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NATIONAL IRANIAN OIL REFINING & DISTRIBUTION COMPANY
NATIONAL IRANIAN OIL ENGINEERING
& CONSTRUCTION COMPANY

NIOEC SP

NIOEC SPECIFICATION FOR INSTRUMENTATION & CONTROL SYSTEM CALIBRATION, INSPECTION AND TESTS

FIRST EDITION

JULY, 2005

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IN THE NAME OF GOD**FOREWORD**

By their very nature, technical standard specifications are continuously subject to modifications and revisions. To strengthen their merit and usefulness, continuous improvements, addendum, deletion of disparate information and consequently provision of updated revisions are to be made in order to ascertain that such standard specifications meet the current requirements, inclusive of Iranian Petroleum Standards (IPS) and the recognized and acceptable national and international standards, as well as the optimal codes and practices based on the accumulated in-house know-how and plant knowledge and experiences.

However, in reality, due to several reasons, not to mention the complexity of the matter, the ultimate goal of continuous direct embedment of the required changes on the relevant standard specifications may be far reaching. Therefore, in the interim periods between the officially issued revisions, the required changes will appear in other documents related to the engineering and design work of the on going projects.

In response to the initiative of the Design Division of the Engineering and Construction Directorate, and considering that the task of the execution of several important and mega projects for the realization of the new oil refineries, pipelines and oil terminals as well as improvements of the existing facilities, has been assigned to NIOEC, it was decided to update the NIOEC Specifications and to issue new official revisions.

The Design Division of the Engineering and Construction Directorate was itself entrusted to carry out this important task, and as such by forming several special technical committees, working in close co-operation and cohesion and sharing their expertise and knowledge, the updated and revised NIOEC Specifications were successfully prepared and complied.

These Specifications are intended to be used for Oil Refineries, Distribution Depots, Oil Terminals, Pipelines and Pump Stations within NIOEC's projects, and have been proven to be of high value for such purposes. It must however be appreciated that these Specifications represent the minimum requirements and should in no way be interpreted as a restriction on the use of better procedures, engineering and design practices or materials.

We encourage and highly appreciate the users and other clear sighted and experts to send their comments on the Specifications to the Design Deputy of the Engineering and Construction Director of NIOEC for evaluation and consideration.

S. R. KASAEIZADEH



EXECUTIVE DIRECTOR

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NOTES:

- 1) THIS SHEET IS A RECORD OF ALL REVISIONS TO THIS SPECIFICATION.
- 2) REMARKS RELATED TO EACH REVISION SHOW A BRIEF DESCRIPTION. THESE REMARKS SHALL BE INTERPRETED IN CONJUNCTION WITH THE REVISED TEXT MARKED BY REVISION NUMBERS.
- 3) WHEN APPROVED EACH REVISION SHALL BE CONSIDERED AS A PART OF THE ORIGINAL DOCUMENT.
- 4) NUMBER OF PAGES EXCLUDES THIS SHEET AND THE COVER SHEET.

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1. SCOPE

1.1 This specification defines NIOEC's minimum requirements for the calibration, testing, inspection of field instruments, control systems, control room equipment and loop checks. Included are the visual check procedures of instrument installation, the pressure testing of instrument pneumatic signal lines, and instrument piping systems lead lines from the process line block valve to the instrument to assure mechanical strength and tightness.

1.2 This specification will provide guidance for construction field inspection, calibration and testing of instruments and control systems prior and during to plant commissioning.

1.3 Instrument piping includes:

1.3.1 All piping and piping components used to connect instruments to other piping or equipment, except the first block valve.

1.3.2 All instrument air lines, except the main instrument air header, and its valved connections.

1.4 Instrument piping excludes:

1.3.1 The piping for-those instruments which are an integral part of a piping system or an integral part of the equipment. Reference shall be made to [NIOEC-SP-50-05](#).

1.3.2 The instruments and/or the permanently sealed fluid filled tubing systems furnished with the instruments.

1.5 Unless the commodity handled constitutes a hazard, systems are not pressure tested when the design pressure is

1.5.1 At or above 0 bar (g) but less than 0.34 bar (g) regardless of the temperature.

1.5.2 At or above 0.34 bar (g) but less than 1.0 bar (g) if the design temperature is below 340°C.

1.6 Nonmetallic systems are excluded from this specification and shall be tested in accordance with their manufacturer's recommendations.

Deviations from this specification will only be permitted on obtaining written approval from NIOEC.

2. REFERENCES

Throughout this specification the following dated and undated standards and codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this specification. For undated references, the latest edition of the referenced document (including any supplements and amendments) applies. For dated references, the edition cited applies.

The applicability of changes in the dated references that occur after the cited date shall be mutually agreed upon by NIOEC and the vendor /contractor.

ANSI	(AMERICAN NATIONAL STANDARD INSTITUTE) ANSI/ FCI 70-2 “Valve Leakage Classifications’
ASME	(AMERICAN SOCIETY OF MECHANICAL ENGINEERS) ASME B31.3 “Process Piping”
NIOEC-SP	(NIOEC SPECIFICATIONS) NIOEC-SP-00-10 “Specification For Units’ NIOEC-SP-50-05 ”Specification for Field Pressure Testing” NIOEC-SP-00-75 “Specification for Pressure and Vacuum Relief Devices”

3. UNITS

International System of Units (SI) shall be used in accordance with [NIOEC-SP-00-10](#), unless otherwise specified.

4. DEFINITIONS

Throughout this specification, the following definitions shall apply:

ESD: Emergency Shutdown System.

F&G: Fire and Gas System

PCS: Process Control System.

SGS: Safeguarding System.

5. GENERAL

5.1 Prior to initial operation, all installed instrument process and utility lead lines shall be pressure tested to a specified pressure as listed on the Control Systems Installation Index. Pressure testing medium shall be Nitrogen or other available inert gas. All connections, joints, fittings, etc. shall be checked for leakage with Snoop, Leak-Tec (or equal) leak detector solution.

5.2 Instrument air supply lines are subheader lines shall be tested, using dry and clean air.

5.3 Transmitted and control signal lines shall be leak tested tested prior to the final instrument inspection and loop check.

6. RECORDS

6.1 NIOEC Instrument Supervisor will maintain a record of all tests on the Instrument Pressure Test Record (See Exhibit 7-1). The completed record will be furnished to the NIOEC Quality Control Superintendent or its representative.

7. TESTING OF THE PROCESS AND UTILITY LEAD LINES

7.1 Testing Pressure

7.1.1 Instrument process or utility lead lines shall be tested at 110 percent of the specified process line design pressure. If the instrument process or utility lines contain a pressure reducing regulator, the test pressure down-stream of the regulator shall be 110 percent of the reduced operating pressure. The specified line design pressure is listed in the Control Systems Installation Index. The reduced operating pressure is listed on the Instrument Specification Sheet of the pressure regulator. The process or utility line design pressure is listed in the NIOEC Pipe Line List prepared by NIOEC Piping Engineering. Instrument process leads normally operate at ambient temperature. If any line operates at a temperature above 340°C for more than ten (10) hours at any one time and will total more than 100 per year, refer to test pressure calculation section of the Field Pressure Testing Specification [NIOEC-SP-50-05](#) to calculate the minimum test pressure.

7.2 Test Preparation

7.2.1 To avoid damage to instruments during the pressure testing, the following guideline should be observed:

- a) Before testing leads to the flow, differential pressure or level instruments, close block valves at process line and open bypass at d/p cell. This enables a test on both legs at the same time and prevents a high differential pressure on the instrument. Line mounted flow transmitters with manifold valves are not tested.
- b) Before testing leads to pressure instruments, close block valve at process line and at instrument.
- c) Before testing leads to level instruments (differential type without bypass valve), close block valves at the vessel and add a temporary bypass line between the high pressure and low pressure sides to prevent high differential pressure on the instrument.
- d) All connections, including welds, shall be left uninsulated and exposed for examination during test.
- e) Components installed in the process leads should be reviewed for maximum pressure rating. If the rating is less than the test pressure, remove the component and install a temporary jumper line.
- f) Lines in vacuum service shall be tested at minimum pressure of 1.0 bar (g) unless limited to lower pressure by line design pressure.
- g) Analyzer sample lines shall be pressure tested up to the meter valve at the analyzer. Disconnect or vent line at the analyzer before testing. Any pressure reducing regulator and/or

sample vaporizers should be removed and a jump line installed during test.

7.3 Test Procedure

7.3.1 Prepare piping to be tested as indicated in Section 7.2, Test Preparation.

7.3.2 Connect the test assembly, shown in Exhibit 7-2, to the instrument leads.

7.3.3 Tubing, fittings and/or pipe necessary to connect the test assembly to the instrument shall be furnished by the field.

7.3.4 When test pressure is over 1.4 bar (g) a preliminary test shall be made at 1.4 bar (g) to locate major leaks. The pressure in the system shall gradually be increased to not more than one half of the test pressure, after which the pressure shall be increased in steps of approximately 1.4 bar (g) pressure until the required test pressure has been reached. All joints welded, screwed or tubing connection shall then be swabbed with leak detection solution and checked for leaks.

7.3.5 When conditions require that a pressure test be maintained for a period of time during which the testing medium in the system would be subject to thermal expansion, provision shall be made for relief of excess pressure.

7.4 Test Completion

7.4.1 In the event that repairs or additions are made following pressure test, the affected lead line or lines shall be retested at the pressure originally specified for the test.

7.4.2 After testing is completed, remove the test assembly and reinstall the test connection plug per job specifications.

7.4.3 Use the Instrument Pressure Test Record to record results of all tests. (See Exhibit 7-1.)

8. INSTRUMENT AIR SUBHEADERS

8.1 Instrument air subheader lines and air supply lines to individual instruments with normal operating pressure not more than 12.0 bar (g) may be tested at normal operating conditions with commodity carried.

8.2 Instrument air lines operating over 12.0 bar(g) shall be tested as an instrument process lead line.

9. TESTING OF PNEUMATIC SIGNAL LINES

9.1 Testing Pressure

9.1.1 Prior to final instrument inspection and loop check, a pressure test shall be made on all control and transmitted signal lines to assure nonleak conditions.

9.1.2 Transmitter leads, and controller leads using leak detector solution shall be tested at 1.0 bar (g) .

9.1.3 Tubing downstream of the filter regulator to be tested with leak detector solution.

9.1.4 In the event instrument air is not available for testing, instrument quality air from a compressor, bottled dry air or nitrogen can be used as the test medium.

9.2 Test Preparation

9.2.1 Prior to pressure testing, establish identity of each component of a given loop and the components conformance to design test pressure.

9.2.2 Blow air lines clean.

9.2.3 Identify positively the air circuit by blowing air through the line or observing pressure increases on system pressure gauge on opposite end of system. The air supply valve may be used through the instrument to the air-operated element by setting the instrument to deliver air and observing air output at the air-operated element.

9.3 Test Procedure

9.3.1 Disconnect air-consuming pilots, if any, from the section of tubing to be tested.

9.3.2 Connect the test assembly shown in Exhibit 7-3 to the tubing to be tested and to the dry air supply.

9.3.3 Open the toggle valve and adjust the pressure regulator until the supply gauge reads 1.0 bar. Adjust the precision relay until the output as shown on the system test gauge reads 1.0 bar. The precision relay has a full scale output change (0 to supply pressure) over a 1 percent change in input signal. The adjustable relay set point is determined by the spring force. This force is changed by turning the adjusting knob.

9.3.4 Close toggle valve. A drop in system pressure, as indicated by the system test gauge, will show a leak.

9.3.5 Use Snoop, Leak-Tec (or equal) leak detector solution to locate leaks.

9.3.6 Under certain simple systems the connections may be bubble tested using Snoop, Leak-Tec (or equal) leak detector solution.

9.4 Permissible Leak Tolerance

9.4.1 Tubing leaks which cause the system test gauge pressure to decrease at the rate of 0.07 bar per hundred feet of 1/4 inch tubing per 5 seconds are usually not acceptable. Instrument air lines that terminate in control valve top works must be corrected by converting the top works capacity to equivalent feet of tubing by means of the following table: