Global Products

Confined Space Entry Standard

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Version 1.3

Confined Space Entry Standard

1.0 Introduction

Confined Space Entry requirements are designed to help prevent injuries to personnel, property damage or adverse environmental impact. Confined spaces are defined as spaces large enough and so configured that a worker can bodily enter and perform assigned work, have limited or restricted means for entry or exit (e.g. tanks, vessels, furnaces, pipelines, storage bins, hoppers, vaults, sumps, pits and excavations) and are not designed for continuous worker occupancy.

This standard defines the Global Products requirements for confined space entry, including confined spaces with special hazardous characteristics (e.g. OSHA permit-required confined space).

The following sections provide minimum requirements for Confined Space Entry as well as supporting guidance to clarify the intent of those requirements.

Requirements of this Standard shall be met.

2.0 Requirements

1. Safer alternative options to conduct work shall be considered before undertaking a confined space entry (e.g. use of mechanical tools or robotics to perform tank cleaning).
2. Employees potentially exposed to identified Confined Spaces in the workplace shall be informed of their existence, location and potential hazards (e.g., signage or other effective means of communication).
3. Measures shall be in place to prevent unauthorized entry into a Confined Space.
    a. the entrance to all confined spaces shall be barricaded by an appropriate means and a warning sign installed at the entrance to prevent unauthorized entrance when the space is left unattended.
4. All Confined Space Entries shall be assessed to determine risk and permitted as follows:
    a. Entries into Confined Spaces with Special Hazardous Characteristics shall require a Confined Space Entry Permit in accordance with the Global Products Permit to Work Standard.
    b. Entries into Confined Spaces without Special Hazardous Characteristics shall be permitted in accordance with the Global Products Permit to Work Standard.
        i. Examples of non-permitted confined space - storage tanks removed from process service and door sheets cut as openings, equipment or valve box with no contact of process, etc.
5. The duration of a Confined Space Entry Permit / Certificate / work form shall not exceed the time required to complete the assigned task or job identified on the permit / work form. (E)

6. Confined Space Entry Permits / Certificate / work form shall be used in conjunction with a Permit to Work in accordance with the Global Products Permit to Work Standard.
    a. Permit Renewal, shift handover, and work completion for Confined Space Entry tasks must conform with the Global Products Permit to Work Standard.

7. The Confined Space Permit / Certificate / work form must include:

    a. The date and time the permit / certificate / work form is valid
    b. Purpose of entry
    c. Hazards and Safeguards
    d. Cross-references to other permits and certificates
    e. A description of the tank's or equipment's previous process contents
    f. The gas test results
    g. A list of minimum PPE for entry (Note: specific tasks may require a higher level of PPE).
    h. The name of the assigned Entry Attendant / Entry Watch (may be noted on the entry log).
    i. Space for writing in any additional requirements or conditions
    j. Space for the signature of the Permit Issuer and the date signed
    k. Space for the signature of the Permit Holder / Requester and the date signed

8. Additional precautions shall be required for a Confined Space that has one or more of the following special hazardous characteristics:

    a. Contains potentially hazardous atmospheres e.g. gas test results that are not within acceptable limits
    b. Contains a material that has the potential for engulfing an entrant, e.g. sludge in space that could cause worker to sink
    c. An internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section, e.g. entering a cone bottom tank
    d. The potential to contain any other recognized serious potential safety or health hazard, e.g. nitrogen in tank used to lower oxygen content to prevent fire / explosion.

9. The additional precautions for Confined Spaces with Special Hazardous Characteristics shall include, but not limited to the following:
    a. A rescue team and appropriate rescue equipment
    b. Entry attendant / Entry Watch
    c. Entry supervisor or equivalent.
    d. Isolation of hazardous energy in accordance with the Isolation of Hazardous Energy OE Standard
    e. Consideration of appropriate air ventilation (e.g. continuous forced, local exhaust, etc.)

10. Downgrading/reclassifying a Confined Space with Special Hazardous Characteristics to a Confined Space without Special Hazardous Characteristics for entry requirements shall be considered under the following conditions:

a. A hazardous atmosphere does not exist and there is not a potential that one could be created.

b. The only hazard in the space is a potential hazardous atmosphere and this is effectively controlled through the use of continuous ventilation.

c. All potential hazards are eliminated without entry into the Confined Space or if entry is required, then the requirements of a Confined Space Entry with Special Hazardous Characteristics are met.

d. Documentation of data, location, and signature of person making the determination to reclassify a Confined Space with Special Hazardous Characteristics to a Confined Space without Special Hazardous Characteristics is available to entrants or their authorized representative.

e. Affected personnel has been notified that the space has been downgraded/reclassified.

f. If special hazardous characteristics arise in a downgraded/reclassified confined space, all authorized entrants shall exit the confined space, and the space shall be reevaluated to determine how it will be classified.

11. A Hazard Analysis shall be performed in accordance with the Global Products Hazard Analysis Standard when planning work involving Confined Space Entry.

12. The Hazard Analysis shall consider additional requirements specific to Confined Space Entry, including but not limited to:
    a. Identification of significant potential hazards from task, space and SIMOPS in area.
    b. Identification of appropriate safeguards to mitigate identified hazards.
    c. Specialized equipment (e.g. respiratory equipment, rescue equipment, ingress & egress equipment, etc.).
       Note: Alternative to SCBA, Supplied Air System consisting of certified oil free air compressor , in-line air-purifying sorbent beds and filters, pressure gauge, air hose, supplied air-respirator and carbon monoxide sensor with alert alarm set at or below 10ppm (prior use) is allowed.
    d. Evaluate need for appropriate heat stress safeguards (e.g. work/rest breaks/rest periods, specialty PPE).
    e. Internal configuration, obstructions, or unique hazards associated with the space (e.g., fall hazards, residues and contaminants, etc.)
    f. Internal configuration or unique hazards associated with the space (e.g., fall hazards, residues and contaminants, etc.)
    g. Acceptable entry conditions (e.g. oxygen concentration, %LEL, etc.).
    h. Gas testing requirements & frequency – See Note below.
    i. Minimum personal protective equipment requirements.
    j. Isolation of hazardous energy requirements and other required permits / certificates/work forms (e.g., excavation, hot work, etc.).
    k. Appropriate air ventilation (e.g. continuous forced, local exhaust, etc.)
    l. Equipment appropriately rated for the space to be used (e.g., electrical equipment rated for the area classification) and mitigating controls for such equipment as necessary (e.g., Hot Work permit).

Note: Continuous gas monitoring in the vicinity of the work inside of the confined space with special hazardous characteristics is required during any confined space entry. Sites shall document circumstances where continuous gas monitoring may be waived due to risk of damage to the equipment (e.g., excessively dusty conditions, water mist) or required monitoring is ineffective, and the alternative mitigations or safeguards in place to maintain a safe atmosphere.

13. A Job Safety Analysis (JSA) or equivalent shall be conducted at the work site in accordance with the Hazard Analysis Standard prior to work involving Confined Space Entry.

14. Confined Space Entry work shall be stopped/suspended and all entrants shall exit the space in the following circumstances:
    a. A required safeguard is no longer present or functional. Some examples include:
        i. Entry attendant/ Entry Watch no longer available
        ii. Communication method failure
        iii. Gas monitoring indicates concentrations outside of the accepted values noted in the Global Products Portable Gas Detection Standard
        iv. Required continuous gas monitoring fails to operate (e.g., the battery is depleted)
        v. A required mechanical ventilation system in the confined space fails or is shut down
        vi. A change in isolation point
    b. An order to evacuate is given by the entry attendant or entry supervisor.
    c. An entrant recognizes any warning sign or symptom of exposure
    d. A facility emergency evacuation alarm is sounded.
    e. Change in work scope
    f. Change in job site conditions
    g. Withdrawal of work permit by permit issuer / approver
    h. An incident has occured

15. Process Equipment & Job Site Preparation for Confined Space Entry
    a. Competent personnel shall complete the steps needed to properly and safely prepare affected equipment for the start of confined space entry. This includes, but is not limited to, applying positive isolation when applicable per the Global Products Isolation of Hazardous Energy Standard and de-pressuring, chemically or steam cleaning, purging, flushing, draining and venting equipment as appropriate.
    b. Gas cylinders (with the exception of breathing air) shall:
        i. Not be taken into confined spaces.
        ii. Have gas cylinder valves closed when not in use.
        iii. Have the leads removed from confined space when not in use unless space is being continuously monitored for hazardous atmospheres.
    c. Using appropriate ventilation once entry is approved
    d. Staging rescue equipment near the confined space when determined to be necessary by Rescue Personnel
    e. All electrical equipment used inside confined spaces shall meet the required Electrical Classifications for that area. (e.g., Class I, Division I or Division II) until all of the following circumstances have been addressed:
        i. The space has been cleaned of residual hydrocarbon

ii. An appropriate Permit for hot work has been approved
iii. A qualified gas tester has determined the space safe for such equipment
iv. Temporary or portable lighting in confined spaces shall be equipped with a Ground Fault Circuit Interrupter (GFCI), earth leakage relay (ELR), or equivalent.

Note 1: A forced/supplied ventilation is required for enclosed confined space (example: above-ground storage tanks) in addition to natural ventilation while the entrants are inside the confined space.

Note 2: Local Exhaust Ventilation extraction point need to be placed closer to the work location and air purifying respirators consisting of Multi-gas Vapor/Gas/Particulate Cartridge or particulate filters suitable to provide protection from welding and paint fumes in confined space need to be considered as part of hazard analysis.

16. Initial, revalidation and renewal gas testing shall be performed by a Qualified Gas Tester (QGT) prior to a Confined Space Entry in accordance with the Global Products Portable Gas Detection Standard.
    a. The gas testing results shall be recorded on the Confined Space Entry Permit / Certificate / work form.
    b. If applicable, BU's must document cases where ventilation must be on to adequately test the space. i.e. initial entry to towers prior to tunneling.
17. All authorized entrants or employee representatives shall have the right to observe any gas monitoring/testing of Confined Spaces.
18. In the absence of continuous gas monitoring, in circumstances where work does not begin or is stopped for a period of more than 30 minutes, the Confined Space Permit/certificate, associated permits/hazard analysis and gas testing shall be revalidated before work can resume.
19. Atmospheric testing and acceptable limits

	Atmospheric Testing Acceptable Limits					
Requirements	**Tests**	**Oxygen (O_2)**	**LFL/LEL**	**Hydrogen Sulfide (H_2S)**	**Carbon Monoxide (CO)**	**Temperature**
	Safe to Enter	19.5 % to 23.5 %	< 5 %	< 5 PPM	< 25 PPM	< 100 deg. F. (< 38 deg. C.)
	Supplied Breathing Air Required	Between 16.5 % and < 19.5 %	N/A	5 to 50 PPM	25 - 1200 PPM	Ventilation required 10 F. -110 F. (38 C. – 43 C.)
	No Entry Allowed	< 16.5 % or > 23 %	≥ 5%	> 50 PPM	> 1200 PPM	> 110 F. (> 43 C.)

	Atmospheric Testing Acceptable Limits

20. Rescue Plans shall be developed for a Confined Space Entry with Special Hazardous Characteristics and include, but not limited to the following requirements:
    a. Responders (onsite and offsite) are trained (including CPR and first aid), properly equipped, define communication methods, and follow established emergency procedures specific for potential hazards in the Confined Space.
    b. Ensure response times are appropriate for potential hazards in the Confined Space.
    c. Responders have access to Confined Spaces.
    d. Eliminate the need of entry-required rescue by the use of retrieval systems or methods that are used by authorized entrants (e.g., chest or full body harness with a retrieval line or wristlets) as long as use does not increase the overall risk of entry and can be used effectively).
    e. Mechanical devices shall be available to retrieve personnel from vertical spaces more than 5 feet (1.52 m) deep.
    f. Rescue drills are conducted and documented by those employees/personnel who are designated to perform Confined Space rescues annually, at a minimum.
    g. Only trained and competent rescue personnel may enter a confined space to rescue individuals in need.
    h. All entrants of Permit Required Confined Spaces shall wear a full body harness and a retrieval line attached to a retrieval device / anchor point unless the use of such equipment would increase the risk of injury during entry or not contribute to the rescue of the entrant.
        i. The entrants shall remain attached to the retrieval device / anchor for the duration of the work.
        ii. The decision to waive one or both of these requirements (harness and retrieval line) shall be documented either on the permit or the rescue plan by a rescue team member or other authority as determined by the BU.
    i. For most vertical top entries, excluding excavations, a harness with a single D ring is acceptable.
        i. For vertical entries that have a restricted opening (<24” wide) which may complicate extraction, a harness with shoulder attachments should be substituted for the D ring arrangement.
        ii. All top entry confined spaces with a fall hazard also require the harness to be attached to an anti-fall retrieval device while ascending and descending entry ladders.
    j. Rescue shall be planned to occur in the following order of preference:
        i. Self-rescue
        ii. Non-entry rescue using retrieval device
        iii. Entry rescue

21. A dedicated Confined Space Entry Attendant / Entry Watch and Entry Supervisor or equivalent oversight shall be provided for Confined Space Entry with Special Hazardous Characteristics and include, but not limited to the following requirements:
    a. Remains in constant contact (voice and/or visual) with workers inside Confined Space.

b. Has an awareness of potential hazards in Confined Space and their related effects.
c. Maintains an entry log (including names of all entrants and entry attendant).
d. Monitors conditions and activities to evaluate safety of entry.
e. Has knowledge of communication protocols (e.g., who, appropriate equipment) in the case of emergency.
f. Remains outside the Confined Space until relieved. If trained to perform rescue, the attendant shall be relieved before entering the space.
g. Never leaves post unless relieved by another entry attendant or all entrants have exited the space.
h. Ensures entry points to confined spaces are adequately barricaded when leaving post and only when all entrants have exited the space.

22. Additional requirements for an entry attendant / Entry Watch monitoring multiple Confined Space Entries with Special Hazardous Conditions shall include, but not limited to the following:
    a. The requirements for a dedicated Confined Space Entry Attendant are met for each Confined Space monitored.
    b. Emergency Response procedures are developed so that an attendant may respond to an emergency and meet all the requirements of a dedicated Confined Space Entry Attendant.
    c. The attendant is not to enter the confined space unless properly trained and relieved from attendant duties.

23. Entry into inert atmospheres is always considered a highly hazardous activity. Requirements for entry into inert atmospheres are outlined in Appendix A: Inert Confined Space Entry Requirements.

24. Lock-On Respiratory Helmets are required for confined space entry work inside a vessel for the following conditions:
    a. All inert entries
    b. All non-inert entries into a reactor or vessel that contains spent catalyst that had processed materials that are flammable or volatile, or self-heating/pyrophoric materials.
    c. All entries where catalyst with self-heating/pyrophoric properties are being loaded.

25. The Confined Space permitting process shall indicate roles, responsibilities, and protocols as described in the Global Products Work Authorization Standard.

26. An annual documented review of all confined space entries with special hazardous characteristics (including permits and “in progress” confined space entries) shall be conducted to assess the need for program revision or training needs.

27. Training requirements and competency assessment for personnel affected by and authorized in the Confined Space Entry shall be documented.

28. The Confined Space Entry Standard shall define the policy for record retention that meets applicable legal, corporate, and operating company requirements (or at least 12 months, whichever is more).

3.0 Roles and responsibilities

Roles, Responsibilities & Competencies Shall be found in the Global Products MSW Process Roles & Responsibilities

4.0 Training Requirements

4.1. Initial Training

Personnel must meet the competency requirements and be trained on the requirements of this standard, prior to starting work.

4.2 Refresher Training

Refresher training session shall be provided as follows:

- As required by local regulations or site policy.
- Whenever a person demonstrates insufficient knowledge of the International Products Confined Space Entry Standard.
- When a serious incident related to Confined Space Entry work occurred and the root cause identified the need to be retrained.
- Trained on the requirements of this standard, at least every three years

5.0 Records

5.1 Records requirements

- Copies of all Permit to Work, Confined Space Entry Forms minutes and associated documentation (including records of inspection, hazard analysis, maintenance and competencies) shall be maintained in accordance with Global Products Managing Safe Work Process (CoW).

5.2 Retention requirements

Records shall be retained for the periods as specified below:

- All records mentioned above shall be retained by the facility for at least 1 year after the job has been completed.
- Training Records shall be maintained for 3 years or until re-training occurs.
- Training records will be kept for personnel until five years beyond termination of employment.
- Copies of letter of authorization of the Permit Issuer and Approver will be kept on file for three years, as proof of role competency.
- In cases where an incident occurred at the job site while the permit was in effect, the permit form and related documents must be kept with the incident investigation documentation.

6.0 Document Reference Information

6.1 Documents Reference List

Required Documents - Title	Attachment
Confined Space Entry Form (as applicable)	Confined Space Entry Form
Confined Space Rescue Plan Template	Confined Space Rescue Plan Template
CS Entry Log – Additional Gas Detection Log	CS Entry Log – Additional Gas Detection Log
CS - Start Work Check (SWC)	CS - Start Work Check
Required Documents - Title	**Attachment**
Storage Tank Gas Detection Forms (as applicable)	Storage Tank Gas Detection Forms

7.0 Document Control

Description	Fuels & Lubricants
Approval Date	July 2021
Next Process Document Review	July 2026
Control Number	Version 1.3

7.1 Document Change History

Changes to this document are listed in the table below by change date.

Date (DD/MMM/YR)	Version Number	Description of Change
1 July 2021	*1.0*	*Development of F&L standard*
9 February 2022	*1.1*	*Revised CO exposure limits to align with NIOSH update*
1 *April 2022*	*1.2*	*Added reference document links to standard*
15 *January 2024*	*1.3*	*Provided revisions as defined in the new Enterprise CS Standard*

Appendix A

Inert Confined Space Entry Standard

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1.0 Purpose

The purpose of this Standard is to protect personnel, the environment and the facility by specifying the minimum requirements for safe inert confined space entry operations within Global Products operated facilities.

2.0 Objective

This document defines the minimum requirements that must be in place to protect employees and contract personnel from the hazards associated with entering and/or working near vessels containing inert atmospheres. This is not limited to but most likely to occur in the framework of reactor catalyst servicing activities. These requirements are in addition to the requirements outlined in the Global Products Confined Space Entry Standard.

2.1 Planning

1. Safer alternative options to conduct the work shall be considered before undertaking an inert confined space entry. The decision to perform an inert confined space entry in lieu of a safer alternative must be reviewed and approved by the appropriate level of management as defined in the Inert Confined Space Entry Critical Consequence Plan Requirements. Appendix B of this document.

2. Entry into inert atmospheres is only permitted after a critical consequence plan, including specific written procedures has been prepared and approved following the Inert Confined Space Entry Critical Consequence Plan Requirements. Appendix B of this document.

3. Chevron personnel are prohibited from making entry into an inert atmosphere. Only contract personnel who are specially trained in working in inert atmospheres may perform this work at Chevron facilities.

4. A rescue plan specific to the vessel being entered must be developed, approved, and posted at the job site prior to entry.

5. Inert entry is classified as an “Always High-Risk” work activity by the Contractor Health and Safety Management process. Contractors performing this specialized work are subject to vetting by a Chevron SME and must demonstrate special qualifications before commencement of work including:

Note: Information and data obtained by Chevron SMEs during assessments of contractors can and should be leveraged by decision makers when considering the use of these specialty contractors.

   a. Training certificates for entry into inert atmospheres showing dates of refresher training and experience of the personnel selected for the job.

   b. Confirmation that named personnel undergo regular medical checks and are physically capable of performing inert entry work.

c. Documented proof of rescue training and certification of personnel tasked with rescue responsibilities.
d. Documented proof of training and certification of Breathing Air Console Operator.
e. The specialty contracting crew shall, at minimum, be comprised of the following personnel: (or equivalent title)
    i. Entry Supervisor
    ii. Top Side Supervisor
    iii. Top Side Safety Attendant (hole watch)
    iv. Top Side Rescue Stand-by (under helmet)
    v. Entrant
    vi. Breathing Air Console Operator
    vii. Inert Gas Supply Operator
    viii. Dedicated Vacuum System Operator (when vacuum system is in use)

6. For vessels containing Ni catalyst, confirmation must be made that shutdown procedures were properly executed regarding the requirements preventing the formation of nickel carbonyl per the Hydroprocessing Shutdown Procedures Best Practice HP-014. If procedures were not, or could not be properly executed, contingency plans must be undertaken to eliminate or mitigate the hazard of nickel carbonyl exposure to would be entrants.

    a. Information concerning Nickel Carbonyl formation and exposure can be found in the Hydrogen BIN Best Practice Document.

2.2 Life Support System

7. Entry into inert confined spaces shall only be made using specialized air-supplied positive pressure breathing apparatus. The Life Support System must, at minimum, include and satisfy the following requirements:
    a. An integrated helmet/respirator assembly that includes primary and secondary air regulators that operate independently of one another.
        i. Positive pressure maintained at the face piece shall be provided.
        ii. The Secondary shall open automatically if there is loss of pressure from the primary breathing air supply.
        iii. The helmet shall be a “lock- on” or “panic proof” design, meaning that the helmet shall not be removable by the wearer but requires a second person to remove it.
    b. Separate primary and secondary breathing air supplies connected to an instrument panel to monitor the air supply source pressure and use of air.
    c. The breathing air supply system shall include audible alarms set not lower than 35 bar/ 500 psi for the primary and secondary supplies.

d. A separate air cylinder, (minimum of one hour supply) typically located near the entry opening, and pressurized hose line or, Emergency Egress Line, (EEL), shall be provided for each entrant.
e. An egress air bottle (typically called 5 or 10 Minute Escape/Egress), shall be attached to the harness of each person under helmet.
f. An umbilical cord (crush proof sheathing) containing primary & secondary air supply hoses, communication cable(s) and a steel safety cable shall be provided.
    i. The umbilical cord shall not be considered or used as fall protection.
g. A Hands-free communication system shall be provided which links all personnel under helmet to the Breathing Air Console Operator and the Safety Attendant. Communication monitoring by the Breathing Air Console Operator shall not be discontinued while a person is inside the inert confined space. An alternative way of alerting a person in the vessel to evacuate in case of loss of communication shall be provided and known by the personnel involved in the entry operation, including the Top Side Safety Attendant, (hole watch).
h. Video capability shall be provided to ensure visual contact with in- vessel crew.

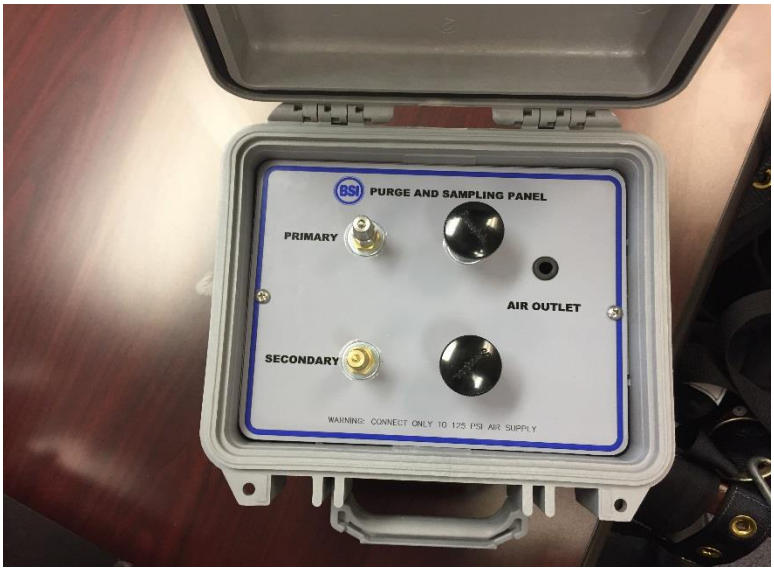
2.3 Breathing Air Supply

8. Breathing air supply shall meet or exceed the specifications for Grade D per CGA 7.1(U.S.), EN 12021(E.U.) or AS/NZS 1715 (Aus.), and must be accompanied by a Certificate of Analysis from the breathing air supplier.

    a. The use of blended or “synthetic” breathing air is prohibited.
    b. After staging and line-up, a test from *each cylinder* of the primary, secondary and EEL breathing air supplies shall be conducted by a qualified gas tester.
        i. * Each cylinder shall be tested and results logged.
        ii. Oxygen levels shall be 20.9% + or – 0.5%.
    c. Breathing air supply valves on the common supply line shall be secured in the open position and tagged while in use.
    d. Once the primary and secondary breathing air supply hoses are connected to the manifold, they shall be purged to remove any potential condensation or debris.
        i. A test of the breathing air coming from the user end of the hose shall be conducted and results logged as final confirmation that breathing air meets the required oxygen levels.

            1. This is facilitated in one of two ways. The purge and test can be conducted at the helmet. This, however, subjects the regulators to possible condensation and debris.

2. Some service providers have devices, (purging panels), pictured below, that the user end of the air supply hose connects to which facilitates a purge and test prior to connecting to the helmet. This method is preferable.



e. The Breathing Air Console Operator shall not switch or open new air cylinders while personnel are under helmet in the vessel.
f. If new air cylinders must be opened, entrant(s) shall immediately be removed from inert environment. A new breathing air system check shall be performed prior to use of new air cylinder line up.

**NOTE: Cylinders that are manifolded together in a single rack, may be sampled as one unit if the cylinders do not have individual valves. If cylinders have individual valves, each cylinder in the rack must be tested individually*

2.4 Control of Work Area

9. To control entry to the general work area or, “warm zone”, by non-essential personnel, a minimum of a 10 ft. (3 m) regulated area shall be established around the perimeter of the general work area using crowd control fence, barricade tape, or equivalent.

    a. Entrance into this area should be restricted to essential personnel.

10. Exclusion Zones or, “hot zones”, within the general work area, shall be established utilizing physical, hard barricades in areas where nitrogen is likely to be present, including vessel openings and venting locations

a. Entry into the exclusion zones shall be regulated and only allowed by authorized persons wearing supplied breathing air.
b. Exclusion zones around vessel manways shall be a minimum of 5ft. (1.5m) radius and be hard barricaded.
c. Exclusion zones around dump nozzles shall be a minimum of 5ft. (1.5m) radius and be hard barricaded.
d. The barricades shall include “Danger Do Not Enter” signage warning of asphyxiation hazard.
e. Continuous gas monitoring shall be conducted near manway exclusion zones to ensure zones are large enough to prevent over - exposure to nitrogen concentrations outside the exclusion zones.
f. Whenever open vessel manways are unattended, a solid cover covering the entire opening must be installed, securely fastened and locked out, and a warning sign must be in place.

2.5 Inert Gas Supply

11. The inert gas used to maintain an inert atmosphere for entry shall be a segregated and dedicated source of nitrogen and meet the following criteria.
    a. Nitrogen from the plant or refinery nitrogen header shall not be used as a primary source of inert gas.
    b. The primary supply of nitrogen shall be from a dedicated source of liquid nitrogen routed through a vaporizer.
    c. The primary nitrogen supply shall be controlled by a dedicated Nitrogen Supply Operator that remains in communication with the entry team.
    d. A backup or secondary independent source of nitrogen shall be provided to be used for egress should the primary source be lost or compromised. This secondary source can either be another truck, a tube trailer or plant nitrogen.
    e. Unattended valves in the primary nitrogen supply shall be locked in the opened position.
    f. Purity of the primary source of nitrogen shall be confirmed to be a minimum of 98% nitrogen.
        i. CO content shall be < 10 PPM.

2.6 Pressure Test

12. A “crust pressure test” shall be conducted and must “pass” prior to initial entry to confirm a buildup of pressure is not present.

    a. A sample pressure test procedure is included in this document as Appendix C.
    b. If the test reveals a crust has formed and pressure is present, special procedures must be developed to relieve the pressure and remove the crust prior to making entry.

2.7 Gas Testing

13. Initial gas testing of the space prior to entry, and continuous monitoring of the space
14. during entry, is required, and should be conducted near the work area. The devices used for gas testing and monitoring shall be suitable for testing an inert atmosphere. This can include but is not limited to catalytic sensors equipped with dilution tubes, and or infrared sensors.

    a. When hydrogen may be present, only “catalytic bead” testers with a dilution tube shall be used. Hydrogen and certain hydrocarbons are not effectively detected by some IR sensors.

Table 1: Inert Entry Requirements

Test	**Limits**	**Initial Entry or Continuous Occupancy**
Oxygen	≤ 2%	Initial Entry
	≤ 4%	Continuous Occupancy
LEL	≤ 5%	Initial Entry & Continuous Occupancy
CO	25PPM	Initial Entry & Continuous Occupancy
H2S	25PPM	Initial Entry & Continuous Occupancy
*Temperature	100°F (38°C)	Initial Entry
	100°F(38°C) or if temperature rises more than 5°F(3°C) in a 15 minute period	Continuous Occupancy

*Note: Entry can be allowed when ambient temperature exceeds limits if properly mitigated with an approved “heat stress management” plan as part of the Critical Consequence Plan. This should include work rotation protocols, notifications when exceedances occur, and oversight by Operations/HES.

2.8 Vacuum Systems

15. Vacuum systems used in the process of conducting inert confined space entries must follow the guidelines established in the Products Standard for Vacuum Truck and Vacuum System Operation. In addition, the following requirements also apply.

    a. Vacuum equipment shall be purged with nitrogen prior to use.
    b. Vacuum hoses and connections shall be inspected for integrity to prevent the ingress of oxygen.

c. Vacuum systems, when in use, shall be continuously manned by a dedicated operator.
d. Vacuum systems, when in use, shall be barricaded with “Danger Do Not Enter” signage.
e. The vacuum unit must be equipped with an emergency shut-down device, (E-Stop), as the use of vacuum breakers during inert vacuuming operations is unacceptable.
f. The following conditions require the shutdown of the vacuum system

    i. % oxygen levels exceed 4%.
    ii. % LEL exceeds 5%.
    iii. Primary source of nitrogen is lost.
    iv. Bonding and or grounding of the vacuum system is compromised.

**NOTE: Many vacuum systems used in catalyst extraction service are being equipped with in-line grounding verification units and LEL sensors with interlock shutdown function.*

2.9 Other Requirements

16. Lighting systems shall be low voltage (12V), explosion proof and supplied by a GFCI or RCD (UK) power source. Transformers shall remain outside the vessel.

17. Pneumatic equipment and tools, such as hammers, grinders, dense loaders etc., used within the inert confined space, shall be powered using nitrogen.

3.0 References

The following table lists internal and external references that apply to this standard.

Table 2: References

Reference	SharePoint Link
Roles and Responsibilities	CoW Roles & Responsibilities
Training and Competency Standard	Training Requirements Tool Training & Competency Standard

Appendix B

Critical Consequence Plan (CCP) Requirements

Global Products shall follow the DS&C CCP Standard as defined.

Figure 1. Inert Entry Critical Consequence Plan Development Flow Chart

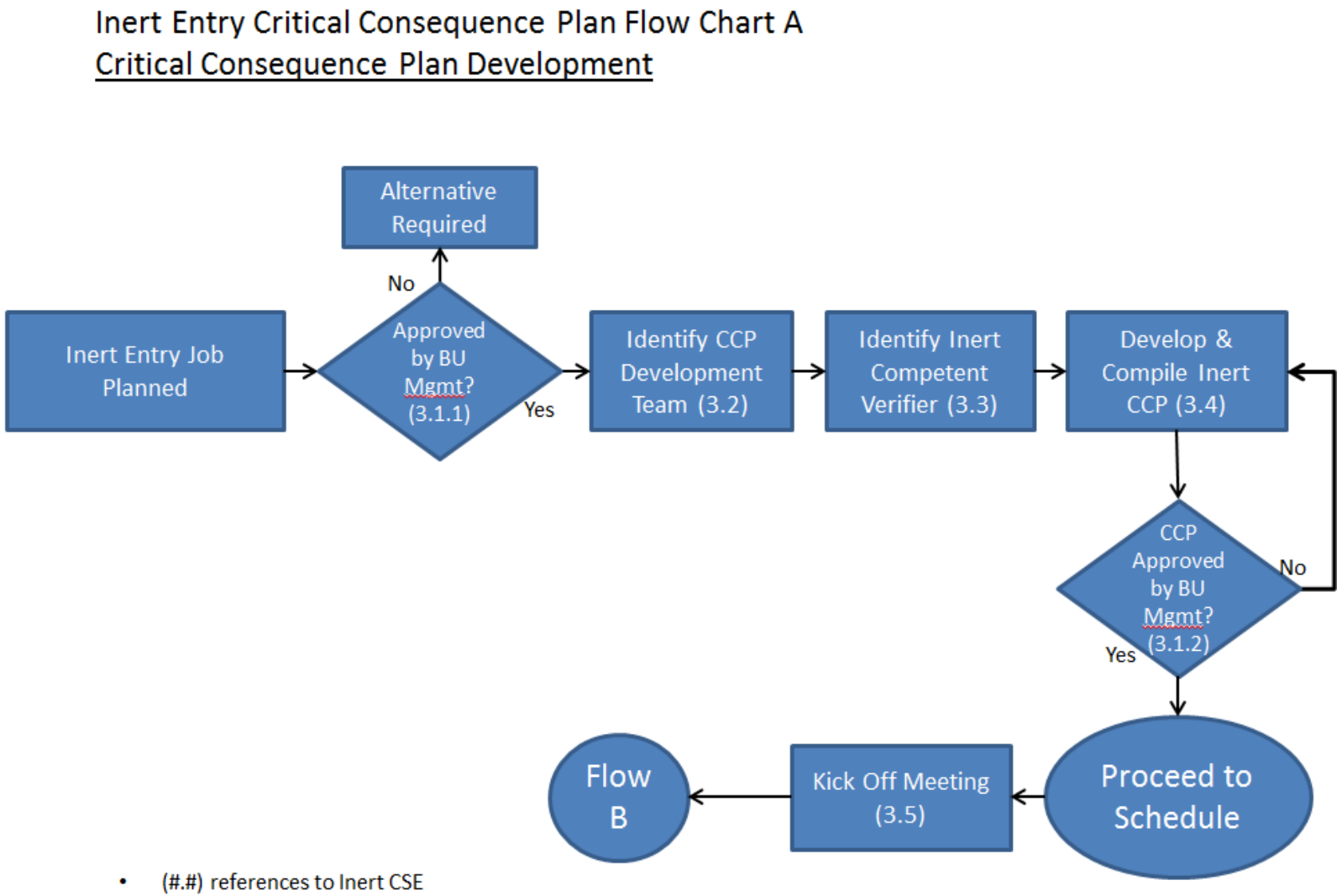
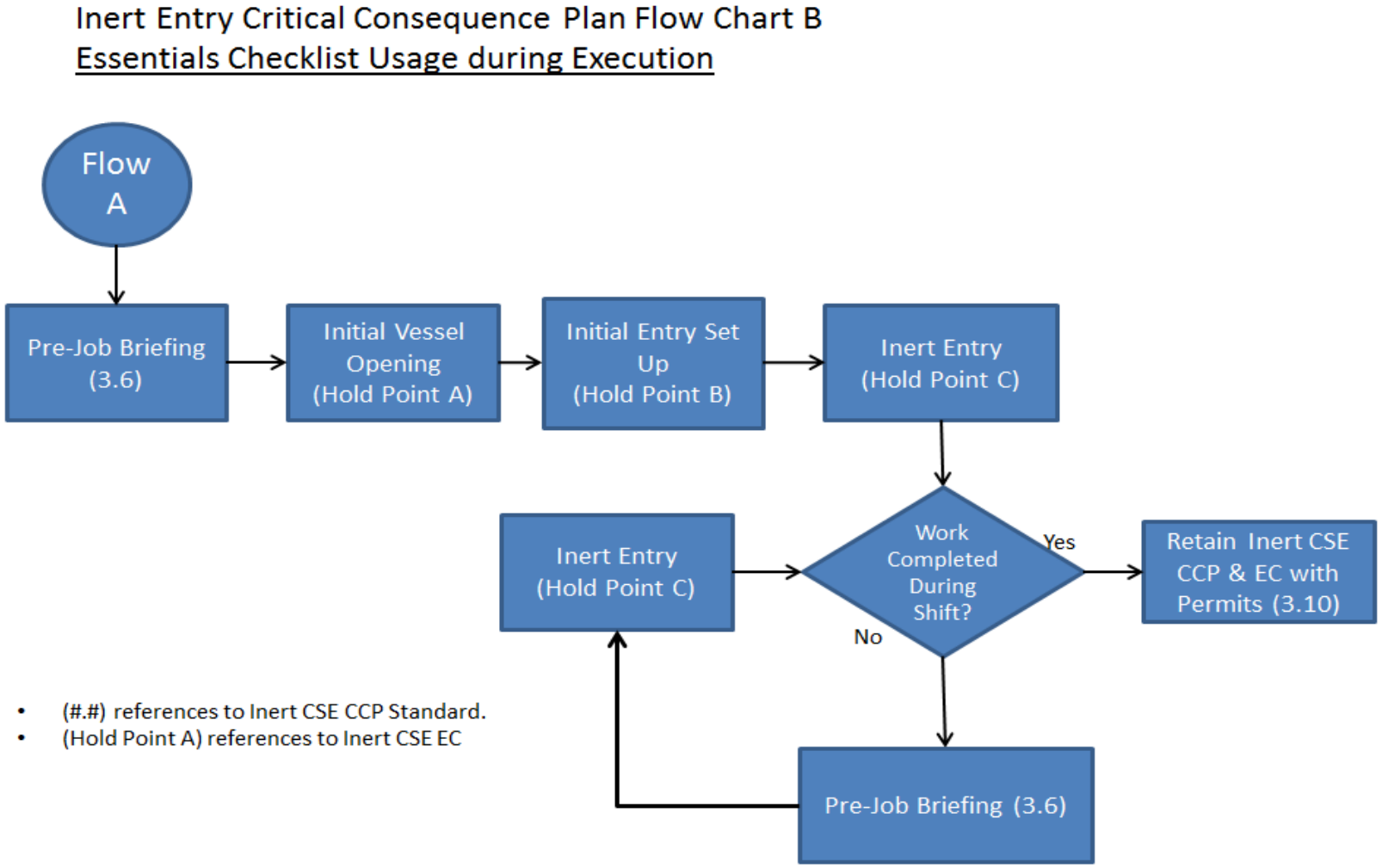


Figure 2. Inert Entry Essentials Checklist Usage Flow Chart



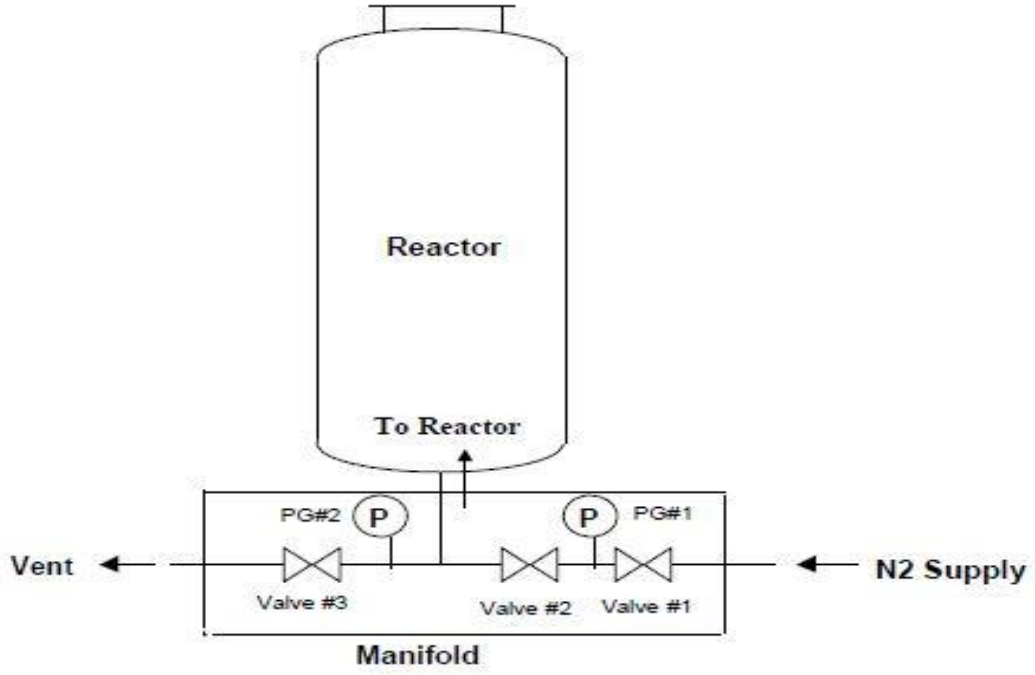
Appendix C

Crust Pressure Test Procedure

Crust Pressure Test Procedure

Purpose: The Manifold described below is a device used to test for crusting of catalyst in a reactor when nitrogen is purged through the bottom. This procedure is performed prior to vessel entry to ensure that no build-up of gas (N2) pressure exists in or below the bed.

Schematic:



Setup Procedure:

1) Place the manifold as close to the reactor purge inlet as possible
2) Make sure the connection point at the reactor is open and clear
3) Connect the manifold to the reactor, and to the nitrogen supply (make sure there is no check valve between the manifold and the reactor inlet)
4) If there is a question of the supply pressure exceeding 300psi, place a relief valve immediately upstream of the manifold (the relief valve should be set to relieve at a maximum of 300psi)

Test Procedure (type "A"):

1) Make sure Valves #1, #2 and #3 are closed.
2) Open Valve #1 (and any valve on the reactor-side downstream of the manifold).
3) Turn on nitrogen supply.
4) Wait for pressure to stabilize.
5) Slowly open Valve #2. Monitor PG #2. Wait for the pressure to stabilize.[1]
6) Close Valve #1[2] and monitor pressure decay via PG #1 and PG #2.
   a) Rapid depressure ➔ Unobstructed nitrogen flow through the reactor, reestablish flow to the reactor and secure valves #1, #2 in the open position according to LOTO procedure. If all other conditions meet entry requirements, obtain a permit and make entry to start work.
   b) Slow/No depressure ➔ Obstructed nitrogen flow, depressure reactor through the vent by slowly opening Valve #3. When the reactor has depressured, go to step 7 for multi-bed reactor with quench pipe(s) or go to step 8 for single-bed reactors or multi-bed reactors with no quench pipe.
7) Hook up the manifold to the next higher quench pipe (setup steps 1 through 4) and repeat test steps 1 through 5.
8) Establish nitrogen purge through the top manway of the reactor, obtain a permit and make entry to start work, provided all other entry requirements are met. Re-test after the "crust" has been broken.

Picture of a Manifold (type "A"):

Material of construction (type "A" minimum requirements):

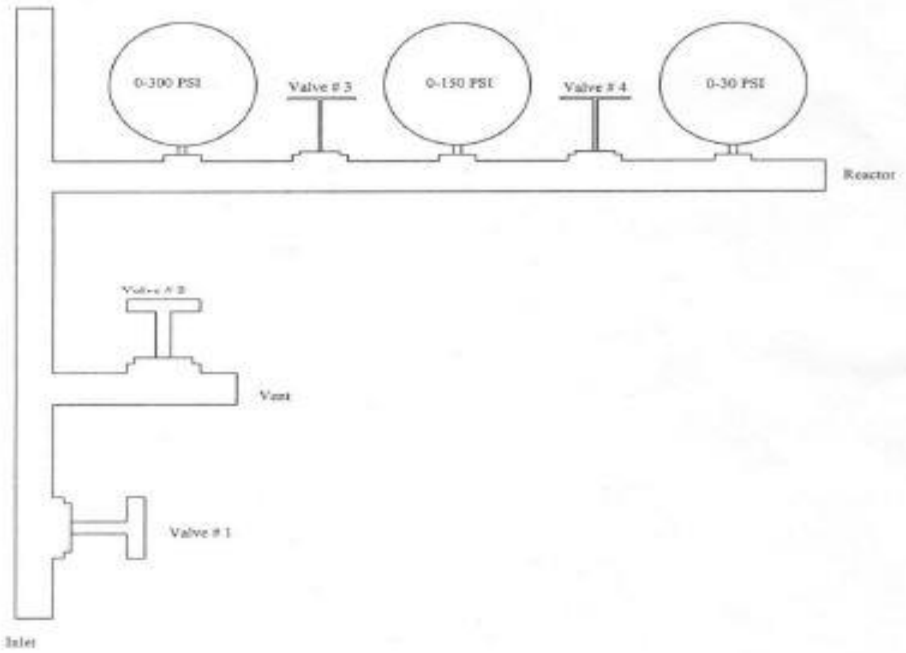
- 2" Schedule 40 Carbon Steel Piping
- 2" 300# NPT Ball Valves (3 each)

- 0-300# ½" White Face Black Numerals Pressure Gauge
- 0-30# ½" White Face Black Numerals Pressure Gauge (see note 1)
- 0-150# ½" White Face Black Numerals Gauge (optional see note 1)

Test Procedure (type "B"):

1) Make sure all valves are in the closed position.
2) Open valve #1 and wait for pressure to stabilize.
3) When the pressure is indicating a level of below 300psi, open valve #4.
4) Slowly open valve #3. This will establish flow to the reactor (make sure that any valves in the purge line downstream of the manifold are open).
5) Monitor the initial gas flow to assure the pressure is not climbing. Wait for the pressure to stabilize[1].
6) Close valve #1[2] and monitor the gauges for pressure decay.
    i) Rapid depressure → Unobstructed nitrogen flow through the reactor, reestablish flow to the reactor and secure Valves#1, #3, and #4 in the open position according to LOTO procedure. If all other conditions meet entry requirements, obtain a permit and make entry to start work.
    ii) Slow/No depressure → Obstructed nitrogen flow, depressure reactor through the vent by slowly opening valve #2. When the reactor has depressured, go to step 7 for multi-bed reactors with quench pipes or go to step 8 for single bed reactors or multi bed reactors with no inner bed quench.
7) Hook up the manifold to the next highest quench pipe (setup steps 1 through 4) and repeat test steps 1 through 6.
8) Establish nitrogen purge through the top manway of the reactor. Obtain a permit and make entry to start work, provided all entry requirements are met. Re-test after the crust has been broken.

Drawing of Manifold (type "B")



Pipe nipples are 1 ½" X 2 ½" sch40 (720 psi WOG rating)
Tees are 1 ½" 150 # malleable iron (300 psi WOG rating)
Ball valves are 1 ½" 150# bronze (600 psi WOG rating)

[1] The stabilizing pressure will depend on the amount of catalyst, supply pressure, and will vary from reactor to reactor.
[2] If your nitrogen supply is coming from a nitrogen-pumping unit, you should notify the operator that you are preparing to block in the nitrogen prior to closing the Grubbs manifold.