DISCLAIMER

SRC Technical Notes are informal memos intended for internal communication and documentation of work in progress. These notes are not necessarily definitive and have not undergone a pre-publication review. If you rely on this note for purposes other than its intended use, you assume all risk associated with such use.
MATERIALS

Materials used in the construction of any component or system which is part of, or interfaces with ultrahigh vacuum shall be metallic, glass or ceramic in nature. No elastomers or organic materials shall be permitted.

The materials used must be of the following, unless otherwise specifically approved: Stainless Steel Series 304, 304L, 316, 316L, 321, 347, 410, 416, 440C; Aluminum 1100, 6061, 7075; Nitronic 60, 33; Invar, Kovar, Gold, Silver, OFHC Copper, OFC Copper, Everdur, Glass, Macor and Ceramics. There is a wide variety of glass and ceramics used for feedthru purposes. We will not attempt to list them all here, but the manufacturer and catalog number must appear on any material list or drawing where glass and/or ceramics are utilized.

FABRICATION TECHNIQUE

A. Surface Preparation

No operation which might result in contaminants becoming imbedded in the material shall be used. Grinding with resin bonded wheels, using rouge, emery cloth, crocus cloth or similar abrasives are prohibited.

Use cleaned file, scraper, vitrified bonded grinding wheel or diamond dust with distilled water.

B. Electropolishing is Permitted Providing that:

1. there are no metal-to-metal surfaces on the vacuum side of the vessel (i.e. interfaces or cracks)
2. all welds are on vacuum side of vessel
3. there are no Con Flat or knife edge flanges on the vessel at the time of electropolishing
4. there are no threaded inserts installed (i.e. Helicoils)
C. Machining Lubrication

No lubricant may be used which results in material contamination that cannot be removed by the required cleaning methods. No sulphur bearing lubricants are permitted. Recommended lubricants are:

<table>
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<tr>
<th>Material</th>
<th>Supplier</th>
<th>Address</th>
<th>City, State, Zip</th>
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<tbody>
<tr>
<td>Stainless Steel</td>
<td>Polar Chip, Inc.</td>
<td>15600 Cornet</td>
<td>Santa Fe Springs, CA 90670</td>
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<tr>
<td></td>
<td>Simcool 400</td>
<td>Manufactured by</td>
<td>Cincinnati Milicron Marketing Co. Cincinnati, OH 45209</td>
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<tr>
<td>Aluminum</td>
<td>Alumicut</td>
<td>Manufactured by</td>
<td>Safe Tap</td>
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<td></td>
<td>Mistic Metal Mover Inc.</td>
<td>Rural Route 2</td>
<td>Manufactured by</td>
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<td></td>
<td></td>
<td>Princeton, IL 61356</td>
<td>Devcon Corp.</td>
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<td>Danvers, MA 01923</td>
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SRC/PSL CHEMICAL CLEANING PROCEDURES

Parts having blind tapped holes, welds and seams, porosity or vacuum chambers having outside welds:

1. Trichloroethane wash
2. Trichloroethane--Ultrasonic or vapor degreaser (Minimum 10 min.)
   Note: Large ultrasonic unit is 16"W x 12"D x 22"L
   Vapor degreaser unit is 15 7/8"W x 18"D x 20"L
3. Acetone--Ultrasonic (Minimum 10 min.)
4. Acetone rinse
5. Methanol--Ultrasonic (Minimum 10 min.)
6. Methanol rinse
7. Air dry or dry N2 (no compressed air)

Procedure before welding of units having smooth surfaced parts, or chambers of Stainless Steel or Aluminum (this is a good first cleaning for parts that have not been cleaned before):

1. Oakite 33 @ 140 F--20% mixture
   A. 100 F on Aluminum & 400 Series Stainless Steel
   B. Do not use on threaded inserts (i.e. Helicoil inserts)
2. Hot tap water rinse
3. Two rinses of boiling distilled water
4. Air dry or dry N2 (no compressed air)
All tools must be cleaned by thoroughly washing and rinsing in clean trichloroethylene.

**SRC/PSL CHEMICAL CLEANING TECHNIQUES AND SAFETY CONSIDERATIONS**

Avoid skin contact, inhalation and open flames around all solvents used for cleaning.

**A. TRICHLOROETHANE (Barcothene)**

The most dangerous of the commonly used solvents at SRC/PSL, gloves must be worn, do not inhale fumes. This solvent is used for preliminary cleaning, removal of heavy grease and oil. The first cycle can be done in used solvent but the final ultrasonic rinse should be done in a clean solution.

**B. ACETONE**

Very flammable, no smoking or open flames. Avoid inhalation. Acetone is used to remove Barcothene residues and contaminants missed in preliminary cleaning. Make sure final cycle is in clean solution.

**C. METHANOL**

**VERY FLAMMABLE!**

Used for final cleaning as it leave few residues. Ultrasonic cleaning and rinse must be done in a clean, clear solution to be effective.

If any of the above chemical rinses appear slightly brown in color, they should be considered too dirty for ultrahigh vacuum cleaning.

**WELDING AND BRAZING**

Approved Joining Methods

1. Tungsten Inert Gas (TIG) (electrodes shall be 2% thoriated tungsten)
   - On aluminum AC welding, 1% Zirconium is permitted
   - On aluminum DC welding, 2% thoriated with helium cover gas
2. Plasma Arc (electrodes shall be 2% thoriated tungsten)
3. Electron Beam welding
4. MIG (Metallic Inert Gas) with compatible filler wire & cover gases
   - Soft solders & fluxes are not permitted
   - Silver brazing & fluxes are not permitted
5. Vacuum brazing with approved alloys & joint design
Prior to welding, all parts must be cleaned in accordance with the SRC/PSL standard cleaning procedure. During welding, new, white nylon gloves must be worn while handling clean parts. For operations which require contact with other than the cleaned surfaces, the gloves must be replaced with new ones. Jigs, fixtures or chill rings, which contact the clean parts, must themselves be cleaned according to SRC/PSL cleaning procedures and handled thereafter in the same manner as a cleaned part. All brushes used for cleaning shall be of the hand type having stainless steel bristles from 0.002" to 0.008" in diameter. Power driven brushes, abrasive papers and abrasive wheels shall not be used. Brushes shall be vapor degreased in thichloroethane before use.

Stainless steel welds shall be back-purged in all cases. Gas flow shall be maintained until the metal cools to prevent oxidation. Cover and purge gas shall be Argon or Nitrogen Commercial Grade 99.98% or mixture thereof. Welding shall take place within 48 hours following chemical cleaning.

LEAK CHECK SPECIFICATIONS

Ultra high vacuum vessels shall pass the following test:

Vessel being tested shall be encapsulated in a plastic envelope inflated with a positive Helium atmosphere for 5 minutes. No indication of leaks on Helium mass spectrometer leak detector with sensitivity capability of $5 \times 10^{-11}$ STD. cc. per second, set in its most sensitive position.

ASSEMBLY PROCEDURES

All assembly must be consistent with good ultrahigh vacuum techniques. Prior to welding of final assembly, all parts must be cleaned to SRC/PSL standard cleaning procedures. Handling of parts must be done using new, clean, white nylon gloves of the electron tube manufacturing type. Gloved hands which touch clean parts must not be allowed to come into contact with surfaces which have not been cleaned in a like manner. Gloves which do come into contact with other than clean parts shall be replaced with a new pair. If hand tools are required during the assembly of parts which are exposed to vacuum, the tools must also be cleaned per SRC/PSL cleaning standards and handled the same as any cleaned assembly part. Tools with wooden, rubber or plastic surfaces shall not be used to assembly of vacuum exposed parts.