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	Technical Specification For AC UPS	
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Technical Specification For AC UPS

00	ISSUED FOR APPROVAL	M.KHAVARI	F.NIKNAM	A.MONFARED	1405/02/08
Rev.	DESCRIPTION	REVISED BY	CHECKED BY	APPROVED	APP DATE

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1.0 GENERAL

1.1 SCOPE

This specification covers general technical requirements for design, equipment engineering, manufacture and shipment of complete AC Uninterruptable Power Supply (UPS).

1.2 DOCUMENT PRIORITY

In the event of any conflict between this specification, the requisition, codes and standards, the priority shall be given in the following order.

- Purchase order
- This specification
- Codes and standards

1.3 CONDITION OF OPERATION

All of the Electrical Equipment & Systems will be suitable for 24 hours, 7 days/week, and 365 days/year operation.

Site Conditions

1.4 Plant Location

The Site is located at Gol-E-Gohar Iron Ore Complex, situated in Sirjan, Province of Kerman in southern part of Islamic Republic of IRAN, approximately 285 km southwest of Kerman city and 335 km north of Bandar Abbas port, in a semi-desertic high plateau terrain, 1750 m above sea level, and flanked by mountains over 2500 m high trending northwest to southwest.

1.5 Meteorological

Ambient Temperature

Max. Temperature:	+40 deg. C (Recorded)
	+50 deg. C (Design)
Min. temperature:	-12 deg. C (Recorded)
	-10 deg. C (Design)
Average temperature:	+15.9 deg. C (Design)

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Wet bulb design temperature (summer): +25 deg C

Relative Humidity: Max. 70%

Wind Velocity

According to National Iranian Code (6th revision):

Basic speed data: 130 Km/h

Basic pressure data: 0.845 KN/m²

Correction factor:

0 - 10 m: 2

10 - 20 m: 2.2

20 - 100 m: 2.4

Rainfall

Yearly 120 mm (average)

Monthly rainfall 260mm (Max)

Barometric Pressure

820 milliards

Geological Conditions

This data is belongs to the existing palletizing plant location. For the engineering the contractor shall be study geotechnical conditions for the essential location according to the project plan.

Altitude: About 1,750 m above mean sea level

Soil bearing: approx. 20t/m²

Ground water level: approx. 60 m below ground level

Earthquake Load

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Equipment in plant will be dimensioned including a safety calculation against earthquake according to the “Iranian Code for Seismic Resistant Design of Buildings – Publication No. S253-2nd edition, autumn 1999” (“Iranian Regulations 2800”) and “Minimum

Design Loads for Building and Structures” (Iranian Regulations 519).

- Design base acceleration: 0.3·g
- Classification of Buildings: Group 2
- Soil classification: soil type III-b

2.0 STANDARDS AND CODES

The UPS systems shall be designed, fabricated and tested in accordance with the latest revision of relevant international codes and standards including but not limited to the following wherever required. For undated references, the latest edition of the referenced document (including any supplements and amendments) applies. For dated references, the edition cited applies. The applicability of changes in the dated references that occur after the cited date shall be mutually agreed upon by CONTRACTOR/EMPLOYER and the VENDOR.

- IEC (International Electro-Technical Commission)

IEC 60309 (all parts)	Electrical installations of buildings
IEC 60529	Degrees of Protection Provided by Enclosures (IP code)
IEC 60801 Part2	Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment
IEC 60076	Power Transformers
IEC 60146	Semiconductor Converters
IEC 60051	Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories
IEC 60289	Reactors

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IEC 60445	Basic and safety principles for man-machine interface, marking and identification- identification of equipment terminals and conductor terminations
IEC 62040 (all parts)	Uninterruptable Power System (UPS)
IEC 60119	Recommendations for polycrystalline semiconductor rectifier stacks and equipment
IEC 60622	Sealed nickel cadmium prismatic rechargeable single cells

- ISO (International Organization For Standardization)

ISO 1000	SI Units and recommendation for use of their multiples and of certain other units
ISO 9001: 1994 or 9001:2000 (Including Design)	Quality management systems- Requirements
ISO 9002:1994	Quality systems- model for quality assurance in production, installation and servicing

3.0 Abbreviations

DCS	Distributed Control System
MCR	Main Control Room
UPS	Uninterruptible Power Supply
FAT	Factory Acceptance Test
PMS	Power Management System
PDP	Power Distribution Panel

4.0 Document Preference

It shall be the VENDOR's responsibility to be, or to become, knowledgeable of the requirement of the referenced codes and standards.

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The VENDOR shall notify the CONTRACTOR of any apparent conflict between this specification, the related data sheets, the codes and standards and any other specifications noted herein. Resolution and/ or interpretation shall be obtained from the CONTRACTOR in writing before proceeding with the design/ manufacture.

In case of conflict, the order of precedence shall be:

- Equipment Data sheets, if any
- This specification/ Inquiry document
- Above mentioned Standards and Codes
- VENDOR's Quality Plan

5.0 Deviation & Alternations

Deviations from this specification are only acceptable where the VENDOR has listed in his quotation the requirements he cannot, or does not wish to comply with, and which the CONTRACTOR/ EMPLOYER has accepted in writing before order is placed. In the absence of a list of deviations, it will be assumed that the VENDOR complies fully with this specification. Technical changes implemented prior to CONTRACTOR/ EMPLOYER approval are subject to rejection.

6.0 General Considerations

6.1 Unit of Measurement

International system of units (SI) shall be used as stated below or fraction of these units.

Electric Current	A, mA, KA
Electric Power	W, KW
Electric Potential	V, KV
Electric Resistance	Ohm
Frequency Hz	
InductanceH	
Capacitance	F

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Pressure Bar, mBar, mmH₂O, mmHG

Temperature °C

Weight Kg, Ton

6.2 Power Supply

The input power to the UPS system will be 400 VAC, $\pm 5\%$, 3 Phase, 50 Hz $\pm 1\%$,

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6.3 Environmental Data

The internal conditions for the rooms are temperature $+26 \pm 2$ °C and relative humidity 45 to 50%.

The shipping and storage conditions will be considered as -20 °C to $+85$ °C and humidity 0% to 100%.

The UPS systems shall be able to continue the operation in case of HVAC failure condition. The maximum temperature in case of HVAC failure is $+50$ °C.

6.4 Hazardous Area Classification and Ingress Protection Degree (IP)

The UPS systems are installed in safe area. The UPS systems shall be protected against ingress of solids and water in accordance with IEC 60529. Protection degree for the UPS systems shall generally be IP 42 for indoor installation.

6.5 Tagging

The VENDOR shall tag UPS systems in his supply with a stainless steel 316 corrosion resistance tag stamped with the specified tag number. The tag shall be permanently fastened but not glued, to the equipment, by the supplier, without any distortion on Instrument's IP.

Characters shall be 5 mm height minimum.

The tag numbering system & serial numbers which will be used by the VENDOR, shall be approved by CONTRACTOR/ EMPLOYER. Following information shall be on the tag name plates as a minimum:

- Manufacturer's name
- Model Number
- Serial Number
- UPS Tag No.
- Nominal input voltage, Current and Frequency

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- Nominal output voltage, Current and Frequency
- Rated capacity of the unit
- IP Degree
- Date of Manufacture (Month, Year)

7.0 Technical Specification:

7.1 General requirements

In general, all material, components and accessories must be suitable for saliferous and dusty environment with high concentrations of wind-borne sand as commonly encountered in onshore installations in the Middle East. The possibility of condensation, as experienced during large temperature fluctuations in a humid atmosphere, shall be considered.

7.2 Operating Principle

- UPS unit shall consist of a rectifier/charger, an inverter, batteries, a static transfer switch, a maintenance bypass switch, a bypass transformer.
- During normal operation a source of alternating current will supply energy to the UPS unit. A rectifier converts incoming AC power to the DC which supplied the inverter and charges the battery. The inverter changes the DC to AC power, which supplied electrical energy to the critical loads through the static transfer switch.
- The output of the rectifier shall continuously supply the power requirements of the load, through the inverter, while simultaneously maintaining the battery in the float charge mode.
- In the event of an interruption or depression in the AC mains voltage, the battery shall supply the power requirements of the load via the inverter.
- Upon restoration of the AC mains voltage, the rectifier shall supply the power requirements of the load via the inverter, while simultaneously

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recharging the battery.

- The UPS unit shall be equipped with a static transfer switch and a bypass transformer.

The output voltage and frequency of the inverter shall be kept synchronized with the bypass supply.

- In the event of rectifier/inverter failure or the load current becoming excessive, either transiently or continuously, the unit enters bypass mode where the load is temporarily supplied via the bypass line from primary or stand-by power.
- In case when the inverter voltage and frequency deviates from the specified tolerances, the static switch initiates uninterrupted transfer of the load to the bypass supply.
- Upon restoration of the inverter output voltage and frequency, the load shall be transferred back to the inverter which resumes synchronous operation with the bypass supply.
- A make before break switch shall also be provided, for manual transfer of the load to the bypass power supply, in order to isolate the rectifier, inverter and static transfer switch for maintenance purposes.

7.3 UPS System Configuration

- One UPS system is used for the plant as the following:
The UPS system shall be redundant (duplicate) unit type (for rectifier and inverter).
- The redundant (duplicate) unit UPS shall energize a single Power Distribution Panel (PDP). The PDP panel is supplied by others.
- The duplicate unit configuration shall be rated for 100% of the rated capacity.

8.0 Electrical Characteristic

The UPS shall meet the following electrical requirements:

Input voltage:

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230 VAC, $\pm 10\%$, 1 Phase, 50 Hz $+3\%$ -5% , without null

Output voltage:

Voltage: 230 VAC, $< 3\%$, 1 phase, 50 Hz $\pm 0.1\%$ (at customer terminals)

Power: 2KVA

Total harmonic distortion:

Less than 3%

Back-up time:

30 min., continuous load

Bypass transformer:

Type: Isolating, Stabilizer

230 VAC, $\pm 5\%$, 3 Phase, 50 Hz $\pm 1\%$, without null

Output: 230 VAC

Mounting: Free standing cabinet to be aligned with UPS

8.1 UPS Cabinet

- The UPS components shall be installed in suitable free standing floor mounted cabinets.
- The cabinets shall be constructed with multiple cable clamp facilities, completed

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with dust seal.

- The cabinets shall be bottom entries and shall be provided with adequate switch lighting and switch socket outlet facility.
- The cabinets shall be equipped with ventilation fans. The ventilation sizing circulation fan shall be based on maximum design temperature +50 °C for the case of HVAC failure condition.

Specification of the cabinets shall be as follows:

- Manufacturer:
- Dimensions: 800x2000 mm (DxH), width as required but not less than 800 mm
- Painted sheet steel according to RAL 7035
- Modular structure
- Internal door pocket for drawings
- IP 42 for indoor installation
- All doors shall be lockable by means of a common key.
- All wires shall be installed in cable duct
- Facilities on top for lifting with crane
- The cabinet design shall allow full and easy access to all components, connections and terminations. The cabinets shall be fully equipped/ wired (Frames and racks, terminal strips and rail, wire markers and ferrules, ...).
- Gland plates shall be provided within the enclosures for cable entrance.
- The components inside the cabinet shall be positioned in an optimum location for operation and servicing purposes.
- All wires shall be identified at each end according to equipment manufacturer's standard numbering system, using cable markers. Conductors shall be identified at each

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termination by the same tag as the terminal by wire sleeves made of oil resistance material. Conductor shall run from terminal to terminal without splices.

- Terminal strips shall be mounted and wired so that the internal and external wiring do not cross over the terminals.
 - The wirings shall be run in suitable wire ways. The wires shall be of extra flexible, standard copper, PVC insulated, 75 °C type.
 - Terminals shall be permanently marked with tags shown on corresponding drawings. Signal wiring shall be screened within the cabinets where necessary to avoid pick up of electrical noise.
 - For input and output signal wiring, screens shall be electronically continuous and the screen shall be connected to the appropriate cabinet instrument earth bar, if required.
 - Internal signal and power wiring shall meet BS 6231 and be flame retardant to BS 4066 Part 1 (IEC 60332 Part 1) or equivalent. Internal communication wiring shall meet BS 4808 Part 2, or equivalent, if used.
-
- Transformer and reactors used in the construction of the UPS shall be dry type air cooled and shall comply with IEC 60076, IEC 60289 and IEC 60146 standards.

The noise level measured at one meter from the UPS units shall not exceed 70 dBA at any load.

- The radio frequency interference shall be minimized and shall not exceed the value defined in relevant IEC recommendations.
- Separate molded case automatic circuit breakers shall be provided for the input AC supply to the rectifier, the bypass circuit supply and batteries. A molded case automatic circuit breaker shall also be

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provided on the output of the UPS system.

- One LCD electronic display module shall be mounted on the cabinet's front door to indicate the following data:
 - AC input voltage
 - DC input circuit
 - Battery charge and discharge currents
 - Output voltage
 - Output current
 - Output frequency

Indicating lights shall be provided to show at least the following operating statue:

- AC input supply available
- Rectifier on
- Inverter on
- Load on inverter
- Load on bypass
- Inverter- bypass synchronized

Alarms shall be provided for failures which affect the overall integrity of the UPS system. At least the following local alarms with indicating lights shall be provided:

- AC input supply failure
- Rectifier failure
- DC voltage low/ high
- DC earth fault

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- Battery discharging
 - Battery disconnected
 - Inverter failure
 - Inverter overload
 - Inverter over temperature
 - AC output voltage low/ high
 - Output frequency low/ high
 - Ventilation failure and/ or high temperature
- A graphic display shows operating modes of the UPS system (Inverter mode/ Bypass mode/ Manual (maintenance) mode) shall be provided on the UPS front door.

8.2 Rectifier/ Charger Construction

- The rectifier/ charger shall be a constant voltage self-regulating static type and shall include a sort start feature to gradually accept load when feeding discharge batteries.
- The rectifier shall be designed to continuously supply power to the inverter system and simultaneously supply DC power shall not be used to energize any load other than the inverter.
- The rectifier shall include provisions to automatically initiate high rate charging, here called equalize charging of batteries, upon restoration of AC power after an outage. The charging of batteries shall automatically reset to float charge, when the battery voltage reaches the nominal voltage.
- Means shall be provided to perform equalize charging of batteries manually. In such case, when the battery voltage reaches the

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nominal voltage, the charging mode shall reset automatically to float charge.

- The rectifier charging performance shall be in accordance with the requirements of the selected batteries, as specified by the battery supplier.
- The rectifier shall be sized to recharge the discharged batteries within 8 hours for Nickel- cadmium batteries, while supplying the full load of the inverter. The sizing of the rectifier shall be based on standard duty class 1 of IEC 60146.

8.3 Battery

- The battery shall be sealed-acid type.
- The UPS systems shall be equipped with suitable numbers of battery cells based on relevant output voltage and current of the UPS.
 - The battery cells shall be sized to supply the load for a period of 30 min. with charger in off condition.
- All the necessary accessories for batteries including jointing cables between cells and a set of standard maintenance and testing tools shall be provided.
- The batteries shall be installed in a separate cabinet. For small UPS units the batteries together with other components can be installed in one enclosure.
- Suitable sized two poles load break switch or circuit breaker shall be provided to connect the battery to the rectifier/ inverter.
- The battery cabinet shall be naturally ventilated in order to prevent the accumulation of flammable gases, if any. Where batteries are installed in the same enclosure as the other

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components, forced air ventilation shall be provided.

8.4 Inverter Construction

- The inverter shall control the output voltage and frequency to maintain synchronism with the bypass power supply up to the steady state limits.
- The inverter steady state output voltage regulation shall be $\pm 1\%$ when operating independently and shall not exceed $\pm 5\%$ when synchronized with bypass supply. In the event of instantaneous load changes of 100% rated output, the voltage variation shall not exceed $\pm 10\%$ and shall be restored to within the steady state limits in 0.1 second.
- For variation beyond state limits, the inverter shall revert to unsynchronized operation with internal control for voltage and frequency. The inverter shall automatically resume synchronous operation with the bypass supply when the voltage and the frequency of the bypass power supply returns within the specified tolerances.
- The inverter shall be equipped with automatic current limiting feature which prevents the output from exceeding the maximum safe rating of the inverter.
- The wave form of the output voltage shall be sinusoidal with total harmonic distortion not exceeding 5% for linear or non-linear loads.
- Means shall be provided to adjust the nominal output voltage of the inverter manually between 90% to 110% of the nominal output voltage.
- The inverter shall be capable of delivering sufficient short circuit current during the time required for the static transfer switch to

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transfer the short-circuited load to the bypass circuit. If the short circuit is not cleared by the downstream protective devices, the circuit breaker or switch fuse feeding the bypass circuit shall clear the fault.

- The inverter shall be capable to accept loads with crest factor of 3 to 1 without de-rating of the output. Crest factor is the ratio of the peak value of the current or voltage waveform to their RMS value.

9.0 Documentation

- Documentation of the UPS systems shall be provided in accordance with but not limited to the general requirements mentioned in this section.
- Vendor drawings shall be prepared by computer aided drafting (ACAD) system. Minimum four hard copies on papers and two soft copies on compact diskettes of all system drawings which shall be handed over to the CONTRACTOR/ EMPLOYER.
- All documents and drawings shall be in English language.
- The data sheet mentioned in “Annexes” section, shall be completed and submitted with the bid proposal by VENDOR.
- Following documents and drawings shall be prepared and submitted by VENDOR:
 - Recommended spare parts lists with their pertinent manufacturer's stock number for commissioning period and two years of operation
 - General arrangement drawings
 - Single line diagrams
 - Main and control circuit schematic diagrams
 - Test reports and performance curves
 - Cable and conduit entrance locations
 - Electrical and signal wiring diagram

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- Layout drawing for the cabinets indicating the location of all inside equipment
- Dimensional drawing for cabinets
- Bill of Material
- Manufacturer standard catalogues and drawings for quoted instrument including system manual, instruction, operating and maintenance manuals.
- Procedure for periodic tests by maintenance personnel
- Installation procedure
- Maintenance and troubleshooting procedure
- List and descriptions of all system error messages
- Termination schedule Electrical and Control Circuit diagram
- The conclusion document of the FAT signed by VENDOR, CONTRACTOR and EMPLOYER.
- Preventive maintenance and calibration routine schedules
- All other certificates including material certificate, ingress protection certificate, area classification certificate, ISO certificate and etc of the UPS system

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10.UPS quotation summery sheet

Following table shall be filled by vendor:

1	Name of project or plant	Golgohar Steel Project
2	Quantity	1 set
3	Tags	AC-UPS-Transfer line
4	Installation Location	Pump station
5	Maximum room temperature	50 C
6	Minimum room temperature	0 C
7	Required numbers of units (redundant (duplicate) or single unit)	Redundant (duplicate)
8	Rated capacity of each unit (kVA)	2 kVA
9	Nominal input voltage, number of phases and voltage variation	230 VAC $\pm 5\%$, 1 Phase,
10	Nominal input frequency and frequency variation	50 Hz $\pm 1\%$
11	Nominal DC voltage for the UPS	
12	DC voltage residual ripple	
13	DC voltage variation	
14	UPS output voltage and voltage variation	
15	UPS output numbers of phases	
16	UPS output frequency and frequency variation	
17	UPS output earthing system	
18	Output harmonic content	
19	Type of bypass isolating transformer	
20	Bypass transformer KVA rating	
21	UPS enclosure IP	
22	Mounting method, floor or wall mounted	
23	Cable entry from top or bottom	
24	Type of batteries	sealed -acid type
25	Battery standby time	30 min.
26	Battery internal resistance	
27	Capacity of UPS battery bank (Amp-Hr) at ... OC	
28	No. of cells in each UPS unit	
29	Battery housed in cabinet or rack	
30	Battery internal resistance	
31	Type of battery racks (Wooden or steel)	
32	Rectifier ampere rating (A)	
33	Inverter rating (KVA)	
34	Inverter overload capacity for one minute (KVA)	
35	Accessories	VENDOR attach list
36	Deviation from this specification if any	VENDOR attach list