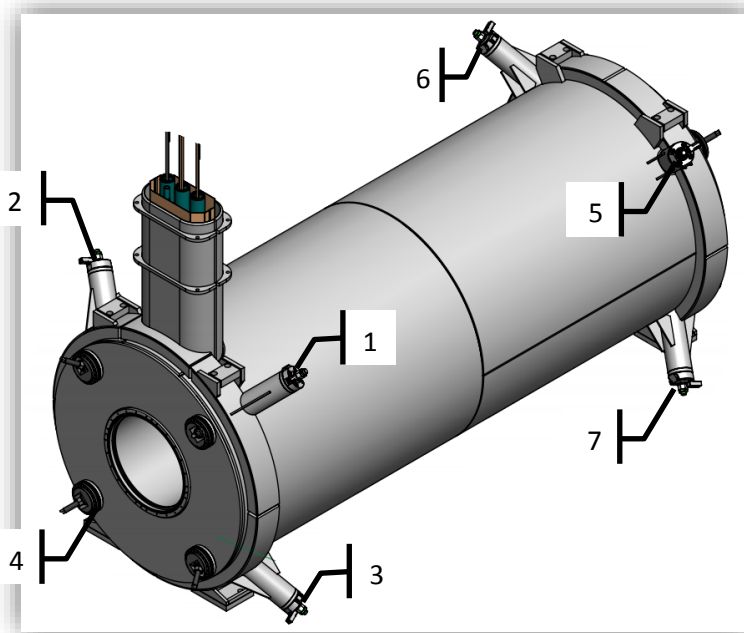|	**Technical Specification** Revision: A (03/10/2016)	SIGMAPHI REFERENCE: 317111 DESIGNATION: Adjustment of suspension links CUSTOMER: Jefferson Laboratory

Technical Specification
Adjustment of suspension links

This technical specification gives the theoretical force applied on each suspension link and the forces measured at Sigmaphi before shipping. The procedure of adjustment is then described.

The following scheme gives the position and number of each suspension link:

1 Theoretical forces in suspension links

The following table gives the theoretical forces in suspension links (unit = Newton) after tilting at 9.2° and after cool down. These forces are calculated for a collared coil weight equal to 15.5 Tons whereas the real weight has been measured at 12.5 Tons. The maximum force in suspension links is in red hereafter.

Suspension Link N°	6	8	7	5	4	2	1	3
coil weight+gravity -Y	55206	87055	96780	55053	109600	64064	63849	109570
Cold	52908	64520	94438	52782	107360	62071	61874	107330
Magnetique force	48450	120990	91623	24125	113360	38538	64109	141790
Acceleration X	69663	147640	68638	6819	91578	21025	86321	167320
pression 0.6 Mpa	66152	147870	68118	4035	89988	19330	84360	166110

2 Calibration data of full bridges

The relation between force (in kN) and signal (in mV/V) has been measured on a traction machine for the 16 full bridges.

Formula: $F\ (kN) = A \times [\,signal\ (mV/V) - s0\ (mV/V)\,]$

Suspension link N°	Full Bridge N°	A	s0
D1	B	102	-0.178021
D1	A	102	0.900000
D2	A	102	-0.130593
D2	B	102	0.107024
D3	B	102	0.295383
D3	A	102	0.513540
D4	B	102	0.021000
D4	A	102	0.233000
D5	B	102	-0.387890
D5	A	102	0.161767
D6	B	102	0.061396
D6	A	102	0.175510
D7	A	102	0.075247
D7	B	102	0.120000
D8	A	102	-0.065000
D8	B	102	-0.169000

3 Forces measured before shipping

The suspension links have been tightened before shipping. The measurements are given hereafter (unit = kN).

100,10 Suspension 1A	**110,26** Suspension 5A
100,89 Suspension 2A	**108,56** Suspension 6A
35,28 Suspension 3A	**40,15** Suspension 7B
35,73 Suspension 4B	**36,92** Suspension 8B

4 Position of the helium vessel inside the cryostat

The magnetic measurements have been performed before welding of the outer vessel and before the tightening of suspension links. Consequently, there is no valuable recording of the position of the helium vessel inside the cryostat since the helium vessel probably moved because of welding and suspensions tightening.

The best way to center the helium vessel inside the yoke is to measure the strain on suspension links when a small current is applied to the coil.

5 Maximum allowable force in suspension links

The maximum allowable force in suspension links is 168 kN which corresponds to the addition of the following cases:

- Coil weight tilted at 9.2°
- Cool down
- Misalignment of 3mm with the yoke
- Lateral acceleration of 1G

All the suspension links have been tested under tension at 168 kN without any damage or yielding.

6 Procedure of adjustment of suspension links

- Before starting the adjustment of the suspension links an acquisition system has to be connected on LEMO connectors.
- Install and tighten the following part which will avoid the suspension link to turn during adjustment. Indeed, if the suspension turns then it will damage the bellow and create a leak very difficult to repair.
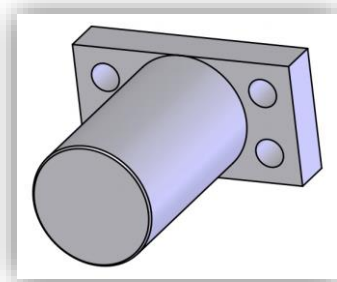
- Tighten the suspension link while checking the force value of all the suspensions (it will also increase the force in the suspension link at the opposite side).
- Once all the suspension links are adjusted remove the parts installed previously.