International Standard 6858

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Aircraft — Ground support electrical supplies — General requirements

Aéronefs — Alimentations électriques de service au sol des avions — Conditions générales requises

First edition — 1982-08-15

UDC 629.7.082 : 621.311 **Ref. No. ISO 6858-1982 (E)**

Descriptors : aircraft, aircraft equipment, airport equipment, electric power supply, electric equipment, specifications, safety requirements.

Price based on 7 pages

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6858 was developed by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, and was circulated to the member bodies in March 1980.

It has been approved by the member bodies of the following countries :

Austria	Egypt, Arab Rep. of	South Africa, Rep. of
Belgium	Ireland	Spain
Brazil	Italy	Sweden
Canada	Netherlands	United Kingdom
China	Poland	USA
Czechoslovakia	Romania	USSR

The member bodies of the following countries expressed disapproval of the document on technical grounds :

France
Germany, F. R.

Printed in Switzerland

Aircraft — Ground support electrical supplies — General requirements

1 Scope

This International Standard specifies electrical output characteristics, and interface requirements, between an aircraft and ground support electrical supplies. Requirements for safety features are included also.

The electrical characteristics relate to nominal 28 V d.c., and 115 /200 V three-phase, 400 Hz, a.c., outputs measured at the connector.

2 Field of application

The ground support electrical supply facilities covered by this International Standard are intended to supply power to an aircraft. In some cases the facility may also be capable of being used for aircraft engine starting.

This International Standard lays down a number of safety features considered essential to protect aircraft in the vicinity of the ground electrical supply facility.

Specifically excluded are requirements for ground traffic control purposes, such as towing points, identification and warning lights etc.

3 References

ISO 461, *Aircraft — Connections for ground electrical supplies.* [1)]

ISO 1540, *Aerospace — Characteristics of aircraft electrical systems.*

4 Definitions

For the purpose of this International Standard the relevant definitions in ISO 1540 and ISO 461, together with the following, apply.

4.1 connector : The supply cable interface with the aircraft.

4.2 facility : Equipment designed to supply electrical power to an aircraft on the ground.

4.3 rated load : Maximum continuous output in kilovoltampers for a.c., and maximum continuous current for d.c.

5 Electrical characteristics

5.1 General

The combination of the facility and the interconnecting cable shall provide electrical power at the aircraft connector having characteristics generally in accordance with ISO 1540 as amended by this specification. The relevant facility specification shall state the appropriate power rating and any special additional characteristics.

The a.c. voltage characteristics stated below apply to line-to-neutral quantities : line-to-line characteristics should be as a result of line-to-neutral values being as specified.

All a.c. voltages are r.m.s. values unless otherwise stated.

All d.c. voltages are mean values unless otherwise stated.

The facility shall be capable of supplying electrical power having the specified characteristics under all extreme environmental conditions encountered at the airfield of use.

5.1.1 A.C. power

The a.c. power system shall be three-phase, four-wire, star-connected having a nominal voltage of 115/200 V, a nominal frequency of 400 Hz and a phase sequence A-B-C. The neutral point shall be connected in accordance with the circuits shown in figure 1.

1) At present at the stage of draft. (Revision of ISO 461-1965.)

5.1.2 D.C. power

The d.c. power system shall be a two wire system having a nominal voltage of 28 V, the output of which should be connected in accordance with the circuits shown in figure 2.

5.2 Interface

The interconnecting cable shall be terminated with a ground supply connector complying with the requirements of ISO 461.

5.3 Electromagnetic interference

The facility shall be tested in accordance with the requirements of the relevant national standard.

5.4 A.C. steady state output characteristics

5.4.1 Voltage regulation

The individual and average of the three-phase voltages at the connector shall be within the range 112 to 118 V for all loads including the permitted unbalance (see 5.4.2), up to rated load at power factors between 0,8 lagging and 1,0.

5.4.2 Voltage unbalance

For unbalanced loads up to 15 % of rated current the maximum difference between individual phase voltages at the connector shall not exceed 3 V.

5.4.3 Phase displacement

For all loads including permitted unbalance (see 5.4.2) the displacement between the corresponding zero points on the waveform shall be within the limits 118 and 122°.

5.4.4 Voltage waveform

When loaded as specified in annex A of ISO 1540, the voltage waveform shall be such that :

a) the crest factor lies between 1,31 and 1,51;

b) the r.m.s. value of the total harmonic content does not exceed 5 % of the fundamental r.m.s. voltage;

c) no individual harmonic exceeds 4 % of the fundamental voltage;

d) the divergence of corresponding ordinates from those of the equivalent sine wave does not exceed $(15,5 + 5,5 \cos 2\theta)$ % of the measured r.m.s. voltage where $V_p \sin \theta$ is the equation of the equivalent sine wave.

5.4.5 Voltage modulation

The modulation of phase voltage (including the effects of frequency modulation) shall not exceed 3,5 V when measured as the peak-to-valley difference between the maximum and minimum peak voltages reached on the modulation envelope over a period of at least 1 s. Frequency components of the modulation envelope waveform shall be within the limits shown in figure 2 of ISO 1540.

5.4.6 Frequency

The frequency of the supply shall be maintained within the limits 390 Hz and 410 Hz.

5.4.7 Frequency drift

Variation of the controlled frequency level within the limits defined in 5.4.6 due to drift shall not exceed ± 5 Hz and the rate of frequency drift shall not exceed 15 Hz/min.

5.4.8 Frequency modulation

Frequency variations owing to modulation shall be such that the departure from the average frequency lies within the band defined in figure 3 of ISO 1540.

5.5 A.C. transient characteristics

5.5.1 Voltage

Transient surge voltages, when converted to their equivalent step functions shall be within the limits of figure 3. The most severe phase transient shall be used in determining conformity with this requirement.

NOTE — The definition of equivalent-step-function is given in 8.3 of ISO 1540.

Limits 4 and 5 of figure 3 apply when switching loads from 0 % up to 80 % and down to 0 % of rated load at unity power factor; limits 2 and 3 apply when switching loads from 0 % up to 150 % and down to 0 %, of rated load at 0,6 power factor lagging.

5.5.2 Frequency

Frequency transients shall be within the limits of figure 4.

Limits 3 and 4 of figure 4 apply when switching loads from 0 % up to 80 % and down to 0 % of rated load at unity power factor; limits 1 and 2 apply when switching loads from 0 % up to 150 % and down to 0 % of rated load at 0,6 power factor lagging.

5.6 D.C. steady state output characteristics

5.6.1 Voltage

The voltage at the connector shall be within the range 26 to 29 V at any load condition up to rated load. When the facility is used for engine starting, the voltage at the connector shall not be less than 20 V. The maximum current rating for this condition shall be declared.

5.6.2 Voltage ripple

The ripple on the d.c. supply shall be such that the maximum departure from the average d.c. level is less than 2 V when measured in accordance with the requirements of 8.2 of ISO 1540.

The r.m.s. values of individual cyclic components of the ripple shall not exceed the values shown in figure 7 of ISO 1540.

5.7 D.C. transient characteristics

Transient surge voltages, when converted to their equivalent step functions, shall be within the limits of figure 5 for all operations of the aircraft system. The most severe transient shall be used in determining conformity with this requirement.

Limits 2 and 3 apply when switching loads from 5 % up to 85 % and down to 5 % of rated load. Limit 4 applies during engine starting.

6 Electrical protection

The minimum protection to be provided shall meet the requirements of 6.1 and 6.2. Means shall be provided for periodic checking of these minimum protection circuits. When a protective circuit has operated the facility shall remain disconnected from the aircraft until manually reset (see 8.2).

6.1 A.C. system protection

6.1.1 Overvoltage

A protection system shall be provided which disconnects the facility from the aircraft electrical system before any line-to-neutral voltage exceeds the limit 1 voltage-time curve in figure 3.

6.1.2 Undervoltage

A protection system shall be provided which disconnects the facility from the aircraft electrical system when the average line-to-neutral voltage drops below 102 V. A time delay of between 2 s and 4 s shall be provided to prevent nuisance tripping. Faster tripping is permissible should the voltage fall below 70 V under fault conditions.

6.1.3 Frequency

A protection system shall be provided which disconnects the facility from the aircraft electrical system when the frequency departs from the range 370 to 430 Hz. A time delay of between 2 s and 7 s shall be provided to prevent nuisance tripping. For frequencies below 320 Hz, the time delay shall be reduced to less than 0,5 s.

6.1.4 Phase sequence

A phase sequence protective system shall be provided which prevents the facility from being connected to the aircraft electrical system when the phase rotation of the generated voltage is incorrect.

6.2 D.C. system protection

6.2.1 Overvoltage

A protection system shall be provided which disconnects the facility from the aircraft electrical system before the voltage exceeds the limit 1 voltage-time curve in figure 5.

6.2.2 Undervoltage

A protection system shall be provided which disconnects the facility from the aircraft electrical system when the voltage drops below 20 V. A time delay of between 2 s and 4 s shall be provided to prevent nuisance tripping.

6.2.3 Reverse polarity

A protection system shall be provided which prevents the facility from being connected to the aircraft if the polarity of the generated voltage is incorrect.

6.2.4 Reverse current

A protection system shall be provided which disconnects the facility from the aircraft electrical system if the reverse current exceeds 5 % of the continuous rating of the facility. In no circumstances shall the aircraft electrical system be permitted to motor the facility's prime-mover.

7 Control circuit and supply

7.1 Control circuits

Unless otherwise required by the relevant specification, the facility shall be capable of connection through aircraft connectors having control circuits wired in accordance with figure 1 for an a.c. facility or in accordance with figure 2 for a d.c. facility.

7.2 Aircraft interlock supply

The current required from the aircraft electrical system for interlock purposes shall not exceed 0,5 A. This supply from the aircraft will be in the range 16 to 29 V d.c. It shall not be possible for the facility to supply the aircraft through this connection.

8 Safety requirements

Each ground support facility shall incorporate, when applicable, the following safety features :

8.1 Mechanical safety features

8.1.1 Fuel tank

The fuel tank filler shall be accessible from ground level and shall be so located to minimize the possibility of fuel impinging on electrical or engine components during filling operations.

8.1.2 Exhaust

The prime-mover exhaust system shall be routed clear of fuel and electrical system components. If routed through areas where leakage of oil and grease or fuel could occur, the exhaust system shall be shielded from direct contact with such leakage.

The exhaust system shall be designed to minimize the emission of sparks.

8.1.3 Control panel

There shall be unrestricted access to the controls and instruments on the control panel which shall contain all controls necessary for the operation and control of the ground power facility. The panel controls and instruments shall be adequately illuminated for night operation. Indicating instruments shall be readable from the operator's normal position and controls shall be clearly identified. The layout of the control panel shall be such that controls and instruments are grouped according to function, i.e. prime-mover, alternator, etc.

Adequate operating instructions shall be placed in close proximity to the control panel.

8.1.4 Ergonomics

The facility shall be easily operated by personnel possessing no special skills who have been given training on the equipment. All operator controls and instruments shall be conveniently grouped at one location. Operation shall be easily accomplished while wearing foul-weather clothing.

8.1.5 Fire fighting

All facilities shall be fitted with a fire extinguisher adequate to deal with an electrical fire and contain any fire propagated by a breakage in the prime-mover fuel supply line.

8.2 Electrical safety features

8.2.1 Overload

Suitable arrangements shall be made to protect the facility against electrical overload.

8.2.2 Fault conditions

The main switch, and any device which breaks the main supply under fault conditions, shall be so designed that an operator cannot readily override the safety features.

8.2.3 Trip switch

All facilities shall incorporate a prominently situated tripping device, coloured red, to isolate the supplies to the aircraft and shut down the facility immediately a dangerous situation is observed.

8.2.4 Earthing

Means shall be provided to earth the facility frame or chassis. The a.c. neutral and d.c. negative outputs shall be electrically isolated from each other and from the facility frame or chassis. Provision shall be made however for connecting them separately to the facility frame or chassis.

NOTE — These may be defined in National Regulations or the contractural specification for the equipment.

8.2.5 facility with electrical supply

The electrical supply for the drive motor and all associated operating and monitoring equipment shall be segregated from that reserved for the circuits for connection to the aircraft. All possible precautions shall be taken to prevent interaction between the input and output circuits.

The neutral of the primary electrical power shall not be earthed at the facility. The input power supply cable and connector shall be in accordance with the requirements of the regulations in force in the user country.

8.3 Features to safeguard personnel

8.3.1 General

Electrically live terminals, rotating parts and hot surfaces shall be protected against inadvertent contact.

8.3.2 Anti-arcing protection

Load contactor(s) interlocked with the aircraft electrical system shall be provided so that the feeder cable(s) do not remain energized except when engaged with the aircraft plug. Standard wiring diagrams are given in figures 1 and 2.

8.3.3 Noise

The overall noise level of a mobile facility shall not exceed 85 dB(A) at a distance of 7 m.

9 Labelling

All ground power facilities shall be fitted with a data plate displaying the following minimum information :

a) nominal output voltage or voltages;

b) continuous and intermittent ratings of the facility;

c) the number of this International Standard.

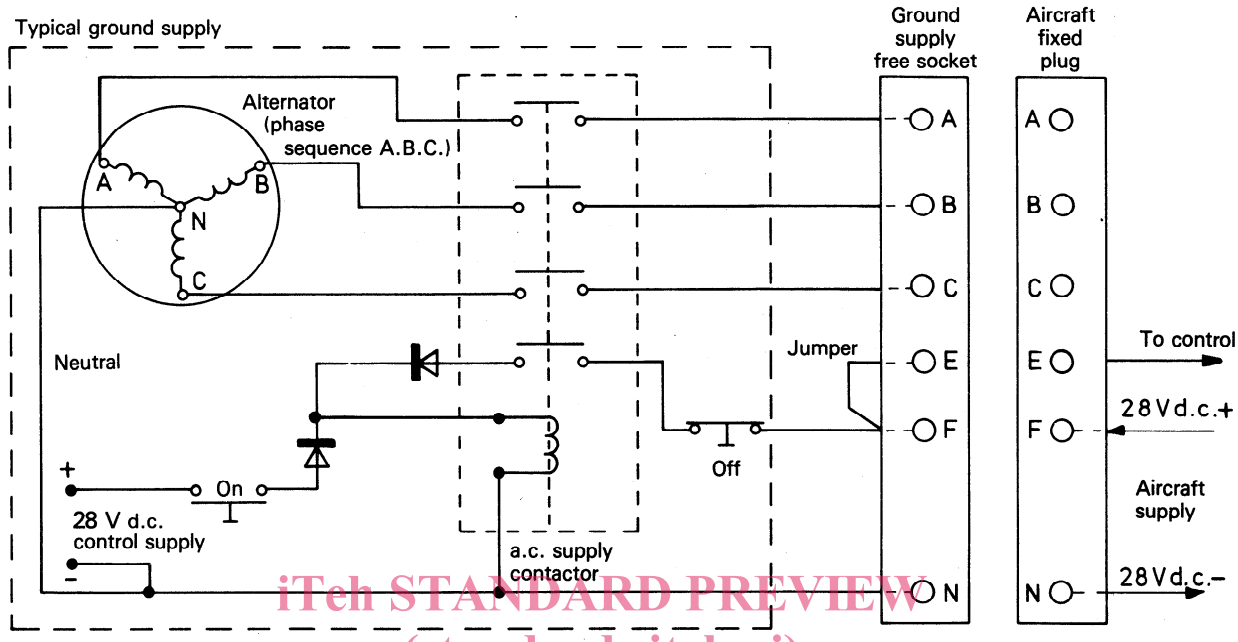

Figure 1 — Standard wiring diagram for three-phase a.c. plug and socket

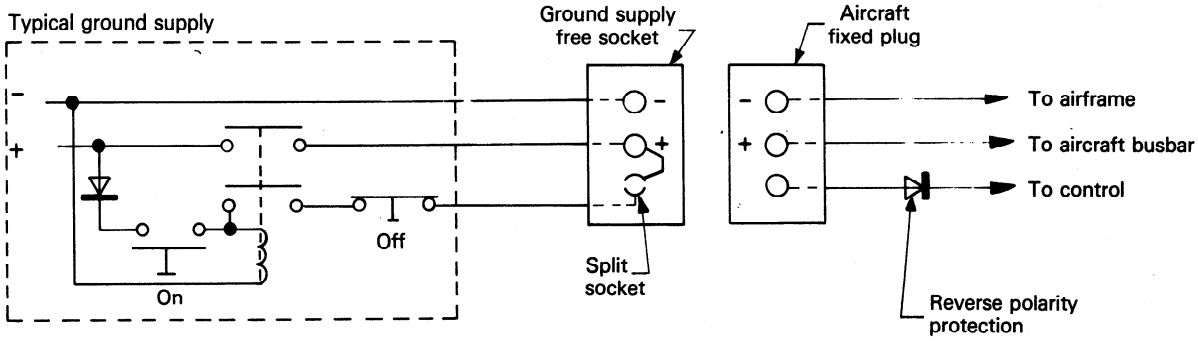

Figure 2 — Standard wiring diagram for d.c. plug and socket

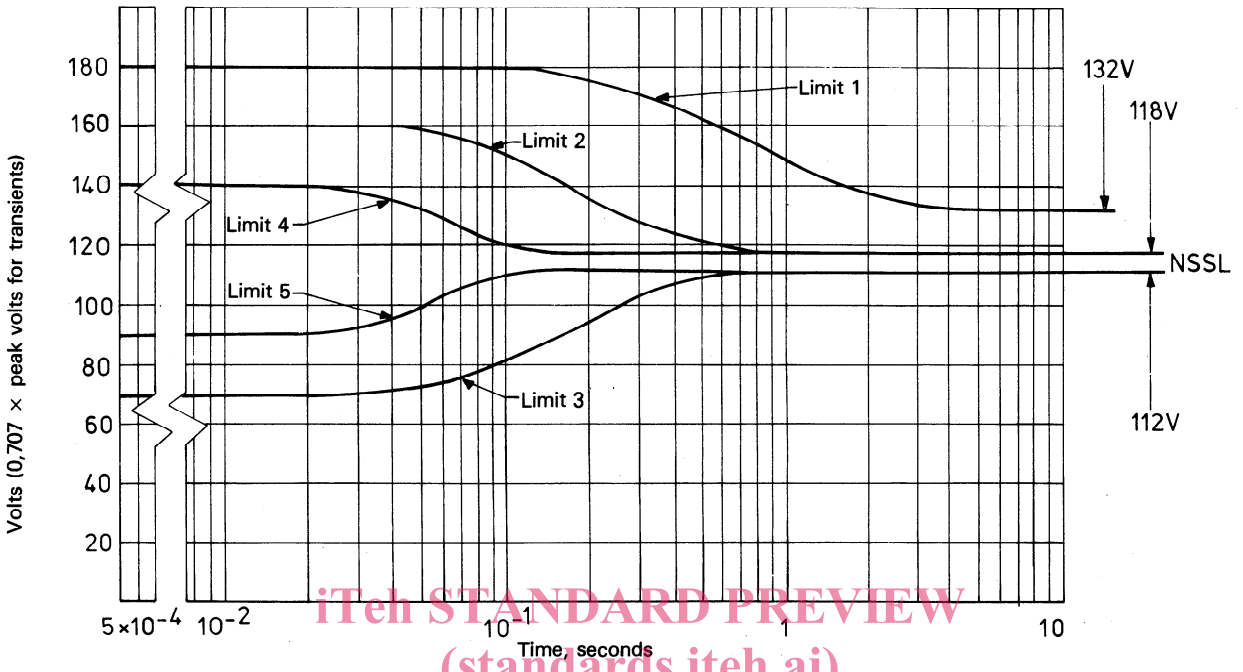

Figure 3 — Envelopes for a.c. surges

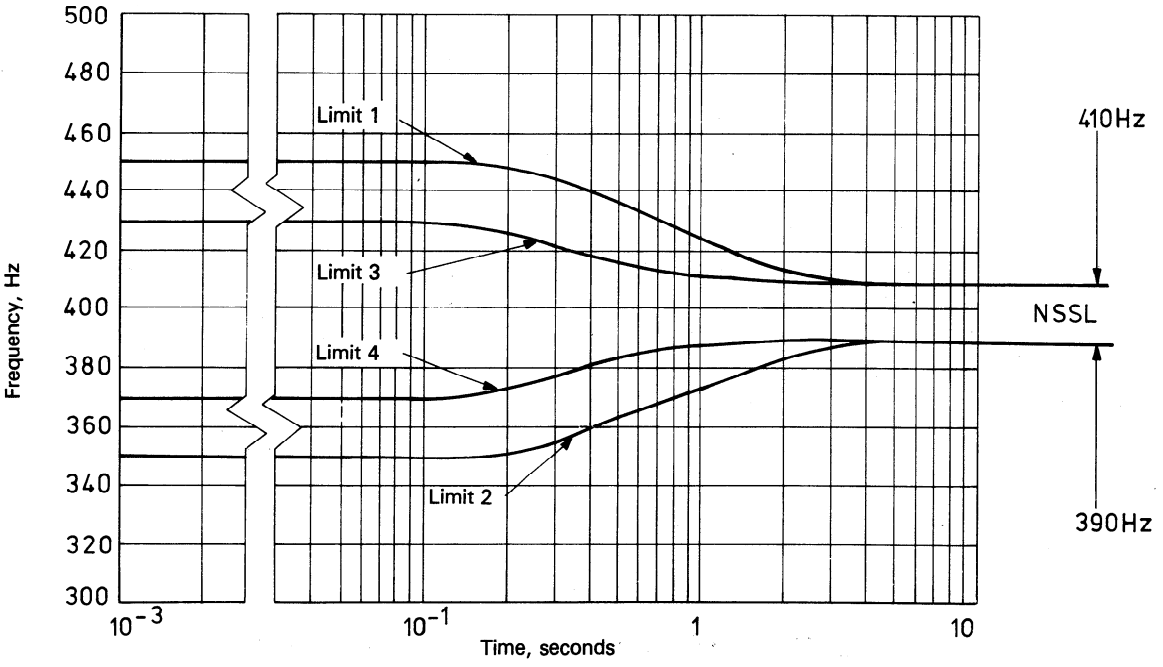

Figure 4 — Envelopes for frequency transients on a.c. supplies

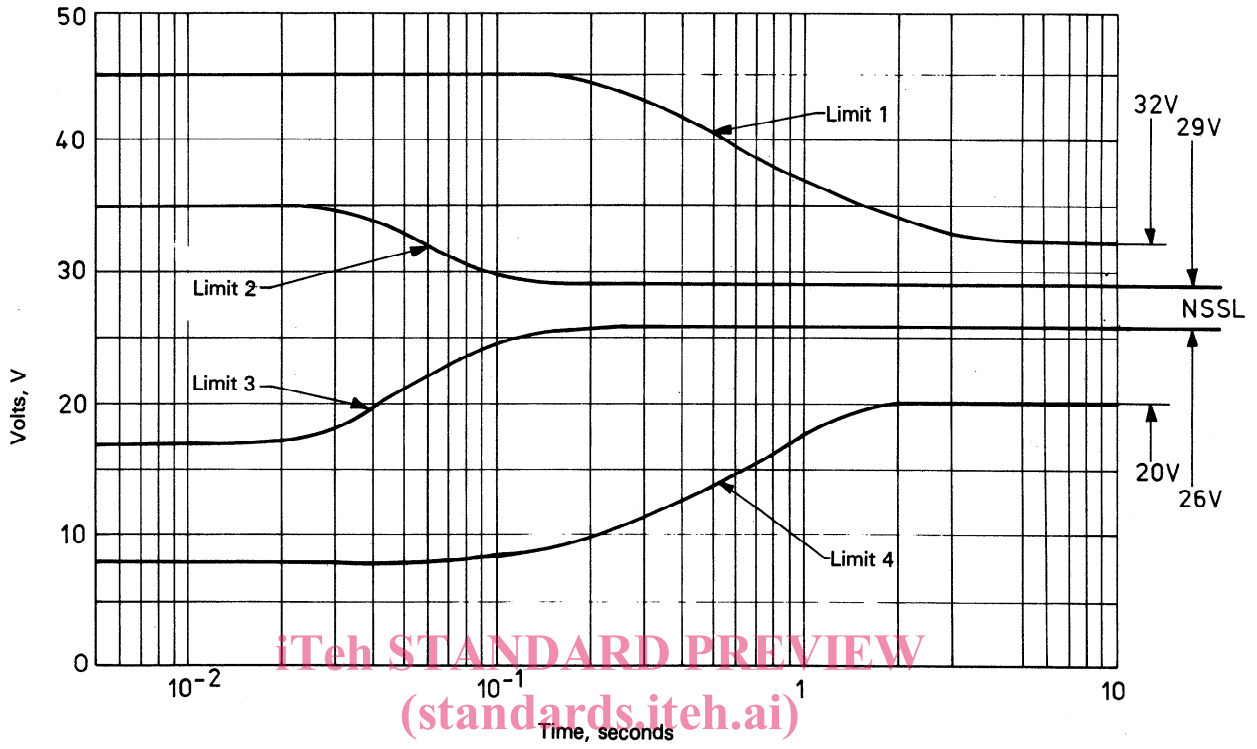

Figure 5 — Envelopes for d.c. surges