|  |
| --- |
| **طرح نگهداشت و افزایش تولید 27 مخزن** |
| **CALCULATION NOTE FOR UPS SYSTEM** **نگهداشت و افزایش تولید میدان نفتی بینک** |
| D04 | May. 2023 | AFD | H.Shakiba | M.Fakharian | A.M.Mohseni |  |
| D03 | Jul. 2022 | IFA | H.Shakiba | M.Fakharian | M.Mehrshad |  |
| D02 | Apr. 2022 | IFA | H.Shakiba | M.Fakharian | M.Mehrshad |  |
| D01 | Dec. 2021 | IFA | H.Shakiba | M.Fakharian | M.Mehrshad |  |
| D00 | Nov. 2021 | 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-709010** |
| **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**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **PAGE** | **D00** | **D01** | **D02** | **D03** | **D04** |  | **PAGE** | **D00** | **D01** | **D02** | **D03** | **D04** |
| **1** | X | X | X | X | X | **51** |  |  |  |  |  |
| **2** | X | X | X | X | X | **52** |  |  |  |  |  |
| **3** | X | X |  |  |  | **53** |  |  |  |  |  |
| **4** | X | X |  |  |  | **54** |  |  |  |  |  |
| **5** | X | X |  |  |  | **55** |  |  |  |  |  |
| **6** | X | X | X | X |  | **56** |  |  |  |  |  |
| **7** | X | X | X |  | X | **57** |  |  |  |  |  |
| **8** | X | X | X | X | X | **58** |  |  |  |  |  |
| **9** |  |  |  | X | X | **59** |  |  |  |  |  |
| **10** |  |  |  |  |  | **60** |  |  |  |  |  |
| **11** |  |  |  |  |  | **61** |  |  |  |  |  |
| **12** |  |  |  |  |  | **62** |  |  |  |  |  |
| **13** |  |  |  |  |  | **63** |  |  |  |  |  |
| **14** |  |  |  |  |  | **64** |  |  |  |  |  |
| **15** |  |  |  |  |  | **65** |  |  |  |  |  |
| **16** |  |  |  |  |  | **66** |  |  |  |  |  |
| **17** |  |  |  |  |  | **67** |  |  |  |  |  |
| **18** |  |  |  |  |  | **68** |  |  |  |  |  |
| **19** |  |  |  |  |  | **69** |  |  |  |  |  |
| **20** |  |  |  |  |  | **70** |  |  |  |  |  |
| **21** |  |  |  |  |  | **71** |  |  |  |  |  |
| **22** |  |  |  |  |  | **72** |  |  |  |  |  |
| **23** |  |  |  |  |  | **73** |  |  |  |  |  |
| **24** |  |  |  |  |  | **74** |  |  |  |  |  |
| **25** |  |  |  |  |  | **75** |  |  |  |  |  |
| **26** |  |  |  |  |  | **76** |  |  |  |  |  |
| **27** |  |  |  |  |  | **77** |  |  |  |  |  |
| **28** |  |  |  |  |  | **78** |  |  |  |  |  |
| **29** |  |  |  |  |  | **79** |  |  |  |  |  |
| **30** |  |  |  |  |  | **80** |  |  |  |  |  |
| **31** |  |  |  |  |  | **81** |  |  |  |  |  |
| **32** |  |  |  |  |  | **82** |  |  |  |  |  |
| **33** |  |  |  |  |  | **83** |  |  |  |  |  |
| **34** |  |  |  |  |  | **84** |  |  |  |  |  |
| **35** |  |  |  |  |  | **85** |  |  |  |  |  |
| **36** |  |  |  |  |  | **86** |  |  |  |  |  |
| **37** |  |  |  |  |  | **87** |  |  |  |  |  |
| **38** |  |  |  |  |  | **88** |  |  |  |  |  |
| **39** |  |  |  |  |  | **89** |  |  |  |  |  |
| **40** |  |  |  |  |  | **90** |  |  |  |  |  |
| **41** |  |  |  |  |  | **91** |  |  |  |  |  |
| **42** |  |  |  |  |  | **92** |  |  |  |  |  |
| **43** |  |  |  |  |  | **93** |  |  |  |  |  |
| **44** |  |  |  |  |  | **94** |  |  |  |  |  |
| **45** |  |  |  |  |  | **95** |  |  |  |  |  |
| **46** |  |  |  |  |  | **96** |  |  |  |  |  |
| **47** |  |  |  |  |  | **97** |  |  |  |  |  |
| **48** |  |  |  |  |  | **98** |  |  |  |  |  |
| **49** |  |  |  |  |  | **99** |  |  |  |  |  |
| **50** |  |  |  |  |  | **100** |  |  |  |  |  |

**CONTENTS**

[1.0 INTRODUCTION 4](#_Toc135212930)

[2.0 GENERAL DEFINITION 4](#_Toc135212931)

[3.0 Scope 5](#_Toc135212932)

[4.0 NORMATIVE REFERENCES 5](#_Toc135212933)

[4.1 Codes & Standards 5](#_Toc135212934)

[4.2 The Project Reference Documents 5](#_Toc135212935)

[4.3 The Project Documents 5](#_Toc135212936)

[4.4 Environmental Data 5](#_Toc135212937)

[4.5 Language & System of Units 5](#_Toc135212938)

[5.0 Design Basis 6](#_Toc135212939)

[6.0 UPS SIZING 7](#_Toc135212940)

[**6.1** **AC LOAD PROFILE** 7](#_Toc135212941)

[**6.2** **Battery Sizing Calculation** 7](#_Toc135212942)

[**6.3** **UPS Battery Charger Calculation** 8](#_Toc135212943)

[7.0 Conclusion 8](#_Toc135212944)

[8.0 Attachments 9](#_Toc135212945)

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, a New Gas Compressor Station (adjacent to existing Binak GCS) shall be constructed to gather of 15 MMSCFD (approx.) associated gases and compress & transfer them to Siahmakan GIS.

1. **GENERAL DEFINITION**

The following terms shall be used in this document.

|  |  |
| --- | --- |
| CLIENT:  | National Iranian South Oilfields Client (NISOC)  |
| PROJECT: | Binak Oilfield Development – Surface Fcilities; New Gas Compressor Station |
| 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. (Vendor Shall Be From AVL) |
| 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 UPS sizing of the required AC power for Instrument and telecomm
system.

1. **NORMATIVE REFERENCES**

## Codes & Standards

* IPS-M-EL-176(2) Material & Equipment Standard for Uninterruptible Power Supply System (UPS)
* IPS-E-EL-100 Engineering Standard For Electrical System Design (Industrial And Non-Industrial)

## The Project Reference Documents

* IEC 62040-3 Uninterruptible power systems-methods of specifying the performance and test requirements
* IEC 60146 Semiconductor Converters
* IEC 60529 Classification of degrees of protection provided by enclosures
* IEEE 1115 Recommended practice for sizing Nickel-Cadmium batteries for stationary applications

## The Project Documents

* BK-GNRAL-PEDCO-000-PR-DB-0001 Process Basis Of Design
* BK-GNRAL-PEDCO-000-EL-DC-0001 Electrical System Design Criteria
* BK-GNRAL-PEDCO-000-EL-SP-0003 Specification For UPS System
* BK-GCS-PEDCO-120-IN-LI-0007 I&C Power Consumption

## Environmental Data

Refer to " Process Basis of Design; Doc. No. BK-GNRAL-PEDCO-000-PR-DB-0001".

## Language & System of Units

All documentation, drawings, data, etc. furnished by the manufacturer shall be in English. SI metric system of measurement shall be used except for pipe and pipe fitting sizes, flange ratings and nozzle dimensions in which inch will be used.

1. **Design Basis**

|  |
| --- |
| **Assumptions for Battery Sizing for AC UPS** |
| Input AC Voltage | 400VAC (3Ph) |
| Input AC Voltage frequency | 50Hz ± 5% |
| AC System Nominal Voltage | 110 VAC ± 1% |
| AC System Voltage Limits | 104.50 VAC ~ 134.20 VAC |
| Overall Aging Factor | 1.1 |
| Design Margin Factor | 1.1 |
| Battery Backup Time | 2 hours |
| Battery Configuration | 2 x 100% |
| Battery Rate | M rate |
| Max. Temperature | 52 oC |
| Min. Temperature | 5 oC |
| Design Temperature | + 20 oC |
| Power Factor | 0.85 |
| Inverter Efficiency | 0.9 |
| DC Link Voltage (\*) | By Vendor |
| Min. System Voltage ( % ) | 10 % |
| Max. System Voltage ( % ) | + 21 % |
| Charger Configuration | 2 x 100% |
| Battery Type | Ni-Cd (SBM) |
| Nominal Cell Voltage | 1.2 V/Cell |
| Battery Float Voltage | 1.4 V/Cell |
| Battery Boost Voltage | 1.44 V/Cell |
| Battery End Voltage | 1.136 V/Cell |
| Battery Equalize Voltage | 1.45 ~ 1.55 V Cell |
| Battery Initial Voltage | 1.65~1.75 V Cell |
| Battery Cell Number | 92 Cells Each Bank |

 **(\*) Shall be finalized by vendor.**

1. **UPS SIZING**

The total required AC power for control and telecomm system which shall be supplied by UPS system in Binak oilfield in Bushehr province is calculated according to the following data. The output rating of UPS should be 110 VAC.

* 1. **AC LOAD PROFILE**

According to I&C Power Consumption Summary Doc No ”BK-GCS-PEDCO-120-IN-LI-0007-”, total required AC power for control system has been shown in table (1):

D04

|  |
| --- |
|  Table (1): AC Load Consumption of instrument & control systems |
| **DESCRIPTION** | **TOTAL POWER (KW)** |
| Total Power Consumption  | 34 |

By considering power factor 0.85, output apparent power will be:

$S=\frac{34}{0.85}=40 KVA$

This consumption is provided by the normal AC supply source through rectifier. Battery does not interfere in normal operating condition. When normal AC supply source fails, then the UPS makes use of its battery to provide the power to loads.

Figure (1) shows the AC load profile for UPS system.

Power (KW)

34

Time (min.)

60

120

#

#

D04

Figure (1): AC Load Profile

* 1. **Battery Sizing Calculation**

Regarding to the specification for UPS System, the size of battery has been calculated at 100% capacity for each battery bank. Based on IEEE 1115 battery sizing are as follows:

Selected Batteries Acc to Attachment-1: SAFT Software Calculation report is 92-Cell SBM1220

* 1. **UPS Battery Charger Calculation**

Based on IPS-M-EL-174(2) standard, the station battery charger should be sized in accordance with the following formulas;

D04

$N=\frac{V\_{DC nominal}}{V\_{Cell nominal}} Formula (1)$

$N=\frac{110 V}{1.2 V/Cell}≅92 Cells$

$I\_{DC Inverter }=\frac{S\_{out}×P\_{f}}{V\_{DC min}×ƞ} Formula (2)$

$$ƞ=Efficiency of Inverter$$

$I\_{DC Inverter }=\frac{40000×0.85}{92×1.136×0.9}=361.46 A$

$I\_{Charger}=I\_{DC Inverter }+0.2×C\_{s} Formula (3)$

$I\_{Ch}=Charger Required Current$

$N=Number of Cells (Each battery Bank)$

$C\_{s}=Battery Capacity (Ah)$

$I\_{Ch}=361.46+0.2×1220=605.46 A$

1. **Conclusion**

The final result of battery / charger systems is calculated as follows:

Number of battery cells : 2 $×$ 92

Cell Battery Ah : 2 $× $92 $×$ 1220 Ah

Charger rated current : 2 $×$ 606 A

Note: The final sizes of UPS, battery Ah and quantity of cells shall be recalculated by vendor according to the final data. In addition vendor shall consider the minimum voltage 93V for UPS system.

1. **Attachments**

**ATTACHMENT A- Native file of 110 VAC Calculation**

D04

**ATTACHMENT B- I&C Power Consumption Summary**

**ATTACHMENT 1- Catalogue**

**ATTACHMENT 2- Battery & Stand Sizing Report for 110 VAC**

**ATTACHMENT 3- Battery Stand proposal for 110 VAC (92xSBM1220+EQ-1US-SU\_\_2)**

**ATTACHMENT 4- Battery Stand proposal for 110 VAC (92xSBM1220+EQ-2US-SU\_\_2)**

**ATTACHMENT 5- Battery Data Sheet**