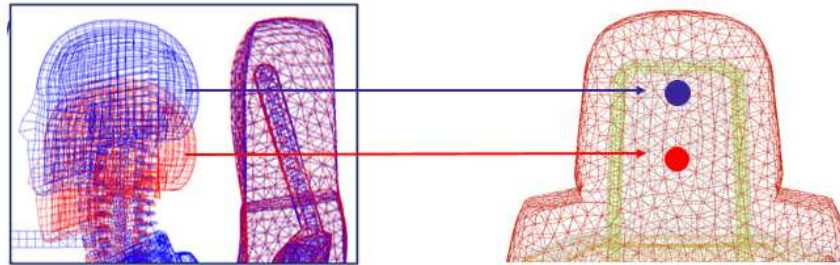




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EQOP - WHIPLASH IMPROVEMENTS

- Relative vertebrae movements when restraining rearward head movement of 50th female



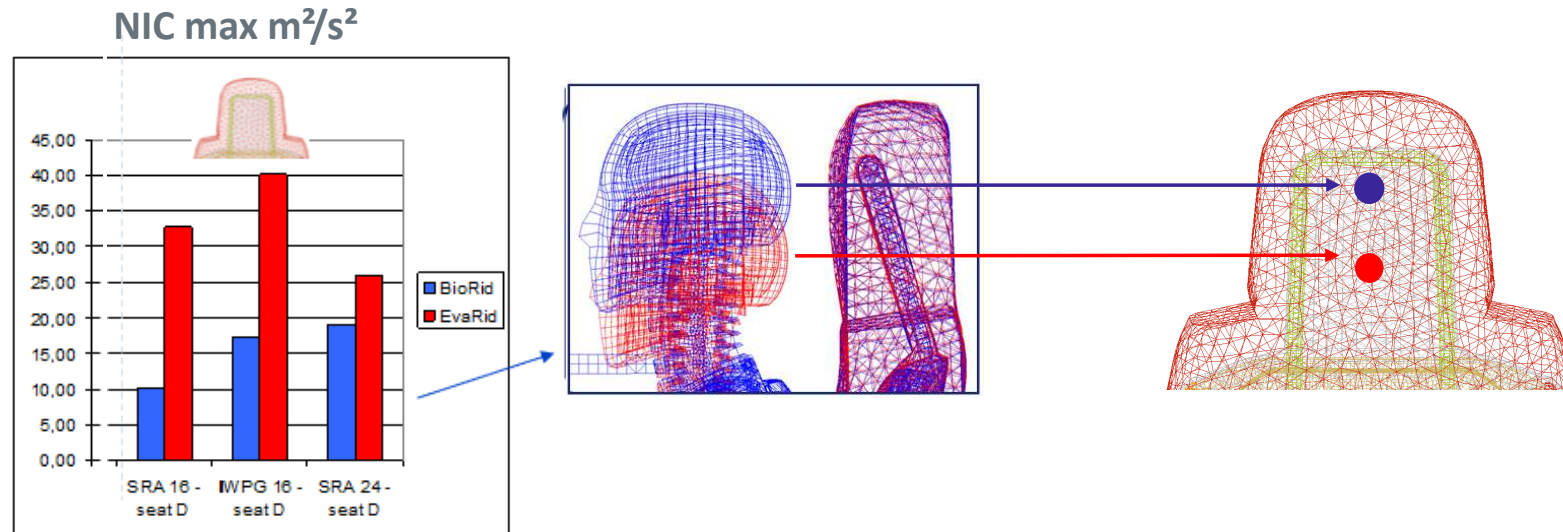
- It was shown in the ADSEAT EU project that in some seats the head of some sizes of occupants may be not equally well retained in low speed rear impact.
- CLEPA proposes therefore an additional geometric check to avoid that smaller occupants could be in a situation where – in spite of adjusting the head restraint to the lowest position – no structural parts of the head restraint



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Difference of whiplash performance mid-size male/female

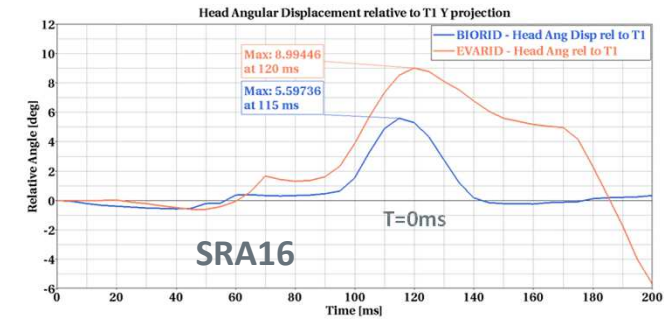
It was shown that the NIC value varied considerable between EvaRid and Biorid at the 3 different whiplash pulses SRA16, IIWPG16 and SRA 24



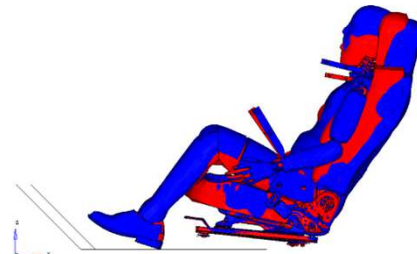
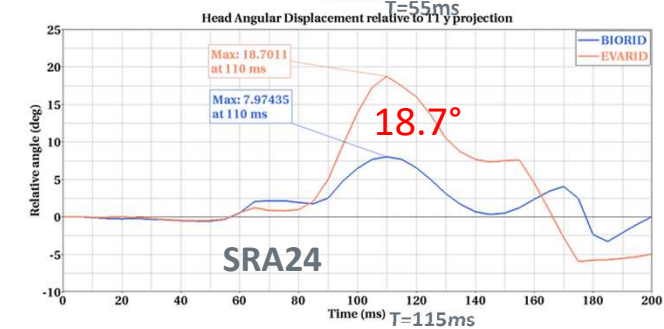
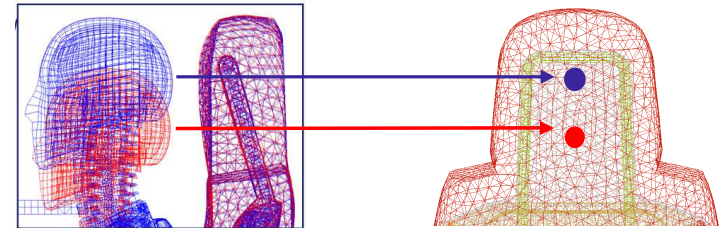
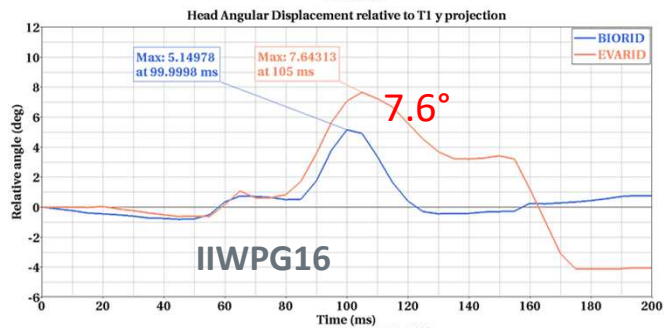
Head of 50th female not sufficiently restrained



Comparison EvaRid – BioRid : head rotation relative to T1



The relative rotation of the head versus T1 of the Evarid is higher at all speeds than for the BIORID



This is caused by a lack of retention of the head at lower heights



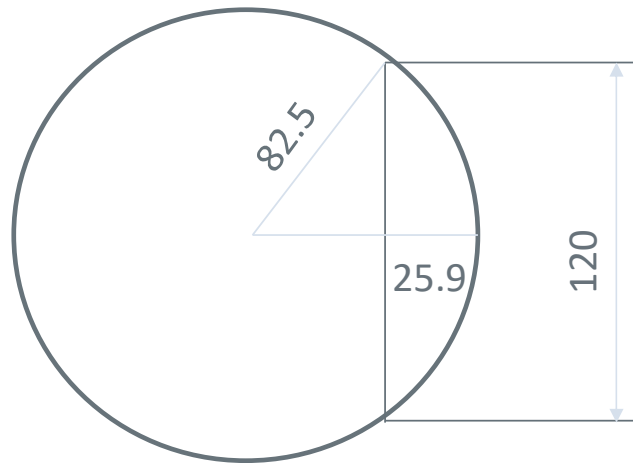
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EqOP - WHIPLASH improvements

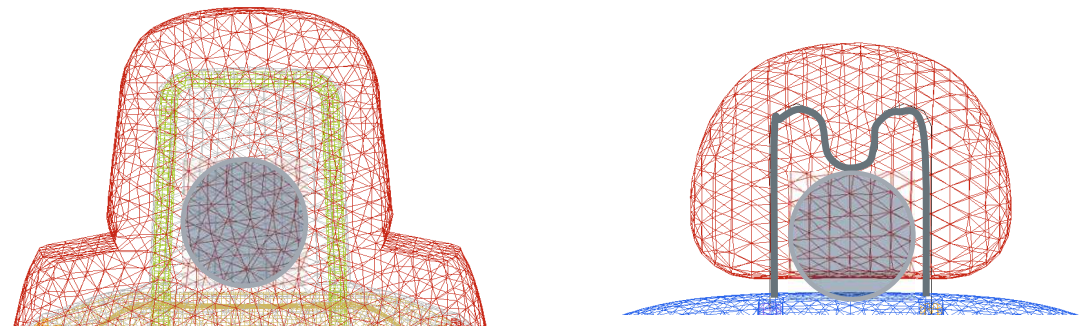
Whiplash for males and females – Proposal – Clepa

of Backset retention zone :

- Using a cylinder of [120mm] would limit the penetration of a sphere of a diameter of 165mm to [25.9]mm



Clepa has therefore proposed to limit intrusion of an occupant head by limiting the areas without structural parts within the head restraint

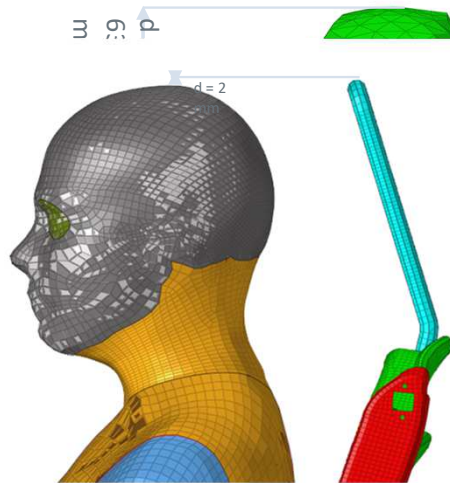




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EqOP - WHIPLASH improvements

Relative vertebrae movements when restraining rearward head movement of 50th female



- > As we have not had anymore an Evarid simulation model, we checked how the vertebrae rotation of a 50th female would be impacted by restraining the movement of the head.
- > We therefore used simulations at 16 km/h IIWPG pulse and Viva+ 50F simulation model with the same seat used in the previous studies.



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EqOP - WHIPLASH improvements

Relative vertebrae movements when restraining rearward head movement of 50th female



- The first simulations showed a significant impact of the crossbar of the head restraint to the 50th female Viva+ model, we have therefore taken the decision to increase the head restraint to have no influence of the upper crossbar of the head restraint to the results.



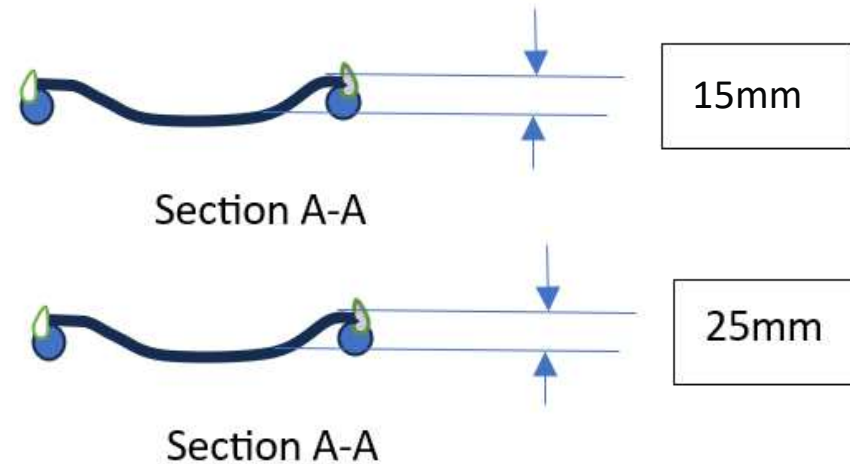
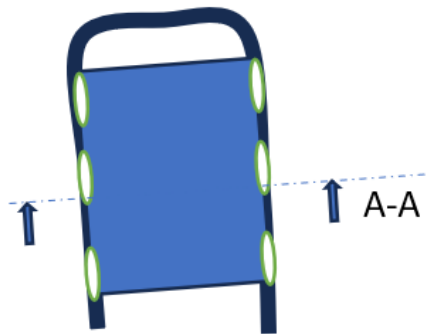
Transmitted by the expert from the CLEPA

EqOP - WHIPLASH improvements

Methodology :

3 simulations :

- original seat, but with higher crossbar on head restraint
- head restraint structure with plate limiting intrusion to 25mm
- head restraint structure with plate limiting intrusion to 15mm





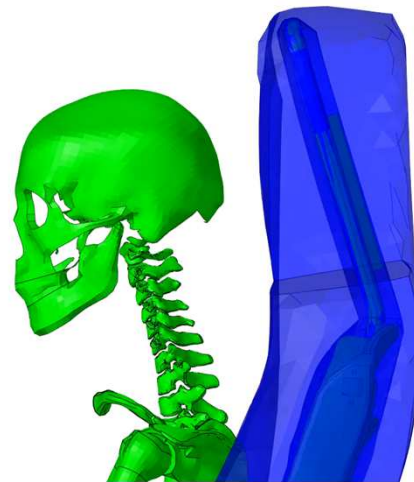
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EqOP - WHIPLASH improvements

Methodology :

Results :

The relative movement of the neck vertebrae were compared to each other.



GR246554:
VIVA 50F (tube extension) - BLUE
GR246904:
VIVA 50F (intrusion 25 mm) - GREEN
Time : 0.00 ms

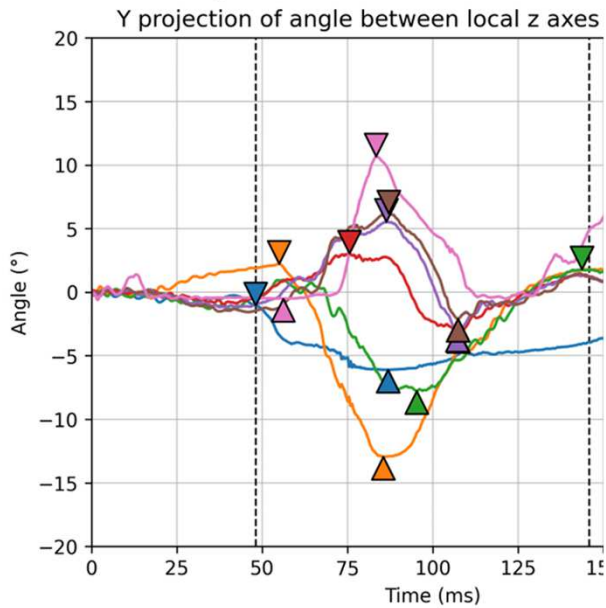


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EqOP - WHIPLASH improvements

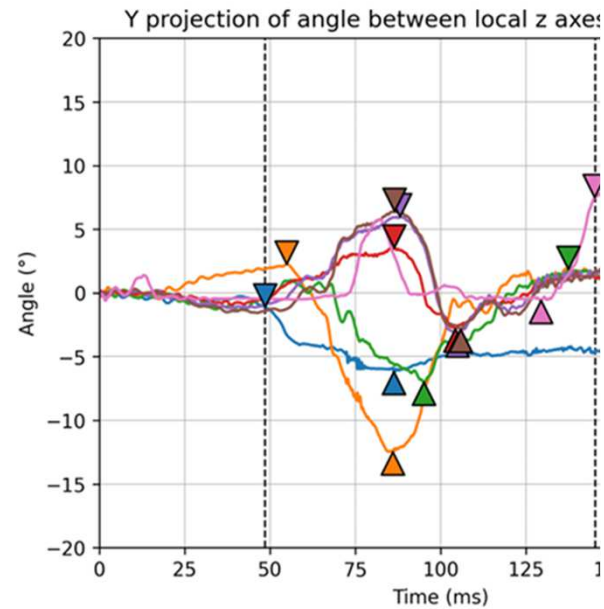
Vetebrae rotation by limiting rearward head intrusion into the head restraint.

Adseat head restraint
with higher crossmember



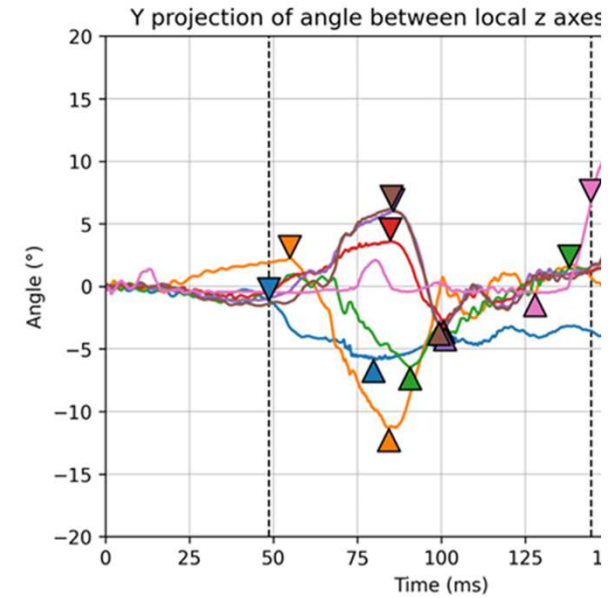
C7_wrt_T1 Max = -1.1 at 48, Min = -6.1 at 87
 C6_wrt_C7 Max = 2.2 at 55, Min = -13.0 at 86
 C5_wrt_C6 Max = 1.8 at 144, Min = -7.8 at 95
 C4_wrt_C5 Max = 3.0 at 76, Min = -3.0 at 108
 C3_wrt_C4 Max = 5.5 at 86, Min = -2.9 at 107
 C2_wrt_C3 Max = 6.2 at 87, Min = -2.1 at 107
 C1_wrt_C2 Max = 10.7 at 83, Min = -0.5 at 56

Intrusion limited to
25mm



C7_wrt_T1 Max = -1.1 at 49, Min = -6.2 at 86
 C6_wrt_C7 Max = 2.2 at 55, Min = -12.5 at 86
 C5_wrt_C6 Max = 1.8 at 137, Min = -7.0 at 95
 C4_wrt_C5 Max = 3.5 at 86, Min = -2.8 at 104
 C3_wrt_C4 Max = 6.0 at 88, Min = -3.2 at 105
 C2_wrt_C3 Max = 6.4 at 87, Min = -2.9 at 106
 C1_wrt_C2 Max = 7.5 at 145, Min = -0.6 at 129

Intrusion limited to
15mm



C7_wrt_T1 Max = -1.1 at 49, Min = -5.9 at 80
 C6_wrt_C7 Max = 2.2 at 55, Min = -11.4 at 84
 C5_wrt_C6 Max = 1.5 at 138, Min = -6.5 at 91
 C4_wrt_C5 Max = 3.6 at 85, Min = -2.7 at 101
 C3_wrt_C4 Max = 6.0 at 86, Min = -3.3 at 101
 C2_wrt_C3 Max = 6.2 at 85, Min = -2.9 at 99
 C1_wrt_C2 Max = 6.7 at 145, Min = -0.6 at 128



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EqOP - WHIPLASH improvements

Results :

The relative rotation of the neck vertebrae were compared to each other and the rotation decreased for most vertebrae when intrusion was limited to 25mm or 15mm.

The largest decrease in rotation was observed for the C1/C2 vertebrae

Limits :

The Viva+ 50F does not indicate a neutral position for the vertebrae. It is therefore not clear how many degrees forward/rearward are acceptable.



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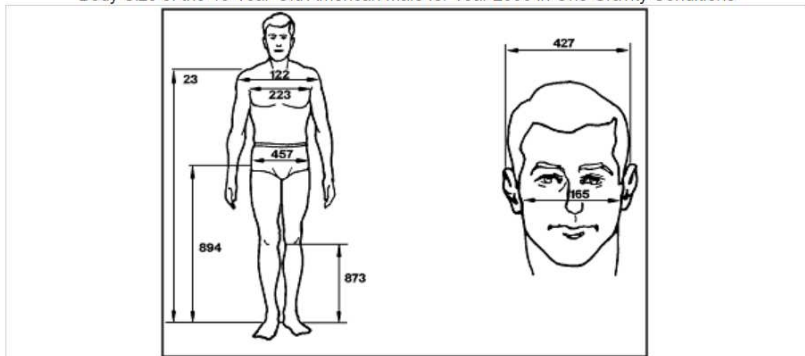
EqOP - WHIPLASH improvements

> Geometric considerations :

Width of the head of occupants according NASA anthropomorphic database in cm (inch) :

Figure 3.3.1.3-1 (8 of 12) Anthropometric Dimensional Data for American Male

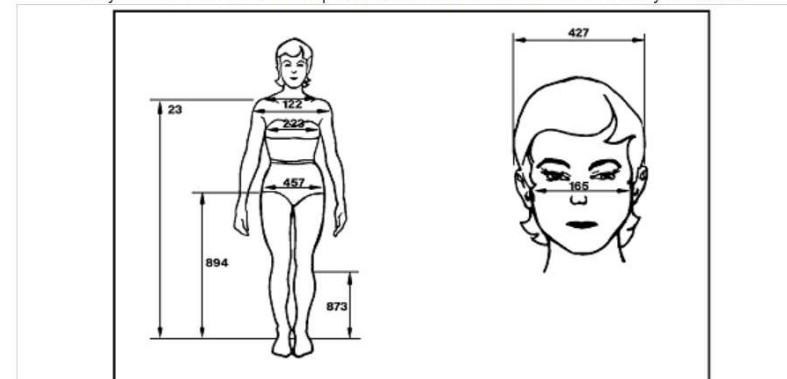
Body Size of the 40-Year-Old American Male for Year 2000 in One Gravity Conditions



Microgravity notes	No.	Dimension	5th percentile	50th percentile	95th percentile
	427	Head breadth	14.8 (5.8)	15.7 (6.2)	16.5 (6.5)

Figure 3.3.1.3-1 (7 of 12) Anthropometric Dimensional Data for American Female

Body Size of the 40-Year-Old Japanese Female for Year 2000 in One Gravity Conditions



Microgravity notes	No.	Dimension	5th percentile	50th percentile	95th percentile
	427	Head breadth	14.4 (5.7)	15.6 (6.1)	16.8 (6.6)

The width of a 95% head (male or female) is about 165 – 168 mm

The width of a 5% head (male or female) is about 144 – 148 mm

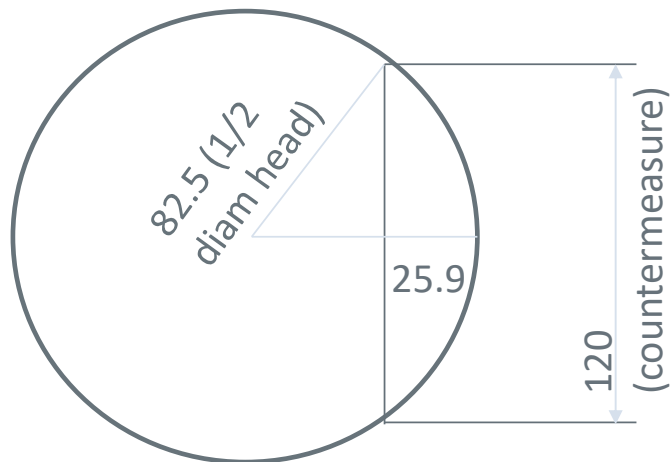


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EqOP - WHIPLASH improvements

> Geometric considerations :

Recalculating intrusion with different head diameters and different countermeasures (120mm, 100mm)



Head diam.	Countermeasure	Head intrusion in mm
165	120	25,9
165	100	16,9
155	120	28,5
155	100	18,3
145	120	31,8
145	100	20