- ambient temperature of the concrete during installation of the anchor;
- admissible processing time (open time) of a cartridge;
- curing time until the anchor may be loaded as a function of the ambient temperature in the concrete during installation;
- torque moment;
- identification of the manufacturing batch.

All data shall be presented in a clear and explicit form.

5.2 Recommendations concerning packaging, transport and storage

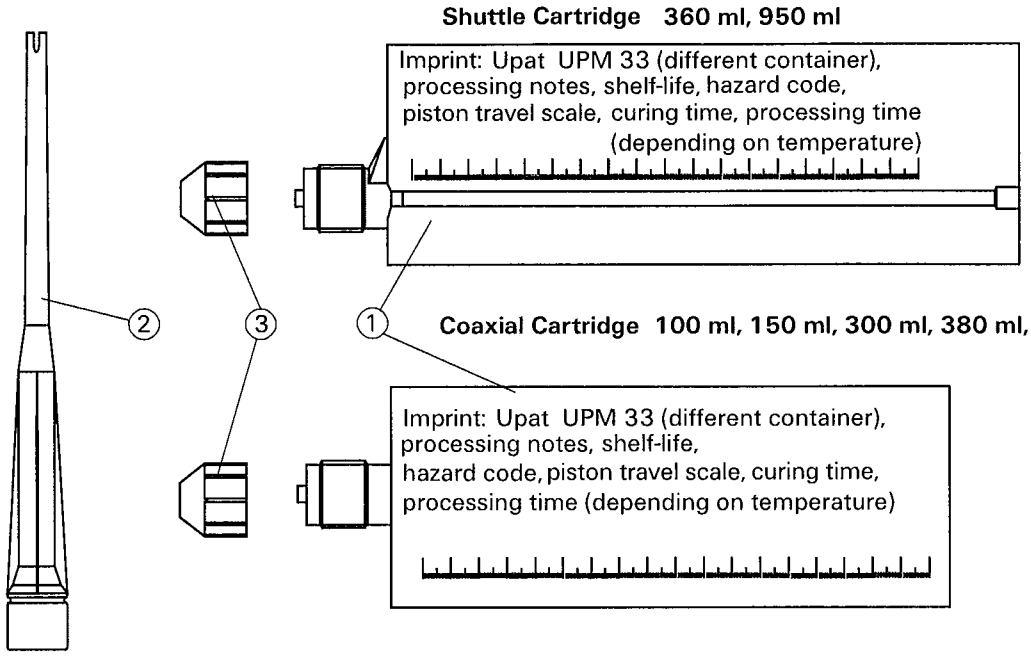
The injection cartridges shall be protected against sun radiation and shall be stored according to the manufacture's installation instructions in dry condition at temperatures of at least +5 °C to not more than +25 °C.

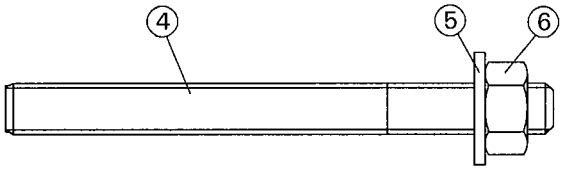
Mortar cartridges with expired shelf life must no longer be used.

The Anchor shall only be packaged and supplied as a complete unit. Injection cartridges and the elements for in-place anchorages being packed separately from anchor rods, nuts and washers or internal threaded anchor.

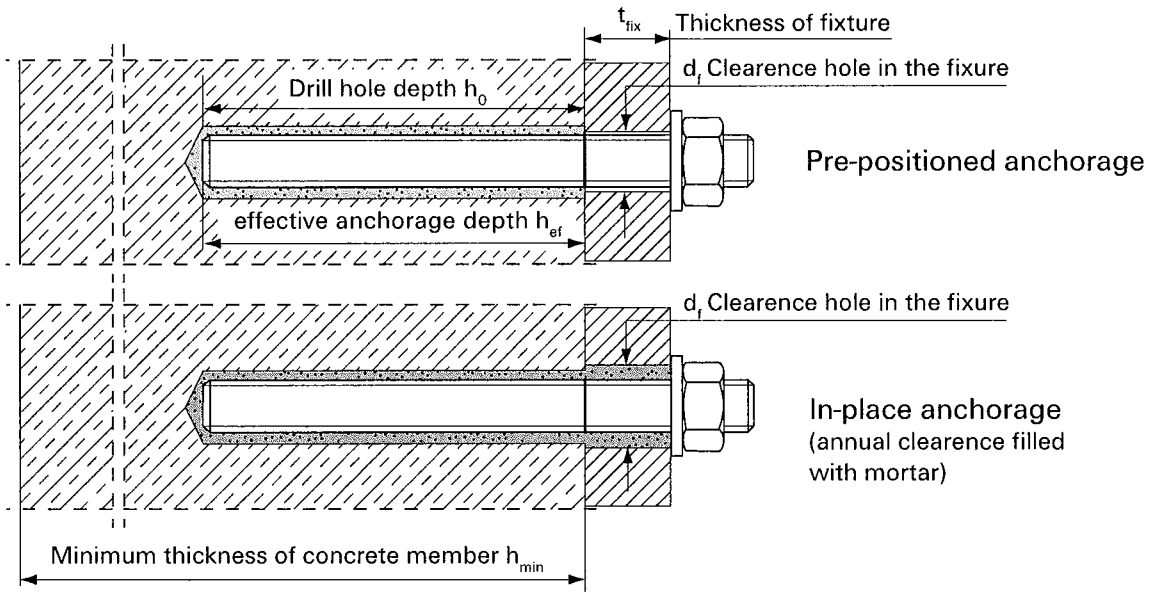
Dipl.-Ing. Georg Feistel
Head of Division Construction Engineering
of Deutsches Institut für Bautechnik
Berlin, 9 July 2010

beglaubigt
Lange





1 Cartridge UPM 33
2 Static mixer
3 Sealing cap
4 Anchor rod
5 Washer
6 Hexagon nut



Intended use in dry and wet concrete

Injection system Upat UPM 33	**Annex 1** of European Technical Approval ETA-10/0171
Product and intented use	

Doc: UPM 33.03.10

Anchor rod M8, M10, M12, M16, M20, M24, M30

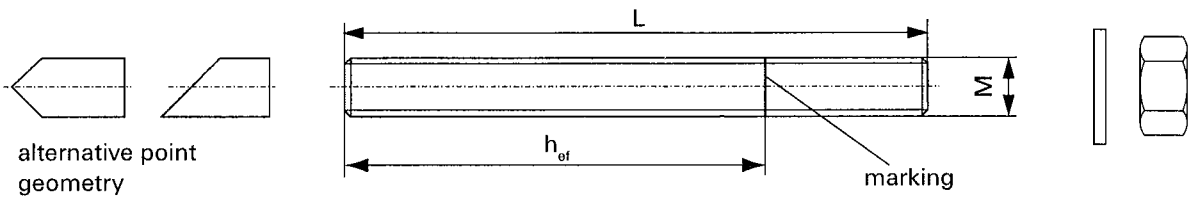


Table 1: Anchor dimensions

Size			M8	M10	M12	M16	M20	M24	M30
Effective anchorage depth h_{ef}	$h_{ef\,min}$	[mm]	64	80	96	125	160	192	240
	$h_{ef\,max}$	[mm]	96	120	144	192	240	288	360
Length of threaded rod L	L_{min}	[mm]	75	95	115	150	190	230	280
	L_{max}	[mm]	1500						

Table 2: Materials

Designation	Materials	
	Steel, zinc plated	**Stainless steel (A4)**
Anchor rod	Property class 5.8 or 8.8; EN ISO 898-1 zinc plated ≥ 5µm, EN ISO 4042 A2K or hot-dip galvanised ≥ 45 µm, EN ISO 10684	Property class 70 EN ISO 3506 EN 10 088 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
Washer	EN ISO 898-1 zinc plated ≥ 5µm, EN ISO 4042 A2K or hot-dip galvanised ≥ 45 µm, EN ISO 10684	EN 10 088 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362
Hexagon nut according to EN 24 032	Property class 5 or 8; EN ISO 20898-2 zinc plated ≥ 5µm, EN ISO 4042 A2K or hot-dip galvanised ≥ 45 µm, EN ISO 10684	Property class 70 EN ISO 3506 EN 10 088 1.4401; 1.4404; 1.4578; 1.4571; 1.4439; 1.4362

Table 3: Temperatur ranges

Temperature range	max long term temperature	max short term temperature
I (-40°C to +80°C)	+50°C	+80°C
II (-40°C to +120°C)	+72°C	+120°C

Injection system Upat UPM 33	**Annex 2** of European Technical Approval ETA-10/0171
Anchor dimensions Materials Temperature ranges	

Table 4: Processing time of the mortar and minimum curing time

(During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature).

Concrete temperature [°C]	Minimum curing time[1] [minutes]
-5 to 0	24 hours
≥0 to +5	3 hours
≥+5 to +10	90
≥+10 to +20	60
≥+20 to +30	45
≥+30 to +40	35

System-temperature (mortar) [°C]	Processing time [minutes]
+ 5	13
+ 10	9
+ 20	5
+ 30	4
+ 40	2

[1] For wet concrete the curing time must be doubled.

Table 5: Installation parameters

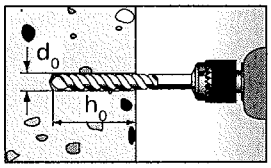
Size			**M 8**	**M 10**	**M 12**	**M 16**	**M 20**	**M 24**	**M 30**
Nominal drill hole diameter		d_0 = [mm]	10	12	14	18	24	28	35
Cutting diameter of drill bit		$d_{cut} \leq$ [mm]	10,45	12,50	14,50	18,50	24,55	28,55	35,70
Depth of drill hole for	$h_{ef\,min}$	$h_0 \geq$ [mm]	64	80	96	125	160	192	240
Depth of drill hole for	$h_{ef\,max}$	$h_0 \geq$ [mm]	96	120	144	192	240	288	360
Diameter of clearance hole in the fixture	Pre-positioned anchorage	$d_f \leq$ [mm]	9	12	14	18	22	26	33
	In-place anchorage	$d_f \leq$ [mm]	11	14	16	20	26	30	40
Diameter of steel brush		d_b = [mm]	11	13	16	20	26	30	40
Torque moment		$T_{inst,max}$ = [Nm]	10	20	40	60	120	150	300
Thickness of fixture	t_{fix}	min [mm]	0						
		max [mm]	1.500						

Steel brush

Injection system Upat UPM 33	**Annex 3** of European Technical Approval ETA-10/0171
Processing time and curing time Installation parameters Steel brush	

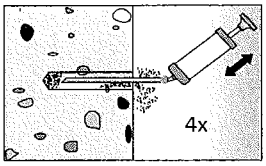
Drilling and cleaning the hole

1



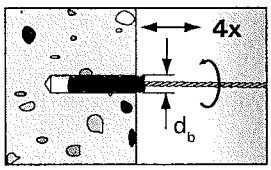
Drill the hole.
Drill hole diameter $\mathbf{d_0}$ and
drill hole depth $\mathbf{h_0}$ see **Table 5**.

2



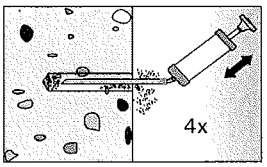
Blow out the drill hole four times. For drill hole diameter $d_0 \geq 18$ mm and drill hole depth $h_0 \geq 150$ mm use oil-free pressure air (P > 6 bar).

3



Brush the drill hole four times, using a steel brush. Diameter of steel brush see **Table 5**. For deep holes use an extension.

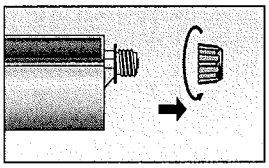
4



Blow out the drill hole four times. For drill hole diameter $d_0 \geq 18$ mm and drill hole depth $h_0 \geq 150$ mm use oil-free pressure air (P > 6 bar).

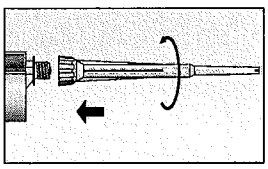
Preparing the cartridge

5



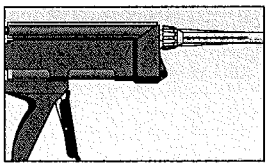
Remove the sealingcap.

6



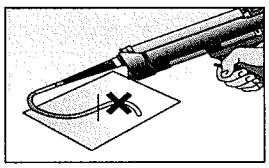
Screw down the static mixer. (the spiral mixer in the statik mixer must be clearly visible)

7



Place the cartridge into the applicator gun.

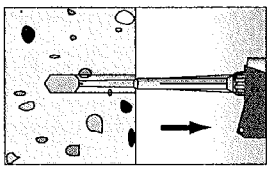
8



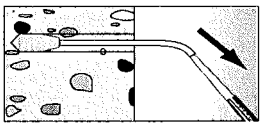
Press approx 10 cm of material out until the resin is evenly grey in colour. Don`t use mortar that is not uniformly gray.

Install the anchor rod

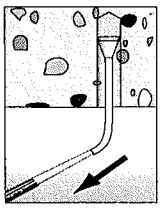
9



Fill approx. 2/3 of the drill hole with mortar. Allways begin from the surface of the hole and avoid bubbles.

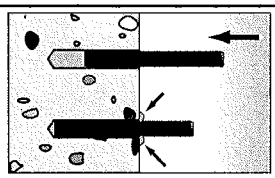


For $h_0 \geq 150$ mm use an extention hose.

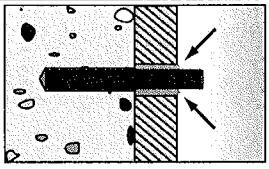


For overhead installation or deep holes $h_0 > 250$ mm use an injectionadapter.

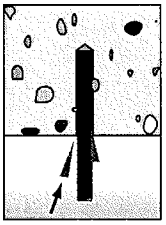
10



Only use clean and oil-free anchors. Mark the anchor for setting depth. Press the anchor rod down to the bottom of the hole, turning it slightly while doing so. Inserting the anchor element, excess mortar must emerge from the mouth of the hole.



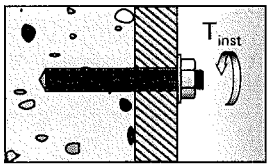
For in-place anchorage fill the annual clearence with mortar.



For overhead installation support the anchor-rod with wedges.

11

Wait for the specified curing time, t_{cure} see **Table 4**



Mounting the fixure.
$T_{inst,max}$ see **Table 5**

Injection system Upat UPM 33	**Annex 4** of European Technical Approval ETA-10/0171
Installation instructions	

Table 6: Minimum distances and member thickness

Anchor size		M8		M10		M12		M16		M20		M24		M30	
	[2]	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$
Effective anchorage depth[1]	h_{ef} [mm]	64	96	80	120	96	144	125	192	160	240	192	288	240	360
Minimum thickness of concrete member	h_{min} [mm]	h_{ef} + 30 mm ≥ 100 mm						h_{ef} + 2 d_0							
Minimum edge distance and spacing	min s = min c [mm]	40		45		55		65		85		105		140	

[1] Anchorage depth $h_{ef,min} \le h_{ef} \le h_{ef,max}$ is possible. The minimum member thickness may be interpolate straight proportional.

[2] $h_{ef,min} < h_{ef} < h_{ef,max}$ is possible

Table 7: Characteristic values to tension loads

Steel failure										
Anchor size			M8	M10	M12	M16	M20	M24	M30	
Characteristic resistance	$N_{Rk,s}$	property class 5.8 [kN]	19	30	44	82	127	183	292	
		property class 8.8 [kN]	29	46	67	126	196	282	449	
		property class A4 [kN]	26	41	59	110	171	247	392	
		property class 70 C [kN]	26	41	59	110	171	247	392	
Partial safety factor	γ_{Ms} [1]	property class 5.8 [-]	1,48							
		property class 8.8 [-]	1,50							
		property class A4 [-]	1,87							
		property class 70 C [-]	1,50							
Combined pullout and concrete failure										
Diameter for calculation		d [mm]	8	10	12	16	20	24	30	
Effective anchorage depth[3]	h_{ef}	$h_{ef,min}$ [mm]	64	80	96	125	160	196	240	
		$h_{ef,max}$ [mm]	96	120	144	192	240	288	360	
Temperature range I (-40°C/+80°C), non-cracked concrete C20/25										
Characteristic bond resistance	$\tau_{Rk,ucr}$	[N/mm²]	10,5	10,5	10,5	10,0	9,5	9,0	8,5	
Edge distance	$c_{cr,Np}$	[mm]	100	125	145	185	225	265	320	
Spacing	$s_{cr,Np}$	[mm]	200	250	290	370	450	530	640	
Temperature range II (-40°C/+120°C), non-cracked concrete C20/25										
Characteristic bond resistance	$\tau_{Rk,ucr}$	[N/mm²]	9,0	9,0	9,0	8,5	8,0	7,5	7,0	
Edge distance	$c_{cr,Np}$	[mm]	95	115	135	170	210	240	290	
Spacing	$s_{cr,Np}$	[mm]	190	230	270	340	420	480	580	
Increasing factors	ψ_c	C25/30 [-]	1,05							
		C30/37 [-]	1,10							
		C35/45 [-]	1,15							
		C40/50 [-]	1,19							
		C45/55 [-]	1,22							
		C50/60 [-]	1,26							
Partial safety factor	$\gamma_{Mc} = \gamma_{Mp}$ [1]	[-]	1,8 [2]							

[1] In absence of other national regulations. [2] The partial safety factor $\gamma_2 = 1,2$ is included.

[3] $h_{ef,min} < h_{ef} < h_{ef,max}$ is possible.

Injection system Upat UPM 33	**Annex 5** of European Technical Approval ETA-10/0171
Minimum distances and minimum member thicknesses Characteristic values to tension load	

Table 8: Characteristic values of splitting failure

Anchor size		M8		M10		M12		M16		M20		M24		M30	
[4]		$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$	$h_{ef,min}$	$h_{ef,max}$
	[mm]	64	96	80	120	96	144	125	192	160	240	192	288	240	360
h_{min} [1)3)]	[mm]	h_{ef} + 30 mm ≥ 100 mm						h_{ef} + 2 d_0							
$c_{cr,sp}$	[mm]	160	205	200	260	240	310	315	415	395	515	475	620	590	770
h [2)]	[mm]	128	192	160	240	192	288	250	384	320	480	384	576	480	720
$c_{cr,sp}$	[mm]	120	150	150	185	180	225	240	300	300	370	360	445	450	555

[1] $h_{min} = h_{ef} + \Delta h \geq 100mm$; $\Delta h \geq \max\{2d_0; 30mm\}$

[2] $h \geq 2h_{ef}$

[3] For member thickness $h_{min} \leq h \leq 2h_{ef}$ the characteristic edge distances and spacing can be derived by linear interpolation.

[4] $h_{ef,min} \leq h_{ef} \leq h_{ef,max}$ is possible

Table 9: Characteristic values to shear load

Anchor size				M8	M10	M12	M16	M20	M24	M30
Effective anchorage depth	h_{ef} [2)]	h_{min}	[mm]	64	80	96	125	160	192	240
		h_{max}	[mm]	96	120	144	192	240	288	360
Steel failure without lever arm										
characteristic resistance $V_{Rk,s}$	property class	5.8	[kN]	9,2	14,5	21,1	39,2	61,2	88,2	140,2
		8.8	[kN]	14,6	23,2	33,7	62,8	98,0	141,2	224,4
	property class 70	A4	[kN]	12,8	20,3	29,5	54,8	85,7	123,4	196,2
		C	[kN]	12,8	20,3	29,5	54,8	85,7	123,4	196,2
partial safety factor γ_{Ms} [1)]	property class	5.8	[-]	1,25						
		8.8	[-]	1,25						
	property class 70	A4	[-]	1,56						
		C	[-]	1,25						
Steel failure with lever arm										
characteristisc resistance $M^0_{Rk,s}$	property class	5.8	[Nm]	20	39	68	173	338	583	1169
		8.8	[Nm]	30	60	105	266	519	896	1797
	property class 70	A4	[Nm]	26	52	92	233	454	785	1574
		C	[Nm]	26	52	92	233	454	785	1574
partial safety factor γ_{Ms} [1)]	property class	5.8	[-]	1,25						
		8.8	[-]	1,25						
	property class 70	A4	[-]	1,56						
		C	[-]	1,25						
Concrete pryout										
Factor k in Equation (5.7) of Technical Report TR 029, Section 5.2.3.3			[-]	2,0						
partial safety factor	γ_{Mc} [1)]		[-]	1,5						
Concrete edge failure										
effective length of anchor l_f		h_{min}	[mm]	64	80	96	125	160	192	240
		h_{max}	[mm]	96	120	144	192	240	288	360
effective diameter of anchor		d	[mm]	8	10	12	16	20	24	30
partial safety factor	γ_{Mc} [1)]		[-]	1,5						

[1] In absence of other national regulations.

[2] $h_{ef\,min} \leq h_{ef} \leq h_{ef\,max}$ is possible.

Injection system Upat UPM 33

Characteristic values of splitting failure
Characteristic values to shear loads

Annex 6
of European Technical Approval
ETA-10/0171

Table 10: Displacements under tension load

Anchor size		M8	M10	M12	M16	M20	M24	M30
Temperature range I -40°C / +80°C		Effective anchorage depth h_{ef} = 8d[1)]						
Tension load in non-cracked concrete	N [kN]	7,7	11,0	15,8	25,5	37,9	51,7	76,3
Displacement	δ_{N0} [mm]	0,2	0,2	0,2	0,2	0,3	0,3	0,3
Displacement	$\delta_{N\infty}$ [mm]	0,6	0,6	0,6	0,6	0,9	0,9	0,9
Temperature range II -40°C /+120°C		Effective anchorage depth h_{ef} = 8d[1)]						
Tension load in non-cracked concrete	N [kN]	6,4	9,5	12,9	21,7	31,9	43,1	62,8
Displacement	δ_{N0} [mm]	0,15	0,15	0,15	0,15	0,25	0,25	0,25
Displacement	$\delta_{N\infty}$ [mm]	0,45	0,45	0,45	0,45	0,75	0,75	0,75

[1)] Values $8d \le h_{ef} \le 12d$ should be calculated:

$\delta_{N0} = \delta_{N01} \frac{h_{ef}}{8d}$ δ_{N01} to h_{ef} 8d

$\delta_{N0} = \delta_{N\infty 1} \frac{h_{ef}}{8d}$ $\delta_{N\infty 1}$ to h_{ef} 8d

Table 11: Displacements under shear load

Anchor size		M8	M10	M12	M16	M20	M24	M30
Temperature range I -40°C /+ 80°C and temperature range II -40°C /+120°C								
Shear load in non-cracked concrete (property class 5.8)	V [kN]	5,1	8,1	11,8	21,9	34,2	49,1	78,3
Displacement	δ_{V0} [mm]	0,9	1,2	1,4	2,0	2,4	2,6	37
Displacement	$\delta_{V\infty}$ [mm]	1,4	1,7	2,1	2,9	3,7	4,1	5,6
Shear load in non-cracked concrete (property class 8.8)	V [kN]	7,0	11,1	16,2	30,1	47,0	67,7	107,7
Displacement	δ_{V0} [mm]	1,2	1,6	1,9	2,8	3,3	3,6	5,1
Displacement	$\delta_{V\infty}$ [mm]	1,9	2,3	2,9	4,0	5,1	5,6	7,7
Shear load in non-cracked concrete (property class 70 / A4)	V [kN]	5,9	9,3	13,5	25,2	39,3	56,4	89,9
Displacement	δ_{V0} [mm]	1,0	1,3	1,6	2,2	2,8	3,4	4,3
Displacement	$\delta_{V\infty}$ [mm]	1,6	2,0	2,4	3,4	4,2	5,6	6,4
Shear load in non-cracked concrete (property class 70 / C)	V [kN]	7,3	11,6	16,9	31,4	49,0	70,4	112,2
Displacement	δ_{V0} [mm]	1,3	1,7	2,0	2,8	3,5	4,2	5,3
Displacement	$\delta_{V\infty}$ [mm]	2,0	2,5	3,0	4,2	5,3	6,3	8,0