

		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
JOB SPECIFICATION FOR GROSS LEAK TEST OF PIPING AND EQUIPMENT	Project No. 080557C001	Document No. 080557C-000-JSC-0093-012		Rev. No. 0	Page 1 of 11

## JOB SPECIFICATION FOR GROSS LEAK TEST OF PIPING AND EQUIPMENT

0	05/12/2019	ISSUED FOR IMPLEMENTATION	KMK	TNVS	TNVS	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED



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## 1. Introduction:

**INDIAN OIL CORPORATION LIMITED (IOCL)** has awarded Fax of Acceptance (FOA) dated 29<sup>th</sup> August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

## 2. Definitions & Abbreviations

Abbreviation	Definition /Expanded form
IOCL/ CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them.
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related
SRU	Sulphur Recovery Unit

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### 3. Scope

The scope of this procedure is to establish the guidelines for Gross Leak Test of Piping and Equipment.

### 4. Purpose

After hydrostatic pressure testing and cleaning, a gross leak test is required to check all flanges and fittings for leaks caused by gaskets which can be damaged, flanges not perfectly tightened and/or drains and vents left open.

Unit should be isolated with blinds from every part containing hydrocarbons, nitrogen or steam.



All the relief valves should be in place and their isolation block valves in the correct position.

This gross leak test serves to ensure the effective tightness of the tested system or subsystem, and it is the preparation of the system for a more exhaustive high pressure leak test, which will be performed by LSTK Contractor during the commissioning of the unit.

### 5. Preliminary Activities

Prior to start the gross leak test, several preliminary activities should be undertaken. These include the following:

- Complete reinstatement of the system to be tested: install all equipment, instrumentation and lines connection according to P&ID's; correct gasket installation check; vents and drain closure. It is mandatory to avoid the reopening of flanges after completion of this activity because it will result in the loss of tightness of the system;
- Clearly define the plant areas to be tested. Provide isolation between these areas and those that do not need test;
- Identify pipe circuit and prepare it for testing, e.g. determine the possible testing medium inlets; check test manometers certification; verify that manometers are installed in visible location; verify and confirm PSV.s fully functional; verify and confirm the position of blinds to protect lower pressure systems;
- Confirm that all drains and vents are closed;
- Remove insulation on flanges to enable checking for leaks;
- The Subsystem or System should be isolated, with blinds, from every part containing hydrocarbons, nitrogen or steam;
- All the relief valves should be in place and their isolation block valves in the correct position, to allow a possible overpressure relief;
- The flare header inside the unit is properly isolated from the flare header already under

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hydrocarbon (if any) and the related PSV.s discharge will be open to atmosphere; this is done to prevent overpressure of the tested system during the air leak test, and at the same time to avoid the introduction of air to the flare header;

- i) Convene a meeting with Construction Contractor, to finalize all technical and safety aspects prior to starting testing;
- j) Prepare a system tailored specific procedure detailing stepwise all the activities to be performed;
- k) Develop a Job Hazard Analysis for each activity prior to execution of Gross leak test.

## 6. Gross Leak Test

Dry (oil free) air or nitrogen is commonly used for gross leak test purposes.

Air shall not be permitted as a pressure test medium in a system previously in hydrocarbon service unless the system has been purged to avoid an explosive hydrocarbon-air mixture.

Gross leak test pressure for the low-pressure utility systems will depend on the operating pressure of the systems to be checked. These are normally tested at operating pressure, taking care to do not exceed systems PSV.s set point.

Process systems will be gross leak tested at the available plant or instrument air and/or nitrogen network pressure.

The leak test at system operating pressure will be carried out during commissioning phase by Owner.



The pressure drop should be checked on manometers and recorded. The leaks should be carefully located and tightened to torque specifications.

As a rule of thumb the gross leak test can be deemed satisfactory when the pressure drop is equal or less than 1% per hour over a two-hours period (a less stringent requirement may be applicable on systems of very small volume. In these cases, the net amount of the losses should be evaluated and their acceptability verified).

The pressure trend observation gives an indication on the tightness of the system. Nevertheless, it does not prevent from leak test on each flange with soap. The following main steps should be followed:

- a) Pressurize the system with dry (oil free) air (or nitrogen) at the specified test pressure;
- b) Check pressure over a length of time. If the test is not satisfactory, every flange and connection must be inspected with soap solution;
- c) Using soap solution check for any sign of soap bubbles being formed. Precaution must be taken during windy weather, as soap bubbles can be produced by wind sweeping over the flange. This can lead to a wrong conclusion that the flange is leaking when it does not;
- d) After correction of leaks, the test will be repeated until satisfactory.

Note: For storage tanks, which cannot be pressurized, the tightness of flanges, manholes, connections,

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etc., will be checked as far as possible during cleaning operations and first filling.

In Systems or subsystems where the main component of the process fluid is the water (understanding by these: utility water, fire water, oily water, etc.); in alternative to the use of air, leak test may be performed pressurizing with water, In order to render easy and expedite the detection of leak by inspecting the flanges.

At the end of the test, record in dedicated form the testing medium, the circuit normal operating pressure, the test pressure and the pressure drop at the end of the test.

The leak detection methods will be also recorded.

Signed record form shall be attached to the quality control forms of involved equipment and/or piping.

## 7. Leak Repairs / Tightening

In most cases, tightening of flanges in the correct manner to ensure that compression on the flange gasket is uniform can eliminate leaks. If this is not sufficient, the equipment must be isolated, depressurized and the gasket replaced.

In most cases, correct re-packing can eliminate the leakage from a valve bonnet.

Note: The control valves packing must not be tightened when dry until the actual product is passing through.

## 8. Quality Control Report

Test results shall be reported in the relevant Pre-commissioning Quality Control Form. Gross leak test operation is not a highly hazardous operation since no high-energy fluid is normally released and it is performed at a pressure that is normally lower or equal than the system operating one. Anyhow system under gross leak test should be always checked against unexpected loss of containment. Special care should be taken in case nitrogen is used in not adequately ventilated areas.

## 9. Hse Precautions



The following represents minimum precautions:

Inspect affected area to avoid conflict with other activities;

Place warning signs and fence off the points where nitrogen (or air) is introduced in the system for gross leak test operation (e.g. hoses for mobile connections or valve for fixed connection) with strips of a color distinguishable from those used for surrounding construction activities. Also, the equipment and the lines involved in gross leak test operation shall be clearly identified;

Restrict access into area to authorized personnel only;

- Instruct involved personnel in how to monitor gross leak test operation and to safely stop activity when required;

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- Flexible hose used for nitrogen (or air) pressurizing will be specified for pressure of relevant network;
- All the relief valves should be in place and their isolation block valves in the operating position;
- Before pressurizing walk through the system to check its proper alignment and integrity;
- During system pressurization check for its integrity (no major leaks);
- Clearly mark and put warning signs on all equipment and lines containing nitrogen.

All the preventive measures identified in the attached JHA (Job Hazard Analysis) shall be followed.

## 10. Attachments

Attachment 1: Job Hazard Analysis for Gross Leak Test of Piping and Equipment.



Attachment 2: Pre-commissioning format for gross leak test.

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**Attachment 1: Typical Job Hazard Analysis for Gross Leak Test of Piping and Equipment.**

TASK	HAZARDS	CONTROLS
<b>GENERAL RISKS</b>	<b>Poor Planning</b>	<ul style="list-style-type: none"> <li>Method statement and specific JHA available – application of the control measures hierarchy</li> <li>PTW ( Permit To Work) is available</li> </ul>
	<b>Poor Worksite - physical</b>	<ul style="list-style-type: none"> <li>Good means of access/egress – ladders</li> <li>Good work place - space available, illumination, housekeeping, scaffoldings</li> <li>Weather conditions, surfaces status</li> </ul>
	<b>Poor Worksite – concurrent operations</b>	<ul style="list-style-type: none"> <li>Isolation of the Area during the operations.</li> <li>Warning signs</li> <li>Coordinate with adjacent areas to ensure gross leak test operation does not affect/ conflict with other activities;</li> </ul>
	<b>Poor Information</b>	<ul style="list-style-type: none"> <li>Orientation for Pre-commissioning phase of work</li> <li>Daily tool-box meeting – review of JHA and related PTW</li> </ul>
	<b>Poor Physical State</b>	<ul style="list-style-type: none"> <li>Workers fit for work</li> <li>Daily stretching</li> </ul>
	<b>Poor Logistics</b>	<ul style="list-style-type: none"> <li>Use appropriate working tools for the job; carry out material lifting using appropriate lifting devices, if handling weights above 20kg;</li> </ul>
	<b>Residual Risks</b>	<ul style="list-style-type: none"> <li>Fall protection when required</li> <li>PPE ( Personnel protective equipment)</li> <li>Area isolation (flagging, barricades). Barricade area with pre-commissioning tape</li> <li>Signals</li> </ul>
	<b>Emergency</b>	<ul style="list-style-type: none"> <li>Emergency instructions: phone/radio numbers, signals, muster point, actions to take</li> <li>Availability of first aid boxes</li> </ul>
	<b>Slips trips hazards</b>	<ul style="list-style-type: none"> <li>Housekeeping: keep work area clean</li> <li>Remove all trip hazards</li> </ul>





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TASK	HAZARDS	CONTROLS
System Preparation	Personnel Injury Equipment Damage	<ul style="list-style-type: none"> <li>– Segregate/ barricade the system to be tested; evacuate the unnecessary personnel from the affected area; restrict the access to the gross leak test area to the direct involved personnel; ensure gross leak test does not conflict with other activities;</li> <li>– When manual handling is required, correct manual handling techniques is to be used.</li> <li>– Use proper scaffold or platform when working at height. A full body harness is to be worn always, with a lanyard attached securely to an anchor point;</li> <li>– Mark-up the system to be tested on a P&amp;IDS;</li> <li>– Identify the instruments or pressure recorders used to monitor any pressure loss;</li> <li>– Line up/ Isolate the system under gross leak test from the adjacent system(s) by means of valve(s) or blind(s); tag-out each isolating valve; confirm or depressurize the respective circuit before opening piping or equipment;</li> <li>– Clearly identify equipment and lines involved in gross leak test on marked up P&amp;ID; develop detailed/ specific gross leak test procedures;</li> <li>– Ensure all temporary lines/hoses withstand the working pressure; secure and run temporary air hoses such that they do not create a hazard for other workers;</li> <li>– Use only temporary air hoses suitable for the pressure test.</li> </ul>

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TASK	HAZARDS	CONTROLS
<b>Tightness Test</b>	Personnel Injury Equipment Damage	<ul style="list-style-type: none"> <li>– Pressure up the system in steps to the desired pressure using instrument air or a pneumatic test compressor. Check at each step the System for leaks;</li> <li>– When the selected pressure is reached, shut off the air supply and monitor the pressure over a fixed time. The standard set depends on the process being tested and the volume of the system;</li> <li>– During the tightness test, the unit or system must be protected against overpressure by safety relief valves of proper capacity with discharge turned, if necessary, to atmosphere;</li> <li>– When a gross leak test is being carried out on a centrifugal compressor system with dry gas seals, satisfy vendor requirement placing in service the lube oil and seal system as required;</li> </ul>
<b>Tightness Repairs</b>	Personnel Injury	<ul style="list-style-type: none"> <li>– If pressure-drop establishes that a leak exists, and the leak location is not obvious, check the piping w/ soap solution;</li> <li>– If the leaks cannot be eliminated by tightening the flanges (in the correct manner to ensure that compression on the flange gasket is uniform), isolate the equipment, depressurize, align and check flange faces and replace the gasket; In all cases the Permit to Work procedures must be followed; use appropriate PPE (ear plugs or mufflers) as required;</li> </ul>
<b>Tightness Test Completion/ Reinstatement</b>	Personnel Injury	<ul style="list-style-type: none"> <li>– Ensure that the temporary air supply is shut off &amp; disconnected and the valve tags are removed after completing tightness test;</li> <li>– Remove all barricade tape at the completion of the task;</li> <li>– Clean up for next worker is safe from injury;</li> <li>– Restore the system to a safe condition.</li> </ul>
<b>Environmental aspects</b>	Noise waste	<ul style="list-style-type: none"> <li>▪ Programmed activities to minimize disturb;</li> <li>▪ All rubbish and debris is to be removed.</li> </ul>

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**Attachment 2: Pre-commissioning format for gross leak test.**

<p align="center"> <b>PRECOMMISSIONING – QUALITY CONTROL REPORT</b>  <b>PIPING / EQUIPMENT</b>  <b>GROSS LEAK TEST</b> </p>
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SYSTEM N° :	REPORT N°	PRECOMM QC FORM: PCF-06P			
UNIT: _____					
LINE N°	REMARKS	DATE D/M/Y	SIGNATURE		
			LSTK Contractor	PMC	OWNER
NOTES:					
INSPECTORS	CONSTRUCTION CONTRACTOR	CONTRACTOR	PMC	OWNER	
NAME					
SIGNATURE					
DATE					