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| **طرح نگهداشت و افزایش تولید 27 مخزن** | | | | | | | |
| **CALCULATION NOTE FOR DC CHARGER SYSTEM - EXTENSION OF BINAK B/C MANIFOLD**  **نگهداشت و افزایش تولید میدان نفتی بینک** | | | | | | | |
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|  |  |  |  |  |  |  |
| D02 | May. 2023 | AFD | H.Shakiba | M.Fakharian | A.M.Mohseni |  |
| D01 | Mar. 2023 | IFA | H.Shakiba | M.Fakharian | M.Mehrshad |  |
| D00 | Sep. 2022 | IFC | H.Shakiba | M.Fakharian | M.Mehrshad |  |
| **Rev.** | **Date** | **Purpose of Issue/Status** | **Prepared by:** | **Checked by:** | **Approved by:** | **Client Approval** |
| **Class: 2** | | **Client Doc. Number: F0Z-709390** | | | | |
| **Status:** | **IDC: Inter-Discipline Check**  **IFC: Issued For Comment**  **IFA: Issued For Approval**  **AFD: Approved For Design**  **AFC: Approved For Construction**  **AFP: Approved For Purchase**  **AFQ: Approved For Quotation**  **IFI: Issued For Information**  **AB-R: As-Built for Client Review**  **AB-A: As-Built –Approved** | | | | | |

**REVISION RECORD SHEET**

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| **PAGE** | **D00** | **D01** | **D02** | **D03** | **D04** |  | **PAGE** | **D00** | **D01** | **D02** | **D03** | **D04** |
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| **3** | X |  |  |  |  | **53** |  |  |  |  |  |
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| **7** | X | X |  |  |  | **57** |  |  |  |  |  |
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1. **INTRODUCTION**

Binak oilfield in Bushehr province is a part of the southern oilfields of Iran, is located 20 km northwest of Genaveh city.

With the aim of increasing production of oil from Binak oilfield, an EPC/EPD Project has been defined by NIOC/NISOC and awarded to Petro Iran Development Company (PEDCO). Also PEDCO (as General Contractor) has assigned the EPC-packages of the Project to "Hirgan Energy - Design and Inspection" JV.

As a part of the Project, construction of well location, access road, wellhead facilities (with electric power supply) for W007S shall be done. In addition, construction of new flowline from aforementioned well location to Binak B/C unit (with extension of relevant manifold) are in the Project scope of work.

**GENERAL DEFINITION**

The following terms shall be used in this document.

|  |  |
| --- | --- |
| CLIENT: | National Iranian South Oilfields Company (NISOC) |
| PROJECT: | Binak Oilfield Development – Construction of Well Location, Wellhead Facilities, Electrification Facilities, Flowlines for W007S and Extension of Binak B/C Manifold |
| EPD/EPC CONTRACTOR (GC): | Petro Iran Development Company (PEDCO) |
| EPC CONTRACTOR: | Joint Venture of : Hirgan Energy – Design & Inspection(D&I) Companies |
| VENDOR: | The firm or person who will fabricate the equipment or material. |
| EXECUTOR: | Executor is the party which carries out all or part of construction and/or commissioning for the project. |
| THIRD PARTY INSPECTOR (TPI): | The firm appointed by EPD/EPC CONTRACTOR (GC) and approved by CLIENT (in writing) for the inspection of goods. |
| SHALL: | Is used where a provision is mandatory. |
| SHOULD: | Is used where a provision is advisory only. |
| WILL: | Is normally used in connection with the action by CLIENT rather than by an EPC/EPD CONTRACTOR, supplier or VENDOR. |
| MAY: | Is used where a provision is completely discretionary. |

1. **Scope**

This specification describes the practices that shall be employed and the Standards that will be required to be met for the DC charger and batteries.

1. **REFERENCES AND STANDARDS**

* IEC 60478 Stabilized Power Supplies, DC Output
* IEC 60623 Secondary Cells and Batteries Containing Alkaline or Other non-acid electrolytes Vented Nickel-Cadmium Prismatic Rechargeable Single Cells
* IEEE 1115 IEEE Recommended Practice for Sizing Nickel-Cadmium Batteries for Stationary Applications
* IPS-E-EL-100 Engineering Standard for Electrical System Design
* IPS-M-EL-174 Material and Equipment Standard for Battery & Battery Charger

1. **DC SIZING ASSUMPTIONS**

The bases of the DC charger calculation performed in this document are summarized as below:

| **Table 1: DC UPS Characteristics for Manifold** | |
| --- | --- |
| **Item** | **24 VDC (F&G)** |
| Input AC Voltage | 440/400/380 V=10% |
| Input AC Voltage frequency | 50Hz=5% |
| DC system Nominal Voltage | 24 VDC |
| DC system Voltage Limits | 22.88 VDC ~ 29.28 VDC |
| Overall Aging Factor | 1.1 |
| Design Margin Factor | 1.1 |
| Battery Backup Time | 24 hours + 5 Min. |
| Battery Configuration | 2 x 50% |
| Charger Configuration | 2 x 100% |
| Battery Type | Ni-Cd (SBLE) |
| Nominal Cell Voltage | 1.2 V/Cell |
| Float Charge Voltage | 1.42 V/Cell |
| Fast Charge Voltage | 1.46 V/Cell |
| End Cell Voltage | 1.144 V/Cell |

1. **DC-UPS Load PROFILE**

The load list of 24VDC F&G which has been derived from instrument discipline is as follow (I&C power consumption summary-extension of BINAK b/c manifold- BK-W007S-PEDCO-110-IN-LI-0007).

|  |  |  |  |
| --- | --- | --- | --- |
| **Table 2: F&G Power Consumption** | | | |
| **Item** | **Description** | **Unit Power Consumption (KW)** | **Back Up Time** |
| 1 | F&G System | 1.776 | 24 hr |
| 2 | 3.12 | 5 Min |

1. **DC LOAD CONSUMPTION**

Total DC consumption of the F&G is calculated at the bottom of the table.

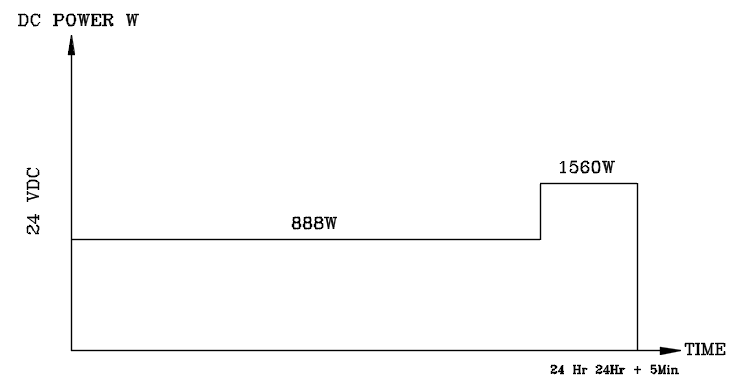
| **Table 3: Total DC Consumption** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **DC System Tag** | **Time** | **Consumption in Normal Condition** | | **Consumption in Worst Case Condition** | |
| **Power (W)** | **Current (A)** | **Power (W)** | **Current (A)** |
| **Manifold-24-CHG-001 &**  **Manifold-24-CHG-002** | 24 hr | 888 | 37 | - | - |
| 5 Min | 1560 | 65 |

**Note:** According to Item 5.3 of IPS-M-El-174(2), the DC power supply shall consist of two similar thyristor type chargers each rated for 100 percent of rated load, two battery banks each rated for 50 percent of the rated load and one DC distribution panel. Therefore to calculate the capacity of battery bank half of demand load shall be considered.

1. **DC DUTY CYCLE**

Duty cycle diagram shows the total load at any time during the cycle is an aid in the analysis of the duty cycle. The details of the consumptions have been listed in separate Tables of Attachment #3 for 24VDC.

* 1. **Battery Duty Cycle Diagram (F&G)**



1. **CALCULATION of Batteries**
   1. **Number of Cells**

With considering nominal DC link voltage equal to 24VDC, the No. of cells is obtaining as below:

No. of cells = Nominal DC Link Voltage /

= 24 / 1.2 ~ 20 cells Final discharge cell voltage

Note: The exact number depends on the type of battery and will be determined by vendor.

* 1. **Battery Selection**

Overall rating of batteries shall be so chosen to provide the load current for 24 hours+5 min for 2 x 50% load, according to project specification.

To calculate battery capacity, the following equation can be used.

(1)

Where:

C: Rated Capacity (Ah)

L: Maintenance Factor (1) (Design Margin 1.1 & Aging Factor 1.1)

n: Number of Loads

I: Load Current

T: Battery Discharge Time

In equation (1), T is the same 24 hours for 50% loads. Therefore:

(2)where, *“I”* is the total current consumption. Using the values of the battery duty cycle diagram presented in clause 7 which obtained from attachment #1, battery capacity can be calculated. The battery calculation is performed by using SAFT BaSics Software. In addition according to Attachment #1, the selected battery set for 24 VDC system is 2 sets of (1×20×SBLE 1350 AH)

The stand proposal proposed in Attachment #2 also. It should be noted that this is only typical and the battery layout can be configured according to the space which is available using the adopted stand structure.

1. **BATTERY CHARGER RATING**

In the worst condition when batteries are completely discharged, the charger should provide power for DC loads and charge the batteries at the same time. The total size of battery chargers shall meet the following equation:

Battery charger current (A) = IC=LLc+2\*(0.2\*C5)

Where:

C5: Battery Capacity (ampere-hours)

LLc: Continuous Dc Load (in amperes)

Battery Charger Rating for 24 VDC is as follow:

According to table 3, LLc is 2×37=74

IC = 74+2 x (0.2x1350) = 614.4

PC = 614.4 x 24/ 0.9 ≈ 16.39 Kw

1. **CONCLUSION\***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Item** | **Charger** | | **Battery** | | **Inverter** | |
| Configuration | Size | Config | Cell No.x Cap. | Config | Size |
| **Manifold-24-CHG-001**  **&**  **Manifold-24-CHG-002** | 2x100% (Redundant) | 615 A | 2x50% | 1 x (20 x SBLE 1350) | - | - |

\*Note: Final calculations shall be provided and/or verified by selected vendor as per type and characteristics of equipment.

1. **REFERENCE DOCUMENTS**

|  |  |
| --- | --- |
| **Document No.** | **Title** |
| BK-GNRAL-PEDCO-000-EL-SP-0005 | Specification for DC Charger |
| BK-W007S-PEDCO-110-IN-LI-0007 | I&C Power Consumption Summary - Extension of Binak B/C Manifold |

1. **ATTACHMENTS**

**ATTACHMENT A- Native file of 24 VDC Calculation**

**ATTACHMENT 1- Battery & Stand Sizing Report for 24 VDC**

**ATTACHMENT 2- Battery Stand Proposal for 24 VDC**

**ATTACHMENT 3- 24 VDC Load Consumption List for F&G**

**ATTACHMENT 4- Catalogue**

**ATTACHMENT 5- Battery Data Sheet for 24 VDC**