



نگهداشت و افزایش تولید میدان نفتی بینک
سطح الارض و ابنیه تحت الارض

خرید پکیج پمپ های آب آتشنشانی ایستگاه تقویت فشار گاز بینک
(قرارداد BK-HD-GCS-CO-0023_00)



شماره پیمان:

۰۵۳ - ۰۷۳ - ۹۱۸۴

BALANCE PROCEDURE (FOR IMPELLERS)

نسخه	سریال	نوع مدرک	رشته	تسهیلات	صادر کننده	بسته کاری	پروژه
V00	0004	PR	QC	120	KP	GCS	BK

شماره صفحه: 1 از 6

طرح نگهداشت و افزایش تولید ۲۷ مخزن

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نگهداشت و افزایش تولید میدان نفتی بینک

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IFI: Issued for Information

AFC: Approved for Construction



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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.

2.0 GENERAL DEFINITION

The following terms shall be used in this document.

CLIENT:	National Iranian South Oilfields Company (NISOC)
PROJECT:	Binak Oilfield Development – Supply Of Fire Water Pumps
EPD/EPC CONTRACTOR (GC):	Petro Iran Development Company (PEDCO)
EPC CONTRACTOR/PURCHASER:	Joint Venture of: Hirgan Energy – Design & Inspection (D&I) Companies
VENDOR:	Kalaye Pump Company
EXECUTOR:	Executor is the party which carries out all or part of construction and/or commissioning for the project.
TPI:	Third Party Inspector.
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

The following describes the procedure for performing single or two plane balancing. The data is used in a balancing program for calculating the required balancing weight and position for attaching a balancing mass to the rotor. The vibration magnitude and phase angle must be obtained using a suitable balancing machine. For recommended balancing limits, see international standards: ISO-1940/1 and API 610 11th.

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4.0 CODES AND STANDARDS

- API 610 11th
- ISO 1940/1

5.0 TERM AND DEFINITION

5.1 .residual unbalance

Amount of unbalance remaining in a rotor after balancing

NOTE: unless otherwise specified, residual unbalance is expressed in gram millimeters (gr.mm) or ounce inches (ozin)

6.0 RESIDUAL UNBALANCE CHECKS

6.1 .General

6.1.1 .When the balancing machine readings indicate that the rotor has been balanced to within the specified tolerance, a residual unbalance check shall be performed before the rotor is removed from the balancing machine.

6.1.2 .To check the residual unbalance, a known trial mass is attached to the rotor sequentially in (6 or 12), if specified by the purchaser) equally spaced radial positions, each at the same radial distance .

7.0 PROCEDURE

7.1 .Single Plane Balancing Procedure

- 1 .Run the machine and record the initial rotor vibration and phase angle.
- 2 .Stop the machine and firmly attach a small Trial Weight to the rotor. Record the Trial Weight mass and position. (Ensure that the Trial Weight is firmly attached to the rotor. It is a serious safety risk if the Trial Weight is not firmly attached and flies off while running the machine).
- 3 .Run the machine and record the new rotor vibration and phase angle.
- 4 .Stop the machine and remove the Trial Weight.
- 5 .Input the data obtained from the 3 steps above in a single plane balancing program to calculate the required balancing weight and position.
- 6 .Firmly attach a balancing weight of the required mass to the calculated position on the rotor.

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- 7 .Run the machine and re-measure vibration. If required, perform a trim balance.
- 7.2 .Two Plane Balancing Procedures
 - 1 .Measure and record the initial rotor vibration and phase angle on both bearings.
 - 2 .Stop the machine and attach a small Trial Weight to plane 1 of the rotor. Record the trial weight mass and position. (Ensure that the Trial Weight is firmly attached to the rotor. It is a serious safety risk if the Trial Weight is not firmly attached and flies off while running the machine).
 - 3 .Run the machine and record the new rotor vibration and phase angle on both bearings.
 - 4 .Stop the machine and remove the Trial Weight from plane 1. Attach a small Trial Weight to plane 2 of the rotor. Record the trial weighs mass and position. (Ensure that the Trial Weight is firmly attached to the rotor. It is a serious safety risk if the Trial Weight is not firmly attached and flies off while running the machine).
 - 5 .Run the machine and record the new rotor vibration and phase angle on both bearings.
 - 6 .Stop the machine and remove the Trial Weight from the plane 2.
 - 7 .Input the data obtained from the 3 steps above in a two-plane balancing program to calculate the required balancing weights and positions.
 - 8 .Firmly attach balancing weights of the required mass to the calculated positions on planes 1and 2 of the rotor. (Ensure that the Balancing weights are firmly attached to the rotor. It is a serious safety risk if a Balancing Weight is not firmly attached and flies off while running the machine).
 - 9 .Run the machine and re-measure vibration. If required, perform a trim balance.
 - 10 .In this regard, Rotors shall be two-plane dynamically balanced at low speed to the Balance grade in Table 17.

8.0 PERMISSIBLE UNBALANCE RELATED TO ROTOR MASS

In general, the larger the rotor mass, the greater the permissible residual unbalance. It is, therefore, appropriate to relate the value of the permissible residual unbalances, U_{per} , to the rotor mass, m , in terms of permissible residual specific unbalance value, e_{per} , as given by the following formula:

$$e_{per} = U_{per} / m$$

Experience shows that, in general, for rotors of the same type, the permissible residual specific unbalance value, e_{per} , varies inversely as the speed of the rotor in the speed range shown in figure 2 for a given balance quality grade, this relationship is given by the following formula:

$$e_{per} \times \omega = \text{Constant}$$

Where ω is the angular velocity of the rotor at maximum service speed.

This relationship follows also from the fact that, for geometrically similar rotors running at equal peripheral velocities, the stresses in rotors and bearings are the same.

The balance quality grades (given in table 1 and illustrated in figure 2) are based on this relationship.

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9.0 BALANCE QUALITY REQUIREMENTS BASED ON ESTABLISHED GRADES

Balance quality grades have been established which permit classification of the quality requirements. Each balance quality grade in table 1 comprises a range of permissible residual specific unbalance from an upper limit to zero, the upper limit being given by a certain magnitude of the product of the relationship ($e_{per} \times \omega$) expressed in millimeters per second. Balance quality grades are designated according to the product of the relationship.

For this project according to API 610 11th edition, 6.9.4.1, the balance quality grade is G2.5.

10.0 REFERENCE & TEST EQUIPMENT

10.1. References:

API 610 11th edition, 2010

NFPA 20, 2003 Edition

ISO 1940-1

10.2. Test equipment

- Balancing machine
- Pickup sensor
- Grinding machine
- Mill CNC machine
- Test mass