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| **طرح نگهداشت و افزایش تولید 27 مخزن** | | | | | | |
| **HYDROSTATIC/ PENUMATIC TEST PROCEDURE**  **نگهداشت و افزایش تولید میدان نفتی بینک** | | | | | | |
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| V02 | Jul.2024 | AFC | Havayar Co. | M.Fakharian | M.Sadeghian |  |
| V01 | Jan. 2024 | IFR | Havayar Co. | M.Fakharian | S.Faramarzpour |  |
| V00 | Oct. 2023 | IFR | Havayar Co. | M.Fakharian | A.M.Mohseni |  |
| **Rev.** | **Date** | **Purpose of Issue/Status** | **Prepared by:** | **Checked by:** | **Approved by:** | **CLIENT Approval** |
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| **Status:** | **IFA: Issued for Approval**  **IFR: Issued for Review**  **IFI: Issued for Information**  **AFC: Approved for Construction** | | | | | |

**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, a New Gas Compressor Station (adjacent to existing Binak GCS) shall be constructed to gather of 15 MMSCFD (approx.) associated gases and compress & transfer them to Siahmakan GIS.

1. **GENERAL DEFINITION**

The following terms shall be used in this document.

|  |  |
| --- | --- |
| CLIENT: | National Iranian South Oilfields Company (NISOC) |
| PROJECT: | Binak Oilfield Development – General Facilities |
| EPD/EPC CONTRACTOR (GC): | Petro Iran Development Company (PEDCO) |
| OWNER: | OWNER is collectively refer to National Iranian South Oil Company (NISOC) and Petro Iran Development Company (PEDCO) |
| EPC CONTRACTOR: | Joint Venture of: Hirgan Energy – Design & Inspection (D&I) Companies |
| VENDOR: | HAVAYAR Company |
| 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 Client rather than by an EPC/EPD Contractor, supplier or Vendor. |
| MAY: | Is used where a provision is completely discretionary. |

1. **Scope**

This procedure prescribes the requirements for hydrostatic test of equipment at shop.

1. **Reference**

* ASME Sec.VIII, Div.1, UG99b (36)
* API 618 – Clause 8
* ASME B31.3

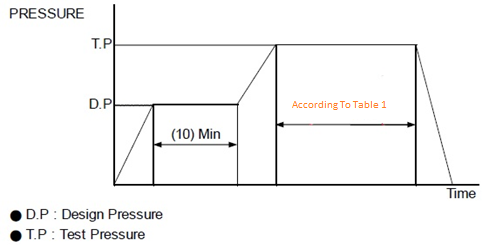
1. **PREPERATION FOR TESTING**
   1. Before commencement of testing, make sure that all repair and NDT testing and field PWHT are complete according to inspection procedure.
   2. Inside and outside of equipment shall be cleaned from debris and foreign materials like paint, liquid, oil or other contaminants.
   3. Eliminate all needless items and clean the test space. only authorized persons are allowed for test.
   4. If the test needs some reinforcements, it must be a perfect form for safety inspection. supports and other items never contact with welded parts.
2. **QUALLITY AND TEMPERATURE OF test WATER** 
   1. Use the clean tap water, if test doesn't require special demand.
   2. The water to be used for the hydrotest of equipment shall be:

* Potable water with chloride content for stainless < 30 ppm and for carbon steel <50 ppm if the equipment can be completely drained and water pockets / stagnations can be removed by rags.
* Demineralized water with chloride content < 10 ppm when a complete drain is not possible.
  1. Temperature of hydrotest water is 60℉ (16℃) ~ 120℉ (48℃). Water temperature shall be measured before test by temperature gauge (TG).
  2. The test pressure will not pressurize until the temperature of test units and hydrotest water are at about the same. This Temperature shall be checked using calibrated a temperature sensor/thermometer.

1. **ACCESSORIES FOR TEST**

* Water pump:
* water pump flow: 3-5 kg/cm2 per minute
* Pressure Gauge:
* Dial indicating pressure gauges used in testing shall be graduated over a range of about double the intended maximum test pressure, but in no case the range shall be less than 1.5 nor more than 4 times that pressure.
* Digital reading pressure gauges having a wider range of pressure may be used provided the readings give the same or greater degree of accuracy than that obtained by dial pressure gauges.
* Pressure gauge for the pressure test shall be checked and calibrated within no longer than six (6) months prior to the test. Gauges shall be recalibrated at any time that there is a reason to believe that they are in error.
* In case of the pressure test, at least 2 pressure gauge shall be attached on the equipment subjected to the pressure test. The calibration of gauges shall be confirmed by project inspector.
* Pressure gauges shall be attached on the bottom and top of the test equipment subjected to the pressure test.
* Blind flange
* Temperature indicator
* Hose
* Fitting

1. **METHOD OF HYDROSTATIC PRESSURE TEST** 
   1. Vent will be provided at all high point of the test unit in the position in which it is to be tested to purge possible air pockets while the test unit is filling.
   2. Test unit will be filled satisfactorily by the low-pressure hose.
   3. Before pressurizing, hydrostatic pressure test workers must check the test equipment, if all low-pressure hoses and other appendages put on each other strongly which don't affect to test pressure.
   4. The design and test pressure of each test unit are according to the Equipment summary shown in Table 1.
   5. The pressure test doesn't have to exceed 6 percent of the test pressure.
   6. Weld zone should be cleaned before accurate inspection for pressure test.
   7. Inspectors of quality control department have to check for any leakage during keeping the pressure and if there is a drop in pressure-by-pressure gauge.
   8. If leakages or other defects are recognized at any stage of the hydrotest, the depressurization sequence shall be immediately initiated to the atmospheric pressure. If required, the equipment shall be emptied from the water to the extent required for performing repairs (Air vents shall be opened prior to emptying the equipment from the test medium). After repairing, again all the above steps shall be re - performed to continue the hydrotest.
   9. After hydrostatic test, the pressure should be reduced slowly until the pressure gauge is zero.
   10. Hydrostatic test is operated by worker of product department under the attendance of quality control department inspector and client and purchaser & GC & EPC contractor.
   11. The inspector of QC department, shall record inspection documents and sign the test report (Attachment A), the director of QC department must recheck and approve the test reports.
   12. Gaskets used during test of an assembled compressor frame shall be of the same design as supplied with the compressor frame.
   13. After hydrostatic test, prior to draining the water, the vents installed on the equipment shall be opened to avoid chance of vacuum and subsequent permanent deformation of the equipment Then water must be drained from the test unit. After elimination water, air blowing shall be done.
   14. After completion of the pressure test (and depressurizing the equipment to the atmospheric pressure), Then the test water in the equipment shall be fully drained and the equipment be given sufficient time in the fresh air to be dried out from any remaining test liquid prior to packing for shipment.
   15. In order to prevent preparing water pool and problem during draining, it’s necessary to lift drain gate window before evacuation of water. During filling and draining, test unit has to be properly vented at the highest point.
   16. The tests shall be performed prior to the installation of the cylinder liner. Compressor cylinders shall be tested as assembled components using the heads, valve covers, clearance pockets, and fasteners to be supplied with the finished cylinder.
   17. At the time of testing, the main/spare bolts and nuts and gaskets of the equipment shall not be used.
   18. The hydrotest graph should be recorded by the recorder.
   19. The hydrotest for all pressure part must be performed before painting.



Picture 1

1. **METHOD OF HELIUM PNEUMATIC TEST for bare block compressor**
   1. The helium pneumatic test mainly conducts for checking the safety during operation.
   2. The damage is serious in case the vessel is broken by the helium pneumatic test, so it will conduct after Checking the intensity by hydrostatic test.
   3. Pressure will go up and down slowly.
   4. The gas used in helium pneumatic test need to dry and clean water has to remove and make clean inside the vessel and welded point.
   5. The gas temperature used in the helium pneumatic test has not to occur in danger of brittle fracture in specific units.
   6. Test pressure must keep the design pressure.

pressure is risen up slowly to test pressure then, hold it during 30min.

* 1. Inspect for leaks using soapy water and remove the soapy water completely after testing.

1. **STANDARD OF TEST PRESSURE**
   1. For rotary equipment, as per API 618, Clause 8.3.2.1, hydrostatic test pressure is 1.5 times of design pressure. (MAWP will be considered as design pressure)
   2. For fixed equipment, as per ASME Sec.VIII, Div.1, UG99b (36) hydrostatic test pressure is 1.3 times of design pressure.
   3. For piping, as per ASME B31.3, Clause 345.4.2 (a) hydrostatic test pressure is 1.5 times of design pressure.

**TABLE.1: EQUIPMENT SUMMARY**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Row | Equipment Name | Tag Number | Design Pressure  (Barg) | Design Temperature  (OC) | Test Pressure  (Barg) | Test Duration |
| 1 | 1st Suction SNUBBER | C-2101-D1  A/B/C | 24.5 | 180 | 31.8 | 1 Hour |
| 2 | 1st Discharge Snubber | C-2101-D2  A/B/C | 24.5 | 180 | 31.8 | 1 Hour |
| 3 | 1st stage Cylinder | C-2101-D1  A/B/C | 24.5 | 180 | 36.8 | 30 min. |
| 4 | 2st Suction SNUBBER | C-2102-D1  A/B/C | 62 | 180 | 80.6 | 1 Hour |
| 5 | 2nd stage cylinder | C-2102  A/B/C | 62 | 180 | 93 | 30 min. |
| 6 | 2st Discharge SNUBBER | C-2102-D2  A/B/C | 62 | 180 | 80.6 | 1 Hour |
| 7 | Collecting Pot | V-2104  A/B/C | 5 | 85 | 6.5 | 1 Hour |
| 8 | Collecting Pot | V-2105 A/B/C | 5 | 85 | 6.5 | 1 Hour |
| 9 | Buffer Gas Filter | F-2101-BF  A/B/C | 10 | 85 | 13 | 1 Hour |
| 10 | Main Oil pump | P-2101-MP A/B/C | 10 | 85 | As per mfg. Standard | 30 min. |
| 11 | Auxiliary Oil pump | P-2101-AP  A/B/C | 10 | 85 | 15 | 30 min. |
| 12 | Lube Oil Cooler | AE-2101-OC A/B/C | 10 | 85 | 13 | 1 Hour |
| 13 | Lube Oil Filter | F-2101-OF  A/B/C | 10 | 85 | 13 | 30 min. |
| 14 | Main Water Pump | P-2101-WP  A/B/C | 10 | 85 | 15 | 30 min. |
| 15 | Auxiliary Water Pump | P-2101-AX  A/B/C | 10 | 85 | 15 | 30 min. |
| 16 | Water Air Cooler | AE-2101-WC A/B/C | 10 | 85 | 13 | 1 Hour |
| 17 | Cooling Water Filter | F-2101/02-WF A/B/C | 10 | 85 | 13 | 1 Hour |
| 18 | Strainer | ST-2101/02 A/B/C | 7 / 24.5 | 180/180 | 9.1 / 31.85 | 1 Hour (for spool) |
| 19 | Heater | H-2101-WH  A/B/C | - | 85 | Full water | 30 min. |
| 20 | Water Reservoir | - | - | 85 | Full water | 30 min. |
| 21 | Process piping | Class CN05 | 24.5 | 180 | 36.8 | 30 min. |
| 22 | Process piping | Class FN05 | 62 | 180 | 93 | 30 min. |
| 23 | Oil Piping | Stainless | 10 | 85 | 15 | 30 min. |
| 24 | Water Piping | CWS/CWR | 7 | 85 | 10.5 | 30 min. |

1. **ATTACHMENT A, PRESSURE TEST REPORT**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | **نگهداشت و افزایش تولید میدان نفتی بینک**  **سطح الارض و ابنیه تحت الارض**  **خرید پکیج های کمپرسور گاز (رفت و برگشتی) بینک**  ***(قرارداد BK-HD-GCS-CO-0008\_03 )*** | | | | oilco  **NISOC** | |
| Page: of | | | **PRESSURE TEST REPORT** | | | | **شماره پیمان:**  9184 – 073 - 053 | |
| Record No.: | | |
| M/o. No.: | | | Type of Test | | | | | |
|  | | | Hydrostatic Test Pneumatic Test Leakage | | | | | |
| Rev. | Traveler /Oper. No. | | Client Name: | | | | Job No. | |
|  |  | | Item Name: | | | | Item No. | |
| Rev. | DWG. No. | | Rev. | | Inst. No. | Rev. | Proc. No. | |
| 4 | 3 | | 2 | | 1 | Pressure Gauge | | |
|  |  | |  | |  | Identification No. | | |
|  |  | |  | |  | Calibration Date | | |
| Remarks | Holding Time (Min.) | | Test Temperature(°C) | | Test Pres.  (Bar G.) | Design Pres.  (Bar G.) |  | |
|  |  | |  | |  |  | Requirement | |
|  |  | |  | |  |  | Actual Result | |
| Sketch:    D.P.: Design Pressure  T.P.: Test Pressure | | | | | | | | |
| NISOC | | PEDCO | | HE/DI | | TPI | | HAVAYAR |
| Client | | EPD/EPC Contractor(GC) | | EPC Contractor | | Third Party Ins. | | Vendor |
| Name & Sign: | | Name & Sign: | | Name & Sign: | | Name & Sign: | | Name & Sign: |
| Date: | | Date: | | Date: | | Date: | | Date: |