

**HEBT Magnet Vacuum Chambers
for Batch 2 and Batch 3
PSP Code 2.3.7.1.2.3.2**

Overview about all magnet chambers



PSP-Code	Chamber type	Quantity	Subtypes	Status
2.3.7.1.2.2.10	dip10 (branching)	6	3	to be assigned
2.3.7.1.2.2.13.2	dip13_0 dip13_3	5	1	BINP (Council)
2.3.7.1.2.2.15	dip15_0 dip15_1	5	3	to be assigned
2.3.7.1.2.2.16	dip16	1	1	to be assigned
2.3.7.1.2.2.17	dip17	1	1	to be assigned
2.3.7.1.2.2.19	dip19	4	1	to be assigned
2.3.7.3.2.3.1	quad 1	1	1	to be assigned (FBL)
2.3.7.1.2.3.10	quad10	4	1	BINP (Council)
2.3.7.1.2.3.11	quad11	69	19	to be assigned
2.3.7.1.2.3.12	quad12	17	8	to be assigned
2.3.7.1.2.3.2	quad2	81	12	BINP (Council)
2.3.7.3.2.3.2	quad2	9		to be assigned (FBL)
2.3.7.1.2.4.1	s100	29	19	to be assigned
2.3.7.1.2.4.2	s18h/v	31	16	to be assigned
2.3.7.3.4.2	s18h/v	3		to be assigned (FBL)
2.3.7.1.2.4.3	s13 large aperture	4	3	to be assigned
2.3.7.3.2.2.4	dip4 (bending)	1	1	to be assigned
2.3.7.3.2.2.5	dip4 (branching)	1	1	
Total		272	91	

Milestones



Milestone	Work Description	Date
M4	<ul style="list-style-type: none">Exchange of signed Contract	01/2019
M6	<ul style="list-style-type: none">Conceptual Design Review (CDR) accepted	03/2019
M7	<ul style="list-style-type: none">Final Design Review (FDR) accepted	05/2019
M8	<ul style="list-style-type: none">Factory Acceptance Test (FAT) of pre-series accepted	07/2019
M9	<ul style="list-style-type: none">Factory Acceptance Test (FAT) accepted	05/2021
M92	<ul style="list-style-type: none">Site Acceptance Test (SATaa) accepted	07/2021
M10	<ul style="list-style-type: none">Site Acceptance Test (SATab) accepted	07/2021
-	<ul style="list-style-type: none">Documentation	09/2021
-	<ul style="list-style-type: none">Final Acceptance	09/2021
-	<ul style="list-style-type: none">Warranty starts	

Vacuum properties



Vacuum properties	Non-bakeable	Bakeable
Integral leak rate	$\leq 1 \times 10^{-10} \frac{\text{mbar l}}{\text{s}}$	$\leq 1 \times 10^{-10} \frac{\text{mbar l}}{\text{s}}$
Outgassing rate (after 10h of pumping)	$\leq 5 \times 10^{-10} \frac{\text{mbar l}}{\text{s cm}^2}$	$\leq 1 \times 10^{-12} \frac{\text{mbar l}}{\text{s cm}^2}$
Residual gas analysis (after 24h of pumping)	<ol style="list-style-type: none"> All peaks between mass 18 and 45 must be 100 times lower than mass 18, except mass 28 and 44. All peaks higher mass 45 must be 1000 lower than mass 18. 	<ol style="list-style-type: none"> All peaks between mass 12 – 18 and mass 28 must be $\leq 10\%$ from mass 2. All peaks between mass 22 – 32, except mass 28, must be $\leq 0.5\%$ from mass 2. Peak 44 must be $\leq 20\%$ of mass 2. All peaks between mass 49 – 100 must be $\leq 0.1\%$ from mass 2.

Inspection Reports (FAT):

Vacuum chamber 2.3.7.1.2.2.14 for magnet dip14_v1 S/N01

- pumping time for measurements must be:
10h for the outgassing rate
24h for RGA measurement
 (deviations can't be accepted)



CVC6- Check off of spectrum of residual gases / Снятие спектра остаточных газов

Residual gas spectrum is shown below / Спектр остаточных газов показан ниже.	Pressure after 120 hours pumping: 9,1E-8 mbar
Type of residual gas analyzer / Тип анализатора остаточного газа	Stanford RGA100 (S/N 160713)
All mass peaks between 18 amu and 46 amu (except peak 28, 32 and 44) shall be 100 times less than the sum of all peaks. All mass peaks higher than 46 amu shall be 1000 times less than sum of peaks of masses 2, 18, 28 and 44 amu.	OK
Outgassing rate after 120 h of continuous pumping	3,2E-11 mbar*l*s ⁻¹ *cm ⁻²
Type of penning gauge / Тип датчика давления	IKR 270 (serial number: 44275349)

Mechanical properties:

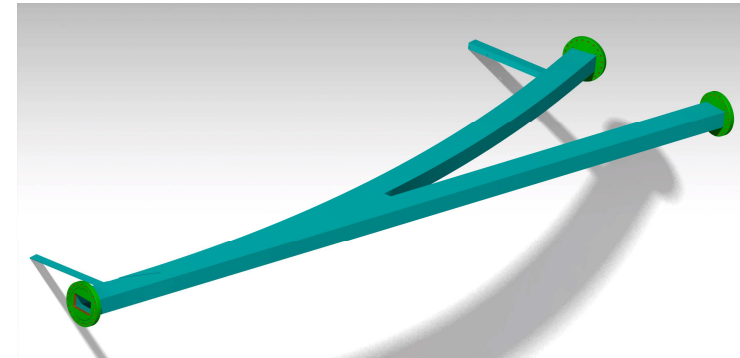
- Check of welding seam according to DIN EN ISO 9712, quality class DIN EN ISO 5817 B
- Surface quality $R_z=25$
- Magnetic permeability:
 - Parts of the body of vacuum chamber that are located at a distance less than the magnetic gap from the yoke edge
→ $\mu_{rel} \leq 1.01$
 - Parts of the body of vacuum chamber that are located at a distance greater than the magnetic gap from the yoke edge
→ $\mu_{rel} \leq 1.05$
 - Components of the vacuum chamber such as flanges, bellows, and other fixed elements such as supports, bolts, nuts, washers, etc. → $\mu_{rel} \leq 1.05$
- Chamber material according DIN EN 10088: 1.4306, 1.4307, 1.4404, 1.4429 or 1.4435
- Flange Material according DIN EN10088: 1.4306, 14307 or higher quality
- Material for bakeable flanges: 1.4429 ESR

HEBT: Dipole Chambers

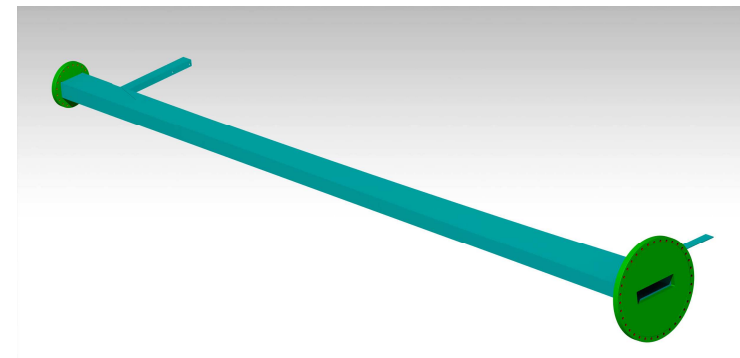


Chamber type	Quantity	Subtypes
dip10	6	3
dip13_0 dip13_3	5	1
dip15_0 dip15_1	5	3
dip16	1	1
dip17	1	1
dip19	4	1
dip4	2	2
Total	24	12

- Overall length: 2000-4500 mm
- Shape: rectangular, bending and branching
- Flanges: DN160CF – DN400CF



dip4 branching chamber



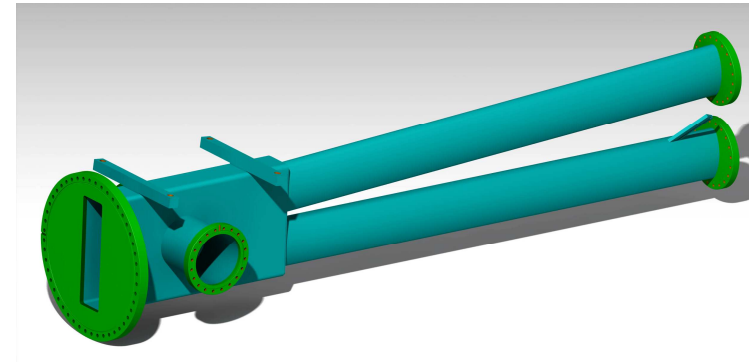
dip10 branching chamber

HEBT: Quadrupole Chambers

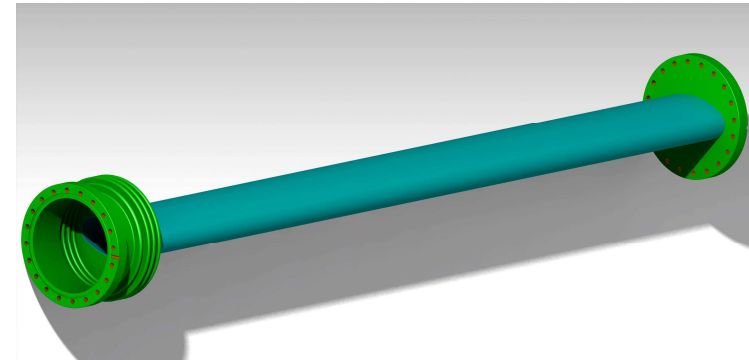


Chamber type	Quantity	Subtypes
quad 1	1	1
quad10	4	1
quad11	69	19
quad12	17	8
quad2	90	12
Total	181	41

- Overall length: 1000-2600 mm
- Shape: round and oval, branching
- Flanges: DN160CF – DN400CF
- Some chambers with bellows



quad12 branching chamber (pre-series)



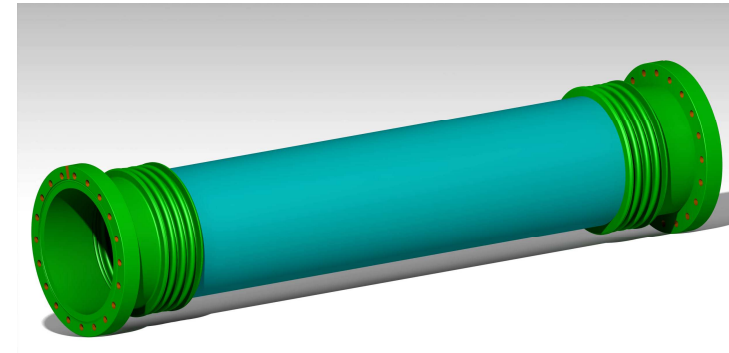
quad12 oval chamber

HEBT: Steerer Chambers

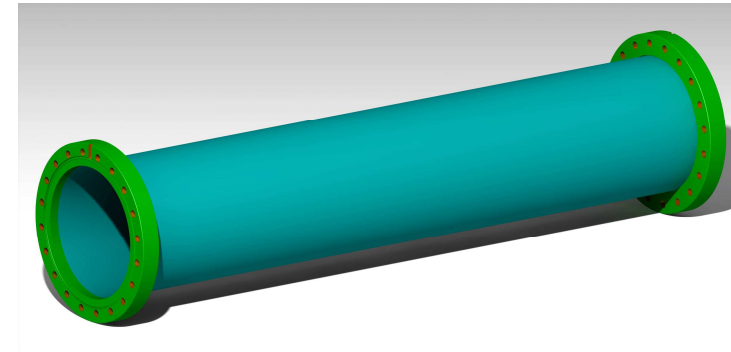


Chamber type	Quantity	Subtypes
s100	29	19
s18h/v	34	16
s13 large aperture	4	3
Total	67	38

- Overall length: 500-1800 mm
- Shape: round
- Flanges: DN160CF – DN400CF
- Some chambers with bellows



s18 round chamber with bellows



s100 round chamber

