

 NISOC	Development Plan of 28 Reservoirs / BIBI HAKIMEH Oilfield (EPC)								 
	Specification for Panels and Cabinets								
Contract No.: 053-073-9189	Project BH	Package 17	Contractor SM	Fac. 100	Disc. IN	Doc. Type SP	Ser. No. 0056	Rev. D04	Page 1 of 19

# Specification for Panels and Cabinets

## AFC

APPROVED FOR CONSTRUCTION

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NISOC Ref. Letter: 01/2294/139956

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Status:

- IDC: Inter-Discipline Check
- IFC: Issued For Comment
- IFA: Issued For Approval
- IFR: Issued for Review
- AFD: Approved For Design
- AFC: Approved For Construction
- AFP: Approved For Purchase
- IFI: Issued For Information
- AB-R: As-Built for COMPANY Review
- AB-A: As-Built –Approved




  
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## 1. INTRODUCTION

National Iranian South Oil Company (NISOC) plans to conduct an integrated project includes several sub-projects to preserve and increase production of Gachsaran oil fields located in south of Iran Khuzestan and Bushehr provinces as follow:



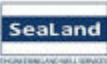

- 1) Revamping of Production and Desalting Units of Bibi Hakimeh 1&2
- 2) Fabrication & Installation a Preheater, Stripping Column and Related Equipment for Nargesi Production Unit

The purposes of first sub-project are equipping and extension of Bibihakime-2 desalting unit to achieve 110,000 SBPD desalted crude oil, and necessary modifications in Bibihakime-2 desalting & production units and Bibihakime-1 production unit so that the new plants will be able to process crude oil with 22% water cut and transfer waste water from Bibihakime-1 production unit to waste water treatment facilities in Bibihakime-1 desalting unit via installation of a none-metal pipe. Therefore, National Iranian South Oil Company (NISOC) has announced this project.

The purpose of second sub-project is crude oil sweetening in Nargesi plant by new design and necessary modifications in existing facilities. National Iranian South Oil Company (NISOC), on behalf of the National Iranian Oil Company (NIOC) is responsible to exploit oil and gas from onshore fields in the south district of Iran. According to management of planning & international affairs of National Iranian Oil Company (NIOC) pronouncement, H<sub>2</sub>S content and RVP specification of exported oil shall be in the specified allowable range; Accordingly, NISOC has decided to fulfil a project, investigating and probing required equipment and operational conditions to meet the desired crude oil specifications of sulphur content and RVP for Nargesi production units.

## 2. SCOPE

This specification defines general design criteria for panels and cabinets utilized in relevant equipment and systems of “Revamping of Production and Desalting Units of Bibi Hakimeh 1&2” and “Fabrication & Installation a Preheater, Stripping Column and Related Equipment for Nargesi Production Unit” sub-projects.

 NISOC	Development Plan of 28 Reservoirs / BIBI HAKIMEH Oilfield (EPC)								 ماشین سازی آراک MACHINE SAZI ARAK	 SEALAND ENGINEERING AND WELL SERVICES	 TR Consulting Engineers
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This specification defines the requirements for instrument panels and cabinets which contain electronic instrumentation. This includes cabinets located both in field areas and in buildings and is applicable to:

- System Cabinets
- Marshalling Cabinets
- Miscellaneous Instrument Cabinets
- Local Panels
- Unit Control Panels (UCPs)
- Etc.

### 3. DEFINITIONS

Within the context of this document, the following definitions are applicable

Owner/Client : National Iranian south oil company (NISOC)

Title : Development Plan of 28 Reservoirs/ BIBI HAKIMEH Oilfield (EPC)

Contractor : Mashin Sazi Arak/ Sealand Engineering and Well Services JV

Consultant : Tehran Raymand Consulting Engineers

Will: Is normally used in connection with the action by the “Company” rather than by a contractor, supplier or vendor.

May: Is used where a provision is completely discretionary



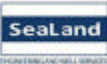
Should: Is used where a provision is advisory only.

Shall: Is used where a provision is mandatory.

### 4. ENVIRONMENTAL CONDITIONS

#### 4.1. Site Condition

All the environmental data used in this document and is to expected to be considered, shall be are obtained from “Process Design Basis for Bibi Hakimeh Production Unit No.1\_BH-17-SM

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100-PR-DB-0158”, “Process Design Basis for Bibi Hakimeh No.2\_BH-17-SM-100-PR-DB-0564” and “Process Design Basis for Nargesi\_BH-18-SM-100-PR-DB-0002”.

#### 4.2. Tropicalization

The field instruments shall be tropicalized to eliminate mildew, fungi and other detrimental effects of a tropical environment and dust, if needed. Electronic circuit boards shall be suitably protected against corrosion and humidity by applying a protective coating, where deemed necessary. Packaging shall be suitable for shipment and storage under tropical conditions.

#### 4.3. Ingress Protection

All field mounted equipment shall be suitable for the environmental conditions. Particular attention shall be paid to possible effects of corrosion, vibration, humidity, and extremes of temperatures.




### 5. CONFLICTS AND DEVIATIONS

Any conflicts between this specification and other applicable specifications, engineering standards, industry standards, codes, etc., shall be resolved in writing by the Owner or Owner's Representative.

### 6. REFERENCES

#### 6.1. Project Documents

- Instrument & Control/Safety System Design Criteria\_ BH-17-SM-100-IN-DC-0052
- Instrument Earthing Typical Diagram\_ BH-17-SM-100-IN-DG-0063
- Process Design Basis for Bibi Hakimeh Production Unit No.1\_BH-17-SM-100-PR-DB-0158
- Process Design Basis for Bibi Hakimeh No.2\_BH-17-SM-100-PR-DB-0564
- Process Design Basis for Nargesi\_BH-18-SM-100-PR-DB-0002

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## 6.2. References standards




The codes and standards which are listed below shall be followed as applicable:

### ➤ Iranian Petroleum Standards (IPS)

IPS-E-IN-190	Engineering & Design Standard for Transmission System
IPS-M-IN-190	Material & Equipment Standard for Transmission System
IPS-M-IN-250	Materials and Equipment Standard for Process Control System (PCS)
IPS-G-IN-220	Engineering and Installation Standard for Control Centers
IPS-G-IN-250	Engineering & Construction Standard for Process Control System (PCS)
IPS-G-IN-290	Engineering & Construction Standard for Programmable Logic Controllers (PLC)
IPS-M-IN-220	Material and Equipment Standard for Control Panels and System Cabinets
IPS-M-IN-290	Material and Equipment Standard for PLC
IPS-E-EL-110	Hazardous Area

### ➤ API Standards

RP 552	Transmission Systems
RP 554	Process Instrumentation and Control

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➤ British Standard (BS)




381C	Specification for Colors for Identification Coding and Special Purposes
4683	Electrical Apparatus for Explosive Atmospheres
6667	Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment
7671	Requirements of Electrical Installations, IEE Wiring Regulations

➤ EN Standards

50014	Electrical Apparatus for Potentially Explosive Atmosphere, General Requirements
50018	Electrical Apparatus for Potentially Explosive Atmospheres. Flameproof Enclosure 'd'
50020	Electrical Apparatus for Potentially Explosive Atmospheres. Intrinsic Safety 'i'
60529	Degrees of Protection Provided by Enclosures (IP Code)

➤ IEC Standards

60331	Tests for Electric Cables under Fire Conditions
60332	Tests on Electric and Optical Fiber Cables under Fire Conditions
60801	EMI and RFI Immunity
60079	Electrical Apparatus for Explosive Gas Atmospheres
60529	Degree of ingress protection
61508	Functional Safety of Electrical/Electronic/Programmable Electronic Safety Related Systems
61131	Programmable Controllers

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#### ➤ IEEE Standards

487 Recommended Practice for The Protection of Wire-Line  
Communication Facilities Serving Electric Supply Locations

EIA RS 232 Communication Specification

#### ➤ ISA Standards

S5.1 Instrumentation Symbols and Identification

S5.2 Binary Logic Diagrams for Process Operations

S5.3 Graphic Symbols for Distributed Control/Shared Display  
Instrumentation logic and computer systems

S5.4 Instrument Loop Diagrams





S18.1 Annunciators, Sequences and Specification

## 7. BASIC PRINCIPLES




### 7.1. Acronyms and Abbreviation

The following abbreviations are commonly used in this document:

ANSI	American National Standard institute
API	American Petroleum institute
ASTM	American Society for Testing and Material
AWG	American Wire Gauge
BS	British Standards
CENELEC	European Committee for Electrical Standardization
CPU	Central processing Units
CR	Control Room
dBA	Decibel Absolute

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DC	Direct Current
DCS	Distribute Control System
DPDT	Double Pole Double Throw
EEX	Europe Explosion Proof
EMI	Electromagnetic Interference
ESD	Emergency Shut Down
FAT	Factory Acceptance Test
FGS	Fire and Gas System
F.S.	Full Scale
I&C	Instrumentation and Control
IEC	International Electrotechnical Commission
I/O	Input/output
IP	Ingress Protection
IPS	Iranian Petroleum Standard
I.S.	Intrinsically Safe
ISA	International Society of Automation
ISO	International Standard Organization
JB	Junction Box
NACE	National Association of Corrosion Engineering
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NPT	National Pipe Thread
OD	Outside Diameter
LED	Light Emitting Diode
P&ID	Piping and Instrumentation Drawing
PCS	Process Control System
PLC	Programming Logic Controller
RFI	Radio Frequency Interference
RTD	Resistance Temperature Detector

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SI	System International of Units
SPDT	Single Pole Double Throw
UPS	Uninterruptible Power Supply
UV	Ultra Violet

## 7.2. Units of Measurement

Generally, International System of units (SI) shall be used. All dimensions and ratings shall be metric. Except for the temperature, which shall be in degrees Celsius instead of Kelvin, and for pipes and fittings threads, which shall be in inches of NPT.

Variable	Units
Temperature	Celsius degree (°C)
Pressure Relative	Psig or Barg
Pressure Absolute	PsiA or barA
Level	m or mm, % of range
Flow	Liquid kg/h or m /h Gas or vapor m3/h or Sm3/h(l) or kg/h Air or nitrogen m3/h or Sm3/h(l) or kg/h
Analysers	pH, molar%, ppm % LEL
Density Liquid Gas	Kg/m3 kg/m3.Or.kg/Sm3(l)

## 8. GENERAL REQUIREMENTS




### 8.1. Electrical Power Supply

110 VAC, 50Hz uninterrupted power shall be used for the supply of control systems, local panels, Printers, monitors, PC-s etc.

Control system power supply shall be in accordance with IPS-M-IN-290. The system power supply shall be provided to operate the PLC's processor. The power supply shall be in redundant hot stand-by configuration to provide power directly to the system chassis backplane.

Electric supply (UPS Supported): 110 V AC, 50 Hz

Electric supply (Non-UPS Supported): 230 V AC, 50 Hz

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Electric measurement signal:	4 to 20 mA (DC)
Instrument Discrete input:	Supervisory and system control voltage
Electrical interface discrete input:	24 V DC
Solenoid control signal:	24 V DC
Electrical interface discrete output:	24 V DC
Relays:	24 V DC

## 8.2. Electrical Hazardous Classification

All electrical devices, electronic instrumentation and wiring installation shall be suitable for installation in the relevant electrical area classification.




# 9. PANELS AND CABINETS TECHNICAL SPECIFICATION

## 9.1. General Requirements




Normally, the panels and cabinets shall be a free-standing sheet steel cubicle with indicating and manual control devices on the front surface. Control panel assemblies shall include all features and devices required to provide complete coordinated, self-contained system.

Overall cabinet dimensions shall be 2100mm high (including 100 mm plinth) x 800mm wide and 800mm deep with front and rear removable and lockable hinged doors. Cabinet protection class shall be IP 42 for indoors and IP54 for outdoors. For outdoor service an appropriate removable canopy may be needed.

- Cabinets to be mounted on sub – floor mountings suitably designed to withstand normal plant vibrations.
- Cable access shall be bottom entry via suitable cable clamping mechanisms or gland plates.
- 20% free space shall also be considered for cabinets (IPS-M-IN-220).
- All incoming and outgoing connections shall be connected to terminal blocks located in convenient positions near the gland plate (Min. 30 cm above the plate) for the incoming cables. Terminal blocks shall also be provided for interconnections between panel sections. No group of terminal blocks shall be used for more than one service class.

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- All terminals shall be screw terminals for conductor up to 2.5mm<sup>2</sup>, based on double terminal blocks with cross wiring.
- All doors shall be the lift off type, and lockable. Keys shall be identical for cabinets or panels of any one type located in the same area. All doors shall be capable of opening at least 90 degrees, and shall be equipped with mechanical stops suitable for the location.
- The inside of each door shall be equipped with a pocket suitable for holding A4 size documents
- Control room panels shall be of front and rear access type.
- The armoring will be secured at the base of the cabinet or panel and the gland plate will be used for sealing purposes only.
- Panels shall also be equipped with air fans for continuous air circulation (with independent circuit breaker), Louvers and removable anti-dust filters. Normally, Fan shall be installed at upper part of the door while the louvers and filter shall be installed at lower part of the door.
- Construction of the control panel rear, front and top shall be made by cold rolled steel (as per TS8 Enclosure of RITTAL).
- Each section of panels shall have 230V AC, 50 Hz socket for portable test instruments use. Only one 230 VAC feeder will be provided for all the 230 VAC consumers (Lamps, heater, sockets).
- Panels shall be closed type and access to inside shall be through front, side or back-mounted door(s).
- The spare capacity of control systems shall be considered according to IPS-M-IN-220.
- Cover plates shall close void spaces.
- The power supplies of the process interface cabinets (PCS, ESD, F&G) shall be redundant.
- Cabinets' finish to be smooth. They shall be painted according to IPS standard any other painting shall be subject to Owner's approval.
- Each section shall have removable lifting lugs designed for lifting without deforming the cabinet.
- Any equipment terminal having voltage in excess of 50 V shall be covered and signed.

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- Marshaling facilities (marshaling cabinet) shall be allocated in rear side of the system cabinets.

All panel front mounted devices or internal mounted devices shall have visible labels providing the plant operator with following data:

- Tag number
- Service description
- The engraving for these labels shall be black on a white background.

## 9.2. Internal Design Requirements

Electronic equipment may be located in fixed racks, on rails, or on swing frames if more convenient to utilize space. Equipment shall be arranged to facilitate access for adjustment or maintenance. All equipment shall be arranged to ensure the flow of cooling air, where necessary. Where separate power supply units (PSU's) are included within the panel these shall be located to minimize heat flow over other electronic components.




Incoming field terminals shall be arranged in vertical columns, unless agreed otherwise. All field cables together with the allocation of signals to cable cores shall be defined by Contractor. Where the Instrument panel also contains terminals for marshaling of signals then the connections to these shall also be defined by Supplier.

Where interposing relays are to be supplied within a panel or cabinet they shall be located in a separate area of the panel. Relay contacts shall be rated as a minimum at 24VDC @5A unless otherwise agreed.

## 9.3. Mounting

Each piece of equipment shall be so mounted and wired that structural member do not prevent access, and that removal and replacement may be accomplished without interruption of service to adjacent equipment.

All equipment mounted inside the structure shall be so located that terminals and adjacent devices are readily accessible without the use of special tools. Terminal markings shall be clearly visible.

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Doors shall be equipped with concealed hinges, latch and chromium T or L handles with key locks. Top and bottom latches shall be operated by rods (chains are not acceptable).

No equipment shall be mounted on the back of the doors or in such a manner as to restrict this means of access.

#### 9.4. Painting

All steel work shall be cleaned by removing all oil, dirt, and grease; it shall then receive a phosphate or approved equivalent treatment.

Following this surface treatment. A coat or rust resistant primer paint shall be applied to all steel surfaces.

The color of final coat of exterior paint applied on the control panels shall be RAL 7035.

All panels, cubicles, etc. shall be provided with hinged doors, which shall have provision for padlocking.

#### 9.5. Panel Wiring

Terminal blocks shall be of the modular screwed type, solder less type, designed to snap on steel mounting tracks, rated for 600V (minimum) and be fitted with marking tags.

Terminal modules for circuits carrying power supplies shall be rated for 600V, 25Amp minimum.

Terminal modules for circuits operating 110V or greater shall be rated for 600V, 10Amp minimum.




Terminal modules for operation at less than 110V shall be rated 250V, 10Amp minimum.

All wiring shall pass the vertical flame test described in ASTM D2633 section 38 or IEC 332 equivalent for PCS.

Wiring in general for ESD shall be fire resistance to IEC 60331. All inter panel wiring within the building shall be via a standard pre-fabricated plug and socket system.

Ferrules identified with appropriate wire numbers shall be provided at both ends of each wire within panels.

All cabinet and panel terminals shall be rail mounted, and of the screw clamp type, unless otherwise specified. All terminals for field cables shall have quick disconnect capability e.g. via knife-edge disconnect contacts, to enable isolation of field signals from the system

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Wire size shall be selected to suit the load current, but for general services the wire area shall be 1 mm<sup>2</sup> as minimum. For all power and solenoid valves cross section of wires shall be 2.5 mm<sup>2</sup> as minimum. Insulation rating shall be not less than 600V RMS.

The insulation color of panel internal wiring shall be as follows:

- AC live: Brown
- AC neutral: Blue
- Safety ground: Green/Yellow
- Instrument ground: Green
- DC positive: Red
- DC negative: Black
- IS signals: Light blue
- NIS signals: Grey
- All others As per VENDOR's standard (subject to owner approval prior to manufacturing)




All terminals, and terminal groups, shall be individually identified. This shall be achieved using identifiers and markers supplied by the terminal manufacturer. Markers shall have black lettering on a white background.

Where stranded wire is employed, wire ends shall be terminated in twin grip, insulated crimp connectors. Crimps shall be selected to suit the wire size, and shall be secured by means of an approved crimping tool. Not more than one wire shall be terminated at any crimp. Only one crimp shall be inserted into any one terminal. In cases where solid core wiring is required crimps shall not be employed.

Where there is a need for parallel wire connections this shall be achieved by the use of combs or shorting bars provided by the terminal manufacturer.

All wiring shall be permanently identified by sleeve type markers, correctly sized for the wire, and attached prior to crimping. Lettering of inserts shall be black on a white background.

Each wire end shall be identified with both source and destination. All lettering or numbering shall read from left to right. Where the wiring is run vertically, identifiers shall read from below (left) to above (right).

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Wiring within panels shall be routed via slotted plastic ducts/trucking. This shall be fully supported over its complete length, and secured to the cabinet or panel structure with stud bolts or screws. Ducts with the exception of field multi-cores, shall also be provided for cables entering the cabinet or panel. To facilitate removal, when necessary, the length of ducts covers shall not exceed 1m.

Ducts containing IS cables shall be colored light blue.

A minimum distance of 50mm shall be maintained between terminals and ducts to ensure that wire markers are fully visible.

Wiring or cables inside wire ducts shall be supported or secured along the run length.

On panel completion the ducts shall not be more than 60% filled.

Where clusters of wires leave the ducts, they shall be bundled together using Spiro wrap, or similar, and suitably supported. Bundles shall not be routed near sharp surfaces. Where wiring or cables pass through access holes then glands or protective grommets shall be used.

All incoming and outgoing connections shall be connected to terminal blocks located in convenient positions near the gland plate for the incoming cables. Terminal blocks shall also be provided for interconnections between panel sections. No group of terminal blocks shall be used for more than one service class.

The incoming power supply to each panel shall be through molded case circuit breakers in such a manner that the supply to any one panel can be isolated from the remaining panels.

DC and AC voltage supplies shall be segregated. Moreover, all wiring shall be segregated according to voltage levels.




The internal cabinet wiring must be carefully protected against mechanical damage and laid out to be immune to interference voltages.

The wiring and the cable ways shall use cable ducts as far as possible and be separated on the basis of EExi and non-Ex signals.

#### 9.6. Glanding and Termination

All cables shall be equipped with suitable glands at both ends using approved glands.

Terminations shall be in accordance with IPS standards.

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## 9.7. Earthing

A 25mm×6mm minimum size copper ground bus shall extend along the length of each panel. Approved compression type terminals shall be provided at each end of the ground bus for connection to the station ground grid.

Bolted joints, splices, and taps (except control and instrument circuit ground connections) to the ground bus shall be made with not less than two bolts each.

Vendor shall fully describe the preferred method for grounding power, signals and signals shields in the system proposal. In particular, the Vendor shall indicate the effect of equipment installation in different locations on the grounding design.

The conductive part of instrumentation equipment installed in the ER and CCR building shall be connected to a specific earth loop which is connected to the main earth loop through existing earth dispatchers.

In order to avoid electronic noise and interference, the instrument earth shall remain totally isolated from the electrical protective earth. The impedance of the instrument earth shall be less than 1 ohm.

Three separate and independent earthing systems shall be provided as required:

Chassis (electrical) earth Bonded to the structure and utilized for electrical safety of metal enclosures and chassis on all instrument and electrical components.

Instrument (I.S.) earth Insulated from the structure and other metal work and utilized for I.S. instrument signal screens.




Instrument (N.I.S.) earth Insulated from the structure and other metal work and utilized for Non I.S. instrument signal screens.

Screening shall be grounded at the control panel and insulated in the field.

Three separate and independent earths shall be provided for protective electrical earth (PE), instrument IS earth (ISE) and instrument NIS earth (IE).

## 10. NAMEPLATES AND LABELS

All cabinets and panels shall be furnished with nameplates front and rear. These shall show the cabinet/panel identification number and service. Similar nameplates shall be provided for each cabinet/panel door, when removable.

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All individual instruments, both front and rear of cabinet/panel, shall be provided with nameplates showing instrument tag number and service. Nameplates shall also be provided to identify non tagged devices, groups of devices, and to assist operating and maintenance personnel, where necessary.