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Description: Direct Contact After Cooler

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Drawing No.: 11435- 0

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Test Pressure Calculation
acc to AD 2000-Merkblatt HP30:2003-01

drawing no: 11435-0
name/ item: Direct Contact After Cooler

input data

Operating Data

maximum allowable pressure	p =	6 bar
relative density of the test fluid	GammaP =	1 dN/dm ³
relative density of the working fluid	GammaF =	1 dN/dm ³
design temperature	T =	120 °C
temperature for test condition	T' =	20 °C
operating mode horizontal = 1	vertical = 2 =	2
pressure test horizontal = 1	vertical = 2 =	1
length (height) of vessel	L / H =	23350 mm
test pressure calculation under consideration of		
maximum ratio K'/K:	1	
or preferably minimum ratio K'/K:	2 =	2

Material Data

name/item: Mantel
material: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strenght value K = 215 N/mm²
yield strength Rp 0.2 [120°C,12mm]
design strength value at T' K' = 265 N/mm²
yield strength Rp 0.2 [20°C,12mm]

results

scope:

Only for a liquid pressure test according to AD 2000 Hp 30, section 4.

Attention!

The condition is that the pressure gauge is placed on the highest level of the vertical or horizontal vessel during testing procedure.

additional pressure from static liquid column pstat = 2.335 bar

intermediate results

no	name / item	material	*	thickness mm	factor K'/K	Fp	req test press bar
1	Mantel	P 265 GH	D	=<16	1.233	1.541	11.579

required test pressure pT = 11.579 bar, for component with no. 1
the lowest ratio of K'/K was taken into account

* D = data from DIMy database resp. F = individual input data

Fp= test pressure factor

Attention: it have to be checked whether all components of the pressure equipment will withstand this calculated test pressure!

For Information

For the calculation of testing condition of the vessel the additional static column from medium (=Di) have to be considered.

Formed Heads with Opening
under internal and external pressure
acc to AD 2000-Merkblatt B3/B9:2000-10

drawing no: 11345-0
name/ item: top head, operation condtion

input data - dished end

design data

design pressure p = 6 bar
design temperature T = 120 °C

material data, dished end

material: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value K = 215 N/mm²
yield strength Rp 0.2 [120°C,12mm]
design strength value at room temperature K20 = 265 N/mm²
yield strength Rp 0.2 [20°C,12mm]
safety factor S = 1.5
joint efficiency v = 1

geometry data, dished end

head type: 2- Korbboogen type
outer diameter Da = 2624 mm
wall thickness se = 12 mm
manufacturing tolerance c1 = 6- DIN 28011-13
corrosion allowance c2 = 3 mm

results - dished end

results shown in percentages signify over-/underdimensioning
for dimensions: (act-req) / req, with other data: (allow-act) / act

req wall thickness without opening [15] sreq = 10.36 mm
» act wall thickness is adequate! res = +16 %
with $\beta = 2.50$ and $(sreq-c)/Da = .0026$
and manuf. tolerance/corrosion allowance c1/c2 = 0.50/3.00 mm
allowances, head (act wall thickness) c1/c2 = 0.50/3.00 mm
max. unreinforced opening crown da max ca 351 mm
knuckle da max ca 279 mm
influence of multiple openings / AD-B9 [8] from $l \leq$ 378.5 mm

max all working pressure pmax = 7.80 bar
- with decisive component: dished end
max all test pressure pTmax = 13.73 bar

input data - opening 1

opening name/item: N2, DN700

type of opening: 3- nozzle, set-through with reinf. pad

material data

nozzle: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value, nozzle K = 215 N/mm²
yield strength Rp 0.2 [120°C,20mm]
design strength value, nozzle at room temp. K20 = 255 N/mm²
yield strength Rp 0.2 [20°C,20mm]
joint efficiency, nozzle v = .85
consideration of v for area comparison = 1- yes
pad: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value, pad K = 215 N/mm²
yield strength Rp 0.2 [120°C,10mm]
design strength value, pad at room temp. K20 = 265 N/mm²
yield strength Rp 0.2 [20°C,10mm]

geometry data

outer diameter	da =	711 mm
actual wall thickness	ss =	12 mm
manufacturing tolerance	c1 =	7- DIN EN 10029A
corrosion allowance	c2 =	3 mm
actual length of nozzle	ls =	100 mm
protruding length	ls' =	0 mm
distance outside diameter - discontinuity	x =	0 mm
distance vessel longit. axis - opening, mean axis	t =	0 mm
inclination of nozzle: 1- radial, psi = 90°		
width of pad reinforcement	b =	100 mm
thickness of a pad reinforcement	h =	10 mm

results - opening 1

opening-name/item: N2, DN700

req wall thickness of nozzle acc AD-B1	[2]	sserf =	5.15 mm
» act wall thickness is adequate!		res =	+133 %
with manuf. tolerance/corrosion allowance		c1/c2 =	0.40/3.00 mm
area comparison acc AD-B9 with actual wall thicknesses:			
resulting stress	[2]	σ_v =	107.2 N/mm ²
allowable stress		K/S =	143.3 N/mm ²
» opening is adequately reinforced!		res =	+34 %
with stressed shell-length	[3]	bmit =	232.4 mm
calculated wall thickness of nozzle		ss =	8.5 mm
with allowances, nozzle (act wall thicknesses)		c1/c2 =	0.50/3.00 mm
calculated outer nozzle length	[6]	ls =	77.3 mm
inner nozzle length		ls' =	0.0 mm
calc. reinforcement thickness	[4]	hv =	4.3 mm
angle of slope, nozzle		psi =	90.0 grd
load-bearing cross sectional area		A σ =	3601 mm ²
pressure load area		Ap =	641499 mm ²

Formed Heads with Opening
under internal and external pressure
acc to AD 2000-Merkblatt B3/B9:2000-10

drawing no: 11435-0
name/ item: Bottom head, operation condition

input data - dished end

design data

design pressure p = 6.2 bar
design temperature T = 120 °C

material data, dished end

material: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value K = 215 N/mm²
yield strength Rp 0.2 [120°C,15mm]
design strength value at room temperature K20 = 265 N/mm²
yield strength Rp 0.2 [20°C,15mm]
safety factor S = 1.5
joint efficiency v = 1

geometry data, dished end

head type: 2- Korbbogen type
outer diameter Da = 2624 mm
wall thickness se = 12 mm
manufacturing tolerance c1 = 6- DIN 28011-13
corrosion allowance c2 = 3 mm

results - dished end

results shown in percentages signify over-/underdimensioning
for dimensions: (act-req) / req, with other data: (allow-act) / act

req wall thickness without opening [15] sreq = 10.54 mm
» act wall thickness is adequate! res = +14 %
with $\beta = 2.48$ and $(sreq-c)/Da = .0027$
and manuf. tolerance/corrosion allowance c1/c2 = 0.50/3.00 mm
allowances, head (act wall thickness) c1/c2 = 0.50/3.00 mm
max. unreinforced opening crown da max ca 327 mm
knuckle da max ca 264 mm
influence of multiple openings / AD-B9 [8] from 1 <= 378.5 mm

max all working pressure pmax = 7.80 bar
- with decisive component: dished end
max all test pressure pTmax = 13.73 bar

input data - opening 1

opening name/item: N5, DN200

type of opening: 1- nozzle, set-through without reinf. pad

material data

nozzle: 0090-St 35.8 (1.0305) DIN 17175 AD-W4/W12
design strength value, nozzle K = 207 N/mm²
yield strength Rp 0.2 [120°C,14.2mm]
design strength value, nozzle at room temp. K20 = 235 N/mm²
yield strength Rp 0.2 [20°C,14.2mm]
joint efficiency, nozzle v = .85
consideration of v for area comparison = 1- yes

geometry data

outer diameter da = 219.1 mm
actual wall thickness ss = 14.2 mm
manufacturing tolerance c1 = 3- DIN 17175
corrosion allowance c2 = 3 mm
actual length of nozzle ls = 100 mm

continuation geometry data

protruding length ls' = 0 mm
distance outside diameter - discontinuity x = 0 mm
distance vessel longit. axis - opening, mean axis t = 0 mm
inclination of nozzle: 2- axial, parallel to mean axis of shell

results - opening 1

opening-name/item: N5, DN200

req wall thickness of nozzle acc AD-B1 [2] sserf = 4.09 mm
» act wall thickness is adequate! res = +247 %
with manuf. tolerance/corrosion allowance c1/c2 = 0.51/3.00 mm
area comparison acc AD-B9 with actual wall thicknesses:
resulting stress [2] σ_v = 98.2 N/mm²
allowable stress K/S = 143.3 N/mm²
» opening is adequately reinforced! res = +46 %
with stressed shell-length [3] bmit = 189.3 mm
calculated wall thickness of nozzle ss = 9.4 mm
with allowances, nozzle (act wall thicknesses) c1/c2 = 1.77/3.00 mm
calculated outer nozzle length [6] ls = 44.5 mm
inner nozzle length ls' = 0.0 mm
angle of slope, nozzle psi = 90.0 grd
load-bearing cross sectional area A σ = 2019 mm²
pressure load area Ap = 318690 mm²

Cylindrical Shells with Opening
under Internal Pressure
acc to AD 2000-Merkblatt B1/B9:2000-10

drawing no: 11435-0
name/ item: lower shell area up to 5400 mm

input data - shell

design data

design pressure p = 6.2 bar
design temperature T = 120 °C

material data, shell

material: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value K = 215 N/mm²
yield strength Rp 0.2 [120°C,12mm]
design strength value at room temperature K20 = 265 N/mm²
yield strength Rp 0.2 [20°C,12mm]
safety factor S = 1.5
joint efficiency v = .85

geometry data, shell

outer diameter Da = 2624 mm
actual wall thickness se = 12 mm
manufacturing tolerance c1 = 7- DIN EN 10029A
corrosion allowance c2 = 3 mm

results - shell

results shown in percentages signify over-/underdimensioning
for dimensions: (act-req) / req, with other data: (allow-act) / act

req wall thickness without opening [2] sreq = 10.16 mm
» act wall thickness is adequate! res = +18 %
manufacturing tolerance / corrosion allowance c1/c2 = 0.50/3.00 mm
allowances, shell (act wall thickness) c1/c2 = 0.50/3.00 mm
max unreinforced opening da max ca 149 mm
influence of multiple nozzles / AD-B9 [8] from l <= 298.2 mm

max all working pressure pmax = 6.30 bar
- with decisive component: opening no. 2
max all test pressure pTmax = 10.87 bar

input data - opening 1

opening - name/item: N1, DN700

type of opening: 3- nozzle, set-through with reinf. pad

material data

nozzle: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value, nozzle K = 215 N/mm²
yield strength Rp 0.2 [120°C,20mm]
design strength value, nozzle at room temp. K20 = 255 N/mm²
yield strength Rp 0.2 [20°C,20mm]
joint efficiency, nozzle v = .85
pad reinf: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value, pad K = 215 N/mm²
yield strength Rp 0.2 [120°C,10mm]
design strength value, pad at room temp. K20 = 265 N/mm²
yield strength Rp 0.2 [20°C,10mm]

geometry data

outer diameter da = 711 mm
actual wall thickness ss = 20 mm
manufacturing tolerance c1 = 7- DIN EN 10029A
corrosion allowance c2 = 3 mm

continuation geometry data

actual length of nozzle	ls =	150 mm
protruding length	ls' =	0 mm
distance nozzle outside diameter - discontinuity	x =	0 mm
width of pad reinforcement	b =	100 mm
thickness of a pad reinforcement	h =	10 mm

results - opening 1

opening-name/item: N1, DN700

req wall thickness of nozzle acc to AD-B1	[2]	sserf =	5.20 mm
» act wall thickness is adequate!		res =	+284 %
with manufact. tolerance/corrosion allowance		c1/c2 =	0.40/3.00 mm
area comparison acc to AD-B9 with act wall thicknesses:			
actual stress	[2]	σ_v =	95.5 N/mm ²
allowable stress		K/S =	143.3 N/mm ²
» actual opening is adequately reinforced!		res =	+50 %
with allowances, nozzle (act wall thickness)		c1/c2 =	0.60/3.00 mm
calculated wall thickness of nozzle		ss =	16.4 mm
calculated outer nozzle length	[6]	ls mit =	133.4 mm
inner nozzle length		ls' mit =	0.0 mm
calculated shell length	[3]	b mit =	189.9 mm
calculated reinforcement thickness	[4]	hv =	5.3 mm
load-bearing cross sectional area		A σ =	4942 mm ²
pressure load area		Ap =	759086 mm ²

input data - opening 2

opening - name/item: N6 Manway DN 600

type of opening: 1- nozzle, set-through without reinf. pad

material data

nozzle: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02

design strength value, nozzle	K =	215 N/mm ²
yield strength Rp 0.2 [120°C, 20mm]		
design strength value, nozzle at room temp.	K20 =	255 N/mm ²
yield strength Rp 0.2 [20°C, 20mm]		
joint efficiency, nozzle	v =	.85

geometry data

outer diameter	da =	600 mm
actual wall thickness	ss =	20 mm
manufacturing tolerance	c1 =	7- DIN EN 10029A
corrosion allowance	c2 =	3 mm
actual length of nozzle	ls =	78 mm
protruding length	ls' =	0 mm
distance nozzle outside diameter - discontinuity	x =	150 mm

results - opening 2

opening-name/item: N6 Manway DN 600

req wall thickness of nozzle acc to AD-B1	[2]	sserf =	4.92 mm
» act wall thickness is adequate!		res =	+306 %
with manufact. tolerance/corrosion allowance		c1/c2 =	0.40/3.00 mm
area comparison acc to AD-B9 with act wall thicknesses:			
actual stress	[2]	σ_v =	141.1 N/mm ²
allowable stress		K/S =	143.3 N/mm ²
» actual opening is adequately reinforced!		res =	+2 %
with allowances, nozzle (act wall thickness)		c1/c2 =	0.60/3.00 mm
calculated wall thickness of nozzle		ss =	16.4 mm
calculated outer nozzle length	[6]	ls mit =	78.0 mm
inner nozzle length		ls' mit =	0.0 mm
calculated shell length	[3]	b mit =	149.1 mm
load-bearing cross sectional area		A σ =	2686 mm ²
pressure load area		Ap =	609937 mm ²

input data - opening 3

opening - name/item: N31+N33, DN80

type of opening: 1- nozzle, set-through without reinf. pad

material data

nozzle: 0090-St 35.8 (1.0305) DIN 17175 AD-W4/W12

design strength value, nozzle

K = 207 N/mm²

yield strength Rp 0.2 [120°C, 6.3mm]

design strength value, nozzle at room temp.

K20 = 235 N/mm²

yield strength Rp 0.2 [20°C, 6.3mm]

joint efficiency, nozzle

v = 1

geometry data

outer diameter

da = 88.9 mm

actual wall thickness

ss = 3.6 mm

manufacturing tolerance

c1 = 3- DIN 17175

corrosion allowance

c2 = 3 mm

actual length of nozzle

ls = 100 mm

protruding length

ls' = 0 mm

distance nozzle outside diameter - discontinuity

x = 0 mm

results - opening 3

opening-name/item: N31+N33, DN80

req wall thickness of nozzle acc to AD-B1 [2]

sserf = 3.55 mm

» act wall thickness is adequate!

res = +1 %

with manufact. tolerance/corrosion allowance

c1/c2 = 0.36/3.00 mm

area comparison acc to AD-B9 with act wall thicknesses:

actual stress

[2] σ_v = 123.7 N/mm²

allowable stress

K/S = 143.3 N/mm²

» actual opening is adequately reinforced!

res = +16 %

with allowances, nozzle (act wall thickness)

c1/c2 = 0.36/3.00 mm

calculated wall thickness of nozzle

ss = 0.2 mm

calculated outer nozzle length

[6] ls mit = 5.8 mm

inner nozzle length

ls' mit = 0.0 mm

calculated shell length

[3] b mit = 149.1 mm

load-bearing cross sectional area

A σ = 1271 mm²

pressure load area

Ap = 252927 mm²

input data - opening 4

opening - name/item: N32+N34, DN80

type of opening: 1- nozzle, set-through without reinf. pad

material data

nozzle: 0090-St 35.8 (1.0305) DIN 17175 AD-W4/W12

design strength value, nozzle

K = 207 N/mm²

yield strength Rp 0.2 [120°C, 12.5mm]

design strength value, nozzle at room temp.

K20 = 235 N/mm²

yield strength Rp 0.2 [20°C, 12.5mm]

joint efficiency, nozzle

v = 1

geometry data

outer diameter

da = 88.9 mm

actual wall thickness

ss = 3.6 mm

manufacturing tolerance

c1 = 3- DIN 17175

corrosion allowance

c2 = 3 mm

actual length of nozzle

ls = 100 mm

protruding length

ls' = 0 mm

distance nozzle outside diameter - discontinuity

x = 0 mm

results - opening 4opening-name/item: N32+N34, DN80

req wall thickness of nozzle acc to AD-B1 [2] sserf = 3.55 mm
 » act wall thickness is adequate! res = +1 %
 with manufact. tolerance/corrosion allowance c1/c2 = 0.36/3.00 mm
 area comparison acc to AD-B9 with act wall thicknesses:
 actual stress [2] σ_v = 123.7 N/mm²
 allowable stress K/S = 143.3 N/mm²
 » actual opening is adequately reinforced! res = +16 %
 with allowances, nozzle (act wall thickness) c1/c2 = 0.36/3.00 mm
 calculated wall thickness of nozzle ss = 0.2 mm
 calculated outer nozzle length [6] ls mit = 5.8 mm
 inner nozzle length ls' mit = 0.0 mm
 calculated shell length [3] b mit = 149.1 mm
 load-bearing cross sectional area $A\sigma$ = 1271 mm²
 pressure load area A_p = 252927 mm²

input data - double-nozzle calculationarea comparison between openings according to AD-B9

first opening- pos./item (no.): 1
 second opening- pos./item (no.): 2
 distance of opening center lines - circumferential: 2- degree
 angle circumferential direction tu = 180 °
 distance of opening center lines - longitudinal tl = 900 mm

results - double-nozzle calculationopening 1 and 2 (N1, DN700 and N6 Manway DN 600)

actual stress [2] σ_v = 52.4 N/mm²
 » influenced nozzles are adequately reinforced! res = +174 %
 with load-bearing cross sectional area $A\sigma$ = 34874 mm²
 pressure load area A_p = 2930015 mm²

Cylindrical Shells with Opening
under Internal Pressure
acc to AD 2000-Merkblatt B1/B9:2000-10

drawing no: 11435-0
name/ item: middle area of shell from 5400 mm to 15300 mm

input data - shell

design data

design pressure p = 6.2 bar
design temperature T = 120 °C

material data, shell

material: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value K = 215 N/mm²
yield strength Rp 0.2 [120°C, 12mm]
design strength value at room temperature K20 = 265 N/mm²
yield strength Rp 0.2 [20°C, 12mm]
safety factor S = 1.5
joint efficiency v = 1

geometry data, shell

outer diameter Da = 2624 mm
actual wall thickness se = 12 mm
manufacturing tolerance c1 = 7- DIN EN 10029A
corrosion allowance c2 = 3 mm

results - shell

results shown in percentages signify over-/underdimensioning
for dimensions: (act-req) / req, with other data: (allow-act) / act

req wall thickness without opening [2] sreq = 9.16 mm
» act wall thickness is adequate! res = +31 %
manufacturing tolerance / corrosion allowance c1/c2 = 0.50/3.00 mm
allowances, shell (act wall thickness) c1/c2 = 0.50/3.00 mm
max unreinforced opening da max ca 149 mm
influence of multiple nozzles / AD-B9 [8] from l <= 298.2 mm

max all working pressure pmax = 6.30 bar
- with decisive component: opening no. 1
max all test pressure pTmax = 10.87 bar

input data - opening 1

opening - name/item: N7, DN600

type of opening: 1- nozzle, set-through without reinf. pad

material data

nozzle: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value, nozzle K = 215 N/mm²
yield strength Rp 0.2 [120°C, 20mm]
design strength value, nozzle at room temp. K20 = 255 N/mm²
yield strength Rp 0.2 [20°C, 20mm]
joint efficiency, nozzle v = .85

geometry data

outer diameter da = 600 mm
actual wall thickness ss = 20 mm
manufacturing tolerance c1 = 7- DIN EN 10029A
corrosion allowance c2 = 3 mm
actual length of nozzle ls = 78 mm
protruding length ls' = 0 mm
distance nozzle outside diameter - discontinuity x = 0 mm

results - opening 1opening-name/item: N7, DN600

req wall thickness of nozzle acc to AD-B1 [2] sserf = 4.92 mm
 » act wall thickness is adequate! res = +306 %
 with manufact. tolerance/corrosion allowance c1/c2 = 0.40/3.00 mm
 area comparison acc to AD-B9 with act wall thicknesses:
 actual stress [2] σ_v = 141.1 N/mm²
 allowable stress K/S = 143.3 N/mm²
 » actual opening is adequately reinforced! res = +2 %
 with allowances, nozzle (act wall thickness) c1/c2 = 0.60/3.00 mm
 calculated wall thickness of nozzle ss = 16.4 mm
 calculated outer nozzle length [6] ls mit = 78.0 mm
 inner nozzle length ls' mit = 0.0 mm
 calculated shell length [3] b mit = 149.1 mm
 load-bearing cross sectional area A_σ = 2686 mm²
 pressure load area A_p = 609937 mm²

input data - opening 2opening - name/item: N3, DN200

type of opening: 3- nozzle, set-through with reinf. pad

material data

nozzle: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
 design strength value, nozzle K = 215 N/mm²
 yield strength Rp 0.2 [120°C, 16mm]
 design strength value, nozzle at room temp. K20 = 265 N/mm²
 yield strength Rp 0.2 [20°C, 16mm]
 joint efficiency, nozzle v = 1
 pad reinf: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
 design strength value, pad K = 215 N/mm²
 yield strength Rp 0.2 [120°C, 14mm]
 design strength value, pad at room temp. K20 = 265 N/mm²
 yield strength Rp 0.2 [20°C, 14mm]

geometry data

outer diameter da = 219.1 mm
 actual wall thickness ss = 14.2 mm
 manufacturing tolerance c1 = 3- DIN 17175
 corrosion allowance c2 = 3 mm
 actual length of nozzle ls = 100 mm
 protruding length ls' = 0 mm
 distance nozzle outside diameter - discontinuity x = 100 mm
 width of pad reinforcement b = 100 mm
 thickness of a pad reinforcement h = 10 mm

results - opening 2opening-name/item: N3, DN200

req wall thickness of nozzle acc to AD-B1 [2] sserf = 3.97 mm
 » act wall thickness is adequate! res = +258 %
 with manufact. tolerance/corrosion allowance c1/c2 = 0.50/3.00 mm
 area comparison acc to AD-B9 with act wall thicknesses:
 actual stress [2] σ_v = 70.9 N/mm²
 allowable stress K/S = 143.3 N/mm²
 » actual opening is adequately reinforced! res = +102 %
 with allowances, nozzle (act wall thickness) c1/c2 = 1.77/3.00 mm
 calculated wall thickness of nozzle ss = 9.4 mm
 calculated outer nozzle length [6] ls mit = 55.6 mm
 inner nozzle length ls' mit = 0.0 mm
 calculated shell length [3] b mit = 100.0 mm
 calculated reinforcement thickness [4] hv = 10.0 mm
 load-bearing cross sectional area A_σ = 2454 mm²
 pressure load area A_p = 279563 mm²

Cylindrical Shells with Opening
under Internal Pressure
acc to AD 2000-Merkblatt B1/B9:2000-10

drawing no: 11435-0

name/ item: top area of shell from 15300 mm to 23500 mm

input data - shell

design data

design pressure p = 6 bar
design temperature T = 120 °C

material data, shell

material: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value K = 215 N/mm²
yield strength Rp 0.2 [120°C, 12mm]
design strength value at room temperature K20 = 265 N/mm²
yield strength Rp 0.2 [20°C, 12mm]
safety factor S = 1.5
joint efficiency v = .85

geometry data, shell

outer diameter Da = 2624 mm
actual wall thickness se = 12 mm
manufacturing tolerance c1 = 7- DIN EN 10029A
corrosion allowance c2 = 3 mm

results - shell

results shown in percentages signify over-/underdimensioning
for dimensions: (act-req) / req, with other data: (allow-act) / act

req wall thickness without opening [2] sreq = 9.95 mm
» act wall thickness is adequate! res = +21 %
manufacturing tolerance / corrosion allowance c1/c2 = 0.50/3.00 mm
allowances, shell (act wall thickness) c1/c2 = 0.50/3.00 mm
max unreinforced opening da max ca 164 mm
influence of multiple nozzles / AD-B9 [8] from l <= 298.2 mm

max all working pressure pmax = 6.10 bar
- with decisive component: opening no. 2
max all test pressure pTmax = 10.50 bar

input data - opening 1

opening - name/item: N8, N9 manway DN600

type of opening: 1- nozzle, set-through without reinf. pad

material data

nozzle: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value, nozzle K = 215 N/mm²
yield strength Rp 0.2 [120°C, 20mm]
design strength value, nozzle at room temp. K20 = 255 N/mm²
yield strength Rp 0.2 [20°C, 20mm]
joint efficiency, nozzle v = .85

geometry data

outer diameter da = 600 mm
actual wall thickness ss = 20 mm
manufacturing tolerance c1 = 7- DIN EN 10029A
corrosion allowance c2 = 3 mm
actual length of nozzle ls = 78 mm
protruding length ls' = 0 mm
distance nozzle outside diameter - discontinuity x = 0 mm

results - opening 1opening-name/item: N8,N9 manway DN600

req wall thickness of nozzle acc to AD-B1 [2] sserf = 4.87 mm
 » act wall thickness is adequate! res = +310 %
 with manufact. tolerance/corrosion allowance c1/c2 = 0.40/3.00 mm
 area comparison acc to AD-B9 with act wall thicknesses:
 actual stress [2] σ_v = 136.5 N/mm²
 allowable stress K/S = 143.3 N/mm²
 » actual opening is adequately reinforced! res = +5 %
 with allowances, nozzle (act wall thickness) c1/c2 = 0.60/3.00 mm
 calculated wall thickness of nozzle ss = 16.4 mm
 calculated outer nozzle length [6] ls mit = 78.0 mm
 inner nozzle length ls'mit = 0.0 mm
 calculated shell length [3] b mit = 149.1 mm
 load-bearing cross sectional area $A\sigma$ = 2686 mm²
 pressure load area A_p = 609937 mm²

input data - opening 2opening - name/item: N10, manway DN 600

type of opening: 1- nozzle, set-through without reinf. pad

material data

nozzle: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
 design strength value, nozzle K = 215 N/mm²
 yield strength Rp 0.2 [120°C,20mm]
 design strength value, nozzle at room temp. K20 = 255 N/mm²
 yield strength Rp 0.2 [20°C,20mm]
 joint efficiency, nozzle v = .85

geometry data

outer diameter da = 600 mm
 actual wall thickness ss = 20 mm
 manufacturing tolerance c1 = 7- DIN EN 10029A
 corrosion allowance c2 = 3 mm
 actual length of nozzle ls = 78 mm
 protruding length ls' = 0 mm
 distance nozzle outside diameter - discontinuity x = 120 mm

results - opening 2opening-name/item: N10, manway DN 600

req wall thickness of nozzle acc to AD-B1 [2] sserf = 4.87 mm
 » act wall thickness is adequate! res = +310 %
 with manufact. tolerance/corrosion allowance c1/c2 = 0.40/3.00 mm
 area comparison acc to AD-B9 with act wall thicknesses:
 actual stress [2] σ_v = 141.0 N/mm²
 allowable stress K/S = 143.3 N/mm²
 » actual opening is adequately reinforced! res = +2 %
 with allowances, nozzle (act wall thickness) c1/c2 = 0.60/3.00 mm
 calculated wall thickness of nozzle ss = 16.4 mm
 calculated outer nozzle length [6] ls mit = 78.0 mm
 inner nozzle length ls'mit = 0.0 mm
 calculated shell length [3] b mit = 120.0 mm
 load-bearing cross sectional area $A\sigma$ = 2439 mm²
 pressure load area A_p = 572001 mm²

input data - opening 3opening - name/item: N4

type of opening: 3- nozzle, set-through with reinf. pad

material data

nozzle: 0090-St 35.8 (1.0305) DIN 17175 AD-W4/W12
 design strength value, nozzle K = 207 N/mm²
 yield strength Rp 0.2 [120°C,14.2mm]

continuation material data

design strength value, nozzle at room temp. K20 = 235 N/mm²
 yield strength Rp 0.2 [20°C, 14.2mm]
 joint efficiency, nozzle v = 1
 pad reinf: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
 design strength value, pad K = 215 N/mm²
 yield strength Rp 0.2 [120°C, 15mm]
 design strength value, pad at room temp. K20 = 265 N/mm²
 yield strength Rp 0.2 [20°C, 15mm]

geometry data

outer diameter da = 114.3 mm
 actual wall thickness ss = 12.5 mm
 manufacturing tolerance c1 = 3- DIN 17175
 corrosion allowance c2 = 3 mm
 actual length of nozzle ls = 50 mm
 protruding length ls' = 0 mm
 distance nozzle outside diameter - discontinuity x = 100 mm
 width of pad reinforcement b = 60 mm
 thickness of a pad reinforcement h = 10 mm

results - opening 3

opening-name/item: N4

req wall thickness of nozzle acc to AD-B1 [2] sserf = 3.61 mm
 » act wall thickness is adequate! res = +246 %
 with manufact. tolerance/corrosion allowance c1/c2 = 0.36/3.00 mm
 area comparison acc to AD-B9 with act wall thicknesses:
 actual stress [2] ov = 68.9 N/mm²
 allowable stress K/S = 143.3 N/mm²
 » actual opening is adequately reinforced! res = +108 %
 with allowances, nozzle (act wall thickness) c1/c2 = 1.25/3.00 mm
 calculated wall thickness of nozzle ss = 8.3 mm
 calculated outer nozzle length [6] ls mit = 37.0 mm
 inner nozzle length ls' mit = 0.0 mm
 calculated shell length [3] b mit = 100.0 mm
 calculated reinforcement thickness [4] hv = 6.0 mm
 load-bearing cross sectional area Aσ = 1811 mm²
 pressure load area Ap = 207069 mm²

input data - double-nozzle calculation

area comparison between openings according to AD-B9

first opening- pos./item (no.): 1
 second opening- pos./item (no.): 2
 distance of opening center lines - circumferential: 0- no distance
 distance of opening center lines - longitudinal tl = 1000 mm

results - double-nozzle calculation

opening 1 and 2 (N8, N9 manway DN600 and N10, manway DN 600)

actual stress [2] ov = 130.4 N/mm²
 » influenced nozzles are adequately reinforced! res = +10 %
 with load-bearing cross sectional area Aσ = 6237 mm²
 pressure load area Ap = 1352563 mm²

Integral Type Flanges

under Internal Pressure and Additional Forces
acc to AD 2000-B7:2000-10 B8:2000-10 DIN V 2505:1986-01

drawing no: 11435-0

name/ item: Manway flange DN600, operation condition

input data

Type Declaration

flange type: 1- welding neck flange (inside gasket)
bolt type: 3- bolts, S=1.8 / S'=1.26 / phi=1.0 (AD-B7)
calculation of bolting torque = 1- yes

Design Data

design pressure p = 6.2 bar
test pressure p' = 11.6 bar
design temperature T = 120 °C
code no. of external loads: 1- without external loads

Geometry Data, Flange

outside diameter flange da = 710 mm
outside diameter hub dr = 600 mm
bolt-circle diameter dt = 665 mm
outer dia of tapered neck at trans to flange d3 = 616 mm
flange thickness hF = 30 mm
total length of flange ha = 50 mm
bolt hole diameter dL = 23 mm
number of bolts or bolt holes n = 24 Stck
act wall thickness of hub respectively tube s1 = 6 mm
manufacturing tolerance of hub respect. tube c1 = 7- DIN EN 10029A
corrosion allowance of hub respect. tube c2 = 3 mm

Material Data, Flange

material: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
strength value, design K = 215 N/mm²
yield strength Rp 0.2 [120°C, 60mm]
safety factor, design S = 1.5
strength value, test/bolting-up K = 245 N/mm²
yield strength Rp 0.2 [20°C, 60mm]
safety factor, test/bolting-up S = 1.05
modulus of elasticity, design [120°C] E = 205400 N/mm²
modulus of elasticity, bolting-up [20°C] E = 212000 N/mm²

Gasket Data

gasket type: 4- asbestos - only for Information
calculation without reduction of setting load = 0- no
retighten the bolts after setting of gasket = 0- No
code no. of medium: 1- design: gases and vapours; test: liquids
outside diameter, gasket dDa = 640 mm
inside diameter, gasket dDi = 600 mm
thickness of gasket hD = 3 mm

Bolt Data

material: 0171-5.6 DIN 267 Teil 13:1993-08 AD-W7:1999-12
strength value, design K = 270 N/mm²
yield strength Rp 0.2 [120°C, 20mm]
strength value, test/bolting-up K' = 300 N/mm²
yield strength Rp 0.2 [20°C, 20mm]
root diameter of screw thread dk = 16.76 mm
effective diameter thread d2 = 18.376 mm
outer diameter of bearing surface (bolting) daS = 30 mm
thread angle, bolts α = 60 °
thread pitch, bolts P = 2.5 mm
min coefficient of friction, thread μG_min = .12
min coefficient of friction, bearing surface μA_min = .12

continuation Bolt Data

max coefficient of friction, thread $\mu_{G_max} = .12$
max coefficient of friction, bearing surface $\mu_{A_max} = .12$

results

summary of results

flange		bolting-up		design		testing		FS0 max
act. stresses and reserve								
section A-A	N/mm ²	110	111%	60	139%	109	114%	301
section B-B	N/mm ²	151	55%	82	75%	149	57%	411
section C-C	N/mm ²	27	766%	11	999%	20	999%	74
act. flange deflection °		0.584		0.327		0.576		1.59
bolts								
req root diameter	dk mm	11.41	116%	11.89	139%	9.52	210%	16.76

geometry data

calc. wall thickness of hub respectively tube $s1 = 2.60$ mm
with manufacturing tolerance $c1 = 0.40$ mm
corosion allowance $c2 = 3.00$ mm
moment arms
- of hub load $aR = 33.80$ mm
- of ring area load $aF = 28.80$ mm
- of gasket load $aD = 22.50$ mm
- of bolt load (for section C-C) $a1 = 24.50$ mm
reduced bolt hole diameter $dL' = 11.50$ mm
mean gasket diameter $dD = 620.00$ mm
effective width of gasket $bD = 20.00$ mm
bolt pitch / $dL = 3.78$

		bolt-up (0)	design (B)	testing (P)
gasket data				
medium		gases/vap.	gases/vap.	liquids
characteristic $k1$	mm	--	26.00	20.00
characteristic $k0 \cdot KD$	N/mm	516.40	--	--
loads				
hub load - int.press.	FI..	--	172276	322322
ring area load	FF..	--	14907	27890
gasket load - design	FD..	--	37678	54226
setting load	FDV	1005833	--	--
red. setting load	FDV'	581627	--	--
min req bolt load	FS..	581627	224860	404439
flange (DIN 2505)				
bending moments				
section A-A,B-B	Nmm	13086609	7099987	12917818
section C-C		13086609	5509080	9908746
section modulus				
section A-A	mm ³	118597	118511	118364
section B-B		86904	86818	86673
section C-C		485612	485612	485612
act stresses				
section A-A	N/mm ²	110.34	59.91	109.14
section B-B		150.59	81.78	149.04
section C-C		26.95	11.34	20.40
design stress	N/mm ²	233.33	143.33	233.33
eff. stress reserve				
section A-A	%	111	139	114
section B-B	%	55	75	57
section C-C	%	766	999	999
act flange deflection	°	0.5837	0.3268	0.5762

			bolt-up (0)	design (B)	testing (P)
bolts					
req root diameter	dk	mm	11.41	11.89	9.52
auxiliary factor	Z		1.27	1.51	1.27
design allowance	c5	mm	0.00	3.00	0.00
stress reserve		%	116	139	210

max allow operating pressure
 max allow test pressure

pmax = 10.84 bar
 pTmax = 18.09 bar

results for bolting up condition (for information)

basic bolt load FS0 max = 1588439 N
 acc. to stress value of 100% of strength value
 of bolts (testing/ bolting-up)

actual stress section A-A = 301.4 N/mm²
 actual stress section B-B = 411.3 N/mm²
 actual stress section C-C = 73.6 N/mm²
 actual flange deflection = 1.594 °
 actual seating stress of gaske = 40.8 N/mm²

bolting torques acc. to VDI-Richtlinie 2230

req bolting torque (with μ_{max}) MAmin = 79 Nm
 with FVM = FS0 = 581627 N / 24 bolts = 24234 N

act seating stress of gasket with MAmin = 14.9 N/mm²

max bolting torque (bolting-up/with μ_{min}) MAmax = 123 Nm
 with FVM = FS0maxT = 901224 N / 24 bolts = 37551 N
 FS0maxT = cause of usage factor of flange reduced force FS0max.

act seating stress of gasket with MAmax = 23.1 N/mm²

$$MA = FVM * (d2/2 * \tan(\phi + \rho') + \mu_A * r_A)$$

$$\phi = \arctan(P / (d2 * \pi))$$

$$\rho' = \arctan(\mu_G / \cos(\alpha / 2))$$

$$r_A = (dL + daS) / 4$$

the seating stress of gasket was not checked with MAmax !

Unstayed and Stayed Flat Ends and Plates
acc to AD 2000-Merkblatt B5:2004-05

drawing no: 11435-0
name/ item: Manway cover, DN600

input data

Type Declaration

shape of plate = 1- circular
bound cond: 13- supplementary marginal moment (chapt 6.3)
calculation of deflection of plate without opening = 0- no

Design Data/ Type of Plate

design pressure p = 6.1 bar
design temperature T = 120 °C

Material Data

plate: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value, plate K = 215 N/mm²
yield strength Rp 0.2 [120°C, 30mm]
design strength value at room temperature K20 = 255 N/mm²
yield strength Rp 0.2 [20°C, 30mm]
modulus of elasticity [120°C] E = 205400 N/mm²
safety factor, plate S = 1.5

Geometry Data

actual wall thickness, plate se = 30 mm
manufacturing tolerance c1 = 7- DIN EN 10029A
corrosion allowance c2 = 3 mm
bolt circle diameter (plate width) dt;f = 665 mm
mean gasket diameter (plate width) dD;f = 620 mm
residual plate thickness sR = 27 mm
gasket type: 4- asbestos - only for Information
width of gasket b = 20 mm
code no. of medium: 1- gases and vapours

Openings in Plates

opening: 0- none

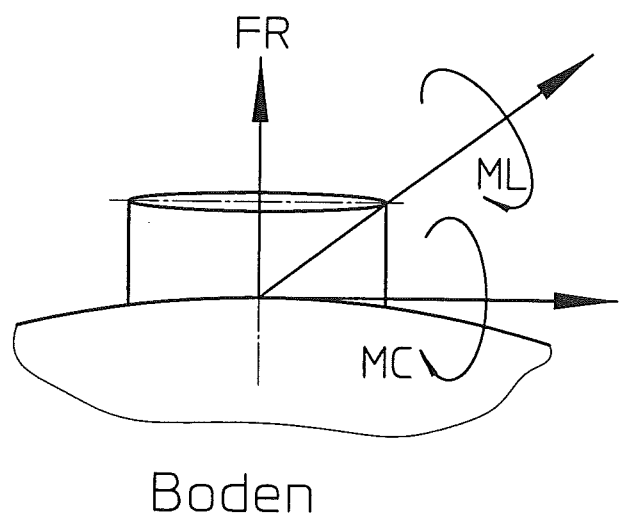
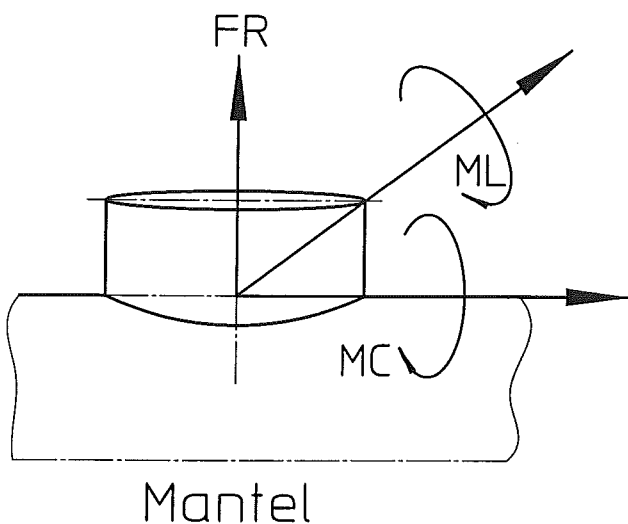
results

results shown in percentages signify over-/underdimensioning
for dimensions: (act-req) / req, with other data: (allow-act) / act

required plate thickness	sreq =	23.38 mm
	res =	+28 %
manufacturing tolerance	c1 =	0.6 mm
corrosion allowance	c2 =	3.0 mm
manuf. toler., act. plate thickness, for Info only	c1 =	0.8 mm
design diameter (width)	D1;f =	620.0 mm
design factor (fig 5)	C1 =	0.489
with diameter ratio	dt/dD =	1.073
with gasket characteristic	k1 =	26.000 mm
with value	delta =	1.201
max allow operating pressure	pmax =	11.37 bar
max allow test pressure	pTmax =	19.26 bar
conditions for flat end design		
req resid thickness	sRmin =	16.37 mm
	res =	+65 %

Stutzen-Zusatzlasten Additional Nozzle loads

Stutzen Nr.	DN	FR [N]	ML [Nm]	MC [Nm]
N1	700	31500	27400	22500
N2	700	31500	27400	22500
N3	200	9000	7200	6400
N4	100	4500	3600	3200
N5	200	9000	954	954



Cylindrical shell

subject to internal pressure and add. loads
WRC 107:1979-03, KTA 3211.2, AD S4:2000-10

drawing no: 11435-0
name/ item: Nozzle N1, DN700

input data

Type Declaration

superposition of int. pressure: 2- AD-S4/KTA 3211

Design Data

design pressure p = 6.2 bar
design temperature T = 120 °C

Additional Loads

lever arm of loading point Please note INFO F1! a = 0 mm
radial force (in direction of vessel - positive) P = -31500 N
shearing force - circumferential direction Vc = 0 N
shearing force - longitudinal direction Vl = 0 N
moment - circumferential direction Mc = 22500 Nm
moment - longitudinal direction Ml = 27400 Nm
torsional moment Mt = 0 Nm

Material Data

material: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value K = 215 N/mm²
yield strength Rp 0.2 [120°C, 22mm]
safety factor S = 1.5
shear stress theory= 1 / deformation energy theory= 2 = 2

Geometry Data Cylindrical Shell

outer diameter DA = 2624 mm
wall thickness T = 22 mm
manufacturing tolerance c1 = 7- DIN EN 10029A
corrosion allowance c2 = 3 mm

Geometry Data Nozzle

code-no: 1- nozzle, round
outer diameter da = 711 mm
wall thickness t = 20 mm
manufacturing tolerance c1 = 7- DIN EN 10029A
corrosion allowance c2 = 3 mm

actual shell thickness T= sH= Te-c1-c2 = 18.40 mm
tolerance cylindrical shell c1/c2 = 0.60/3.00 mm
actual shell thickness t= sA= te-c1-c2 = 16.40 mm
tolerance nozzle c1/c2 = 0.60/3.00 mm

geometrical values

WRC: Gamma = 70.804 β = 0.239
KTA: t/T = 0.891 $d_m/\sqrt{(D_m \cdot T)}$ = 3.172

	factors resulting WRC-diagrams			
	A-B		C-D	
N ϕ - P	7.655	(4C)	3.603	(3C)
M ϕ - P	0.016	(2C-1)	0.039	(1C)
N ϕ - Mc			2.336	(3A)
M ϕ - Mc			0.062	(1A)
N ϕ - Ml	5.131	(3B)		
M ϕ - Ml	0.015	(1B-1)		
Nx - P	3.603	(3C)	7.655	(4C)
Mx - P	0.039	(1C-1)	0.016	(2C)
Nx - Mc			6.523	(4A)
Mx - Mc			0.025	(2A)
Nx - Ml	2.637	(4B)		
Mx - Ml	0.022	(2B-1)		

	factors resulting KTA-Diagrams							
	A-B				C-D			
	ϕ -up	ϕ -lo	x-up	x-lo	ϕ -up	ϕ -lo	x-up	x-lo
Pl	4.48	4.48	0.39	0.39	-0.38	-0.38	-0.33	-0.33
PlQ	3.64	5.25	0.13	0.68	0.71	-1.49	0.50	-1.20

N / M = bending- / membran stress component () = diagram
 Mc / Ml = circumferential / longitudinal moment P = radial load
 ϕ / x = circumferential / longitudinal component up/lo = upper/lower
 Pl / PlQ = membr. / membr.+bend. stress acc. to internal Pressure

single stresses

σ	N/mm ²	Au	Al	Bu	Bl	Cu	Cl	Du	Dl
N ϕ - P		10.1	10.1	10.1	10.1	4.7	4.7	4.7	4.7
M ϕ - P		9.1	-9.1	9.1	-9.1	21.8	-21.8	21.8	-21.8
N ϕ - Mc						-7.0	-7.0	7.0	7.0
M ϕ - Mc						-79.1	79.1	79.1	-79.1
N ϕ - Ml		-18.9	-18.9	18.9	18.9				
M ϕ - Ml		-22.7	22.7	22.7	-22.7				
total - ϕ		-22.4	4.8	60.7	-2.9	-59.6	54.9	112.7	-89.1
Nx - P		4.7	4.7	4.7	4.7	10.1	10.1	10.1	10.1
Mx - P		21.8	-21.8	21.8	-21.8	9.1	-9.1	9.1	-9.1
Nx - Mc						-19.7	-19.7	19.7	19.7
Mx - Mc						-32.5	32.5	32.5	-32.5
Nx - Ml		-9.7	-9.7	9.7	9.7				
Mx - Ml		-34.6	34.6	34.6	-34.6				
total - x		-17.7	7.8	70.8	-42.0	-33.0	13.7	71.3	-11.8
τ - Mt		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
τ - Fc		0.0	0.0	0.0	0.0				
τ - Fl						0.0	0.0	0.0	0.0
total - τ		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Au= Location A upper, Al= Location A lower, Bu= Loc B upper, etc.
 N = membran stress, M= bending stress, τ =Tau= shear stress
 P = radial force, Mc/Ml= moment of load, Vc/Vl= shear force
 Mt= torsional moment, ϕ = circumf. direction x= longit. direction

combines stress according to AD-Merkblatt S4

GEH: distortion energy theory

m stress		A		B		C		D	
N/mm ²									
WRC- ϕ	$\sigma m\phi$	-8.8		28.9		-2.3		11.8	
WRC-x	σmx	-5.0		14.4		-9.6		29.7	
WRC- τ	$\sigma m\tau$	0.0		0.0		0.0		0.0	
KTA- ϕ	$\sigma mP\phi$	196.5		196.5		-16.6		-16.6	
KTA-x	σmPx	17.0		17.0		-14.7		-14.7	
total- ϕ	$\sigma mT\phi$	187.7		225.4		-18.9		-4.8	
total-x	σmTx	12.1		31.5		-24.3		15.0	
comb.str.	σmC	182.0	18%	211.5	2%	22.1	872%	17.9	999%
allowable	1.5*f	215.0		215.0		215.0		215.0	

m+b stress		Au		Bu		Cu		Du	
N/mm ²									
WRC- ϕ	$\sigma mb\phi$	-22.4	4.8	60.7	-2.9	-59.6	54.9	112.7	-89.1
WRC-x	σmbx	-17.7	7.8	70.8	-42.0	-33.0	13.7	71.3	-11.8
WRC- τ	$\sigma mb\tau$	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KTA- ϕ	$\sigma mbP\phi$	159.7	230.4	159.7	230.4	31.3	-65.4	31.3	-65.4
KTA-x	$\sigma mbPx$	5.8	29.7	5.8	29.7	21.9	-52.6	21.9	-52.6
total- ϕ	$\sigma mbT\phi$	137.3	235.2	220.4	227.5	-28.3	-10.4	144.0	-154.5
total-x	$\sigma mbTx$	-11.9	37.5	76.6	-12.2	-11.1	-38.8	93.2	-64.4
comb.str.	σmbC	143.6	218.8	193.8	233.9	24.7	34.8	126.5	134.4
		199%	96%	122%	84%	999%	999%	240%	220%
allowed	3*f	430.0		430.0		430.0		430.0	

m= membrane stress b= bending stress C= combined stress
 ϕ = circumf. direction x= tangential direction T= total stress

reference: - Welding Research Council Bulletin No.107, edition 3.79
 - KTA 3211.2
 - stress rating according to AD-Merkblatt S4

Cylindrical shell

subject to internal pressure and add. loads
WRC 107:1979-03, KTA 3211.2, AD S4:2000-10

drawing no: 11435-0
name/ item: Nozzle N3, DN200

input data

Type Declaration

superposition of int. pressure: 2- AD-S4/KTA 3211

Design Data

design pressure $p = 6.2 \text{ bar}$
design temperature $T = 120 \text{ °C}$

Additional Loads

lever arm of loading point Please note INFO F1! $a = 0 \text{ mm}$
radial force (in direction of vessel - positive) $P = 9000 \text{ N}$
shearing force - circumferential direction $V_c = 0 \text{ N}$
shearing force - longitudinal direction $V_l = 0 \text{ N}$
moment - circumferential direction $M_c = 6400 \text{ Nm}$
moment - longitudinal direction $M_l = 7200 \text{ Nm}$
torsional moment $M_t = 0 \text{ Nm}$

Material Data

material: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value $K = 215 \text{ N/mm}^2$
yield strength $R_p 0.2 [120\text{°C}, 25\text{mm}]$
safety factor $S = 1.5$
shear stress theory= 1 / deformation energy theory= 2 $= 2$

Geometry Data Cylindrical Shell

outer diameter $DA = 2624 \text{ mm}$
wall thickness $T = 22 \text{ mm}$
manufacturing tolerance $c1 = 7- \text{ DIN EN 10029A}$
corrosion allowance $c2 = 3 \text{ mm}$

Geometry Data Nozzle

code-no: 1- nozzle, round
outer diameter $da = 219.1 \text{ mm}$
wall thickness $t = 14.2 \text{ mm}$
manufacturing tolerance $c1 = 7- \text{ DIN EN 10029A}$
corrosion allowance $c2 = 3 \text{ mm}$

results FOR INFORMATION ONLY

actual shell thickness $T = sH = T_e - c1 - c2 = 18.40 \text{ mm}$
tolerance cylindrical shell $c1/c2 = 0.60/3.00 \text{ mm}$
actual shell thickness $t = sA = t_e - c1 - c2 = 10.70 \text{ mm}$
tolerance nozzle $c1/c2 = 0.50/3.00 \text{ mm}$

geometrical values

WRC: Gamma = 70.804 $\beta = 0.074$
KTA: $t/T = 0.581$ $dm/\sqrt{(Dm \cdot T)} = 0.952$

	factors resulting WRC-diagrams							
	A-B		C-D					
N ϕ - P	12.265	(4C)	11.034	(3C)				
M ϕ - P	0.094	(2C-1)	0.132	(1C)				
N ϕ - Mc			1.965	(3A)				
M ϕ - Mc			0.097	(1A)				
N ϕ - Ml	6.436	(3B)						
M ϕ - Ml	0.047	(1B-1)						
Nx - P	11.034	(3C)	12.265	(4C)				
Mx - P	0.132	(1C-1)	0.094	(2C)				
Nx - Mc			2.629	(4A)				
Mx - Mc			0.056	(2A)				
Nx - Ml	1.847	(4B)						
Mx - Ml	0.072	(2B-1)						
	factors resulting KTA-Diagrams							
	A-B				C-D			
	ϕ -up	ϕ -lo	x-up	x-lo	ϕ -up	ϕ -lo	x-up	x-lo
Pl	3.09	3.09	0.19	0.19	-0.23	-0.23	0.41	0.41
PlQ	2.84	3.32	0.47	-0.14	0.18	-0.48	0.66	0.41

N / M = bending- / membran stress component () = diagram
 Mc / Ml = circumferential / longitudinal moment P = radial load
 ϕ / x = circumferential / longitudinal component up/lo = upper/lower
 Pl / PlQ = membr. / membr.+bend. stress acc. to internal Pressure

single stresses

σ	N/mm ²	Au	Al	Bu	Bl	Cu	Cl	Du	Dl
N ϕ - P		-4.6	-4.6	-4.6	-4.6	-4.1	-4.1	-4.1	-4.1
M ϕ - P		-15.0	15.0	-15.0	15.0	-21.1	21.1	-21.1	21.1
N ϕ - Mc						-5.5	-5.5	5.5	5.5
M ϕ - Mc						-114.5	114.5	114.5	-114.5
N ϕ - Ml		-20.2	-20.2	20.2	20.2				
M ϕ - Ml		-62.6	62.6	62.6	-62.6				
total - ϕ		-102.3	52.8	63.2	-32.1	-145.2	125.9	94.7	-92.0
Nx - P		-4.1	-4.1	-4.1	-4.1	-4.6	-4.6	-4.6	-4.6
Mx - P		-21.1	21.1	-21.1	21.1	-15.0	15.0	-15.0	15.0
Nx - Mc						-7.3	-7.3	7.3	7.3
Mx - Mc						-66.5	66.5	66.5	-66.5
Nx - Ml		-5.8	-5.8	5.8	5.8				
Mx - Ml		-96.4	96.4	96.4	-96.4				
total - x		-127.4	107.5	76.9	-73.6	-93.4	69.5	54.2	-48.8
τ - Mt		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
τ - Fc		0.0	0.0	0.0	0.0				
τ - Fl						0.0	0.0	0.0	0.0
total - τ		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Au= Location A upper, Al= Location A lower, Bu= Loc B upper, etc.
 N = membran stress, M= bending stress, τ =Tau= shear stress
 P = radial force, Mc/Ml= moment of load, Vc/Vl= shear force
 Mt= torsional moment, ϕ = circumf. direction x= longit. direction

combines stress according to AD-Merkblatt S4

GEH: distortion energy theory

m stress		A		B		C		D	
N/mm ²									
WRC- ϕ	$\sigma m\phi$	-24.8		15.6		-9.6		1.3	
WRC-x	σmx	-9.9		1.6		-11.9		2.7	
WRC- τ	$\sigma m\tau$	0.0		0.0		0.0		0.0	
KTA- ϕ	$\sigma mP\phi$	135.8		135.8		-10.1		-10.1	
KTA-x	σmPx	8.2		8.2		17.9		17.9	
total- ϕ	$\sigma mT\phi$	111.0		151.3		-19.7		-8.7	
total-x	σmTx	-1.7		9.9		6.0		20.7	
comb.str.	σmC	111.8	92%	146.6	47%	23.3	824%	26.1	722%
allowable	1.5*f	215.0		215.0		215.0		215.0	

m+b stress		Au		Bu		Cu		Du	
N/mm ²									
WRC- ϕ	$\sigma mb\phi$	-102.3	52.8	63.2	-32.1	-145.2	125.9	94.7	-92.0
WRC-x	σmbx	-127.4	107.5	76.9	-73.6	-93.4	69.5	54.2	-48.8
WRC- τ	$\sigma mb\tau$	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KTA- ϕ	$\sigma mbP\phi$	124.6	145.9	124.6	145.9	7.9	-20.9	7.9	-20.9
KTA-x	$\sigma mbPx$	20.7	-6.3	20.7	-6.3	28.9	18.1	28.9	18.1
total- ϕ	$\sigma mbT\phi$	22.3	198.7	187.8	113.9	-137.2	105.1	102.6	-112.9
total-x	$\sigma mbTx$	-106.7	101.2	97.6	-79.9	-64.5	87.6	83.2	-30.7
comb.str.	σmbC	119.4	172.1	162.7	168.7	118.9	97.5	94.4	101.1
		260%	150%	164%	155%	262%	341%	356%	325%
allowed	3*f	430.0		430.0		430.0		430.0	

m= membrane stress b= bending stress C= combined stress
 ϕ = circumf. direction x= tangential direction T= total stress

reference: - Welding Research Council Bulletin No.107, edition 3.79
 - KTA 3211.2
 - stress rating according to AD-Merkblatt S4

combines stress according to AD-Merkblatt S4
 GEH: distortion energy theory

m stress		A		B		C		D	
N/mm ²									
WRC- ϕ	$\sigma m \phi$	-11.4		6.8		-5.1		0.3	
WRC-x	$\sigma m x$	-4.8		-0.1		-5.5		0.9	
WRC- τ	$\sigma m \tau$	0.0		0.0		0.0		0.0	
KTA- ϕ	$\sigma m P \phi$	134.7		134.7		-14.1		-14.1	
KTA-x	$\sigma m P x$	10.1		10.1		22.9		22.9	
total- ϕ	$\sigma m T \phi$	123.3		141.6		-19.2		-13.9	
total-x	$\sigma m T x$	5.3		10.0		17.4		23.8	
comb.str.	$\sigma m C$	120.8	78%	136.8	57%	31.7	578%	33.0	552%
allowable	1.5*f	215.0		215.0		215.0		215.0	

m+b stress		Au		Bu		Cu		Du	
N/mm ²									
WRC- ϕ	$\sigma m b \phi$	-87.4	64.5	59.2	-45.5	-142.6	132.4	108.3	-107.8
WRC-x	$\sigma m b x$	-123.4	113.8	89.0	-89.2	-91.6	80.7	63.5	-61.7
WRC- τ	$\sigma m b \tau$	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KTA- ϕ	$\sigma m b P \phi$	131.9	138.8	131.9	138.8	3.3	-20.8	3.3	-20.8
KTA-x	$\sigma m b P x$	23.7	-8.1	23.7	-8.1	26.3	35.2	26.3	35.2
total- ϕ	$\sigma m b T \phi$	44.6	203.3	191.1	93.2	-139.3	111.6	111.6	-128.6
total-x	$\sigma m b T x$	-99.6	105.8	112.8	-97.2	-65.3	115.9	89.8	-26.5
comb.str.	$\sigma m b C$	127.9	176.1	166.4	165.0	120.7	113.8	102.5	117.6
		236%	144%	158%	161%	256%	278%	320%	266%
allowed	3*f	430.0		430.0		430.0		430.0	

m= membrane stress b= bending stress C= combined stress
 ϕ = circumf. direction x= tangential direction T= total stress

reference: - Welding Research Council Bulletin No.107, edition 3.79
 - KTA 3211.2
 - stress rating according to AD-Merkblatt S4

Spherical shell

subject to internal pressure and add. loads
WRC 107:1979-03, KTA 3211.2, AD S4:2000-10

drawing no: 11435-0
name/ item: Nozzle N2 DN700

input data

Type Declaration

superposition of int. pressure: 2- KTA 3211

Design data

design pressure p = 6 bar
design temperature T = 120 °C

Additional Loads

lever arm of loading point a = 0 mm
radial force (in direction of vessel - positive) P = 31500 N
shearing force in direction 1-1 V1 = 0 N
shearing force in direction 2-2 V2 = 0 N
moment in direction 1-1 M1 = 35454 Nm
moment in direction 2-2 M2 = 0 Nm
torsional moment Mt = 0 Nm

Material Data

material: 0841-X 2 CrNiMoN 17 11 2 (1.4406) DIN EN 10028-7 AD-W2
design strength value K = 246 N/mm²
yield strength Rp 1.0 [120°C, 24mm]
safety factor S = 1.5
shear stress theory= 1 / deformation energy theory= 2 = 1

Geometry Data Spherical Shell

outer diameter of spherical shell DA = 4222 mm
actual wall thickness Te = 20 mm
manufacturing tolerance c1 = 6- DIN 28011-13
corrosion allowance c2 = 3 mm

Geometry Data Nozzle

code-no: 1- nozzle, round
nozzle outer diameter da = 711 mm
nozzle wall thickness t = 12 mm
manufacturing tolerance c1 = 7- DIN EN 10029A
corrosion allowance c2 = 3 mm

actual thickness of spherical shell T= sH= Te-c1-c2 = 16.50 mm
tolerance spherical shell c1/c2 = 0.50/3.00 mm
actual thickness of nozzle t= sA= te-c1-c2 = 8.50 mm
tolerance nozzle c1/c2 = 0.50/3.00 mm

geometrical values WRC

for rho= 1.94; gamma=41.32; u=1.909
 Nx*T/P:0.0103 | Mx/P:0.0064 | Nx*T*√(RmT)/M:0.0095 | Mx*√(RmT)/M:0.0067
 Ny*T/P:0.1105 | My/P:0.0081 | Ny*T*√(RmT)/M:0.1002 | My*√(RmT)/M:0.0096

This values has been interpolated from the diagrams

SP-1 to SP-10 and SM-1 to SM-10 using the folowing values

for gamma = 15 and rho = 1 and 2

and gamma = 50 and rho = 4

N= normal force, M= moment, x= meridional-, y= tangential-component

explanation to scope of Diagrams of WRC 107

	Gamma=5	Gamma=15	Gamma=50
Rho= 0.25			
Rho= 1			
Rho= 2	+++++	*	
Rho= 4	+++++		
Rho= 10		+++++	

+: in WRC specified values *: vallue needed for calculation

geometrical values KTA

$$da/\sqrt{((DA-T)*T)} = 2.67$$

$$(DA-T)/T = 254.88$$

$$t/T = 0.52$$

	stress value a	local membran stress
membran component	4.24	161.90
membran + bending comp.	7.43	284.06

single stresses

σ N/mm ²	Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Nx - P	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2
Mx - P	-4.5	4.5	-4.5	4.5	-4.5	4.5	-4.5	4.5
Nx - M1					-6.7	-6.7	6.7	6.7
Mx - M1					-28.1	28.1	28.1	-28.1
Nx - M2	0.0	0.0	0.0	0.0				
Mx - M2	0.0	0.0	0.0	0.0				
total - x	-5.6	3.3	-5.6	3.3	-40.4	24.7	29.1	-18.1
Ny - P	-12.8	-12.8	-12.8	-12.8	-12.8	-12.8	-12.8	-12.8
My - P	-5.6	5.6	-5.6	5.6	-5.6	5.6	-5.6	5.6
Ny - M1					-70.0	-70.0	70.0	70.0
My - M1					-40.3	40.3	40.3	-40.3
Ny - M2	0.0	0.0	0.0	0.0				
My - M2	0.0	0.0	0.0	0.0				
total - y	-18.4	-7.2	-18.4	-7.2	-128.7	-36.9	92.0	22.6
τ - V1					0.0	0.0	0.0	0.0
τ - V2	0.0	0.0	0.0	0.0				
τ - Mt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
total - Tau	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Au=position A upper, Al= position A lower, Bl= position B upper
 N= membran components, M = bending components, τ =tau= shear stress
 P= radial force, M11/M22= overtuning moment, V1/V2= shear load
 Mt=torsional moment, x = meridian dir. (1-1) y= tangential (2-2)

combines stress according to AD-Merkblatt S4

SSH: shear stress theory

m stresses		A		B		C		D	
N/mm ²									
WRC-x	σ_{mx}	-1.2		-1.2		-7.8		5.5	
WRC-y	σ_{my}	-12.8		-12.8		-82.8		57.3	
WRC- τ	$\sigma_{m\tau}$	0.0		0.0		0.0		0.0	
KTA	σ_{mP}	161.9		161.9		161.9		161.9	
total-x	σ_{mTx}	160.7		160.7		154.1		167.4	
total-y	σ_{mTy}	149.1		149.1		79.1		219.2	
comb.str.	σ_{mC}	160.7	53%	160.7	53%	154.1	60%	219.2	12%
allowed	$1.5 \cdot f$	246.0		246.0		246.0		246.0	

m+b stresses		Au		Al		Bu		Bl		Cu		Cl		Du		Dl	
N/mm ²																	
WRC-x	σ_{mbx}	-5.6	3.3	-5.6	3.3	-40.4	24.7	29.1	-18.1								
WRC-y	σ_{mby}	-18.4	-7.2	-18.4	-7.2	-128.7	-36.9	92.0	22.6								
WRC- τ	$\sigma_{mb\tau}$	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								
KTA	σ_{mbP}	284.1		284.1		284.1		284.1									
total-x	σ_{mbTx}	278.4	287.3	278.4	287.3	243.7	308.7	313.1	265.9								
total-y	σ_{mbTy}	265.7	276.9	265.7	276.9	155.3	247.1	376.0	306.6								
comb.str.	σ_{mbC}	278.4	287.3	278.4	287.3	243.7	308.7	376.0	306.6								
		77%	71%	77%	71%	102%	59%	31%	60%								
allowed	$3 \cdot f$	492.0		492.0		492.0		492.0									

m= membrane stress b= bending stress C= combined stress
 x= meridian direc. y= tangential direction T= total stress

reference: - Welding Research Council Bulletin No.107, edition 3.79
 - stress rating according to AD-Merkblatt S4
 - KTA 3211.2

please check the calculation with p=0

Following formulas are used to calculate the stresses:

- calculation with int. pressure loading acc. to KTA

$$\begin{aligned}\sigma_{mTx} &= \sigma_{mx} + \sigma_{mP} & \sigma_{mbTx} &= \sigma_{mbx} + \sigma_{mbP} \\ \sigma_{mTy} &= \sigma_{my} + \sigma_{mP} & \sigma_{mbTy} &= \sigma_{mby} + \sigma_{mbP}\end{aligned}$$

- calculation of combined stress according to SS- theory

$$\begin{aligned}\sigma_{mC}: & \max \text{ from } \frac{1}{2} * [(\sigma_{mx} + \sigma_{my}) \pm \text{SQR}((\sigma_{mx} - \sigma_{my})^2 + 4 * \tau^2)] \\ & \text{and } \text{SQR}((\sigma_{mx} - \sigma_{my})^2 + 4 * \tau^2) \\ \sigma_{mbC}: & \max \text{ from } \frac{1}{2} * [(\sigma_{mbx} + \sigma_{mby}) \pm \text{SQR}((\sigma_{mbx} - \sigma_{mby})^2 + 4 * \tau^2)] \\ & \text{and } \text{SQR}((\sigma_{mbx} - \sigma_{mby})^2 + 4 * \tau^2)\end{aligned}$$

- abbreviations:

σ_m : membrane stress (WRC 107)	σ_{mb} : membrane+ bending stress WRC
σ_{mP} : int.press.stress (membr.)	σ_{mbP} : int.press.stress(m.+bending)
σ_{mT} : total membran stress	σ_{mbT} : total membran+bending stress
σ_{mC} : combined membran stress	σ_{mbC} : combined m. + bending stress
τ : shearing stress (WRC 107)	

Spherical shell

subject to internal pressure and add. loads
WRC 107:1979-03, KTA 3211.2, AD S4:2000-10

drawing no: 11435-0
name/ item: Nozzle N5, Bottom head, DN200

input data

Type Declaration

superposition of int. pressure: 2- KTA 3211

Design data

design pressure	p =	6.2 bar
design temperature	T =	120 °C

Additional Loads

lever arm of loading point	a =	0 mm
radial force (in direction of vessel - positive)	P =	0 N
shearing force in direction 1-1	V1 =	0 N
shearing force in direction 2-2	V2 =	0 N
moment in direction 1-1	M1 =	1350 Nm
moment in direction 2-2	M2 =	0 Nm
torsional moment	Mt =	0 Nm

Material Data

material: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02	
design strength value	K = 215 N/mm ²
yield strength Rp 0.2 [120°C, 15mm]	
safety factor	S = 1.5
shear stress theory= 1 / deformation energy theory= 2	= 1

Geometry Data Spherical Shell

outer diameter of spherical shell	DA = 4198 mm
actuall wall thickness	Te = 12 mm
manufacturing tolerance	c1 = 6- DIN 28011-13
corrosion allowance	c2 = 3 mm

Geometry Data Nozzle

code-no: 1- nozzle, round	
nozzle outer diameter	da = 219.1 mm
nozzle wall thickness	t = 10 mm
manufacturing tolerance	c1 = 3- DIN 17175
corrosion allowance	c2 = 3 mm

attention

Rho- value out of scope of figure SP1-10 und SM1-10 of WRC 107
see informationen to geometry data in DIMy-part results

error KTA 3211:

Dm/T = 492.882 out of scope
scope of KTA: $50 \leq Dm/T \leq 400$
charts were used for parameter Dm/T = 400

t/T = 0.676 out of scope
range for KTA : $0.77 \leq t/T \leq 1.3$
values were extrapolated.
DIMy extrapolation range: $0.5 \leq t/T \leq 0.77$

results may not be conservative.

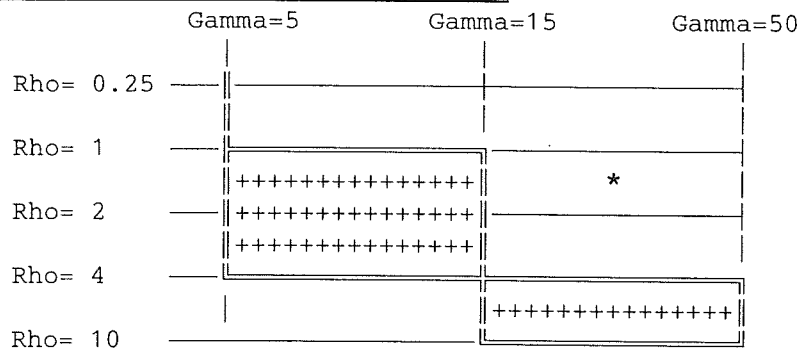
results FOR INFORMATION ONLY

actual thickness of spherical shell $T = sH = T_e - c1 - c2 = 8.50 \text{ mm}$
 tolerance spherical shell $c1/c2 = 0.50/3.00 \text{ mm}$
 actual thickness of nozzle $t = sA = t_e - c1 - c2 = 5.75 \text{ mm}$
 tolerance nozzle $c1/c2 = 1.25/3.00 \text{ mm}$

geometrical values WRC

for $\rho = 1.48$; $\gamma = 18.55$; $u = 0.821$
 $N_x \cdot T/P : 0.0307$ | $M_x/P : 0.0447$ | $N_x \cdot T \cdot \sqrt{(R_m T)}/M : 0.0486$ | $M_x \cdot \sqrt{(R_m T)}/M : 0.0856$
 $N_y \cdot T/P : 0.1544$ | $M_y/P : 0.0244$ | $N_y \cdot T \cdot \sqrt{(R_m T)}/M : 0.1685$ | $M_y \cdot \sqrt{(R_m T)}/M : 0.0561$
 This values has been interpolated from the diagrams
 SP-1 to SP-10 and SM-1 to SM-10 using the following values
 for $\gamma = 15$ and $\rho = 1$ and 2
 and $\gamma = 50$ and $\rho = 4$
 N= normal force, M= moment, x= meridional-, y= tangential-component

explanation to scope of Diagrams of WRC 107



+: in WRC specified values *: value needed for calculation

geometrical values KTA

$da/\sqrt{((DA-T) \cdot T)} = 1.13$ $(DA-T)/T = 400.00$ $t/T = 0.68$
 stress value a local membran stress
 membran component 2.28 174.36
 membran + bending comp. 3.08 234.98

single stresses

σ N/mm ²	Au	Al	Bu	Bl	Cu	Cl	Du	Dl
Nx - P	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mx - P	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nx - M1					-6.8	-6.8	6.8	6.8
Mx - M1					-71.9	71.9	71.9	-71.9
Nx - M2	0.0	0.0	0.0	0.0				
Mx - M2	0.0	0.0	0.0	0.0				
total - x	0.0	0.0	0.0	0.0	-78.7	65.1	78.7	-65.1
Ny - P	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
My - P	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ny - M1					-23.6	-23.6	23.6	23.6
My - M1					-47.1	47.1	47.1	-47.1
Ny - M2	0.0	0.0	0.0	0.0				
My - M2	0.0	0.0	0.0	0.0				
total - y	0.0	0.0	0.0	0.0	-70.7	23.5	70.7	-23.5

continuation single stresses

σ	N/mm ²	Au	Al	Bu	Bl	Cu	Cl	Du	Dl
	N/mm ²								
τ - V1						0.0	0.0	0.0	0.0
τ - V2		0.0	0.0	0.0	0.0				
τ - Mt		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
total - Tau		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Au=position A upper, Al= position A lower, Bl= position B upper
 N= membran components, M = bending components, τ =tau= shear stress
 P= radial force, M11/M22= overtuning moment, V1/V2= shear load
 Mt=torsional moment, x = meridian dir. (1-1) y= tangential (2-2)

combines stress according to AD-Merkblatt S4

SSH: shear stress theory

m stresses		A		B		C		D	
	N/mm ²								
WRC-x	σ_{mx}	0.0		0.0		-6.8		6.8	
WRC-y	σ_{my}	0.0		0.0		-23.6		23.6	
WRC- τ	$\sigma_{m\tau}$	0.0		0.0		0.0		0.0	
KTA	σ_{mP}	174.4		174.4		174.4		174.4	
total-x	σ_{mTx}	174.4		174.4		167.5		181.2	
total-y	σ_{mTy}	174.4		174.4		150.8		198.0	
comb.str.	σ_{mC}	174.4	23%	174.4	23%	167.5	28%	198.0	9%
allowed	1.5*f	215.0		215.0		215.0		215.0	

m+b stresses		Au	Al	Bu	Bl	Cu	Cl	Du	Dl
	N/mm ²								
WRC-x	σ_{mbx}	0.0	0.0	0.0	0.0	-78.7	65.1	78.7	-65.1
WRC-y	σ_{mby}	0.0	0.0	0.0	0.0	-70.7	23.5	70.7	-23.5
WRC- τ	$\sigma_{mb\tau}$	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
KTA	σ_{mbP}	235.0		235.0		235.0		235.0	
total-x	σ_{mbTx}	235.0	235.0	235.0	235.0	156.2	300.1	313.7	169.9
total-y	σ_{mbTy}	235.0	235.0	235.0	235.0	164.3	258.5	305.7	211.5
comb.str.	σ_{mbC}	235.0	235.0	235.0	235.0	164.3	300.1	313.7	211.5
		83%	83%	83%	83%	162%	43%	37%	103%
allowed	3*f	430.0		430.0		430.0		430.0	

m= membrane stress b= bending stress C= combined stress
 x= meridian direc. y= tangential direction T= total stress

reference: - Welding Research Council Bulletin No.107, edition 3.79
 - stress rating according to AD-Merkblatt S4
 - KTA 3211.2

Following formulas are used to calculate the stresses:

- calculation with int. pressure loading acc. to KTA

$$\begin{aligned}\sigma_{mTx} &= \sigma_{mx} + \sigma_{mP} & \sigma_{mbTx} &= \sigma_{mbx} + \sigma_{mbP} \\ \sigma_{mTy} &= \sigma_{my} + \sigma_{mP} & \sigma_{mbTy} &= \sigma_{mby} + \sigma_{mbP}\end{aligned}$$

- calculation of combined stress according to SS- theory

$$\begin{aligned}\sigma_{mC}: \text{ max from } \frac{1}{2} * [(\sigma_{mx} + \sigma_{my}) \pm \text{SQR} ((\sigma_{mx} - \sigma_{my})^2 + 4 * \tau^2)] \\ \text{ and } \text{SQR} ((\sigma_{mx} - \sigma_{my})^2 + 4 * \tau^2) \\ \sigma_{mbC}: \text{ max from } \frac{1}{2} * [(\sigma_{mbx} + \sigma_{mby}) \pm \text{SQR} ((\sigma_{mbx} - \sigma_{mby})^2 + 4 * \tau^2)] \\ \text{ and } \text{SQR} ((\sigma_{mbx} - \sigma_{mby})^2 + 4 * \tau^2)\end{aligned}$$

- abbreviations:

σ_m : membrane stress (WRC 107)	σ_{mb} : membrane+ bending stress WRC
σ_{mP} : int.press.stress (membr.)	σ_{mbP} : int.press.stress(m.+bending)
σ_{mT} : total membran stress	σ_{mbT} : total membran+bending stress
σ_{mC} : combined membran stress	σ_{mbC} : combined m. + bending stress
τ : shearing stress (WRC 107)	

Lifting Trunnions

Direct Contact After Cooler

Drawing No.: 11435-0

Wolf Job No.: 37.106

Use of Lifting Trunnions nominal size 5 acc. to DIN 28085

The total empty weight of the vessel is 53 000 kg

Force per trunnion $F_t = 53\,000 \cdot 9.81/2 = 259\,965\text{ N}$

Allowable total loading per trunnion „Nominal size 5, Shape A“ acc. to DIN 28085 under consideration of an impact factor of 1.6:

$F_{\text{allow}} = \underline{325\,188\text{ N} > 259\,965\text{ N}}$

Accordingly a stress calculation of the trunnions itself is not necessary.

Design calculation of the welding seams between vessel wall and reinforcement plate for lifting trunnions

Impact factor for erection: $\gamma = 2$

Material (vessel wall and reinforcement plate): P265 GH

Yield strength $K = 265\text{ N/mm}^2$

Safety factor $S = 1.5$

Thickness of fillet weld = 6 mm

Joint efficiency for fillet welds $E = 0.55$

Dimensions of reinforcement plate: 710 x 710 x 32 mm

-Maximum force per trunnion $F_{le} = 53000/2 \cdot 9.81 \cdot 2 = 519\,930\text{ N}$

-Total cross area of fillet welds $A_f = 4 \times 710 \times 6 = 17\,040\text{ mm}^2$

-Shearing stress: $\sigma_s = F_{le} / A_f = 519\,930 / 17\,040 = 30.5\text{ N/mm}^2$

-Maximum bending moment:

$M_{\text{max}} = F_{le} \times l = 519\,930 \times 140 = 72\,790\,200\text{ Nmm}$

-**Moment of resistance:** $W = \frac{B \times H^3 - b \times h^3}{6 \times H} = \frac{722 \times 722^3 - 710 \times 710^3}{6 \times 722} = 4\,067\,451\text{ mm}^3$

-Bending stress: $\sigma_b = M_{\text{max}} / W = 72\,790\,200 / 4\,067\,451 = 17.9\text{ N/mm}^2$

-**Total stress:** $\sigma_{\text{tot}} = \sigma_s + \sigma_b = 30.5 + 17.9 = 48.4\text{ N/mm}^2$

-**Allowable stress for fillet welds:** $\sigma_{\text{allow}} = 265 \times 0.55 / 1.5 = 97.2\text{ N/mm}^2$

$\sigma_{\text{allow}} > \sigma_{\text{tot}}$

The verification of stability of the vessel wall will be done acc. to WRC 107, see following pages.

prepared: Strake

Date: 22.11.04

Calculation of tailing lug for Direct Contact After Cooler W13001
acc. to drawing no. 11435-0 Com.: 37.106

The calculation was prepared following DIN 28086

Loads:

The empty weight of one PSA Adsorber
 is about 530000 N

Impact factor: 1,6

$$F_e = 530000 * 0,25 * 1,6 = \underline{212000} \text{ N}$$

Number of tailing lugs

n= 2

S₁= 20 mm

R₁= 120 mm

d= 50 mm

h₁= 120 mm

b= 95 mm

2c= 145 mm

F₁= 106000 N

1. Calculation of tailing eye:

Moments and stresses:

$$M_b = \frac{F_e * 2c}{8} = \underline{3842500,00} \text{ Nmm}$$

$$W_{(actual)} = \frac{S_1 * b^2}{6} = \underline{30083,33} \text{ mm}^3$$

$$A_{(act)} = S_1 * b = \underline{1900,00} \text{ mm}^2$$

Bending stress

$$\delta_{(b)} = \frac{M_b}{W_{(actual)}} = \underline{127,73} \text{ N/mm}^2$$

Tension

$$\delta_{(z)} = \frac{F_1}{A_{(actual)}} = \underline{55,79} \text{ N/mm}^2$$

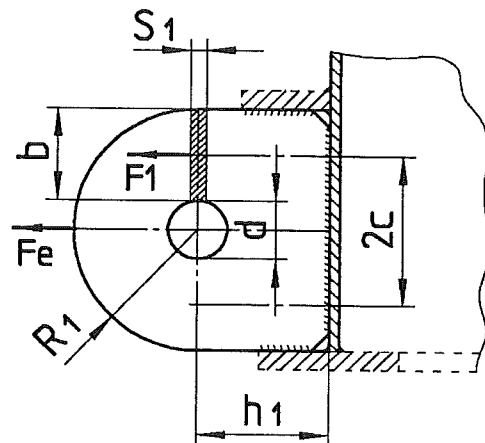
Total stress

$$\delta_{(tot)} = \delta_{(b)} + \delta_{(z)} = \underline{183,52} \text{ N/mm}^2$$

Allowable stress value acc. to DIMY

$$R_p 0.2 \text{ (yield strength)} = \underline{235,00} \text{ N/mm}^2$$

$$\delta_{(tot)} = \underline{183,52} \text{ N/mm}^2 < S_{(allow.)} = \underline{235,00} \text{ N/mm}^2 \quad (28,1 \%)$$



2. Calculation of welding seams:

Total length of fillet welds:

$$L_{(tot)} = L_1 + L_2 + L_3 = \underline{615,00} \text{ mm}$$

Total cross area of fillet welds:

$$A_{(s)} = 2 * L_{(ges)} * a = \underline{12300,00} \text{ mm}^2$$

Total moment of resistance:

$$W_{(s)} = \frac{2 * a * L_{(ges)}^2}{6} = \underline{1260750,00} \text{ mm}^3$$

The angle of maximum strain is

$$\beta \sim 65^\circ$$

$$\cos \beta = 0,42$$

$$\sin \beta = 0,91$$

$$F_x = F_e * \cos \beta = \underline{89595,07} \text{ N}$$

$$F_y = F_e * \sin \beta = \underline{192137,25} \text{ N}$$

Bending stress:

$$\delta_{(b)} = \frac{M_b}{W_{(s)}} = \frac{F_y * h_1}{W_{(s)}} = \underline{18,29} \text{ N/mm}^2$$

Tension:

$$\delta_{(z)} = \frac{F_x}{A_{(s)}} = \underline{7,28} \text{ N/mm}^2$$

Total stress:

$$\delta_{(tot)} = \delta_{(b)} + \delta_{(z)} = \underline{25,57} \text{ N/mm}^2$$

Shear stress:

$$\tau = \frac{F_y}{A_{(s)}} = \underline{15,62} \text{ N/mm}^2$$

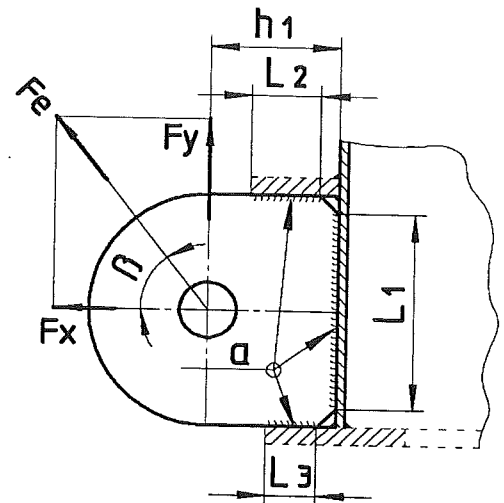
Relative stress:

$$\delta_{(v)} = \sqrt{\delta_{(tot)}^2 + \tau^2} = \underline{29,97} \text{ N/mm}^2$$

Allowable stress value for welding seams with a joint efficiency E of 0,55

$$S_w = E * S_{(90\% \text{ of Yield Strength})} = \underline{129,25} \text{ N/mm}^2$$

$$\delta_{(v)} = \underline{29,97} \text{ N/mm}^2 < S_{(allow.)} = \underline{129,25} \text{ N/mm}^2 \quad (331,3 \%)$$



22.11.2004 Ruppel

Equipment: Direct Contact After Cooler W13001 Drawing No.: 11435-0**1. Calculation of supporting beam, section B-B**

-Loading force acc. to customer's drawing: max. 1000 kg = 9810 N

-Maximum bending moment:

$$M_{\max} = F \times D / 8 = 9810 \times 2600 / 8 = 3\,188\,250 \text{ Nmm}$$

-required moment of resistance: for a T-beam of material S235 JRG2, at $t = 120^\circ\text{C}$ and a safety factor of $S = 1.5$ (yield strength: $R_{p0.2} = 187 \text{ N/mm}^2$):

$$W_{\text{req}} = M_{\max} \times S / R_{p0.2} = 3\,188\,250 \text{ Nmm} \times 1.5 / 187 \text{ N/mm}^2 = 25\,574 \text{ mm}^3 = \underline{25.574 \text{ cm}^3}$$

-chosen: HE-B 100 acc. to DIN 1025 T.2, with $W_x = 89.9 \text{ cm}^3$ (new condition), resp. $W_x = 64.56 \text{ cm}^3$ (corroded condition, calculated with CAD-Program ME10 for 1.5mm corrosion allowance at all sides)

$$W_{\text{exist}} = 64.56 \text{ cm}^3 > W_{\text{req}} = 25.574 \text{ cm}^3$$

2. Calculation of supporting beams for grating, sections C-C

- Total loading force acc. to customer's drawing: 4 100 kg = 40 221 N

- Total grating area $A_{\text{tot}} = 260^2 \times \pi / 4 = 53\,093 \text{ cm}^2$

- Proportionate width per beam $B = 260 / 5 = 52 \text{ cm}$

-Calculation of central beam with the largest span:

- Proportionate area of central beam $A_{T\max} = 260 \text{ cm} \times 52 \text{ cm} = 13\,520 \text{ cm}^2$

- Load per unit of length: $F_{T\max} = 40\,221 \text{ N} / 53\,093 \text{ cm}^2 \times 13\,520 \text{ cm}^2 = 10\,242 \text{ N}$

-Maximum bending moment:

$$M_{\max} = F \times D / 8 = 10\,242 \times 2\,600 / 8 = 3\,328\,708 \text{ Nmm}$$

-required moment of resistance: for a I-beam of material S235 JRG2, at $t = 120^\circ\text{C}$ and a safety factor of $S = 1.5$ (yield strength: $R_{p0.2} = 187 \text{ N/mm}^2$):

$$W_{\text{req}} = M_{\max} \times S / R_{p0.2} = 3\,328\,708 \text{ Nmm} \times 1.5 / 187 \text{ N/mm}^2 = 26\,701 \text{ mm}^3 = \underline{26.701 \text{ cm}^3}$$

-chosen: HE-B 100 acc. to DIN 1025 T.2, with $W_x = 89.9 \text{ cm}^3$ (new condition), resp. $W_x = 64.56 \text{ cm}^3$ (corroded condition, calculated with CAD-Program ME10 for 1.5mm corrosion allowance at all sides)

$$W_{\text{exist}} = 64.56 \text{ cm}^3 > W_{\text{req}} = 26.701 \text{ cm}^3$$

-Grating:

-Load per unit of area = 4 100 kg / 5,3 m² = 772 kg/m²

-chosen: Pressed grating with support bars 30x2mm, pitch ~33 mm,

-allowable load: 2015 kg/m² at a span of 700 mm (actual span = 520mm).

3. Calculation of supporting beams , sections D-D

- Total loading force acc. to customer's drawing: $1\,700\text{ kg} = 16\,677\text{ N}$
- Load per one beam $= 16\,677\text{ N} / 2 = 8338.5\text{ N}$

-Maximum bending moment:

$$M_{\max} = F \times D / 8 = 8338.5 \times 2457 / 8 = 2\,560\,962\text{ Nmm}$$

-required moment of resistance: for a T-beam of material S235 JRG2, at $t = 120^\circ\text{C}$ and a safety factor of $S = 1.5$ (yield strength: $R_{p0.2} = 187\text{ N/mm}^2$) :

$$W_{\text{req}} = M_{\max} \times S / R_{p0.2} = 2\,560\,962\text{ Nmm} \times 1.5 / 187\text{ N/mm}^2 = 20\,542\text{ mm}^3 = \underline{20.542\text{ cm}^3}$$

-chosen: HE-B 100 acc. to DIN 1025 T.2, with $W_x = 89.9\text{ cm}^3$ (new condition),
resp. $W_x = 64.56\text{ cm}^3$ (corroded condition, calculated with CAD-Program ME10 for 1.5mm
corrosion allowance at all sides)

$$W_{\text{exist}} = 64.56\text{ cm}^3 > W_{\text{req}} = 20.542\text{ cm}^3$$

aufgestellt:

Strake

Datum: 22.11.04

Standsicherheitsnachweis

Statical Analysis

Vertical vessels supported by skirt
Behälter auf Standzargen

Discription/Benennung : *Direct Contact After Cooler*

Tag. No.: *W13001*

Drwg./Zeichng. No.: *11435-0*

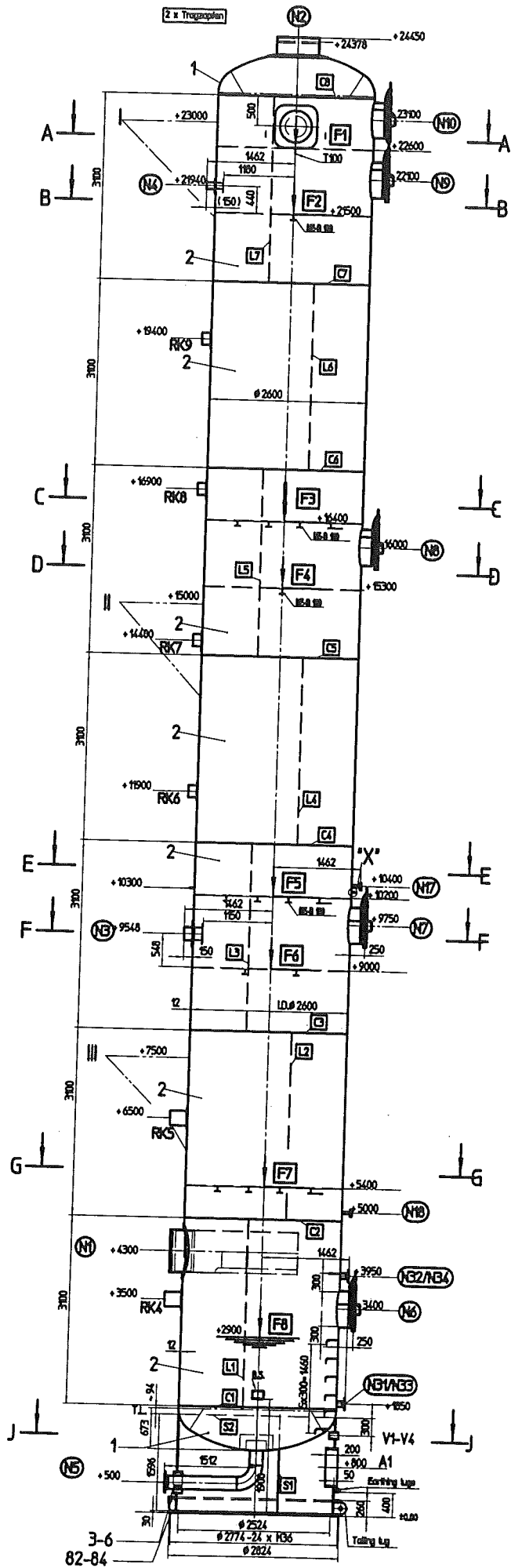
Place of erection : *Kosice, Slovakia*
Aufstellungsort:

prepared/aufgestellt
by/durch : *Strake*

Date/Datum : *22.11.2004*

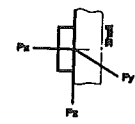
Revision :

F:\QPW\Standsicherheitsnachweis\10331-0



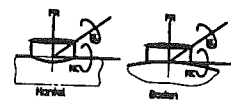
Laften durch Rohrleitungen
Piping clip loads

Piping clip No.	Wp	Px	Py	Pz
1	1000	500	500	500
2	1000	500	500	500
3	1000	500	500	500



Stützen-Zusatzlasten
Additional Nozzle loads

Stützen Nr.	DN	PR	NL	NC
N1	700	3500	2700	2200
N2	700	3500	2700	2200
N3	200	800	700	600
N4	100	400	300	200
N5	200	800	700	600



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Betriebsdaten : Abmessungen - Behälter, Anbauteile.
4. APPLICABLE LOADS / Lastannahmen.
 - 4.1 WIND WORKING SURFACE / Windangriffsflächen.
 - 4.2 COEFFICIENT OF RESISTANCE / Widerstandsbeiwerte.
 - 4.3 HORIZONTAL FORCES CAUSED BY WIND / Horizontalkräfte aus Wind.
 - 4.4 MOMENTUM CAUSED BY WIND / Momente aus Wind.
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Zusatzmomente aus Erdbeben.
5. VERIFICATION OF STABILITY SEE ATTACHED COMPUTER SHEETS. 53... TO... 58...
Spannungsnachweise (Ergebnisse siehe Computerausdruck Seite..53.....bis..58....)

1. GENERAL / Allgemeines.

*Subject: Pressure vessel within the meaning of the PED
with static load.*

*Es handelt sich um einen Druckbehälter im Sinne der Druckgeräterichtlinie 97/23/EG
mit ruhender Belastung.*

H / D \leq 7

Place of erection/

Aufstellungsort:

Kosice No.9, Slovakia

2. Quoted technical rules:

Zitierte Technische Regeln:

2.1 *Air Liquide-Spezifikation*

TAG-Nr. W13001

2.2 *Wind loads / Windlasten*

DIN 1055 T4

2.3 *AD - Regelwerk*

Reihe S

2.4 *Earthquake loads / Erdbebenlasten*

*acc. Assessment of Seismic Hazard
of Construction Edifice 730036*

the value of proposed seismic acceleration a_g is $0,33 \text{ m / s}^2$ is almost similar to the value of $0,3 \text{ m / s}^2$ (paragraph 4.1.2.6), hence seismic effects onto the building object negligible. Die angenommene Beschleunigung durch Erdbeben $a_g = 0,33 \text{ m/s}^2$ entspricht fast dem Wert von $0,3 \text{ m/s}^2$ (pragraph 4.1.2.6), so dass Erbebenbelastungen auf das zu bauende Object als unwesentlich einzustufen sind. Eine Erdbebenberechnung ist folglich nicht nötig!

3. Design data, dimensions of vessel and attachments Betriebsdaten : Abmessungen- Behälter, Anbauteile.

3.1. Operating data/Betriebsdaten:

3.1.1 Operating condition/Betriebszustand:

Design pressure/zul. Betriebsdruck	p =	6 bar (g)
Design temperature/zul. Betriebstemperatur	t =	120 °C

Weight empty/Leergewicht Behälter	G =	265 kN
Weight fluid/Eigengewicht Medium	G =	140 kN
Weight inner equipm./Gesamtgewicht Einbauten 1)	G =	265 kN
Weight outer equipm./Gesamtgewicht Anbauten 2)	G =	153,3 kN

max. operating weight/Betriebsgewicht	G =	823,3 kN
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3.1.2 Test condition/Prüfzustand:

Test pressure/Prüfdruck	p' =	11,6 bar
Test temperature/Prüftemperatur	t' =	20 °C

Weight empty/Leergewicht Behälter	G =	265 kN
Weight water/Eigengewicht Wasser	G =	1200 kN
Weight inner equipm./Gesamtgewicht Einbauten 1)	G =	265 kN
Weight outer equipm./Gesamtgewicht Anbauten 2)	G =	0 kN

Test weight/Prüfgewicht	G' =	1730 kN
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3.1.3 Erection/Montage:

without pressure/drucklos	p =	atm. bar
Temperature/Temperatur	t =	20 °C
Empty weight/Leergewicht Behälter	G =	310 kN

1) Abscheider, Verteilerböden, Packungen	ges. ca.	265 kN
2) Ring-, u. Kopfbühnen mit Verkehrslasten	= 0	kN
Isolation-Zylinder ä. $\varnothing 2,72 \times \pi / 4 \text{ m} \times 24,45 \text{ m}$ hoch	= 142,1 m ² x 30 kg	= 42,62 kN
Isolation-Dach ä. $\varnothing 2,72 \times \pi / 4 \text{ m} = 5,81 \text{ m}^2$	x 30 kg	= 1,74 kN
Schneelasten	ca.	17,43 kN
Stützen N1,N3,N4,N5: vertikale Kraftkomponente	FL = 0	kN
Stützen N2: vertikale Kraftkomponente	FR = 31,5	kN
Vertikallasten auf Rohrkonsolen 5t+0,5t+0,5t=6t	= 60	kN

Gesamt	ca. 153,3	kN
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3.2 Vessel / Behälter:

- Vessel diameter/Behälterdurchm.	D =	2624 mm
- Vessel heigth from skirt's bearing/ Behälterhöhe ab UK-Standzarge	H =	24250 mm
- Thickness of Insulation/Isolationsdicke	S =	100 mm

3.3 Pipelines/Rohrleitungen:

Ø	d1 =	711 mm
Heigth/Höhe	h1 =	24450 mm

3.4 Circular platform/Ringbühne:

-OD of Platform/ä.Ø der Bühne	dr =	0 mm
-Height of Platform/Höhe der Bühne	hr =	0 mm
-No. of platforms/Anzahl der Bühnen in: 0 < H ≤ 8 m	n =	0
-No. of platforms/Anzahl der Bühnen in: 8 < H ≤ 20 m	n =	0
-No. of platforms/Anzahl der Bühnen in: H > 20 m	n =	0

3.5 Head platform/Kopfbühne :

Ø	dk =	0 mm
Heigth/Höhe	hk =	0 mm
Level/Höhenlage	h3 =	mm

3.6 Ladder/Aufstiegsleiter:

Heigth/Höhe	h4 =	0 mm
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3.7 Erection platf./Montagegerüst:

Heigth/Höhe	h5 =	0 mm
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4. Applicable loads/Lastannahmen.

4.1 Wind working surfaces/Windangriffsflächen

Vessel (projected area): / Behälter (projizierte Fläche):			
Height/Höhe H:	$\leq 8\text{m}$	Ab1= 22,592	m ²
Height/Höhe H:	$8\text{m} < H \leq 20\text{m}$	Ab2= 33,888	m ²
Height/Höhe H:	$> 20\text{m}$	Ab3= 12,002	m ²

Pipeline (projected area):/Rohrleitung (projizierte Fläche):			
Height/Höhe h1:	$\leq 8\text{m}$	Ar1= 5,688	m ²
Height/Höhe h1:	$8\text{m} < h1 \leq 20\text{m}$	Ar2= 8,532	m ²
Height/Höhe h1:	$> 20\text{m}$	Ar3= 3,16395	m ²

Platforms:			
Circuler platform / Ringbühne	$h2 \leq 8\text{m}$	Ab= 0	m ²
Circuler platform / Ringbühne	$8 < h2 \leq 20\text{m}$	Ab= 0	m ²
Circuler platform / Ringbühne	$h2 > 20\text{m}$	Ab= 0	m ²
Head platform / Kopfbühne		Ak= 0	m ²

Ladder (projected area): / Leiter (projizierte Fläche):			
Height/Höhe h4	$\leq 8\text{m}$	Al= 0	m ²
Height/Höhe h4	$8 < h4 \leq 20\text{m}$	Al= 0	m ²
Height/Höhe h4	$> 20\text{m}$	Al= 0	m ²

Erection platf.(projected area):/Montagegerüst (projizierte Fläche):			
Height/Höhe h5	$\leq 8\text{m}$	Ag= 0	m ²
Height/Höhe h5	$8 < h5 \leq 20\text{m}$	Ag= 0	m ²
Height/Höhe h5	$> 20\text{m}$	Ag= 0	m ²

4.2 Coefficients of resistance / Widerstandbeiwerte "C"

Vessel /Behälter	$c = 0,8$
Pipeline /Rohrleitung	$c = 1,5$
Platforms /Bühnen	$c = 1,4$
Ladders /Aufstiegsleitern	$c = 1,2$
Erection- /Montagegerüst platform	$c = 1,2$

4.3 Horizontal forces caused by wind / Horizontalkräfte aus Wind

Wind pressure/	at 0 m < H ≤ 8 m	q = 0,5	kN/m ²
Staudruck	at 8 m < H ≤ 20 m	q = 0,8	kN/m ²
	at 20 m < H ≤ 100 m	q = 1,1	kN/m ²
Vessel/ Behälter	H ≤ 8 m Höhe	Fh = 9,0368	kN
	8 m < H ≤ 20 m Höhe	Fh = 21,68832	kN
	H > 20 m Höhe	Fh = 10,56176	kN
Pipeline/ Rohrleitung	h1 ≤ 8 m Höhe	Fh = 4,266	kN
	8 m < h1 ≤ 20 m Höhe	Fh = 10,2384	kN
	h1 > 20 m Höhe	Fh = 5,2205175	kN
Circular platf./ Ringbühne	h2 ≤ 8 m Höhe	Fh = 0	kN
	8 m < h2 ≤ 20 m Höhe	Fh = 0	kN
	h2 > 20 m Höhe	Fh = 0	kN
Head platform/ Kopfbühne		Fh = 0	kN
Ladder/ Aufstiegsleiter	h4 ≤ 8 m Höhe	Fh = 0	kN
	8 m < h4 ≤ 20 m Höhe	Fh = 0	kN
	h4 > 20 m Höhe	Fh = 0	kN
Mounting platf./ Montagegerüst	h5 ≤ 8 m Höhe	Fh = 0	kN
	8 m < h5 ≤ 20 m Höhe	Fh = 0	kN
	h5 > 20 m Höhe	Fh = 0	kN

Operating condition/Betriebszustand	max. Fh = 61,0117975 kN
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Test condition/Prüfzustand	max. Fh = 61,0117975 kN
-----------------------------------	--------------------------------

Erection platform/Montagegerüst	max. Fh = 0 kN
--	-----------------------

4.4 Moments caused by wind, calculated from skirt's bearing

Momente aus Wind, bezogen auf UK-Standzarge

Vessel/ Behälter	H ≤ 8 m Höhe	M = 36,1472	kNm
	8 m < H ≤ 20 m Höhe	M = 390,38976	kNm
	H > 20 m Höhe	M = 233,67894	kNm
Pipeline/ Rohrleitung	h1 ≤ 8 m Höhe	M = 17,064	kNm
	8 m < h1 ≤ 20 m Höhe	M = 184,2912	kNm
	h1 > 20 m Höhe	M = 116,026	kNm
Circular platform/ Ringbühne	h2 ≤ 8 m Höhe	M = 0	kNm
	8 m < h2 ≤ 20 m Höhe	M = 0	kNm
	h2 > 20 m Höhe	M = 0	kNm
Head platform/ Kopfbühne		M = 0	kNm
Ladder/ Aufstiegsleiter	h4 ≤ 8 m Höhe	M = 0	kNm
	8 m < h4 ≤ 20 m Hohe	M = 0	kNm
	h4 > 20 m Hohe	M = 0	kNm
Mounting platform/ Montagegerüst	h5 ≤ 8 m Höhe	M = 0	kNm
	8 m < h5 ≤ 20 m Hohe	M = 0	kNm
	h5 > 20 m Hohe	M = 0	kNm

Operating condition/Betriebszustand	max, M = 977,5971	kNm
Test condition/Prüfzustand	max, M = 977,5971	kNm
Erection platform/Montagegerüst	max, M = 0	kNm

4.5.1 Additional Moments from Piping / Zusatzmomente aus Rohrleitungen an Stutzen.

Description / Benennung: Direct Contact After Cooler
Drawing No. / Zeichnung Nr.: 11435-0
Place of erection / Aufstellungsort: ASU Kosice No.9

acc. Specification from Air Liquide TAG-Nr. W13001 following additional Nozzle loads have to be considered in the statical calculation:

Nozzle / Stutzen N2 = DN700: Horizontal load / Horizontalkraft FR = 31500 N
Moment based on bottom of skirt
Moment, bezogen auf Unterkante Standzarge
 $M_{N1} = 31.500 \times 24.45 \text{ m} = \underline{770175 \text{ Nm}}$

Nozzle / Stutzen N1 = DN700: Horizontal load / Horizontalkraft FR = 31500 N
Moment based on bottom of skirt
Moment, bezogen auf Unterkante Standzarge
 $M_{N1} = 31500 \times 4.3 \text{ m} = \underline{135450 \text{ Nm}}$

Nozzle / Stutzen N3 = DN 200: horizontal load / Horizontalkraft FR = 9000 N
Moment based on bottom of skirt
Moment, bezogen auf Unterkante Standzarge
 $M_{N3} = 9000 \times 9,55 \text{ m} = \underline{85950 \text{ Nm}}$

Nozzle / Stutzen N4 = DN 100: horizontal load / Horizontalkraft FR = 4500 N
Moment based on bottom of skirt
Moment, bezogen auf Unterkante Standzarge
 $M_{N4} = 4500 \times 21,94 \text{ m} = \underline{98730 \text{ Nm}}$

Nozzle / Stutzen N5 = DN 200: horizontal loads / Horizontalkraft FR = 9000 N
Moment based on bottom of skirt
Moment, bezogen auf Unterkante Standzarge
 $M_{N5} = 9000 \times 0,5 \text{ m} = \underline{4500 \text{ Nm}}$

4.5.2 total result of all Moments / Summe aller Momente

The result overall Moments including those from wind for the operation and testing case is:
Die Summe aller Momente, einschließlich derjenigen aus Wind beträgt für den Betriebs- und Prüfzustand:

$$M_{\text{ges.}} = M_{\text{wind}} + M_{N1} + M_{N2} + M_{N3} + M_{N4} + M_{N5} - M_{N11}$$

$$M_{\text{ges.}} = 977.597 + 770.175 + 135.450 + 85.950 + 98.730 + 4500$$

$$M_{\text{ges.}} = \underline{\underline{2.072.402 \text{ Nm}}}$$

4.6 Moments from seismic effects

The seismic effects onto the building object is negligible see Assessment of Seismic Hazard of construction Edifice 730036

Die Erdbebenbelastungen auf das zu bauende Objekt sind unwesentlich siehe „Assessment of Seismic Hazard construction Edifice 730036.

prepared / aufgestellt: Strake

Datum: 22.11.2004

Vessels on Stand Frames
General Verification of Stability for Pressure Vessels
acc to AD 2000-Merkblatt S3/1:2001-09

drawing no: 11345-0

name/ item: Direct contact after cooler W13001

input data

part description

design type: 2- B- connection of skird support in knuckle area
type of dished end acc to AD-Merkblatt B3: 2- Korbboogen type
calculation of stand frame/foot construction = 1- yes

design data

loading case acc to AD-S3/0 sect 4.2: 1- load case BF1
internal pressure, temperature, dead/ external/ live/ wind/ snow load
design pressure p = 6 bar
pressure by hydrostatic column ph = .2 bar
design temperature T = 120 °C
perpendicular external force F1 = 683300 N
weight of filling FF = 140000 N
vessel weight beneath section 2-2 dF = 823300 N
external moment at stand frame connection M1 = 2072402 Nm
external moment (stand frame, section 4-4) M4 = 2072402 Nm
loading force in section 4-4 F4 = 823300 N
external moment (stand frame, section 5-5) M5 = 2072402 Nm
max loading force in section 5-5 F5max = 823300 N
min loading force in section 5-5 F5min = 310000 N

geometry data

outer diameter of vessel Da = 2624 mm
wall thickness of shell se = 12 mm
manufacturing tolerance c1 = 6- DIN 28011-13
corrosion allowance c2 = 3 mm
outer diameter of stand frame DaZ = 2624 mm
wall thickness of stand frame sZ = 12 mm
manufacturing tolerance c1 = 7- DIN EN 10029A
corrosion allowance c2 = 0 mm
mat.vessel: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value, vessel KB = 215 N/mm²
yield strength Rp 0.2 [120°C,12mm]
mat. frame: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value, frame KZ = 215 N/mm²
yield strength Rp 0.2 [120°C,12mm]
safety factor, vessel / frame, section 3-3 S = 1.5
mat.baser.: 0703-S 235 JR G2 (1.0038) DIN EN 10025:1994-03 AD-W1:1998-02
design strength value, base ring KF = 180 N/mm²
yield strength Rp 0.2 [120°C,40mm]
safety factor support features, frame below 3-3 S = 1.5
allow design stress frame acc to AD-S3/0, table 1 fZ = 143.33 N/mm²
allow design stress base ring, AD-S3/0, table 1 fR = 120 N/mm²
mat. bolts: 0043-St 52-3 (1.0570) DIN 17100:1980-01 AD-W13:1998-02
design strength value, anchor bolts Ks = 234 N/mm²
yield strength Rp 0.2 [120°C,42mm]
safety factor, anchor bolts S = 2.2
allow design stress acc to AD-S3/0, table 1 fs = 106.36 N/mm²
prestress bolt load (unknown = 0) Fv = 0 N

geometry data stand frame / base ring

outside width of opening of stand frame ba = 640 mm
thickness of pad reinforcement of opening tZ = 20 mm
width of pad reinf. of frame opening bZ = 200 mm
external overstanding of pad reinforcement fv = 50 mm

continuation geometry data stand frame / base ring

base ring type	simple= 1 / reinforced= 2 =	2
number of foundation bolts	n =	24
foundation bolt hole circle	Dt =	2674 mm
diameter of bolt hole	dt =	48 mm
act base ring thickness, without allowances	eR =	29.2 mm
base ring width	b =	150 mm
external overstanding of base ring	l =	100 mm
act web-plate thickness, without allowances	eP =	9.8 mm
gap between two web plates	t =	90 mm
act pressure plate or girth ring thickness	eD =	29.2 mm
width of pressure plate or girth ring	i =	125 mm

results

results shown in percentages signify over-/underdimensioning
 for dimensions: (act-req) / req, with other data: (allow-act) / act

actual wall thickniess, vessel	eB =	8.5 mm
without manufact.-tol./ corrosion allowance	c1/c2 =	0.5/ 3.0 mm
actual wall thickness, stand frame	eZ =	11.5 mm
without manufact.-tol./ corrosion allowance	c1/c2 =	0.5/ 0.0 mm

intermediate values:

section forces	Fzp =	1522816 N	Fzq =	-4816016 N
local bending moments	Mp =	15124083 Nmm	Mq =	-47831000 Nmm
bending stress of knuckle	obsp=	21.8 N/mm ²	with factor $\alpha = 4.30$	
angle Gamma =	13.56 °	moment arm a =	9.93 mm	

stresses in vessel 1-1,2-2 / stand frame 3-3

membran stresses: N/mm ²		p (luv)		q (lee)		perm stresses	
						p	q
section 1-1	om..	81.8	75%	-9.0	1491%	143	
section 2-2	om..	59.9	139%	59.9	139%	143	
section 3-3	om..	16.1	788%	-51.0	181%	143	

additional calculation of stability of vessel is necessary, $\sigma m1 < 0!$
 see AD-Merkblatt S3/1, section 6.1, explanation to formula 2.
 calc. of stability of stand frame, section 3-3 is necessary, $\sigma m3 < 0!$
 see AD-Merkblat s3/1, section 6.1, explanation to formula 6/7.

bending stresses: N/mm ²							
section 1-1/2-2	ob..	91.5		-289.5		-	
section 3-3	ob..	50.1		-158.3		-	
total stresses : N/mm ²							
section 1-1	$\sigma gesi..$	12.0	3226%	302.3	42%	399	430
	$\sigma gesa..$	151.5	163%	-320.3	34%	399	430
section 2-2	$\sigma gesi..$	173.3	139%	-207.8	99%	413	413
	$\sigma gesa..$	-53.4	674%	327.7	26%	413	413
section 3-3	$\sigma gesi..$	-33.9	1164%	107.3	289%	429	418
	$\sigma gesa..$	66.2	548%	-209.4	100%	429	418

verifications in section 4-4

bending moment-change of center of gravity	dM4 =	4179 Nm
with displacement of geometrical center	epsilon =	5.08 mm
half aperture angle of opening	Delta =	0.2475
moment of inertia	I4 =	8.087E+10 mm ⁴
moment of resistance	W4 =	5.915E+07 mm ³
cross sections area	A4 =	94950 mm ²
bending stress in opening area (formula 23)	σm4p =	26.4 N/mm ²
	res =	442 %
bending stress in opening area (formula 23)	σm4q =	-43.8 N/mm ²
	res =	227 %

calc. of stability of stand frame, section 4-4 is necessary, σm4 < 0!
 and opening parameter rq = 2.59 =< 2 not fulfilled
 see explanation to section 7 of AD-Merkblatt S3/1!

verifications in section 5-5

stress stand frame, sec. 5-5 (formula 23)	σm5p =	25.0 N/mm ²
	res =	472 %
stress stand frame, sec. 5-5 (formula 23)	σm5q =	-42.5 N/mm ²
	res =	237 %

verification of shear resistance section 5-5

The shear resistance is not implemented in this program.
 Referring to AD-S3/1, section 8.1 it could be carried out according
 to DIN 18800 Part1 when ratio of horizontal to vertical load is high.

anchor bolts

force at one anchor bolt (formula 27)	FKp =	117545 N
req bolt cross-section= 1105.16 mm ² / bolt diameter =		37.5 mm

verification of base ring

max concrete compression (formula 28)	σmbq =	-3.2 N/mm ²
req thickness of base ring (Formel 32)	eR_req =	24.7 mm
	res =	18 %
with factor	K =	2.253
req thickness of web plate (formula 33)	eP_req =	4.9 mm
	res =	100 %

Calculation of stability could be necessary according to
 AD-S3/4, Section 7.3

req thickness pressure plate (Formel 35)	eD_req =	24.4 mm
	res =	20 %

shear moment FKp*k according to section 8.3.2
 calculation can be performed with reference to AD-Merkblatt S3/4 e.g.
 mit NF=FKp = 117545 N und ap = 25.0 mm

distance of 2 brackets, determined with Dt

geometrical conditions of base ring section 5-5:	T =	240.4 mm
eR/eZ ≥ 1.5 :	2.433 ≥	1.5
l ≤ 15 * eP :	100.0 ≤	147.0
eD ≤ 3 * eP :	29.2 ≤	29.4
b ≥ 3/2 * l :	150.0 ≥	150.0

Angle of inclination of stand frame has to be ≤ 7 degree !
 no calculations of stability were carried out!

Vessels on Stand Frames

General Verification of Stability for Pressure Vessels
acc to AD 2000-Merkblatt S3/1:2001-09

drawing no: 11345-0

name/ item: Direct contact after cooler W13001

input data

part description

design type: 2- B- connection of skird support in knuckle area
type of dished end acc to AD-Merkblatt B3: 2- Korbbogen type
calculation of stand frame/foot construction = 1- yes

design data

loading case acc to AD-S3/0 sect 4.2: 1- load case BF1
internal pressure, temperature, dead/ external/ live/ wind/ snow load
design pressure $p = 9.35 \text{ bar}$
pressure by hydrostatic column $p_h = 2.45 \text{ bar}$
design temperature $T = 20 \text{ }^\circ\text{C}$
perpendicular external force $F_1 = 530000 \text{ N}$
weight of filling $FF = 1200000 \text{ N}$
vessel weight beneath section 2-2 $dF = 1730000 \text{ N}$
external moment at stand frame connection $M_1 = 1727524 \text{ Nm}$
external moment (stand frame, section 4-4) $M_4 = 1727524 \text{ Nm}$
loading force in section 4-4 $F_4 = 1730000 \text{ N}$
external moment (stand frame, section 5-5) $M_5 = 1727524 \text{ Nm}$
max loading force in section 5-5 $F_{5\text{max}} = 1730000 \text{ N}$
min loading force in section 5-5 $F_{5\text{min}} = 530000 \text{ N}$

geometry data

outer diameter of vessel $Da = 2624 \text{ mm}$
wall thickness of shell $se = 12 \text{ mm}$
manufacturing tolerance $c_1 = 6- \text{ DIN } 28011-13$
corrosion allowance $c_2 = 3 \text{ mm}$
outer diameter of stand frame $DaZ = 2624 \text{ mm}$
wall thickness of stand frame $sZ = 12 \text{ mm}$
manufacturing tolerance $c_1 = 7- \text{ DIN EN } 10029A$
corrosion allowance $c_2 = 0 \text{ mm}$
mat.vessel: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value, vessel $KB = 265 \text{ N/mm}^2$
yield strength $R_p 0.2 [20^\circ\text{C}, 12\text{mm}]$
mat. frame: 0741-P 265 GH (1.0425) DIN EN 10028-2:1992 AD-W1:1998-02
design strength value, frame $KZ = 265 \text{ N/mm}^2$
yield strength $R_p 0.2 [20^\circ\text{C}, 12\text{mm}]$
safety factor, vessel / frame, section 3-3 $S = 1.5$
mat.baser.: 0703-S 235 JR G2 (1.0038) DIN EN 10025:1994-03 AD-W1:1998-02
design strength value, base ring $KF = 225 \text{ N/mm}^2$
yield strength $R_p 0.2 [20^\circ\text{C}, 40\text{mm}]$
safety factor support features, frame below 3-3 $S = 1.5$
allow design stress frame acc to AD-S3/0, table 1 $fZ = 176.66 \text{ N/mm}^2$
allow design stress base ring, AD-S3/0, table 1 $fR = 150 \text{ N/mm}^2$
mat. bolts: 0043-St 52-3 (1.0570) DIN 17100:1980-01 AD-W13:1998-02
design strength value, anchor bolts $Ks = 335 \text{ N/mm}^2$
yield strength $R_p 0.2 [20^\circ\text{C}, 42\text{mm}]$
safety factor, anchor bolts $S = 2.2$
allow design stress acc to AD-S3/0, table 1 $fs = 152.27 \text{ N/mm}^2$
prestress bolt load (unknown = 0) $Fv = 0 \text{ N}$

geometry data stand frame / base ring

outside width of opening of stand frame $ba = 640 \text{ mm}$
thickness of pad reinforcement of opening $tZ = 20 \text{ mm}$
width of pad reinf. of frame opening $bZ = 200 \text{ mm}$
external overstanding of pad reinforcement $fv = 50 \text{ mm}$

continuation geometry data stand frame / base ring

base ring type	simple= 1 / reinforced= 2 =	2
number of foundation bolts	n =	24
foundation bolt hole circle	Dt =	2674 mm
diameter of bolt hole	dt =	48 mm
act base ring thickness, without allowances	eR =	34.2 mm
base ring width	b =	150 mm
external overstanding of base ring	l =	100 mm
act web-plate thickness, without allowances	eP =	9.8 mm
gap between two web plates	t =	90 mm
act pressure plate or girth ring thickness	eD =	29.2 mm
width of pressure plate or girth ring	i =	125 mm

results

results shown in percentages signify over-/underdimensioning
for dimensions: (act-req) / req, with other data: (allow-act) / act

actual wall thickniess, vessel	eB =	8.5 mm
without manufact.-tol./ corrosion allowance	c1/c2 =	0.5/ 3.0 mm
actual wall thickness, stand frame	eZ =	11.5 mm
without manufact.-tol./ corrosion allowance	c1/c2 =	0.5/ 0.0 mm

intermediate values:

section forces	Fzp =	-818021 N	Fzq =	-6101979 N
local bending moments	Mp =	-8124302 Nmm	Mq =	-60602740 Nmm
bending stress of knuckle obsp=	41.5 N/mm ² with factor $\alpha = 4.30$			
angle Gamma =	13.56 °	moment arm a =	9.93 mm	

stresses in vessel 1-1,2-2 / stand frame 3-3

		p (luv)		q (lee)		perm stresses	
						p	q
membran stresses:	N/mm ²						
section 1-1	$\sigma_{m..}$	102.2	73%	26.5	566%	177	
section 2-2	$\sigma_{m..}$	113.9	55%	113.9	55%	177	
section 3-3	$\sigma_{m..}$	-8.7	1938%	-64.6	173%	177	

calc. of stability of stand frame, section 3-3 is necessary, $\sigma_{m3} < 0!$
see AD-Merkblat s3/1, section 6.1, explanation to formula 6/7.

bending stresses:	N/mm ²						
section 1-1/2-2	$\sigma_{b..}$	-49.2		-366.8		-	
section 3-3	$\sigma_{b..}$	-26.9		-200.6		-	
total stresses :	N/mm ²						
section 1-1	$\sigma_{gesi..}$	192.8	154%	434.8	21%	491	527
	$\sigma_{gesa..}$	11.5	4152%	-381.7	38%	491	527
section 2-2	$\sigma_{gesi..}$	106.2	353%	-211.5	127%	481	481
	$\sigma_{gesa..}$	121.6	296%	439.2	10%	481	481
section 3-3	$\sigma_{gesi..}$	18.2	2806%	136.0	278%	530	514
	$\sigma_{gesa..}$	-35.6	1390%	-265.3	94%	530	514

verifications in section 4-4

bending moment-change of center of gravity	dM4 =	8781 Nm
with displacement of geometrical center	epsilon =	5.08 mm
half aperture angle of opening	Delta =	0.2475
moment of inertia	I4 =	8.087E+10 mm ⁴
moment of resistance	W4 =	5.915E+07 mm ³
cross sections area	A4 =	94950 mm ²
bending stress in opening area (formula 23)	σ_{m4p} =	11.1 N/mm ²
	res =	1487 %
bending stress in opening area (formula 23)	σ_{m4q} =	-47.6 N/mm ²
	res =	271 %

calc. of stability of stand frame, section 4-4 is necessary, $\sigma_{m4} < 0!$
and opening parameter $r_q = 2.59 \leq 2$ not fulfilled
see explanation to section 7 of AD-Merkblatt S3/1!

verifications in section 5-5

stress stand frame, sec. 5-5	(formula 23)	$\sigma_{m5p} =$	9.8 N/mm ²
		res =	1699 %
stress stand frame, sec. 5-5	(formula 23)	$\sigma_{m5q} =$	-46.5 N/mm ²
		res =	280 %

verification of shear resistance section 5-5

The shear resistance is not implemented in this program.
Referring to AD-S3/1, section 8.1 it could be carried out according
to DIN 18800 Part1 when ratio of horizontal to vertical load is high.

anchor bolts

force at one anchor bolt	(formula 27)	FKp =	87799 N
req bolt cross-section=	576.60 mm ² / bolt diameter =		27.1 mm

verification of base ring

max concrete compression	(formula 28)	$\sigma_{mbq} =$	-3.6 N/mm ²
req thickness of base ring	(Formel 32)	$e_{R_req} =$	23.1 mm
		res =	48 %
with factor		K =	2.253
req thickness of web plate	(formula 33)	$e_{P_req} =$	2.9 mm
		res =	235 %

Calculation of stability could be necessary according to
AD-S3/4, Section 7.3

req thickness pressure plate	(Formel 35)	$e_{D_req} =$	18.8 mm
		res =	55 %

shear moment FKp*k according to section 8.3.2

calculation can be performed with reference to AD-Merkblatt S3/4 e.g.
mit NF=FKp = 87799 N und ap = 25.0 mm

distance of 2 brackets, determined with Dt T = 240.4 mm
geometrical conditions of base ring section 5-5:

$e_R/e_Z \geq 1.5$:	2.850	\geq	1.5
$l \leq 15 * e_P$:	100.0	\leq	147.0
$e_D \leq 3 * e_P$:	29.2	\leq	29.4
$b \geq 3/2 * l$:	150.0	\geq	150.0

Angle of inclination of stand frame has to be ≤ 7 degree !
no calculations of stability were carried out!

4.7.Load table Foundation loads

(following loads are taken into account: deadload of vessel, snow- and wind loads and additional Nozzle loads)

Description **Direct Contact After Cooler**

Item No.: **W 13001**

Drawing No.: **11435-0**

maximal foundation loads:

skirt	vertical load V / kN	horizontal load ax. H/kN		Moment axial M / kN/m	
operating	823,30	61,0		2072,4	
testing	1730,00	61,0		2072,4	

Hole circle **Ø2774**

Number of anchorbolts per template **24**

dimension: M 36 bolt crossectional area = **30,84 mm**

material: **4.6**

Messer Griesheim GmbH
 Industriegase Krefeld
 Fülingsweg 34 · D - 47805 Krefeld
 Hr. Reddemann Tel.: 02151 / 379 - 432
 Fax: 02151 / 379 - 357

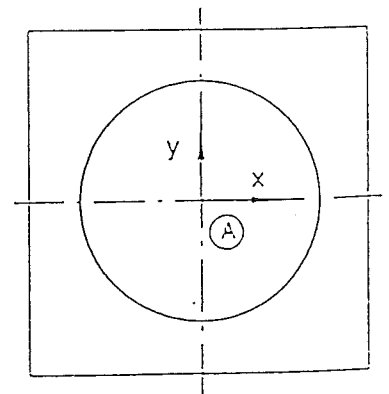
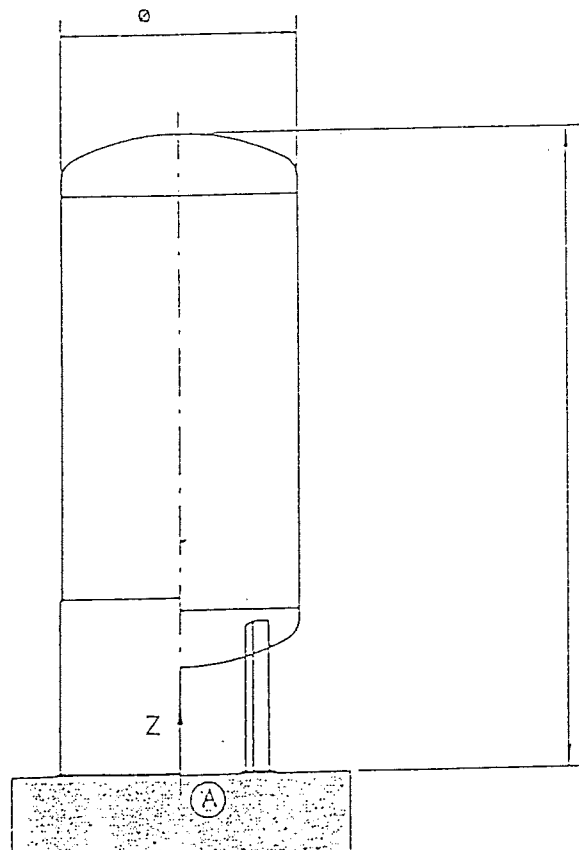
MESSER AGS GMBH
 ADVANCED GAS SYSTEMS
 Dießener Bruch 100 · 47805 Krefeld

MESSER 

Apparate
 Behälter

Lastangaben zur Fundamentauslegung
 Stehende Behälter

- 1 Behälterbezeichnung DCAC W 13 001
- 2 System und Abmessungen
- ☒ Behälter mit Standzarge
 - ☐ Behälter mit 4 Stützfüßen ($\theta = 90^\circ$)
 - ☐ Behälter mit 3 Stützfüßen ($\theta = 120^\circ$)



①

3 Lastangaben zur Fundamentauslegung

siehe separate Blätter

Anschlußlasten des Behälters bezogen auf Systemachse und						
<input checked="" type="checkbox"/> Unterkante Standzarge (A) <input type="checkbox"/> Unterkante Stützfüße (A)						
Lastfall	V, [kN]	H [kN]		M [kNm]		
	z	x	y	x	y	z
Leergewicht						
min. Füllgewicht						
Stützenlasten						
min V						

Leergewicht						
max. Füllgewicht						
Stützenlasten						
max V						

Wind x						
Wind y						

Erdbebenlasten						
----------------	--	--	--	--	--	--

Erdbebenlasten nur bei Aufstellung des Behälters in Erdbebenzonen angeben.

4 Befestigungsangaben

4.1 Verankerung

- ☐ Keine Verankerung erforderlich, da Kippsicherheit erfüllt
☒ Verankerung erforderlich

Zuganker					Ankerkraft
<input checked="" type="checkbox"/> pro Standzarge <input type="checkbox"/> pro Stützfuß					
Bezeichnung	DIN	Anzahl	Ø	Werkstoff	max. Z_A [kN]
		24	M 36	4.6	

max. Z_A : vorhandene maximale Zugkraft im höchstbeanspruchten Zuganker bei ungünstigster Lastkombination.

2

4.2 Schubsicherung

- ☒ Keine Schubsicherung erforderlich, da Gleitsicherheit erfüllt
☐ Schubsicherung erforderlich

Schubknaggen				Schubkraft	
<input type="checkbox"/> pro Standzarge <input type="checkbox"/> pro Stützfuß					
Profil	DIN	Anzahl	Werkstoff	max. $H_{K,x}$ [kN]	max. $H_{K,y}$ [kN]

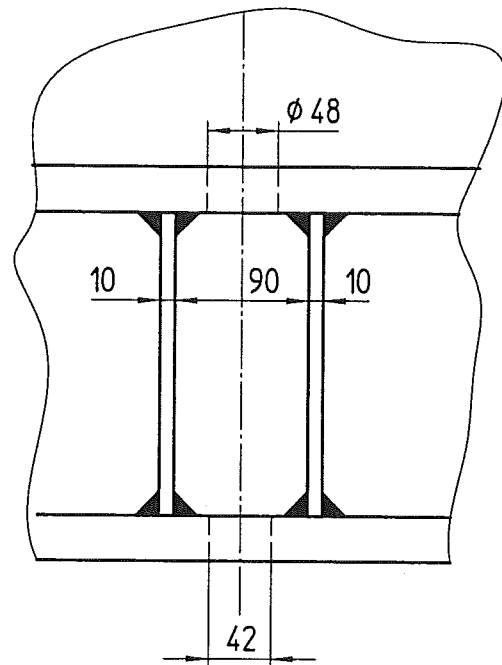
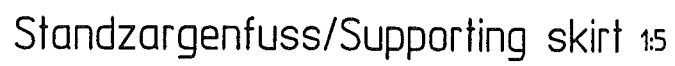
max. $H_{K,x}$; max. $H_{K,y}$: vorhandene maximale Schubkraft in der höchstbeanspruchten Schubknagge bei ungünstigster Lastkombination.

5 Lochbild

Ein vermaßtes Lochbild (Aufsicht) mit Angabe des Teilkreisdurchmessers und Lage der Schubknaggen ist unbedingt beizufügen.

Hinweis: Beispiel für einen Behälter mit Standzarge siehe Seite 4.

3



4.7. Load table Foundation loads

(following loads are taken into account: deadload of vessel, snow- and wind loads and additional Nozzle loads)

Description **Direct Contact After Cooler**

Item No.: **W 13001**

Drawing No.: **11435-0**

maximal foundation loads:

skirt	vertical load V / kN	horizontal load ax. H/kN		Moment axial M / kN/m	
operating	823,30	61,0		2072,4	
testing	1730,00	61,0		2072,4	

Hole circle **Ø2774**

Number of anchorbolts per template **24**

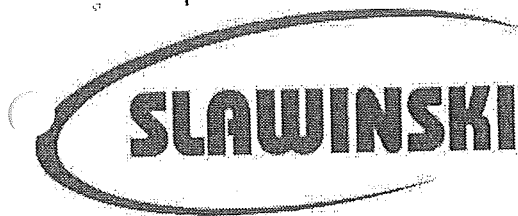
dimension: M 36 bolt crosssectional area = 30,84 mm

material: **4.6**

Materialliste

Pos.: Part .	Benennung Designation	Abmessung Dimension	Werkstoff Material	Schmelze Nr.: heat No.	Probe Nr.: test No.	Zeichen marks
1	ellips.head	Ø2600 x 12	P 265 GH	21211	1413501	Slawinski
2	shell	Ø2624 x 12	P 265 GH	43855	165885-2 165886-2 165887-1 165886-1 165886-3 165887-2 165885-1	Ilsenburger
3	skirt	Ø2624 x 12	P 265 GH	43855	165887-1	fzo.
9	pipe made from plate	Ø600 x 20	P 265 GH	56236	052-052	Ruuki
10	WN-flange	600 ä.Ø730	C 22.8	307629	48317	Brück
11	blindflange	C Ø730 x 30	P 265 GH	59514	A2	Danske
29	frame	Ø711 x 12	P 265 GH	71653	ML731/1	Corus
30+34	reinforcem.pad	Ø915/715 x 10	P 265 GH	49986	857189-1	Ilsenburger
31+33	round plate	Ø731 x 22	P 265 GH	33105	51527-01	Dillinger
32	frame	Ø711 x 20	P 265 GH	56236	052-052	Ruukki
40+42	seamless pipe	Ø219,1 x 10	St 35.8I	376022		V&M
41	elbow	Ø219,1 x 12,5	St 35.8I	434300	3609	Lindemann
45	seamless pipe	Ø219,1 x 14,2	St 35.8I	254752		ESW
46	plain face flange	B Ø445/222x24	S235JRG2	341554		Geldbach
47+51	reinforcem.pad	10 mm	P 265 GH	627018	39670202	Thyssen K
48+52	round plate	6 mm	S235JRG2	428861		Clabecq
49	seamless pipe	Ø114,3 x 12,5	St 35.8I	598646		Benteler
50	plain face flange	B Ø285/116x20	S235JRG2	71330		Bifrangi
53	seamless pipe	Ø88,9 x 5,6	St 35.8I	41218		Maxhütte
79+82	plate	10 mm	S235JRG2	0113100201		GTS

„Die nicht aufgeführten Kleinteile entsprechen den AD-Merkblättern der Reihe W“



SLAWINSKI & CO. GMBH
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D-57076 Siegen

eMail: info@slawinski.de
http://www.slawinski.de

Abnahmeprüfzeugnis 3.1B nach EN 10204

Inspection / Test Certificate 3.1B acc. to EN 10204
Certificat de réception d'usine 3.1B suivant EN 10204

Prüfgrundlage: AD 2000-Merkblatt HP 8/1, TRD 202 für kaltverformte Böden
Inspection based on: AD 2000-Merkblatt HP 8/1, TRD 202 for cold formed heads
Base d'essai: AD 2000-Merkblatt HP 8/1, TRD 202 pour fonds bombés façonnés à froid

Zulassungen: Werkstoffhersteller nach DGR 97/23/EG durch den TÜV Rheinland/Berlin-Brandenburg
Approvals: Manufacturer of materials in accordance to PED 97/23/EG by TÜV Rheinland/Berlin-Brandenburg
Autorisations: Producteur de matières selon Directive PED 97/23/EG par TÜV Rheinland/Berlin-Brandenburg

AD 2000-Merkblatt W0/TRD 100, HPO/TRD 201 durch den RW-TÜV
AD 2000-Merkblatt W0/TRD 100, HPO/TRD 201 by RW-TÜV
AD 2000-Merkblatt W0/TRD 100, HPO/TRD 201 par RW-TÜV

Daten der Lieferung / Dates on material delivered / Données de livraison

Besteller / Customer / Client : Robert Josef Wolf GmbH & Co. KG, Dortmunder Str. 2, 57234 Wilsdorf

Bestell-Nr. / Order-No. / Numéro de commande : 37106

Werks-Nr. / Works-No. / Numéro d'usine : 13927

Folgende Böden wurden von uns mit Rechnung vom *geliefert.

02.02.2005 *

The following heads have been delivered by us together with our invoice dated *

Les fonds suivants ont été livrés par nous avec notre facture du *

Stück	Art / Norm(en)	Abmessung (mm)	Werkstoff	Schmelze-/probennummer	Stahlwerk	Zeugnis-Nr. oder Datum
quantity	type / standard(s)	dimension (mm)	material	heat/sample no.	steelwork	certificate no. or date
quantité	type / norme(s)	dimension (mm)	matériau	numéro de charge / d'échantillon	usine d'acier	numéro ou date du certificat
2	Korbbogenboden DIN 28013	2600 li. Ø x 12	P265GH	21211/1413501	Ilsenburger	338256

Zeugnis Nr. 37
Certificate No.
Blatt von
Page of

Wir bestätigen, dass die gelieferten Böden nach dem Kaltformen bei ca. 920° C normalgeglüht wurden
gem. AD 2000-Merkblatt HP 7/2.

This is to certify that the dished ends supplied by us have been normalized at ca. 920° C after cold pressing acc. to AD 2000-Merkblatt HP 7/2.

Nous confirmons que les fonds livrés ont été recuits à une température d'environ de 920° C après le formage à froid suivant AD 2000-Merkblatt HP 7/2.

Die Original-Glühbescheinigung des von uns beauftragten Werkes liegt bei uns vor und kann eingesehen werden.

The original certificate of the works in charge is in our possession and may be examined.

Le certificat de recuit établi par l'entreprise qui était chargée de ce travail par nous se trouve dans notre possession et peut toujours être examinés.

Prüfung und Besichtigung der fertigen Böden:

Examination and control of finished heads:

Examination et contrôle des fonds finis:

ohne Beanstandung

without complaint

sans objections

SLAWINSKI & CO. GMBH

Erwendet wurden Bleche lt. beiliegendem Attest nach EN 10204

3.1 B

We used plates in accordance to attestation EN 10204

Nous avons utilisé des tôles conformes au certificat ci-joint EN10204

Die Bleche wurden von uns soweit erforderlich umgestempelt und mit unserem Stempel versehen.

The plates have been marked if necessary and have been provided with our stamp

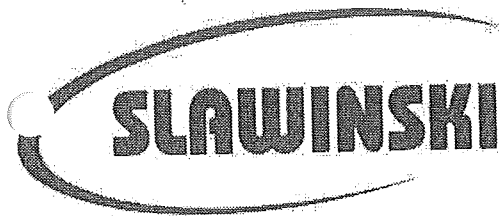
Le report du poinçon de contrôle des tôles a été effectué si nécessaire et les tôles ont été marquées par notre tampon

Der Werksachverständige

Inspection engineer of manufacturing
L'expert de l'atelier

D-57076 Siegen,
02.02.2005/SL

SL



SLAWINSKI & CO. GMBH
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D-57031 Siegen

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Fax: +49 (0) 271 / 7004-124

Industriestraße 11
D-57076 Siegen

eMail: info@slawinski.de
http://www.slawinski.de

Protokoll Materialidentifikation und Maßprüfung

Test report of material's identification and of the measurement test
Procès-verbal de l'identification du matériel et du contrôle dimensionnel

Prüfgegenstand / test object / corps d'essai: Korbbojenboden nach DIN 28013
Abmessung / dimension / dimension: 2628 mm ä. ø x 12 mm Nwd.
Anzahl / quantity / quantité: 2 Stk.
Werkstoff / material / matériau: P 265 GH

Besteller / Customer / Client: Robert Josef Wolf GmbH & Co. KG, Dortmunder Str. 2, 57234 Wilsdorf
Bestell-Nr. / Order-No. / Numéro de commande: 37106
Arbeits-Nr. / Works-No. / Numéro d'usine: 13927

Ergebnisse der Prüfungen

Test results
Résultats d'examen

lfd. Nr.	Werkstoff	Schmelze	Probe	U(mm)	h1(mm)	h3(mm)	dmax (mm)	dmin (mm)	Smin (mm)	r1 (mm)	r2 (mm)
number	material	heat	test no.	Umfang	Bordhöhe	Innenhöhe	Durchm. max	Durchm. min	Mindestwanddicke	Kalottenradius	Eckradius
numéro	matériel	charge	numéro d'échantillon	circumference	straight flange	internal height	max. diameter	min. diameter	min. wall thickness	crown radius	knuckle radius
				circumference	hauteur du bord	hauteur int.	diamètre ext.	diamètre min.	épaisseur min.	rayon de courbure	rayon de bride
Anforderungen / requirements / exigences:				8256	40	702	2628	2628	-	2102	405
1	P265GH	21211	1413501	8257	40	718	2599	2596	14,3	2102	405
2	P265GH	21211	1413501	8259	40	714	2600	2596	13,8	2102	405
3											
4											
5											
6											
7											
8											

Toleranzen nach: DIN 28013

tolerances acc. to:
tolérances suivant:

Die Wanddickenmessung erfolgte mittels Ultraschall.

The wall thickness has been controlled by ultrasonic testing.
L'épaisseur du fond a été contrôlée par les ultra-sons.

Die Radien wurden mittels Schablonen kontrolliert.

The radius have been controlled by the help of templates.
Les rayons ont été contrôlés à l'aide d'un pochoir.

SLAWINSKI & CO. GMBH

Datum der Prüfung: 26.01.2005

date of inspection:
Date de l'inspection:

Prüfer: Herr Radelt

Inspector:
Contrôleur:

Der Werksachverständige

Inspection engineer of manufacturing
L'expert de l'atelier

D-57076 Siegen, 01.02.2005/SL

P 5709

Abnahmeprüfzeugnis 3.1.B
Inspection certificate 3.1.B
DIN EN 10204 - ISO 10474

 Nr./No. **338256**
 Seite / Page **1/2**
 Datum / Date **06.11.2004**

 Nr./No. **14-13.41347** 01.07.2004 Nr./No. **11/1495**
 Besteller **Salzgitter Stahlhandel GmbH,** Empfänger **Slawinski & Co. GmbH**
 Purchaser **Düsseldorf NL Gladbeck** Customer **Blechverarbeitung**
45955 Gladbeck **57031 Siegen**

 Erzeugnis **Grobbblech**
 Product **Heavy plate**

 Werksauftrags-Nr. **0000004310**
 Works order No.
 Lieferschein-Nr. **0080269567**
 Dispatch note No. **03.11.2004**
 Abnahme **WS**
 Inspection

 Werkstoff und Lieferbedingung **P265GH**
 Steel grade and terms of delivery **DIN EN 10028-2 09/03**
AD 2000-Mbl. W 1 05/02
DIN EN 10029 C 10/91
EN 10 163

 Kennzeichnung des Materials / Marking of the product
 Herstellerzeichen / Stahlsorte / Schmelzen-Nr /
 Erzeugnis-Nr. / Sachverständigenstempel
 Trademark / Steelgrade / Heat-No / Product-No /
 inspector's stamp

Materialdaten / Material data

Pos. Item	Anzahl Quantity	Erzeugnis-Nr. Product No.	Schmelzen-Nr. Heat No.	Lieferzustand Cond. of delivery	Dicke x Breite x Länge Thickness x Width x Length	mm x mm x mm
01	1	141350 1 ✓	21211 ✓	N	14,40 x 3220,0 x 6450	
01	1	141350 2	21211	N	14,40 x 3220,0 x 6450	
Σ	2	Gewicht Weight	4.952 kg kgs	N: normalisiert / normalized		

 Maßprüfung und Sichtkontrolle auf äußere Beschaffenheit: ohne Beanstandung
 Dimensional check and visual examination of the surface condition:
 without objection

Schmelzenanalyse / Ladle analysis

Herstellerangaben / Manufacturer standard

Schmelzen-Nr. Heat No.	C %	Si %	Mn %	P %	S %	N %	Al %	Cu %	Cr %	Ni %
	≤0,20	≤0,40	0,80 - 1,40	≤0,025	≤0,015	≤0,012	≥0,020	≤0,30	≤0,30	≤0,30
21211	0,14	0,19	0,89	0,010	0,006	0,003	0,046	0,05	0,03	0,05
Schmelzen-Nr. Heat No.	Mo %	V %	Ti %	Nb %	EV1 1) %	Al/N %	Sn %	EV2 2) %		
	≤0,08	≤0,02	≤0,03	≤0,02	≤0,70	≥2				
21211	0,01	0,00	0,00	0,00	0,14	15	0,01	0,30		

1) EV1: Cr+Cu+Mo+Ni

2) EV2: CEV=C+Mn/6+Mo/5+N/15+Cr/5+V/5+Cu/15

 Erschmelzungsverfahren: Sauerstoffaufblasverfahren
 Steelmaking process: Basic oxygen process

 Es wird bestätigt, daß die Lieferung den Anforderungen der Lieferbedingung entspricht.
 We hereby certify that the delivered material complies with the terms of the order.
 QM-System: Certification as per ISO 9001 since 28 February 1990

 Herstellerzeichen
 Trademark

 Ilsenburger Grobblech GmbH
 Veckenstedter Weg 10
 D-38871 Ilsenburg

 Sachverständigenstempel
 Inspector's Stamp

 Qualitätswesen
 Abnahme
 Werksachverständiger
 Works Inspector

 Diese durch ein geeignetes Datenverarbeitungssystem erstellte Bescheinigung ist gemäß EN 10 204, Abschnitt 5, ohne Unterschrift gültig.
 This certificate was prepared by a suitable data processing system and is valid without signature according to EN 10 204, section 5.

Cyron

Abnahmeprüfzeugnis 3.1.B		Nr./No.	338256
Inspection certificate 3.1.B		Seite / Page	2/2
DIN EN 10204 - ISO 10474		Datum / Date	06.11.2004
Nr./No.	14-13.41347	01.07.2004	Nr./No.
Besteller	Salzgitter Stahlhandel GmbH,		Empfänger
Purchaser	Düsseldorf NL Gladbeck		Customer
	45955 Gladbeck		Slawinski & Co. GmbH
			Blechverarbeitung
			57031 Siegen
Erzeugnis	Grobblech	Werkauftrags-Nr.	0000004310
Product	Heavy plate	Works order No.	
		Lieferschein-Nr.	0080269567
Werkstoff und Lieferbedingung	P265GH	Dispatch note No.	03.11.2004
Steel grade and terms of delivery	DIN EN 10028-2 09/03	Abnahme	WS
	AD 2000-Mbl. W 1 05/02	Inspection	
	DIN EN 10029 C 10/91		
	EN 10 163		

Zugversuch / Tensile test

Proben-Nr. Specimen No.	Schmelzen-Nr. Heat No.	Ort Location	Richt. Direct.	Zustand Cond.	Form Type	Streckgrenze Yield point ReH N/mm ²	Zugfestigkeit Tensile strength Rm N/mm ²	Bruchdehnung Elongation A5 7) %	ReH/Rm ReH/Rm	
141350	21211	K4G	Q	N	P	346	467	29	0,74	

1) K: Kopf / Top
 2) 4: 1/4 Breite / 1/4 Width
 3) G: Erzeugnisdicke / Thickness of product
 4) Q: quer / transversal
 5) N: normalisiert / normalized
 6) P: prismatisch / prismatic
 7) A5: Lo=5,65 √So

Kerbschlagbiegeversuch / Impact test

Proben-Nr. Specimen No.	Schmelzen-Nr. Heat No.	Ort Location	Richt. Direct.	Zustand Cond.	Probenform Type of specimen	Temperatur Temperature °C	Schlagarbeit Impact energy 1 2 3 MW 6) J J J
141350	21211	K4O	Q	N	KV450	-020	98 101 95 98

1) K: Kopf / Top
 2) 4: 1/4 Breite / 1/4 Width
 3) O: oberflächennah / near surface
 4) Q: quer / transversal
 5) N: normalisiert / normalized
 6) MW: Mittelwert / Average

Es wird bestätigt, daß die Lieferung den Anforderungen der Lieferbedingung entspricht.
 We hereby certify that the delivered material complies with the terms of the order.
 QM-System: Certification as per ISO 9001 since 28 February 1990



Herstellerzeichen
Trademark

Ilseburger Grobblech GmbH
 Veckenstedter Weg 10
 D-38871 Ilseburg



Sachverständigenstempel
Inspector's Stamp



Qualitätswesen
 Abnahme
 Werkssachverständiger
 Works Inspector



ILSENBURGER
GROBBLECH

Ein Unternehmen der Salzgitter Gruppe

Abnahmeprüfzeugnis 3.1.B

Inspection certificate 3.1.B
DIN EN 10204 - ISO 10474

Nr./No. **347151**
Seite / Page **1/2**
Datum / Date **12.01.2005**

Nr./No. **C40003741** **14.10.2004**
Besteller **C & M Stahlhandel GmbH & Co.**
Purchaser **KG**
59014 Hamm

Nr./No. **C & M Stahlhandel GmbH & Co.**
Empfänger **KG**
Customer **59014 Hamm**

Erzeugnis **Grobblech**
Product **Heavy plate**

Werkauftrags-Nr. **0000005235**
Works order No.
Lieferschein-Nr. **0080342229**
Dispatch note No. **11.01.2005**
Abnahme **WS**
Inspection

Werkstoff und Lieferbedingung **P265GH**
Steel grade and terms of delivery **DIN EN 10028-2 09/03**
AD 2000 W1 10/03
DIN EN 10029 B 10/91
DIN EN 10163-2 KL.B 10/91

Kennzeichnung des Materials / Marking of the product

Herstellerzeichen / Stahlsorte / Schmelzen-Nr /
Erzeugnis-Nr. / Sachverständigenstempel
Trademark / Steelgrade / Heat-No / Product-No /
inspector's stamp

Zeugnis Nr. 2
Certificate No.

Blatt von
Page of

Materialdaten / Material data

Pos. Item	Anzahl Quantity	Erzeugnis-Nr. Product No.	Schmelzen-Nr. Heat No.	Lieferzustand Cond. of delivery	Dicke x Breite x Länge Thickness x Width x Length	mm x mm x mm
01	1	165885 1	43855	N	12,00 x 3130,0 x	8270
01	1	165885 2	43855	N	12,00 x 3130,0 x	8270
01	1	165886 1	43855	N	12,00 x 3130,0 x	8270
01	1	165886 2	43855	N	12,00 x 3130,0 x	8270
01	1	165886 3	43855	N	12,00 x 3130,0 x	8270
01	1	165887 1	43855	N	12,00 x 3130,0 x	8270
01	1	165887 2	43855	N	12,00 x 3130,0 x	8270
Σ	7	Gewicht Weight	17.660 kgs	N: normalisiert / normalized		

Maßprüfung und Sichtkontrolle auf äußere Beschaffenheit: ohne Beanstandung
Dimensional check and visual examination of the surface condition:
without objection

Schmelzenanalyse / Ladle analysis

Herstellerangaben / Manufacturer standard

Schmelzen-Nr. Heat No.	C %	Si %	Mn %	P %	S %	N %	Al %	Cu %	Cr %	Ni %
	≤0,20	≤0,40	0,80 - 1,40	≤0,025	≤0,015	≤0,012	≥0,020	≤0,30	≤0,30	≤0,30
43855	0,15	0,20	0,90	0,013	0,003	0,004	0,039	0,08	0,04	0,04
Schmelzen-Nr. Heat No.	Mo %	V %	Ti %	Nb %	EV1 1) %	Al/N %	EV2 2) %			
	≤0,08	≤0,02	≤0,03	≤0,02	≤0,70	≥2				
43855	0,00	0,00	0,00	0,00	0,16	10	0,32			

1) EV1: Cr+Cu+Mo+Ni

2) EV2: CEV=C+Mn/6+Mo/5+Ni/15+Cr/5+V/5+Cu/15

Erschmelzungsverfahren: Sauerstoffaufblasverfahren
Steelmaking process: Basic oxygen process

Es wird bestätigt, daß die Lieferung den Anforderungen der Lieferbedingung entspricht.

We hereby certify that the delivered material complies with the terms of the order.

QM-System: Certification as per ISO 9001 since 28 February 1990



Herstellerzeichen
Trademark

ILsenburger Grobblech GmbH
Veckenstedter Weg 10
D-38871 Ilsenburg



Sachverständigenstempel
Inspector's Stamp



Qualitätswesen
Abnahme
Werkssachverständiger
Works Inspector

Diese durch ein geeignetes Datenverarbeitungssystem erstellte Bescheinigung ist gemäß EN 10 204, Abschnitt 5, ohne Unterschrift gültig.
This certificate was prepared by a suitable data processing system and is valid without signature according to EN 10 204, section 5.

Cyron

Abnahmeprüfzeugnis 3.1.B
Inspection certificate 3.1.B
DIN EN 10204 - ISO 10474

Nr./No. **347151**
Seite / Page **2/2**
Datum / Date **12.01.2005**

Nr./No. **C40003741** **14.10.2004**
Besteller **C & M Stahlhandel GmbH & Co.**
Purchaser **KG**
59014 Hamm

Nr./No. **C & M Stahlhandel GmbH & Co.**
Empfänger **KG**
Customer **59014 Hamm**

Erzeugnis **Grobblech**
Product **Heavy plate**

Werkauftrags-Nr. **0000005235**
Works order No.
Lieferschein-Nr. **0080342229**
Dispatch note No. **11.01.2005**
Abnahme **WS**
Inspection

Werkstoff und Lieferbedingung **P265GH**
Steel grade and terms of delivery **DIN EN 10028-2 09/03**
AD 2000 W1 10/03
DIN EN 10029 B 10/91
DIN EN 10163-2 KL.B 10/91

Zugversuch / Tensile test

Proben-Nr. Specimen No.	Schmelzen-Nr. Heat No.	Ort Location 1) 2) 3)	Richt. Direct. 4)	Zustand Cond. 5)	Form Type 6)	Streckgrenze Yield point ReH N/mm ² ≥ 265	Zugfestigkeit Tensile strength Rm N/mm ² 410 - 530	Bruchdehnung Elongation A5 7) %	ReH/Rm ReH/Rm
165885	43855	K4G	Q	N	P	331	471	32	0,70
165886	43855	K4G	Q	N	P	335	473	35	0,71
165887	43855	K4G	Q	N	P	349	475	30	0,73

- 1) K: Kopf / Top
2) 4: 1/4 Breite / 1/4 Width
3) G: Erzeugnisdicke / Thickness of product
4) Q: quer / transversal

- 5) N: normalisiert / normalized
6) P: prismatisch / prismatic
7) A5: Lo=5,65 √So

Kerbschlagbiegeversuch / Impact test

Proben-Nr. Specimen No.	Schmelzen-Nr. Heat No.	Ort Location 1) 2) 3)	Richt. Direct. 4)	Zustand Cond. 5)	Probenform Type of specimen	Temperatur Temperature °C	Schlagarbeit Impact energy 1 2 3 MW 6) J J ≥ 19 ≥ 27			
165885	43855	K4O	Q	N	KV450	-020	87	99	73	86
165886	43855	K4O	Q	N	KV450	-020	101	97	86	95
165887	43855	K4O	Q	N	KV450	-020	112	103	89	101

- 1) K: Kopf / Top
2) 4: 1/4 Breite / 1/4 Width
3) O: oberflächennah / near surface

- 4) Q: quer / transversal
5) N: normalisiert / normalized
6) MW: Mittelwert / Average

Es wird bestätigt, daß die Lieferung den Anforderungen der Lieferbedingung entspricht.
We hereby certify that the delivered material complies with the terms of the order.
QM-System: Certification as per ISO 9001 since 28 February 1990



Herstellerzeichen
Trademark

Ilseburger Grobblech GmbH
Veckenstedter Weg 10
D-38871 Ilseburg



Sachverständigenstempel
Inspector's Stamp



Qualitätswesen
Abnahme
Werkssachverständiger
Works Inspector

Diese durch ein geeignetes Datenverarbeitungssystem erstellte Bescheinigung ist gemäß EN 10 204, Abschnitt 5, ohne Unterschrift gültig.
This certificate was prepared by a suitable data processing system and is valid without signature according to EN 10 204, section 5.

Cyron

Tilaja Purchaser Besteller Acheteur

Vastaanottaja Consignee Empfänger Destinataire

Päivämäärä Date Datum Date

FA. WOLF GMBH & CO.KG

FA. WOLF GMBH & CO.KG

25.12.2004

D-57234 WILNSDORF DEUTSCHLAND

D-57234 WILNSDORF DEUTSCHLAND

TOIMITUSERA DELIVERY LIEFERUNG LIVRAISON

Laatuleimaus Quality Stamping
Markenbezeichnung Qualite

Tilaus Order
Bestellung Commande
Merkki Mark
Zeichen Marque
Tilausvahvistus Order Confirmation
Auftragsbestätigung Accuse de reception
Läiväus Shipping
Verschiffung Embarquement
Toimitustyyppi Delivery type
Versandart Type de livraison
Todistus Certificate
Zeugnis Certificat

BKDW25112004
LAGER/BRENNMASCHINE
11649
PARAMAR
TOTAL DELIVERY
4A0TUV

Sulatus nro levy nro Cast No. plate No. x x x x x
Schmelzen Nr. Walztafel Nr. Coulee No. tole No. x x x x
Valmistajan merkki Mark of the Manufacturer
Zeichen des Herstellers Signe du producteur
Tarkastajan leima Stamp of work's Inspector
Stempel des Werkssachverständigen Poincon de controle
Vastaanottajan leima Stamp of Surveyor
Stempel des Sachverständigen Poincon d'expert
Muut leimaukset Other Stamps
Andere Stempelung Les autres repères poinconnes

Tuote Product
Erzeugnisform Produit
Laatu Quality
Werkstoff Qualite
Laatustelitys Quality Specification
Qualitätspezifikation Specification de qualite

HEAVY PLATES
EN10028-2 P265GH
PRESSURE VESSEL STEEL

Toleranssit Tolerances Toleranzen Tolerances
EN 10029/1991 CLASS B
EN10028 :1992/2003

Tekniset vaatimukset ja/tai viralliset määräykset
Lieferbedingungen und/oder amtliche Vorschriften
Technical terms of Delivery and/or Official Regulations
Stipulations de la commande et/ou prescriptions officielles

PED 97/23/EC. AD 2000-W1.

Positio Item Pos. Poste	Mitat mm Dimensions mm Abmessungen mm Dimensions mm	Merkki Mark Zeichen Marque	Kpl Pcs Stück Quantite	Paino kg Weight kg Gewicht kg Poids kg	Sulatus levy nro Cast plate No. Schmelz Walztafel Nr. Coulee Tole No	Koe nro Test No Prüf No Essai No
----------------------------------	--	-------------------------------------	---------------------------------	---	---	---

NORMALIZED STEEL PLATES

SURFACE CONDITION EN 10 163-2:1991 CLASS B3

005	8.00 X 3000	X	12000	1	2304	55451 034 034
005	8.00 X 3000	X	12000	2	4608	56236 071 071
005	8.00 X 3000	X	12000	2	4608	56236 072 072

SURFACE CONDITION EN 10 163-2:1991 CLASS B3

006	20.00 X 3000	X	12000	1	5760	56236 052 052
006	20.00 X 3000	X	12000	1	5760	56236 053 053

SURFACE CONDITION EN 10 163-2:1991 CLASS B3

007	25.00 X 3000	X	12000	1	7200	55579 014 014
007	25.00 X 3000	X	12000	1	7200	55995 051 051

*	9	37440
**	9	37440
***	9	37440

Zeugnis Nr. 32
Certificate No.
Blatt von
Page of

BESICHTIGUNG UND MASSKONTROLLE OHNE FEHLBEFUND

23.12.2004

RUUKKI PRODUCTION Raabe Steel Works

Testaus ja tarkastus
Prüfung und Kontrolle

Testing and Inspection
Essais et Contrôle

Täten todistamme, että toimitus on tilausvahvistuksen mukainen.
We hereby certify that the material described above has been tested and complies with the terms of the order contract.
Es wird bestätigt, dass die Lieferung geprüft wurde und den Vereinbarungen bei der Bestellannahme entspricht.
Nous certifions que la livraison est conforme aux stipulations de l'acceptation de la commande.

Überprüft nach AD 2000-Merkblatt W0 und AD-Merkblatt W0/TRD 100 durch den TÜV Nord e.V. mit Verzicht auf Gegenzeichnung. Zertifiziert nach Druckgeräte-Richtlinie (97/23/EG) durch die TÜV CERT-Zertifizierungsstelle für Druckgeräte der TÜV NORD GRUPPE; benannte Stelle, Kennur. 0045

M. Valkama
MINNA VALKAMA
Valtuutettu tarkastaja Authorized Inspector
Werkssachverständiger Inspecteur autorisé

RUUKKI PRODUCTION
Yhtiön nimi Company Name
RAUTARUUKKI OYJ

Osoite Address
PL 93, P.O. Box 93
FIN-02101 RAAHE, FINLAND
Kotipaikka Registered Office
HELSINKI

Puhelin Telephone
020 5911
+358 20 5911

Telekopio Telefax
020 592 2736
+358 20 592 2736

Y-tunnus Business ID
0113276-9

Tilaja Purchaser Beststeller Ac

FA. WOLF GMBH & CO.KG

BEHÄLTER- U. APPARATEBAU

Tilaus nro Order No. Bestellung Nr. Commande No.

BKDW25112004

Vastaanottaja Consignee Empfänger Destinataire

FA. WOLF GMBH & CO.KG

BEHÄLTER- U. APPARATEBAU

Läh. merkki Shipping mark Versandzeichen Marque d'expédition

LAGER/BRENNMASCHINE

Päivämäärä Date Datum Date

25.12.2004

Valmistajan merkki
Mark of the Manufacturer
Zeichen des
Herstellerwerkes
Signe de producteur



Laatu Quality Werkstoff Nuance

EN10028-2 P265GH

Laatuselvitys Quality Specifications Qualitätspezifikation Spécification de qualité

Lisävaat. Add. requirem. Weitere Anforder. Autres prescript.

EN 10029/1991 CLASS B

Jatkuvavalettua
happiterästä
Oxygen steel,
continuous casting
Oxygenstahl, Stranguss
Acier à l'oxygène,
coulée continue

PRESSURE VESSEL STEEL

Positio Item Pos. Poste	Paksuus Thickness Dicke Epaiss.	Sulatus nro Cast No Schmelz-Nr. No coulée	Cekv Ceq Cq Cég	Sulatusanalyysi % Chemical composition of cast % Chem. Zusammensetzung auf schmelzen % Composition Chimique de coulée %															
				C	SI	MN	P	S	AL	NB	V	TI	CU	CR	NI	MO	N		
005	8.00	55451	.35	.18	.22	0.96	.009	.007	.038	.003	.005	.002	.038	0.04	0.05	.002	.006		
005	8.00	56236	.34	.14	.29	1.11	.011	.009	.026	.003	.006	.002	.052	0.04	0.05	.004	.006		
006	20.00	56236	.34	.14	.29	1.11	.011	.009	.026	.003	.006	.002	.052	0.04	0.05	.004	.006		
007	25.00	55579	.30	.15	.21	0.84	.008	.007	.032	.003	.004	.002	.046	0.03	0.04	.001	.006		
007	25.00	55995	.30	.15	.20	0.82	.009	.007	.033	.002	.004	.003	.038	0.05	0.05	.006	.005		

CEKV=C+MN/6+(CR+MO+V)/5+(NI+CU)/15 PED 97/23/EC. AD 2000-W1.

Pos. Item Pos. Poste	Sulatus, k.ä. nro Cast. test No Schmelze Prüf Nr. Coulée, Essai No	T-tila Cond Zust Etat	Vetokoe, Tensile test Zugversuch, Essai de traction				Taivutusk. Bend test Faltvers. Edeplage D = X t	Iskukoe, Impact test Kerbschlagversuch, Essai de resilience					Keskiarvo Average Mittelw. Moyenne	Erikoistesteet Special tests Sonderversuche Essais Speciaux		
			K2	Re N/mm2	Rm N/mm2	A %		K3	°C	1	2	3				
				REH		5										
005	55451	034 N	11	350	488	31		114	-20	064	049	053	055	034	RP0.2+300	212
								114	+00	056	055	056	056			
005	56236	071 N	11	342	483	31		114	-20	046	050	050	049			
								114	+00	060	051	052	054			
005	56236	072 N	11	355	491	30		114	-20	043	046	043	044	072	RP0.2+300	231
								114	+00	047	045	049	047			
006	56236	052 N	11	315	474	30		112	-20	101	104	101	102	052	RP0.2+300	218
								112	+00	137	133	135	135			
006	56236	053 N	11	320	474	29		112	-20	092	105	094	097			
								112	+00	115	128	135	126			
007	55579	014 N	51	280	434	30		152	-20	116	118	144	126	014	RPO.2+300	198
								152	+00	134	131	143	136			
007	55995	051 N	51	282	439	29		152	-20	071	086	064	074	051	RPO.2+300	185
								152	+00	080	120	098	099			

K2: 11=TOP, TRANSV., 51=BOTTOM, TRANSV.

K3: 114=CH-V/ISO-V(J), 5X10, TOP, TRANSV, KV600, 112=CH-V/ISO-V(J), 10X10, TOP, TRANSV,

KV600, 152=CH-V/ISO-V(J), 10X10, BOTTOM, TRANSV, KV600

RUUKKI PRODUCTION Raahe Steel Works

Testaus ja tarkastus
Prüfung und Kontrolle

Testing and Inspection
Essais et Contrôle

Täten todistamme, että toimitus on tilausvahvistuksen mukainen.
We hereby certify that the material described above has been
tested and complies with the terms of the order contract.
Es wird bestätigt, dass die Lieferung geprüft wurde und
den Vereinbarungen bei der Bestellannahme entspricht.
Nous certifions que la livraison est conforme aux
stipulations de l'acceptation de la commande.

23.12.2004 LV

H. Valkama
MINNA VALKAMA

Valtuutettu tarkastaja
Werkssachverständiger

Authorized Inspector Puh. 020 5911
Inspekteur autorisé Tel +358 20 5911

AR kuumavalssattu as rolled warmgewalzt état de laminage	N normalisoitu normalized normalgegluht normalisé	NR normalisoitu valssattu normalizing rolling normalisiert gewalzt laminage normalisant	CR kontrollidisturi valssattu controlled rolled temperatureregelt laminage controle	TM termomek valssattu thermomech. treated thermomech. behandelt traitement thermomecanique	NT normalisointi + päästö normalizing + tempering normalisiert + anlassen normalisation + revenu	Q karkaistu quenched gehärtet tempe
---	--	--	--	---	---	--

12822

Certified acc. to
PED 97/23/EC

DIE BESSERE VERBINDUNG



Brück GmbH Ensheim · Postfach 50 01 20 · D-66063 Saarbrücken

Brück GmbH
Mühlenbachweg 26

40724 Hilden

Werkzeugnis nach DIN EN 10204 - 2.2 Report based on quality control as per ISO 10474 Relevé de contrôle suivant NF EN 10204 - 2.2		Nr.
Abnahmeprüfzeugnis nach DIN EN 10204 - 3.1B Works Certificate as per ISO 10474 C.C.P.U. suivant NF EN 10204 - 3.1B	x	Nr. E 33
Abnahmeprüfprotokoll nach DIN EN 10204 - 3.2 Test Certificate as per ISO 10474 Certificat de réception suivant NF EN 10204 - 3.2		Nr.

Kunden Bestell-Nr. / Clients order no / No. de commande du client

39009/S

Unsere Auftrags-Nr. / Our works no / Notre no. de commande

2049451

Stempel des Lieferwerkes / Stamp of the manufacturer / Siegle du fournisseur

BRÜCK

ZEUGNIS
CERTIFICATE/CERTIFICAT

Werkstoff / Material / Matière C 22.8 N			Wärmebehandlung / Heat treatment / Traitement thermique normalgeglüht										
Gemäß / As per / Suivant Vd TÜV 350/3/9.2001 AD2000 W9			Prüfgegenstand / Test object / Objet de contrôle V-Flansch										
			Erschmelzungsart / Melting process / Méthode d'élaboration Y										
			Probenlage / Position of sample / Position de l'échantillon tg.										
Schmelzen-Nr. Heat no No. de coulée	Position Item Poste	Anzahl Quantity Quantité	Abmessungen / Dimensions / Dimensions										
307629	3	5	DN600x40 DIN 28034-CD s=8,00 mm Maß-+Sichtkontrolle durchgeführt. Ergebnis: ohne Beanstandung.										
H	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	V %	N %	Al %		
307629	.19	.26	.57	.012	.023	.06					.020		
H Schmelzanalyse laut Stahlhersteller Heat analysis according to steel manufacturer Analyse de coulée suivant fournisseur						C Check analysis Stückanalyse Analyse sur pièce							
Schmelzen-Nr. Heat No. No. de coulée	Position Item Poste	Probe Nr. Sample No.. No. d'essai	Prüftemp. / Test temp. / Temp. d'essai RT °C				Brinell Härte Brinell Hardness Dureté Brinell		Kv (AN = 300J) Imp. strength Résilience	J da J/cm² ftxlbs	x	Kerbform Notch Entaille	Prüftemp Testtemp Temp dess °C
Soll / Requ. / dem.			230		410-540	19			31			ISO-V	
												ISO-U	
												CVN	
												DVM	
307629	3	48317	293		432	36	77		225-232-248			KV	x RT
												KCU	
												Biegeversuch Bend test Essai de pliage	

Es wird bestätigt, daß die Lieferung geprüft wurde und den Vereinbarungen bei der Bestellannahme entspricht.
We hereby certify, that the material described above has been tested and complies with the terms of the order.
Nous certifions que la livraison a été vérifiée et est conforme aux stipulations de la commande.

Amtsgericht Saarbrücken HRB 6080
Geschäftsführer:
Dipl.-Kfm Matthias Brück
Anne Brück
Dipl.-Kfm. Volker Datzko
Ust.ID.-Nr. DE 138 100 637

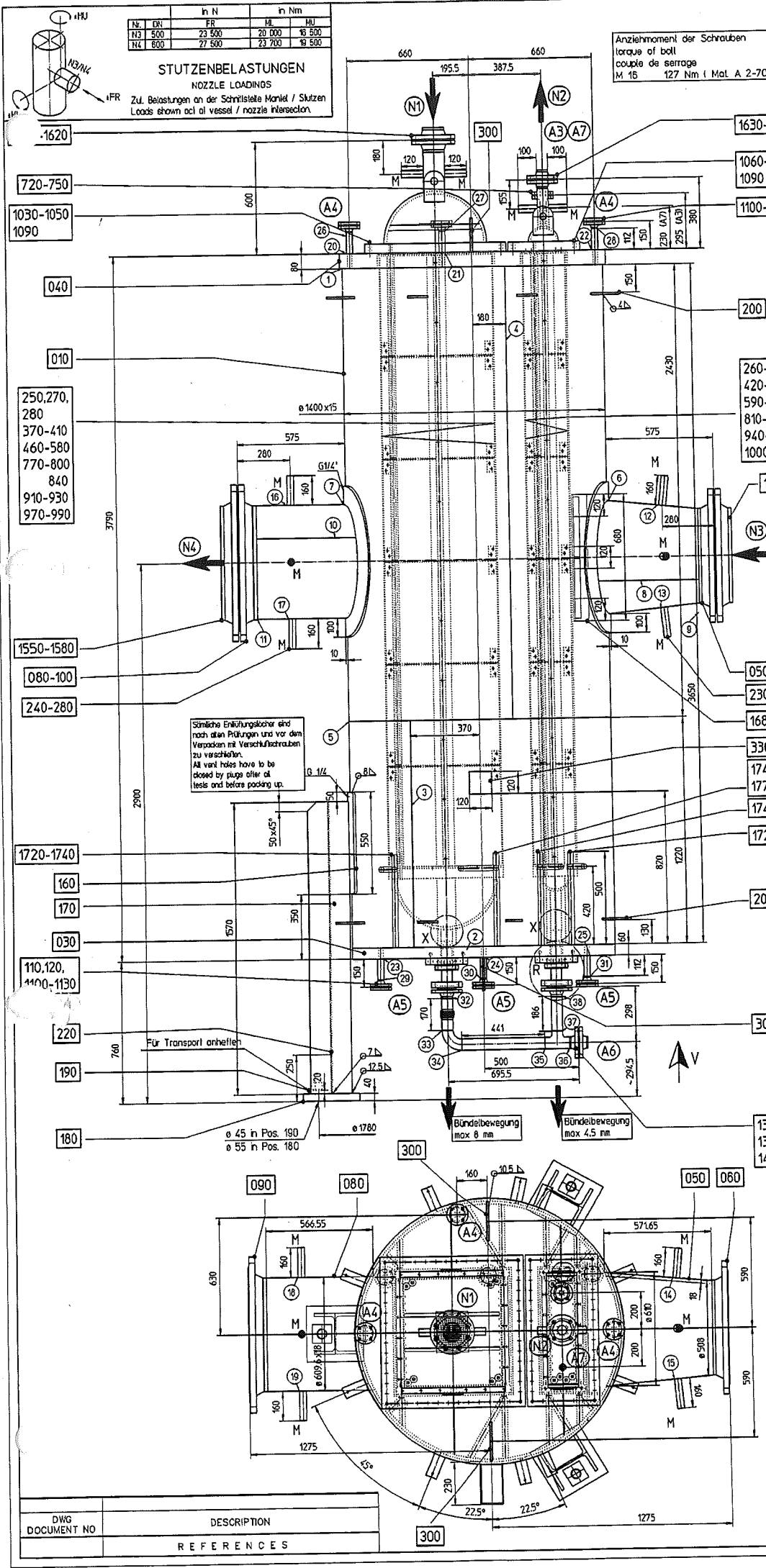
Brück GmbH Ensheim
Brückstraße 16
D-66131 Saarbrücken
Telefon: (06893) *840
Telefax: (06893) 842 58

Datum / Date: 5-1-2005

Becker

Der Werkstoffverständige / Works inspector / L'expert d'usine G

BRÜCK GMBH



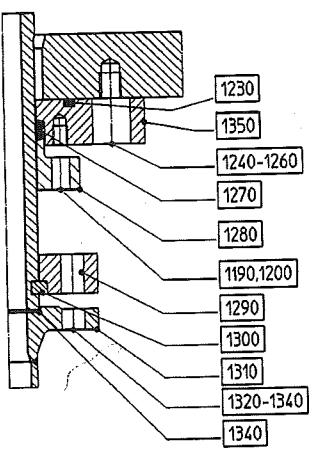
Oberflächenbehandlung
Vorbehandlung: Sandstrahlen Sa 2 1/2 nach DIN 55928
Mantel außen: 1 Komp. Silikat-Zinklack (GEOHOLZK S1, F35-763) Trockenschichtdicke 75 µm
Mantel innen ohne Anstrich
Kammern innen ohne Anstrich
Rohrböden auf Dampfseite ohne Anstrich
N₂ betriebl. Flächen ohne Anstrich
Bündelbohle ohne Anstrich

Surface treatment
Pre-treatment: Sandblasting Sa 2 1/2 acc. to DIN 55928
Shell outside: One-component silicate zinc (GEOHOLZK S1, F35-763) Dry film thickness 75 µm grey
Shell inside without coating
Channels inside without coating
Tube sheets on steam side without coating
N₂ side without coating
Side walls without coating

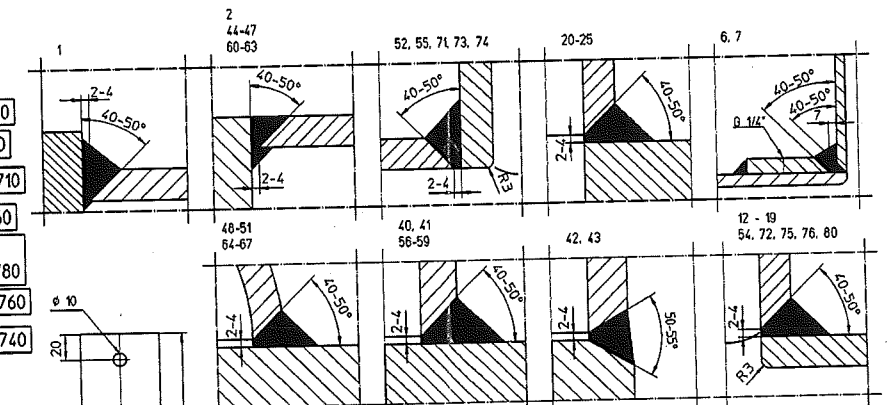
Mantel- und rohrrseitig Stickstofffüllung 0,3 bar g
Shell side and tube side filled with nitrogen 0.3 bar g

Helium-Dichtheitsprüfung Bündel 1 = 10⁻⁴ mbar l/s.
Helium tightness test 1 = 10⁻⁴ mbar l/s.

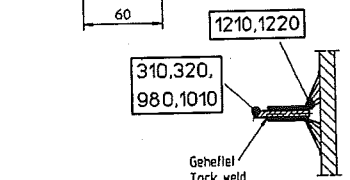
Detail R



Soweit als möglich gegenschweißen!
Back welded as possible!



Detail X



Kühlrohre eingeschränkt.
Nach dem Schweißen walzen.
Haftaufweitung 3-5%
Tube-tubesheet welded in
After welding tubes
expanded.
Expansion rate 3-5%.

Stutzen-Nr.	DN	DN / ASPE	Dichtheits-Bezeichnung
1 N1	100	2635	C
1 N2	50	2635	C
1 N3	500	2635	C
1 N4	600	2635	C
1 A3	25	2635	C
1 A4	25	2635	C
1 A5	25	2635	C
1 A6	50	2635	C
1 A7	6 1/2	ISO 228	---
12 H	6 1/2	ISO 228	---

Pos. 350

Manufakturer
Vibrobox

Tag No.: W15001

CE 0036

Tag No.: W15001

EKE 140.320.216R

105/5839/04

7 500 kg

5 405 kg

5 150

220 / 35

11

41

Ausführung nach Design acc. to Construction suivant	Handelsseite Shell side / Côté coque	Rohrseite Tube side / Côté tubes
Min./max. zul. Betriebstemperatur Max. admissible working temp. Température de service admissible	-20/+250	-20/+310
Arbeitsdruck Operating pressure / Pression de service	11	11 - 14
Zul. Betriebsüberdruck Max. allow. working pressure Pression de service max. adm.	6	21
Prüfdruck Test pressure / Pression d'essai	11	41
Prüfmedium Test fluid / Fluide d'essai	Wasser / water	Wasser / water
Medium Fluid / Fluide	H ₂ / Dusk	Steam/Condensate Vapeur / Condensat
Inhalt Content / Volume	5 150	220 / 35
Abnutzungszuschlag Corrosion allowance / Surpression de corrosion	10	10
Kühlerhöhe Tubes / Tubes d'échangeur	0	0
Wärmebehandlung Heat treatment / Traitement thermique	Nein / no	Nein / no
Zeichnungsvorprüfung Drawing approval / Approbation des plans	TÜV, Air Liquide AGS	
Abnahme durch Inspection by / Inspection par	TÜV	
Gewicht (ohne Gegenflansch) Weight (without counter flange) Weight / in service / full of water	~ 7 500 / 7 500 / 12 905	kg
Gewicht Gegenflansch inkl. Schrauben und Mutter Weight of counter flange incl. bolts and nuts	~ 300	kg
Bündelgewicht Bundle weight	Bündel 1 / Bundle 1: ca. 2 150 Bündel 2 / Bundle 2: ca. 600	kg
Zugehörige Unterlagen Associated documents / Documents annexes	44 940 - 4	
Stückliste / part list / nomenclature	OP 44 940	
Prüfplan / Check-list / OC-list	WP 44 940	
Schweißplan / weld plan / plan de soudage	CA 44 940 - 4	
Berechnung / calculation / note de calcul		
Ausnutzung der zulässigen Berechnungsspannung in der Schweißnaht 85 % Utilisation of admissible stress calculation in weld 85 % Test of welding upon plates and non destructive test acc. to AD 2000 - Merkblatt HP 5/2 u. 5/3 Utilisation de contrainte de calcul admissible en soude 85 % Essai des plaques avant et après soudage et essai non destructif suivant AD 2000 - Merkblatt HP 5/2 u. 5/3		



Air Liquide AGS GmbH

DATE: NAME: CHECKED: HISTORY FILE:

JOB CODE: K7001 SCALE: ORIGINAL FORMAT: DIN A3

REFERENCE: ASU No.9 Kosice Regeneriergaswärmer SHEET: 01 SHEETS: 01

TITLE: DRAWING No.: REV.

REPLACES: REV.

REPLACED BY: REV.

Änderungsliste - List of Revision - Modification

Zulässige Abweichung für Maße ohne Toleranzangabe
Allow. deviation for dimension without tolerance specification
Divergence admissible pour dimension sans spécification de tolérance

Für Wärmeaustauscher
For heat exchanger
Pour échangeurs de chaleur

Für Behälter
For vessels
Pour réservoirs

DIN 28 005

105/5839/04
ASU KOSICE

OELIECHNIK

Regeneriergaswärmer W15001
EKE 140.320.216R

KU 44 940 - 0

1:10

REVISIONS

Det Danske Stålvalseværk A/S

DK-3300 Frederiksværk · Telefon 47 77 03 33 · Telefax 42 12 46 66 · Telex 40191

3172 YH26GP 00

CARL SPAETER GMBH
POSTFACH 101 468
D-46014 OBERHAUSEN

Bleche / Plates
Seite/Page... 1.1 Nr./No.: 35615
Type: EN 10204/3.1B (2)

Ihrer Auftrag/Your order: 3001311-BRENNMAS.
Unser Auftrag/Our order: 14888
Datum/Date: 20.01.2000
Lieferstelle/Delivery address:
WOLF GMBH & CO KG
DORTMUNDER STR. 2
D-57234 WILNSDORF

Lieferbedingung / Specification:
DIN 17155 HII EN10028 P265GH U-ZEICH
TUV: AD-W1 TRB100 TRD101

Lieferung/
Delivery: OX95838 DSV
Toleranz/
Tolerance: EN10029 CLASS B

Pos.		Zeichen/Marking				Abmessungen/Dimensions						Stk./Pcs.	Gewicht/Weight	Schmelze/Heat	Slab	Walznr./Millno.							
1	1					12000	3000	20,0				1	5760	59514	B1	5726S	0	N					
2	2					10000	3000	32,0				1	7680	59514	A2	5547S	0	N					
3	3					10000	3000	45,0				1	10800	59301	A2	3023S	0	N					
Gewicht durch nominelle Abmessungen berechnet Calculated weight based on nominal dimensions																		3	24240				
C	Mn	Si	P	S	Cr	Cu	Ni	Mo	Sn	Al	Nb	Ti	V	B	N	Ceq = Carbon-Equivalent (IIW - formula)							
12	113	23	10	5	5	25	9	1		32	3	2	5			Lieferzustand/Condition of Delivery							
12	113	23	10	5	5	25	9	1		32	3	2	5			= Walzzustand/as rolled							
12	113	22	11	10	6	26	8	1		28	2	1	3			N = Normalisierend gewalzt/Normalized Rolled oder/ Normalgeglüht/Normalized 900°C 25 mm min. 3 Minuten/Minutes 25.1 mm min. 5 Minuten/Minutes							
																M = TM-gewalzt/TM-rolled							
																Masskontrolle, Besichtigung: Ohne Beanstandung							
																Dimension check. Inspection: Without remarks							
																Kennzeichnung/Marking							
																Stahlsorte/Quality							
																HII P265GH							
																Sachverständigen/Quality inspector: PA 0							
																Schmelz nr. / Heat no.							
																1-89.999 Electro-Ofen/El-arc-furnace							
																Im Pflanne raffiniert/Ladle refined							
																90.000-99.999 Konverter-verfahren/ Oxygen converter							
Zugversuch quer/Tensile test transverse						Kerbschlagbiegeversuch/Impact test						KV = ISO - V						Warmzugversuch/ Hot tensile test					
Re	Rmt	A	Re	Rmt	A	1	2	3	Mittel/ Average	Temp	1	2	3	Mittel/ Average	Temp	*	R _{0.2}	Temp					
345	479	36	342	479	37	236	243	235	238	0	231	194	224	216	0	1T	251	300					
337	472	34	343	472	35	248	224	248	240	0	250	242	220	237	0	1T	250	300					
323	470	30	337	472	31	146	148	144	146	0	143	146	149	146	0	4T	280	300					
Zeugnis Nr. Certificate No. Blatt von Page of																							
N/mm ²		%		N/mm ²		%		Joule			°C			Joule			°C			N/mm ²		°C	

Dehnung/Elongation: A5

UBERPRÜFT NACH AD-WO/TRD 100 DURCH
TUV E.V HAMBURG, MIT VERZICHT AUF
GEGENZEICHNUNG AZ: 121 W158126.
TESTED ACC. TO AD-WO/TRD 100 BY
TUV E.V HAMBURG, WITH RENOUNCE OF
COUNTERSIGNMENT AZ: 121 W158126.

S. D. Jensen
Sachverständiger

* Probelage und Zustand Testpiece location and condition	
Probelage Width of testpc	Lage/location
1 10.0	Oberfläche/Surface
2 10.0	Mitte/Center
3 10.0	1/3t von Oberfl./from surface
4 10.0	1/4t von Oberfl./from surface
5 5.0	
7 7.5	
9	Blechedicke/Plate thickness
Zustand/Condition	
T=KV-TRANS	

Fallversuch/Bend Test --
Wir bestätigen, dass die Lieferung den Anforderungen
der obengenannten Lieferbedingungen entspricht.
We hereby certify, that the material has been made and
tested in accordance with the mentioned specification.

Z. Greisen
Chief Metallurgist
Det Danske Stålvalseværk A/S



A1

INSPECTION CERTIFICATE

A2

In Accordance with DIN.50042/EN10204 3.1B

Management System



BLUME STAHLSERVICE GMBH
(MULHEIM STOCK DEPOT)
UMSCHLAG 10
45478 MUELHEIM/RUHR
GERMANY

IV

INSPECTION
WORKS SECTION

County Ref No

62105/ 9

Work Order/Item No.

AB

EC139260/1

B1/B2

Specification/Product
EN10C28-2:2003 P265GH
To A.D. 2000 Merkbblatt W.1 + TRD.101/TRB.100
ASME/ASTM SA516M-2001 60/415

Plate 12000 X 3000 X 12.00mm Piece Weight 3391.2Kg
 "N". Normalised at 890/330 Degrees C for a minimum of 1.5 minutes
 per mm of thickness.

B8/A10 DIMS/EO139260-1/MULHEIM

TWO WHITE SPLASHES AT FRONT CORNERS

[illegible]

Zeugnis
Certifica
Blatt v
Page c

Ausgestellt im einvernehmen mit dem RW TÜV Essen vom 26.04.78, G-NR. 2.3.6.-155/74 wird auf die gegenzeichnung verzichtet. Das oben beschriebene material ist nach verfahren hergestellt worden. ergebnis der besichtigung und massprüfung: keine beanstandung.

21

M.D.Houghton, Test House Manager, Scunthorpe A5 H0915
 UK Limited Inspection Certificate

All original Inspection Certificates issued by Corus UK Limited will contain either an embossed seal, or be imprugmented with a Corus UK Limited seal or watermarking should ensure that it is a true and accurate reproduction of the original.


**ILSENBURGER
GROBBLECH**

Ein Unternehmen der Salzgitte Gruppe

Abnahmeprüfzeugnis 3.1.B
Inspection certificate 3.1.B
DIN EN 10204 - ISO 10474

 Nr./No. **307556**
 Seite / Page **1/3**
 Datum / Date **07.04.2004**

 Nr./No. **C40003240** 23.01.2004 Nr./No.
 Besteller **C & M Stahlhandel GmbH & Co.** Empfänger **C & M Stahlhandel GmbH & Co.**
 Purchaser **KG** Customer **KG**
59014 Hamm **59014 Hamm**

 Erzeugnis **Grobblech**
 Product **Heavy plate**

 Werksauftrags-Nr. **7500417943**
 Works order No.
 Lieferschein-Nr. **0080042419**
 Dispatch note No. **05.04.2004**
 Abnahme **WS**
 Inspection

 Werkstoff und Lieferbedingung **P265GH**
 Steel grade and terms of delivery **DIN EN 10028-2 04/93**
AD 2000-Mbl. W 1 05/02
DIN EN 10029 C 10/91
EN 10 163

 Kennzeichnung des Materials / Marking of the product
 Herstellerzeichen/Stahlsorte/Schmelzen-Nr/
 Erzeugnis-Nr./Sachverständigenstempel
 Trademark/Steelgrade/Heat-No/Product-No/
 inspector's stamp

 Zeugnis Nr. **304**
 Certificate No.
 Blatt von
 Page of

Materialdaten / Material data

Pos. Item	Anzahl Quantity	Erzeugnis-Nr. Product No.	Schmelzen-Nr. Heat No.	Lieferzustand Cond. of delivery	Dicke x Breite x Länge Thickness x Width x Length	mm x mm x mm
01	1	865443 1	67167	N	17,00 x 3450,0 x	9420
01	1	865443 2	67167	N	17,00 x 3450,0 x	9420
01	1	865444 1	67167	N	17,00 x 3450,0 x	9420
01	1	865444 2	67167	N	17,00 x 3450,0 x	9420
02	1	857189 1	49986	N	x 10,00 x 3000,0 x	9440
02	1	864050 1	49457	N	10,00 x 3000,0 x	9440
02	1	865270 1	65325	N	10,00 x 3000,0 x	9440
01	4	Gewicht 18.507	kg	N: normalisiert / normalized		
02	3	Weight 7.113	kgs			
Σ	7	25.620				

 Maßprüfung und Sichtkontrolle auf äußere Beschaffenheit: ohne Beanstandung
 Dimensional check and visual examination of the surface condition:
 without objection

Schmelzenanalyse / Ladle analysis

Herstellerangaben / Manufacturer standard

Schmelzen-Nr. Heat No.	C %	Si %	Mn %	P %	S %	N %	Al %	Cu %	Cr %	Ni %
	≤ 0,20	≤ 0,40	0,50 - 1,40	≤ 0,030	≤ 0,025		≥ 0,020	≤ 0,30	≤ 0,30	≤ 0,30
49457	0,15	0,17	0,89	0,012	0,002	0,005	0,031	0,02	0,03	0,02
49986	0,15	0,17	0,88	0,010	0,001	0,004	0,026	0,02	0,03	0,03
Schmelzen-Nr. Heat No.	Mo %	V %	Ti %	Nb %	EV1 1) %	EV2 2) %				
	≤ 0,08	≤ 0,02	≤ 0,03	≤ 0,01	≤ 0,70					
49457	0,00	0,00	0,00	0,00	0,07	0,31				
49986	0,00	0,00	0,00	0,00	0,08	0,31				

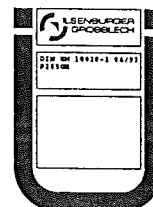
1) EV1: Cr+Cu+Mo+Ni

2) EV2: CEV=C+Mn/6+Mo/5+Ni/15+Cr/5+V/5+Cu/15

 Es wird bestätigt, daß die Lieferung den Anforderungen der Lieferbedingung entspricht.
 We hereby certify that the delivered material complies with the terms of the order.
 QM-System: Certification as per ISO 9001 since 28 February 1990

 Herstellerzeichen
 Trademark

 Ilseburger Grobblech GmbH
 Veckenstedter Weg 10
 D-38871 Ilseburg

 Sachverständigenstempel
 Inspector's Stamp

 Qualitätswesen
 Abnahme
 Werkssachverständiger
 Works Inspector

 Diese durch ein geeignetes Datenverarbeitungssystem erstellte Bescheinigung ist gemäß EN 10 204, Abschnitt 5, ohne Unterschrift gültig.
 This certificate was prepared by a suitable data processing system and is valid without signature according to EN 10 204, section 5.

Cyron

Abnahmeprüfzeugnis 3.1.B
Inspection certificate 3.1.B
DIN EN 10204 - ISO 10474

Nr./No. 307556
Seite / Page 2/3
Datum / Date 07.04.2004

Nr./No. C40003240 23.01.2004
Besteller C & M Stahlhandel GmbH & Co.
Purchaser KG
59014 Hamm

Nr./No.
Empfänger C & M Stahlhandel GmbH & Co.
Customer KG
59014 Hamm

Erzeugnis Grobblech
Product Heavy plate

Werkauftrags-Nr. 7500417943

Works order No.

Lieferschein-Nr. 0080042419

Dispatch note No. 05.04.2004

Abnahme
Inspection WS

Werkstoff und Lieferbedingung P265GH
Steel grade and terms of delivery DIN EN 10028-2 04/93
AD 2000-Mbl. W 1 05/02
DIN EN 10029 C 10/91
EN 10 163

Schmelzenanalyse / Ladle analysis

Herstellerangaben / Manufacturer standard

Schmelzen-Nr. Heat No.	C %	Si %	Mn %	P %	S %	N %	Al %	Cu %	Cr %	Ni %
	≤ 0,20	≤ 0,40	0,50 - 1,40	≤ 0,030	≤ 0,025		≥ 0,020	≤ 0,30	≤ 0,30	≤ 0,30
65325 67167	0,16 0,15	0,17 0,18	0,87 0,87	0,009 0,010	0,005 0,006	0,004 0,004	0,035 0,032	0,06 0,03	0,03 0,03	0,05 0,03
Schmelzen-Nr. Heat No.	Mo %	V %	Ti %	Nb %	EV1 1) %	EV2 2) %				
	≤ 0,08	≤ 0,02	≤ 0,03	≤ 0,01	≤ 0,70					
65325 67167	0,01 0,00	0,00 0,00	0,00 0,00	0,00 0,01	0,15 0,09	0,32 0,31				

1) EV1: Cr+Cu+Mo+Ni

2) EV2: CE/(-C-Mn/6+Mo/5+Ni/15-Cr,5-V/5+Cu/15)

Erschmelzungsverfahren: Sauerstoffaufblasverfahren
Steelmaking process: Basic oxygen process

Zugversuch / Tensile test

Proben-Nr. Specimen No.	Schmelzen-Nr. Heat No.	Ort Location	Richt. Direct	Zustand Cond.	Form Type	Streckgrenze Yield point ReH N/mm ²	Zugfestigkeit Tensile strength Rm N/mm ²	Bruchdehnung Elongation A5 7) %	ReH/Rm ReH/Rm
		1) 2) 3)	4)	5)	6)		410 - 530	≥ 23	
857189	49986	K4G	Q	N	P	331	470	34	0,70
864050	49457	K4G	Q	N	P	332	477	31	0,70
865270	65325	K4G	Q	N	P	365	483	30	0,76
865443	67167	K4G	Q	N	P	373	472	29	0,79
865444	67167	K4G	Q	N	P	345	466	30	0,74

1) K: Kopf / Top

2) 4: 1/4 Breite / 1/4 Width

3) G: Erzeugnisdicke / Thickness of product

4) Q: quer / transversal

5) N: normiert / normalized

6) P: prismatisch / prismatic

7) A5: Lo=5,65 x So

Es wird bestätigt, daß die Lieferung den Anforderungen der Lieferbedingung entspricht.

We hereby certify that the delivered material complies with the terms of the order.

OM-System: Certification as per ISO 9001 since 28 February 1990


Herstellerzeichen
Trademark

Ilsenburg Grobblech GmbH
Veckenstecker Weg 10
D-38871 Ilsenburg

Sachverständigenstempel
Inspector's Stamp

Qualitätswesen
Abnahme
Werkssachverständiger
Works Inspector

Diese durch ein geeignetes Datenverarbeitungssystem erstellte Bescheinigung ist gemäß EN 10 204, Abschnitt 5, ohne Unterschrift gültig.
This certificate was prepared by a suitable data processing system and is valid without signature according to EN 10 204, section 5.

Cyron

**Abnahmeprüfzeugnis 3.1.B
Inspection certificate 3.1.B
DIN EN 10204 - ISO 10474**

 Nr. / No. 307556
 Seite / Page 3/3
 Datum / Date 07.04.2004

 Nr. / No. C40003240 23.01.2004
 Besteller C & M Stahlhandel GmbH & Co.
 Purchaser KG
 59014 Hamm

 Nr. / No.
 Empfänger C & M Stahlhandel GmbH & Co.
 Customer KG
 59014 Hamm

 Erzeugnis Grobblech
 Product Heavy plate

 Werksauftrags-Nr. 7500417943
 Works order No.
 Lieferschein-Nr. 0030042419
 Dispatch note No. 05.04.2004
 Abnahme WS
 Inspection

 Werkstoff und Lieferbedingung P265GH
 Steel grade and terms of delivery DIN EN 10028-2 04/93
 AD 2000-Mbl. W 1 05/02
 DIN EN 10029 C 10/91
 EN 10 163

Kerbschlagbiegeversuch / Impact test

Proben-Nr. Specimen No.	Schmelzen-Nr. Heat No.	Ort Location 1) 2) 3)	Richt. Direct 4)	Zustand Cond. 5)	Probenform Type of specimen	Temperatur Temperature °C	Schlagarbeit Impact energy			
							1	2	3	MW 6) J
857189	49986	K40	Q	N	KV450/7,5	+000	146	141	128	138
864050	49457	K40	Q	N	KV450/7,5	+000	95	107	87	96
865270	65325	K40	Q	N	KV450/7,5	+000	76	71	73	73
865443	67167	K40	Q	N	KV450	+000	110	104	105	106
865444	67167	K40	Q	N	KV450	+000	85	106	86	92

1) K: Kopf / Top
 2) 4: 1/4 Breite / 1/4 Width
 3) 0: oberflächennah / near surface

4) Q: quer / transversal
 5) N: normalisiert / normalized
 6) MW: Mittelwert / Average

Der Verzicht auf den Nachweis der Warmstreckgrenze erfolgt entsprechend der Stellungnahme des TÜV Hannover/Sachsen-Anhalt e.V. vom 03.04.2003 (Aktenzeichen 6636 P 0045 3).

Es wird bestätigt, daß die Lieferung den Anforderungen der Lieferbedingung entspricht.
 We hereby certify that the delivered material complies with the terms of the order.
 QM-System: Certification as per ISO 9001 since 28 February 1990


 Herstellerzeichen
 Trademark

 Ilsenburger Grobblech GmbH
 Veckenstedter Weg 10
 D-38871 Ilsenburg

 Sachverständigenstempel
 Inspector's Stamp

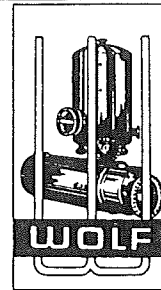
 Qualitätswesen
 Abnahme
 Werkstoffverständiger
 Works Inspector

WOLF

GmbH &
Co. KG

BEHÄLTER- UND APPARATEBAU

Dortmunder Straße 2 • 57234 Wilnsdorf



Glattrohrwärmeaustauscher
Behälter und Apparate
für chemische Industrie
und Umwelttechnik
Druckbehälter
Filterbehälter
Kolonnen
Speisewasserbehälter
Warmwasserbereiter

Robert Josef Wolf GmbH & Co. KG • Postfach 1251 • 57226 Wilnsdorf

RWTÜV Systems GmbH
Leimbachstr.227

57074 Siegen

Ihr Zeichen/Ihre Nachricht vom

Unser Zeichen/unsere Nachricht vom
w-be-gw

Tel.-Durchwahl
-22

Datum
25.04.2005

Verstempelungsbescheinigung
Direct Contact After Cooler Tag No. W13001
Pos.30 reinforcement pad 10 mm P 265 GH

Sehr geehrte Damen und Herren,
beim Umstempeln o.g. Pos. ist uns ein Fehler unterlaufen.

Wir haben anstatt der richtigen Schmelze-Nr.

49986/857189-1 die Schmelze-Nr. 16773/840504-1

gestempelt.

Wir bitten Sie unseren Fehler zu entschuldigen.

Wolf GmbH & Co.KG

Wolf GmbH & Co.KG
Quality Control

Geschäftsführer:
Klaus Dieter Wolf

Telefon: (0 27 39) 89 70-0
Telefax: (0 27 39) 89 70-10

Amtsgericht Siegen HRB 3696
UST Id-Nr: DE 126 574 240

E-Mail: RJWOLF@CITYWEB.de
Internet: www.RJWOLF.de

Banken: Deutsche Bank AG Weidenau (BLZ 460 700 90) 1 802 388
Volksbank im Siegerland e.G. (BLZ 460 600 40) 4 415 263 900
Sparkasse Siegen (BLZ 460 500 01) 53 000 758
Dresdner Bank AG (BLZ 460 800 10) 350 202 800
Postbank: Köln (BLZ 370 100 50) 2097 21-501

Bahnstation:
57233 Kreuztal





DILLINGER HÜTTE

Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02 ABNAHMEPRUEFZEUGNIS 3.1.B DIN EN 10204 - EN 10204 - DIN 50049 CERTIFICAT DE RECEPTION 3.1.B NF EN 10204 INSPECTION CERTIFICATE 3.1.B BS EN 10204 - ISO 10474 MATERIAL TEST REPORT		A09 Advice of dispatch No./ Date of dispatch 76828-13.08.02		A08/ Manufacturer's order/ A03 Certificate No. 10226		Sheet 1/...									
A05 Established inspecting body DH		A06 Purchaser C+M STAHLH., HAMM		A07.1 No. C20002426		B01 Product HOT ROLLED PLATES									
B02/ Steel grade P265GH		Final receiver C+M STAHLH., HAMM		A07.2 No.											
B03 Specifications DIN-EN10028-2:93															
B01-B99 Product description															
B09 Item No.	B10 Quantity	B11 Thickness	B12 Width	B13 Length	B14	B04 Delivery condition	B08 Heat No.	B07 Rolled plate No./ Test No.	B16 Customer reference						
01	1	25,00	x 3000	x 10000		N	33105	51527-01							
01	1	25,00	x 3000	x 10000		N	33105	51527-02							
**	2														
**	2														
B06 Marking															
ITEM NO.: 01															
STEEL GRADE P265GH															
HEAT NO. / TRADEMARK / ROLLED PLATE NO./TEST NO. / INSPECTOR'S STAMP															
C10-C29 Tensile test															
B09 Item No.	B08 Heat No.	B07 Rol.plate/ Test No.	B05 Reference condition	C01	C02/ C01	C03 Temp. GR.C	C11 MPA RPO2	C12 REH	C13 A % L ₀ =5D	C14-C15					
01	33105	51527		K4 Q	Q	300 RT	242	336	464 35,0						
C40-C49 Impact test															
B09 Item No.	B08 Heat No.	B07 Rol.plate/ Test No.	B05 Reference condition	C01	C02/ C01	C03 Temp. GR.C	C11 Specimen width	C40 Type of specimen	C44 Testing method	C45 C42 Individual values AV=J	C43 Average value				
01	33105	51527		K4 Q	Q	0	0	CHP-V		AV 309 293	295 299				
C70-C99 Chemical composition % - Heat analysis															
B08 Heat No.	C70	C	SI	MN	P	S	N	AL	CU	MO	NI	CR	V	NB	TI
33105	Y	0,108	0,300	1,16	0,012	0,0008	0,0041	0,044	0,042	0,022	0,057	0,057	0,002	0,001	0,008
Z01/Z02 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.															
A04		D/H		QM-System: Certification as per ISO 9001 since 14 March 1990		AG der Dillinger Hüttenwerke		Postfach 1580, D-66748 Dillingen/Saar		Inspection department		Date 13.08.02		RD 1	



Erläuterungen siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)

A02	ABNAHMEPRÜFZEUGNIS CERTIFICAT DE RECEPTION INSPECTION CERTIFICATE		3.1.B DIN EN 10204 - NF EN 10204 - BS	EN 10204 - EN 10204 - ISO 10474	DIN 50049	A09	Advice of dispatch No./ Date of dispatch	A08/ Manufacturer's order/ A03 Certificate No.	Sheet
A05	Established inspecting body DH	A06 Purchaser Final receiver	C+M STAHLH., HAMM C+M STAHLH., HAMM	A07.1 No. A07.2 No.	C20002426	76828-13.08.02		254510-001	2
B02/	Steel grade	AD-W1/TRB-100							
B03	Specifica-	AD-W10/TRB-100							
		AD2000-W1:00							
C94 Heat analysis Carbon equivalent / Alloying restrictions									
B08	Heat								
33105		FO-55= 0,18							
C94 Carbon equivalent formula / Alloying restrictions									
FO-55 = CU+MO+NI+CR									
D01 Checking of marking, surface, shape and dimensions									
ITEM NO.: 01									
RESULT OF MARKING, SURFACE, SHAPE AND DIMENSIONS: NO REMARKS									
SURFACE AS PER DIN-EN10163-B2									
THICKNESS AS PER DIN-EN10029-A:91									
LENGTH AND WIDTH AS PER DIN-EN10029:91									
FLATNESS AS PER DIN-EN10029-T4L:91									
A04									
Z01/Z02 We hereby certify, that the above mentioned materials have been delivered in accordance with the terms of order.									
QM-System: Certification as per ISO 9001 since 14 March 1990									
AG der Dillinger Hüttenwerke Postfach 1580, D-66748 Dillingen/Saar Inspection department									
A01									
A01									



V&M
VALLOUREC & MANNESMANN TUBES

V & M DEUTSCHLAND GmbH • Postfach 33 02 30 • D-40435 Düsseldorf

F03/ 488/00000000/00/01/01/1
(A02)

VERTEILER: SIEHE UNTEN

(A03)

12828

ABNAHMEPRUEFZEUGNIS 3.1.B NACH EN 10204: 1991 + A1:1995		Nr./No 88802	Blatt/ Page 1/ 4
Zur Lieferanzeige-Nr. To delivery note no A l'avis d'expédition	(A09) 41/ 77/0079	Datum Date 28.07.04	

(A06)

THYSSEN MANNESMANN HANDEL GMBH
POSTFACH 105061

40041 DUESSELDORF

Lieferwerk
Supply plant
Usine expéditrice
(B01 - B04)
(A01)
RATH



(A08)

VMD-Auftrags-Nr.
VMD-order no
No de commande VMD

877/4752 2

Bestimmungsort
Destination
Pays de destination

(A07)

Kunden-Bestell-Nr.
Purchaser-order no
No de commande client

278/45770411

Bestell-Datum
Date of order
Date de commande

Verwender
User
Utilisateur

6.04.04

Verwender-Bestell-Nr.
User-order no
No de commande utilisateur

NAHTLOSE STAHLROHRE, WARMGEFERTIGT #
EN 10216-2:2002 - PRUEFKATEGORIE 1 #
DIN 17175/05.79, GUETESTUFE 1 / DIN 2448/02.81 /
TRD 102, 06.98 MIT BEILAGE 05.99 / AD 2000-MERKBLATT W 4,
09.2001 UND AD-MERKBLATT W 4, 05.92 EINSCHLIESSLICH
ABSCHNITT 7 / TRB 100, 07.80(02.95) / DIN 2470, TEIL 1,12.87
/ TRBF 131/1, 09.92 #

TMH - V&M SPEC. ST 35.8/I / P235GH TC1, REV. 0 # P235GH-TC1
/ ST 35.8/I # HL 6000 - 7000 MM #
ENDEN GLATT, SENKRECHT ZUR ROHRACHSE ABGESCHNITTEN, GRATFREI
INNEN UND AUSSEN OHNE ROSTSCHUTZ
DAS WERK WENDET EIN QUALITAETSMANAGEMENTSYSTEM NACH
DRUCKGERAEETE-RICHTLINIE (DRL) 97/23/EG, ANNEX I,
ABSCHNITT 4.3 AN.

- CHEMISCHE WERTE GEMAESS TU 37-C NACH NFA 49-213
AUSGABE 03.90
- MECHANISCHE WERTE GEMAESS TU 37-C NACH NFA 49-213/L1
AUSGABE 03.90, JEDOCH OHNE PRUEFUMFANG NFA 49-213/L1

(B11 - B13)

(B09)

Zeugnis Nr. 4014
Certificate No.
Blatt von
Page of

(B10)

(B14)

Pos.	Lief.	Abmessung / Positionstext	Stück	Kg	Gesamtlänge in m
9	Ganz	A.DURCHM. WANDDICKE 219,1 X 10 IDENT-NR. 45969613 KD.-POS. 11 MM	63	22.347	434,79



VMD-Nr./No	877/4752 2	Nr./No	88802	Blatt/ Page	2 / 4
Kunden-Nr./Purchaser no./client No	278/45770411				

(B09) (B11 - B13)

(B10) (B14)

Pos.	Lief.	Abmessung / Positionstext	Stück	kg	Gesamtlänge in m
------	-------	---------------------------	-------	----	------------------

ROHRE LOSE

Ergebnisse der Schmelzeanalyse (S) Z

(B08) (C70) (C71 - C92)

SCHMELZEN-NR.	ERSCHM.-ART	C	SI	MN	P	S	AL	CU	CR	NI	MO	V
MINIMUM			0,100	0,40			0,020					
MAXIMUM			0,300	0,75	0,025	0,0120		0,250	0,300	0,300	0,080	0,020
376022 S	OXYGEN	0,120	0,220	0,61	0,011	0,0020	0,026	0,060	0,050	0,040	0,010	<0,004

SCHMELZEN-NR. ERSCHM.-ART SN TI NB N EF1

MINIMUM												
MAXIMUM			0,0300	0,040	0,010						0,70	
376022 S	OXYGEN	0,0030	0,002	<0,001	0,0065						0,16	

EF1 = CR + MO + NI + CU

CHEMISCHE ANALYSE GEMAESS TU 37-C NACH NF A 49-213/03.90

Ergebnisse des Zugversuchs

(C00)	(B08)	(C10)	(C02)	(C01)	(C03)	(C11)	(C12)	(C13)	Rp/ Z
Proben- nummer	Schmelzen- nummer	Proben- abmessung mm	Proben- richtung form	Pro- ben- ort	Pro- ben- lage	Prüf- temperatur Grad C	Streck-/Dehngrenze ReH MPa(N/qmm)	Zugfestigkeit Rm MPa(N/qmm)	Dehnung (%) Lo=5.65VS0(A5)
MINIMUM							235	360	25,0
MAXIMUM							275	460	
8681	376022	19,85	9,66	23	längs	RT	271	417	35,0
8682	376022	20,05	9,86	23	längs	RT	270	420	28,5
									0,66
									0,65

Schlüsselhinweise zum Zugversuch

PROBENFORM : 23 ROHRSTREIFENPROBE

MECHANISCHE WERTE GEMAESS TU 37-C NACH NFA 49-213/L1

AUSGABE 03.90, JEDOCH OHNE PRUEFUMFANG NACH NFA 49-213/L1

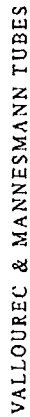
Sonstige Prüffeststellungen (D01 - D99)

Kennzeichnung der Erzeugnisse (B06 - B07)

-WAERMEBEHANDLUNG: NORMALISIEREND ENDGEWALZT >850 GRAD C/LUFT BEIDSEITIG STAHLGESTEMPELT

-DICHTHEITSPRUEFUNG GEM. SEP 1925: BESTANDEN ABGERUNDETE STEMPEL

-RINGZUGVERSUCH: BESTANDEN V&M41



067

WMD-Nr./No	877/4752 2	Nr./No	88802	Blatt/ Page	3/ 4
Kunden-Nr./Purchaser no./client No	278/45770411				

-BESICHTIGUNG UND MASSKONTROLLE: BESTANDEN (D01)
-RM (A-2) GROESSER 10.500

LIEFERBED./SPEZIFIKATION EN 10216-2/DIN17175
P235GH-TC1 / ST35.8/I
219,1 X 10
SCHMELZEN-NR.
WA
87747522
POSITIONS-NR. 9
STEMPELFELD UMRANDET
WEISS
EINSEITIG SCHABLONIERT
LFD. ROHR-NR.
VALLOUREC & MANNESMANN
FARBRING BEIDSEITIG
WEISS

KLAMMERANGABEN IM ZEUGNIS ENTSPRECHEN DER KENNZEICHNUNG NACH EN 168-86.
HERSTELLERKENNZEICHEN (A04) STEMPEL DES ABNAHMEBEAUFTRAGTEN (202)

DIE ERZEUGNISSE WURDEN BESTELLUNGSGEMÄSS GEPRÜFT UND FÜR IN ORDNUNG BEFUNDEN.

(A05) V & M DEUTSCHLAND GMBH, WERK RATH, ABNAHME STOPFENSTRASSE
40435 DÜSSELDORF, POSTFACH 330230

Dieses Zeugnis bzw. diese Bescheinigung darf weder verändert noch für andere Erzeugnisse verwendet werden. Zuwiderhandlungen werden als Urkundenfälschung und Betrug strafrechtlich verfolgt.

Went

(ZOL) WARTEN, WERKSACHVERSTAENDIGER
DÜSSELDORF, DEN 28.07.2004, TELEFON: +49(0)2119603954
TELEFAX: +49(0)2119602216
E-MAIL: WERNER.WARTEN@VMTUBES.DE



VALLOUREC & MANNESMANN TUBES

491

Zeugnisverteiler

1 X THYSSEN MANNESMANN HANDEL GMBH

- ILT-WZ -

POSTFACH 101565

40835 RATINGEN

VMD-Nr./No	877/4752 2	Nr./No	88802	Blatt/ Page	4/ 4
Kunden-Nr./Purchaser no./client No	278/45770411				

LINDEMANN
GMBH & CO. KG
ORION EISENVERARBEITUNG

ALBERT-SCHWEITZER-STRASSE 167
D-32257 BÜNDE



82 94 74 87 - 12825

TELEFON (05223) 9986-0
TELEFAX (05223) 998699
eMail Lindemann-Buende@t-online.de
USt-IdNr. DE 124330915

Hersteller: LINDEMANN GMBH & CO. KG · P.O. BOX 2260 · D-32222 BÜNDE
Lieferer:
Manufacturier
Fournisseur

EN 10204 -
Works certificate/
Certificat d'usine

3.1 B Abnahmeprüfzeugnis

Bestell-Nr. Bünde, den 2.03.04
Your order No./af 099/77712393 /EK Pr.-Nr.: 9475
Votre commande no./d

Werk-Nr.
Works-No.
N°ordre No

59658/ 19503

Kennzeichnung:
Marking / Marquis

Zeichen des Herstellers:
Mark of factory/Poinçon d'usine
Stempel des Werksachverständigen:
Mark of factory's inspector
Poinçon de réception d'usine

Werkstoff
Material/Matériau
Schmelze-Kenn-Nr.
Heat-Ident-No.
Charge-Symbole-No.

DIN

Besteller:
Customer
Client

RFF HANDELS GMBH

POSTF 13 65

28803 STUHR 1 / BRINKUM

Pos.-Nr. Item Poste	Stückzahl Quantity Nombre	NAHTL.ROHRBOGEN DIN 2609 SEAMLESS ELBOWS FOR WELDING	Schmelze-Kenn-Nr. Heat-Ident-No. Charge-Symbole-No.	Schmelze-Nr. Heat-No. No. de Coulée	Probe-Nr. Specimen-No. Epreuve no.
1	75	F-ST35.8 1,5 T.L.DIN17175 5/79 AD 2000-Mb1.W13/W4,HP100R,TRD 107/102 DIN 2470/1, gem.Richtl. 97/23/EG,TRB 100, VdTÜV-Mb1. 1252 DIN2605-1- 90-3, 219,1x12,5,5-F F2 3609,		434300	3609
		FASE 0+U = GLATTE ENDEN plan ends FASE 2+F = DIN 2559,BL.1,5/73,FORM 21/22 bevelled ends			

Ergebnis der Prüfungen:/Test Results:/Valeurs obtenues:

Zugversuch

Kerbschlagbiegeversuch Härteprüfung

Probe-Nr. Specimen-No. Epreuve no.	Probenlage Text position Position de l'Epreuve	Abmessung der Probe Dimensions mm	Prüftemperat. Test temperat. Temp. d'essai Grad C.	Streckgrenze Yield strength Limite Elasticité N/mm²	Zugfestigkeit Tensile strength Résistance à la traction N/mm²	Dehnung Elongation Allongement %	Einschnürung Reduction Striction %	Kerbschlagarbeit Impact Value Résistance ISO-Vule	Härte HB 187,5/2,5 Hardness Dureté
	L=Longs Q=Quar T=Tangential	Anforderungen: Requirements Conditions	RT	>=235	360-480	>=25L >=23Q		L=48 Q=34	HB 105-145
3609/1	Q	8 Ø	RT	329	447	30		142- 88-114	127-133
/2	Q	8 Ø	RT	314	431	31		121-134-106	

Zeugnis Nr. 41
Certificate No.
Blatt von

Zerstörungsfreie Prüfung: Non-destructive test: Contrôle non destructive:	Befund: Result: Rapport:	Werkstoffgutachten des Einsatzrohres Certificate of base material/Certificat des matériaux utilisés
Verwechslungsprüfung: Spectrum analysis: Analyse spectrale:	Befund: Result: Rapport:	Werk/TÜV Manufacturier/ Fournisseur
Verformungstemperatur: 850-950 Grad Celsius Forming Temperatur : 850-950 Grad Celsius	VOEST 3.1B	Z 30142
Wärmebehandl./Heat treatment/Traitement Thermique	168x12,5	*
normalisierend um- geformt, hot formed at controlled temperature	IN ORDER o.B. *Dichtheitsprüfung o.B.	

Schmelzanalyse:/ Chemical Analysis/Analyse Chimique:										
Schmelze-Nr. Heat-No. No. de Coulée	% C	% Si	% Mn	% P	% S	% Cr	% Mo	% Ni	% Al	% N
434300	0,148	0,188	0,740	0,011	0,013	0,022	0,002	0,014	0,024	



AT: 82947487 - 01



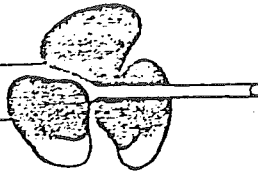
Die gestellten Anforderungen sind erfüllt.
The requirements are fulfilled.
Les conditions imposées sont satisfaites.

LINDEMANN
GMBH & CO. KG
ORION EISENVERARBEITUNG
Der Werksachverständige

Zertifiziert nach Druckgeräte Richtlinie 97/23/EG
Certified acc. to PED 97/23/EC
Überprüft als Hersteller nach AD2000-W0/TRD 100

ESW

Röhrenwerke GmbH



Austraße 25
5160 Eschweiler
Telefon 0 24 03 / 792 0
Telefax 0 24 03 / 79 22 37 und
79 22 38

EINGEGANGEN

07. JUNI 1993

ESW Röhrenwerke GmbH, Austraße 25, 5160 Eschweiler

Erled.

LIEFERSCHEIN *

Abnahmeprüfzeugnis B/
Inspection certificate B/
nach EN 10204

FIRMA
BARTHEL KG
HAMBURGER STRASSE 6-12

D-4000 DUESSELDORF 1

NUMMER 656465
DATUM 17.05.93
KUNDENNUMMER 532068

Zeugnis Nr. 45
Certificate No.
Blatt von
Page of

KUNDEN-BEST-NR.: 1/5418
AUFTRAGS-POS.-NR.: 385793 11

NAHTLOSE WARMGEWALZTE STAHLROHRE
Seamless, hot rolled steel tubes/Tubes sans soudure laminés à chaud DIN 2448

ARTIKEL	L-VON	L-BISMENGEMENGE
M0305021911420	5000-	7200	27,200 M	1982 KG
ST 35.8/I	219,10 X	14,20 MM	4 STUECK	1 BUNDE

APZ B NACH EN 10204
CHARGEN-NR.: 254752
IN LAENGEN VON 6,56-6,94 M
HALLE 10

Prüfbedingungen/Technical Requirements: TRD 102 + TRB 100 + AD-W4 Abschnitt 7
Lieferbedingungen/Terms of Delivery: DIN 17175/79 Gütest./grade/ deqze ESW St 35.8 III US
Kennzeichnung/Marking: AS

Es wird bestätigt, daß die Lieferung geprüft wurde und den oben angeführten Prüf- und Lieferbedin-
gungen entspricht.
Hereby it is certified that the material has been tested and complies with the above mentioned technical
requirements and terms of delivery.
Die gestellten Anforderungen sind i. Anlage erfüllt./The requirements are fulfilled as per enclosure.
Der Rohrwertstoff entspricht nach Markenbezeichnung und Gütestufe den angegebenen Lieferbedingungen.
The material of the tubes/pipes complies with the terms of delivery described above.
Die Rohre befinden sich über ihre ganze Länge in sachgemäßem Wärmebehandlungszustand.
The tubes/pipes are in a relevant heat-treated condition.
Lieferzustand/Condition of Delivery: normalisiert/normalized.

ESW-Röhrenwerke GmbH
Abnahmestelle/Inspect. Dep.

1 Anlage(n)/Enclosure(s)

20 JUN 1995

TECHNIP
N° 77
ACCEPTED ☐ NOT ACCEPTED

Der Fachsachverständige/Works Inspector

Bankkonto:
Kreissparkasse Aachen,
Zugst. Pumpe
Konto-Nr.: 3 100 582
RZ 7 391 54110

Geschäftsführer:
Dipl. Betriebswirt Herbert Lenzen,
Aufsichtsratsvorsitzender:
Friedrich Lönghoff
Amerikanische Abteilung: W. K. R. 702

401137 Auf.: 81/070172 Pos: 001 Rohre ST35.8/I 219.1 x 14.2 3.1B S. 1 u. 2 2014878.00

Anlage/Enclosure 1

Prüfergebnis / Test results

LS Nr.: 656465

Werks-Nr./Our Order-No.: 385793

Schmelzanalyse/Chem. Composition of Cast												
Pos. / Item	Schmelzen-Nr. Cast-No.	Erschm.Art/ Melting-furnace	% C	% Si	% Mn	% P	% S	% Cr	% Mo	%	%	%
11	254752	Y	0,10	0,20	0,43	0,013	0,002					
Pos. / Item	Schmelzen-Nr. / Cast-No.	Probe-Nr. Test-Nr.	Streckgrenze/ Yield stress N/mm²	Zugfestigkeit/ Tensile strength N/mm²	Bruch-dehnung/ Elongation% A ₅	Kerbschlagarbeit/Impact Value					Prüfdruck Test Pressure bar	Bemerkungen Remarks
						-Probe/Type						
Anforderungen Requirements:			min. 235	360-480	min. 25	bevat: °C	1.	2.	3.	Mittel/ Average		
11	254752		311	431	30,9						80	

<input checked="" type="checkbox"/>	Besichtigung und Ausmessung/ Results of inspection and measurement:
<input checked="" type="checkbox"/>	ZerreiBversuch (siehe Tafel)/ Tensile Test (see table):
<input type="checkbox"/>	Ringaufcomversuch/ Ring expanding test:
<input checked="" type="checkbox"/>	Ringzugversuch/ Ring Tensile Test:
<input type="checkbox"/>	Ringfaltversuch Flattening test:
<input type="checkbox"/>	Aufweitversuch/ Flaring test:
<input checked="" type="checkbox"/>	Sämtliche Rohre haben den Wasserinnendruckversuch bestanden, sie sind dicht und haben freien Durchgang. The tubes/pipes have passed the hydraulic pressure test without leakage and have a free passage.
<input type="checkbox"/>	Ultraschall-Prüfung gem./ Ultrasonic Test acc. to:
<input type="checkbox"/>	Die Prüfung auf Werkstoffverwechslung wurde an allen Röhren durchgeführt./Each tube/pipes is tested for exchange of material.
<input type="checkbox"/>	Beizscheibenprüfung/ Etching Test:
<input checked="" type="checkbox"/>	Die mit *x* bezeichneten Prüfungen wurden durchgeführt und nicht beanstandet./The tests marked with *x* were performed and did not lead to objection.

Eschweiler 03.06.93

ESW Röhrenwerke GmbH

Eschweiler

Aufnahmeleiter/Inspector Dep.

TECHNIP	INSP. DEPT.
Nr 77	NAME CASTALDO
<input checked="" type="checkbox"/> ACCEPTED	<input type="checkbox"/> NOT ACCEPTED

20 JUN 1993

Der Prüfer/Inspector

Ihre Bestellung Nr.n
Your order No./or/ Votre commande No./de

71510/LA

Besteller/Customer/Le commandant

13.08.96

STAHL U PLASTIC-FLANSCHEN 59439 HOLZWICKEDE

Kenzeichnung/marking/marque

of firm - material - heat - workinspector: B,C,D,F,N,Z

Erstschmelzungsart

Kind of melting/Mode de fusion

Stempel des Lieferwerkes

Mark of factory/Poinçon d'usine

Unser Kom.-Nr.

Zeugnis-Nr.

Certificate No./Certificat No.

DIN, ND, NW,

Tag

EN 10204

DIN 50049

3.1.B

Page

1

Prüftemperatur

Temperature of test

20 degrees Celsius

Probenart

Kind

Type

ISO-V

HB 10/30

Position

tangential

JC

Miltest-Certificate/Certificat d'usine

Pos.	Stück	Probe	Maße der Probe	Schmelze	Streckgrenze	Zugfestigkeit	Dehnung	Einschnürung	Kerbschl.-zähigkeit	C%	Si%	Mn%	P%	S%
Item.	Quantity	Specimen	Dimensions of test	Heat	Yield point	Tensile strength	Elongation	Reduction of	Imp. strength	N %	Al%	Cu%	Mo%	Ni%
Pos.	Nr./No.	Eprouvette	piece / Dimensions	Charge	Limite d'élasticité	Resistance à la traction	(Lo-5d)/2"-4d	areal Striction	Resilience	V%	Nb%	0,000	0,000	0,000
27	DIN 2576,NW 200/219,1													
	,gedr.Mt1,RST 37-2													
30	16420 10 / 50			341554	332	419	33,0	66,0	126	88	72	110-130		
	16421 10 / 50			341554	300	426	31,0	67,0	80	63	70			

Zeugnis Nr. 46
Certificate No.
Blatt von
Page of

104187




Besichtigung und Abmessung ohne Beanstandung. Die gestellten Anforderungen sind erfüllt.
Visual inspection and dimensions satisfactory. / Aucun défaut au point de vue aspect et dimension.
Manufacturing requirements are satisfied. / Les résultats ont été trouvés satisfaisants.
Wir bestätigen, daß die Analyse mit dem Originalwerkzeugnis übereinstimmt.

Friedrich Geldbach GmbH & Co. (Der Werkssachverständige)

(Brand)

Kommanditgesellschaft Sitz Gelsenkirchen · Registriertgericht Gelsenkirchen, I HRB 206 · Persönlich haftende Gesellschafterin: Goltbach Verwaltungs-Gesellschaft mbH, Sitz Gelsenkirchen
Rechtsanwältin Gelsenkirchen, I HRB 449 · Geschäftsführer: Frau, Peter Behrman

12428
006400

ZEUGNIS / CERTIFICATE / CERTIFICAT NR. (NO.): 000729788001 DUISBURG-SUED			 ThyssenKrupp Stahl Ein Unternehmen von ThyssenKrupp Steel			
DISPO-NR. ***** 0004320553	Werks-Nr. Works-No. No de l'usine 7178875	Bestell-Nr. Order-No. No de commande G04-1039/1300	05.04.04 02035275207 02035275213			
ThyssenKrupp Stahl - 47161 Duisburg			BESCHEINIGUNG ÜBER MATERIALPRÜFUNGEN EN 10204 DOCUMENT ON MATERIALS TESTS EN 10204 DOCUMENT DE CONTROLE DES MATERIAUX EN 10204 ABNAHMEPRUEFZEUGNIS 3.1 B Blatt-Nr. Page-No. Page-No 1 INSPECTION CERTIFICATE 3.1 B CERTIFICAT DE RECEPTION 3.1 B			
UNION STAHL GMBH POSTFACH 142047 D 47210 DUISBURG						
Werkstoff; Quality; Matériau / Lieferbedingungen; Specification; Conditions de livraison P 265 GH / EN 10028-2 - 9.03 AD-W1 / AD2000-W1 / TRD 101						
Kennzeichnung: WERKSTOFF; SCHMELZ-NR., FERTIGUNGS-/PROBE-NR. Zeichen des Lieferwerkes: Marking: MATERIAL, HEAT-NO., MANUFACTURING/SAMPLE-NO. Supplier's mark: Marque: MATERIEL, NO. DE COULEE, NO. DE FABRICATION/D'EPROUVETTE Marque d'usine: 						
ABNAHMEPRUEFSTEMPEL / INSPECTOR'S STAMP / POINCON DU RECEPIONNAIRE 						
ERZEUGNISFORM TYPE OF PRODUCT DESIGNATION DU PRODUIT GROBBLECH, UNGEBEIZT PLATES, FLAT, UNPICKLED TOLE, PLAT, NON DECAPEES Zeugnis Nr. 47151 Certificate No. Blatt von Page of						
POS.	STUECK Zahl	GEWICHT GEWOG.	GEWICHT THEOR.	SCHMELZE	BLECH-NR	PAKET
ITEM	NUMBER PIECES	WEIGHT	WEIGHT THEO.	HEAT NO.	PLATE-NO	BUNDLE
POS.	NOMBRE PIECES	POIDS	POIDS THEO.	NO. DE COULEE	NO. DE TOLE	PAQUET
001	15,01 X 3000,0 X 8000 [mm] KG 1 2841,000 1 2841,000 1 2841,000 3 8523,000					
002	15,01 X 3000,0 X 12000 [mm] KG 1 4261,000					
				627018 627018 627018 *	39666101 39666102 39666203	
				672742	39669101	

ThyssenKrupp Stahl
Abnahmetechnik

Es wird bestätigt, dass die oben genannten Erzeugnisse in
Übereinstimmung mit den Bestellvereinbarungen geliefert wurden
It is confirmed that the products named at the top were supplied in
accordance with the order agreements
C'est confirme que les produits appeles en haut eta ent livres en
conformite avec les accords de commande






ZEUGNIS/CERTIFICATE/CERTIFICAT NR. (NO.): 000729788001 DUISBURG-SUED				 ThyssenKrupp Stahl Ein Unternehmen von ThyssenKrupp Steel																																											
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ThyssenKrupp Stahl · 47161 Duisburg UNION STAHL GMBH POSTFACH 142047 D 47210 DUISBURG			BESCHEINIGUNG ÜBER MATERIALPRÜFUNGEN EN 10204 DOCUMENT ON MATERIALS TESTS EN 10204 DOCUMENT DE CONTROLE DES MATERIAUX EN 10204 ABNAHMEPRUEFZEUGNIS 3.1 B INSPECTION CERTIFICATE 3.1 B CERTIFICAT DE RECEPTION 3.1 B Blatt-Nr. Page-No. 2																																												
Werkstoff; Quality; Matériau / Lieferbedingungen; Specification; Conditions de livraison <div style="text-align: right;"> P 265 GH / EN 10028-2 - 9.03 AD-W1 / AD2000-W1 / TRD 101 </div>																																															
Kennzeichnung: WERKSTOFF; SCHMELZ-NR., FERTIGUNGS-/PROBE-NR. Zeichen des Lieferwerkes: Marking: MATERIAL, HEAT-NO., MANUFACTURING/SAMPLE-NO. Supplier's mark: Marque: MATERIEL, NO. DE COULEE, NO. DE FABRICATION/D'EPROUVETTE Marque d'usine:																																															
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">1</td> <td style="width: 20%;">4261,000</td> <td style="width: 5%;">672742</td> <td style="width: 20%;">39669202</td> <td style="width: 50%;"></td> </tr> <tr> <td>1</td> <td>4261,000</td> <td>627018</td> <td>39670101</td> <td></td> </tr> <tr> <td>1</td> <td>4261,000</td> <td>627018</td> <td>39670202</td> <td>X</td> </tr> <tr> <td>1</td> <td>4261,000</td> <td>672742</td> <td>39673101</td> <td></td> </tr> <tr> <td>1</td> <td>4261,000</td> <td>672742</td> <td>39673202</td> <td></td> </tr> <tr> <td>6</td> <td>25566,000</td> <td>*</td> <td></td> <td></td> </tr> <tr> <td>9</td> <td>34089,000</td> <td>**</td> <td></td> <td></td> </tr> </table>						1	4261,000	672742	39669202		1	4261,000	627018	39670101		1	4261,000	627018	39670202	X	1	4261,000	672742	39673101		1	4261,000	672742	39673202		6	25566,000	*			9	34089,000	**									
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9	34089,000	**																																													
TRANSPORT-NR./TRANSPORT-NO./NO. DE TRANSPORT 318048162099																																															
CHEMISCHE ZUSAMMENSETZUNG VON SCHMELZPROBEN % CHEMICAL COMPOSITION OF THE LADLE SAMPLES % COMPOSITION CHIMIQUE SUR ECHANTILLONS DE COULEE %																																															
<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%;">SCHMELZE HEAT NR.</th> <th style="width: 10%;">C</th> <th style="width: 10%;">SI</th> <th style="width: 10%;">MN</th> <th style="width: 10%;">P</th> <th style="width: 10%;">S</th> <th style="width: 30%;">SCHMELZVERFAHR. HEAT PROCESS COULEE LABORAT.</th> </tr> <tr> <td>627018</td> <td>,120</td> <td>,190</td> <td>1,120</td> <td>,014</td> <td>,0030</td> <td></td> </tr> <tr> <td>672742</td> <td>,120</td> <td>,220</td> <td>1,160</td> <td>,011</td> <td>,0010</td> <td></td> </tr> <tr> <td></td> <td>AL-G</td> <td>B-G</td> <td>CR</td> <td>CU</td> <td>MO</td> <td></td> </tr> <tr> <td>627018</td> <td>,029</td> <td>,0001</td> <td>,060</td> <td>,160</td> <td>,010</td> <td></td> </tr> <tr> <td>672742</td> <td>,035</td> <td>,0001</td> <td>,070</td> <td>,150</td> <td>,010</td> <td></td> </tr> </table>						SCHMELZE HEAT NR.	C	SI	MN	P	S	SCHMELZVERFAHR. HEAT PROCESS COULEE LABORAT.	627018	,120	,190	1,120	,014	,0030		672742	,120	,220	1,160	,011	,0010			AL-G	B-G	CR	CU	MO		627018	,029	,0001	,060	,160	,010		672742	,035	,0001	,070	,150	,010	
SCHMELZE HEAT NR.	C	SI	MN	P	S	SCHMELZVERFAHR. HEAT PROCESS COULEE LABORAT.																																									
627018	,120	,190	1,120	,014	,0030																																										
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ThyssenKrupp Stahl

Abnahmetechnik

Es wird bestätigt, dass die oben genannten Erzeugnisse in
 Übereinstimmung mit den Bestellvereinbarungen geliefert wurden
 It is confirmed that the products named at the top were supplied in
 accordance with the order agreements
 C'est confirmé que les produits appelés en haut étaient livrés en
 conformité avec les accords de commande






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Werkstoff; Quality; Matériau / Lieferbedingungen; Specification; Conditions de livraison P 265 GH / EN 10028-2 - 9.03 AD-W1 / AD2000-W1 / TRD 101				
Kennzeichnung: WERKSTOFF; SCHMELZ-NR., FERTIGUNGS-/PROBE-NR. Zeichen des Lieferwerkes: Marking: MATERIAL, HEAT-NO., MANUFACTURING/SAMPLE-NO. Supplier's mark: Marque: MATERIEL, NO. DE COULEE, NO. DE FABRICATION/D'EPROUVETTE Marque d'usine:				
<div style="text-align: right;">   </div> <p> THYSSENKRUPP STAHL VERFUEGT UEBER EIN UEBERPRUEFTES QM-SYSTEM NACH PED 97/23/EG, ANHANG I, ABSATZ 4.3 FUER STÄHLE NACH EN 10028-1 BIS 6. RW-TUEV-ZERTIFIKAT: 04 202 2 44 01 0011 UND IST ANERKANNTER WERKSTOFFHERSTELLER GEMAESS MERKBLAETTER AD-W0/TRD100 UND AD-2000 W0 RW-TUEV-ZERTIFIKAT: 04701 6112 UEBERWACHT DURCH DEN RW-TUEV (MIT VERZICHT AUF GEGENZEICHNUNG) </p> <p> THYSSENKRUPP STAHL RUNS AN APPROVED QM-SYSTEM ACC. TO PED97/23/EC, ANNEX1 CHAP.4.3 WITH RESPECT TO STEEL PRODUCTS COVERED BY EN 10028-1 TO 6. RWTUEV-APPROVAL CERTIFICAT-NO.: 04 202 2 44 01 0011 THYSSENKRUPP STAHL IS AN ACCEPTED STEEL MANUFACTURER CONCERNING AD-W0/TRD 100 AND AD-2000 W0 RWTUEV-APPROVAL CERTIFICAT-NO.: 04701 6112 (WITH RENOUNCE OF COUNTERSIGN) </p> <p> THYSSENKRUPP STAHL DISPOSE D'UN SYSTEME DE GESTION DE LA QUALITE CONTROLE SELON PED 97/23/EC, APP.I, PARA. 4.3 POUR LES ACIERS DES NORMES EN 10028-1 A 6. RW-TUEV-CERTIFICAT: 04 202 2 44 01 0011 ET EST UN PRODUCTEUR DE MATERIAUX RECONNU SELON PRECRIPTIONS AD-W0/TRD100 ET AD-2000 W0. RW-TUEV-CERTIFICAT: 04701 6112 SURVEILLE PAR LE RW-TUEV (AVEC RENONCEMENT A LA CONTRESIGNATURE) </p>				

ThyssenKrupp Stahl

Abnahmetechnik

Es wird bestätigt, dass die oben genannten Erzeugnisse in
 Übereinstimmung mit den Bestellvereinbarungen geliefert wurden
 It is confirmed that the products named at the top were supplied in
 accordance with the order agreements
 C'est confirme que les produits appeles en haut etaient livres en
 conformite avec les accords de commande



ZEUGNIS/CERTIFICATE/CERTIFICAT
NR. (NO.): 000729788001 DUISBURG-SUED



ThyssenKrupp Stahl

Ein Unternehmen von
ThyssenKrupp Steel

DISPO-NR. ***** 0004320553	Werks-Nr. Works-No. No de l'usine 7178875	Bestell-Nr. Order-No. No de commande G04-1039/1300 BLAU/WEISS/BLAU	 05.04.04 02035275207 02035275213
----------------------------------	--	--	--

ThyssenKrupp Stahl - 47161 Duisburg

UNION STAHL GMBH

POSTFACH 142047
D 47210 DUISBURG

BESCHEINIGUNG ÜBER MATERIALPRÜFUNGEN EN 10204
DOCUMENT ON MATERIALS TESTS EN 10204
DOCUMENT DE CONTROLE DES MATERIAUX EN 10204
ABNAHMEPRUEFZEUGNIS 3.1 B
INSPECTION CERTIFICATE 3.1 B
CERTIFICAT DE RECEPTION 3.1 B

Blatt-Nr.
Page-No. 10
Page-No

Werkstoff: Quality: Matériau / Lieferbedingungen: Specification: Conditions de livraison

P 265 GH / EN 10028-2 - 9.03
AD-W1 / AD20C0-W1 / TRD 101

Kennzeichnung: WERKSTOFF; SCHMELZ-NR., FERTIGUNGS-/PROBE-NR. Zeichen des Lieferwerkes:
Marking: MATERIAL, HEAT-NO., MANUFACTURING/SAMPLE-NO. Supplier's mark
Marque: MATERIEL, NO. DE COULEE, NO. DE FABRICATION/D'EPROUVETTE Marque d'usine:



DIESE BESCHEINIGUNG WURDE DURCH EIN GEEIGNETES DATENVERARBEITUNGS-
SYSTEM ERSTELLT UND IST GEMAESS EN 10204, ABS. 5 OHNE UNTERSCHRIFT
GUELTIG.

THIS CERTIFICATE HAS BEEN ISSUED BY A QUALIFIED ELECTRONIC DATA
SYSTEM AND IS VALID ACC. TO EN 10204, PARA. 5 WITHOUT SIGNATURE.

CE DOCUMENT A ETE ETABLI PAR UN SYSTEME INFORMATIQUE APPROPRIE ET
EST CONFORME SANS SIGNATURE COMME PREVU DANS EN 10204, P. 5.

WERKSSACHVERSTAENDIGER : Schallwig / Stabbert

WORKS EXPERT : Schallwig / Stabbert

EXPERT D'USINE : Schallwig / Stabbert

ThyssenKrupp Stahl


Abnahmetechnik

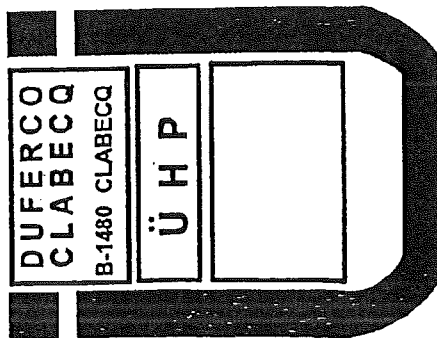
Es wird bestätigt, dass die oben genannten Erzeugnisse in
Übereinstimmung mit den Bestelleinbarungen geliefert wurden.
It is confirmed that the products named at the top were supplied in
accordance with the order agreements.
C'est confirme que les produits appeles en haut etaient livres en
conformite avec les accords de commande.



[illegible]

RECEPTION 3.1.B AD MERKBLATT W1, ... selon EN.10204

DUFERCO CLABECQ Rue de la Déportation 218 1480 TUBIZE (BELGIQUE)		SIGLE PRODUCTEUR HERSTELLERZEICHEN TRADE MARK A04 		N° 5333 N° PAGE 3/3 BLATT NR PAGE No		A03	
PLQUES-BLECHE-PLATES Organisation des services de conseil 202		CLIENT / DESTINATAIRE - BESTELLER / EMPFÄNGER - PURCHASER / CONSIGNEE SALZGITTER Stahlhandel GmbH Postfach 520 D - 45955 GLADBECK		N° COMMANDE COURRIER / LIST - MAßSTAB / ORDERSTILL-NUMMER - A07 1616-14/45020590/0101 du 24.05.00		B15 N° Commande usine Werksbuch N° 7560	
N° normalisé ou laminage normalisé - normalized or normalizing rolling Normaleigenschaft oder normalisierendes Walzen BL. Biv. de laminage - Warmgewalzt unbehandelt - As rolled M. laminage thermomécanique - thermomechanical rolling - thermomechanisches Walzen R. Revenu - Vergütet - Tempered D. Déformé - Spannungsreligiert - Stress relieved LC. Laminage contrôlé - Gleichwertige Temperaturführung - Controlled rolling ALMANCE ET SPECIFICATIONS TECHNIQUES - B07 STAALSOORTEN EN TOEGELIJDENDE SPECIFICATIES S235 JRG2 EN (N.E.) EN 10025 /93		B03 ETAT / CONDITION AS DELIVERED 100 TREATMENT OF TEST SAMPLES B03		BL		B03 RELEVÉ DE RÉFÉRENCE PROTEST REFERENCE HANDLING TREATMENT OF TEST SAMPLES B03	



DUFERCO - CLABECQ S.A.
 Rue De La Déportation, 218
 1480 CLABECO

Handwritten signature

Umstempelungsbescheinigung


Gegenstand:	Grobbleche	Besteller:	WOLF GMBH & CO. KG
Werkstoff:	S 235 JRG 2	Bestell-Nr.	34796 807 Lager
Hersteller:	s. APZ	Auftrags-Nr.:	30001485
Abmessungen:	6 x 2500 x 6000	Zeichnungs-Nr.:	
Menge:	1 St	Teil-Nr.:	

Stempelbild vorher:

S 235 JRG 2
428861
6x2,5x12
Herstellerzeichen

nachher:

428861
6x2,5x12



S 235 JRG 2

Abnahmeprüfzeugnis 3.1 B nach DIN EN 10 204

Nr.: 5333

Austellungs-Datum: +

ausgestellt von: +


+ = s. APZ (Salzgitter-Archiv-Nr. Z 7497807)

liegt vor.

Bemerkungen:


Das Umstempeln erfolgt mit Zustimmung des *RWTÜV e. V.* gemäß Vereinbarung vom 15.12.1993, G.-Nr.: 2.3-121/93

Stempel des Umstempelungsberechtigten



31.10.2000

Datum


Couvaris
Der Umstempelungsberechtigte

Benteler Stahl/Rohr GmbH & Co. KG
Postfach 13 40
D-33043 Paderborn
Tel.: (05254) 81-0 Telex: 936866
Telefax: (05254) 13666

ABNAHMEPRÜFZEUGNIS EN 10204-3.1.B

INSPECTION CERTIFICATE EN 10204-3.1.B
CERTIFICAT DE RECEPTION EN 10204-3.1.B
EN 10204 - 1991 + A1: 1995

Benteler Stahl/Rohr GmbH & Co. KG - Postfach - D-33043 Paderborn

Buhlmann
Rohr-Fittings-Stahlhandel
Lise-Meitner-Straße 14

40721 Hilden

Dokument-Nr.: 65-027456/001/808492

Document No.:
No. du document:

Kunden-Bestell-Nr.:
Purchase Order No.:
No. de commande du client:

Benteler Auftrags-Nr.:
Benteler Order No.:
No. de commande Benteler:

Versandanzzeigen-Nr.:
Dispatch Note No.:
No. d'avis d'expédition:

Produkt: NAHTLOSE STAHLROHRE
Product: SEAMLESS STEEL TUBES
Produit: TUBES D'ACIER SANS SOUDURE

Prüf-Nr.:
Inspection No.:
No. du certificat:

Hersteller:
Manufacturer:
Producteur:

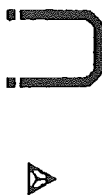
Herstellereichen:
Manufacturer's brand:
Marque du producteur:

Stempel des Sachverständigen:
Inspector's stamp:
Poinçon de l'expert:

Stahlschmelzungsverfahren:
Steelmaking process:
Procédé d'élaboration de l'acier:

Blatt: 1 / 4
Page:
Page:

Benteler Stahl/Rohr GmbH & Co. KG
Warmrohrwerk Dinslaken



Stahlsorte:

Steel grade:
Nuance d'acier:

Lieferbedingungen:

Terms of delivery:
Conditions de livraison:

Maße - Toleranzen:

Dimensions-tolerances:
Dimensions-tolerances:

Lieferzustand:

Delivery condition:
État de livraison:

ST 35.8 (I)
ST 35.8 (I)
ST 35.8 (I)

DIN 17175-79 Gütestufe I, TRD 102, TRB 100, STOOMWEZEN M 0301, AD-Merkblatt W 4 inkl. Abschnitt 7
DIN 17175-79 quality grade I, TRD 102, TRB 100, STOOMWEZEN M 0301, AD-Merkblatt W 4 including section 7
DIN 17 175-79 degré de qualité I, TRD 102, TRB 100, STOOMWEZEN M 0301, AD-Merkblatt W 4 y compris section 7

DIN 17175-79, DIN 2448-81, Warmgefertigt
DIN 17175-79, DIN 2448-81, hot-finished
DIN 17175-79, DIN 2448-81, finis à chaud

Normalgeglüht
Normalized
Normalisé

Zeugnis Nr. 43
Certificate No.
Blatt 1/4




Es wird bestätigt, daß die gelieferten Erzeugnisse den techn. Lieferbedingungen des Auftrages entsprechen.
We certify that the supplied products comply with the order specification.
Nous attestons que les produits livrés sont conformes aux stipulations de la commande.

ABNAHMEPRÜFZEUGNIS EN 10204-3.1.B
INSPECTION CERTIFICATE EN 10204.3.1.B
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Produktkennzeichnung:

- FK: Farbringe ein weißer, Farbringe RAL 9016
- FK: Coloured rings: one white, RAL 9016
- FK: Anneaux de couleur: un blanc, RAL 9016
- FS: ABMESSUNG ST 35.8 SCHMELZEN-NR
- FS: DIMENSION ST 35.8 HEAT-NO.
- FS: DIMENSION ST 35.8 COULEE-NO
- PS:  ST 35.8 SCHMELZEN-NR WA
- PS:  ST 35.8 HEAT-NO. WA
- PS:  ST 35.8 COULEE-NO WA

Product marking:
Marquage du produit:

FK = Farbkennzeichnung, colour marking, marquage par couleur
LS = Längsschablonierung, longitudinal stencilling, marquage longitudinal par peinture
TS = Textilsitzkennzeichnung, ink jet spray marking, imprimante à jet d'encre
FS = Farbschablonierung, paint stencilling, marquage par peinture
PK = Etikettenkennzeichnung, tag marking, marquage sur étiquette
PS = Prägestempel, die stamp, marquage par poinçonnage
FSD = Farbstahlprüfdruck, Colour jet printer, imprimante à jet d'encre de couleur

Pos.	Stück	Maße	Länge	Gewicht	Schmelzen-Nr.	Prüfdruck	Rohr-Nr.-Gruppe	Vielfachlängen
Item	Number	Dimensions	Length	Weight	Heat No.	Test pressure	Tube number group	Multiple lengths
Poste	Nombr	Dimensions	Longueur	Poids	No. de coulée	Pression d'épreuve	Série de no. des tubes	Longueurs multiples
0100	22	114,300 X 12,500 mm	6000	- 7000	148,25	4620	598646	
		mm		kg				

Schmelzenanalyse / Heat analysis / Analyse sur coulée [%]

Pos.	Schmelzen-Nr.	C	SI	MN	P	S	AL	N	CU
Item	Heat No.								
Poste	No. de coulée								
0100	598646	0,105	0,161	0,47	0,005	0,003	0,029	0,006	0,10

Prüfergebnisse / Test results / Résultats des essais

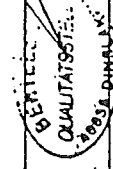
Die Rohre sind auf Dichtheit geprüft durch:

The tubes have been submitted to a leak tightness test by:

Les tubes ont passé un contrôle d'étanchéité par:

ET-Dichtheitsprüfung: nach SEP 1925
ET-leak tightness test: acc. to SEP 1925
ET-essai d'étanchéité: svt. SEP 1925

08.05.2001



BESTANDEN
PASSED
PASSE

ABNAHMEPRÜFZEUGNIS EN 10204-3.1.B

INSPECTION CERTIFICATE EN 10204-3.1.B
CERTIFICAT DE RECEPTION EN 10204-3.1.B

Dokument-Nr.:
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No. du certificat:

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Augensichtkontrolle:		BESTANDEN		BESTANDEN		BESTANDEN		Maßkontrolle:		BESTANDEN	
Visual inspection:		PASSED		Blegetest:		PASSED		Dimensions examination:		PASSED	
Examen visuel:		PASSE		Essai de cintrage:		PASSE		Vérification des dimensions:		PASSE	
Ringaufdornversuch:		BESTANDEN									
Ring expanding test:		PASSED									
Essai de dilaton d'anneaux:		PASSE									

Ergebnisse der mechanischen Prüfung / Results of mechanical testing / Résultats des essais mécaniques

Die Probenahme erfolgte an Vielfachlängen.

The sampling was carried out on multiple lengths.
L'échantillonnage était réalisé aux longueurs multiples.

Zugversuch / Tensile test / Essai de traction

Pos.	Proben-Nr.	Schmelzen-Nr.	Probenabmessung	Streckgrenze	Zugfestigkeit	Dehnung	Einschnürung	Re/Rm
Item	Specimen No.	Heat No.	Specimen dimensions	Yield strength	Tensile strength	Elongation	Area reduction	Re/Rm
Poste	No. de l'éprouvette	No. de coulée	Dimensions de l'éprouv.	Limite d'écoulement	Résistance à la traction	Allongement	Coefficient de striction	Re/Rm
Anforderungen								
			mm	ReH	Rm	A5		1. Formel
				N/mm ²	N/mm ²	%		1. Formula
				MIN 235	360-480	MIN 25		1. Formule
0100	000001	598646	25,40 X 12,50	292	409	34,00		
0100	000002	598646	25,40 X 12,50	291	410	33,00		

Pos.	Ihr Zeichen	Kundenmaterial	Kundenbestell-Nr.
Item	Your reference	Customer's Material No.	Purchase Order No.
Poste	Votre référence	No. de matière du client	No. de commande du client
0100			18/2935/01

Benteler Stahl/Rohr GmbH & Co. KG
Postfach 13 40
D-33043 Paderborn
Tel.: (05254) 81-0 Telex: 936866
Telefax: (05254) 13666

BENTELER
STAHL/ROHR

ABNAHMEPRÜFZEUGNIS EN 10204-3.1.B

INSPECTION CERTIFICATE EN 10204-3.1.B
CERTIFICAT DE RECEPTION EN 10204-3.1.B

Dokument-Nr.:
Document No.:
No. du document:

65-027456/001/808492

Prüf-Nr.:
Inspection No.:
No. du certificat:

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Page:

Vermerk / Remark / Remarque

Pos. / Item / Poste: 0100

Zeugnisvermerk: Das Material entspricht dem TU 37 C nach NF A 49-213, zulässig für Gas nach DIN 2470 Teil 1, TRBF 131 Teil 1
Certificate remarks: The material corresponds to TU 37 C acc. to NF A 49-213, approval for gas acc. to DIN 2470 part 1, TRBF 131 part 1
Certificat-remarques: Le matériel correspond à TU 37 C svt. NF A 49-213, admission pour gaz svt. DIN 2470 partie 1, TRBF 131 partie 1

Verkäufer(in) / Salesman / Personne chargée

Herr KOTTHOFF, Tel.: 05254/81-1681, Fax: 2798

Dinslaken, 17.04.2001, TEL.: 02064 / 623-572 FAX: 02064 / 54658

Der Werkssachverständige

Work's Inspector

L'expert d'usine

TRITTEL / SCHEF

Dieses Dokument wurde mittels EDV erstellt und ist ohne Unterschrift rechtsgültig.
This document was prepared by means of electronic data processing and is valid without signature.
Ce document a été établi par traitement électronique de l'information et est valide sans signature.

5634

**Werkzeugnis nach DIN 50049/2.2
EN 10204/2.2**

**Abnahmeprüfzeugnis nach DIN 50049/3.1B
EN 10204/3.1B**

**bifrangì**
S.p.A.

Bestseller - commitments

[illegible]

Zeugnis Nr. 50
Certificate No.
Blatt von
Page of

Laut Schreiben des TÜV
Bayern e.V. vom 03.08.87
wird auf eine Gegen-
zeichnung verzichtet.

1997
2000
2003

**Stempel und Unterschrift
des Werksachverständigen**

2000

Werkstoffe
Werkstoffe

bitranel S.p.A.
Laboratorio

Es wird bestätigt, dass die Lieferung den vereinbarten Lieferbedingungen entspricht

**Si conferma che la formula corrisponde
Bealchilung und Ausmessung: o.B.**

Kennzeichnung: *marcultura*

Herstellerzeichen *Signi del produttore*

Workstoff *Typo 41*

di Schmelze Nr. 7 colata

Zeichen des Werkstoffverständigen *Sigla del lid*
Massa und Nenndruck *Dimensione e pressione*

מחיר

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11051
A 031

CV/N
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ALAC

emp. in C

07 + 10

01 + 0

UAE

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R = RST 37.2

C - C 22.3

Vrijduv - vstbl. 364

K = C 22.8

Vdtuv - wstbl 350:3

A = A105

A105/C21
Vollzug: Herbst 2000

 $L = A350/LF2$

Vdluv - wstbl 488

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Rohrwerk Neue Maxhütte GmbH, 92237 Sulzbach-Rosenberg

MH - Rohr

X) Abnahmeprüfzeugnis B / Inspection certificate B / Certificat de réception B DIN 50 049/ EN 10204 - 3.1 B

Post: 92231 Sulzbach-Rosenberg, Postfach 13 58

Bahnstation: Sulzbach-Rosenberg Hülle

Telefon: (09661) 60-1

Drahtanschrift: Maxhütte Sulzbach-Rosenberg

Telex Rohre: 63837-50 mhs d Rohrwerk

Telefax: 09661 / 60-875

92237 Sulzbach-Rosenberg

Rosenbachstraße 11

Datum: 19.03.1998

Lieferanzzeige/delivery note: Blatt 1 von 2

concernement l'avis d'expédition:

Nr./No.: vom/of/du:

102 863 16.03.1998

Bescheinigung der Kontrolle der Produkte durch das Werk NF A 49 000 - 5.2.2.1 Modell D CERTIFICAT DE CONTRÔLE DES PRODUITS PAR L'USINE (C.C.P.U.) - ACCEPTANCE CERTIFICATE (NF A 49-000 5.2.2.1.) MODÈLE D (A 49-001)				Erzeugnisform/Product/Produit: ROHR / TUBE / TUBE			
Besteller/Purchaser/Commandant: Mannesmann Handel AG Am Ostkal 24 70327 Stuttgart		Werkstoff/Lieferzustand Quality/Condition of delivery Qualité/Etat de livraison St 35.8 I		Lieferbedingungen und/oder amtliche Vorschriften: Terms of delivery and/or official regulations: Conditions de livraison et/ou prescriptions officielles DIN 2448:02.81/17175:05.79 AD-W4 TRD 102, TRB 100		Prüfverfahren/testing method/ Procédé d'essai US	
Werks-Nr./Works-No./ No. de l'usine	Gewicht kg/ weight/ poids	Menge m	Zeichen/ Bunde	Stück	Abmessungen/Dimensions/Dimensions mm	Bestell-Nr./ Order No./ No. de commande	
187 045	12 5.849	512,4	3	97	88,9 x 5,6 5-5,6 m Charge-Nr. 41218	810/45607078 v. 24.11.97	

Es wird bestätigt, daß die Lieferung den Vereinbarungen bei der Bestellung entspricht.
 We hereby certify that the material described above has been tested and complies with the terms of the order.
 Il est confirmé que le matériel est essayé et conforme aux conditions de la commande.

Ergebnis der Prüfungen: Siehe Anlage
 Test results: cf. enclosure
 Résultats des essais: Pièce jointe

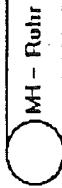
MH

MH

Zeichen des Herstellers:
 Mark of the manufacturer:
 Signe du manufacturier:

 Zeichen des Sachverständigen:
 Inspector's stamp:
 Marque de l'inspecteur:

 Qualitätsstelle /
 quality control point
 poste de contrôle de qualité
 MH ROHR ROSENBERG



Ergebnis der Prüfungen/ Test results/
résultats des essais

Sulzbach-Rosenberg

19.03.1998

Anlage/Enclosure/Pièce jointe

Blatt 2 von 2

zu Lieferanzettel/ to delivery note/ de commande

102.863

Unsere Auftrags-Nr.		Erschmelzungsart: melting process: mode d'elaboration:		OBM (-Verfahren) Oxygen-Bodenblas- Maxhütte (-Metallurgie)/ Oxygen-Bottom Blown Maxhütte * = E-Stahl							
Our order no.: No. de notre commande		Pos./ Item	Schmelz-Nr./ Heat No./ Coulée No.	% C	% Si	% Mn	% P	% S			
187 045		12*	41218	0,07	0,20	0,55	0,009	0,025			
		Werkstoff entspricht TU 37 c nach NFA 49 212 (213) und Grade HFS 360 nach BS 3602/2									
Pos./ Item	Probe Nr. Test No Epreuve	R eH (N/mm²) >	R m (N/mm²)	A 5 (%) >				Probe Nr. Test No Epreuve	R eH (N/mm²) >	R m (N/mm²)	A 5 (%) >
		235	360-480	25					235	360-480	25
12	1	316	442	40,2							
	2	320	446	40,0							
Rm (A-2) > 10500											

FormblattNr.: QSRW-06-006 Rev 0 vom 03.03.98

X	Besichtigung und Ausmessung/ Inspection and measurement/ Inspection et mesure
X	Zugversuch (s. Tafel)/tensile test (cf. table)/ Essai de traction (voir tableau)
X	Ringaufdornversuch/ ring expanding test/ Essai d'évasement d'anneau
	Ringflattversuch/ flattening test/ Essai d'aplatissement
	Ringzugversuch/ ring tensile test/ essai de traction à l'anneau
	Kerbschlag-Biegeversuch/ notched bar impact test/ essai de résilience
	Verwechslungsprüfung: ohne Befund/ test for mixing steel grade: without evidence/ Essai au confusion de qualités d'acier: néant
	Ultra-Schall Prüfung am Vormaterial: o. Befund/ultrasonic testing on blooms: without evidence/ essai d'ultra-son sur blooms: néant
X	Auf Dichtheit geprüft/ Inspected for tightness/ Essays sur étanchéité:
X	Mit Wirbelstromwilleh eddy current test/ avec courant de Foucault SEP 1925/80
	Mit Wasserinnendruck/ with hydr. test/hydrauliquement à ... bar
X	Die Röhre haben freien Durchgang/ The tubes have free passages/ propre/ pas d'objections
X	Walztemperatur/ final temperature of rolling/ température finale de laminage ca.: 900°C
X	Glühzustand/ annealing condition/ état recuit
X	einwandfrei/ unobjectionable/ irréusable normalisiert/ normalized/ normalisé
	luftvergütet/ air hardened/ trempé à l'air
X	Die mit "X" bezeichneten Prüfungen wurden durch- geführt und nicht beanstandet./ The tests marked with "X" were performed and did not lead to objection./ Les essais marqués d' un "X" étaient accomplis et n'entraînaient pas d'objections.

Qualitätsstelle / ROHRWERK / quality control point/ Tube mill

poste de contrôle de qualité / Laminoir âtubes

Der Werksachverständige/Inspector/Inspecteur de l'usine

CERTIFICAT DE RECEPTION 3-1-B SELON EN10204 / ISO10474
INSPECTION CERTIFICATE 3-1-B TO EN10204 / ISO10474

8610392299 Page: 001



Tolierie Forte T.F.K
Boite postale 6-317
59379 Dunkerque cedex 1
Tél: Usupdk 13281 F
Tél: 03 28 29 30 00

TFK

(5) CDC-Conforme au cahier des charges / According specifications (1)
 BL: Brut de laminage / As rolled
 LN: Laminage normalisé / Normalising forming
 A: Revenu / Tempered
 TE: Trempé à l'eau / Water quenching
 LTC: Laminage à température contrôlée / Thermo-controlled forming
 TM: Laminage thermo-mécanique / Thermo-mechanical forming
 NN: Normalisé / Normalised
 D: Détendue / Stress relieved
 G: Adouci par recuit / Soft annealed

B03

Nuances et spécifications techniques / Quality and specifications

N° Commande Usine
 Work order N°

N° Commande Client
 Buyer's order N°

Client et/ou destinataire
 Purchaser and/or consignee

Identification du produit
 Product identification

Repère pièce
 Plate number

Purchaser and/or consignee			Countrv/client Broker Purchaser's order N°			Work order N°			S236-REZ EN-10025-90-A1:93 ADM1:98			Delivery condition LN			B04 B05			U S I N E			A05																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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Identification du produit Product Identification			Poste Item			Nombre de pièces Pieces			Dimensions			Masse unitaire Theoretical weight			Em- pla- ce- ment Loca- tion			Traction /Tensile test			Résilience /Notch toughness			Moyenne Average																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
Repère pièce Plate number			Coulée Brème Heat-Slab			B07			B08			B09			B10			B11			B12			B13			B14			C01			C02			C03			C04			C05			C06			C07			C08			C09			C10			C11			C12			C13			C14			C15			C16			C17			C18			C19			C20			C21			C22			C23			C24			C25			C26			C27			C28			C29			C30			C31			C32			C33			C34			C35			C36			C37			C38			C39			C40			C41			C42			C43			C44			C45			C46			C47			C48			C49			C50			C51			C52			C53			C54			C55			C56			C57			C58			C59			C60			C61			C62			C63			C64			C65			C66			C67			C68			C69			C70			C71			C72			C73			C74			C75			C76			C77			C78			C79			C80			C81			C82			C83			C84			C85			C86			C87			C88			C89			C90			C91			C92			C93			C94			C95			C96			C97			C98			C99			C100			C101			C102			C103			C104			C105			C106			C107			C108			C109			C110			C111			C112			C113			C114			C115			C116			C117			C118			C119			C120			C121			C122			C123			C124			C125			C126			C127			C128			C129			C130			C131			C132			C133			C134			C135			C136			C137			C138			C139			C140			C141			C142			C143			C144			C145			C146			C147			C148			C149			C150			C151			C152			C153			C154			C155			C156			C157			C158			C159			C160			C161			C162			C163			C164			C165			C166			C167			C168			C169			C170			C171			C172			C173			C174			C175			C176			C177			C178			C179			C180			C181			C182			C183			C184			C185			C186			C187			C188			C189			C190			C191			C192			C193			C194			C195			C196			C197			C198			C199			C200			C201			C202			C203			C204			C205			C206			C207			C208			C209			C210			C211			C212			C213			C214			C215			C216			C217			C218			C219			C220			C221			C222			C223			C224			C225			C226			C227			C228			C229			C230			C231			C232			C233			C234			C235			C236			C237			C238			C239			C240			C241			C242			C243			C244			C245			C246			C247			C248			C249			C250			C251			C252			C253			C254			C255			C256			C257			C258			C259			C260			C261			C262			C263			C264			C265			C266			C267			C268			C269			C270			C271			C272			C273			C274			C275			C276			C277			C278			C279			C280			C281			C282			C283			C284			C285			C286			C287			C288			C289			C290			C291			C292			C293			C294			C295			C296			C297			C298			C299			C300			C301			C302			C303			C304			C305			C306			C307			C308			C309			C310			C311			C312			C313			C314			C315			C316			C317			C318			C319			C320			C321			C322			C323			C324			C325			C326			C327			C328			C329			C330			C331			C332			C333			C334			C335			C336			C337			C338			C339			C340			C341			C342			C343			C344			C345			C346			C347			C348			C349			C350			C351			C352			C353			C354			C355			C356			C357			C358			C359			C360			C361			C362			C363			C364			C365			C366			C367			C368			C369			C370			C371			C372			C373			C374			C375			C376			C377			C378			C379			C380			C381			C382			C383			C384			C385			C386			C387			C388			C389			C390			C391			C392			C393			C394			C395			C396			C397			C398			C399			C400			C401			C402			C403			C404			C405			C406			C407			C408			C409			C410			C411			C412			C413			C414			C415			C416			C417			C418			C419			C420			C421			C422			C423			C424			C425			C426			C427			C428			C429			C430			C431			C432			C433			C434			C435			C436			C437			C438			C439			C440			C441			C442			C443			C444			C445			C446			C447			C448			C449			C450			C451			C452			C453			C454			C455			C456			C457			C458			C459			C460			C461			C462			C463			C464			C465			C466			C467			C468			C469			C470			C471			C472			C473			C474			C475			C476			C477			C478			C479			C480			C481			C482			C483			C484			C485			C486			C487			C488			C489			C490			C491			C492			C493			C494			C495			C496			C497			C498			C499			C500			C501			C502			C503			C504			C505			C506			C507			C508			C509			C510			C511			C512			C513			C514			C515			C516			C517			C518			C519			C520			C521			C522			C523			C524			C525			C526			C527			C528			C529			C530			C531			C532			C533			C534			C535			C536			C537			C538			C539			C540			C541			C542			C543			C544			C545			C546			C547			C548			C549			C550			C551			C552			C553			C554			C555			C556			C557			C558			C559			C560			C561			C562			C563			C564			C565			C566			C567			C568			C569			C570			C571			C572			C573			C574			C575			C576			C577			C578			C579			C580			C581			C582			C583			C584			C585			C586			C587			C588			C589			C590			C591			C592			C593			C594			C595			C596			C597			C598			C599			C600			C601			C602			C603			C604			C605			C606			C607			C608			C609			C610			C611			C612			C613			C614			C615			C616			C617			C618			C619			C620			C621			C622			C623			C624			C625			C626			C627			C628			C629			C630			C631			C632			C633			C634			C635			C636			C637			C638			C639			C640			C641			C642			C643			C644			C645			C646			C647			C648			C649			C650			C651			C652			C653			C654			C655			C656			C657			C658			C659			C660			C661			C662			C663			C664			C665			C666			C667			C668			C669			C670			C671			C672			C673			C674			C675			C676			C677			C678			C679			C680			C681			C682			C683			C684			C685			C686			C687			C688			C689			C690			C691			C692			C693			C694			C695			C696			C697			C698			C699			C700			C701			C702			C703			C704			C705			C706			C707			C708			C709			C710			C711			C712			C713			C714			C715			C716			C717			C718			C719			C720			C721			C722			C723			C724			C725			C726			C727			C728			C729			C730			C731			C732			C733			C734			C735			C736			C737			C738			C739			C740			C741			C742			C743			C744			C745			C746			C747			C748			C749			C750			C751			C752			C753			C754			C755			C756			C757			C758			C759			C760			C761			C762			C763			C764			C765			C766			C767			C768			C769			C770			C771			C772			C773			C774			C775			C776			C777			C778			C779			C780			C781			C782			C783			C784			C785			C786			C787			C788			C789			C790			C791			C792			C793			C794			C795			C796			C797			C798			C799			C800			C801			C802			C803			C804			C805			C806			C807			C808			C809			C810			C811			C812			C813			C814			C815			C816			C817			C818			C819			C820			C821			C822			C823			C824			C825			C826			C827			C828			C829			C830			C831			C832			C833			C834			C835			C836			C837			C838			C839			C840			C841			C842			C843			C844			C845			C846			C847			C848			C849			C850			C851			C852			C853			C854			C855			C856			C857			C858			C859			C860			C861			C862			C863			C864			C865			C866			C867			C868			C869			C870			C871			C872			C873			C874			C875			C876			C877			C878			C879			C880			C881			C882			C883			C884			C885			C886			C887			C888			C889			C890			C891			C892			C893			C894			C895			C896			C897			C898			C899			C900			C901			C902			C903			C904			C905			C906			C907			C908			C909			C910			C911			C912			C913			C914			C915			C916			C917			C918			C919			C920			C921			C922			C923			C924			C925			C926			C927			C928			C929			C930			C931			C932			C933			C934			C935			C936			C937			C938			C939			C940			C941			C942			C943			C944			C945			C946			C947			C948			C949			C95		

CERTIFICAT DE RECEPTION 3-1-B selon EN10204 / ISO10474
INSPECTION CERTIFICATE 3-1-B TO EN10204 / ISO10474

01: YS >= 235 N/MM2 340 <= UTS <= 470 N/MM2 ES,66 >= 24 %
 02: KV L +20,0 C >= 27 J (AVE) KV >= 19 J (IND)

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A02

(6) CDC: Conforme au cahier des charges / According specifications
 BL: Brut de laminage / As rolled
 LN: Laminage normalisant / Normalizing forming
 A: Revenu / Tempered
 TR: Trempe à l'eau / Water quenching
 LTC: Laminage à température contrôlée / Thermo-controlled forming
 TMC: Laminage thermo-mécanique / Thermo-mechanical forming
 N: Normalisé / Normalised
 CR: Détendu par recuit / Soft annealed
 B03: Conformes aux spécifications techniques / Quality and specifications

N° Commande Usine / Work order N°

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PLAQUES / PLATES

N° Commande Client / Purchaser's order N°

1538-14/45019855

/0101

Client et/ou destinataire / Purchaser and/or consignee

SALZGITTER STAHLHANDEL GMBH

D-45955 ELADREX

ALLEMAGNE / GERMANY

N° Commande Client / Purchaser's order N°

1538-14/45019855

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N° Commande Usine / Work order N°

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PLAQUES / PLATES

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PLAQUES / PLATES

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PLAQUES / PLATES

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CERTIFICAT DE RECEPTION 3-1-B EN10204 / ISO10474
INSPECTION CERTIFICATE 3-1-B TO EN10204 / ISO10474

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INDUSTRIES

Tolara Forte T.F.K

Boite postale 6-317
 59379 Dunkerque cedex 1
 Tél : Usinpeck 132281 F
 Tél : 03 28 29 30 00

TFK

Signature du producteur
 Trade mark

(5) CDC: Conforme au cahier des charges / According specifications (1)
 BL: Brut de laminage / As rolled
 LN: Laminage normalisé / Normalising forming
 A: Revendu / Tempered
 TE: Trempé à l'eau / Water quenching
 LTC: Laminage à température contrôlée / Thermo-controlled forming
 TM: Laminage thermo-mécanique / Thermo-mechanical forming
 NN: Normalisé / Normalised
 D: Détendus / Stresses relieved
 G: Adouci par recuit / Soft annealed

Nuances et spécifications techniques / Quality and specifications

N° Commande Usine
 Work order N°

N° Commande Client
 Buyer's order N°

Client et/ou destinataire
 Purchaser and/or consignee

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SALZGITTER STAHLHANDEL GMBH

D-45955 GLADBACH

PLAQUES/PLATES

Identification du produit Product identification		Poste Item	Nombre of pieces	Dimensions			Mass Theoretical weight B14	Em- pla- ce- ment (2)	Traction / Tensile test										Em- Loc- ation (2)	Resilience / Notch toughness					
Repère pièce Plate number	Coulee Brasse Heat-Slab			Epaisseur Thickness B10	Largeur Width B12	Longueur Length B13			S (3)	Pos (3)	Type Form C10	Bat (5)	Temp °C C03	REH YS C11	RM UTS C12	A5 65 E5 65 C13				Bat (5)	Type Form C40	S (3)	Temp °C C08	Pos Z(4) C62	Valeurs individuelles Individual values <- C42 ->
511618	0113100501						1	T	P	TPRIS	01	300	401	42		1	02	KV	L	20,0	PPP	296	294	292	294
511616	0113100502						1	T	P	TPRIS	01	306	407	39		1	02	KV	L	20,0	PPP	288	288	276	284
511613	0113100503						1	T	P	TPRIS	01	361	430	32		1	02	KV	L	20,0	PPP	292	288	298	293
Coulee pour la coulée		33				64,7																			
Coulee générale		47				91,1																			

AC C = < 0,17 MN = < 1,40 P = < 0,045 S = < 0,045

Méth. making (5)	Repère pièce Plate number	N° de coulée Heat number	Analyse sur produit / Check analysis										Commande réalisée conformément à notre manuel ASSURANCE QUALITE Order manufactured in accordance with our QUALITY ASSURANCE manual										L'agent de réception HOUSSEIN							
C09	B08	B07 011310	C%	Mn%	P%	S%	C%	C71	C72	C73	C74	C75	C76	C77	C78	C79	C80	C81	C82	C83	C84	C85	C86	C87	C88	C89	C90	C91	Date 15/06/00	Agent/Name HOUSSEIN
C09	B08	B07 011310	0,07	0,73	0,012	0,001	0,18	0,034	0,04	0,07	0,02	0,02	0,001	0,000	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001

MARKING: EMPACEMENT B07 = N° HEAT (5 FIRST NUMBERS) N° SLAB (3 LAST NUMBERS) TFK
 ACCORDING (WE 588) AND DISPENSE OF COUNTER-SIGNING OF 27/11/80 TUV RHEINLAND

(2) Emplacement / Location
 1 T / Top
 2 Pied / Bottom
 3 1/2 Longueur / 1/2 length

(3) Orientation / Direction
 L: Longitudinal
 T: Transverse
 Z: Travers court / Through thick

(4) Position
 C: Cœur / Core
 P: Peau / Rolled surface
 D: 1/3 Epaisseur / Thickness
 G: 1/4 Epaisseur / Thickness
 F: 1/5 Epaisseur / Thickness

(6) Méthode de fabrication / Manufacturing method
 T: Thomas M. Martin
 E: Electrique / Electric
 CC: Coulee continue / Continuous casting
 OV: Oxygène / Basic oxygen

(7) Longueur / Length
 C01: C02: C03: C04: C05: C06: C07: C08: C09: C10: C11: C12: C13: C14: C15: C16: C17: C18: C19: C20: C21: C22: C23: C24: C25: C26: C27: C28: C29: C30: C31: C32: C33: C34: C35: C36: C37: C38: C39: C40: C41: C42: C43: C44: C45: C46: C47: C48: C49: C50: C51: C52: C53: C54: C55: C56: C57: C58: C59: C60: C61: C62: C63: C64: C65: C66: C67: C68: C69: C70: C71: C72: C73: C74: C75: C76: C77: C78: C79: C80: C81: C82: C83: C84: C85: C86: C87: C88: C89: C90: C91: C92: C93: C94: C95: C96: C97: C98: C99: C100: C101: C102: C103: C104: C105: C106: C107: C108: C109: C110: C111: C112: C113: C114: C115: C116: C117: C118: C119: C120: C121: C122: C123: C124: C125: C126: C127: C128: C129: C130: C131: C132: C133: C134: C135: C136: C137: C138: C139: C140: C141: C142: C143: C144: C145: C146: C147: C148: C149: C150: C151: C152: C153: C154: C155: C156: C157: C158: C159: C160: C161: C162: C163: C164: C165: C166: C167: C168: C169: C170: C171: C172: C173: C174: C175: C176: C177: C178: C179: C180: C181: C182: C183: C184: C185: C186: C187: C188: C189: C190: C191: C192: C193: C194: C195: C196: C197: C198: C199: C200: C201: C202: C203: C204: C205: C206: C207: C208: C209: C210: C211: C212: C213: C214: C215: C216: C217: C218: C219: C220: C221: C222: C223: C224: C225: C226: C227: C228: C229: C230: C231: C232: C233: C234: C235: C236: C237: C238: C239: C240: C241: C242: C243: C244: C245: C246: C247: C248: C249: C250: C251: C252: C253: C254: C255: C256: C257: C258: C259: C260: C261: C262: C263: C264: C265: C266: C267: C268: C269: C270: C271: C272: C273: C274: C275: C276: C277: C278: C279: C280: C281: C282: C283: C284: C285: C286: C287: C288: C289: C290: C291: C292: C293: C294: C295: C296: C297: C298: C299: C300: C301: C302: C303: C304: C305: C306: C307: C308: C309: C310: C311: C312: C313: C314: C315: C316: C317: C318: C319: C320: C321: C322: C323: C324: C325: C326: C327: C328: C329: C330: C331: C332: C333: C334: C335: C336: C337: C338: C339: C340: C341: C342: C343: C344: C345: C346: C347: C348: C349: C350: C351: C352: C353: C354: C355: C356: C357: C358: C359: C360: C361: C362: C363: C364: C365: C366: C367: C368: C369: C370: C371: C372: C373: C374: C375: C376: C377: C378: C379: C380: C381: C382: C383: C384: C385: C386: C387: C388: C389: C390: C391: C392: C393: C394: C395: C396: C397: C398: C399: C400: C401: C402: C403: C404: C405: C406: C407: C408: C409: C410: C411: C412: C413: C414: C415: C416: C417: C418: C419: C420: C421: C422: C423: C424: C425: C426: C427: C428: C429: C430: C431: C432: C433: C434: C435: C436: C437: C438: C439: C440: C441: C442: C443: C444: C445: C446: C447: C448: C449: C450: C451: C452: C453: C454: C455: C456: C457: C458: C459: C460: C461: C462: C463: C464: C465: C466: C467: C468: C469: C470: C471: C472: C473: C474: C475: C476: C477: C478: C479: C480: C481: C482: C483: C484: C485: C486: C487: C488: C489: C490: C491: C492: C493: C494: C495: C496: C497: C498: C499: C500: C501: C502: C503: C504: C505: C506: C507: C508: C509: C510: C511: C512: C513: C514: C515: 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C848: C849: C850: C851: C852: C853: C854: C855: C856: C857: C858: C859: C860: C861: C862: C863: C864: C865: C866: C867: C868: C869: C870: C871: C872: C873: C874: C875: C876: C877: C878: C879: C880: C881: C882: C883: C884: C885: C886: C887: C888: C889: C890: C891: C892: C893: C894: C895: C896: C897: C898: C899: C900: C901: C902: C903: C904: C905: C906: C907: C908: C909: C910: C911: C912: C913: C914: C915: C916: C917: C918: C919: C920: C921: C922: C923: C924: C925: C926: C927: C928: C929: C930: C931: C932: C933: C934: C935: C936: C937: C938: C939: C940: C941: C942: C943: C944: C945: C946: C947: C948: C949: C950: C951: C952: C953: C954: C955: C956: C957: C958: C959: C960: C961: C962: C963: C964: C965: C966: C967: C968: C969: C970: C971: C972: C973: C974: C975: C976: C977: C978: C979: C980: C981: C982: C983: C984: C985: C986: C987: C988: C989: C990: C991: C992: C993: C994: C995: C996: C997: C998: C999: C1000: C1001: C1002: C1003: C1004: C1005: C1006: C1007: C1008: C1009: C1010: C1011: 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