

the interpretation of
BS EN 50131-6:1998
alarm systems – intrusion systems
part 6: power supplies – industry guideline



Warning: This guide should be read only in conjunction with I&HAS installed to PD6662:2004 scheme.

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Abbreviations

The following abbreviations are used in this document:

APS	Alternative Power Source
CIE	Control and Indicating Equipment
DDP	Deep Discharge Protection
EPS	External Power Source
I&HAS	Intruder and Hold-up Alarm System
PPS	Prime Power Source
PS	Power Supply
PU	Power Unit
SD	Storage Device
SPPS	Supplementary Prime Power Source

1. Introduction

BS EN 50131-6: Alarm systems – Intrusion Systems: Power Supplies, was issued in 1998 with Amendment No. 1, May 1999. The standard is currently undergoing its five year review. However no date has been set for completion of the review and subsequent issue of an initial draft of the revised standard.

In order for the effective implementation and assessment of intruder alarm systems meeting the requirements of PD6662:2004, it is necessary for the UK electronic security industry to adopt an effective and consistent interpretation of this standard.

This document has been prepared to give guidance on the interpretation of some of the clauses in the standard that have been open to misinterpretation or that are in need of further clarification.. It is intended this guideline can be used by manufacturers to self certify their products to conform to the standard. This guidance document may change as the results of the five year CENELEC review of the 1998 standard are published.

Only those items in BS EN50131-6: 1998 that have been the subject of formal comment by BSIA members are listed below. All other clauses or parts of the standard are believed to be self-explanatory.

Advisory note:

This guide has been produced for use in PD6662:2004 – Scheme for the application of European standards for Intruder and Hold up alarm systems. With the implementation of PD6662:2010 and the dual running period associated with this transition, other BSIA Industry guidance may have been produced for the later Scheme and therefore you should ensure you seek the appropriate guidance. If you are unsure please contact the BSIA Technical team on 085 389 3889 or email: technical@bsia.co.uk

2. Interpretation of clauses

National foreword, additional information

The references in this paragraph to standby time requirements for a I&HASystem in the event of loss of external mains power have been superseded by PD6662:2004 Appendix E2. However the output current rating of a power supply is still governed by the standby times of Table 2 in BSEN50131-6. Note that the rated output current of a power supply is the continuous current supply capacity both in the presence and absence of external power (e.g. mains) supply. The overall system requirements will require the mean and peak current requirements to be considered when assessing overall standby device capacity and power supply current rating.

Normative References

Refer to list within PD6662:2004.

Power sources

There is inconsistent usage of PPS (Prime Power Source) and EPS (External Power Source) in the EN50131 series of standards. Amended Figure 102 shows the relationship between each of these entities. Essentially the PPS is the national grid mains supply. In those installations having a standby generator capability e.g. hospital, then the standby generator is the SPPS. The (mains) power input to an I&HAS may come from either source (PPS or SPPS) of which the I&HAS may have no knowledge and this input is therefore generically known to the I&HAS as the EPS. The APS is typically represented by any local standby power source (e.g. rechargeable battery) within the design and control of the I&HAS that can power the I&HAS (or part thereof) for a predetermined period of time in the event of loss of the EPS. Note that from EN50131-1 clause 9.2, if an SPPS is automatically switched into operation on loss of the PPS, the overall system standby period from the APS is reduced to 4 hours for I&HAS grades 2, 3 and 4.

Clause 3.1.2 – Deep discharge protection

This clause refers to the level of discharge as defined by the manufacturer of the storage device.

Clause 3.1.4 – Independent power outputs

This clause refers to completely independent outputs from a power supply where a short circuit and/or overload on one output will have no effect on the others. Each output may have multiple connections. Simple fused outputs may not qualify as being independent if an overload or short circuit on one has an affect, even if only transitory (e.g. during finite time for fuseable link to fail), on another.

For the purposes of this interpretation the following diagram gives a typical example.

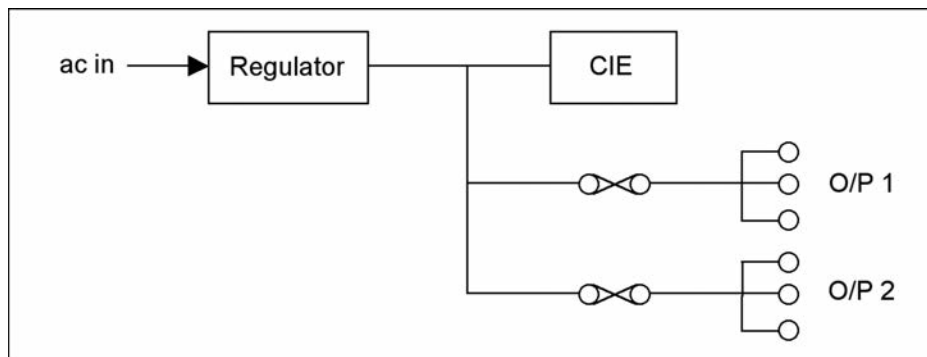


Figure 101 – Example general arrangement of PS and CIE with independent outputs

In the example shown in Figure 101, O/P 1 and O/P 2 may only be considered independent power outputs if applying a short circuit or overload to one will have no effect on the other. Although the CIE module is connected to the output of the regulating element, this connection is not considered an independent output of the PS for the purposes of the tests of clause 8.2.

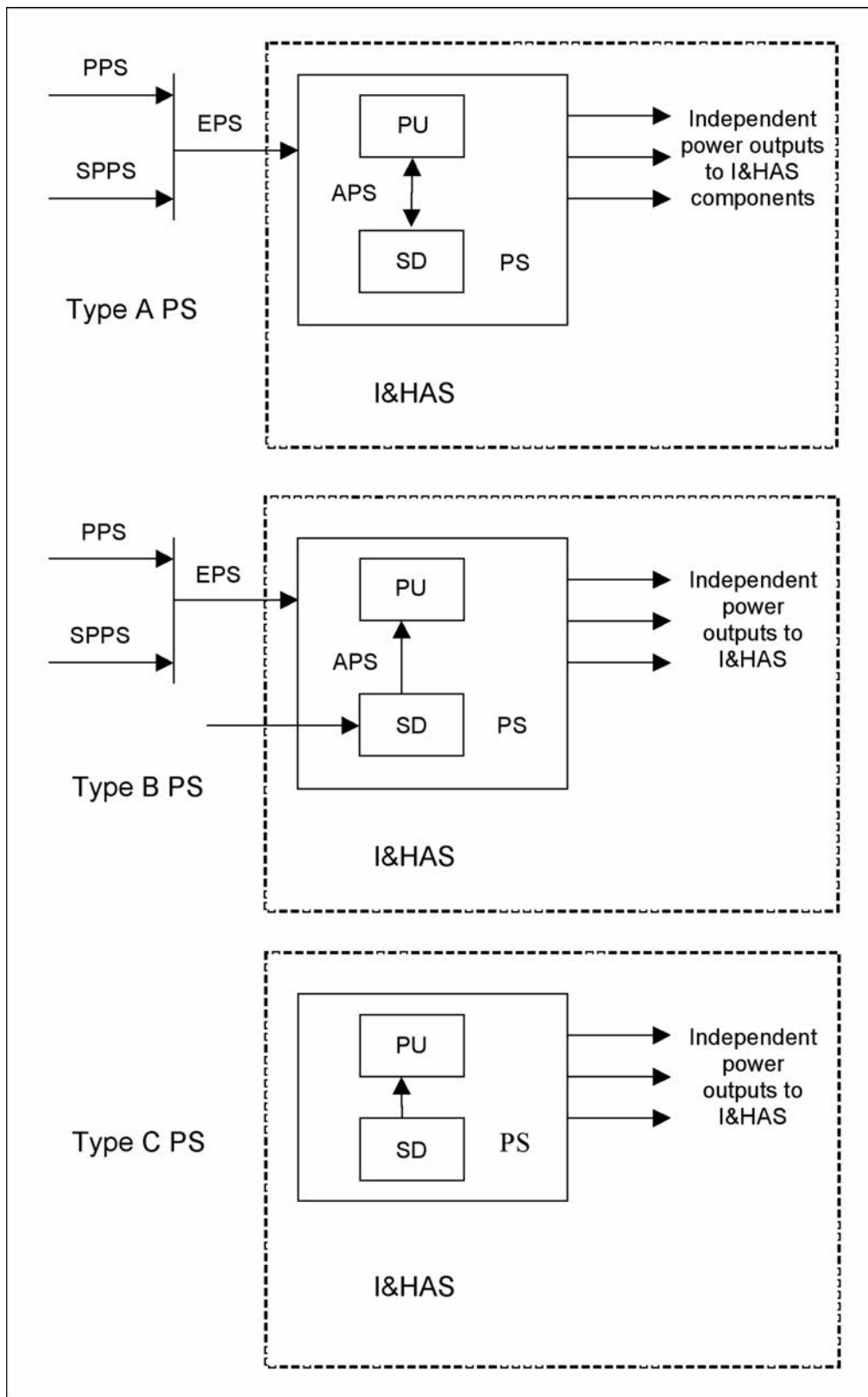


Figure 102 – Types of power supplies

Clause 3.1.9 – Normal operative condition

This clause refers to "...the applied EPS..."

Power Supply Rating

The rating of the power supply (PS) is the total continuous output current capacity of the PS when operating under all conditions of EPS or from a SD of capacity as defined by the PS manufacturer for a grade dependent time. This is the output current that is available to power system components and does NOT include the additional current that is used by the PS to recharge any attached storage device. Note that where the PS is integral to another component e.g. a CIE, then the rating of the PS should exclude the CIE and the manufacturer should declare the CIE current consumption separately as a system component.

Note: the PS manufacturer must clearly state in the product documentation that the total PS rating must not be exceeded where independent power outputs have continuous rated outputs, the sum of which is greater than the total PS rating e.g. multiple fused connections.

Clause 4 – Functional requirements, figure 1 types of power supplies

See Figure 102 above for a clearer representation of the three different PS types.

Clause 4.2.1 – Monitoring of PS type A and type B

The definition of a power supply fault in clause 3.1.14 is unclear. Table 101 below provides a fuller definition.

The PS shall be capable of generating separately the three grade dependent monitoring signals or messages identified in Table 101. These signals or messages must be capable of being processed by/at the CIE. The following table further clarifies the conditions under which the monitoring signals or messages are generated:

Monitoring signal or message	Condition	Timing
EPS fault	Detection of loss of EPS	Fault signal active within 10s after detection of loss of EPS. Fault signal restored within 10s after detection of reconnection of EPS.
APS fault	(i) SD voltage falls below voltage defined by PS manufacturer when EPS fault active (ii) disconnection of SD when EPS is present (iii) detection of SD failure according to defined test procedure	Fault signal active within 10s after SD reaches low voltage threshold, SD is disconnected, or detection of SD failure. Fault signal restored within 10s after reset of SD voltage, reconnection of SD, or detection of healthy SD.
Power output fault	Voltage on one or more independent power outputs falls below the minimum rated output voltage e.g. due to PS failure or intervention of output protection device	Fault signal active within 10s after output voltage falls below threshold. Fault signal restored within 10s after reset of normal output voltage.

Table 101 – Fault signal events and timing

The SD low voltage level shall be greater than the minimum power output voltage for the PS. The SD low voltage signal is effectively an early warning before the SD is disconnected and the system ceases operation and should be stated in the product documentation by the PS manufacturer.

It is not clear under what conditions the APS Fault Low voltage is cleared when EPS is restored. The PS manufacturer should make a clear statement in the product documentation under what conditions the APS Fault is cleared.

Where the PS has the capability of being used with more than one SD, then each SD shall be monitored independently, although only a single combined fault signal or message need be generated.

Loss of total function in the PS shall generate active fault signals irrespective of the grade of PS or nature of the PS failure.

Determination of Storage device failure

In order to determine if the storage device is healthy it is necessary to apply a load to the SD for a defined minimum period of time and verify that its voltage remains above the minimum output voltage level.

The following example methods are deemed to meet this requirement.

- a) During operation from the External Power Source, a load is applied to the APS at least equal to the maximum peak expected system load and for a minimum time period appropriate for the type of Storage Device (SD) in use, see Table 102 below. During application of this load the voltage at the output of the APS must not fall below the minimum permissible operating voltage of the system and there must be no impact upon the normal operation of the I&HAS.
- b) The voltage of a programmable power supply may be reduced in a controlled manner to a level such that the APS is switched into circuit as the power source for the I&HAS for a minimum time period appropriate for the type of Storage Device (SD) in use, see Table 102 below. During the test period, the system load should be equivalent to that expected in full alarm condition. The voltage at the output of the APS must not fall below the minimum permissible operating voltage of the system during the test period and there must be no impact upon the normal operation of the I&HAS. Should the APS be detected as unhealthy, the power supply to the I&HAS must immediately be returned to operation from the EPS without any transients that may cause erroneous behaviour of the I&HAS.

Type of storage device	Minimum load time	Notes
Sealed lead acid battery	10s	
Lead acid battery	10s	Similar behaviour to sealed lead acid battery
Dry cell battery	1s	eg. alkaline, lithium ion etc
Other	10s	eg. standby generator

Table 102 – Minimum load times for common storage devices in use in I&HAS

The maximum time period between such tests shall be 24 hours. These tests must be applied only when the EPS is available.

These tests are in line with a number of standard tests accepted by leading European electronic security product test houses.

Clause 4.2.2 – Monitoring of PS type C

The “low voltage storage device” signal shall be generated within 10s of the SD voltage falling below the threshold defined by the PS manufacturer. This is effectively a Battery Change Required signal or message.

Clause 4.3 – Standby period

The note below Table 2.0 clarifies that the standby periods referred to in Table 2.0 are the minimum times for which a type A or B PS shall continuously supply its rated output when fitted with its declared SD. These times are different from those declared within EN50131-1 since Part 1 refers to the system requirements which may require discontinuous peak current requirements for short durations e.g. during alarm notification periods. The PS manufacturer must state in his product documentation the maximum continuous output current available from the PS irrespective of whether the EPS is present or not and in the latter for what maximum continuous period when fitted with a SD of declared capacity. Where the SD is a battery, it is not necessary to take into account the differences in available capacity at differing levels of discharge rate and a simple relationship between battery capacity (Ah), time (h) and current available (A) is acceptable.

Clause 4.4 – Recharging for PS type A

This clause refers to recharging of a SD from the level of discharge at which the Deep Discharge Protection (DDP) device disconnected the SD from the load.

The SD shall be recharged to 80% of its nominal capacity within the recharge time periods specified in Table 3.

Clause 5.1 and Table 7 – Overvoltage protection

It is unclear precisely what set of conditions this requirement is attempting to prevent and therefore for the purposes of this interpretation the assumption has been made that this requirement addresses the condition in which the power supply has failed, not due to any sabotage attempt. To resolve the discrepancy between the Grade dependency of clause 5.1 and Table 7, overvoltage protection will only be mandatory for Grade 4 products. The standard does not imply any particular mechanism to prevent the output voltage exceeding the maximum rated output and therefore for test purposes, the manufacturer should provide the relevant information to enable compliance to be verified.

Clause 5.2 and Table 7 – Short circuit and overload protection

Note that there is an error in Table 7 and overload protection is applicable at all grades according to the requirements of clause 5.2.

Clause 5.6.1 Tamper protection

There is an inconsistency between the Severity level and Impact energy in Table 4.0 for Grade 3 product. The Impact energy for Grade 3 should be 2J. Note that EN50102:1995 has been superseded by EN62262:2002.

Clause 6 – Product Documentation

A number of the requirements in clause 6 are unclear.

6(d) should be interpreted as the maximum and minimum continuous output voltages under any condition of EPS voltage (230Vac +10% -15%) and SD voltage (up until point of DDP or minimum SD voltage as recommended by the SD manufacturer).

The following additional information should be provided:

- (i) The rating of the power supply when fitted with a SD of declared capacity.
- (ii) The voltage at which the storage device will fail the low voltage storage device test (clause 3.1.6)
- (iii) The SD voltage below which the APS Fault: Low Voltage SD signal will be generated
- (iv) The PS output voltage below which the Power Output Fault signal will be generated.
- (v) The SD voltage at which the Deep Discharge Protection function operates

Clause 8 – Tests

There is some inconsistency between the functional requirements for a PS as defined in the standard and the corresponding tests to verify that the requirements have been met. The following paragraphs give explanations of the tests and clarify and correct the test conditions and pass/fail criteria to match the requirements.

Where the tests refer to application of full rated load and the sum of maximum ratings of individual fused connections exceeds the overall rated output of the power supply, the total load shall be the total rating applied as necessary across one or more fused connections. Test loads less than full rating should be applied proportionally.

Table 7

Clause 5.2 requires that overload protection test is required at Grade 1.

The grade dependency of the Tamper Detection requirements according to clause 5.6.2 requires the 3 separate tests of 8.2.18 to be defined separately:

There are no requirements corresponding to the gradual and switched load variation tests and therefore it is not required to undertake these tests.

There is no requirement corresponding to the maintenance of charge test and therefore it is not required to undertake this test.

Tests	Subclause	Grade 1	Grade 2	Grade 3	Grade 4
Gradual load variation	8.2.4	Op	Op	Op	Op
Switched load variation	8.2.5	Op	Op	Op	Op
Overload protection	8.2.7	ABC	ABC	ABC	ABC
Maintenance of charge	8.2.9	Op	Op	Op	Op
Tamper detection: opening of a closure	8.2.18.1	ABC	ABC	ABC	ABC
Tamper detection: removal from mounting	8.2.18.2	Op	Op	ABC	ABC
Tamper detection: penetration	8.2.18.3	Op	Op	Op	ABC

Clause 8.1.6 – Reduced Functional Tests

The description of reduced functional tests is unclear in the standard. The quoted tests should be replaced by:

(a) Object

To demonstrate the ability of the PS to function correctly by undertaking a number of key functional, but not exhaustive, tests. These tests shall be used before, during, and after subjecting the PS to environmental stress according to the verification requirement.

(b) Principle

For a Type A PS, the tests consist of applying full rated load to the PS with a fully discharged SD and verifying that the voltage at each independent output remains within the manufacturer's specified limits at the upper and lower range of EPS voltage.

For a Type B PS, the tests are the same as for a Type A except that the SD may be at any state of charge.

For a Type C PS, the tests consist of applying full rated load to the PS with its SD at any state of charge such that its on-load voltage is above the Low Voltage SD fault signal threshold.

(c) Test conditions

Each independent output shall be loaded to 100% rated capacity.

For a Type A PS a fully discharged SD shall be connected.

For Type A and B PS, an EPS shall be provided at the voltages specified in Table 8.

(d) Test procedure

For Type A and B PS, undertake 2 tests by applying the two EPS voltages specified in Table 8 and monitor the voltage at each independent power output for no less than 60 seconds.

For Type C PS, monitor the voltage at each independent power output for no less than 60 seconds.

(e) Test measurement

The output voltage at each independent power output shall be measured.

(f) Pass/fail criteria

The measured output voltage shall remain within the PS manufacturer's rated values.

Clause 8.2.2 – Marking

There is no requirement to conduct test 8.2.19 as this is already covered under the requirements of EN60950 and EN60065.

Clause 8.2.3 – Maximum Load

This test covered by this clause is unclear and is to be replaced with:

(a) Object

To demonstrate the ability of the PS to maintain the voltage at each independent output within rated values under maximum load condition.

(b) Principle

For a Type A PS, the tests consist of applying rated full load to the PS with a fully discharged SD and verifying that the voltage at each independent output remains within the manufacturer's specified limits at the upper and lower range of EPS voltage.

For a Type B PS, the tests are the same as for a Type A except that the SD may be at any state of charge.

For a Type C PS, the tests consist of applying full rated load to the PS with its SD at any state of charge such that its on-load voltage is above the Low Voltage SD fault signal threshold.

(c) Test conditions

Each independent output shall be loaded to 100% rated capacity.

For a Type A PS a fully discharged SD shall be connected.

For Type A and B PS, an EPS shall be provided at the voltages specified in Table 8.

(d) Test procedure

For Type A and B PS, undertake 2 tests by applying the two EPS voltages specified in Table 8 and monitor the voltage at each independent power output for no less than 60 seconds.

For Type C PS, monitor the voltage at each independent power output for no less than 60 seconds.

(e) Test measurement

The output voltage at each independent power output shall be measured.

(f) Pass/fail criteria

The measured output voltage shall remain within the PS manufacturer's rated values.

Table 8

The heading for this table is misleading and should be read as "EPS Test Conditions"

Clause 8.2.4 – Gradual load variation

- There is no requirement corresponding to this test and therefore it is not required to undertake the test. Therefore figure 2 is not required.

Clause 8.2.5 – Switched load variation

- There is no requirement corresponding to this test and therefore it is not required to undertake the test. Therefore figure 2 is not required.

Clause 8.2.6 – Short circuit

- This test checks that applying a short circuit to one output has no adverse affect on any other output. Effectively this checks that independent outputs are individually protected.
- If PS has only one output, then this test checks that PS returns to normal operation on removal of short circuit and re-instatement of any mechanical protection e.g. fuse.
- Independent outputs should be loaded to 10% of their maximum current rating.
- Short circuit should be applied for a minimum period of 60 seconds.
- For Type A PS, perform at max and min EPS voltages with a discharged SD for worst case conditions.
- Short circuit each output individually and check that the voltage on the other outputs remains within rated limits and there are no adverse transients ($< \pm 40\%$ of maximum output voltage and $< 1\text{ms}$).
- The test should also verify that after removal of the short circuit and re-instating any non-autoresetting protection (e.g. mechanical fuse), the PS returns to normal operation without any transients appearing on the other outputs.

Clause 8.2.7 – Overload

- This test checks that applying an overload to one output has no adverse affect on any other output. Effectively this checks that independent outputs are individually protected.
- Independent outputs should be loaded to 10% of their maximum current rating.
- For Type A PS, perform at max and min EPS voltages with a discharged SD for worst case conditions.
- Apply a gradually increasing load to each output independently until the overload protection operates on that output. Check the voltage on the other outputs remains within rated limits and there are no adverse transients ($< \pm 40\%$ of maximum output voltage and $< 1\text{ms}$).
- Remove overload, reinstate any non-autoresetting protection e.g. mechanical fuse, and check that the PS returns to normal operation without any transients appearing on the other outputs.

Clause 8.2.8 – SD Recharging

- This test checks that the SD can be recharged to 80% of its capacity from full discharge (as defined by the Deep Discharge Protection condition) within the Grade dependent recharge time.
- The PS shall be loaded to 100% rated output.
- Initially connect a fully discharged SD (as defined by the Deep Discharge Protection condition).
- For Type A PS, perform at max and min EPS voltages.
- Measure the current delivered into the SD over the grade dependent recharge time and verify that this is greater than or equal to the amount required to reach 80% capacity.
- Note that this test method measures the ability of the PS to supply current to charge a battery and uses the battery simply as a real load.

Clause 8.2.9 – Maintenance of SD charge

- There is no requirement corresponding to this test and therefore it is not required to undertake the test.

Clause 8.2.10 – Ripple

- This test verifies that the PS can supply an output voltage with low ripple under all operating conditions of EPS voltage and load.
- For Type A and B PS, perform at max and min EPS voltages. Table 10 should read 230Vac +10%-15%.
- Initially connect a fully discharged SD (as defined by the Deep Discharge Protection condition)
- Apply varying loads to each independent output simultaneously at the extremes of EPS voltage according to Table 10. The test condition to be maintained for a period between 60 and 120 seconds.
- Measure and check that the peak-peak ripple voltage at each independent output is < 5% maximum rated output voltage.

Clause 8.2.11 – EPS Failure

- This test verifies that a PS Type A or B can generate an EPS Fault signal or message in the event of loss of EPS.
- Connect a fully charged SD and apply 50% of total rated load.
- Monitor the EPS Fault or message signal. Disconnect the EPS, wait for 30s and re-connect the EPS.
- Check that the EPS Fault signal or message is generated within 10s of the removal of EPS. Check that the EPS Fault signal or message is cleared within 10s of re-connection of the EPS. If PS is integrated with another component that is used to process the EPS Fault signal or message e.g. CIE, then the 10s must be adjusted to 20s to accommodate the permitted processing time.

Clause 8.2.12 – SD Failure

- This test verifies that a PS Type A or B can generate an APS Fault signal or message in the event of a failure of the SD with the EPS connected.
- The test should be devised following an inspection of a statement by the PS manufacturer describing the SD monitoring approach.

Clause 8.2.13 – Low Voltage SD

- This test verifies that a PS can generate an APS Fault signal or message when the SD voltage falls below the SD Low Voltage threshold specified by the manufacturer with the EPS disconnected.
- Simulate an SD by connecting a variable voltage source capable of supplying the full PS load current to the voltage connections of the PS.
- Independent outputs should be loaded to 10% of their maximum current rating.
- Disconnect the EPS. Reduce the variable voltage source output voltage and verify that an APS Fault signal or message is generated within 10 seconds of the SD voltage falling below the SD Low Voltage threshold defined by the manufacturer. If PS is integrated with another component that is used to process the APS Fault signal or message e.g. CIE, then the 10s must be adjusted to 20s to accommodate the permitted processing time.

Clause 8.2.14 – Low Output Voltage

- This test verifies that a Grade 3 or 4 PS can generate a Power Output Fault signal or message when the voltage at any independent output falls below the minimum power output level with the EPS (Type A and B only) and SD connected.
- The test should be devised by agreement with the PS manufacturer as to how a low output voltage may be simulated.

Clause 8.2.15 – High Output Voltage

- This test demonstrates the ability of a Type A or B Grade 3 PS using switching technology, or a Type A or B Grade 4 PS irrespective of technology used, to prevent its output exceeding the maximum power output voltage.
- The test should be devised by agreement with the PS manufacturer as to how a high output voltage may be simulated.

Clause 8.2.16 – Deep Discharge Protection

- This test demonstrates the ability of the PS to prevent deep discharge of the SD.
- Simulate a SD by connecting a variable voltage source capable of supplying the full PS load current to the voltage connections of the PS.
- The PS should be loaded to 100% of its rated value and the EPS disconnected (Type A and B only).
- Reduce the simulated SD voltage and verify that the SD is disconnected from the load before the deep discharge disconnect voltage specified by the PS manufacturer.

Clause 8.2.17 Tamper Protection

- This test demonstrates the ability of the PS to prevent access to internal components without visible damage
- Verify correct PS performance by undertaking the reduced functional test of §8.1.6.
- Subject the PS to impacts as defined in Table 4.0 and in accordance with the test procedure defined in EN50130-5.
- Following the impact tests, verify that:
 - (a) it is not possible to access the internal components without (further) visible damage
 - (b) an appropriate tool is required to achieve normal access to the internal components.
 - (c) the correct PS performance by undertaking the reduced functional test of §8.1.6.

Clause 8.2.18.1 – Tamper Detection: Opening of the Enclosure

- This test verifies that the PS generates a tamper signal or message when its enclosure is opened by normal means and that the tamper detection may not be over-ridden by a rod of grade dependent diameter.
- Mount PS according to manufacturer's instructions.
- For Type A and B, apply the nominal EPS voltage.
- Verify that the enclosure may only be opened with an appropriate tool as specified by the manufacturer and that a tamper signal or message is generated.
- During opening, verify that it is not possible using a test rod as defined in Table 6 to overcome the tamper detection device.

Clause 8.2.18.2 – Tamper Detection: Removal from Mounting

- This test verifies that the PS generates a tamper signal or message when it is removed from its mounting.
- Place the PS on a flat surface with the tamper detection device adjusted according to the manufacturer’s instructions.
- For Type A and B, apply the nominal EPS voltage.
- Verify that a tamper signal or message is generated when the PS is raised by more than 10mm from the mounting surface.

Clause 8.2.18.3 – Tamper Detection: Penetration

- This test verifies that the PS generates a tamper signal or message when the PS enclosure is penetrated.
- Mount PS according to manufacturer’s instructions.
- For Type A and B, apply the nominal EPS voltage.
- Verify that a tamper signal or message is generated when the enclosure is penetrated using a tool to create a hole greater than 4mm in diameter in at least one of the normally accessible faces.

Clause 8.2.19 – Marking

- There is no requirement to conduct test 8.2.19 as this is already covered under the requirements of EN60950 and EN60065.

Clause 8.4 and subclauses: Environmental Tests

The individual environmental tests in clause 8.4 and sub-clauses are more clearly defined in EN50130-5 and this environmental standard should be used in place of the 8.4 and subclause tests.

The PS under test should be subject to the Reduced Functional Tests of §8.1.6 before and after each environmental test. In addition the fault signals or messages should be monitored during the vibration tests to verify that no spurious signals are generated. The tamper detection tests of §8.2.18.1 and §8.2.18.2 should be undertaken before and after the salt mist tests (Table 11, test 9) and the penetration test §8.2.18.3 should also be undertaken after the salt mist tests.

Annex A

This Annex is not required as the verification of correct charging of an SD by PS Type A is covered by the tests as defined above for §8.2.8.

Document history

Date	Issue	Comment
30/04/05	Issue 1	First issue
23/06/12	Issue 1.1	Reconfirmation of 5yr review. Retained for use in I&HAS installed installed to PD6662:2004