



NATIONAL PETROCHEMICAL COMPANY STANDARDS

MATERIAL STANDARD FOR U.P.S.

NPCS-MS-EL-08

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1 SCOPE

- 1.1 The *intent* of this standard is to define the minimum requirements for the design, manufacture, testing and supply of "Uninterruptable Power System" (UPS) meant to feed critical electronic instruments, boiler controls, process control instrumentation, computers or other similar systems.
- 1.2 The UPS shall be completely static and solid state in design.
- 1.3 In case of conflict between documents listed below, the ones appearing first in sequence of this listing will precede over the following ones.
- a) **Purchase order.**
 - b) Data sheets.
 - c) Interconnection drawings.
 - d) Requirements of the requisition.
 - e) This material standard.
 - f) Other specifications and standards referred to in the above documents.
 - g) Vendor drawings.
- 1.4 Compliance by the manufacturer with the provisions of this standard does not relieve him of the responsibility of furnishing unit of proper design, mechanically suited to meet operating guarantees at the specified operating conditions.
- 1.5 Such deviations from this standard which the manufacturer may consider advisable, shall be **submitted** in writing to Purchaser, together with his quotation, in order purchaser may approve or reject such deviations.
- 1.6 Exceptions other than those included in the above mentioned documents *shall not be* considered.
- 1.7 Vendor shall only supply equipment of proven design and construction, of which satisfactory operation over at least a three years period can be proven in similar service and operating conditions.
- 1.8 All documentation shall be issued, using SI metric system of measurement, according to NPCS-ES-GN-03.

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- 1.9 The English language shall be used for all correspondence documents, catalogues, drawings and nameplates.
- 1.10 In the reference numbers of this standard, purchaser means National Petrochemical Company of Iran, NPC.
- 2 STANDARDS AND CODES
- The UPS shall be designed, constructed, wired and tested in accordance with all applicable sections of the latest below listed standards and codes.
- 2.1 FOR EQUIPMENT MANUFACTURED IN EUROPE
- | | |
|----------|---|
| IEC | International Electrotechnical Commission. |
| IEC-51 | Recommendations for Indicating Electrical Measuring Instruments and Their Accessories. |
| IEC-76 | Power Transformers. |
| IEC-86 | Primary Batteries. |
| IEC-144 | Degrees of Protection of Enclosures for Low Voltage Switchgear and Control Gear. |
| IEC-1.46 | Semi-Conductor Converters. |
| IEC-157 | Low Voltage Switchgear and Control Gear. |
| IEC-158 | Low Voltage Control Gear. |
| IEC-185 | Current Transformers. |
| IEC-186 | Voltage Transformers. |
| IEC-364 | Electrical Installation of Degree for Protection by Enclosures. |
| IEC-408 | Low Voltage Air Break Switches, Air Break Disconnectors, Air Break Switch Disconnectors and Fuse Combination Units, |
| IEC-529 | Classification of Degree of Protection Provided by Enclosures. |
| IEC-540 | Cables and Wires. |



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IEC-563 Classification of Electrical and Electronic Equipment with regard to Protection against Electrical Shock.

Other relevant IEC Publications, supplemented by this standard.

VDE 0875 Specification for Radio Interface Suppression of Electrical Appliances and systems.

2.2 FOR EQUIPMENT MANUFACTURED IN USA

NEMA National Electrical Manufacturers Association

NEC National Electrical Code

IEEE 450 Maintenance, Testing and Replacement of Large Lead Storage Batteries.

2.3 For equipment manufactured outside Europe and USA either of the standards and codes specified in Clause 2.1 or 2.2 above must be met.

2.4 The equipment as a whole may conform with the national standards of the country of manufacturer, provided these standards are based on the IEC recommendations. The vendor shall state in the quotation the standards to which the equipment conforms. If these are the national standards, then the vendor shall state in the quotation, the deviations, if any, from the above mentioned standards and codes.

2.5 The testing and certification by following authorities are acceptable, where relevant. Other authorities may be considered subject to client approval:

- a) European Organization for Testing and Certification under CENELEC Administration (EOTC).
- b) Underwriters Laboratories Inc. (UL).
- c) Electrical Equipment Certification Services (EECS).



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3 GENERAL REQUIREMENT

3.1 DESCRIPTION

3.1.1 The UPS system shall consist of, but not to be limited, a rectifier/charger, inverter, filtering, batteries, static transfer switch, maintenance by-pass switch, by-pass isolation transformer, alarms, and auxiliary systems as described in this standard.

3.1.2 The rectifier converts incoming AC power to DC which supplies the inverter and charges the battery. The inverter changes the DC to AC to supply the critical loads.

3.1.3 The UPS system shall be suitable for supplying power to process control instrumentation, boiler controls, computers, and other items as will be shown on the data sheet.

3.1.4 Input and output voltages, frequencies and phases, KVA, and energy storage capacity will be defined on the data sheets.

3.1.5 When specified on the data sheets, the equipment shall include fungus-proofing. This generally entails the use of non-hygroscopic insulation and the spraying of wires and components with a clear, moisture-resistant varnish after assembly.

3.1.6 The equipment shall be completely factory-built, assembled, wired, and tested. When it is necessary to break up units for ease of transportation, adequate materials and instructions shall be provided for easy field assembly.

3.2 SYSTEM OPERATION

The system operation shall be as follows:

- a) During normal operation, a source of alternating current shall supply energy to the UPS. The full wave controlled rectifier section, shall furnish energy to the inverter and also to the storage batteries at required voltage for float charging. The inverter section shall receive the output of the rectifier section through a filter and generate alternating current in the form of a low harmonic content sinusoidal wave to feed the load through a static switch.



- b Upon loss of the AC line, the batteries shall power the load at specified voltage for 2 hr "minimum **battery** protection time" period. Upon "Normal" AC line restoration, the system shall revert to normal operation and recharge the batteries. If power is not restored, the inverter shall shut-down at the manufacturer's minimum recommended discharge voltage to protect the batteries against excessive discharging.
- c In the event of UPS system failure, the load shall be automatically and instantaneously transferred to the by-pass circuit through a static transfer switch. Circuitry shall be provided to allow the switch to be reset either manually or automatically.
- d) When specified on the data sheets, the by-pass line shall connect to a separate source of power and the inverter shall be provided with a synchronization circuit to keep the inverter output synchronized to the by-pass circuit.

3.3 SAFETY AND RELIABILITY

3.3.1 The UPS shall be so designed to minimize any risk of short circuits and to ensure personnel and operational safety under all conditions of operation, inspection and maintenance.

3.3.2 All component material used *in the* construction of a UPS shall be fire resistant and non-flame propagating.

3.3.3 Electrolytes, e.g. for capacitors, shall be non-toxic and totally free from poly-Chlorinated biphenyls.

3.4 ELECTRICAL SUPPLY SYSTEM

3.4.1 The AC supply to the UPS may be single phase or symmetrical three-phase with a nominal voltage and frequency as what will be indicated in the requisition. The wave form of the input voltage, with UPS disconnected, will be sinusoidal. The input supply variations shall be limited under steady state conditions:

Nominal voltage $\pm 10\%$

Nominal frequency $\pm 5\%$

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3.4.2 In addition to the above variations, the input voltage may be subject to transients, comprising voltage depressions up to 20% of the nominal voltage during motor starting, and to voltage interruptions during system short circuits. Transient high-frequency voltages up to 2 KV peak, may also be superimposed on the input voltage as a consequence of system switching operations, etc.

3.5 SERVICE AND ENVIRONMENTAL CONDITIONS

3.5.1 The UPS will be installed in safe area in control rooms which will be ventilated and air conditioned to provide clean, dust free air: ambient temperature will be within the limits of IEC 439.

3.5.2 Climate conditions, design temperatures, relative humidity, atmospheric details and altitude will be specified in the requisition. The UPS shall stand these conditions while in transport, storage, installation and an upset of air conditioning.

4 TECHNICAL REQUIREMENTS

4.1 GENERAL

4.1.1 The UPS system shall be designed to meet the following overall requirements:

- a) The UPS system voltage regulation shall be between $\pm 1\%$ at 1.0 power factor.
- b) The UPS system power factor shall exceed 75% for all load ranges.
- c) The UPS system efficiency at half load shall exceed 75% for single phase units, and 85% for three-phase units.-
- d) The UPS system frequency regulation shall be $\pm 0.5\%$.
- e) The transient voltage drop shall not exceed 20% and shall return with the steady state limit of $\pm 1\%$ in 0.05 S for all normal operations, any transfer to and from the by-pass circuits, and the sudden application of full load.
- f) Harmonic distortion shall not exceed 5% at linear resistive loads.