

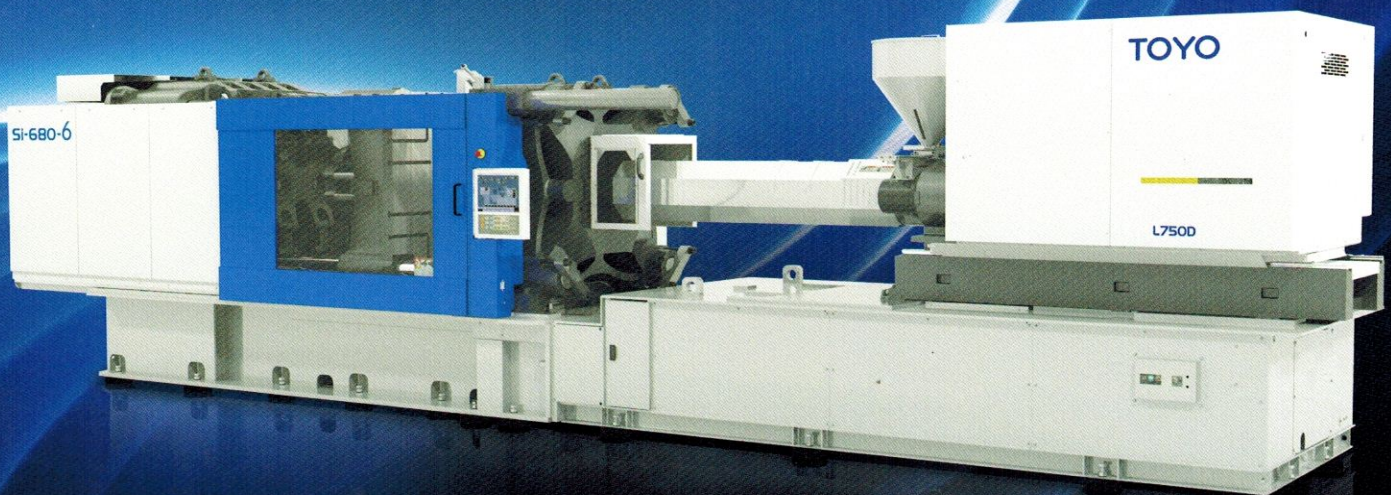
Middle-size models

Si-280-6 / Si-350-6 / Si-450-6



Fully Electric Injection Molding Machine

# Si-6series



Large-size models

Si-680-6 / Si-850-6 / Si-950-6

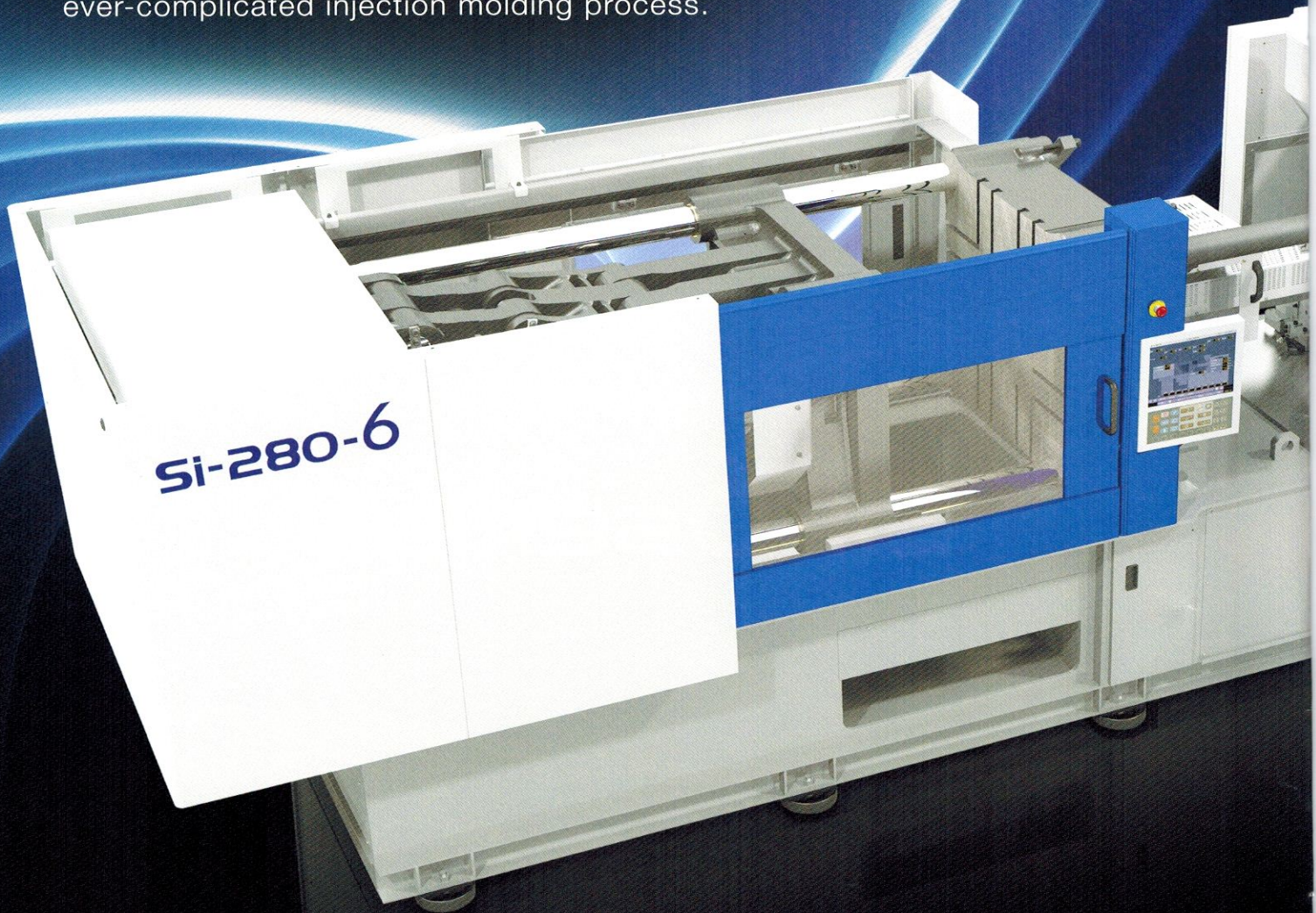


# SMART MOLDING

Powerful yet Simple Process Control

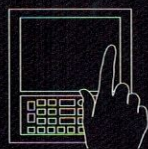
## Si-6series

The Si-6 series provides a SMART solution to ever-complicated injection molding process.



### 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 maintenance work thanks to the nozzle-touch-rod-eliminated structure, one-touch connection of the nozzle heater and thermocouple, and light covers with fewer 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.





## 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)



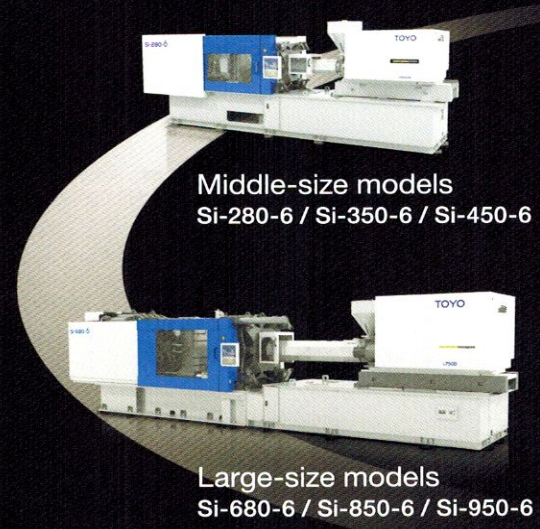
Safety specifications are available to meet the safety standards for each country.



## LINE UP

Six models in middle and large sizes

※Actual appearance will differ depending upon the destination and specifications.



Middle-size models  
 Si-280-6 / Si-350-6 / Si-450-6

Large-size models  
 Si-680-6 / Si-850-6 / Si-950-6

## Wide selection of injection units for your specific needs

Injection unit construct

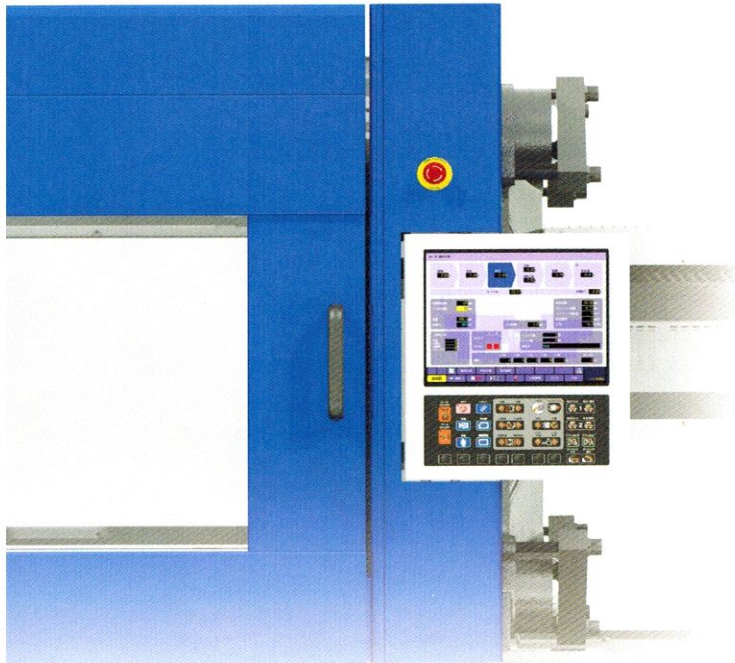
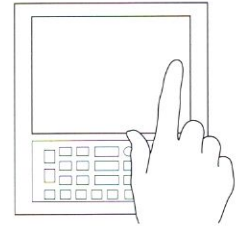
Injection unit construct	Injection unit			Screw diameter (mm)		
	Standard unit	High-pressure unit	High-speed unit	50	55	60
Si-280-6		J370D	JH600D	55	60	68
Si-350-6	J450D	J450HD	JH750D	60	68	75
Si-450-6	K600D			68	75	83
Si-680-6						
Si-850-6	L750D			83	90	100
Si-950-6	M750D				100	110
	N1100D				110	120

Standard injection units and screw diameters



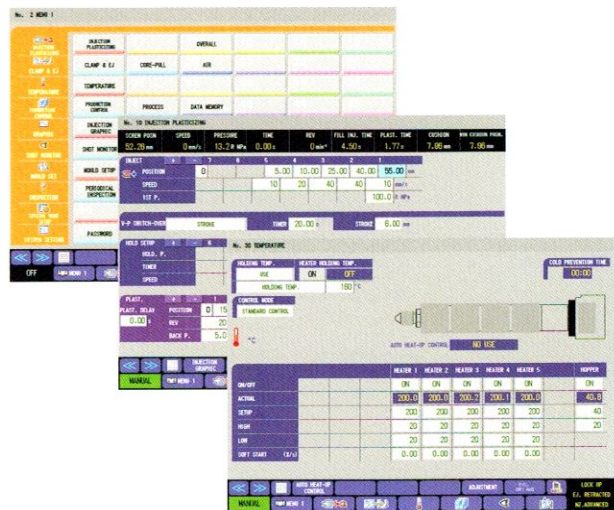
# Totally new control system New stage of high speed and high response operation

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.



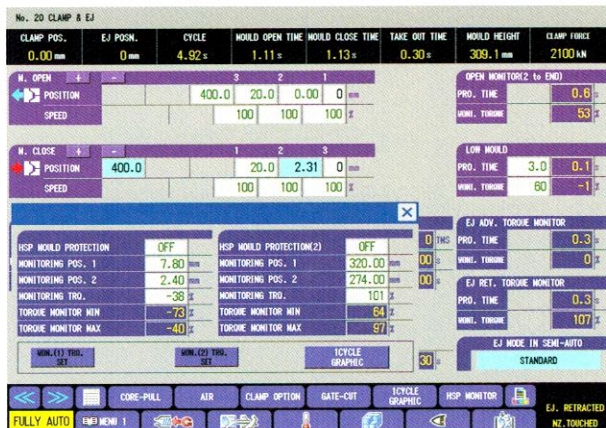
## 15-inch touch panel NEW

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.



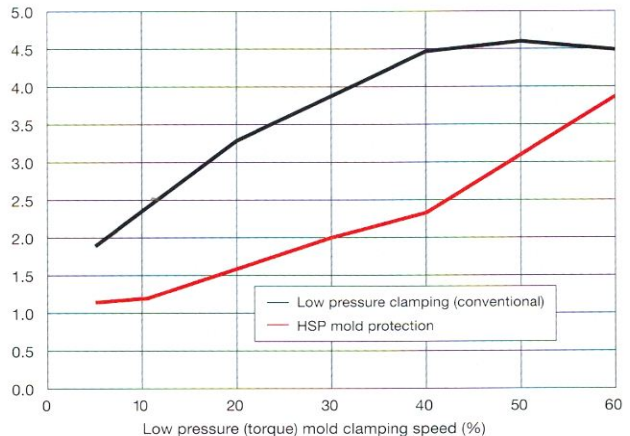
## Example of foreign object detection

### 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

Crush volume (mm)



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

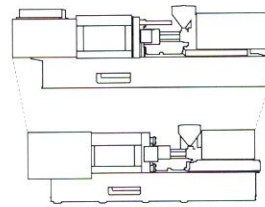






# One of the most space-efficient machines in the industry\*1

The newly designed injection mechanism and a new design concept have greatly reduced the machine size, which contributes to an efficient use of the factory floor.



\*1 According to our survey of Japan's major five manufactures as of July, 2013

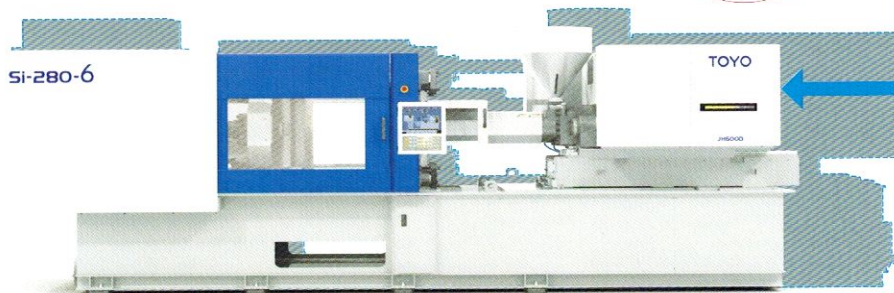
**Middle-size models** Si-280-6 / Si-350-6 / Si-450-6 (Clamping force : 280 ton / 350 ton / 450 ton)

## The new injection mechanism has greatly reduced the machine length.

The newly designed injection mechanism has shortened the injection unit, eventually reducing the total machine length.

Machine length Max.  
**740 mm** shorter in 280 ton model

3-model average  
**6%** or more shorter



※ Comparison is made with Toyo's equivalent 2013 model in the Si-V series.

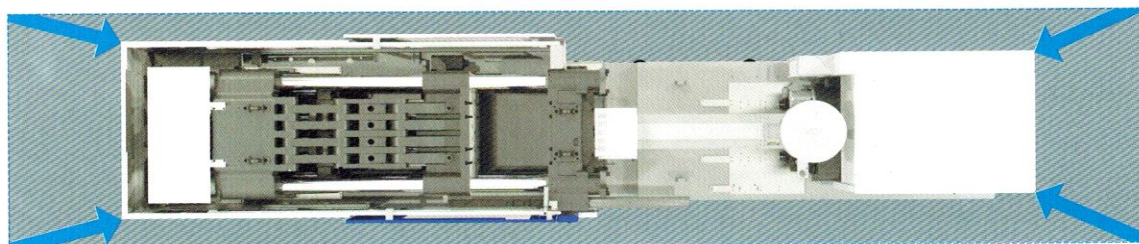
**Large-size models** Si-680-6 / Si-850-6 / Si-950-6 (Clamping force : 680 ton / 850 ton / 950 ton)

## Machine length and footprint are greatly reduced from the previous equivalent model.

One-class greater clamping force is provided compared with each previous model with a clamping unit of an equivalent size. As clamping force is large enough, you can expect longer servicing life of the machine.

Total machine length Max.  
**1,234 mm** shorter in 850 ton model

Footprint Max.  
**20%** smaller in 850 ton model



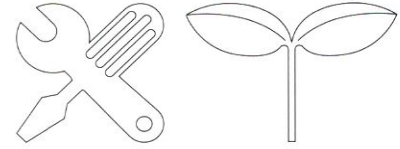
※ Comparison is made with Toyo's equivalent 2013 model in the Si-V series.

### Clamping force and tie-bar clearance, Si-V vs. Si-6

Clamping force (ton)	Previous series Si-V		Increased clamping force	New series Si-6	
	Model	Tie-bar clearance (mm)		Model	Tie-bar clearance (mm)
950	—	—	Increased clamping force	Si-950-6	1320×1320
850	Si-850V	1320×1320		Si-850-6	1145×1145
680	Si-680V	1145×1145		Si-680-6	970×970
550	Si-550V	970×970		—	—



# 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.

**Heat-insulating heat barrel cover**

Heater's power consumption is greatly reduced.

**One-touch connection of heater and thermocouple**

The nozzle heater and thermocouple can be connected in one-touch operation, so that the heat barrel can be exchanged very quickly.

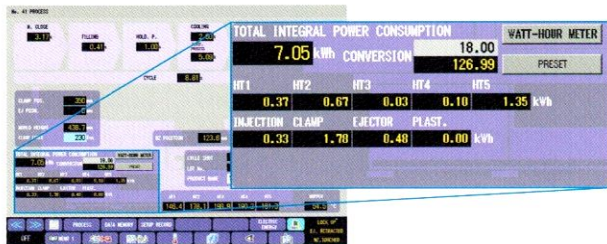
**Nozzle touch rod-eliminated structure**

Heat barrel-related maintenance work such as nozzle or screw replacement can be made easily.

## Power consumption display

Visualization of power consumption promotes energy saving activity

Either integrated total power consumption or hourly consumption from a preset point 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<sub>2</sub>.



## Extended safety door opening stroke

Middle-size models

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



Model	Si-V		Si-6 [At any mold height]
	At min. mold height	At max. mold height	
280 ton	755 mm	1105 mm	1250 mm
350 ton	733 mm	1103 mm	1285 mm
450 ton	1010 mm	1460 mm	1540 mm

## 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.

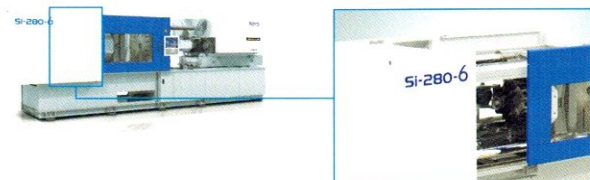


Having the same lubrication property as that of the "B3 No.2", the "H1-2" grease is certified by NSF International in the U.S. as grease that can be used for the machine that molds sanitary-controlled products such as food container.

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

## Easily mountable and dismountable toggle cover

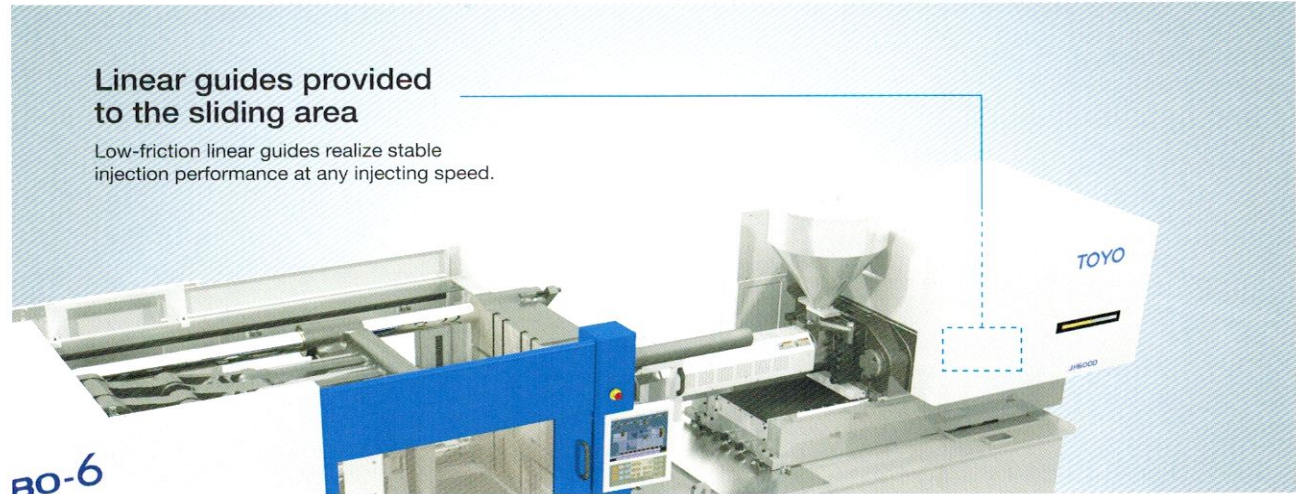
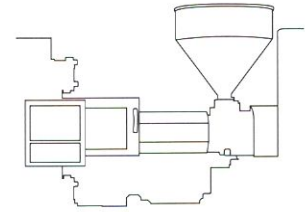
The toggle cover has been designed so that it can be easily mounted or dismounted to facilitate maintenance work. In addition to the cover structure itself, mounting method is changed and the number of fixing bolts is reduced.





# High precision injection for constant molding of quality products

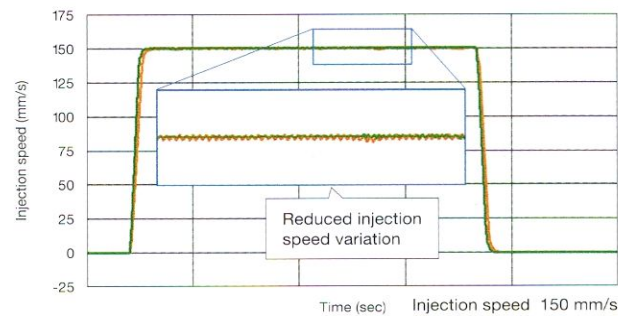
The injection unit is equipped with low-friction linear guides so that stable injecting performance can be achieved, eventually contributing to constant quality of the molding.



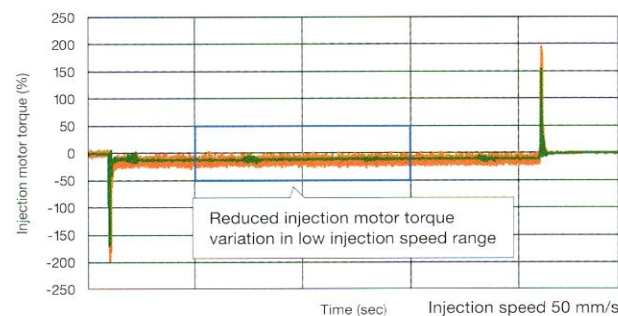
## Improved stability in the low speed range

The linear guides can reduce speed variation even in the low injection speed range where variation tends to become large otherwise.

Injection speed graph



Injection motor torque graph in low speed range



[ — Si-6 Injection unit: J450HD / — Si-V Injection unit: J450HC ]

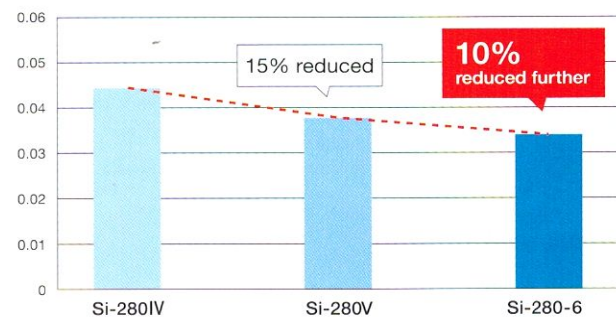
## Molding's weight variation reduced by 10%\*

In comparison with Toyo's former models, the Si-IV series (started in 2007) and the Si-V series (started in 2010), the Si-6 series proves greater stability in molded products, which is realized by highly stable injecting motion and the new control SYSTEM 600.

Comparison of molding's weight variation

Item	Si-280IV	Si-280V	Si-280-6
Screw diameter	Φ60	Φ60	Φ60
Product weight	311.00~311.16 g	310.79~310.98 g	310.58~310.73 g
R (max-min)	0.16	0.19	0.15
X (average)	311.09 g	310.91 g	310.67 g
σ (standard deviation)	0.0460	0.0392	0.0350
R / X	0.0514	0.0611	0.0480
3σ / X	0.0444	0.0378	0.0340

Molding weight (3σ/X)

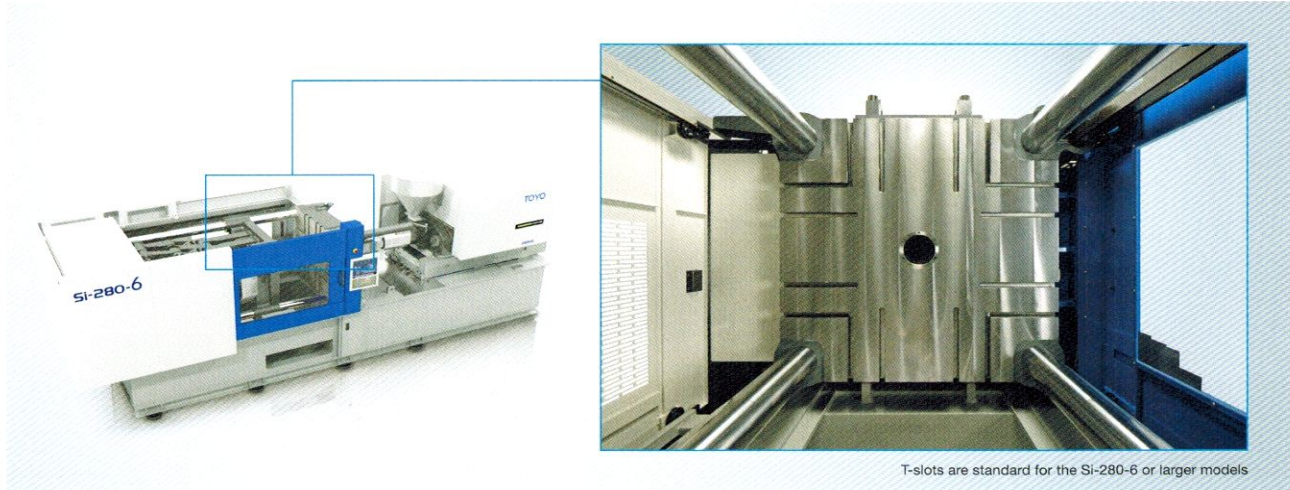
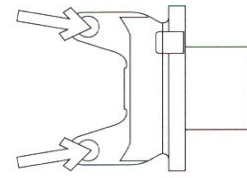


\* Comparison is made against the Si-280IV (2009 model) and the Si-280V (2013 model) in equivalent specifications.



# The Si-6 adopts fruits of collaboration with academy

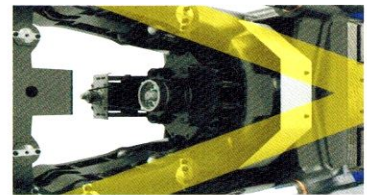
The clamping unit of the Si-6 series is equipped with various technologies such as “V-clamp” developed in collaboration with Kyoto University, and basic specifications such as tie-bar clearance and ejector stroke are enhanced.



T-slots are standard for the Si-280-6 or larger models

## 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.



## One of the largest tie-bar clearances in the industry\* Middle-size models

Employed to the Si-280-6, Si-350-6 and Si-450-6, the largest-class tie-bar clearances in the industry facilitate mold replacement work and gives high flexibility in designing molds.

Comparison of tie-bar clearances

Model	Industry average* Tie-bar clearance	Si-6 Tie-bar clearance
280 ton	690×670 mm	730×730 mm
350 ton	780×750 mm	810×810 mm
450 ton	850×820 mm	870×870 mm

\* Average of Japan's five major makers based on Toyo's survey in January, 2013

## Extended ejector stroke Large-size models

Employed to the Si-680-6, Si-850-6 and Si-950-6, the extended ejector stroke is effective in molding deep products such as containers.

Comparison of ejector stroke

Previous Si-V models		New Si-6 models	
Model	Ejector stroke (mm)	Model	Ejector stroke (mm)
—	—	Si-950-6	300 mm
Si-850V	200 mm	Si-850-6	280 mm (+80 mm)
Si-680V	200 mm	Si-680-6	250 mm (+50 mm)
Si-550V	180 mm	—	—

Extended ejector stroke

## High speed V-Clamp toggle mechanism Large-size models

High cycle by reduced mold opening and closing time

The V-Clamp toggle mechanism is also adopted to large models, Si-680-6, Si-850-6 and Si-950-6, so that the mold opening and closing time is reduced by about 6% on an average compared with three previous equivalent models.



# Toyo's own technologies make otherwise complicated molding process simple

## Gas suppression screw

### SAG (Screw Against Gas) Option

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

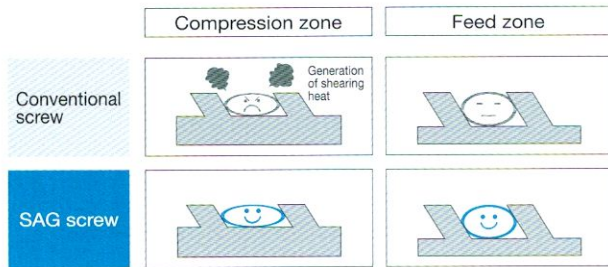
The SAG screw reduces above defects and troubles and increases yield rate.



### 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.

## Automatic melt viscosity control program *meltcon* Option

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 SAG's effect

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

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



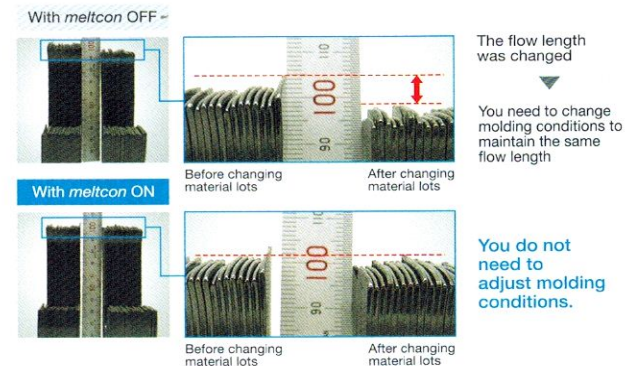
No maintenance needed even after

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



### 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.





# A great variety of plasticizing components to support SMART MOLDING

## Special screw lineup Option

**I SAT design**  
High-mixing sub-flight screw



For high-mixing and high cycle molding

**I MIT design**  
High-mixing screw



For high-mixing and high color dispersion molding

**I LOT design**  
Screw for high viscosity resin



For molding optical products of PMMA, PC, etc.

**I HIT design**  
Screw for low viscosity resin



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

**I MIT design**  
High-mixing screw



For low-density Master Batch use

**I SOT design**  
Special specification screw



For turbulent, high-mixing and color-dispersion use

## Nozzle lineup Standard / Option

**I Small diameter**  
(Heater OD:  $\phi 26$ )



Standard: up to  $\phi 20$

**I One-piece type**  
nozzle



Standard:  $\phi 24$  to  $\phi 36$

**I Separate type nozzle**



Standard:  $\phi 40$  and up  
Option: up to  $\phi 36$

**I High performance**  
chip type nozzle



Option:  $\phi 16$  to  $\phi 32$   
For molding precision parts of LCP, PA, etc.

**I One-piece type**  
long nozzle



For special form parts

**I Special type nozzle**



For hot runner molds

## Screw check triplet Standard / Option

**I Screw check triplet (non-rotation)**



**I 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						★

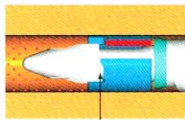
## Other special options

The SRC-III metering system (PAT.) prevents melt back flow PAT. No. 3432776/  
No. 3432782

Expansion of temperature control circuit

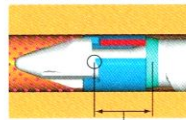
The SRC-III eliminates an unstable factor of the check ring

**I During plasticization**



Locking mechanism

**I After metering with SRC-III**



Check ring is locked.

Screw triplet for SRC-III PAT.



Check ring

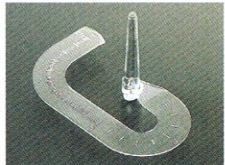
Check seat

Check head

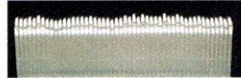
Evaluation of melt density stability by SRC-III metering

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]



**I Conventional metering system**



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

Melt density (mm)



**I SRC-III metering system**



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

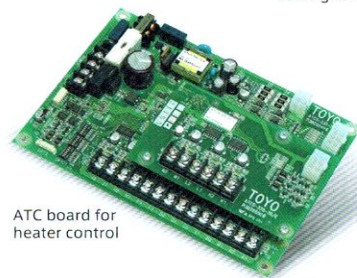
Melt density (mm)



By adding temperature controlling ATC boards (10 channels/board), mold and hot runner temperature controls can be performed at the molding machine.



Setting screen



ATC board for heater control