

1 Warranty

Details of warranty

- Warranty period

The warranty period for the product purchased (hereinafter called "product") is subject to the signed contract and is up to 24 months since the date of manufacture of the product.

- Warranty scope

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

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

- Natural wear and tear
- Handling of the product not in conformity with the product instruction or user manual
- Unauthorized or inappropriate modifications, alterations or repairs
- Damages from faulty or negligent handling, use or maintenance, overload conditions
- Excessive strain or use of unsuitable appurtenances
- Defective installation or erection not carried out by Siemens
- Inappropriate storage or any other external impact on the product not explicitly assumed by Siemens
- Device (drives, motors) damages due to use of the non-Siemens cable assemblies, for example, improper cables you made by yourself or cables from a third party
- 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 product itself
- Abuse of the 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 Siemens
- Malfunctions arising from natural or man-made disasters or events not attributable to Siemens

Limitations of liability

- In no event is Siemens responsible for any loss of use, production, profit, interest, revenues, loss of information or data, damages or indemnification based on the customer's third party contracts or any indirect or consequential damages or losses, regardless of whether those damages are foreseeable.
- The information provided in product catalogs or manuals is to help customer select 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 Siemens or third parties, nor does it construe a license.
- Siemens shall not be liable 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.
- The indemnity obligation of Siemens for all losses of the customer attributable to Siemens does not exceed the total amount paid by the customer for purchasing the relevant product.

Suitability for use

- It is the customer's responsibility to confirm conformity with any standards, codes, or regulations that apply if the Siemens product is used in combination with any other products.
- The customer must confirm that the Siemens product is suitable for the systems, machines, and equipment used by the customer.
- Consult with Siemens 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 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 Siemens 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 Siemens product correctly to prevent accidental harm to third parties.
- Adhere to the instructions including but not limited to product manuals and safety notices during the use of the product. Siemens does not accept any liability for personal injuries, property damage, legal disputes or interest conflicts arising from non-adherence to product manuals and safety notices or arising from Force Majeure.

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 Siemens representative to confirm the actual specifications before purchasing a product.

2 Cable and connector

You are recommended to use Siemens cable assemblies and connectors in the following table. All Siemens cable assemblies and connectors are tested and compliant with the CE standards and EMC requirements. If you use non-Siemens cable assemblies, for example, cables you made by yourself or cables from a third party, Siemens does not guarantee that the drive system composed of V90 servo drive and 1FL6 servo motor meets the CE standards. If you use non-Siemens cable assemblies in your drive system, and the drive system are required to be operated in a CE-compliant environment, you need to reapply for certification for the drive system.

Siemens allows you assemble your own cables in the case that, for example, cables of the special length is needed; therefore Siemens provides the instructions for assembling cables and connectors. However, Siemens does not guarantee that cables you made meet the CE standards and EMC requirements. When you made cables, you need to observe the assembly procedures in the SINAMICS V90, SIMOTICS S-1FL6 Operating Instructions. Besides, you need to prepare appropriate tools, raw cables, and Siemens connectors according to the information in this section.

Siemens does not guarantee the performance of the cables you made. For device (drives, motors) damages due to use of the cables that you made the warranty is not assumed.

Cable type	Article No. ¹⁾ 6FX3002-	Cross-section of cores (mm ²)	Minimum bending radius		Outer diameter (mm)	Bending cycles ²⁾	Shielding coverage	Drive side connector (6FX2003-)	Motor side connector		
			Static (mm)	Dynamic (mm)					Article No. (6FX2003-)	Pin type ³⁾	Packaging specifications
Power cable	5CK01-....	4 × 0.75	5 × outer diameter	155	∅ (6.7 ± 0.4)	100000	≥ 60%	-	OLL12	Soldering	5 pieces
	5CK32-....	4 × 2.5	5 × outer diameter	155	∅ (6.7 ± 0.4)	1000000	≥ 85%	-	OLL13	Crimping	5 pieces
	5CL02-....	4 × 1.5	5 × outer diameter	155	∅ (6.7 ± 0.4)	1000000	≥ 85%	-	OLL13	Crimping	5 pieces
	5CL12-....	4 × 2.5	5 × outer diameter	155	∅ (6.7 ± 0.4)	1000000	≥ 85%	-	OLL13	Crimping	5 pieces
Brake cable	5BK02-....	2 × 0.75	5 × outer diameter	155	∅ (6.1 ± 0.3)	100000	≥ 60%	-	OLL52	Soldering	5 pieces
	5BL03-....	2 × 0.75	5 × outer diameter	155	∅ (6.1 ± 0.3)	1000000	≥ 85%	-	OLL53	Crimping	5 pieces
Encoder cable	2CT20-....	3 × 2 × 0.20 + 2 × 2 × 0.25	5 × outer diameter	155	∅ (7.2 ± 0.3)	100000	≥ 60%	OSB14	OSL12	Soldering	5 pieces
	2CT12-....	3 × 2 × 0.22 + 2 × 2 × 0.25	5 × outer diameter	155	∅ (7.2 ± 0.3)	1000000	≥ 85%	OSB14	OSL13	Crimping	5 pieces
	2DB10-...	3 × 2 × 0.22 + 2 × 2 × 0.25	5 × outer diameter	155	∅ (7.2 ± 0.3)	1000000	≥ 85%	OSB14	ODB11	Soldering	30 pieces
	2DB20-....	3 × 2 × 0.20 + 2 × 2 × 0.25	5 × outer diameter	155	∅ (7.2 ± 0.3)	100000	≥ 60%	OSB14	ODB12	Soldering	5 pieces
	2DB12-....	3 × 2 × 0.22 + 2 × 2 × 0.25	5 × outer diameter	155	∅ (7.2 ± 0.3)	1000000	≥ 85%	OSB14	ODB13	Crimping	5 pieces

Illustrations of the motor side connectors (6FX2003-)

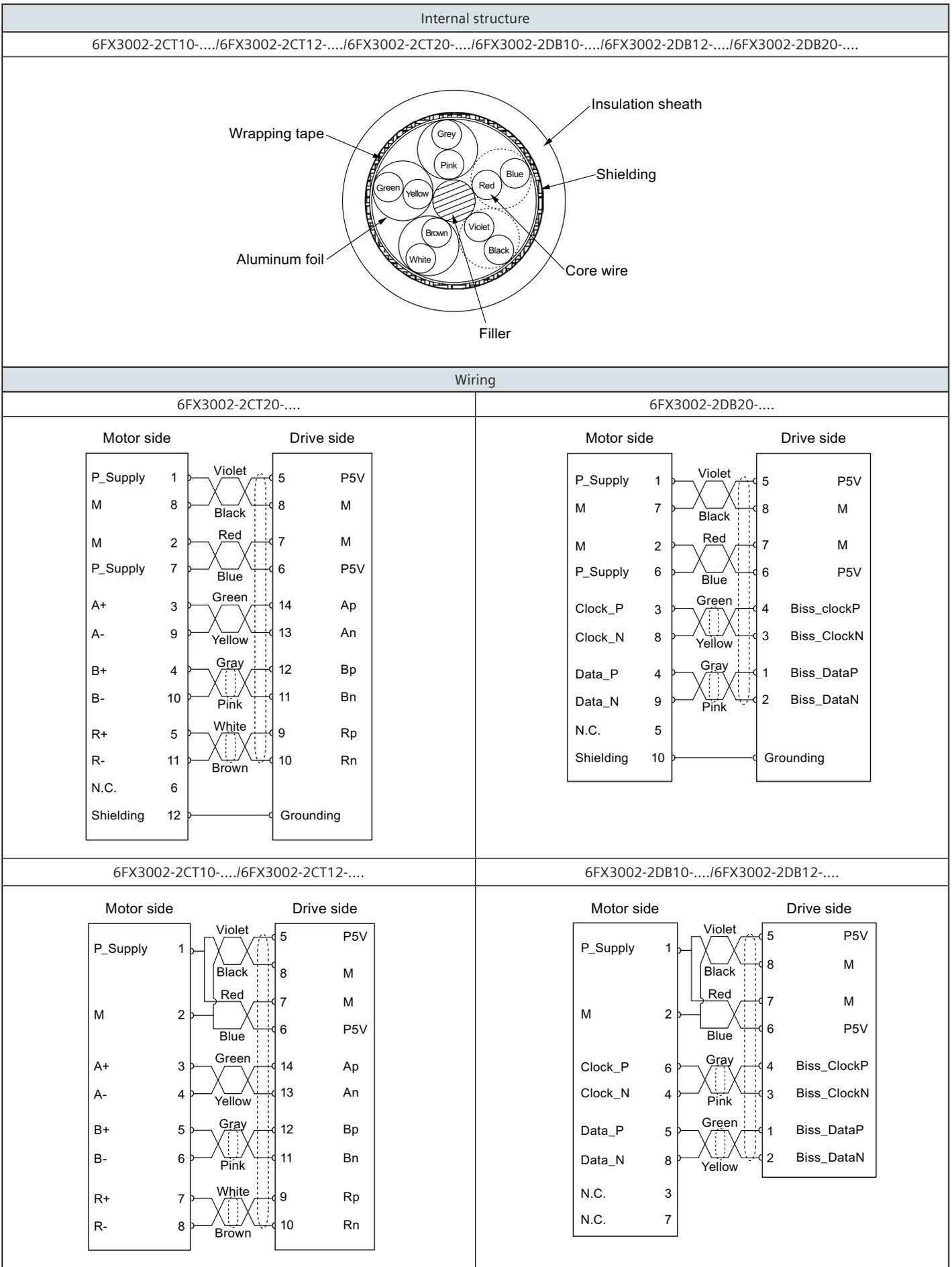
OLL12	OLL13	OLL52	OLL53	OSL12	OSL13	ODB11	ODB12	ODB13
								

¹⁾ The "..." in the article number indicates the code for cable length, in which 1AD0 = 3 m, 1AF0 = 5 m, 1AH0 = 7 m, 1BA0 = 10 m, 1BF0 = 15 m, 1CA0 = 20 m

²⁾ Maximum acceleration 3 m/s², maximum speed 40 m/min

³⁾ Mind the pin type when assembling the cable connectors. Do not solder on the crimping type connectors or crimp the soldering type connectors

3 Internal structure and wiring of the encoder cable



Twisted-pair wires
 Shielding

4 EMC requirements for cables

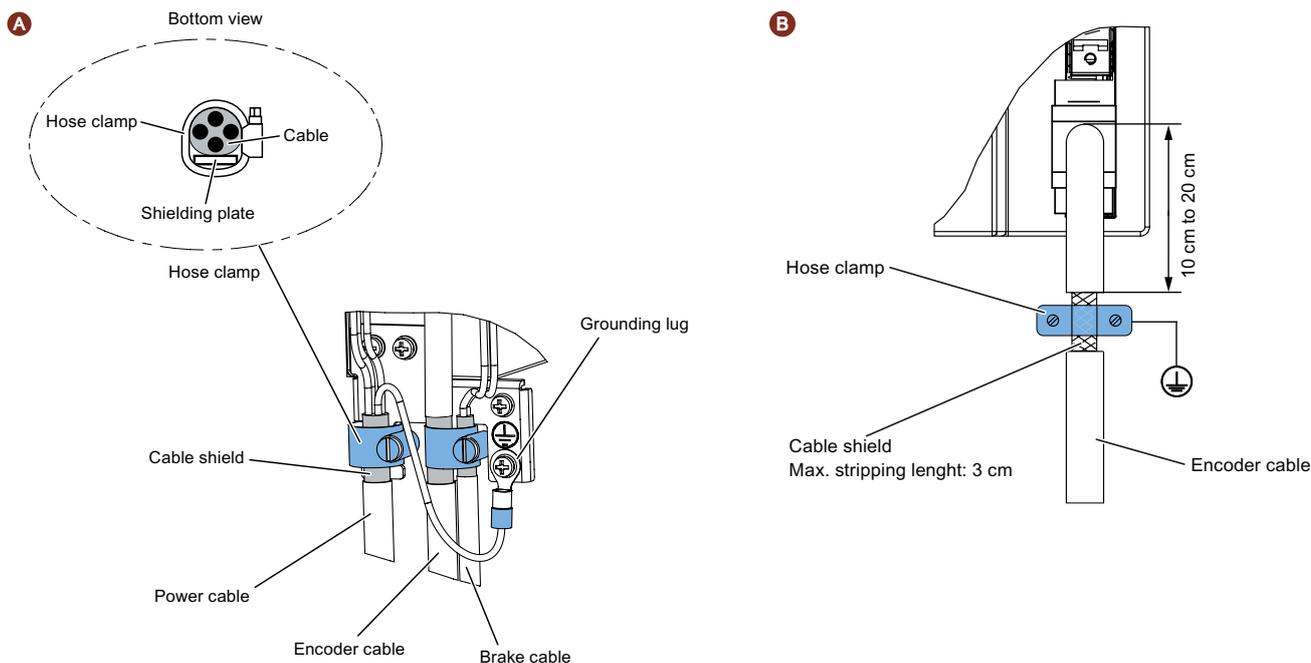
- To comply with the EMC standards, all cables connected with the SINAMICS V90 system must be shielded cables, which include the line supply cables (cables from the line supply to the line filter and from the line filter to the SINAMICS V90 drive), power cable, encoder cable and brake cable.
- Route signal cables and power cables separately in different cable conduits. The signal cables shall be at least 10 cm away from the power cables.
- The shielding coverage and other technical data must be complied with the requirements in Section "Cable and connector" on page 3.

Requirements of cable shields connection

- 5 To achieve EMC-compliant installation of the drive, connect the shields of the power cable to the shielding plate via the hose clamps. The shielding plate is shipped with the drive. See figure A for steps to connect cable shields with the shielding plate.

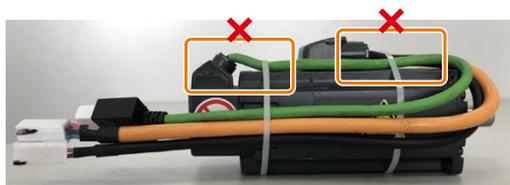
To ensure better EMC effects, you are recommended to strip the brake cable and the encoder cable and connect the cable shields to earth, as shown in the figure A and figure B. Make sure that the shielding plate, the drive and the motor are properly grounded.

Clamping cables on the motor side



- 6 When clamping cables on the motor side, observe the following requirements:

- The way of clamping the cable must be fully examined so that bending stress and cable's own weight stress are not applied to the cable connection.
- For use in any application where the servo motor moves, fix the cables (power cable, encoder cable, and brake cable) supplied with the servo motor, and flex the cables. Use the cables within the bending cycle of the cables.
- Avoid any probability that the cable sheath might be cut by sharp chips, rubbed by a machine corner or stamped by workers or vehicles.
- For installation on a machine where the servo motor will move, the bending radius should be made as large as possible.



7 Cable assembly

Cables connecting the SINAMICS V90 servo drives and SIMOTICS S-1FL6 servo motors are important components of a servo drive system. They are essential to the stable and reliable operation of the system. When you made cables yourself, you need to observe the assembly procedures in the SINAMICS V90, SIMOTICS S-1FL6 Operating Instructions and the following requirements:

Operation requirements

When you made cable yourself, observe the following requirements:

- The assembly must be performed by qualified personnel
- Use appropriate tools to solder or crimp cables and ensure the operation quality

- Tool: 10 A/16 A cold crimping tool
- Cable cross-section range: 0.14 mm² to 6 mm²
- Illustration:



Cable and connector requirements

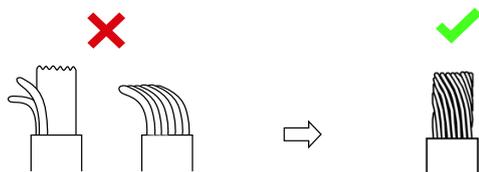
- Use raw cables that with shields
Power cables and encoder cables must be shielded cables, and the shield coverage must be conformed to the Siemens requirements.
- Use Siemens connectors only
For more information about the cable and connector requirements, see Section "Cable and connector" on page 3.

Assembly requirements

Observe the assembly procedures in the SINAMICS V90, SIMOTICS S-1FL6 Operating Instructions as well as the following key points:

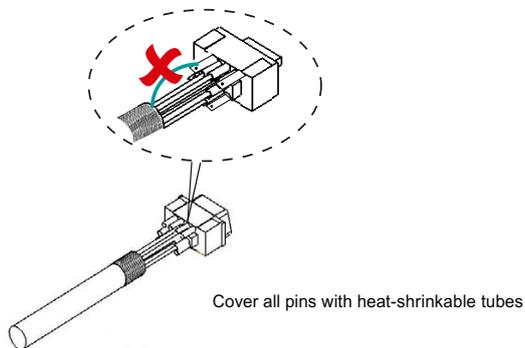
- **Stripping cables**

After you remove the outer sheath of the cables, make sure that all conductors are smooth and straight.



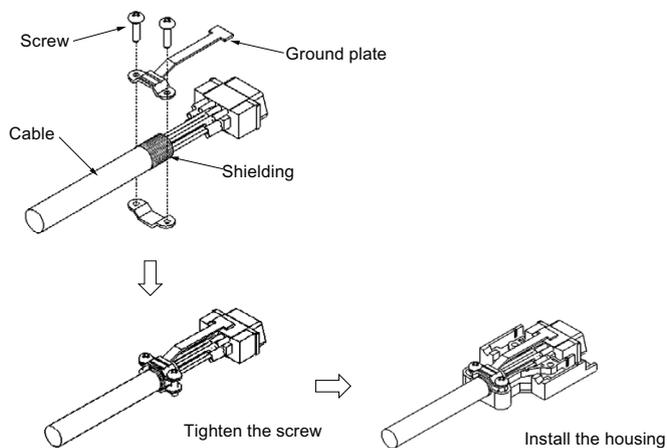
- **Processing unused pins on the connectors**

To avoid the short-circuiting between the shielding wire and the unused pin on the connector, cover all unused pins with heat-shrinkable tubes.



- **Connecting cable shields**

When you assemble the drive side encoder connectors, the cable shields must be connected to the ground plate and then connected to the housing.



1 关于保修

保修内容

• 保修期限

所购买产品（下称“产品”）的保修期以合同约定为准，但最长不超过产品生产日起的 24 个月。

• 保修范围

如果在上述保修期内发生了本公司责任范围内的故障，本公司将免费提供替代产品或修理故障品。因产品到达寿命而造成的故障以及消耗部件、寿命部件的更换不属于保修范围。

此外，当故障原因符合下列情形之一时，不属于保修范围：

- 产品使用中正常的损耗
- 不符合产品手册和产品说明的操作
- 未经本公司授权的改造、变更或修理
- 由于使用、维护或处理中的故意或过失或在超负荷条件下使用
- 对产品施加过分的压力或者使用不适当的附属器件
- 非本公司进行的不适当安装
- 不适合的存放或者其他本公司没有明确表示负责的其他任何外力对产品造成的损害
- 因使用非西门子电缆组件，例如，不适当的自制电缆或第三方电缆，而造成的的西门子设备（如驱动、电机等）故障
- 因非产品样本、手册或另行交付的规格书等资料中记载的不恰当条件、环境、操作及使用而造成的故障时
- 因产品以外的原因而造成故障时
- 因其他对产品使用方法不当而造成故障时
- 因本公司出厂当时的科学、技术水平无法预计的事由而造成故障时
- 因天灾、灾害等其它不属于本公司责任的原因而造成故障时

责任限制

- 在任何情况下本公司对与产品相关的使用、生产、利润、利息以及收入损失、信息或数据的丢失、第三方的合同的损害赔偿或补偿或任何间接的或后果性的损坏或损失都不承担责任，无论该等损失是否可以预见。
- 产品样本或操作手册中记载的信息是为了使用户根据用途选购最适合的产品。本公司不保证或承诺使用这些信息不会对本公司及第三方的知识产权或其他权利产生权利侵害。
- 对于因使用产品样本或手册中记载的信息而侵害了第三方的知识产权或其他权利的权利侵害，本公司不承担责任。
- 本公司对由其责任所导致的客户各类损失的最大赔偿总额不超过客户购买相关产品所支付的金额。

适用用途、条件等的确认

- 将本公司产品与其它产品配套使用时，请由用户确认应当满足的标准、应当遵守的法规或限制条款。
- 请由用户确认其使用的系统、机械、装置是否适用于本公司产品。
- 将产品用于下列用途前，请事先咨询本公司，确定是否可行。如果可行，则应采用赋予额定值、性能余量的使用方法，或者采取万一发生故障时将风险降至最低的安全措施。
 - 用于室外、受到潜在的化学污染或电子干扰用途，或者产品样本及操作手册中无记载的条件和环境。
 - 原子能控制设备、焚烧设备、铁路/航空/车辆设备、医疗器械、娱乐器材及符合行政机构和各行业限制规定的设备。
 - 可能危及人身、财产安全的系统、机械、装置。
 - 燃气、自来水、电气供应系统或 24 小时连续运行系统等需要高度可靠性的系统。
 - 其它以上述各项为准的需要高度安全性的系统。
- 将本公司产品用于可能危及人身、财产安全的用途时，请务必通过危险警告或冗余设计，事先确认设计可确保必要的安全性以及本公司产品已进行了适当的配电和设置。
- 产品样本或操作手册中所记载回路范例及其它应用范例仅供参考。请在确认所用设备、装置的功能和安全性后再采用。
- 请在准确理解所有使用禁止事项和注意事项的基础上正确使用本公司产品，以免给第三方造成意外损害。
- 在使用产品的过程中，请严格遵守并执行包括但不限于产品手册和安全须知里的要求。对于违反产品手册或安全须知所提示的使用行为或不可抗因素导致的一切人身伤害、事故、财产损失、法律纠纷，及其他一切造成利益冲突的不利事件，本公司不承担任何责任。

规格的变更

产品样本或手册中记载的品名、规格、外观及附件等可能会因质量改进或其它事由而变更，恕不事先告知。变更后，产品样本或手册的资料编号将进行更新，并作为改订版发行。考虑使用或订购资料中记载的产品时，请事先咨询销售代表。

2 电缆和连接器

推荐使用下表中的西门子电缆组件和连接器。所有西门子电缆组件和连接器均经过严格测试，满足 CE 标准以及 EMC 要求。如果使用非西门子电缆组件，例如，自制电缆或第三方电缆，西门子无法保证由 V90 伺服驱动器和 1FL6 伺服电机所构成的系统符合 CE 标准。如果在 V90 系统中使用了非西门子电缆组件，并且该系统需应用于符合 CE 标准的应用环境，则需要该系统的使用者重新获取认证。

西门子公司允许客户因特殊长度等需求自制电缆，因此西门子公司提供电缆及连接器的装配制作说明。但西门子公司无法保证自制电缆能够达到 CE 以及 EMC 的要求。在自制电缆时，须使用符合下表参数的同等电缆原线和西门子连接器，且须根据《SINAMICS V90, SIMOTICS S-1FL6 操作说明》中的标准步骤进行装配，但西门子不能保证该自制电缆的性能。

因使用不符合下表参数的电缆原线、非西门子连接器或使用非标准步骤进行装配的自制电缆而导致的西门子设备（如驱动、电机等）的故障不包含在保修范围内。

电缆类型	订货号 ¹⁾ 6FX3002-	芯线根数 × 截面积 (根数 × mm ²)	最小折弯半径		电缆外径 (mm)	折弯次数 ²⁾	屏蔽率	驱动侧连接器 (6FX2003-)	电机侧连接器		
			静态 (mm)	动态 (mm)					订货号 (6FX2003-)	针脚类型 ³⁾	包装规格
电机动力电缆	5CK01-....	4 × 0.75	5 × 电缆外径	155	∅ (6.7 ± 0.4)	100000	≥ 60%	-	OLL12	焊接	5 个/盒
	5CK32-....	4 × 2.5	5 × 电缆外径	155	∅ (6.7 ± 0.4)	1000000	≥ 85%	-	OLL13	压接	5 个/盒
	5CL02-....	4 × 1.5	5 × 电缆外径	155	∅ (6.7 ± 0.4)	1000000	≥ 85%	-	OLL13	压接	5 个/盒
	5CL12-....	4 × 2.5	5 × 电缆外径	155	∅ (6.7 ± 0.4)	1000000	≥ 85%	-	OLL13	压接	5 个/盒
抱闸电缆	5BK02-....	2 × 0.75	5 × 电缆外径	155	∅ (6.1 ± 0.3)	100000	≥ 60%	-	OLL52	焊接	5 个/盒
	5BL03-....	2 × 0.75	5 × 电缆外径	155	∅ (6.1 ± 0.3)	1000000	≥ 85%	-	OLL53	压接	5 个/盒
编码器电缆	2CT20-....	3 × 2 × 0.20 + 2 × 2 × 0.25	5 × 电缆外径	155	∅ (7.2 ± 0.3)	100000	≥ 60%	OSB14	OSL12	焊接	5 个/盒
	2CT12-....	3 × 2 × 0.22 + 2 × 2 × 0.25	5 × 电缆外径	155	∅ (7.2 ± 0.3)	1000000	≥ 85%	OSB14	OSL13	压接	5 个/盒
	2DB10-....	3 × 2 × 0.22 + 2 × 2 × 0.25	5 × 电缆外径	155	∅ (7.2 ± 0.3)	1000000	≥ 85%	OSB14	ODB11	焊接	30 个/盒
	2DB20-....	3 × 2 × 0.20 + 2 × 2 × 0.25	5 × 电缆外径	155	∅ (7.2 ± 0.3)	100000	≥ 60%	OSB14	ODB12	焊接	5 个/盒
	2DB12-....	3 × 2 × 0.22 + 2 × 2 × 0.25	5 × 电缆外径	155	∅ (7.2 ± 0.3)	1000000	≥ 85%	OSB14	ODB13	压接	5 个/盒

电机侧连接器示意图 (6FX2003-)

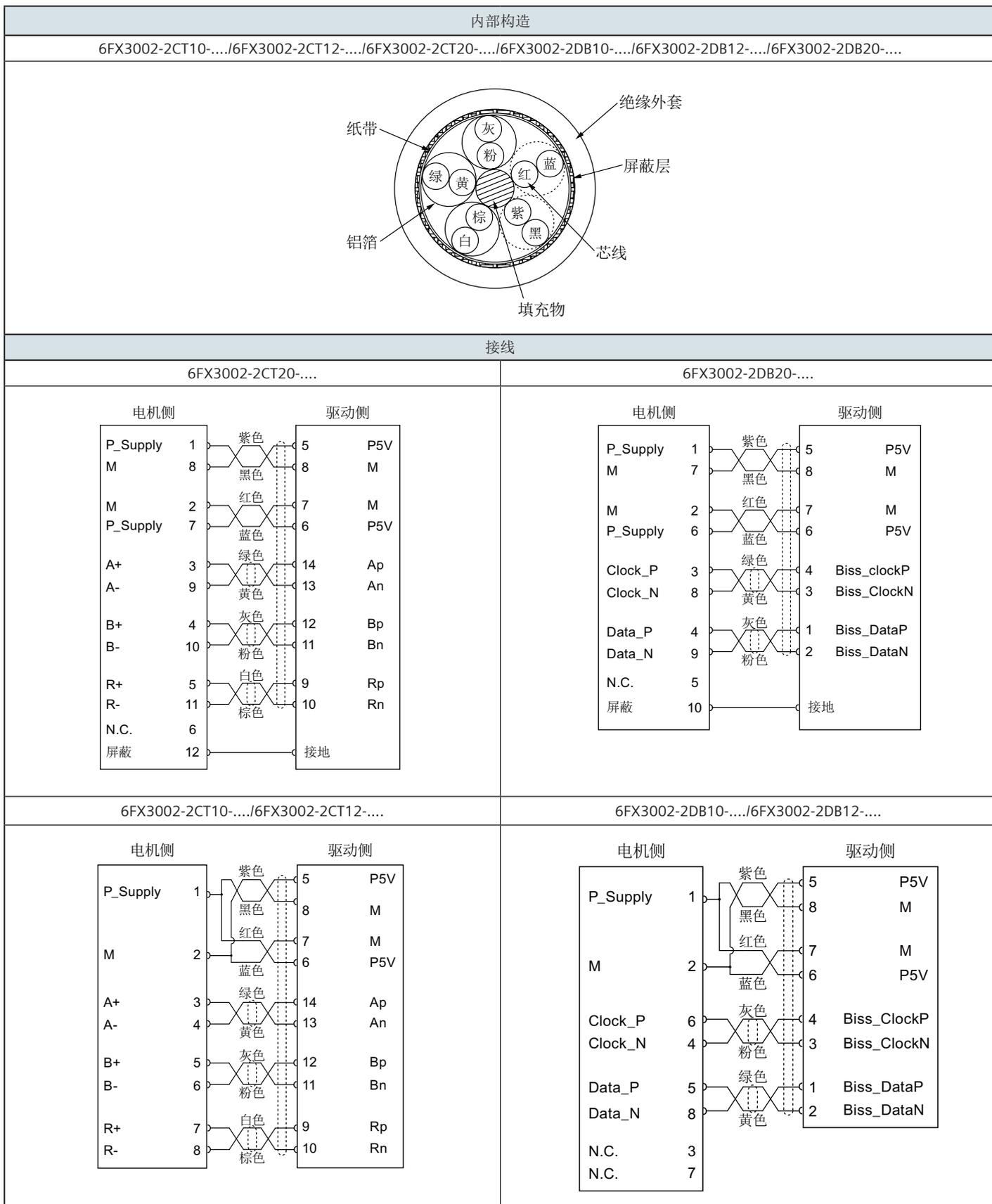
OLL12	OLL13	OLL52	OLL53	OSL12	OSL13	ODB11	ODB12	ODB13
								

¹⁾ 订货号中的“....”为电缆的长度代码，其中 1A00 = 3 m, 1A05 = 5 m, 1A10 = 7 m, 1BA0 = 10 m, 1BF0 = 15 m, 1CA0 = 20 m

²⁾ 最大加速度 3 m/s²，最大转速 40 m/min

³⁾ 在进行连接器的装配时，请注意连接器的针脚类型，采用压接工艺的连接器不允许进行焊接；同样，采用焊接工艺的连接器也不允许进行压接

3 编码器电缆内部构造及接线



— — 双绞线

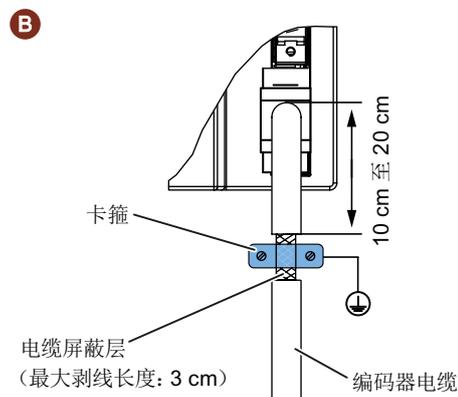
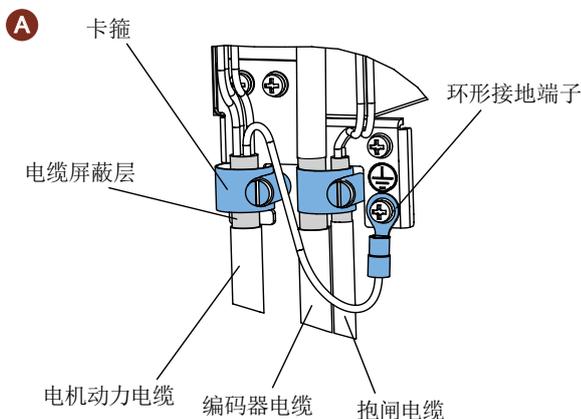
() 屏蔽

4 电缆 EMC 要求

- 为符合 EMC 标准，所有与 SINAMICS V90 系统相连接的电缆必须为屏蔽电缆，包括电源电缆（电源到电源滤波器的电缆和电源滤波器到驱动的电
缆）、电机动力电缆、编码器电缆以及抱闸电缆。
- 编码器电缆和电机动力电缆需分开敷设在不同的电缆槽中。编码器电缆必须与电机动力电缆保持 10 cm 以上的距离。
- 使用电缆的屏蔽率及各项其他技术参数须符合“电缆和连接器”（页 8）部分的要求。

5 电缆屏蔽层接地要求

为保证驱动的安装符合 EMC 要求，须将电机动力电缆的屏蔽层使用卡箍进行 360° 环形接地。将电机动力电缆的屏蔽层连接到驱动的屏蔽板上，连接方法如图 A 所示。为保证更好的 EMC 效果，建议将抱闸电缆和编码器电缆的屏蔽层也进行接地，连接方法如图 A、图 B 所示。同时必须保证将驱动的屏蔽板、伺服驱动及伺服电机良好接地。

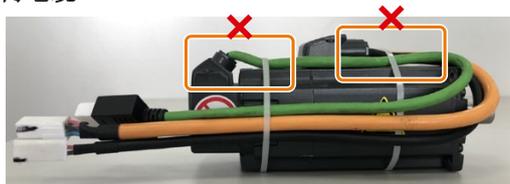


6 电机端电缆安装及捆扎要求

当需要在电机侧将电缆进行捆扎固定时，遵循以下要求：

- 须充分考虑电缆的夹装方法，勿对电缆的连接部分施加弯曲压力和电缆自重压力。
- 在伺服电机自身也移动的用途下使用时，请注意不要对伺服电机连接器的连接部分施加压力，固定电缆时应使电缆（电机动力电缆、编码器电缆、制动电缆）与连接器连接部分保持松弛余量。请在电缆弯曲寿命范围内使用电缆。
- 外部绝缘层会因锐利物品的切割而破损、与机械的棱角接触而擦伤、人或车的碾压而损坏，所以应避免上述情况发生。
- 伺服电机安装在可移动的机械上时，应尽量加大弯曲半径。

自制电缆



连接 SINAMICS V90 驱动器和 SIMOTICS S-1FL6 伺服电机的电缆是伺服驱动系统的重要组成部分，是保证伺服驱动系统稳定可靠运行的必要条件。因此如果需要自制电缆，必须严格遵循《SINAMICS V90, SIMOTICS S-1FL6 操作说明》中的标准装配步骤，以及下列规范：

作业要求

自制电缆时，须注意并遵守以下要求：

- 必须由有资质的专业人员进行作业
- 采用压接工艺的电缆必须使用符合要求的压接工具，且必须保证压接质量及可靠性：
 - 工具：10 A/16 A 冷压钳
 - 压接线径范围：0.14 mm² 至 6 mm²
 - 图片示例：



电缆和连接器要求

- 选用带屏蔽的电缆线材

电机动力电缆以及信号电缆必须全部采用屏蔽电缆线材。电机动力电缆采用屏蔽线材可以有效防止电缆中的干扰对电机、驱动器以及其他设备运行的可靠性产生影响。信号电缆采用屏蔽线材可以有效防止电气柜中各种干扰源对位置测量系统的可靠性的影响。

- 选用西门子提供的连接器

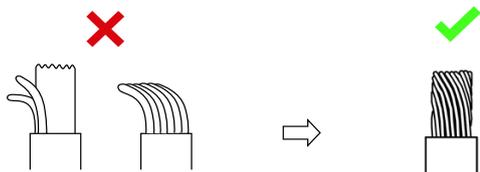
屏蔽电缆要求及连接器订货信息请参见“电缆和连接器”（页 8）部分。

线束装配

线束装配步骤请参见《SINAMICS V90, SIMOTICS S-1FL6 操作说明》中的附录 A，同时还须注意以下做线要点：

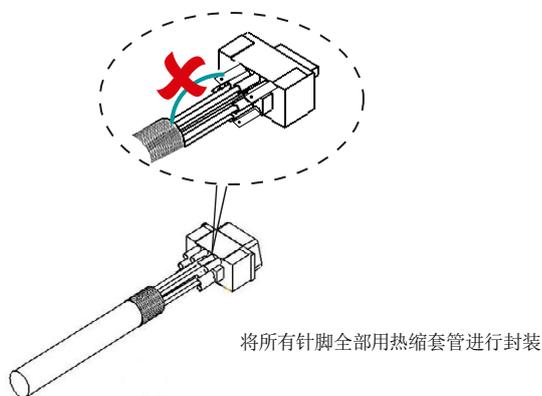
- 剥线要求

将电缆的绝缘外皮剥掉后，须将不平整和弯曲的芯线轻轻捻直。



- 未使用针脚的处理

为避免屏蔽线与连接器上未使用的针脚短接，须将连接器上未使用的针脚全部用热缩套管进行封装。



- 屏蔽层的处理

在装配驱动侧编码器连接器时，须将屏蔽电缆的屏蔽层确实连接到接地板并安装到连接器外壳。

