SRI LANKA STANDARD 992 : PART 2 : 1994

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SPECIFICATION FOR STABILIZED POWER SUPPLIES D. C. OUTPUT PART 2 : RATING AND PERFORMANCE

SRI LANKA STANDARDS INSTITUTION

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PART 2 - RATING AND PERFORMANCE

SLS 992 : Part 2 : 1994

Gr.9

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Sri Lanka.

Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This standard does not purport to include all the necessary provisions of a contract.

SRI LANKA STANDARD
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PART 2 - RATING AND PERFORMANCE

FOREWORD

This standard was approved by the Sectoral Committee on Electronic Engineering standards and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 94.12.05.

This standard is presented in four parts, namely;
Part 1 Terminology
Part 2 Rating and performance
Part 3 Radio-frequency interference tests
Part 4 Tests other than radio frequency interference

All values given in this specification are in SI units.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the results of a test or observation, shall be rounded off in accordance with **SLS 102**. The number of figures to be retained in the rounded off values shall be the same as that of the specified value in this standard.

In the preparation of this standard, the assistance derived from the publication **478-2** of the International Electrotechnical Commission, is gratefully acknowledged.

1 SCOPE

This part of the specification prescribes rating and performance applicable to stabilized power supplies designed to supply d.c. power from an a.c. or d.c. source, for applications such as computers, communication, laboratory and industry.

Calibrated stabilized power supplies for electrical measurement purposes are excluded.

2 REFERENCES

IEC	50	Safety of information technology equipment, including electrical bussiness equipment
IEC	651	Sound level meters
SLS	102	Presentation of numerical values
SLS	992	Stabilized power supplies d.c. output Part 1 Terminology Part 4 Tests other than radio-frequency interference

3 DEFINITIONS

For the purpose of this standard, the definitions given in **SLS 992 : Part 1 : 1994** shall apply in addition to the following:

3.1 **height** : Height is the overall dimension in the vertical direction of normal usage.

3.2. **width** : Width is the overall horizontal dimension parallel to the surface which is intended to be accessible during operation or for setting.

3.3 **depth** : Depth is the overall horizontal dimension perpendicular to the plane described by height and width.

3.4 **basic insulation** : Insulation to provide basic protection against electric shock.

3.5 **supplementary insulation** : Independent insulation applied in addition to basic insulation in order to ensure protection against electric shock in the event of a failure of the basic insulation.

3.6 **double insulation** : Insulation comprising both basic insulation and supplementary insulation.

3.7 **reinforced insulation** : A single insulation system which provides a degree of protection against electric shock equivalent to double insulation under the conditions specified in this standard.

NOTE

The term "insulation system" does not imply that the insulation has to be in one homogeneous piece. It may comprise several layers which cannot be tested as supplementary or basic insulation.

3.8 **Safety Extra Low Voltage (SELV)** : An extra-low voltage which is electrically separated from earth and from other systems in such a way that a single fault cannot give rise to the risk of electric shock.

NOTE

Under normal conditions this limit is either 42.4 V peak, or 60 V d.c. between conductors, and between any conductor and earth.

4 REQUIREMENTS

4.1 Performance

The performance of a stabilized power supply shall comply with the specified values of the quantities listed in the manufacturer's data sheet or other documents mutually agreed on by the manufacturer and user.

4.1.1 *Operating conditions*

Different performance ratings are valid under different operating conditions. These conditions are defined by different sets of values or ranges of values of the influence quantities and the stabilized output quantity. These conditions are defined in **4.1.1.1, 4.1.1.2 and 4.1.1.3.**

4.1.1.1 Reference conditions

Reference conditions are defined by values or ranges of values for the influence quantities and the stabilized output quantity which reflect typical operating conditions.

Reference conditions serve :

a) as conditions under which the intrinsic error may be determined (Tolerance I see Table 1 and Table 2) ;

b) as specific conditions for the validity of performance specifications which need not be known or verified under rated conditions (Tolerance G see Table 1 and Table 2)

The widened tolerances which typically apply to the case of Item b) relate to the initial setting of the quantities and may not be construed to denote permissible changes during the measurement.

4.1.1.2 Rated conditions

Rated conditions are defined by simultaneously applicable rated ranges of values for the influence quantities and the stabilized output quantity over which the stabilized power supply is intended to operate and remain within its performance specifications.

4.1.1.3 Limit conditions

Limit conditions are defined by a limiting range of values for one influence quantity and rated ranges of values for the other influence quantities and the stabilized output quantity which can be tolerated by the stabilized power supply without damage, but within which it does not necessarily meet all performance specifications.

If limiting ranges of values are indicated for more than one influence quantity, they shall be permitted only on an individual basis, unless otherwise stated.

4.1.2 *Required rating data*

Nominal values or rated ranges for the quantities listed in Table 1 shall be the required rating data.

Table 1 indicates further :

a) which value is to serve as reference, and which tolerances apply thereto, depending on the intention for which reference conditions are established;

b) which ratings may be assumed to constitute rated conditions in the absence of an explicit statement.

Rated conditions as listed in Table 1 shall be required ratings.

4.1.3 *Optional rating data*

The additional influence quantities listed in Table 2 may be of functional importance in unusual environments or when a stabilized power supply is particularly susceptible to them. The reference values and ratings recommended for this case are given in Table 2.

4.1.4 *Limit influence ratings*

If limiting ranges of values are indicated for influence quantities in Table 1 and Table 2, those performance ratings which are no longer met shall be specified.

4.1.5 *Performance ratings*

Performance ratings are listed in Table 3. In specifying the performance of a power supply, a distinction is made between mandatory performance ratings and others where performance ratings are merely recommended; mandatory indications are in italic type in Table 3.

4.2 Physical Requirements

The data sheet presented by Manufacturer shall contain the following physical characteristics.

4.2.1 *Dimensions*

4.2.1.1 Overall dimensions

Overall dimensions shall include all parts that are attached to the power supply and are required for its operation such as control knobs, terminals, bushings, legs, etc., including minimum bend radius of source cords.

4.2.1.2 Order of dimensions

Dimensions should be listed in the following order:
height x width x depth.

4.2.1.3 Internal depth

In the case of rack-mounted power supplies, an additional dimension is required, "internal depth", which is that dimension in the same direction as depth, but measured from the mounting surface.

4.2.1.4 Clearance dimensions

If clearance is required for proper operation of the power supply, the dimensions of the space to be available shall be listed in the same order as the overall dimensions.

4.2.2 *Mass*

List the total mass including all parts attached to the power supply during normal operation. In the case of fluid-filled units, this includes the fluid.

5 MARKING

The following information shall be permanently affixed to the power supply:

a) name of manufacturer or supplier;
b) model number;
c) serial number (optional);
d) output ratings: rated values or rated ranges of values for output voltage and current;
e) input ratings: nominal values for source voltage, source current and frequency, number of phases;
f) protection class. (See Appendix A)
g) An arrow pointing "up" shall be marked on a vertical surface, if the mounting position is not obvious from construction and if it is required that the power supply be mounted in a specified manner.

NOTE

Attention is drawn to Certification facilities offered by SLSI. See the inside back cover of this standard.

TABLE 1 - Required rating data

Influence quantity	Reference conditions			Rated conditions
	Reference values	Tolerance		Rated ranges of values
		I [1]	G [2]	
(1)	(2)	(3)	(4)	(5)
Source voltage	Nominal value	±1%	±3%	A.C. input: 80% to 110% of nominal value D.C. input: 85% to 115% of nominal value
Source frequency	Nominal value	±1%	±1%	98% to 102% of nominal value
Output current (constant voltage power supplies)	Nominal value or maximum value of rated range	±1%	±2%	0% to 100% of nominal value or rated range
Output voltage (constant current power supplies)	Nominal value or maximum value of rated range	±1%	±2%	0% to 100% of nominal value or rated range
Ambient temperature	27°C	±1 °C	±5°C	0 °C to 40 °C
Cooling medium temperature (when different from ambient temperature)	Nominal value	±3 °C	±5 °C	Air cooling: up to 35 °C Water cooling: up to 25 °C
Cooling medium flow volume (forced cooling)	Nominal value	±10%	+50% −10%	Down to 90% of nominal value
Stabilized output quantity				
Output voltage (constant voltage power supplies)	Nominal value or maximum value of rated range	Not applicable	±2%	0% to 100% of nominal value or rated range
Output current (constant current power supplies)	Nominal value or maximum value of rated range	Not applicable	±2%	0% to 100% of nominal value or rated range

[1] Tolerance applicable for the determination of intrinsic error.
[2] Tolerance applicable in general.

TABLE 2 – Optional rating data

Influence quantity	Reference conditions			Rated conditions
	Reference values	Tolerance		Rated ranges of values
		I [1]	G [2]	
(1)	(2)	(3)	(4)	(5)
Total source voltage distortion	A.C. input: relative harmonic content of 3%	+0 −3 percentage points	+3 −3 percentage points	A.C. input: total harmonic content up to 10%
	D.C. input: peak-to-peak ripple of 10%	+0 −10 percentage points	+0 −10 percentage points	D.C. input: peak-to-peak ripple up to 20%
Voltage unbalance	1%	—	—	3%
Relative humidity	65 %	±15 percentage points	±20 percentage points	45 % to 90 %
Barometric pressure	101 kPa	±5 kPa	+5 kPa −15 kPa	86 kPa to 106 kPa
Magnetic field strength at source-frequency	Up to 1 A/m	—	—	0 A/m to 100 A/m
Vibration	Under consideration			
Shock: product of peak acceleration and duration of shock pulse	0.1 m/s	—	—	0.2 m/s

[1] Tolerance applicable for the determination of intrinsic error.
[2] Tolerance applicable in general.

TABLE 3 — Performance ratings

Item	Specified quantity	Specified data	Applicable conditions	Reference	
				Test*	Definition**
(1)	(2)	(3)	(4)	(5)	(6)
1.	**Quantities related to source**				
1.1	Inrush current	Maximum instantaneous value, typical duration of transient	Rated conditions: maximum instantaneous peak source voltage drops to less than 10% of rated peak value	67 to 71	2.10
1.2	*Rated source current*	Typical r.m.s. value for a.c. — typical mean value for d.c.	Rated conditions	67 to 71	—
1.3	Efficiency	Unit or system efficiency, typical value	Reference conditions and at arithmetic mean of control range limits	67 to 71	2.13
1.4	Power factor	Typical value	—	67 to 71	2.9
1.5	Relative harmonic content of source current	Maximum percentage value	Rated conditions; relative harmonic content of source voltage less than 5%	67 to 71	2.11.1
1.6	Ripple on d.c. source current	Maximum r.m.s. value or peak-to-peak value	Rated conditions, superimposed ripple on source voltage less than 3% r.m.s. or 10% peak-to-peak respectively	67 to 71	—
2.	**Quantities related to steady-state conditions**				
2.1	*Load effect* [1]	Maximum value, expressed as percentage of the stabilized output quantity and/or as absolute value	Rated conditions	7 to 13	4.4.3
2.2	*Source voltage effect* [1]			15 to 20	4.4.3
2.3	Source frequency effect			53 to 57	4.4.3
2.4	*Temperature effect* [1] [2]			37 to 41	4.4.3
2.5	*Temperature coefficient* [1] [2]				—

* Sub-clauses of SLS 992 - 4
** Sub-clauses of SLS 992 - 1
[1] Mandatory only if total effect and/or tolerance band are not specified.
[2] Only Item 2.4 or 2.5 is required.

TABLE 3 - Performance ratings (contd.)

Item	Specified quantity	Specified data	Applicable conditions	Reference	
				Test	Definition
(1)	(2)	(3)	(4)	(5)	(6)
2.6	Other individual effects	Maximum value, expressed as percentage of the stabilized output quantity and/or as absolute value	Rated conditions	53 to 57	4.4.1
2.7	*Combined effects* [1]			58 to 62	4.4.3
2.8	*Total effect* [1]			63 to 66	4.10
2.9	*Tolerance band* [1]			63 to 66	4.12
2.10	*PARD—periodic and random deviation*	Maximum r.m.s. and/or peak-to-peak value	Rated conditions; considered frequency range: 20 Hz to 10 MHz	21 to 25	4.7
2.11	*Drift* [2]	Maximum value; time interval and upper frequency limit	Reference conditions; considered frequency range: 0 Hz to 20 Hz; time interval: 8 h	26 to 30	4.8
2.12	Output capacitance	Nominal value	—	—	5.6.2
2.13	*Settling effect* [3]	Maximum value; influence quantity subjected to change	Rated conditions	51.2	4.9
2.14	*Settling time* [3]	Maximum value; influence quantity subjected to change	Rated conditions	51.3	4.13
3.	**Quantities related to dynamic conditions**				
3.1	Maximum overshoot amplitude	Maximum value; quantity subjected to step change; magnitude and direction of step change	Rated conditions; considered frequency range: 0 MHz to 10 MHz	42 to 47	5.2.1
3.2	Maximum output rate of change				5.4
3.3	Transient delay time	Maximum value; quantity subjected to step change; magnitude and direction of step change; width of recovery band, unless equal to corresponding effect band or unless the total effect band or tolerance band serves, as recovery band			5.5.1.1
3.4	Transient recovery time				5.5.1.2
3.5	*Recovery time*				5.5.1
3.6	Turn-on delay time	Maximum value	Reference conditions	42 to 47	5.5.2
3.7	Turn-on recovery time	Maximum value	Reference conditions	42 to 47	5.5.3

[1] Mandatory only if load effect, source voltage effect, and either temperature effect or temperature coefficient are not specified. Only Item 2.8 or 2.9 is required.
[2] Mandatory only if total effect and/or tolerance band are not specified.
[3] Mandatory only if the settling effect is not included in the individual effects and/or drift.

TABLE 3 – Performance ratings (contd.)

Item	Specified quantity	Specified data	Applicable conditions	Reference	
				Test	Definition
(1)	(2)	(3)	(4)	(5)	(6)
3.8	Turn-off decay time	Maximum value	Reference conditions; end of decay at 1% of maximum rated value	42 to 47	5.5.4
3.9	Turn-on (turn-off) overshoot	Maximum value	Reference conditions	42 to 47	5.5.2
3.10	Turn-on (turn-off) output polarity reversal				5.2.3
3.11	Start-up time				4.13.1
3.12	Warm-up time				4.13.2
3.13	Output impedance	Typical value as a function of frequency		31 to 36	5.6
4.	**Quantities related to control**				
4.1	Setting range	Maximum value for upper limit and minimum value for lower limit of stabilized output quantity	Limit conditions, if any; otherwise rated conditions	98 to 101	4.14
4.2	*Control range*	Minimum value for upper limit and maximum value for lower limit of stabilized output quantity	Rated conditions		4.14.1
4.3	Discontinuous control resolution	Typical value	Reference conditions, whole control range of stabilized output quantity		4.15
4.4	Incremental control coefficient				4.15.1
4.5	Control coefficient	Nominal value		—	4.17
4.6	Control deviation band	Upper and lower limit values as a function of the control quantity		98 to 101	4.17.2
4.7	Control rate	Maximum value			4.16
4.8	Control time constant				4.16.1
4.9	Intrinsic error				4.3.1
5.	**Quantities related to limit conditions**				
5.1	Current limiting threshold	Minimum value; setting range, if any	Limit conditions, if any; otherwise rated conditions except for the unstabilized output quantity	84 to 92	7.9.1
5.2	Voltage limiting threshold				7.10.1

TABLE 3 - Performance ratings (contd.)

Item	Specified quantity	Specified data	Applicable conditions	Reference	
				Test	Definition
(1)	(2)	(3)	(4)	(5)	(6)
5.3	Maximum limited current	Maximum value; setting range, if any; maximum duration of limiting operation, if other than infinite	Limit conditions, if any; otherwise rated conditions except for the whole setting range for the stabilized output quantity	84 to 92	7.9.2
5.4	Maximum limited voltage				—
5.5	Short-circuit current				7.9.3
5.6	Open circuit voltage				7.10.2
5.7	Peak short-circuit current	Maximum value			—
5.8	Peak open circuit voltage				—
5.9	Cross-over area	Position and size of the widened load effect band or tolerance band	Rated conditions		2.5
5.10	Over-current protection	Protective device; reset; typical value for tripping threshold; setting range; tripping margin; tripping delay; overshoot; maximum duration of operation	Limit conditions if any; otherwise rated conditions except for the unstabilized output quantity	84 to 92	7.3
5.11	Over-voltage protection	Protective device; reset; typical value for tripping threshold; setting range, if any; tripping margin; tripping delay; overshoot; maximum duration of operation			7.4
5.12	Reverse current protection	Maximum value and duration of voltage and/or reversed current at output terminals	Rated conditions and non-energized condition		7.7
5.13	Reverse voltage protection	Maximum value and duration of current and/or reverse voltage at the output terminals			7.6
6.	**Miscellaneous**				
6.1	Isolation voltage	Maximum value; terminals considered	Rated conditions	—	3.6
6.2	Insulation resistance	Minimum value; terminals considered; test voltage	Non-energized condition	—	3.5

TABLE 3 - Performance ratings (concluded)

Item	Specified quantity	Specified data	Applicable conditions	Reference	
				Test	Definition
(1)	(2)	(3)	(4)	(5)	(6)
6.3	Insulation test voltage	Maximum (r.m.s) value duration		—	3.5.1
6.4	Capacitance to source	Maximum value; terminals considered		72 to 75	3.4.1
6.5	Capacitance to frame			76 to 79	3.4
6.6	Common mode current	Maximum value; terminals considered	Reference conditions	80 to 83	3.7
6.7	Sound level		Rated conditions	93 to 97	—
6.8	Electromagnetic interference emanation	Input/output maximum values for conducted radio-frequency interference (r.f.i.)	Rated conditions; considered frequency range up to 30 MHz		—
6.9	Cooling medium temperature	Maximum value of temperature rise of cooling medium	Rated conditions	—	3.2

APPENDIX A

PROTECTION CLASSES

A.1 Classes of Equipment - Protection Against Electric Shock

A.1.1 *class I equipment* : Equipment where protection against electric shock is achieved by :

a) using basic insulation, and also

b) providing a means of connecting to the protective earthing conductor in the building wiring those conductive parts that are otherwise capable of assuming hazardous voltages if the basic insulation fails.

NOTES

1. Class I equipment may have parts with double insulation or reinforced insulation, or parts operating in SELV circuits.

2. For equipment intended for use with a power supply cord, this provision includes a protective earthing conductor as part of the cord.

A.1.2 *class II equipment* : Equipment in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions, such as double insulation or reinforced insulation, are provided, there being no provision for protective earthing or reliance upon installation conditions.

NOTES

Class II equipment may be of one of the following types :

1. Equipment having a durable and substantially continuous electrical enclosure of insulating material which envelops all conductive parts, with the exception of small parts, such as nameplates, screws and rivets, which are isolated from parts at hazardous voltage by insulation at least equivalent to reinforced insulation; such equipment is called insulation-encased class II equipment;

2. Equipment having a substantially continuous metallic electrical enclosure, in which double or reinforced insulation is used throughout such equipment is called metal-encased class II equipment; and

3. Equipment which is a combination of the above two types.

A.1.3 *class III equipment* : Equipment in which protection against electric shock relies upon supply from SELV circuits and in which hazardous voltages are not generated.

SLS CERTIFICATION MARK

The Sri Lanka Standards Institution is the owner of the registered certification mark shown below. Beneath the mark, the number of the Sri Lanka Standard relevant to the product is indicated. This mark may be used only by those who have obtained permits under the SLS certification marks scheme. The presence of this mark on or in relation to a product conveys the assurance that they have been produced to comply with the requirements of the relevant Sri Lanka Standard under a well designed system of quality control inspection and testing operated by the manufacturer and supervised by the SLSI *which includes surveillance inspection of the factory, testing of both factory and market samples.*

Further particulars of the terms and conditions of the permit may be obtained from the Sri *Lanka Standards Institution, 17, Victoria Place, Elvitigala Mawatha, Colombo 08.*

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SRI LANKA STANDARDS INSTITUTION

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The principal objects of the Institution as set out in the Act are to prepare standards and promote their adoption, to provide facilities for examination and testing of products, to operate a Certification Marks Scheme, to certify the quality of products meant for local consumption or exports and to promote standardization and quality control by educational, consultancy and research activity.

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