طرح نگهداشت و افزایش تولید 27 مخزن

SAT PROCEDURE

نگهداشت و افزایش تولید میدان نفتی بینک

V02	APR. 2025	AFC	Kalaye Pump	M.Fakharian	S.Faramarzpour	
V01	FEB. 2025	AFC	Kalaye Pump	M.Fakharian	S.Faramarzpour	
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Status:

IFA: Issued for Approval
IFI: Issued for Information
AFC: Approved for Construction

REVISION RECORD SHEET

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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

This executive method aims to illustrate the way of the test and testing manufactured/repaired pumps in the factory to achieve assurance about their alignment to those determined characteristics as well as their quality.

4.0 USAGE DOMAIN

The usage domain of this executive instruction includes all projects of Kalay-E-Pump Company and other common productions.

5.0 LIABILITIES

The quality control director is responsible for executing this instruction, furthermore product supervisor and technical office representative are present in the examination (Test) steps entirely, as auditors.

6.0 REFERENCES

The testing operation of pumps/Electro pumps/Diesel Pumps belonging to Kalay-E-Pump Company is accomplished based on derivate tests of creditable global collected standards for centrifugal and fire fighting pumps and gathered movements. (API 610, NFPA 20)

7.0 PROCEEDING DESCRIPTION

The performance tests for all project pumps is carried out according to API 610 and this procedure as well as customer project documents.”

7.1. Performance Test (Closed Cycle Method):

The purpose of this test is to be sure of the electro pump's technical features such as liquid pressure (Head) and output capacity (Debby) and their alignment with provided curves and characteristics for the customer. The closed cycle method was used in this test and output capacity (Debby) is measured using flow meter equipment.

7.1.1. Place the electro pump on the specific allocated site and attach input-output junctions and electricity connections. Install pressure gauge before input and after output. It should be noted that any knee or corner joints and converters are not used before the gauge.

7.1.2. When the electro pump is starting up you should consider the rotation direction which is clockwise for the pump shaft from the coupling side.

7.1.3. While the test is carried out, performance parameters such as differential head (bar), output capacity (m3/h), electromotor current (A) and voltage (V), and shaft rotation speed (rpm) must be measured and documented in all auditing points.

7.1.4. The job seals and bearings shall be used in the pump for the performance test. The seal (or seals) shall not have any leakage.

7.1.5. The performance curve is based on water (or gasoil) with the specifications of kinematics viscosity 1 cSt, and Specific Gravity 1kg/lit.

7.1.6. The test point for rated flow shall be within a tolerance band of ±3% of rated flow.

7.1.7. Control the flow with a control valve on the discharge line. Opening the discharge valve will cause to increase in the flow and a decrease in the differential head.

7.1.8. Document all mentioned parameters in 7.1.3 for a range of flow from shut off to 150% of rated flow as follows :

A) Shut off
B) Minimum Continuous Flow (MCF)
C) Midpoint of MCF and rated flow
D) Between rated flow and 105% of rated flow
E) Approximately the best efficiency flow (if rated flow is not within 5 % of best efficiency flowrate)
F) 150% of rated flow

7.1.9. Result of these tests with corresponding curves are provided in the performance test report sheets .

7.1.10. After the test, the casing will be filled with gasoil to prevent oxidation.

7.1.11. The equipment used for this test is pressure gauges, a flow meter, probe to indicate the temperature, vibration, speed (rpm), and noise level indicator.

7.1.12. The power consumed by the electromotor is:
Power in (kw) = (√3 V (voltage)*I (amp)*cosØ*motor η)/1000
The hydraulic power produced by pump is:
Hydraulic Power (KW) = (Q(m3/h) * H (m)) / 367

8.0 MECHANICAL RUNNING TEST

The running test (including bearing temperature test, vibration test, noise level test) for all project pumps is carried out according to API 610 and this procedure as well as customer project documents".

"Equipment, material and utilities for the specified inspections and tests will be provided by the vendor".

8.1. Test equipment and tools

Following meters will be used in mechanical running test"

- Flow meter
- Laser thermometer
- Digital photo-optical speed counter
- Vibration meter in mm/s RMS unit
- Photometer for noise level.

8.2. Description

This provides a unified test procedure for each mechanical running test. After test, report shall be issued by test bed and controlled by this procedure.

8.2.1. The pump shall be run on the test stand until oil temperature stabilization has been achieved.

8.2.2. Test Points:

Test point shall be equal to rated differential pressure in data sheet within the tolerance band of +3% and -3% of rated point (API 610-11th ed.)

8.2.3. Test Condition

Calibration of all apparatus and instruments using during the test shall be checked and verified before the test.

8.2.3.1. Tests shall be performed using water at a temperature not exceeding 55 °C (130 °F).

8.2.3.2. Following meters can be used for testing:

A) Electromagnetic or ultrasonic flow meter

B) Optical temperature meter

C) Digital photo-optical speed counter

D) Vibration measuring meter in mm/s RMS unit

E) Noise level meter

F) Digital pressure gauge (for the value of head : differential pressure can be calculated with 2 digital pressure gauge installed at the inlet and outlet of the pump)

Unless otherwise specified, seal specified in contract shall be used in pump for testing.

8.2.3.3. The pump shall be mechanically run for 4 hours, unless otherwise specified or agreed, this run shall be performed at rated flow.

During mechanical running test contract motor, seal, seal system, coupling skid shall be used to make sure run the pumps with the complete unit.

The test data shall be recorded each 30 minutes for the whole performance test length, such as running speed, temperature rise, vibrations, sound level, flow rate and discharge pressure, etc.

8.2.4. Test items are:

8.2.4.1. Vibration of pump bearing at horizontal & vertical direction.

Note: Vibration must be according to table 9 of API 610 standard.

8.2.4.2. For diesel pump, vibration and noise level test is not applicable.

8.2.4.3. Temperature of pump bearings.

8.2.4.4. Shaft speed.

8.2.4.5. Noise level at 1 meter distance around of package.

8.2.4.6. Leakage by visual checking from mechanical seal.

8.2.5. Acceptable Factors

8.2.5.1. If there is no leakage by visual checking, mechanical seal is acceptable. Dripping leakage is acceptable for soft packing seal.

8.2.5.2. Noise level of pump set shall be lower than 85 dB under rated flow in 1 meter distance and 1.5 m above ground.

8.2.5.3. Vibration must be according to table 8 of API 610 standard.

8.2.5.4. For ring-oiled or splash system, an oil temperature below 82°C (180°F) during shop testing, the sump oil temperature rise shall not exceed 40°K (70°R) above the ambient temperature in the test cell measured at the time of each reading and if bearing temperature sensor are supplied, outer ring temperature shall not exceed 93°C (200° F).

9.0 EQUIPMENT ALIGNMENT CHECK

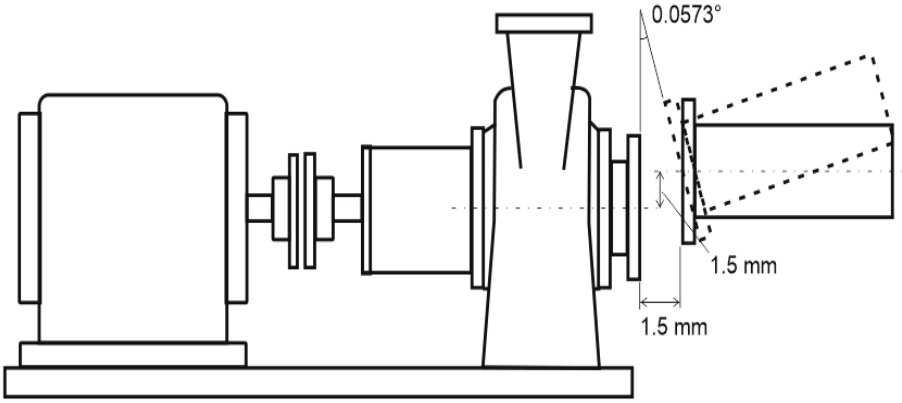
9.1. Requirements

Equipment flange must perfectly match the piping flange otherwise the problems will occur during bolting procedure. If alignment between pipe and pump is not perfect, then several problems may happen during installation like problems with bolting, and during operation like too high loads transferred on equipment nozzle, vibration etc. The alignment check should be performed for both inlet and outlet lines.

API RP 686 code provides the piping to equipment alignment requirements:

- Lateral direction allowable misalignment 1.5 mm (square sum of squares of two axis misalignments). The pipe and equipment flange axis lateral offset should not be greater than 1.5 mm (1/16 in.), without applying any external force. This requirement needed to ensure that flange bolts can be easily installed without application of external force.
- Axial direction allowable misalignment 1.5 mm. Flange face separation shall be within the gasket spacing ±1.5 mm (1/16 in.). Only one gasket per flanged connection shall be used.
- Rotation allowable misalignment 0.0573 degrees. The equipment and piping flange faces shall be parallel to less than 0.01 mm per 10 mm (0.001 in. per in.) of pipe flange outer diameter up to 0.75 mm (0.030 in.). For piping flange outer diameters smaller than 25 cm (10 in.), the flanges shall be parallel to 250 micrometers (0.010 in.) or less. Allowable angle calculated using the equation: ArcTan(0.01 mm/10 mm) = 0.0573 deg

Also, the equipment manufacturers may offer their own guidelines regarding the allowable misalignment values.



9.2. Importance of Flange Alignment

It is critical that the piping be carefully aligned to the pump flanges, and that the piping not be forced into place when the pipe flanges are bolted to the pump flanges. Poor flange alignment will place a tremendous amount of force on the casing – a condition referred to as flange loading – and may result in shaft misalignment as the casing shifts, increased vibration, bearing failures, mechanical seal failures, and cracks in the pump casing.

9.3. How do you check flange alignment?

Flange alignment does not have to be as perfect as shaft alignment. When checking flange alignment the goal is to ensure that the piping is not exerting force on the flange bolts, and through them, the pump casing.

In order to verify that the piping is not loading the pump flanges, while the piping and pump are empty and out of service loosen all of the flange bolts at the same time and verify that they slide in and out of the bolt holes easily. If the piping is pressing the bolts against the bolt holes in the pump flange, then the bolts will not slide easily and the piping is not adequately aligned to the pump flange.

*NOTE: For the specified pumps, the following items shall be considered during SAT.

TITLE	PUMP TAG NUMBER			
	P2301 A	P2301 B	P 2302 A	P 2302 B
Visual check after transportation and installation	☐	☐	☐	☐
Check of electrical and piping connections	☐	☐	☐	☐
Uncoupling for no load run	☐	☐	☐	☐
Check of rotation	☐	☐	☐	☐
30min no load run	☐	☐	☐	☐
Recoupling and alignment check	☐	☐	☐	☐
Full load run till stabilization of bearing temp.	☐	☐	☐	☐
Check of pump and motor during test run (temperature, vibration, current)	☐	☐	☐	☐
Check of pump performance (head, flow)	☐	☐	☐	☐
Check of control panel (visualization and settings)	☐	☐	☐	☐
Setting of recirculation valve (if any)	☐	☐	☐	☐
Simulation of remote control and alarm signal	☐	☐	☐	☐