

IWAKI  
CHEMICAL  
GEAR  
PUMPS





# Fine ceramic used in internal gear

The Iwaki G series chemical pump is the first internal gear pump designed for chemical process applications, in which gears of fine ceramic (SiC and Silicon nitride) are used. Our pump technology, developed over more than 50 years, has made it possible for Iwaki to equip standard pumps with fine ceramic gears. Without detracting from any of the advantages of conventional internal gear pumps abrasion resistance, chemical resistance, low-viscosity characteristics and sealing characteristics have been remarkably improved. In addition to the gland packing/mechanical seal type (Model GX), magnetic drive sealless type (Model GM) are available as standard products for an expanded range of uses. The G series is an advanced gear pump, capable of dealing with a wide range of industrial processes which continue to increase in sophistication.

## Ceramic vs stainless steel gear comparison

Type of gear	Corrosion resistance	Thermal resistance	Seizing resistance	Exfoliation resistance	Abrasion resistance	Coefficient of friction	Impact resistance
Ceramic gear	○	○	○	○	○	○	×
Metal gear	Heat-treated	×	○	△	△	○	○
	Hard coated	△	○	×	○	△	△

○ Good    △ Please contact us for details    × No good

## Both high viscosity and low viscosity liquids can be handled

When a low-viscosity liquid is handled by a conventional gear pump, "jamming" and "seizing" tend to occur. SiC ceramic gears do not have this problem even when the pump functions at a high speed. Silicon nitride ceramic gears show stable performance in handling high viscous liquids, due to their strength and toughness.

## Ability to handle fine slurries

Now that gears and other sliding components including bearings are made of ceramic, the handling of fine slurries hard and soft will not impair the longevity of these pumps. Do not specify GM type for slurry applications.

## Magnetic drive type added to standard line

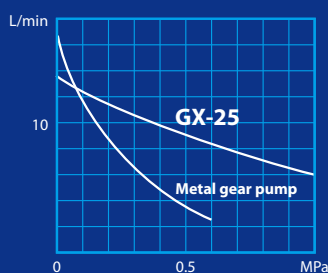
Superior anticorrosive materials such as silicon carbide, silicon nitride, alumina ceramic, PTFE, carbon and stainless steel are used in liquid ends so that all sorts of chemical liquids can be handled. GM is ideal for handling chemical liquids which need strict control on liquid leakage and air contact.

## Improved performance characteristics

Performance has been noticeably improved. Ceramic gears make it possible to reduce spaces between parts, therefore outperforming conventional metal gear models.

### Performance comparison curves

In the graph below, changes in output at varying discharge pressures are compared between the G series pump and a metal gear pump. The graph shows that the G series, which employs ceramics gears, is far less subject to declining output under high pressure due to its close seal clearance in the gear housing.



## Quiet liquid transfer with less pulsation

Without the pulsation that is common to reciprocating pump and general use type gear pumps, liquid is transferred quietly and smoothly no agitating or foaming.

## High self-priming ability

Because the suction port is at the top of the pump, the pump chamber remains full when pump stops working. Self-priming is enhanced at re-start.

## Constant flow injection

Regardless of the temperature change, viscous liquid can be handled at accurate flow rate, which cannot do with other pumps. As the output is linearly related to rpm, the flow rate is easily controlled by changing speed.



GM type

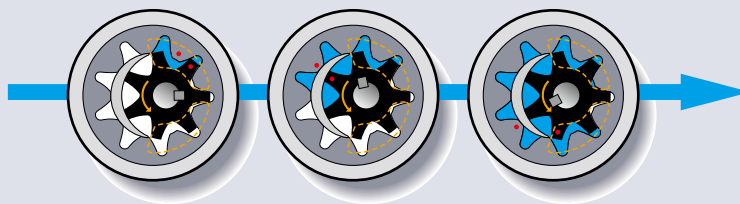


GX type

## Construction

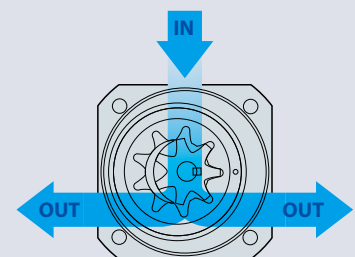


## Operating principle



A pinion (drive gear) coupled with a shaft supported by two bearings meshes with an internal gear (driven gear) whose periphery is supported by a strong bearing. Liquid is transferred by a change in the capacity of this meshed portion. In the suction process, the gears are disengaged and a space defined by the

two gears and the casing expands. The liquid is drawn into the space by the negative pressure generated. In the discharge process, their teeth begin to mesh and space defined by the two gears and the casing is reduced to force out the liquid.



Left or right discharge port selection



Drive magnet ass'y

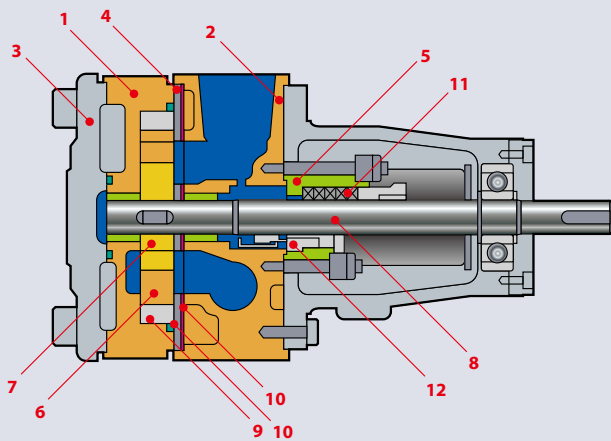
Port housing

Rear casing  
Magnet capsule

GM type exploded view

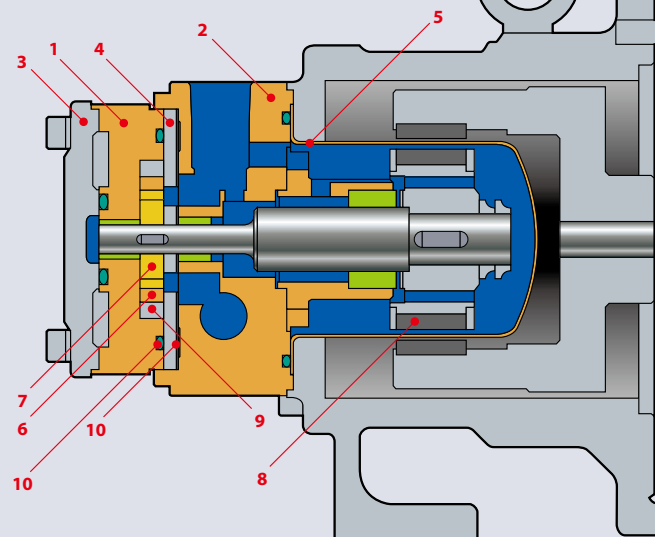
## Construction / Wet end materials

GX type



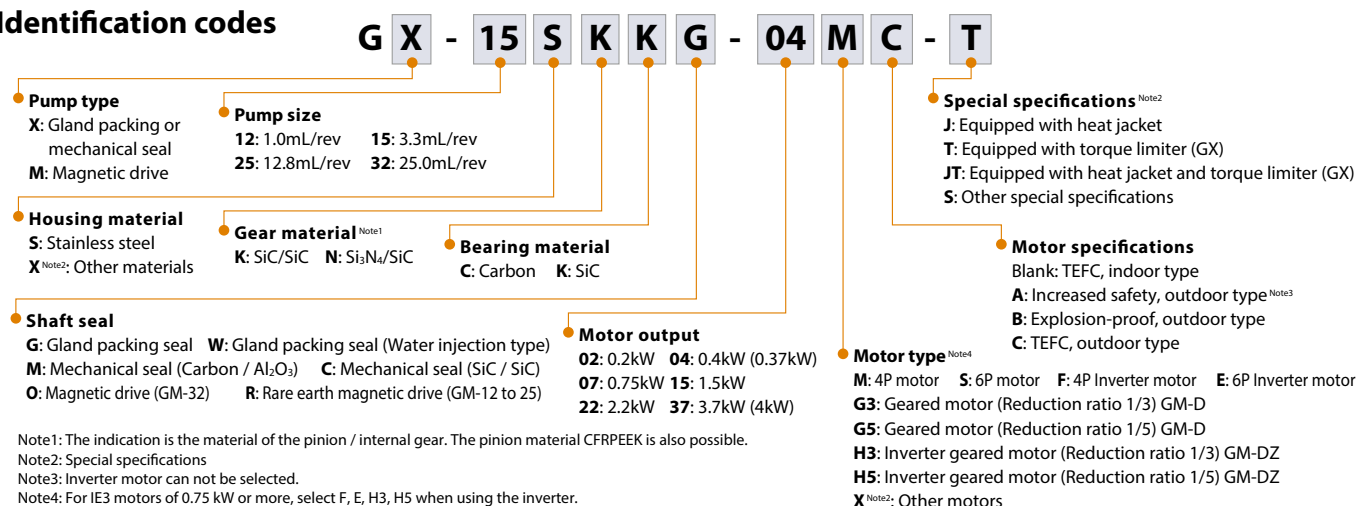
Parts	Wet end materials
1 Gear housing	SUS316
2 Port housing	SUS316
3 Cover	SCS14
4 Side plate	SUS316
5 Seal case	SCS14 or SUS316
6 Internal gear	SiC
7 Pinion	SiC or Si <sub>3</sub> N <sub>4</sub>
8 Shaft	SUS630Equi. or SUS316/Cr <sub>2</sub> O <sub>3</sub>
9 Bearing	Carbon or SiC
10 Gasket / O-ring	PTFE
11 Gland packing	PTFE
12 Mechanical seal	SUS316/Al <sub>2</sub> O <sub>3</sub> /Carbon/PTFE SUS316/SiC/SiC/PTFE

GM type



Parts	Wet end materials
1 Gear housing	SUS316
2 Port housing	SUS316
3 Cover	SCS14
4 Side plate	SUS316
5 Rear casing	SUS316
6 Internal gear	SiC
7 Pinion	SiC or Si <sub>3</sub> N <sub>4</sub>
8 Magnet capsule	SUS329J1/SUS316
9 Bearing	Carbon or SiC
10 Gasket / O-ring	PTFE

## Identification codes



## Specifications

Model	Discharge per revolution mL/rev	Max. speed min <sup>-1</sup>	Max. discharge pressure MPa    *1		Temp. range °C	Viscosity range mPa·s    *2	Vacuum KPa    *3	Connections	
								IN	OUT
GX-12	1.0	1800	1.0		0 - 150	0.5 - 10,000	5.3	Rc <sup>1</sup> /2	Rc <sup>3</sup> /8
GX-15	3.3							Rc <sup>1</sup> /2	Rc <sup>3</sup> /8
GX-25	12.8							Rc1	Rc <sup>3</sup> /4
GX-32	25.0							Rc1 <sup>1</sup> /4	Rc1
GM-12	1.0	1800	0.5	0 - 80 (0 - 50)	0.5 - 1000	5.3	Rc <sup>1</sup> /2	Rc <sup>3</sup> /8	
GM-15	3.3						Rc <sup>1</sup> /2	Rc <sup>3</sup> /8	
GM-25	12.8		0.7	0 - 80	0.5 - 100		Rc1	Rc <sup>3</sup> /4	
GM-32	25.0						Rc1 <sup>1</sup> /4	Rc1	

\*1. These are maximum values, which vary depending on motor speed and liquid viscosity.

\*2. Motor speed and motor output suited to the viscosity of your liquid should be selected.

\*3. These are values with clear water at 25°C.

## Standard pumps selection table

Model	Viscosity range mPa·s	Pump specifications 50/60Hz		Motor		
		Max. pressure MPa	Max. flow rate L/min			
GX-12	0.5≤viscosity<1	0.3 / 0.36	1.4 / 1.7	4P, 0.2kW		
	1≤viscosity<9	0.47 / 0.57				
	9≤viscosity<200	1.0 / 1.0			0.9 / 1.1	6P, 0.2kW
	200≤viscosity<1000					
	1000≤viscosity<3000	0.7 / 0.7	0.5 / 0.6	4P, 0.4kW, 1/3		
	3000≤viscosity≤10000		0.3 / 0.36	4P, 0.4kW, 1/5		
GM-12 S□□R	0.5≤viscosity<1	0.3 / 0.36	1.4 / 1.7	4P, 0.2kW	Note1	
		0.38	1.8		Note2	
	1≤viscosity<9	0.40 / 0.48	1.4 / 1.7		Note1	
		0.5	1.8		Note2	
	9≤viscosity<200	0.5 / 0.5	1.4 / 1.7		Note1	
		0.5	1.8		Note2	
	200≤viscosity≤1000	0.5	1.8	6P, 0.2kW	Note2	
	GX-15	0.5≤viscosity<1	0.54 / 0.65	4.7 / 5.6	4P, 0.2kW	
		1≤viscosity<9	0.7 / 0.7			
9≤viscosity<200		1.0 / 1.0	3.0 / 3.7			6P, 0.4kW
200≤viscosity<1000						
1000≤viscosity<3000		0.7 / 0.7	1.7 / 2.0	4P, 0.4kW, 1/3		
3000≤viscosity≤10000			1.0 / 1.2	4P, 0.4kW, 1/5		
GM-15 S□□R	0.5≤viscosity<9	0.5 / 0.5	4.7 / 5.6	4P, 0.2kW	Note1	
		0.5	5.9	Note2		
	9≤viscosity<200	0.5 / 0.5	4.7 / 5.6	4P, 0.4kW	Note1	
		0.5	5.9	Note2		
	200≤viscosity≤1000	0.5	1.2	6P, 0.4kW	Note2	

Model	Viscosity range mPa·s	Pump specifications 50/60Hz		Motor		
		Max. pressure MPa	Max. flow rate L/min			
GX-25	0.5≤viscosity<9	0.7 / 0.7	18.0 / 21.8	4P, 0.75kW		
	9≤viscosity<200	1.0 / 1.0		4P, 1.5kW		
	200≤viscosity<1000		11.8 / 14.2	6P, 1.5kW		
	1000≤viscosity<3000	0.7 / 0.7	6.4 / 7.7	4P, 0.75kW, 1/3		
	3000≤viscosity≤10000		3.8 / 4.6	4P, 0.75kW, 1/5		
GM-25 S□□R	0.5≤viscosity<9	0.7 / 0.7	18.0 / 21.8	4P,	Note3	
		0.7	23	0.75kW	Note2	
	9≤viscosity<200	0.7 / 0.7	18.0 / 21.8	4P,	Note3	
		0.7	23	1.5kW	Note2	
	200≤viscosity≤1000	0.7	15.3	6P,	Note2	
				1.5kW		
GX-32	0.5≤viscosity<9	0.7 / 0.7	35.2 / 42.5	4P, 2.2kW		
	9≤viscosity<100	1.0 / 1.0		4P, 3.7kW		
	100≤viscosity<200			23.0 / 27.7		6P, 2.2kW
	200≤viscosity<500		12.5 / 15.0			4P, 1.5kW, 1/3
	500≤viscosity<1000			0.7 / 0.7	7.5 / 9.0	4P, 1.5kW, 1/5
	1000≤viscosity<3000	0.7 / 0.7				35.2 / 42.5
	3000≤viscosity≤10000		30≤viscosity≤100	4P, 3.7kW		

Caution: To protect pump install strainer and safety valve. Strainer mesh depends on liquid. For water or equivalent 100 to 150 mesh is recommended. Ask us for details.

The recommended gear materials are K(SiC/SiC) for a viscosity below 200mPa·s and N(Si<sub>3</sub>N<sub>4</sub>/SiC) for above 200mPa·s.

Note1: General purpose motor

Note2: Inverter motor

Note3: Commercial power supply direct drive operation

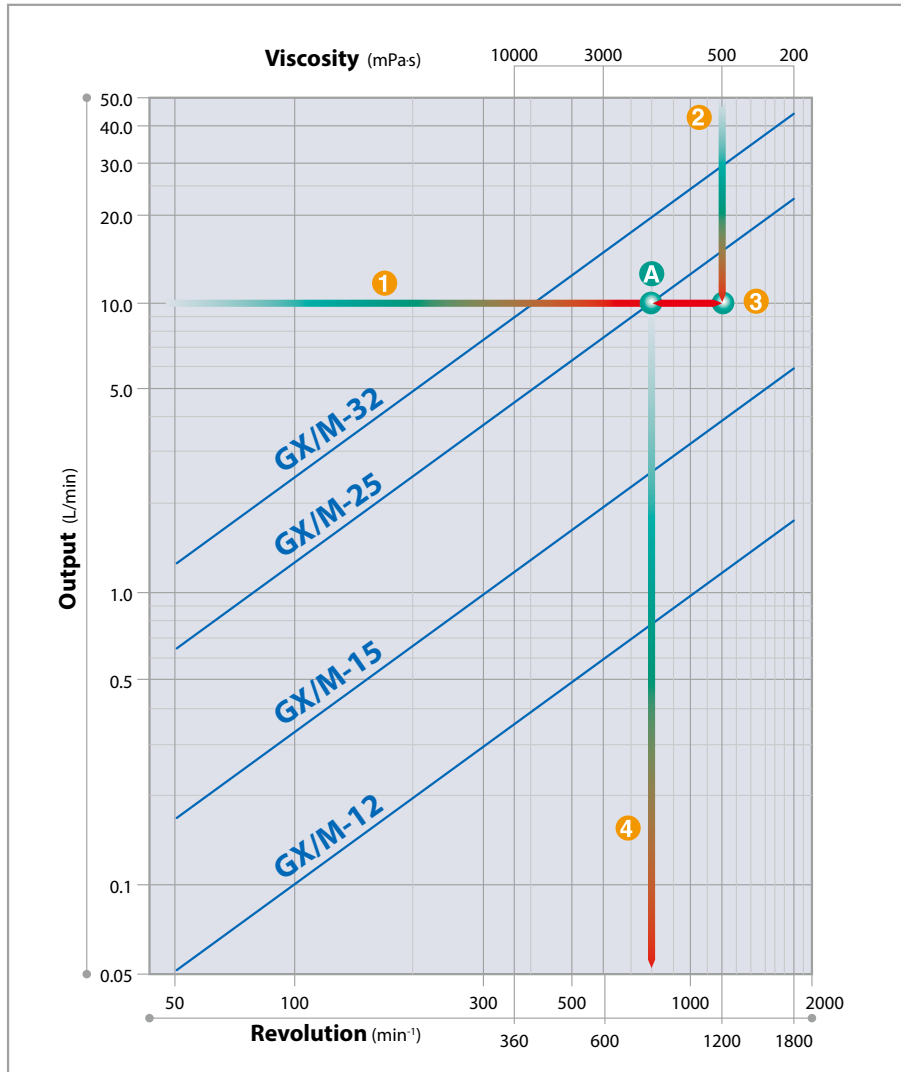
• For handling liquids containing slurry, sticky liquids, liquids that harden easily, etc., select a model with a torque limiter. Please ask us for information on pumps with torque limiters.

• Max. Pressure varies depending on pump size, viscosity of transferred fluid, and motor used.

Please contact us separately for combinations other than the standard model selection table.

• The maximum liquid temperature when transferring liquid of 200 mPa·s or more with GM is 50 °C.

## Performance chart



The chart on the left shows output at a discharge pressure of 0MPa. The output changes in proportion to  $\text{min}^{-1}$ , but  $\text{min}^{-1}$  should be reduced when pumping viscous liquid. Knowing required output and viscosity, the proper pump/motor  $\text{min}^{-1}$  can be selected as in the following example.

### STEP - 1

Mark the value of your required output (10L/min) on the scale on the left, and draw a horizontal line to the right.

### STEP - 2

Mark the value of your viscosity (500mPa·s) on the scale at the top and draw a line downward. In the event your viscosity falls in the middle of two scale lines, select the line on the left (the higher value).

### STEP - 3

Extend the intersected point ③ to the left horizontally until intersecting the first pump line (GX/M-25). This point ④ specifies pump.

### STEP - 4

Draw a downward line from ④ to specify motor rpm ④.

### For slurries

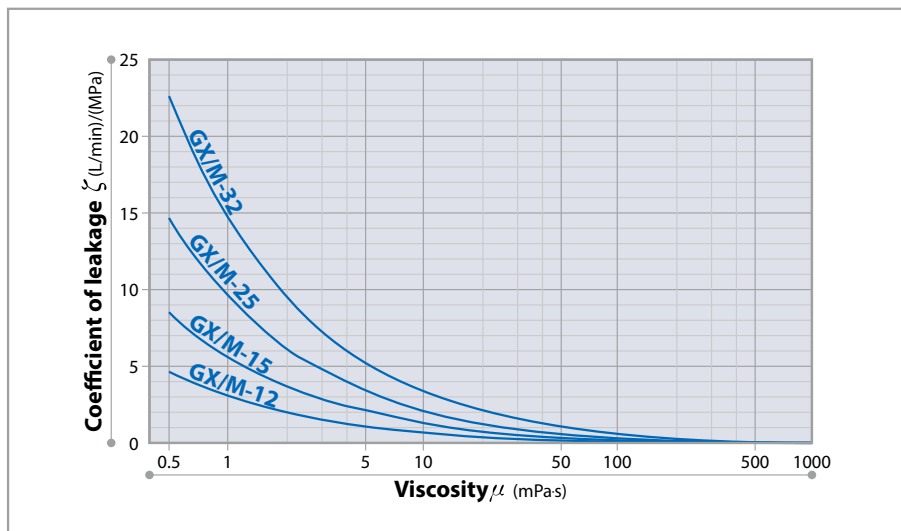
For soft slurries, reduce rpm by 75%.

For hard slurries, reduce rpm by 50%.

In principle, only slurries of less than 10 $\mu\text{m}$  in diameter can be handled.

GM type pumps cannot handle slurries.

## Viscosity-leakage coefficient graph



### When discharge pressure rises

The lower the viscosity, as discharge pressure rises, the lower the output will be. You can estimate the actual output, in case of a change in viscosity or discharge pressure, from the following formula. (See note below).

$$\zeta = K \times \mu^{-0.65} \quad (1)$$

$$Q_c = q \times N / 1000 - \zeta \times \Delta P \quad (2)$$

$Q_c$  : Estimated output (L/min)

$q$  : Output per revolution (mL/rev)

$N$  :  $\text{min}^{-1}$

$\Delta P$  : Effective differential pressure (MPa)

$\zeta$  : Coefficient of leakage (L/min)/(MPa)

$\mu$  : Viscosity (mPa·s)

$K$  : Constant

GX/M-12 :  $K=3$

GX/M-15 :  $K=5.5$

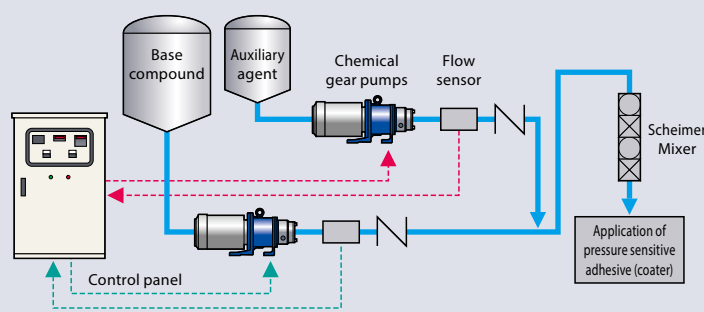
GX/M-25 :  $K=9.5$

GX/M-32 :  $K=15$

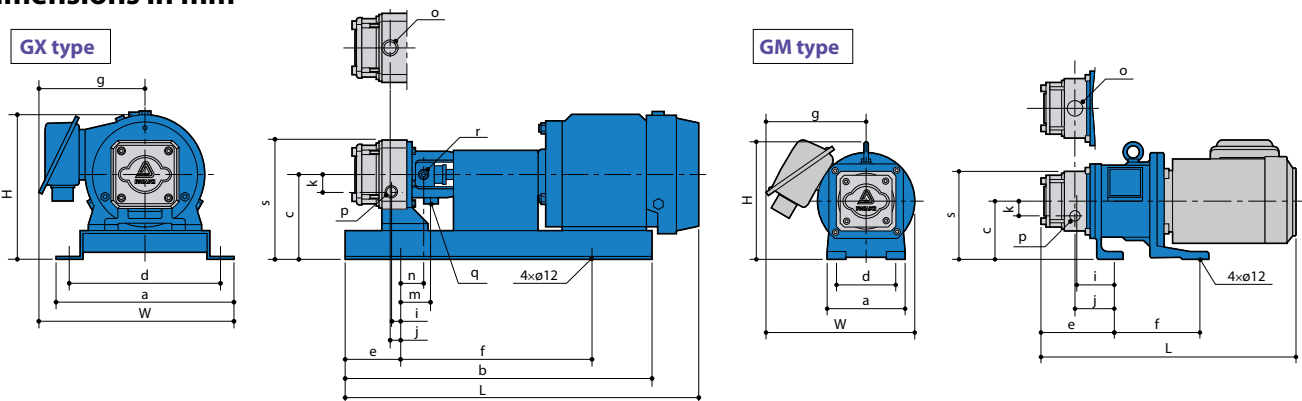
For the value of the coefficient of leakage in formula (1), see the viscosity-leakage coefficient graph.

## Applications

- Non pulsatile quantitative injection of glue liquor in copper foil manufacturing process
- Quantitative transfer of magnetic slurry liquid
- Quantitative transfer of paint and dye slurry liquid
- Quantitative injection of coagulant
- Quantitative injection of paper strength enhancer
- Non pulsatile quantitative transfer of fine slurry of electronic materials
- Ammonia water / urea water spray in flue gas denitration equipment such as cleaning factory
- Transfer of perfume such as detergent
- Transfer of cleaning solvent for metal parts, electronic parts etc.
- Solvent-based adhesive transfer
- Chemical liquid transfer for various processes (caustic soda, 98% sulfuric acid, nitric acid etc.)



## Dimensions in mm



Model	Motor	a	b	c	d	e	f	g	H	i	j	k	L	m	n	W	o	p	q	r	s	Mass kg Less motor
<b>GX-12S</b>	<b>02MC</b>	252	440	111.5	222	80	280	142	182.5	13	14	24	442	41	27.5	268	Rc1/2	Rc3/8	Rc1/8	Rc1/8	160.5	17
<b>GX-15S</b>	<b>04MC</b>	252	440	111.5	222	80	280	151	186.5	13	14	24	469	41	27.5	277					160.5	19
	<b>02SC</b>	252	440	111.5	222	80	280	151	186.5	13	14	24	469	41	27.5	277					160.5	19
	<b>04SC</b>	252	440	120	222	80	280	152	205	13	14	24	501	41	27.5	278					169	26
	<b>04G □</b>	252	440	111.5	222	80	280	160	219.5	13	14	24	528	41	27.5	286					160.5	24
<b>GM-12S</b>	<b>02M/FC</b>	128	-	95	98	121	141	150	193	65	66	24	400	-	-	230	Rc1/2	Rc3/8	-	-	144.5	24
	<b>02EC</b>	128	-	95	98	121	141	165	193	65	66	24	421	-	-	245			-	-	144.5	30
	<b>02M/FC</b>	128	-	95	98	121	141	150	193	65	66	24	400	-	-	230			-	-	144.5	24
<b>GM-15S</b>	<b>04M/FC</b>	128	-	95	98	121	141	165	193	65	66	24	421	-	-	245			-	-	144.5	27
	<b>04EC</b>	128	-	95	98	121	141	165	235	65	66	24	436	-	-	265			-	-	144.5	32
<b>GX-25S</b>	<b>07MC</b>	266	570	140.5	236	100	360	152	225.5	8	9.5	30	553	49.5	36	285	Rc1	Rc3/4	Rc1/4	Rc1/8	202.5	34
	<b>15MC</b>	266	570	140.5	236	100	360	166	241.5	8	9.5	30	607	49.5	36	299					202.5	42
	<b>15SC</b>	266	570	150	236	100	360	172	289	8	9.5	30	648	49.5	36	305					212	49
	<b>07G □</b>	266	570	140.5	236	100	360	165	265.5	8	9.5	30	606	49.5	36	298					202.5	35
	<b>07M/FC</b>	120	165	245	165	235	83.5	85	-	90	466	-	120	-	265	160			-	-	182.5	43
<b>GM-25S</b>	<b>15M/FC</b>	120	165	245	178	235	83.5	85	-	90	533	-	120	-	278	160	Rc1-1/4	Rc1	Rc3/8	Rc1/4	182.5	50
	<b>15EC</b>	160	169	224	185	275	245	89	-	116	600	-	146	-	310	205					208.5	70
<b>GX-32S</b>	<b>22MC</b>	340	740	170	300	115	510	210	309	0	0	37	707	80	60	380					247	69
	<b>37MC</b>	340	740	170	300	115	510	227	331	0	0	37	724	80	60	397					247	79
	<b>22SC</b>	340	740	170	300	115	510	227	331	0	0	37	724	80	60	397					247	79
<b>GM-32S</b>	<b>22MC</b>	205	-	146	160	190	224	210	288.5	91	91	37	650	-	-	335					247	74
																					223	80

Note: The dimensions may differ with the type of motor installed.

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**Caution for safety use:**  
Before use of pump, read instruction manual carefully to use the product correctly.

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