screw diameters

High precision mold clamping mechanism to produce high grade products (Si-50-6, Si-80-6, Si-100-6)



Combining the proven V-clamp mechanism and a newly designed guide structure, we have realized high precision clamping needed to produce small precision products.



Linear guides for straight mold movement *plus* strengthened machine frame.

❄ The picture shows the high precision clamping mechanism for Si-50-6, Si-80-6, and Si-100-6. The double rollers-guided system is used for larger models.

High precision mold clamping mechanism

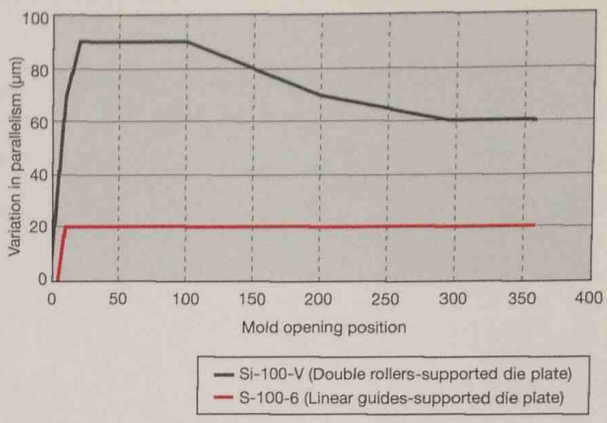
(Si-50-6, Si-80-6, Si-100-6)

1 Straight mold movement along the entire stroke reduces uneven wear of mold guide pins to a minimum.

2 Alignment and parallelism of the clamping component can be maintained for extensive years.

3 No grease scattering over the mold thanks to eliminated tie-bar guides.

Parallelism variation during mold opening



The V-Clamp mold clamping structure realizes ideal clamping

The mold-clamping unit employs the V-shaped toggle mechanism, the V-clamp, and die-plates, both of which have been developed in collaboration with Kyoto University. Owing to the center-press effect, the V-clamp provides well-balanced and uniformed surface pressure over the mold, realizing ideal mold clamping. The die-plates are optimally designed so that they can be slim but have high rigidity.

Extended tie-bar clearance

For the Si-6 models ranging from 50 ton to 130 ton, tie-bar clearance has been extended compared with the equivalent 2013 models in the Si-V series, which facilitates mold replacement work and gives high freedom in designing molds.

Comparison of tie-bar clearances

Model	Si-V Tie-bar clearance	Si-6 Tie-bar clearance
50 ton	360×325 mm	360×360 mm
80 ton	410×375 mm	410×410 mm
100 ton	460×410 mm	460×460 mm
130 ton	510×460 mm	510×510 mm

※ Si-180-6 and Si-230-6 have the same clearances as those of Si-V series.

Extended mold height dimensions

The Si-6 series covers previously optional mold height extension, which gives high freedom in designing molds.

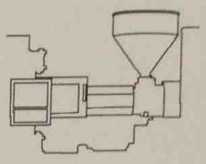
Comparison of max. mold heights

Model	Si-V Max. mold height	Si-6 Max. mold height
100 ton	450 mm	510 mm
130 ton	450 mm	550 mm
180 ton	500 mm	600 mm
230 ton	580 mm	680 mm

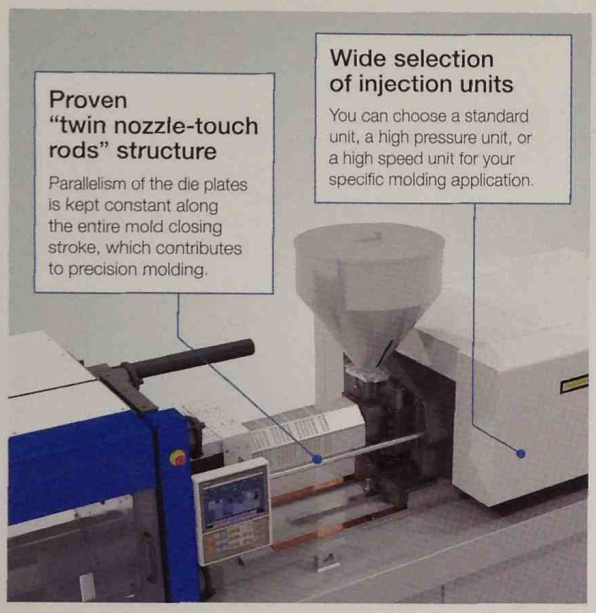
※ 50, 80 tons same as Si-V series.

Injection Mechanism

High precision injection for constant molding of quality products



The Si-6 series offers a wide selection of injection units for your specific molding needs. The proven twin nozzle-touch rods structure secures high molding quality.



▶ Molding's weight variation reduced by 20%*

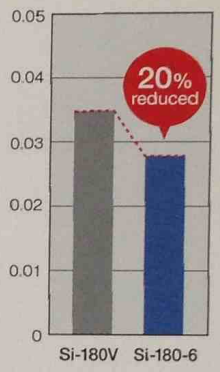
Compared with the previous Si-V series, the Si-6 offers higher quality thanks to its stable injection performance and SYSTEM 600 control system.

▮ Comparison of molding's weight variation

Item	Si-180V	Si-180-6
Screw diameter	Φ50	Φ55
Product weight	137.44~ 137.52g	135.87~ 135.92g
R (max-min)	0.08	0.05
X (average)	137.48g	135.89g
σ (standard deviation)	0.0161	0.0127
R / X	0.0582	0.0368
3σ / X	0.0351	0.0280

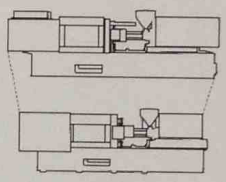
* Comparison was made with Si-180V in 2013 model.

▮ Molding weight (3σ /X)

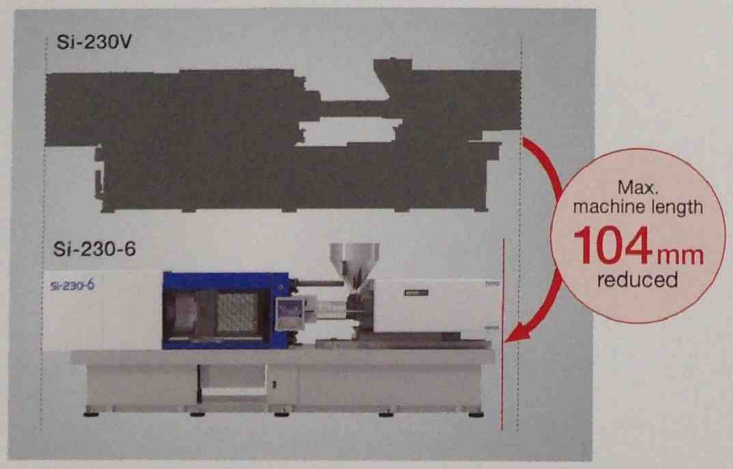


Downsizing

Space-efficient design even in small-size models



The new clamping unit structure has reduced the machine length, which contributes to efficient use of the factory floor.



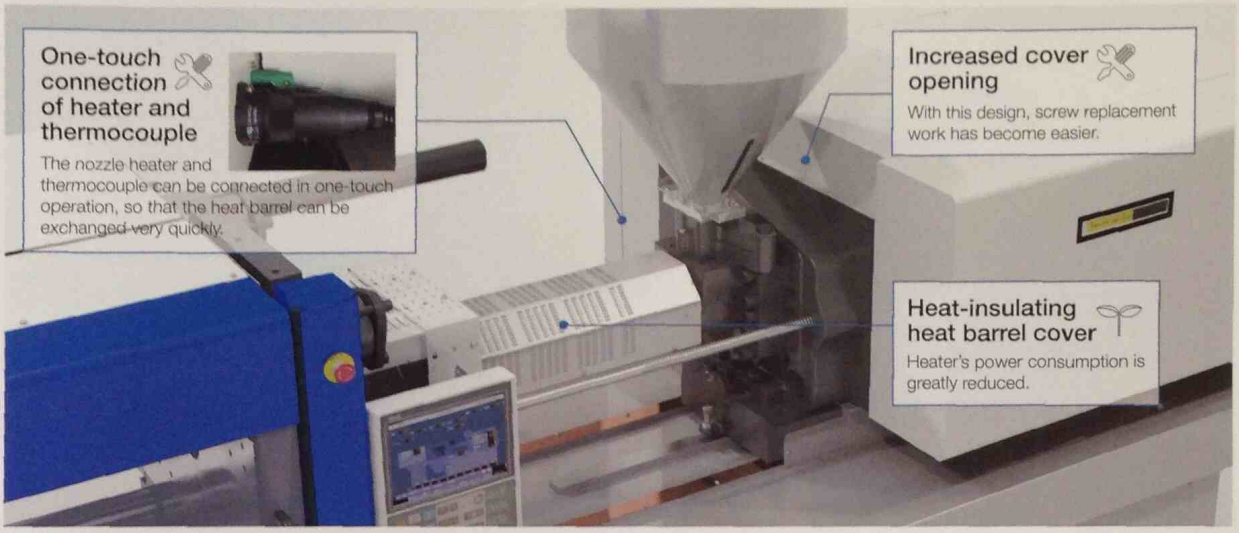
▶ Reduced machine length with increased mold height

The optional mold height extension in the previous model is now standard; but the machine length is reduced. This design contributes to easier handling of larger molds and efficient use of the factory floor.

※ For Si-80-6, and Si-80-6, the mold height remains the same.
※ Comparison is made with equivalent 2013 models in Si-V series.

Easier maintenance and improved eco-efficiency

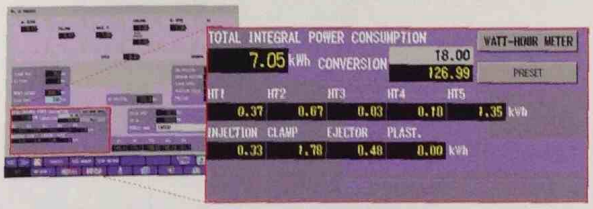
Reflecting desires from users, the Si-6 series is a practically easy machine to maintain. In addition, energy-efficiency and eco-friendliness are greatly increased.



Power consumption display

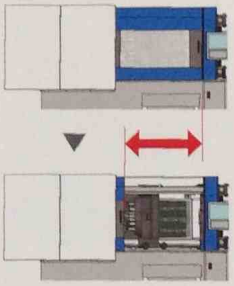
Visualization of power consumption promotes energy saving activity

Either integrated total power consumption from a preset point or hourly consumption can be displayed by switching. In addition, the consumed power can be displayed in the desired unit such as JP¥, US$ or emitted amount of CO_2.



Extended safety door opening stroke

The safety door-opening stroke is extended so that mold maintenance work can be made easily and safely.



Model	Si-V		Si-6
	At min. mold height	At max. mold height	[At any mold height]
50 ton	346 mm	576 mm	580 mm
80 ton	376 mm	636 mm	650 mm
100 ton	402 mm	702 mm	750 mm
130 ton	445 mm	845 mm	1000 mm
180 ton	550 mm	950 mm	1080 mm
230 ton	672 mm	1122 mm	1250 mm

Easy access to the area behind the movable die-plate

Toyo-developed food-grade grease

Option

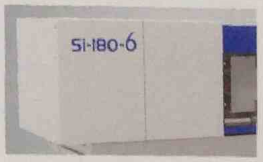
In addition to Toyo's own "PLASTAR GREASE B3 No.2", which is required only 1/10 the consumption of ordinary grease, a food-grade grease "PLASTAR GREASE H1-2" has been developed.

Having the same lubrication property as that of the "B3 No.2", the "H1-2" grease is certified by NSF International in the U.S. as grease that can be used for the machine that molds sanitary-controlled products such as food container.

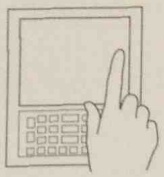
[H1: Products that can be used at the place where products happen to touch with food.]

Split toggle cover

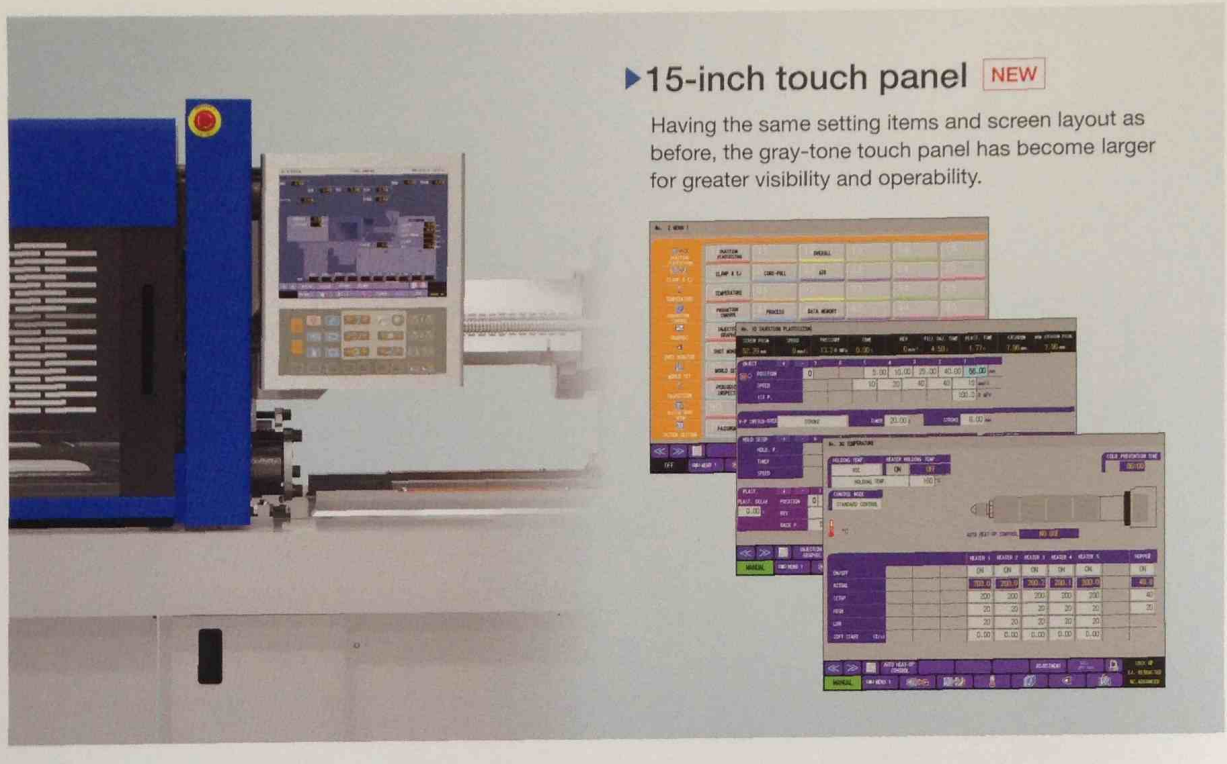
The guide bar supporting structure is changed; and the toggle cover is split, for easier maintenance work.



Totally new control system New stage of high speed and high response operation



Equipped with an easy-to-operate large touch panel, the latest control system SYSTEM 600 provides a variety of enhanced functions including improved mold protection and operator-supporting functions such as mold condition analyzing and molding navigation.



▶15-inch touch panel NEW

Having the same setting items and screen layout as before, the gray-tone touch panel has become larger for greater visibility and operability.

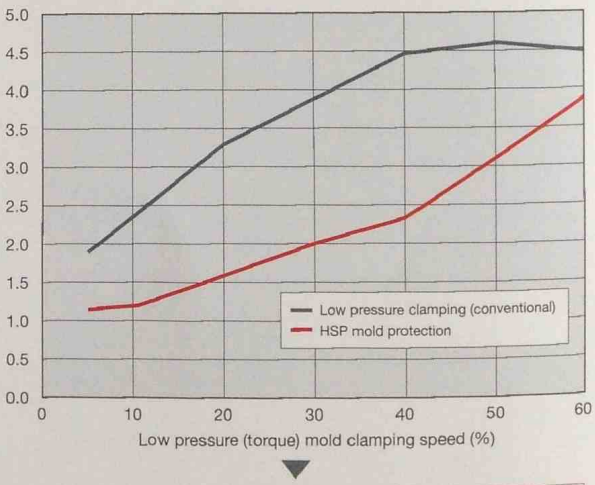
▶HSP mold protection system NEW

High response of SYSTEM 600 control and specially set two torque monitoring areas combined, the HSP (High Sensitive Protection) mold protection system shows greater performance in protecting the mold from damage due to product pinching between mold halves. Mold protection accuracy has been much improved even in high cycle operation, so that cycle time can be shortened without concern for any damage to the mold.

[Example of foreign object detection]

Condition	In testing the effect of the HSP system, a 5.82 mm-thick molding was placed between the mold halves on the Si-280-6.

▌Comparison of crush volume in foreign object detection test



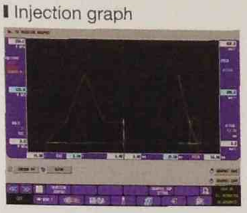
The HSP system reduced the "crush volume" by 55% at maximum.

Trouble diagnosing support NEW

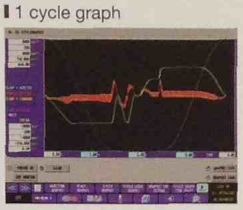
For quick recovery, data necessary to diagnose a trouble are automatically stored.

The four graphs shown below are automatically stored when any alarm is issued in a certain cycle.
This function is particularly useful to solve a trouble at a unmanned night shift or a seldom-reproducible trouble.

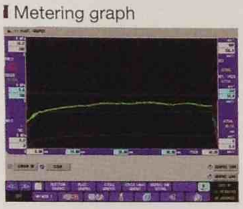
Injection graph



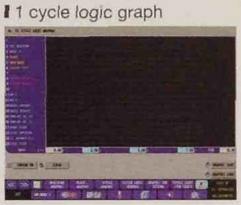
1 cycle graph



Metering graph

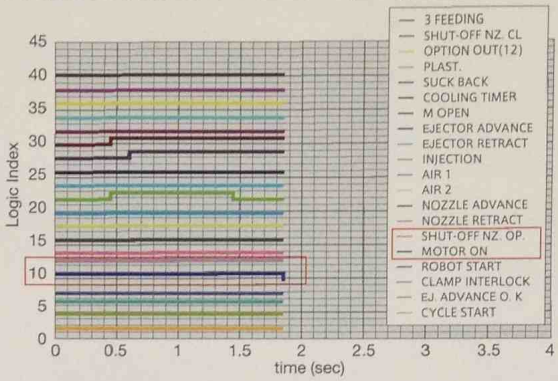


1 cycle logic graph



These four graphs are automatically stored in a USB memory in a cycle where the machine has stopped due to any alarm.

Graph in Excel form converted from one cycle logic graph

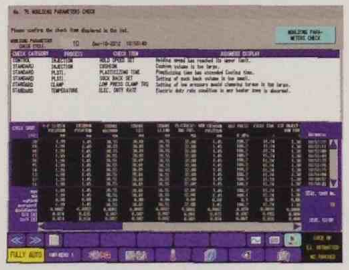


I/O signal-related troubles such as an instantaneous signal stop during automatic operation could be discovered

※ The graphic data-reading tool (option) is required

Molding condition analyzing function NEW

By comparing operator-set molding parameters with the stored reference data*, this analyzing function finds out setting problems and displays advice for correction, so that an operator can set proper molding conditions in a short time.

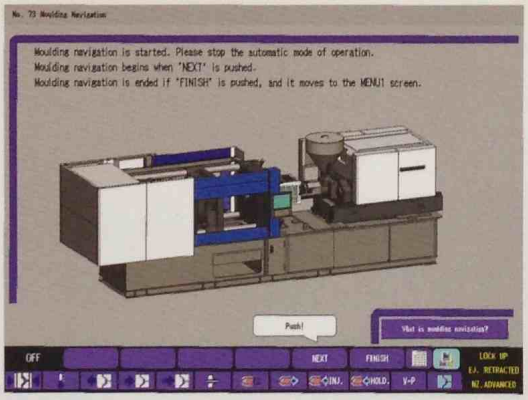


Automatic identification of setting problems	Corrective advice on the screen
·Oversight in parameters setting ·Unintended machine motion	·Problematic settings are displayed ·Problem visualization leads to quality molding

* Reference data has been established based on Toyo's long standing experience.

Molding navigation system

This system guides an operator step-by-step along the setting process of molding parameters based on the basic setting principle. This function is helpful not only for novice operators not accustomed to Toyo molding machines but for molding experts to recall the basic setting method.



Other special functions

Just Pack control High precision holding pressure control

By precisely controlling the holding pressure right after the first injection process, smoother melt filling can be made compared with conventional control. This control suppresses burrs and minimizes the residual stress that tends to cause warping.

Example: Light guide plate

Standard control

Thickness deviation and residual stress are reduced

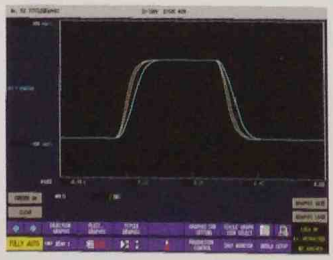
Just Pack control

The graph shows the transition of the holding pressure with an upper line by conventional control and a lower line by Just Pack control. The light-blue area is excessive pressure by conventional control.

V-mode control Response-speed adjusting function

This function automatically controls acceleration and deceleration in injection, mold opening and closing, and ejection. Unlike conventional system, ideal acceleration and deceleration patterns can be set simply by choosing a desired mode.

Acceleration and deceleration in each mode



The graph shows acceleration and deceleration curves depending on the V-mode selection.

Toyo's own technologies make otherwise complicated molding process simple

Gas suppression screw Option

SAG (Screw Against Gas)

Gas-caused defects account for a large part of molding defects.

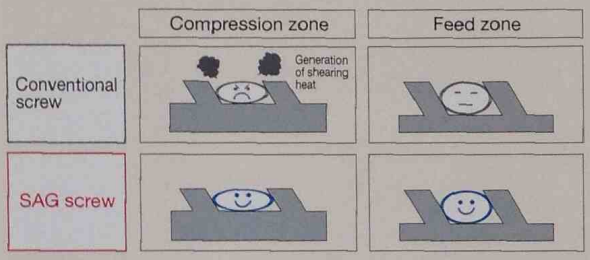
Molding defects	silver, discoloring, burn, short shot, flash
Affects to mold	sticking of grime, clogging of vent

The SAG screw reduces above defects and troubles and increases yield rate.

Cause of gas generation

Main cause: Unbalance between pellets feeding and melting in the heat barrel

- Over-heating due to excessive feeding of pellets
- Local heating due to variation of feed volume or melt adhesion to heat barrel



Advantage of SAG screw

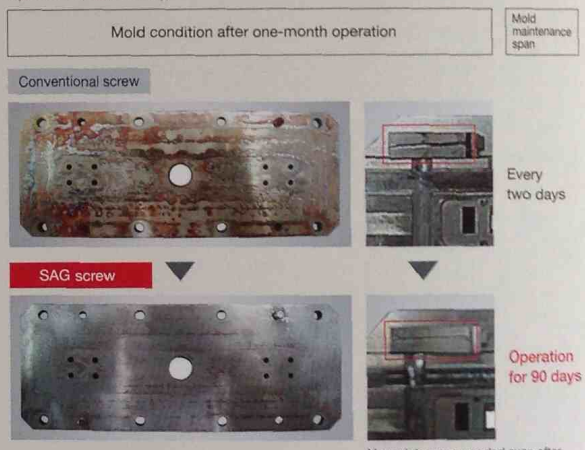
The SAG screw alone can solve the problem.

Thanks to its unique screw design, the SAG screw controls shearing heat during plasticization process so that gas generation can be suppressed. You do not need any other equipment to solve the gas-caused problems.

Sample case of SAG's effect

Extended span of mold maintenance
Greatly reduced grime adhered to the mold

Material: PC / Product: Battery case / Machine: 100-tonner with ϕ24 screw / Cycle: 24 s (24 hours/day)



Many other effective cases have been reported in processing LCP, PA6T, PA66, PPS, PVC, etc.

Automatic melt viscosity control program Option

meltcon

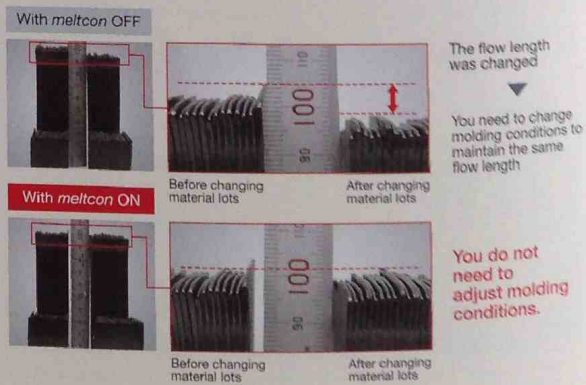
Melt condition of resin varies when following factors are changed: Production lots of resin, drying conditions, contents of grinded material, molding machines, plasticizing components The *meltcon* automatically controls melt viscosity so that the machine can keep producing quality products despite the changes of above factors.

Feature of meltcon

You set the base melt density at first to produce products with desired quality. After that, the *meltcon* automatically controls the heat barrel temperature to maintain the preset melt density. Condition adjustment by an operator is not necessary.

Sample case of *meltcon's* performance

Product: Spiral flow / Material: PC / Comparison method: The flow length was measured before and after changing material lots without changing any molding parameters.



Optional Plasticization Parts

A great variety of plasticizing components to support SMART MOLDING

Special screw lineup (Option)

SAT design
High-mixing sub-flight screw

For high-mixing and high cycle molding

MIT design
High-mixing screw

For high-mixing and high color dispersion molding

LOT design
Screw for high viscosity resin

For molding optical products of PMMA , PC, etc.

HIT design
Screw for low viscosity resin

For molding connectors of LCP, PA, PPS, etc.

MIT design
High-mixing screw

For low-density Master Batch use

SOT design
Special specification screw

For turbulent, high-mixing and color-dispersion use

Nozzle lineup (Standard / Option)

Small diameter
(Heater OD: ϕ26)

Standard: up to ϕ20

One-piece type nozzle

Standard: ϕ24 to ϕ36

Separate type nozzle

Standard: ϕ40 and up
Option: up to ϕ36

High performance chip type nozzle

Option: Φ16 to Φ32
For molding precision parts of LCP, PA, etc.

One-piece type long nozzle

For special form parts

Special type nozzle

For hot runner molds

Screw check triplet (Standard / Option)

Screw check triplet (non-rotation)

Screw check triplet with CrN or C-TiN coating

Specifications on plasticizing components

		Standard	Wear-resistant I	Wear-resistant II	Wear-resistant III	Fluorine-resistant
Material	Heat barrel	Nitriding	Wear-resistant I	Wear-resistant II	Wear-resistant III	Fluorine-resistant material
	Screw	Plating	Wear-resistant I	Wear-resistant II	Wear-resistant III	Fluorine-resistant material
	Check triplet	Wear-resistant I		Wear-resistant II	Wear-resistant III	Fluorine-resistant material
Available surface treatment	Nitriding	○	–	–	–	–
	Plating	○	○	–	–	–
	CrN	–	○	○	–	–
	C-TiN	–	○	○	–	–
Applicable resin		With no GF, no inflammability	GF: 30% or less Inflammability HB~V1	GF: 30% or more	GF: 50% or more GF: 30% or more + Inflammability V0	Fluorine resin
Corrosion resistance	More ★ signs show greater performance	★	★★	★★★	★★★★	★★★★★
Wear resistance						★

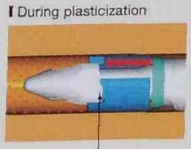
Other special options

The SRC-Ⅲ metering system (PAT.) prevents melt back flow

PAT. No. 3432776/ No. 3432782

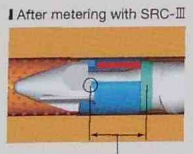
The SRC-Ⅲ eliminates an unstable factor of the check ring

During plasticization



Locking mechanism

After metering with SRC-Ⅲ



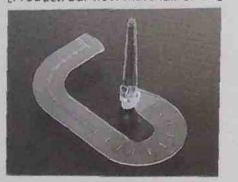
Check ring is locked.

Screw triplet for SRC-Ⅲ PAT.

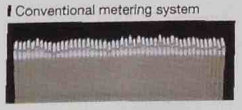
Evaluation of melt density stability by SRC-Ⅲ metering

The condition of melt density was observed by checking the length of bar-flows that were molded with a constant injection stroke without using holding pressure control.

[Product: Bar-flow Material: GP-PS]

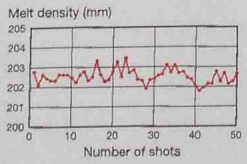


Conventional metering system

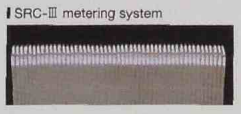


$\bar{X}$=202.5mm R=1.67mm
σ=0.3496mm R/$\bar{X}$=0.825%

Melt density (mm)

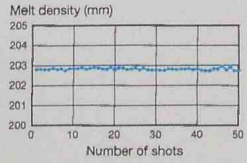


SRC-Ⅲ metering system



$\bar{X}$=202.8mm R=0.21mm
σ=0.0511mm R/$\bar{X}$=0.104%

Melt density (mm)



Expansion of temperature control circuit

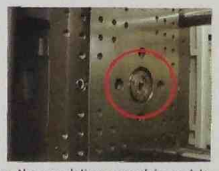
By adding temperature controlling ATC boards, mold and hot runner temperature controls can be performed at the molding machine.

Setting screen

Servo unscrewing unit

PAT. No. 3304950

Ejector axis rotation linked to the mold rotation axis. The controls can be performed at the molding machine.



Connecting part on the molding machine side