

SIEMENS

Tests carried out on drives
This documentation pertains to
LV Umrichter
E11 F72 F76 F79 L45 L50 L57 L68 M54 U11

Reference Manual

Converter

SINAMICS G150

Type 6SL37102G

Edition

02/2019

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Converter

SINAMICS G150 Type 6SL37102G

Reference Manual

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

 DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.

 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.

 CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.


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Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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 WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction

This document describes the preconditions when testing drives. The fulfillment of these preconditions is the basis for achieving the smoothest possible testing process and maximum possible customer satisfaction.

The following drive tests are described:

- Routine tests
- Tests that are offered as standard

Note

If the scope of testing and inspection cannot fulfill all customer requirements, please consult your Siemens sales advisor at head office.

General scope of services

A variable-speed drive can include the following components:

- Induction motor, synchronous motor or PEM motor with or without speed encoder
- SINAMICS drives
- Drive transformer
- Cooling unit for water-cooled drives
- Small PLCs with drive functionality.

The Nuremberg Vogelweiherstrasse factory offers test equipment adapted to these types of systems.

Note

Contact your sales person if additional components must be taken into account for your particular project.

Scope of services offered

Unless otherwise stated in the quotation, the scope of services includes all activities, equipment, materials and expendables required to perform the specified tests. The deadline and testing period stated, and the quoted cost, can be met only if all the test and inspection procedures to be performed are **clarified in detail in advance**. Due to the high capacity utilization of the associated equipment, it might not be possible to carry out individual inspections and tests that are requested late if the planned test is already in progress.

If you have received specific requirements from your customer, please send these as soon as possible – with the necessary key data – to the Nuremberg Vogelweiherstrasse factory.

Sequence of a customer acceptance

A customer acceptance test is generally executed in the sequence:

1. Installation and commissioning of the components before the customer arrives.
2. Kickoff with presentation of the test schedule and discussion of individual steps in the acceptance test workflow.
3. Execution of the tests according to the test schedule
4. Discussion of the test results
5. Preparation of test documentation for the customer.
The test documentation is created before or after the customer leaves depending on the scope of testing and the time schedule.

Components provided by customer

Components provided by the customer must be available in plenty of time so that tests can be carried out on time. The Nuremberg Vogelweiherstrasse factory has no access to components that are not within the PD LD scope of supply. This also applies to components ordered from other Siemens' Groups. The technical data for these components is required at the latest eight weeks before the start of the acceptance test, e.g.:

- Dimensions
- Weights
- Energy Requirement
- Interfaces

Location of the customer acceptance

All customer acceptance tests in the test fields for drives are performed as part of the manufacturing process.

Note

Limited number of persons in the test field

For safety reasons, the number of persons in the test field is limited. In addition to the regional sales partner, only two persons from the customer are permitted in the test field at the same time.

Note

Test without load motors or multipulse infeeds via transformers in the test field

Some tests are simulated or performed in test mode with limited rated data.

Note

Tests with the customer's own cooling units or excitation equipment

If the customer's own cooling units or excitation equipment are to be tested, a system test can be ordered with option F97.

2.1 Routine test

During production, the drive is subject to an internal routine test.

2.2 Visual inspection

The visual inspection is performed to ensure that the equipment complies with the order specifications. The tests are carried out with the drive in a no-voltage condition.

The visual inspection together with the customer – or with the company accepting the equipment – is carried out with the drive installed and labeled. Each test step is documented in the acceptance report with the specific results of the step.

The visual inspection is part of the function test (F72, F73).

Visual inspection	Order codes	
	Without the customer present	With the customer present
<ul style="list-style-type: none"> • Rating plate • Housing degree of protection • Electrical cabinet components • Cable installation • Cable markings • Setting values of circuit breakers, if used • Dimensions 	-	F03

See also

Visual inspection (Page 16)

The following additional tests are available for low voltage drives in the marine version.

Visual inspection	Order codes	
	Without the customer present	With the customer present
<ul style="list-style-type: none"> • Derating diagram • List of the miniature circuit breakers and circuit breakers • Marine version 	-	F03

See also

Visual inspection (Page 16)

2.3 Function tests

The drive functions are tested according to IEC 61800-5-1. In addition, excerpts from additional standards apply, which are listed in the relevant chapters as well as internal Siemens directives within the scope of quality assurance.

The function tests are performed and documented in the Siemens test field by internal test field personnel. For the function test, the drive is in the test mode with restricted monitoring functions.

The successful test is confirmed in a 3.1 certificate – or in the case that the customer has ordered the acceptance test, in a 3.2 certificate.

See also

Function test (Page 21)

2.4 Insulation test

The insulation resistance is measured before and after the high-voltage test. The insulation test can only be ordered and carried out together with the function test (F72, F73).

Insulation test	Order codes	
	Without the customer present	With the customer present
<ul style="list-style-type: none">• High-voltage test• Measuring the insulation resistance	F76	F77

The successful test is confirmed in a 3.1 certificate – or in the case that the customer has ordered the acceptance test, in a 3.2 certificate.

See also

Insulation test (Page 29)

Tests

3

The tests that have been expressly ordered for the drive with serial number 12345670001001 are listed in the following.

3.1 Visual inspection

The visual inspection is performed to ensure that the drive complies with the requirements of the order. The individual test steps are performed with the drive in a no-voltage condition.

The test together with the customer – or his representative – is carried out with the drive installed and labeled. The results of all of the tests are documented in the acceptance report.

3.1.1 Rating plate

Fundamentals

The technical data and ordered options on the rating plate and the routine test certificate are checked to ensure that they match up.

Test procedure

1. The data on the rating plate and the routine test certificate are visually compared.

Result

The test is passed if the data match up.

3.1.2 Housing degree of protection

Fundamentals

A check is made as to whether the housing degree of protection ordered complies with what is described in the catalog.

Test procedure

1. The housing degree of protection is identified based on what is stamped on the rating plate.
2. Depending on the version, the following components are visually checked, e.g.:
 - Canopies
 - Cooling slots
 - Fittings and rubber seals in the doors and between the cabinet units
 - Cable entries
 - Openings for water pipes, if available
 - Additional components, if available

Result

The test is passed if the components required for the specified housing degree of protection are available.

3.1.3 Electrical cabinet components**Fundamentals**

A visual inspection is made to see whether the electrical cabinet components are installed as defined in the layout diagram and/or circuit diagram.

Test procedure

1. The customer selects electrical cabinet components by random sampling.
2. The selected electrical cabinet components are visually checked to ensure that they are correctly installed and marked.

Result

The test is passed if the selected electrical cabinet components are installed as specified in the layout diagram and/or circuit diagram.

3.1.4 Cable installation**Fundamentals**

Visual and mechanical checks are made to ensure that cables and conductors have been installed correctly and are connected correctly according to the circuit diagram.

Test procedure

1. The customer selects cables or conductors by random sampling.
2. The following is inspected:
 - Are the cables firmly connected?
 - Have edge protectors been attached to sharp edges?
 - Are the cables routed according to the circuit diagram?

Result

The inspection is passed if the cable installation does not exhibit any deficiencies and matches the information in the circuit diagram.

3.1 Visual inspection

3.1.5 Cable markings

Fundamentals

A visual inspection is made to see whether cables and conductors are marked as defined in the circuit diagram.

Test procedure

1. The customer selects cables or conductors by random sampling.
 - Are the cable end tags and conductor colors of cables and conductors marked as defined in the circuit diagram?

Result

The test is passed if the cable and conductor markings match what is specified in the circuit diagram.

3.1.6 Setting values of circuit breakers, if used

Fundamentals

The circuit breaker settings are visually checked against what is specified in the circuit diagram.

Test procedure

1. The customer selects circuit breakers by random sampling.
2. The circuit breaker settings are visually checked against what is specified in the circuit diagram.

Result

The test is passed if the circuit breaker settings match what is specified in the circuit diagram.

3.1.7 Dimensions

Fundamentals

The drive dimensions are measured. The basis for the visual inspection is the order-specific dimension drawing.

Test procedure

1. The external dimensions, length, width and height of the drive are measured.

Result

The test is passed if the dimensions match with what is specified in the dimension drawing.

3.1.8 Derating diagram**Fundamentals**

The power must be derated for operation under higher ambient temperatures. The derating diagram required is attached to one of the drive doors.

Test procedure

1. The existence of the diagram is checked.

Result

The check is passed if the diagram is available

3.1.9 List of the miniature circuit breakers and circuit breakers**Fundamentals**

The existence of the list with miniature circuit breakers and circuit breakers is checked.

Test procedure

1. Random samples of the values in the list are compared with the circuit diagram.

Result

The test is passed if the checked values match what is specified in the circuit diagram.

3.1.10 Marine version**Fundamentals**

A check is made as to whether the mechanical housing design of the ordered marine version complies with what is described in the catalog.

3.1 Visual inspection

Test procedure

1. The housing is checked for the following components:
 - Door bracing
 - Frame bracing
 - Handrail

Result

The check is passed if the components required for the marine version are available.

3.2 Function test

3.2.1 Auxiliary voltages

Fundamentals

Tests are performed according to DIN EN 60146-1. The auxiliary voltages are visually checked using indicator lights or using a voltmeter.

Test procedure

1. The drive power section is switched off.
2. The auxiliary voltages are switched on.
3. The auxiliary voltages are checked.

Result

The test is passed if all of the auxiliary voltages are available.

3.2.2 Interrupted cable to the operator panel

Fundamentals

An interrupted cable to the operator panel is simulated.

Test procedure

1. The drive power section is switched off.
2. The auxiliary voltage is present.
3. The interface cable between the operator panel and Control Unit is withdrawn at the operator panel.

Result

The test is passed if the appropriate fault message is displayed on the operator panel.

3.2.3 DriveCLiQ connection, identification of the installed modules

Fundamentals

In automatic configuration, the installed DriveCLiQ components are detected and displayed on the test station computer. Actual and reference state of the DriveCLiQ topology are compared.

Test procedure

1. The auxiliary voltage is present.
2. The DriveCLiQ connector is removed at any DriveCLiQ component.
A message is displayed on the test station computer.

Result

The test is passed if the appropriate message is displayed on the test station computer.

3.2.4 Anti-condensation heating

Fundamentals

A check is made as to whether the anti-condensation heating heats up after switching on. This prevents the formation of condensation in the drive when it is not operational.

Test procedure

1. The temperature of the anti-condensation heating is measured using an infrared thermometer.
2. The auxiliary voltage for the anti-condensation heating is switched on.
The anti-condensation heating elements heat up.
3. The temperature is measured again.

Result

The test is passed if the anti-condensation heating elements heat up after they have been switched on.

3.2.5 Socket outlets and lighting

Fundamentals

Socket outlets and lighting are checked.

Test procedure

1. The voltage at the socket outlets is measured.
2. The lighting is checked.

Result

The test is passed if the correct voltage is available at the socket outlets and the lighting functions.

3.2.6 Sensing the actual DC link voltage

Fundamentals

The DC link voltage actual value sensing is tested.

Test procedure

1. The DC link is charged up to the rated voltage.
2. The actual value sensing devices in the drive measure the voltage.
The DC link voltage is displayed at the test station computer in the appropriate parameters.

Result

The test is passed if the displayed value at the test station computer matches the reference value.

3.2.7 Switching thresholds of the optional temperature evaluation device

Fundamentals

The switching thresholds of the temperature monitoring function are checked.

Test procedure

1. The auxiliary voltage is present.
2. The switching thresholds at the temperature sensor inputs are triggered.
The following messages are displayed on the test station computer:
 - T_1 : Alarm
 - T_2 : Fault

Result

The test is passed if the appropriate messages are displayed on the test station computer. The tolerance range at the switching thresholds is ± 5 K.

3.2.8 Safety shutdown (optional)

Fundamentals

The tests are performed according to IEC 60146-1-1 and IEC 60204-11. The safety shutdown of the power section is tested according to the category that was ordered.

Test procedure

1. The auxiliary voltage is present.
2. The drive is in operation.
3. The button is pressed.

Result

The test is passed if the drive is switched off in accordance with the category that was ordered – and the appropriate message is displayed on the test station computer.

3.2.9 Temperature monitoring

Fundamentals

Depending on the version and application, the temperature thresholds differ for alarm and fault. Further, in operation, the drive continually recalculates the temperature thresholds. This is the reason that predefined temperature thresholds cannot be specified in the report, as only actual values are documented.

Test procedure

1. The auxiliary voltage is present.
2. The switching thresholds at the temperature sensor inputs are triggered.
The following messages are displayed on the test station computer:
 - T₁: Alarm
 - T₂: Fault
3. The actual values for alarm and fault are documented.

Result

The test is passed if the appropriate messages are displayed on the test station computer.

3.2.10 DC link voltage failure

Fundamentals

The drive shuts down if the DC link voltage fails. DC link voltage failure is simulated by switching off the supply.

Test procedure

1. The auxiliary voltage is present. The drive is in operation.
2. The DC link is charged up to 100 %.
3. The supply is switched off automatically.
The DC link voltage collapses.

Result

The test is passed if the drive is shut down and the appropriate message is displayed on the test station computer.

3.3 Function test with the test station motor

3.3.1 Operation with the test station motor

Fundamentals

A check is made as to whether the connected test station motor is correctly controlled by the drive, and the specified speed is kept.

Test procedure

1. The auxiliary voltage is present.
2. The drive is switched on and controls the test station motor up to its rated speed.
The rated speed is displayed on the test station computer.

Result

The test is passed if the speed setpoint and actual value match.

3.3.2 Flying restart of the rotating test station motor

Fundamentals

The test reveals whether the connected test station motor is correctly controlled after the drive fails.

Test procedure

1. The auxiliary voltage is present.
2. The drive is switched on and controls the test station motor.
The actual speed is displayed on the test station computer.
3. The drive is switched off.
The motor coasts down.
4. The drive is switched on again.
The drive synchronizes itself with the motor, and controls it to the speed that was last set.

Result

The test is passed if the speed last set is returned to after the drive has recovered.

3.3.3 Reduction of the output current

Fundamentals

The test reveals whether the current limiting controller actively intervenes in the drive control when an output current reduction is simulated.

Test procedure

1. The auxiliary voltage is present.
2. The drive is switched on and controls the test station motor.
The actual speed is displayed on the test station computer.
3. The output current is reduced with the current limiting controller.
The speed decreases. The appropriate alarm is displayed on the test station computer.
4. The output current is further reduced until it is no longer sufficient to operate the motor.
The drive is switched off.
The motor coasts down. The appropriate fault is displayed on the test station computer.

Result

The test is passed if the appropriate messages are displayed on the test station computer, and the drive is shut down.

3.4 Cooling system test

3.4.1 Air flow direction

Fundamentals

It is only guaranteed that the drive is correctly cooled when the fan rotates in the correct direction of rotation.

Test procedure

1. The auxiliary voltage is present.
2. The drive is switched on.
The fans switch on.
3. The air flow direction is checked at the ventilation grilles.

Result

The test is passed if the air flows from the doors up to the roof section.

3.5 Insulation test

3.5.1 High-voltage test

Fundamentals

The test is carried out according to the following standards:

- IEC 61800-5-1
- IEC 62103
- For marine applications, additional requirements from the marine classification societies may apply.

The high-voltage test verifies the voltage strength (test voltage) for overvoltage conditions specified in the standard.

Test equipment

A calibrated test instrument is used for the test.

Test procedure

1. The circuits to be tested are separately short-circuited corresponding to the individual voltage levels.
 - Power circuit/circuits
 - Various auxiliary circuits
2. The circuits that are presently not connected to the test instrument are connected to ground potential.
3. The test voltage is adjusted for each circuit corresponding to the insulation test report.
4. The circuits are tested with respect to one another and with respect to the PE protective conductor at the electrical cabinet.
The test duration is 1 s, for marine applications, 60 s.
5. The test is repeated with 80% test voltage.

Result

The test is passed if the test instrument is not switched off (tripped) during the test as a result of flashover.

3.5.2 Measuring the insulation resistance

Fundamentals

Tests are performed in accordance with IEC 62103.

The insulation resistance of the individual circuits is measured before and after the high-voltage test, and the following value must be obtained:

Rated operating voltage	Insulation resistance
Below 1000 V	At least 1 MΩ
Above 1000 V	At least 10 MΩ

Test equipment

A calibrated test instrument is used for the test.

Test procedure

1. The circuits to be tested are separately short-circuited corresponding to the individual voltage levels.
 - Power circuit/circuits
 - Various auxiliary circuits
2. The circuits that are presently not connected to the test instrument are connected to ground potential.
3. The test voltage is adjusted for each circuit corresponding to the insulation test report.
4. The circuits are tested with respect to one another and with respect to the PE protective conductor at the electrical cabinet.

Result

The test is passed if the insulation resistances lie within the tolerance specified by the standard.

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Further Information

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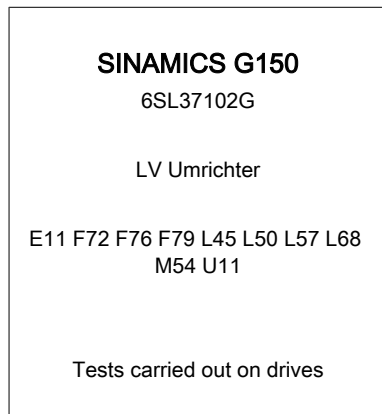
Dear Sir / Madam,

Many thanks for your order, the documentation for which is enclosed.

Yours very truly,



Spine label for binder 50 mm (120 g/m2)



Spine label for binder 162 mm (120 g/m2)

