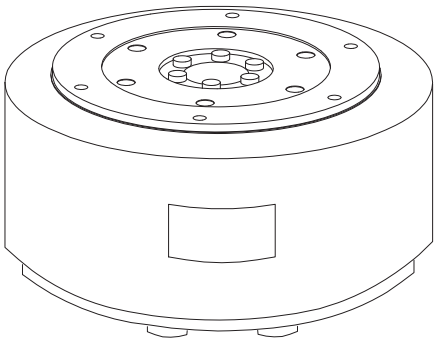
YASKAWA

Σ-7-Series AC Servo Drive

Direct Drive Servomotor

Product Manual

Model: SGMCS/SGMCV



MANUAL NO. SIEP S800001 38A

About this Manual

This manual provides information required to select, install, connect, and maintain Direct Drive Servomotors for Σ-7-Series AC Servo Drives.

Read and understand this manual to ensure correct usage of the Σ-7-Series AC Servo Drives.

Keep this manual in a safe place so that it can be referred to whenever necessary.

Outline of Manual

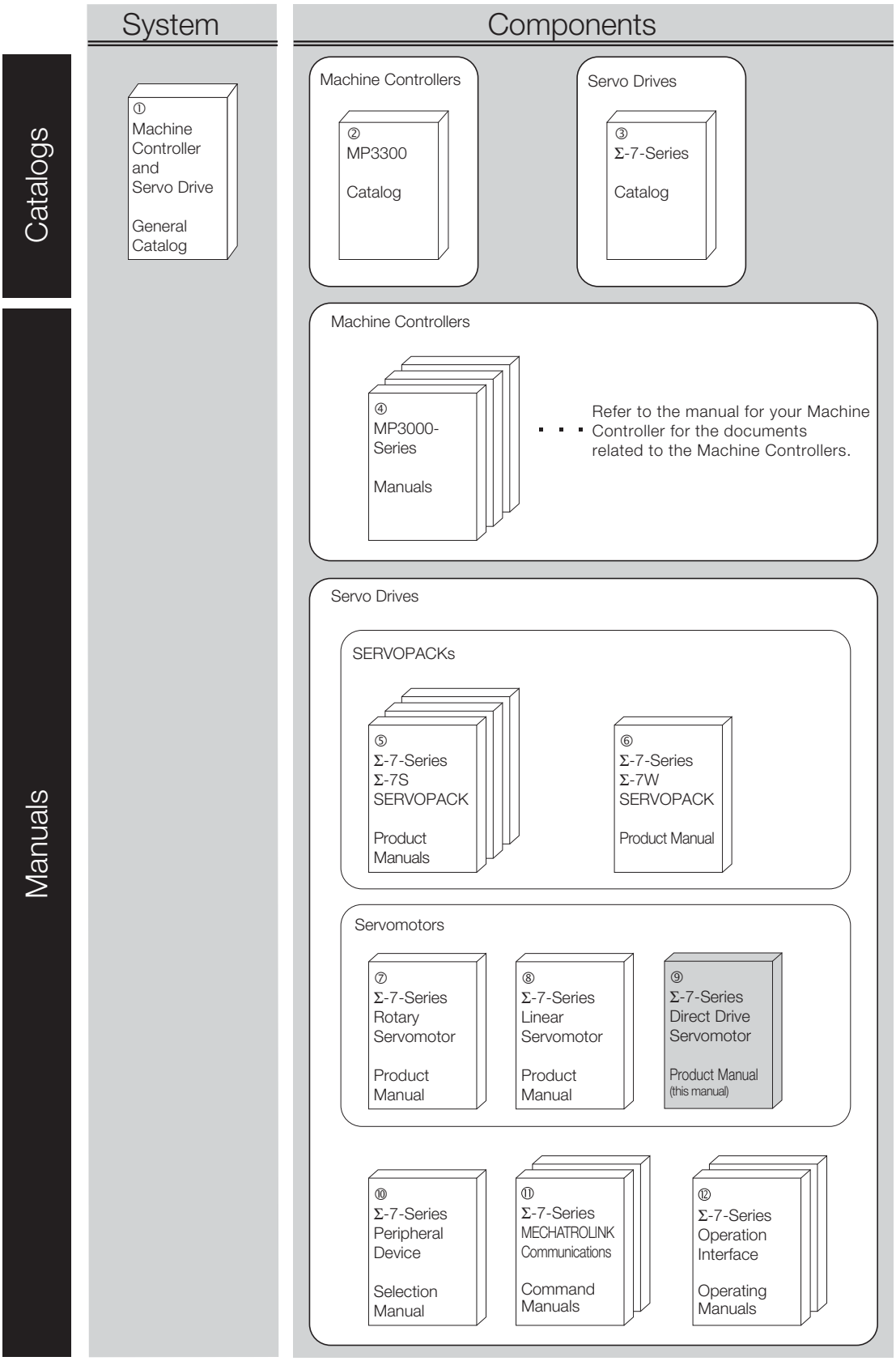
The contents of the chapters of this manual are described in the following table.

Refer to these chapters as required.

Chapter	Chapter Title	Contents
1	Basic Information on Servomotors	Provides basic information on Direct Drive Servomotors, including Servomotor part names and combinations with SERVOPACKs.
2	Capacity Selection	Describes calculation methods to use when selecting Servomotor capacities.
3	Specifications, Ratings, and External Dimensions of SGMCS Servomotors	Describes how to interpret the model numbers of SGMCS Servomotors and gives their specifications, ratings, and external dimensions.
4	Specifications, Ratings, and External Dimensions of SGMCV Servomotors	Describes how to interpret the model numbers of SGMCV Servomotors and gives their specifications, ratings, and external dimensions.
5	Servomotor Installation	Describes the installation conditions and precautions for Servomotors.
6	Connections between Servomotors and SERVOPACKs	Describes the cables that are used to connect the Servomotors and SERVOPACKs and provides related precautions.
7	Maintenance and Inspection	Describes the maintenance, inspection, and disposal of a Servomotor.
8	Appendix	Provides information to use when selecting Servomotor capacities.

Related Documents

The relationships between the documents that are related to the Servo Drives are shown in the following figure. The numbers in the figure correspond to the numbers in the table on the following pages. Refer to these documents as required.



Classification	Document Name	Document No.	Description
① Machine Controller and Servo Drive General Catalog	Machine Controller and Servo Drive Solutions Catalog	KAEP S800001 22	Provides detailed information required to select MP3000-Series Machine Controllers and Σ-7-Series AC Servo Drives.
② MP3300 Catalog	Machine Controller MP3300	KAEP C880725 03	Provides detailed information on MP3300 Machine Controllers, including features and specifications.
③ Σ-7-Series Catalog	AC Servo Drives Σ-7 Series	KAEP S800001 23	Provides detailed information on Σ-7-Series AC Servo Drives, including features and specifications.
④ MP3000-Series Manuals	Machine Controller MP3000 Series MP3300 Product Manual	SIEP C880725 21	Describes the functions, specifications, operating methods, maintenance, inspections, and troubleshooting of the MP3000-series MP3300 Machine Controllers.
⑤ Σ-7-Series Σ-7S SERVOPACK Product Manuals	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with MECHATROLINK-III Communications References Product Manual	SIEP S800001 28	Provide detailed information on selecting Σ-7-Series SERVOPACKs and information on installing, connecting, setting, performing trial operation for, tuning, and monitoring the Servo Drives.
	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with MECHATROLINK-II Communications References Product Manual	SIEP S800001 27	
	Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with Analog Voltage/Pulse Train References Product Manual	SIEP S800001 26	
⑥ Σ-7-Series Σ-7W SERVOPACK Product Manual	Σ-7-Series AC Servo Drive Σ-7W SERVOPACK with MECHATROLINK-III Communications References Product Manual	SIEP S800001 29	
⑦ Σ-7-Series Rotary Servomotor Product Manual	Σ-7-Series AC Servo Drive Rotary Servomotor Product Manual	SIEP S800001 36	Provide detailed information on selecting, installing, and connecting the Σ-7-Series Servomotors.
⑧ Σ-7-Series Linear Servomotor Product Manual	Σ-7-Series AC Servo Drive Linear Servomotor Product Manual	SIEP S800001 37	
⑨ Σ-7-Series Direct Drive Servomotor Product Manual	Σ-7-Series AC Servo Drive Direct Drive Servomotor Product Manual	This manual (SIEP S800001 38)	

Continued on next page.

Continued from previous page.

Classification	Document Name	Document No.	Description
⑩ Σ-7-Series Peripheral Device Selection Manual	Σ-7-Series AC Servo Drive Peripheral Device Selection Manual	SIEP S800001 32	Describes the peripheral devices for a Σ-7-Series Servo System.
⑪ Σ-7-Series MECHATROLINK Communications Command Manuals	Σ-7-Series AC Servo Drive MECHATROLINK-II Communications Command Manual	SIEP S800001 30	Provides detailed information on the MECHATROLINK-II communications commands that are used for a Σ-7-Series Servo System.
	Σ-7-Series AC Servo Drive MECHATROLINK-III Communications Standard Servo Profile Command Manual	SIEP S800001 31	Provides detailed information on the MECHATROLINK-III communications standard servo profile commands that are used for a Σ-7-Series Servo System.
⑫ Σ-7-Series Operation Interface Operating Manuals	Σ-7-Series AC Servo Drive Digital Operator Operating Manual	SIEP S800001 33	Describes the operating procedures for a Digital Operator for a Σ-7-Series Servo System.
	AC Servo Drives Engineering Tool SigmaWin+ Online Manual Σ-7 Component	SIEP S800001 48	Provides detailed operating procedures for the SigmaWin+ Engineering Tool for a Σ-7-Series Servo System.

Using This Manual

◆ Technical Terms Used in This Manual

The following terms are used in this manual.

Term	Meaning
Servomotor	A Σ-7-Series Direct Drive Servomotor.
SERVOPACK	A Σ-7-Series Servo Amplifier.
Servo Drive	The combination of a Servomotor and SERVOPACK.
Main Circuit Cable	One of the cables that connect to the main circuit terminals of a SERVOPACK, including the Main Circuit Power Supply Cable, Control Power Supply Cable, and Servomotor Main Circuit Cable.

◆ Trademarks

- MECHATROLINK is a trademark of the MECHATROLINK Members Association.
- QR code is a trademark of Denso Wave Inc.
- Other product names and company names are the trademarks or registered trademarks of the respective company. “TM” and the ® mark do not appear with product or company names in this manual.

◆ Visual Aids

The following aids are used to indicate certain types of information for easier reference.

Indicates precautions or restrictions that must be observed.
Also indicates alarm displays and other precautions that will not result in machine damage.

Indicates definitions of difficult terms or terms that have not been previously explained in this manual.

Example Indicates operating or setting examples.

Information Indicates supplemental information to deepen understanding or useful information.

Safety Precautions

◆ Safety Information

To prevent personal injury and equipment damage in advance, the following signal words are used to indicate safety precautions in this document. The signal words are used to classify the hazards and the degree of damage or injury that may occur if a product is used incorrectly. Information marked as shown below is important for safety. Always read this information and heed the precautions that are provided.

⚠ DANGER

- Indicates precautions that, if not heeded, are likely to result in loss of life, serious injury, or fire.

⚠ WARNING

- Indicates precautions that, if not heeded, could result in loss of life, serious injury, or fire.

⚠ CAUTION

- Indicates precautions that, if not heeded, could result in relatively serious or minor injury, or in fire.

NOTICE

- Indicates precautions that, if not heeded, could result in property damage.

◆ Safety Precautions That Must Always Be Observed

■ General Precautions

⚠ DANGER

- Read and understand this manual to ensure the safe usage of the product.
- Keep this manual in a safe, convenient place so that it can be referred to whenever necessary. Make sure that it is delivered to the final user of the product.
- Do not remove covers, cables, connectors, or optional devices while power is being supplied to the SERVOPACK.
  There is a risk of electric shock, operational failure of the product, or burning.

⚠ WARNING

- Connect the ground terminals on the SERVOPACK and Servomotor to ground poles according to local electrical codes (100 Ω or less for a SERVOPACK with a 100-VAC or 200-VAC power supply, and 10 Ω or less for a SERVOPACK with a 400-VAC power supply).
  There is a risk of electric shock or fire.
- Do not attempt to disassemble, repair, or modify the product.
  There is a risk of fire or failure.
  The warranty is void for the product if you disassemble, repair, or modify it.

⚠ CAUTION

- The SERVOPACK heat sinks, regenerative resistors, Servomotors, and other components can be very hot while power is ON or soon after the power is turned OFF. Implement safety measures, such as installing covers, so that hands and parts such as cables do not come into contact with hot components.
  There is a risk of burn injury.
- Do not damage, pull on, apply excessive force to, place heavy objects on, or pinch cables.
  There is a risk of failure, damage, or electric shock.
- Do not use the product in an environment that is subject to water, corrosive gases, or flammable gases, or near flammable materials.
  There is a risk of electric shock or fire.

NOTICE

- Do not attempt to use a SERVOPACK or Servomotor that is damaged or that has missing parts.
- Install external emergency stop circuits that shut OFF the power supply and stops operation immediately when an error occurs.
- Always use a Servomotor and SERVOPACK in one of the specified combinations.
- Do not touch a SERVOPACK or Servomotor with wet hands.
  There is a risk of product failure.

■ Storage Precautions

⚠ CAUTION

- Do not place an excessive load on the product during storage. (Follow all instructions on the packages.)
  There is a risk of injury or damage.

NOTICE

- Do not install or store the product in any of the following locations.
  - Locations that are subject to direct sunlight
  - Locations that are subject to ambient temperatures that exceed product specifications
  - Locations that are subject to relative humidities that exceed product specifications
  - Locations that are subject to condensation as the result of extreme changes in temperature
  - Locations that are subject to corrosive or flammable gases
  - Locations that are near flammable materials
  - Locations that are subject to dust, salts, or iron powder
  - Locations that are subject to water, oil, or chemicals
  - Locations that are subject to vibration or shock that exceeds product specifications
  - Locations that are subject to radiation

  If you store or install the product in any of the above locations, the product may fail or be damaged.
- Consult with your Yaskawa representative if you have stored products for an extended period of time.

■ Transportation Precautions

⚠ CAUTION

- Transport the product in a way that is suitable to the mass of the product.
- Do not hold onto the cables, rotating part, or connectors when you move a Servomotor.
  There is a risk of disconnection, damage, or injury.
- Do not use the eyebolts on a SERVOPACK or Servomotor to move the machine.
  There is a risk of damage or injury.
- When you handle a SERVOPACK or Servomotor, be careful of sharp parts, such as the corners.
  There is a risk of injury.
- Do not place an excessive load on the product during transportation. (Follow all instructions on the packages.)
  There is a risk of injury or damage.

NOTICE

- A SERVOPACK or Servomotor is a precision device. Do not drop it or subject it to strong shock.
  There is a risk of failure or damage.
- Do not subject connectors to shock.
  There is a risk of faulty connections or damage.
- If disinfectants or insecticides must be used to treat packing materials such as wooden frames, plywood, or pallets, the packing materials must be treated before the product is packaged, and methods other than fumigation must be used.
  Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more.
  If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogen, which includes chlorine, fluorine, bromine, or iodine can contribute to the erosion of the capacitors.
- Do not overtighten the eyebolts on a SERVOPACK or Servomotor.
  If you use a tool to overtighten the eyebolts, the tapped holes may be damaged.

■ Installation Precautions

⚠ CAUTION

- Securely mount the Servomotor to the machine.
  If the Servomotor is not mounted securely, it may come off the machine during operation.
- Install the Servomotor or SERVOPACK in a way that will support the mass given in technical documents.
- Install SERVOPACKs, Servomotors, and regenerative resistors on nonflammable materials.
  Installation directly onto or near flammable materials may result in fire.
- Do not step on or place a heavy object on the product.
  There is a risk of failure, damage, or injury.
- Do not allow any foreign matter to enter the SERVOPACK or Servomotor.
  There is a risk of failure or fire.
- Implement safety measures, such as installing a cover so that the rotating part of the Servomotor cannot be touched accidentally during operation.

NOTICE

- Do not install or store the product in any of the following locations.
  - Locations that are subject to direct sunlight
  - Locations that are subject to ambient temperatures that exceed product specifications
  - Locations that are subject to relative humidities that exceed product specifications
  - Locations that are subject to condensation as the result of extreme changes in temperature
  - Locations that are subject to corrosive or flammable gases
  - Locations that are near flammable materials
  - Locations that are subject to dust, salts, or iron powder
  - Locations that are subject to water, oil, or chemicals
  - Locations that are subject to vibration or shock that exceeds product specifications
  - Locations that are subject to radiation

  If you store or install the product in any of the above locations, the product may fail or be damaged.
- Use the product in an environment that is appropriate for the product specifications.
  If you use the product in an environment that exceeds product specifications, the product may fail or be damaged.
- A SERVOPACK or Servomotor is a precision device. Do not drop it or subject it to strong shock.
  There is a risk of failure or damage.
- A Servomotor is a precision device. Do not subject the output shaft or the main body of the Servomotor to strong shock.
- Design the machine so that the thrust and radial loads on the motor shaft during operation do not exceed the allowable values given in the catalog.
- The shaft opening of a Servomotor is not waterproof or oilproof. Implement measures in the machine to prevent water or cutting oil from entering the Servomotor.
  There is a risk of failure.
- In an application where the Servomotor would be subjected to large quantities of water or oil, implement measures to protect the Servomotor from large quantities of liquid, such as installing covers to protect against water and oil.
- In an environment with high humidity or oil mist, face Servomotor lead wires and connectors downward and provide cable traps.
  There is a risk of failure or fire due to insulation failure or accidents from short circuits.

■ Wiring Precautions

⚠ DANGER

- Do not change any wiring while power is being supplied.
  There is a risk of electric shock or injury.

⚠ WARNING

- Wiring and inspections must be performed only by qualified engineers.
  There is a risk of electrick shock or product failure.

⚠ CAUTION

- Observe the precautions and instructions for wiring and trial operation precisely as described in this document.
  Failures caused by incorrect wiring or incorrect voltage application in the brake circuit may cause the SERVOPACK to fail, damage the equipment, or cause an accident resulting in death or injury.
- Check the wiring to be sure it has been performed correctly.
  Connectors and pin layouts are sometimes different for different models. Always confirm the pin layouts in technical documents for your model before operation.
  There is a risk of failure or malfunction.
- Connect wires to power supply terminals and motor connection terminals securely with the specified methods and tightening torque.
  Insufficient tightening may cause wires and terminal blocks to generate heat due to faulty contact, possibly resulting in fire.
- Use shielded twisted-pair cables or screened unshielded multi-twisted-pair cables for I/O Signal Cables and Encoder Cables.
- Observe the following precautions when wiring the SERVOPACK's main circuit terminals.
  - Turn ON the power supply to the SERVOPACK only after all wiring, including the main circuit terminals, has been completed.
  - If a connector is used for the main circuit terminals, remove the main circuit connector from the SERVOPACK before you wire it.
  - Insert only one wire per insertion hole in the main circuit terminals.
  - When you insert a wire, make sure that the conductor wire (e.g., whiskers) does not come into contact with adjacent wires.

NOTICE

- Whenever possible, use the Cables specified by Yaskawa.
  If you use any other cables, confirm the rated current and application environment of your model and use the wiring materials specified by Yaskawa or equivalent materials.
- Securely tighten cable connector screws and lock mechanisms.
  Insufficient tightening may result in cable connectors falling off during operation.
- Do not bundle power lines (e.g., the Main Circuit Cable) and low-current lines (e.g., the I/O Signal Cables or Encoder Cables) together or run them through the same duct. If you do not place power lines and low-current lines in separate ducts, separate them by at least 30 cm.
  If the cables are too close to each other, malfunctions may occur due to noise affecting the low-current lines.
- Install a battery at either the host controller or on the Encoder Cable.
  If you install batteries both at the host controller and on the Encoder Cable at the same time, you will create a loop circuit between the batteries, resulting in a risk of damage or burning.
- When connecting a battery, connect the polarity correctly.
  There is a risk of battery rupture or encoder failure.

■ Operation Precautions

⚠ WARNING

- Before starting operation with a machine connected, change the settings of the switches and parameters to match the machine.
  Unexpected machine operation, failure, or personal injury may occur if operation is started before appropriate settings are made.
- Do not radically change the settings of the parameters.
  There is a risk of unstable operation, machine damage, or injury.
- Install limit switches or stoppers at the ends of the moving parts of the machine to prevent unexpected accidents.
  There is a risk of machine damage or injury.
- For trial operation, securely mount the Servomotor and disconnect it from the machine.
  There is a risk of injury.
- Forcing the motor to stop for overtravel is disabled when the Jog (Fn002), Origin Search (Fn003), or Easy FFT (Fn206) utility function is executed. Take necessary precautions.
  There is a risk of machine damage or injury.
- When an alarm occurs, the motor will coast to a stop or stop with the dynamic brake according to a setting in the SERVOPACK. The coasting distance will change with the moment of inertia of the load. Check the coasting distance during trial operation and implement suitable safety measures on the machine.
- Do not enter the machine's range of motion during operation.
  There is a risk of injury.
- Do not touch the moving parts of the Servomotor or machine during operation.
  There is a risk of injury.

⚠ CAUTION

- Always turn OFF the servo before you turn OFF the power supply. If you turn OFF the main circuit power supply or control power supply during operation before you turn OFF the servo, the Servomotor will stop as follows:
  - If you turn OFF the main circuit power supply during operation without turning OFF the servo, the Servomotor will stop abruptly with the dynamic brake.
  - If you turn OFF the control power supply without turning OFF the servo, the stopping method that is used by the Servomotor depends on the model of the SERVOPACK. For details, refer to the manual for the SERVOPACK.

NOTICE

- Always measure the vibration of the Servomotor with the Servomotor mounted to the machine and confirm that the vibration is within the allowable value.
  If the vibration is too large, the Servomotor will be damage quickly and bolts may become loose.
- When you adjust the gain during system commissioning, use a measuring instrument to monitor the torque waveform and speed waveform and confirm that there is no vibration.
  If a high gain causes vibration, the Servomotor will be damaged quickly.
- An alarm or warning may occur if communications are performed with the host controller while the SigmaWin+ or Digital Operator is operating.
  If an alarm or warning occurs, it may interrupt the current process and stop the system.

■ Maintenance and Inspection Precautions

⚠ DANGER

- Do not change any wiring while power is being supplied.
  There is a risk of electric shock or injury.

⚠ WARNING

- Wiring and inspections must be performed only by qualified engineers.
  There is a risk of electric shock or product failure.

⚠ CAUTION

- Wait for six minutes after turning OFF the power supply and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the power supply terminals while the CHARGE lamp is lit after turning OFF the power supply because high voltage may still remain in the SERVOPACK.
  There is a risk of electric shock.

■ Troubleshooting Precautions

⚠ WARNING

- The product may suddenly start to operate when the power supply is recovered after a momentary power interruption. Design the machine to ensure human safety when operation restarts.
  There is a risk of injury.

⚠ CAUTION

- When an alarm occurs, remove the cause of the alarm and ensure safety. Then reset the alarm or turn the power supply OFF and ON again to restart operation.
  There is a risk of injury or machine damage.
- If the Servo ON signal is input to the SERVOPACK and an alarm is reset, the Servomotor may suddenly restart operation. Confirm that the servo is OFF and ensure safety before you reset an alarm.
  There is a risk of injury or machine damage.
- If there is the possibility that an external force (including gravity) may move the current position and create a hazardous situation when power is interrupted or an error occurs, install an external braking mechanism that ensures safety.

■ Disposal Precautions

- When disposing of the product, treat it as ordinary industrial waste. However, local ordinances and national laws must be observed. Implement all labeling and warnings as a final product as required.

■ General Precautions

- Figures provided in this document are typical examples or conceptual representations. There may be differences between them and actual wiring, circuits, and products.
- The products shown in illustrations in this document are sometimes shown without covers or protective guards. Always replace all covers and protective guards before you use the product.
- If you need a new copy of this document because it has been lost or damaged, contact your nearest Yaskawa representative or one of the offices listed on the back of this document.
- This document is subject to change without notice for product improvements, specifications changes, and improvements to the manual itself.
  We will update the document number of the document and issue revisions when changes are made.
- Any and all quality guarantees provided by Yaskawa are null and void if the customer modifies the product in any way. Yaskawa disavows any responsibility for damages or losses that are caused by modified products.

Warranty

◆ Details of Warranty

■ Warranty Period

The warranty period for a product that was purchased (hereinafter called the “delivered product”) is one year from the time of delivery to the location specified by the customer or 18 months from the time of shipment from the Yaskawa factory, whichever is sooner.

■ Warranty Scope

Yaskawa shall replace or repair a defective product free of charge if a defect attributable to Yaskawa occurs during the above warranty period.
This warranty does not cover defects caused by the delivered product reaching the end of its service life and replacement of parts that require replacement or that have a limited service life.

This warranty does not cover failures that result from any of the following causes.

- Improper handling, abuse, or use in unsuitable conditions or in environments not described in product catalogs or manuals, or in any separately agreed-upon specifications
- Causes not attributable to the delivered product itself
- Modifications or repairs not performed by Yaskawa
- Use of the delivered product in a manner in which it was not originally intended
- Causes that were not foreseeable with the scientific and technological understanding at the time of shipment from Yaskawa
- Events for which Yaskawa is not responsible, such as natural or human-made disasters

◆ Limitations of Liability

- Yaskawa shall in no event be responsible for any damage or loss of opportunity to the customer that arises due to failure of the delivered product.
- Yaskawa shall not be responsible for any programs (including parameter settings) or the results of program execution of the programs provided by the user or by a third party for use with programmable Yaskawa products.
- The information described in product catalogs or manuals is provided for the purpose of the customer purchasing the appropriate product for the intended application. The use thereof does not guarantee that there are no infringements of intellectual property rights or other proprietary rights of Yaskawa or third parties, nor does it construe a license.
- Yaskawa shall not be responsible for any damage arising from infringements of intellectual property rights or other proprietary rights of third parties as a result of using the information described in catalogs or manuals.

◆ Suitability for Use

- It is the customer's responsibility to confirm conformity with any standards, codes, or regulations that apply if the Yaskawa product is used in combination with any other products.
- The customer must confirm that the Yaskawa product is suitable for the systems, machines, and equipment used by the customer.
- Consult with Yaskawa to determine whether use in the following applications is acceptable. If use in the application is acceptable, use the product with extra allowance in ratings and specifications, and provide safety measures to minimize hazards in the event of failure.
    - Outdoor use, use involving potential chemical contamination or electrical interference, or use in conditions or environments not described in product catalogs or manuals
    - Nuclear energy control systems, combustion systems, railroad systems, aviation systems, vehicle systems, medical equipment, amusement machines, and installations subject to separate industry or government regulations
    - Systems, machines, and equipment that may present a risk to life or property
    - Systems that require a high degree of reliability, such as systems that supply gas, water, or electricity, or systems that operate continuously 24 hours a day
    - Other systems that require a similar high degree of safety
- Never use the product for an application involving serious risk to life or property without first ensuring that the system is designed to secure the required level of safety with risk warnings and redundancy, and that the Yaskawa product is properly rated and installed.
- The circuit examples and other application examples described in product catalogs and manuals are for reference. Check the functionality and safety of the actual devices and equipment to be used before using the product.
- Read and understand all use prohibitions and precautions, and operate the Yaskawa product correctly to prevent accidental harm to third parties.

◆ Specifications Change

The names, specifications, appearance, and accessories of products in product catalogs and manuals may be changed at any time based on improvements and other reasons. The next editions of the revised catalogs or manuals will be published with updated code numbers. Consult with your Yaskawa representative to confirm the actual specifications before purchasing a product.

Compliance with UL Standards, EU Directives, and Other Safety Standards

Certification marks for the standards for which the product has been certified by certification bodies are shown on nameplate. Products that do not have the marks are not certified for the standards.

◆ North American Safety Standards (UL)

Product	Model	UL Standards (UL File No.)
SERVOPACKs*1	SGD7S	UL 61800-5-1
Rotary Servomotors*1	• SGM7A • SGM7J • SGM7P • SGM7G	UL 1004-1 UL 1004-6
Direct Drive Servomotors*1	• SGMCV	
Linear Servomotors	• SGLGW • SGLFW • SGLFW2*2 • SGLTW	UL 1004 (E165827)

*1. Certification is scheduled for April 2014.
*2. Certification is scheduled for April 2015.

◆ European Directives

Product	Model	European Directive	Harmonized Standards
SERVOPACKs*1	SGD7S	Machinery Directive 2006/42/EC	EN ISO13849-1: 2008 EN 954-1
		EMC Directive 2004/108/EC	EN 55011 group 1, class A EN 61000-6-2 EN 61000-6-4 EN 61800-3
		Low Voltage Directive 2006/95/EC	EN 50178 EN 61800-5-1
Rotary Servomotors*1	• SGM7A • SGM7J • SGM7P • SGM7G	EMC Directive 2004/108/EC	EN 55011 group 1, class A EN 61000-6-2 EN 61800-3
		Low Voltage Directive 2006/95/EC	EN 60034-1 EN 60034-5
Direct Drive Servomotors	• SGMCS-□□B, □□C, □□D, □□E (small capacity, coreless) • SGMCV	EMC Directive 2004/108/EC	EN 55011 group 1, class A EN 61000-6-2 EN 61800-3*2
		Low Voltage Directive 2006/95/EC	EN 60034-1 EN 60034-5
Linear Servomotors	• SGLG • SGLF • SGLFW2*3 • SGLT • SGLC	EMC Directive 2004/108/EC	EN 55011 group 1, class A EN 61000-6-2 EN 61000-6-4
		Low Voltage Directive 2006/95/EC	EN 60034-1

*1. Certification is scheduled for April 2014.
*2. Only the SGMCV is certified.
*3. Certification is scheduled for April 2015.

◆ Safety Standards

Product	Model	Safety Standards	Standards
SERVOPACKs	SGD7S	Safety of Machinery	EN ISO13849-1: 2008 EN 954-1 IEC 60204-1
		Functional Safety	IEC 61508 series IEC 62061 IEC 61800-5-2
		EMC	IEC 61326-3-1

Note: Certification is scheduled for April 2014.

◆ Safe Performance

Item	Standards	Performance Level
Safety Integrity Level	IEC 61508	SIL3
	IEC 62061	SILCL3
Performance Level	EN ISO 13849-1	PLe (Category 3)
Stop Category	IEC 60204-1	Stop category 0
Safety Function	IEC 61800-5-2	STO

Note: Certification is scheduled for April 2014.

Contents

Basic Information on Servomotors

1

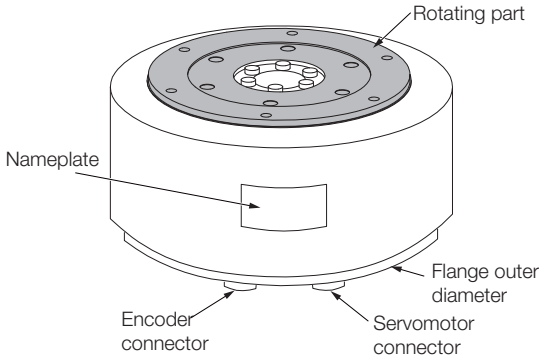
This chapter provides basic information on Direct Drive Servomotors, including Servomotor part names and combinations with SERVOPACKs.

1.1 Servomotor Part Names

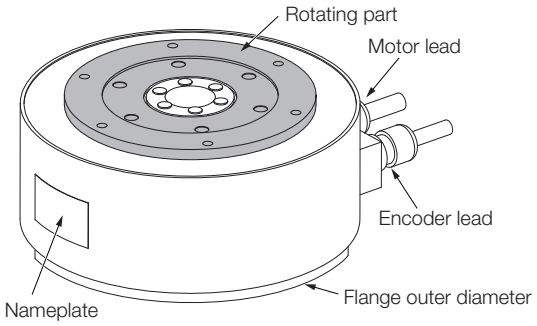
1.1.1 SGMCS

Small-Capacity, Coreless Servomotors

- Flange Specification 1

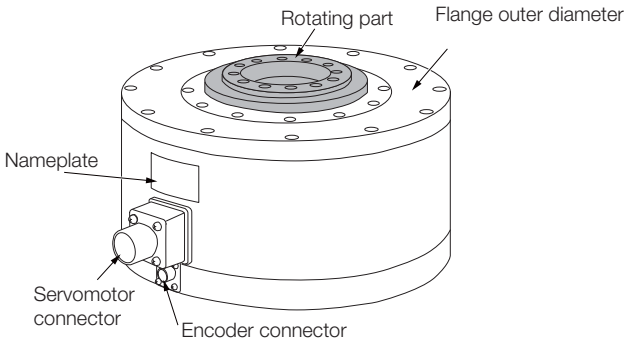


- Flange Specification 4



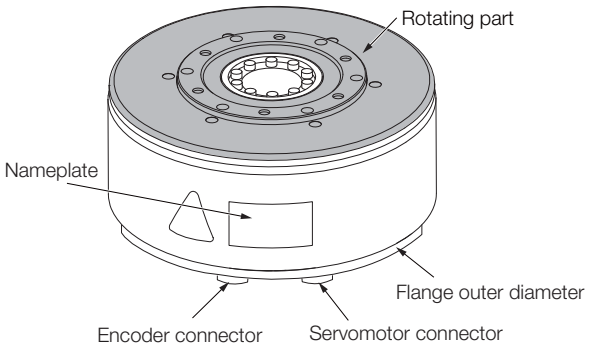
Medium-Capacity Servomotors with Cores

- Connectors

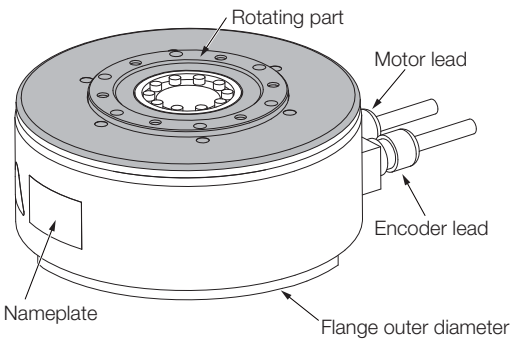


1.1.2 SGMCV

- Flange Specification 1



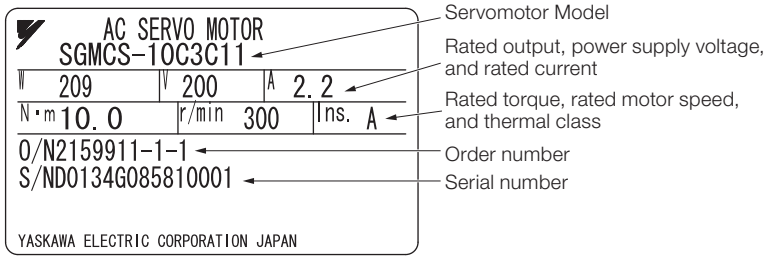
- Flange Specification 4



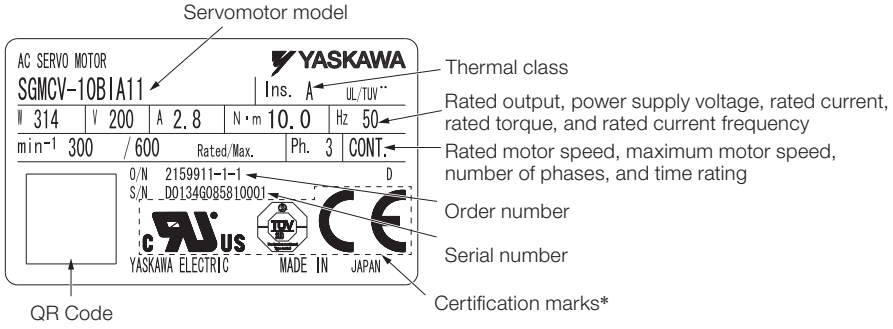
1.2 Nameplate

The nameplate provides the basic information that is given below.

1.2.1 SGMCS



1.2.2 SGMCV



* Certification marks for the standards for which the Servomotor has been certified by certification bodies are shown on the product.

1.3 Outline of Model Designations

1.3.1 Servomotors

This section outlines the model numbers of Σ-7-Series Servomotors. For details, refer to the chapter for your type of Servomotor.

SGMC□ - 02 B 3 C 1 1

Series | 1st+2nd digits | 3rd digit | 4th digit | 5th digit | 6th digit | 7th digit

Series Σ-7-Series Servomotors

Code	Specifications	Reference
SGMCS	Small capacity, coreless	Chapter 3
	Medium capacity, with core	
SGMCV	Small capacity, with core	Chapter 4

1st+2nd digits Rated Output

3rd digit Servomotor Outer Diameter

4th digit Serial Encoder Specification

Servomotor	Serial Encoder Specification
SGMCS	20-bit single-turn absolute encoder
	20-bit incremental encoder
SGMCV	22-bit single-turn absolute encoder
	22-bit multiturn absolute encoder

5th digit Design Revision Order

6th digit Flange Specifications

- Non-load side installation
- Load side installation

7th digit Options

- High mechanical precision

1.3.2 SERVOPACKs

This section outlines the model numbers of Σ-7-Series SERVOPACKs. For details, refer to the manual for your SERVOPACK.

- 🕮 *Σ-7-Series Σ-7S SERVOPACK with Analog Voltage/Pulse Train References Product Manual* (Manual No.: SIEP S800001 26)
- 🕮 *Σ-7-Series Σ-7S SERVOPACK with MECHATROLINK-II Communications References Product Manual* (Manual No.: SIEP S800001 27)
- 🕮 *Σ-7-Series Σ-7S SERVOPACK with MECHATROLINK-III Communications References Product Manual* (Manual No.: SIEP S800001 28)
- 🕮 *Σ-7-Series Σ-7W SERVOPACK with MECHATROLINK-III Communications References Product Manual* (Manual No.: SIEP S800001 29)

SGD7□ - R70 A 00 A 000

Series | 1st+2nd+3rd digits | 4th digit | 5th+6th digits | 7th digit | 8th+9th+10th digits

Series Σ-7-Series SERVOPACKs

Code	Specification
SGD7S	Single-axis SERVOPACKs
SGD7W	Two-axis SERVOPACKs

1st+2nd+3rd digits Maximum Applicable Motor Capacity

0.05 kW to 1.5 kW

4th digit Power Supply Voltage

- 200 VAC

5th+6th digits Interface

- Analog voltage/pulse train reference
- MECHATROLINK-II communications reference
- MECHATROLINK-III communications reference

7th digit Design Revision Order

8th+9th+10th digits Options

- Rack-mounted installation
- Varnished

1.4 Combinations of Servomotors and SERVOPACKs

Direct Drive Servomotor Model		Rated Torque N·m	Instantaneous Maximum Torque N·m	SERVOPACK Model	
				SGD7S-□□□□	SGD7W-□□□□
Small Capacity, Coreless (SGMCS)	SGMCS-02B	2	6	2R8A	
	SGMCS-05B	5	15		
	SGMCS-07B	7	21		
	SGMCS-04C	4	12		
	SGMCS-10C	10	30		
	SGMCS-14C	14	42		
	SGMCS-08D	8	24		
	SGMCS-17D	17	51		
	SGMCS-25D	25	75		
	SGMCS-16E	16	48	5R5A	
	SGMCS-35E	35	105		
Medium Capacity, with Core (SGMCS)	SGMCS-45M	45	135	7R6A	
	SGMCS-80M	80	240	120A	–
	SGMCS-80N	80	240		
	SGMCS-1AM	110	330	180A	
	SGMCS-1EN	150	450	200A	
	SGMCS-2ZN	200	600		
Small Capacity, with Core (SGMCV)	SGMCV-04B	4	12	2R8A	
	SGMCV-10B	10	30		
	SGMCV-14B	14	42	5R5A	
	SGMCV-08C	8	24	2R8A	
	SGMCV-17C	17	51	5R5A	
	SGMCV-25C	25	75	7R6A	

Capacity Selection

2

This chapter describes calculation methods to use when selecting Servomotor capacities.

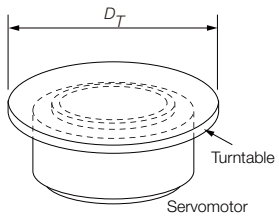
2.1 Selecting the Servomotor Capacity

Use Yaskawa's SigmaJunmaSize+, an AC servo drive capacity selection program, to select the Servomotor capacity. With the SigmaJunmaSize+, you can find the optimum Servomotor capacity by simply selecting and entering information according to instructions from a wizard.

Contact your Yaskawa representative for information on the SigmaJunmaSize+.

Refer to the following selection examples to select Servomotor capacities with manual calculations rather than with the above software.

1. Mechanical Specifications



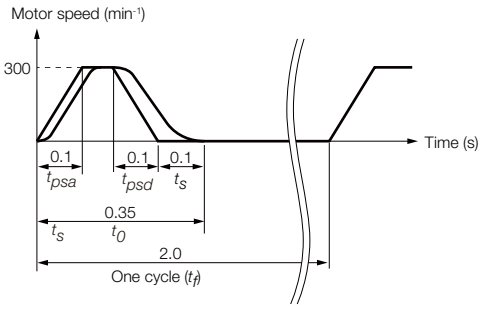
Item	Code	Value
Turntable Mass	W	12 kg
Turntable Diameter	D_T	300 mm
Rotational Angle per Cycle	θ	270 deg
Positioning Time	t_0	0.35 s

Item	Code	Value
Acceleration/ Deceleration Time	t_p $= t_{psa}$ $= t_{psd}$	0.1 s
Operating Frequency	t_f	2 s
Load Torque	T_L	0 N·m
Settling time	t_s	0.1 s

2. Motor Speed of Direct Drive Servomotor

$$N_O = \frac{\theta}{360} \times \frac{60}{(t_0 - t_p - t_s)} = \frac{270}{360} \times \frac{60}{(0.35 - 0.1 - 0.1)} = 300\ (\text{min}^{-1})$$

3. Operation Pattern



4. Load Moment of Inertia

$$J_L = \frac{1}{8} \times D_T^2 \times W = \frac{1}{8} \times (300 \times 10^{-3})^2 \times 12 = 0.135\ (\text{kg·m}^2)$$

5. Load Acceleration/Deceleration Torque

$$T_a = J_L \times 2\pi \times \frac{N_O/60}{t_p} = 0.135 \times 2\pi \times \frac{300/60}{0.1} = 42.4\ (\text{N·m})$$

6. Provisional Selection of Direct Drive Servomotor

① Selection Conditions

- Load acceleration/deceleration torque < Instantaneous maximum torque of Direct Drive Servomotor
- Load moment of inertia < Allowable load moment of inertia ratio (J_R) × Moment of inertia of Direct Drive Servomotor (J_M)

The following Servomotor meets the selection conditions.

- SGMCV-17CEA11

② Specifications of the Provisionally Selected Servomotor

Item	Value
Rated Torque	17 (N·m)
Instantaneous Maximum Torque	51 (N·m)
Moment of Inertia (J_M)	0.00785 (kg·m^2)
Allowable Load Moment of Inertia Ratio (J_R)	25

7. Verification of the Provisionally Selected Servomotor

- Verification of required acceleration torque:

$$T_{Ma} = \frac{(J_L + J_M) \times N_O}{9.55 \times t_{psa}} = \frac{(0.135 + 0.00785) \times 300}{9.55 \times 0.1}$$

$\approx$ 44.9 (N·m) < Maximum instantaneous torque...Satisfactory

- Verification of required deceleration torque:

$$T_{Md} = -\frac{(J_L + J_M) \times N_O}{9.55 \times t_{psd}} = -\frac{(0.135 + 0.00785) \times 300}{9.55 \times 0.1}$$

$\approx$ -44.9 (N·m) < Maximum instantaneous torque...Satisfactory

- Verification of effective torque value:

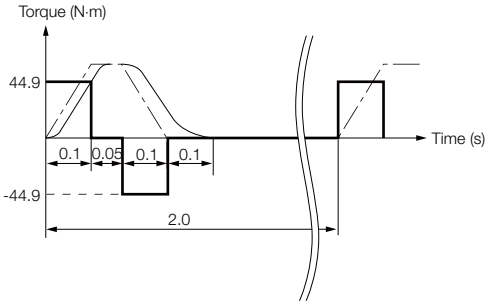
$$Trms = \sqrt{\frac{T_{Ma}^2 \times t_{psa} + T_L^2 \times t_c + T_{Md}^2 \times t_{psd}}{tf}} = \sqrt{\frac{44.9^2 \times 0.1 + 0^2 \times 0.05 + (-44.9)^2 \times 0.1}{2}}$$

$\approx$ 14.2 (N·m) < Rated torque...Satisfactory

t_c =Time of constant motor speed = $t_0 - t_s - t_{psa} - t_{psd}$

8. Result

It has been verified that the provisionally selected Servomotor is applicable.
The torque diagram is shown below.



Specifications, Ratings, and External Dimensions of SGMCS Servomotors

3

This chapter describes how to interpret the model numbers of SGMCS Servomotors and gives their specifications, ratings, and external dimensions.

3.1 Model Designations

SGMCS - 02 B 3 C 1 1

Direct Drive Servomotors: SGMCS	1st+2nd digits	3rd digit	4th digit	5th digit	6th digit	7th digit

1st+2nd digits Rated Output

● Small-Capacity, Coreless

Code	Specification
02	2 N·m
04	4 N·m
05	5 N·m
07	7 N·m
08	8 N·m
10	10 N·m
14	14 N·m
16	16 N·m
17	17 N·m
25	25 N·m
35	35 N·m

● Medium-Capacity, with Core

Code	Specification
45	45 N·m
80	80 N·m
1A	110 N·m
1E	150 N·m
2Z	200 N·m

3rd digit Servomotor Outer Diameter

Code	Specification
B	135-mm dia.
C	175-mm dia.
D	230-mm dia.
E	290-mm dia.
M	280-mm dia.
N	360-mm dia.

4th digit Serial Encoder

Code	Specification
3	20-bit single-turn absolute encoder
D	20-bit incremental encoder

5th digit Design Revision Order

Code	Specification
A	Model with servomotor outer diameter code M or N
B	Model with servomotor outer diameter code E
C	Model with servomotor outer diameter code B, C, or D

6th digit Flange

Code	Mounting	Servomotor Outer Diameter Code (3rd Digit)					
		B	C	D	E	M	N
1	Non-load side	✓	✓	✓	✓	–	–
	Load side	–	–	–	–	✓	✓
3	Non-load side	–	–	–	–	✓	✓
4	Non-load side (with cable on side)	✓	✓	✓	✓	–	–

✓ : Applicable models.

7th digit Options

Code	Specification
1	Without options

Note: Direct Drive Servomotors are not available with holding brakes.

3.2 Specifications and Ratings

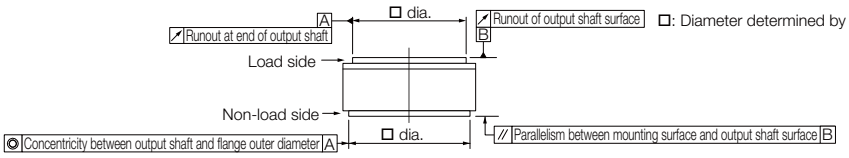
3.2.1 Small-Capacity, Coreless Servomotors: Specifications

Voltage			200 V									
Model SGMCS-			02B	05B	07B	04C	10C	14C	08D	17D	25D	16E	35E
Time Rating			Continuous										
Thermal Class			A										
Insulation Resistance			500 VDC, 10 MΩ min.										
Withstand Voltage			1,500 VAC for 1 minute										
Excitation			Permanent magnet										
Mounting			Flange-mounted										
Drive Method			Direct drive										
Rotation Direction			Counterclockwise (CCW) for forward reference when viewed from the load side										
Vibration Class*1			V15										
Absolute Accuracy			±15 s										
Repeatability			±1.3 s										
Protective Structure*2			Totally enclosed, self-cooled, IP42										
Environmental Conditions	Surrounding Air Temperature		0°C to 40°C (with no freezing)										
	Surrounding Air Humidity		20% to 80% relative humidity (with no condensation)										
	Installation Site		• Must be indoors and free of corrosive and explosive gases. • Must be well-ventilated and free of dust and moisture. • Must facilitate inspection and cleaning. • Must have an altitude of 1,000 m or less. • Must be free of strong magnetic fields.										
	Storage Environment		Store the Servomotor in the following environment if you store it with the power cable disconnected. Storage Temperature: -20°C to 60°C (with no freezing) Storage Humidity: 20% to 80% relative humidity (with no condensation)										
Mechanical Tolerances*3	Runout of Output Shaft Surface	mm	0.02										
	Runout at End of Output Shaft	mm	0.04										
	Parallelism between Mounting Surface and Output Shaft Surface	mm	0.07						0.08				
	Concentricity between Output Shaft and Flange Outer Diameter	mm	0.07						0.08				
Shock Resistance*4	Impact Acceleration Rate at Flange		490 m/s^2										
	Number of Impacts		2 times										
Vibration Resistance*5	Vibration Acceleration Rate at Flange		49 m/s^2										
Applicable SERVOPACKs			Refer to *1.4 Combinations of Servomotors and SERVOPACKs* on page 1-5.										

*1. A vibration class of V15 indicates a vibration amplitude of 15 μm maximum on the Servomotor without a load at the rated motor speed.
*2. The hollow hole section, motor mounting surface, output shaft surface, and gap around the rotating part of the shaft are excluded. Protective structure specifications apply only when the special cable is used.

3.2.1 Small-Capacity, Coreless Servomotors: Specifications

*3. Refer to the following figure for the relevant locations on the Servomotor. Refer to the dimensional drawings of the individual Servomotors for more information on tolerances.



*4. The shock resistance for shock in the vertical direction when the Servomotor is mounted with the shaft in a horizontal position is given in the above table.

Shock Applied to the Servomotor

*5. The vertical, side-to-side, and front-to-back vibration resistance for vibration in three directions when the Servomotor is mounted with the shaft in a horizontal position is given in the above table. The strength of the vibration that the Servomotor can withstand depends on the application. Always confirm the vibration acceleration rate.

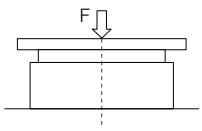
3.2.2 Small-Capacity, Coreless Servomotors: Ratings

Voltage			200 V									
Model SGMCS-			02B	05B	07B	04C	10C	14C	08D	17D	25D	16E	35E
Rated Output*1		W	42	105	147	84	209	293	168	356	393	335	550
Rated Torque*1, *2		N·m	2.00	5.00	7.00	4.00	10.0	14.0	8.00	17.0	25.0	16.0	35.0
Instantaneous Maximum Torque*1		N·m	6.00	15.0	21.0	12.0	30.0	42.0	24.0	51.0	75.0	48.0	105
Stall Torque*1		N·m	2.05	5.15	7.32	4.09	10.1	14.2	8.23	17.4	25.4	16.5	35.6
Rated Current*1		Arms	1.8	1.7	1.4	2.2		2.8	1.9	2.5	2.6	3.3	3.5
Instantaneous Maximum Current*1		Arms	5.4	5.1	4.1	7.0		8.3	5.6	7.5	8.0	9.4	10.0
Rated Motor Speed*1		min^{-1}	200			200			200		150	200	150
Maximum Motor Speed*1		min^{-1}	500			500	400	300	500	350	250	500	250
Torque Constant		N·m/Arms	1.18	3.17	5.44	2.04	5.05	5.39	5.10	7.79	10.8	5.58	11.1
Motor Moment of Inertia		$\times 10^{-4}$ kg·m^2	28.0	51.0	77.0	77.0	140	220	285	510	750	930	1430
Rated Power Rate*1		kW/s	1.43	4.90	6.36	2.08	7.14	8.91	2.25	5.67	8.33	2.75	8.57
Rated Angular Acceleration Rate*1		rad/s^2	710	980	910	520	710	640	280	330		170	240
Heat Sink Size		mm	350 × 350 × 12			450 × 450 × 12			550 × 550 × 12			650 × 650 × 12	
Allowable Load Moment of Inertia (Motor Moment of Inertia Ratio)			10 times				5 times	3 times					
Allowable Load*3	Allowable Thrust Load	N	1500			3300			4000			11000	
	Allowable Moment Load	N·m	40	50	64	70	75	90	93	103	135	250	320

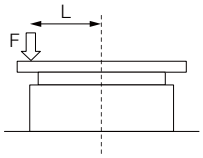
*1. These values are for operation in combination with a SERVOPACK when the temperature of the armature winding is 100°C. The values for other items are at 20°C. These are typical values.

*2. The rated torques are the continuous allowable torque values at 40°C with a steel heat sink of the dimensions given in the table.

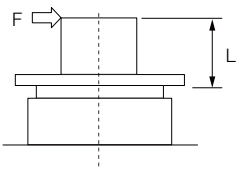
*3. The thrust loads and moment loads that are applied while a Servomotor is operating are roughly classified into the following patterns. Design the machine so that the thrust loads or moment loads will not exceed the values given in the table.



Where F is the external force,
Thrust load = F + Load mass
Moment load = 0



Where F is the external force,
Thrust load = F + Load mass
Moment load = F × L

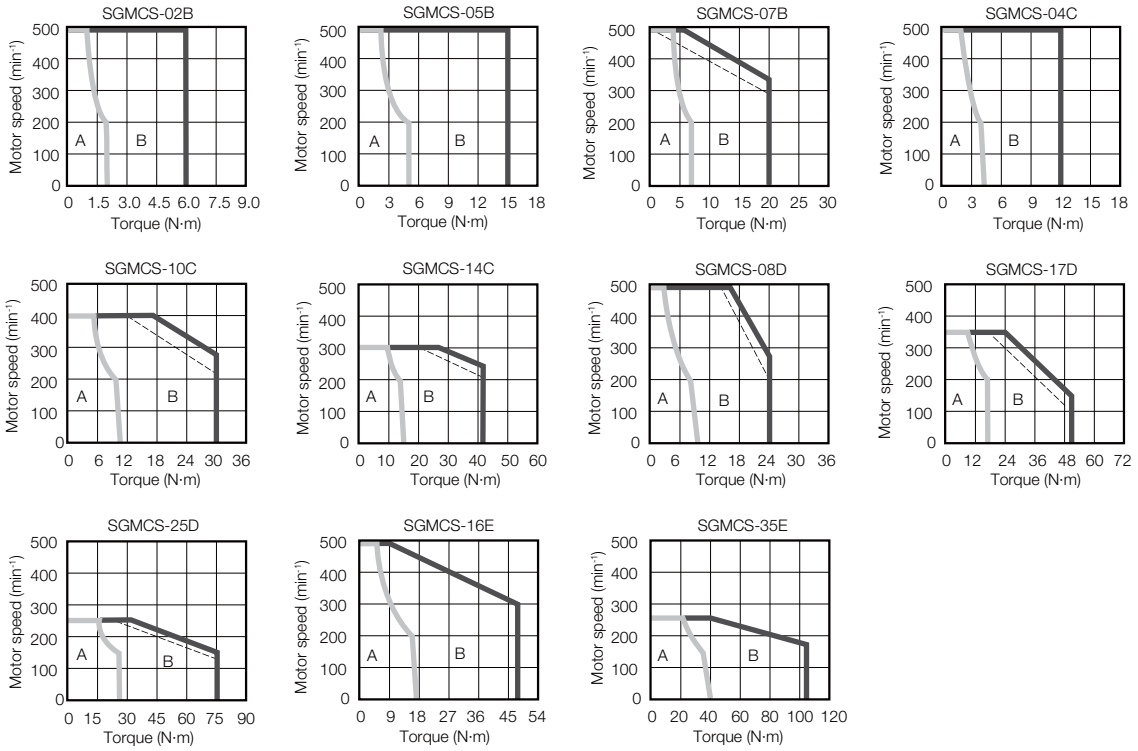


Where F is the external force
Thrust load = Load mass
Moment load = F × L

Note: For the bearings used in these Servomotors, the loss depends on the bearing temperature. The amount of heat loss is higher at low temperatures.

3.2.3 Small-Capacity, Coreless Servomotors: Torque-Motor Speed Characteristics

A : Continuous duty zone ——— (solid lines): With three-phase 200-V input
B : Intermittent duty zone - - - - - - - - (dotted lines): With single-phase 100-V input



Note: 1. These values are for operation in combination with a SERVOPACK when the temperature of the armature winding is 100°C. These are typical values.

2. The characteristics in the intermittent duty zone depend on the power supply voltage.

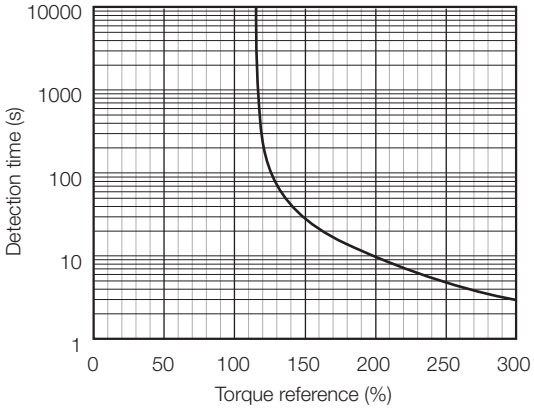
3. If the effective torque is within the allowable range for the rated torque, the Servomotor can be used within the intermittent duty zone.

4. If you use a Servomotor Main Circuit Cable that exceeds 20 m, the intermittent duty zone in the torque-motor speed characteristics will become smaller because the voltage drop increases.

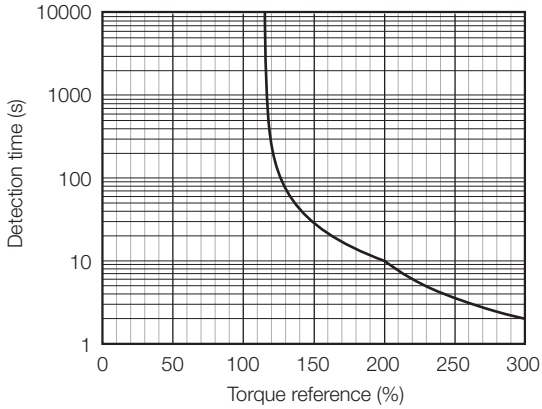
3.2.4 Small-Capacity, Coreless Servomotors: Servomotor Overload Protection Characteristics

The overload detection level is set for hot start conditions with a Servomotor ambient temperature of 40°C.

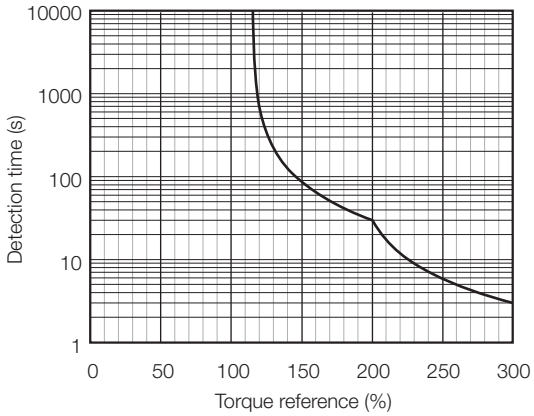
SGMCS-02B, -05B, -07B, -10C, -17D, and -35E



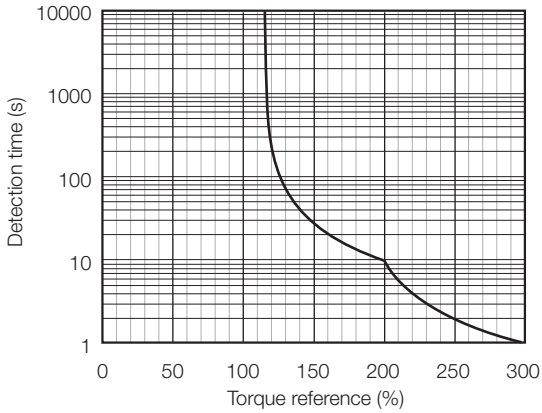
SGMCS-04C



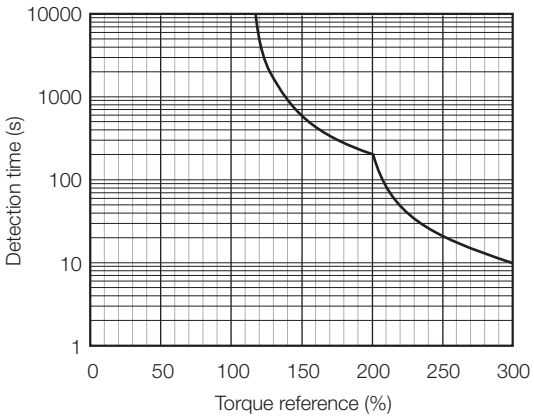
SGMCS-14C



SGMCS-08D and -16E



SGMCS-25D



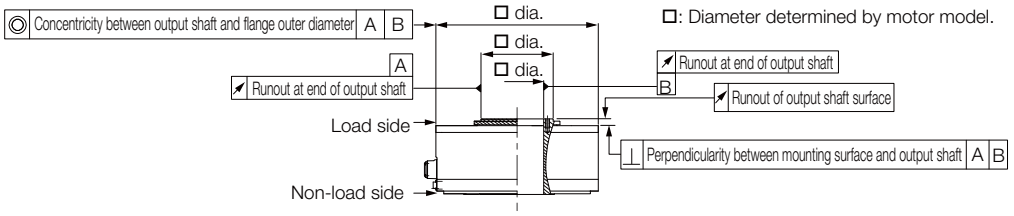
Note: The above overload protection characteristics do not mean that you can perform continuous duty operation with an output of 100% or higher. Use the Servomotor so that the effective torque remains within the continuous duty zone given in *3.2.3 Small-Capacity, Coreless Servomotors: Torque-Motor Speed Characteristics* on page 3-6.

3.2.5 Medium-Capacity Servomotors with Cores: Specifications

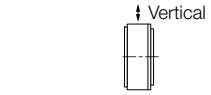
Voltage			200 V					
Model SGMCS-			45M	80M	1AM	80N	1EN	2ZN
Time Rating			Continuous					
Thermal Class			F					
Insulation Resistance			500 VDC, 10 MΩ min.					
Withstand Voltage			1,500 VAC for 1 minute					
Excitation			Permanent magnet					
Mounting			Flange-mounted					
Drive Method			Direct drive					
Rotation Direction			Counterclockwise (CCW) for forward reference when viewed from the load side					
Vibration Class*1			V15					
Absolute Accuracy			±15 s					
Repeatability			±1.3 s					
Protective Structure*2			Totally enclosed, self-cooled, IP44					
Environmental Conditions	Surrounding Air Temperature		0°C to 40°C (with no freezing)					
	Surrounding Air Humidity		20% to 80% relative humidity (with no condensation)					
	Installation Site		• Must be indoors and free of corrosive and explosive gases. • Must be well-ventilated and free of dust and moisture. • Must facilitate inspection and cleaning. • Must have an altitude of 1,000 m or less. • Must be free of strong magnetic fields.					
	Storage Environment		Store the Servomotor in the following environment if you store it with the power cable disconnected. Storage Temperature: -20°C to 60°C (with no freezing) Storage Humidity: 20% to 80% relative humidity (with no condensation)					
Mechanical Tolerances*3	Runout of Output Shaft Surface	mm	0.02					
	Runout at End of Output Shaft	mm	0.04					
	Parallelism between Mounting Surface and Output Shaft Surface	mm	–					
	Concentricity between Output Shaft and Flange Outer Diameter	mm	0.08					
	Perpendicularity between Mounting Surface and Output Shaft	mm	0.08					
Shock Resistance*4	Impact Acceleration Rate at Flange		490 m/s^2					
	Number of Impacts		2 times					
Vibration Resistance*5	Vibration Acceleration Rate at Flange		24.5 m/s^2					
Applicable SERVOPACKs			Refer to *1.4 Combinations of Servomotors and SERVOPACKs* on page 1-5.					

*1. A vibration class of V15 indicates a vibration amplitude of 15 μm maximum on the Servomotor without a load at the rated motor speed.
*2. This does not apply to the shaft opening. Protective structure specifications apply only when the special cable is used.

*3. Refer to the following figure for the relevant locations on the Servomotor. Refer to the dimensional drawings of the individual Servomotors for more information on tolerances.

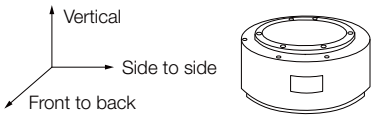


*4. The shock resistance for shock in the vertical direction when the Servomotor is mounted with the shaft in a horizontal position is given in the above table.



Shock Applied to the Servomotor

*5. The vertical, side-to-side, and front-to-back vibration resistance for vibration in three directions when the Servomotor is mounted with the shaft in a horizontal position is given in the above table. The strength of the vibration that the Servomotor can withstand depends on the application. Always confirm the vibration acceleration rate.



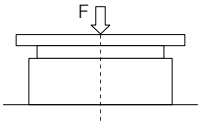
3.2.6 Medium-Capacity Servomotors with Cores: Ratings

Voltage			200 V					
Model SGMCS-			45M	80M	1AM	80N	1EN	2ZN
Rated Output*1		W	707	1260	1730	1260	2360	3140
Rated Torque*1, *2		N·m	45.0	80.0	110	80.0	150	200
Instantaneous Maximum Torque*1		N·m	135	240	330	240	450	600
Stall Torque*1		N·m	45.0	80.0	110	80.0	150	200
Rated Current*1		Arms	5.8	9.7	13.4	9.4	17.4	18.9
Instantaneous Maximum Current*1		Arms	17.0	28.0	42.0	28.0	56.0	56.0
Rated Motor Speed*1		min^{-1}	150			150		
Maximum Motor Speed*1		min^{-1}	300			300	250	
Torque Constant		N·m/Arms	8.39	8.91	8.45	9.08	9.05	11.5
Motor Moment of Inertia		$\times 10^{-4}$ kg·m^2	388	627	865	1360	2470	3060
Rated Power Rate*1		kW/s	52.2	102	140	47.1	91.1	131
Rated Angular Acceleration Rate*1		rad/s^2	1160	1280	1270	588	607	654
Heat Sink Size		mm	750 × 750 × 45					
Allowable Load Moment of Inertia (Motor Moment of Inertia Ratio)			3 times					
Allowable Load*3	A	mm	33			37.5		
	Allowable Thrust Load	N	9000			16000		
	Allowable Moment Load	N·m	180			350		

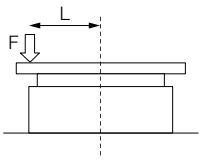
*1. These values are for operation in combination with a SERVOPACK when the temperature of the armature winding is 20°C. These are typical values.

*2. The rated torques are the continuous allowable torque values at 40°C with a steel heat sink of the dimensions given in the table.

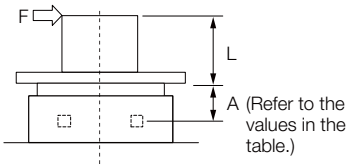
*3. The thrust loads and moment loads that are applied while a Servomotor is operating are roughly classified into the following patterns. Design the machine so that the thrust loads or moment loads will not exceed the values given in the table.



Where F is the external force,
Thrust load = F + Load mass
Moment load = 0



Where F is the external force,
Thrust load = F + Load mass
Moment load = F × L

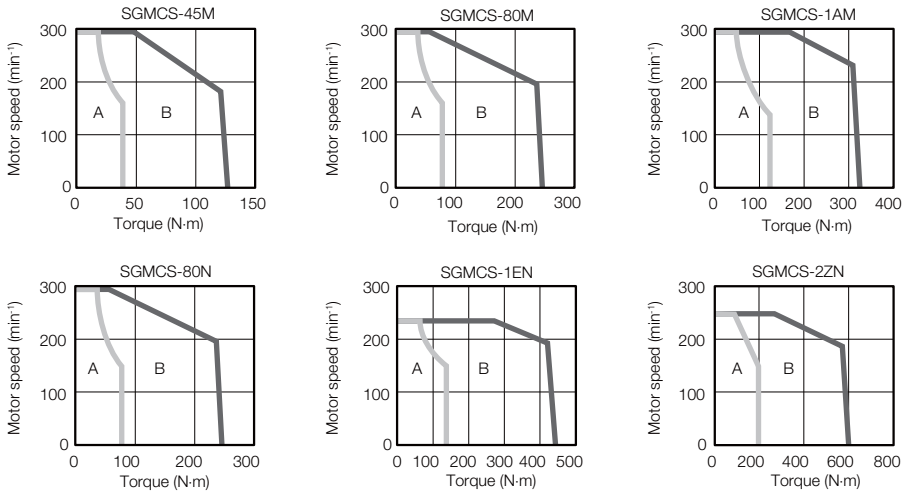


Where F is the external force,
Thrust load = Load mass
Moment load = F × (L + A)

Note: For the bearings used in these Servomotors, the loss depends on the bearing temperature. The amount of heat loss is higher at low temperatures.

3.2.7 Medium-Capacity Servomotors with Cores: Torque-Motor Speed Characteristics

A : Continuous duty zone
B : Intermittent duty zone

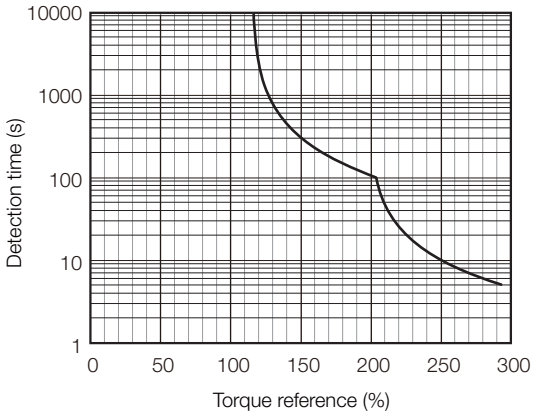


Note: 1. These values are for operation in combination with a SERVOPACK when the temperature of the armature winding is 20°C. These are typical values.
2. If the effective torque is within the allowable range for the rated torque, the Servomotor can be used within the intermittent duty zone.
3. If you use a Servomotor Main Circuit Cable that exceeds 20 m, the intermittent duty zone in the torque-motor speed characteristics will become smaller because the voltage drop increases.

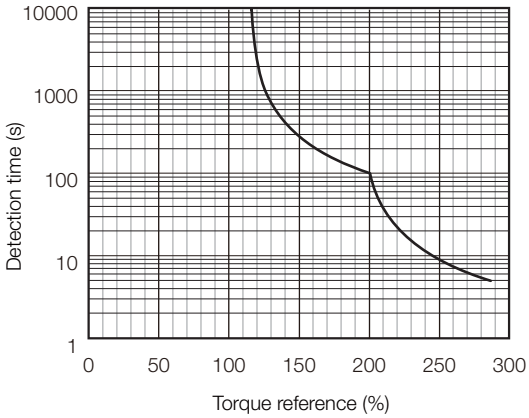
3.2.8 Medium-Capacity Servomotors with Cores: Servomotor Overload Protection Characteristics

The overload detection level is set for hot start conditions with a Servomotor ambient temperature of 40°C.

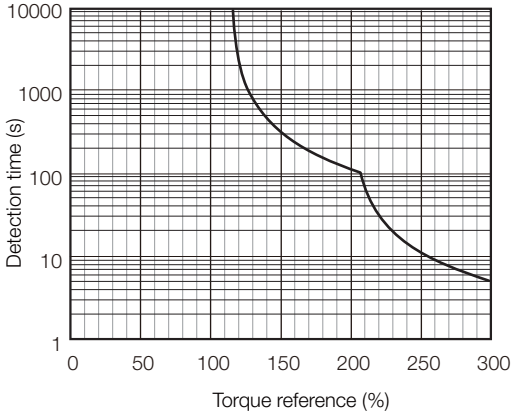
SGMCS-45M□A



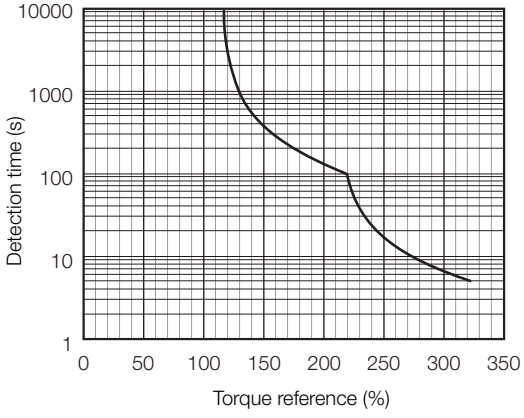
SGMCS-80M□A



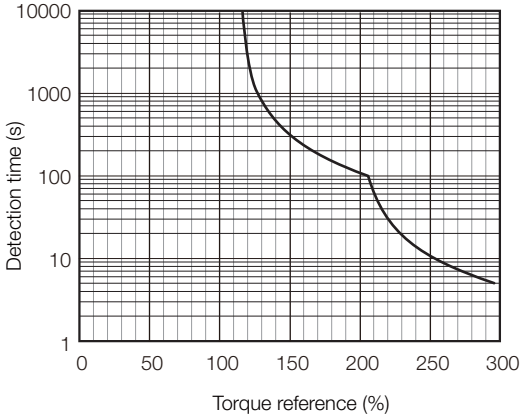
SGMCS-1AM□A and -80N□A



SGMCS-1EN□A



SGMCS-2ZN□A



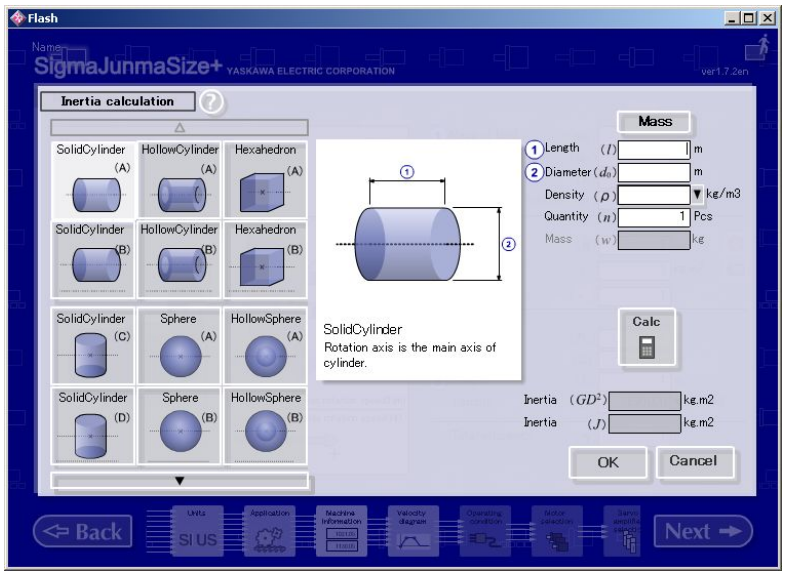
Note: The above overload protection characteristics do not mean that you can perform continuous duty operation with an output of 100% or higher. Use the Servomotor so that the effective torque remains within the continuous duty zone given in *3.2.7 Medium-Capacity Servomotors with Cores: Torque-Motor Speed Characteristics* on page 3-11.

3.2.9 Load Moment of Inertia

The load moment of inertia indicates the inertia of the load. The larger the load moment of inertia, the worse the response. If the moment of inertia is too large, operation will become unstable.

The allowable size of the load moment of inertia (J_L) for the Servomotor is restricted. (Refer to *3.2.2 Small-Capacity, Coreless Servomotors: Ratings* on page 3-5 or *3.2.6 Medium-Capacity Servomotors with Cores: Ratings* on page 3-10. This value is provided strictly as a guideline and results depend on Servomotor driving conditions.

Use the SigmaJunmaSize+ AC Servo Drive Capacity Selection Program to check the driving conditions. Contact your Yaskawa representative for information on the SigmaJunmaSize+.



An Overvoltage Alarm (A.400) is likely to occur during deceleration if the load moment of inertia exceeds the allowable load moment of inertia. SERVOPACKs with a built-in regenerative resistor may generate a Regenerative Overload Alarm (A.320). Perform one of the following steps if this occurs.

- Reduce the torque limit.
- Reduce the deceleration rate.
- Reduce the maximum motor speed.
- Install an external regenerative resistor if the alarm cannot be cleared using the above steps.

Regenerative resistors are not built into SERVOPACKs for 400-W Servomotors or smaller Servomotors. Even for SERVOPACKs with built-in regenerative resistors, an external regenerative resistor is required if the energy that results from the regenerative driving conditions exceeds the allowable loss capacity (W) of the built-in regenerative resistor.

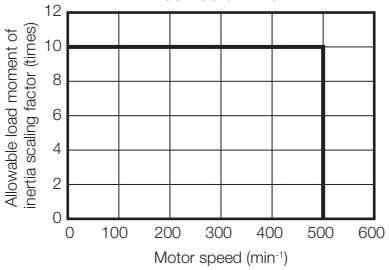
3.2.10 Allowable Load Moment of Inertia Scaling Factor for SERVOPACKs without Built-in Regenerative Resistors

The following graphs show the allowable load moment of inertia scaling factor of the motor speed for SERVOPACKs without built-in regenerative resistors when an External Regenerative Resistor is not connected (applicable SERVOPACK: SGD7S-2R8A).

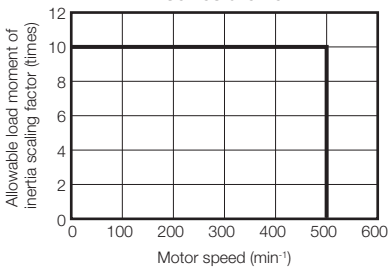
If the Servomotor exceeds the allowable load moment of inertia, an overvoltage alarm may occur in the SERVOPACK.

These graphs provide reference data for deceleration at the rated torque or higher with a 200-VAC power supply input.

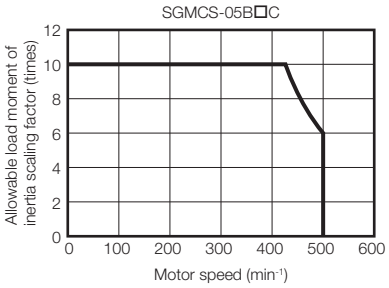
SGMCS-02B□C



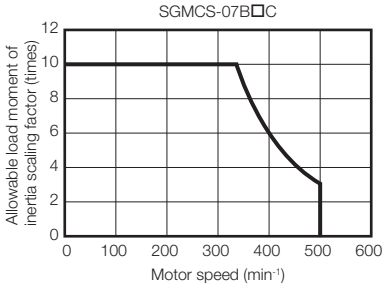
SGMCS-04C□C



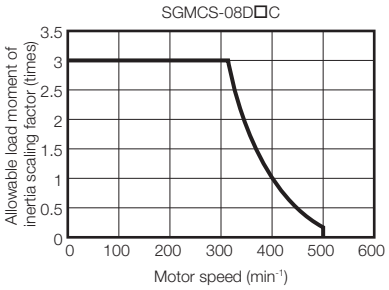
SGMCS-05B□C



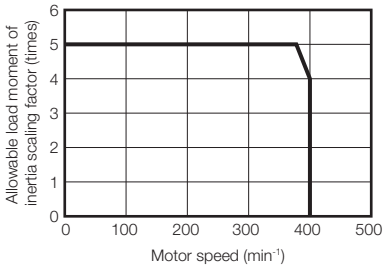
SGMCS-07B□C



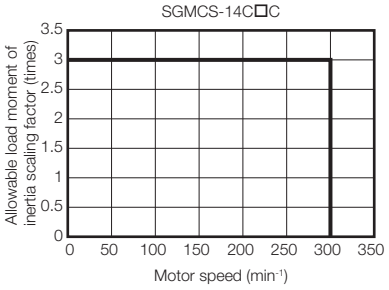
SGMCS-08D□C



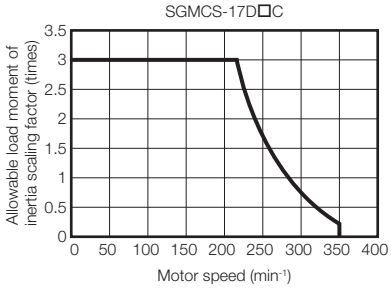
SGMCS-10C□C



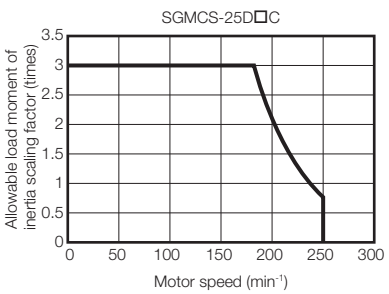
SGMCS-14C□C



SGMCS-17D□C



SGMCS-25D□C

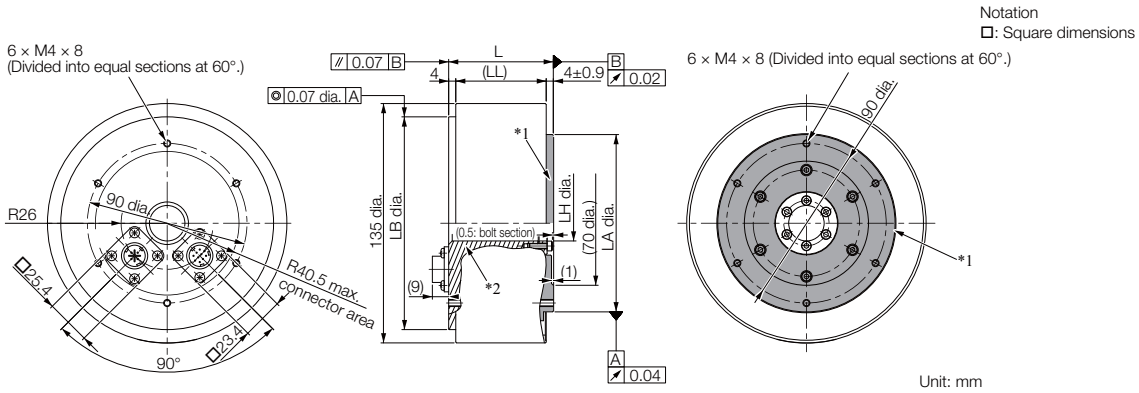


3.3 External Dimensions

3.3.1 Small-Capacity, Coreless Servomotors

◆ SGMCS-□□B

• Flange Specification 1



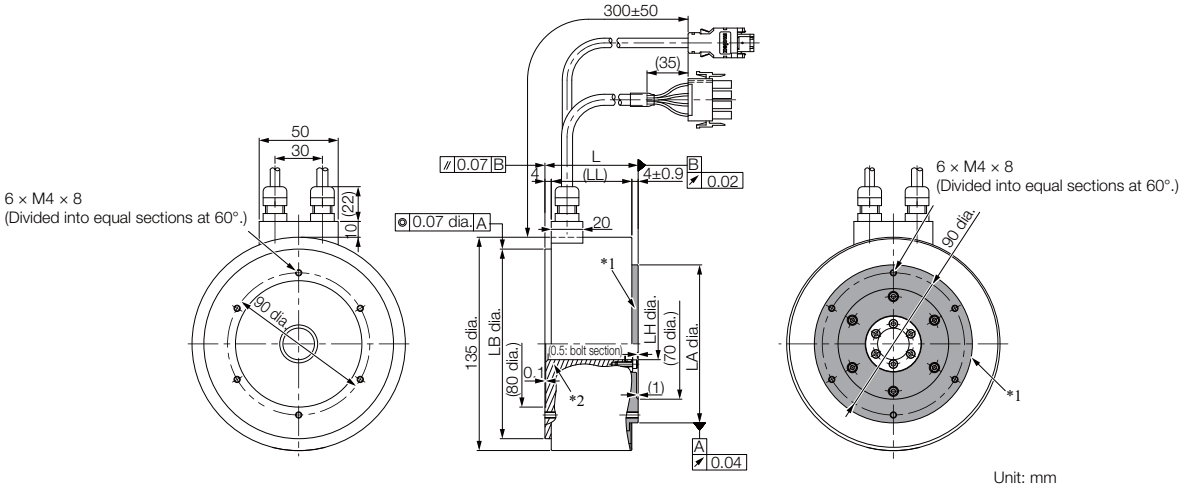
*1. The shaded section indicates the rotating parts.

*2. The hatched section indicates the non-rotating parts.

Note: Values in parentheses are reference dimensions.

Model SGMCS-	L	(LL)	LB	LH	LA	Approx. Mass [kg]
02B□C11	59	51	$120^{\ 0}_{-0.035}$	$20^{+0.4}_{\ 0}$	$100^{\ 0}_{-0.035}$	4.8
05B□C11	88	80	$120^{\ 0}_{-0.035}$	$20^{+0.4}_{\ 0}$	$100^{\ 0}_{-0.035}$	5.8
07B□C11	128	120	$120^{\ 0}_{-0.035}$	$20^{+0.4}_{\ 0}$	$100^{\ 0}_{-0.035}$	8.2

• Flange Specification 4



*1. The shaded section indicates the rotating parts.

*2. The hatched section indicates the non-rotating parts.

Note: Values in parentheses are reference dimensions.

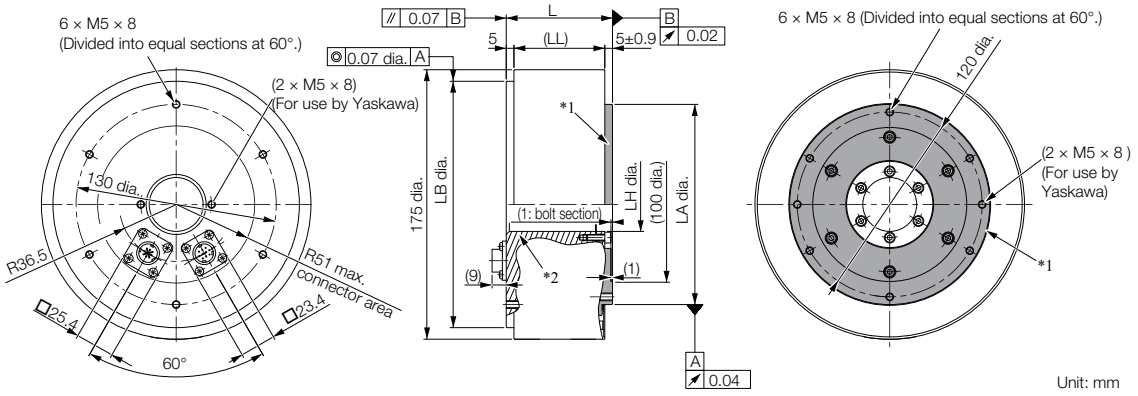
Model SGMCS-	L	(LL)	LB	LH	LA	Approx. Mass [kg]
02B□C41	59	51	$120^{\ 0}_{-0.035}$	$20^{+0.4}_{\ 0}$	$100^{\ 0}_{-0.035}$	4.8
05B□C41	88	80	$120^{\ 0}_{-0.035}$	$20^{+0.4}_{\ 0}$	$100^{\ 0}_{-0.035}$	5.8
07B□C41	128	120	$120^{\ 0}_{-0.035}$	$20^{+0.4}_{\ 0}$	$100^{\ 0}_{-0.035}$	8.2

Refer to the following section for information on connectors.

☞ *3.3.3 Connector Specifications* on page 3-21

◆ SGMCS-□□C

• Flange Specification 1



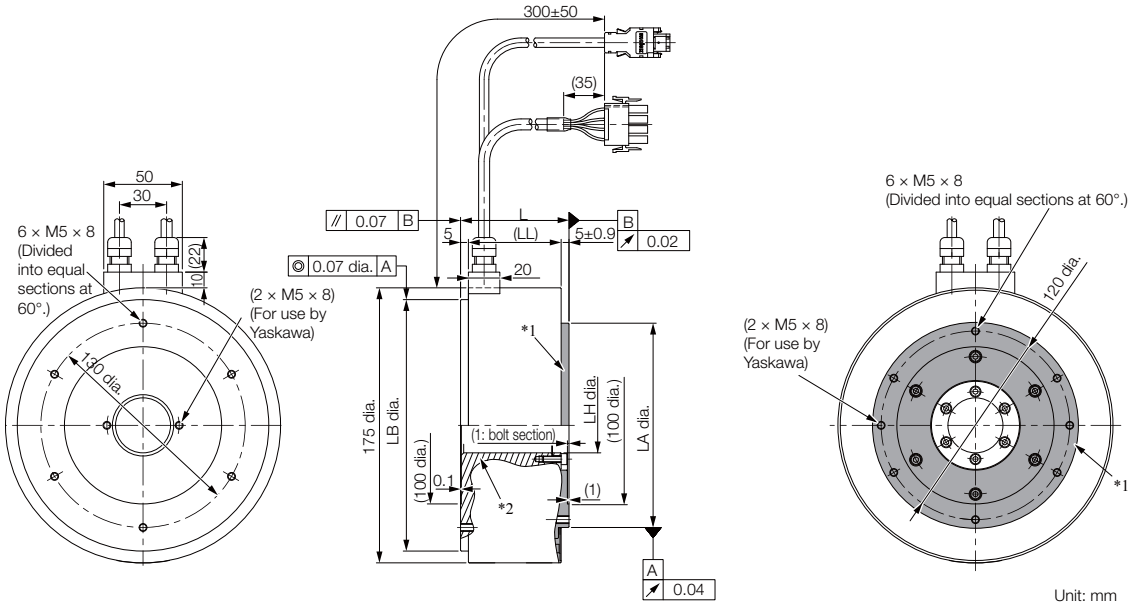
*1. The shaded section indicates the rotating parts.

*2. The hatched section indicates the non-rotating parts.

Note: Values in parentheses are reference dimensions.

Model SGMCS-	L	(LL)	LB	LH	LA	Approx. Mass [kg]
04C□C11	69	59	$160^{\ 0}_{-0.040}$	$35^{+0.4}_{\ 0}$	$130^{\ 0}_{-0.040}$	7.2
10C□C11	90	80	$160^{\ 0}_{-0.040}$	$35^{+0.4}_{\ 0}$	$130^{\ 0}_{-0.040}$	10.2
14C□C11	130	120	$160^{\ 0}_{-0.040}$	$35^{+0.4}_{\ 0}$	$130^{\ 0}_{-0.040}$	14.2

• Flange Specification 4



*1. The shaded section indicates the rotating parts.

*2. The hatched section indicates the non-rotating parts.

Note: Values in parentheses are reference dimensions.

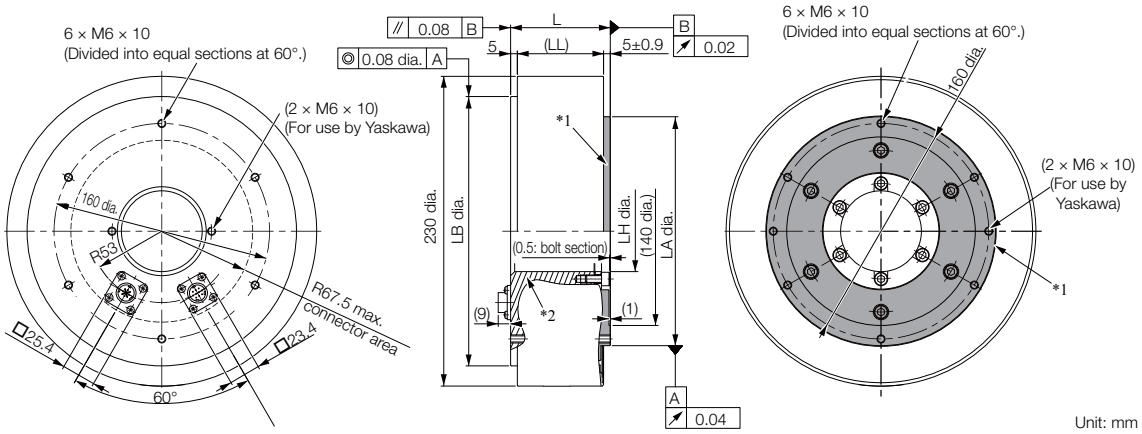
Model SGMCS-	L	(LL)	LB	LH	LA	Approx. Mass [kg]
04C□C41	69	59	$160^{\ 0}_{-0.040}$	$35^{+0.4}_{\ 0}$	$130^{\ 0}_{-0.040}$	7.2
10C□C41	90	80	$160^{\ 0}_{-0.040}$	$35^{+0.4}_{\ 0}$	$130^{\ 0}_{-0.040}$	10.2
14C□C41	130	120	$160^{\ 0}_{-0.040}$	$35^{+0.4}_{\ 0}$	$130^{\ 0}_{-0.040}$	14.2

Refer to the following section for information on connectors.

☞ *3.3.3 Connector Specifications* on page 3-21

◆ SGMCS-□□D

• Flange Specification 1



Unit: mm

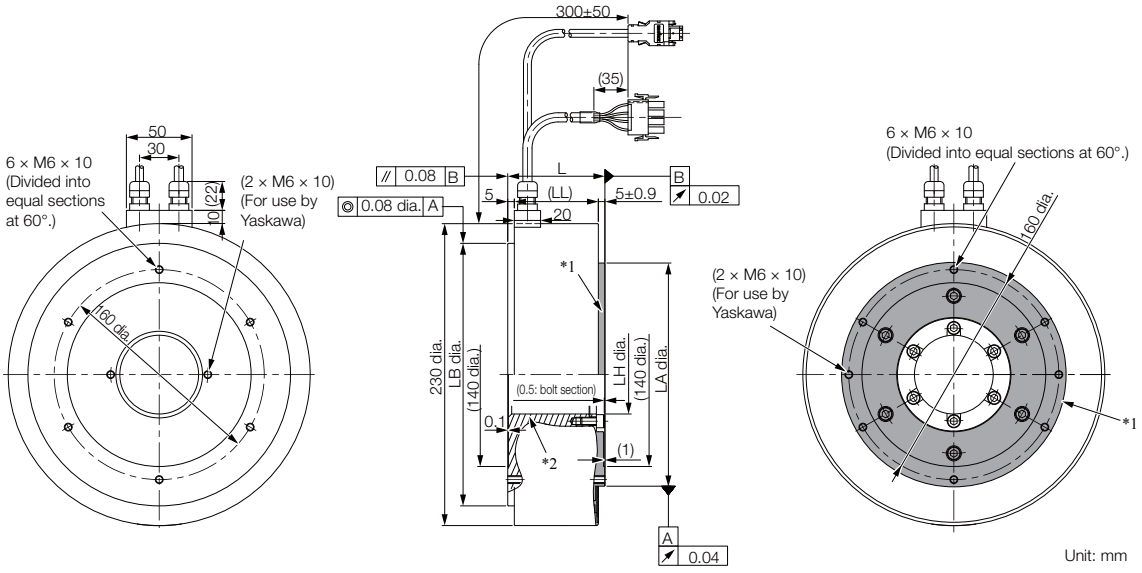
*1. The shaded section indicates the rotating parts.

*2. The hatched section indicates the non-rotating parts.

Note: Values in parentheses are reference dimensions.

Model SGMCS-	L	(LL)	LB	LH	LA	Approx. Mass [kg]
08D□C11	74	64	$200^{\ 0}_{-0.046}$	$60^{+0.4}_{\ 0}$	$170^{\ 0}_{-0.040}$	14.0
17D□C11	110	100	$200^{\ 0}_{-0.046}$	$60^{+0.4}_{\ 0}$	$170^{\ 0}_{-0.040}$	22.0
25D□C11	160	150	$200^{\ 0}_{-0.046}$	$60^{+0.4}_{\ 0}$	$170^{\ 0}_{-0.040}$	29.7

• Flange Specification 4



Unit: mm

*1. The shaded section indicates the rotating parts.

*2. The hatched section indicates the non-rotating parts.

Note: Values in parentheses are reference dimensions.

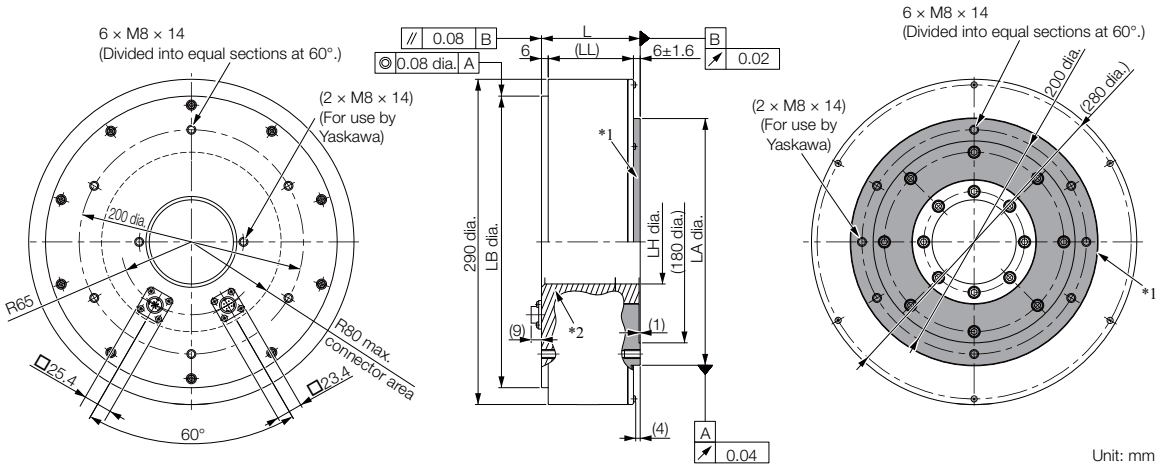
Model SGMCS-	L	(LL)	LB	LH	LA	Approx. Mass [kg]
08D□C41	74	64	$200^{\ 0}_{-0.046}$	$60^{+0.4}_{\ 0}$	$170^{\ 0}_{-0.040}$	14.0
17D□C41	110	100	$200^{\ 0}_{-0.046}$	$60^{+0.4}_{\ 0}$	$170^{\ 0}_{-0.040}$	22.0
25D□C41	160	150	$200^{\ 0}_{-0.046}$	$60^{+0.4}_{\ 0}$	$170^{\ 0}_{-0.040}$	29.7

Refer to the following section for information on connectors.

☞ *3.3.3 Connector Specifications* on page 3-21

◆ SGMCS-□□E

• Flange Specification 1



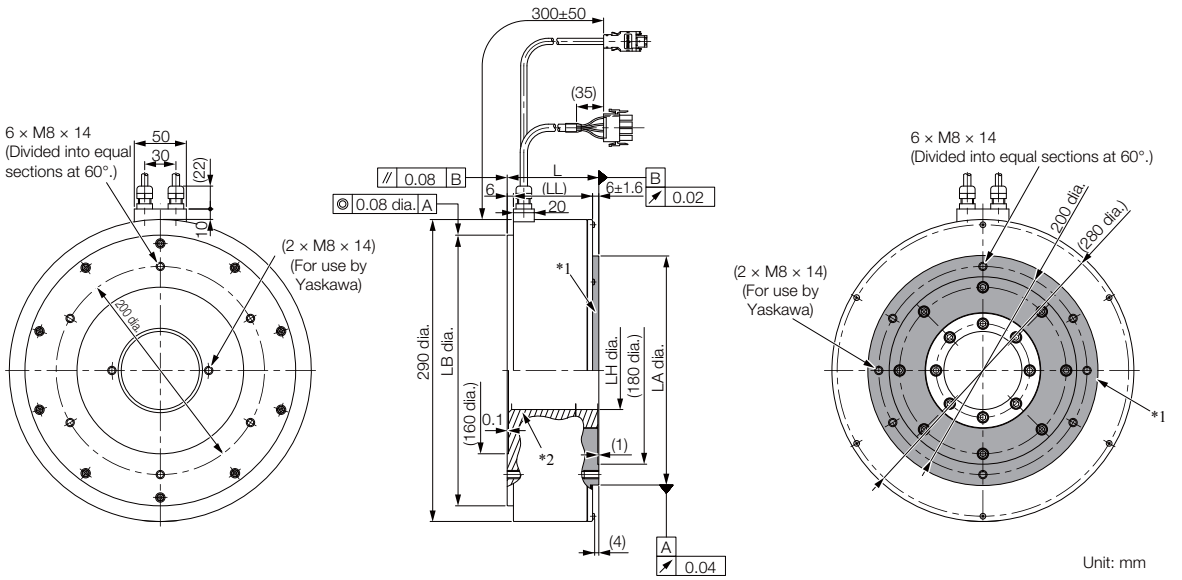
*1. The shaded section indicates the rotating parts.

*2. The hatched section indicates the non-rotating parts.

Note: Values in parentheses are reference dimensions.

Model SGMCS-	L	(LL)	LB	LH	LA	Approx. Mass [kg]
16E□B11	88	76	$260^{\ 0}_{-0.052}$	$75^{+0.4}_{\ 0}$	$220^{\ 0}_{-0.046}$	26.0
35E□B11	112	100	$260^{\ 0}_{-0.052}$	$75^{+0.4}_{\ 0}$	$220^{\ 0}_{-0.046}$	34.0

• Flange Specification 4



*1. The shaded section indicates the rotating parts.

*2. The hatched section indicates the non-rotating parts.

Note: Values in parentheses are reference dimensions.

Model SGMCS-	L	(LL)	LB	LH	LA	Approx. Mass [kg]
16E□B41	88	76	$260^{\ 0}_{-0.052}$	$75^{+0.4}_{\ 0}$	$220^{\ 0}_{-0.046}$	26.0
35E□B41	112	100	$260^{\ 0}_{-0.052}$	$75^{+0.4}_{\ 0}$	$220^{\ 0}_{-0.046}$	34.0

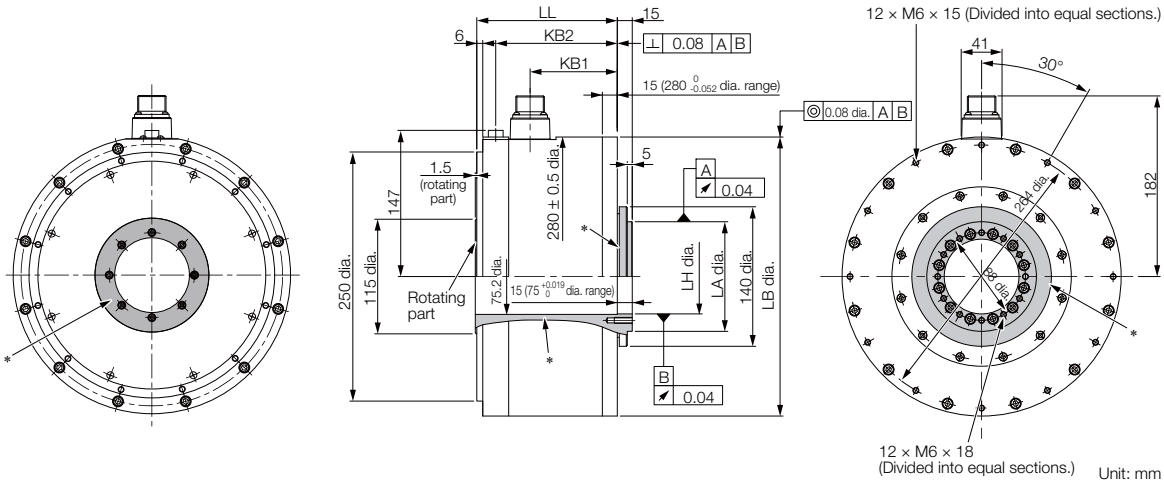
Refer to the following section for information on connectors.

☞ *3.3.3 Connector Specifications* on page 3-21

3.3.2 Medium-Capacity Servomotors with Cores

◆ SGMCS-□□M

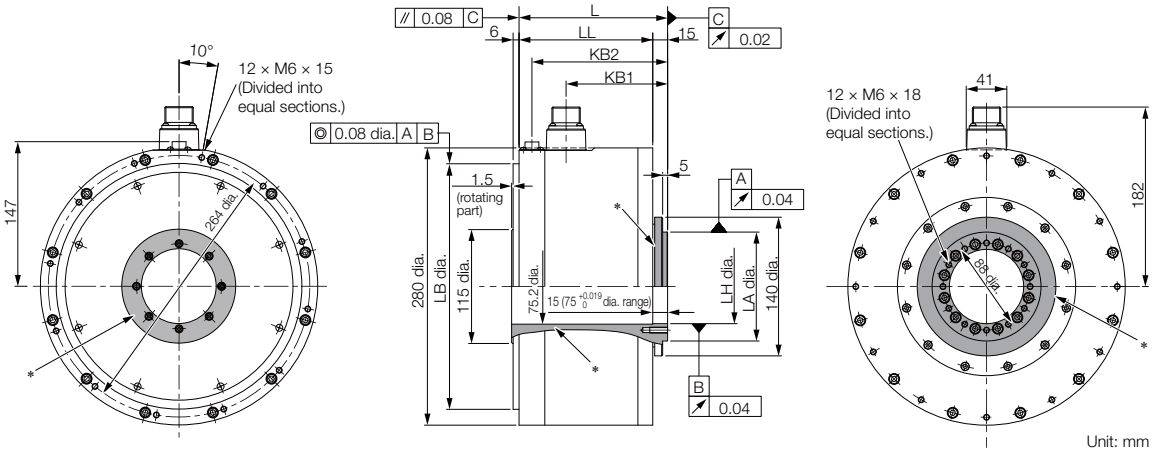
• Flange Specification 1



* The shaded section indicates the rotating parts.

Model SGMCS-	LL	KB1	KB2	LB	LH	LA	Approx. Mass [kg]
45M□A11	141	87.5	122	280 $^{0}_{-0.052}$	75 $^{+0.019}_{0}$	110 $^{0}_{-0.035}$	38
80M□A11	191	137.5	172	280 $^{0}_{-0.052}$	75 $^{+0.019}_{0}$	110 $^{0}_{-0.035}$	45
1AM□A11	241	187.5	222	280 $^{0}_{-0.052}$	75 $^{+0.019}_{0}$	110 $^{0}_{-0.035}$	51

• Flange Specification 3



* The shaded section indicates the rotating parts.

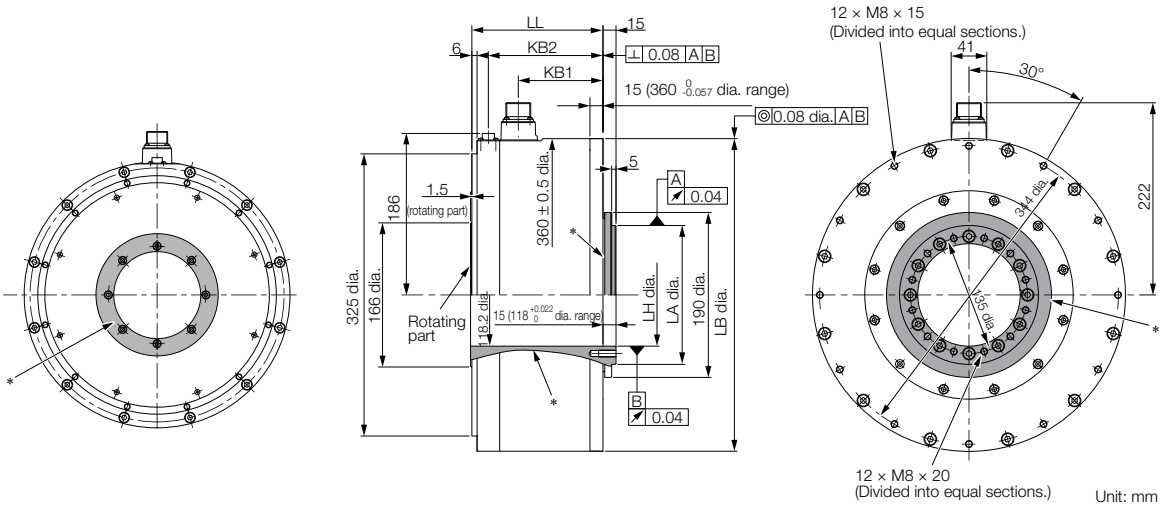
Model SGMCS-	L	LL	KB1	KB2	LB	LH	LA	Approx. Mass [kg]
45M□A31	150	135	102.5	137	248 $^{0}_{-0.046}$	75 $^{+0.019}_{0}$	110 $^{0}_{-0.035}$	38
80M□A31	200	185	152.5	187	248 $^{0}_{-0.046}$	75 $^{+0.019}_{0}$	110 $^{0}_{-0.035}$	45
1AM□A31	250	235	202.5	237	248 $^{0}_{-0.046}$	75 $^{+0.019}_{0}$	110 $^{0}_{-0.035}$	51

Refer to the following section for information on connectors.

☞ *3.3.3 Connector Specifications* on page 3-21

◆ SGMCS-□□N

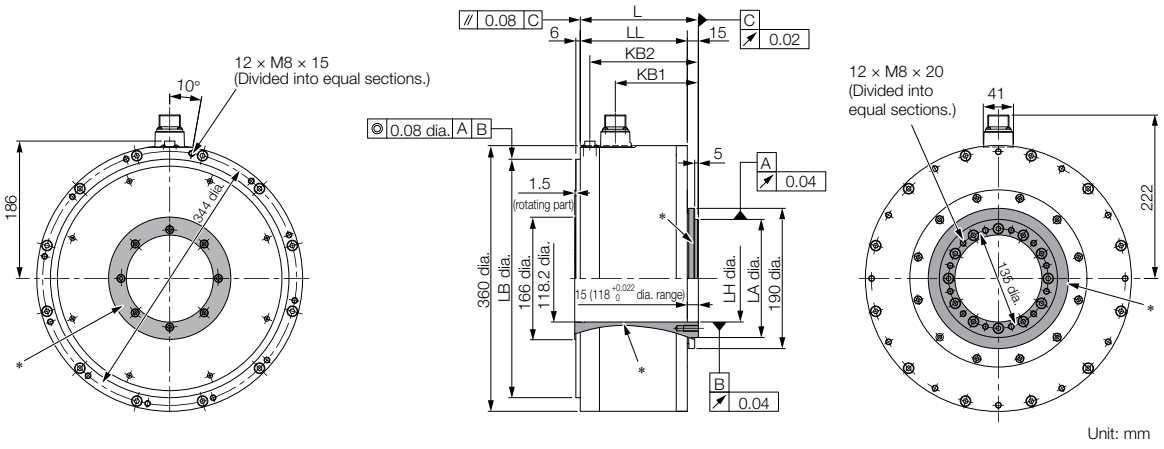
• Flange Specification 1



* The shaded section indicates the rotating parts.

Model SGMCS-	LL	KB1	KB2	LB	LH	LA	Approx. Mass [kg]
80N□A11	151	98	132	360 $^{0}_{-0.057}$	118 $^{+0.022}_{0}$	160 $^{0}_{-0.040}$	50
1EN□A11	201	148	182	360 $^{0}_{-0.057}$	118 $^{+0.022}_{0}$	160 $^{0}_{-0.040}$	68
2ZN□A11	251	198	232	360 $^{0}_{-0.057}$	118 $^{+0.022}_{0}$	160 $^{0}_{-0.040}$	86

• Flange Specification 3



* The shaded section indicates the rotating parts.

Model SGMCS-	L	LL	KB1	KB2	LB	LH	LA	Approx. Mass [kg]
80N□A31	160	145	113	147	323 $^{0}_{-0.057}$	118 $^{+0.022}_{0}$	160 $^{0}_{-0.040}$	50
1EN□A31	210	195	163	197	323 $^{0}_{-0.057}$	118 $^{+0.022}_{0}$	160 $^{0}_{-0.040}$	68
2ZN□A31	260	245	213	247	323 $^{0}_{-0.057}$	118 $^{+0.022}_{0}$	160 $^{0}_{-0.040}$	86

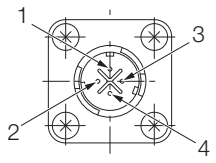
Refer to the following section for information on connectors.

☞ *3.3.3 Connector Specifications* on page 3-21

3.3.3 Connector Specifications

◆ SGMCS-☐☐B, -☐☐C, -☐☐D, or -☐☐E with Flange Specification 1

• Servomotor Connector Specifications

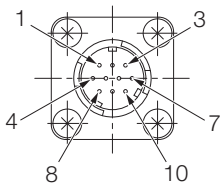


Model: JN1AS04MK2R
Manufacturer: Japan Aviation Electronics Industry, Ltd.

Mating connector:
JN1DS04FK1
(Not provided by Yaskawa.)

1	Phase U	Red
2	Phase V	White
3	Phase W	Blue
4	FG (frame ground)	Green (yellow)

• Encoder Connector Specifications



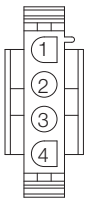
Model: JN1AS10ML1-R
Manufacturer: Japan Aviation Electronics Industry, Ltd.

Mating connector:
JN1DS10SL1
(Not provided by Yaskawa.)

1	PS	Light blue	6	–	–
2	/PS	Light blue/ white	7	FG (frame ground)	Shield
3	–	–	8	–	–
4	PG5V	Red	9	PG0V	Black
5	–	–	10	–	–

◆ SGMCS-☐☐B, -☐☐C, -☐☐D, or -☐☐E with Flange Specification 4

• Servomotor Connector Specifications



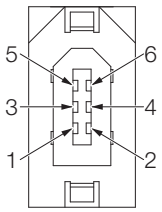
Model
- Plug: 350779-1
- Pins: 350561-3 or 350690-3 (No.1 to 3)
- Ground pin: 350654-1 or 350669-1 (No. 4)

Manufacturer: Tyco Electronics Japan G.K.

Mating Connector
- Cap: 350780-1
- Socket: 350570-3 or 350689-3

1	Phase U	Red
2	Phase V	White
3	Phase W	Blue
4	FG (frame ground)	Green (yellow)

• Encoder Connector Specifications



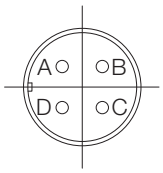
Model: 55102-0600
Manufacturer: Molex Japan Co., Ltd.

Mating connector: 54280-0609

1	PG5V	Red
2	PG0V	Black
3	–	–
4	–	–
5	PS	Light blue
6	/PS	Light blue/ white
Connector case	FG (frame ground)	Shield

◆ SGMCS-□□M or -□□N with Flange Specification 1 or 3

• Servomotor Connector Specifications

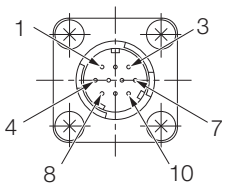


Model: CE05-2A18-10PD
Manufacturer: DDK Ltd.

Mating Connector
Plug: CE05-6A18-10SD-B-BSS
Cable clamp: CE3057-10A-□(D265)

A	Phase U
B	Phase V
C	Phase W
D	FG (frame ground)

• Encoder Connector Specifications



Model: JN1AS10ML1
Manufacturer: Japan Aviation Electronics Industry, Ltd.

Mating connector:
JN1DS10SL1

1	PS	6	–
2	/PS	7	FG (frame ground)
3	–	8	–
4	PG5V	9	PG0V
5	–	10	–

Specifications, Ratings, and External Dimensions of SGMCV Servomotors

4

This chapter describes how to interpret the model numbers of SGMCV Servomotors and gives their specifications, ratings, and external dimensions.

4.1 Model Designations

SGMCV - 04 B E A 1 1

Direct Drive Servomotors: SGMCV	1st+2nd digits	3rd digit	4th digit	5th digit	6th digit	7th digit

1st+2nd digits Rated Output

Code	Specification
04	4 N·m
08	8 N·m
10	10 N·m
14	14 N·m
17	17 N·m
25	25 N·m

3rd digit Servomotor Outer Diameter

Code	Specification
B	135-mm dia.
C	175-mm dia.

4th digit Serial Encoder

Code	Specification
E	22-bit single-turn absolute encoder
I	22-bit multiturn absolute encoder

5th digit Design Revision Order

A

6th digit Flange

Code	Mounting
1	Non-load side
4	Non-load side (with cable on side)

7th digit Options

Code	Specification
1	Without options
5	High machine precision (runout at end of shaft and runout of shaft surface: 0.01 mm)

Note: Direct Drive Servomotors are not available with holding brakes.

4.2 Specifications and Ratings

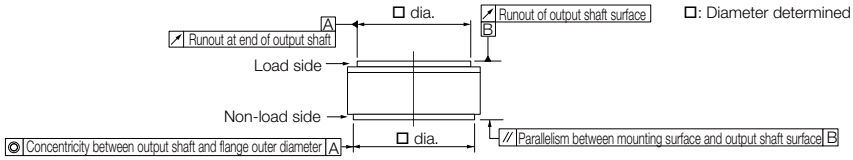
4.2.1 Specifications

Voltage			200 V					
Model SGMCV-			04B	10B	14B	08C	17C	25C
Time Rating			Continuous					
Thermal Class			A					
Insulation Resistance			500 VDC, 10 MΩ min.					
Withstand Voltage			1,500 VAC for 1 minute					
Excitation			Permanent magnet					
Mounting			Flange-mounted					
Drive Method			Direct drive					
Rotation Direction			Counterclockwise (CCW) for forward reference when viewed from the load side					
Vibration Class*1			V15					
Absolute Accuracy			±15 s					
Repeatability			±1.3 s					
Protective Structure*2			Totally enclosed, self-cooled, IP42					
Environmental Conditions	Surrounding Air Temperature		0°C to 40°C (with no freezing)					
	Surrounding Air Humidity		20% to 80% relative humidity (with no condensation)					
	Installation Site		• Must be indoors and free of corrosive and explosive gases. • Must be well-ventilated and free of dust and moisture. • Must facilitate inspection and cleaning. • Must have an altitude of 1,000 m or less. • Must be free of strong magnetic fields.					
	Storage Environment		Store the Servomotor in the following environment if you store it with the power cable disconnected. Storage Temperature: -20°C to 60°C (with no freezing) Storage Humidity: 20% to 80% relative humidity (with no condensation)					
Mechanical Tolerances*3	Runout of Output Shaft Surface	mm	0.02 (0.01 for high machine precision option)					
	Runout at End of Output Shaft	mm	0.04 (0.01 for high machine precision option)					
	Parallelism between Mounting Surface and Output Shaft Surface	mm	0.07					
	Concentricity between Output Shaft and Flange Outer Diameter	mm	0.07					
Shock Resistance*4	Impact Acceleration Rate at Flange		490 m/s^2					
	Number of Impacts		2 times					
Vibration Resistance*5	Vibration Acceleration Rate at Flange		49 m/s^2					
Applicable SERVOPACKs			Refer to *1.4 Combinations of Servomotors and SERVOPACKs* on page 1-5.					

*1. A vibration class of V15 indicates a vibration amplitude of 15 μm maximum on the Servomotor without a load at the rated motor speed.

*2. The hollow hole section, motor mounting surface, output shaft surface, and gap around the rotating part of the shaft are excluded. Protective structure specifications apply only when the special cable is used.

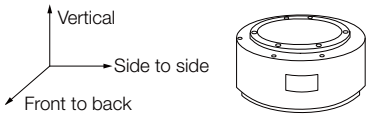
*3. Refer to the following figure for the relevant locations on the Servomotor. Refer to the dimensional drawings of the individual Servomotors for more information on tolerances.



*4. The shock resistance for shock in the vertical direction when the Servomotor is mounted with the shaft in a horizontal position is given in the above table.

Shock Applied to the Servomotor

*5. The vertical, side-to-side, and front-to-back vibration resistance for vibration in three directions when the Servomotor is mounted with the shaft in a horizontal position is given in the above table. The strength of the vibration that the Servomotor can withstand depends on the application. Always confirm the vibration acceleration rate.



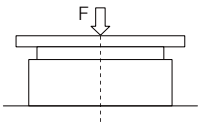
4.2.2 Ratings

Voltage			200 V					
Model SGMCV-			04B	10B	14B	08C	17C	25C
Rated Output*1		W	126	314	440	251	534	785
Rated Torque*1, *2		N·m	4.00	10.0	14.0	8.00	17.0	25.0
Instantaneous Maximum Torque*1		N·m	12.0	30.0	42.0	24.0	51.0	75.0
Stall Torque*1		N·m	4.00	10.0	14.0	8.00	17.0	25.0
Rated Current*1		Arms	1.8	2.8	4.6	2.3	4.5	
Instantaneous Maximum Current*1		Arms	5.6	8.9	14.1	7.3	14.7	13.9
Rated Motor Speed*1		min^{-1}	300			300		
Maximum Motor Speed*1		min^{-1}	600			600		500
Torque Constant		N·m/Arms	2.39	3.81	3.27	3.81	4.04	6.04
Motor Moment of Inertia		$\times 10^{-4}$ kg·m^2	16.2	25.2	36.9	56.5	78.5	111
Rated Power Rate*1		kW/s	9.88	39.7	53.1	11.3	36.8	56.3
Rated Angular Acceleration Rate*1		rad/s^2	2470	3970	3790	1420	2170	2250
Heat Sink Size		mm	350 × 350 × 12			450 × 450 × 12		
Allowable Load Moment of Inertia (Motor Moment of Inertia Ratio)			25 times	40 times	45 times	15 times	25 times	25 times
Allowable Load*3	Allowable Thrust Load	N	1500			3300		
	Allowable Moment Load	N·m	45	55	65	92	98	110

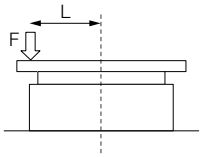
*1. These values are for operation in combination with a SERVOPACK when the temperature of the armature winding is 100°C. The values for other items are at 20°C. These are typical values.

*2. The rated torques are the continuous allowable torque values at 40°C with a steel heat sink of the dimensions given in the table.

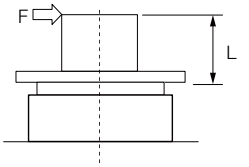
*3. The thrust loads and moment loads that are applied while a Servomotor is operating are roughly classified into the following patterns. Design the machine so that the thrust loads or moment loads will not exceed the values given in the table.



Where F is the external force,
Thrust load = F + Load mass
Moment load = 0



Where F is the external force,
Thrust load = F + Load mass
Moment load = F × L

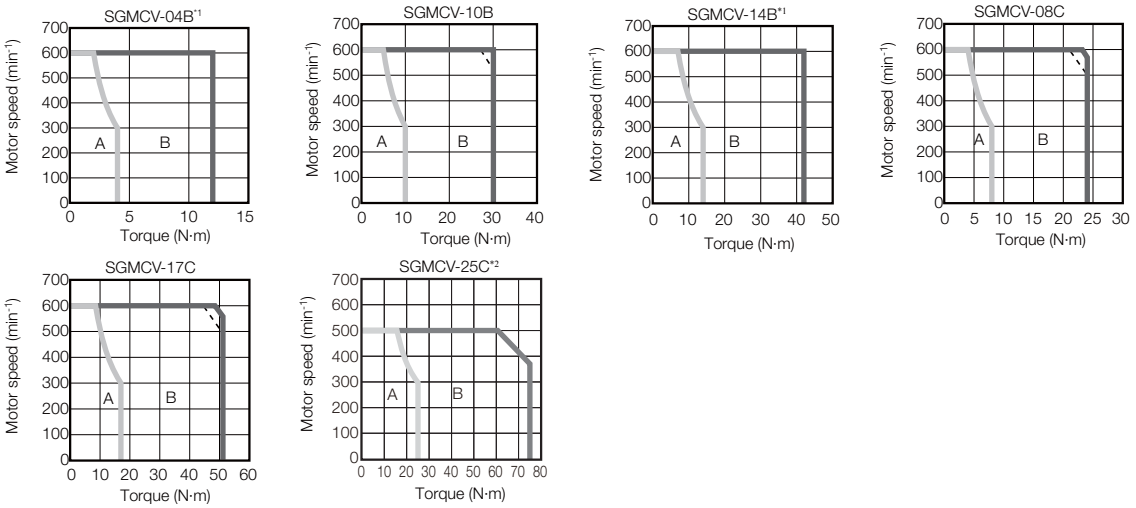


Where F is the external force,
Thrust load = Load mass
Moment load = F × L

Note: For the bearings used in these Servomotors, the loss depends on the bearing temperature. The amount of heat loss is higher at low temperatures.

4.2.3 Torque-Motor Speed Characteristics

A : Continuous duty zone ——— (solid lines): With three-phase 200-V or single-phase 230-V input
B : Intermittent duty zone - - - - - - - - (dotted lines): With single-phase 200-V input



*1. The characteristics are the same for three-phase 200 V and single-phase 200 V.

*2. Contact your Yaskawa representative for information on the SGMCV-25C.

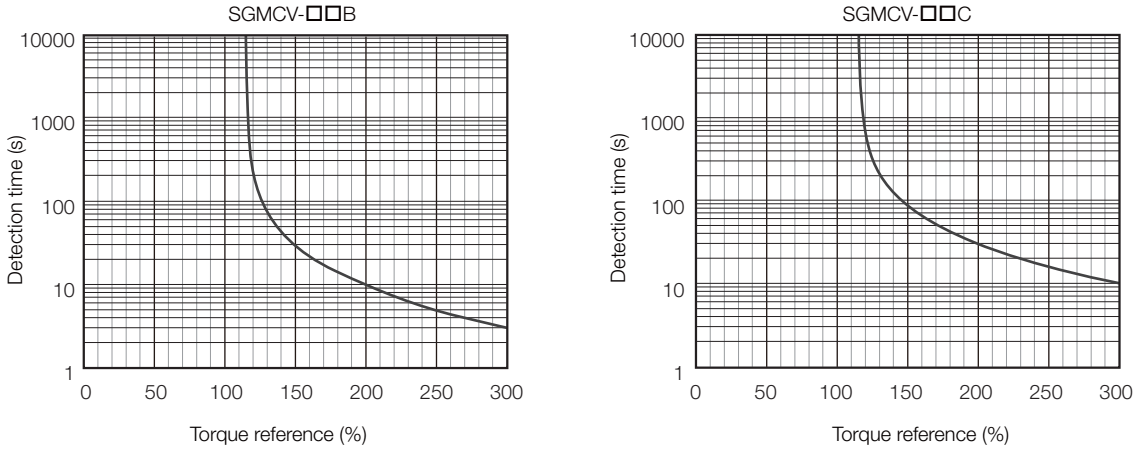
Note: 1. These values are for operation in combination with a SERVOPACK when the temperature of the armature winding is 100°C. These are typical values.

2. The characteristics in the intermittent duty zone depend on the power supply voltage.

3. If you use a Servomotor Main Circuit Cable that exceeds 20 m, the intermittent duty zone in the torque-motor speed characteristics will become smaller because the voltage drop increases.

4.2.4 Servomotor Overload Protection Characteristics

The overload detection level is set for hot start conditions with a Servomotor ambient temperature of 40°C.



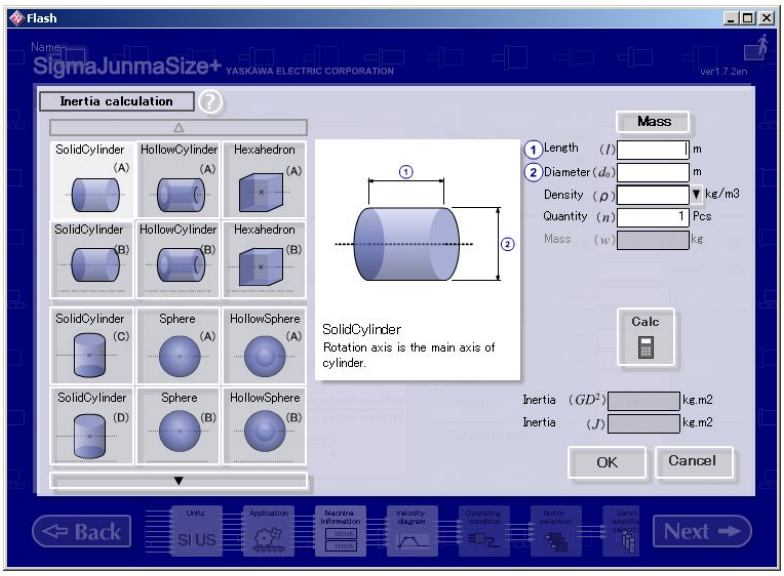
Note: The above overload protection characteristics do not mean that you can perform continuous duty operation with an output of 100% or higher. Use the Servomotor so that the effective torque remains within the continuous duty zone given in *4.2.3 Torque-Motor Speed Characteristics* on page 4-6.

4.2.5 Load Moment of Inertia

The load moment of inertia indicates the inertia of the load. The larger the load moment of inertia, the worse the response. If the moment of inertia is too large, operation will become unstable.

The allowable size of the load moment of inertia (J_L) for the Servomotor is restricted. Refer to *4.2.2 Ratings* on page 4-5. This value is provided strictly as a guideline and results depend on Servomotor driving conditions.

Use the SigmaJunmaSize+ AC Servo Drive Capacity Selection Program to check the driving conditions. Contact your Yaskawa representative for information on the SigmaJunmaSize+.



An Overvoltage Alarm (A.400) is likely to occur during deceleration if the load moment of inertia exceeds the allowable load moment of inertia. SERVOPACKs with a built-in regenerative resistor may generate a Regenerative Overload Alarm (A.320). Perform one of the following steps if this occurs.

- Reduce the torque limit.
- Reduce the deceleration rate.
- Reduce the maximum motor speed.
- Install an external regenerative resistor if the alarm cannot be cleared using the above steps.

Regenerative resistors are not built into SERVOPACKs for 400-W Servomotors or smaller Servomotors. Even for SERVOPACKs with built-in regenerative resistors, an external regenerative resistor is required if the energy that results from the regenerative driving conditions exceeds the allowable loss capacity (W) of the built-in regenerative resistor.

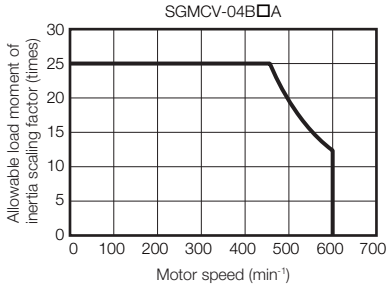
4.2.6 Allowable Load Moment of Inertia Scaling Factor for SERVOPACKs without Built-in Regenerative Resistors

The following graphs show the allowable load moment of inertia scaling factor of the motor speed for SERVOPACKs without built-in regenerative resistors when an External Regenerative Resistor is not connected (applicable SERVOPACK: SGD7S-2R8A).

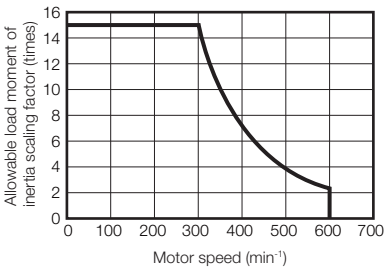
If the Servomotor exceeds the allowable load moment of inertia, an overvoltage alarm may occur in the SERVOPACK.

These graphs provide reference data for deceleration at the rated torque or higher with a 200-VAC power supply input.

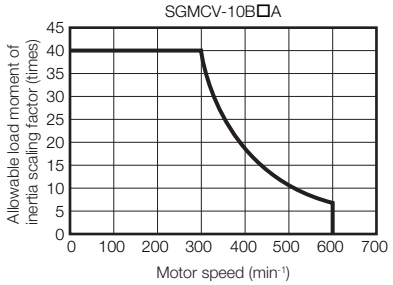
SGMCV-04B□A



SGMCV-08C□A



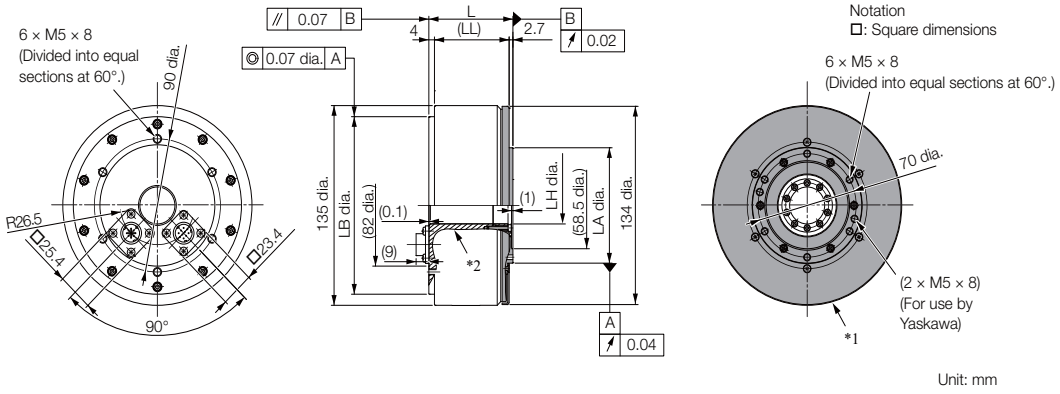
SGMCV-10B□A



4.3 External Dimensions

◆ SGMCV-□□B

• Flange Specification 1



Unit: mm

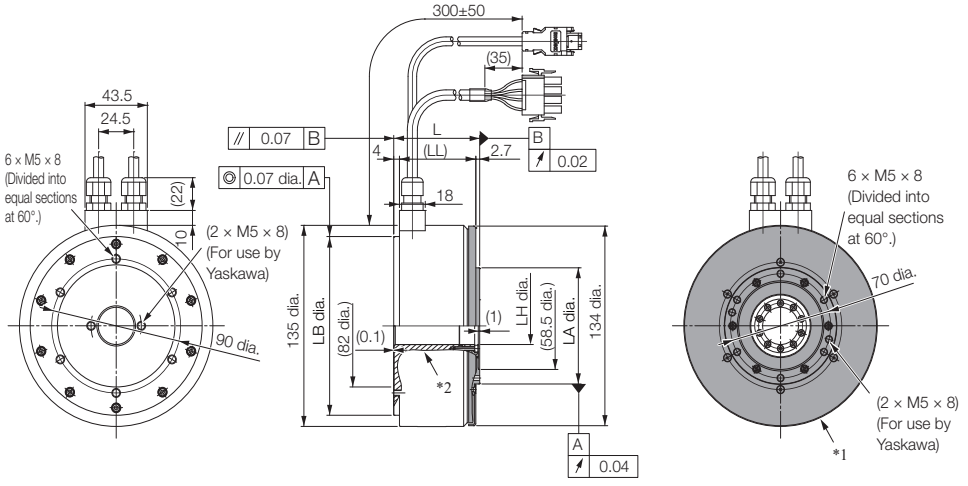
*1. The shaded section indicates the rotating parts.

*2. The hatched section indicates the non-rotating parts.

Note: Values in parentheses are reference dimensions.

Model SGMCV-	L	(LL)	LB	LH	LA	Approx. Mass [kg]
04B□A11	60	53.3	$120^{\ 0}_{-0.035}$	$25^{+0.3}_{+0.1}$	$78^{\ 0}_{-0.030}$	5.0
10B□A11	85	78.3	$120^{\ 0}_{-0.035}$	$25^{+0.3}_{+0.1}$	$78^{\ 0}_{-0.030}$	6.5
14B□A11	115	108.3	$120^{\ 0}_{-0.035}$	$25^{+0.3}_{+0.1}$	$78^{\ 0}_{-0.030}$	9.0

• Flange Specification 4



Unit: mm

*1. The shaded section indicates the rotating parts.

*2. The hatched section indicates the non-rotating parts.

Note: Values in parentheses are reference dimensions.

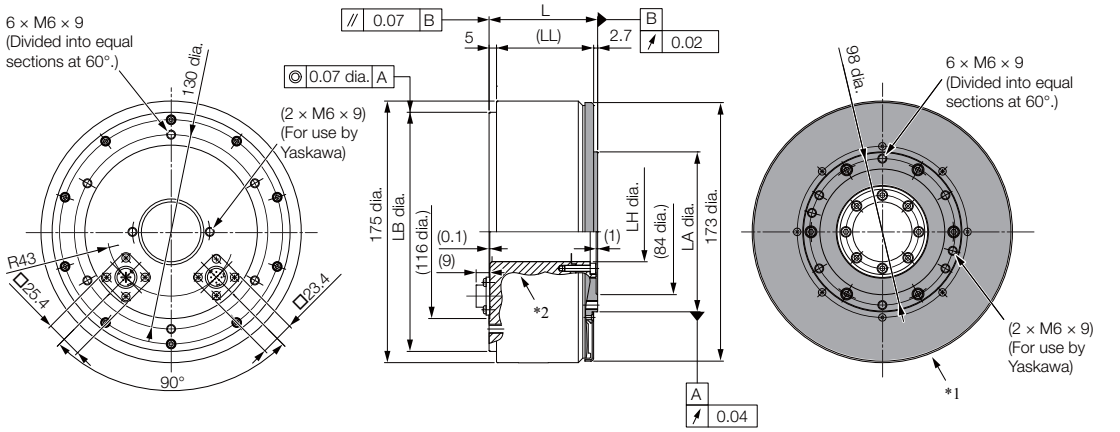
Model SGMCV-	L	(LL)	LB	LH	LA	Approx. Mass [kg]
04B□A41	60	53.3	$120^{\ 0}_{-0.035}$	$25^{+0.3}_{+0.1}$	$78^{\ 0}_{-0.030}$	5.0
10B□A41	85	78.3	$120^{\ 0}_{-0.035}$	$25^{+0.3}_{+0.1}$	$78^{\ 0}_{-0.030}$	6.5
14B□A41	115	108.3	$120^{\ 0}_{-0.035}$	$25^{+0.3}_{+0.1}$	$78^{\ 0}_{-0.030}$	9.0

Refer to the following section for information on connectors.

☞ *4.3.1 Connector Specifications* on page 4-11

◆ SGMCV-□□C

• Flange Specification 1



Unit: mm

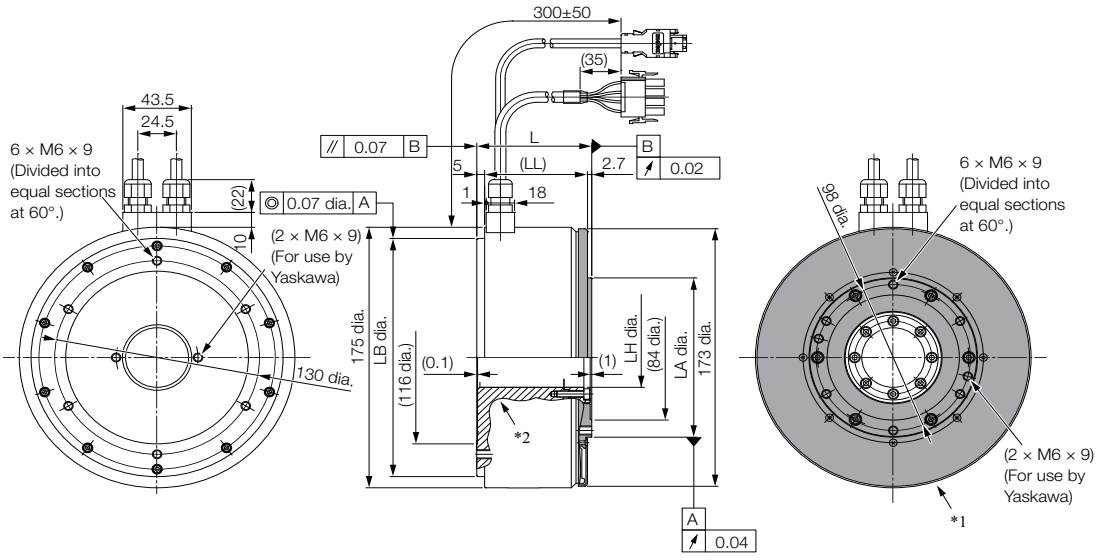
*1. The shaded section indicates the rotating parts.

*2. The hatched section indicates the non-rotating parts.

Note: Values in parentheses are reference dimensions.

Model SGMCV-	L	(LL)	LB	LH	LA	Approx. Mass [kg]
08C□A11	73	65.3	$160^{\ 0}_{-0.040}$	$40^{+0.3}_{+0.1}$	$107^{\ 0}_{-0.035}$	9.0
17C□A11	87	79.3	$160^{\ 0}_{-0.040}$	$40^{+0.3}_{+0.1}$	$107^{\ 0}_{-0.035}$	11.0
25C□A11	117	109.3	$160^{\ 0}_{-0.040}$	$40^{+0.3}_{+0.1}$	$107^{\ 0}_{-0.035}$	15.0

• Flange Specification 4



Unit: mm

*1. The shaded section indicates the rotating parts.

*2. The hatched section indicates the non-rotating parts.

Note: Values in parentheses are reference dimensions.

Model SGMCV-	L	(LL)	LB	LH	LA	Approx. Mass [kg]
08C□A41	73	65.3	$160^{\ 0}_{-0.040}$	$40^{+0.3}_{+0.1}$	$107^{\ 0}_{-0.035}$	9.0
17C□A41	87	79.3	$160^{\ 0}_{-0.040}$	$40^{+0.3}_{+0.1}$	$107^{\ 0}_{-0.035}$	11.0
25C□A41	117	109.3	$160^{\ 0}_{-0.040}$	$40^{+0.3}_{+0.1}$	$107^{\ 0}_{-0.035}$	15.0

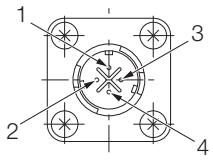
Refer to the following section for information on connectors.

☞ *4.3.1 Connector Specifications* on page 4-11

4.3.1 Connector Specifications

◆ Flange Specification 1

• Servomotor Connector Specifications

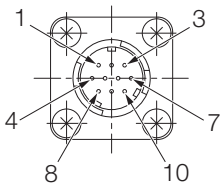


Model: JN1AS04MK2R
Manufacturer: Japan Aviation Electronics Industry, Ltd.

Mating connector: JN1DS04FK1
(Not provided by Yaskawa.)

1	Phase U	Red
2	Phase V	White
3	Phase W	Blue
4	FG (frame ground)	Green (yellow)

• Encoder Connector Specifications



Model: JN1AS10ML1-R
Manufacturer: Japan Aviation Electronics Industry, Ltd.

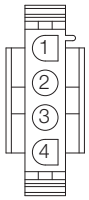
Mating connector: JN1DS10SL1
(Not provided by Yaskawa.)

1	PS	Not used	6	–	–
2	/PS	Light blue/ white	7	FG (frame ground)	Shield
3	–	–	8*	BAT	Orange
4	PG5V	Red	9	PG0V	Black
5*	BAT0	Orange/ white	10	–	–

* Only models with multiturn data.

◆ Flange Specification 4

• Servomotor Connector Specifications



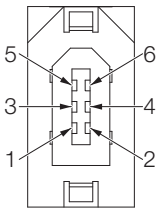
Model
- Plug: 350779-1
- Pins: 350561-3 or 350690-3 (No.1 to 3)
- Ground pin: 350654-1 or 350669-1 (No. 4)

Manufacturer: Tyco Electronics Japan G.K.

Mating Connector
- Cap: 350780-1
- Socket: 350570-3 or 350689-3

1	Phase U	Red
2	Phase V	White
3	Phase W	Blue
4	FG (frame ground)	Green (yellow)

• Encoder Connector Specifications



Model: 55102-0600
Manufacturer: Molex Japan Co., Ltd.

Mating connector: 54280-0609

1	PG5V	Red
2	PG0V	Black
3*	BAT	Orange
4*	BAT0	Orange/white
5	PS	Light blue
6	/PS	Light blue/ white
Connector case	FG (frame ground)	Shield

* Only models with multiturn data.

Servomotor Installation

5

This chapter describes the installation conditions and precautions for Servomotors.

5.1 Installation Conditions

The service life of a Servomotor will be shortened or unexpected problems will occur if the Servomotor is installed incorrectly or in an inappropriate location. Always observe the following installation instructions.

5.1.1 Installation Precautions

⚠ CAUTION

- Implement safety measures, such as installing a cover so that the rotating part of the Direct Drive Servomotor cannot be touched accidentally during operation.
- Never use the Servomotor in an environment that is subject to water, corrosive gases, or flammable gases, or near flammable objects. Failure to observe this caution may result in electric shock or fire.

Important

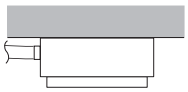
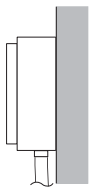
- Mount the Servomotor to a nonflammable material. Installation directly onto or near flammable objects may result in fire.
- Mount the SERVOPACK and Direct Drive Servomotor on a structure that will support the masses that are given in the user's manuals.
- Do not step on or place a heavy object on the Servomotor. Failure to observe this caution may result in injury.
- Install the Servomotor within the specified ambient conditions. Refer to the specifications for each type of Servomotor for the ambient conditions.
- Direct Drive Servomotors are precision devices. Never drop a Servomotor or subject it to strong shock.
- Do not place a Direct Drive Servomotor with the connector side facing down. Doing so will damage the connectors.
- Do not place any load on the cover on the rotating part of an SGMCV Direct Drive Servomotor. Doing so will deform or damage the cover.
- Do not attempt to install or operate a Direct Drive Servomotor that is damaged or missing parts.
- When you transport a Direct Drive Servomotor, do not hold onto the cables, rotating part, or connectors. Failure to observe this caution may result in damage or injury.
- Securely mount the Direct Drive Servomotor onto the machine. If the Servomotor is not mounted securely, it may come off during operation, possibly causing injury.
- When you couple the load to the Direct Drive Servomotor, do not strike the Servomotor with a hammer or otherwise subject it to shock. Failure to observe this caution may result in damage to the encoder.
- Do not place more than the allowable load on the rotating part of the Direct Drive Servomotor. Failure to observe this caution may result in damage to the rotating part.
- Consult your Yaskawa representative if you plan to use a Direct Drive Servomotor that has been stored for an extended period of time.
- Check the level of vibration while the Direct Drive Servomotor is mounted to the machine. If the vibration is too strong, the bearings and encoder will be damaged faster, faulty connector contacts may occur, and bolts may become loose.
- When you adjust the gain during equipment commissioning, use a measuring instrument to monitor the torque waveform and speed waveform and confirm that there is no vibration. If a high gain causes vibration, the Direct Drive Servomotor will be damaged faster.

5.1.2 Installation Environment

Refer to the specifications for each type of Servomotor for the mechanical specifications, protective structure, and environmental conditions related to Servomotor installation.

5.1.3 Installation Orientation

You can install the Servomotor either vertically or horizontally.

Installation Orientation		Figure	Precautions
Vertical direction	Shaft end up		–
	Shaft end down		• Securely attach the Servomotor to the machine. • Confirm in advance that large loads (a payload that exceeds the allowable payload or an excessive shock load) will not be applied to the Servomotor. • Install a mechanism on the machine to provide protection in case the Direct Drive Servomotor falls off.
Horizontal direction			–

5.2 Mounting to the Machine


Important

- When you mount the Direct Drive Servomotor to the machine, use the flange outer diameter to center the Servomotor and the machine.
- When you couple the Direct Drive Servomotor to the load, sufficiently center the output shaft with the load. Consult your Yaskawa representative if you plan to use a rigid coupling with the machine shaft.

• Allowable Loads

When you connect a load to the Servomotor, do not place a load on the rotating part that exceeds the allowable limits. If you exceed the allowable limits, the service life of the bearings will be reduced and the rotating part will be damaged.

Refer to the specifications for each type of Direct Drive Servomotor for the allowable loads on the rotating part of the Servomotor.

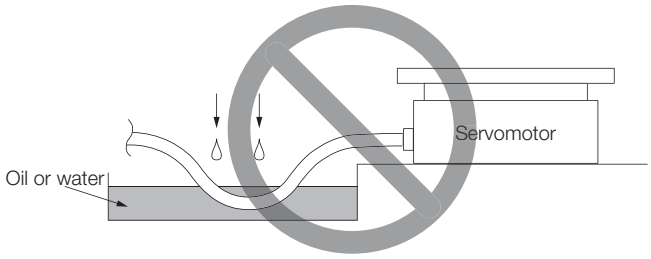

Note

The allowable loads that are given in the specifications include the static load in one direction and the dynamic load that occurs during rotation. Consider the dynamic load when you select a Servomotor or design the equipment.

5.3 Oil and Water Countermeasures

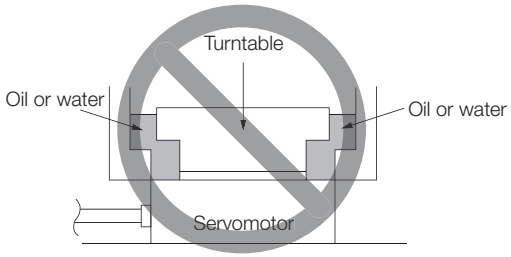
Observe the following instructions so that water, oil, or other foreign matter will not enter the Servomotor.

- Do not allow the cables to be in oil or water.



If contact with oil or water is unavoidable, use oil-resistant cables. Oil-resistant cables are not provided by Yaskawa.

- Do not use the Servomotor where oil or water from the machine, a turntable, or other source would come into contact with the Servomotor.



If contact with oil or water is unavoidable, implement countermeasures in the machine so that oil or water does not enter the Servomotor.

- Do not use the Servomotor where it would come into contact with cutting fluids.
  Depending on the type of cutting fluid, the cables or other part may be adversely affected.
- Do not use the Servomotor where it would be continuously in contact with oil mist, water vapor, oil, water, or grease.
  If usage under the above conditions is unavoidable, implement countermeasures in the machine to protect against dirt and water.

5.4 Equipment Structure

5.4.1 Minimum Angle of Oscillation

If you use a Direct Drive Servomotor for oscillating rotation, rotate the Servomotor 90° or more at least once a day to ensure sufficient bearing lubrication.

Consult your Yaskawa representative if you cannot perform this operation.

5.4.2 Precautions on Passing the Origin

- If you use an SGMCS Servomotor with an Incremental Encoder, you must perform an origin return operation after you turn ON the power supply.
  If you use the SERVOPACK's origin pulse (phase C) output, rotate the Direct Drive Servomotor at least two turns before you start the origin return operation.
  If the Direct Drive Servomotor cannot be rotated two or more times, perform an origin return operation at a motor speed of 6 min^{-1} or lower.
- If the equipment structure prevents the Direct Drive Servomotor from rotating a complete turn, install the Servomotor so that the origin within one encoder rotation is passed.

5.5 Servomotor Temperature Increase

This section describes measures to suppress temperature increases in the Servomotor.

- When you install the Servomotor, observe the cooling conditions (heat sink sizes) that are given in the specifications for each type of Servomotor.
  The Servomotor generates heat when it operates. The heat generated by the Servomotor radiates to the heat sink through the motor mounting surface. Therefore, if the surface area of the heat sink is too small, the temperature of the Servomotor may increase abnormally.
- If the operating environment makes it difficult to use a large heat sink, or if the ambient operating temperature or altitude given in the specifications is exceeded, implement the following measures.
  - Derate the Servomotor.
    Contact your Yaskawa representative for information on derating.
  - Use external forced-air cooling for the Servomotor with a cooling fan or other means.

Do not place packing or any other insulating material between the Servomotor and heat sink. Doing so will cause the motor temperature to increase, affect resistance to noise, and may cause motor failure.

Connections between Servomotors and SERVOPACKs

6

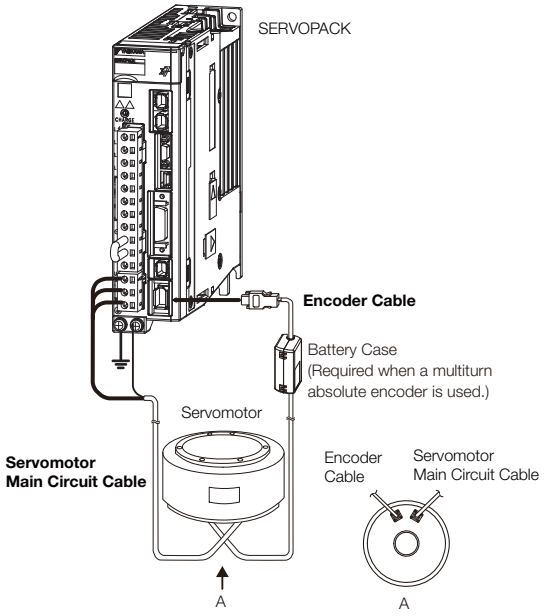
This chapter describes the cables that are used to connect the Servomotors and SERVOPACKs and provides related precautions.

6.1 Selecting Cables

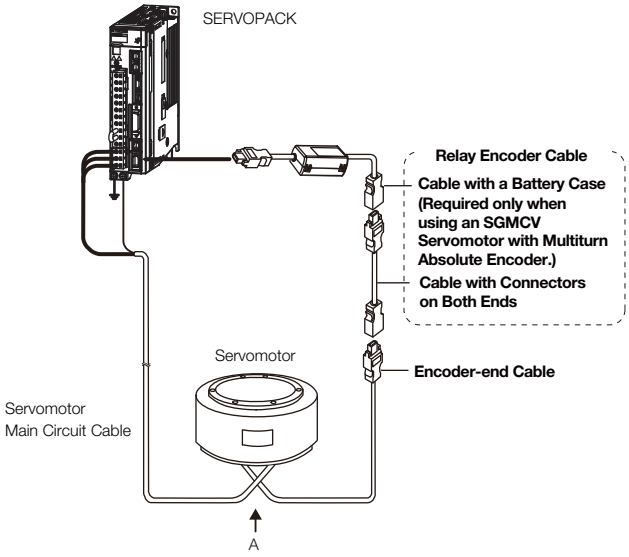
6.1.1 System Configurations

The cables shown below are required to connect a Servomotor to a SERVOPACK.

Encoder Cable of 20 m or Less



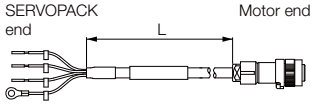
Encoder Cable of 30 m to 50 m (Relay Cable)



Note: 1. If the cable length exceeds 20 m, be sure to use a Relay Encoder Cable.
2. If the length of the Servomotor Main Circuit Cable exceeds 20 m, the intermittent duty zone in the torque-motor speed characteristics will become smaller because the voltage drop increases.
3. Refer to the *Σ-7-Series Peripheral Device Selection Manual* (Manual No.: SIEP S800001 32) for the following information.
   • Cable dimensional drawings and cable connection specifications
   • Order numbers and specifications of individual connectors for cables
   • Order numbers and specifications for wiring materials

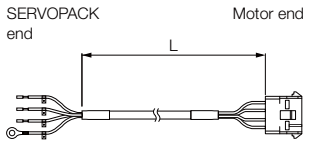
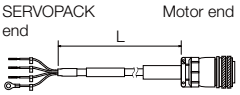
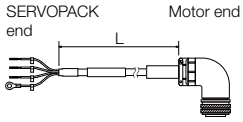
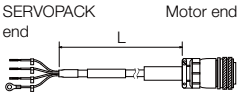
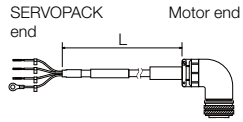
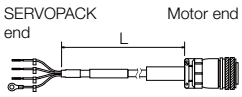
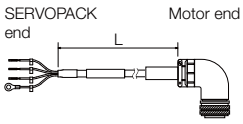
6.1.2 Servomotor Main Circuit Cables

◆ SGMCS-□□

Servomotor Model	Length	Order Number		Appearance
		Standard Cable	Flexible Cable*1*2	
SGMCS-□□B□□1 SGMCS-□□C□□1 SGMCS-□□D□□1 SGMCS-□□E□□1	3 m	JZSP-CMM60-03-E	JZSP-CSM60-03-E	
	5 m	JZSP-CMM60-05-E	JZSP-CSM60-05-E	
	10 m	JZSP-CMM60-10-E	JZSP-CSM60-10-E	
	15 m	JZSP-CMM60-15-E	JZSP-CSM60-15-E	
Flange specification*3: 1 Non-load side installation	20 m	JZSP-CMM60-20-E	JZSP-CSM60-20-E	

Continued on next page.

Continued from previous page.

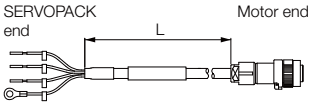
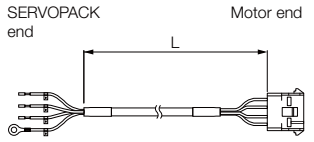
Servomotor Model	Length	Order Number		Appearance
		Standard Cable	Flexible Cable*1*2	
SGMCS-□□B□□4 SGMCS-□□C□□4 SGMCS-□□D□□4 SGMCS-□□E□□4 Flange specification*3: 4 Non-load side installation (with cable on side)	3 m	JZSP-CMM00-03-E	JZSP-CMM01-03-E	
	5 m	JZSP-CMM00-05-E	JZSP-CMM01-05-E	
	10 m	JZSP-CMM00-10-E	JZSP-CMM01-10-E	
	15 m	JZSP-CMM00-15-E	JZSP-CMM01-15-E	
	20 m	JZSP-CMM00-20-E	JZSP-CMM01-20-E	
SGMCS-□□M SGMCS-□□N □□: 45 □□: 80	3 m	JZSP-USA101-03-E	JZSP-USA121-03-E	
	5 m	JZSP-USA101-05-E	JZSP-USA121-05-E	
	10 m	JZSP-USA101-10-E	JZSP-USA121-10-E	
	15 m	JZSP-USA101-15-E	JZSP-USA121-15-E	
	20 m	JZSP-USA101-20-E	JZSP-USA121-20-E	
	3 m	JZSP-USA102-03-E	JZSP-USA122-03-E	
	5 m	JZSP-USA102-05-E	JZSP-USA122-05-E	
	10 m	JZSP-USA102-10-E	JZSP-USA122-10-E	
	15 m	JZSP-USA102-15-E	JZSP-USA122-15-E	
	20 m	JZSP-USA102-20-E	JZSP-USA122-20-E	
SGMCS-□□M SGMCS-□□N □□: 1A	3 m	JZSP-USA301-03-E	JZSP-USA321-03-E	
	5 m	JZSP-USA301-05-E	JZSP-USA321-05-E	
	10 m	JZSP-USA301-10-E	JZSP-USA321-10-E	
	15 m	JZSP-USA301-15-E	JZSP-USA321-15-E	
	20 m	JZSP-USA301-20-E	JZSP-USA321-20-E	
	3 m	JZSP-USA302-03-E	JZSP-USA322-03-E	
	5 m	JZSP-USA302-05-E	JZSP-USA322-05-E	
	10 m	JZSP-USA302-10-E	JZSP-USA322-10-E	
	15 m	JZSP-USA302-15-E	JZSP-USA322-15-E	
	20 m	JZSP-USA302-20-E	JZSP-USA322-20-E	
SGMCS-□□M SGMCS-□□N □□: 1E □□: 2Z	3 m	JZSP-USA501-03-E	JZSP-USA521-03-E	
	5 m	JZSP-USA501-05-E	JZSP-USA521-05-E	
	10 m	JZSP-USA501-10-E	JZSP-USA521-10-E	
	15 m	JZSP-USA501-15-E	JZSP-USA521-15-E	
	20 m	JZSP-USA501-20-E	JZSP-USA521-20-E	
	3 m	JZSP-USA502-03-E	JZSP-USA522-03-E	
	5 m	JZSP-USA502-05-E	JZSP-USA522-05-E	
	10 m	JZSP-USA502-10-E	JZSP-USA522-10-E	
	15 m	JZSP-USA502-15-E	JZSP-USA522-15-E	
	20 m	JZSP-USA502-20-E	JZSP-USA522-20-E	

*1. Use Flexible Cables for moving parts of machines, such as robots.
*2. The recommended bending radius of the Flexible Cables are given in the following table.

Order Number	Recommended Bending Radius (R)	Order Number	Recommended Bending Radius (R)
JZSP-CSM60-□□-E	55 mm min.	JZSP-USA321-□□-E	113 mm min.
JZSP-CMN01-□□-E		JZSP-USA322-□□-E	
JZSP-USA121-□□-E	96 mm min.	JZSP-USA521-□□-E	150 mm min.
JZSP-USA122-□□-E		JZSP-USA522-□□-E	

*3. Refer to *Flange Specifications* on page 6-7 for the flange specifications.
Note: Direct Drive Servomotors are not available with holding brakes.

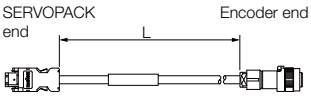
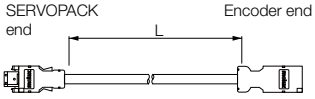
◆ SGMCV-□□

Servomotor Model	Length	Order Number		Appearance
		Standard Cable	Flexible Cable*1*2	
SGMCV-□□B□□1 SGMCV-□□C□□1 Flange specification*3: 1 Non-load side installation	3 m	JZSP-CMM60-03-E	JZSP-C7MDN23-03-E	
	5 m	JZSP-CMM60-05-E	JZSP-C7MDN23-05-E	
	10 m	JZSP-CMM60-10-E	JZSP-C7MDN23-10-E	
	15 m	JZSP-CMM60-15-E	JZSP-C7MDN23-15-E	
	20 m	JZSP-CMM60-20-E	JZSP-C7MDN23-20-E	
SGMCV-□□B□□4 SGMCV-□□C□□4 Flange specification*3: 4 Non-load side installation (with cable on side)	3 m	JZSP-CMM00-03-E	JZSP-C7MDS23-03-E	
	5 m	JZSP-CMM00-05-E	JZSP-C7MDS23-05-E	
	10 m	JZSP-CMM00-10-E	JZSP-C7MDS23-10-E	
	15 m	JZSP-CMM00-15-E	JZSP-C7MDS23-15-E	
	20 m	JZSP-CMM00-20-E	JZSP-C7MDS23-20-E	

*1. Use Flexible Cables for moving parts of machines, such as robots.
*2. The recommended bending radius (R) is 90 mm or larger.
*3. Refer to *Flange Specifications* on page 6-7 for the flange specifications.
Note: Direct Drive Servomotors are not available with holding brakes.

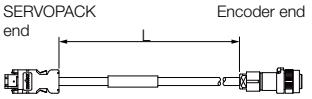
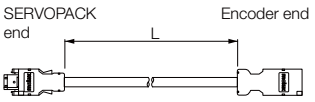
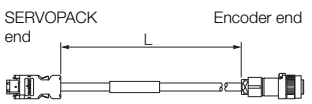
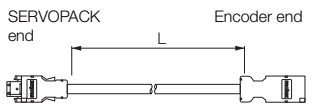
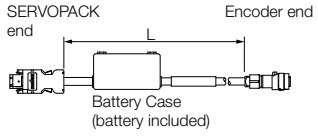
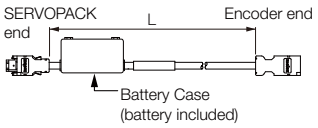
6.1.3 Encoder Cables of 20 m or Less

◆ SGMCS-□□

Servomotor Model	Name	Length	Order Number		Appearance
			Standard Cable	Flexible Cable*1*2	
SGMCS-□□ Flange specification*3: 1 or 3	For incremental/ absolute encoder	3 m	JZSP-CMP60-03-E	JZSP-CSP60-03-E	
		5 m	JZSP-CMP60-05-E	JZSP-CSP60-05-E	
		10 m	JZSP-CMP60-10-E	JZSP-CSP60-10-E	
		15 m	JZSP-CMP60-15-E	JZSP-CSP60-15-E	
		20 m	JZSP-CMP60-20-E	JZSP-CSP60-20-E	
SGMCS-□□ Flange Specification*3: 4		3 m	JZSP-CMP00-03-E	JZSP-CMP10-03-E	
		5 m	JZSP-CMP00-05-E	JZSP-CMP10-05-E	
		10 m	JZSP-CMP00-10-E	JZSP-CMP10-10-E	
		15 m	JZSP-CMP00-15-E	JZSP-CMP10-15-E	
		20 m	JZSP-CMP00-20-E	JZSP-CMP10-20-E	

*1. Use Flexible Cables for moving sections such as robot arms.
*2. The recommended bending radius (R) is 68 mm or larger.
*3. Refer to *Flange Specifications* on page 6-7 in the model designations for the flange specifications.

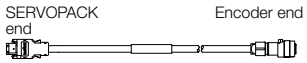
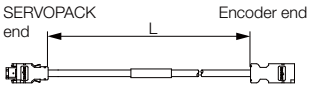
◆ SGMCV-□□

Servomotor Model	Name	Length	Order Number		Appearance
			Standard Cable	Flexible Cable*1*2	
SGMCV-□□BE□1 SGMCV-□□CE□1 Flange specification*3: 1	For single-turn absolute encoder (without Battery Case)	3 m	JZSP-CMP60-03-E	JZSP-CSP60-03-E	
		5 m	JZSP-CMP60-05-E	JZSP-CSP60-05-E	
		10 m	JZSP-CMP60-10-E	JZSP-CSP60-10-E	
		15 m	JZSP-CMP60-15-E	JZSP-CSP60-15-E	
		20 m	JZSP-CMP60-20-E	JZSP-CSP60-20-E	
SGMCV-□□BE□4 SGMCV-□□CE□4 Flange specification*3: 4		3 m	JZSP-CMP00-03-E	JZSP-CMP10-03-E	
		5 m	JZSP-CMP00-05-E	JZSP-CMP10-05-E	
		10 m	JZSP-CMP00-10-E	JZSP-CMP10-10-E	
		15 m	JZSP-CMP00-15-E	JZSP-CMP10-15-E	
		20 m	JZSP-CMP00-20-E	JZSP-CMP10-20-E	
SGMCV-□□BI□1 SGMCV-□□CI□1 Flange specification*3: 1	For multiturn absolute encoder: (without Battery Case)*4	3 m	JZSP-C7PI00-03-E	JZSP-C7PI20-03-E	
		5 m	JZSP-C7PI00-05-E	JZSP-C7PI20-05-E	
		10 m	JZSP-C7PI00-10-E	JZSP-C7PI20-10-E	
		15 m	JZSP-C7PI00-15-E	JZSP-C7PI20-15-E	
		20 m	JZSP-C7PI00-20-E	JZSP-C7PI20-20-E	
SGMCV-□□BI□4 SGMCV-□□CI□4 Flange specification*3: 4		3 m	JZSP-CMP00-03-E	JZSP-CMP10-03-E	
		5 m	JZSP-CMP00-05-E	JZSP-CMP10-05-E	
		10 m	JZSP-CMP00-10-E	JZSP-CMP10-10-E	
		15 m	JZSP-CMP00-15-E	JZSP-CMP10-15-E	
		20 m	JZSP-CMP00-20-E	JZSP-CMP10-20-E	
SGMCV-□□BI□1 SGMCV-□□CI□1 Flange specification*3: 1	For multiturn absolute encoder (with Battery Case)	3 m	JZSP-C7PA00-03-E	JZSP-C7PA20-03-E	
		5 m	JZSP-C7PA00-05-E	JZSP-C7PA20-05-E	
		10 m	JZSP-C7PA00-10-E	JZSP-C7PA20-10-E	
		15 m	JZSP-C7PA00-15-E	JZSP-C7PA20-15-E	
		20 m	JZSP-C7PA00-20-E	JZSP-C7PA20-20-E	
SGMCV-□□BI□4 SGMCV-□□CI□4 Flange specification*3: 4		3 m	JZSP-CSP19-03-E	JZSP-CSP29-03-E	
		5 m	JZSP-CSP19-05-E	JZSP-CSP29-05-E	
		10 m	JZSP-CSP19-10-E	JZSP-CSP29-10-E	
		15 m	JZSP-CSP19-15-E	JZSP-CSP29-15-E	
		20 m	JZSP-CSP19-20-E	JZSP-CSP29-20-E	

*1. Use Flexible Cables for moving sections such as robot arms.
*2. The recommended bending radius (R) is 68 mm or larger.
*3. Refer to *Flange Specifications* on page 6-7 in the model designations for the flange specifications.
*4. Use one of these Cables if a battery is installed at the host controller.

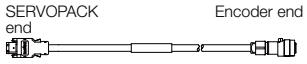
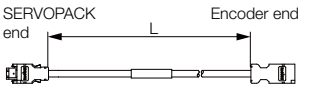
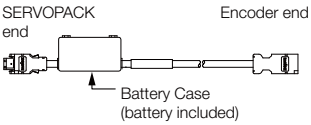
6.1.4 Relay Encoder Cables of 30 m to 50 m

◆ SGMCS-□□

Servomotor Model	Name	Length	Order Number*1	Appearance
SGMCS-□□ Flange specification*2: 1 or 3	Encoder-end Cable (for incremental or absolute encoder)	0.3 m	JZSP-CSP15-E	
SGMCS-□□ Flange specification*2: 1, 3, or 4	Cables with Connectors on Both Ends (for incremental or absolute encoder)	30 m	JZSP-UCMP00-30-E	
		40 m	JZSP-UCMP00-40-E	
		50 m	JZSP-UCMP00-50-E	

*1. Flexible Cables are not available.
*2. Refer to *Flange Specifications* on page 6-7 in the model designations for the flange specifications.

◆ SGMCV-□□

Servomotor Model	Name	Length	Order Number*1	Appearance
SGMCV-□□BE SGMCV-□□BI SGMCV-□□CE SGMCV-□□CI Flange specification*2: 1	Encoder-end Cable (for single-turn/multiturn absolute encoder)	0.3 m	JZSP-C7PRC0-E	
SGMCV-□□BE SGMCV-□□BI SGMCV-□□CE SGMCV-□□CI Flange specification*2: 1 or 4	Cables with Connectors on Both Ends (for single-turn/multiturn absolute encoder)	30 m	JZSP-UCMP00-30-E	
		40 m	JZSP-UCMP00-40-E	
		50 m	JZSP-UCMP00-50-E	
SGMCV-□□BI SGMCV-□□CI Flange specification*2: 1 or 4	Cable with a Battery Case*3 (for multiturn absolute encoder)	0.3 m	JZSP-CSP12-E	

*1. Flexible Cables are not available.
*2. Refer to *Flange Specifications* on page 6-7 in the model designations for the flange specifications.
*3. This Cable is not required if a battery is connected at the host controller.

Flange Specifications

◆ SGMCS-□□

Flange Specification Code (6th Digit)	Flange Location	Servomotor Outer Diameter Code (3rd Digit)					
		B	C	D	E	M	N
1	Non-load side	✓	✓	✓	✓	–	–
	Load-side	–	–	–	–	✓	✓
3	Non-load side	–	–	–	–	✓	✓
4	Non-load side (with cable on side)	✓	✓	✓	✓	–	–

✓: Applicable models

◆ SGMCV-□□

Flange Specification Code (6th Digit)	Flange Location	Servomotor Outer Diameter Code (3rd Digit)	
		B	C
1	Non-load side	✓	✓
4	Non-load side (with cable on side)	✓	✓

✓: Applicable models

6.2 Wiring Servomotors and SERVOPACKs

6.2.1 Wiring Precautions

⚠ CAUTION

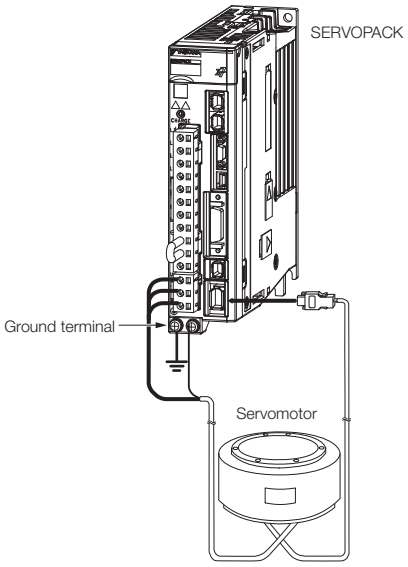
- Do not connect the Servomotor directly to an industrial power supply. Doing so will destroy the Servomotor. You cannot operate a Servomotor without a SERVOPACK that is designed for it

General Precautions

- Never perform any wiring work while the power supply is ON.
- Always connect the Servomotor Main Circuit Cable before you connect the Encoder Cable. If you connect the Encoder Cable first, the encoder may be damaged due to the difference in electrical potential from the FG.
- Never touch the connector pins on the Servomotor directly with your hands. Particularly the encoder may be damaged by static electricity.
- For a Medium-Capacity Servomotor with a Core, use the joint nuts to secure the cable connectors to the Servomotor. Make sure that they are securely attached.
  If they are not securely attached, the protective structure specifications may not be satisfied.
- Separate the Servomotor Main Circuit Cable from the I/O Signal Cables and Encoder Cable by at least 30 cm.
- Do not connect magnetic contactors, reactors, or other devices on the cables that connect the SERVOPACK and Servomotor. Failure to observe this caution may result in malfunction or damage.
- Do not subject the cables to excessive bending stress or tension. The conductors in the Encoder Cable and Servomotor Main Circuit Cable are as thin as 0.2 mm^2 or 0.3 mm^2. Wire them so that they are not subjected to excessive stress.
- If you secure the cables with cable ties, protect the cables with cushioning material.
- If the cable will be bent repeatedly, e.g., if the Servomotor will move in the machine, use Flexible Cables. If you do not use Flexible Cables, the cables may break.
- Before you connect the wires, make sure that there are no mistakes in the wiring.
- Always use the connectors specified by Yaskawa and insert them correctly.
- When you connect a connector, check it to make sure there is no foreign matter, such as metal clippings, inside.
- The connectors for Small-Capacity Servomotors are made from resin. To prevent damage, do not apply any strong impact.
- Perform all wiring so that stress is not applied to the connectors. The connectors may break if they are subjected to stress.
- If you move the Servomotor while the cables are connected, always hold onto the main body of the Servomotor. If you lift the Servomotor by the cables when you move it, the connectors may be damaged or the cables may be broken.

Grounding Precautions

The ground terminal on the SERVOPACK is used to ground the Servomotor.



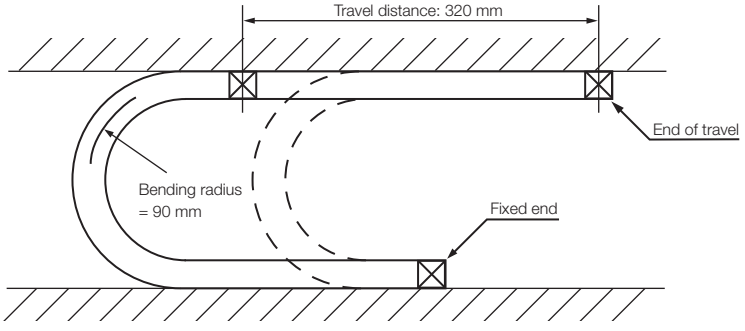
Precautions for Standard Cables

Do not use standard cables in applications that require a high degree of flexibility, such as twisting and turning, or in which the cables themselves must move. When you use Standard Cables, observe the recommended bending radius given in the following table and perform all wiring so that stress is not applied to the cables. Use the cables so that they are not repeatedly bent.

Cable Diameter	Recommended Bending Radius [R]
Less than 8 mm	15 mm min.
8 mm	20 mm min.
Over 8 mm	Cable diameter × 3 mm min.

Precautions for Flexible Cables

- The Flexible Cables have a service life of 10,000,000 operations minimum when used at the recommended bending radius of 90 mm or larger under the following test conditions. The service life of a Flexible Cable is reference data under special test conditions. The service life of a Flexible Cable greatly depends on the amount of mechanical shock, how the cable is attached, and how the cable is secured.
  Test Conditions
  - One end of the cable is repeatedly moved forward and backward for 320 mm using the test equipment shown in the following figure.
  - The lead wires are connected in parallel, and the number of cable return operations until a lead wire breaks are counted. One round trip is counted as one bend.



Note: The service life of a Flexible Cable indicates the number of bends while the lead wires are electrically charged for which no cracks or damage that affects the performance of the cable sheathing occur. Breaking of the shield wire is not considered.

- Straighten out the Flexible Cable when you connect it. If the cable is connected while it is twisted, it will break faster. Check the indication on the cable surface to make sure that the cable is not twisted.
- Do not secure the portions of the Flexible Cable that move. Stress will accumulate at the point that is secured, and the cable will break faster. Secure the cable in as few locations as possible.
- If a Flexible Cable is too long, looseness will cause it to break faster. It the Flexible Cable is too short, stress at the points where it is secured will cause it to break faster. Adjust the cable length to the optimum value.
- Do not allow Flexible Cables to interfere with each other. Interference will restrict the motion of the cables, causing them to break faster. Separate the cables sufficiently, or provide partitions between them when wiring.

6.2.2 Wiring Procedure

Wire according to the figure on the following page.
☞ *6.1.1 System Configurations* on page 6-2

Refer to the SERVOPACK manual for information on wiring the SERVOPACKs.

Maintenance and Inspection

7

This chapter describes the maintenance, inspection, and disposal of a Servomotor.

7.1 Periodic Inspections

The following table gives the periodic inspection items for a Servomotor. The inspection periods given in the table are guidelines. Determine the optimum inspection periods based on the application conditions and environment.

⚠ CAUTION

- Before you perform any maintenance or inspection work, turn OFF the power supply, confirm that the CHARGE indicator on the front of the SERVOPACK has gone out, and then use a tester to check the voltage between the positive and negative terminals on the SERVOPACK. Start inspection work only after you have confirmed that the main circuit voltage has dropped.
  If there is any main circuit voltage left, the risk of electric shock still exists. Do not touch the Servomotor or any wiring.
- All inspection and maintenance work must be performed only by qualified engineers.
  There is a risk of electric shock or injury.
- Contact your Yaskawa representative for help with failures, repairs, or part replacement.

Item	Inspection Period	Basic Inspection and Maintenance Procedure	Remarks
Check the coupling between the Servomotor and the machine.	Before starting operation	• Make sure that there are no loose mounting screws between the Servomotor and machine. • Make sure that there is no looseness in the coupling between the Servomotor and machine. • Make sure that there is no misalignment.	–
Check for vibration and noise.	Daily	Inspect by touching and by listening.	There should be no more vibration or noise than normal.
Exterior	Check for dirt and grime.	Clean off the dirt and grime with a cloth or pressurized air.	–
Measure the insulation resistance.	At least once a year	Disconnect the Servomotor from the SERVOPACK and measure the insulation resistance at 500 V with an insulation resistance meter. (Measurement method: Measure the resistance between phase U, V, or W on the Servomotor's power line and FG.) The insulation is normal if the resistance is 10 MΩ or higher.	If the resistance is less than 10 MΩ, contact your Yaskawa representative.
Overhaul	At least once every 5 years or every 20,000 hours	Contact your Yaskawa representative.	–

7.2 Service Lives of Parts

The following table gives the standard service lives of the parts of the Servomotor. Contact your Yaskawa representative using the following table as a guide. After an examination of the part in question, we will determine whether the part should be replaced. Even if the service life of a part has not expired, replacement may be required if abnormalities occur. The standard service lives in the table are only for reference. The actual service lives will depend on the application conditions and environment.

Part	Standard Service Life	Remarks
Bearings	20,000 hours	The service life is affected by operating conditions. Check for abnormal sounds and vibration during inspections.

7.3 Disposing of Servomotors

When disposing of a Servomotor, treat it as ordinary industrial waste.

However, local ordinances and national laws must be observed. Implement all labeling and warnings as a final product as required.

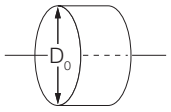
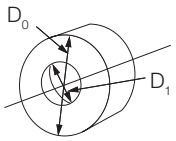
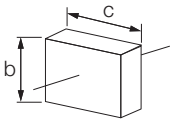
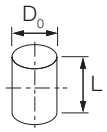
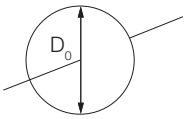
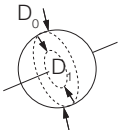
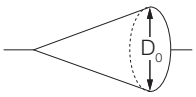
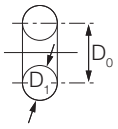
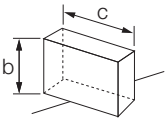
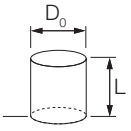
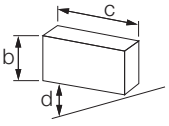
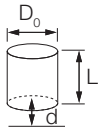
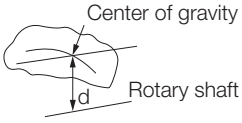
Appendix

8

The appendix provides information to use when selecting Servomotor capacities.

8.1 Reference Information for Servomotor Capacity Selection

8.1.1 GD^2 for Simple Diagrams

<table>
<tr>
<td>When Rotary Shaft Is Aligned with Center Line of Cylinder</td>
<td>Solid cylinder
$(D^2 = D_0^{\,2}/2)$
 
OR
$GD^2 = 125\pi\,\rho LD^4$
ρ: Density (g/cm^3)...Copper: 7.866
L : Length (m)
D: Diameter (m)</td>
<td>Hollow cylinder
$D^2 = (D_0^{\,2} + D_1^{\,2})/2$
 
OR
$GD^2 = 125\pi\,\rho L\,(D_0^{\,4} + D_1^{\,4})$
ρ:Density (g/cm^3)
L : Length (m)
D_0 , D_1 :Diameter (m)</td>
</tr>
<tr>
<td rowspan="3">When Rotary Shaft Runs Through Gravitational Center</td>
<td>Rectangular solid
$D^2 = (b^2 + c^2)/3$
  </td>
<td>Cylindrical body
$D^2 = L^2/3 + D_0^{\,2}/4$
  </td>
</tr>
<tr>
<td>Sphere
$D^2 = \frac{2}{5}D_0^{\,2}$
  </td>
<td>Hollow sphere
$D^2 = \frac{2}{5} \cdot \frac{D_0^{\,5} - D_1^{\,3}}{D_0^{\,3} - D_1^{\,3}}$
  </td>
</tr>
<tr>
<td>Cone
$D^2 = \frac{3}{10}D_0^{\,2}$
  </td>
<td>Wheel
$D^2 = D_0^{\,2} + \frac{3}{4}D_1^{\,2}$
  </td>
</tr>
<tr>
<td>When Rotary Shaft Is on One End</td>
<td>Rectangular solid
$D^2 = (4b^2 + C^2)/3$
  </td>
<td>Cylindrical body
$D^2 = \frac{4}{3}L^2 + \frac{D_0^{\,2}}{4}$
  </td>
</tr>
<tr>
<td>When Rotary Shaft Is Outside Rotating Body</td>
<td>Rectangular solid
$D^2 = \frac{4b^2 + C^2}{3} + 4(bd + d^2)$
  </td>
<td>Cylindrical body
$D^2 = \frac{4}{3}L^2 + \frac{D_0^{\,2}}{4} + 4(dL + d^2)$
  </td>
</tr>
<tr>
<td>General Formula When Rotary Shaft Is outside Rotating Body</td>
<td colspan="2">General Formula for Diameter of Rotation When Rotary Shaft Is Outside Rotating Body
$D_2^{\,2} = D_1^{\,2} + 4d^2$
D_1 : Diameter of rotation when shaft that is parallel to rotary shaft and runs through center of gravity virtually operates as a rotary shaft
  </td>
</tr>
</table>

Information GD^2 = Weight × (Diameter of rotation)^2

8.1.2 Conversions between Traditional Units and SI Units

Quantity	Traditional Unit	SI Unit	Conversion Factor
Force or load	kgf	N	1 kgf = 9.80665 N
Weight	kgf	–	The numerical values are the same for mass in the traditional unit and the SI unit. (The mass SI unit Wkg is used for objects in the *W*kgf traditional unit.)
Mass	$kgf \cdot s^2/m$	kg	
Torque	kgf·m	N·m	1 kgf·m = 9.80665 N·m
Inertia (moment of inertia)	$gf \cdot cm \cdot s^2$	$kg \cdot m^2$	1 $gf \cdot cm \cdot s^2$ = 0.980665 × 10^{-4} $kg \cdot m^2$
GD_2	$kgf \cdot m^2$	$kg \cdot m^2$	Relationship between GD^2 ($kgf \cdot m^2$) and moment of inertia J ($kg \cdot m^2$) $J = \frac{GD^4}{4}$

Revision History

The revision dates and numbers of the revised manuals are given on the bottom of the back cover.

MANUAL NO. SIEP S800001 38A

Published in Japan April 2014 14-4

Date of publication

Date of original publication

Date of Publication	Rev. No.	Section	Revised Content
April 2014	–	–	First edition

Σ-7-Series AC Servo Drive

Direct Drive Servomotor

Product Manual

IRUMA BUSINESS CENTER (SOLUTION CENTER)
480, Kamifujisawa, Iruma, Saitama 358-8555, Japan
Phone 81-4-2962-5151 Fax 81-4-2962-6138
http://www.yaskawa.co.jp

YASKAWA AMERICA, INC.
2121 Norman Drive South, Waukegan, IL 60085, U.S.A.
Phone 1-800-YASKAWA (927-5292) or 1-847-887-7000 Fax 1-847-887-7310
http://www.yaskawa.com

YASKAWA ELÉTRICO DO BRASIL LTDA.
Avenida Piraporinha 777, Diadema, São Paulo, 09950-000, Brasil
Phone 55-11-3585-1100 Fax 55-11-3585-1187
http://www.yaskawa.com.br

YASKAWA EUROPE GmbH
Hauptstraβe 185, Eschborn 65760, Germany
Phone 49-6196-569-300 Fax 49-6196-569-398
http://www.yaskawa.eu.com

YASKAWA ELECTRIC KOREA CORPORATION
9F, Kyobo Securities Bldg. 26-4, Yeouido-dong, Yeongdeungpo-gu, Seoul, 150-737, Korea
Phone 82-2-784-7844 Fax 82-2-784-8495
http://www.yaskawa.co.kr

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.
151 Lorong Chuan, #04-02A, New Tech Park 556741, Singapore
Phone 65-6282-3003 Fax 65-6289-3003
http://www.yaskawa.com.sg

YASKAWA ELECTRIC (CHINA) CO., LTD.
12F, Carlton Bld., No.21 HuangHe Road, HuangPu District, Shanghai 200003, China
Phone 86-21-5385-2200 Fax 86-21-5385-3299
http://www.yaskawa.com.cn

YASKAWA ELECTRIC (CHINA) CO., LTD. BEIJING OFFICE
Room 1011, Tower W3 Oriental Plaza, No.1 East Chang An Ave.,
Dong Cheng District, Beijing 100738, China
Phone 86-10-8518-4086 Fax 86-10-8518-4082

YASKAWA ELECTRIC TAIWAN CORPORATION
9F, 16, Nanking E. Rd., Sec. 3, Taipei 104, Taiwan
Phone 886-2-2502-5003 Fax 886-2-2505-1280

YASKAWA ELECTRIC CORPORATION

MANUAL NO. SIEP S800001 38A

Published in Japan April 2014 14-4
13-6-9
Original instructions