طرح نگهداشت و افزایش تولید ۲۷ مخزن

CALCULATION NOTE FOR DC CHARGER SYSTEM

نگهداشت و افزایش تولید میدان نفتی بینک

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IFC: Issued For Comment
IFA: Issued For Approval
AFD: Approved For Design
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REVISION RECORD SHEET

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CONTENTS

1.0 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.

2.0 GENERAL DEFINITION

The following terms shall be used in this document.

CLIENT:	National Iranian South Oilfields Company (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.
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 COMPANY (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.

3.0 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.

4.0 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
- IEC 60947 LV Switchgear & Control Gear
- 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

5.0 DC SIZING ASSUMPTIONS

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

Table 1: DC UPS Characteristics for Compressor Station

Item	110 VDC	24 VDC (F&G)
Input AC Voltage	440/400/380 V=10%	440/400/380 V=10%
Input AC Voltage frequency	50Hz=5%	50Hz=5%
DC system Nominal Voltage	110 VDC	24 VDC
DC system Voltage Limits	104.89 VDC~151.8 VDC	22.88 VDC ~ 29.28 VDC
Overall Aging Factor	1.1	1.1
Design Margin Factor	1.1	1.1
Battery Backup Time	8 hours	24 hours + 5 Min.
Battery Configuration	2 x 50%	2 x 50%
Charger Configuration	2 x 100%	2 x 100%
Battery Type	Ni-Cd (SBLE)	Ni-Cd (SBLE)
Nominal Cell Voltage	1.2 V/Cell	1.2 V/Cell
Float Charge Voltage	1.42 V/Cell	1.42 V/Cell
Fast Charge Voltage	1.47 V/Cell	1.46 V/Cell
End Cell Voltage	1.14 V/Cell	1.144 V/Cell

6.0 DC-UPS LOAD PROFILE

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The load list of 110 VDC is in excel attached file, but the 24VDC F&G which has been derived from instrument discipline is as follow (I&C Power Consumption Sammary-BK-GCS-PEDCO-120-IN-0007)

Table 2: F&G Power Consumption

Item	Description	Unit Power Consumption (KW)	With 20% Spare Capacity	Back Up Time
1	F&G System	1.52	1.824	24 hr
2		2.73	3.276	5 min

7.0 DC LOAD CONSUMPTION

DC load consists of the power absorbed by control and protection devices in switchgear cabinets. These devices include CB spring charging motors, CB closing coils, CB opening coils, contactors coils, auxiliary relays, protective relays, signal lamps, annunciations and transducers.

Depending on the type of a feeder, different equipment in the relevant cubicle shall be used. The DC power consumed in each cubicle equals to sum of the consumptions.

Where more than one equipment of the same type is used, a utilization factor is applied to consider the non-simultaneous operation. In, DC load of each substation is calculated in normal status and during plant shutdown. For each switchgear, there is a separate table comprising of all available types of feeders. Here also, a utilization factor is used for non-simultaneous operation of the similar feeders.

Total DC consumption of the switchgear is calculated at the bottom of the table.

Table 1 shows a summary of total DC consumption of each substation during normal and shutdown status.

Table 3: Total DC Consumption

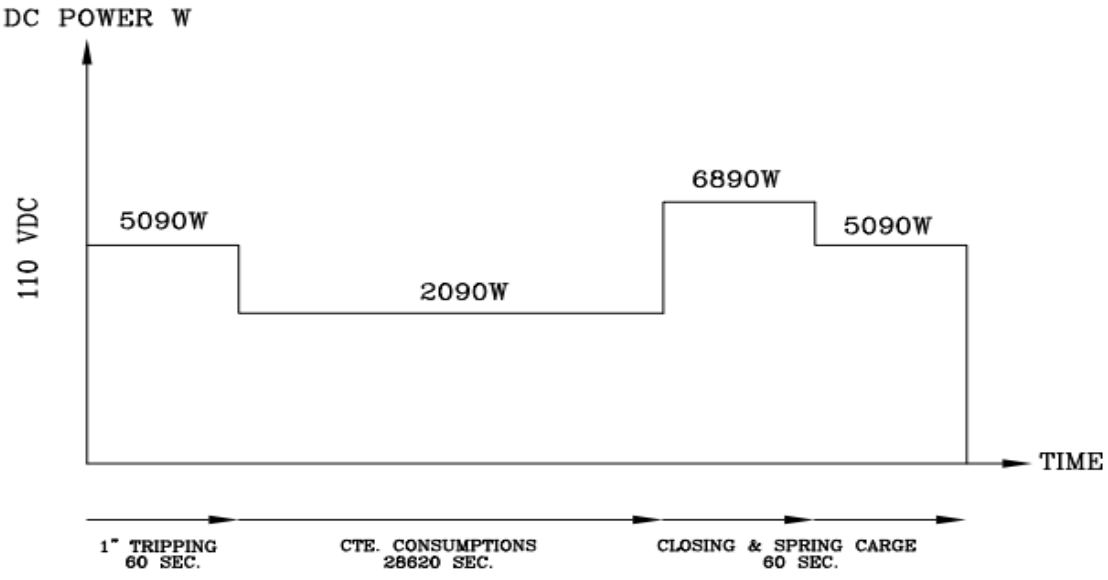
DC System Tag / Substation	Time	Consumption in Normal Condition		Consumption in Worst Case Condition	
		Power (W)	Current (A)	Power (W)	Current (A)
DC-UPS-01 (110 VDC)	8 HR	2090	19	5090	46.27
DC-UPS-02 (24 VDC)	24 HR	912	38	-	-
	5 Min	1638	68.25	-	-

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.

8.0 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. This profile obtained based on two consecutives tripping of the switchgears. The details of the consumptions have been listed in separate Tables of Attachment #1 for 110 VDC.
In addition, for 24 VDC calculation, 5000 W for 24 hours has been assumed.

8.1 Battery duty cycle diagram (110 VDC)



8.2 Battery Duty Cycle Diagram (F&G)

9.0 NUMBER OF CELL CALCULATION

9.1 110 VDC Cell

With considering nominal DC link voltage equal to 110VDC, the No. of cells is obtaining as below:

No. of cells = Nominal DC Link Voltage /

= 110 / 1.2 ~ 92 cells Final discharge cell voltage

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

9.2 24 VDC Cell

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 the vendor.

9.3 Battery Selection

Overall rating of batteries shall be so chosen to provide the load current for 8 hours for 2 x 50% load, according to project specification.

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

$$C = \frac{1}{L}\sum_{i=1}^{n} I_i T_i \qquad (1)$$

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 8 hours for 50% loads in the substations. Therefore,

$$C = \frac{1}{L}(T)\sum_{i=1}^{n} I_i \qquad (2)$$

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. According to the results presented in Attachment #2 & #4, the selected battery set for 110 VDC system is 2 sets of (1×92×SBLE 325 AH). In addition according to Attachment #4, the selected battery set for 24 VDC system is 2 sets of (1×20×SBLE 1400 AH)

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The stand proposal proposed in Attachment #3 & #5, 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.

10.0 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 110 VDC is as follow:

According to table 3, LLc is 2×19=38

$IC=LLc+2*(0.2*C_5)$

IC = 38+2 x (0.2x325) = 168

PC = 168x104.89 / 0.9~20 Kw

Battery Charger Rating for 24 VDC is as follow:

According to table 3, LLc is 2×38=76

IC = 76+2 x (0.2x1400) = 636

PC = 636x22.88 / 0.9~16.16 Kw

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11.0 CONCLUSION*

Item	Charger		Battery		Inverter	
	Configuration	Size	Config	Cell No.x Cap.	Config	Size
DC-UPS-01(110VDC)	2x100% (Redundant)	168 A	2x50%	2 x (92 x SBLE 325)	-	-
DC-UPS-02 (24 VDC)	2x100% (Redundant)	636 A	2x50%	1 x (20 x SBLE 1400)	-	-

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

12.0 REFERENCE DOCUMENTS

Document No.	Title
BK-GNRAL-PEDCO-000-EL-SP-0005	Specification for DC Charger
BK-GCS-PEDCO-120-EL-SL-0001	Electrical Overall Single Line Diagram
BK-GCS-PEDCO-120-EL-SL-0002	LV Switchgear/MCC Single Line Diagram
BK-GCS-PEDCO-120-EL-SL-0003	Existent MV Switchgear Expansion Single Line Diagram
BK-GCS-PEDCO-120-IN-LI-0007	I&C Power Consumption Summary

13.0 ATTACHMENTS

ATTACHMENT A- Native file of 110 VDC Calculation

ATTACHMENT B- Native file of 24 VDC Calculation

ATTACHMENT 1- 110 VDC Load Consumption List for Substation

ATTACHMENT 2- Battery & Stand Sizing Report for 110 VDC

ATTACHMENT 3- Battery Stand proposal for 110 VDC

ATTACHMENT 4- Battery Datasheet for 110 VDC

ATTACHMENT 5- I&C Power Consumption Summary

ATTACHMENT 6- Battery &Stand Sizing Report for 24 VDC

ATTACHMENT 7- Battery Stand proposal for 24 VDC

ATTACHMENT 8- Battery Datasheet for 24 VDC