		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
Job Specification for Nitrogen Purging and Inertization		CLIENT	INDIAN OIL CORPORATION LIMITED		
Project No. 080557C001		Document No. 080557C-000-JSC-0093-010		Rev. No. 0	Page 1 of 10

JOB SPECIFICATION FOR NITROGEN PURGING AND INERTIZATION

0	04/12/2019	ISSUED FOR IMPLEMENTATION	KMK	TNVS	TNVS	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

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 	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
Job Specification for Nitrogen Purging and Inertization	Project No. 080557C001	Document No. 080557C-000-JSC-0093-010	Rev. No. 0	Page 2 of 10

TABLE OF CONTENTS

1. Introduction:.....	3
2. Definitions & Abbreviations.....	3
3. Purpose.....	4
4. Purge Techniques	4
4.1 Continuous Purge.....	4
4.2 Displacement Purge.....	4
4.3 Pressure Cycle Purge.....	4
4.4 Purge Technique Selection.....	5
4.5 Explosive Limits.....	5
5. Purge Procedures	7
5.1 Storage Tank (Continuous Purge).....	8
5.2 Vessel (Pressure Cycle Purge).....	8
5.3 Process Pipe-work and Other Equipment (Displacement Purge).....	9
6. Purged Systems Identification.....	9



		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	IOCL Paradip Refinery		
Job Specification for Nitrogen Purging and Inertization	Project No. 080557C001	Document No. 080557C-000-JSC-0093-010	Rev. No. 0	Page 3 of 10	

1. Introduction:

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th 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

		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	IOCL Paradip Refinery		
Job Specification for Nitrogen Purging and Inertization	Project No. 080557C001	Document No. 080557C-000-JSC-0093-010	Rev. No. 0	Page 4 of 10	

3. Purpose

All Piping networks, vessels and other plant equipment normally contain air before they are commissioned. The introduction of hydrocarbon feed for the first time into said equipment can produce an explosive mixture which poses a serious safety hazard to plant and personnel. "Purging" is a necessary operation in those plant process systems that subsequently will handle hydrocarbons and flammable materials.

Purging eliminates the hazard by replacing the air inside the system with an inert gas such as nitrogen. This renders the environment non-hazardous because of the absence of oxygen required for combustion. Hydrocarbon gases can then be introduced safely by displacing the inert gas.

In the reverse situation, that is, the process system is totally filled with hydrocarbons and entry for maintenance work is required, a safe working atmosphere for personnel must be established. This is accomplished by displacing the hydrocarbons with a blanket of inert gas and then displacing the inert gas with air. The displacement of inert gas with air for vessel entry of men is not covered by this procedure.

4. Purge Techniques

The selected purge technique will depend on the physical characteristics of the process system in subject.

Three types of purge technique can be used:

- a) Continuous purge
- b) Displacement purge
- c) Pressure purge

4.1 Continuous Purge



Continuous purging is used on large tanks in which a significant density difference between purge medium and tank contents cannot be maintained, and mixing of the purge medium and tank contents will inevitably occur. This technique requires introduction of the inert medium at the base of the tank as far as possible away from the vent point to avoid erratic or incomplete purging.

4.2 Displacement Purge

Displacement purging is most often practiced on pipe systems where purge gas can be introduced at one end of the system, will travel through the system as a plug, and will vent at the far end of the system.

4.3 Pressure Cycle Purge

Pressure cycle purging is commonly used on medium size pressure vessels where vessel

 		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
Job Specification for Nitrogen Purging and Inertization	Project No. 080557C001	Document No. 080557C-000-JSC-0093-010		Rev. No. 0	Page 5 of 10

connections and purge facilities are not ideal for a combination of continuous/displacement purge. This technique requires pressurizing the vessel with inert gas to a stated pressure and then depressurizing. The procedure is repeated several times until satisfactory oxygen level is achieved.

4.4 Purge Technique Selection



Unless specific reasons dictate otherwise, the purging technique shall be selected according to the following criteria:

- a) Storage tanks: continuous purge.
- b) Individual vessel: pressure cycle purge.
- c) Process pipe-work, heat exchangers, Pumps, etc. (Subdivided into convenient sections): displacement purge.

4.5 Explosive Limits

A list of Explosive (Flammable) Limits (in air) for gaseous or vapour substances is given in Table below.

typical below



 	PROJECT	Standby SRU & Additional Tanks		
	CLIENT	IOCL Paradip Refinery		
Job Specification for Nitrogen Purging and Inertization	Project No. 080557C001	Document No. 080557C-000-JSC-0093-010	Rev. No. 0	Page 6 of 10

A list of Explosive (Flammable) Limits (in air) for gaseous or vapour substances is given in Table below.

Substance	LEL	UEL
Hydrogen	4	75
Methane	5	15
Ethane	3	15.5
Propane	2	9.5
Isobutane	1.8	8.5
n-Butane	1.5	8.5
n-Pentane	1.4	8.0
n-Hexane	1.1	7.5
Benzene	1.2	8.0
n-Heptane	1.1	6.7
Gasoline	1.4	7.6
Kerosene	0.7	6.0
Gas Oil	0.5	5.0
CO	12.5	74
H ₂ S	4.0	45.5
NH ₃	15.0	28.0

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 	PROJECT	Standby SRU & Additional Tanks		
	CLIENT	IOCL Paradip Refinery		
Job Specification for Nitrogen Purging and Inertization	Project No. 080557C001	Document No. 080557C-000-JSC-0093-010	Rev. No. 0	Page 7 of 10

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Ethane	3	15.5
Propane	2	9.5
Isobutane	1.8	8.5
n-Butane	1.5	8.5
n-Pentane	1.4	8.0
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5. Purge Procedures

The purge procedures outlined here are for general guidance and not intended to specify in

		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
Job Specification for Nitrogen Purging and Inertization	Project No. 080557C001	Document No. 080557C-000-JSC-0093-010	Rev. No. 0	Page 8 of 10	

detail the specific requirements for each system purge. This is the responsibility of the LSTK Contractor who must review and check individual systems prior to purging.



5.1 Storage Tank (Continuous Purge)

- Isolate storage tank from all other systems by means of available valving and spectacle blinds.
- Connect inert gas purge to suitable connections at base of tank. Several connections may be used to ensure uniform distribution.
- Purge through the system, through the tank vapour vent, purging the tank vapour line (if any) at the same time.
- Continue purge until vent gases have been reduced to required oxygen level. To reduce oxygen concentration below 5 %, approximately two tank volumes of purge gas will be required.
- Ensure all dead legs are purged by opening vents, draining connections and blowing through these points. Close vents and drains.
- Discontinue purge and isolate tank while maintaining slight positive overpressure (10-20 mm W.G.) to prevent air entry.

The system is now ready to receive hydrocarbon liquid and vapour.

5.2 Vessel (Pressure Cycle Purge)

- Isolate vessel from all other systems by means of available block valve and spectacle blinds.
- Connect inert gas purge supply at a suitable point.
- Pressurise system with inert gas to approximately 2,5 kg/cm²g; this pressure can vary depending on equipment available and decision of supervisor.
- Vent system at far end ensuring that no undiluted pockets of air remain.
- Block in vessel again and repeat pressurising/venting cycle.
- Three pressure cycles should be enough to reduce oxygen content to below flammable limit. Sample vent gases at several points in system and test for oxygen level.
- Continue purge until acceptable oxygen level is reached.
- Ensure all dead legs in the system have been purged by opening vents, draining connections and blowing through these points. Close vents and drains.

		PROJECT	Standby SRU & Additional Tanks		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
Job Specification for Nitrogen Purging and Inertization	Project No. 080557C001	Document No. 080557C-000-JSC-0093-010	Rev. No. 0	Page 9 of 10	

- i) Discontinue purge and isolate system maintaining a slight positive overpressure (0,2-0,3 kg/cm²g) to prevent air entry.

The system is now ready to receive hydrocarbon liquid and vapour.

5.3 Process Pipe-work and Other Equipment (Displacement Purge)

Pipe systems and other equipment should be analysed and divided into convenient sections to carry out displacement purging.

- Select system and isolate from other pipe-work or equipment using available block valves and blinds.
- Introduce inert gas at one end of system and purge through, venting gases at far ends.
- Purge rate and selected injection points and vent points should be such that plug purge mechanism is encouraged.
- Analyse oxygen level in vented purge gases and continue purge until acceptable level is reached. Some mixing of air and purge gases will take place and plug purge mechanism will not be ideal. Approximately one and a half times system volume of purge gas will be required.
- Ensure all branches and dead legs in system are purged by venting at suitable points. Isolate entire system and maintain pressure (0,2-0,3 kg/cm²g) slightly above atmospheric to prevent air entry.

The system is now ready to receive hydrocarbon liquid and vapour.

6. Purged Systems Identification

Systems that have been purged and are under nitrogen pressure shall be identified in field with proper indication marks to avoid unwanted loss of nitrogen containment with the possible risks related to nitrogen inhalation and to air re-entering in the system.



SAFETY PRECAUTIONS

During Nitrogen purging, adequate measures should be taken to safeguard personnel and prevent environmental pollution. The following represent minimum precautions:

Ensure that system to be purged is clean from any material or contaminant that could be cause personnel harm or damage to environment

Ensure that system to be purged is correctly isolated

Place warning signs and fence off the entire purging area with strips of a colour distinguished from those used for surrounding construction activities

 		PROJECT	Standby SRU & Additional Tanks IOCL Paradip Refinery		
		CLIENT	INDIAN OIL CORPORATION LIMITED		
Job Specification for Nitrogen Purging and Inertization	Project No. 080557C001	Document No. 080557C-000-JSC-0093-010		Rev. No. 0	Page 10 of 10

Restrict access into purging area to authorized personnel

Instruct personnel in how to monitor purging operations and to stop purging activity when required

Check for instrumentation that could be damaged by contact with nitrogen (e.g. on line analyzer) and eventually exclude/remove them.

Ensure that vent is placed in a safe location far from any pit or any other accessible or unventilated area

Ensure that O2 levels measurement is carried out properly and that stream that is monitored represent actual content of the system