ordernr 18,030
bestand: 18030A
d.d. 31-01-2018

poer t.b.v windturbine ENAIR windgebied 3

mast lg 26m

Opdrachtgever: KBP Eibergen
Hupselseweg 25
7151 EL Eibergen

bouwkundige Johan Assink
Goudsbloemstraat 1
7151 GB Eibergen

konstruktieburo ten vergert
lonnekeresweg 45

tel 053-4308089
fax 053-4305214

7524RH lonneker/Enschede
Email:info@tenvergert.com

ordernr 18,030
bestand: 18030A

Inhoudsopgave

gebruikte normen:

NEN-EN 1991	grondslagen van het construktief ontwerp
NEN-EN 1991-1-1	algemene belastingen
NEN-EN 1991-1-3	sneeuwbelasting
NEN-EN 1991-1-4	windbelasting
NEN-EN 1992	Betonconstructies
NEN-EN 1993	Staalconstructies
NEN-EN 1995	Houtkonstrukties
NEN-EN 1996	Steenkonstrukties

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Belastingaannames

gevolgklasse CC1	1
veiligh.factor e.g.	1,08
veiligh.factor v.b.	1,35

volgens opgave leverancier !

E 30pro	16m hoog	eigen gewcht 81kN	diameter 3,8m	h=1,5 H=16m
E 70pro	20m hoog	eigen gewcht 148kN	diameter 4,3m	h=1,9m H=20
	26m hoog	eigen gewcht 170kN	diameter 4,3m	h=2,5m H=26

windbelasting op 15m	qw=	0,8 kN/m²	**windgebied 3**
windbelasting op 18,1m	qw=	0,85 kN/m²	**windgebied 3**
windbelasting op 23,5m	qw=	0,91 kN/m²	**windgebied 3**

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Technische omschrijving

Het project dat in de navolgende berekening wordt behandeld , betreft het plaatsen van een windturbine. Deze berekening bestaat uit de berekening van de fundering. windgebied 3

Voor de berekenig van de fundering is uitgegaan van een vaste grondslag. Dit in het werk (laten) controleren.De Beddingsconstante moet minimaal 10000kN/m³ zijn, anders worden de verplaatsingen te groot. Minimale sondeerwaarde op ontgravingsnivo minimaal 4N/mm²

---

mastlengte 26,0m 2,5m in de grond

breedte mast voor wind 0,5m

diameter bladen 4,3m aanhouden voor wind 2m²

q1= 0,5x0,8x1,35x0,91x2= 0,98 kN/m

q2= 2x0,8x1,35x0,91x2= 3,93 kN

Md= 0,5x0,98x23,5²x1,35 + 23,5 x 3,93x 1,35= 489 kNm

poer 3500x3500x250 **wapening O+B # ø8-150**

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Fundering

Phi'_e;d =	32,50 dgr.
Gamma'_sat =	21,00 kN/m3
Gamma'_e;d =	9,09 kN/m3
N_gamma =	30
sigma'_max;d =	136,36 *B_ef
F_r;v;d =	136,36 *B_ef² + 0

poer 3500x3500x250 hoog 2500mm

eg poer= 3,5x3,5x2,5x20 = 612 kN

eg mast opgave 170 kN

totaal 782 kN

Md_ windbelasting= 489,00 kNm

poten h.o.h 2100m

T=D= 172 kN gebruiksbelasting

belasting poot eg= 85 kN

aanname Beddingsconstante 10000 kN/m³

voor berekening zie blz 4 t/m 13

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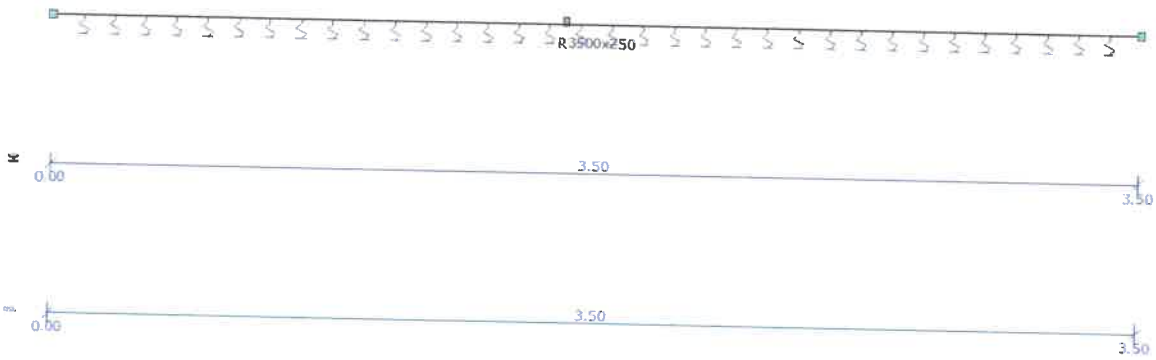
AFB. GEOMETRIE LIGGER



BALKGEOMETRIE

	Positie	Profielnaam	Hoek	Traagheidsmoment	Materiaal	E-Modulus	Uitzettingcoeff	Gewicht
0,000 - L(3,500)		R3500x250	0	4.5573e-03	C30/37	3.3000e+07	10.0000e-06	21.88
	m -		°	m4 -		kN/m2	C°m	kN/m

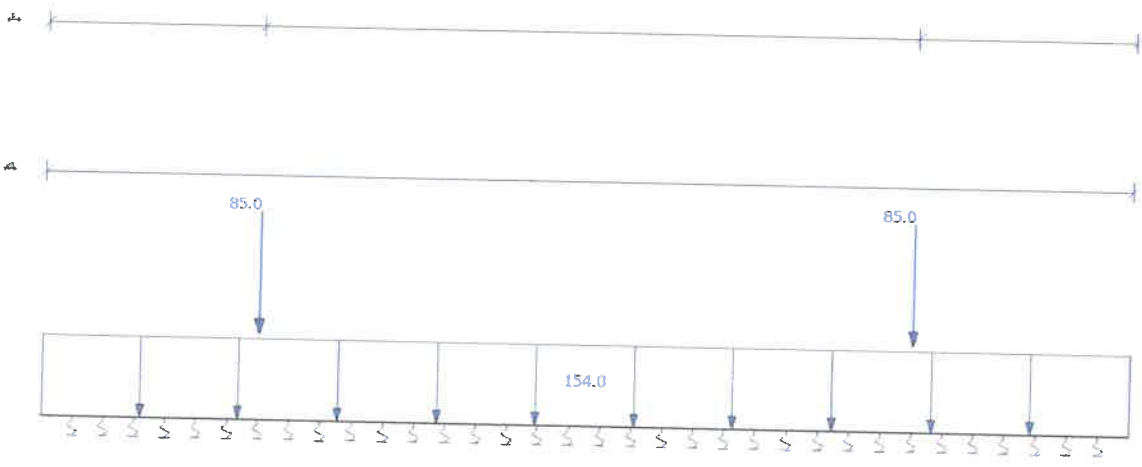
ELASTISCHE BEDDING

Staaf	Positie	Verl. h.	Type constant	Eenheden	Cz B	Cz E	Pasternak	Instellingen Pasternak	Cfy B	Cfy E	Breedte	Trek Verwijdering
S1	0,000 - L(3,500)	Nee	Fundering	kN/m3	10000.00	10000.00	Nee		0.00	0.00	Projectie	Nee
-	m -		-	-	kN/m3*(m)	kN/m3*(m)	-		kN/m3*(m)	kN/m3*(m)	m	-

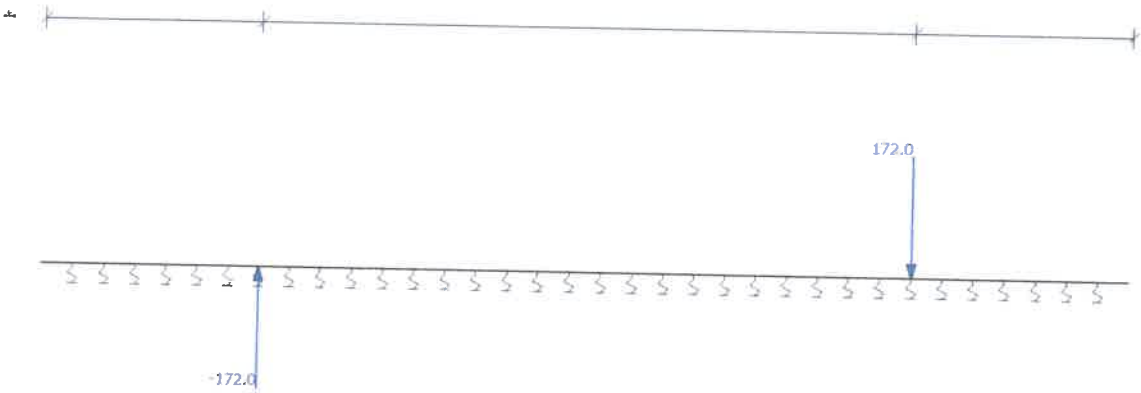
BELASTINGSGEVALLEN TYPEN

Oplegg.	Staven	B.G.Type	Gunstig/Ong.	Element	Niveau	Veld	Psi0	Psi1	Psi2	Cprob
B.G.1	Permanent	Permanent	-		N.v.t.	N.v.t.				
B.G.2	Windbelasting	Windbelasting	-		N.v.t.	N.v.t.		0.20		1,00

AFB. LASTEN B.G.1 PERMANENT



AFB. LASTEN B.G.2 WINDBELASTING



FUNDAMENTEEL BELASTINGSCOMBINATIES (TABEL)

B.G.	Omschrijving	Fu.C.1	Fu.C.2
B.G.1	Permanent	1.08	1.22
B.G.2	Windbelasting	1.35	-

KARAKTERISTIEK BELASTINGSCOMBINATIES (TABEL)

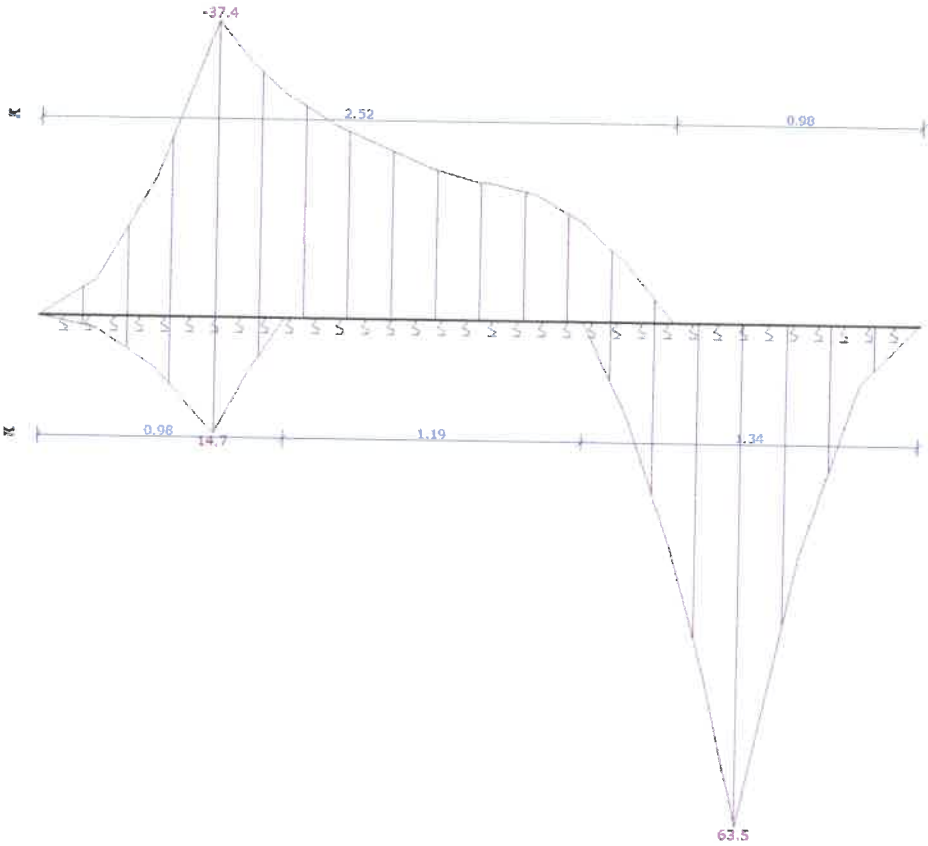
B.G.	Omschrijving	Ka.C.(wi)	Ka.C.1	Ka.C.2
B.G.1	Permanent	1.00	1.00	1.00
B.G.2	Windbelasting	-	-	1.00

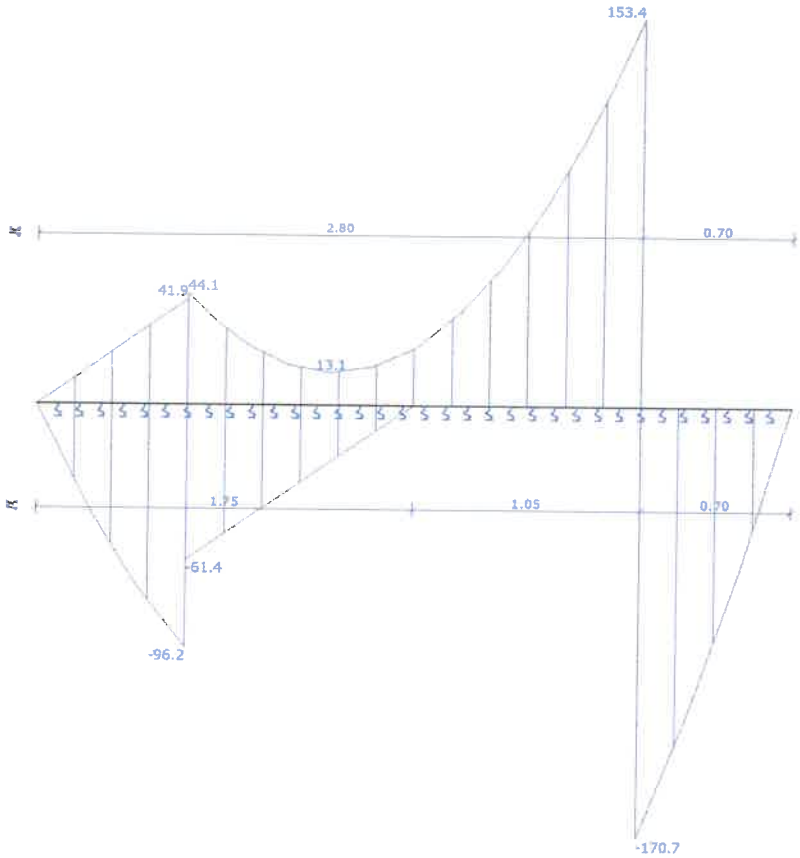
UITGANGSPUNTEN VAN DE ANALYSE

Lineaire Elastische Analyse uitgevoerd

AFB. FU.C. MOMENT (MY) OMHULLENDE

Fundamenteel Belastingscombinaties





FU.C. STAAFKRACHTEN

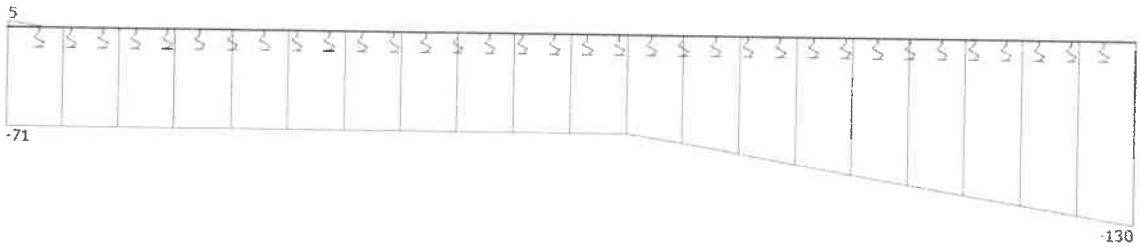
Veld	Positie B.G.	Mb	Mmax	xMmax	Me	x-M0	x-M0	Vb	Vmax	Ve
Veld 1	0,000 - 3,500 Fu.C.1	0.00	63.54	2.800	0.00	2.164	0.000	0.00	-170.70	0.00
	0,000 - 3,500 Fu.C.2	0.00	-17.38	1.776	0.00	0.976	2.524	0.00	-61.40	0.00
-	m -	kNm	kNm	m	kNm	m	m	kN	kN	kN

FU.C. OPLEGREACTIES

B.C.	Oplegging	Positie	Z	Yr	Z	My
	Som Reacties					
	Som Lasten					
-	-	m	kN/m	kNm/rad	kN	kNm

B.G. OPLEGREACTIES

B.C.	Oplegging	Positie	Z	Yr	Z	My
	Som Reacties					
	Som Lasten					
-	-	m	kN/m	kNm/rad	kN	kNm



FU.C. BODEMDRUK

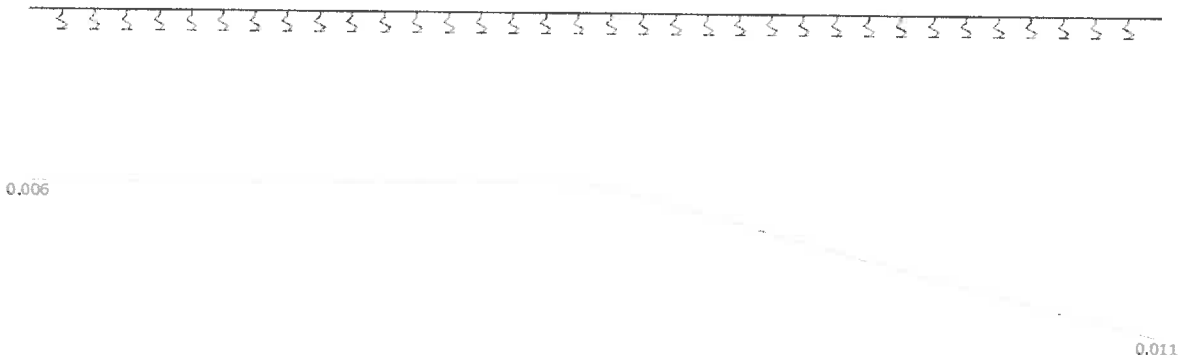
Staaf	B.C.	Coordinaat	Cz	Bodemdruk Z	Breedte	Tegendruk Z / breedte
S1	Fu.C.1	0.000	-35000.00	16.62	3,50	4,75
	Fu.C.1	0.350	-35000.00	-29.10	3,50	-8,31
	Fu.C.1	0.700	-35000.00	-75.15	3,50	-21,47
	Fu.C.1	1.050	-35000.00	-122.06	3,50	-34,88
	Fu.C.1	1.366	-35000.00	-165.06	3,50	-47,16
	Fu.C.1	1.400	-35000.00	-169.75	3,50	-48,50
	Fu.C.1	1.750	-35000.00	-218.03	3,50	-62,29
	Fu.C.1	2.100	-35000.00	-266.74	3,50	-76,21
	Fu.C.1	2.164	-35000.00	-275.71	3,50	-78,77
	Fu.C.1	2.450	-35000.00	-315.52	3,50	-90,15
	Fu.C.1	2.800	-35000.00	-363.66	3,50	-103,90
	Fu.C.1	3.150	-35000.00	-410.47	3,50	-117,28
	Fu.C.1	3.500	-35000.00	-456.73	3,50	-130,50
	Fu.C.2	0.000	-35000.00	-247.26	3,50	-70,64
	Fu.C.2	0.050	-35000.00	-247.21	3,50	-70,63
	Fu.C.2	0.350	-35000.00	-246.95	3,50	-70,56
	Fu.C.2	0.700	-35000.00	-246.53	3,50	-70,44
	Fu.C.2	0.976	-35000.00	-245.99	3,50	-70,28
	Fu.C.2	1.050	-35000.00	-245.83	3,50	-70,24
	Fu.C.2	1.400	-35000.00	-245.22	3,50	-70,06
	Fu.C.2	1.750	-35000.00	-244.98	3,50	-69,99
	Fu.C.2	1.776	-35000.00	-244.98	3,50	-69,99
	Fu.C.2	1.929	-35000.00	-245.04	3,50	-70,01
	Fu.C.2	2.100	-35000.00	-245.22	3,50	-70,06
	Fu.C.2	2.450	-35000.00	-245.83	3,50	-70,24
	Fu.C.2	2.524	-35000.00	-245.99	3,50	-70,28
	Fu.C.2	2.800	-35000.00	-246.53	3,50	-70,44
	Fu.C.2	3.150	-35000.00	-246.95	3,50	-70,56
	Fu.C.2	3.500	-35000.00	-247.26	3,50	-70,64
-	-	m	kN/m3*(m)	kN/m	m	kN/m2

B.G. BODEMDRUK

Staaf	B.G.	Coordinaat	Cz	Bodemdruk Z	Breedte	Tegendruk Z / breedte
S1	B.G.1	0.000	-35000.00	-203.50	3,50	-58,14
	B.G.1	0.150	-35000.00	-203.40	3,50	-58,11
	B.G.1	0.350	-35000.00	-203.25	3,50	-58,07
	B.G.1	0.700	-35000.00	-202.90	3,50	-57,97
	B.G.1	0.976	-35000.00	-202.46	3,50	-57,85
	B.G.1	1.050	-35000.00	-202.33	3,50	-57,81
	B.G.1	1.400	-35000.00	-201.83	3,50	-57,66
	B.G.1	1.750	-35000.00	-201.63	3,50	-57,61
	B.G.1	1.776	-35000.00	-201.63	3,50	-57,61

Staaf	B.G.	Coordinaat	Cz	Bodemdruk Z	Breedte	Tegendruk Z / breedte
S1	B.G.1	1.980	-35000.00	-201.72	3,50	-57,63
	B.G.1	2.100	-35000.00	-201.83	3,50	-57,66
	B.G.1	2.450	-35000.00	-202.33	3,50	-57,81
	B.G.1	2.524	-35000.00	-202.46	3,50	-57,85
	B.G.1	2.800	-35000.00	-202.90	3,50	-57,97
	B.G.1	3.150	-35000.00	-203.25	3,50	-58,07
	B.G.1	3.500	-35000.00	-203.50	3,50	-58,14
	B.G.2	0.000	-35000.00	175.32	3,50	50,09
	B.G.2	0.350	-35000.00	141.25	3,50	40,36
	B.G.2	0.700	-35000.00	106.86	3,50	30,53
	B.G.2	1.050	-35000.00	71.65	3,50	20,47
	B.G.2	1.400	-35000.00	35.93	3,50	10,26
	B.G.2	1.750	-35000.00	-0.00	3,50	0,00
	B.G.2	1.776	-35000.00	-2.63	3,50	-0,75
	B.G.2	2.100	-35000.00	-35.93	3,50	-10,26
	B.G.2	2.450	-35000.00	-71.65	3,50	-20,47
	B.G.2	2.800	-35000.00	-106.86	3,50	-30,53
	B.G.2	3.150	-35000.00	-141.25	3,50	-40,36
	B.G.2	3.500	-35000.00	-175.32	3,50	-50,09
-	-	m	kN/m3*(m)	kN/m	m	kN/m2

AFB. KA.C. VERPLAATSINGEN OMHULLENDE — Karakteristiek Belastingscombinaties



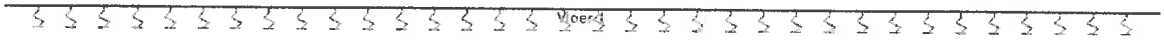
KA.C. KNOOPVERPLAATSINGEN

Knoop	B.C.	Z	Yr
K1	Ka.C.(w1)	0.0058	0.020e-03
	Ka.C.1	0.0058	0.020e-03
	Ka.C.2	0.0008	-2.759e-03
K2	Ka.C.(w1)	0.0058	-0.020e-03
	Ka.C.1	0.0058	-0.020e-03
	Ka.C.2	0.0108	-2.799e-03
-	-	m	rad

KA.C. DOORBUIGINGEN

Veld	Positie B.C.	Veld Begin		Veld			Veld Eind
		Z	Z'afst	Z'	Z' glb dist	Z' glb	Z
S1	0,000 - 3,500 Ka.C.(w1)	0,0058	1,980	-0,0001	0.000	0.0058	0,0058
S1	0,000 - 3,500 Ka.C.1	0,0058	1,980	-0,0001	0.000	0.0058	0,0058
S1	0,000 - 3,500 Ka.C.2	0,0008	1,263	-0,0001	3.500	0.0108	0,0108
-	m -	m	m	m	m	m	m

FIG. BETONDEFINITIE



BETON EIGENSCHAPPEN (NEN-EN1992-1-1:2015\NB:2016)

Naam	Waarde	Eenheden
Hoek drukdiagonaal	21.80	°

CONSTRUCTIEDELEN

Staaf	Profiellabel	Profiel	Betonkwal.	Constr.Dl.	Type	Begin:	Eind:	Groep
S1	P4	R3500x250	C30/37	Vloer 1	Vloer	0.000	3.500	G1
-	-	-	-	-	-	m	m	-

GROEPGEGEVENS

Groep	Cstr.Deel	Fabric.	L1	L2	Staal	N.Kor.	Stortsl.	Scheurvormming	Toetsing	afmeting	
G1	Vloer	l.h.w.	N/A	N/A	B500B	31.5	0	Ja	h,min:	250 >= 80	NEN-EN1992-1-1#9.3(1)
-	-	-	-	-	-	mm	mm	-	-		

KRUIP

Groep	Cement	Rel.V.(%)	Ouderdom	Tijd T	Kruip type	Kruipcoeff.
G1	S	60 %	28 Dagen	Inf	Berekend	2.2
-	-	-	-	-	-	-

BRAND

Groep	Label	Profiel	Constr.	Brandw.	Br.res.	Boven	Links	Onder	Rechts	Staal
G1	P4	R3500x250	Vloer	Nee	120	Nee	Nee	Nee	Nee	Warm
-	-	-	-	-	min.	-	-	-	-	-

DEKKING

Groep	Str.Class	Boven						Onder						Zij- + Voorkant					
		Mil.	Ruw	Met.	C,min	C,no	C,toe	Mil.	Ruw	Met.	C,min	C,no	C,toe	Mil.	Ruw	Met.	C,min	C,no	C,toe
G1	S4	XC3	Nee	Norm.	25	30	35	XC3	Nee	Norm.	25	30	35	XC3	Nee	Norm.	25	30	35
-	-	-	-	-	mm	mm	mm	-	-	-	mm	mm	mm	-	-	-	mm	mm	mm

OPLEGGEGEVENS

Positie	Oplegg.	Type	Afmeting	Staaf	Afmeting	Mti	Mti bov.	Mti ond.	Dwarskr.	Moment
m	-	-	m	-	m	-	kNm	kNm	-	-

VLOER 1

DOORSNEDE BOVENWAPENING — Vloer 1

Positie	Md	Toetsing		Toegepast		Normartikel
0.700	37,40 kNm	As,toe	1.173 mm2	As,min2:	1173 > 513	NEN-EN1992-1-1#9.2.1.1(1)
		h - d = 39,0	d = 211,0	As,max:	1173 < 35000	NEN-EN1992-1-1#9.2.1.1(3)
		x,u = 9,7		As;ben(T)	1173 > 0	NEN-EN1992-1-1#6.1
		Mu: 105,67	Mr: 147,84	As;toe	1173 > 410	NEN-EN1992-1-1#6.1
		w;ben = 0,056	w;toe = 0,159	As;toe(ver.)	335 > 23	NEN-EN1992-1-1#9.3.1.1(2)
		Md/(bd^2): 240				
		Basiswapening:	R8-150	Basiswapening is niet noodzakelijk		NEN-EN1992-1-1#9.3.1.1(8)
		Verd.:	R8-150			
		Hoofdwapening:	R8-150	S,max:	150 < 250	NEN-EN1992-1-1#9.3.1.1
		Verd.:	R8-150	S,min:	142 > 37	NEN-EN1992-1-1#8.2
				S,max(ver.):	150 < 400	NEN-EN1992-1-1#9.3.1.1
				S,min(ver.):	142 > 37	NEN-EN1992-1-1#8.2

		Dekking:	35 mm	C,nom	35 >= 30	NEN-EN1992-1-1#4.4.1
		Scheurvorming:		Sigma;s:	152.08	
		Mrep: 0,00		D,max:	8.0 <= 23.0	NEN-EN1992-1-1#7.3.3(2)
				S,max:	150 <= 300	NEN-EN1992-1-1#7.3.3(2)
1.776	17,38 kNm	As,toe	1.173 mm2	As,min2:	1173 > 237	NEN-EN1992-1-1#9.2.1.1(1)
		h - d = 39,0	d = 211,0	As,max:	1173 < 35000	NEN-EN1992-1-1#9.2.1.1(3)
		x,u = 9,7		As;ben(T)	1173 > 0	NEN-EN1992-1-1#6.1
		Mu: 105,67	Mr: 147,84	As;toe	1173 > 190	NEN-EN1992-1-1#6.1
		w;ben = 0,026	w;toe = 0,159	As;toe(ver.)	335 > 11	NEN-EN1992-1-1#9.3.1.1(2)
		Md/(bd^2): 112				
		Basiswapening:	R8-150	Basiswapening is niet noodzakelijk		NEN-EN1992-1-1#9.3.1.1(8)
		Verd.:	R8-150			
		Hoofdwapening:	R8-150	S,max:	150 < 250	NEN-EN1992-1-1#9.3.1.1
		Verd.:	R8-150	S,min:	142 > 37	NEN-EN1992-1-1#8.2
				S,max(ver.):	150 < 400	NEN-EN1992-1-1#9.3.1.1
				S,min(ver.):	142 > 37	NEN-EN1992-1-1#8.2
		Dekking:	35 mm	C,nom	35 >= 30	NEN-EN1992-1-1#4.4.1
		Scheurvorming:		Sigma;s:	56.99	
		Mrep: -13,85		D,max:	8.0 <= 23.0	NEN-EN1992-1-1#7.3.3(2)
				S,max:	150 <= 300	NEN-EN1992-1-1#7.3.3(2)
m	-	-	-	-	-	- -

DOORSNEDE ONDERWAPENING — **Vloer 1**

Positie	Md	Toetsing		Toegepast		Normartikel
0.700	14,69 kNm	As,toe	1.173 mm2	As,min2:	1173 > 201	NEN-EN1992-1-1#9.2.1.1(1)
		h - d = 39,0	d = 211,0	As,max:	1173 < 35000	NEN-EN1992-1-1#9.2.1.1(3)
		x,u = 9,7		As;ben(T)	1173 > 0	NEN-EN1992-1-1#6.1
		Mu: 105,67	Mr: 147,84	As;toe	1173 > 160	NEN-EN1992-1-1#6.1
		w;ben = 0,022	w;toe = 0,159	As;toe(ver.)	335 > 9	NEN-EN1992-1-1#9.3.1.1(2)
		Md/(bd^2): 94				
		Basiswapening:	R8-150	S,max:	150 < 400	NEN-EN1992-1-1#9.3.1.1(8)
		Verd.:	R8-150	S,min:	142 > 37	NEN-EN1992-1-1#8.2
				S,max(ver.):	150 < 450	NEN-EN1992-1-1#9.3.1.1(8)
				S,min(ver.):	142 > 37	NEN-EN1992-1-1#8.2
				Diam,min:	8 >= 5	NEN-EN1992-1-1#9.3.1.1(5)
		Hoofdwapening:	R8-150	S,max:	150 < 250	NEN-EN1992-1-1#9.3.1.1(3)
		Verd.:	R8-150	S,min:	142 > 37	NEN-EN1992-1-1#8.2
				S,max(ver.):	150 < 400	NEN-EN1992-1-1#9.3.1.1(3)
				S,min(ver.):	142 > 37	NEN-EN1992-1-1#8.2
		Dekking:	35 mm	C,nom	35 >= 30	NEN-EN1992-1-1#4.4.1
		Scheurvorming:		Sigma;s:	18.97	
		Mrep: 4,61		D,max:	8.0 <= 23.0	NEN-EN1992-1-1#7.3.3(2)
				S,max:	150 <= 300	NEN-EN1992-1-1#7.3.3(2)
2.800	63,54 kNm	As,toe	1.173 mm2	As,min2:	1173 > 875	NEN-EN1992-1-1#9.2.1.1(1)
		h - d = 39,0	d = 211,0	As,max:	1173 < 35000	NEN-EN1992-1-1#9.2.1.1(3)
		x,u = 9,7		As;ben(T)	1173 > 0	NEN-EN1992-1-1#6.1
		Mu: 105,67	Mr: 147,84	As;toe	1173 > 700	NEN-EN1992-1-1#6.1
		w;ben = 0,095	w;toe = 0,159	As;toe(ver.)	335 > 40	NEN-EN1992-1-1#9.3.1.1(2)
		Md/(bd^2): 408				
		Basiswapening:	R8-150	S,max:	150 < 400	NEN-EN1992-1-1#9.3.1.1(8)
		Verd.:	R8-150	S,min:	142 > 37	NEN-EN1992-1-1#8.2
				S,max(ver.):	150 < 450	NEN-EN1992-1-1#9.3.1.1(8)
				S,min(ver.):	142 > 37	NEN-EN1992-1-1#8.2
				Diam,min:	8 >= 5	NEN-EN1992-1-1#9.3.1.1(5)
		Hoofdwapening:	R8-150	S,max:	150 < 250	NEN-EN1992-1-1#9.3.1.1(3)
		Verd.:	R8-150	S,min:	142 > 37	NEN-EN1992-1-1#8.2
				S,max(ver.):	150 < 400	NEN-EN1992-1-1#9.3.1.1(3)
				S,min(ver.):	142 > 37	NEN-EN1992-1-1#8.2
		Dekking:	35 mm	C,nom	35 >= 30	NEN-EN1992-1-1#4.4.1
		Scheurvorming:		Sigma;s:	80.50	
		Mrep: 19,56		D,max:	8.0 <= 23.0	NEN-EN1992-1-1#7.3.3(2)
				S,max:	150 <= 300	NEN-EN1992-1-1#7.3.3(2)
m	-	-	-	-	-	- -

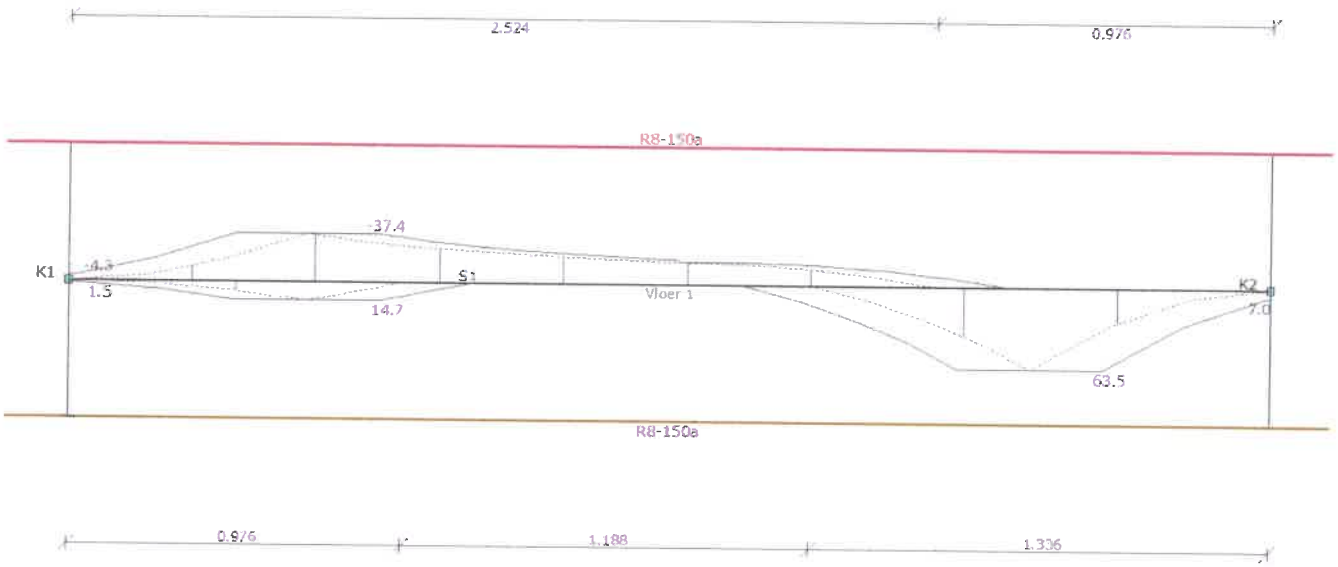
DOORSNEDE FLANKWAPENING — Vloer 1

Positie	Mx	Toetsing		Toegepast		Normartikel	
0,00	0,00	Dekking: Wapening	35 mm	C,nom	35 >= 30	NEN-EN1992-1-1#4.4.1	
m	-	-	-	-	-	-	-

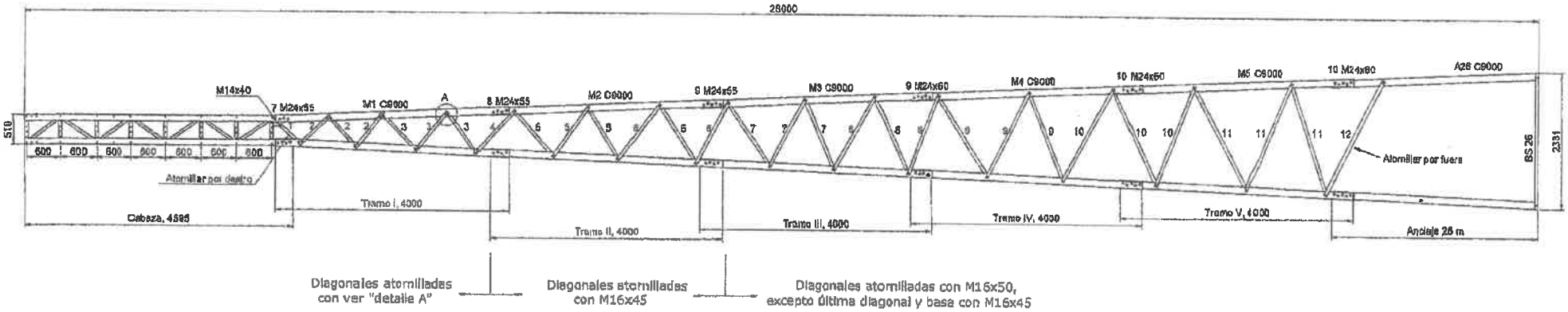
DOORSNEDE BEUGELWAPENING — Vloer 1

Positie		Toetsing		Toegepast		Normartikel
0.000	0,00 kN	As,toe	0 mm	Vrd;c	0.00 < 392.52	NEN-EN1992-1-1#6.2.2
		Wapening:	-	Vrd,max: S,max s;Ldr.	0.00 < 2640.88	NEN-EN1992-1-1#6.2.3
0.700	96,16 kN	As,toe	0 mm	Vrd;c	96.16 < 392.52	NEN-EN1992-1-1#6.2.2
		Wapening:	-	Vrd,max: S,max s;Ldr.	96.16 < 2640.88	NEN-EN1992-1-1#6.2.3
0.700	61,40 kN	As,toe	0 mm	Vrd;c	61.40 < 392.52	NEN-EN1992-1-1#6.2.2
		Wapening:	-	Vrd,max: S,max s;Ldr.	61.40 < 2640.88	NEN-EN1992-1-1#6.2.3
1.366	22,27 kN	As,toe	0 mm	Vrd;c	22.27 < 392.52	NEN-EN1992-1-1#6.2.2
		Wapening:	-	Vrd,max: S,max s;Ldr.	22.27 < 2640.88	NEN-EN1992-1-1#6.2.3
2.800	153,41 kN	As,toe	0 mm	Vrd;c	153.41 < 392.52	NEN-EN1992-1-1#6.2.2
		Wapening:	-	Vrd,max: S,max s;Ldr.	153.41 < 2640.88	NEN-EN1992-1-1#6.2.3
2.800	170,70 kN	As,toe	0 mm	Vrd;c	170.70 < 392.52	NEN-EN1992-1-1#6.2.2
		Wapening:	-	Vrd,max: S,max s;Ldr.	170.70 < 2640.88	NEN-EN1992-1-1#6.2.3
3.500	0,00 kN	As,toe	0 mm	Vrd;c	0.00 < 392.52	NEN-EN1992-1-1#6.2.2
		Wapening:	-	Vrd,max: S,max s;Ldr.	0.00 < 2640.88	NEN-EN1992-1-1#6.2.3
m	-	-	-	-	-	-

AFB. LANGSWAPENING. (AFBOUW) VLOER 1



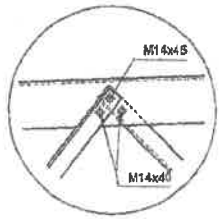
APOYO ENAIR200-26m



MONTANTES	
Marcaje	Cantidad
M1 C9000	4
M2 C9000	4
M3 C9000	4
M4 C9000	4
M5 C9000	4
Ax C9000	4

DIAGONALES		
Símbolo plano	Marcaje	Cantidad
1	DG1 9000	4
2	DG2 9000	12
3	DG3 9000	12
4	DG4 7000	4
5	DG5 7090	12
6	DG6 7090	12
7	DG7 7090	12
8	DG8 7090	12
9	DG9 7090	12
10	DG10 7090	12
11	DG11 7090	12
12	DG12 7090	4
BS 26	BS26 7090	4

TORNILLERIA	
Tornillo	Cantidad
M14x40	65
M14x45	29
M16x45	37
M16x50	68
M24x55	98
M24x60	122



DETALLE A

Una vez montada la estructura es imprescindible granetear las roscas.

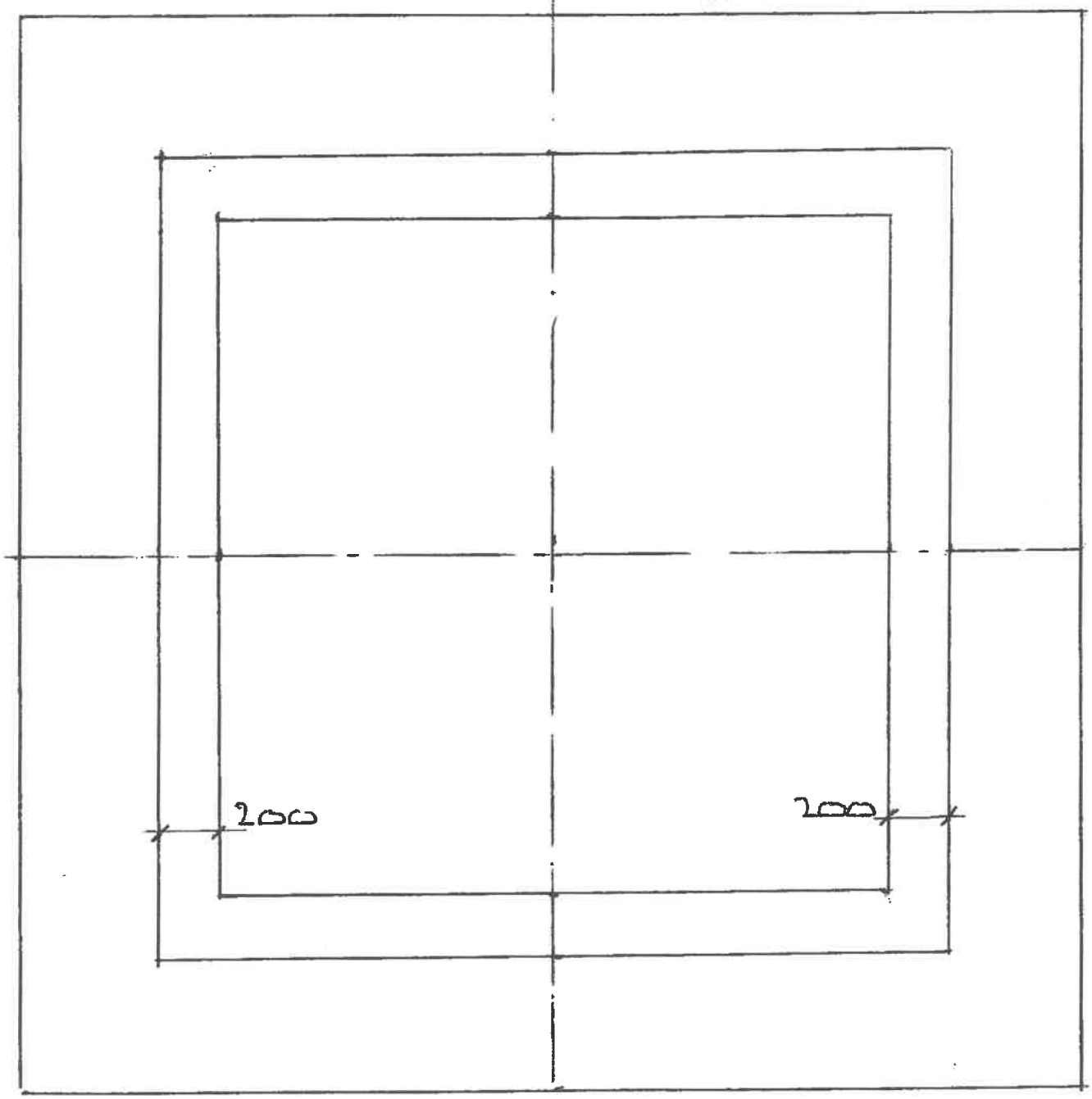
			Actualización de formatos de plano y revisión general	F.J.R.H.	15/01/14	01
			Modificación	Nombre:	Fecha:	Rev.:
Proyectado:	15/01/2014	P. R.	APOYO CELOSÍA ENAIR200-26m PLANO DE MONTAJE			
Comprobado:	15/01/2014	P. M.				
Aprobado:	15/01/2014	J. M.				
Formato: A3	FECHA:	NOMBRE:	Referencia: ---		E: S/E	HOJA Nº: 1/1

Konstruktieburo TEN VERGERT
Hout-, Beton- en Staalkonstrukties
Lonnekeresweg 45 - 7524 RH Enschede
Tel. 053 - 4308089 - Fax 053 - 4305214

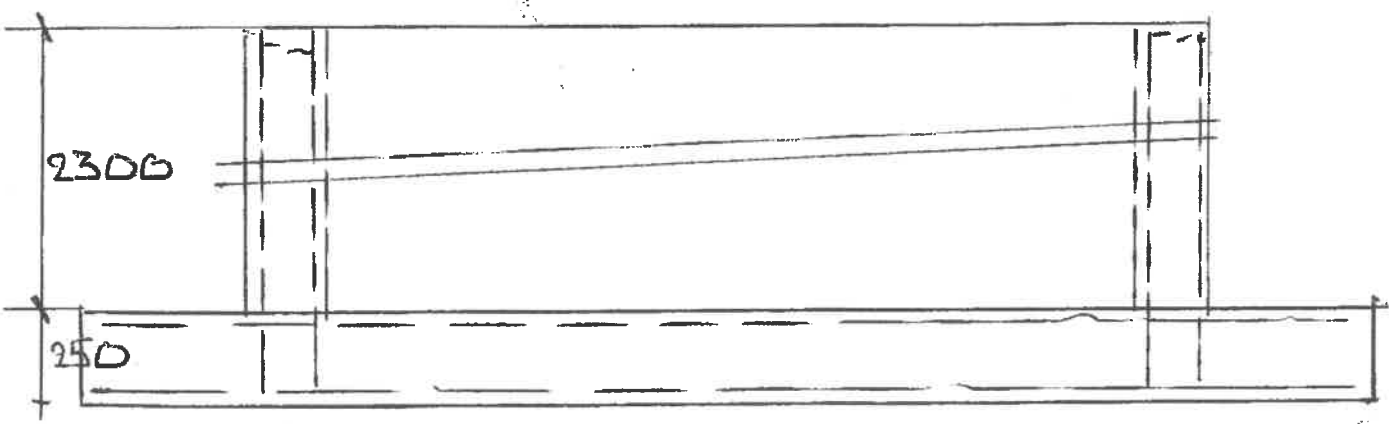
ORDER NR.: 18.030

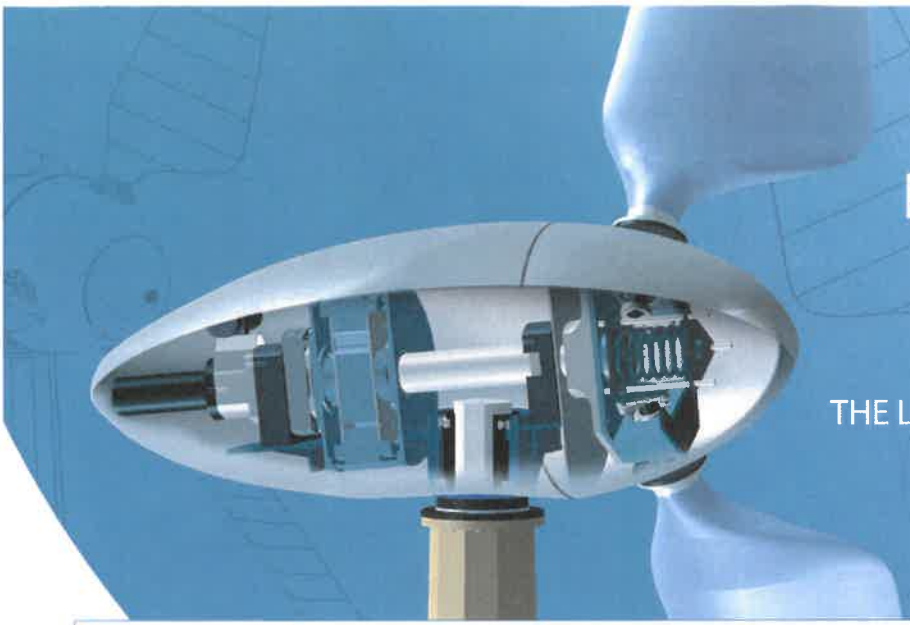
BLAD:

Mast 4 28m



□ 3500 x 3500 x 250





E200 WIND TURBINE

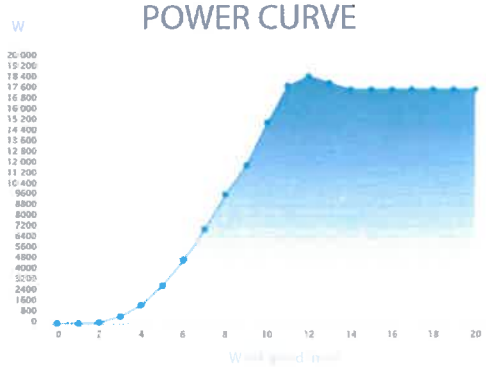
DATA SHEET

THE LARGE WIND TECHNOLOGY IN SMALL

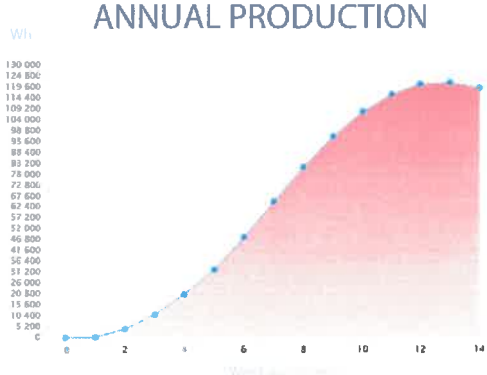
Our patented technology is an intelligent adaptation of the main systems which big turbines have to small turbines from 10 to 60 kW.
High security, maximum control and the best efficiency on the market in power generation.

GENERATOR	Nominal power	20kW
	Configuration	3 phases - 500V - Direct drive
TURBINE	Configuration	3 blades, horizontal axis, Upwind
	Rated power	18kW - IEC61400
	Applications	Direct grid tied - Micro grids
	Rotor speed	120 - rpm
	Start rotation	1,85m/s
	Cut production	30m/s
	Protection	Ip - 65 - Sand and high protection
	Weight	1000kg.
	Yaw	Aerodynamic downwind orientation
ROTOR	Diameter	9,8m
	Swept Area	75,4m^2
	Blade length	4,5m
	Blade material	Fibreglass, flex resins and polyurethane
	Regulation speed	Active pitch, electronical regulation and brake
BRAKE SAFETY SYSTEM	Pitch	Variable pitch with active control
		By wind and power
	Brake	Electromechanical safety brake
	Electronic control of	Wind speed Temperature (optional) Frecuency Voltage Grid failure Sensors failure
TURBINE CONTROL	Electronic system	Programmable system to adapt the turbine Register alarms
	Software	Customizable software. General screen of key parameters (optional)
INVERTER	Solar inverter	Compatible with solar inverters of constant voltage at 500V

POWER CURVE



ANNUAL PRODUCTION



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+34 96 556 00 18 info@enair.es

www.enair.es

E200 WIND TURBINE
TECHNICAL PROFILE

PITCH CONTROL

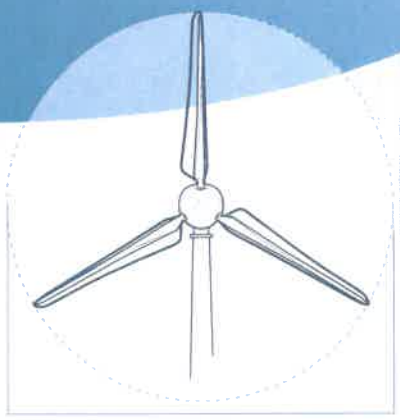
Patented technology. Characteristics:
Sturdiness
- High endurance
- Full angle pitch control
- Spring passive security, if any fault
- Hydraulic control

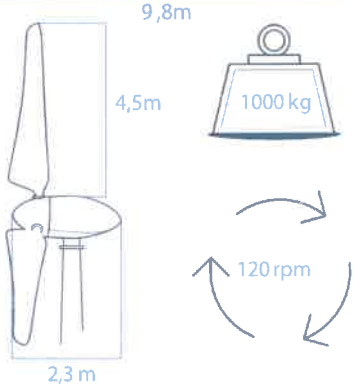
Scalable technology from 5 to 100 kW of power:
- Simple
- Very secure
- Fully controlled

ELECTRONIC CONTROL

Multi-program functions:
Full control of:
rpm, Hz, m/s, torque, AC/DC voltage

Reads all the turbine parameters, which let you decide the best actions in external controls to optimize your production and security.
The software enables different types of behaviours depending on the wind conditions to increase the efficiency.





ACTIVE PITCH AND PASSIVE PROTECTION

The active pitch control enables the position of the blade for production to vary for each engine rotation speed and wind speed from the beginning up to high wind speed.
The benefits of mechanical simplicity and advanced electronics are combined to make a perfect tandem and maximize energy production.

THE CFD AND AERODYNAMIC DESIGNS

For the full wind turbine design it has been done a complex aerodynamic study based on the most modern techniques of computational fluid dynamics.
In this case, the studies required a very hight computing capacity and expert knowledge because the conditions are complex due to the wind turbines operation conditions.

MONITORING SYSTEM

To say that our product is the best, it is necessary to prove it, so we have chosen to provide a complete monitoring system of various parameters of the wind turbine to left the user to check the production and it condition, even from the Internet, without being on site.

Silent
The aerodynamic profile of the blades is based in the FX profile series, and its design is for magnimize production and minimize noise

Efficiency
The control system allows to extract the power maxinum available since the start of rotation and can adapt to any environment

Greater safety than ever
3 security systems, active and passive: electromechanical active brake, aerodynamic and passive dock, which actin any condition

Waterproof
The materials used are made with a tropicalization treatment to install in islands, deserts or aggressive environments.

High endurance
According to IEC 61400-2 the design of the wind turbine is classified as Class 1, with safety factors in the critics components of an Fs = 9

PREMIO A LA INNOVACIÓN EMPRESARIAL 2014

GARANTÍA 5 AÑOS

CO2 FREE

IN PROCESS OF CERTIFICATION:
AWEA MCS Intertek

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