

# LIMS<sup>®</sup>

## Liquid Injection Molding System





# A molding system for the modern age.

# LIMS

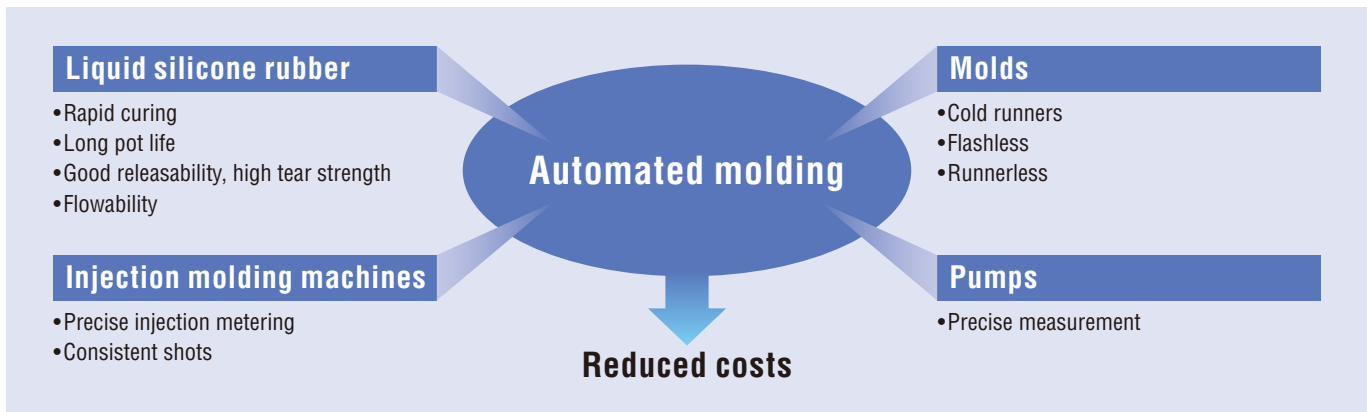
Liquid Injection Molding System



With LIMS, users can achieve significant cost reductions thanks to reduced molding time, improved yield and greater production efficiency.

LIMS (Liquid Injection Molding System) is a new type of molding system. Fine liquid silicone rubber is metered precisely and consistently by special molding equipment. After loading the two liquid components (A & B) into the molding machine, all steps proceed automatically, from mixing to molding. The molding process is simpler and takes less time, making it easy to produce high quality molded products. And the many fine properties of liquid silicone rubbers make this system ideal for electronic, automotive and food product applications, to name but a few. LIMS is highly economical, because it helps improve productivity and reduce labor costs. In addition, there is Self-adhesive Liquid Silicone which bonds well to a variety of metals or thermo plastics without primers. The short cycle times required for molding this Silicone, coupled with the ease with which the molding processes may be automated, leads to improved quality and productivity.

- Excellent material properties**  
 These silicones have excellent heat resistance, high strength and flame retardancy. Some are electrical insulators, while others are conductors. Our transparent products can be used as is, or can be colored easily. Our silicone materials are ideal for a wide range of applications.
- Reduced molding time**  
 Addition-cure liquid silicone is used, so cure time is short. The molding process takes less time.
- Improved productivity**  
 The system uses liquid materials, so molding can be done at low injection pressures and it is suitable for molding high-precision components. The two liquid components are mixed precisely and contaminants are kept out, resulting in high quality molds and greater efficiency.
- Automated molding**  
 Can be used for flashless, runnerless molding. After curing, molded items eject easily, so the molding process can be automated. Continuous automated molding with short cycle times is also possible.
- More eco-friendly molding**  
 No by-products are produced in the curing reaction. Flashless, runnerless molding eliminates the need for disposal of waste material, so the manufacturing process is gentler to the environment.



## Overview

| Series                  | Feature   | Hardness Durometer A | Note (Regulatory)  |
|-------------------------|---|----------------------|--|
| <b>KE-1950 Series</b>   | For General Purpose, Low Viscosity  | 10 to 70             | FDA, BfR: 30 to 70★  |
| <b>KEG-2000 Series</b>  | For General Purpose, Fast Curing  | 20 to 80             | FDA, BfR: 30 to 80★<br>USP Class VI: 40 to 75★<br>ISO 10993: 20 to 80★<br>UL94HB listed: 20 to 75★ |
| <b>KEG-2001 Series</b>  | Very Fast Curing  | 40 to 70             | FDA, BfR: 40 to 70★<br>USP Class VI: 40 to 70★<br>ISO 10993: 50 to 70★                             |
| <b>KEG-2002 Series</b>  | Low Viscosity   | 50, 60               | FDA, BfR: 50, 60★  |
| <b>KEG-2003H Series</b> | Non Post Cure,<br>Reduced Low-Molecular-Weight (LMW) Siloxane                       | 30 to 70             | FDA, BfR: 30 to 70★<br>USP Class VI: 30 to 70★<br>ISO 10993: 30 to 70★                             |
| <b>KE-2017</b>          | Non Post Cure, Oil Bleeding,<br>Reduced Low-Molecular-Weight (LMW) Siloxane         | 20                   | Especially for Automotive  |
| <b>KEG-2017 Series</b>  |   | 30 to 50             |  |
| <b>KE-2019 Series</b>   | Non Post Cure<br>Reduced Low-Molecular-Weight (LMW) Siloxane<br>Low Compression Set | 40 to 60             | Especially for Automotive  |
| <b>KE-2090 Series</b>   | Self-adhesive<br>For General Purpose  | 10 to 70             | USP Class VI: 30 to 70★<br>ISO 10993: 20, 40★  |
| <b>KE-2098 Series</b>   | Self-adhesive<br>For PA resins and Metals   | 40 to 60             | Universal for Plastic and Metal  |
| <b>KE-1935</b>          | High Transparency   | 55                   | For LED, Lens, etc   |
| <b>KE-2062 Series</b>   |   | 30 to 80             |  |

★ Hardness (Durmeter A)

| Product  | Appearance  | Hardness<br>Durometer A | Density<br>g/cm <sup>3</sup> | Viscosity (A/B)<br>Pa·s |  |
|--|-------------|-------------------------|------------------------------|-------------------------|--|
| <b>KE-1950 Series*<sup>1</sup> (For General Purpose, Low Viscosity)</b>    |             |                         |                              |                         |  |
| KE-1950-10-A/B   | Translucent | 13                      | 1.08                         | 60/60                   |  |
| KE-1950-20-A/B   | Translucent | 20                      | 1.10                         | 160/160                 |  |
| KE-1950-30-A/B   | Translucent | 31                      | 1.10                         | 250/250                 |  |
| KE-1950-35-A/B   | Translucent | 36                      | 1.13                         | 560/500                 |  |
| KE-1950-40-A/B   | Translucent | 39                      | 1.12                         | 530/530                 |  |
| KE-1950-50-A/B   | Translucent | 49                      | 1.13                         | 680/630                 |  |
| KE-1950-60-A/B   | Translucent | 57                      | 1.14                         | 730/690                 |  |
| KE-1950-70-A/B   | Translucent | 68                      | 1.13                         | 680/650                 |  |
| <b>KEG-2000 Series*<sup>2</sup> (For General Purpose, Fast Curing)</b>     |             |                         |                              |                         |  |
| KEG-2000-20-A/B  | Translucent | 23                      | 1.08                         | 700/700                 |  |
| KEG-2000-30-A/B  | Translucent | 32                      | 1.12                         | 1,200/1,200             |  |
| KEG-2000-40-A/B  | Translucent | 43                      | 1.12                         | 1,300/1,300             |  |
| KEG-2000-50-A/B  | Translucent | 51                      | 1.14                         | 1,400/1,400             |  |
| KEG-2000-60-A/B  | Translucent | 60                      | 1.14                         | 1,600/1,600             |  |
| KEG-2000-70-A/B  | Translucent | 70                      | 1.14                         | 1,400/1,400             |  |
| KEG-2000-75-A/B  | Translucent | 77                      | 1.15                         | 1,400/1,400             |  |
| KEG-2000-80-A/B  | Translucent | 81                      | 1.13                         | 1,120/1,080             |  |
| <b>KEG-2001 Series (Very Fast Curing)</b>                                  |             |                         |                              |                         |  |
| KEG-2001-40-A/B  | Translucent | 42                      | 1.12                         | 1,000/1,000             |  |
| KEG-2001-50-A/B  | Translucent | 52                      | 1.13                         | 1,000/1,000             |  |
| KEG-2001-60-A/B  | Translucent | 60                      | 1.13                         | 1,320/1,280             |  |
| KEG-2001-70-A/B  | Translucent | 70                      | 1.14                         | 1,200/1,200             |  |
| <b>KEG-2002 Series (Low Viscosity)</b>                                     |             |                         |                              |                         |  |
| KEG-2002-50-A/B  | Translucent | 51                      | 1.13                         | 700/700                 |  |
| KEG-2002-60-A/B  | Translucent | 59                      | 1.13                         | 500/500                 |  |
| <b>KEG-2003H Series*<sup>3</sup> (Non Post Cure, Reduced LMW Siloxane)</b> |             |                         |                              |                         |  |
| KEG-2003H-30-A/B   | Translucent | 31                      | 1.13                         | 740/690                 |  |
| KEG-2003H-40-A/B   | Translucent | 41                      | 1.13                         | 900/960                 |  |
| KEG-2003H-50-A/B   | Translucent | 51                      | 1.13                         | 1,030/1,000             |  |
| KEG-2003H-60-A/B   | Translucent | 60                      | 1.13                         | 750/700                 |  |
| KEG-2003H-70-A/B   | Translucent | 69                      | 1.14                         | 1,040/1,010             |  |

Curing condition: 150°C × 5 min + 200°C × 4 h Standard: JIS K 6249

\*1 Curing condition: 120°C × 5 min + 150°C × 1 h

\*2 Curing condition: 120°C × 10 min + 200°C × 4 h

\*3 Curing condition (Non post cure): 150°C × 5 min

\*4 Curing speed at 150°C

\*5 Curing condition: 150°C × 15 min + 150°C × 1 h Testing condition: 150°C × 22 h

\*6 Curing condition: 150°C × 15 min + 200°C × 4 h Testing condition: 175°C × 22 h

|  | Curing Speed at 130°C (MDR) sec |      | Linear Shrinkage<br>% | Tensile Strength |       | Elongation at break<br>% | Tear Strength |     | Compression Set<br>% |
|--|---------------------------------|------|-----------------------|------------------|-------|--------------------------|---------------|-----|----------------------|
|  | T10                             | T90  |                       | MPa              | psi   |                          | kN/m          | ppi |                      |
|  | 47*4                            | 99*4 | 2.3                   | 4.3              | 620   | 750                      | 10            | 58  | 12*5                 |
|  | 47*4                            | 98*4 | 2.3                   | 7.3              | 1,060 | 970                      | 24            | 139 | 15*5                 |
|  | 35*4                            | 44*4 | 2.3                   | 8.2              | 1,190 | 710                      | 22            | 128 | 22*5                 |
|  | 29*4                            | 38*4 | 2.2                   | 9.5              | 1,380 | 730                      | 28            | 162 | 36*5                 |
|  | 28*4                            | 42*4 | 2.2                   | 9.3              | 1,350 | 670                      | 31            | 180 | 20*5                 |
|  | 33*4                            | 55*4 | 2.2                   | 8.9              | 1,290 | 560                      | 37            | 215 | 28*5                 |
|  | 30*4                            | 53*4 | 2.2                   | 8.0              | 1,160 | 420                      | 39            | 226 | 22*5                 |
|  | 28*4                            | 45*4 | 2.2                   | 9.5              | 1,380 | 470                      | 39            | 226 | 34*5                 |
|  | 26                              | 42   | 2.4                   | 6.2              | 900   | 880                      | 15            | 87  | 28*6                 |
|  | 31                              | 53   | 2.3                   | 9.2              | 1,330 | 830                      | 28            | 162 | 14*6                 |
|  | 25                              | 45   | 2.3                   | 9.9              | 1,440 | 630                      | 34            | 197 | 17*6                 |
|  | 31                              | 64   | 2.2                   | 12.7             | 1,840 | 670                      | 38            | 220 | 11*6                 |
|  | 35                              | 76   | 2.1                   | 11.5             | 1,670 | 550                      | 48            | 220 | 20*6                 |
|  | 29                              | 61   | 2.1                   | 10.8             | 1,570 | 470                      | 34            | 197 | 18*6                 |
|  | 31                              | 66   | 2.1                   | 8.6              | 1,250 | 220                      | 5.5           | 32  | 25*6                 |
|  | 27*4                            | 40*4 | 2.2                   | 8.0              | 1,160 | 200                      | 5             | 29  | —                    |
|  | 22                              | 38   | 2.3                   | 11.0             | 1,600 | 630                      | 33            | 191 | —                    |
|  | 18                              | 35   | 2.2                   | 11.8             | 1,710 | 530                      | 40            | 232 | —                    |
|  | 21                              | 39   | 2.2                   | 9.2              | 1,330 | 550                      | 44            | 255 | —                    |
|  | 22*4                            | 40*4 | 2.1                   | 9.5              | 1,380 | 420                      | 40            | 232 | —                    |
|  | 27                              | 41   | 2.5                   | 10.0             | 1,450 | 520                      | 35            | 203 | —                    |
|  | 27                              | 40   | 2.5                   | 9.5              | 1,380 | 460                      | 43            | 249 | —                    |
|  | 23                              | 44   | 2.4                   | 9.3              | 1,348 | 900                      | 30            | 174 | —                    |
|  | 23                              | 45   | 2.4                   | 9.1              | 1,320 | 830                      | 36            | 209 | —                    |
|  | 21                              | 41   | 2.4                   | 10.6             | 1,537 | 790                      | 40            | 232 | —                    |
|  | 22                              | 43   | 2.4                   | 9.9              | 1,436 | 660                      | 46            | 267 | —                    |
|  | 30                              | 61   | 2.4                   | 9.1              | 1,320 | 490                      | 46            | 267 | —                    |

(Not specified values)

| Product   | Appearance  | Hardness<br>Durometer A | Density<br>g/cm <sup>3</sup> | Viscosity (A/B)<br>Pa·s |  |
|---|-------------|-------------------------|------------------------------|-------------------------|--|
| <b>KE-2017 (Non Post Cure, Oil Bleeding, Reduced LMW Siloxane)</b>                            |             |                         |                              |                         |  |
| KE-2017-20-A/B  | Translucent | 21                      | 1.09                         | 500/380                 |  |
| <b>KEG-2017 Series*<sup>1</sup> (Non Post Cure, Oil Bleeding, Reduced LMW Siloxane)</b>       |             |                         |                              |                         |  |
| KEG-2017-30-A/B   | Translucent | 33                      | 1.13                         | 1,840/1,450             |  |
| KEG-2017-40-A/B   | Translucent | 42                      | 1.13                         | 1,800/1,700             |  |
| KEG-2017-50-A/B   | Translucent | 52                      | 1.13                         | 1,700/1,500             |  |
| <b>KE-2019 Series*<sup>1</sup> (Non Post Cure, Reduced LMW Siloxane, Low Compression Set)</b> |             |                         |                              |                         |  |
| KE-2019-40-A/B  | Transparent | 42                      | 1.11                         | 320/300                 |  |
| KE-2019-50-A/B  | Transparent | 52                      | 1.13                         | 840/710                 |  |
| KE-2019-60-A/B  | Transparent | 62                      | 1.14                         | 720/810                 |  |
| <b>KE-2090 Series*<sup>2</sup> (Self-adhesive, for General Purpose)</b>                       |             |                         |                              |                         |  |
| KE-2090-10-A/B  | Translucent | 9                       | 1.06                         | 90/85                   |  |
| KE-2090-20-A/B  | Translucent | 21                      | 1.07                         | 250/250                 |  |
| KE-2090-30-A/B  | Translucent | 30                      | 1.11                         | 400/700                 |  |
| KE-2090-40-A/B  | Translucent | 40                      | 1.11                         | 300/700                 |  |
| KE-2090-50-A/B  | Translucent | 52                      | 1.12                         | 300/700                 |  |
| KE-2090-60-A/B  | Translucent | 59                      | 1.12                         | 400/700                 |  |
| KE-2090-70-A/B  | Translucent | 69                      | 1.13                         | 500/600                 |  |
| <b>KE-2098 Series*<sup>2</sup> (Self-adhesive, for PA resins and Metals)</b>                  |             |                         |                              |                         |  |
| KE-2098-40-A/B  | Translucent | 40                      | 1.14                         | 1,040/1,150             |  |
| KE-2098-50-A/B  | Translucent | 49                      | 1.14                         | 1,100/1,210             |  |
| KE-2098-60-A/B  | Translucent | 59                      | 1.14                         | 940/975                 |  |
| <b>KE-1935 (High Transparency)</b>  |             |                         |                              |                         |  |
| KE-1935-A/B* <sup>3</sup>   | Transparent | 55                      | 1.03                         | 88/41                   |  |
| <b>KE-2062 Series (High Transparency)</b>   |             |                         |                              |                         |  |
| KE-2062-30-A/B* <sup>4</sup>  | Transparent | 30                      | 1.02                         | 160/80                  |  |
| KE-2062-40-A/B* <sup>4</sup>  | Transparent | 40                      | 1.03                         | 166/90                  |  |
| KE-2062-50-A/B* <sup>4</sup>  | Transparent | 50                      | 1.03                         | 155/85                  |  |
| KE-2062-60-A/B* <sup>4</sup>  | Transparent | 59                      | 1.04                         | 159/69                  |  |
| KE-2062-70-A/B* <sup>4</sup>  | Transparent | 69                      | 1.05                         | 195/85                  |  |
| KE-2062-80-A/B* <sup>4</sup>  | Transparent | 78                      | 1.07                         | 187/75                  |  |

Standard: JIS K 6249

\*1 Curing condition (Non post cure): 150°C × 15 min

\*2 Curing condition (Non post cure): 120°C × 10 min

\*3 Curing condition: 120°C × 5 min + 150°C × 1 h

\*4 Curing condition: 120°C × 10 min + 150°C × 1 h

\*5 Curing speed at 150°C (ODR)

\*6 Curing speed at 120°C (ODR)

|  | Curing Speed at 130°C (MDR) sec |                   | Linear Shrinkage<br>% | Tensile Strength |       | Elongation at break<br>% | Tear Strength |     | Compression Set<br>150°C × 70 h % |
|--|---------------------------------|-------------------|-----------------------|------------------|-------|--------------------------|---------------|-----|-----------------------------------|
|  | T10                             | T90               |                       | MPa              | psi   |                          | kN/m          | ppi |                                   |
|  | 31                              | 83                | 2.6                   | 7.9              | 1,150 | 860                      | 10            | 58  | 14                                |
|  | 41                              | 77                | 2.5                   | 9.9              | 1,440 | 740                      | 20            | 116 | 16                                |
|  | 36                              | 76                | 2.5                   | 10.2             | 1,480 | 650                      | 33            | 191 | 18                                |
|  | 32                              | 75                | 2.5                   | 9.4              | 1,360 | 490                      | 38            | 220 | 18                                |
|  | 30                              | 73                | 2.4                   | 9.8              | 1,420 | 655                      | 35            | 203 | 12                                |
|  | 27                              | 69                | 2.3                   | 9.3              | 1,350 | 538                      | 44            | 255 | 16                                |
|  | 38                              | 65                | 2.3                   | 9.8              | 1,420 | 470                      | 47            | 273 | 42                                |
|  | 26* <sup>5</sup>                | 50* <sup>5</sup>  | 2.4                   | 3.4              | 490   | 870                      | 11            | 64  | —                                 |
|  | 22* <sup>5</sup>                | 68* <sup>5</sup>  | 2.6                   | 7.3              | 160   | 970                      | 18            | 104 | —                                 |
|  | 62* <sup>6</sup>                | 80* <sup>6</sup>  | 2.0                   | 9.5              | 1,380 | 800                      | 20            | 116 | —                                 |
|  | 85* <sup>6</sup>                | 105* <sup>6</sup> | 2.0                   | 9.0              | 1,310 | 650                      | 30            | 174 | —                                 |
|  | 70* <sup>6</sup>                | 100* <sup>6</sup> | 2.0                   | 8.3              | 1,200 | 450                      | 29            | 168 | —                                 |
|  | 94* <sup>6</sup>                | 154* <sup>6</sup> | 2.0                   | 7.5              | 1,090 | 320                      | 30            | 174 | —                                 |
|  | 72* <sup>6</sup>                | 110* <sup>6</sup> | 2.0                   | 7.8              | 1,130 | 250                      | 8             | 46  | —                                 |
|  | 25                              | 54                | —                     | 9.7              | —     | 650                      | 33            | —   | —                                 |
|  | 25                              | 46                | —                     | 9.6              | —     | 600                      | 47            | —   | —                                 |
|  | 23                              | 48                | —                     | 8.4              | —     | 410                      | 39            | —   | —                                 |
|  | 41                              | 96                | —                     | 5.3              | 769   | 400                      | 8             | 46  | —                                 |
|  | 25                              | 75                | 2.3                   | 3.5              | —     | 270                      | 4.5           | —   | —                                 |
|  | 28                              | 66                | 2.3                   | 6.5              | —     | 210                      | 3             | —   | —                                 |
|  | 30                              | 88                | 2.3                   | 7.0              | —     | 160                      | 5             | —   | —                                 |
|  | 32                              | 87                | 2.3                   | 9.0              | —     | 130                      | 5             | —   | —                                 |
|  | 32                              | 80                | 2.3                   | 9.6              | —     | 120                      | 6             | —   | —                                 |
|  | 34                              | 83                | 2.3                   | 11.0             | —     | 71                       | 6             | —   | —                                 |

(Not specified values)



## ■ Cure temperature

The standard temperature range for curing is between 130°C and 200°C, although the ideal temperature varies depending on the thickness and shape of the molded item. Generally speaking, molding can be done at temperatures from 90°C to 210°C.

## ■ Injection pressure

Best results are achieved at cure temperatures from 130°C to 200°C and pressures from 40 kg/cm<sup>2</sup> to 120 kg/cm<sup>2</sup>.

## ■ Cure time

At 150°C, cure time is under 10 seconds per 1-mm of thickness. This enables molding with very short cycle times.

## ■ Linear shrinkage

At temperatures between 100°C and 150°C, linear shrinkage is about 2%-3%.

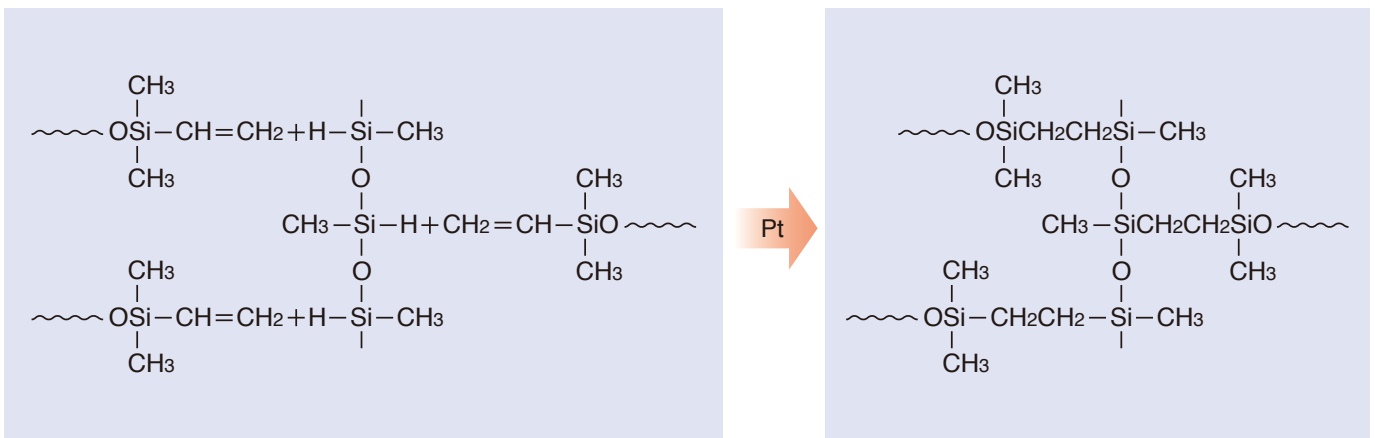
## ■ Pot life

The pot life of a given product after mixing components A and B is dependent on temperature. Ordinary products will retain a suitable viscosity (one that will not cause problems for molding) for 72 hours at room temperature (25°C). To extend the pot life, install a chiller to cool the mixing section.



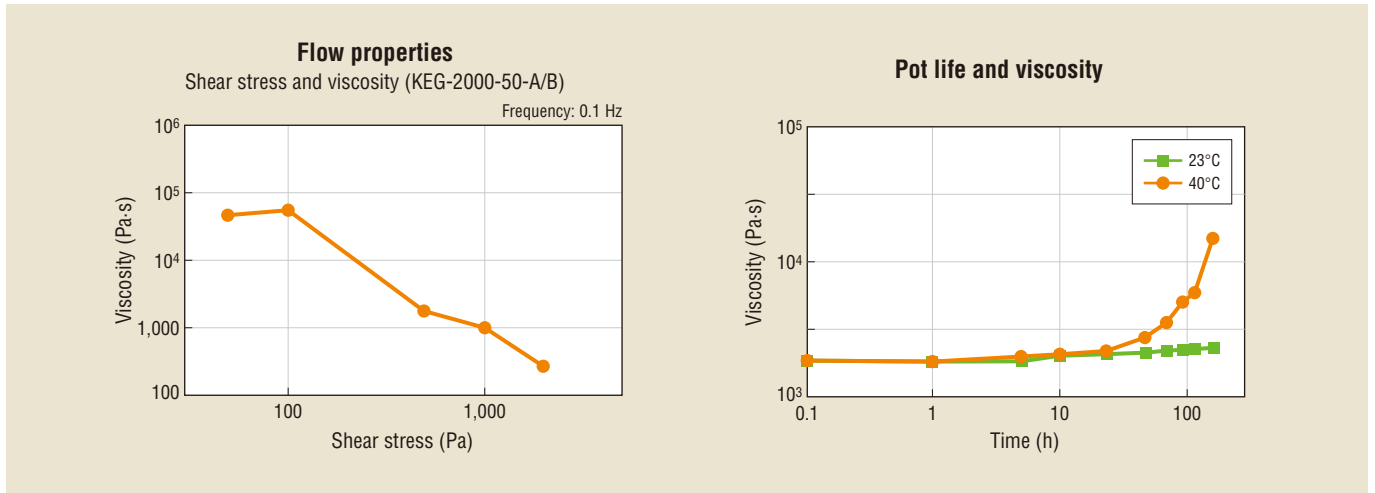
## ■ Curing mechanism

LIMS liquid silicone rubbers normally cure by addition reaction as shown below. Heating accelerates the reaction, and cure time decreases as the temperature increases.





## Flow properties and pot life of KEG-2000-50-A/B



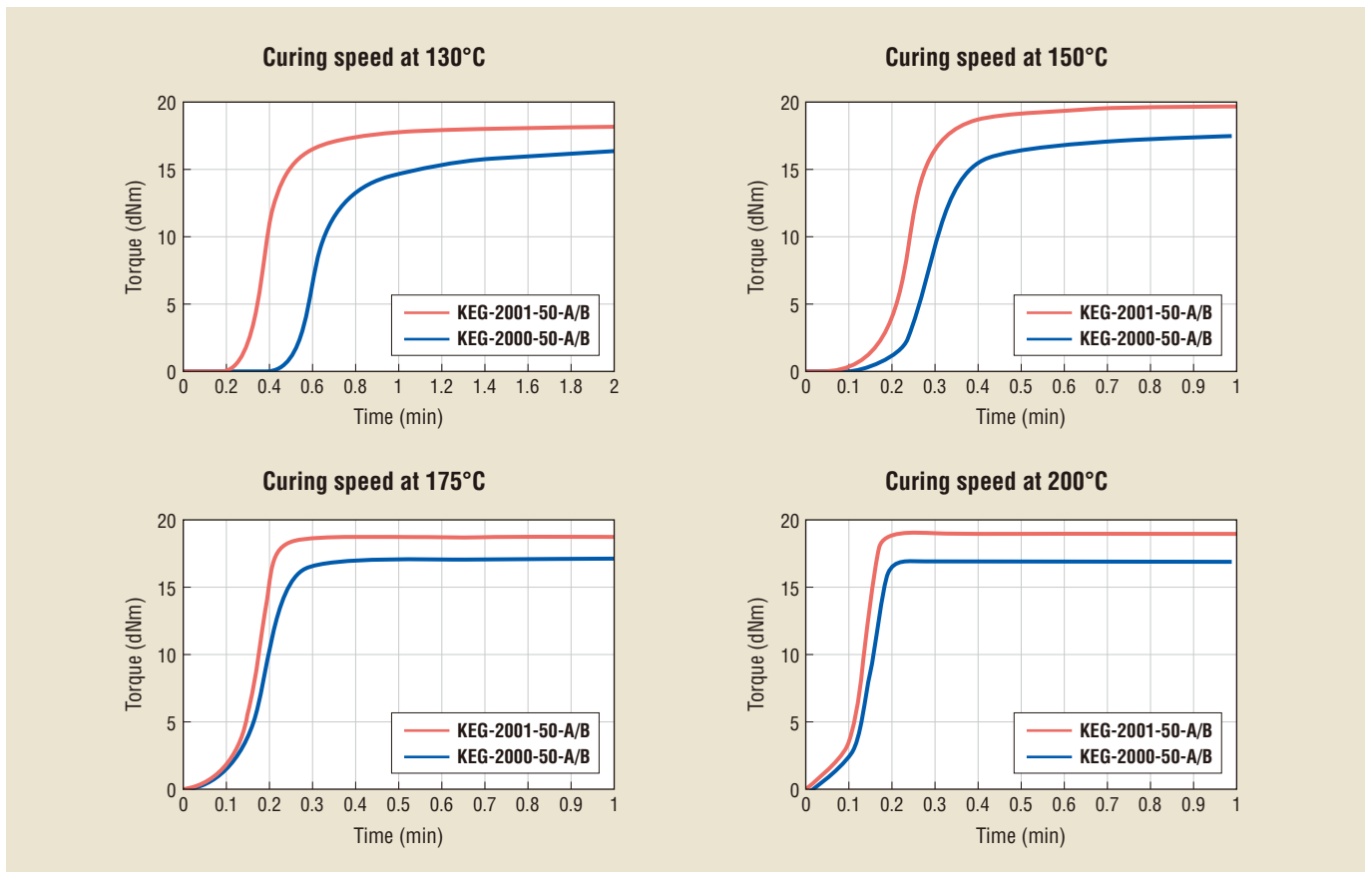
## Curing profile of KEG-2000-50-A/B and KEG-2001-50-A/B by means of MDR (Moving Die Rheometer)

KEG-2001-50-A/B is the fast curing version of KEG-2000-50-A/B.

(Unit: sec)

| Curing speed<br>Temperature | KEG-2000-50-A/B |     |     | KEG-2001-50-A/B |     |     |
|-----------------------------|-----------------|-----|-----|-----------------|-----|-----|
|                             | T10             | T50 | T90 | T10             | T50 | T90 |
| 110°C                       | 151             | 167 | 227 | 58              | 70  | 141 |
| 130°C                       | 31              | 38  | 64  | 18              | 23  | 35  |
| 150°C                       | 13              | 18  | 25  | 10              | 14  | 20  |
| 175°C                       | 8               | 11  | 15  | 7               | 10  | 13  |
| 200°C                       | 5               | 9   | 11  | 5               | 8   | 10  |

T10: How long it takes time until the cured torque has achieved to 10% of maximum torque. T50: Up to 50% of maximum torque. T90: Up to 90% of maximum torque.

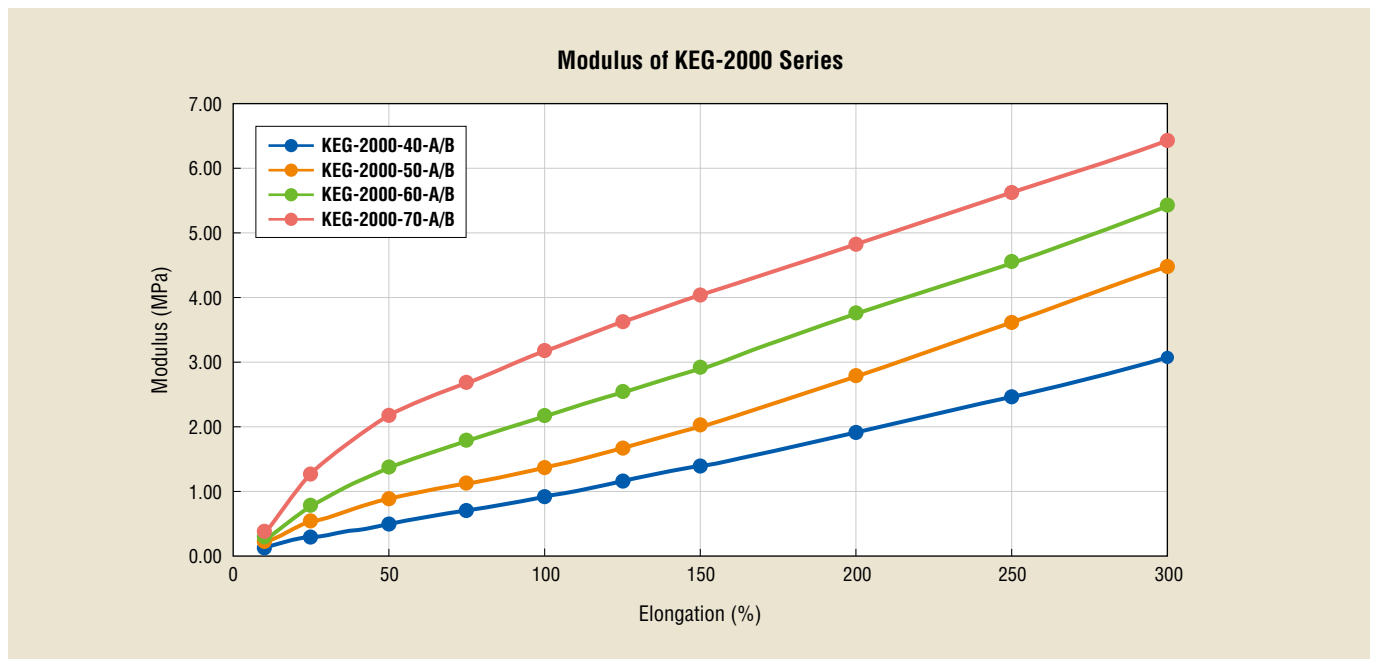


## Modulus of KEG-2000 Series

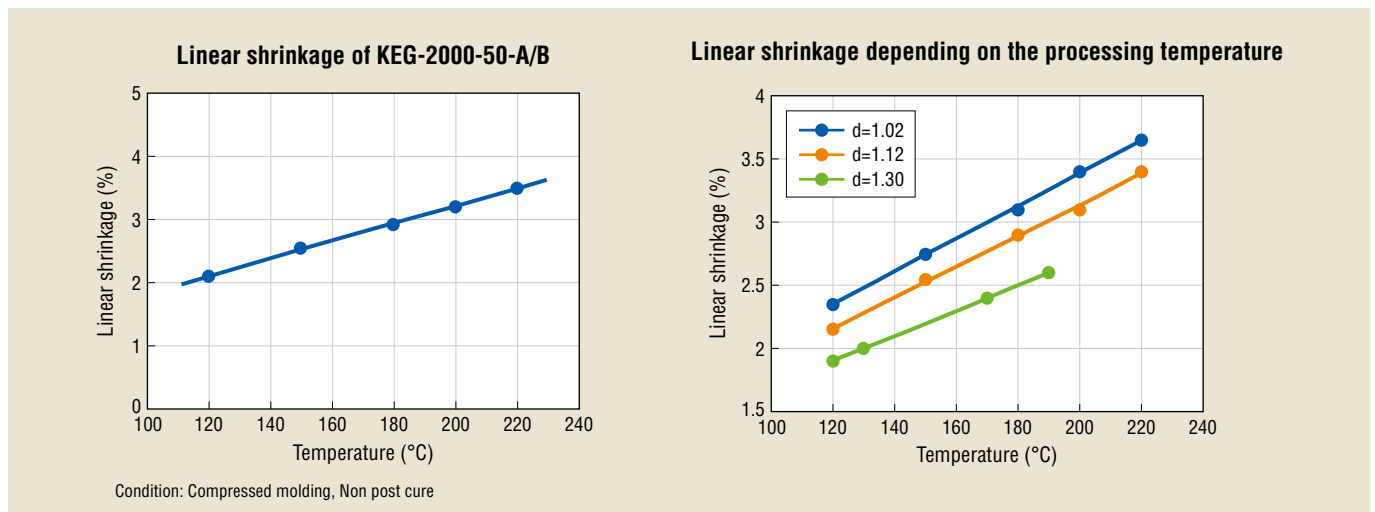
(Unit: MPa)

|      | KEG-2000-40-A/B | KEG-2000-50-A/B | KEG-2000-60-A/B | KEG-2000-70-A/B |
|------|-----------------|-----------------|-----------------|-----------------|
| 10%  | 0.15            | 0.22            | 0.23            | 0.35            |
| 25%  | 0.28            | 0.53            | 0.76            | 1.24            |
| 50%  | 0.49            | 0.85            | 1.36            | 2.14            |
| 75%  | 0.68            | 1.10            | 1.77            | 2.68            |
| 100% | 0.90            | 1.36            | 2.14            | 3.15            |
| 125% | 1.14            | 1.66            | 2.52            | 3.59            |
| 150% | 1.37            | 2.00            | 2.92            | 4.01            |
| 200% | 1.89            | 2.76            | 3.73            | 4.83            |
| 250% | 2.45            | 3.60            | 4.55            | 5.62            |
| 300% | 3.05            | 4.48            | 5.40            | 6.42            |

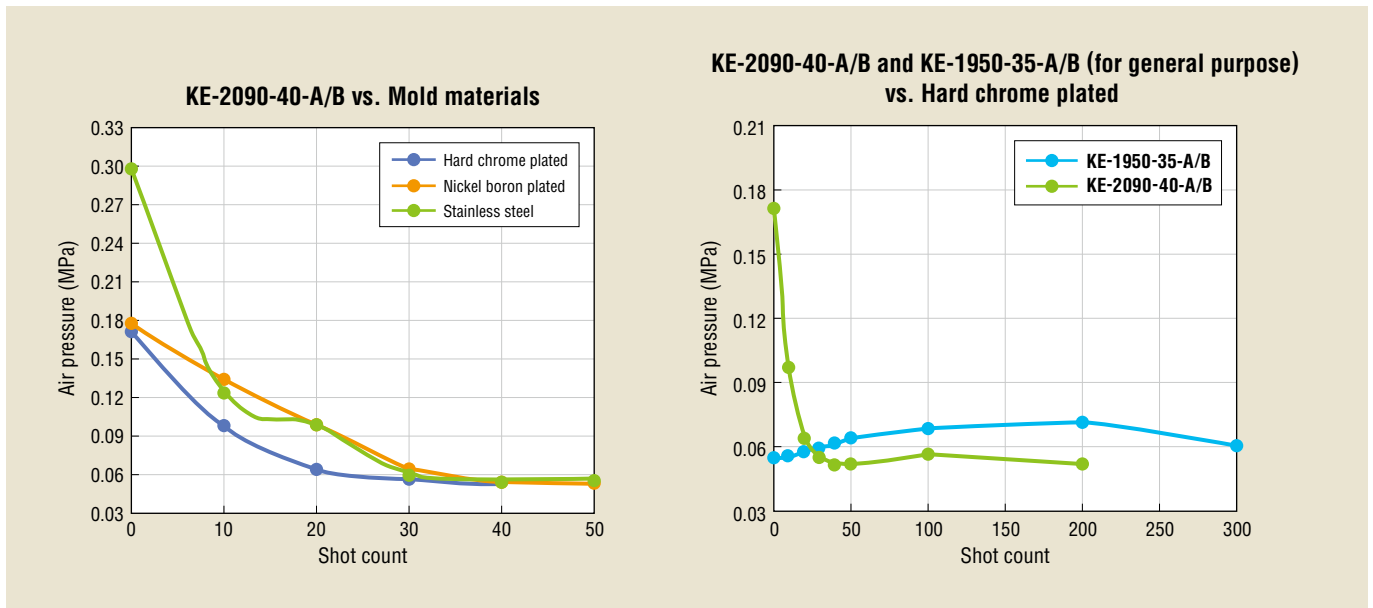
Curing condition: 120°C × 10 min + 150°C × 1 h



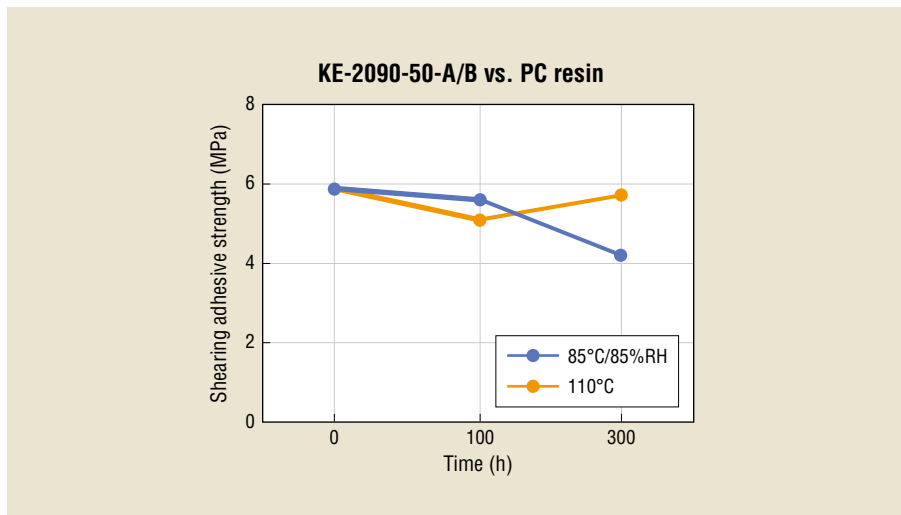
## Linear Shrinkage of KEG-2000 Series



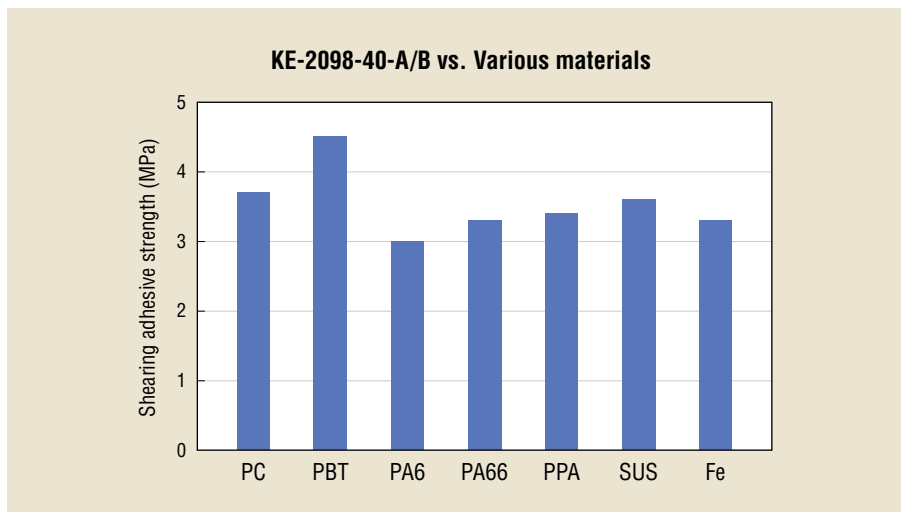
■ Differences in demolding force of KE-2090-40-A/B (Air pressure when ejecting piece from mold)



■ Differences in adhesive durability by temperature and humidity of KE-2090-50-A/B



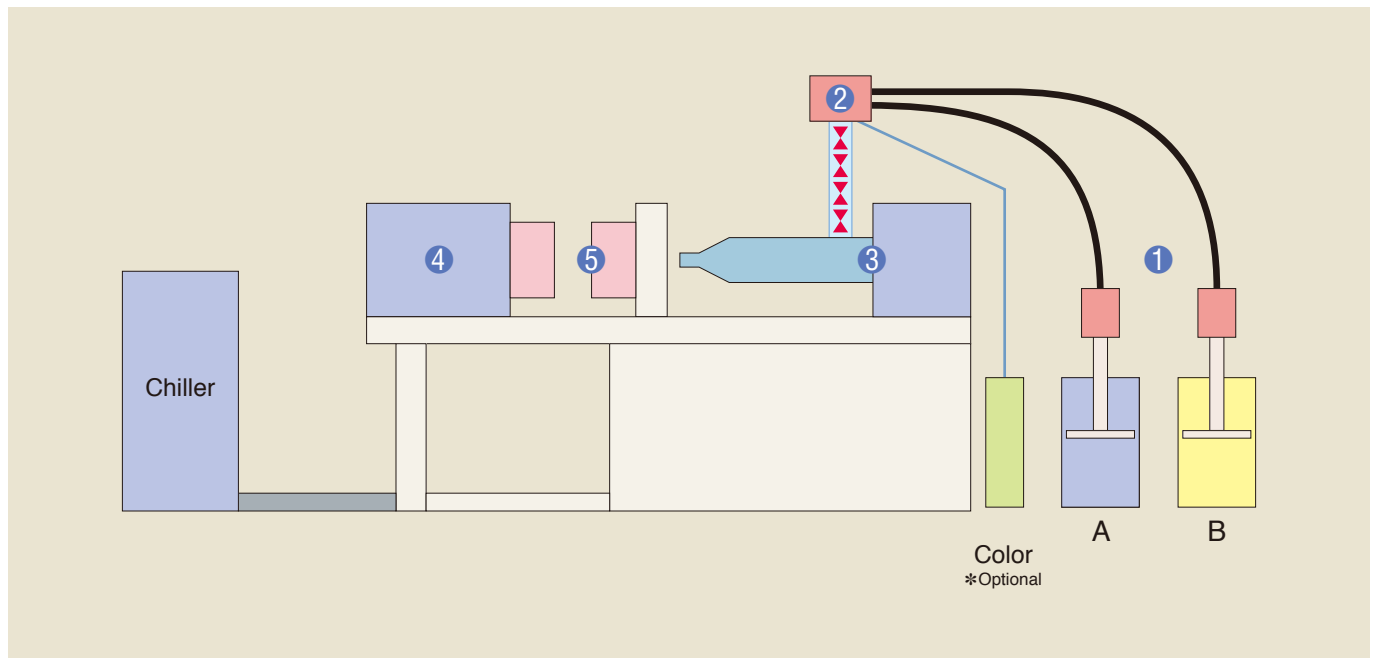
■ Shearing adhesive strength on various materials of KE-2098-40-A/B



## LIMS molding machines

LIMS materials consist of two viscous fluid components, with viscosities between 50 and 2,000 Pa·s at room temperature. Two components ("A" and "B") are mixed in a 100:100 ratio and the mixture quickly vulcanizes in a high temperature heated tool. LIMS molding requires an injection unit which can be cooled by water and a dosage system which feeds and mixes the material. Please contact a Shin-Etsu representative for more information about molding machines.

### Basic configuration of a LIMS molding machine



**1 Material supply unit**

This should pump both components in a 100:100 ratio into the mixing unit.

**2 Mixing unit**

Mixes two components homogeneously.

A static mixer is often utilized in order to avoid air entrainment.

\* Pigment line is joined here if coloring is necessary.

**3 Injection unit**

LIMS material is highly flowable, therefore LIMS molding can be done at low injection pressure.

The user sets the injection speed/pressure according to the volume or shape of the product.

This unit is water-cooled in order to retard reaction progress.

**4 Molding machine**

This controls clamping, opening, ejection, etc.

The operation is basically same as one for thermoplastics.

**5 Mold**

For LIMS molding, cold-runner system is becoming popular to minimize sprue and runner scrap that cannot be reused.

A typical mold



## ■ Points to consider when putting together a system

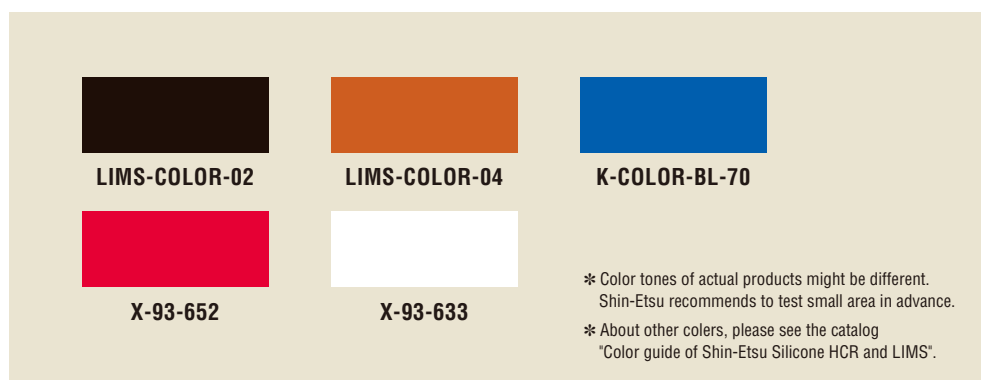
- The most important consideration when putting together a system is the material to be used for the seals. For example, for sliding and rotating parts, use nitrided steel or ceramic, avoid metal-on-metal contact, and use 1-3 Teflon-based gaskets.
  - Be careful to prevent leakage, because the liquid molding compound can easily seep into gaps.
  - The inorganic fillers contained in the molding compounds can cause increased wear on the mechanical components (mixing unit, mold). This should be considered when selecting materials for the components.
  - In designing the mechanisms "downstream" of the mixing unit (shut-off nozzle, mold clamping unit, mold, etc.), take care to avoid configurations that create spots where the molding compound can collect.
  - The molding compounds are compressible fluids, so be sure to adjust the timing so that the liquids flow into the mixing system simultaneously.
  - Be sure the mold configuration permits air bleeding.
- \* For more information, please talk to a Shin-Etsu representative.

## ■ Molding defects: causes and remedies

| Problem                                  | Cause  | Remedy   |
|--|--|--|
| Blistering                               | Insufficient cure                            | Increase curing time, increase temperature.                                    |
|  | Insufficient molding pressure                | Increase pressure.   |
|  | Air bubbles                                  | Thoroughly remove air from pails. Adjust injection rate.                       |
|  | Uneven heating                               | Adjust heating unit.   |
| Voids<br>Surface bubbles<br>Uneven color | Insufficient cure                            | Increase curing time.  |
|  | Insufficient air removal                     | Thoroughly remove air from pail.   |
|  | Trapped air                                  | Prevent introduction of air during injection.                                  |
|  | Mold temperature too high                    | Reduce mold temperature. Be aware of temperature distribution throughout mold. |
|  | Uneven mixing                                | Adjust injection rate. Check mixing unit.                                      |
| Weld marks                               | Improper mix ratio and uneven mixing         | Adjust mix ratio. Adjust injection rate.                                       |
|  | Improper molding pressure                    | Increase pressure. Reduce temperature.   |
|  | Injection time too long                      | Reduce injection time.   |
|  | Insufficient air-bleed at the fused sections | Make an air bleed.   |
|  | Unbalanced gates                             | Balance the gates.   |
| Poor gloss                               | Insufficient cure                            | Increase curing time. Raise mold temperature.                                  |
|  | Roughness of the mold surface                | Polish and use hard chrome plating. Use weaker release agent.                  |
| Poor mold release                        | Improper curing conditions                   | Increase curing time.  |
|  | Poor mold surface                            | Repair mold.   |
|  | Uneven surface temperature distribution      | Consider changing heating method.  |
| Nozzle leaks                             | Worn or damaged nozzle                       | Inspect shut-off nozzle.   |
| Poor cure                                | Curing inhibition                            | Eliminate curing inhibitors.   |
|  | Mix ratio                                    | Check mixing system.   |

## Coloring agents

As silicone rubber materials have good transparency, materials can be easily pigmented and bright-colored articles can be produced.



## Primers

### General-purpose primer

#### PRIMER-NO.4

This is a general-purpose, quick-drying primer. Easy to use due to its low viscosity.

#### Instructions for use

- Apply by dipping, spray on, or apply by brush, etc.
- Allow primer to dry for 15 minutes at room temperature.
- As a general rule, mold should be used within 24 hours after primer application.

#### General properties

| Grade                           | PRIMER-NO.4           |         |
|---------------------------------|-----------------------|---------|
| Appearance                      | Colorless transparent |         |
| Viscosity                       | mm <sup>2</sup> /s    | 0.2-1.0 |
| Specific gravity                | 0.77-0.78             |         |
| Active ingredient               | %                     | 20      |
| Solvent                         | n-Heptane             |         |
| Usable time (after application) | h                     | 24      |
| Drying conditions               | Air dry min           | 15      |

UN Classification: Flammable Liquids, UN No: 1133

(Not specified values)

### For plastics

#### X-33-156-20

This primer is designed for plastic molds. It can be air-dried or baked on.

#### Instructions for use

- Apply by dipping, spray on, or apply by brush, etc.
- When using an air-dry method, allow primer to dry for 30 minutes at room temperature. If the situation permits, after air drying, bake on at 80-120°C for 10-20 minutes to ensure more consistent adhesion.
- As a general rule, mold should be used within 24 hours after primer application.
- After use, seal container tightly and store in a cool, dark place.
- Contains n-heptane (solvent). Handle with caution.

#### General properties

| Grade                           | X-33-156-20        |         |
|---------------------------------|--------------------|---------|
| Appearance                      | Pale yellow        |         |
| Viscosity                       | mm <sup>2</sup> /s | 0.2-1.0 |
| Specific gravity                | 0.70-0.72          |         |
| Active ingredient               | %                  | 3-5     |
| Usable time (after application) | h                  | 24      |

UN Classification: Flammable Liquids, UN No: 1133

(Not specified values)

## Handling Precautions

### ■ Handling precautions

1. Seal container tightly and store in a cool, dark place (25°C or below, out of direct sunlight) with good ventilation. Keep away from heat and flame because the primers used may be classified as flammable hazardous materials.
2. LIMS liquid silicone rubbers may not cure properly if they come in contact with certain substances, including amines, sulfur, organophosphorus compounds and organotin compounds. If there is a possibility of curing inhibition, the user should perform a test to determine whether the product will cure properly.

#### Some curing inhibitors

- Chloroprene and other synthetic rubbers
  - Sulfur compounds
  - Soft PVC
  - Amine-cure epoxies
  - PVC insulating tape
  - Soldering flux that contains rosin
3. Mixing Liquid B with alkaline substances produces flammable hydrogen gas, so handle with caution.

### ■ Cautions in using self-adhesive liquid silicone

1. Even among the same resin materials, some materials are not suited to addition reactions of silicone rubbers or cannot sufficiently exert adhesion depending on their method of polymerization, degree of refining and types of additive and resin. When designing, check the resin to be used in advance.
2. In the situations where the resin surface is dirty, clean the surface with a solvent or similar.
3. As for polyamide resin, it is recommended to dry the resin before molding since it has high water absorption properties. Moreover, attention must be paid to the molding procedure and conditions in the situations where heat treatment and humidity conditioning are performed to acquire dimensional stability.
4. The release properties may vary depending on the mold material and condition of the surface (plating), so be sure to test prior to use.

## Packaging

All products are supplied in 20 L pails (Net Wt. 20 kg\*) or 200 L drums (Net Wt. 200 kg).

\* KE-1950-10-A/B and KE-1950-20-A/B are supplied in 20 L pails (Net Wt. 18 kg).

## Hazardous Materials Classification

All products are NOT classified as UN Hazardous Materials.

### ■ Safety and hygiene

1. When handling the products, take care to avoid contact with the skin and mucous membranes by wearing protective glasses and protective gloves. In case of skin contact, immediately wipe off with dry cloth and then flush thoroughly with running water. In case of accidental eye contact, flush immediately with plenty of clean water for at least 15 minutes and then seek medical attention. Contact lens wearers must take special care. If the products get into the eye, the contact lens may become stuck to the eye.
2. In the small place with poor ventilation, please wear a protective mask. And it is recommended to install a local exhaust ventilation system. If you become uncomfortable with inspiring the vapors, move to an area with fresh air immediately.
3. Keep out of the reach of children.
4. Please read the Safety Data Sheets (SDS) before use. SDS can be obtained from our sales department.
5. If these LIMS materials are to be used to manufacture items that will be used in contact with food, be sure to determine whether the materials meet relevant food sanitation laws.



### Silicone Division Sales and Marketing Department Ⅲ

Marunouchi Eiraku Bldg., 4-1, Marunouchi 1-chome, Chiyoda-ku, Tokyo 100-0005, Japan  
 Phone : +81-(0)3-6812-2408 Fax : +81-(0)3-6812-2415

#### Shin-Etsu Silicones of America, Inc.

1150 Damar Drive, Akron, OH 44305, U.S.A.  
 Phone : +1-330-630-9860 Fax : +1-330-630-9855

#### Shin-Etsu do Brasil Representação de Produtos Químicos Ltda.

Rua Coronel Oscar Porto, 736 - 8º Andar - Sala 84,  
 Paraíso São Paulo - SP Brasil CEP: 04003-003  
 Phone : +55-11-3939-0690 Fax : +55-11-3052-3904

#### Shin-Etsu Silicones Europe B.V.

Bolderweg 32, 1332 AV, Almere, The Netherlands  
 Phone : +31-(0)36-5493170 Fax : +31-(0)36-5326459  
 (Products & Services: Products for Cosmetics Application)

#### Germany Branch

Rheingastrasse 190-196, 65203 Wiesbaden, Germany  
 Phone : +49-(0)611-962-5366 Fax : +49-(0)611-962-9266  
 (Products & Services: Products for Industrial Applications)

#### Shin-Etsu Silicone Taiwan Co., Ltd.

Hung Kuo Bldg. 11F-D, No. 167, Tun Hua N. Rd.,  
 Taipei, 105406 Taiwan, R.O.C.  
 Phone : +886-(0)2-2715-0055 Fax : +886-(0)2-2715-0066

#### Shin-Etsu Silicone Korea Co., Ltd.

GT Tower 15F, 411, Seocho-daero, Seocho-gu,  
 Seoul 06615, Korea  
 Phone : +82-(0)2-590-2500 Fax : +82-(0)2-590-2501

#### Shin-Etsu Singapore Pte. Ltd.

4 Shenton Way, #10-03/06, SGX Centre II, Singapore 068807  
 Phone : +65-6743-7277 Fax : +65-6743-7477

#### Shin-Etsu Silicones India Pvt. Ltd.

Unit No. 403A, Fourth Floor, Eros Corporate Tower,  
 Nehru Place, New Delhi 110019, India  
 Phone : +91-11-43623081 Fax : +91-11-43623084

#### Shin-Etsu Silicones (Thailand) Ltd.

7th Floor, Harindhorn Tower, 54 North Sathorn Road,  
 Bangkok 10500, Thailand  
 Phone : +66-(0)2-632-2941 Fax : +66-(0)2-632-2945

#### Shin-Etsu Silicone International Trading (Shanghai) Co., Ltd.





29F Junyao International Plaza, No.789,  
 Zhao Jia Bang Road, Shanghai 200032, China  
 Phone : +86-(0)21-6443-5550 Fax : +86-(0)21-6443-5868

#### Guangzhou Branch

Room 2409-2410, Tower B, China Shine Plaza, 9 Linhexi Road,  
 Tianhe, Guangzhou, Guangdong 510610, China  
 Phone : +86-(0)20-3831-0212 Fax : +86-(0)20-3831-0207

- The data and information presented in this catalog may not be relied upon to represent standard values. Shin-Etsu reserves the right to change such data and information, in whole or in part, in this catalog, including product performance standards and specifications without notice.
- Users are solely responsible for making preliminary tests to determine the suitability of products for their intended use. Statements concerning possible or suggested uses made herein may not be relied upon, or be construed, as a guaranty of no patent infringement.
- For detailed information regarding safety, please refer to the Safety Data Sheet (SDS).
- The silicone products described herein have been designed, manufactured and developed solely for general industrial use only; such silicone products are not designed for, intended for use as, or suitable for, medical, surgical or other particular purposes. Users have the sole responsibility and obligation to determine the suitability of the silicone products described herein for any application, to make preliminary tests, and to confirm the safety of such products for their use.

- Users must never use the silicone products described herein for the purpose of implantation into the human body and/or injection into humans.
- Users are solely responsible for exporting or importing the silicone products described herein, and complying with all applicable laws, regulations, and rules relating to the use of such products. Shin-Etsu recommends checking each pertinent country's laws, regulations, and rules in advance, when exporting or importing, and before using the products.
- Please contact Shin-Etsu before reproducing any part of this catalog. Copyright belongs to Shin-Etsu Chemical Co., Ltd.

The Development and Manufacture of Shin-Etsu Silicones are based on the following registered international quality and environmental management standards.

|                      |                      |                         |
|----------------------|----------------------|-------------------------|
| <b>Gunma Complex</b> | ISO 9001 (JCQA-0004) | ISO 14001 (JCQA-E-0002) |
| <b>Naoetsu Plant</b> | ISO 9001 (JCQA-0018) | ISO 14001 (JCQA-E-0064) |
| <b>Takefu Plant</b>  | ISO 9001 (JQA-0479)  | ISO 14001 (JQA-EM0298)  |