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Title: LANL SCE Experimental Series -- Nimble Feedthrough Qualification -- 125% High Explosive Overpressure Test Plan

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LANL SCE Experimental Series -- Nimble Feedthrough Qualification -- 125% High Explosive Overpressure Test Plan

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Revision History

Revision	Date	Description of Change
A		Initial release

Acronyms

Term	Description
CO	Carbon Monoxide
DSA	Document Safety Analysis
DAS	Data Acquisition System
E-6	LANL Non-Destructive Testing & Evaluation Group
EBW	Exploding Bridge Wire
Eu_2O_3	Europium Oxide
FCC	Fire Control Center
FEA	Finite Element Analysis
FS	Firing Set
HE	High Explosives
IH	Industrial Hygiene
J-2	Dynamic Structure Design and Engineering
J-4	Experiments and Diagnostics
J-6	Engineering Operations and Physics
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
MV	Manual Bellows-Sealed Valve
NNSS	Nevada National Security Site
OPT	Over-Pressure Test
P&ID	Piping and Instrumentation Diagram
Q-6	LANL Detonator Technology Group
SCE	Subcritical Experiment
SS	Safety Significant
SSC	Structures, System, and Components
TA	Technical Area
TE	Test Engineer
VCS	Vessel Confinement System
WIV	Worchester Isolation Valves

Table of Contents

1.0 SUMMARY

The primary purpose of this High Explosive (HE) Over-Pressure Test (OPT) is to qualify top cover diagnostic feedthroughs that will be used on LLNL Nimble Subcritical Experiment (SCE) Series designs per experimental design verification requirements specified in ASME Boiler and Pressure Vessel Code Case 2564, *Impulsively-Loaded Pressure Vessels, Section VIII, Division 3* [1]; and to satisfy the over-test requirement of DOE-STD-1212 [5]. The diagnostic feedthroughs are part of the Vessel Confinement System (VCS), which is credited as a Safety Significant Design Feature per the U1a Facility Documented Safety Analysis (DSA). The OPT will be conducted at the LANL Area 1, R306 Firing Site (TA-15-R306) in a 3-foot diameter VCS depicted in Figure 1.

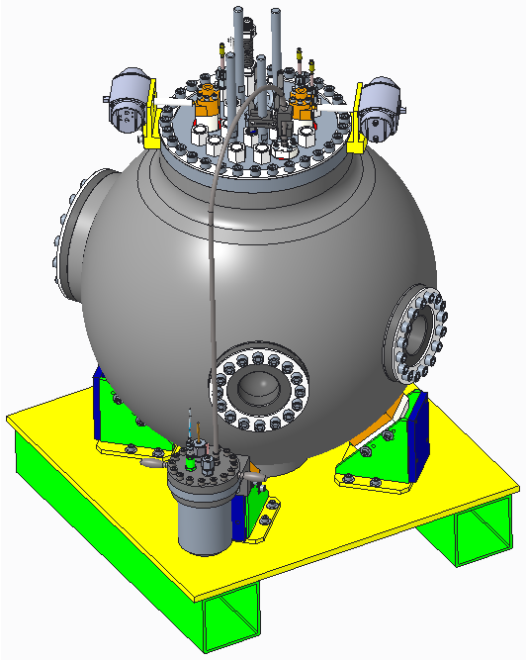


Figure 1. Nimble overpressure vessel confinement system drawing number 180Y1801735.

2.0 INTRODUCTION

2.1 DESIGN AND PROJECT-RELATED REASONS FOR TEST

The 3-foot VCS consists of the vessel weldment, radiographic entrance and exit covers, and top cover assembly with pressure retaining feedthroughs. This assembly will be used to execute SCE's at the NNSS U1a Facility, and is currently credited as a Safety Significant (SS) Design Feature (DF) per the U1a Facility Documented Safety Analysis (DSA). The U1a Facility DSA requires that the VCS meets the construction rules of ASME Boiler and Pressure Vessel Code (B&PVC) Section VIII, Division 3, *Alternative Rules for Construction of High Pressure Vessels* [2] and ASME Code Case 2564, *Impulsively Loaded Pressure Vessels, Section VIII, Division 3* [1]. LANL Engineering Process W-SE-0027U, *Engineering Process for Confinement and Containment Systems used in the Execution of Dynamic Experiments* (W-SE-0027U, Rev A, Dec 22, 2010) [3] is the LANL Weapons Program-Approved engineering process requiring use of the construction rules of ASME B&PVC Section VIII, Division 3 for Impulsively loaded vessels.

The Overpressure Test (OPT) to qualify the diagnostic feedthroughs for LLNL Nimble SCE Series of experiments will be conducted in SCE 3-foot Vessel #7 (Serial Number 3-1-5-SE-7) depicted in Figure 1.

2.2 TEST OBJECTIVES

ASME Code Case 2564, W-SE-0027U, JNPO-SCE-RPT-044 [4] and DOE-STD-1212-2019 [5] require that an HE over-pressure test be performed to:

- Ensure confinement design requirements are fully met (W-SE-0027U).
- Ensure leak rate specifications of the system are met (JNPO-SCE-RPT-044, Section 5.2).
- Ensure the system is over-tested according to DOE-STD-1212-2019, 30.10.3.1 [5].
- Ensure design of the diagnostic covers and instrument penetrations are experimentally verified in accordance with ASME Code Case 2564.

The principle objectives of the OPT include:

- Validating the design of the diagnostic instrument penetrations on the top cover.
- Validating that the diagnostic feedthrough assembly maintains a pre and post-execution pressure retaining confinement boundary (i.e., limiting the release of materials form within the system).

3.0 TEST FACILITIES/EQUIPMENT DESCRIPTION

The vessel components will be prepared and inspected at the TA-15 CAT House, which will include general surface preparation, sealing surface cleaning, visual inspection, and review of the Pressure Chamber Assembly.

Vessel and Top Cover assembly will be conducted primarily at the TA-15-Vessel Preparation Building where Radiographic covers will be assembled and one axis entry and exit windows will be installed. The Top Cover Assembly will includ feedthrough assembly and installation.

The HE Support Assembly will be conducted at TA15-242 HE Preparation Facility by Qualified HE Handlers with Test Engineer or designee oversight.

4.0 EXPERIMENTAL AREAS

This overpressure test will be conducted at the LANL Area-1, R306 Firing Site (TA15-R306)

5.0 TEST CONFIGURATION

5.1 TEST ARTICLE

The Nimble High Explosives Overpressure feedthrough qualification test (NIMBLE OPT) will be based on the Overpressure Test for the Red Sage Nightshade test plan and procedures, Plan-TA15-1426 and Plan-TA15-1450. All covers fielded in the previous OPT will be reused for the NIMBLE OPT.

To achieve the 125% impulse required by Section 3.2 of ASME Code Case 2564 for 'Experimental Design Verification,' HE over-pressure TNT-equivalent impulse of this experiment configuration, a single 1664 grams charge of Comp C-4 in a spherical or near spherical shape will be used. TNT equivalent charge weights are calculated with the UFC-3-340 heat of detonation method [6], using values published in Table 2-1 of UFC-3-340 [6]. The Comp C-4 will be hand packed into a volume of approximately 1120 cubic centimeters and embedded with an RP-1 detonator and a 9407 ½" by ½" booster at its center. The HE support/hanger (Figure 2) will be secured to a simplified Racklito mounted to the Top Cover Assembly as depicted in Figure 3.

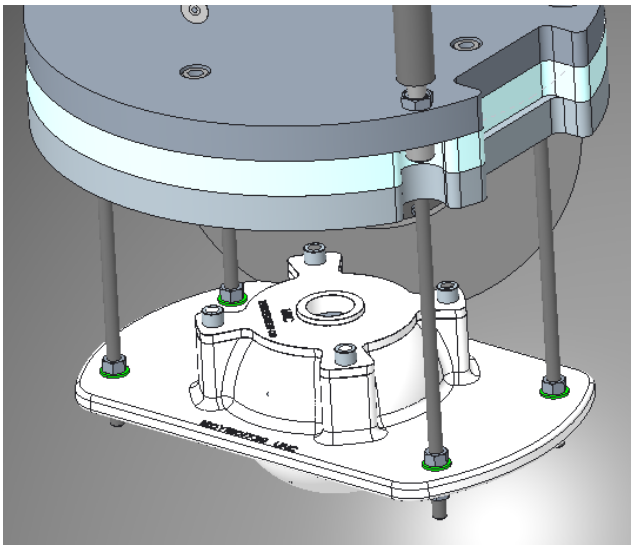


Figure 2. HE Support and Hanger assembly drawing number 180Y1801736.

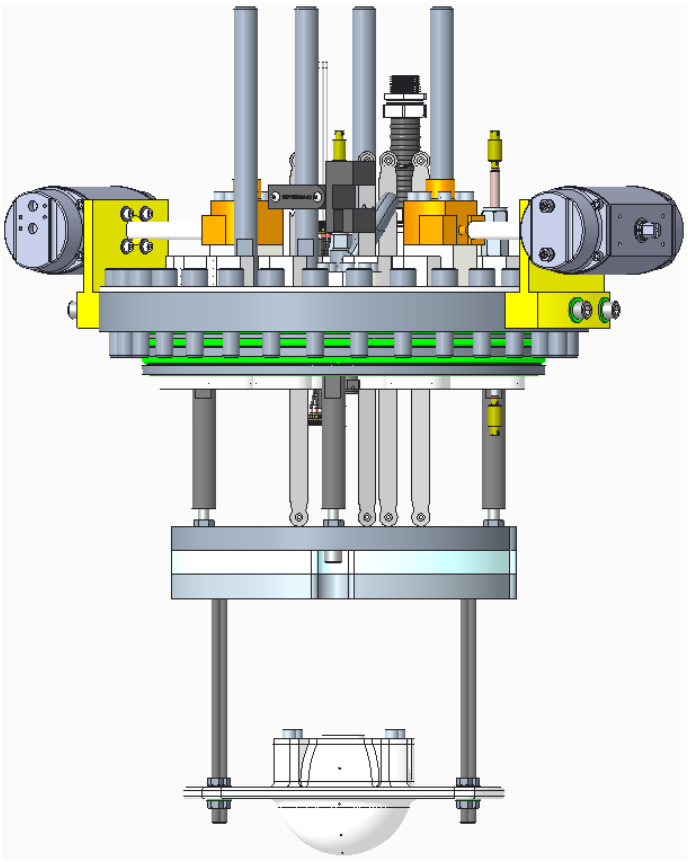


Figure 3. Example of HE Support Assembly attachment to Racklito that is connected to the Top Cover.

5.2 VESSEL CONFIGURATION

The Nimble OPT Vessel System Assembly is documented in LANL Drawing Number 180Y1801735. This test will employ the following diagnostics:

- One pressure transducer will be mounted on the external pressure chamber.
- One pressure transducer will be mounted internally to the external pressure chamber.
- Three surface mounted thermocouples on the vessel exterior surface at the top cover, equator of the vessel and bottom of the vessel.
- One internally mounted thermocouple will be installed within the external pressure chamber.
- Time of Arrive Diagnostics (TOAD) on the HE support assembly will be used to confirm full HE detonation.

Figure 4 illustrates a cross-sectional view of the OPT Confinement Vessel System and its Structures, System, and Components (SSC).

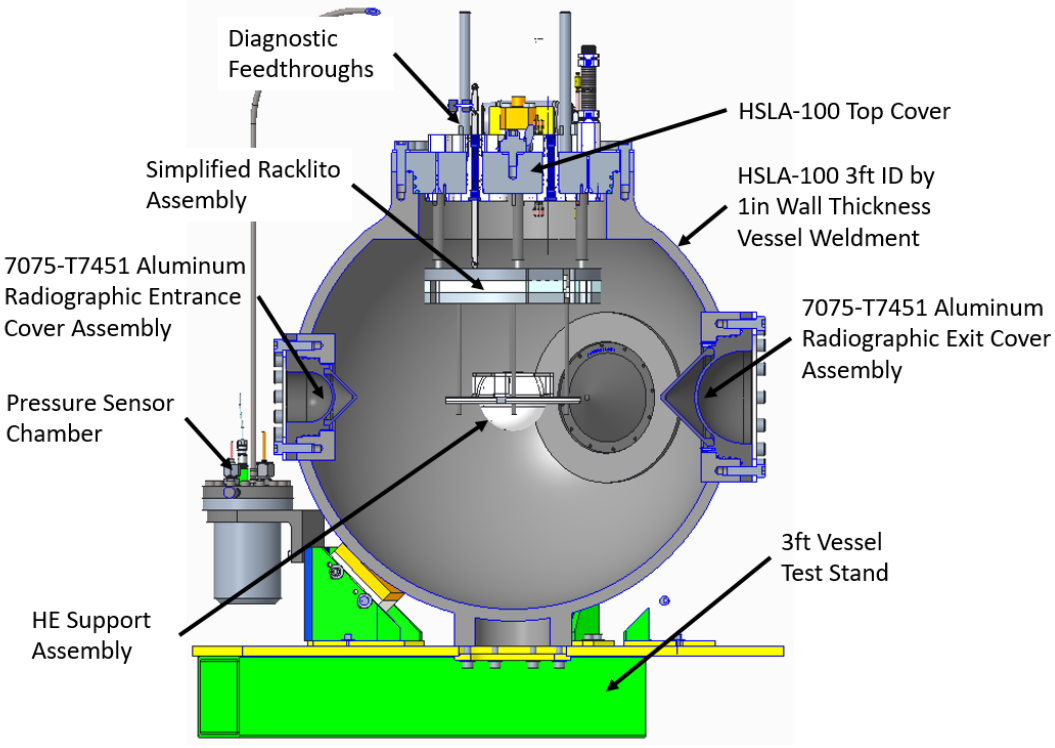


Figure 4. Nimble OPT Vessel System and Structures, System, and Components.

This test will employ Europium Oxide (Eu2O3) particulate tracer for experiment material detection considerations. 42 grams will be suspended in the OPT vessel system near the HE charge. Approximate location is illustrated in Figure 5. Assuming an equal deposition to the surface post-execution, this should result in a surface concentration of 12 ug/100cm2.

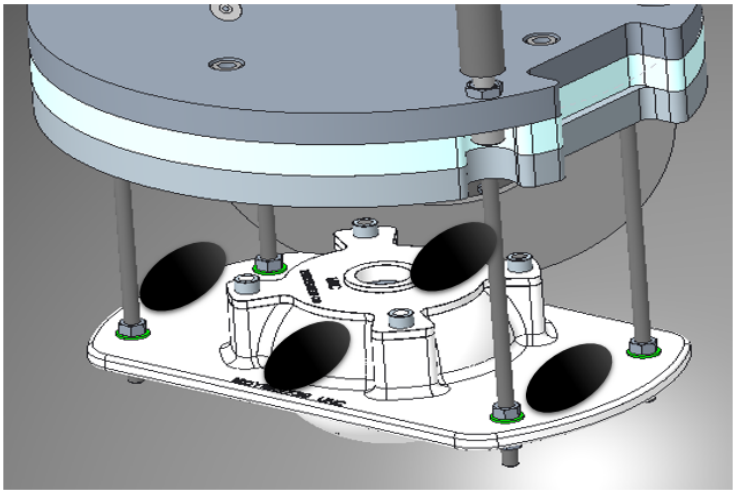


Figure 5. Approximate location of Europium Oxide Tracer Packets

5.3 TEST COMPONENTS

Table 1. Overpressure Test Major System Components, Drawing Numbers, and Descriptions.

Item Number	Drawing Number	Item Description
1	180Y1801735	OVER PRESSURE VESSEL ASSEMBLY
2	180Y1801303	ARENA RACKLITO ASSEMBLY
3	180Y1801544	VESSEL 7, NOZZLE 5, EXIT COVER ASSEMBLY
4	180Y1801745	OVER PRESSURE VESSEL TOP COVER ASSEMBLY
5	180Y1801736	HE SUPPORT ASSEMBLY
6	180Y1801755	PRESSURE SENSOR CHAMBER ASSEMBLY
7	180Y1801549	VESSEL 7, NOZZLE 4, EXIT COVER ASSEMBLY
8	180Y1801553	3-FT SCE VESSEL ENTRANCE COVER ASSEMBLY
9	180Y1801584	3-FT SCE VESSEL EXIT COVER WASHER RING
10	180Y1801587	3-FT VESSEL TOP COVER WASHER RING
11	180Y1801592	3-FT SCE VESSEL ENTRANCE COVER WASHER RING
12	33Z1942022	AS BUILT, RED SAGE VESSEL #7
13	C-4, 1664 grams	EXPLOSIVE CHARGE
14	RP-1	EBW DETONATORS
15	9407 1/2 " by ½"	BOOSTER

The feedthrough designs listed in Table 2 will be tested in this over-pressure test. Feedthroughs are also listed in the Top Cover Assembly Drawing (180Y1801745).

Table 2. Nimble OPT Top Cover MSTS Feedthroughs, Drawing Numbers, and Descriptions.

MSTS Drawing Number	Item Description
N-340840-01	HV Coax 2
N-339623-01	Single Mode Fiber, 312 Channel
N-339966-1	H.V. STRIP built with LANL strip line cable P/N:9Y295975D01
N-339966-1	H.V. STRIP built with strip line cable P/N:1007601787-AA, 900 mm LLNL cable
N-339966-1	ASSEMBLY, H.V. STRIP built with LANL strip line cable P/N:9Y296104D01
TBD	HV Coax 3 Concept 3
TBD	HV Coax 3 Concept 4
TBD	Coax 13 Concept
TBD	Feedthrough Blank

6.0 TEST SETUP

6.1 PRE-EXECUTION ACTIVITIES

The vessel will be cleaned of any loose debris and should be clean, dry, and free of contaminants. Once vessel clean out and preparation is complete the vessel will be mounted to the test stand and applicable radiographic window assemblies will be installed at the TA-15-Area 2 Vessel Prep Building by J-2 & J-6 personnel. J-2 vessel assembly technicians will assemble the Top Cover Assembly with all feedthroughs, and venting systems on the top cover Barolo assembly stand. The HE support assembly will be prepared by the J-6 firing site leader at TA-15-242 per drawing 180Y1801736.

All vessel components including SCE Vessel number 7 with applicable nozzle covers installed and its test stand, Top Cover assembly and the Barolo Assembly/Support Stand, remaining two Radiographic windows, Pressure Chamber assembly and hose, and HE support assembly will all be transported to firing site R306 with coordination from the Firing Site Leaders and Vessel Assembly staff.

R306 Firing Site preparation will be conducted before shot-execution. This will include DAS setup and operation checks, GMS setup and operation checks, and timing and firing runs conducted by Firing Site Leaders.

The pre-assembled test article will be installed into the vessel per the test article insertion procedures outlined in Attachment D of this document by the J-2 & 6 insertion team at the TA-15-R306 firing site. The test engineer will ensure, with the support of J-2 & 6 personnel, that proper assembly order and procedures are adhered to which are referenced in Appendix D, *Nimble Feedthrough Overpressure Test Article Insertion Procedure and Checklist.*

TA-15 Access Control personnel will provide the site-specific requirements that include hazard signs, barricades, communications, etc.. All personnel present at the R306 firing site will follow routine operation procedures. Personnel who will perform work at the firing site must participate in the pre-job briefing and must sign the appropriate page in the Integrated Work Document (IWD) provided by J-6 and Crane Crew personnel.

The vessel assembly will be helium leak tested after the test article has been inserted and the vessel has been sealed. The helium leak test will be performed by putting in helium gas at approximately 10 to 14

psi in the vessel and using a sniffer probe sensor to detect leaks of all mechanical joints. The measured leak rate at any location shall not exceed $1 \times 10^{-5}\ STD\ \frac{cc}{s}$. The leak check shall be conducted 30 minutes after helium is introduced into the vessel. The leak detector shall be calibrated to an adequate standard leak to ensure the leak rate criteria is met. If the helium leak test fails, the Test Engineer will determine whether to proceed with the overpressure test.

Following the pre-execution helium leak test:

- Surface samples/swipes will be collected from the top cover near each feedthrough to provide a baseline background for the Europium Oxide tracer Field Sampling Operations Technical Procedure (TP-VPB-011).
- The post-execution gas and material detection process will require that individual feedthroughs and the top cover will then be bagged with plastic sheet wrapped around each component and adhered with duct tape to limit cross contamination of any leaked post-execution detonation gases and particulates from one item to another.
- All Entry and exit windows will be bagged to capture CO in the event that a Dynamic Gas Blow By or 'burp' occurs.

6.2 Post-Execution Activities

J-6 firing site leader will communicate any re-entry procedures after the test article is fired, all required measurements are recorded, and the vessel gases have been vented.. Europium Oxide samples, CO measurements will be collected prior to the Post Execution helium leak test. The post Execution Helium Leak Test will be performed to verify that $1 \times 10^{-5}\ STD\ cc/s$ criteria has been met and that the sealing integrity and confinement boundary of the vessel has been maintained.

Following the helium leak test, the vessel will be vented to relieve any internal gas pressure before it will be transported to the TA-15 Vessel Prep building for disassembly, clean out, and inspection. All disassembly and post-execution forensics will be witnessed by the Test Engineer.

6.3 Test Instrumentation and Calibrations

All instruments that generate data will comply with LANL Procedure P330-2 requirements.

The instrumentation fielded for the overpressure test will include two (2) Pressure Transducers, internal and external thermocouples to monitor interior and exterior vessel temperatures, and Time Of Arrival Device (TOAD) probes to verify full HE detonation.

6.4 Test Conditions and Limitations

All testing will be performed in and under general conditions and regulations of the experimental areas. These include but are not limited to the TA15-R306 firing site, TA15 Vessel Prep Building, TA15 CAT house, and TA-15 Building 242 HE Preparation Facility

6.5 Test Installation/Assembly

J-2 & J-6 personnel will perform the installation of the test article into the vessel.

6.6 OPERATIONAL REQUIREMENTS

The Test Engineer for the given test will be present for the start-up for all tests. The vessel temperature at the time of the test will be no less than 40 degrees Fahrenheit within the R306 White House.

7.0 TEST FACILITY OPERATING PROCEDURES

Facility test procedures, as applicable to the tests described herein, are stipulated in the documents for each segment of the test sequence and will be archived in the experimental documentation.

8.0 DATA

8.1 DIAGNOSTICS

The following diagnostics will be fielding on the Nimble Feedthrough 125% Overpressure Test.

Diagnostic	Purpose
Point-and-Shoot Camera	Record experiment configuration setup before and after shot execution.
High-Speed Camera	Detection and record of vessel motion.
Pressure Sensors	Provide pressure data inside the VCS.
Helium Leak Test	Verify vessel confinement.
Time of Arrival Diagnostic (TOAD) probes	Validate HE detonation.
CO Monitoring	Verify vessel confinement.
Particulate Smears	Detect post-execution particles on vessel exterior.

8.2 TEST DATA

Data	Description
1	Results of Pre-Execution Europium Oxide sampling.
2	Results of Pre-Execution CO monitoring.
3	Results of Pre-Execution helium leak test
4	Record time required for internal gas pressure to reach apparent equilibrium by allowing Post-Execution detonation gas by-products to cool to the point where there is no apparent drop (± 5%) in pressure or temperature after a 30 minute duration. Data will be recorded by using the Data Acquisition System (DAS).
5	Record of the internal vessel post-execution pressure until the pressure remains within ±5 % for a 30 minute duration per JNPO-SCE-RPT-004. Will be recorded by DAS. If pressure chamber sensor loss occurs, vessel vent valve on top cover will be opened to pressure vent line up to HEPA filter valve (AIV-1) on wall manifold where both reading from a pressure transducer and an analog pressure gauge can be taken.

Data	Description
6	Magnitude of the internal gas pressure and temperature loss, 30 minutes after apparent equilibrium has been reached. This will be recorded by DAS.
7	Results of Post-Execution Europium Oxide sampling.
8	Results of Post-Execution CO monitoring.
9	Results of the Post-Execution helium leak test.
10	Photographs of vessel assembly and feedthrough bagging.
11	Photographs and description of any damage to the vessel, radiographic cones and window cover assemblies, and bottom of Top Cover assembly.

8.3 TEST RECORDS

All test data, test records, test procedures, and other records identified in the test requirements document will be collected and stored in a specified binder (test record). This information will also be stored electronically via PDMLink. As a minimum and where applicable, the test data and records will identify: the item tested, date of test, name of Test Engineer and person recording the data, type of observation, results and acceptability, action taken in connection with any deviation to the data requirements, and the person evaluating the test results.

The following test records will be retained in PDMLink to prevent deterioration (for the life of the project) of the test results and to allow for access far beyond the life of the project:

Record	Description
1	Test Procedure, Test Plan, Test Specifications (requirements), and working copies (with markups).
2	Completed Test Checklists.
3	Applicable document and drawings as referenced in the test procedure, test plans, and test specifications.
4	Instrument calibration results/certificates.
5	Certified material inspection reports (if applicable).
6	Test log notebook/binder.
7	Electronic data files and collected data.
8	Formal Drawings of experimental setup.
9	Photographs and written descriptions of test article condition and/or damage, if appropriate.

9.0 ACCEPTANCE CRITERIA

The following acceptance criteria will be used when validating the adequacy of the NIMBLE feedthrough design to confine the NIMBLE experiment series.

ID	Criteria	Acceptance Evidence
1	Perform a helium leak test of the sealed vessel assembly prior to shot execution.	Verifying a helium leak rate of no greater than $1 \times 10^{-5}\ STD\ \frac{cc}{s}$, verified by the sniffer probe method.
2	Verify full detonation of HE	TOAD data to validate that the OPT is successful.
3	Prior to venting the vessel, ensure that the VCS maintains a pressure greater than 0.0 psig following the qualification experiment. Allowing Post-Execution detonation gas by-product to cool for 30 minutes to establish pressure and temperature equilibrium.	Monitor the post shot execution gas pressure and temperature. Verify that the gas pressure remains positive and stable to within $\pm\ 5\%$ over a 30 minute minimum time interval.
4	Sniff bagged ports/feedthroughs for detectable CO gas post-execution. NOTE: The observation of CO Post-Execution, which is attributed to dynamic-blow-by or "burping", is not in and of itself a cause to consider this test a failure, as long as there is no other evidence of continuous Post-Execution leakage.	No evidence of continuous Post-Execution leakage through the ports. Verified by venting the port bags in the event of CO detection and monitoring the port bags for continued or increasing CO detection with 10 to 14 psig inside the vessel Post-Execution.
5	Sample exterior port for tracer particles post-execution for information.	Detection of Eu_2O_3 tracer particles on the exterior of the vessel does not invalidate the OPT. However, detection of Eu_2O_3 tracer particles outside the vessel confinement boundary constituting a limited material release will be evaluated for acceptance by J-Division Management, the LANL U1a Facility Design Authority Representative (FDAR), and SCE Program Management.
6	Perform a helium leak test of the sealed vessel assembly Post-Execution after complete detonation.	Verifying a helium leak rate of no greater than$1 \times 10^{-5}\ STD\ \frac{cc}{s}$, verified by the sniffer probe method.

ID	Criteria	Acceptance Evidence
7	Visual surface examination of any damage on the inside surface of the vessel, the radiographic cones, window assemblies, and top cover assembly will be documented through photography and written description including depth, length, width, shape, and location of the damage.	Deformation of the cones are permitted as long as it does not contact the radiographic window dome. NOTE: Large deformation of the cone will be evaluated by the Test Engineer or designee and the FDAR for acceptance.
8	Visually examine the O-rings Post-Execution for damage (i.e. extrusion, singeing, leakage, etc.), recording any damage noted.	Damage to the O-rings will be evaluated for acceptance by the Test Engineer or designee and the FDAR for VCS.

10.0 QUALITY, SAFETY, & SECURITY

10.1 DEVIATIONS

If a major deviation from this controlled test plan or from the test procedure occurs or is imminent, the Test Engineer will be notified. Work will not proceed until corrective action, in accordance with the Test Engineer and J-Division Management, has been completed. Corrective action will include documented concurrence by the Test Engineer or a designee.

10.2 SAFETY REQUIREMENTS

All personnel will adhere to all IWDs, TPs, safety postings and procedures and other facility specific safety requirements.

10.3 SECURITY REQUIREMENTS

All personnel will adhere to all security policies regarding the handling of classified parts, material and information associated with this project.

11.0 REFERENCES

[1] Anon, *Code Case 2564-4; Impulsively Loaded Pressure Vessels; Section VIII, Division 3,* 2014.

[2] Anon, *ASME Boiler and Pressure Vessel Code, Section VIII, Division 3; Alternative Rules for Construction of High Pressure Vessels,* ASME, 2015.

[3] C. Romero, *W-SE-0027U, The Engineering Process for Confinement and Containment Systems used in the Execution of Dynamic Experiments,* 2010.

[4] M. Lavelle, *JNPO-SCE-RPT-004, Subcritical Experiment (SCE) Vessel Confinement System Requirements,* 2011.

[5] Anon, *DOE-STD-1212-2019; DEO Standard, Explosives Safety,* 2019.

[6] Anon, *UFC-3-340-02, Unified Facilities Criteria (UFC), Structures to Resist the Effects of Accidental Explosions,* Department of Defense, 2008.

[7] Field Sampling Operations TP-VPB-011.

12.0 ATTACHMENTS

Number	Title
A	Nimble OPT Vessel Subassemblies Preparation
B	Pre-Execution Vessel Assembly
C	Firing Site Preparation
D	Test Article Insertion
E	Pre-Execution Operations & Helium Leak Test
F	Shot-Execution Operations
G	Post-Execution Activities & Helium Leak Test
H	Test Instrumentation
I	Drawings

ATTACHMENT A: NIMBLE OPT VESSEL SUBASSEMBLIES PREPARATION

This document delineates the procedural steps to be used to execute the over-pressure test for the Nimble feed-thru qualification. The scope covers the pre-test, test, and post-test activities. If the order of steps or given steps need to be changed, this will be noted in the Test Record being kept by the responsible test engineer.

1.0 RADIOGRAPHIC COVER ASSEMBLIES

1.1 PROCEDURE SCOPE

This section contains the procedural steps to be used to assemble the radiographic cover assemblies. **These assemblies are *custom fit* to accommodate the as built dimensions of Vessel #7.**

1.2 REQUIRED EQUIPMENT

1. Calibrated Torque Wrenches
    a. 10 to 170 in-lbs
    b. 1 to 50 ft-lbs

1.3 REQUIRED SUPPLIES

1. Isopropyl Alcohol
2. Simple Green degreaser
3. Lint-free wipes/clothes
4. Dow Corning® high vacuum grease (or equivalent Viton compatible) for O-rings
5. Paint Marker (for marking bolt and feedthroughs)

1.4 REQUIRED DRAWINGS

Item Number	Drawing Number	Item Description
1	180Y1801544	Vessel 7 Nozzle 5 Exit Cover Assembly
2	180Y1801549	Vessel 7 Nozzle 4 Exit Cover Assembly
3	180Y1801553	3-FT SCE Vessel Entrance Cover Assembly

1.5 RADIOGRAPHIC COVER ASSEMBLY PROCEDURE & CHECKLIST

1.5.1 ENTRY COVER ASSEMBLY PROCEDURE & CHECKLIST FOR BOTH ENTRY COVER ASSEMBLIES

<table>
<tr><th>Step</th><th>Activity</th><th>Initial</th><th>Date</th></tr>
<tr><td>A1.5.1-1</td><td>VERIFY assembly drawings are current and appropriate for Nimble OPT.</td><td></td><td></td></tr>
<tr><td>A1.5.1-2</td><td>INSPECT & DOCUMENT Entrance Cover components for damage from previous shot.</td><td></td><td></td></tr>
<tr><td>A1.5.1-3</td><td>INSTALL Entrance Cone (180Y1801497) on 3-FT SCE Vessel Entrance Cover (180Y1801554-00)</td><td></td><td></td></tr>
<tr><td>A1.5.1-4</td><td>INSTALL Entrance Clamp Ring (180Y1800646) over Entrance Cone.</td><td></td><td></td></tr>
<tr><td>A1.5.1-5</td><td>INSTALL 8 by #10-24 SHCS X 0.50” using an alternating torque sequence.</td><td></td><td></td></tr>
<tr><td>A1.5.1-6</td><td>TORQUE to the required bolt torque:
8 by #10-24 SHCS X 0.50”<table><tr><td>Bolt Torque Spec:</td><td>50 in-lbs (4.2 ft-lbs)</td></tr><tr><td>Torque Wrench Setting:</td><td></td></tr><tr><td>Calibration Exp. Date:</td><td></td></tr><tr><td>Torque Wrench SN:</td><td></td></tr></table></td><td></td><td></td></tr>
</table>

1.5.2 NOZZLE 4 EXIT COVER ASSEMBLY PROCEDURE & CHECKLIST

Step	Activity	Initial	Date
A1.5.2-1	**VERIFY** assembly drawings are current and appropriate for Nimble OPT.		
A1.5.2-2	**INSPECT** & **DOCUMENT** Exit Cover components for damage from previous shot.		
A1.5.2-3	**INSTALL** Exit Cone (180Y1801498-00) on Vessel 7 Nozzle 4 Exit Cover (10Y1801550-00).		
A1.5.2-4	**INSTALL** Exit Clamp Ring (180Y1800647) over Exit Cone.		
A1.5.2-5	**INSTALL 12 by ¼-20 SHCS X 0.75”** using an alternating torque sequence.		
A1.5.2-6	**TORQUE** to the required bolt torque: **12 by ¼-20 SHCS X 0.75”** **Bolt Torque Spec:** 90 in-lbs (7.5 ft-lbs) **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		

1.5.3 NOZZLE 5 EXIT COVER ASSEMBLY PROCEDURE & CHECKLIST

Step	Activity	Initial	Date
1.5.3-1	**VERIFY** assembly drawings are current and appropriate for Nimble OPT.		
1.5.3-2	**INSPECT** & **DOCUMENT** Exit Cover components for damage from previous shot.		
1.5.3-3	**INSTALL** Exit Cone (180Y1801498-00) on Vessel 7 Nozzle 5 Exit Cover (10Y1801496-00).		
1.5.3-4	**INSTALL** Exit Clamp Ring (180Y1800647) over Exit Cone.		
1.5.3-5	**INSTALL 12 by ¼-20 SHCS X 0.75”** using an alternating torque sequence.		
1.5.3-6	**TORQUE** to the required bolt torque: **12 by ¼-20 SHCS X 0.75”** **Bolt Torque Spec:** 90 in-lbs (7.5 ft-lbs) **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		

2.0 TOP COVER ASSEMBLY

2.1 PROCEDURE SCOPE

This section contains the procedural steps to be used to assemble the Nimble Overpressure Top Cover and components. This includes installation of the Top Cover on Barolo Racklito Stand, Worcester Vales, MSTS Feedthroughs, plugs, and associated hardware.

2.2 REQUIRED EQUIPMENT

1. Barolo Racklito Stand (34Y1760236)
2. ¾" Swivel Hoist Ring 5000 lb working load limit for Critical Lift
3. Calibrated Torque Wrenches
    a. 10 to 100 ft-lbs
4. Crows Foot for feedthrough nuts
    a. 1-5/8"
    b. 1-3/4"

2.3 REQUIRED SUPPLIES

1. Isopropyl Alcohol
2. Simple Green degreaser
3. Lint-free wipes/clothes
4. Dow Corning® high vacuum grease for feedthrough threads
5. Dow Corning® high vacuum grease or equivalent for O-rings
6. Thread Locker Loctite® 242
7. Paint Marker (for marker bolts and feedthroughs)

2.4 REQUIRED DRAWINGS

Item Number	Drawing Number	Item Description
1	180Y1801745	Nimble Overpressure Test Top Cover Assembly
2	34Y1760236	Barolo Racklito Stand

2.5 TOP COVER ASSEMBLY PROCEDURE & CHECKLIST

2.5.1 WORCESTER VALVE ASSEMBLY AND INSTALLATION

Step	Activity	Initial	Date
A2.5.1-1	**VERIFY** assembly drawings are current and appropriate for Nimble OPT.		
A2.5.1-2	**VERIFY** all feedthroughs have undergone pressure leak test per ENG-DR-J2-1393 by reviewing documentation provided with each feedthrough by the MSTS.		
A2.5.1-3	**INSTALL** ¾" swivel hoist ring on top cover. **Bolt Torque Spec:** 100 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		
A2.5.1-4	**BOLT** Top Cover (180Y1801583-00) to Barolo Racklito Stand (34Y1760236) using **8 by ¾-10 SHCS by 2.25" HAND TIGHTEN.**		
A2.5.1-5	**MARK** Feedthrough Hole numbers in accordance with Top Cover Assembly drawing (180Y1801745).		
A2.5.1-6	**INSPECT** valve flange O-ring grooves for damage, burrs, dirt, or packing debris and clean if necessary.		
A2.5.1-7	**INSPECT** O-rings and backing rings for damage by lightly stretching the ring and checking for cracks in material.		
A2.5.1-8	**VERIFY** Worcester Valves are in **CLOSED** Position.		

<table>
<tr><td>A2.5.1-9</td><td>INSTALL Worcester valve flange O-rings and backing rings with light coat of vacuum grease.<table><tr><th>Qty</th><th>Item number</th><th>Description</th></tr><tr><td>4</td><td>2-210</td><td>Viton O-ring</td></tr><tr><td>4</td><td>8-210</td><td>Viton Back-up O-ring</td></tr><tr><td>2</td><td>2-026</td><td>Viton surface seal</td></tr></table></td><td></td><td></td></tr>
<tr><td>A2.5.1-10</td><td>INSTALL Worcester Valve and Flange in corresponding penetrations 19 and 20 per Top Cover Assembly Drawing.</td><td></td><td></td></tr>
<tr><td>A2.5.1-11</td><td>TORQUE attachment bolts.
12 by 3/8-16 SHCS x 5.00”<table><tr><td>Bolt Torque Spec:</td><td>38 ft-lb as-received</td></tr><tr><td>Torque Wrench Setting:</td><td></td></tr><tr><td>Calibration Exp. Date:</td><td></td></tr><tr><td>Torque Wrench SN:</td><td></td></tr></table></td><td></td><td></td></tr>
</table>

2.5.2 FEEDTHROUGH ASSEMBLY AND INSTALLATION

Step	Activity	Initial	Date
A2.5.2-1	**VERIFY** assembly drawings are current and appropriate for Nimble OPT.		
A2.5.2-2	**VERIFY** all feedthroughs have undergone pressure leak test per ENG-DR-J2-1393 by reviewing documentation provided with each feedthrough by the MSTS.		
A2.5.2-3	**INSPECT** feedthrough O-ring grooves for damage, burrs, dirt, or packing debris and clean is necessary.		
A2.5.2-4	**INSPECT** O-rings and backing rings for damage by lightly stretching the ring and checking for cracks in material.		
A2.5.2-5	**INSTALL** the O-rings and Backing rings on individual feedthrough gland bodies per specifications detailed on Top Cover Assembly Drawing (180Y180Y1801745). **O-rings per feedthrough:** **Qty** / **Item number** / **Description** **3** / **2-125** / **Viton O-ring** **3** / **8-125** / **Viton Back-up O-ring**		
A2.5.2-6	**CLEAN** Top Cover penetrations and feedthrough bodies of particulate and film EXCEPT light coating of high vacuum grease on O-rings.		
A2.5.2-7	**INSTALL** Gland style feedthroughs in corresponding penetrations according to Top Cover Assembly Drawing.		
A2.5.2-8	**RECORD** Feedthrough serial number and installation date in table below in Step A2.5.2-9.		

A2.5.2-9

Penetration #	Drawing #	Feedthrough Type	Serial #	Date Installed
1	TBD	Coax 13 Concept		
2	N-339966-1	H.V. STRIP built with LANL strip line cable P/N:9Y295975D01		
3	N-339966-1	H.V. STRIP built with strip line cable P/N:1007601787-AA, 900 mm LLNL cable		
4	N-339966-1	ASSEMBLY, H.V. STRIP built with LANL stripline cable P/N:9Y296070D01, UNCL W026980 054848525A03		
5	N-339966-1	ASSEMBLY, H.V. STRIP built with LANL strip line cable P/N:9Y296104D01		
6	ND-337426	Blank		
7	ND-337426	Blank		
8	N-340840-01	H.V. Coax 2		
9	N-339623-01	Single-mode fiber, 312 Channel		
10	ND-337426	Blank		
11	TBD	HV Coax 3 Concept 3		
12	TBD	HV Coax 3 Concept 4		
13	ND-337426	Blank		
14	LANL DRW #?	Pressure Chamber Flange (Revised)		
15	ND-337426	Blank		
16	ND-337426	Blank		
17	ND-337426	Blank		
18	ND-337426	Blank		
19	204 754 Z 120A	Worchester Vacuum/Purge Valve		
20	204 754 Z 120A	Worchester Vacuum/Purge Valve		

<table>
<tr><th>Step</th><th>Activity</th><th>Initial</th><th>Date</th></tr>
<tr><td>A2.5.2-10</td><td>ALIGN Feedthroughs to allow proper positioning of cabling.</td><td></td><td></td></tr>
<tr><td>A2.5.2-11</td><td>INSTALL the 8 by ¼-20 SHCS x 1.00” in the as-received condition in each feedthrough. Use alternating torque pattern.<table><tr><td>Bolt Torque Spec:</td><td>125 in-lb (10.4 ft-lbs)</td></tr><tr><td>Torque Wrench Setting:</td><td></td></tr><tr><td>Calibration Exp. Date:</td><td></td></tr><tr><td>Torque Wrench SN:</td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>A2.5.2-12</td><td>RECORD torque wrench settings, calibration information, the date the feed through was installed in table below (Step A2.5.2-13).</td><td></td><td></td></tr>
</table>

A2.5.2-13

Penetration #	Feedthrough Description	Torque Wrench Setting	Calibration Expiration Date	Date Installed / Initial Z#
1	Coax 13 Concept			
2	H.V. with LANL strip line cable P/N:9Y295975D01			
3	H.V. with strip line cable P/N:1007601787-AA			
4	ASSEMBLY, H.V. STRIP built with LANL strip line cable P/N:9Y296070D01			
5	ASSEMBLY, H.V. STRIP built with LANL strip line cable P/N:9Y296104D01			
6	Blank			
7	Blank			
8	H.V. Coax 2			
9	Single-mode fiber, 312 Channel			
10	Blank			
11	HV Coax 3 Concept 3			
12	HV Coax 3 Concept 4			
13	Blank			
14	Pressure Chamber Flange (Revised)			
15	Blank			
16	Blank			
17	Blank			
18	Blank			
19	Worchester Vacuum/Purge Valve			
20	Worchester Vacuum/Purge Valve			

A2.5.2-14

LUBRICATE the top nut feedthrough threads after the glands are installed in the Top Cover by pre-coating threads with a light coat of high vacuum grease.

A2.5.2-15

TORQUE & MARK each top nut after torque is achieved.

Bolt Torque Spec:	100 ft-lbs
Torque Wrench Setting:	
Calibration Exp. Date:	
Torque Wrench SN:	

A2.5.2-16	**RECORD** torque wrench settings, calibration information, the date the feed through was installed in table below (Step A2.5.2-17).		

A2.5.2-17

Penetration #	Feedthrough Description	Torque Wrench Setting	Calibration Expiration Date	Date Installed / Initial Z#
1	Coax 13 Concept			
2	H.V. with LANL strip line cable P/N:9Y295975D01			
3	H.V. with strip line cable P/N:1007601787-AA			
4	ASSEMBLY, H.V. STRIP built with LANL strip line cable P/N:9Y296070D01			
5	ASSEMBLY, H.V. STRIP built with LANL strip line cable P/N:9Y296104D01			
6	Blank			
7	Blank			
8	H.V. Coax 2			
9	Single-mode fiber, 312 Channel			
10	Blank			
11	HV Coax 3 Concept 3			
12	HV Coax 3 Concept 4			
13	Blank			
14	Pressure Chamber Flange (Revised)			
15	Blank			
16	Blank			
17	Blank			
18	Blank			
19	Worchester Vacuum/Purge Valve			
20	Worchester Vacuum/Purge Valve			

3.0 ARENA RACKLITO ASSEMBLY

3.1 PROCEDURE SCOPE

This section outlines the assembly and installation of the Arena Racklito Assembly on the underside of the Top Cover assembly.

3.2 REQUIRED EQUIPMENT

1. Calibrated Torque Wrenches
    a. 10 to 100 ft-lb
2. ¾" Crows Foot

3.3 REQUIRED SUPPLIES

6.

1. Isopropyl Alcohol
2. Simple Green degreaser
3. Lint-free wipes/clothes

3.4 REQUIRED DRAWINGS

Item Number	Drawing Number	Item Description
1	180Y1801303	Arena Racklito Assembly

3.5 ARENA RACKLITO ASSEMBLY PROCEDURE & CHECKLIST

Step	Activity	Initial	Date
A3.5-1	**VERIFY** assembly drawings are current and appropriate for Nimble OPT.		
A3.5-2	**INSTALL** Plate 1 (180Y1801292-00) onto Plate 2 (180Y1801293-00) per drawing 180Y1801303. **4 by ½-13 SHCS x 1.25"** **Bolt Torque Spec:** 24 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		
A3.5-3	**INSTALL** Plate 3 (180Y1801294-00) to Plate 2 (180Y1801293-00). **4 by ½-13 SHCS x 1.25"** **Bolt Torque Spec:** 24 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		
A3.5-4	**INSTALL** Racklito Support Rods (180Y1801156-00) onto the bottom of the top cover. **Bolt Torque Spec:** 24 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		
A3.5-5	**INSTALL** the **3 by ½-13 SHCS by 2.50"** through Plate 3 (180Y1801294) into Support Rods and **3 by ½-13 Hex Lock Nuts.**		
A3.5-6	**TORQUE 3 by ½-13 SHCS by 2.50"** **Bolt Torque Spec:** 24 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		

A3.5-7	**TORQUE 3 by ½-13 Hex Lock Nuts.** **Bolt Torque Spec:** Snug tight **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		

4.0 NIMBLE OPT HE SUPPORT ASSEMBLY LOAD TEST

4.1 PROCEDURE SCOPE

This section outline the HE Support Assembly Load Test required for a Critical Lift outlined in LANL P101.25 Section 3.1.1.c *Critical Lift Planning and Plan Requirements* and defined in ASME B30.20 *Below-the-Hook Lifting Devices* Section 20-1.3.8.2 *Load Testing*. The test load for the He Support assembly is required to be load tested to 125% designed weight capacity. This test will use two (2) time the calculated mass of the HE contained within the HE Support Assembly equating to eight (8) pounds load testing weight. This load test will be conducted by installation of the Arena Racklito Assembly to the Top Cover that will be attached to the Barolo Racklito Stand (Figure 6). The HE Support Assembly will then be

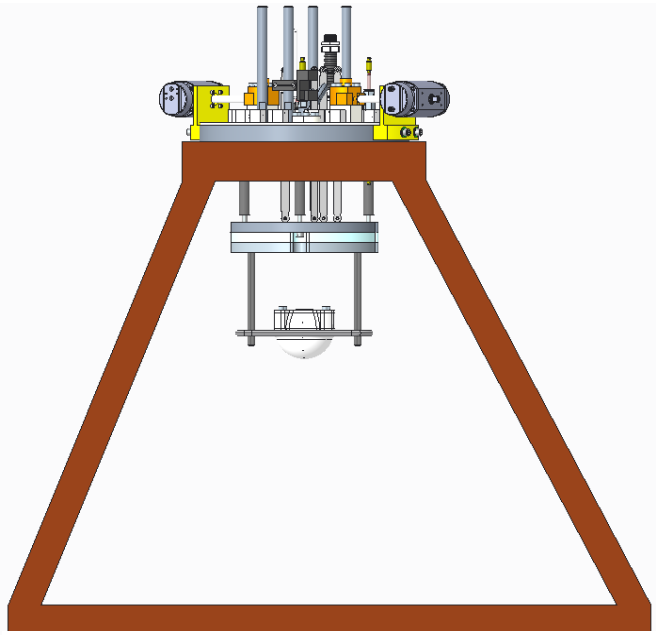


Figure 6. Overview of HE Support load test with Top Cover secured to Barolo Assembly Stand.

attached to the Arena Racklito Assembly by its Nylon All-Thread rods and lock nuts. A weight of eight pound will then be placed on top of the HE Support Assembly and will be left in place for a 24 hour period. This period encompasses and overcompensates for the expected time that the HE would be suspended from the Arena Racklito in the event of postponement of the experiment after the test article has been inserted in the vessel.

4.2 REQUIRED EQUIPMENT

1. 4 by Nylon All-thread rods 3/8-16 by 10 inches long.
2. 8 by Nylon nuts 3/8-16.
3. ~ 8 pound bag of Tungsten powder.
4. Torque Wrenches:
    a. 10-100 ft-lb.
    b. 10-100 in-lb.
5. Point and Shoot Camera

4.3 REQUIRED SUPPLIES

1. Isopropyl Alcohol
2. Simple Green degreaser
3. Lint-free wipes/clothes

4.4 REQUIRED DRAWINGS

Item Number	Drawing Number	Item Description
1	180Y1801303	Arena Racklito Assembly
2	180Y1801736	Nimble OPT HE Support Assembly
3	34Y1760236	Barolo Racklito Stand

4.5 NIMBLE OPT HE SUPPORT ASSEMBLY LOAD TEST PROCEDURE & CHECKLIST

Step	Activity	Initial	Date
A4.5-1	**VERIFY** assembly drawings are current and appropriate for Nimble OPT.		
A4.5-2	**BOLT** Top Cover (180Y1801583-00) to Barolo Racklito Stand (34Y1760236) using **8 by ¾-10 SHCS by 2.25"** **HAND TIGHTEN.**		
A4.5-3	**INSTALL** Racklito Support Rods (180Y1801156-00) onto the bottom of the top cover. **Bolt Torque Spec:** 24 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		
A4.5-4	**INSTALL** the **3 by ½-13 SHCS by 2.50"** through Plate 3 (180Y1801294) into Support Rods and **3 by ½-13 Hex Lock Nuts.**		
A4.5-5	**TORQUE 3 by ½-13 SHCS by 2.50"** **Bolt Torque Spec:** 24 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		
A4.5-6	**TORQUE 3 by ½-13 Hex Lock Nuts.** **Bolt Torque Spec:** snug tight **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		
A4.5-7	**INSTALL 4 by** Nylon All-thread rod in to PLATE 1 on bottom of Arena Racklito Assembly. Thread in until **Hand Tight**. **4 by Nylon All-thread Rod 3/8-16 by 10" long**		
A4.5-8	**INSTALL** 4 by 3/8-16 Nylon Nuts onto All-thread rods such that the bottom of the nut is approximately 7.885" from the bottom of the top cover. **4 by Nylon Nuts 3/8-16**		

<table>
<tr><td>A4.5-9</td><td>INSTALL Nimble OPT HE Support Mount (180Y1801738-00) by first placing 4 by 3/8” flat washers before sliding HE Support Mount onto All-thread rods.
INSTALL 4 by flat washers and nylon nuts onto threaded rod after HE Support Mount is in place.</td><td></td><td></td></tr>
<tr><td>A4.5-10</td><td>TORQUE Nylon Nuts 4 by 3/8-16.<table><tr><td>Bolt Torque Spec:</td><td>snug tight</td></tr><tr><td>Torque Wrench Setting:</td><td></td></tr><tr><td>Calibration Exp. Date:</td><td></td></tr><tr><td>Torque Wrench SN:</td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>A4.5-11</td><td>PHOTOGRAPH installation.</td><td></td><td></td></tr>
<tr><td>A4.5-12</td><td>WEIGH Test Weight and RECORD Weight below.<table><tr><td>Test Weight Value:</td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>A4.5-13</td><td>PHOTOGRAPH Setup and weight on scale.</td><td></td><td></td></tr>
<tr><td>A4.5-14</td><td>PLACE ≥8 pound test weight in HE Support Volume.</td><td></td><td></td></tr>
<tr><td>A4.5-15</td><td>PHOTOGRAPH Installation.</td><td></td><td></td></tr>
<tr><td>A4.5-16</td><td>RECORD Time and Date when test weight is applied.
WAIT for a ~24 hour duration.<table><tr><th>START TIME</th><th>START DATE</th></tr><tr><td></td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>A4.5-17</td><td>RECORD END Time and Date of the load test after a ~24 hour period.<table><tr><th>END TIME</th><th>END DATE</th></tr><tr><td></td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>A4.5-18</td><td>REMOVE Test Weight.</td><td></td><td></td></tr>
<tr><td>A4.5-19</td><td>INSPECT HE Support mount and All-thread connecting rods visually for signs of deformation.
RECORD any relevant observations:</td><td></td><td></td></tr>
<tr><td>A4.5-20</td><td>PHOTOGRAPH any relevant observations.</td><td></td><td></td></tr>
</table>

5.0 NIMBLE OPT HE SUPPORT ASSEMBLY

5.1 PROCEDURE SCOPE

This procedure will outline the steps to install the detonator setup into the HE that will be packed into the HE Support Mount by the HE handler.

5.2 REQUIRED EQUIPMENT

1. Allen wrenches
2. Extended DET Sleeve
3. DET Core Drill
4. Calibrated Scale

5.3 REQUIRED SUPPLIES

1. HE Handler Discretion

5.4 REQUIRED DRAWINGS

Item Number	Drawing Number	Item Description
2	180Y1801736	Nimble OPT HE Support Assembly

5.5 NIMBLE OPT HE SUPPORT ASSEMBLY PROCEDURE & CHECKLIST

This procedure and checklist **does not** require Test Engineer observation or signoff.

<table>
<tr><th>Step</th><th>Activity</th><th>Initial</th><th>Date</th></tr>
<tr><td>A5.5-1</td><td>VERIFY assembly drawings are current and appropriate for Nimble OPT.</td><td></td><td></td></tr>
<tr><td>A5.5-2</td><td>VERIFY that the type and quantity of the HE to be used in this installation is appropriate.</td><td></td><td></td></tr>
<tr><td>A5.5-3</td><td>COLLECT if available, the HE material data sheet from the manufacturer.</td><td></td><td></td></tr>
<tr><td>A5.5-4</td><td>VERIFY accuracy of the HE scale by using calibrated weights.</td><td></td><td></td></tr>
<tr><td>A5.5-5</td><td>RECORD calibration weight and scale readout during verification.
<table>
<tr><th>CALIBRATION WEIGHT</th><th>SCALE READING</th></tr>
<tr><td></td><td></td></tr>
</table></td><td></td><td></td></tr>
<tr><td colspan="4">NOTE: IF scale reading and calibration weight are outside of manufactures allowed tolerances, the scale should not be used and should be recalibrated OR a substitution made.</td></tr>
</table>

<table>
<tr><td>A5.5-6</td><td>WEIGH the HE Support Mount, HE Support Cover, the 4 by 3/8-16 by 1” long Nylon SHCS, and Extended DET Sleeve for use as HE Weight confirmation later.
<table><tr><th>ITEM</th><th>WEIGHT</th></tr><tr><td>HE Support Mount</td><td></td></tr><tr><td>HE Support Cover</td><td></td></tr><tr><td>4 by 3/8-16 by 1”L SHCS</td><td></td></tr><tr><td>Extended DET Sleeve</td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>A5.5-7</td><td>PACK HE into HE Support Mount to top of opening.
RECORD HE measurements for the amounts that are to be added to the HE Support Mount.
<table><tr><th>ALIQOUT #</th><th>WEIGHT</th></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table></td><td></td><td></td></tr>
</table>

<table>
<tr><td>A5.5-8</td><td>INSTALL HE Support Cover.</td><td></td><td></td></tr>
<tr><td>A5.5-9</td><td>INSTALL 2 to 4 3/8-16 by 1” long SHCS into the hold HE Support Mount to secure HE Support Cover into place.</td><td></td><td></td></tr>
<tr><td>A5.5-10</td><td>USE 3D printed DET Core Drill to hand drill and clear HE volume for DET Sleeve insertion. Depth is preset on Drill.</td><td></td><td></td></tr>
<tr><td>A5.5-11</td><td>RECORD weight of HE removed form Step A5.5-10.
<table>
<tr><th>VOLUME REMOVED #</th><th>WEIGHT</th></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table></td><td></td><td></td></tr>
<tr><td>A5.5-12</td><td>INSERT DET Sleeve into cored out volume in the HE.
CONFIRM with HE Handler that DET Sleeve fit up is acceptable.
LEAVE DET Sleeve in HE.</td><td></td><td></td></tr>
<tr><td>A5.5-13</td><td>INSTALL remaining 3/8-16 by 1” long Nylon SHCS into HE Support Mount to secure HE Support Cover.
HAND TIGHTEN</td><td></td><td></td></tr>
<tr><td>A5.5-14</td><td>WEIGH HE Support Assembly with HE Support Cover installed and DET Sleeve installed.
RECORD HE Support Assembly
<table>
<tr><th>HE Support ASM Weight</th><td></td></tr>
</table></td><td></td><td></td></tr>
<tr><td>A5.5-15</td><td>CONFIRM HE weight meets target weight of ~1663 grams (~3.6 lbs). Use weights recorded in Step A5.5-6 and Step A5.5-14.
<table>
<tr><th>ITEM</th><th>WEIGHT</th></tr>
<tr><td>HE Support Mount</td><td>-</td></tr>
<tr><td>HE Support Cover</td><td>-</td></tr>
<tr><td>4 by 3/8-16 by 1”L SHCS</td><td>-</td></tr>
<tr><td>Extended DET Sleeve</td><td>-</td></tr>
<tr><td>Loaded HE Support ASM</td><td>+</td></tr>
<tr><td>TOTAL HE WEIGHT</td><td></td></tr>
</table></td><td></td><td></td></tr>
<tr><td>A5.5-16</td><td>TRANSPORT HE Support Assembly to R306 at direction of Firing Site Leader.</td><td></td><td></td></tr>
</table>

ATTACHMENT B: PRE-EXECUTION VESSEL ASSEMBLY

1.0 PRE-EXECUTION VESSEL ASSEMBLY

1.1 PROCEDURE SCOPE

This section contains the procedural steps to be used for preparation of the vessel and hardware and movement test assembly to the firing point

1.2 REQUIRED EQUIPMENT

1. Digital point and shoot camera
2. Barolo Racklito Stand (34Y1760236)
3. ¾" Swivel Hoist Ring, with 500 pound working load limit rated for Critical Lift
4. Calibrated Torque Wrenches:
    a. 10 to 100 ft-lb
    b. 30 to 320 ft-lb

1.3 REQUIRED SUPPLIES

1. Paint marker
2. Duct tape
3. Dow Corning® high vacuum grease or equivalent
4. Thread Locker, Loctite 242
5. Isopropyl Alcohol
6. Lint free wipes

1.4 REQUIRED DRAWINGS

Item Number	Drawing Number	Item Description
1	180Y1801745	Nimble Overpressure Test Top Cover Assembly
2	180Y1801755	Pressure Sensor Chamber Assembly
3	180Y1801592	3-FT SCE Vessel Entry Cover Washer Ring
4	180Y1801553-00	3-FT SCE Vessel Entrance Cover Assemblies

1.5 PRE-EXECUTION VESSEL ASSEMBLY PROCEDURE & CHECKLIST

<table>
<tr><th>Step</th><th>Activity</th><th>Initial</th><th>Date</th></tr>
<tr><td>B-1</td><td>VERIFY assembly drawings are current and appropriate for Nimble OPT.</td><td></td><td></td></tr>
<tr><td>B-2</td><td>PREFORM a visual inspection of vessel interior and nozzles. DOCUMENT any observable pre-test surface damage.</td><td></td><td></td></tr>
<tr><td>B-3</td><td>INSTALL vessel on the Test Stand.</td><td></td><td></td></tr>
<tr><td>B-4</td><td>VERIFY the required bolt torque at the Vessel and Stand interface.
Fasteners to be installed in the as-received condition.
8 by 5/8 - 11 SHCS X 2.25”
<table><tr><td>Bolt Torque Spec:</td><td>179 ft-lb</td></tr><tr><td>Torque Wrench Setting:</td><td></td></tr><tr><td>Calibration Exp. Date:</td><td></td></tr><tr><td>Torque Wrench SN:</td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>B-5</td><td>COVER vessel nozzle #1</td><td></td><td></td></tr>
<tr><td>B-6</td><td>PREPARE to install Radiographic Vessel 7, Nozzle 3, and Entry Cover ASSY (180Y1801553-00).</td><td></td><td></td></tr>
<tr><td>B-7</td><td>PERFORM visual surface inspection of the interior of the vessel, sealing surfaces, and cover sealing surfaces.</td><td></td><td></td></tr>
<tr><td>B-8</td><td>DOCUMENT observable surface damage.</td><td></td><td></td></tr>
<tr><td>B-9</td><td>CLEAN vessel and cover sealing surfaces.</td><td></td><td></td></tr>
<tr><td>B-10</td><td>Install and torque to 100 ft-lbs, bolts 2-10-16-14 in the as-received condition. See steps below on how to locate these bolt locations.</td><td></td><td></td></tr>
<tr><td>B-11</td><td>LUBRICATE remaining fasteners with NIKAL.
12 by ¾ - 10 SHCS X 2.50”</td><td></td><td></td></tr>
<tr><td>B-12</td><td>INSTALL 3-FT SCE Vessel Entry Cover Washer Ring (180Y1801592) on surface of Nozzle 3 Entry Cover. Ensure the washer ring countersink is facing away from the vessel.
12 by ¾ - 10 SHCS X 2.50”</td><td></td><td></td></tr>
</table>

	ENSURE bolts are snug tight.		
B-13	**MARK** bolt pattern on Nozzle 3 entry cover per Figure B-1 below.		

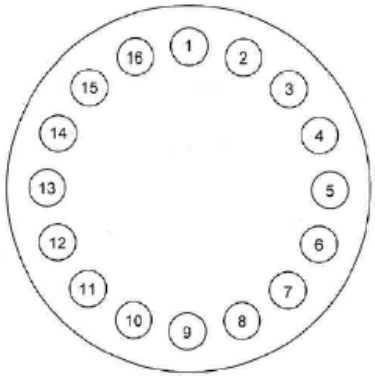


Figure B-1. Nozzle 3 Entry Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
-	**-**

B-14	**TORQUE 16 by ¾ - 10 SHCS X 2.50”** **PASS 1** **Bolt Torque Spec:** 100 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**	**Initial / Z#**	**Date**
B-15	**Remove the 4 bolts that were installed in the as-received condition and apply Nikal lubricant and re-install and torque to 100 ft-lbs in the sequence provided above**		

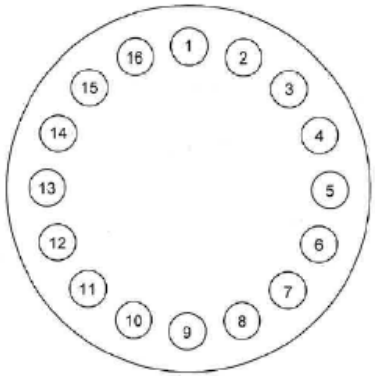


Figure B-1. Nozzle 3 Entry Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
4	**2-10-6-14**

B-16	**TORQUE 16 by ¾ - 10 SHCS X 2.50”** **PASS 2** **Bolt Torque Spec:** 160 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**	**Initial / Z#**	**Date**

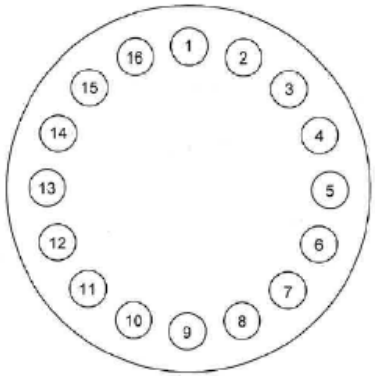


Figure B-1. Nozzle 3 Entry Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
4	**2-10-6-14**

B-17	**TORQUE 16 by ¾ - 10 SHCS X 2.50”** **PASS 3** **Bolt Torque Spec:** 220 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**	**Initial / Z#**	**Date**

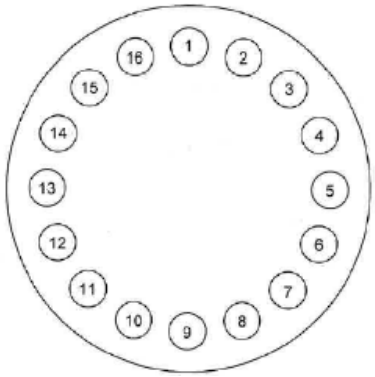


Figure B-1. Nozzle 3 Entry Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
4	**2-10-6-14**

B-18	**TORQUE 16 by ¾ - 10 SHCS X 2.50”** **PASS 4** **Bolt Torque Spec:** 320 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**	**Initial / Z#**	**Date**
B-19	**PREPARE** to install 3-FT SCE Vessel Entrance Cover Assembly (180Y1801553-00) on Nozzle 2.		
B-20	**PERFORM** visual surface inspection of the interior of the vessel, sealing surfaces, and cover sealing surfaces.		
B-21	**DOCUMENT** observable surface damage.		
B-22	**CLEAN** vessel and cover sealing surfaces.		
B-23	**Install and torque to 100 ft-lbs, bolts 2-10-16-14 in the as-received condition. See steps below on how to locate these bolt locations.**		
B-24	**LUBRICATE remaining** fasteners with NIKAL. **12 by ¾ - 10 SHCS X 2.50”**		

B-25	**INSTALL** 3-FT SCE Vessel Entrance Cover Washer Rings (180Y1801592-01) on nozzle 2. Ensure the washer ring countersink is facing away from the vessel. **12 by ¾-10 SHCS X 2.50”** **ENSURE** fasteners are snug tight.		
B-26	**MARK** bolt pattern on Nozzle 2 exit cover per Figure B-1 below.		

TORQUE SEQUENCE PASS 1

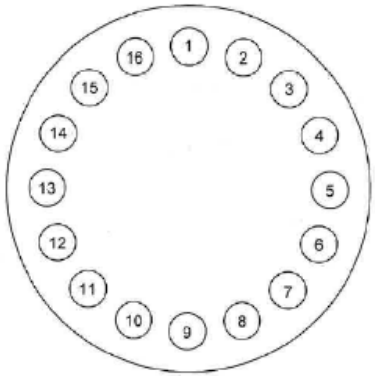


Figure B-1. Nozzle 2 Entry Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
-	**-**

B-27	**TORQUE 16 by ¾ - 10 SHCS X 2.50”** **PASS 1** **Bolt Torque Spec:** 100 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**	**Initial / Z#**	**Date**
B-28	**Remove the 4 bolts that were installed in the as-received condition and apply Nikal lubricant and re-install and torque to 100 ft-lbs in the sequence provided above**		

TORQUE SEQUENCE PASS 2

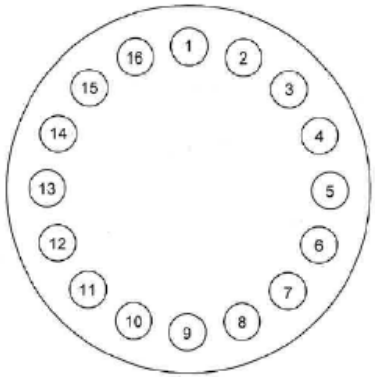


Figure B-1. Nozzle 2 Entry Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
4	**2-10-6-14**

B-29	**TORQUE 16 by ¾ - 10 SHCS X 2.50”** **PASS 2** **Bolt Torque Spec:** 160 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**	**Initial / Z#**	**Date**

TORQUE SEQUENCE PASS 3

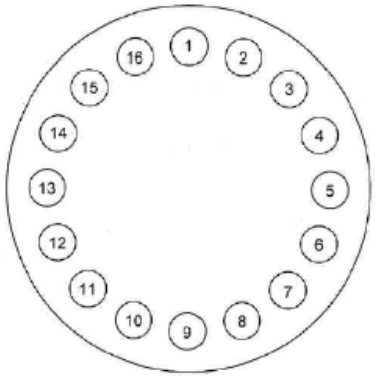


Figure B-1. Nozzle 2 Entry Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
4	**2-10-6-14**

B-30	**TORQUE 16 by ¾ - 10 SHCS X 2.50”** **PASS 3** **Bolt Torque Spec:** 220 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**	**Initial / Z#**	**Date**

TORQUE SEQUENCE PASS 4

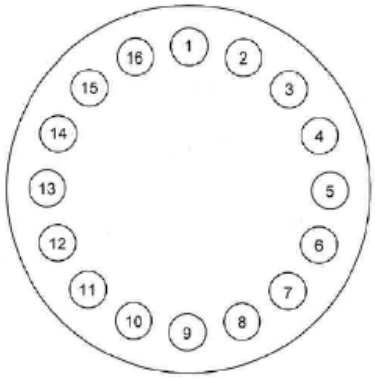


Figure B-1. Nozzle 2 Entry Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
4	**2-10-6-14**

B-31	**TORQUE 16 by ¾ - 10 SHCS X 2.50"** **PASS 4** **Bolt Torque Spec:** 320 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**	**Initial / Z#**	**Date**
B-32	**TRANSPORT** Vessel Assembly on its test stand to R306.		
B-33	**TRANSPORT** Top Cover Assembly on it Support Stand to R306.		
B-34	**TRANSPORT** HE test article to R306		

ATTACHMENT C: FIRING SITE PREPARATION

TA15-R306 Firing Site will be used for the Nimble OPT Feedthrough Qualification. The setup will be the vessel on its support stand inside the environmental enclosure (White House) on the firing point at the direction of the Firing Site Leader. DAS cabling will be routed through conduits into the Firing Control Center Bunker. Setup and testing of the gas handling manifold and venting system will be conducted. The Top Cover Assembly and Barolo Racklito Stand will be placed in position suited for Test Article Insertion and allow for checkout and connections to be made on Top Cover components near the vessel assembly. For Test Article Insertion, the HE Support Assembly will be connected to the top cover assembly along with all of the final hardware. When complete, the Top Cover Assembly will be unbolted from the Barolo Racklito Stand and inserted onto the Vessel.

Step	Activity	Initial	Date
C-1	**VERIFY** that the environmental enclosure (White House) is ready to receive Vessel and Top Cover Stands.		
C-2	**PLACE** the vessel and its support stand inside the White House at the direction of the Firing Site Leader. **ALLOW** adequate working clearance on all sides of the vessel.		
C-3	**PLACE** the Top Cover assembly and support stand inside the White House at the direction of the Firing Site Leader. **ALLOW** adequate working clearance on all sides of top cover support stand.		
C-4	**ROUTE** the DAS cabling from vessel to bunker. **ENSURE** each cable has adequate labeling and protection from damage.		
C-5	**TRANSPORT** all necessary DAS equipment to the TA15-R306 and setup where applicable.		
C-6	**SWAP** GMS Control Unit to accommodate SCE vent valve actuators.		
C-7	**SETUP** remote actuation system to allow for remote venting of the post-detonation gas products and verify function.		
C-8	**MAKE** DAS equipment cable connections in the bunker. **NOTE:** Triggering signal between the Fire Control Center (FCC) and DAS equipment will be required on some instrumentation.		

ATTACHMENT D: TEST ARTICLE INSERTION

1.0 TEST ARTICLE INSERTION

1.1 PROCEDURE SCOPE

This section outlined the reception of the vessel assembly & stand, Top Cover Assembly & Stand, HE Test Article at R306 firing point, and the HE test article insertion procedure.

1.2 REQUIRED EQUIPMENT

1. Digital point and shoot camera
2. ¾" Swivel Hoist Ring, with 500 pound working load limit rated for Critical Lift
3. Calibrated Torque Wrenches:
    a. 10 to 100 ft-lb
    b. 30 to 320 ft-lb

1.3 REQUIRED SUPPLIES

1. Paint marker
2. Duct tape
3. Aluminum Tape
4. Jet-lube NIKAL® thread lubricant
5. Dow Corning® high vacuum grease or equivalent
6. Thread Locker, Loctite 242
7. Isopropyl Alcohol
8. Lint free wipes

1.4 REQUIRED DRAWINGS

Item Number	Drawing Number	Item Description
1	180Y1801755	Nimble Overpressure Test Top Cover Assembly
2	180Y1801736	NIMBLE OPT HE Support Assembly
3	180Y1801735	NIMBLE OPT Vessel Assembly
4	180Y1801544	Cygnus Vessel 7, Nozzle 5 Exit Cover
5	180Y1801549	Cygnus Vessel 7, Nozzle 4 Exit Cover
6	180Y1801646	Pressure Sensor Chamber Assembly

1.5 DEVICE INSERTION PROCEDURE & CHECKLIST

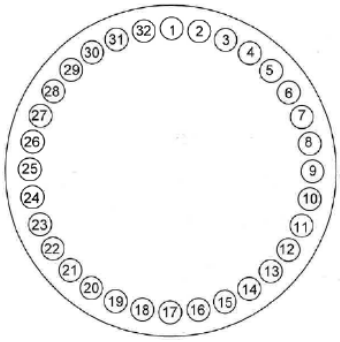
Step	Activity	Initial	Date
D-1	**VERIFY** assembly drawings are current and appropriate for Nimble OPT.		
D-2	**PERFORM** visual surface inspection of the interior of the vessel, sealing surfaces, and cover sealing surfaces.		
D-3	**DOCUMENT** observable surface damage.		
D-4	**CLEAN** vessel and cover sealing surfaces.		
D-5	**VERIFY** that the Critical Lift Plan is complete and signed.		
D-6	**VERIFY** that the Crane Support Personnel are present and prepared to support test activities.		
D-7	**VERIFY** that the Diagnostic Personnel are present and prepared to make Diagnostic connections between the test article and the top cover feedthroughs.		
D-8	**CONDUCT** a Pre-Job briefing on preparing the vessel for HE Charge Insertion and the HE operations that will be performed.		
D-9	**VERIFY** that both Worcester Valves on the top cover are in the **CLOSED** position.		
D-10	**IF** not done so already, **TRANSPORT** HE test article to R306 Firing Site.		
D-11	**INSPECT** HE Test Article. A representative of J-6 and the Test Engineer or designee will inspect the HE Test Article and **VERIFY** that it is the correct test article for NIMBLE OPT.		
D-12	**ATTACH** the HE Support Hardware to Top Cover Racklito. This will be conducted by Firing Site Crew and HE Handler using appropriate LANL HE handling procedures. Reference drawings 180Y1801735 and 180Y1801736.		
D-13	**MAKE** the diagnostic connection for TOAD and photodiode diagnostics.		
D-14	**MAKE** the detonator cable connections to the appropriate Top Cover Feedthroughs per the appropriate Firing Site Procedure.		

D-15	**ATTACH** the four (4) (10.5 gram per packet) Europium Oxide tracer packets to the Racklito using strips of duct tape.		
D-16	**POKE** a small hole in each packet to allow for pressure equalization during vacuum operations during Helium Leak Test.		
D-17	**INSTALL** appropriate rigging to Top Cover ¾" Swivel Hoist Ring.		
D-18	**VERIFY** with Diagnostic Coordinator (or Designee) that diagnostic connections are made and ready for final vessel closure.		
D-19	**INSPECT** vessel Top Cover Nozzle tapped holes for debris or oil. **CLEAN** if necessary.		
D-20			
D-21	**INSTALL** the Top Cover Alignment All-thread Guide Pins onto vessel top flange.		
D-22	**REMOVE** the White House access lid.		
!!!WARNING!!! **CRITICAL LIFT** The following movement was determined to be a critical lift according to the LANL Critical Lift Determination Criteria. Personal injury and/or contamination could result from failure to carefully perform this task.			
D-23	**MOVE** the Top Cover Assembly and Racklito Support Stand in accordance with applicable critical lift document(s) to a safe and secure height and position for O-ring installation onto Top Cover.		
D-24	**ADJUST** the top of the nuts on the Alignment All-Thread Guide Pins to approximately 1 -1/2 inches above the vessel top flange.		
D-25	**INSPECT** O-rings for any damage or debris. **CLEAN** if necessary. **Qty** / **Item number** / **Description** **1** / **2-386** / **Viton O-ring** **2** / **2-462** / **Viton O-ring** **1** / **2-461** / **Viton O-ring**		
D-26	**CLEAN** and **INSPECT** top cover sealing surfaces for damage.		

D-27	**DOCUMENT** observable surface damage.		
D-28	**APPLY** a light coating of high vacuum grease to O-rings.		
D-29	**INSTALL** the O-rings onto the Top Cover and Apply additional vacuum grease as needed.		
D-30	**CONNECT** any final diagnostic or detonator connections below the Top Cover.		
D-31	**PHOTOGRAPH** final diagnostic connections.		
!!!WARNING!!! **CRITICAL LIFT** The following movement was determined to be a critical lift according to the LANL Critical Lift Determination Criteria. Personal injury and/or contamination could result from failure to carefully perform this task.			
D-32	**MOVE** the Top Cover per applicable critical lift documents onto the Alignment All-Thread Guide Pins.		
D-33	**LOWER** the Top Cover into the vessel using the Alignment All-Thread Guide Pins and tapered alignment bolts to facilitate the process.		
D-34	**REMOVE** the Alignment All-Thread Guide Pins form the Vessel Top Flange.		
D-35	**FINISH** lowering the Top Cover Assembly into the vessel with nuts removed for the bottom side of the Top Cover.		
Note: A pry bar may be used to appropriately maneuver and position the Top Cover to achieve proper alignment with the Top Cover Flange.			
D-36	**INSTALL** 2X washer rings (180Y1801592) on the Top Cover. Ensure the washer ring countersink is facing away from the vessel.		
D-37	**WIPE** the 32 by ¾”-10 X 3.00” SHCS bolts with a lint free cloth to remove excess oil.		
D-38	**Install and torque to 100 ft-lbs, bolts 2-18-10-26 & 8-24-16-32 in the as-received condition. See steps below on how to locate these bolt locations.**		
D-39	**APPLY** Jet-Lube NIKAL® bolt lube to the threads of the remaining 24 of the 32 by ¾”-10 X 3.00” SHCS Top Cover Bolts.		

D-40	**SNUG** the Top Cover onto the Top Cover Flange using 32 by ¾”-10 X 3.00” SHCS.		
D-41	**REMOVE** the tapered alignment bolts if used.		
D-42	**MARK** near each bolt hole on Top Cover bolt pattern as shown in Torque Sequence Description Block below.		

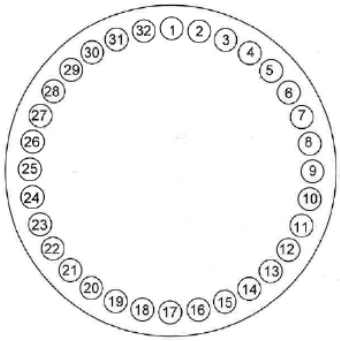
TORQUE SEQUENCE PASS 1



Torque Sequence	Bolt Number
1	**1-17-9-25**
2	**5-21-13-29**
3	**3-19-11-27**
4	**7-23-15-31**
-	**-**
6	**4-20-12-28**
7	**6-22-14-30**
-	**-**

D-43	**TORQUE 32 by ¾’-10 SHCS X 3.00”** **PASS 1** **Bolt Torque Spec:** 100 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**	**Initial / Z#**	**Date**
D-44	**Remove the 8 bolts that were installed in the as-received condition and apply Nikal lubricant and re-install and torque to 100 ft-lbs in the sequence provided above**		

TORQUE SEQUENCE PASS 2



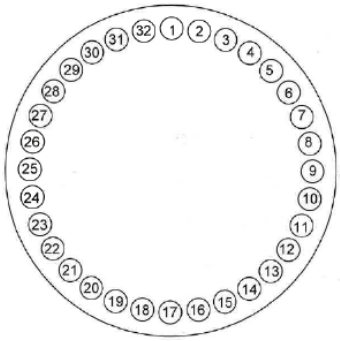
Torque Sequence	Bolt Number
1	**1-17-9-25**
2	**5-21-13-29**
3	**3-19-11-27**
4	**7-23-15-31**
5	**2-18-10-26**
6	**4-20-12-28**
7	**6-22-14-30**
8	**8-24-16-32**

D-45

TORQUE 32 by ¾”-10 SHCS X 3.00”
PASS 2

Bolt Torque Spec:	160 ft-lb
Torque Wrench Setting:	
Calibration Exp. Date:	
Torque Wrench SN:	

TORQUE SEQUENCE PASS 3



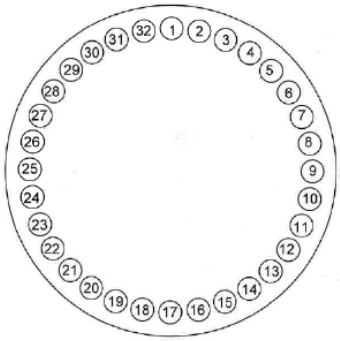
Torque Sequence	Bolt Number
1	**1-17-9-25**
2	**5-21-13-29**
3	**3-19-11-27**
4	**7-23-15-31**
5	**2-18-10-26**
6	**4-20-12-28**
7	**6-22-14-30**
8	**8-24-16-32**

D-46

TORQUE 32 by ¾'-10 SHCS X 3.00"
PASS 3

Bolt Torque Spec:	220 ft-lb
Torque Wrench Setting:	
Calibration Exp. Date:	
Torque Wrench SN:	

TORQUE SEQUENCE PASS 4



Torque Sequence	Bolt Number
1	**1-17-9-25**
2	**5-21-13-29**
3	**3-19-11-27**
4	**7-23-15-31**
5	**2-18-10-26**
6	**4-20-12-28**
7	**6-22-14-30**
8	**8-24-16-32**

D-47	**TORQUE 32 by ¾'-10 SHCS X 3.00"** **PASS 4** **Bolt Torque Spec:** 320 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		
D-48	**CONFIRM TORQUE** of the ¾" SHCS using a Circular Pattern beginning at fastener 1 and ending at fastener 32. **TORQUE 32 by ¾'-10 SHCS X 3.00"** **FINAL PASS** **Bolt Torque Spec:** 320 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		
D-49	**MARK** each ¾" SHCS after torqueing using paint marker.		

D-50	**ENSURE** Swivel Hoist Ring and rigging are removed from Top Cover.		
D-51	**WIPE** any excess NIKAL extruded from the cover joint during installation.		
D-52	**ENSURE** Valve Actuators are in the closed position.		
D-53	**INSTALL** Valve Actuator #1 and **ADJUST** actuator and/or valve to align with coupling.		
D-54	**INSTALL** the air-lines onto Actuator #1.		
D-55	**INSTALL** Valve Actuator #2 and **Adjust** actuator and/or valve to align with coupling.		
D-56	**INSTALL** the air-lines onto Actuator #2.		
D-57	**FUNCTION CHECK** Valve Actuator operation.		
D-58	**PREPARE** to install Radiographic Vessel 7, Nozzle 4- Exit Cover ASSY (180Y1801549-00).		
D-59	**PERFORM** visual surface inspection of the interior of the vessel, sealing surfaces, and cover sealing surfaces.		
D-60	**DOCUMENT** observable surface damage.		
D-61	**CLEAN** vessel and cover sealing surfaces.		
D-62	**Install and torque to 100 ft-lbs, bolts 2-10-16-14 in the as-received condition. See steps below on how to locate these bolt locations.**		
D-63	**LUBRICATE** fasteners with NIKAL. **12 by ¾ - 10 SHCS X 2.50”**		
D-64	**INSTALL** 3-FT SCE Vessel Exit Cover Washer Ring (180Y1801584-01) on surface of Nozzle 4 Exit Cover. Ensure the washer ring countersink is facing away from the vessel. **12 by ¾ - 10 SHCS X 2.50”** **ENSURE** bolts are snug tight.		
D-65	**MARK** bolt pattern on Nozzle 4 exit cover per Figure B-1 below.		

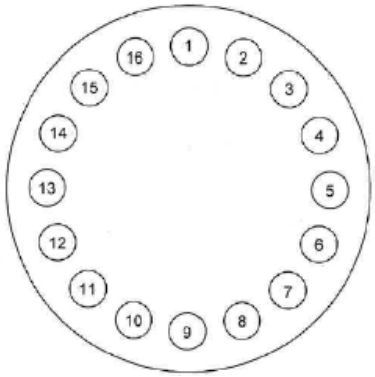


Figure B-1. Nozzle 4 Exit Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
-	**-**

D-66	**TORQUE 16 by ¾ - 10 SHCS X 2.50”** **PASS 1** **Bolt Torque Spec:** 100 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		
D-67	**Remove the 4 bolts that were installed in the as-received condition and apply Nikal lubricant and re-install and torque to 100 ft-lbs in the sequence provided above**		

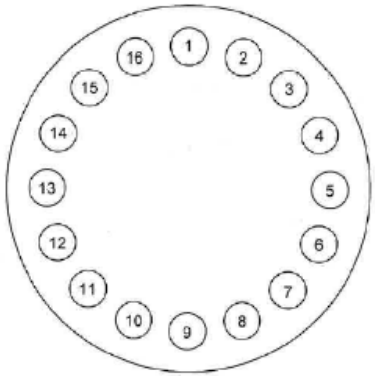


Figure B-1. Nozzle 4 Exit Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
4	**2-10-6-14**

D-68	**TORQUE 16 by ¾ - 10 SHCS X 2.50”** **PASS 2** **Bolt Torque Spec:** 160 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		

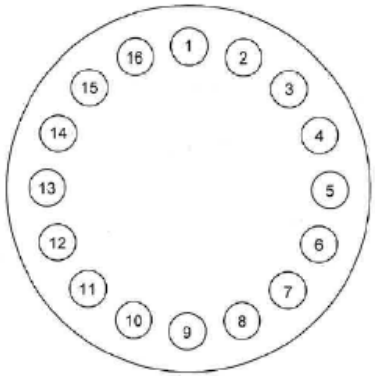


Figure B-1. Nozzle 4 Exit Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
4	**2-10-6-14**

D-69	**TORQUE 16 by ¾ - 10 SHCS X 2.50”** **PASS 3** **Bolt Torque Spec:** 220 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		

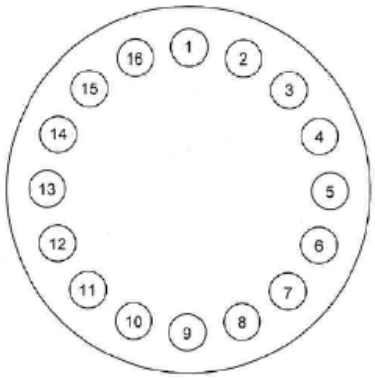


Figure B-1. Nozzle 4 Exit Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
4	**2-10-6-14**

D-70	**TORQUE 16 by ¾ - 10 SHCS X 2.50”** **PASS 4** **Bolt Torque Spec:** 320 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		
D-71	**PREPARE** to install Radiographic Vessel 7, Nozzle 5- Exit Cover ASSY (180Y1801544-00).		
D-72	**PERFORM** visual surface inspection of the interior of the vessel, sealing surfaces, and cover sealing surfaces.		
D-73	**DOCUMENT** observable surface damage.		
D-74	**CLEAN** vessel and cover sealing surfaces.		
D-75	**Install and torque to 100 ft-lbs, bolts 2-10-16-14 in the as-received condition. See steps below on how to locate these bolt locations.**		
D-76	**LUBRICATE remaining** fasteners with NIKAL. **12 by ¾ - 10 SHCS X 2.50”**		

D-77	**INSTALL** 3-FT SCE Vessel Exit Cover Washer Ring (180Y1801584-01) on surface of Nozzle 5 Exit Cover. Ensure the washer ring countersink is facing away from the vessel. **12 by ¾ - 10 SHCS X 2.50”** **ENSURE** bolts are snug tight.		
D-78	**MARK** bolt pattern on Nozzle 5 exit cover per Figure B-1 below.		

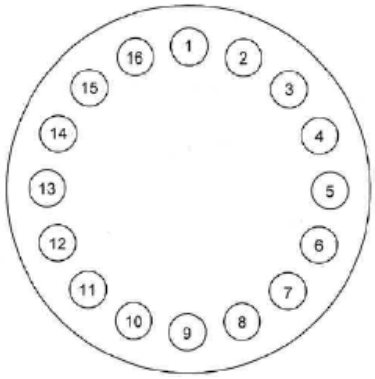


Figure B-1. Nozzle 5 Exit Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
-	**-**

D-79	**TORQUE 16 by ¾ - 10 SHCS X 2.50”** **PASS 1**		
D-80	**Remove the 4 bolts that were installed in the as-received condition and apply Nikal lubricant and re-install and torque to 100 ft-lbs in the sequence provided above**		

Bolt Torque Spec:	100 ft-lb
Torque Wrench Setting:	
Calibration Exp. Date:	
Torque Wrench SN:	

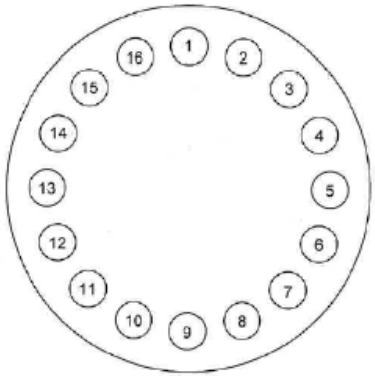


Figure B-1. Nozzle 5 Exit Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
4	**2-10-6-14**

D-81

TORQUE 16 by ¾ - 10 SHCS X 2.50”
PASS 2

Bolt Torque Spec:	160 ft-lb
Torque Wrench Setting:	
Calibration Exp. Date:	
Torque Wrench SN:	

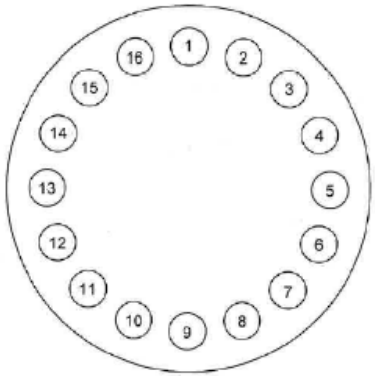


Figure B-1. Nozzle 5 Exit Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
4	**2-10-6-14**

D-82	**TORQUE 16 by ¾ - 10 SHCS X 2.50”** **PASS 3** **Bolt Torque Spec:** 220 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		

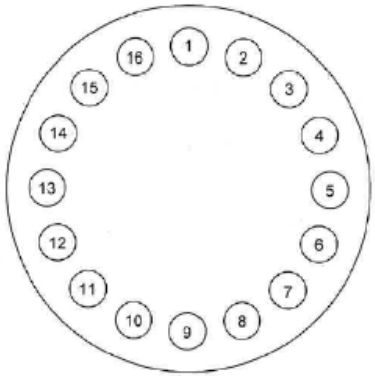


Figure B-1. Nozzle 5 Exit Cover Bolt Pattern

Torque Sequence	Bolt Numbers
1	**1-9-5-13**
2	**3-11-7-15**
3	**4-12-8-16**
4	**2-10-6-14**

D-83	**TORQUE 16 by ¾ - 10 SHCS X 2.50”** **PASS 4** **Bolt Torque Spec:** 320 ft-lb **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		
D-84	**INSTALL** Pressure Sensor Chamber and Mounting Ring to Vessel Support Stand. **2 by ½”-13 SHCS X 1.75”** **2 by ½” Flat Washers** **Bolt Torque Spec:** snug tight **Torque Wrench Setting:** **Calibration Exp. Date:** **Torque Wrench SN:**		
D-85	**ENSURE** the Pressure Sensor Chamber Assembly is seated in its mount properly as shown in Drawing 180Y1801735		
D-86	**MAKE** connections to the Sensors in the Pressure Sensor Chamber Assembly using Locktite 565.		

<table>
<tr><td>D-87</td><td>INSTALL (TC-1, TC-2, TC-3) Type-K Thermocouple on Exterior Surface of vessel at BOTTOM, MID, and TOP of vessel using Aluminum Tape.</td><td></td><td></td></tr>
<tr><td>D-88</td><td>INSTALL (TC-4) on Top Cover using Aluminum Tape</td><td></td><td></td></tr>
<tr><td>D-89</td><td>MAKE connections to the vessel thermocouples.
TC-1 TOP OF VESSEL
TC-2 MID OF VESSEL
TC-3 BOTTOM OF VESSEL
TC-4 TOP COVER
TC-5 PRESSURE CHAMBER INTERNAL
TC-6 PRESSURE CHAMBER EXTERNAL</td><td></td><td></td></tr>
<tr><td>D-90</td><td>RECORD the pressure indicated (Volts/psig) at Ambient Temperature and Pressure:
<table><tr><td>PS-1</td><td></td></tr><tr><td>PS-2</td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>D-91</td><td>RECORD pressure sensor model and serial numbers.
<table><tr><th>P-Sensor ID</th><th>Model#</th><th>Serial #</th></tr><tr><td>PS-1</td><td></td><td></td></tr><tr><td>PS-2</td><td></td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>D-92</td><td>COLLECT pressure sensor calibration data for test report.</td><td></td><td></td></tr>
<tr><td>D-93</td><td>VERIFY Thermocouple operation and readout.</td><td></td><td></td></tr>
<tr><td>D-94</td><td>COLLECT thermocouple model and serial numbers.
<table><tr><th>T/c ID</th><th>Model</th><th>Serial #</th></tr><tr><td>TC-1</td><td></td><td></td></tr><tr><td>TC-2</td><td></td><td></td></tr><tr><td>TC-3</td><td></td><td></td></tr><tr><td>TC-4</td><td></td><td></td></tr><tr><td>TC-5</td><td></td><td></td></tr><tr><td>TC-6</td><td></td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>D-95</td><td>VERIFY WIV-1 valve actuator #1 function.</td><td></td><td></td></tr>
<tr><td>D-96</td><td>VERIFY WIV-2 valve actuator #2 function.</td><td></td><td></td></tr>
<tr><td>D-97</td><td>CLOSE WIV-1 Valve Actuator #1.</td><td></td><td></td></tr>
</table>

D-98	**CLOSE WIV-2** Valve Actuator #2.		
D-99	**CONDUCT** Pre-Shot Execution CO sampling per **Field Sampling Operations Technical Procedure (TP-VPB-011)**		

ATTACHMENT E: PRE-EXECUTION OPERATIONS & HELIUM LEAK TEST

1.0 PRE-SHOT OPERATIONS

1.1 PROCEDURE SCOPE

This section outlines the procedural step to be used to conduct the pre-execution Helium Leak Test for NIMBLE Feedthrough OPT.

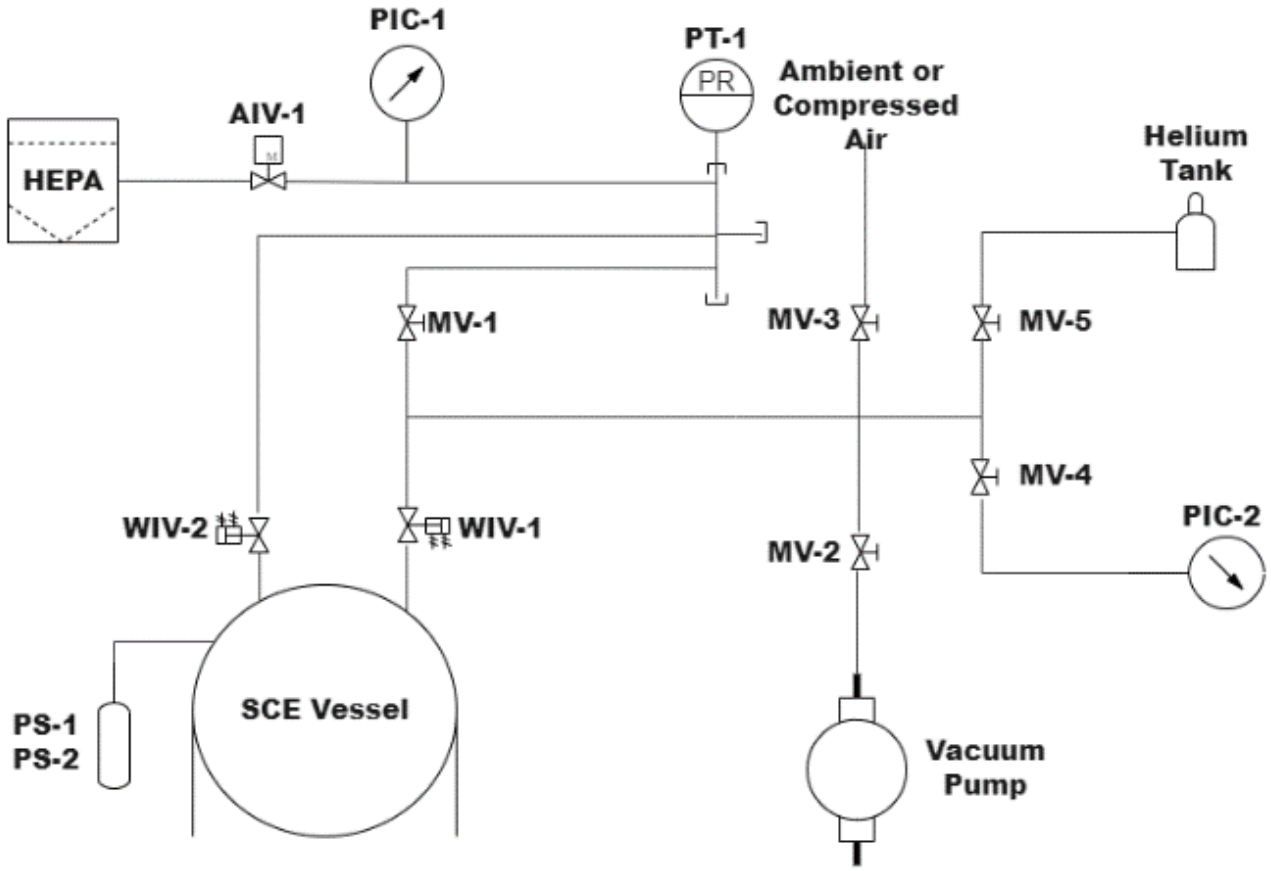
1.2 REQUIRED EQUIPMENT

1. Calibrated Helium leak tester
2. Handheld O_2 Monitor
3. Vacuum gauge
4. Vacuum pump
5. Crows Foot for feedthrough top nuts:
    a. 1 – 5/8”
    b. 1 – ¾”
6. Calibrated Torque Wrenches:
    a. 10 to 170 ft-lb
    b. 30 to 320 ft-lb

1.3 REQUIRED SUPPLIES

9. Smear samples, 20 pre-shot samples
10. Plastic for bagging of feedthroughs and vessel ports
11. Paint marker
12. Duct tape
13. Jet-lube NIKAL® thread lubricant
14. Dow Corning® high vacuum grease or equivalent
15. Thread Locker, Loctite 242
16. Isopropyl Alcohol
17. Lint free wipes

1.4 REQUIRED DRAWINGS

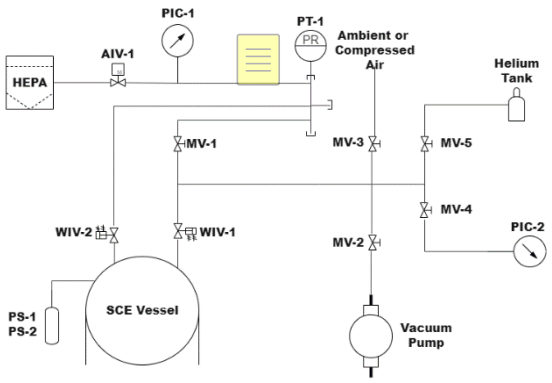


1.5 PRE-EXECUTION OPERATIONS PROCEDURES & CHECKLIST

Step	Activity	Initial	Date
E-1	**PERFORM** a visual inspection of the NIMBLE Feedthrough OPT assembly and GMS to confirm that they are ready for Helium Leak Test.		
E-2	**SAMPLE** the vessel exterior surface to establish pre-execution Eu_2O_3 and Be baseline reading per **Field Sampling Operations Technical Procedure (TP-VPB-011)**		
	Pre-Execution Helium Leak Test **NOTE-1:** ***Helium Leak Test procedures and operations are to be performed at the discretion and guidance of the ASNT Level II or III NDT Inspector.*** **NOTE-2:** ***IF an ASNT Level II or III NDT Inspector is not available then the Helium Leak Test can be performed by an individual that has knowledge of Helium Leak Testing using the following procedure as a guide since input from a SME has been provided for this procedure.***		
E-3	**RECORD** Name ASNT Level II NDT Inspector **IF** onsite and ready to perform the Helium Leak Test.		
E-4	**CONFIRM** the Helium Leak Detector is onsite and equipped with a Detector Probe.		
E-5	**POWER ON** leak detector. Allow for 30 minute minimum warm up time.		
E-6	**RECORD** the Leak Detector Description, SN, and Calibration Info.		
E-7	**CONFIRM** Helium Calibrated Leak is onsite.		

ASNT Level II or III NDT Inspector	
NAME:	
Z#:	

Description	Serial Number	Notes

<table>
<tr><td>E-8</td><td>RECORD calibration information, Serial Number, and initial reading form PIC-1 and PIC-2.
<table>
<tr><th></th><th>PIC-1</th><th>PIC-2</th></tr>
<tr><td>Calibration Exp. Date</td><td></td><td></td></tr>
<tr><td>Serial Number</td><td></td><td></td></tr>
<tr><td>Initial Reading</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>E-9</td><td>RECORD the applicable Helium calibrated leak information.
<table>
<tr><td>Serial Number</td><td></td></tr>
<tr><td>Calibration Number</td><td></td></tr>
<tr><td>Calibration Expiration Date</td><td></td></tr>
<tr><td>Calibrated Leak Rate (atm-cc/sec)</td><td></td></tr>
</table></td></tr>
<tr><td>E-10</td><td>ENSURE TCU’s are ON to move fresh air into the White House to minimize the ambient Helium Concentration.</td></tr>
<tr><td>E-11</td><td>PLACE the GMS valves in the following positions:
WIV-1: OPEN
WIV-2: CLOSED
MV-1: CLOSED
MV-2: OPEN
MV-3: CLOSED
MV-4: OPEN
MV-5: CLOSED
AIV-1: CLOSED
 
</td></tr>
<tr><td>E-12</td><td>EVACUATE the NIMBLE OPT vessel assembly to ASNT Level II NDT Inspector calculation of minimum required vacuum pressure, based on 10 psi Helium backfill, to ensure 90% minimum Helium concentration inside NIMBLE OPT Vessel Assembly.

Minimum OPT Vessel Assembly pressure prior to Helium backfill:_____

ASNT Level II DNT Inspector Signature:
_____ Date:_____</td></tr>
</table>

E-13	**CLOSE** MV-2 when complete.		
E-14	**PRESSURIZE** the NIMBLE OPT Vessel Assembly with Helium to 10 to 14 psig by **OPENING** MV-5 and monitoring calibrated pressure gauge (PIC-2). NOTE: Allow time for Helium pressure to equilibrate after cooling during fill process.		
E-15	**CLOSE** MV-5 when complete.		
E-16	**RECORD** the final pressure in NIMBLE OPT Vessel Assembly. **Helium Pressure** |		
E-17	**CALIBRATE** Helium Leak Detector per the ASNT Level II Inspector's instructions.		
E-18	**SET** the Leak Rate Reject and Audio Set Point to 1.0E-5 atm-cc/sec.		
E-19	**CONFIRM** system audio set point by scanning known source of Helium taking care not to flood the system.		
E-20	**ENSURE** a minimum Helium soak time, at test pressure, of 30 minutes prior to scanning.		
E-21	**IF** higher than normal background levels are detected; **THEN** Ventilate the area around the vessel using TCUs.		
E-22	**PERFORM** the leak test by scanning test surfaces at a rate no greater than 1 inch/second. **Ensure** leak rate is no greater than 1.0E-5 atm cc/sec. NOTE: Start at the highest point in the system first.		
E-23	**RECORD** any leaks detected in table (Step E-24)		

E-24

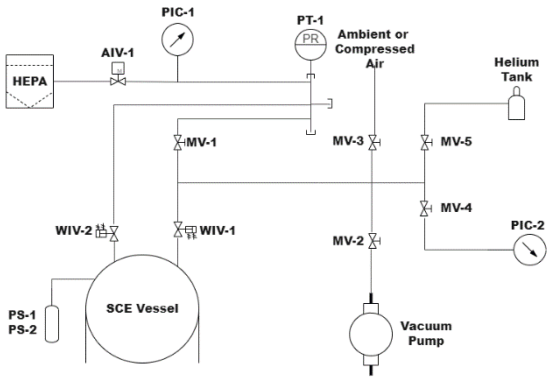
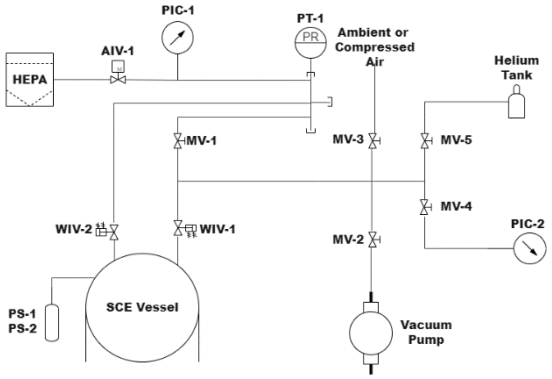
LOCATION	LEAK RATE	NOTES
Nozzle 1		
Nozzle 2		
Nozzle 3		
Nozzle 4		
Nozzle 5		
Pressure Sensor Chamber		
Feed-thru 1		
Feed-thru 2		
Feed-thru 3		
Feed-thru 4		
Feed-thru 5		
Feed-thru 6		
Feed-thru 7		
Feed-thru 8		
Feed-thru 9		
Feed-thru 10		
Feed-thru 11		
Feed-thru 12		
Feed-thru 13		
Feed-thru 14		
Feed-thru 15		
Feed-thru 16		
Feed-thru 17		
Feed-thru 18		
Feed-thru 19		
Feed-thru 20		

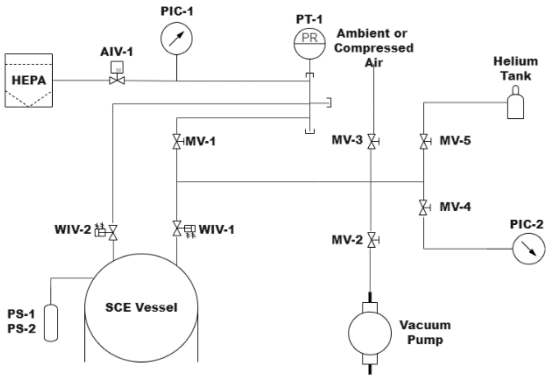
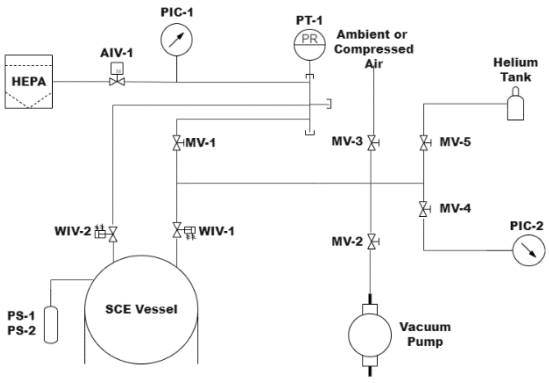
E-25

IF leak is detected tighten items to see if leak can be eliminated**.**

IF tightening does not correct problem **VENT** vessel to make repairs as required.

NOTES:

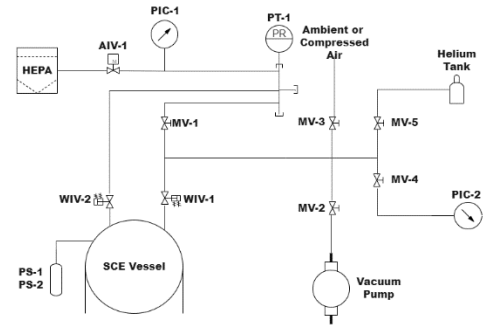
E-26	**REPEAT** steps E-11 through E-24 as necessary.		
E-27	**IF** no further detector activities are needed **power OFF** the system.		
E-28	**VENT** NIMBLE OPT Vessel Assembly to atmospheric pressure. WIV-1: OPEN WIV-2: CLOSED MV-1: OPEN MV-2: CLOSED MV-3: CLOSED MV-4: OPEN MV-5: CLOSED AIV-1: OPEN 		
E-29	**PURGE** the NIMBLE OPT Vessel Assembly by repeated VACUUM and FILLING the vessel with air. 2 vaccum and purge cycles should be sufficient. **VACUUM** NIMBLE OPT Vessel Assembly to velar Helium from system. WIV-1: OPEN WIV-2: CLOSED MV-1: CLOSED MV-2: OPEN MV-3: CLOSED MV-4: OPEN MV-5: CLOSED AIV-1: CLOSED  **VACUUM:** **OPEN** MV-2 **TURN ON** the vacuum pump. **CLOSE** MV-2 when complete.		

E-30	**VENT** NIMBLE OPT Vessel Assembly to atmospheric pressure monitoring PIC-2. WIV-1: OPEN WIV-2: CLOSED MV-1: CLOSED MV-2: CLOSED MV-3: OPEN MV-4: OPEN MV-5: CLOSED AIV-1: CLOSED  **PURGE:** **OPEN** MV-3 **ALLOW** the vessel to return to atmopheric pressure. **CLOSE** MV-3 when complete.		
E-31	**REPEAT** Steps 29 and 30 for a second time.		
E-32	**RECORD** O_2 Concentration exiting vacuum pump when purge complete. Acceptable range would be 19.5% to 23.5%. **REPEAT** vacuum/purge cycle as nessesary to achieve acceptable O2 concentration. **O_2 Concentration:** **NOTE:** This measurement is relative and does not require a calibrated O_2 monitor.		
E-33	**POSITION** valves to following configuration when venting is complete. WIV-1: CLOSED WIV-2: CLOSED MV-1: OPEN MV-2: CLOSED MV-3: CLOSED MV-4: CLOSED MV-5: CLOSED AIV-1: CLOSED 		

<table>
<tr><td>E-34</td><td colspan="3">CONFIRM Helium Leak Test Result.
<table><tr><td>ACCEPTED
☐</td><td>REJECTED
☐</td><td>DATE:</td></tr><tr><td colspan="3">ANST Level II Sign Off</td></tr><tr><td>NAME:</td><td colspan="2"></td></tr><tr><td>Z #:</td><td colspan="2"></td></tr><tr><td>SIGNATURE:</td><td colspan="2"></td></tr></table></td></tr>
<tr><td>E-35</td><td>BAG the Ports/Feedthroughs to capture post-execution detonation CO gas.
BAG each port individually.
BAG each Feedthrough individually.
BAG the Pressure Sensor Chamber Assembly.
BAG the Pressure Sensor Chamber Hose.</td><td></td><td></td></tr>
<tr><td>E-36</td><td>PLACE real-time CO monitor, with particulate filter attached, under the bag covering the Top Cover.</td><td></td><td></td></tr>
<tr><td>E-37</td><td>RECORD the Pressure Sensor readings.
<table><tr><td>PS-1</td><td></td></tr><tr><td>PS-2</td><td></td></tr><tr><td>PT-1</td><td></td></tr></table></td><td></td><td></td></tr>
</table>

ATTACHMENT F: SHOT-EXECUTION OPERATIONS

This section outlines the procedural steps to be used to execute the NIMBLE Feedthrough Overpressure Test. Preparation for execution activities will include the completion of the pre-execution checklists and confirmation from Test Engineer and Firing Site Leader that OPT is ready for execution.

<table>
<tr><th>Step</th><th>Activity</th><th>Initial</th><th>Date</th></tr>
<tr><td>F-1</td><td>CONFIRM that pre-execution checklists are complete.</td><td></td><td></td></tr>
<tr><td>F-2</td><td>VERIFY Vent Valve Positions.
WIV-1: CLOSED
WIV-2: CLOSED
MV-1: OPEN
MV-2: CLOSED
MV-3: CLOSED
MV-4: CLOSED
MV-5: CLOSED
AIV-1: CLOSED
 
</td><td></td><td></td></tr>
<tr><td>F-3</td><td>CONFIRM that the vessel temperature is at least 40°F.
RECORD the vessel temperature, method, and location.<table><tr><td>Method:</td><td></td></tr><tr><td>Top:</td><td></td></tr><tr><td>Middle:</td><td></td></tr><tr><td>Bottom:</td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>F-4</td><td>PERFORM detonation resistive load test.</td><td></td><td></td></tr>
<tr><td>F-5</td><td>PERFORM detonator runs if necessary.</td><td></td><td></td></tr>
<tr><td>F-6</td><td>CONNECT and SET triggers for High Speed Camera.</td><td></td><td></td></tr>
<tr><td>F-7</td><td>CONNECT and SET triggers for pressure transducers.</td><td></td><td></td></tr>
<tr><td>F-8</td><td>CONNECT and SET triggers for TOAD Diagnostics.</td><td></td><td></td></tr>
<tr><td>F-9</td><td>SEND diagnostic triggers to diagnostics</td><td></td><td></td></tr>
<tr><td>F-10</td><td>CONFRIM diagnostic trigger to diagnostics functionality for High Speed Camera.</td><td></td><td></td></tr>
<tr><td>F-11</td><td>CONFRIM diagnostic trigger to diagnostics functionality for pressure transducers.</td><td></td><td></td></tr>
<tr><td>F-12</td><td>CONFRIM diagnostic trigger to diagnostics functionality for TOAD Diagnostics.</td><td></td><td></td></tr>
<tr><td>F-13</td><td>CONFIRM with Firing Site Leader that the Firing Site and FCC are ready to fire charge.</td><td></td><td></td></tr>
</table>

F-14	**CONFIRM** with the DAS operating personnel that all DAS systems are ready for shot.		
F-15	The Firing Site Leader will give a **COUNTDOWN** and fire the charge. **RECORD** the time execution occurred. **SHOT TIME:**		

ATTACHMENT G: POST-EXECUTION ACTIVITIES & HELIUM LEAK TEST

1.0 POST-EXECUTION ACTIVITIES

1.1 PROCEDURE SCOPE

This section outlines the procedural Steps to be used after the execution of the NIMBLE Feedthrough OPT.

1.2 REQUIRED EQUIPMENT

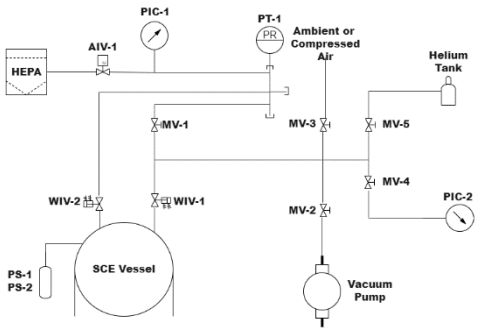
1. Digital point and shoot camera
2. Handheld Gas Monitor
3. Stationary CO Monitor
4. Handheld O_2 Monitor
5. Two(2) particulate air samplers
6. Air compressor
7. Calibrated Helium Leak Tester
8. Vacuum Gauge
9. Vacuum Pump
10. ¾" Swivel Hoist Ring, with 500 pound working load limit, rated for critical lift.
11. Calibrated Torque Wrenches:
    a. 10 to 100 ft-lb
    b. 30 to 320 ft-lb

1.3 REQUIRED SUPPLIES

1. Smear samples, 20 post-execution samples
2. Paint marker
3. Duct tape

1.4 POST-EXECUTION PROCEDURE & CHECKLIST

<table>
<tr><th>Step</th><th>Activity</th><th>Initial</th><th>Date</th></tr>
<tr><td>G-1</td><td>CONFIRM with Firing Site Leader that complete detonation of HE has occurred, and the method that was used to confirm complete detonation.
NOTES:</td><td></td><td></td></tr>
<tr><td>G-2</td><td>RECORD the vessel’s internal and residual pressure until an apparent state of pressure equilibrium has been reached after 120 minutes.
Recorded data point interval <u>should not exceed 5 seconds</u>.<table><tr><td>Initial Pressure:</td><td></td></tr><tr><td>Final Pressure:</td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>G-3</td><td>IF pressure sensor failure;
OPEN WIV-2 to allow manifold mounted PT-1 sensor to pressurize.
CONFIRM stable pressure reading (± 5%) after 30 minutes.<table><tr><td>PT-1 Pressure:</td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>G-4</td><td>MONITOR the CO concentration for a minimum of 15 minutes via real-time monitor located on the Top Cover.
RECORD CO Concentration and TIME taken at 5 minute intervals.<table><tr><th>TIME</th><th>Concentration</th></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>G-5</td><td>The Firing Site Leader will SAFE the firing system and any other system per appropriate firing site procedures.</td><td></td><td></td></tr>
<tr><td>G-6</td><td>CONFIRM with the Firing Site Leader that is safe to VENT.</td><td></td><td></td></tr>
</table>

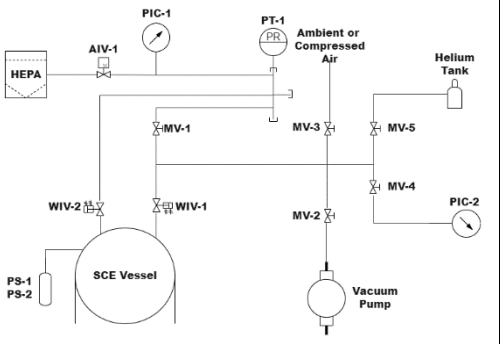
<table>
<tr><td>G-7</td><td>RECORD pre-venting vessel pressure when pressure is around 100 psig.
IF PS-1 & PS-2 have failed OPEN WIV-1 to pressurize PT-1.<table><tr><td>PS-1</td><td></td></tr><tr><td>PS-2</td><td></td></tr><tr><td>PT-1</td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>G-8</td><td>MOVE Valves to positions indicated below:
WIV-1: CLOSED
WIV-2: OPEN
MV-1: OPEN
MV-2: CLOSED
MV-3: CLOSED
MV-4: CLOSED
MV-5: CLOSED
AIV-1: OPEN
 
NOTE: If venting does not occur OPEN WIV-1.</td><td></td><td></td></tr>
<tr><td>G-9</td><td>MONITOR the pressure reading from PS-1 & PS-2 or PT-1 to achieve the 10 to 14 psig residual pressure.
CLOSE AIV-1 periodically to get accurate pressure reading.</td><td></td><td></td></tr>
<tr><td>G-10</td><td>At 10 to 14 psig CLOSE AIV-1.</td><td></td><td></td></tr>
<tr><td>G-11</td><td>RECORD the final vessel pressure.<table><tr><td>PS-1</td><td></td></tr><tr><td>PS-2</td><td></td></tr><tr><td>PT-1</td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>G-12</td><td>The Firing Site Leader will ASCEND the firing mound and inspect far any hazards to personnel.</td><td></td><td></td></tr>
<tr><td>G-13</td><td>CONFIRM with Firing Site Leader that Firing Point is safe to ascend.</td><td></td><td></td></tr>
<tr><td>G-14</td><td>ASCEND to Firing Point. Test Engineer and Test Support Personnel.</td><td></td><td></td></tr>
<tr><td>G-15</td><td>POWER DOWN all DAS equipment after residual pressure and gas temperature data recording is complete.</td><td></td><td></td></tr>
<tr><td>G-16</td><td>CONDUCT Post-Shot Execution CO Sampling per Field Sampling Operations Technical Procedure (TP-VPB-011).</td><td></td><td></td></tr>
</table>

G-17

RECORD CO concentration in port and feedthrough bags.

LOCATION	CONCENTRATION	NOTES
Nozzle 1		
Nozzle 2		
Nozzle 3		
Nozzle 4		
Nozzle 5		
Pressure Sensor Chamber		
Feed-thru 1		
Feed-thru 2		
Feed-thru 3		
Feed-thru 4		
Feed-thru 5		
Feed-thru 6		
Feed-thru 7		
Feed-thru 8		
Feed-thru 9		
Feed-thru 10		
Feed-thru 11		
Feed-thru 12		
Feed-thru 13		
Feed-thru 14		
Feed-thru 15		
Feed-thru 16		
Feed-thru 17		
Feed-thru 18		
Feed-thru 19		
Feed-thru 20		

G-18	**IF** tape holding bag has detached **OR IF** CO is detected, **RE-BAG** and **WAIT** 15 minutes to allow bag to equilibrate **THEN** re-sample the bag again per **TP-VPB-011**. **RECORD** concentration and note in step G-17.		
G-19	**OPEN AIV-1** to vent vessel of residual pressure.		

<table>
<tr><td>G-20</td><td>RECORD the final vessel pressure.<table><tr><td>PS-1</td><td></td></tr><tr><td>PS-2</td><td></td></tr><tr><td>PT-1</td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>G-21</td><td>EXCHANGE the vessel gasses using compressed air through MV-3 until CO concentration is < 50 ppm at HEPA filter discharge.
Valve Configuration:
WIV-1: OPEN
WIV-2: OPEN
MV-1: CLOSED
MV-2: CLOSED
MV-3: OPEN
MV-4: CLOSED
MV-5: CLOSED
AIV-1: OPEN
 
</td><td></td><td></td></tr>
<tr><td>G-22</td><td>RECORD the final CO concentration at HEPA Filter discharge.<table><tr><td>Final CO Concentration</td><td></td></tr></table></td><td></td><td></td></tr>
<tr><td>G-23</td><td>SAMPLE the vessel exterior surface to establish post-execution Eu_2O_3 and Be post-shot reading per TP-VPB-011.</td><td></td><td></td></tr>
</table>

Post-Execution Helium Leak Test

NOTE-1: ***Helium Leak Test procedures and operations are to be performed at the discretion and guidance of the ASNT Level II or III NDT Inspector.***

NOTE-2: ***IF an ASNT Level II or III NDT Inspector is not available then the Helium Lead Test can be performed by an individual that has knowledge of Helium Leak Testing using the following procedure as a guide since input from a SME has been provided for this procedure.***

G-24	**RECORD** Name ASNT Level II NDT Inspector **IF** onsite and ready to perform the Helium Leak Test.		

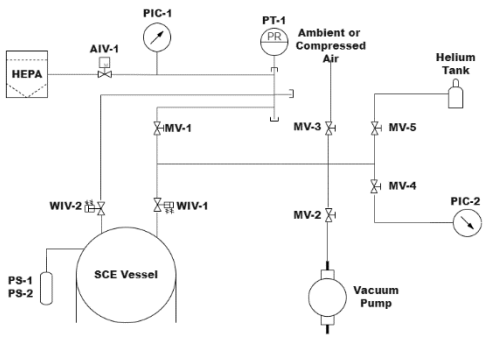
ASNT Level II or III NDT Inspector	
NAME:	
Z#:	

G-25	**CONFIRM** the Helium Leak Detector is onsite and equipped with a Detector Probe.		
G-26	**POWER ON** leak detector. Allow for 30 minute minimum warm up time.		
G-27	**RECORD** the Leak Detector Description and SN.		

Description	**Serial Number**	**Notes**

G-28	**CONFIRM** Helium Calibrated Leak is onsite.		
G-29	**RECORD** the applicable Helium calibrated leak information.		

Serial Number	
Calibration Number	
Calibration Expiration Date	
Calibrated Leak Rate (atm-cc/sec)	

G-30	**ENSURE** TCU's are ON to move fresh air into the White House to minimize the ambient Helium Concentration.		
G-31	**PLACE** the GMS valves in the following positions: WIV-1: OPEN WIV-2: CLOSED MV-1: CLOSED MV-2: OPEN MV-3: CLOSED MV-4: OPEN MV-5: CLOSED AIV-1: CLOSED 		
G-32	**EVACUATE** the NIMBLE OPT vessel assembly to ASNT Level II NDT Inspector calculation of minimum required vacuum pressure, based on 10 psi Helium backfill, to ensure 90% minimum Helium concentration inside NIMBLE OPT Vessel Assembly. Minimum OPT Vessel Assembly pressure prior to Helium backfill:_____ ASNT Level II DNT Inspector Signature: _____ Date:_____		
G-33	**CLOSE** MV-2 when complete.		
G-34	**PRESSURIZE** the NIMBLE OPT Vessel Assembly with Helium to 10 to 14 psig by **OPENING** MV-5 and monitoring calibrated pressure gauge (PIC-2). NOTE: Allow time for Helium pressure to equilibrate after cooling during fill process.		
G-35	**CLOSE** MV-5 when complete.		
G-36	**RECORD** the final pressure in NIMBLE OPT Vessel Assembly. **Helium Pressure** |		
G-37	**CALIBRATE** Helium Leak Detector per the ASNT Level II Inspector's instructions.		
G-38	**SET** the Leak Rate Reject and Audio Set Point to 1.0E-5 atm-cc/sec.		

G-39	**CONFIRM** system audio set point by scanning known source of Helium taking care not to flood the system.		
G-40	**ENSURE** a minimum Helium soak time, at test pressure, of 30 minutes prior to scanning.		
G-41	**IF** higher than normal background levels are detected; **THEN** Ventilate the area around the vessel using TCUs.		
G-42	**PERFORM** the leak test by scanning test surfaces at a rate no greater than 1 inch/second. **Ensure** leak rate is no greater than 1.0E-5 atm cc/sec. NOTE: Start at the highest point in the system first.		
G-43	**RECORD** any leaks detected in table (Step G-44)		

G-44

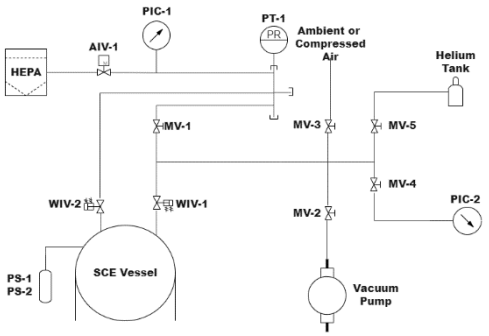
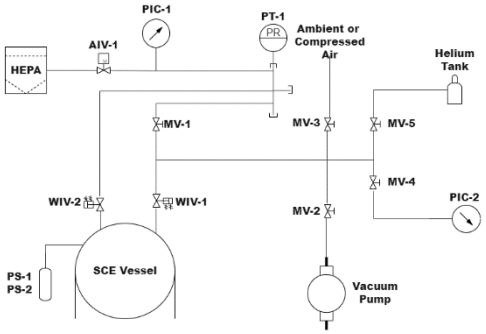
LOCATION	LEAK RATE	NOTES
Nozzle 1		
Nozzle 2		
Nozzle 3		
Nozzle 4		
Nozzle 5		
Pressure Sensor Chamber		
Feed-thru 1		
Feed-thru 2		
Feed-thru 3		
Feed-thru 4		
Feed-thru 5		
Feed-thru 6		
Feed-thru 7		
Feed-thru 8		
Feed-thru 9		
Feed-thru 10		
Feed-thru 11		
Feed-thru 12		
Feed-thru 13		
Feed-thru 14		
Feed-thru 15		
Feed-thru 16		
Feed-thru 17		
Feed-thru 18		
Feed-thru 19		
Feed-thru 20		

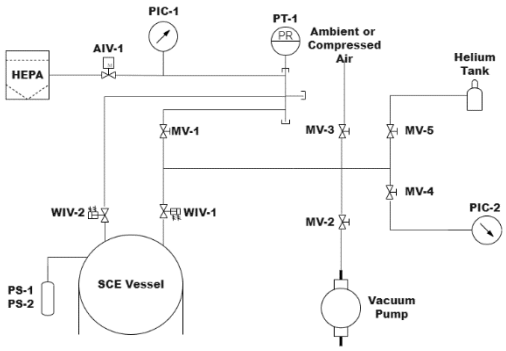
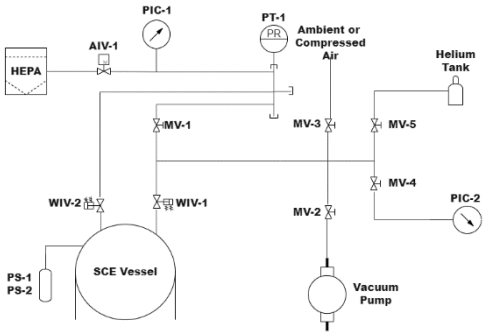
G-45

IF leak is detected tighten items to see if leak can be eliminated**.**

IF tightening does not correct problem **VENT** vessel to make repairs as required.

NOTES:

G-46	**REPEAT** steps G-42 through E-45 as necessary.		
G-47	**IF** no further detector activities are needed **power OFF** the system.		
G-48	**VENT** NIMBLE OPT Vessel Assembly to atmospheric pressure. WIV-1: OPEN WIV-2: CLOSED MV-1: OPEN MV-2: CLOSED MV-3: CLOSED MV-4: OPEN MV-5: CLOSED AIV-1: OPEN 		
G-49	**PURGE** the NIMBLE OPT Vessel Assembly by repeated VACUUM and FILLING the vessel with air. 2 vaccum and purge cycles should be sufficient. **VACUUM** NIMBLE OPT Vessel Assembly to velar Helium from system. WIV-1: OPEN WIV-2: CLOSED MV-1: CLOSED MV-2: OPEN MV-3: CLOSED MV-4: OPEN MV-5: CLOSED AIV-1: CLOSED  **VACUUM:** **OPEN** MV-2 **TURN ON** the vacuum pump. **CLOSE** MV-2 when complete.		

G-50	**VENT** NIMBLE OPT Vessel Assembly to atmospheric pressure monitoring PIC-2. WIV-1: OPEN WIV-2: CLOSED MV-1: CLOSED MV-2: CLOSED MV-3: OPEN MV-4: OPEN MV-5: CLOSED AIV-1: CLOSED  **PURGE:** **OPEN** MV-3 **ALLOW** the vessel to return to atmopheric pressure. **CLOSE** MV-3 when complete.		
G-51	**REPEAT** Steps 49 and 50 for a second cycle.		
G-52	**RECORD** O_2 Concentration exiting vacuum pump when purge complete. Acceptable range would be 19.5% to 23.5%. **REPEAT** vacuum/purge cycle as nessesary to achieve acceptable O2 concentration. **O_2 Concentration:** **NOTE:** This measurement is relative and does not require a calibrated O_2 monitor.		
G-53	**POSITION** valves to following configuration when venting is complete. WIV-1: CLOSED WIV-2: CLOSED MV-1: CLOSED MV-2: CLOSED MV-3: CLOSED MV-4: CLOSED MV-5: CLOSED AIV-1: CLOSED 		
G-54	**DISCONNECT** feedthroughs and gas handling lines.		
G-55	**DISCONNECT** the vessel diagnostics, DET cables, and GMS. **MAINTAIN** vessel confinement boundary.		
G-56	**GENERATE & ARCHIVE** test report in PDMLink.		

ATTACHMENT H: TEST INSTRUMENTATION

NIMBLE OPT DAQ MAP and Calibration Data

Compiled 02/18/21 by Jake Ancipink, J-2

The information on the following pages is to be used for the setup and execution of NIMBLE OPT at the R306 firing site. Reference this data to appropriately setup the thermocouple hardware and software to collect temperature qualification data.

- *Note 1: Two spare, loose, calibrated thermocouples have been prepared as a contingency for the experiment setup. All of these thermocouples are calibrated and are acceptable for use to gather qualification evidence. In the event that any of these thermocouples are used during the test, the test engineer shall document the thermocouple sensing location and DAQ channels through which they are routed.*

NIMBLE OPT Thermocouple DAS MAP and Calibration Data							
Channel	**Location**	**TC Serial #**	**Internal External**	**Agilent Channel**	**CHUBS Channel**	**Cal Slope**	**Cal Intercept**
1	Vessel Top		External	101			
2	Vessel Mid		External	102			
3	Vessel Bot		External	103			
4	Top Cover		External	104			
5	Internal Pressure Chamber		Internal	105			
6	External Pressure Chamber		External	106			
7	Spare			107			
8	Spare			108			

NIMBLE OPT Pressure Transducer DAS MAP and Calibration Data						
Channel	**Location**	**PT Serial #**	**Agilent Channel**	**CHUBS Channel**	**Cal Slope**	**Cal Intercept**
PT-1	Vent Manifold (Wall Mount)		201			
PS-1	External Pressure Chamber		202			
PS-2	External Pressure Chamber		203			

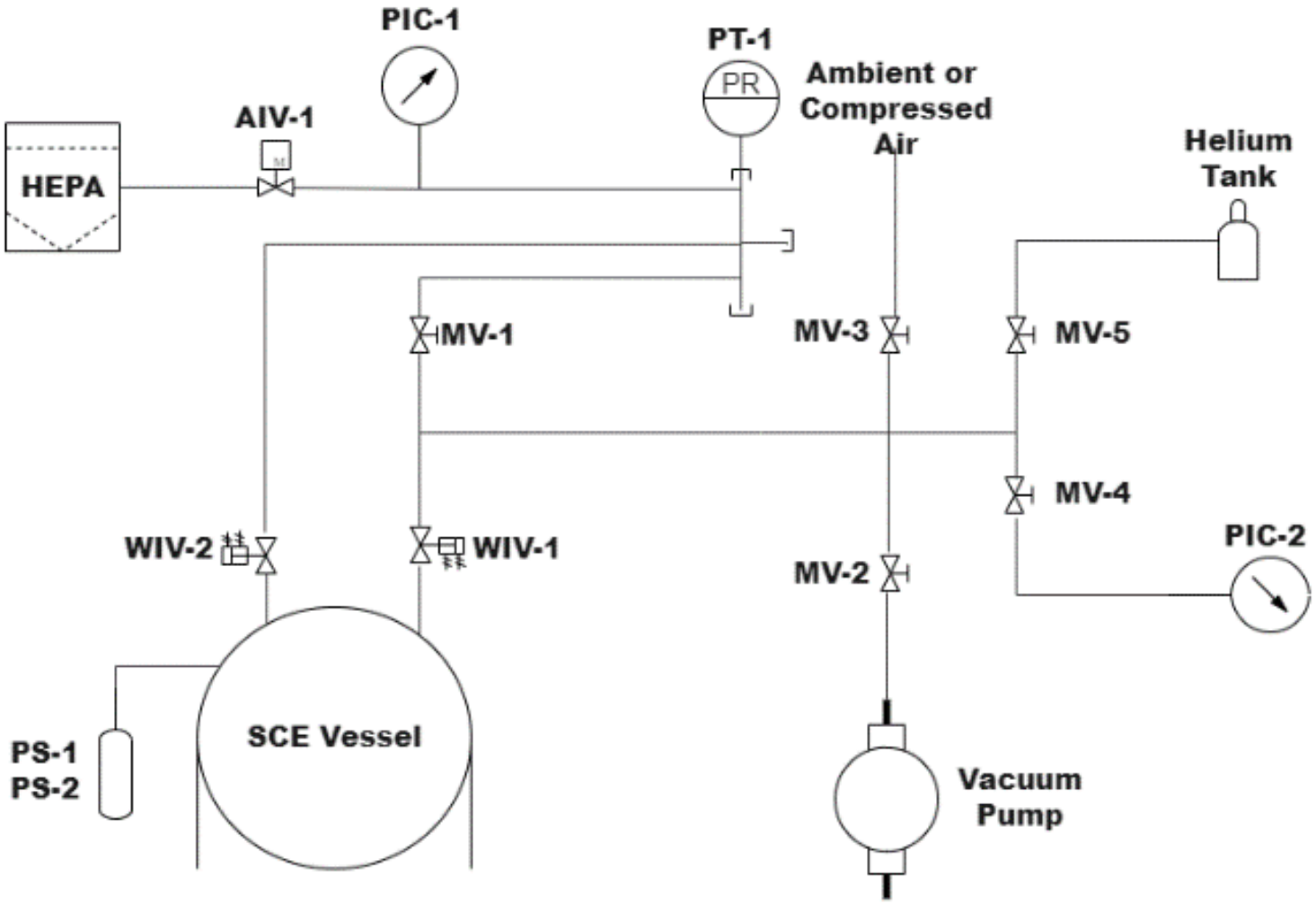
Thermocouple ID	**Location**
TC#1	Vessel Top
TC#2	Vessel Mid
TC#3	Vessel Bottom
TC#4	Top Cover
TC#5	Internal Pressure Chamber
TC#6	External Pressure Chamber

Pressure Transducer ID	**Location**
PT-1	Vent Manifold, Wall Mount
PS-1	External Pressure Chamber
PS-2	External Pressure Chamber

Pressure Gauge ID	**Location**
PIC-1	Vent Manifold, Wall Mount
PIC-2	Vacuum Manifold

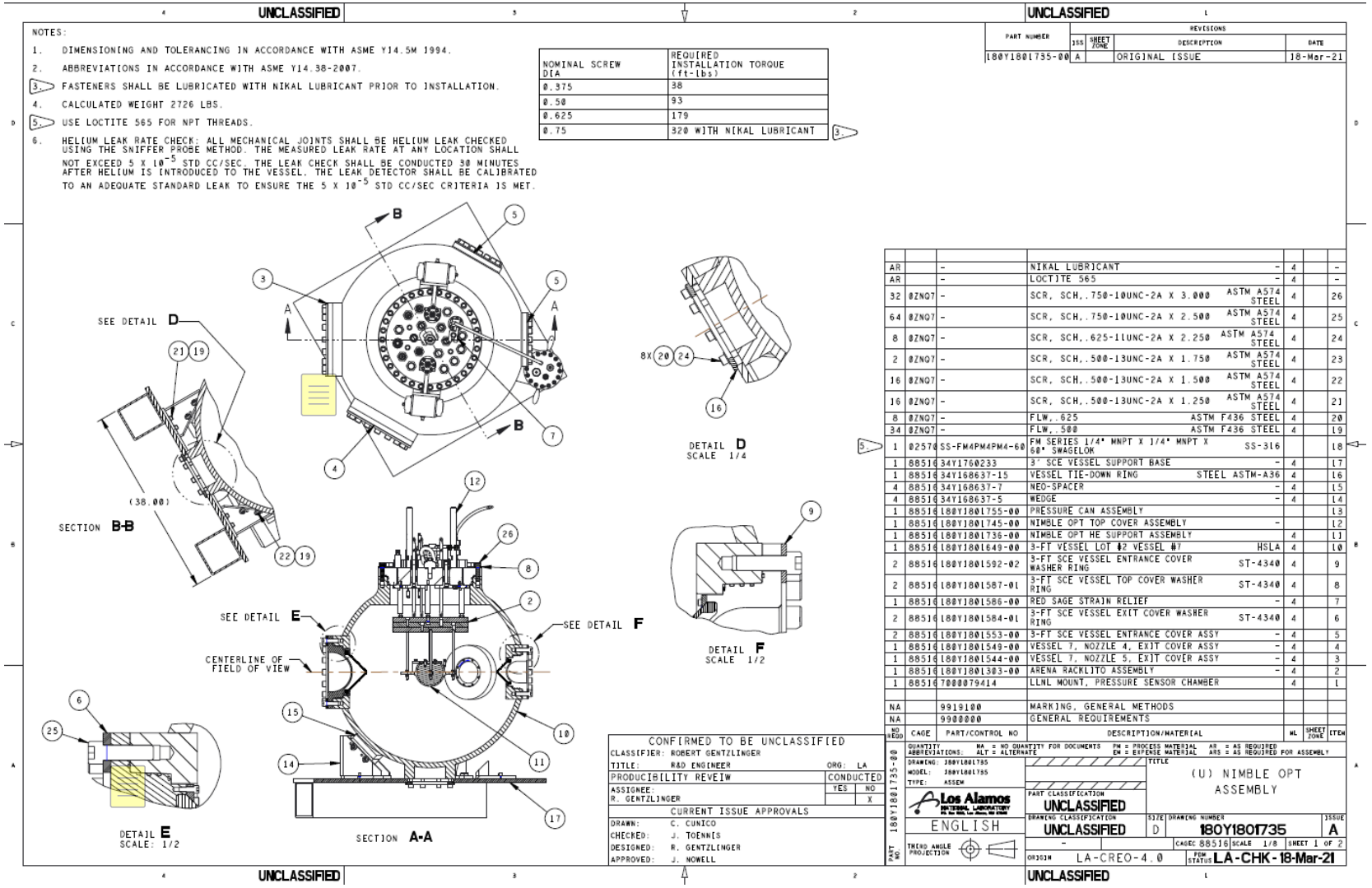
ATTACHMENT I: DRAWINGS

I.1 NIMBLE FEEDTHROUGH OPT PIPING & INSTRUMENTATION DIAGRAM (P&ID) FOR WHITE HOUSE GMS

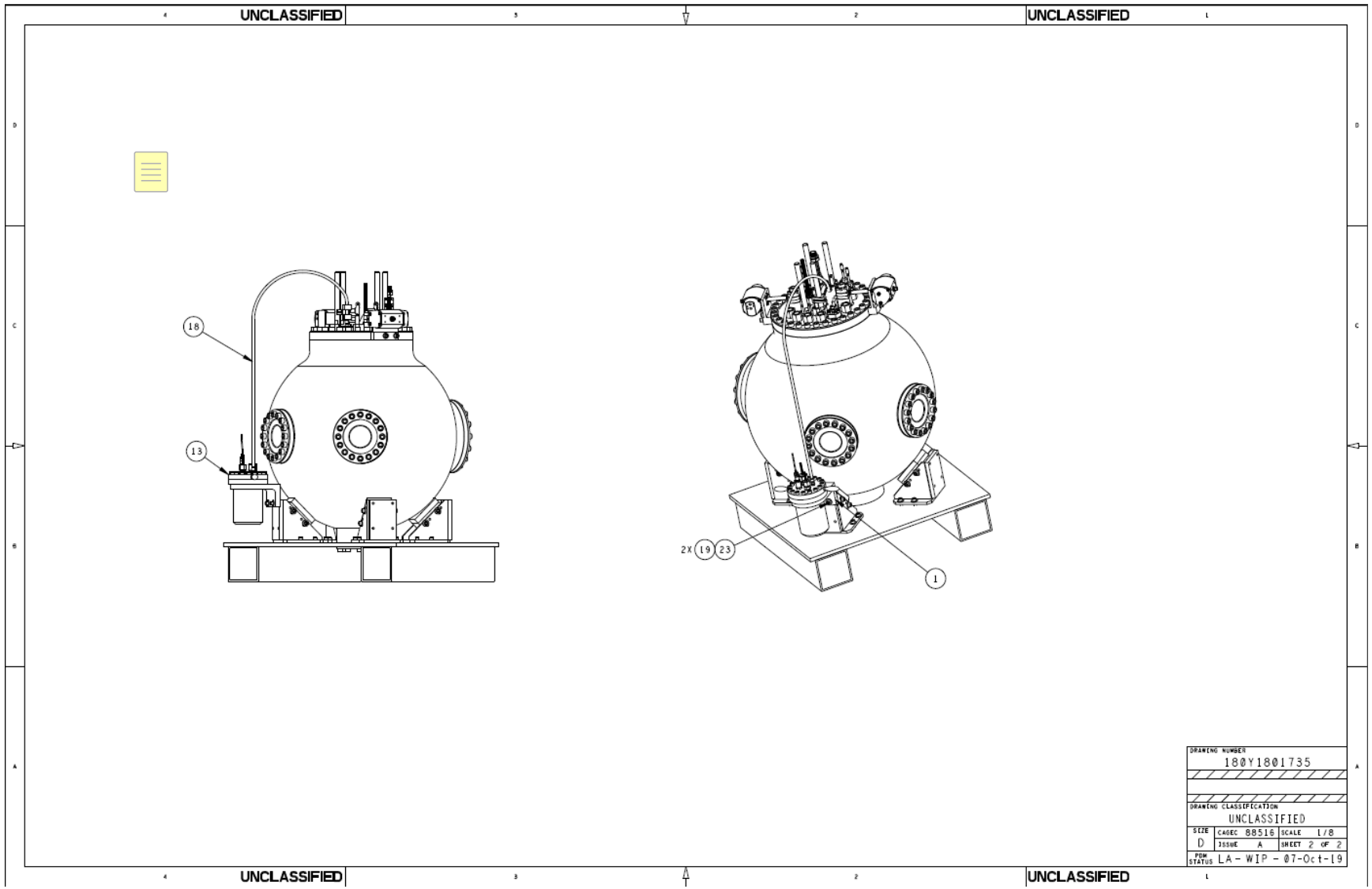


ATTACHMENT I: DRAWINGS (cont'd)

I.2 NIMBLE FEEDTHROUGH OPT VESSEL CONFIGURATION

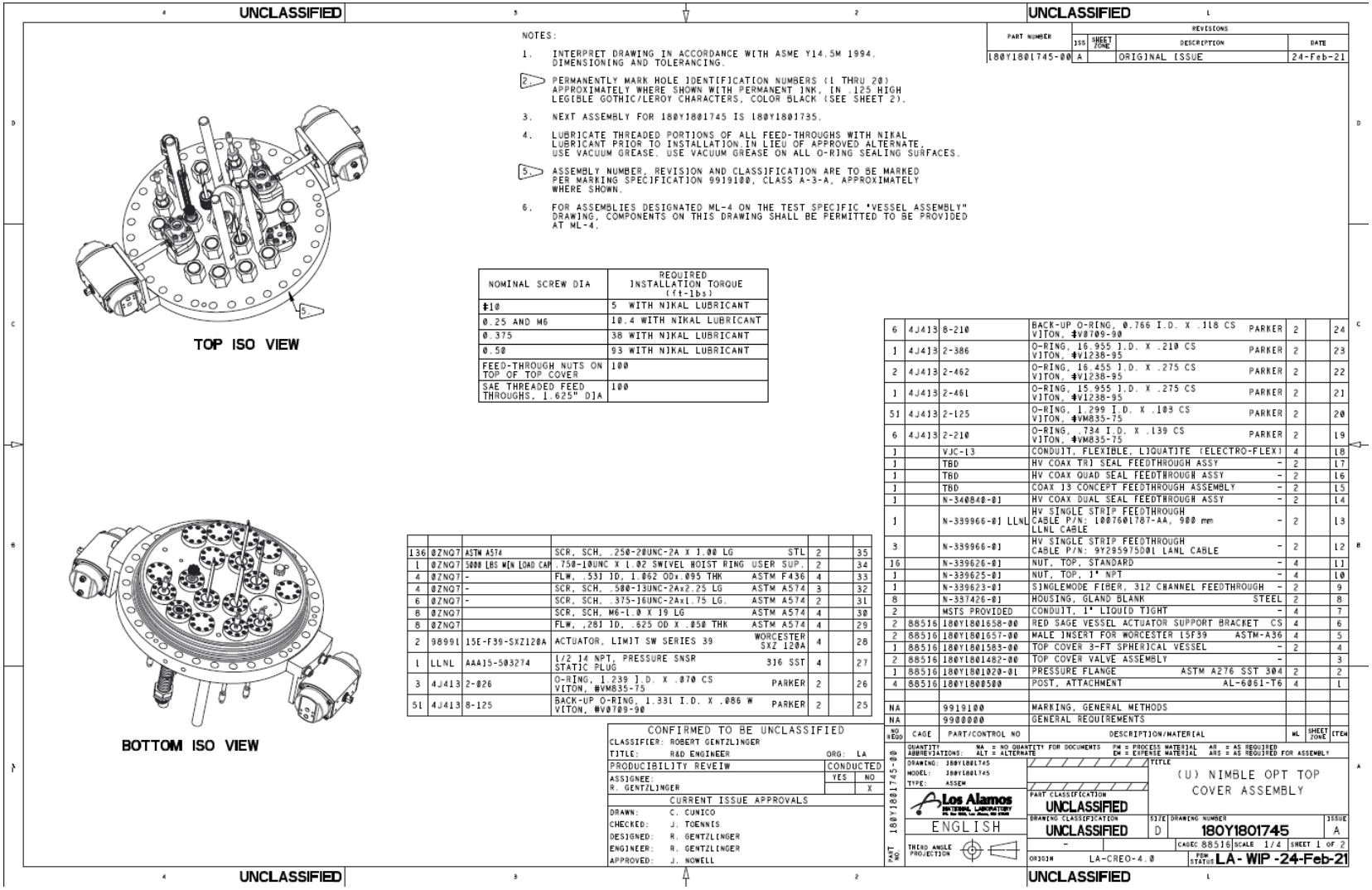


ATTACHMENT I: DRAWINGS (cont'd)

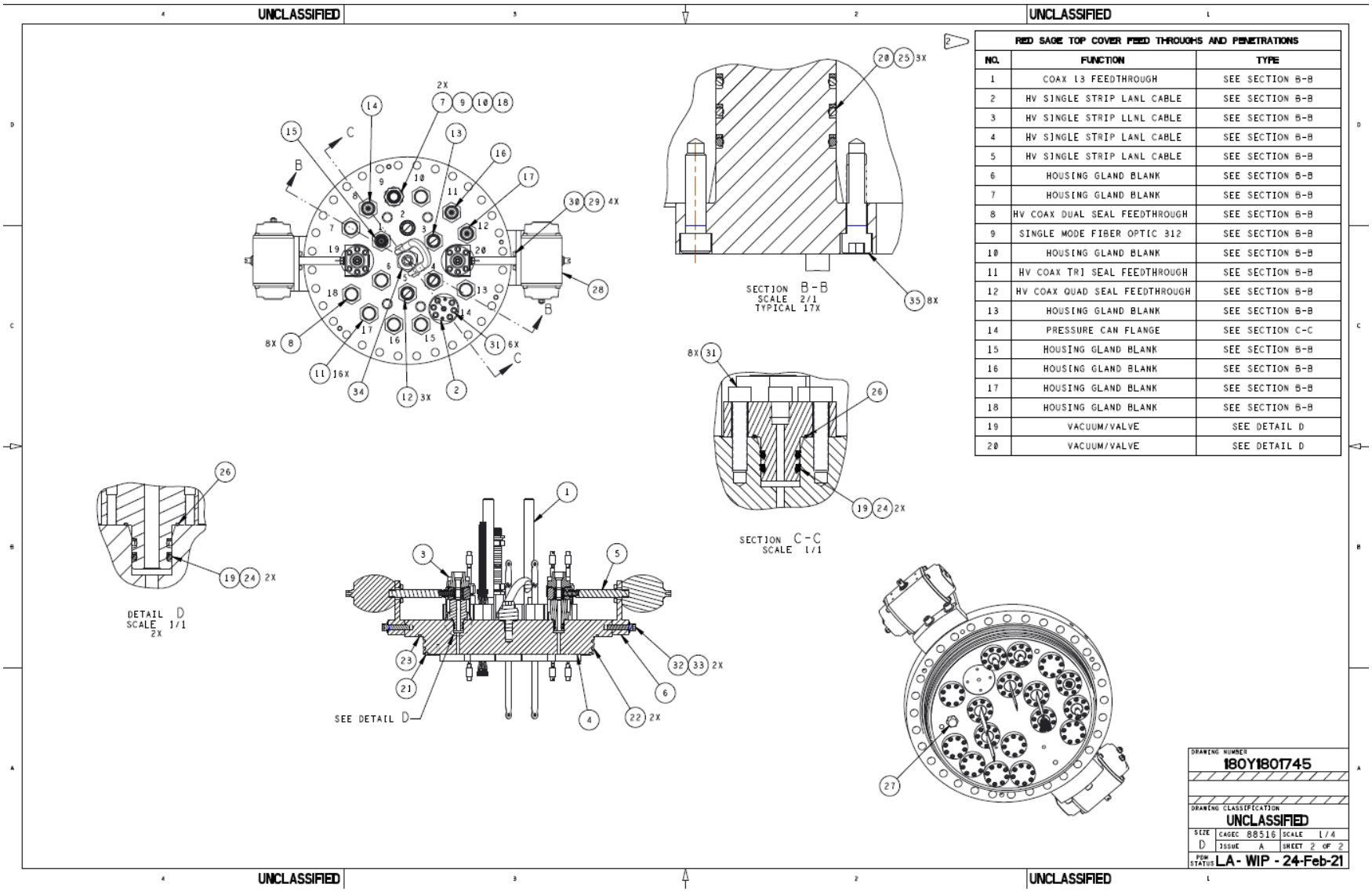


ATTACHMENT I: DRAWINGS (cont'd)

I.3 NIMBLE FEEDTHROUGH OPT TOP COVER LAYOUT



ATTACHMENT I: DRAWINGS (cont'd)

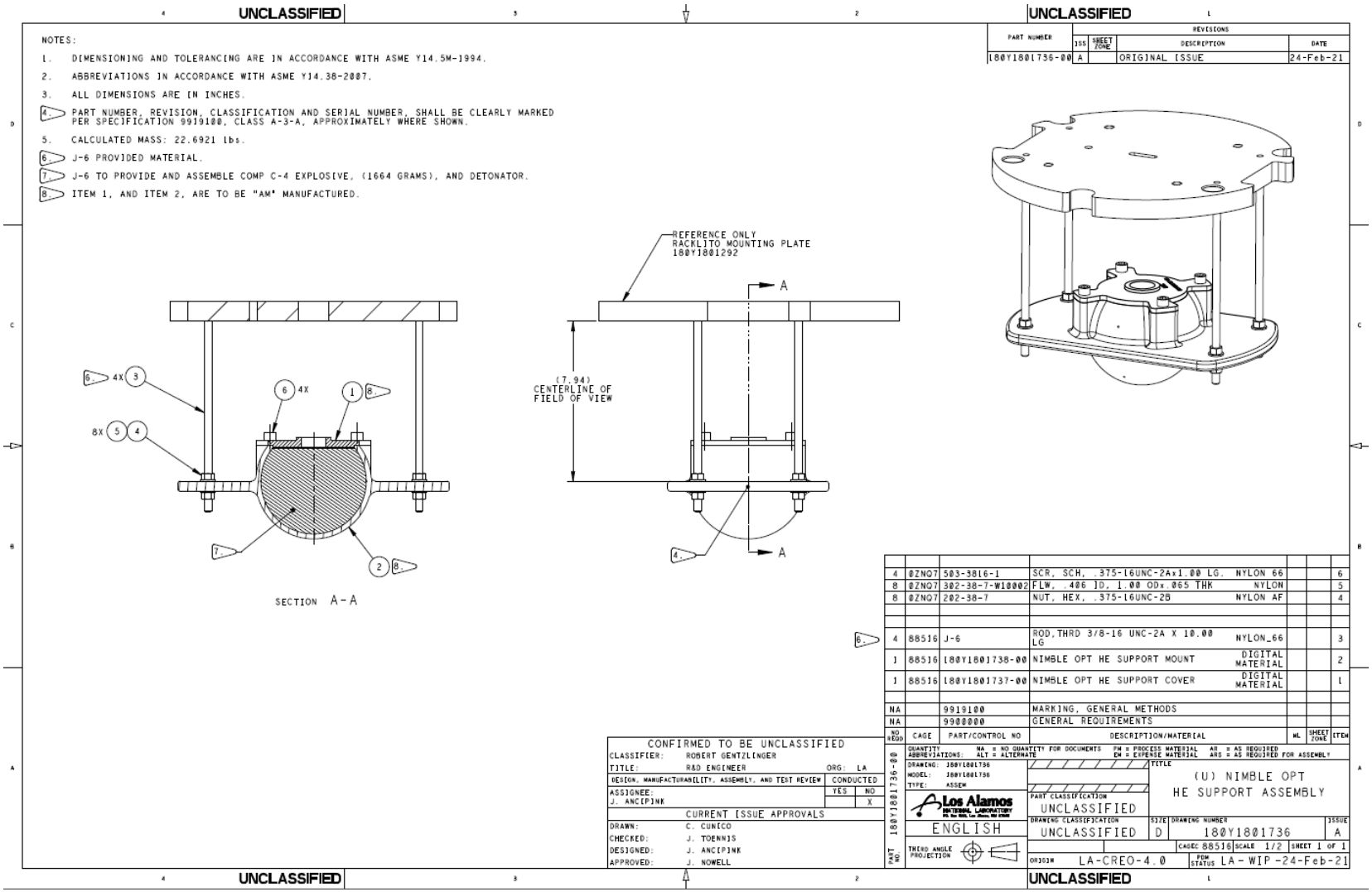


RED SAGE TOP COVER FEED THROUGHS AND PENETRATIONS

NO.	FUNCTION	TYPE
1	COAX 13 FEEDTHROUGH	SEE SECTION B-B
2	HV SINGLE STRIP LANL CABLE	SEE SECTION B-B
3	HV SINGLE STRIP LLNL CABLE	SEE SECTION B-B
4	HV SINGLE STRIP LANL CABLE	SEE SECTION B-B
5	HV SINGLE STRIP LANL CABLE	SEE SECTION B-B
6	HOUSING GLAND BLANK	SEE SECTION B-B
7	HOUSING GLAND BLANK	SEE SECTION B-B
8	HV COAX DUAL SEAL FEEDTHROUGH	SEE SECTION B-B
9	SINGLE MODE FIBER OPTIC 312	SEE SECTION B-B
10	HOUSING GLAND BLANK	SEE SECTION B-B
11	HV COAX TRI SEAL FEEDTHROUGH	SEE SECTION B-B
12	HV COAX QUAD SEAL FEEDTHROUGH	SEE SECTION B-B
13	HOUSING GLAND BLANK	SEE SECTION B-B
14	PRESSURE CAN FLANGE	SEE SECTION C-C
15	HOUSING GLAND BLANK	SEE SECTION B-B
16	HOUSING GLAND BLANK	SEE SECTION B-B
17	HOUSING GLAND BLANK	SEE SECTION B-B
18	HOUSING GLAND BLANK	SEE SECTION B-B
19	VACUUM/VALVE	SEE DETAIL D
20	VACUUM/VALVE	SEE DETAIL D

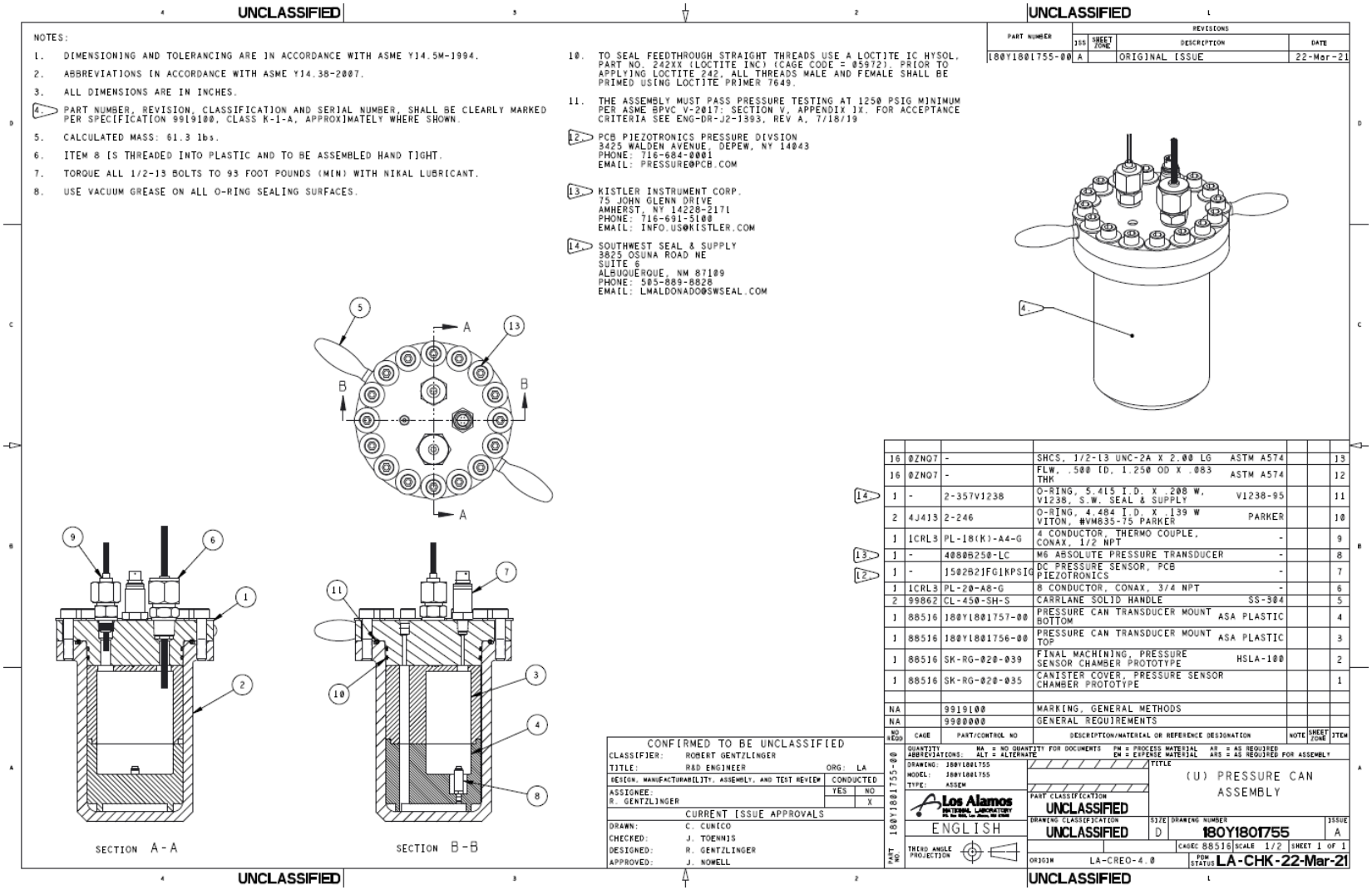
ATTACHMENT I: DRAWINGS (cont'd)

I.4 NIMBLE FEEDTHROUGH OPT HE SUPPORT ASSEMBLY



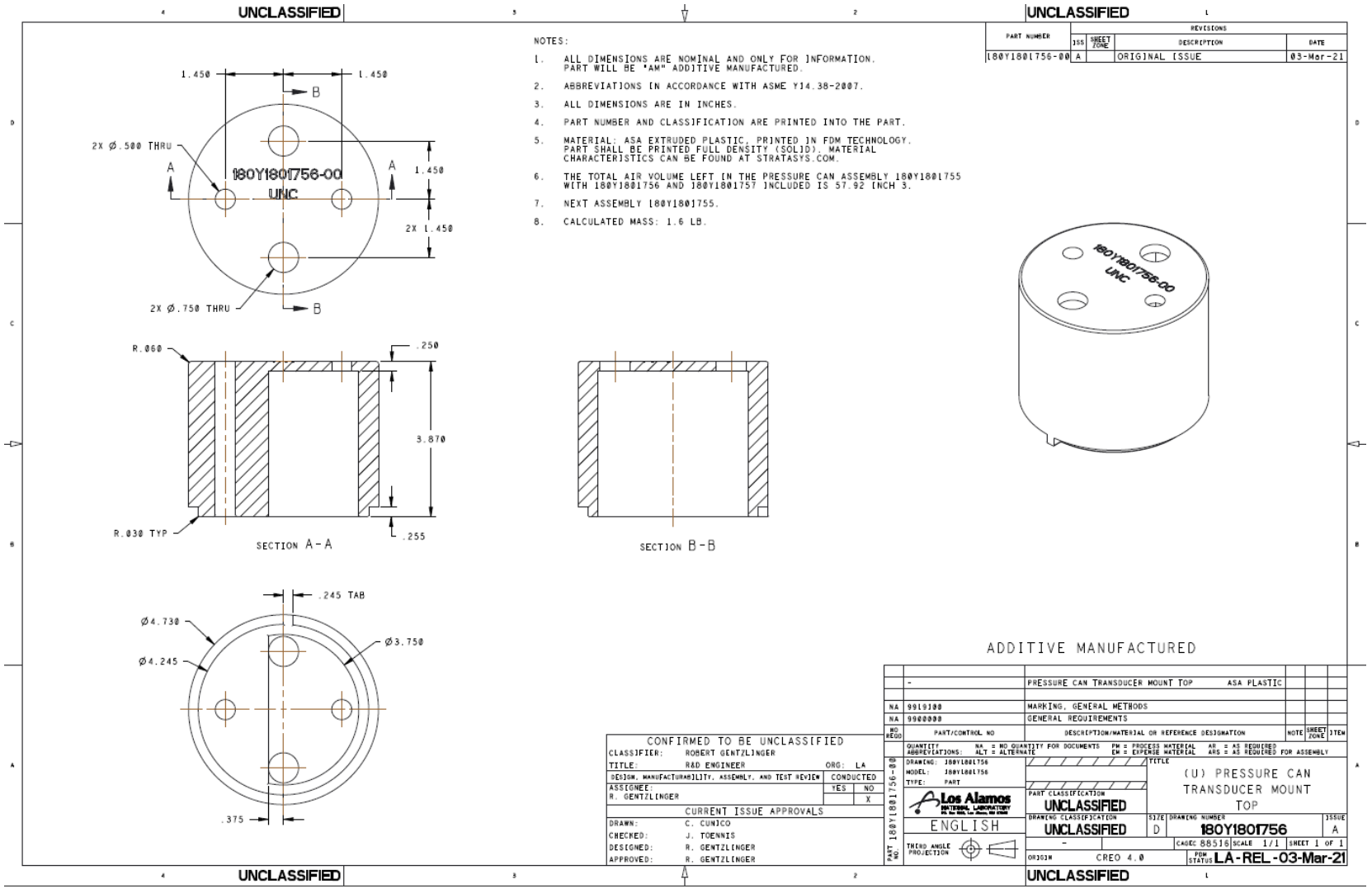
ATTACHMENT I: DRAWINGS (cont'd)

I.5 PRESSURE CAN ASSEMBLY



ATTACHMENT I: DRAWINGS (cont'd)

I.5 PRESSURE CAN TRANSDUCER MOUNT TOP



ATTACHMENT I: DRAWINGS (cont'd)

I.6 PRESSURE CAN TRANSDUCER MOUNT BOTTOM