Create your future Sodick

LIM & HCR
Injection Molding Machine

Thermosetting Injection Molding Machine vol.2
(LIM & Rubber)

V-LINE® creates
the value of the next generation.

V-LINE

Sodick's LIM Machine Leading Next Generation Market

The combination of a thermosetting liquid material with excellent characteristics and
Sodick's injection molding machine for thermosetting which performs precise and stable molding provides new markets.

V-LINE®
Thermosetting Vertical Single Action
Injection Molding Machine

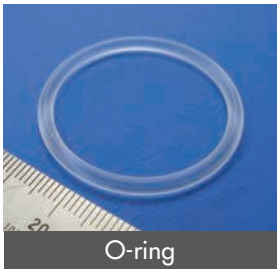
LS40EHV

V-LINE®
Thermosetting Horizontal
Injection Molding Machine

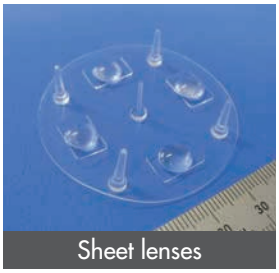
GL30-LSR

LIM (Liquid Injection Molding)

The LIM (Liquid Injection Molding) is a processing method which performs injection molding of thermosetting liquid material with excellent characteristics.
Molded products with a high shape degree of freedom realized by the high liquidity of the liquid material, and high definition and high quality molded products can be acquired without foreign matter mixing in by using a tightly sealed mold.
Particularly, the characteristics of silicone rubber material, such as high heat resistance and low temperature resistance, excellent electrical characteristics and non-adhesiveness, and excellent physiological inactivity, has the potential of expanding its range of usage more than ever in a wide range of fields, including electrical components, heat dissipating components, medical equipment and automobile parts in the future.


O-ring


Baby bottles nipples


Sheet lenses

LS/LSR Series supports liquid materials of an extensive range of viscosities from super-low viscosity to medium and high viscosity

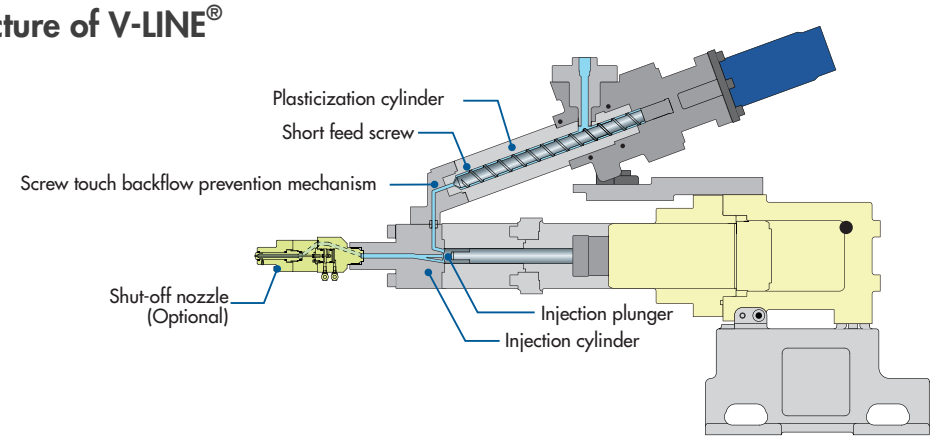
The viscosity of thermosetting resins increases along with the progression of the polymerization reaction (increase in level of polymerization) even for the same material (same monomer), which decreases the flowability. Generally, resins with lower viscosity are liquids with sufficient flowability, which allows molding at low injection pressure. Resins with higher viscosity change to a rubbery state, which requires high injection pressure during molding.
Sodick's injection molding machines for thermosetting are available in two types of injection specifications, an electromotive type and a hydraulic type which supports an extensive range of viscosities from low viscosity to high viscosity.

Reference Classification	LS Model Machine for super-low viscosity [to 100 Pa・s]		LSR Model Standard specification machine [100 to 2,000 Pa・s]						
Injection control system	Electric Servo Specification		Hydraulic Pressure Linear Servo Specification						
Plunger diameter (ϕ) (mm)	16	22	12	16	22	25	28	32	40
Max. injection pressure (MPa)	40	20	288	262	260	240	240	220	210

Lineup of Thermosetting Injection Molding Machines

Horizontal Type: GL Series	Vertical Type: EHV Series	Vertical Type: VRE Series
GL30-LS/LSR	LS40EHV	LS40VRE
GL60-LSR	LS75EHV	LS75VRE
GL100-LSR		
GL150-LSR		

Structure of V-LINE®



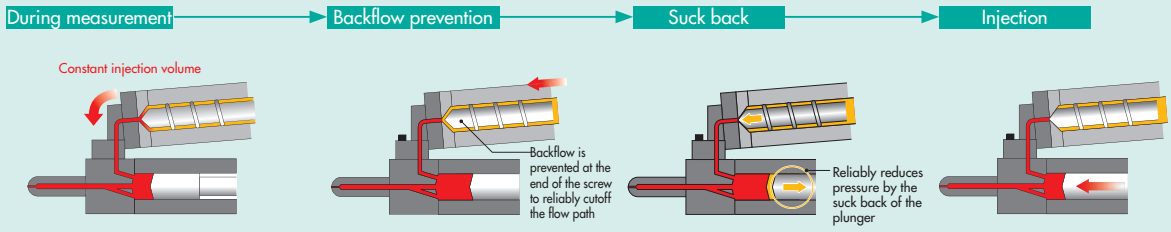
Reason why V-LINE® is Superior to Inline

Actual Operation during Injection which Enables Reliable Filling

V-LINE®

Since the entire operation of the V-LINE® is completely independent,
the mold can be filled reliably with actually measured resin without leakage of the measured material.

Process from measurement to injection by V-LINE®



The suck back in the V-LINE® uses the same principle as a syringe. Since the flow path is cutoff at the end of the screw and the injection plunger moves backwards, the pressure in the injection cylinder can be reduced reliably without transferring the material feed pressure to the injection cylinder side. The actual measured value stabilizes without resin leakage from the nozzle tip, or post-measurement phenomena.

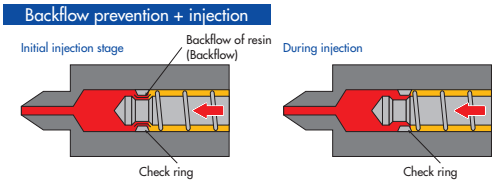
Inline

In inline, the backflow of the resin occurs between the screw and backflow prevention check ring in the initial stage of injection.
Since the amount of resin that backflows in uncontrollable, the amount cannot be fixed.

For this reason,

the actual filling amount varies in each shot in an inline.

Process from backflow prevention to injection by inline



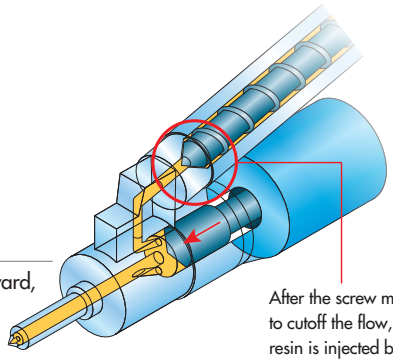
Perfect Backflow Prevention Mechanism

V-LINE®

The simple structure and operation of the V-LINE®
completely prevents backflow,
even with super-low viscosity materials.

Backflow Prevention Mechanism

Since the backflow prevention is completed by moving the screw body forward, there is no backflow prevention ring structure where the resin flows through a narrow flow path.



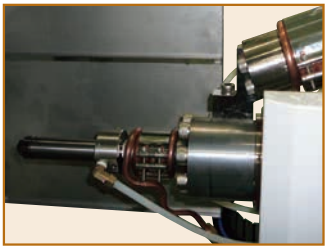
After the screw moves forward to cutoff the flow, resin is injected by the plunger

- Backflow prevention mechanism of the V-LINE® type molding machine is simple and logical
- Completely prevents backflow by moving the screw a few millimeters only
- Material does not backflow during the injection, because the flow path can be shut down after the measurement is completed

LIM Dedicated Unit

- The short flow path in the LIM dedicated injection unit makes assembly and disassembly easier which is excellent in maintainability.
- The screw portion and injection cylinder are independent, and the flow path is shut down by the feed screw except during measurement. For this reason, the residual pressure of the material while the material is being fed accumulates in the plasticizing cylinder.

* An electric servo injection specification is also available for the low viscosity material dedicated unit.

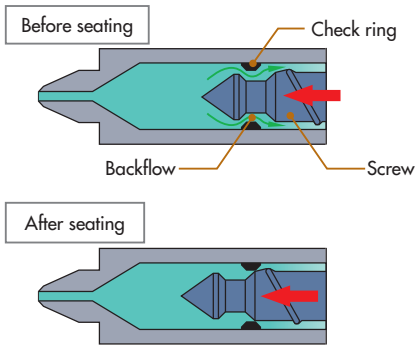


Inline

Due to the check ring structure, **there are limitations in the low viscosity range which can be molded** in an inline.

Backflow Prevention Mechanism

In inline, back flow can be prevented by the check ring.
The seating (backflow prevention) of the check ring is completed when the screw moves forward.



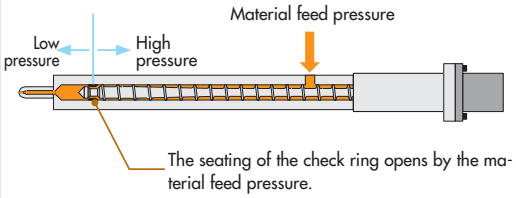
Troubles caused by check ring

Due to the structure, the leakage amount during injection and the sealability after backflow prevention is limited in the super-low viscosity range, as it is influenced by the viscosity of the material.

If the clearance between the backflow prevention ring and injection cylinder is reduced to increase the sealability, the ring and the inner wall of the cylinder will be worn which leads to scorching trouble (premature curing).

Seating condition of check ring

In the case of LIM, the pressure on the rear side of the screw becomes relatively high due to the material feed pressure from the feed unit. The seating of the check ring is completed by the pressure difference generated before and after the ring.



Troubles of check ring peculiar to LIM

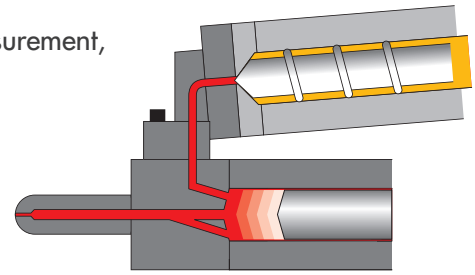
Since the backflow prevention check ring remains open even after the measurement, the material moves after the measurement is completed by the residual pressure of the material fed by the pump, which makes it easier for post-measurement phenomenon to occur, and as a result the measurement value varies.

A shut-off nozzle cannot be used as a measure for this trouble.

V-LINE® Unique Fine Filling Volume Control Technology

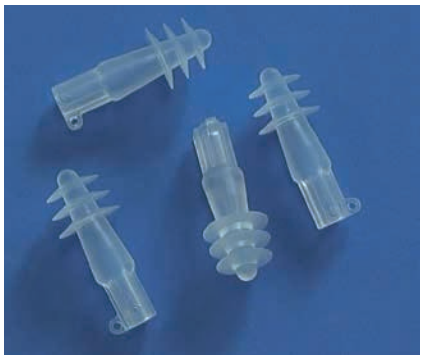
Sodick's unique plunger method with
no backflow of resin allows for several injections by one measurement,
which shortens the molding cycle time.

- Since the injection and screw portion are independent in the V-LINE® system, measurements can be performed for a multiple number of injections at once for molding.
- Improvement in two liquid feed amount control, variations in the mixing ratio, and poor kneading can be expected with measurement of a multiple number of injections at once.



Stability of Product Weight

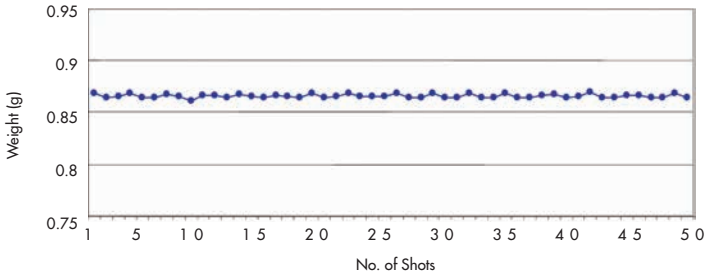
This is an example of molding by the V-LINE® without variations.



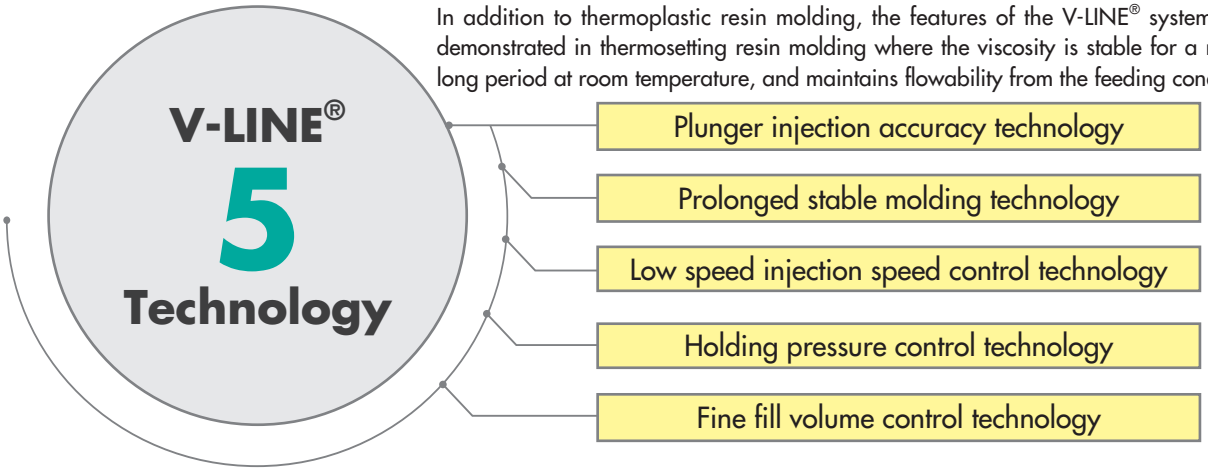
Product name	Ear plugs
Molding Machine	GL30-LSR
Material	LSR (Hardness 40)
No. of cavities	4 cavities
Filling rate	95% filling (Short-shot product)

Evaluation of product weight stability in 50 shot molding

Average weight (1 cav)	0.8657 g
Range value	0.0085 g
Standard deviation	0.0019
Coefficient of variation	0.2157 %



V-LINE® 5 Technology



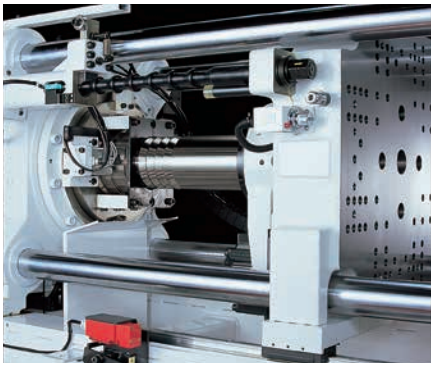
In addition to thermoplastic resin molding, the features of the V-LINE® system can be demonstrated in thermosetting resin molding where the viscosity is stable for a relatively long period at room temperature, and maintains flowability from the feeding condition.

- Plunger injection accuracy technology
- Prolonged stable molding technology
- Low speed injection speed control technology
- Holding pressure control technology
- Fine fill volume control technology

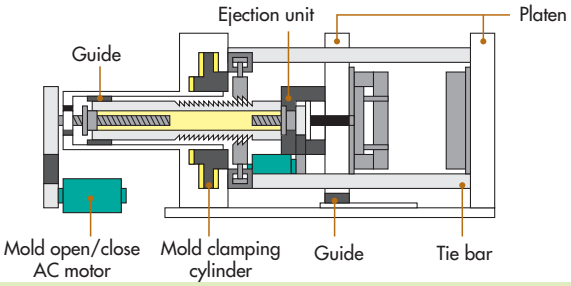
Electric hybrid direct pressure mold clamping

Electric Hybrid Direct Pressure Mold Clamping

Sodick's unique electric hybrid direct pressure mold clamping which uniformly distributes the mold clamping force,
further realizes burr-less molding of liquid thermosetting resins.



The mold clamping accuracy is also an important point to realize burr-less molding. All of Sodick's injection molding machines including the injection unit, provide mechanisms that are suitable for thermosetting resins.



Features

- Direct pressure mold clamping by the mold clamping cylinder, realizes uniform distribution of the mold clamping force.
- Since the guide on the backmost part of the clamping mechanism and the guide of the movable platen maintain the mold open/close operation over a long span, excellent straightness can be demonstrated.
- There is no application of excessive clamping force, or effect from the distortion of the tie bars, because the movable platen does not move through the tie bars.

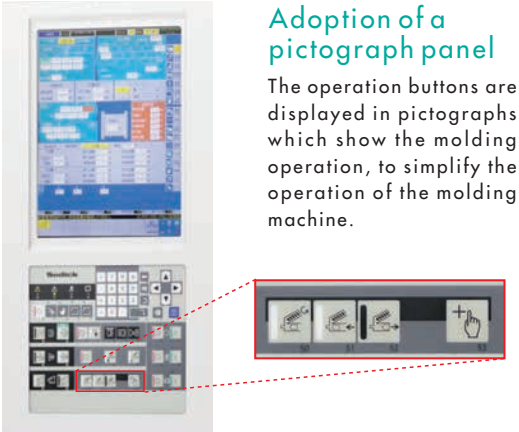
Operation System

Operating System

Operability which improves productivity "In-house Developed IMC7 Controller"

15 inch operation screen with improved visibility

Operation panel



Adoption of a pictograph panel

The operation buttons are displayed in pictographs which show the molding operation, to simplify the operation of the molding machine.

New screen

New mold setting screen

Three setting screens for injection, mold open/close, and temperature were integrated into one screen.
The basic settings of a molding machine can be performed in one screen.

Features of IMC7 Controller

50μ sec — Injection performance: 50μsecond

Troubleshooting function: Displays trouble location

Analysis support: Saves past operation history

Image saving feature: Saves an image of the screen and molding conditions

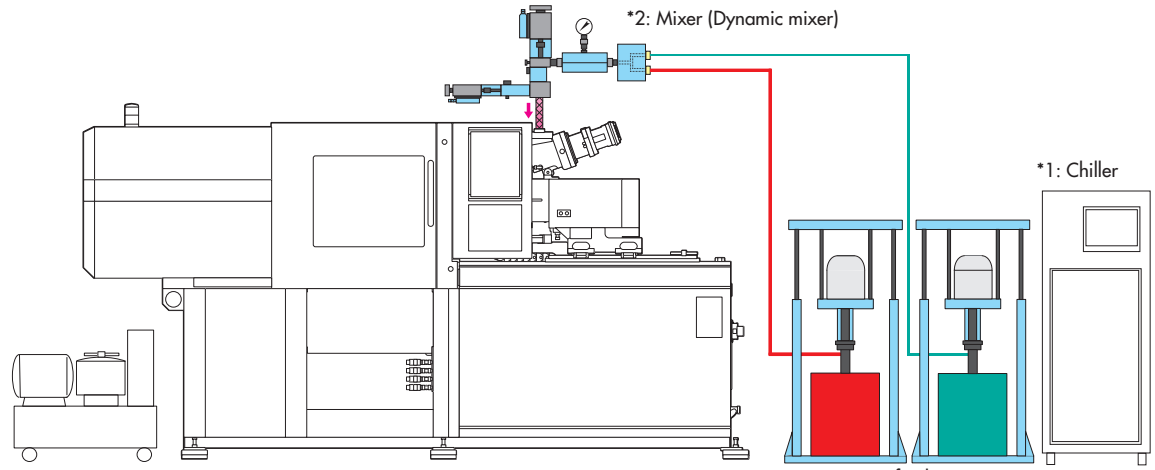
Maintenance support: Notification of maintenance period

5-language support: Japanese, English, Chinese (2 Dialects), Korean

USB memory version upgrade: Mounts USB ports

Configuration of LIM System

The basic configuration of the LIM system combines a pressure feed pump unit and a mixer (dynamic mixer), and supplies thermosetting resin which is completely mixed with two or more liquid materials to the injection unit.
Also contact Sodick for peripheral equipment, such as the chiller which controls the temperatures of the injection unit and mold, and a vacuum pump for vacuuming the mold.



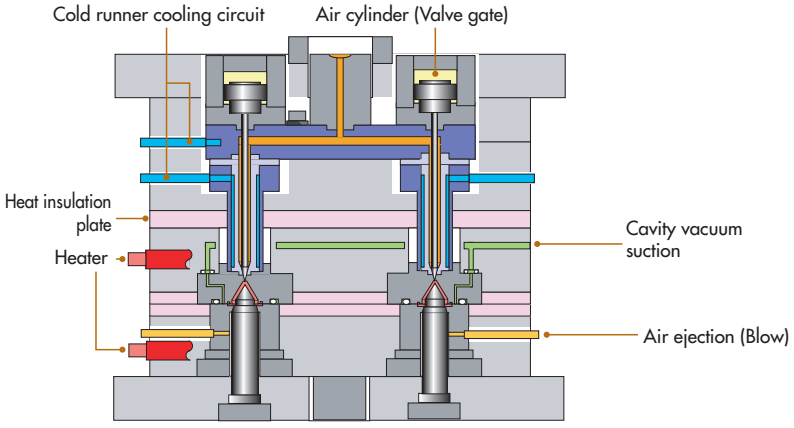
*1: Customer prepared equipment *2: Optional equipment

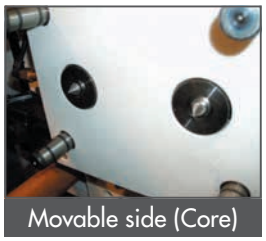
LIM Mold

Features of LIM Mold

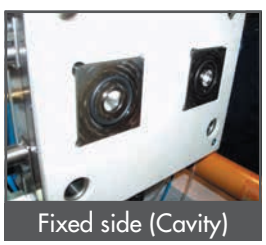
- Advanced packing function which prevents leakage of liquid resin
- Cold runner cooling circuit to prevent hardening in the core side mold
- Heater for hardening in the cavity side mold
- Heat insulation plates between the core side and cavity side
- Air-blow for ejection

Product
(Medical application check valve)





Movable side (Core)



Fixed side (Cavity)

GUM Specification

Millable Type Silicone Rubber Molding

This is a GUM specification machine equipped with a "stuffer BOX" which pushes in the millable silicone rubber. Injection molding process with high productivity can be realized with high quality millable silicone rubber that requires high injection pressure.


Stuffer BOX

Features

- The millable silicone rubber is a heat-curable high viscous material blended with a curing agent (hardening agent), and is also called heat cured rubber (HCR).
  The material is composed of silicone having an intermediate structure between inorganic-organic, and has excellent features, such as high heat resistance, excellent low temperature resistance, high insulating properties, and high fire retardancy, etc. The needs of this material are expanding for water tight and airtight sealing materials used for gaskets and O-rings particularly, parts for medical equipment utilizing it's compatibility with the human body.
- Sodick's V-LINE® Injection Molding Machine enables high injection pressure by a hydraulic injection unit that is ideal for the molding of millable silicone rubber, which is a high viscous material of 4,000 Pa-s or more.
  Unlike an in-line machine, there is no shearing effect by the check ring in the V-LINE® injection unit, and does not generate scorching (premature curing). Since there is also no check valve which is adopted in other plunger units, there is no stagnation of the silicone rubber, and contamination can be suppressed.

Example of Molding Material


Millable
silicone rubber

Material dimensions	
Diameter:	ϕ 100 to 130 mm
Length:	200 to 230 mm

Example of Molding Process


O-ring


Catheter balloons

Specification List

Horizontal Type

		GL Series				
		GL30-LS	GL30-LSR	GL60-LSR	GL100-LSR	GL150-LSR
Clamping Unit						
Mold open / close system		AC servo motor control				
Clamping system		Direct pressure locking type				
Max. clamping force	kN	294[392]*	294[392]*	588	980	1472
Tie-bar interval	mm	310 x 310	310 x 310	360 x 320	460 x 420	560 x 520
Platen dimension	mm	440 x 440	440 x 440	520 x 460	640 x 610	720 x 680
Open daylight (Min. Mold Thickness + Maximum stroke)	mm	550	550	650	800	900
Min./Max. mold thickness	mm	150 / 360	150 / 360	200 / 390	250 / 550	250 / 600
Mold open / close force	kN	6.8 / 13.6	6.8 / 13.6	9.9 / 19.8	9.9 / 19.8	14.2 / 28.5
Ejecting system		AC servo motor control				
Ejector ejecting force / Ejection retention force	kN	9.8 / 5.8	9.8 / 5.8	13.7 / 7.8	21.5 / 12.7	28.8/ 17.6
Ejector stroke	mm	50	50	80	100	120
Screw Injection Unit						
Compatible material viscosity (Guide)	Pa • s	1 to 100 (Low viscosity)	100 up (Medium, high viscosity)			
Screw/injection system		Feed screw & plunger system				
Injection drive system		Electric injection	Hydraulic injection			
Screw rotation specification		Electric	Hydraulic			
Screw diameter	mm	22	14 / 22	14 / 22 / 28	28	28 / 40
Plunger diameter	mm	16 / 22	12 / 16 / 22	12 / 16 / 22 / 28	28	28 / 40
Max. injection pressure	MPa	40 / 20	288 / 262 / 260	288 / 262 / 260 / 240	240	240 / 210
Theoretical injection volume	cm^3	14 / 27	4.5 / 14 / 27	4.5 / 14 / 27 / 83	83	83 / 251
Injection rate	cm^3/s	2 / 3.8	22 / 40 / 76	22 / 40 / 76 / 123	123	123 / 251
Plunger stroke	mm	70	40 / 70	40 / 70 / 135	135	135 / 200
Max. injection speed	mm/s	10	200	200	200	200
Max. screw revolution	rpm	100	200	200	200	200
Rated screw torque	N.m	6.22	59 / 147	59 / 147 / 235	235	235 / 411
No. of temperature display zones (Water temperature control)		2	2	2	2	2
Nozzle pressing force	kN	4.9	4.9	4.9 / 6.8 / 15.7	15.7	15.7 / 19.6
Unit traveling stroke	mm	280	220	320	400	365 / 365
Hydraulic Pressure / Air Pressure						
For hydraulic pump motor capacity	kW	3.0	3.0	3.0 / 4.4	4.4	4.4 / 6.0
Hydraulic circuit pressure	MPa	15	15	15	15	15
Tank capacity	ℓ	68	68	68 / 90	90	90
Motor capacity for AC servo	kW	3.1	2.9	2.9 / 4.2	4.2	6.4
Machine Dimension / Weight						
Machine Dimension (L x W x H)	mm	3150 × 1064 × 1679	3150 × 1064 × 1679	3685 × 1136 × 1679	4030 × 1227 × 1792	4400 × 1378 × 1878
Machine weight	kg	2000	2000	2700 / 2800	3100	5000 / 5100

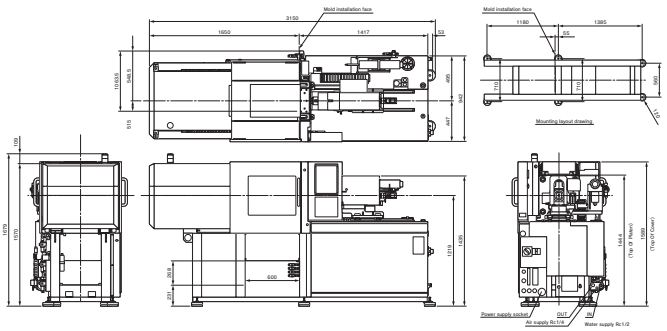
*: Mold clamping force [392kN] is an optional specification.

Vertical Type

		EHV Series		VRE Series	
		LS40EHV	LS75EHV	LS40VRE	LS75VRE
Clamping Unit					
Mold open / close system		AC servo motor control		Hydraulic cylinder	
Clamping system		Mold downward direct pressure		Direct pressure locking type	
Max. clamping force	kN	392	735	392	735
Tie-bar interval	mm	360 x 360	450 x 450	-	-
Platen dimension	mm	520 x 520	670 x 670	-	-
Max. mold size	mm	-		300 x 300	400 x 400
Max. mold weight	kg	-			Lower mold 400kg x 2 sides
Turntable dimensions	mm	-		1016	1200
Open daylight (Min. Mold Thickness + Maximum stroke)	mm	500	550	400	500
Minimum mold thickness	mm	250	250	200	250
Mold open / close force	kN	12.0 / 24.0	17.6 / 35.1	(close) 17.3 / (open) 37.7	(close) 29.4 / (open) 49.0
Turntable drive system		-		Electric servo motor	
Ejecting system		AC servo motor control			
Ejector ejecting force / Ejection retention force	kN	8.2 / 4.9	21.5 / 12.7	13.2 / 7.8	21.5 / 12.7
Ejector stroke	mm	40	60	60	60
Screw Injection Unit					
Compatible material viscosity (Guide)	Pa・s	100 up (Medium, high viscosity)			
Screw/injection system		Feed screw & plunger system			
Injection drive system		Hydraulic injection			
Screw rotation specification		Hydraulic			
Screw diameter	mm	14 / 22 / 28	28	14 / 22 / 28	28
Plunger diameter	mm	16 / 22 / 28	28 / 32	16 / 22 / 28	28 / 32
Max. injection pressure	MPa	262 / 256 / 252	252 / 234	262 / 256 / 252	252 / 234
Theoretical injection volume	cm^3	14 / 27 / 83	83 / 108	14 / 27 / 83	83 / 108
Injection rate	cm^3/s	40 / 76 / 123	123 / 160	40 / 76 / 123	123 / 160
Plunger stroke	mm	70 / 135	135	70 / 135	135
Max. injection speed	mm/s	200	200	200	200
Max. screw revolution	rpm	200	200	200	200
Rated screw torque	N.m	105 / 186 / 245	235	105 / 186 / 245	235
No. of temperature display zones (Water temperature control)		2	2	2	2
Nozzle pressing force	kN	9.0	17.6	9.0	17.6
Unit traveling stroke	mm	255	255	255	300
Hydraulic Pressure / Air Pressure					
For hydraulic pump motor capacity	kW	11.0	11.0	11.0	6.0
Hydraulic circuit pressure	MPa	MAX. 18.5	MAX. 18.5	MAX. 18.5	MAX. 20.7
Tank capacity	ℓ	90.2	130.0	64.0	100.0
Motor capacity for AC servo	kW	3.9	5.6	7.2	7.2
Machine Dimension / Weight					
Machine Dimension (L x W x H)	mm	1934 × 1727 × 3175	2138 × 1811 × 3672	2432 × 1581 × 2750	2432 × 1581 × 2900 / 2934 × 1446 × 3244
Machine weight	kg	3000 / 3200	4800	3300	3500 / 5000

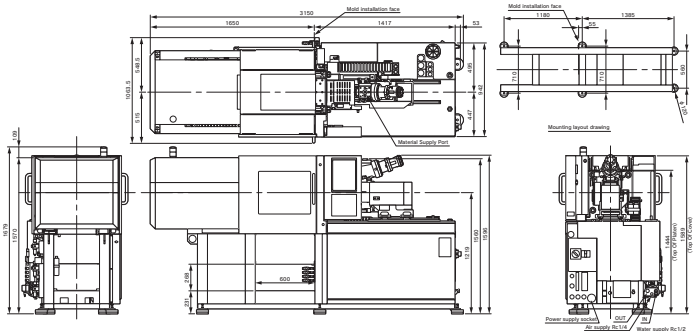
Machine Dimensions & Installation Drawings

GL30-LS



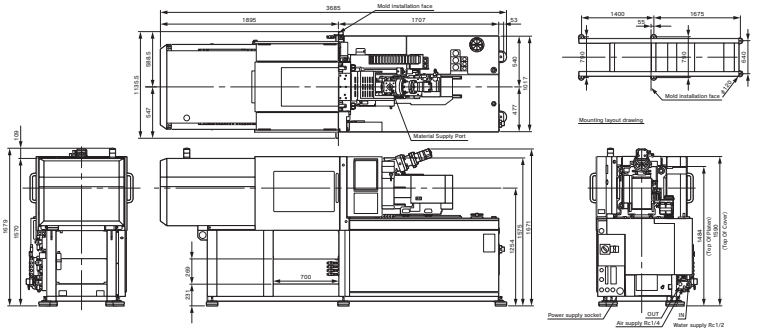
Unit: mm

GL30-LSR



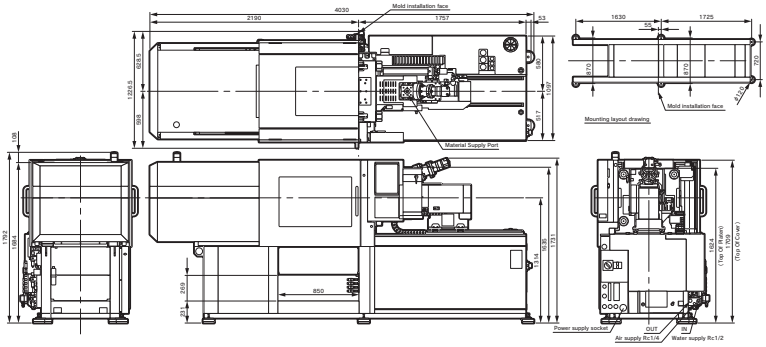
Unit: mm

GL60-LSR



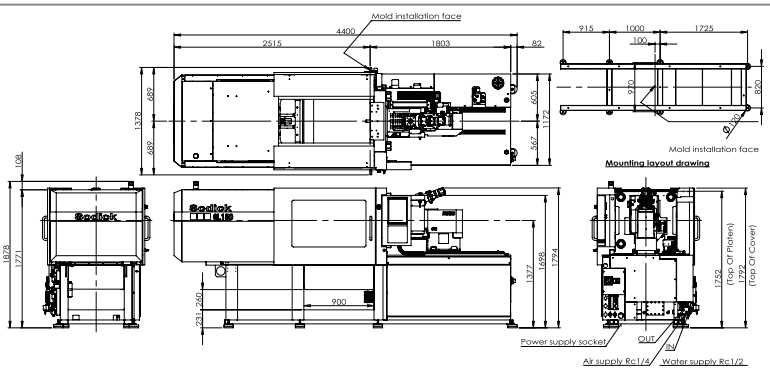
Unit: mm

GL100-LSR



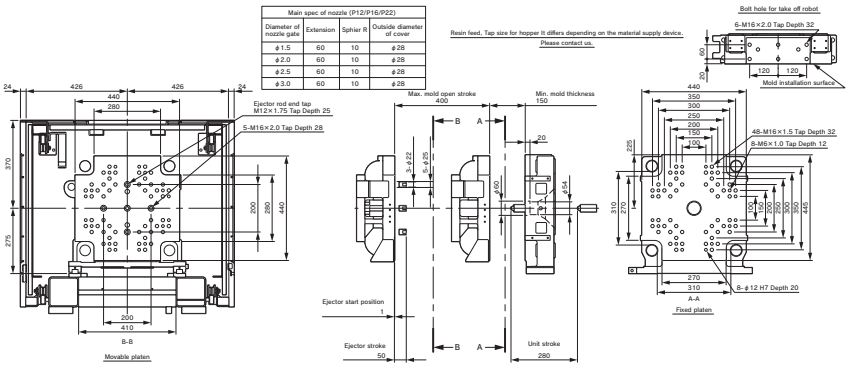
Unit: mm

GL150-LSR



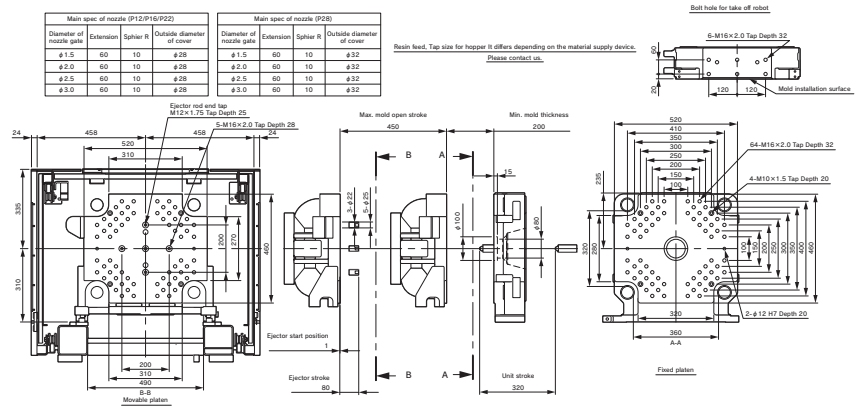
Unit: mm

GL30-LS, GL30-LSR



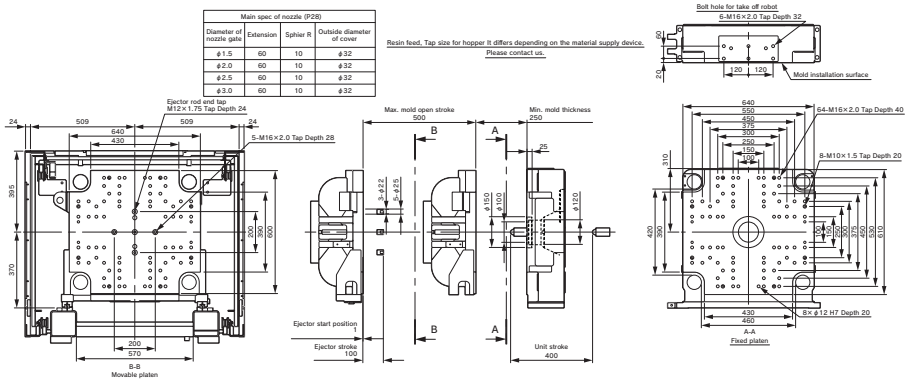
Unit: mm

GL60-LSR



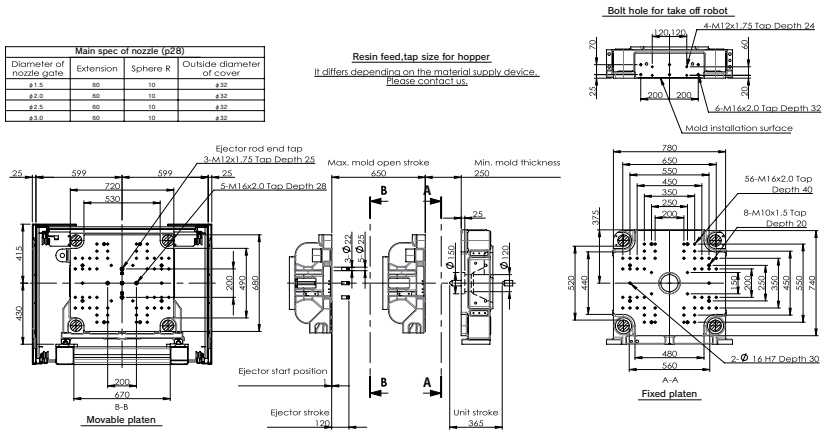
Unit: mm

GL100-LSR



Unit: mm

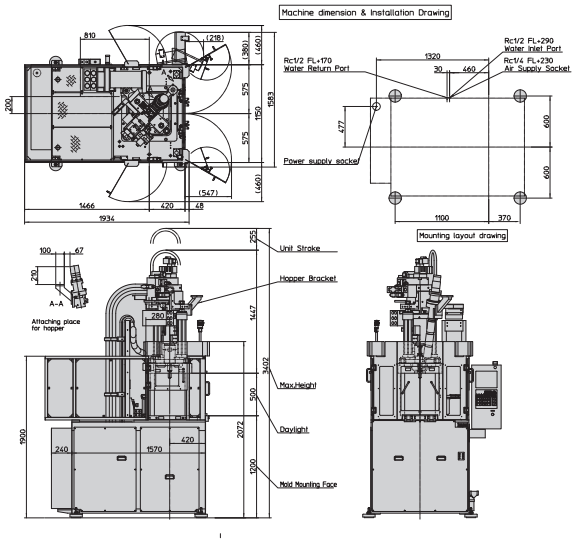
GL150-LSR



Unit: mm

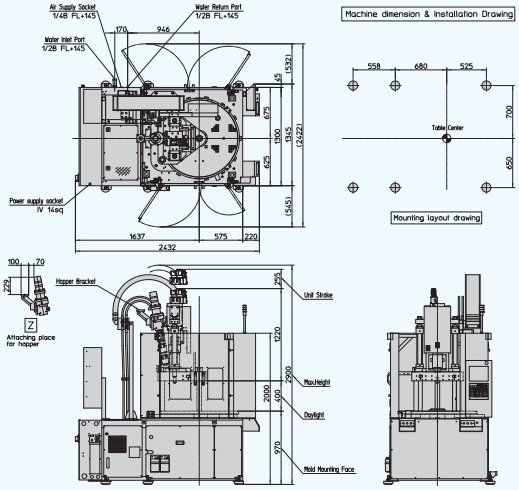
Machine Dimensions & Installation Drawings

LS40EHV



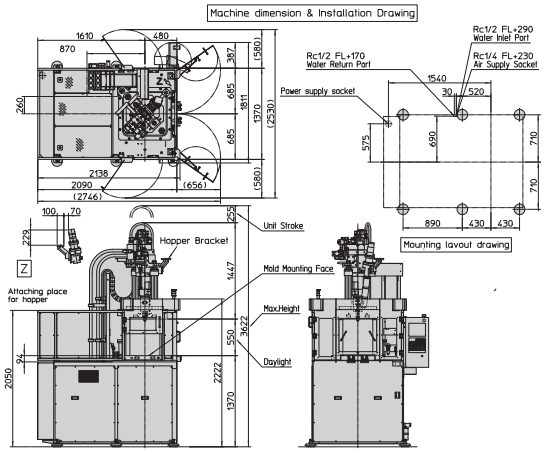
Unit: mm

LS40VRE



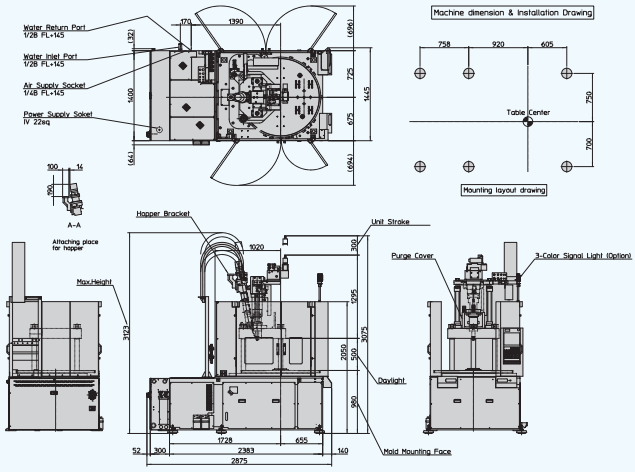
Unit: mm

LS75EHV



Unit: mm

LS75VRE



Unit: mm

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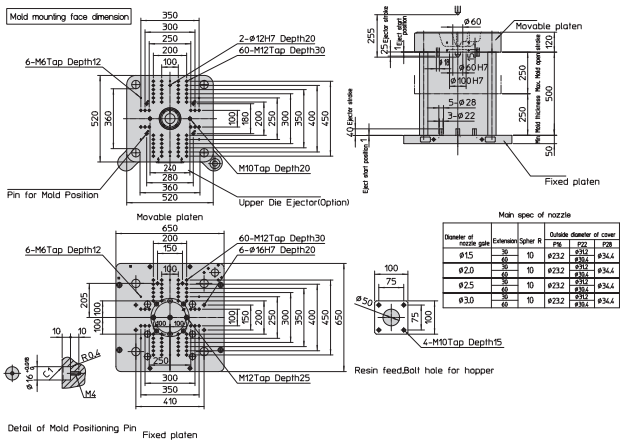

Unit: mm

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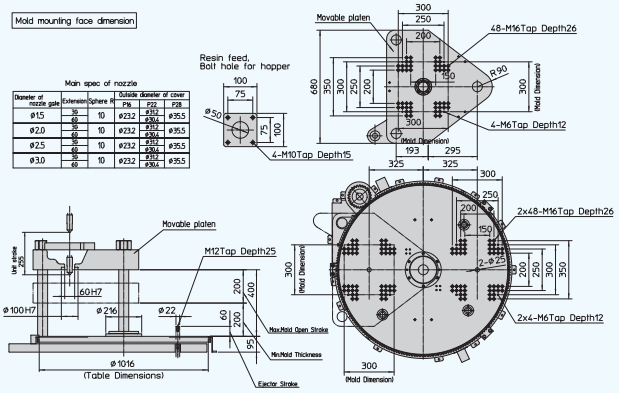

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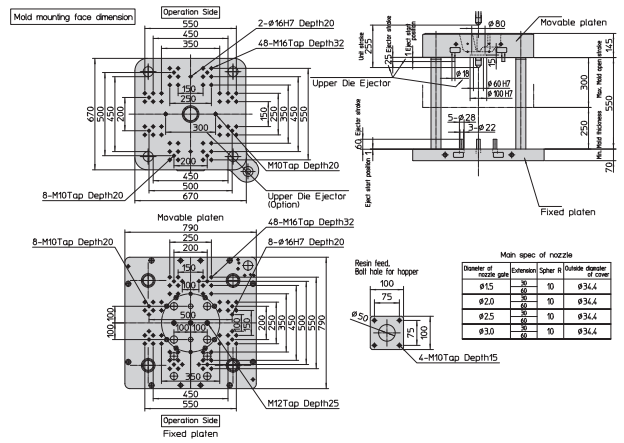
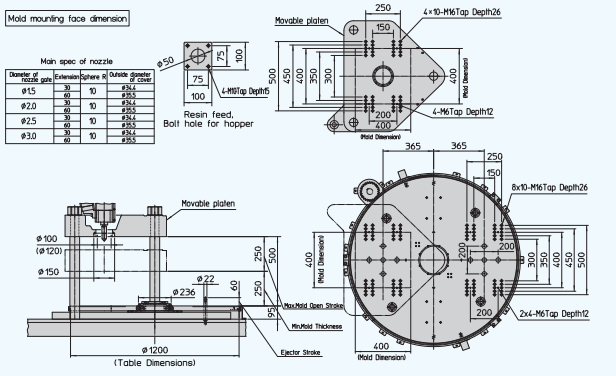


Unit: mm

LS75VRE



Unit: mm

LIM & HCR Injection Molding Machine

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