

**TEST INSTRUCTION IEC EN 60947-3**  
**CONDITIONS FOR TESTING SWITCHES, DISCONNECTORS,**  
**SWITCH-DISCONNECTORS AND FUSE COMBINATION UNITS.**

This test instruction is based on the following standards:

**IEC 60947-3: 2008 (Edition 3.0)**

**EN 60947-3: 2009**

in conjunction with:  
IEC 60947-1 and EN 60947-1

Note: Neither IEC 60947-3 nor EN 60974-3 refer to a specific edition of the corresponding 60947-1. The actual editions of these 60947-1 standards are:

IEC: ed. 5.0 (2007) + amendment 1 (2010)  
EN: 2007

It complies with these standards in all respects, and provides additional information ensuring a suitable degree of repeatability of the tests between the different test stations.

Signed by

Dr. Saverio MANGANARO  
Chairman of the LOVAG Technical Commit...



Valid from : 18<sup>th</sup> October 2011

Edition 3.0  
6<sup>th</sup> April 2011  
Author ASEFA

**PREAMBLE**

For convenience in the use of this test instruction the paragraphs are numbered according to the clauses in the IEC documents.

All references to clauses of the General Rules are preceded by the letter G.

Reference to clauses in appendix A of the "Switches" standard: "Equipment for the direct switching of a single motor", are preceded by the letter A.

Tests must be carried out according to the standard; the test instruction only adds a few specific details.

**8.2      Type Tests for constructional requirements**

Refer to standard and G 8.2

The standard distinguishes between type tests for constructional requirements (8.2) and type tests for performance (8.3).

The test sequences concern only the type tests for performance; only the test in sub-clause 8.2.5 is included in sequence I.

**8.2.4    Mechanical properties of terminals**

Refer to standard and G 8.2.4.

This type test, which concerns the constructional requirements, is not included in a sequence and therefore is not listed in table 9.

Unless otherwise stated by the manufacturer, it may be carried out on any equipment, before any of the test sequences.

The results shall be recorded in the test report, with the values of the torques used clearly specified.

**8.2.5    Strength of actuator mechanism**

LOVAG requires the verification of the strength of the actuator mechanism to be carried out for all devices whose main contacts are not visible in the OFF position and which do not provide other means of indication of the contact position.

**8.2.5.1   Condition of equipment for tests**

According to tables 9 and 10 of the standard, this test is scheduled at the end of sequence I.

However, the measurement of the force (F) necessary to open the contacts is carried out on the device in new condition, i.e. before any other tests, without locking of the contacts. This measurement is used to define the test force (3 F) mentioned in table 8.

**8.2.5.2   Method of test**

In the case of a fused disconnecter, the requesting party shall specify the complete reference(s) of the fuses to be used. The reference(s) concerned shall be mentioned in the test report. The locking device, if used shall be supplied by the requesting party.

When using a torque measurement device for determination of the normal operation force necessary to open the contacts, the value of the force  $F$  is calculated taking into account the application point and it is acceptable to remove the handle to allow the torque measurement being done directly on the shaft of the device under test.

The measured force ( $F$ ) shall be taken to be equal to the average value obtained from three consecutive tests.

In accordance with the standard, the contacts of the pole for which the test is deemed to be the most severe shall be kept closed. This pole shall be determined by evaluation of the construction. If this is not possible it is necessary to carry out a quick preliminary test on a separate sample to determine which one causes the most unfavourable distortion under the action of the force ( $3F$ ).

For practical reasons, it is acceptable to slightly change the point of application of the force, with respect to Figure 1, provided that the same application point is used for the measurement of  $F$  and for the application of the test force defined in table 8.

It is also acceptable to add an intermediate support part (a screw for example) or a handle extension.

The operator should follow the manufacturers' instructions to determine the type of actuator and then apply table 8 and; if none, the choice is made by the operator taking into account the true practical possibility of operation, during normal utilization, which is materialized by the space available on the actuator.

If there are several possibilities among cases of figures 1b to 1g, the most unfavourable condition shall be used.

### **8.2.5.3 Condition of equipment during and after test**

Refer to the standard and to G.8.2.5.

If the equipment is fitted with separate means of indication of contact position, all means of indication of contact position including the actuator itself shall continue to function correctly after the test.

Moreover, there shall not be any contradictory information given by all the position indicators. However, a result where the actuator indicates an indefinite position and the separate indicator shows a closed position can be acceptable.

#### **8.2.5.3.1 Dependent and independent manual operation**

It is acceptable for the actuator mechanism to be distorted or broken, provided that:

- the manufacturer's locking mechanism cannot be operated while the strain is being applied,
- the position indicator does not show the open position when the strain is released.

#### **8.2.5.3.2 Dependent and independent powered operation**

It is acceptable for the actuator mechanism to be distorted, provided that:

- the equipment does not show any damage such as to impair its normal operation.
- the manufacturer's locking mechanism cannot be operated while the strain is being applied,
- the position indicator does not show the open position when the strain is released.

### **8.3 Type tests for performance**

Table 9 of the standard is provided for information, according to each type of equipment. Only tables 10, 11 and 13 to 16 are used to define the test programme.

**8.3.1 Test sequences**

Refer to standard including table 10.

For disconnectors in categories AC 20 or DC 20, the making and breaking capacity test is not applicable; however, the test can be carried out only if rated performance values have been declared by the manufacturer.

**8.3.2 General test conditions****8.3.2.1 General requirements**

According to G 8.3.2.1, the unit can be operated, ~~by hand~~ without load before the test. The number of operations shall be stated in the test report.

For all types of equipment, the measurement of the force (F) necessary to open the device is systematically carried out at the beginning of each sequence, under the same conditions as in 8.2.5.2 of the standard. It shall not exceed the maximum value specified in table 8, and shall be mentioned in the test report.

**G.8.3.2.2.2 Tolerances on test quantities**

The tolerances are specified in table 8 of G 8.3.2.2.2. More severe test quantities than those specified in table 8 are taken as those exceeding the positive tolerance for current, voltage and time constant and the negative tolerance for power factor.

**G.8.3.2.2.3 Recovery voltage****a) Power-frequency recovery voltage**

The average of the recovery voltage for all phases shall be equal to 1.05 times the value of the operational voltage assigned by the manufacturer (within the tolerances of table 8 of part 1 of the standard).

The test voltage may be increased with the approval of the manufacturer according to note 3 of subclause 8.3.2.2.3 of part 1 of the standard.

**b) Transient recovery voltage: refer to G.8.3.2.2.3.****8.3.3 Test sequence I: General Performance Characteristics**

The sequence starts by the measurement of the force (F) necessary to open the device. See 8.3.2.1 of this test instruction.

**8.3.3.1 Temperature-rise**

Fuse-links, dummy or otherwise, used for test must be supplied by the requesting party and have their power loss verified before test under the measurement conditions of IEC 60269-1. Compliance may be demonstrated by a manufacturer's declaration and this shall be included in the test report.

In the case where the temperature-rise steady-state value is not reached within 8 hours, this shall be mentioned in the test report and the equipment shall be certified for eight-hour duty.

**8.3.3.3.3 Transient recovery voltage**

If the load circuit is a motor, the transient voltage does not have to be verified. The length and disposition of the motor supply wires shall be specified in the test report.

**8.3.3.4 Dielectric verification**

The time between the last electrical operation and the dielectric test shall be as short as possible. For practical reasons, it may sometimes be greater than 30 minutes. The time shall be recorded in the report.

**8.3.3.5 Leakage current**

In the case of a three-pole device, nine readings must be taken. These are, for each phase, device open:

- incoming terminal/outgoing terminal
- incoming terminal/chassis
- outgoing terminal/chassis

The application of the test voltage may be limited to the time required to read the value to be measured.

**8.3.4 Test sequence II : Operational performance capability.**

*In test sequence I the force (F) is already measured and it is not necessary to repeat this measurement at the beginning of each sequence.*

**8.3.4.2 Dielectric verification**

Refer to standard and to 8.3.3.4 of this test instruction.

**8.3.4.3 Leakage current**

Refer to standard and to 8.3.3.5 of this test instruction.

**8.3.5 Test sequence III**

*In test sequence I the force (F) is already measured and it is not necessary to repeat this measurement at the beginning of each sequence.*

**8.3.5.1.3 Calibration of the test circuit**

For platforms supplied by a generator, it is acceptable for the calibration to be carried out at a voltage less than the test voltage. This proposal allows prospective current tests to be made repeatedly without undue stress to the generator supply. However, as some short-circuit generators do not exhibit a linear relationship, care should be exercised in application of this procedure to ensure that the rated prospective current is available for the test. In any case, the prospective current test shall not be made at a value less than 75% of the test voltage relative to the rated value, the linearity characteristic having been predetermined by test at periodic intervals.

**8.3.5.2.4 Test procedure**

The two closing operations are carried out by the device to be tested: the circuit is opened by another device during the off time duration, between the two closing operations.

**8.3.6 Test sequence IV**

*In test sequence I the force (F) is already measured and it is not necessary to repeat this measurement at the beginning of each sequence.*

**8.3.7 Test Sequence V: Overload Performance Capability**

*In test sequence I the force (F) is already measured and it is not necessary to repeat this measurement at the beginning of each sequence.*

**8.3.7.1 Overload Test**

Fuse links used for test shall be supplied by the requesting party and shall be rated for the maximum rated current that can be fitted to the device under test

**APPENDIX A: EQUIPMENT FOR DIRECT SWITCHING OF A SINGLE MOTOR**

This Appendix should also be read in conjunction with LTI IEC 60947-4-1 and pages of TRF 60947-4-1 may be used as appropriate.

**A.3 Making and breaking capacities**

The tests are carried out on the same device

**A.10.1.1 Mechanical durability test****A.10.1.3 Test procedure**

The operating procedure shall be also specified in the test report.  
Devices with trip coils can be operated by means of the coil.

**A.10.1.4 Results to be obtained**

The inspection consists in checking the tightening of the terminals, carrying out a visual inspection and checking that the rated current flows through the contacts at any appropriate voltage.