



نگهداشت و افزایش تولید میدان نفتی بینک  
فعالیت های روزمینی در بسته های کاری تحت الارض  
عمومی و مشترک



شماره پیمان:

۰۵۳ - ۰۷۳ - ۹۱۸۴

Calculation note for diesel generator sizing of well pads

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادر کننده	بسته کاری	پروژه
D02	0008	CN	EL	110	PEDCO	SSGRL	BK

شماره صفحه: ۱ از ۹

## طرح نگهداشت و افزایش تولید ۲۷ مخزن

## CALCULATION NOTE FOR DIESEL GENERATOR SIZING Of WELL PADS

نگهداشت و افزایش تولید میدان نفتی بینک

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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



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شماره صفحه: ۲ از ۹

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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 diesel generator. The diesel generator set under consideration, will provide emergency power to essential loads in the case of loss of power.

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

## 3.0 NORMATIVE REFERENCES

### 3.1 Local Codes & Standard

- IPS-E-EL-100 Engineering Standard for Electrical System Design

### 3.2 The Project Documents

- BK-SSGRL-PEDCO-110-EL-LI-0001 Electrical Load List of Well Pads
- BK-GNRAL-PEDCO-000-EL-SP-0009 Specification For Diesel Generator
- BK-SSGRL-PEDCO-110-EL-DT-0004 Data Sheets For Diesel Generator of Well Pads
- BK-SSGRL-PEDCO-110-EL-SL-0002 Single Line Diagram For LV Switchgear 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



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- Iranian Petroleum Standard (IPS)
- Reference international Code & Standards

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.

D02

## 4.0 DIESEL SIZING

### 4.1 Continuous Operation

According to Electrical Load List “BK-SSGRL-PEDCO-110-EL-LI-0001-D02”, total required Emergency Active Power is equal to 127.33 kW. Considering 20% spare capacity, diesel generator load will be equal to:

$$P_{de} = 127.33 \times 1.2 = 152.8 \text{ kW (This will be used for diesel engine sizing)}$$

(Note: Since one welding socket has been added to layout, it is assumed that in case of emergency operation, welding socket will be out of service. In other words, only in normal operation, welding socket will be in service. Therefore welding socket has no effect on diesel sizing.)

According to Electrical Load List, total required Emergency Apparent Power is equal to 148.86 kVA. Considering 20% spare capacity, diesel generator load will be equal to:

$$S_{de} = 148.86 \times 1.2 = 178.64 \text{ kVA (This will be used for generator sizing)}$$

For calculation of mechanical shaft power, electrical demand shall be divided by generator efficiency. Generator efficiency according to attached typical efficiency curves (Appendix 1) is about 94.6 @ 80% of rated kVA, so  $P_{dm} = P / 0.946 = 152.8 / 0.946 = 161.5 \text{ kWm (net engine power)}$

10kW cooling fan power requirement (typical value) shall be added to this power:

$$P_d = 161.5 + 10 \text{ (fan)} = 171.5 \text{ Kw (gross engine power)}$$

Derating factor for site conditions shall be foreseen for diesel engine.



- For humidity no derating factor is recommended by manufacturers.

Typical derating factor for ambient temperature is 1.0% per each 5° Cover 40°C

So, derating factor for 52°C ambient temperature is  $dt = (52-40)/5 \times 1.0 = 2.4\%$

- For altitudes below 1000m no derating factor is required ( $da = 1$ )

Derating factor for site conditions will be  $da \times dt = 0.976$

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$$P = P_{dm} / (da \times dt) = 161.5 / 0.976 = 165.5 \text{ kWm (net engine power)}$$

$$P = P_d / (da \times dt) = 171.5 / 0.976 = 175.7 \text{ kWm (gross engine power)}$$

Diesel engine prime power shall be 165.5 kWm (net) / 175.7 kWm (gross)

According to client letter 1401-2294-156941 dated on 1401-05-06, the coefficient of continuous diesel is 1.15, and therefore diesel sizing will be:

Diesel engine prime power shall be  $165.5 \times 1.15 = 190.3$  kWm (net) /  $175.7 \times 1.15 = 202$  kWm (gross)

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#### 4.2 Diesel Sizing - Standby Operation (The Biggest Motor Starting)

According to PEDCO letter 6585 and letter 156941, wherever VFD is used, the effect of biggest motor starting on diesel is negligible. Because the inrush current of motor & nominal current at full load are the same. Therefore we do not consider the effect of motor starting in diesel sizing.

Diesel engine standby power shall be  $165.5 \times 1.1 = 182$  kWm (net) /  $175.7 \times 1.1 = 193$  kWm (gross)

#### 4.3 Diesel Sizing – Conclusion

Diesel engine continuous power shall be > 165.5 kWm (net)

Diesel engine prime power shall be > 190.3 kWm (net)

Diesel engine standby power shall be > 182 kWm (net)

### 5.0 GENERATOR SIZING



#### 5.1 Generator Sizing – Continuous Operation

According to clause 4.1,  $S_{de} = 178.6$  kVA. So, generator shall have a power rating more than 178.6 kVA at site conditions. Since the site condition is  $52^\circ\text{C}$ , to consider effect of working in  $40^\circ\text{C}$ , a typical de-rating factor equals to 0.9 according to APPENDIX 2 is considered. So, the rated generator apparent power shall be about  $178.6 / 0.9 = 198.5$  kVA at  $52^\circ\text{C}$ . So, generator shall have power rating more than 198.5 kVA at  $52^\circ\text{C}$ . (Total Loads)

#### 5.2 Generator Sizing – Motor Starting Study

Based on part 4.2, since there is VFD to start motor, therefore motor starting capability of diesel generator system will not be studied.

\*Noted: According to NEMA MG-1, generators shall be capable of withstanding a current equal to 1.5 times the rated current for not less than 30 seconds when the generator is initially at normal operating temperature. So the size of generator can be selected 132KVA (198.5KVA/1.5).

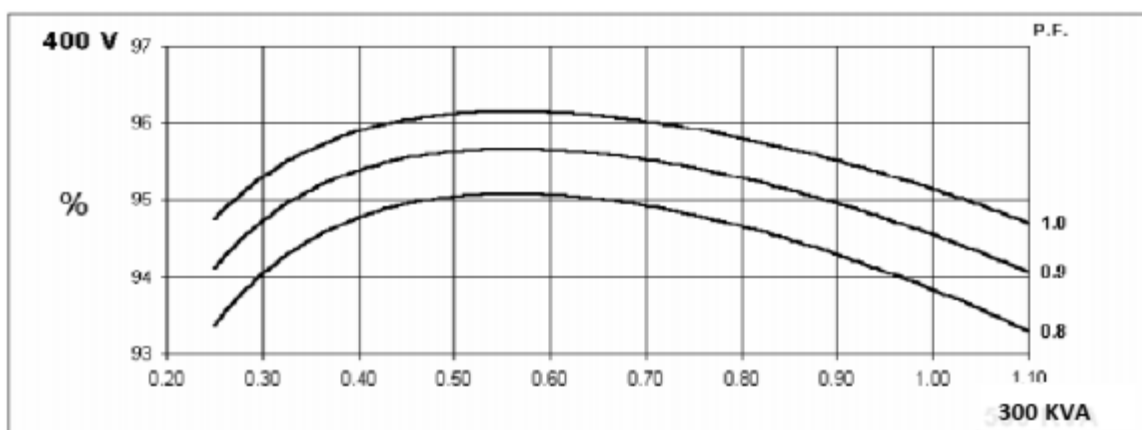
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### 5.3 Generator Sizing – Conclusion

According to above calculation, the generator sizing will be 198.5 KVA

**Note:** Diesel Generator sizing calculation will be checked and finalized by IRP Manufacturer based on IRP motor and VFD characteristics.

### APPENDIX 1 GENERATOR EFFICIENCY







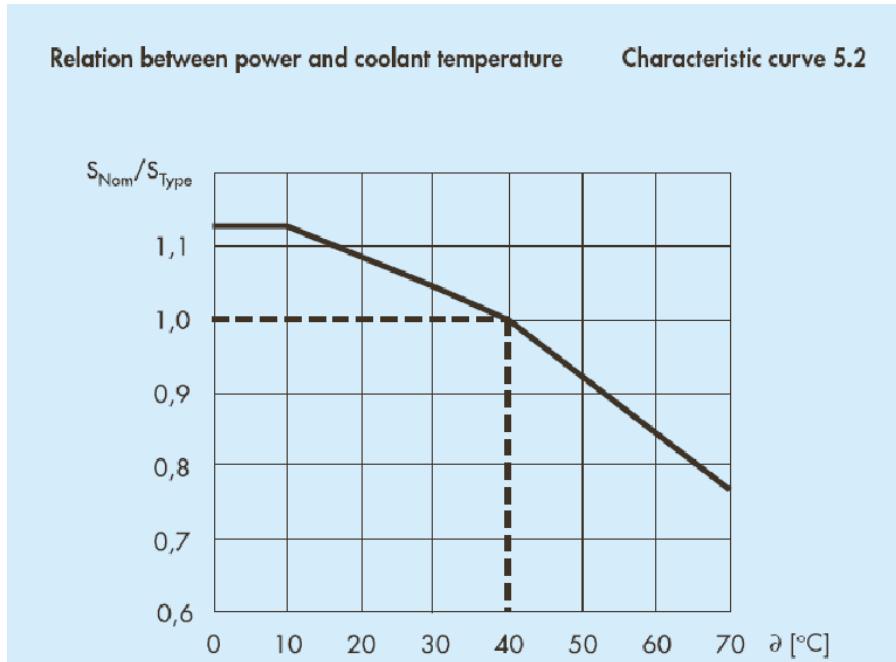
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APPENDIX 2

AMBIENT TEMPERATURE DERATING FACTOR (GENERATOR)



Derating

- The engine may be operated up to 2130 m altitude without derating at 1500rpm.
- The engine may be operated up to 1130 m altitude without derating at 1800rpm.
- For operation at higher altitudes the power will be derated according to the graph below.
- There is no derating for ambient temperature or humidity.

