



شماره پیمان:	CALCULATION NOTE FOR LV CAPACITOR BANK OF WELL PADS							شماره صفحه: ۱ از ۷	
	پروژه	بسته کاری	صادرکننده	تسهیلات	رشته	نوع مدرک	سریال		نسخه
	۹۱۸۴ - ۰۷۳ - ۰۵۳	BK	SSGRL	PEDCO	110	EL	CN		0010



D01	Jul. 2022	IFA	H.Shakiba	M.Fakharian	M.Mehrshad	
D00	Jan. 2022	IFC	H.Shakiba	M.Fakharian	M.Mehrshad	
<b>Rev.</b>	<b>Date</b>	<b>Purpose of Issue/Status</b>	<b>Prepared by:</b>	<b>Checked by:</b>	<b>Approved by:</b>	<b>CLIENT Approval</b>

**Class:2**

**CLIENT Doc. Number: F0Z-707386**

**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**

 <p>NISOC</p>	<p>نگهداشت و افزایش تولید میدان نفتی بینک</p> <p>فعالیت های رو زمینی در بسته های کاری تحت الارض</p> <p>عمومی و مشترک</p>																	
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## 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, construction of well location, access roads, wellhead facilities for 6 new wells (with electric power supply for 2 of them) and required modifications on 4 workover wells (with electric power supply) shall be done. In addition, construction of 6 new flowlines from new wells 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 New Well Locations, Modifications on Workover Wells, Wellhead Facilities, Electrification Facilities, Flowlines 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

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CLIENT rather than by an EPC/EPD CONTRACTOR, supplier or VENDOR.

MAY:

Is used where a provision is completely discretionary.

## 2.0 SCOPE

This document covers minimum necessary requirements for the design, selection, manufacture, inspection, testing and delivery of Capacitor bank.

It shall be used in conjunction with data/requisition sheets for present document subject.

## 3.0 NORMATIVE REFERENCES

### 3.1 LOCAL CODES AND STANDARDS

- IPS-E-EL-100 (1) Engineering Standard for Electrical System Design
- IPS-M-EL-181 (2) Material & Equipment Standard for Power Factor Improvement Capacitor

### 3.2 THE PROJECT DOCUMENTS

- BK-SSGRL-PEDCO-110-EL-LI-0001 Electrical Load List of Well Pads



### 3.3 ENVIRONMENTAL DATA

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

### 3.4 ORDER OF PRECEDENCE

In case of conflict between requirements specified herein & the requirements of any other referenced document, the most approved stringent requirements of below listed items shall be considered based on the approval given by the owner's representative:

- Purchase order
- Material Requisition
- MTO & Data Sheet
- This Specification
- Drawing & Other Specification
- Reference Project Specification
- Iranian Petroleum Standard (IPS)
- Reference international Code & Standards

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When the term “Authorized”, Authorization”, “Approval”, or “Approved” are used in this specification, it shall mean authorization or Approval from OWNER.

In case of any conflict between the project documents, the most stringent one shall be considered.

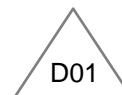
## 4.0 CALCULATION

### 4.1 Calculation for LV Capacitor Bank

According to Electrical Load List of Well Pads (BK-SSGRL-PEDCO-110-EL-LI-0001-D02):

Total Active Peak Load Power for LV switchgear is 155.413 Kw

Total Reactive Peak Load Power for LV switchgear is 93.764 Kvar



Therefore:

$$\tan(\psi_1) = \frac{Q}{P} = \frac{93.764}{155.413} = 0.6 \text{ while } \cos(\psi_1) = 0.86$$

According to IPS-M-EL-181 power factor shall improve to 0.95

So  $\cos(\psi_2) = 0.95$  then  $\tan(\psi_2) = 0.33$

$$Q = P \times (\tan(\psi_1) - \tan(\psi_2)) \quad \text{Formula (1)}$$

According to formula (1) we calculate:

$$Q_L = 155.413 \times (0.6 - 0.33) = 41.9 \text{ Kvar}$$

Therefore  $Q_L \cong 40 \text{ Kvar}$

**Note 1:** Since there is one LV switchgear which will power both normal & emergency bus & there is not Coupler CB, therefore an interlock will be considered between capacitor bank & generator starting mode to prevent malfunction of diesel generator & capacitor bank.

**Note 2:** Since there is VFD on LV switchgear, vendor shall consider any technical requirement for capacitors selection.



**Note 3:** this calculation is valid for each 6 number of well pads.

Also current of capacitor bank will be calculated from following formula:

$$I = Q / (\sqrt{3} \times 0.4) \quad \text{Formula (3)}$$

According to formula (3):

$$I = \frac{40}{\sqrt{3} \times 0.4} \cong 57.7 \text{ A}$$

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We consider upstream breaker bigger than 1.5 I:

$$I_b = 1.5 \times 57.7 = 86$$

Then we select 125A MCCB circuit breaker on LV Switchgear for more reliability.