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| **طرح نگهداشت و افزایش تولید 27 مخزن** |
| **CALCULATION NOTE FOR 11 KV OVER HEAD LINE** **SAG AND TENSION** **نگهداشت و افزایش تولید میدان نفتی بینک** |
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**REVISION RECORD SHEET**

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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 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.

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| CLIENT:  | National Iranian South Oilfields CLIENT (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 EPC CONTRACTOR (GC) and approved by GC & 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 COMPANY rather than by an EPC/EPD CONTRACTOR, supplier or VENDOR. |
| MAY:  | Is used where a provision is completely discretionary. |

1. **Scope**

This document covers minimum necessary requirements for Over Head Line Sag and Tension Calculation.

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

1. **NORMATIVE REFERENCES**

## Local Codes & Standards

* IPS-E-EL-100 Engineering Standard for Electrical System Design
* IPS-E-EL-160 Engineering Standard for Overhead Transmission & Distribution Lines

## International Codes & Standards

* آیین نامه بارگذاری برج ها- جلد 50.211 استاندارد جامع مهندسی و طراحی خطوط انتقال نیروی برق ایران
* نقشه پهنه بندی کشور- جلد 50.221 استاندارد جامع مهندسی و طراحی خطوط انتقال نیروی برق ایران

## The Project Documents

* BK-W046S-PEDCO-110-EL-DW-0002 Over Head Line Plan and Profile - W046S
* BK-W046S-PEDCO-110-EL-RT-0001 Over Head Line Study Report - W046S
* BK-W007S-PEDCO-110-EL-DW-0002 Over Head Line Plan and Profile - W007S
* BK-W007S-PEDCO-110-EL-RT-0001 Over Head Line Study Report - W007S
* BK-BK12-PEDCO-110-EL-DW-0002 Over Head Line Plan and Profile - BK12
* BK-BK12-PEDCO-110-EL-RT-0001 Over Head Line Study Report - BK12
* BK-BK15-PEDCO-110-EL-DW-0002 Over Head Line Plan and Profile - BK15
* BK-BK15-PEDCO-110-EL-RT-0001 Over Head Line Study Report - BK15
* BK-BK05-PEDCO-110-EL-DW-0002 Over Head Line Plan and Profile - BK05
* BK-BK05-PEDCO-110-EL-RT-0001 Over Head Line Study Report - BK05

## Environmental Data

Refer to "Electrical System Design Criteria; Doc. No. “BK-GNRAL-PEDCO-000-EL-DC-0001“.

1. **sag-tension calculation**

Sag and tension calculation is performed by TL Package Software.

The result will be referred to prepare plan and profile document considering the conductor tensions tolerate and maximum acceptable distance between towers and to specify the acceptable sag, UTS percentage and flash of the conductor for spotting of the towers and finalizing the optimum spans.

## General Characteristics

This program is able to calculate the sag and tension of conductor, maximum sag, minimum sag, cold parameter and hot parameter for different ruling span on each loading condition. This software is used to choose appropriate ruling span for line design and finding sag and tension for every span length of transmission line.

The software has capability to consider conductor creep phenomena in final Sag-Tension calculation by selecting suitable hot parameter with creep effect.





## Loading conditions for the four climatic regions of the country





## input data

Ice unit weight (in gr/cm3): This item is unit weight of ice.

Equivalent creep temperature (°C): In this software creepage of conductor is modeled by increasing a creep temperature to the maximum temperature for finding maximum sag of conductor and determining tower height.

EDS Temperature: It is the everyday stress temperature in loading condition.

First span: Start span for calculating Sag-Tension table.

End Span: Final span for calculating Sag-Tension table

Step of Span: Step of increasing span length for calculating Sag-Tension table.

Study Zone specification Frame: This frame use for entering loading condition of transmission line project. According to Iranian standard for power transmission line design (No.104) the project is located in Light weather zone thus eight loading cases shall be studied for tension limits as shown in the following page.

Ice Tick. (mm): Thickness of Ice in the case (in mm).

Wind speed: Speed of wind in the case (in m/s).

Temp: Conductor temperature in applied case.

% UTS: Maximum allowable tension of conductor in percentage of conductor ultimate Tensile Strength (UTS).

## output data

Sag-Tension Table: Main output of this program appeared in this table. In this table, for every span from “first span” to “end span” with increment of “step of span” which specified in input window we have the following output:

Govern. Case: This Item show governing case number. Governing Case is the loading case in any ruling span that it’s tension is equal to it’s allowable tension limit (specified as %UTS in input window), while in other loading condition the tension is lower than the allowable tension.

Hot parameter (m): Hot parameter is parameter of conductor at maximum temperature case in loading condition table. This parameter is used for determining conductor clearance above earth and choosing ruling span.

Cold parameter: Cold parameter is parameter of conductor at minimum temperature case in loading condition table. This parameter is used for checking tower uplift condition.

Sag in Hot Parameter: This item is Sag of conductor at maximum temperature.

Maximum Sag in case: This program has capability to compute sag in all cases and show maximum of them that may be in other case rather than maximum temperature condition.

Case No.: The case that maximum Sag happened on will appear in this column.

Max creep Tension: This program calculate the tension in maximum temperature case with considering the creep (Max Temp. + Creep Temp.) and compare this tension with tension in maximum temperature and choose the lower value to compute the hot parameter.

EDS Initial Tension: This tension is calculated to check this tension with the results of stringing tension.

Tension in Case: In other columns for every case that entered in input table, tension (kg) and percentage as per UTS will be appeared.

## conclusion

As you know, the Sag-Tension calculations are a prerequisite for the plan profile drawing and spotting document.

The tower loading are calculated and finally by ruling span and Sag-Tension calculations that attached. the output information of all cases is specified in the software output table, from cases 1 to 10 that sag & tension & UTS% of conductor is specified.

1. **Attachments: Over Head Line Sag &Tension Calculation Note**