

Calculation report

EN 13445 Ed. 2014 Issue 4

Project: HV Kralupy prelozka
Item: UT - CCBC
Customer: DIGITRONIC CZ s.r.o.
Drawing:
Revision:
Date: 18.10.2021

Internal design pressure	P	=	1.60 MPa
Internal design temperature	T	=	105.00 °C
Internal corrosion allowance	c	=	1.00 mm
External corrosion allowance	ce	=	0 mm
Joint efficiency	z	=	1.00
Minimum design temperature		=	0 °C

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Test pressure (MPa)

<i>Component</i>	<i>P</i>	<i>Static head (design)</i>	<i>Static head (test)</i>	<i>Stress ratio</i>	<i>1.25·P·f₀/f</i>	<i>1.43·P</i>
trubka DN100	1.60	0	0.006	1,143	2.29	2.29
trubka DN125	1.60	0	0.01	1,143	2.29	2.29
oblouk DN100, tvar 3D, R=152mm, typ A	1.60	0	0.002	1,143	2.29	2.29
oblouk DN125, tvar 3D, R=190mm, typ A	1.60	0	0.01	1,143	2.29	2.29
redukce DN125/100, typ A	1.60	0	0.007	1,143	2.29	2.29

All pressures in MPa.

Item design pressure $P = 1.60$ MPa

Item maximum allowable design pressure (P_{max}) = 4.78 MPa (limited by trubka DN125)

Item lowest stress ratio = 1.143 (limited by trubka DN100)

Item test pressure = $P_t = \max[1.25 \cdot P_d \cdot (\text{Item } f_0/f); 1.43 \cdot P_d] = 2.29$ MPa

Maximum Pressures (MPa)

<i>Component</i>	<i>Internal, test</i>	<i>Internal</i>
trubka DN100	12.68	5.03
trubka DN125	11.49	4.78
oblouk DN100, tvar 3D, R=152mm, typ A	12.68	5.03
oblouk DN125, tvar 3D, R=190mm, typ A	11.49	4.78
redukce DN125/100, typ A	13.78	5.94

All pressures in MPa.

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Bill of materials

Component	Dimensions	Material
trubka DN100	Id = 107.10 mm, Od = 114.30 mm, Tk = 3.60 mm, L = 400.00 mm	P235GH (EN 10216-2:2008) - Seamless tube (t ≤ 16.00 mm) - No.: 1.0345
trubka DN125	Id = 131.70 mm, Od = 139.70 mm, Tk = 4.00 mm, L = 400.00 mm	P235GH (EN 10216-2:2008) - Seamless tube (t ≤ 16.00 mm) - No.: 1.0345
oblouk DN100, tvar 3D, R=152mm, typ A	Id = 107.10 mm, Od = 114.30 mm, Tk = 3.60 mm, L = 238.76 mm	P235GH (EN 10216-2:2008) - Seamless tube (t ≤ 16.00 mm) - No.: 1.0345
oblouk DN125, tvar 3D, R=190mm, typ A	Id = 131.70 mm, Od = 139.70 mm, Tk = 4.00 mm, L = 298.45 mm	P235GH (EN 10216-2:2008) - Seamless tube (t ≤ 16.00 mm) - No.: 1.0345
redukce DN125/100, typ A	Min Id = 107.10 mm, Max Id = 131.70 mm, Tk = 4.00 mm, α = 10.00 °, L = 70.11 mm	P235GH (EN 10216-2:2008) - Seamless tube (t ≤ 16.00 mm) - No.: 1.0345

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Material properties summary

P235GH (EN 10216-2:2008) - Seamless tube ($t \leq 16.00$ mm) - No.: 1.0345

<i>Temp.</i>	<i>Allowable</i>	<i>Yield strength</i>	<i>Tensile strength</i>	<i>Elasticity</i>	<i>Thermal expansion</i>
Room	150.00 MPa	235.00 MPa	360.00 MPa	200 021.00 MPa	0.000011500 1/°C
Design	131.27 MPa	196.90 MPa	360.00 MPa	195 763.20 MPa	0.000012138 1/°C
Test	223.81 MPa				

Notes

Allowable stress calculation may vary upon component type or characteristics

Yield strength shown refers to 0.2% plastic strain

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Standard Cylindrical shell - trubka DN100*According to: EN 13445 Ed. 2014 Issue 4, Part 3, Clause 7 and 8***Design data**

Internal design temperature

Ti = 105.00 °C

Internal design pressure

Pi = 1.60 MPa

Joint efficiency

z = 1.00

Standard pipe

= EN 10216-2

Material: P235GH (EN 10216-2:2008) - Seamless tube (t ≤ 16.00 mm)

Nominal design stress at internal design temperature

$$f = \min\left(\frac{R_{p0.2/T}}{1.5}, \frac{R_m/20}{2.4}\right) = 131.27 \text{ MPa}$$

Nominal design stress at room temperature

$$f = \min\left(\frac{R_{p0.2/20}}{1.5}, \frac{R_m/20}{2.4}\right) = 150.00 \text{ MPa}$$

Nominal design stress in test condition

$$f_{\text{test}} = \left(\frac{R_{p0.2/T_{\text{test}}}}{1.05}\right) = 223.81 \text{ MPa}$$

Geometry

Inside diameter

Di = 107.10 mm

Outside diameter

De = 114.30 mm

Length

L = 400.00 mm

Nominal thickness

en = 3.60 mm

Corrosion allowance

c = 1.00 mm

External corrosion allowance

ce = 0 mm

Undertolerance

δ = 0.45 mm

Internal pressure

Overpressure due to static head

Ph = 0 MPa

Calculation pressure

P=Pi+Ph = 1.60 MPa

Outside diameter

De'=De-2ce = 114.30 mm

Minimum required thickness

$$e = \frac{P \cdot D_e'}{2f \cdot z + P} + c + ce + \delta = 2.14 \text{ mm}$$

e/De ≤ 0,16 (0.01900 ≤ 0.16000): Ok**en ≥ e: Ok****Maximum allowable pressures (at the top of the vessel)**

Maximum allowable test pressure

= 12.68 MPa

Maximum allowable design pressure

= 5.03 MPa

Deformation according to EN13445-4 Clause 9

Ratio of deformation

F=50·en/(Di/2+en/2) = 3.252 %

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Hydrostatic test

Item or side minimum allowables ratio	Item f0/f =	1.14271
Coincident design pressure for the maximum pressure load case	Pd =	1.60 MPa
Test pressure as per EN13445-5 formula 10.2.3.3.1-1	Pt1 = 1.25·Pd·(Item f0/f) =	2.29 MPa
Test pressure as per EN13445-5 formula 10.2.3.3.1-2	Pt2 = 1.43·Pd =	2.29 MPa
Item or side hydrostatic test pressure	Pt=max(Pt1,Pt2) =	2.29 MPa
Overpressure due to static head in test condition	Pht =	0.006 MPa
Calculation pressure	Pc=Pt+Pht =	2.29 MPa
Outside diameter	De'=De =	114.30 mm
Minimum required thickness	$e = \frac{P \cdot D_e'}{2 \cdot f \cdot z + P} + \delta =$	1.03 mm
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en ≥ e: Ok		

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Standard Cylindrical shell - trubka DN125*According to: EN 13445 Ed. 2014 Issue 4, Part 3, Clause 7 and 8***Design data**

Internal design temperature

Ti = 105.00 °C

Internal design pressure

Pi = 1.60 MPa

Joint efficiency

z = 1.00

Standard pipe

= EN 10216-2

Material: P235GH (EN 10216-2:2008) - Seamless tube (t ≤ 16.00 mm)

Nominal design stress at internal design temperature

$$f = \min\left(\frac{R_{p0.2/T}}{1.5}, \frac{R_m/20}{2.4}\right) = 131.27 \text{ MPa}$$

Nominal design stress at room temperature

$$f = \min\left(\frac{R_{p0.2/20}}{1.5}, \frac{R_m/20}{2.4}\right) = 150.00 \text{ MPa}$$

Nominal design stress in test condition

$$f_{\text{test}} = \left(\frac{R_{p0.2/T_{\text{test}}}}{1.05}\right) = 223.81 \text{ MPa}$$

Geometry

Inside diameter

Di = 131.70 mm

Outside diameter

De = 139.70 mm

Length

L = 400.00 mm

Nominal thickness

en = 4.00 mm

Corrosion allowance

c = 1.00 mm

External corrosion allowance

ce = 0 mm

Undertolerance

δ = 0.50 mm

Internal pressure

Overpressure due to static head

Ph = 0 MPa

Calculation pressure

P=Pi+Ph = 1.60 MPa

Outside diameter

De'=De-2ce = 139.70 mm

Minimum required thickness

$$e = \frac{P \cdot D_e'}{2f \cdot z + P} + c + ce + \delta = 2.35 \text{ mm}$$

e/De ≤ 0,16 (0.01700 ≤ 0.16000): Ok**en ≥ e: Ok****Maximum allowable pressures (at the top of the vessel)**

Maximum allowable test pressure

= 11.49 MPa

Maximum allowable design pressure

= 4.78 MPa

Deformation according to EN13445-4 Clause 9

Ratio of deformation

F=50·en/(Di/2+en/2) = 2.948 %

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Hydrostatic test

Item or side minimum allowables ratio	Item f0/f =	1.14271
Coincident design pressure for the maximum pressure load case	Pd =	1.60 MPa
Test pressure as per EN13445-5 formula 10.2.3.3.1-1	Pt1 = 1.25·Pd·(Item f0/f) =	2.29 MPa
Test pressure as per EN13445-5 formula 10.2.3.3.1-2	Pt2 = 1.43·Pd =	2.29 MPa
Item or side hydrostatic test pressure	Pt=max(Pt1,Pt2) =	2.29 MPa
Overpressure due to static head in test condition	Pht =	0.01 MPa
Calculation pressure	Pc=Pt+Pht =	2.30 MPa
Outside diameter	De'=De =	139.70 mm
Minimum required thickness	$e = \frac{P \cdot D_e'}{2 \cdot f \cdot z + P} + \delta =$	1.21 mm
e/De ≤ 0,16 (0.00900 ≤ 0.16000): Ok		
en ≥ e: Ok		

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Standard Elbow - oblouk DN100, tvar 3D, R=152mm, typ A*According to: EN 13445 Ed. 2014 Issue 4, Part 3, Clause 7 and 8, EN 13480-3: 2012***Design data**

Internal design temperature	Ti =	105.00 °C
Internal design pressure	Pi =	1.60 MPa
Joint efficiency	z =	1.00
Standard pipe	=	EN 10216-2

Material: P235GH (EN 10216-2:2008) - Seamless tube (t ≤ 16.00 mm)

Nominal design stress at internal design temperature	$f = \min\left(\frac{R_{p0.2/T}}{1.5}, \frac{R_m/20}{2.4}\right) =$	131.27 MPa
Nominal design stress at room temperature	$f = \min\left(\frac{R_{p0.2/20}}{1.5}, \frac{R_m/20}{2.4}\right) =$	150.00 MPa
Nominal design stress in test condition	$f_{test} = \left(\frac{R_{p0.2/T_{test}}}{1.05}\right) =$	223.81 MPa

Geometry

Inside diameter	Di =	107.10 mm
Outside diameter	De =	114.30 mm
Length	L =	238.76 mm
Nominal thickness	en =	3.60 mm
Corrosion allowance	c =	1.00 mm
External corrosion allowance	ce =	0 mm
Undertolerance	δ =	0.45 mm
Center-to-End radius	R =	152.00 mm

Internal pressure

Overpressure due to static head	Ph =	0 MPa
Calculation pressure	P=Pi+Ph =	1.60 MPa
Outside diameter	De'=De-2ce =	114.30 mm
Minimum required thickness	$e = \frac{P \cdot D_e'}{2 \cdot f \cdot z + P} + c + ce + \delta =$	2.14 mm
e/De ≤ 0,16 (0.01900 ≤ 0.16000): Ok		
en ≥ e: Ok		

Minimum thickness according to EN 13480

Minimum required wall thickness for a straight pipe without allowances and tolerances	$e = \frac{P D_e}{2 f \cdot z + P} =$	0.69 mm
Minimum required thickness without allowances and tolerances on the intrados	$e_{int} = e \frac{R/D_e - 0,25}{R/D_e - 0,5} =$	0.90 mm
Minimum required thickness without allowances and tolerances on the extrados	$e_{ext} = e \frac{R/D_e + 0,25}{R/D_e + 0,5} =$	0.60 mm
Minimum required thickness	$e_{min} = \text{MAX}(e_{int}; e_{ext}) + c + ce + \delta =$	2.35 mm
en ≥ e,min: Ok		

Maximum allowable pressures (at the top of the vessel)

Maximum allowable test pressure	=	12.68 MPa
Maximum allowable design pressure	=	5.03 MPa

Deformation according to EN13445-4 Clause 9

Ratio of deformation	F=100·De/2R =	37.599 %
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Hydrostatic test

Item or side minimum allowables ratio	Item f0/f =	1.14271
Coincident design pressure for the maximum pressure load case	Pd =	1.60 MPa
Test pressure as per EN13445-5 formula 10.2.3.3.1-1	Pt1 = 1.25·Pd·(Item f0/f) =	2.29 MPa
Test pressure as per EN13445-5 formula 10.2.3.3.1-2	Pt2 = 1.43·Pd =	2.29 MPa
Item or side hydrostatic test pressure	Pt=max(Pt1,Pt2) =	2.29 MPa
Overpressure due to static head in test condition	Pht =	0.002 MPa
Calculation pressure	Pc=Pt+Pht =	2.29 MPa
Outside diameter	De'=De =	114.30 mm
Minimum required thickness	$e = \frac{P \cdot D_e'}{2 \cdot f \cdot z + P} + \delta$ =	1.03 mm
e/De ≤ 0,16 (0.00900 ≤ 0.16000): Ok		
en ≥ e: Ok		

Minimum thickness according to EN 13480

Minimum required wall thickness for a straight pipe without allowances and tolerances	$e = \frac{P D_e}{2 f \cdot z + P}$ =	0.58 mm
Minimum required thickness without allowances and tolerances on the intrados	$e_{int} = e \frac{R/D_e - 0,25}{R/D_e - 0,5}$ =	0.76 mm
Minimum required thickness without allowances and tolerances on the extrados	$e_{ext} = e \frac{R/D_e + 0,25}{R/D_e + 0,5}$ =	0.50 mm
Minimum required thickness	e,min = MAX(e,int; e,ext) + δ =	1.21 mm
en ≥ e,min: Ok		

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Standard Elbow - oblouk DN125, tvar 3D, R=190mm, typ A*According to: EN 13445 Ed. 2014 Issue 4, Part 3, Clause 7 and 8, EN 13480-3: 2012***Design data**

Internal design temperature	Ti =	105.00 °C
Internal design pressure	Pi =	1.60 MPa
Joint efficiency	z =	1.00
Standard pipe	=	EN 10216-2

Material: P235GH (EN 10216-2:2008) - Seamless tube (t ≤ 16.00 mm)

Nominal design stress at internal design temperature	$f = \min\left(\frac{R_{p0.2/T}}{1.5}, \frac{R_m/20}{2.4}\right) =$	131.27 MPa
Nominal design stress at room temperature	$f = \min\left(\frac{R_{p0.2/20}}{1.5}, \frac{R_m/20}{2.4}\right) =$	150.00 MPa
Nominal design stress in test condition	$f_{test} = \left(\frac{R_{p0.2/T_{test}}}{1.05}\right) =$	223.81 MPa

Geometry

Inside diameter	Di =	131.70 mm
Outside diameter	De =	139.70 mm
Length	L =	298.45 mm
Nominal thickness	en =	4.00 mm
Corrosion allowance	c =	1.00 mm
External corrosion allowance	ce =	0 mm
Undertolerance	δ =	0.50 mm
Center-to-End radius	R =	190.00 mm

Internal pressure

Overpressure due to static head	Ph =	0 MPa
Calculation pressure	P=Pi+Ph =	1.60 MPa
Outside diameter	De'=De-2ce =	139.70 mm
Minimum required thickness	$e = \frac{P \cdot D_e'}{2 \cdot f \cdot z + P} + c + ce + \delta =$	2.35 mm
e/De ≤ 0,16 (0.01700 ≤ 0.16000): Ok		
en ≥ e: Ok		

Minimum thickness according to EN 13480

Minimum required wall thickness for a straight pipe without allowances and tolerances	$e = \frac{P D_e}{2 f \cdot z + P} =$	0.85 mm
Minimum required thickness without allowances and tolerances on the intrados	$e_{int} = e \frac{R/D_e - 0,25}{R/D_e - 0,5} =$	1.09 mm
Minimum required thickness without allowances and tolerances on the extrados	$e_{ext} = e \frac{R/D_e + 0,25}{R/D_e + 0,5} =$	0.73 mm
Minimum required thickness	$e_{min} = \text{MAX}(e_{int}; e_{ext}) + c + ce + \delta =$	2.59 mm
en ≥ e,min: Ok		

Maximum allowable pressures (at the top of the vessel)

Maximum allowable test pressure	=	11.49 MPa
Maximum allowable design pressure	=	4.78 MPa

Deformation according to EN13445-4 Clause 9

Ratio of deformation	F=100·De/2R =	36.763 %
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Hydrostatic test

Item or side minimum allowables ratio	Item f0/f =	1.14271
Coincident design pressure for the maximum pressure load case	Pd =	1.60 MPa
Test pressure as per EN13445-5 formula 10.2.3.3.1-1	Pt1 = 1.25·Pd·(Item f0/f) =	2.29 MPa
Test pressure as per EN13445-5 formula 10.2.3.3.1-2	Pt2 = 1.43·Pd =	2.29 MPa
Item or side hydrostatic test pressure	Pt=max(Pt1,Pt2) =	2.29 MPa
Overpressure due to static head in test condition	Pht =	0.01 MPa
Calculation pressure	Pc=Pt+Pht =	2.30 MPa
Outside diameter	De'=De =	139.70 mm
Minimum required thickness	$e = \frac{P \cdot D_e'}{2 \cdot f \cdot z + P} + \delta$ =	1.21 mm
	e/De ≤ 0,16 (0.00900 ≤ 0.16000): Ok	
	en ≥ e: Ok	

Minimum thickness according to EN 13480

Minimum required wall thickness for a straight pipe without allowances and tolerances	$e = \frac{P D_e}{2 f \cdot z + P}$ =	0.71 mm
Minimum required thickness without allowances and tolerances on the intrados	$e_{int} = e \frac{R/D_e - 0,25}{R/D_e - 0,5}$ =	0.92 mm
Minimum required thickness without allowances and tolerances on the extrados	$e_{ext} = e \frac{R/D_e + 0,25}{R/D_e + 0,5}$ =	0.62 mm
Minimum required thickness	e,min = MAX(e,int; e,ext) + δ =	1.42 mm
	en ≥ e,min: Ok	

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Conical shell - redukce DN125/100, typ A*According to: EN 13445 Ed. 2014 Issue 4, Part 3, Clause 7 and 8***Design data**

Internal design temperature	Ti =	105.00 °C
Internal design pressure	Pi =	1.60 MPa
Joint efficiency	z =	1.00

Material: P235GH (EN 10216-2:2008) - Seamless tube (t ≤ 16.00 mm)

Nominal design stress at internal design temperature	$f = \min\left(\frac{R_{p0.2/T}}{1.5}, \frac{R_{m/20}}{2.4}\right) =$	131.27 MPa
Nominal design stress at room temperature	$f = \min\left(\frac{R_{p0.2/20}}{1.5}, \frac{R_{m/20}}{2.4}\right) =$	150.00 MPa
Nominal design stress in test condition	$f_{test} = \left(\frac{R_{p0.2/T_{test}}}{1.05}\right) =$	223.81 MPa

Geometry

Length	L =	70.11 mm
Nominal thickness	en =	4.00 mm
Corrosion allowance	c =	1.00 mm
External corrosion allowance	ce =	0 mm
Undertolerance	δ =	0 mm
Maximum Inside Diameter	Di =	131.70 mm
Maximum Outside Diameter	De =	139.70 mm
Minimum Inside Diameter	di =	107.10 mm
Minimum Outside Diameter	de =	115.10 mm
Half-apex angle	α =	10.00 °
Thickness at large end	e2nL =	4.00 mm
Thickness at small end	e2ns =	4.00 mm
Nominal thickness of cylinder at large end	e1nL =	4.00 mm
Minimum required thickness of cylinder at large end	e1L =	2.35 mm
Nominal thickness of cylinder at small end	e1ns =	3.60 mm
Minimum required thickness of cylinder at small end	e1s =	2.14 mm

Internal pressure

Overpressure due to static head	Ph =	0 MPa
Calculation pressure	P=Pi+Ph =	1.60 MPa
Mean diameter of the cone at large end	Dc=Di+e1nL+c+ce+δ =	136.70 mm
Minimum length along cone	l2L=√((Dc*e2L)/cos(α)) =	10.66 mm
Calculation diameter	DK=Dc-e1L-2r[1-cos(α)]-l2L·sin(α) =	131.52 mm
Minimum required cone thickness	e2+c+ce+δ (iterative) =	1.82 mm

e2nL ≥ ej: Ok**Large end junction (without knuckle)**

Minimum length along cylinder	1.4·l1L=1.4·√(Dc·e1L) =	25.07 mm
Minimum length along cone	1.4·l2L=1.4·√((Dc·e2L)/cos(α)) =	14.93 mm
β factor defined in 7.6.6	7.6.6 =	0.42544
Minimum required thickness at the junction at the large end of the cone	e2L=ej=(P·Dc·β)/(2f+c+ce+δ) =	1.35 mm
Maximum allowable pressure of junction at large end	Pmax(large end)=2·f·e2nL/(β·Dc) =	13.54 MPa

e2nL ≥ ej: Ok

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Small end junction

Mean diameter of the cone	$dc=di+e1ns+c+ce+\delta$	=	111.70 mm
Minimum length along cylinder	$l1s=\sqrt{(dc*e1s')}$	=	15.50 mm
Minimum length along cone	$l2s=\sqrt{((dc*e2s')/\cos(\alpha))}$	=	18.45 mm
s factor defined in 7.6.8	$s=e2ns/e1ns$	=	1.39535
τ factor defined in 7.6.8	7.6-24/23	=	2.44491
βH factor defined in 7.6.8	7.6-25	=	0.70793
Minimum required thickness at the junction at the small end of the cone	$e2s$ (iterative)	=	1.01 mm
Maximum allowable pressure of junction at small end	$Pmax(small\ end)=2 \cdot f \cdot z \cdot e1/(dc \cdot \beta H)$	=	7.14 MPa
			$e2ns \geq e2s$: Ok
			$en \geq e$: Ok

Maximum allowable pressures (at the top of the vessel)

Maximum allowable test pressure		=	13.78 MPa
Maximum allowable design pressure		=	5.94 MPa

Deformation according to EN13445-4 Clause 9

Ratio of deformation	$F=50 \cdot en/(di/2+en/2)$	=	3.600 %
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Hydrostatic test

Item or side minimum allowables ratio	Item $f0/f$	=	1.14271
Coincident design pressure for the maximum pressure load case	Pd	=	1.60 MPa
Test pressure as per EN13445-5 formula 10.2.3.3.1-1	$Pt1 = 1.25 \cdot Pd \cdot (Item\ f0/f)$	=	2.29 MPa
Test pressure as per EN13445-5 formula 10.2.3.3.1-2	$Pt2 = 1.43 \cdot Pd$	=	2.29 MPa
Item or side hydrostatic test pressure	$Pt=\max(Pt1,Pt2)$	=	2.29 MPa
Overpressure due to static head in test condition	Pht	=	0.007 MPa
Calculation pressure	$Pc=Pt+Pht$	=	2.29 MPa
Mean diameter of the cone at large end	$Dc=Di+e1nL+\delta$	=	135.70 mm
Minimum length along cone	$l2L=\sqrt{((Dc*e2L)/\cos(\alpha))}$	=	9.71 mm
Calculation diameter	$DK=Dc-e1L-2r[1-\cos(\alpha)]-l2 \cdot \sin(\alpha)$	=	130.68 mm
Minimum required cone thickness	$e2+\delta$ (iterative)	=	0.68 mm
			$en \geq e2$: Ok

Large end junction (without knuckle)

Minimum length along cylinder	$1.4 \cdot l1L=1.4 \cdot \sqrt{(Dc*e1L)}$	=	24.98 mm
Minimum length along cone	$1.4 \cdot l2L=1.4 \cdot \sqrt{((Dc*e2L)/\cos(\alpha))}$	=	13.59 mm
β factor defined in 7.6.6	7.6.6	=	0.45516
Minimum required thickness at the junction at the large end of the cone	$e2L=ej=(P \cdot Dc \cdot \beta)/(2f+\delta)$	=	0.32 mm
Maximum allowable pressure of junction at large end	$Pmax(large\ end)=2 \cdot f \cdot e2nL/(\beta \cdot Dc)$	=	28.99 MPa
			$e2nL \geq ej$: Ok

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Drawing

Revision

Small end junction

Mean diameter of the cone	$dc=di+e1ns+c+ce+\delta$	=	110.70 mm
Minimum length along cylinder	$l1s=\sqrt{(dc*e1s')}$	=	19.96 mm
Minimum length along cone	$l2s=\sqrt{((dc*e2s')/\cos(\alpha))}$	=	21.20 mm
s factor defined in 7.6.8	$s=e2ns/e1ns$	=	1.11111
τ factor defined in 7.6.8	7.6-24/23	=	2.12275
βH factor defined in 7.6.8	7.6-25	=	0.68425
Minimum required thickness at the junction at the small end of the cone	$e2s$ (iterative)	=	0.008 mm
Maximum allowable pressure of junction at small end	$P_{max}(\text{small end})=2 \cdot f \cdot z \cdot e1/(dc \cdot \beta H)$	=	21.27 MPa
$e2ns \geq e2s$: Ok			
$e1n \geq e$: Ok			