

Preparation and installation of stainless steel source tubes into HF wedge assemblies.

April 12, 2002

Source system components of a wedge assembly

Each wedge assembly contains 31 stainless steel source tubes. The tubing has an outside diameter of 1.27mm and a wall thickness of 0.15mm. At one end of each tube is a brass coupler pin that is used to transition from the plastic tubing used outside of the wedge assembly to the stainless tubes within the assembly. These pins are attached to the tubes by brazing prior to installation. Pins are held in place by pin retaining blocks located at the ends of the two source tubing channels machined into the wedge assembly strong backs. Two holders are installed into each tubing channel to keep the tubes below the surface of the strong back so that they cannot be damaged during the back-plane installation process. Figure 1 illustrates the locations of these items.

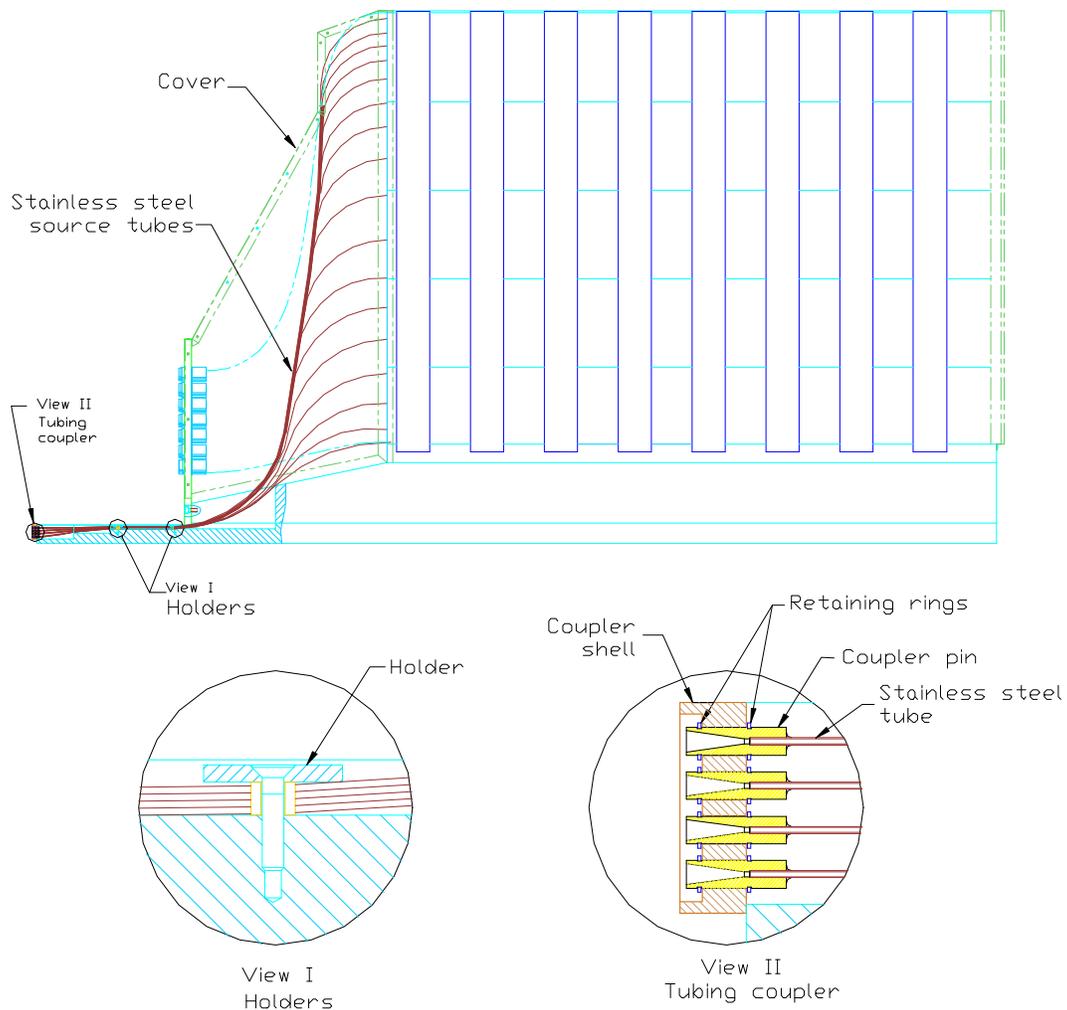


Fig. 1: Source system components.

Source tubing preparation.

Source tubing is to be delivered in 20 foot [6.1 meters] lengths. Depending on the locations of the source tubes within the absorber, some of these will need to be cut into two lengths in order to efficiently utilize the tubing provided. Table 1 lists the estimated lengths for each of the tubes.

TUBE No.	ESTIMATED LENGTH	TUBE No.	ESTIMATED LENGTH
1A	2701	14A	2701
1B	2742	14B	2742
2A	2802	15A	2802
2B	2876	15B	2876
3A	2866	16A	2866
3B	3050	16B	3050
4	3138	17	3138
5	3251	18	3251
6	3341	19	3341
7	3421	20	3421
8	3484	21	3484
9	3550	22	3550
10	3639	23	3639
11	3673	24	3673
12	3693	12B	3693
13	3712		

Table 1: Stainless steel source tube length estimates. Red lines indicate estimated tube pairs that can be derived from a single 20 foot length.

Before attachment of the brass coupling pins the tubes should be inspected to ensure that they are free of kinks or deformations. The ends that are to have the pins must be cut such that they are perpendicular to the tubing axis in a manner that does not deform the circular cross section of the tubing. This has been done in the past with good success by using an abrasive cutting wheel. After cutting, the ends should be cleaned of any burrs left over from the cutting process. The inside edge should be deburred with a 90 degree counter sink. Care should be taken not to flare or distort the ends during the deburring process.

The brass pins are then brazed onto the tubes. Tubes provided for the first two wedges were prepared by brazing with a low temperature brazing alloy to minimize distortion of the tubing and to reduce the risk of damaging the parts. A holding fixture

was also used to keep the tubing straight and to protect the ends of the pins. Figure 2 shows a cross section of a coupler pin/source tube assembly.

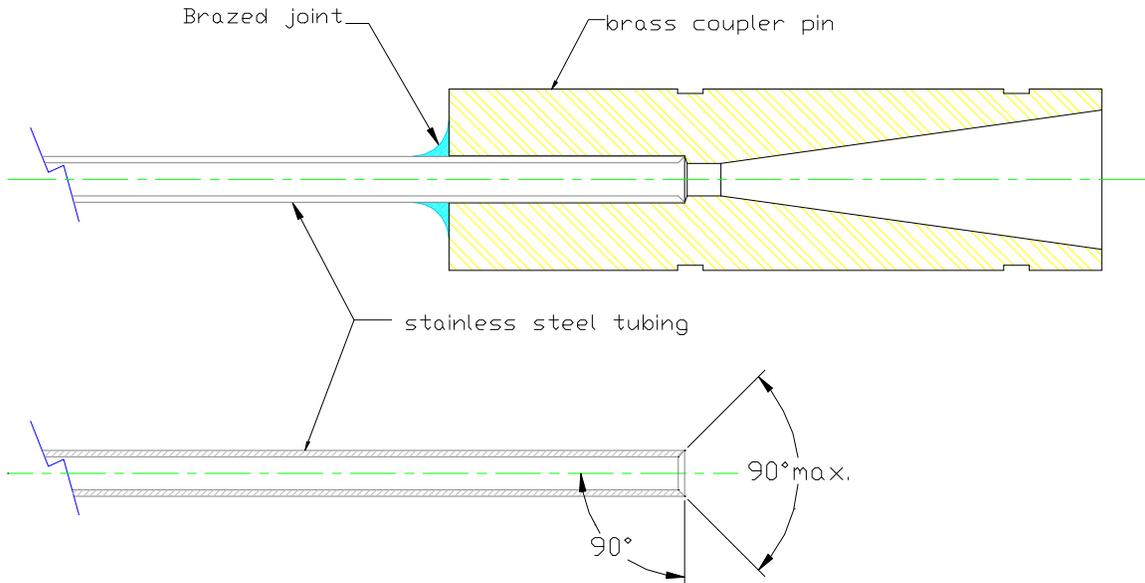


Fig. 2: Source tube and coupler pin assembly cross-section.

After brazing the assemblies should be cleaned and inspected. It is important to check that the tubing is straight and has not been deformed or kinked. The outer surface of the pin including the retaining ring grooves should be checked to ensure that it is free of residue that would interfere with assembly into the pin retainers. The end of the pins should be checked to make sure it has not been distorted or damaged. Finally a 0.9mm O.D. wire should be inserted into the full length of the tube to verify that the entire tube is free of obstructions.

Source tubing installation

Source tubes are to be inserted into the absorber during the fiber insertion process as source locations are encountered. The tubes may be either inserted into the absorber first then routed into the channels to the couplers, or guided through the channels and up into the absorber. Experience will determine which method is most appropriate. Once a tube is roughly in place the coupler pin should be fastened into its designated place in the retainer with retaining rings. Figure 3 shows the mapping between source tube numbers and their locations within the pin retainers. Care should be taken to prevent the tubes from being glued to the absorber during the fiber stuffing process since the final adjustments can only be made after all the tubes are in place.

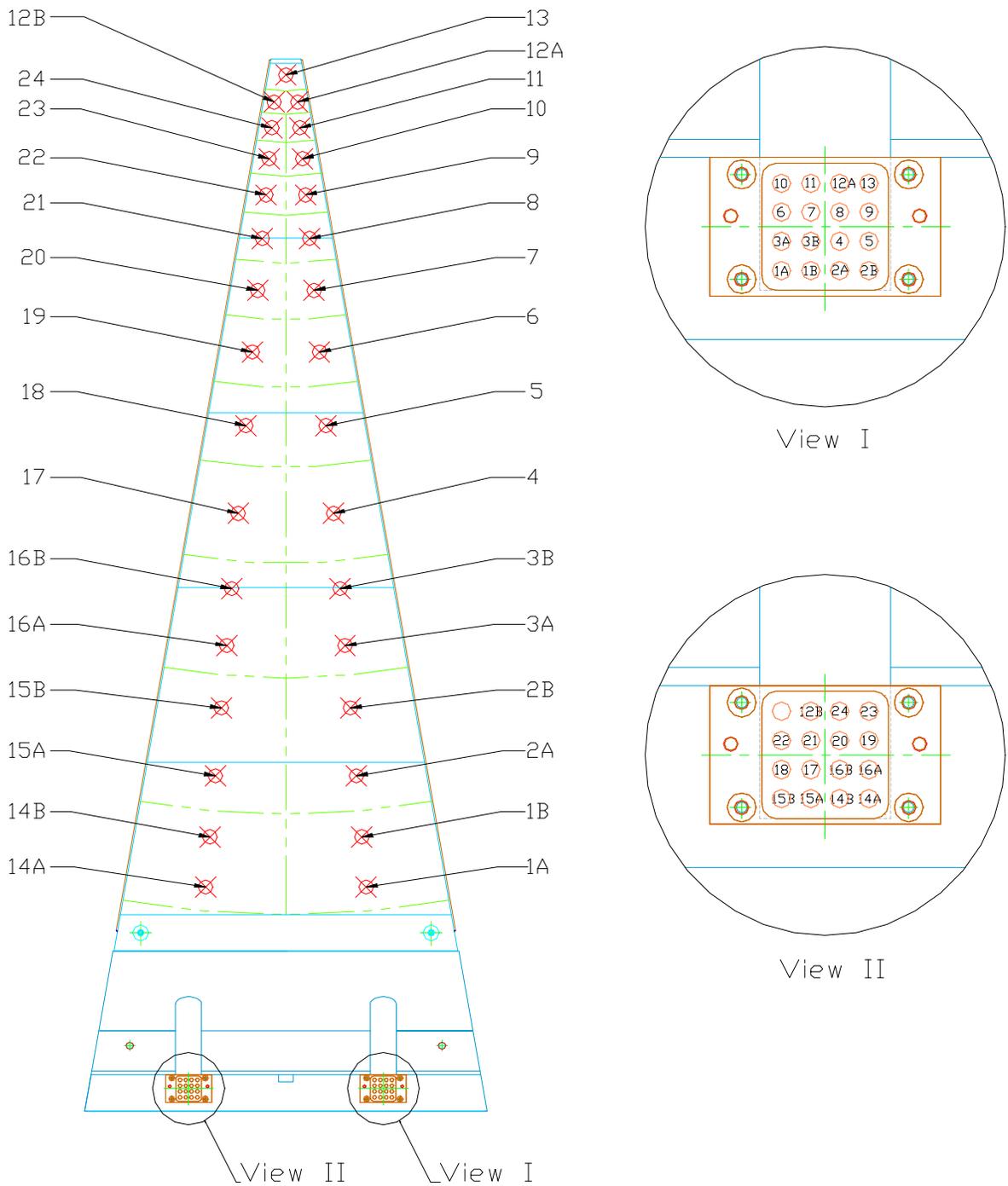


Figure 3: Source tube numbering and coupler pin location assignments.

Once insertion is complete the tubes should be made to lay nice and flat in the strong back slots and the holders should be installed. Care should be taken not to crush the tubes while tightening the holders. The height of the holders and screw heads should be checked to make sure that they do not protrude above the surface of the strong back.

Next the source tubes should be adjusted to provide maximum bend radii and to eliminate places where stress concentration could kink the tubes. This adjustment can be made by moving the tubes in or out of the absorber. Tubes located near the base of the wedge will naturally tend to follow the nominal path. Tubes higher up on the wedge can not following the most natural path due to the space constraints imposed by the cover. These tubes can be made to follow nice circular bends that fit within the space by tying the upper source tubes together into a bundle. This should not be difficult since tubes above number six are not obstructed by fibers like the lower tubes are. A template should be used to verify that the source tubes will not interfere with the cover. Figure 4 illustrates the overall form of the source tubes and some of the anticipated bend radii. Extreme care should be taken not to kink the tubes. Even a very small kink can interfere with the movement of the source wire within the tubing. Kinks are most likely to happen near the top of the absorber where the weight of a tube can cause a kink where the tube enters the absorber.

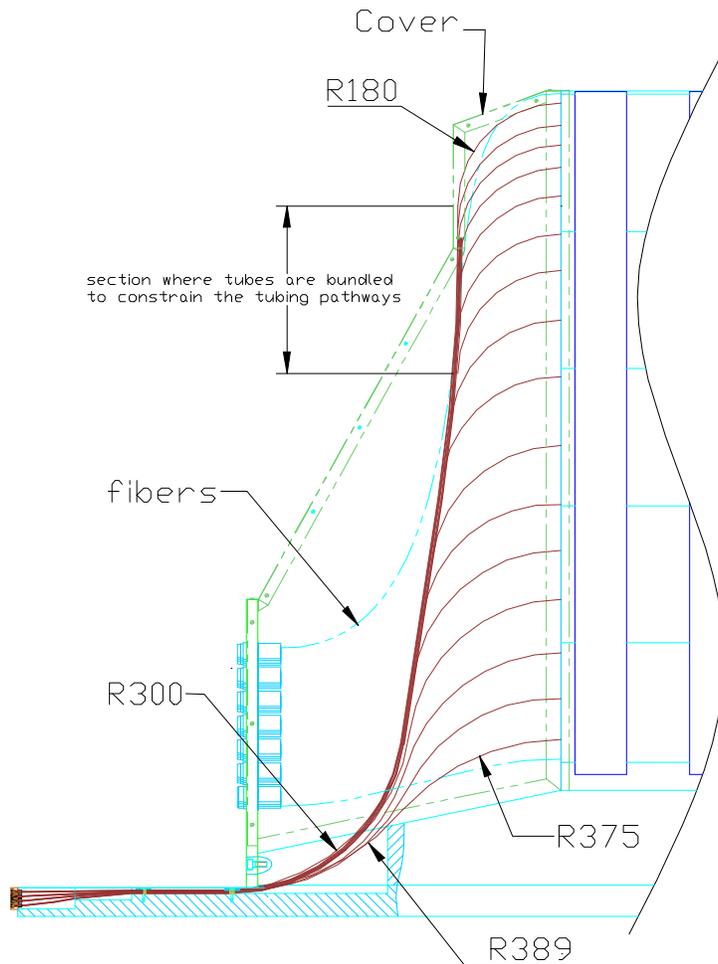


Figure 4

When all of the tubes are in nominal positions the tubes can be cut to their final length and terminated. Because the termination process will require moving the tubing, the cut points on all of the tubes should be marked before cutting begins. The original plan for termination of the tubes was to have a short soft wire plug inserted into the end of the tubes and then crimped with a four jaw crimping tool commonly used on crimp pins for electrical connectors. This may be excessive and it may be sufficient to simply cut the tubes with conventional wire cutters that crush the end of the tubing shut before cutting through it. The method of termination should be discussed and agreed upon before the wedge assembly process is started.

After all of the tubes are terminated they should be pushed back into their nominal positions. The overall shape of the tubing pathways should be inspected and the clearance between the tubes and cover should be checked again.

Notes:

1.

If it becomes necessary to bend the tubes the bending should not be done with the hands. Bending the tubing by hand causes little concentrated kinks in the tubing and a non-uniform bend. Kinks are absolutely fatal to the proper operation of the source delivery system. Bending should be investigated before trying it on a final assembly.

2. The method and materials used to constrain the tubes to fit within the cover need to be established.

3. fixation of the source tubes to the absorber with epoxy may contribute to the overall stability of the system but has not yet been discussed.