CRUST CHECK PROCEDURE

V:2023.1

Industrial Performance Services ★ Industrial Tubular Catalyst Services

Crust Check Procedure

January 2023

Purpose

The purpose of this procedure is to ensure that all reactors entered by IPS★ITCS personnel are safe for entry with limited crusting and no accumulated pressure from the inert gas purge. When reactors are made inert by the use of N2 or other gases the condition of the catalyst bed can be such that the gas builds pressure and does not flow through the materials due to fusion or a “crust”. When this crust breaks the release of accumulated pressure can be violent, ejecting the contents of the reactor along with any occupants. As such this procedure shall be the standard for all “Grubbs” testing prior to entry to an inert atmosphere.

Scope

The scope of this procedure shall include, but is not limited to, equipment requirements, personnel requirements, and procedures for conducting the “Grubbs” testing.

Equipment

The testing of the reactor shall be conducted using specially designed manifold system that can be connected into the N2 introduction line. This manifold must have a reliable gauge that is in good repair and a pressure relief device.

Personnel

The entry supervisor shall work closely with equipment owner and operator of the N2 introduction device.

Process

The Grubbs manifold shall be connected at or near the point of entry for the inert gas, always downstream (process) of the entry point for personnel. The inert gas shall be applied to the reactor until the desired volume of gas has been reached. The persons involved shall verify that there is No accumulation of pressure and that the output of gas is equal to the input. If either of these conditions is not met, there shall be no entry, as the release of any pressure can be catastrophic.

Conclusion

The actual testing of each reactor shall vary from reactor to reactor; however, this document and its contents shall be the standard by which IPS★ITCS shall plan and execute all “Grubbs” testing.

The Catalyst bed(s) should be tested to identifying if the catalyst has been crusted over.

All valves in the nitrogen supply system shall be tagged and/or locked as available to prevent unauthorized opening/closing.

Steps

1. Ensure that a permit has been issued to install the Grubbs Manifold

2. Install the Grubbs Manifold as directed by the diagram below. Superintendents (Supt.) are the only people allowed to perform the test. At a minimum one IPS★ITCS Supt. and client representative must be present during the test. No entry will be allowed until a pass has been achieved using the Grubbs Manifold.

3. Valves on the Grubbs Manifold **C** & **E** should be in the open position. Valves **F** & **H** will remain in the closed position to ensure that the low-pressure gauge will not be damaged from the nitrogen source during the test.

4. Once the maximum nitrogen flow or SCFH intended for vacuuming purposes during entry has been established, record the rates per hour and proceed to step 5

5. Maintain maximum nitrogen flow for the first ten minutes and then record the pressure readings on gauge **D**. Maintain maximum flow rate for an additional ten minutes to ensure that the swing of pressure has stabilized from the first recorded primary reading. If the pressure has changed continue to purge at maximum nitrogen flow until the pressure readings stabilize. (Note: there will be some fluctuations in readings). If there is no change in the fluctuation of pressure from the initial or secondary readings proceed with the Grubbs test.

6. Establish a clear & direct communication with the operator of the nitrogen truck via radio only.

7. To check for back pressure, instruct the nitrogen operator to block the truck source. Once the truck operator has communicated that he is shutting down, watch gauge **D** and block in valve **C** when the pressure has dropped to the lowest established fluctuation point. When gauge **D** reaches 30 psig open valve **F** and there should be an immediate rise and fall of pressure on gauge **G**.

   Note: DO NOT OPEN VALVE IF GAUGE D IS ABOVE 30 PSIG. EQUIPMENT FAILURE or POTENTIAL INJURY WILL OCCUR with GAUGE **G**

   The duration time once valve **C** is blocked and gauge **D** & **G** reach zero must be five seconds or less.

8. Once gauge **D** & **G** have reached zero open valve **H** and check for any detectible back pressure. If pressure is detected from valve **H** and exceeds five seconds from the closing of valve **C**, the test fails and a potential blockage in the catalyst bed is likely and or isolation blinds are not installed correctly.

9. The Supt must ensure that all sources leading to the reactor or associated piping are blocked in. Check the vessel for complete isolation (Walk the Structure). Repeat steps 3 through 8 once all potential entry points have been inspected and isolation is reconfirmed.

10. For multibed vessels individual test may be performed provided that no check valves

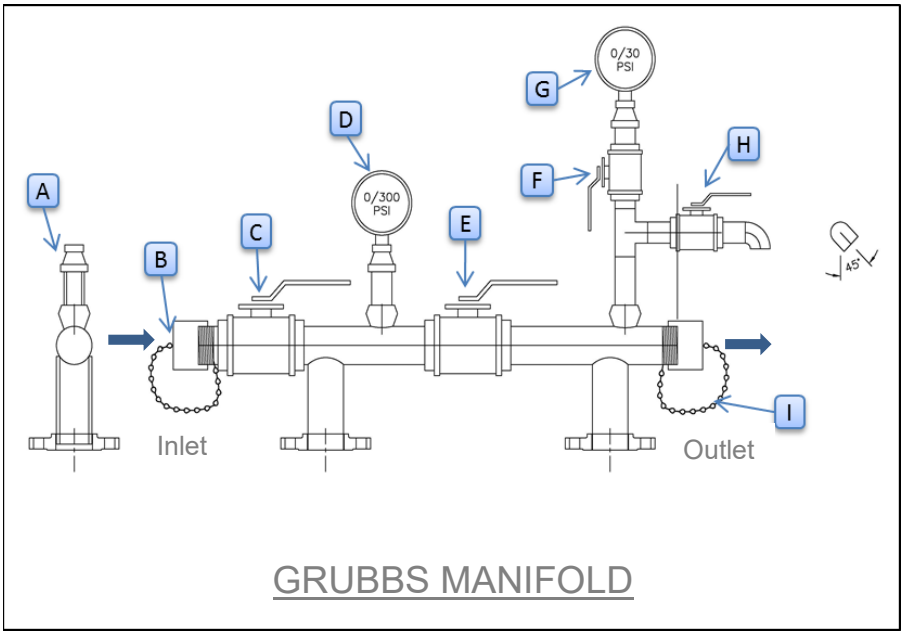
exist between the Grubbs Manifold and the purge point. Follow steps 3 through 8 for each bed. This can be done by piping N_2 in through the reactors existing quench lines located between each bed. If a failed test has been reached, discussions between the client, Supt and IPS★ITCS Sr. Management will occur before any deviations can be agreed upon.

Note: A slight discharge for an extended period may indicate a flow restriction in the upper portion of the catalyst bed (i.e., Top layer may be crusted). A greater pressure discharge for a shorter period may indicate a flow restriction in the lower portion of the catalyst bed (i.e., elephant stool). Back up Valve E is to be used only in cases of emergency (i.e., failure of Valve C).

Caution: During step # 8, N2 will be vented into the atmosphere. If there are large amounts of N2 being vented, proper PPE is required. The area around the Grubbs Manifold will be considered IDLH and Breathing Air will be required.

Danger: If the N2 flow cannot be maintained without the building of back pressure, shut down the N2 immediately and notify the customer. Alternative means of purging will be necessary to make entry and remove the N2 restrictions. If the N2 flow reaches an excess pressure at or above 290 psig or causes any PRVs to activate immediately stop all flow of N2 to the reactor and notify the customer.

GRUBBS MANIFOLD DIAGRAM



GRUBBS MANIFOLD

DESCRIPTION

- A — PRV Rated @ 300psi
- B — Nitrogen (N_2) Supply
- C — Primary Block Valve
- D — High PSI Gauge
- E — Secondary Safety Block Valve - To be used in emergency only.
- F — Low PSI Gauge Block Valve
- G — Low PSI Gauge
- H — Bleeder Valve
- I — To Reactor

Revision History

Rev	Rev Date	Rev By	Approved By	Description
1.0	1.3.2022	Shayne Torrans	Shayne Torrans	Initial Procedure Document
1.1	11.23.2022	Shayne Torrans	Shayne Torrans	Added Grubbs Diagram & Steps

Approvals:

Procedure Owner

_____ _____
Print Name Date

_____
Signature

Competency Assessment

No.	Questionnaire	C/NYC
Q1		
A1		
Q2		
A2		
Q3		
A3		
Q4		
A4		
Q5		
A5		

Enclosed Attachments	
Risk Assessment	☑
Environmental Aspect and Impact	☑
Training and Competency	☑
Measure and Evaluation Tools	☑

Competency Checklist

To be filled out by Trainer and signed by Employee, Assessor and Supervisor before being returned to the HSEQT Manager for recording purposes.

Procedure	Competency	Date	Competent YES / NO	Employee Signature

(Please tick appropriate box)

This employee is competent in performing the job. ☐

This employee has not attained the competency level. ☐ *

* *If the employee has not attained all competency levels, the General Manager must assess the action to be taken, provide an extension of training or alternative action as listed below.*

Alternate action to be taken: _____

Signed By

Employee: _____ Date: _____

Trainer: _____ Date: _____

Assessor: _____ Date: _____

Regional Manager: _____ Date: _____

Environmental Aspects and Impacts

Identified Environmental Aspects and Impacts

The following table is a summary of the likely environmental aspects and impacts that may be identified during site inspections. The significance of each impact needs to be assessed using the Risk Assessment Model.

Activity	Aspect	Impact
Purchasing & Administrative Work	Consumption of goods	Conservation of natural resources
	Consumption of energy (eg. Electrical equipment and facilities)	Release of greenhouse gases and atmospheric pollution; Consumption of natural resources; Habitat loss
	Generation of waste (eg. Paper)	Consumption of space for waste disposal; Habitat loss
Climate Control	Consumption of energy	Release of greenhouse gases and atmospheric pollution; Consumption of natural resources; Habitat loss
	Generation of noise	Disturbance to community; Habitat loss
Cleaning of – offices / vehicles	Storage, use and release of chemicals	Contamination of air, water or soil; Risk to human health
Transport (Fleet vehicles / staff travel)	Consumption of energy	Release of greenhouse gases and atmospheric pollution; Consumption of natural resources; Loss of habitat at all stages of generation; Light pollution
	Consumption of goods (eg. Oil)	Consumption of natural resources; Generation of waste; Habitat loss; Biodiversity impacts
	Generation of waste (eg. Oil)	Consumption of space for waste disposal; Potential contamination of water or soil; Habitat loss
	Exhaust emission	Release of greenhouse gases and atmospheric pollution
	Use of dangerous goods (eg. Batteries)	Potential contamination of air, water or soil; Risk to human health
	Generation of noise	Disturbance to community; Habitat degradation
Operations		

Risk Assessment

Risk Assessment // insert name here					
Step No: Logical sequence	**Sequence of Basic Job Steps documented in the Procedure, Work Instruction and project plans. Break down Job into steps.** Each step should be logical and accomplish a major task.	**Potential Safety & Environmental Hazards/Impacts at the site of the Job** Identify the actual and potential health and safety hazards and the environmental impacts associated with each step of the job.	**Risk Rating** Refer to the risk matrix or HSEQT.PRO. Risk Mgt	**Recommended Corrective Action or Procedure** ***Determine the corrective actions necessary to reduce the risk to as low as reasonably practical (ALARP) refer to HSEQ.PRO.Risk Mgt. The risk must be rediced or controlled to ALARP before work commences.*** Document who is responsible for implementing the controls to manage each hazard identified.	**Risk Rating** refer to the risk matrix or HSEQT.PRO.Risk Mgt
1.					
2.					
3.					
4.					
5.					

Audit

Process: insert// **Procedure**: Insert //	Date:	Audited by:
	Location of Audit:	Area Mgr/Supervisor:

Item	Question	Evidence Sited	Comments	Conformance Score 0,3,5
1.				
2.				
3.				
4.				
5.				
6.				
7.				

AUDITOR'S SIGNATURE: SAFETY REP'S SIGNATURE:	CONFORMANCE SCORE: / 25 CONFORMANCE %:	0 – Non-Conformance 3 – Continuous Improvement Opportunity 5 – Total Conformance