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Betreff/Subj.: Closure of AI HP-2-ASED-0182/2

Dear Sir,

in the annex you find closure of AI HP-2-ASED-0182/2.

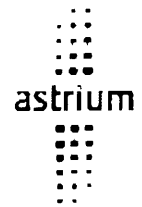
Kind regards

Astrium GmbH

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1.) ISO Design

Item	Material	Description	Reference
Screw	2.0835.73 Copper alloy	DIN912-M5x30	ISO-DL- AH00.01.00.00F
Washer	Stainless Steel	0.8 mm	
Clamping block	2.1030.26 Bronze	Thickness 20 mm	ISO-DW- AH00.01.00.01F
Strap	Copper	Thickness 2 mm (max)	

Helium Tank I/F, Instrument I/F was not identical for all instruments.

Torque: 4.7 Nm

As all items are of material with nearly identical thermal shrinkage no loss of pretension due to cooling down has to be expected. The pre-tension load is depending on the friction between screw and the other items. These friction values are scattering from screw to screw.

Friction	Pre-Tension Per Screw	Pre-Tension on I/F (2 screws)	Remark
0.1	3250 N		Assumed minimum
0.2	6590 N		Assumed maximum
0.12	5264 N		best guess nominal

2) Comparison of Screw Sizes

The values are based on 0.12 as friction assumption for all screws.

Screw Size	Torque in Nm	Pre-Tension at room Temperature in N
M3	1.0	1718
M4	2.3	3326
M5	4.7	5260
M6	9.0	8905
M8	18	12713

Comparison of different discussed configurations

4 x M3 → 6872 N
 2 x M5 → 10320 N (ISO)

3) Impact of Cooling down:

The pretension loss due to cooling down is dependent on the detailed design (material selection, length of screw, washer). For the Spire Level 0 connection the design is not yet fixed, therefore number can not be given. But in principle it is possible to minimise the pre-tension loss either by using copper screws (to fix a copper link see ISO) or by using stainless steel screws and an Invar washer to compensate the thermal shrinkage.