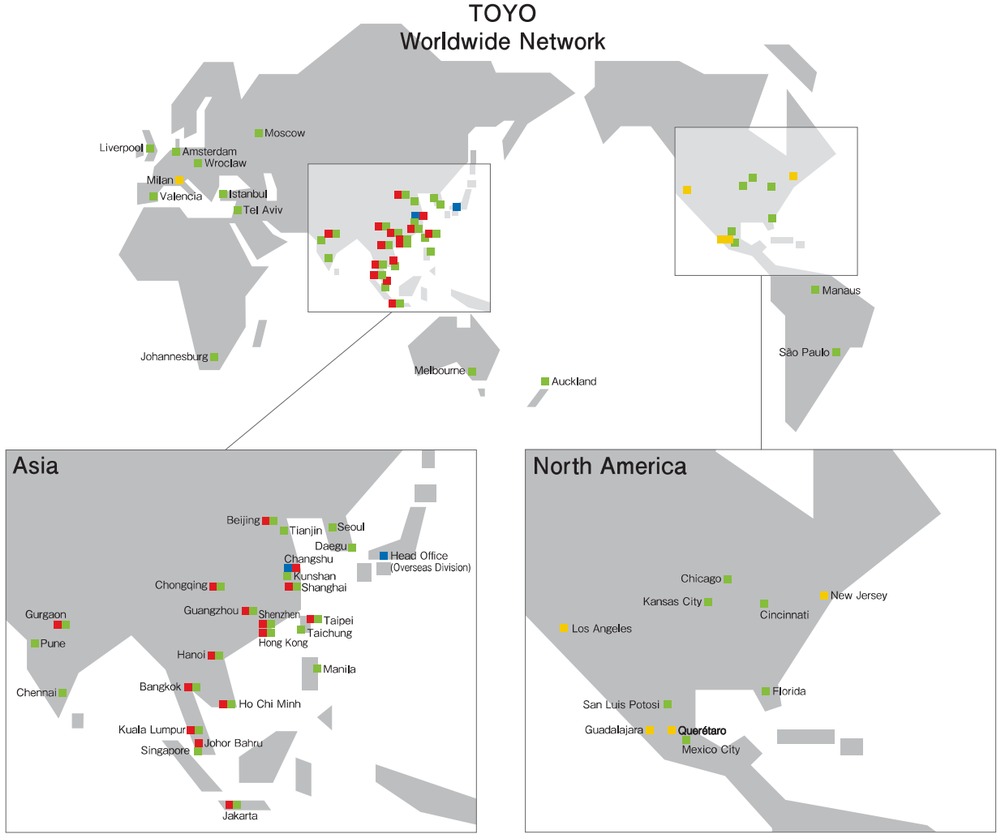
Si-6S series

TOYO Worldwide Network



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TOYO TOYO MACHINERY & METAL CO., LTD.

JAB CM009 ISO 9001 JQA-1825 ISO 14001 JACO EC99J1235 UKAS ENVIRONMENTAL MANAGEMENT 051

The products are produced at the factory certified with ISO-14001.

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Precaution

For safe use of the machine, please read the respective manual carefully, especially sections for operation and maintenance, and follow all the safety precaution instructions specified in the manual.

①Photographs in the catalog include optional devices.
②For the improvement of the product, the appearance and specification are subject to change without notice.
③If these products and technologies (including programs) are subject to the Japanese export control laws, including the Japanese Foreign Exchange and Foreign Trade Law, the products and technologies are required to obtain an export license of the Japanese government, when exported from Japan.
④Some machine pictures and images on the controller screen are superimposed.

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Customer's Value Up

TOYO
TOYO MACHINERY & METAL CO., LTD.
EURO

Fully Electric Injection Molding Machine

Si-6S series

Small-size models
Si-50-6S / Si-80-6S / Si-100-6S
Si-130-6S / Si-180-6S / Si-230-6S

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

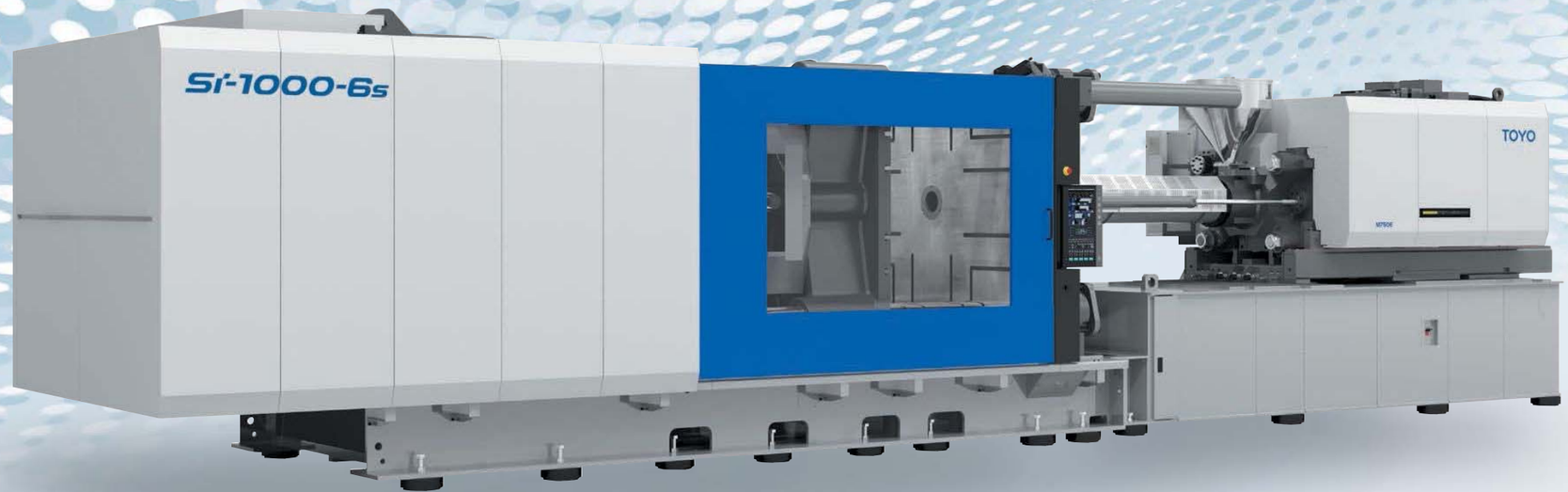
Large-size models
Si-550-6S / Si-680-6S / Si-850-6S / Si-1000-6S

SMART MOLDING

Powerful yet Simple Process Control

Si-6S series

Based on previous Si-6 series, the Si-6S series is furnished with a renovated control system.
The Si-6S is the latest electric servomotor-driven Injection Molding Machines versioned up from the user's perspective.



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.

Carrying technology proven on Si-6 series

The Si-6S series carries the fruits of joint development with academic sector.

- V-shaped toggle mechanism, developped in collaboration with Kyoto University, evenly distributes clamping force over the mold thanks to the center-press effect.
- The mold-mounting die-plates, also developped under collaboration with Kyoto University, are slim and yet highly rigid.
- High speed toggle supports high cycle operation.

New Control SYSTEM 800

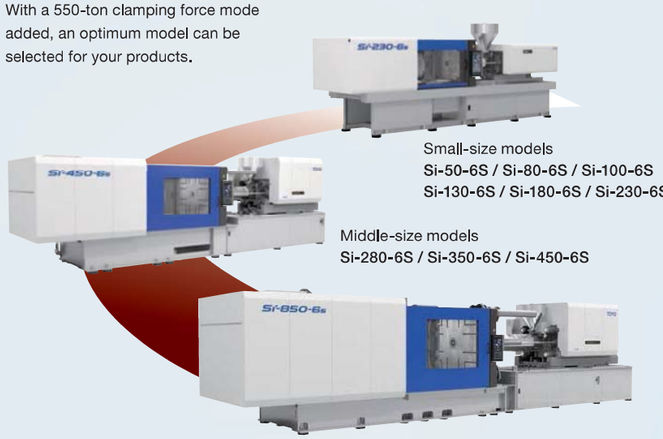
New Control
SYSTEM 800
Functional beauty

Feature 1 High visibility
Feature 2 High operability
Feature 3 Customization ability
Feature 4 Operator friendliness

The superior HMI (Human-Machine Interface) with an 18.5-inch large color LCD screen allows you to operate the machine as if you were handling a smartphone.

LINE UP

With a 550-ton clamping force mode added, an optimum model can be selected for your products.



Small-size models
Si-50-6S / Si-80-6S / Si-100-6S
Si-130-6S / Si-180-6S / Si-230-6S

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

Large-size models
Si-550-6S / Si-680-6S / Si-850-6S / Si-1000-6S

New Control
SYSTEM 800
Functional beauty

SYSTEM 800 for higher operator-friendliness and information integration

The HMI (Human-Machine Interface) with a 18.5-inch large color LCD screen is equipped with an electrostatic capacitance system multi-touch panel, so you can operate the machine as if you were handling a smartphone with a feeling of luxury. SYSTEM 800 boasts high visibility, high operability, customization feature, and operator-friendliness.

Feature 1 High visibility
Feature 2 High operability
Feature 3 Customization ability
Feature 4 Operator friendliness

Electrostatic capacitance system multi-touch panel is employed.

●

18.5-inch large color LCD screen

●

For higher information aggregation and operator-friendliness

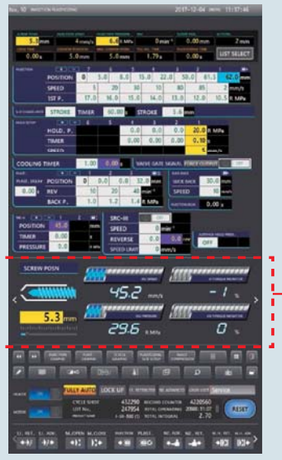
●

Luxury feeling and smartphone-touch operability

High visibility
All necessary information is in one screen so that you can grasp machine conditions at a glance.

A large 18.5-inch LED screen is laid vertically long, where all the necessary information can be displayed in a single screen. The machine status indicating screen in the middle part is for you to visually and intuitively grasp the current machine status, where strokes, pressures and torques are displayed on the numerical meters. Besides the meter display, you can choose small graph indication, cycle monitor indication, or the like at your convenience.

A large 18.5-inch LED screen is laid vertically long, where all the necessary information can be displayed in a single screen.



Present machine status is visually recognized by meter display.

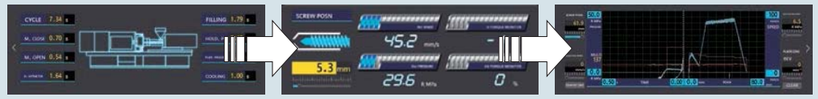
Displayed contents can be switched.

High operability
You can intuitively operate the touch panel like a smartphone.

You can operate the screen as if you were handing a smartphone.

Smartphone-touch screen operation

Screen transition by flick operation
Changeover of contents of the machine status indicating screen can be made easily by right-left flick operation on the screen.



Letter entry by flick operation

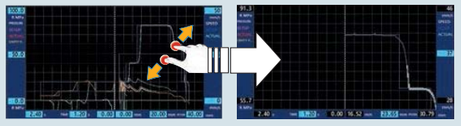
Letter entry like name entry to the molding condition is also made by flick operation.

Item selection by drag and drop operation

Item selection is made by drag and drop operation.

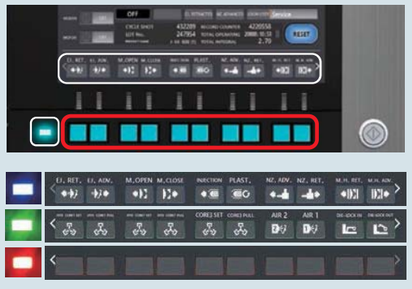
Pinch-in, pinch-out operation in reading graphn

The area in the graph you want to see in detail can be zoomed-in or zoomed-out by pinch-in or pinch-out operation, so that you can easily grasp and help adjust the molding condition.



Non-look operation

Operations such as injection, metering, and mold opening and closing are made by pushing respective tactile switches instead of conventional touch panel operation. You can operate the machine with a feeling of clicking.



Operation keys can be changed by swiping operation.
Color indication of LED is different depending on the operated keys, so that wrong key operation can be visually warned.
By changing programs, key application can be expanded to special requirements.

Respective machine operations are made by pressing tactile switches.

Customization ability

Displaying only chosen data for instant recognition of operating conditions.

Selectability of measured items that can be displayed

On the top part of each screen, monitored data of the ongoing molding cycle are displayed. You can choose the items that are displayed. To set the items, drag and drop the ones you want them to be displayed from the LIST SELECT.

You can set measured items that are displayed on the top of the screen by drag and drop operation of the items you choose from the LIST SELECT.

Three types of MENU screens

The machine is equipped with three kinds of screen-selecting MENU screens.

Screens list display

As with previous models, screens list is displayed in tiled manner.

Categorized display

Screens list is displayed in each category group. By conducting long tapping operation, you can move to an individual screen.

Customized display

You can design the layout of screen items for each log-in user.

Operator-friendliness

High information collecting and aggregating function for easy use as necessary.

Files stored in the hard memory of the SYSTEM 800 or USB memories can be displayed on the screen. For example, you can read Instruction Manual or Operation Manual stored in a PDF file on the machine screen when necessary.

Display of PDF file, movie file and image file

You can watch material or color changing procedures stored in movie files on the screen, so that you can conduct such work swiftly and correctly. Unlike paper manuals, you can easily convey highly skilled expertise including intuitive and secret knowhow on the work to the workers. This function helps workers raise their skill level.

PDF files
Examples: Operation Manual and Instruction Manual

Movie files
Examples: Educational movies showing molding procedure or maintenance procedure

Image files
Examples: Images showing how to find defective products

Memo hand writing function

The memo hand writing function allows you to handwrite notes on the screen of the molding machine, and the screens can be captured and stored in image. For example, when you find something defective, you handwrite such information on the screen for record, and it can be helpful for future troubleshooting.

Hand-written memo
Example: Record of defect location

Camera image showing function

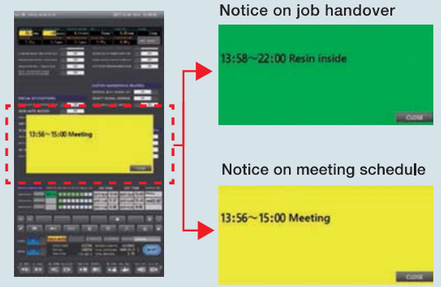
If you set a camera on the machine, pictures taken by the camera can be displayed on the screen, so that you can grasp in real time the conditions inside the mold at the time of taking out of products, and you can handle the situation promptly in terms of combination with the post-molding equipment.

Display of camera image via USB
Examples: Images for monitoring of molding conditions or post-molding process

*A camera is not included in the machine.

Pop-up display of notice

Pre-registered text information can be popped up on the screen at a designated time. For example, messages in job handover or a meeting schedule can be displayed on the screen, so that the operator in the next shift can get to notice it without fail.



Notice on job handover

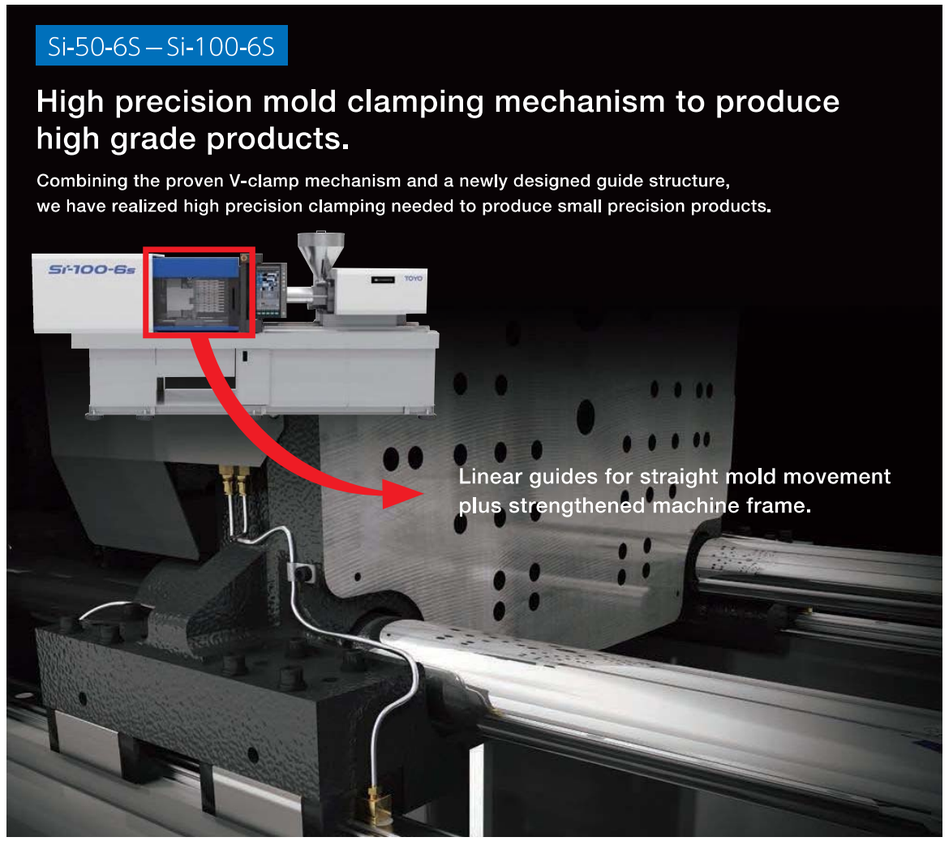
Notice on meeting schedule

Mold Clamping Mechanism

Si-50-6S – Si-100-6S

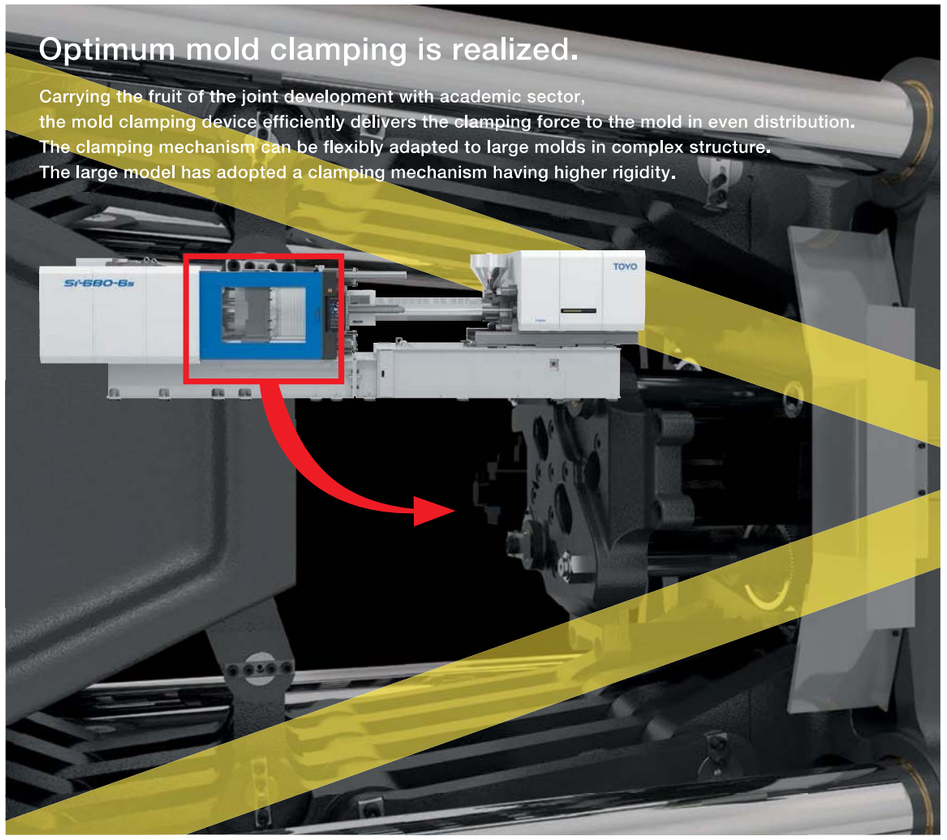
High precision mold clamping mechanism to produce high grade products.

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



Optimum mold clamping is realized.

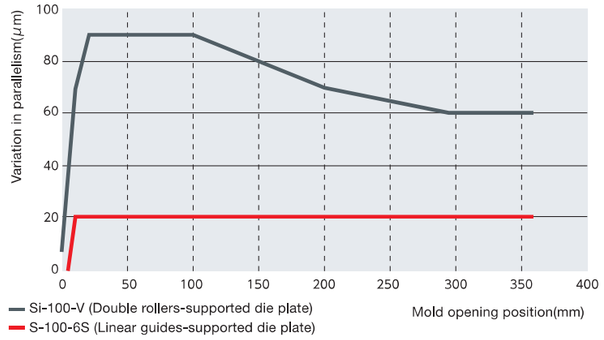
Carrying the fruit of the joint development with academic sector,
the mold clamping device efficiently delivers the clamping force to the mold in even distribution.
The clamping mechanism can be flexibly adapted to large molds in complex structure.
The large model has adopted a clamping mechanism having higher rigidity.



High precision mold clamping mechanism Small models (Si-50-6S – Si-100-6S)

- Straight mold movement along the entire stroke reduces uneven wear of mold guide pins to a minimum.
- Alignment and parallelism of the clamping component can be maintained for extensive years.
- No grease scattering over the mold thanks to eliminated tie-bar guides.

■ Parallelism variation during mold opening



Proven technology, ‘V-clamp’ mold clamping mechanism

The V-clamp mold clamping mechanism, which has been standard since the Si-Ⅳseries, effectively delivers the clamping force to the center of the mold owing to its “center press effect.” And the high rigidity and yet slim mold mounting plates, which are also time-proven, evenly distributes the clamping force over the entire mold.
Well-balanced even distribution of clamping force can be maintained without applying a clamping force beyond necessity.

Mold Clamping Mechanism

Extended tie-bar clearance

Small models

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

Comparison of tie-bar clearances

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

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

Extended mold height dimensions

Small models

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

Comparison of maximum mold heights

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

* 50, 80 tons same as Si-V series.

Largest-class tie-bar clearance in industry

Middle models

The models from 280-ton to 450-ton in clamping force have one of the largest tie-bar clearance in the industry. The large tie-bar clearance facilitates mold-changing work and provides greater flexibility in mold design.

Comparison of tie-bar clearances

Model	Industry average * Tie-bar clearance	Si-6S Tie-bar clearance
280ton	715 × 680mm	730 × 730mm
350ton	810 × 770mm	810 × 810mm
450ton	875 × 845mm	870 × 870mm

* Average among five major makers in Japan, based on survey in July 2017.

Long stroke ejector

Large models

The models of 680-ton or larger in clamping force, the long stroke ejector, adopted on the previous Si-6 series, is standard. The long stroke ejector is effective in molding deep products such as containers.

Table of ejector strokes by model

Model	Ejector stroke
Si-550-6S	180mm
Si-680-6S	250mm(+50)*
Si-850-6S	280mm(+80)*

* Extended stroke from Si-V series.

Increased mold height as standard

Middle models

In the models from 280-ton to 350-ton in clamping force, the maximum mold height is increased as standard by taking in previously optional mold height extension. This feature provides greater flexibility in handling larger and more complex molds.

Comparison of maximum mold heights

Model	Si-6 Maximum mold height	Si-6S Maximum mold height
280ton	650mm	750mm
350ton	670mm	770mm

High rigidity mold clamping mechanism

Large models

The toggle mechanism of the models of 450-ton or larger in clamping force is provided with guide bars that extends from the movable plate to the tailstock, forming a lattice type structure. The high rigid mechanism contributes to molding stability.

High speed toggle structure

Large models

The models of 680-ton or larger in clamping force are provided with the high speed toggle structure, carried from the previous Si-6 series. This toggle structure contributes to high cycle molding by decreasing the mold opening and closing time.

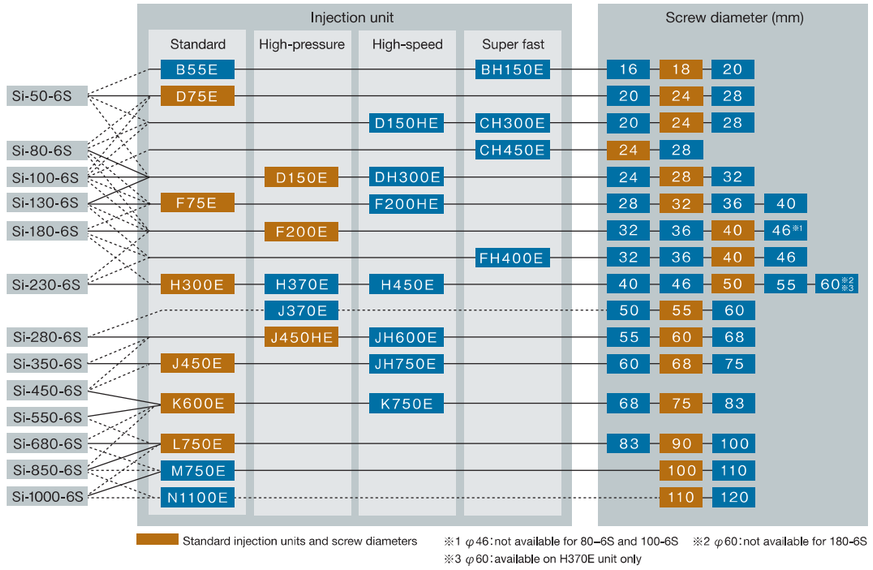
Injection Mechanism

Superior molding stability in high speed, high pressure, large volume and small volume injections

To cope with injection at an increasingly high speed and high pressure, the Si-6S series have a variety of injection units from large volume to small volume, so that the Si-6S series can address the demands from each customer. The injection controlling technology, utilizing accumulated expertise, realizes high precision injection, thus contributing to high molding stability and productivity.

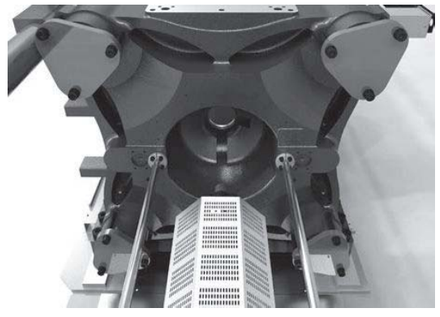
Wide variety of injection units

The Si-6S series has newly added K750 high speed injection unit which achieves a maximum injection speed of 250 mm/s, 138% faster than that of the standard K600E. And the models of 680-ton or larger in clamping force can accommodate a one-size larger injection unit compared with the previous series. With 'standard,' 'high pressure,' 'high speed,' 'large volume,' and 'small volume' injection units, the Si-6S series can cope with various needs from each customer.



Increased injection pressure

The increased rigidity of the injection unit allows higher injection pressures to be set.
And the double nozzle-touch rods structure prevents the inclination of the stationary mold mounting plate.



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.

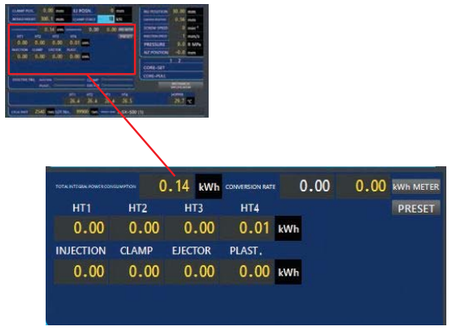
Heat-insulating heat barrel cover
Heater's power consumption is greatly reduced.

Increased cover opening
With this design, screw replacement work has become easier.

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 CO2.



Light weight splittable cover

The light weight and splittable cover design has eased removing or installing work of covers at the screw access area and the toggle area. This cover design facilitates maintenance work including screw maintenance work and toggle cleaning work. These covers also secure further safety.

High degree of serviceability and safety, essential to the machine, are provided.

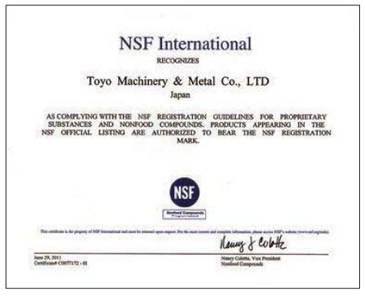
The fully automated lubrication control and the wide opening stroke safety door are among the features of the Si-6S series, which facilitate maintenance work and secure greater safety.
These features reflect on comments and suggestions from customers who have been using our machines.

Totally automatic grease-lubrication system as standard

Si-280-6S and more

The Si-6S series is equipped with the totally automatic grease-lubrication system as standard that covers not only ball screws, toggles, tie-bars and guide bars but also all other greasing points that were previously optional.
In addition, the food-grade grease "H1-2"* having the same lubrication property as that of our own "B3 No.2" grease can also be used for this grease-lubrication system. The food-grade grease "H1-2" is authorized by the U.S. public healthcare equipment accreditation body NSF International as "H1 grade grease" that can be used in molding of sanitary-controlled food-grade products. This system has greatly eased the burden in greasing work.

* H1-2 grease is optional.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H1 lubricants may be used in applications where incidental food contact may potentially occur.

Widely opening safety door

The Si-6S series is equipped with the widely opening safety door, which had been adopted on the previous Si-6 series. The widely opening safety door facilitates the mold changing work without taking unreasonable attitude, contributing to reduced work time and higher safety.

Table of safety door opening stroke by model

Model	Opening stroke
Si-50-6S	580mm
Si-80-6S	650mm
Si-100-6S	750mm
Si-130-6S	1000mm
Si-180-6S	1080mm
Si-230-6S	1250mm
Si-280-6S	1250mm
Si-350-6S	1285mm
Si-450-6S	1540mm
Si-550-6S	1750mm
Si-680-6S	1750mm
Si-850-6S	1900mm
Si-1000-6S	2490mm

OPTION

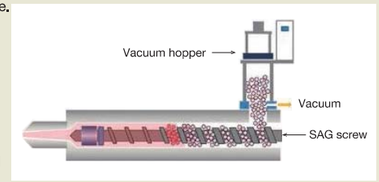
Combining vacuum hopper with SAG screw, de-gassing performance is improved further

SAG+α Ⅱ

The newly developed vacuum hopper suctions low-boiling-point gases inevitably generated during plasticizing process, so that amount of such gases drawn into the mold can be reduced. Combining it with a gas generation suppressing SAG screw, the SAG＋αⅡ system greatly reduces gas-caused molding defects, resulting in improved productivity.

Features of SAG＋α Ⅱ

- Feeder-less, single damper simple structure.
- Condition setting and operation are made from screen on molding machine. (* In case of Si-V or older models, a hopper controller is required.)
- Vacuum pump can be built-in in the molding machine. (Option)
- Space-saving and easy maintenance.
- Mold maintenance cycle can be extended further.



Resin	Cycle time	Standard screw	SAG screw	SAG+α Ⅱ
PA66	16 sec	Mold maintenance required every 14 to 17 hours	Mold maintenance required every 32 – 42 hours	Mold maintenance not required for 65 to 90 hours
PPA	34 sec	Mold maintenance required every 4 to 6 hours	Mold maintenance required every 72 hours	Mold maintenance not required for 275 hours or longer

- Variation of drying condition is accommodated.

Standard screw
Lots of silvers

SAG-design screw suppresses gas generation and demonstrates high de-gassing performance.

SAG screw

Vacuum hopper vacuums up low boiling-point gases.

SAG＋αⅡ
No silvers

Resin: PC not processed with dryer

* SAG＋αⅡ requires a SAG screw and a vacuuming-applicable heat barrel in addition to the vacuum hopper.
* Products, resins and mold structures affect the performance of SAG＋αⅡ.

Automatic melt viscosity control program

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.

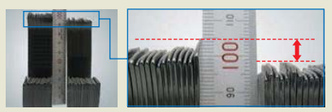
Feature of meltcon

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.

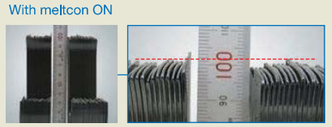
With meltcon OFF



The flow length was changed

You need to change molding conditions to maintain the same flow length

With meltcon ON



You do not need to adjust molding conditions.

A great variety of plasticizing components to support SMART MOLDING

Special screw lineup

SAG design
For inhibition of gas

For suppressing outgassing

HIT design
For high compressipn

For molding connectors of LCP, PA etc.

LOT design
For low compressipn

For molding optical products of PMMA, PC, etc.

V&D design
For long fiber pellets

Reducing fiber breakage, improving fiber dispersibility

SAT design
For mixing performance

For mixing and high cycle molding

MIT design
For dispersion performance

For mixing and color dispersion molding

MXT design
For high mixing performance

For high-mixing and high color dispersion molding

Screw check triplet

Standard / Option

Screw check triplet (non-rotation)

Screw check triplet with CrN or C-TiN coating

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

Comparison of tie-bar clearances

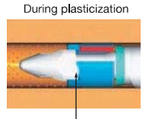
		Standard	Wear-resistant Ⅰ	Wear-resistant Ⅱ	Wear-resistant Ⅲ	Fluorine-resistant
Material	Heat barrel	Nitriding	Wear-resistant Ⅰ	Wear-resistant Ⅱ	Wear-resistant Ⅲ	Fluorine-resistant material
	Screw	Plating	Wear-resistant Ⅰ	Wear-resistant Ⅱ	Wear-resistant Ⅲ	Fluorine-resistant material
	Check triplet	Wear-resistant 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

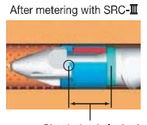
The SRC-Ⅲ eliminates an unstable factor of the check ring

During plasticization



Locking mechanism

After metering with SRC-Ⅲ



Check ring is locked.

Screw triplet for SRC-Ⅲ

Evaluation of melt density stability by SRC-Ⅲ metering

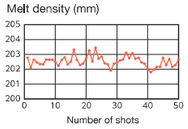
The condition of melt density was observed by checking the length of bar-flows that were molded with a constant injection stroke without using holding pressure control.

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

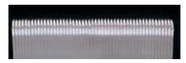
Conventional metering system

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

Melt density (mm)

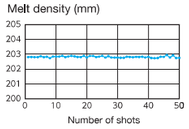


SRC-Ⅲ metering system



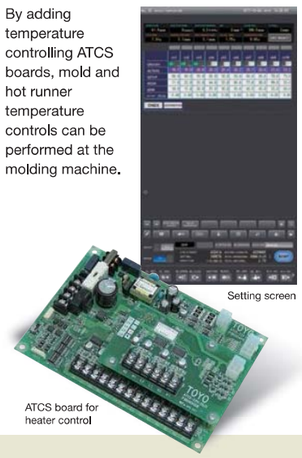
$\bar{X}$=202.8mm R=0.21mm
σ=0.0511mm R/$\bar{X}$=0.104%

Melt density (mm)



Expansion of temperature control circuit

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



Setting screen

ATCS board for heater control