ESSB-2017-05

MEBT-BI-BP93-01

BPM Welding Acceptance Test Plan

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Change History

Rev.	Date	Author(s)	Description
0.0	2017-05-14	I. Bustinduy	First Version
0.1	2017-05-18	S. Varnasseri	Second Version

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1. Test Plan

Acceptance tests of the welding process for pieces of BPM and for the whole BPM setsis evaluated by three main measurements and checks during and after fabrication:

- RF measurements
- Vacuum leakage tests
- Metrology and mechanical errors

In some stages the magnetic permeability tests also is performed. There are four main stages applicable to the welding process of the BPM pieces.

1.1. Welding the feedthrough to the SL-Box

Each stripline box (SL-Box) includes two vacuum HF feedthroughs. After welding the two feedthroughs into the SL-Box, the vacuum leakage tests shall be performed. In case of any leakage, the pieces are rejected to continue. At this stage, breaking of brazing junction of the feedthrough has the highest probability of failure.

Figure 1: Two feedthroughs e-beam welded to SL-Box during prototype process.

1.2. Welding the strips to feedthrough pins

Each SL-Box includes one thin 0.8 mm strip from stainless steel. After welding the strip to feedthroughs pins in downstream and upstream of each strip. The following evaluations and checks are performed:

- **Visual inspection** for possible cracks and welding quality
- **Magnetic permeability** checks ($\mu r<1.1$)

- **RF measurements** (reflection and transmission parameters)
- **Vacuum leakage** checks (leakage reference value 2x10^-10 mbar.l/s)

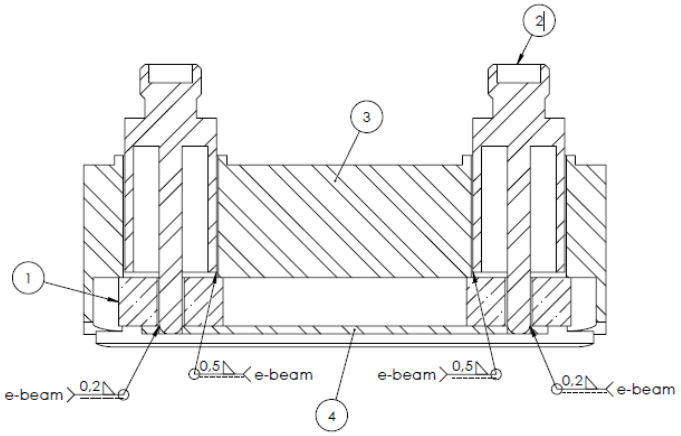

Figure 2: BPM SL-Box assembly drawing showing spacer(1), feedthrough (2), SL-box body(3) and strip(4)

Figure 3: SL-Box welded and ready for checks during prototype process.

1.3. Welding the SL-Box to the BPM tube

Each BPM includes of one tube and 4 SL-Boxes. The SL-Boxes which passed previous checks can be welded to the tube of BPM. After welding the four SL-Box on the tube, the following measurements and checks shall be performed.

- **Visual inspection** for possible cracks and welding quality
- **Magnetic permeability** checks (μr<1.1)
- **RF measurements** (reflection and transmission parameters)

- **Vacuum leakage** checks if applicable (leakage reference value 2x10^-10 mbar.l/s)
- **Metrology**and error checks

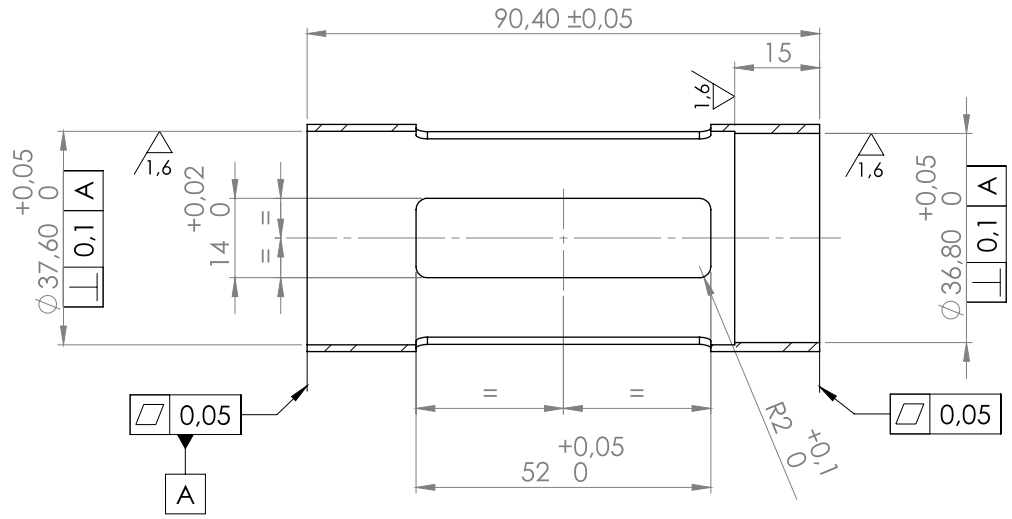

Figure 4: One BPM sectiontube.

Overall 8 BPM sets are distributed in various locations within MEBT. However the BPM core is identical, but due to integration boundaries, there will be 5 different types of BPM sets with differences in tube length and bellows.

1.4. Welding of bellows to the tube

Six of the BPM sets have bellows welded to tube (Fig. 5). After welding of bellows the visual inspection has to be performed of the welding quality. No further checks are performed.

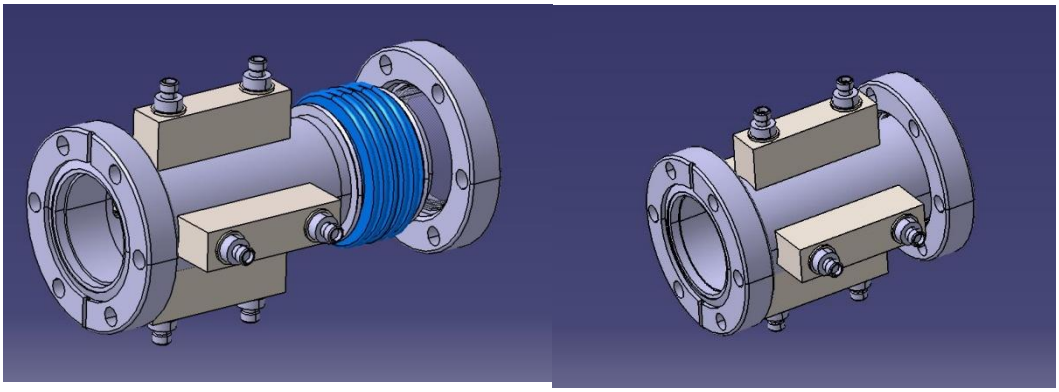

Figure. 5: BPM sets with and without bellows.

1.5. Welding of flanges to the tube

All the BPM sets require flanges welded in both sides (Figure. 6). Overall there are 15 CF40 flanges and one CF63 flange. The only CF63 flange is welded to the last BPM which connects the MEBT to DTL section. After welding the flanges, the following checks and measurements shall be performed:

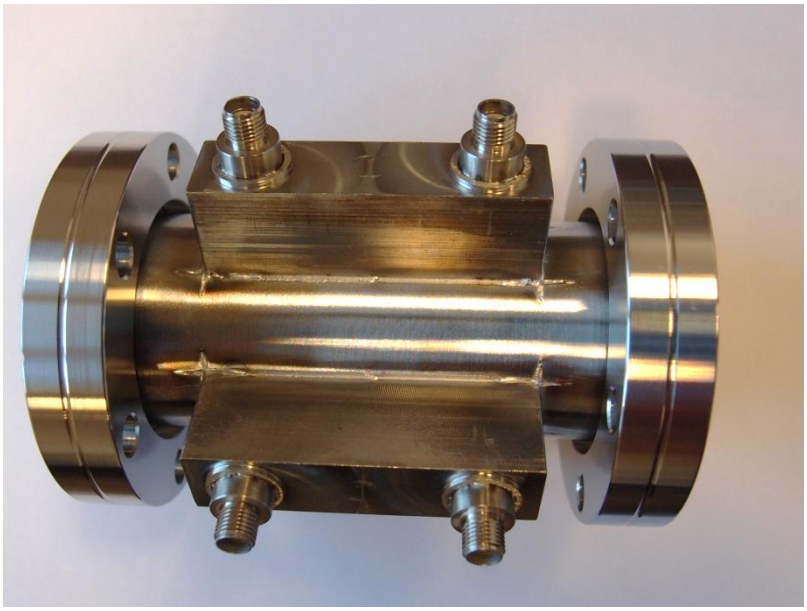

Figure 6: CF40 Flanges welded to tube of BPM during prototype fabrication.

- **Visual inspection** for possible cracks and welding quality
- **RF measurements** (reflection and transmission parameters)
- **Magnetic permeability** checks (μr<1.1)
- **Vacuum leakage** checks (leakage reference value 2x10^-10 mbar.l/s)
- **Metrology**

The mentioned checks at this stage are considered as the acceptance tests, and afterward if the sets passed this stage, they shall be ready to be installed inside quadrupole magnets.

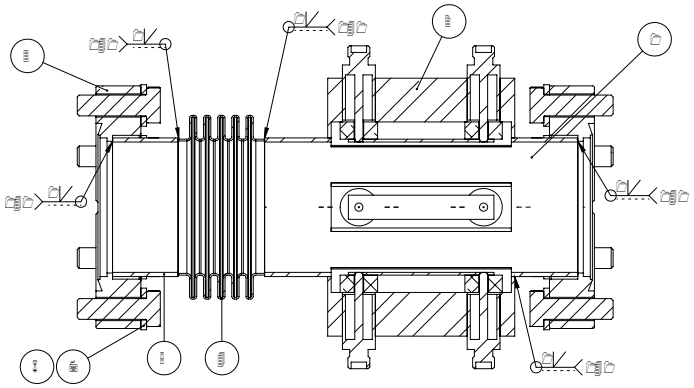

Figure 7: Rotatable flanges welded to the right side of beam pipe, and welded to left side of bellow.