

SECTION 15456
VACUUM SYSTEM TUBING & COMPONENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions, apply to this Section.
- B. Division 15 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.
- C. See specification 18100A for welding requirements.

1.2 SUMMARY

- A. This Section includes the vacuum tubing specification.

1.3 SUBMITTALS

- A. Six (6) copies of the following shall be submitted in accordance with General and Supplementary Conditions.
 - 1. Equipment and Performance Engineering data
 - 2. Manufacturer's Catalog Data
 - 3. Certificates of Compliance
 - 4. As built drawings of the final tubing configuration.
- B. Prior to fabrication or installation of tubing, the Contractor shall furnish legible Certificates of Compliance signed by the material supplier stating that the tube, fittings, weld rods/materials furnished are in compliance with the drawings and specifications. Separate Certificates shall be furnished for each group of like items.
 - 1. Certificates for tubing shall also show the results of chemical analysis and physical tests made on the mill run from which the tube material was obtained.
 - 2. Certificates for clamp type connectors shall verify that the design is in compliance with ANSI B31.3 and ANSI B31.1

1.4 QUALITY ASSURANCE:

- A. Provide listing/approval stamp, label, or other marking on tubing made to specified standards.

1.5 APPLICABLE CODES, AND STANDARDS

- A. American National Standards Institute:
 - 1. ANSI B16.9 - Factory made wrought steel butt-weld fittings
 - 2. ANSI B16.25 – Butt-welding ends
 - 3. ANSI B16.34 – Butt-weld end valves
 - 4. ANSI B31.1 - Power Piping Code
 - 5. ANSI/ASME B31.3 - Chem. Plant and Petroleum Refinery Piping
 - 6. ANSI B36.19 - Stainless Steel Pipe
- B. American Society for Testing Materials
 - 1. ASTM A312 - Standard specification for seamless and austenitic stainless steel pipe
 - 2. ASTM A403-Wrought Austenitic Stainless Steel Pipe Fittings

3. ASTM E94 - Recommended Practices for Radiographic Testing
 4. ASTM A269, "Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service"
- C. MIL STDS.
1. MIL-STD-1246C - Military Standard Product Cleanliness Levels and Contamination Control Program

PART 2 - PRODUCTS

2.1 TUBE & FITTINGS

- A. Provide tubing materials and products in accordance with the Equipment Schedules located in the Appendix. Contractor shall make every effort to purchase tubing and fittings from the same manufacturer to limit the amount of spare parts inventory required by system operator.

2.2 JOINING MATERIALS

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.
- B. Welding-Joint Filler Metals: See Specification 18100A.

2.3 BLOCK VALVES AND SOLENOID VALVES

- A. Characteristics and suggested models for each valve are given in the Equipment Schedules located in the Attachment C. Contractor shall make every effort to purchase block valves from the same manufacturer to limit the amount of spare parts inventory required by system operator.
- B. Block Valves for Vacuum Service
1. 304 stainless steel valve body.
 2. T321 stainless steel bellows
 3. Vacuum gaskets – High purity – oxygen free, hard copper.
 4. Pressure range Atm to 10^{-9} torr
 5. Body leak rate $< 10^{-10}$ sccs He.
 6. Main seal leak rate $< 10^{-9}$ sccs He.
 7. End connections shall be butt weld tube or bolted CF (ConFlat) flanges as specified.
 8. Suggested Manufacturers include:
 - a. Varian
 - b. Nor-Cal Products

2.4 CONDENSATE TRAPS

- A. Characteristics and suggested models for each trap are given in the Equipment Schedules located in the Attachment C. Contractor shall make every effort to purchase condensate traps from the same manufacturer to limit the amount of spare parts inventory required by system operator.
- B. Condensate Traps for Vacuum Service
1. 304 stainless steel body.
 2. End connection to be ISO Klein Flange –25
 3. Vacuum o-ring - Viton V747-75.

4. Pressure range Atm to 10^{-9} torr
5. Body leak rate $< 10^{-10}$ sccs He.
6. Main seal leak rate $< 10^{-9}$ sccs He.
7. Trap to be supplied with a condensate drain connection.
8. Suggested Manufacturers include:
 - a. Varian
 - b. Nor-Cal Products

2.5 EQUIPMENT (GFE)

- A. The following equipment will be purchased using data sheets and will be provided to the contractor for installation.

- | | | |
|----|-----------------------|---------------------------------------|
| 1. | 1060600000-DS-A006-R0 | VAC PUMPS VAC-1522A/B and VAC-1523A/B |
| 2. | 1060600000-DS-A007-R0 | VAC PUMPS VAC-2033A/B and VAC-1003 |
| 3. | 1060600000-DS-A008-R0 | VAC PUMPS VAC-2534A/B |
| 4. | 1060600000-DS-A009-R0 | EJECTOR EJ-2580 |
| 5. | 1060600000-DS-A010-R0 | HOT CELL VACUUM PUMP GLOVE BOX |
| 6. | 1060600000-DS-A012-R0 | MERCURY REMOVAL CHARCOAL SYSTEM |
| 7. | 1060600000-DS-A015-R0 | VAC PUMP VAC-9332 |

PART 3 - EXECUTION

3.1 TUBING APPLICATIONS

- A. All tubing shall be designed in accordance with ANSI B31.3.

3.2 VALVE APPLICATIONS

- A. Equipment schedules and general arrangement views indicate valve type, end connection type, and approximate location to be used.

3.3 TUBING INSTALLATION, GENERAL

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic tubing installation.

3.4 JOINT CONSTRUCTION.

- A. All joints shall be designed in accordance with ASME B31.3. Butt-welded joints shall comply with ANSI B16.9.
- B. Radiographed, welded joints on tubing will be numbered on shop drawings and field marked with stencils or stainless steel tags. Weld inspection views around the joint shall also be identified alphabetically "A-B", "B-C", "C-D", etc. returning to position A. A record of radiograph films shall be maintained and submitted for all inspected weldments.

3.5 CLEANING

- A. Attachment B provides a sample cleaning specification, contractor to provide a plan similar in content direction for construction manager approval.

- B. Clean field assembled tubing as indicated in Attachment B.

3.6 TESTING

- A. The sequence of required inspection is as follows:
 1. 100% Visual weld joint inspection
 2. 100% Radiographic Inspection, with documented reports of all inspection test results.
 3. Disassembly, cleaning, sample tests, and re-assembly
 4. Cycle Valves
 5. Blowdown/System Drying and final cleanliness sampling
 6. Leak Test in accordance with Attachment A.
- B. The procedure for radiographic inspection of weldments shall follow the recommendations of ANSI B31.1 and B31.3, and the references therein (namely ASME Boiler and Pressure Vessel Code Section V, and ASTM E94).
- C. Welds in tubing shall be x-ray or gamma-ray radiographed with technique of sufficient sensitivity to indicate the feature of the penetrant. Welds shall be examined with a minimum of 3 views (120 degrees apart if only 3 views are used), or a sufficient number to cover the entire weld. Developed film with water marks, blemishes, darkness, etc. that interferes with the interpretation of the weld will not be considered acceptable.
- D. Pneumatic Leak Test
 1. Vacuum system leak testing shall be in accordance with attachment A.
 2. Individual system test pressures shall be in accordance with the table noted below:

TABLE 1

Pump and System	Pump Down Pressure
VACP - 1003	1X10 ⁻² TORR
VACP – 1522A/B	3X10 ⁻⁸ TORR
VACP - 1523 A/B	3X10 ⁻⁸ TORR
VACP – 2033 A/B	1X10 ⁻² TORR
VACP – 2534 A/B	5X10 ⁻³ TORR
VACP - 9332	7 X 10 ⁻³ TORR

- 3.
- E. The Contractor shall reassemble all tubing systems after cleaning. Extreme care shall be taken to preserve the cleanliness of all tubing and components prior to and during re-assembly. A clean GN2 purge shall be maintained where feasible. It shall be the responsibility of the Contractor to maintain the cleanliness level for each piping system to the requirements as stated in MIL-STD-1246C Military Standard Product Cleanliness Levels and Contamination Control Program.
- F. Copper gasket in Conflat flange connections shall not be reused. Gasket shall be replaced whenever flanged connection is disturbed.
- G. All valves in tubing systems shall be cycled at ambient temperature and pressure.
- H. Blowdown/System Drying

1. The Contractor shall blow all lines clear with high pressure nitrogen. The blowdown plan, pressure connection, and configuration shall be submitted by the supplier for approval. The blowdown shall be repeated until the line is free of particulate matter and dry.
2. System tubing shall be dried to the following dew points:
 - a. GHe -65°F

END OF SECTION 15456

APPENDIX - TUBING MATERIALS SPECIFICATIONS

TUBING SPECIFICATION: VACUUM SERVICE, STAINLESS STEEL

Pressure Temperature Service Cleanliness	0 to 760 torr -400 to 100 F Vacuum 300 per MIL-STD-1246B
Tube	1/2" thru 3", .065" wall, ASTM A312 TP 304L seamless stainless steel, B36.19, buttweld edge. 6" 0.109" wall, ASTM A312 TP 304L seamless stainless steel, B36.19, Buttweld edge.
Welded Fittings	1/2" thru 3", ASTM A304 .065" wall 304L Butt Weld compliant with ANSI B16.9 6", ASTM A304 0.109" wall, 304L Butt Weld compliant with ANSI B16.9
Flanged Fittings	CF(ConFlat) Flange, 304 Stainless Steel with high purity, oxygen free, copper Gaskets, except as noted for Condensate traps.
Bends	6 Tube diameters or greater per ANSI B31.1 Maintain minimum wall after bending
Welded Elbows	1/2" thru 3", ASTM A304 0.065" wall 304L Butt Weld compliant with ANSI B16.9, Elbows to be 1-1/2 tube diameters. 6", ASTM A304 0.109" wall 304L Butt Weld compliant with ANSI B16.9, Elbows to be 1-1/2 tube diameters.
End Preparation	Bevel ends per ANSI B31.3
Joint Inspection	All joints shall be 100% visually inspected. Ten percent radiographic inspection required per ANSI B31.3 and per UW-51 and UW-52 of ASME Code, Section VIII, Div. 1

ATTACHMENT A
PRESSURE AND LEAK TESTING

SPALLATION NEUTRON SOURCE

Vacuum System Pressure and Leak Test

1.0 PURPOSE

This procedure provides instructions for the validation of the vacuum piping system. The integrity of the installed vacuum systems shall be determined by pulling a vacuum until the desired vacuum level is achieved at the pump suction (see table 1 sec 3.6). When no further improvement in the vacuum level is evident, the pump shall be valved-off from the system and the rate of change in the pressure shall be recorded. The pressure shall be recorded until the cause for the rise is determined (i.e., out gassing or real leaks or a combination of both). The rise in the pressure shall be no greater than that which would result from a system in leakage rate of $1 \times 10E-6$ torr-liters/sec. If the in leakage rate exceeds this value, the Contractor shall be responsible for identifying the location of and repairing the leak(s) to ensure the Specified system in leakage rate is not exceeded. Shop testing individual piping spools using a sensitive leak detection method to simplify field leak testing of the installed system will be left up to the discretion of the Contractor. The Contractor shall submit a Leak Testing Procedure for approval by the Construction Manager and the SNS Target Systems Construction Engineer.

This validation includes verification of the following:

- A. Component Installation and Size
- B. Conflat and Klien Flanges
- C. Configuration and component orientation
- D. Pressure Test Conformance

2.0 EQUIPMENT / RESOURCE REQUIREMENTS

<u>QTY</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>REMARKS</u>
None			

3.0 REFERENCE DRAWINGS / DOCUMENTS

- P&ID of associated Vacuum system under test

4.0 CONFIGURATION REQUIREMENTS

None

5.0 GENERAL NOTES / SAFETY PRECAUTIONS

1. All fittings, pipe, components, and seals to be checked for proper installation.
2. Verify all instruments have valid calibration due dates.
3. Do not perform leak repairs when system is under a vacuum. Isolate discrepant component from vacuum source and vent line prior to making repair.
4. Torque of Conflat and Klien fittings, to be per manufacturer's recommendations:

Procedure	Verification Required	Comments
<p>6.0 TEST PROCEDURE</p> <p>6.1. Identifier and Part Number Verification</p> <p>6.1.1. Verify components (in section to be tested) listed in attachment C are installed and correctly labeled with identifier number and part number. Verify pressure gages and transducers have a valid calibration which will remain in effect for six months minimum. Record due date next to gage/transducer identifier in chart below.</p>		

Procedure	Verification Required	Comments
<p>6.2. Vacuum System Configuration Verification</p> <p>NOTE Flow direction is from inlet to outlet. Flow direction should be verified on installed component when inlet and outlet is used to describe plumbing.</p> <p>6.2.1. Verify section 6.1 completed.</p>		
<p>6.2.2. Identify the pipe/tube runs to be tested</p>		

Procedure	Verification Required	Comments
<p>6.3. Vacuum System Relief Valve Test</p> <p>6.3.1. Not Applicable</p>		

Procedure	Verification Required	Comments

Procedure	Verification Required	Comments
<p>6.4. Vacuum System Pressure and Leak Test</p> <p>6.4.1. Confirm all portions of section 6.1, 6.2 and 6.3 have been performed.</p> <p>6.4.2. Isolate connection at technical component and any other open system connections and begin pumping down the system to the ultimate pressure prescribed in the table in specification 15456 for the system under test.</p> <p>6.4.3. Isolate pump inlet using pump inlet hand valve and terminate power to the pump when ultimate pressure is achieved. Monitor system pressure for a decay rate exceeding the limits provided in section 1.0 of this procedure.</p> <p>6.4.4. If system decay rate exceeds that prescribed in section 1.0, a second test may be performed.</p> <p>6.4.5. If a second test fails, the system must be tested using a helium sensing device and a means of introducing helium to each system connection to determine the leak location.</p> <p>6.4.6. Following the location and repair of the leaking connection, the system must be re-tested using the decay procedure.</p> <p>6.4.7. When the system passes the decay procedure test, it is deemed acceptable.</p> <p>6.4.8. System test complete</p>		

ATTACHMENT B
CLEANING REQUIREMENTS

Cleaning, Inspection and Testing
of Stainless Steel Tubing & Piping
Installed at Spallation Neutron Source
Oak Ridge, TN

FIELD CLEANING PROCESS GUIDELINES

APPROVAL PAGE

FIELD REVISIONS

Revision	Reason for Revision	Date
NC	NEW	TBD

1.0 GENERAL

This procedure describes the precision cleaning process and contamination control measures for tubing/piping surface interiors to fulfill the specification requirements for field cleaning the installed tubing and piping systems.

2.0 SCOPE OF WORK

The field process involves removal and reinstallation of associated components (by others), and precision cleaning the interior significant surface of various sized stainless steel tubing and piping. The interior surface of tubing and piping systems will be chemically cleaned in accordance with this procedure to meet specification requirements, dried with filtered gaseous nitrogen to a specified dew point (-65°F), sealed and blanketed with the specified gas to a positive pressure of 3 – 5 psig, where possible.

3.0 ASSOCIATED DOCUMENTS

The documents listed below form a part of this procedure to the extent indicated by reference to them or to specifications associated with them.

3.1 SNS DRAWINGS (Latest Revisions are Applicable)

- Ring Injection Dump Building Drawings to be provided here

3.2 Government and/or Customer Specifications

- MIL-STD-1246C, “Product Cleanness Levels and Contamination Control Program”.
- ARP 598B, The Determination of Particulate Contamination in Liquids by the Particle Count Method.

4.0 APPLICABLE MATERIALS

MIL-P-27401, GR B, Typ 1	Nitrogen
MIL-B-81705, TY II	Polyethylene Sheet or Bag
PPP-T-66E, TYP I CL B, SIMPLE GREEN	Tape, Pressure Sensitive Vinyl
Deionized Water	

5.0 CONTROL LIMITS

5.1 The control limits of solutions used herein shall be as referenced in Section 16, Cleaning and Test Parameters. These solution control limits are based on manufacturers recommendations, specification guidance, and the combined experience and expertise of cleaning personnel

knowledgeable in the specialized area of cleaning, flushing and processing tubing and piping systems.

- 5.2 Control limits of processing fluids used herein shall be as referenced in Section 16, Cleaning and Test Parameters. These processing fluid control limits are based on manufacturers recommendations, specification guidance, and the combined experience and expertise of cleaning personnel knowledgeable in the specialized area of cleaning, flushing and processing tubing and piping systems.
- 5.3 Environmentally controlled areas in the field including; mobile cleanrooms, work stations, and mobile labs shall be certified to standard controls and meet FED-STD-209 to the extent necessary for contract compliance. Controlled work areas generally follow the disciplines of Class 100,000 clean; however, some environmental parameters, if approved, may be less stringent.
- 5.3.1 Cleanroom operations include: precision cleaning of cleaning contractor valves, instruments, gauges, hoses, fittings, flanges, seals, gaskets, etc. The verification of cleanliness samples taken from piping, NVR and particle counts, etc., and precision packaging to specified levels of cleanliness.

6.0 INSPECTION PROCEDURES AND SAMPLING METHODS

- 6.1 Inspection procedures shall be in accordance with CPP 3003, Section 3.0. Sampling methods will be per common liquid sampling methods and Arp598B.

7.0 CONTROL OF TUBES/PIPES AND TUBING/PIPING ASSEMBLIES

- 7.1 Control of tubes/pipes and tubing/piping assemblies refers to completed tubes/pipes and tube/pipe assemblies and all installed fittings and components being chemically processed during the cleaning and inspection of a tubing/piping system. Any damage or distortion to significant surfaces, including interior surface and flanged tube/pipe ends or other tube/pipe fittings shall be recorded in the remarks section of this procedure and brought to the attention of cleaning contractor Quality Control Field Representative and the cognizant SNS representative.

8.0 FIELD CLEANING REQUIREMENTS

- 8.1 This procedure shall not be used for installed systems, components, or assemblies where complete removal of cleaning, flushing, and rinsing fluids cannot be assured, and/or degradation of components may occur. Such systems shall be disassembled by others prior to cleaning to the extent that entrapment areas are eliminated, and sensitive components are removed.
- 8.2 Systems or subsystems subjected to component removal or any other disassembly to facilitate field cleaning shall have their integrity restored during reassembly/ reinstallation according to the

established requirements for proof pressure, leak test, electrical bonding and grounding, and fabrication/installation.

- 8.3 No fluid shall be used or introduced in the system during or after acceptance testing except those specified herein, without prior written customer approval.

9.0 FIELD ENVIRONMENTAL CONTROLS

- 9.1 This section establishes the minimum field contamination control requirements for installed tubing/piping. The cleanliness of such systems shall not be compromised by improper contamination control techniques during any operation in which the system is opened to an uncontrolled environment. Localized clean operations or entrance to clean systems may be conducted in several ways, any of which are acceptable provided the following requirements are met:

- a. Area Cleanup: The area in which the reinstallation is to be preformed shall undergo stringent housecleaning. Prior to this cleaning, all loose or extraneous equipment shall be removed from the area.
- b. Controlled Environment Enclosure: A temporary “enclosure” (cleaned to the same level as the component or system) shall be placed around the open portion of the clean system to preclude contaminating the open system (or installation part) by exposure to the uncontrolled environment.
- c. System Purge: A purge with inert gas shall be established in the system prior to opening or removing clean seals. A purge shall be provided from both directions when installing components between cleaned portions of the system. The purge shall prevent foreign materials from entering the system. Vents open to the atmosphere do not require a purge. The purge gas shall be filtered to exceed system cleanliness level requirements. The gas flow rate shall be such that a positive pressure from the system to the environment shall prevail. The purge shall continue until installation is complete and the system is closed.

NOTE: When a gas purge is not used, the open system lines shall be protected by approved seals per the specification requirements of MIL-STD-1246C.

- d. Enclosure Operations: No operations shall be conducted in a clean enclosure unless the system purge and filtered air inputs are “on”. “Operations” include the presence of properly clothed personnel, unsealing of clean-packaged components, opening or closing the system, installing or removing components from clean systems, etc. Personnel in walk-in style clean enclosures during installation operations involving clean systems shall wear cleanroom attire.

Special attention shall be given to all surfaces contacted by hand. Clean gloves, clothing, and tools are mandatory. Vacuum cleaning and wiping of all hardware and the processing area is essential for assembly and disassembly of clean components or systems.

10.0 FIELD CLEANING EQUIPMENT

- 10.1 All measuring and test equipment used for acceptance purposes shall be checked prior to use for evidence of proper calibration, including a current calibration label with the date calibrated, the date the item is due for calibration, and evidence of acceptance by the person performing the calibration. Measuring and test equipment which do not have evidence of current calibration shall not be used.
- 10.2 Measuring and test equipment shall be selected so the upper range limit of the item characteristic being checked falls within the upper two-thirds of the test equipment which is being used to take the reading and accurate within 1% of full scale.
- 10.3 Equipment selected for the cleaning process shall be visibly clean so as not to introduce undue contamination into the system being cleaned. Equipment selected for testing of previously cleaned systems shall be of equal or greater cleanliness than the system being tested.
- 10.4 Equipment selection shall be based on system compatibility, adequate flow rates, sufficient pressure outputs, reservoir capacities, etc. No equipment shall be used which appears to be unsafe or which is not rated for the service and pressures of the process.
- 10.5 Equipment connecting directly to system piping or components shall be in good condition and undamaged at all sealing areas. Flanges and fittings shall be correct and not damaged or corroded so as to cause damage or introduce corrosion into system piping or components. Only wrenches of the proper type and size shall be used on piping flanges.

11.1 HAZARDOUS WASTE MANAGEMENT

- 11.1 Industrial and/or hazardous waste generated during cleaning operations shall be handled in accordance with the provisions of the SNS Hazardous Waste Management Guidelines.

12.0 FIELD OPERATIONS SAFETY

- 12.1 All personnel working at or performing operations during the field cleaning and testing process shall observe all safety rules as described in the cleaning contractor's Safety Program.
- 12.2 Field supervisors shall ensure that all personnel working directly on any field cleaning or testing operations are provided the necessary personal protective equipment necessary for the type of work being performed and that each person is familiar with its use and/or operation.

- 12.3 Field supervisors shall ensure that prior to the start of each job a “stand-up” safety meeting is conducted with all personnel involved with the operation. Field supervisors shall discuss safety standards particular to the job and ensure that each person knows and understands the safety requirements of the job at hand, has the proper personal protection equipment needed to safely accomplish all operations, and verify that personnel performing the cleaning and/or tests are familiar with the methods and requirements of the job.
- 12.4 The Field Supervisor of the job shall advise personnel working in the area that cleaning and/or testing is in process via paging system, signs, safety flagging or tape, or other suitable means as approved by SNS Safety.
- 12.5 Field Supervisors are responsible for ensuring that all test set-ups are correct and that proper pressures will be used for the system to be tested. Flagging must be present at initiation and termination valves, and at any vents or openings which might discharge cleaning solutions or contaminated waste around personnel working in the area.
- 12.6 Field Supervisors are responsible for performing a walk around of the cleaning and/or test site prior to the beginning of any operation to ensure that all equipment being used and the piping system is correctly set up and safety procedures have been followed.

13.0 NOTIFICATION OF SNS PERSONNEL

- 13.1 Notification will be made to SNS Inspection, Safety or Environmental personnel (as may be required) to the start of system flushing operations.

14.0 FIRE PREVENTION AND FIRE EXTINGUISHERS

- 14.1 Based on the fire potential of the job, Field Supervisors shall ensure that sufficient fire protection and extinguishing equipment are properly located at the site.

16.0 CLEANING AND TEST PARAMETERS (Example to be proposed by Contractor)

PRECLEAN FLUSH

Cleanliness Requirements: DEGREASE pH requirements: H2O base only 6 – 8

Cleaning Media: SIMPLE GREEN Media Temperature: 120 – 180°F

Solution Strength: 15 – 25% / VOL Estimated Waste: _____

Duration: 2 – 4 HOURS Method: FLUSH

Rinse Media: DEIONIZED WATER* Drying Media: VISUAL DRY

*NOTE: Those systems not requiring an analysis for nonvolatile residue (NVR) may be sampled for cleanliness after the final deionized water rinse of the above operation. If the results are satisfactory there is no need to flush. Drying of the lines shall be performed to the requirements stated below.

Cleanliness Requirement: MIL-STD-1246C Drying requirement: -65.0°F

Flushing Media: TBD Media Temperature: AMBIENT

Solution Strength: 100% Estimated Waste: _____

Duration: 30 MINUTES (MINIMUM) Method: FLUSH

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Specific system cleanliness level shall be as specified per contract requirements.

Rinse Media: No Rinse Required Drying Media: GN2 or dry compressed air dew point –40F

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CLEANLINESS LEVELS SPECIFIED FOR SNS SYSTEMS:

MIL-STD-1246C

Vacuum LEVEL 300

(System walkdown to be completed prior to performing work)

Cleaning Contractor System Walkdown Signoff:

(Name)

(Date)

Adequate Support: Yes No Boundary Verification: Yes No

COMMENTS:

17.0 OPERATIONAL WORK INSTRUCTIONS (Example only)

OPER.	DESCRIPTION OF WORK	NTS	CUST	DATE
17.1	Verify proper calibration of all gauges and test equipment to be used during cleaning and test.			
17.2	<p>Safety Meeting: Conduct Safety meeting with all personnel involved with job. Discuss safety standards particular to the job and ensure that personal protection equipment is issued and in use.</p> <p>Ensure that adequate fire protection is available as needed.</p>			
17.3	Verify with SNS personnel that all systems are complete and ready for cleaning.			
17.4	<p>Locate and identify tubing/piping to be cleaned.</p> <p>Disassemble tubing/piping as required from main system and isolate for cleaning and test as required.</p> <p>Loop tubing/piping in series with appropriate spools, flex hoses or whips, use new/clean gaskets, o-rings or seals, clean test fittings and flushing hose connections to cleaning/test equipment.</p> <p>Verify that all connections are properly made with proper gaskets and torqued correctly.</p>			
17.5	<p style="text-align: center;">PRECLEAN FLUSH</p> <p>Ensure the media holding tank is of sufficient volume for system to be cleaned.</p> <p>Mix MIRACHEM 750 at 15 to 25% by volume, balance D.I. water.</p> <p>Heat flushing media to specified temperature for preclean. Maintain temperature throughout flushing cycle.</p> <p>Fill system and vent excess air. Circulate for required</p>			

OPER.	DESCRIPTION OF WORK	NTS	CUST	DATE
	<p>duration.</p> <p>Start Time: _____ Ending Time: _____</p>			
17.6	<p>Carefully blow back flushing media to mixing tank with GN2 using back flow connection points specified per cleaning contractor.</p> <p style="text-align: center;">CAUTION</p> <p>Do not exceed 50 psig during blow back. Always use the lowest pressure possible during this operation.</p>			
17.7	<p style="text-align: center;">RINSE/FLUSH</p> <p>Fill system with filtered (10 μ) D.I. water and flush until proper pH (6 – 8) is obtained using litmus paper. Check for residual soap by filling sample jar with rinse water and shaking to check for foaming.</p> <p style="text-align: center;">pH _____</p>			
17.8	<p>If the system being cleaned does not require an analysis for NVR perform operation 17.11 followed by drying to required dewpoint. If particulate analysis is satisfactory proceed from operation 17.11.</p>			
17.9	<p>Crack all flanges and fittings, open low point drains and remove as much excess flushing media as possible. Reconnect all flanges and fittings, close low point drains.</p> <p>Purge system with filtered, dry GN2 to visual dry.</p>			
17.10	<p style="text-align: center;">FINAL CLEAN & FLUSH</p> <p>Fill system with final flushing media and vent excess air from lines. Ensure that vented media is caught in waste</p>			

OPER.	DESCRIPTION OF WORK	NTS	CUST	DATE
	<p>container for disposal.</p> <p>Circulate flushing media at specified GPM through 10 μ (minimum) filter for a minimum of 30 minutes.</p> <p>Start Time: _____ Ending Time: _____</p>			
17.11	<p style="text-align: center;">SYSTEM SAMPLING</p> <p>Obtain a bagged and precision cleaned container of sufficient volume for the collection of media sample.</p> <p>Exercise caution when extracting sample and ensure that no outside contamination is introduced during this operation.</p> <p>Extract 500 ml of final flushing media from pipe system and send to lab for analysis in accordance with the cleanliness requirements stated in Section 16 of this procedure for Final Clean & Flush of the tubing/piping listed in Section 15.</p> <p>Certification results of lab test: Pass Fail*</p> <p>Certification Report #: _____</p> <p> </p> <p>*If the lab results indicate that the system does not yet meet the requirements for cleanliness as specified, reflush for an additional 20 minutes and resample as required until an acceptable level is obtained.</p> <p>Record results of reflushing and resampling if the system did not pass with the first sample drawn.</p> <p>Certification results of lab test: Pass Fail*</p>			

OPER.	DESCRIPTION OF WORK	NTS	CUST	DATE
	Certification Report #: _____			
17.12	<p>Carefully blow back final flushing media to mixing tank using filtered GN2.</p> <p style="text-align: center;">CAUTION</p> <p>Do not exceed 50 psig during blow back. Always use the lowest pressure possible during this operation.</p> <p style="text-align: center;">CAUTION: CLEAN SYSTEM</p> <p style="text-align: center;">System is now considered precision clean do not open system to uncontrolled environment when draining system of flushing media. Do not introduce contamination during this operation.</p> <p>Crack all flanges and fittings, open low point drains and remove as much excess flushing media as possible. Tighten all flanges and fittings, close low point drains.</p> <p>Purge system with filtered (10 μ), dry GN2 to specified dew point. Check with dew point meter following mfr instructions.</p> <p>Check dew point at system end point or low point. Continue until specified dew point is reached.</p> <p>Specified Dew Point: Accept Reject</p>			
17.13	<p style="text-align: center;">CAUTION: CLEAN SYSTEM</p> <p>Maintain field environmental control, protect system openings in accordance with the requirements of this procedure. Minimize the actual time the system is open.</p> <p>Disconnect all flushing hoses, fittings and test connections using proper environmental controls. Maintain clean per specification requirements by immediately</p>			

OPER.	DESCRIPTION OF WORK	NTS	CUST	DATE
	<p>capping or bagging ends to maintain cleanliness level.</p> <p>NOTE: Poly bags, end caps and fittings used to cover tube or pipe ends shall be at least as clean as the system cleanliness requirement.</p>			
17.14	<p style="text-align: center;">SYSTEM BLANKET</p> <p>Upon completion of tubing/piping cleaning, and component reinstallation when required, establish a GN2 blanket pressure of 3-5 psig. Vents or drains open to the atmosphere do not require a blanket.</p>			
17.15	<p>Collect all industrial or hazardous waste created during this job and label all containers in accordance with SNS HAZARDOUS MAT'L GUIDELINES.</p>			
17.16	<p>Clean up and secure job area. Stow all cleaning and test equipment after ensuring that equipment is clean.</p>			
17.17	<p>Coordinate with SNS all documentation and clean certifications for acceptance of system.</p> <p>The tubing/piping listed has been cleaned in accordance with this procedure to meet the requirements of:</p> <p>MIL-STD-1246C Level_____</p> <p>System Commodity:_____</p> <p>Description of system tubing or piping cleaned and processed:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>			

OPER.	DESCRIPTION OF WORK	NTS	CUST	DATE
	<hr/> <hr/> <hr/> <hr/> <p data-bbox="337 604 1052 716">Signature below signifies acceptance of the completed tubing and/or piping systems specified in this document.</p> <hr/> <p data-bbox="358 884 672 915">SNS Field Representative</p> <p data-bbox="883 926 943 957">Date</p> <p data-bbox="337 1003 1052 1157">Signature below certifies that the tubing and/or piping systems specified in this document have been cleaned and processed in accordance with the requirements of the contract.</p> <hr/> <p data-bbox="358 1398 607 1430">Cleaning Contractor</p> <p data-bbox="899 1440 959 1472">Date</p>			

NOTE: *The double polyethylene 6-mil bags/film used for primary and secondary sealing on cleaned systems is not intended as a permanent seal. Extremes in temperature cause the polyethylene to deteriorate over time and the tape adhesive to fail and come loose. Condensation between the bags is common and does not signify loss of cleanliness in the system. It is advisable that permanent connections be made or hard caps, plugs, flanges, etc., are installed as soon as possible.*

ATTACHMENT C
EQUIPMENT LISTING

Component Number	DRAWING #	DESCRIPTION	SIZE
VACP-1522A		VACUUM PUMP see Data Sheet 106060000-A006	
VACP-1522B		VACUUM PUMP see Data Sheet 106060000-A006	
VACP-1523A		VACUUM PUMP see Data Sheet 106060000-A006	
VACP-1523B		VACUUM PUMP see Data Sheet 106060000-A006	
SV-1530	A022-1	DELETED	1-1/2"
SV-1531	A022-1	DELETED	1-1/2"
CKV-1571	A022-1	CHECK VALVE, 1", Pneumatically Actuated in line Seal valve, SS with Viton Seal, with welded 1" tube ends, 24VDC solenoid, 60-80 PSIG air required, Nor-Cal Products Model # AIVP-100-S41	1"
CKV-1573A	A022-1	CHECK VALVE, 1-1/2", Pneumatically Actuated angle Seal valve, SS with Viton Seal, with welded 1-1/2" tube ends, 24VDC solenoid, 60-80 PSIG air required, Nor-Cal Products Model # ESVP-150-S41	1-1/2"
CKV-1573B	A022-1	CHECK VALVE, 1-1/2", Pneumatically Actuated angle Seal valve, SS with Viton Seal, with welded 1-1/2" tube ends, 24VDC solenoid, 60-80 PSIG air required, Nor-Cal Products Model # ESVP-150-S41	1-1/2"
HV-1574	A022-1	MANUAL BLOCK VALVE, 1-1/2" Angle in line valve SS, with 2.75 bolted Conflat flange connections both ends, Nor-Cal Products mdl# AIV-1502-CF	1-1/2"
HV-1575	A022-1	MANUAL BLOCK VALVE, 1/2", Angle, SS, welded Tube ends, Nor-Cal Products mdl# ESV-050	1/2"
HV-1576	A022-1	MANUAL BLOCK VALVE, 1-1/2" Angle in line valve SS, with 2.75 bolted Conflat flange connections both ends, Nor-Cal Products mdl# AIV-1502-CF	1-1/2"
HV-1577	A022-1	MANUAL BLOCK VALVE, 1/2", Angle, SS, welded Tube ends, Nor-Cal Products mdl# ESV-050	1/2"
CKV-1584	A022-1	CHECK VALVE, 3/4", Straight Through plug valve, SS with Viton Seal, with welded 3/4" tube ends, 24VDC solenoid, 60-80 PSIG air required, Nor-Cal Products Model # STVP-075-S41	3/4"
CKV-1586A	A022-1	CHECK VALVE, 1-1/2", Pneumatically Actuated angle Seal valve, SS with Viton Seal, with welded 1-1/2" tube ends, 24VDC solenoid, 60-80 PSIG air required, Nor-Cal Products Model # ESVP-150-S41	1-1/2"
CKV-1586B	A022-1	CHECK VALVE, 1-1/2", Pneumatically Actuated angle Seal valve, SS with Viton Seal, with welded 1-1/2" tube ends, 24VDC solenoid, 60-80 PSIG air required, Nor-Cal Products Model # ESVP-150-S41	1-1/2"
HV-1587	A022-1	MANUAL BLOCK VALVE, 1-1/2" Angle in line valve SS, with 2.75 bolted Conflat flange connections both ends, Nor-Cal Products mdl# AIV-1502-CF	1-1/2"

HV-1588	A022-1	MANUAL BLOCK VALVE, 1/2", Angle, SS, welded Tube ends, Nor-Cal Products mdl# ESV-050	1/2"
HV-1589	A022-1	MANUAL BLOCK VALVE, 1-1/2" Angle in line valve SS, with 2.75 bolted Conflat flange connections both ends, Nor-Cal Products mdl# AIV-1502-CF	1-1/2"
HV-1590	A022-1	MANUAL BLOCK VALVE, 1/2", Angle, SS, welded Tube ends, Nor-Cal Products mdl# ESV-050	1/2"
HV-1604	A022-1	MANUAL BLOCK VALVE, 2", Angle in line valve, SS, 3.38 bolted conflat Flange connections both ends, Nor-Cal Products mdl# AIV-2002-CF.	2"
HV-1606	A022-1	MANUAL BLOCK VALVE, 1/2", inline, SS, welded Tube ends, Nor-Cal Products mdl# ILV-050	1/2"
SV-1781	A022-1	SOLENOID VALVE, 1/2" Inline, with 24 VDC solenoid, air operated, SS, Welded Tube ends, Nor-Cal Products mdl# AIVP-050-S21	1/2"
SV-1782	A022-1	SOLENOID VALVE, 1" Inline, with 24 VDC solenoid, air operated, SS, Welded Tube ends, Nor-Cal Products mdl# AIVP100-S21	1"
SV-1783	A022-1	SOLENOID VALVE, 1/2" Inline, with 24 VDC solenoid, air operated, SS, Welded Tube ends, Nor-Cal Products mdl# ILVP-050-S21	1/2"
SV-1784	A022-1	SOLENOID VALVE, 1/2" Inline, with 24 VDC solenoid, air operated, SS, Welded Tube ends, Nor-Cal Products mdl# ILVP-050-S21	1/2"
SV-1785	A022-1	SOLENOID VALVE, 1/2" Inline, with 24 VDC solenoid, air operated, SS, Welded Tube ends, Nor-Cal Products mdl# ILVP-050-S21	1/2"
SV-1786	A022-1	SOLENOID VALVE, 1/2" Inline, with 24 VDC solenoid, air operated, SS, Welded Tube ends, Nor-Cal Products mdl# ILVP-050-S21	1/2"
SV-1789	A022-1	SOLENOID VALVE, 1/2" Inline, with 24 VDC solenoid, air operated, SS, Welded Tube ends, Nor-Cal Products mdl# ILVP-050-S21	1/2"
SV-1790	A022-1	SOLENOID VALVE, 1/2" Inline, with 24 VDC solenoid, air operated, SS, Welded Tube ends, Nor-Cal Products mdl# ILVP-050-S21	1/2"
VACP-2033A	A023-1	VACUUM PUMP see Data Sheet 106060000-A007	
VACP-2033B	A023-1	VACUUM PUMP see Data Sheet 106060000-A007	
CKV-2232A	A023-1	CHECK VALVE, 1", Pneumatically Actuated angle Seal valve, SS with Viton Seal, with welded 1" tube ends, 24VDC solenoid, 60-80 PSIG air required, Nor-Cal Products Model # ESVP-100-S41	1"
CKV-2232B	A023-1	CHECK VALVE, 1", Pneumatically Actuated angle Seal valve, SS with Viton Seal, with welded 1" tube ends, 24VDC solenoid, 60-80 PSIG air required, Nor-Cal Products Model # ESVP-100-S41	1"
HV-2233	A023-1	MANUAL BLOCK VALVE, 1" Angle in line valve SS, with 2.17 bolted Conflat flange connections both ends, Nor-Cal Products mdl# AIV-1002-CF	1"
HV-2234	A023-1	MANUAL BLOCK VALVE, 1/2", Angle, SS, welded Tube ends, Nor-Cal Products mdl# ESV-050	1/2"
HV-2235	A023-1	MANUAL BLOCK VALVE, 1" Angle in line valve SS, with 2.17 bolted Conflat flange connections both ends, Nor-Cal Products mdl# AIV-1002-CF	1"
HV-2236	A023-1	MANUAL BLOCK VALVE, 1/2", Angle, SS, welded Tube ends, Nor-Cal Products mdl# ESV-050	1/2"
CKV-2533	A024-2	CHECK VALVE, 1", Straight Through plug valve, SS with Viton Seal, with welded 1" tube ends, 24VDC solenoid, 60-80 PSIG air required, Nor-Cal Products Model # STVP-100-S41	1"

HV-2633	A024-2	MANUAL BLOCK VALVE, 6" Gate Valve, SS with Viton Seal, 8.00 bolted Conflat flange connections, Nor-Cal Products Model # GV-6002-CF	6"
HV-2534	A024-2	MANUAL BLOCK VALVE, 1" Angle valve SS, with Welded Tube Ends, Nor-Cal Products mdl# ESV-100	1"
VACP-2534A	A024-2	VACUUM PUMP see Data Sheet 106060000-A008	
VACP-2534B	A024-2	VACUUM PUMP see Data Sheet 106060000-A008	
COND-2534	A024-1	CONDENSATE TRAP, Varian Condensate Trap M/N CT25 P/N P1124301, with ISO KF 25 Flanges	
FA-2534	A024-1	FLAME ARRESTOR – TBD	
HV-2535	A024-2	MANUAL BLOCK VALVE, 1" Angle valve SS, with Welded Tube Ends, Nor-Cal Products mdl# ESV-100	1"
CKV-2539	A024-2	CHECK VALVE, 3/4", Straight Through plug valve, SS with Viton Seal, with welded 3/4" tube ends, 24VDC solenoid, 60-80 PSIG air required, Nor-Cal Products Model # STVP-075-S41	3/4"
HV-2542	A024-2	MANUAL BLOCK VALVE, 1" Angle valve SS, with Welded Tube Ends, Nor-Cal Products mdl# ESV-100	1"
CHK-2544A	A024-2	CHECK VALVE, 3" Fail Safe Right Angle Valve. Spring to close, solenoid operated, 3" welded connections either end, SS, Requires 60 – 80 PSIG Air, Nor-Cal Products Model # FSVP-300-S41	3"
CHK-2544B	A024-2	CHECK VALVE, 3" Fail Safe Right Angle Valve. Spring to close, solenoid operated, 3" welded connections either end, SS, Requires 60 – 80 PSIG Air, Nor-Cal Products Model # FSVP-300-S41	3"
HV-2545	A024-2	MANUAL BLOCK VALVE, 3" Angle in line valve SS, with 4.62 bolted Conflat flange connections both ends, Nor-Cal Products mdl# AIV-3002-CF	3"
HV-2546	A024-2	MANUAL BLOCK VALVE, 3" Angle in line valve SS, with 4.62 bolted Conflat flange connections both ends, Nor-Cal Products mdl# AIV-3002-CF	3"
HV-2547	A024-2	MANUAL BLOCK VALVE, 1" Angle valve SS, with Welded Tube Ends, Nor-Cal Products mdl# ESV-100	1"
HV-2548	A024-2	MANUAL BLOCK VALVE, 1" Angle valve SS, with Welded Tube Ends, Nor-Cal Products mdl# ESV-100	1"
SV-2771	A024-2	DELETED	3"
EJR-2580	A024-2	EJECTOR see Equipment Data Sheet 106060000-A009	
SV-2631	A024-2	SOLENOID VALVE 1/2", Normally closed, SS, 24 VDC, ASCO mdl# 8211A37	1/2"
HV-2632	A024-2	MANUAL BLOCK VALVE, 1" Angle valve SS, with Welded Tube Ends, Nor-Cal Products mdl# ESV-100	1"
SV-2772	A024-2	SOLENOID VALVE, 1" Inline, with 24 VDC solenoid, air operated, SS, Welded Tube ends, Nor-Cal Products mdl# AIVP100	1"

SV-2787	A024-2	SOLENOID VALVE, 3" Gate Valve, SS with Viton Seat, 24 VDC Solenoid, air operated, bolted 4.62 Conflat flange connections, connections, Nor-Cal Model # GVP-3002-CF-S21	3"
SV-2788	A024-2	SOLENOID VALVE, 3" Gate Valve, SS with Viton Seat, 24 VDC Solenoid, air operated, bolted 4.62 Conflat flange connections, Nor-Cal Model # GVP-3002-CF-S21	3"
PCV-7500	A024-2	PRESSURE CONTROL VALVE, 5 - 50 psid range, Brooks 5850i Thermal Mass Flow Controller	1/2"
SV-8016	A024-2	SOLENOID VALVE, 3" Gate Valve, SS with Viton Seat, 24 VDC Solenoid, air operated, bolted 4.62 Conflat flange connections, Nor-Cal Model # GVP-3002-CF-S21	3"
SV-8061A	A024-2	SOLENOID VALVE, 1" Inline, with 24 VDC solenoid, air operated, SS, Welded Tube ends, Nor-Cal Products mdl# AIVP100	1"
CKV-2926	A024-2	CHECK VALVE, 1", Straight Through plug valve, SS with Viton Seal, with welded 1" tube ends, 24VDC solenoid, 60-80 PSIG air required, Nor-Cal Products Model # STVP-100-S41	1"
CKV-1077	A002-1	CHECK VALVE, 1" Fail Safe Right Angle Valve. Spring to close, solenoid operated, 1" welded connections either end, SS, Requires 60 - 80 PSIG Air, Nor-Cal Products Model # FSVP-100-S41	1"
HV-1274	A002-1	GFE	
HV-1275	A002-1	GFE	
VACP-1003		VACUUM PUMP see Data Sheet 106060000-A007	
HV-1275	A002-1	GFE	
VACP-9332	A020-1	VACUUM PUMP see Data Sheet 106060000-A0015	
HV-9375	A020-1	MANUAL BLOCK VALVE, 1-1/2" Angle in line valve SS, with 2.75 bolted Conflat flange connections both ends, Nor-Cal Products mdl# AIV-1502-CF	1-1/2"
HV-9376	A020-1	MANUAL BLOCK VALVE, 1" Angle valve SS, with Welded Tube Ends, Nor-Cal Products mdl# ESV-100	1"
HV-9583	A020-1	MANUAL BLOCK VALVE, 1" Angle valve SS, with Welded Tube Ends, Nor-Cal Products mdl# ESV-100	1"
CKV-9374	A020-1	CHECK VALVE, 1-1/2" Fail Safe Right Angle Valve. Spring to close, solenoid operated, 1-1/2" welded connections either end, SS, Requires 60 - 80 PSIG Air, Nor-Cal Products Model # ESVP-150-S41	1-1/2"
T	A020-1	CONDENSATE TRAP, 1" inlet and outlet, ISO-NW25 connections, Varian Model # CT-25	1"
HV-9373	A020-1	MANUAL BLOCK VALVE, 1/2" Angle valve SS, with Welded Tube Ends, Nor-Cal Products mdl# ESV-050	1/2"

DWG J8E-8700-A023 sht 3, Note (7)

Component Number	Vendor Model Number	Description
D	SENIOR FLEXONICS M/N	1" SIZE, 15 ft long, end connections TBD

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ATTACHMENT D
EQUIPMENT DATA SHEETS
ALL VACUUM EQUIPMENT DATA SHEET ITEMS TO BE GFE