

Lead Preparation, Cutting and Swaging Instructions

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Introduction

The lead for the construction of the BCAL production modules will be received from Vulcan Resources in four main shipments, each comprising approximately 25% of the total order. A fifth small shipment will contain enough lead to account for the rejection rates so that 48 modules can be built, and a sixth, even smaller order will contain 13-cm wide sheets to be used for the top sheet in each 12-cm build, in order to suppress epoxy migration to the top surface.

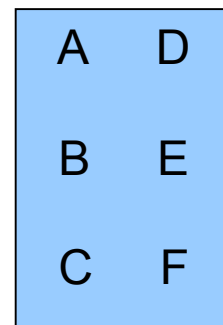
The lead comes in coils (rolls), each packaged in a clear plastic bag inside a cardboard box. Coils are cut to width by the vendor: 10-cm, 11-cm, 12-cm and 13-cm wide, and weigh 50-70 lbs each. Each shipment is inspected upon arrival. Some coils (still in their cardboard box) are extracted from the crates and arranged on shelving in LB113.1 and LB113.2. The remainder is left in 'cold storage' until needed.

Each coil yields on average ten 398-cm-long cuts. As swaging progresses, the cuts are processed, inspected for acceptance and returned to dedicated shelving in LB113 (main) to be used towards construction.

NOTE: At least two persons are needed to flip over a lead sheet.

Preparing and Cutting

1. Remove lead coil from packaging. Record Lot # from sticker on coil.
2. Insert an aluminum rod through the coil's core and balance the rods ends on lead blocks at the far right (in-feed) edge of the swager table, thus creating a dispenser. Dispense lead from the bottom onto the swager table.
3. Pull lead gently to uncoil.
4. Cut a 30 cm test piece and mark the coil code and width on it using a marker.
 - a. Mark 3 points along each end (A, B, C, etc, as shown in adjacent figure), for a total of 6 points.
 - b. Swag the cut.
 - c. Measure the swaged cut's thickness at each point using the standard brass gauge and micrometer. Measure its length. Record the measurements.
5. Cut ten 398 cm pieces from coil, in the following manner.
 - a. Unroll the lead from its dispenser along the swager in-feed table.

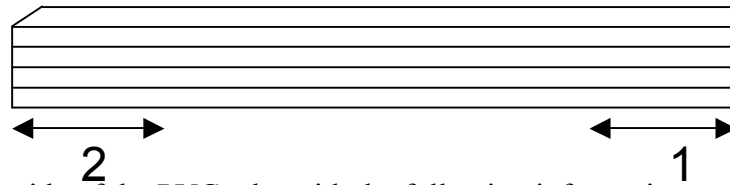


- b. Inspect the lead, smoothing out any wrinkles or blemishes on its surface and noting any irregularities. If there are irregularities notify the Construction Manager.
 - c. Use a measuring tape to mark the 398-cm mark, and cut the sheet slowly and carefully using scissors.
6. Clean the top surface of the lead using ethanol and wipe-all lint free cloths. Ensure that each piece is clean and free of excess oxidization (yellow-white dust). If there is excessive oxidization, use a Brillo pad and ethanol, and flip the lead over and clean the other side.

Swaging

1. One person mans the in-feed station of the swager and one mans the out-feed side.
2. Prior to swagging each sheet, make sure that it is PERFECTLY straight and flat. Push the sheet gently up along the polyethylene guide wall along its entire length on the in-feed side, working out (“massaging”) any banana-type curvatures or ripples. Flip the sheet over and repeat massaging when needed. If the sheet does not align with the guide or there are defects (e.g. folds, creases) that could affect swaging or the build, contact the Construction Manager.
3. The out-feed person turns the swager on in the forward direction (controlled by a switch which should be in the up position), with the speed set to 1 on the dial.
4. Douse the end of the sheet closest to the machine with ethanol on both sides to prevent it sticking to the swager rollers.
5. The in-feed person gently feeds the sheet into the swager being sure to keep it firmly against the guide using only a sideways force, while avoiding the creation of folds or wrinkles. Do not press down on the sheet.
6. The out-feed person is ready to peel the sheet off the rollers if it becomes stuck and/or to ensure that it comes off the rollers and onto the out-feed table surface. Slow speed (dial at 1 or 2) on the motor and attention are the keys to this crucial step. If the sheet is stuck too firmly onto the top roller or catches the edge of the out-feed table and thus rips or bends, the swager needs to be turned off (by moving the switch to the middle position) and the sheet is peeled off and any damage done should be assessed and repaired accordingly.
7. When the sheet is lying flat on the out-feed table the swager should be turned back on (if it had been turned off before) and the sheet is fed through continuously with the speed dial at position 2 or 3, or at a speed that is easy for the out-feed person to handle.
8. The out-feed person should gently keep the sheet flat on the out-feed table (it tends to ‘hill up’ as it comes out of the swager) and be ready to stop the motor if any irregularity occurs.
9. Ensure that the sheet is completely out of the swager.
10. Clip the corner of the sheet at a 45-degree angle on the end that started in the swager and is against the metal edging/guide. This is done to identify which edge came out of the guide side, as the swager tends to produce swaged sheets that are slightly thinner on the that side.

11. Ensure that the long side of the lead is parallel and square to the guide. Work out banana curvatures; if not possible mark the sheet with a tag inside the PVC tubing and store for recycling.
12. Run a toothpick along the two outermost grooves. If none or one groove is lost from one edge and appears on the opposite edge, the sheet is acceptable for building. If off by two grooves or more mark and store the sheet for recycling. Never use sheets that are off by two or more grooves in a build.
13. Measure and record the swagged length of the sheet. Acceptable length is between 404 cm to 407 cm; if longer, cut to 406 cm; if shorter, discard.
14. Roll/wrap the sheet around a pre-cut section of 3" PVC tubing (shell) after the ethanol has evaporated completely. Roll the sheet ensuring that the grooves lock into place and that it forms a tight, compact roll, and that the edges remain lined up. Roll it in one of two orientations:
 - i. Rolling from the end closer to the swagger (type 1)
 - ii. Rolling from the end away from the swagger (type 2)



15. Label the inside of the PVC tube with the following information: coil code (ie AA); sheet number (1-10); width; length; type (ie. 11 cm, AA-2, type 1, 406 cm).
16. Measure and record the length of the remaining piece of lead on the original coil. Label this lead with the coil code, width, and length. (ie AA 11 cm, 189 cm left) Leftovers are stored for recycling.
17. Record the following information in the log book:
 - i. Date, workers' initials,
 - ii. Lot #, width,
 - iii. Coil code,
 - iv. Length of each piece before and after swagging,
 - v. Thickness of test piece.
18. Record information on all swaged sheets in the Elog at the end of the shift.
19. Store coiled lead sheet together with like-length coils, until it is time to use it in a build.

Prior to Build

- All quality control checks on the lead sheets occurs during the swaging process.
- The PVC-rolled sheets are dispensed on the build always left to right, so that precise alignment of the left edges can be accomplished and the differences in sheet length are manifested on the right side. This allows accurate tracking of the length so that after machining the final, cleaned-up length of 390 cm can be achieved. It also avoids tolerance stacking, since the thin side is alternatively positioned at the front/back of the module, owing to the manner in which each sheets is rolled on the PVT tubing (see Swaging point 14 above).