

3.9 Safety Recommendations in the High Field NMR Laboratory

Safety considerations

Superconducting magnets cause potential safety hazards due to their extended magnetic stray field, their large attractive forces on ferromagnetic objects and their large content of cryogenic liquids. It is the sole responsibility of our customers to ensure safety in their NMR laboratories and to comply with local safety regulations. Bruker/Spectrospin is not responsible for any injuries or damages due to an improper room layout or due to improper operation routines.

Magnetic stray field

It is generally accepted that stray fields are harmless below 3 - 5 Gauss (ten times the earth magnetic field). Stronger stray fields closer to the magnet may disturb heart pace makers, erase magnetic cards and storage devices and adversely affect watches and micro mechanical devices.

It is therefore recommended to mark the 3 - 5 Gauss line with warning signs and to limit access to areas with more than 10 - 20 Gauss field to the NMR staff only. Be aware that a magnetic stray field extends in all three dimensions and does not get blocked by the walls, floor or ceiling. For vertical magnets the vertical extension is even larger than the horizontal one. High fields will also affect the rooms above and below the magnet.

Strong attraction of ferromagnetic objects may occur at close distances to the magnet, where the magnetic field is above 50 to 100 Gauss. Massive iron objects such as pressurized gas cylinders, are extremely dangerous in the vicinity of a superconducting magnet. They should be mounted very close to the door and away from the magnet, or preferably outside the magnet room. Inside the magnet room a wall mounted gas distribution system is recommended.

Strayfield	Remarks and recommendations
below 0.3 mTesla	This region can be opened to the public without restrictions.
between 0.3 mTesla and 0.5 mTesla	This region can be used semi publicly (offices, storage areas), if the magnetic stray field is over 0.3 mTesla only in areas of the room normally not entered by persons wearing a pace maker device (floor, ceiling, corners).
between 0.5 mTesla and 1.0 mTesla	Admission should be forbidden for persons with pace makers and clear warning signs should be fixed on all doors.
Over 1.0 mTesla	Access must be limited to NMR staff only, by a locked door or by similar means. Admission is clearly forbidden for persons with pace makers and clear warning signs must be fixed on all doors.
Over 5.0 mTesla	Plastic chains or floor markings should be used to indicate the safety limit for attraction of iron objects.

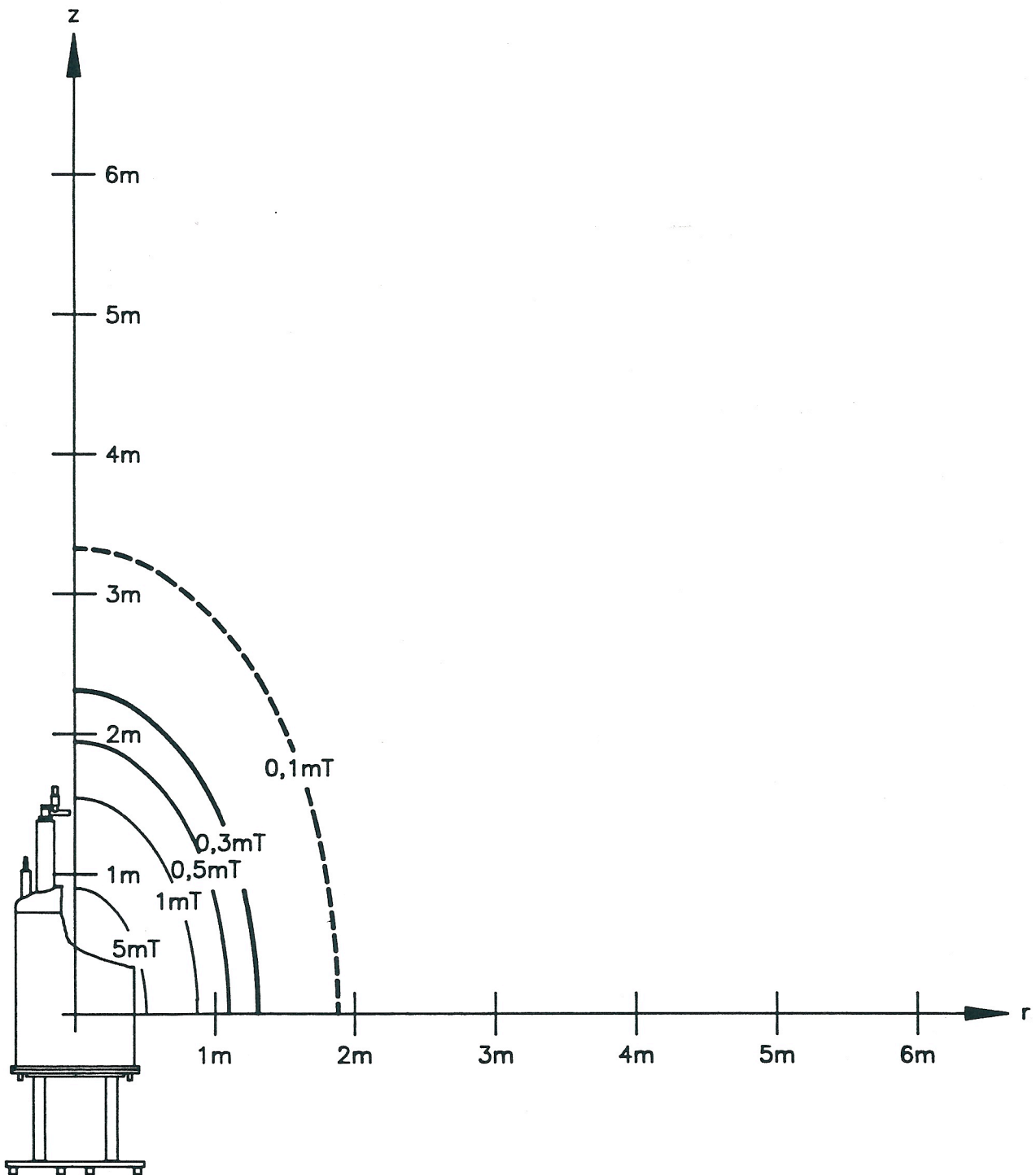
Note:

- 1 mTesla = 10 Gauss
- warning signs are delivered with each magnet.

Additional signs can be obtained from every Bruker or Spectrospin office.

3.10 Stray Field Plot

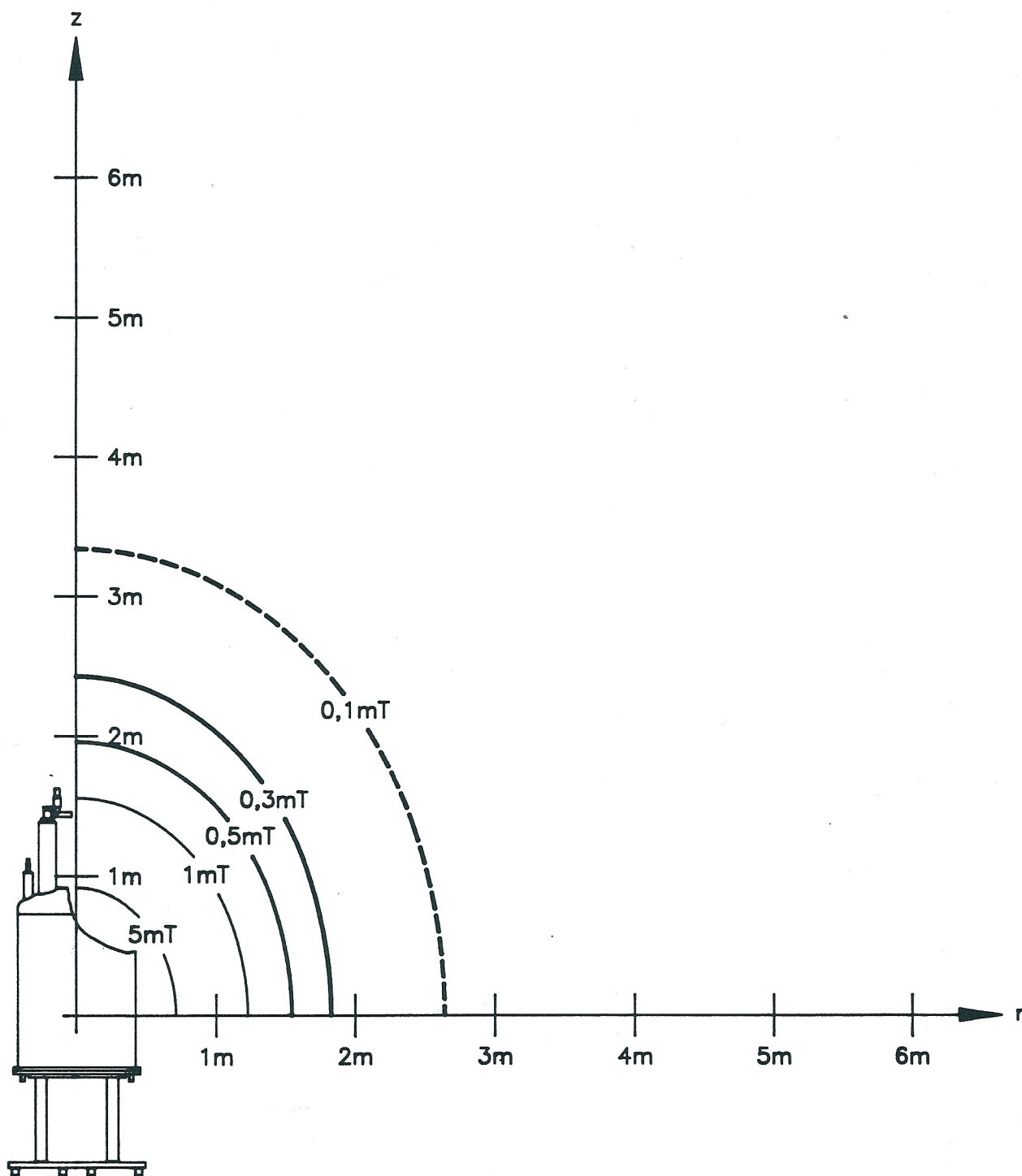
200/67G



0,1mT = 1 Gauss

3.10 Stray Field Plot

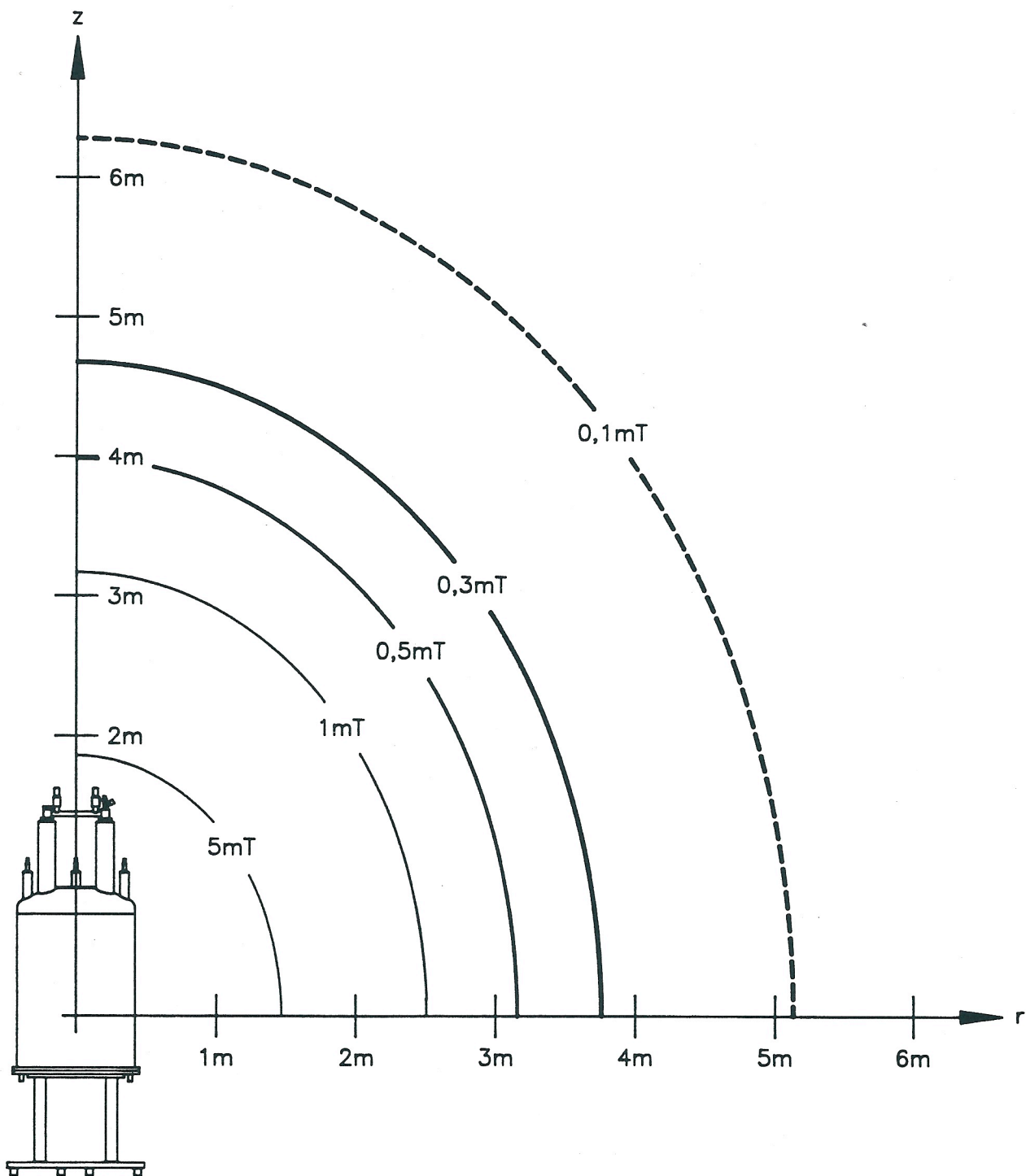
300/67H



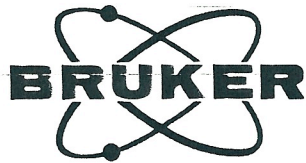
0,1mT = 1 Gauss

3.10 Stray Field Plot

500/67E

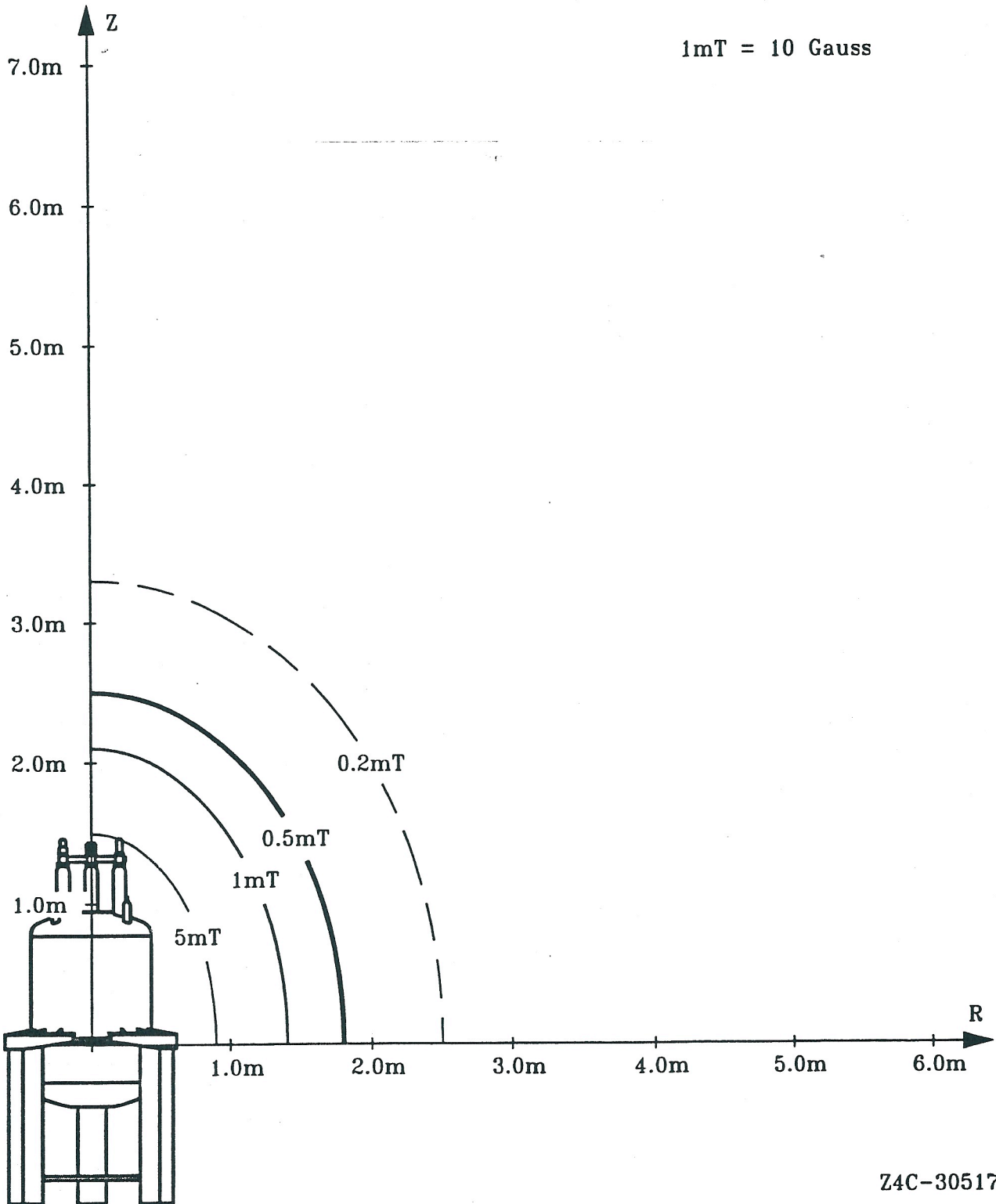


0,1mT = 1 Gauss



3.15 Stray Field Plot

UltraShield™ 600/70D



Z4C-30517A

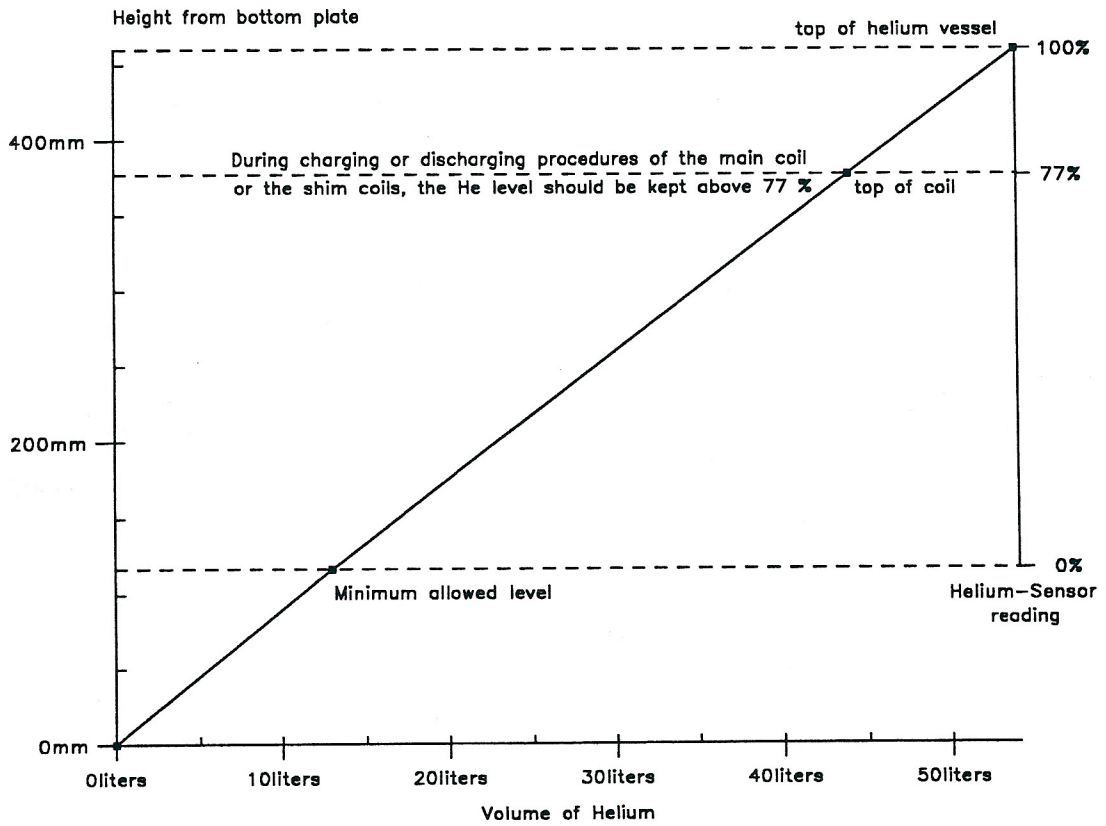
4.3 Liquid Helium

**Dewar 131/52
Helium Levelsensor 950/360N**

Initial filling		56 ltr
Volume between maximum and minimum allowed level		ca. 44 ltr
Boil off rate	+))	ca. 9 mltr/h
Hold time	++))	> 200 days

+) Mean value measured under normal conditions.
 ++)) Maximum time interval between two fillings.

4.3.1 Helium Level Graph



4.4 Liquid Nitrogen

131/52

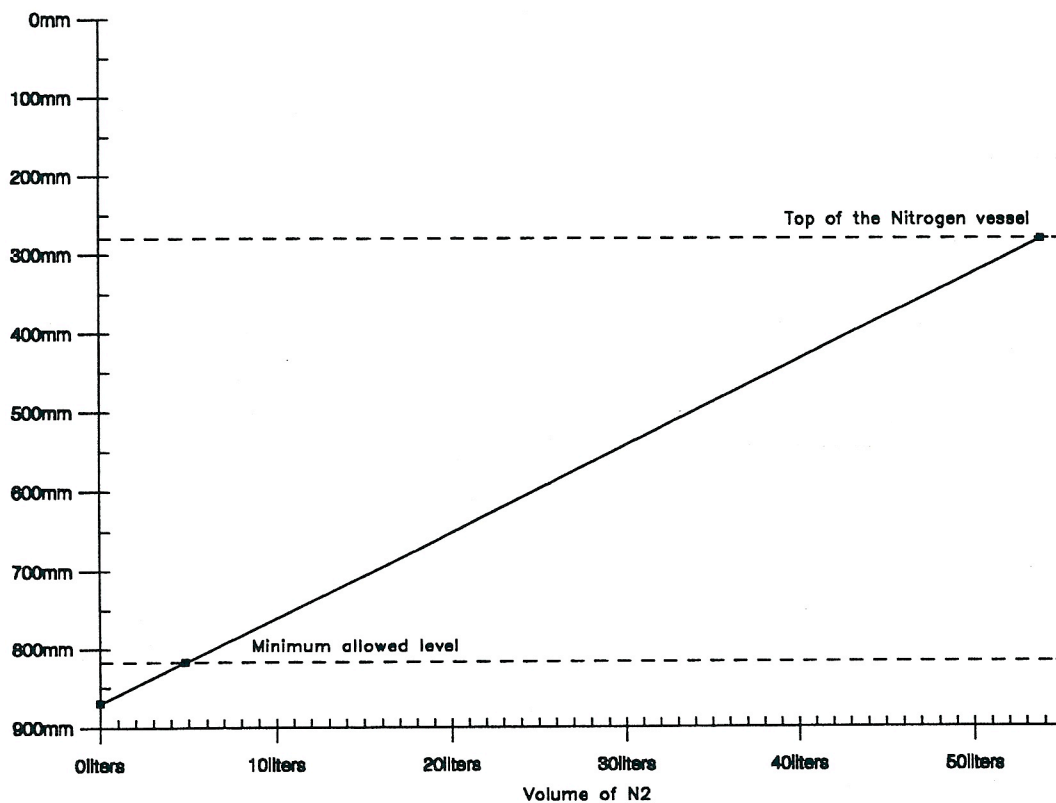
Initial filling		54 ltr
Volume between maximum and minimum allowed level		40 ltr
Boil off rate	*)	< 200 mltr/h
Hold time	**)	> 10 days

*) Mean value measured under normal conditions

***) Maximum time interval between two fillings.

4.4.1 Nitrogen Level Graph

Height from the top of N2 filling tube (mm)



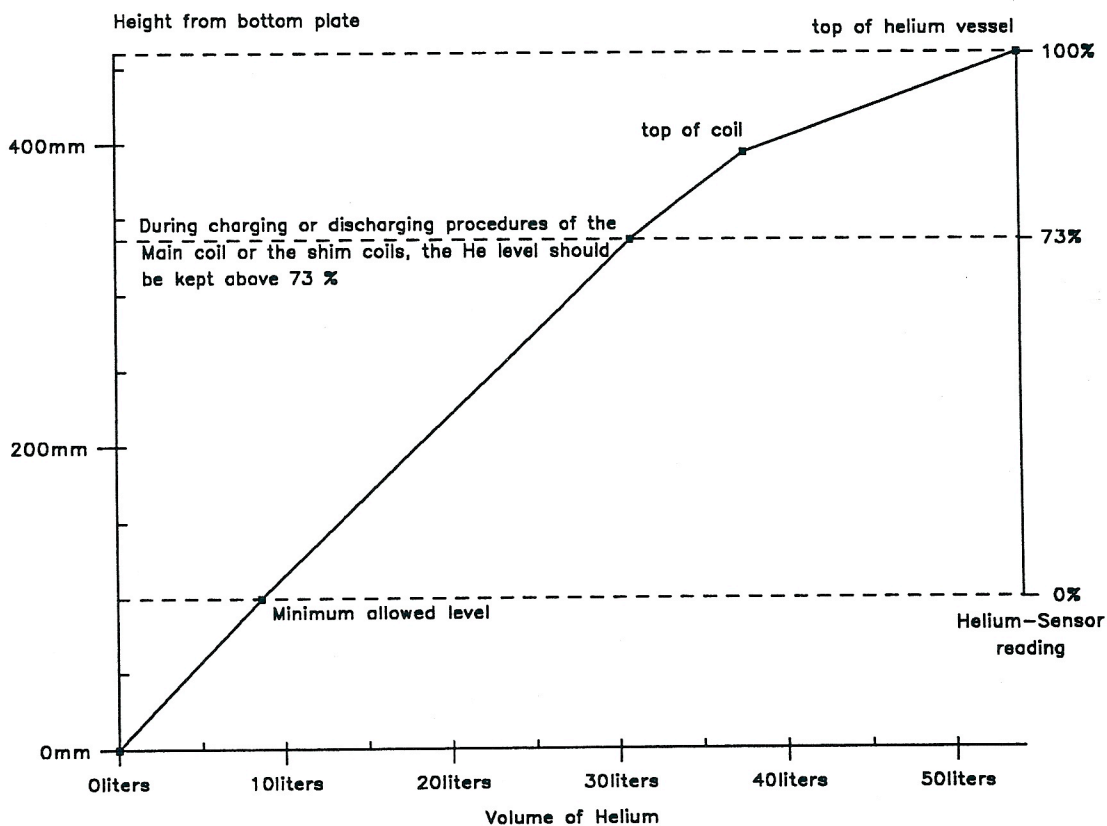
4.3 Liquid Helium

Dewar 131/52
Helium Levelsensor 950/360N

Initial filling		54 ltr
Volume between maximum and minimum allowed level		ca. 45 ltr
Boil off rate	+))	ca. 9 mltr/h
Hold time	++))	> 180 days

+) Mean value measured under normal conditions.
++)) Maximum time interval between two fillings.

4.3.1 Helium Level Graph



4.4 Liquid Nitrogen

131/52

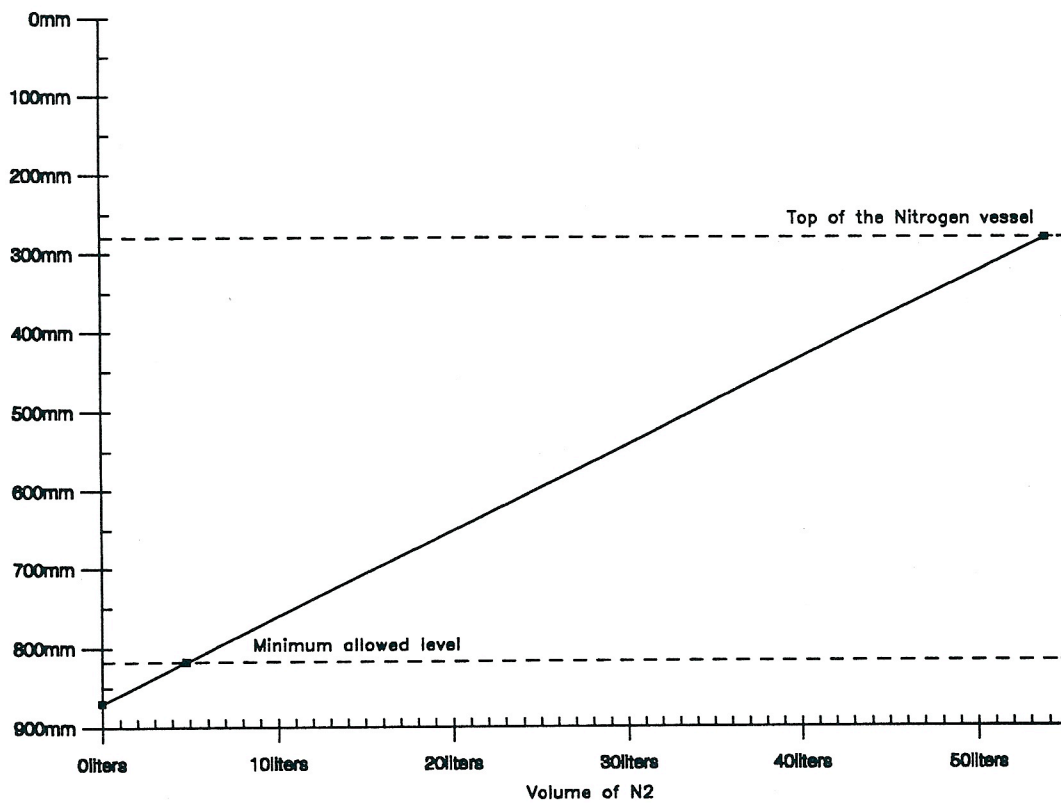
Initial filling		54 ltr
Volume between maximum and minimum allowed level		49 ltr
Boil off rate	*)	< 200 mltr/h
Hold time	**)	> 10 days

*) Mean value measured under normal conditions

***) Maximum time interval between two fillings.

4.4.1 Nitrogen Level Graph

Height from the top of N2 filling tube (mm)



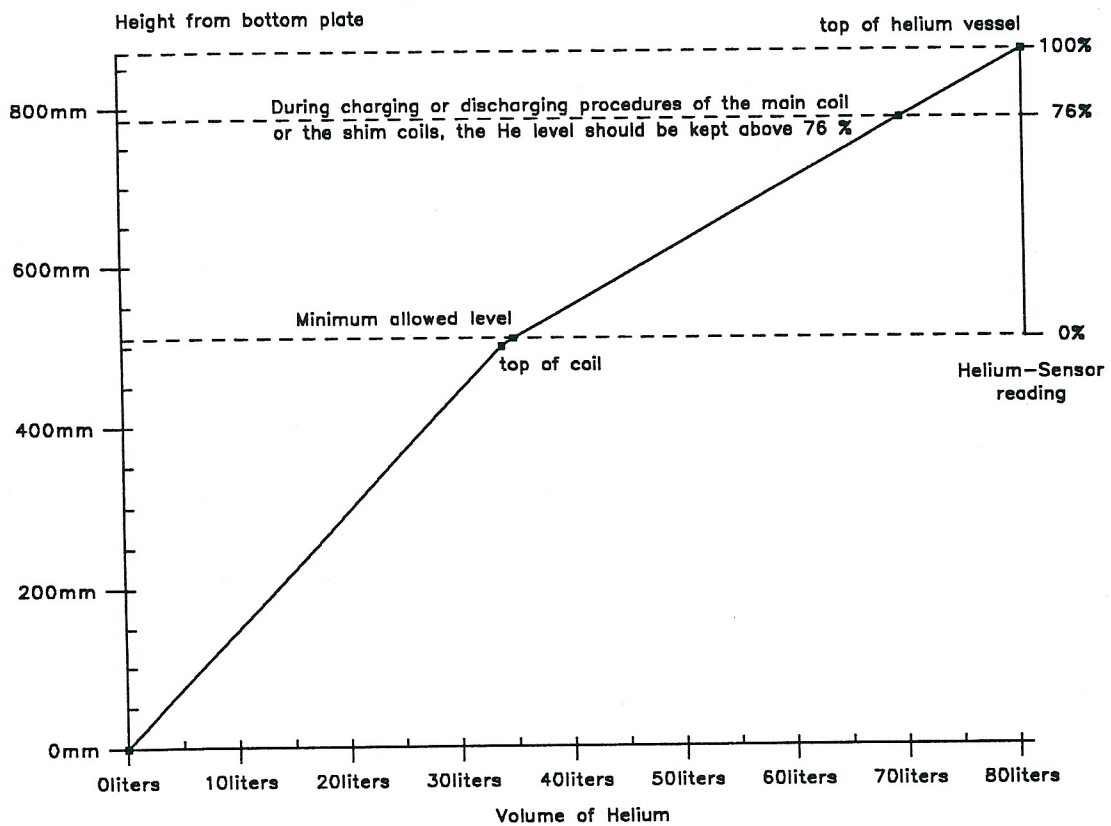
4.3 Liquid Helium

Dewar 122/52
Helium Levelsensor 1000/360S

Initial filling		81 ltr
Volume between maximum and minimum allowed level		47 ltr
Boil off rate	+))	ca. 16 mltr/h
Hold time	++))	> 125 days

+) Mean value measured under normal conditions.
++)) Maximum time interval between two fillings.

4.3.1 Helium Level Graph



4.4 Liquid Nitrogen

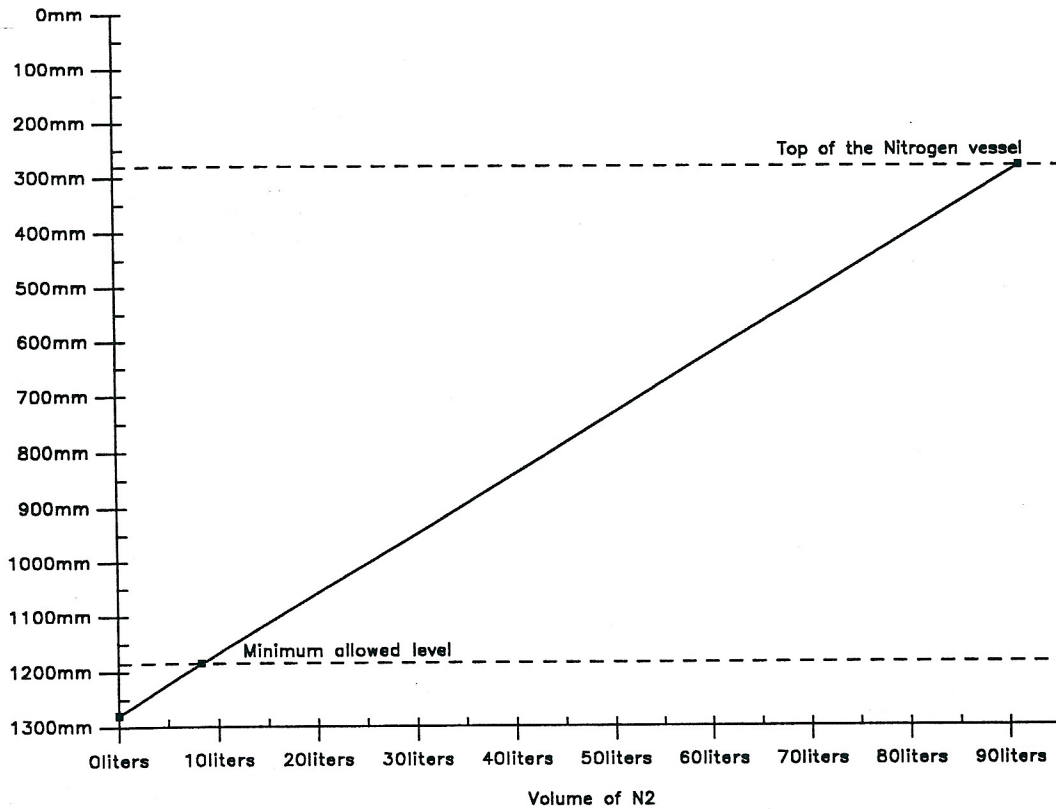
122/52

Initial filling		91,5 ltr
Volume between maximum and minimum allowed level		83 ltr
Boil off rate	*)	< 240 mltr/h
Hold time	**)	> 14 days

- *) Mean value measured under normal conditions
 **) Maximum time interval between two fillings.

4.4.1 Nitrogen Level Graph

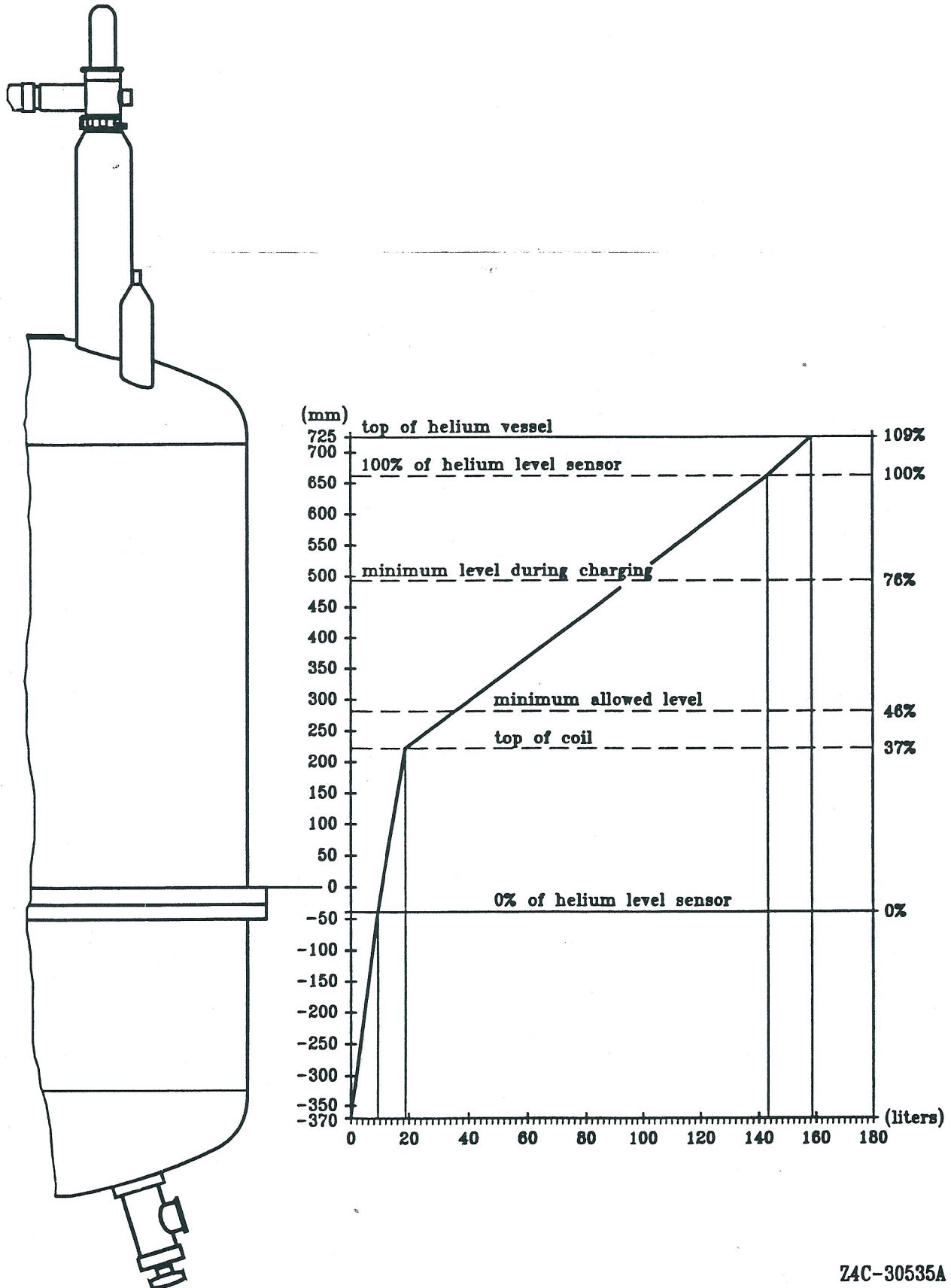
Height from the top of N2 filling tube (mm)





4.18 Helium Level Graph

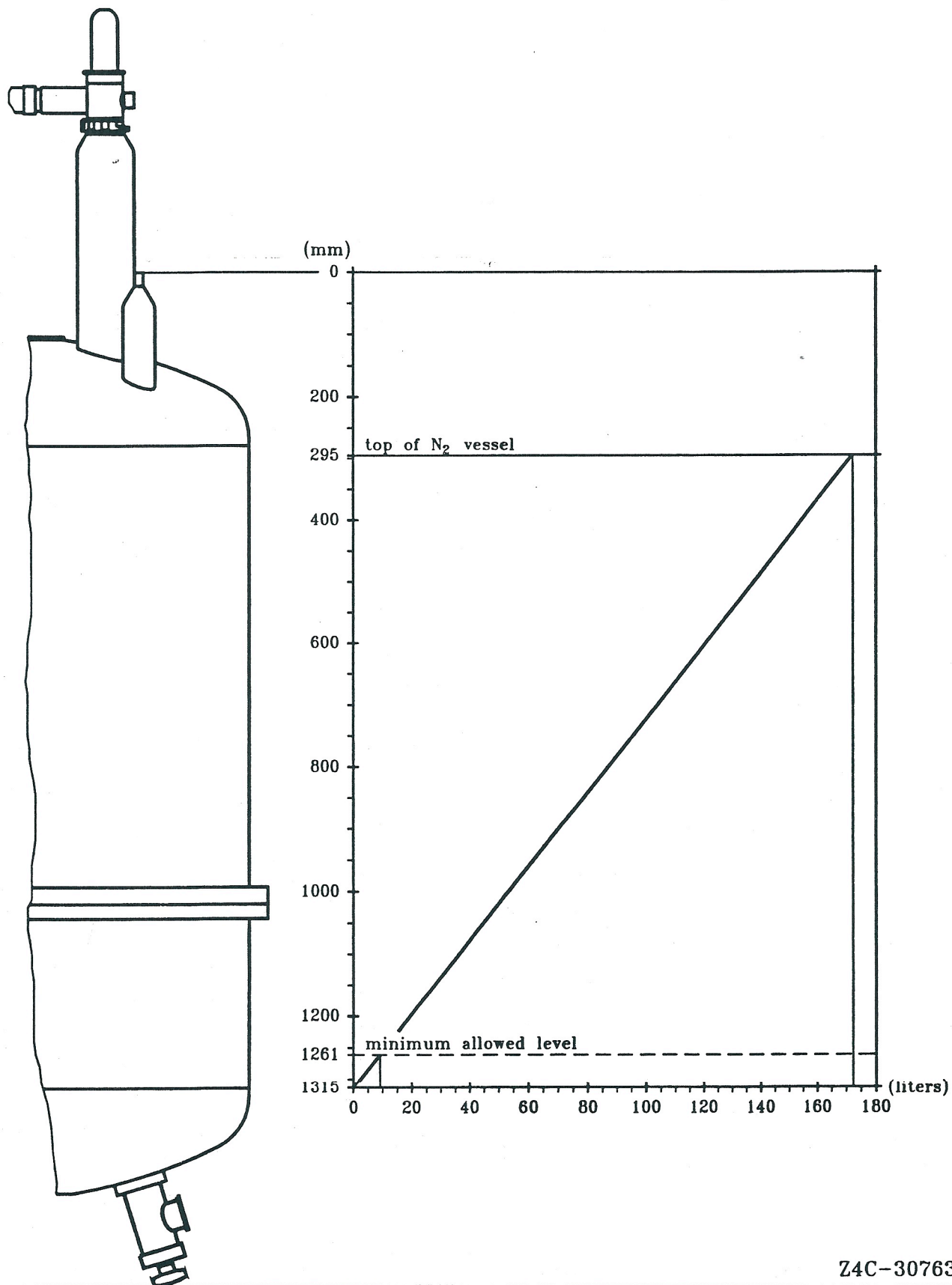
Helium Level Sensor 1300/700N



Z4C-30535A



4.19 Nitrogen Level Graph



Z4C-30763