

**Project summary****Project : Tullis****ID No.: DN500****References**

European Standard .....	EN 13480-3
Standard title .....	Metallic industrial piping
Standard edition .....	Issue 1
Standard dated .....	2002-08-05
ICS number .....	ICS 23.040.01
Program version .....	Version 1.0
Program build .....	Build 070 20-03-2010
Program development .....	Danish Exergy Technology - DXT

***Nomenclature, equation numbers and figure numbers are made with direct reference to the English printed version of this European Standard.***

Component type	Component name	Component ID	Mat. code	Mat. grade	Status
Cylindrical shell	Steam Manifold	DN500	EN10216-2	P235GH	OK
Nozzle No. 1	STEAM IN DN250	OD273x14,2	EN10216-2	P235GH	OK
Nozzle No. 2	STEAM OUT DN400	OD406x20	EN10216-2	P235GH	OK
Nozzle No. 3	DE-AREATOR DN125	OD139,7x6,3	EN10216-2	P235GH	OK
Nozzle No. 4	PRESS. MEAS. DN25	OD33,7x6,3	EN10216-2	P235GH	OK
Nozzle No. 5	DRAIN DN50	OD60,3x4,5	EN10216-2	P235GH	OK
Combination No. 1	Nozzle No. 1 / Nozzle No. 1				OK
Combination No. 2	Nozzle No. 1 / Nozzle No. 1				OK
Combination No. 3	Nozzle No. 1 / Nozzle No. 1				OK
Combination No. 4	Nozzle No. 1 / Nozzle No. 3				OK
Combination No. 5	Nozzle No. 3 / Nozzle No. 2				OK
Combination No. 6	Nozzle No. 2 / Nozzle No. 4				OK
Combination No. 7	Nozzle No. 4 / Nozzle No. 5				OK
Cap	CAP DN500	DIN2617/S3	EN10216-2	P235GH	OK

**Project Tullis**  
**Component : Steam Manifold**  
**ID No.: DN500****Global data**

Shell type .....	--	Cylindrical
Nominal diameter .....	mm	500
Product PSxDN .....	bar mm	9000
Piping class according to EN13480-1 Table4.1-1 .....	--	3
Pipe volume .....	liter	0
Weight of pipe including content (W) .....	kg	0
Weight of fluid (WF) .....	kg	0

**Operation data**

Medium .....	--	Steam
Fluid state .....	--	Liquid
Fluid group .....	--	2
Maximum operation pressure .....	barg	15,0
Maximum operation temperature .....	°C	275,0
Number of full load cycles .....	No	500
Component lifetime .....	hours	200000
Lifetime monitor system provided Yes/No .....	--	No

**Design data for internal pressure**

Maximum allowable internal pressure (PSmax) .....	barg	18,0
Design pressure (Pd) .....	barg	18,0
Calculation pressure (Pc) .....	barg	18,0
Minimum allowable temperature (TSmin) .....	°C	20,0
Maximum allowable temperature (TSmax) .....	°C	290,0
Calculation temperature (tc) .....	°C	290,0

**Design data for external pressure**

Maximum allowable external pressure (PSmax) .....	barg	0,0
Design pressure (Pd) .....	barg	0,0
Calculation pressure (Pc) .....	barg	0,0
Minimum allowable temperature (TSmin) .....	°C	20,0
Maximum allowable temperature (TSmax) .....	°C	20,0
Calculation temperature (tc) .....	°C	20,0

**Test conditions**

Testing group .....	--	--
Testing method .....	--	hydrostatic
Extent of NDT for governing welded joints .....	%	--
Test temperature .....	°C	20,0
Design stress at test conditions .....	N/mm <sup>2</sup>	223,3
Design stress ratio at test pressure calculation (fa/ft) .....	--	1,73
Test pressure according to EN13480-5 (9.3.2-2) .....	barg	39,0
Test pressure according to EN13480-5 (9.3.2-3) .....	barg	25,7
Test pressure .....	barg	39,0
Maximum allowable internal test pressure .....	barg	46,3
		39,0

**Assembly conditions**

Assembly pressure (PA) .....	barg	0,0
Assembly temperature (TA) .....	°C	20,0
Design stress at assembly conditions .....	N/mm <sup>2</sup>	--



EN13480 ver 1.0

CALCULATION OF CYLINDRICAL SHELL ACCORDING TO EN13480-3

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Revision ..... 01  
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**Project Tullis****Component : Steam Manifold****ID No.: DN500****Shell under internal pressure**

Material code .....	--	EN10216-2
Material designation .....	--	P235GH
Material number .....	--	1.0345
Minimum tensile stress at 20°C (Rm) .....	N/mm <sup>2</sup>	360,0
Minimum tensile stress at design temperature (Rmt) .....	N/mm <sup>2</sup>	0,0
Minimum 0,2% proof stress at design temperature (Rp02) .....	N/mm <sup>2</sup>	135,6
Minimum 1,0% proof stress at design temperature (Rp10) .....	N/mm <sup>2</sup>	0,0
Creep rupture 200000 h at design temperature (RmT200) .....	N/mm <sup>2</sup>	0,0
Elasticity module at design temperature (E) *1,0E-03 .....	N/mm <sup>2</sup>	191,6
Elongation after rupture .....	%	0,0
Dimensioning stress .....	--	Rp02
Safety factor (S) .....	--	1,50
Design stress (f) .....	N/mm <sup>2</sup>	90,4
Thickness tolerance code .....	--	EN10216-2
Thickness class .....	--	None
Minus tolerance on ordered nominal wall thickness (C1p) .....	%	15,0
Minus tolerance on ordered nominal wall thickness (C1) .....	mm	2,13
Allowance for possible thinning during manufacturing process (C2) .....	mm	0,00
Allowance for metal wastage (C0) .....	mm	1,00
Outside shell diameter (Do) .....	mm	508,0
Ordered nominal wall thickness of shell (eord) .....	mm	14,2
Actual wall thickness of shell excl allowance (ea) .....	mm	11,1
Internal diameter (Di) .....	mm	485,9
Mean diameter (Dm) .....	mm	496,9
Weld or joint efficiency (z) .....	--	1,00
Minimum wall thickness with efficiency = 1,0 excl allowance .....	mm	5,008
Minimum wall thickness with efficiency = 1,0 incl allowance .....	mm	8,138
Minimum wall thickness with actual efficiency excl. allowance (e) (eq 6.1-1) .....	mm	5,008
Minimum wall thickness with actual efficiency incl allowance (e+C0+C1+C2) .....	mm	8,138
Max allowable pressure with actual efficiency (Pmax) .....	barg	40,2
Allowable efficiency (Za) .....	--	0,447
Max allowable internal pressure at test conditions .....	barg	99,5
Notional pressure (Pr) .....	barg	66,8

**Project : Tullis****Component : STEAM IN DN250****ID No.: OD273x14,2**

Nozzle number .....	:	1
Nozzle type .....	--	Set on
Nozzle radial angle (Psi1) .....	deg	0,0
Nozzle axial angle (Psi2) .....	deg	0,0
Material code .....	--	EN10216-2
Material grade .....	--	P235GH TC2
Material number .....	--	1.0345
Minimum tensile stress at 20°C (Rm) .....	N/mm <sup>2</sup>	360,0
Minimum tensile stress at design temperature (Rmt) .....	N/mm <sup>2</sup>	0,0
Minimum 0,2% proof stress at design temperature (Rp02) .....	N/mm <sup>2</sup>	135,6
Minimum 1,0% proof stress at design temperature (Rp10) .....	N/mm <sup>2</sup>	0,0
Dimensioning stress .....	--	Rp02
Safety factor .....	--	1,50
Design stress (fb) .....	N/mm <sup>2</sup>	90,4
Calculation stress (fob) .....	N/mm <sup>2</sup>	90,4
Thickness tolerance code .....	--	EN10216-2
Thickness class .....	--	NA
Minus tolerance on ordered wall thickness (C1p) .....	%	12,5
Minus tolerance on ordered wall thickness (C1) .....	mm	1,78
Allowance for metal wastage (C0) .....	mm	1,00
Ordered nominal outside diameter of nozzle (db) .....	mm	273,00
Ordered nominal wall thickness of nozzle (eord,b) .....	mm	14,20
Length of nozzle extending outside shell (lb) .....	mm	54,66
Length of nozzle extending inside shell (lbi) .....	mm	0,00
Nominal thickness of reinforcing plate (epn) .....	mm	0,00
Nominal width of reinforcing plate (lp) .....	mm	0,00
Distance between opening and shell discontinuity (X) ..... (Figure 8.3.2-1) .....	mm	--
Nozzle welding coefficient factor (z) .....	mm	1,00
Inside diameter of nozzle excl allowance (dib) .....	mm	250,16
Effective wall thickness of nozzle (eb) .....	mm	11,42
Analysis thickness of nozzle (eab) .....	mm	11,42
Effective length of compensation shell (ls) ..... (eq 8.4.1-2) .....	mm	74,17
Effective length of external projection (l'b) ..... (eq 8.4.3-1) .....	mm	54,66
Effective length of inner projection (l'bi) ..... (eq 8.4.3-2) .....	mm	0,00
Effective thickness of reinforcing plate (eapl) ..... (eq 8.4.3-5) .....	mm	0,00
Effective width of reinforcing plate (lpl) ..... (eq 8.4.3-4) .....	mm	0,00
Minimum distance between opening and shell discontinuity (Xmin) (eq 8.3.2-1) .....	mm	33,21
Pressure area in shell (Aps) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	51177,8
Pressure area in branch (Apb) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	8221,0
Pressure area total (Ap) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	59398,7
Stress area shell (Afs) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	947,5
Stress area nozzle (Afb) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	624,2
Stress area reinforcing plate (Afp) ..... (Figure 8.4.3-2) .....	mm <sup>2</sup>	0,0
Load capacity shell ..... (eq 8.4.3-3) .....	N	84798
Load capacity nozzle ..... (eq 8.4.3-3) .....	N	55863
Load capacity reinforcing pad ..... (eq 8.4.3-3) .....	N	0
TOTAL LOAD CAPACITY ..... (eq 8.4.3-3) .....	N	140661
TOTAL LOAD ..... (eq 8.4.3-3) .....	N	106918
Max allowable pressure at design temperature (Pmax) .....	barg	23,6

**Project : Tullis****Component : STEAM OUT DN400****ID No.: OD406x20**

Nozzle number .....	:	2
Nozzle type .....	--	Set on
Nozzle radial angle (Psi1) .....	deg	0,0
Nozzle axial angle (Psi2) .....	deg	0,0
Material code .....	--	EN10216-2
Material grade .....	--	P235GH TC2
Material number .....	--	1.0345
Minimum tensile stress at 20°C (Rm) .....	N/mm <sup>2</sup>	360,0
Minimum tensile stress at design temperature (Rmt) .....	N/mm <sup>2</sup>	0,0
Minimum 0,2% proof stress at design temperature (Rp02) .....	N/mm <sup>2</sup>	135,6
Minimum 1,0% proof stress at design temperature (Rp10) .....	N/mm <sup>2</sup>	0,0
Dimensioning stress .....	--	Rp02
Safety factor .....	--	1,50
Design stress (fb) .....	N/mm <sup>2</sup>	90,4
Calculation stress (fob) .....	N/mm <sup>2</sup>	90,4
Thickness tolerance code .....	--	EN10216-2
Thickness class .....	--	NA
Minus tolerance on ordered wall thickness (C1p) .....	%	15,0
Minus tolerance on ordered wall thickness (C1) .....	mm	3,00
Allowance for metal wastage (C0) .....	mm	1,00
Ordered nominal outside diameter of nozzle (db) .....	mm	406,00
Ordered nominal wall thickness of nozzle (eord,b) .....	mm	20,00
Length of nozzle extending outside shell (lb) .....	mm	78,99
Length of nozzle extending inside shell (lbi) .....	mm	0,00
Nominal thickness of reinforcing plate (epn) .....	mm	0,00
Nominal width of reinforcing plate (lp) .....	mm	0,00
Distance between opening and shell discontinuity (X) ..... (Figure 8.3.2-1) .....	mm	750,00
Nozzle welding coefficient factor (z) .....	mm	1,00
Inside diameter of nozzle excl allowance (dib) .....	mm	374,00
Effective wall thickness of nozzle (eb) .....	mm	16,00
Analysis thickness of nozzle (eab) .....	mm	16,00
Effective length of compensation shell (ls) ..... (eq 8.4.1-2) .....	mm	0,00
Effective length of external projection (l'b) ..... (eq 8.4.3-1) .....	mm	78,99
Effective length of inner projection (l'bi) ..... (eq 8.4.3-2) .....	mm	0,00
Effective thickness of reinforcing plate (eapl) ..... (eq 8.4.3-5) .....	mm	0,00
Effective width of reinforcing plate (lpl) ..... (eq 8.4.3-4) .....	mm	0,00
Minimum distance between opening and shell discontinuity (Xmin) (eq 8.3.2-1) .....	mm	33,21
Pressure area in shell (Aps) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	49314,8
Pressure area in branch (Apb) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	16841,9
Pressure area total (Ap) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	66156,7
Stress area shell (Afs) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	177,1
Stress area nozzle (Afb) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	1263,9
Stress area reinforcing plate (Afp) ..... (Figure 8.4.3-2) .....	mm <sup>2</sup>	0,0
Load capacity shell ..... (eq 8.4.3-3) .....	N	15852
Load capacity nozzle ..... (eq 8.4.3-3) .....	N	113119
Load capacity reinforcing pad ..... (eq 8.4.3-3) .....	N	0
TOTAL LOAD CAPACITY ..... (eq 8.4.3-3) .....	N	128971
TOTAL LOAD ..... (eq 8.4.3-3) .....	N	119082
Max allowable pressure at design temperature (Pmax) .....	barg	19,5

**Project : Tullis****Component : DE-AREATOR DN125****ID No.: OD139,7x6,3**

Nozzle number .....	:	3
Nozzle type .....	--	Set on
Nozzle radial angle (Psi1) .....	deg	0,0
Nozzle axial angle (Psi2) .....	deg	0,0
Material code .....	--	EN10216-2
Material grade .....	--	P235GH TC2
Material number .....	--	1.0345
Minimum tensile stress at 20°C (Rm) .....	N/mm <sup>2</sup>	360,0
Minimum tensile stress at design temperature (Rmt) .....	N/mm <sup>2</sup>	0,0
Minimum 0,2% proof stress at design temperature (Rp02) .....	N/mm <sup>2</sup>	135,6
Minimum 1,0% proof stress at design temperature (Rp10) .....	N/mm <sup>2</sup>	0,0
Dimensioning stress .....	--	Rp02
Safety factor .....	--	1,50
Design stress (fb) .....	N/mm <sup>2</sup>	90,4
Calculation stress (fob) .....	N/mm <sup>2</sup>	90,4
Thickness tolerance code .....	--	EN10216-2
Thickness class .....	--	NA
Minus tolerance on ordered wall thickness (C1p) .....	%	12,5
Minus tolerance on ordered wall thickness (C1) .....	mm	0,79
Allowance for metal wastage (C0) .....	mm	1,00
Ordered nominal outside diameter of nozzle (db) .....	mm	139,70
Ordered nominal wall thickness of nozzle (eord,b) .....	mm	6,30
Length of nozzle extending outside shell (lb) .....	mm	24,69
Length of nozzle extending inside shell (lbi) .....	mm	0,00
Nominal thickness of reinforcing plate (epn) .....	mm	0,00
Nominal width of reinforcing plate (lp) .....	mm	0,00
Distance between opening and shell discontinuity (X) ..... (Figure 8.3.2-1) .....	mm	--
Nozzle welding coefficient factor (z) .....	mm	1,00
Inside diameter of nozzle excl allowance (dib) .....	mm	130,68
Effective wall thickness of nozzle (eb) .....	mm	4,51
Analysis thickness of nozzle (eab) .....	mm	4,51
Effective length of compensation shell (ls) ..... (eq 8.4.1-2) .....	mm	74,17
Effective length of external projection (l'b) ..... (eq 8.4.3-1) .....	mm	24,69
Effective length of inner projection (l'bi) ..... (eq 8.4.3-2) .....	mm	0,00
Effective thickness of reinforcing plate (eapl) ..... (eq 8.4.3-5) .....	mm	0,00
Effective width of reinforcing plate (lpl) ..... (eq 8.4.3-4) .....	mm	0,00
Minimum distance between opening and shell discontinuity (Xmin) (eq 8.3.2-1) .....	mm	33,21
Pressure area in shell (Aps) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	34986,5
Pressure area in branch (Apb) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	2336,7
Pressure area total (Ap) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	37323,2
Stress area shell (Afs) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	871,0
Stress area nozzle (Afb) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	111,4
Stress area reinforcing plate (Afp) ..... (Figure 8.4.3-2) .....	mm <sup>2</sup>	0,0
Load capacity shell ..... (eq 8.4.3-3) .....	N	77952
Load capacity nozzle ..... (eq 8.4.3-3) .....	N	9967
Load capacity reinforcing pad ..... (eq 8.4.3-3) .....	N	0
TOTAL LOAD CAPACITY ..... (eq 8.4.3-3) .....	N	87919
TOTAL LOAD ..... (eq 8.4.3-3) .....	N	67182
Max allowable pressure at design temperature (Pmax) .....	barg	23,5



**Project : Tullis****Component : PRESS. MEAS. DN25****ID No.: OD33,7x6,3**

Nozzle number .....	:	4
Nozzle type .....	--	Set on
Nozzle radial angle (Psi1) .....	deg	0,0
Nozzle axial angle (Psi2) .....	deg	0,0
Material code .....	--	EN10216-2
Material grade .....	--	P235GH TC2
Material number .....	--	1.0345
Minimum tensile stress at 20°C (Rm) .....	N/mm <sup>2</sup>	360,0
Minimum tensile stress at design temperature (Rmt) .....	N/mm <sup>2</sup>	0,0
Minimum 0,2% proof stress at design temperature (Rp02) .....	N/mm <sup>2</sup>	135,6
Minimum 1,0% proof stress at design temperature (Rp10) .....	N/mm <sup>2</sup>	0,0
Dimensioning stress .....	--	Rp02
Safety factor .....	--	1,50
Design stress (fb) .....	N/mm <sup>2</sup>	90,4
Calculation stress (fob) .....	N/mm <sup>2</sup>	90,4
Thickness tolerance code .....	--	EN10216-2
Thickness class .....	--	NA
Minus tolerance on ordered wall thickness (C1p) .....	%	12,5
Minus tolerance on ordered wall thickness (C1) .....	mm	0,79
Allowance for metal wastage (C0) .....	mm	1,00
Ordered nominal outside diameter of nozzle (db) .....	mm	33,70
Ordered nominal wall thickness of nozzle (eord,b) .....	mm	6,30
Length of nozzle extending outside shell (lb) .....	mm	11,47
Length of nozzle extending inside shell (lbi) .....	mm	0,00
Nominal thickness of reinforcing plate (epn) .....	mm	0,00
Nominal width of reinforcing plate (lp) .....	mm	0,00
Distance between opening and shell discontinuity (X) ..... (Figure 8.3.2-1) .....	mm	--
Nozzle welding coefficient factor (z) .....	mm	1,00
Inside diameter of nozzle excl allowance (dib) .....	mm	24,68
Effective wall thickness of nozzle (eb) .....	mm	4,51
Analysis thickness of nozzle (eab) .....	mm	4,51
Effective length of compensation shell (ls) ..... (eq 8.4.1-2) .....	mm	74,17
Effective length of external projection (l'b) ..... (eq 8.4.3-1) .....	mm	11,47
Effective length of inner projection (l'bi) ..... (eq 8.4.3-2) .....	mm	0,00
Effective thickness of reinforcing plate (eapl) ..... (eq 8.4.3-5) .....	mm	0,00
Effective width of reinforcing plate (lpl) ..... (eq 8.4.3-4) .....	mm	0,00
Minimum distance between opening and shell discontinuity (Xmin) (eq 8.3.2-1) .....	mm	33,21
Pressure area in shell (Aps) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	22111,2
Pressure area in branch (Apb) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	278,2
Pressure area total (Ap) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	22389,4
Stress area shell (Afs) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	871,0
Stress area nozzle (Afb) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	51,7
Stress area reinforcing plate (Afp) ..... (Figure 8.4.3-2) .....	mm <sup>2</sup>	0,0
Load capacity shell ..... (eq 8.4.3-3) .....	N	77952
Load capacity nozzle ..... (eq 8.4.3-3) .....	N	4631
Load capacity reinforcing pad ..... (eq 8.4.3-3) .....	N	0
TOTAL LOAD CAPACITY ..... (eq 8.4.3-3) .....	N	82584
TOTAL LOAD ..... (eq 8.4.3-3) .....	N	40301
Max allowable pressure at design temperature (Pmax) .....	barg	36,5

**Project : Tullis****Component : DRAIN DN50****ID No.: OD60,3x4,5**

Nozzle number .....	:	5
Nozzle type .....	--	Set on
Nozzle radial angle (Psi1) .....	deg	0,0
Nozzle axial angle (Psi2) .....	deg	0,0
Material code .....	--	EN10216-2
Material grade .....	--	P235GH TC2
Material number .....	--	1.0345
Minimum tensile stress at 20°C (Rm) .....	N/mm <sup>2</sup>	360,0
Minimum tensile stress at design temperature (Rmt) .....	N/mm <sup>2</sup>	0,0
Minimum 0,2% proof stress at design temperature (Rp02) .....	N/mm <sup>2</sup>	135,6
Minimum 1,0% proof stress at design temperature (Rp10) .....	N/mm <sup>2</sup>	0,0
Dimensioning stress .....	--	Rp02
Safety factor .....	--	1,50
Design stress (fb) .....	N/mm <sup>2</sup>	90,4
Calculation stress (fob) .....	N/mm <sup>2</sup>	90,4
Thickness tolerance code .....	--	EN10216-2
Thickness class .....	--	NA
Minus tolerance on ordered wall thickness (C1p) .....	%	12,5
Minus tolerance on ordered wall thickness (C1) .....	mm	0,56
Allowance for metal wastage (C0) .....	mm	1,00
Ordered nominal outside diameter of nozzle (db) .....	mm	60,30
Ordered nominal wall thickness of nozzle (eord,b) .....	mm	4,50
Length of nozzle extending outside shell (lb) .....	mm	12,99
Length of nozzle extending inside shell (lbi) .....	mm	0,00
Nominal thickness of reinforcing plate (epn) .....	mm	0,00
Nominal width of reinforcing plate (lp) .....	mm	0,00
Distance between opening and shell discontinuity (X) ..... (Figure 8.3.2-1) .....	mm	--
Nozzle welding coefficient factor (z) .....	mm	1,00
Inside diameter of nozzle excl allowance (dib) .....	mm	54,42
Effective wall thickness of nozzle (eb) .....	mm	2,94
Analysis thickness of nozzle (eab) .....	mm	2,94
Effective length of compensation shell (ls) ..... (eq 8.4.1-2) .....	mm	74,17
Effective length of external projection (l'b) ..... (eq 8.4.3-1) .....	mm	12,99
Effective length of inner projection (l'bi) ..... (eq 8.4.3-2) .....	mm	0,00
Effective thickness of reinforcing plate (eapl) ..... (eq 8.4.3-5) .....	mm	0,00
Effective width of reinforcing plate (lpl) ..... (eq 8.4.3-4) .....	mm	0,00
Minimum distance between opening and shell discontinuity (Xmin) (eq 8.3.2-1) .....	mm	33,21
Pressure area in shell (Aps) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	25342,2
Pressure area in branch (Apb) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	654,6
Pressure area total (Ap) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	25996,7
Stress area shell (Afs) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	853,6
Stress area nozzle (Afb) ..... (Figure 8.4.3-1) .....	mm <sup>2</sup>	38,2
Stress area reinforcing plate (Afp) ..... (Figure 8.4.3-2) .....	mm <sup>2</sup>	0,0
Load capacity shell ..... (eq 8.4.3-3) .....	N	76397
Load capacity nozzle ..... (eq 8.4.3-3) .....	N	3417
Load capacity reinforcing pad ..... (eq 8.4.3-3) .....	N	0
TOTAL LOAD CAPACITY ..... (eq 8.4.3-3) .....	N	79814
TOTAL LOAD ..... (eq 8.4.3-3) .....	N	46794
Max allowable pressure at design temperature (Pmax) .....	barg	30,5



**Nozzle Combination**

Nozzle combination number .....	:	1
First nozzle in combination .....	:	1
Second nozzle in combination .....	:	1
Longitudenal pitch .....	mm	750,0
Circumferential pitch (Pfi) .....	deg	0,0
Center-to-center distance between openings at mean surface of shell (Lb).....	mm	750,0
Projection of psi on LB-plane for nozzle 1 (P <sub>sie1</sub> ) .....	deg	0,0
Projection of psi on LB-plane for nozzle 2 (P <sub>sie2</sub> ) .....	deg	0,0
Variabel (ros) for nozzle 1 (eq 9.6-11) .....	mm	0,0
Variabel (ros) for nozzle 2 (eq 9.6-11) .....	mm	0,0
Variabel (delta) for nozzle 1 (eq 9.6-12) .....	rad	0,0
Variabel (delta) for nozzle 2 (eq 9.6-12) .....	rad	0,0
Distance a for nozzle 1 (a1) .....	mm	136,5
Distance a for nozzle 2 (a2) .....	mm	136,5
Shell compensation length nozzle 1 (Iso1) (eq 9.5-2) .....	mm	74,2
Shell compensation length nozzle 2 (Iso2) (eq 9.5-2) .....	mm	74,2
Minimum distance for isolated nozzles (eq 9.5-1) .....	mm	421,3
Minimum distance between nozzles (eq 9.6-1) .....	mm	33,2
Stress area of shell along Lb (AFLS) (eq 9.6-7) .....	mm <sup>2</sup>	5280
Stress area welding (AFw) .....	mm <sup>2</sup>	0
Stress area nozzle 1 (Afb1) .....	mm <sup>2</sup>	624
Stress area nozzle 2 (Afb2) .....	mm <sup>2</sup>	624
Stress area reinforcing plate nozzle 1 .....	mm <sup>2</sup>	0
Stress area reinforcing plate nozzle 2 .....	mm <sup>2</sup>	0
Pressure area of shell along Lb (APLS) (eq 9.6-6) .....	mm <sup>2</sup>	182198
Pressure area nozzle 1 (Ap1) .....	mm <sup>2</sup>	8221
Pressure area nozzle 2 (Ap2) .....	mm <sup>2</sup>	8221
Shell load capacity .....	N	472595
Nozzle 1 load capacity .....	N	55863
Nozzle 2 load capacity .....	N	55863
Total load capacity .....	N	584321
Total load .....	N	357551
Capacity/Load ratio .....	--	1,634

**Nozzle Combination**

Nozzle combination number .....	:	2
First nozzle in combination .....	:	1
Second nozzle in combination .....	:	1
Longitudenal pitch .....	mm	750,0
Circumferential pitch (Pfi) .....	deg	0,0
Center-to-center distance between openings at mean surface of shell (Lb).....	mm	750,0
Projection of psi on LB-plane for nozzle 1 (P <sub>sie1</sub> ) .....	deg	0,0
Projection of psi on LB-plane for nozzle 2 (P <sub>sie2</sub> ) .....	deg	0,0
Variabel (ros) for nozzle 1 (eq 9.6-11) .....	mm	0,0
Variabel (ros) for nozzle 2 (eq 9.6-11) .....	mm	0,0
Variabel (delta) for nozzle 1 (eq 9.6-12) .....	rad	0,0
Variabel (delta) for nozzle 2 (eq 9.6-12) .....	rad	0,0
Distance a for nozzle 1 (a <sub>1</sub> ) .....	mm	136,5
Distance a for nozzle 2 (a <sub>2</sub> ) .....	mm	136,5
Shell compensation length nozzle 1 (Iso1) (eq 9.5-2) .....	mm	74,2
Shell compensation length nozzle 2 (Iso2) (eq 9.5-2) .....	mm	74,2
Minimum distance for isolated nozzles (eq 9.5-1) .....	mm	421,3
Minimum distance between nozzles (eq 9.6-1) .....	mm	33,2
Stress area of shell along Lb (AFLS) (eq 9.6-7) .....	mm <sup>2</sup>	5280
Stress area welding (AFw) .....	mm <sup>2</sup>	0
Stress area nozzle 1 (Afb1) .....	mm <sup>2</sup>	624
Stress area nozzle 2 (Afb2) .....	mm <sup>2</sup>	624
Stress area reinforcing plate nozzle 1 .....	mm <sup>2</sup>	0
Stress area reinforcing plate nozzle 2 .....	mm <sup>2</sup>	0
Pressure area of shell along Lb (APLS) (eq 9.6-6) .....	mm <sup>2</sup>	182198
Pressure area nozzle 1 (Ap1) .....	mm <sup>2</sup>	8221
Pressure area nozzle 2 (Ap2) .....	mm <sup>2</sup>	8221
Shell load capacity .....	N	472595
Nozzle 1 load capacity .....	N	55863
Nozzle 2 load capacity .....	N	55863
Total load capacity .....	N	584321
Total load .....	N	357551
Capacity/Load ratio .....	--	1,634

**Nozzle Combination**

Nozzle combination number .....	:	3
First nozzle in combination .....	:	1
Second nozzle in combination .....	:	1
Longitudenal pitch .....	mm	750,0
Circumferential pitch (Pfi) .....	deg	0,0
Center-to-center distance between openings at mean surface of shell (Lb).....	mm	750,0
Projection of psi on LB-plane for nozzle 1 (P <sub>sie1</sub> ) .....	deg	0,0
Projection of psi on LB-plane for nozzle 2 (P <sub>sie2</sub> ) .....	deg	0,0
Variabel (ros) for nozzle 1 (eq 9.6-11) .....	mm	0,0
Variabel (ros) for nozzle 2 (eq 9.6-11) .....	mm	0,0
Variabel (delta) for nozzle 1 (eq 9.6-12) .....	rad	0,0
Variabel (delta) for nozzle 2 (eq 9.6-12) .....	rad	0,0
Distance a for nozzle 1 (a1) .....	mm	136,5
Distance a for nozzle 2 (a2) .....	mm	136,5
Shell compensation length nozzle 1 (Iso1) (eq 9.5-2) .....	mm	74,2
Shell compensation length nozzle 2 (Iso2) (eq 9.5-2) .....	mm	74,2
Minimum distance for isolated nozzles (eq 9.5-1) .....	mm	421,3
Minimum distance between nozzles (eq 9.6-1) .....	mm	33,2
Stress area of shell along Lb (AFLS) (eq 9.6-7) .....	mm <sup>2</sup>	5280
Stress area welding (AFw) .....	mm <sup>2</sup>	0
Stress area nozzle 1 (Afb1) .....	mm <sup>2</sup>	624
Stress area nozzle 2 (Afb2) .....	mm <sup>2</sup>	624
Stress area reinforcing plate nozzle 1 .....	mm <sup>2</sup>	0
Stress area reinforcing plate nozzle 2 .....	mm <sup>2</sup>	0
Pressure area of shell along Lb (APLS) (eq 9.6-6) .....	mm <sup>2</sup>	182198
Pressure area nozzle 1 (Ap1) .....	mm <sup>2</sup>	8221
Pressure area nozzle 2 (Ap2) .....	mm <sup>2</sup>	8221
Shell load capacity .....	N	472595
Nozzle 1 load capacity .....	N	55863
Nozzle 2 load capacity .....	N	55863
Total load capacity .....	N	584321
Total load .....	N	357551
Capacity/Load ratio .....	--	1,634

**Nozzle Combination**

Nozzle combination number .....	:	4
First nozzle in combination .....	:	1
Second nozzle in combination .....	:	3
Longitudenal pitch .....	mm	600,0
Circumferential pitch (Pfi) .....	deg	0,0
Center-to-center distance between openings at mean surface of shell (Lb).....	mm	600,0
Projection of psi on LB-plane for nozzle 1 (P <sub>sie1</sub> ) .....	deg	0,0
Projection of psi on LB-plane for nozzle 2 (P <sub>sie2</sub> ) .....	deg	0,0
Variabel (ros) for nozzle 1 (eq 9.6-11) .....	mm	0,0
Variabel (ros) for nozzle 2 (eq 9.6-11) .....	mm	0,0
Variabel (delta) for nozzle 1 (eq 9.6-12) .....	rad	0,0
Variabel (delta) for nozzle 2 (eq 9.6-12) .....	rad	0,0
Distance a for nozzle 1 (a1) .....	mm	136,5
Distance a for nozzle 2 (a2) .....	mm	69,9
Shell compensation length nozzle 1 (Iso1) (eq 9.5-2) .....	mm	74,2
Shell compensation length nozzle 2 (Iso2) (eq 9.5-2) .....	mm	74,2
Minimum distance for isolated nozzles (eq 9.5-1) .....	mm	354,7
Minimum distance between nozzles (eq 9.6-1) .....	mm	33,2
Stress area of shell along Lb (AFLS) (eq 9.6-7) .....	mm <sup>2</sup>	4358
Stress area welding (AFw) .....	mm <sup>2</sup>	0
Stress area nozzle 1 (Afb1) .....	mm <sup>2</sup>	624
Stress area nozzle 2 (Afb2) .....	mm <sup>2</sup>	111
Stress area reinforcing plate nozzle 1 .....	mm <sup>2</sup>	0
Stress area reinforcing plate nozzle 2 .....	mm <sup>2</sup>	0
Pressure area of shell along Lb (APLS) (eq 9.6-6) .....	mm <sup>2</sup>	145758
Pressure area nozzle 1 (Ap1) .....	mm <sup>2</sup>	8221
Pressure area nozzle 2 (Ap2) .....	mm <sup>2</sup>	2337
Shell load capacity .....	N	390015
Nozzle 1 load capacity .....	N	55863
Nozzle 2 load capacity .....	N	9967
Total load capacity .....	N	455845
Total load .....	N	281368
Capacity/Load ratio .....	--	1,620

**Nozzle Combination**

Nozzle combination number .....	:	5
First nozzle in combination .....	:	3
Second nozzle in combination .....	:	2
Longitudenal pitch .....	mm	750,0
Circumferential pitch (Pfi) .....	deg	0,0
Center-to-center distance between openings at mean surface of shell (Lb).....	mm	750,0
Projection of psi on LB-plane for nozzle 1 (P <sub>sie1</sub> ) .....	deg	0,0
Projection of psi on LB-plane for nozzle 2 (P <sub>sie2</sub> ) .....	deg	0,0
Variabel (ros) for nozzle 1 (eq 9.6-11) .....	mm	0,0
Variabel (ros) for nozzle 2 (eq 9.6-11) .....	mm	0,0
Variabel (delta) for nozzle 1 (eq 9.6-12) .....	rad	0,0
Variabel (delta) for nozzle 2 (eq 9.6-12) .....	rad	0,0
Distance a for nozzle 1 (a <sub>1</sub> ) .....	mm	69,9
Distance a for nozzle 2 (a <sub>2</sub> ) .....	mm	203,0
Shell compensation length nozzle 1 (Iso1) (eq 9.5-2) .....	mm	74,2
Shell compensation length nozzle 2 (Iso2) (eq 9.5-2) .....	mm	74,2
Minimum distance for isolated nozzles (eq 9.5-1) .....	mm	421,2
Minimum distance between nozzles (eq 9.6-1) .....	mm	33,2
Stress area of shell along Lb (AFLS) (eq 9.6-7) .....	mm <sup>2</sup>	5282
Stress area welding (AFw) .....	mm <sup>2</sup>	0
Stress area nozzle 1 (Afb1) .....	mm <sup>2</sup>	111
Stress area nozzle 2 (Afb2) .....	mm <sup>2</sup>	1264
Stress area reinforcing plate nozzle 1 .....	mm <sup>2</sup>	0
Stress area reinforcing plate nozzle 2 .....	mm <sup>2</sup>	0
Pressure area of shell along Lb (APLS) (eq 9.6-6) .....	mm <sup>2</sup>	182198
Pressure area nozzle 1 (Ap1) .....	mm <sup>2</sup>	2337
Pressure area nozzle 2 (Ap2) .....	mm <sup>2</sup>	16842
Shell load capacity .....	N	472744
Nozzle 1 load capacity .....	N	9967
Nozzle 2 load capacity .....	N	113119
Total load capacity .....	N	595829
Total load .....	N	362477
Capacity/Load ratio .....	--	1,644

**Nozzle Combination**

Nozzle combination number .....	:	6
First nozzle in combination .....	:	2
Second nozzle in combination .....	:	4
Longitudenal pitch .....	mm	500,0
Circumferential pitch (Pfi) .....	deg	0,0
Center-to-center distance between openings at mean surface of shell (Lb).....	mm	500,0
Projection of psi on LB-plane for nozzle 1 (P <sub>sie1</sub> ) .....	deg	0,0
Projection of psi on LB-plane for nozzle 2 (P <sub>sie2</sub> ) .....	deg	0,0
Variabel (ros) for nozzle 1 (eq 9.6-11) .....	mm	0,0
Variabel (ros) for nozzle 2 (eq 9.6-11) .....	mm	0,0
Variabel (delta) for nozzle 1 (eq 9.6-12) .....	rad	0,0
Variabel (delta) for nozzle 2 (eq 9.6-12) .....	rad	0,0
Distance a for nozzle 1 (a1) .....	mm	203,0
Distance a for nozzle 2 (a2) .....	mm	16,9
Shell compensation length nozzle 1 (Iso1) (eq 9.5-2) .....	mm	74,2
Shell compensation length nozzle 2 (Iso2) (eq 9.5-2) .....	mm	74,2
Minimum distance for isolated nozzles (eq 9.5-1) .....	mm	368,2
Minimum distance between nozzles (eq 9.6-1) .....	mm	33,2
Stress area of shell along Lb (AFLS) (eq 9.6-7) .....	mm <sup>2</sup>	3101
Stress area welding (AFw) .....	mm <sup>2</sup>	0
Stress area nozzle 1 (Afb1) .....	mm <sup>2</sup>	1264
Stress area nozzle 2 (Afb2) .....	mm <sup>2</sup>	52
Stress area reinforcing plate nozzle 1 .....	mm <sup>2</sup>	0
Stress area reinforcing plate nozzle 2 .....	mm <sup>2</sup>	0
Pressure area of shell along Lb (APLS) (eq 9.6-6) .....	mm <sup>2</sup>	121465
Pressure area nozzle 1 (Ap1) .....	mm <sup>2</sup>	16842
Pressure area nozzle 2 (Ap2) .....	mm <sup>2</sup>	278
Shell load capacity .....	N	277563
Nozzle 1 load capacity .....	N	113119
Nozzle 2 load capacity .....	N	4631
Total load capacity .....	N	395313
Total load .....	N	249453
Capacity/Load ratio .....	--	1,585



**Nozzle Combination**

Nozzle combination number .....	:	7
First nozzle in combination .....	:	4
Second nozzle in combination .....	:	5
Longitudenal pitch .....	mm	100,0
Circumferential pitch (Pfi) .....	deg	0,0
Center-to-center distance between openings at mean surface of shell (Lb).....	mm	100,0
Projection of psi on LB-plane for nozzle 1 (P <sub>sie1</sub> ) .....	deg	0,0
Projection of psi on LB-plane for nozzle 2 (P <sub>sie2</sub> ) .....	deg	180,0
Variabel (ros) for nozzle 1 (eq 9.6-11) .....	mm	0,0
Variabel (ros) for nozzle 2 (eq 9.6-11) .....	mm	0,0
Variabel (delta) for nozzle 1 (eq 9.6-12) .....	rad	0,0
Variabel (delta) for nozzle 2 (eq 9.6-12) .....	rad	0,0
Distance a for nozzle 1 (a1) .....	mm	16,9
Distance a for nozzle 2 (a2) .....	mm	30,2
Shell compensation length nozzle 1 (Iso1) (eq 9.5-2) .....	mm	74,2
Shell compensation length nozzle 2 (Iso2) (eq 9.5-2) .....	mm	74,2
Minimum distance for isolated nozzles (eq 9.5-1) .....	mm	195,3
Minimum distance between nozzles (eq 9.6-1) .....	mm	33,2
Stress area of shell along Lb (AFLS) (eq 9.6-7) .....	mm <sup>2</sup>	587
Stress area welding (AFw) .....	mm <sup>2</sup>	0
Stress area nozzle 1 (Afb1) .....	mm <sup>2</sup>	52
Stress area nozzle 2 (Afb2) .....	mm <sup>2</sup>	38
Stress area reinforcing plate nozzle 1 .....	mm <sup>2</sup>	0
Stress area reinforcing plate nozzle 2 .....	mm <sup>2</sup>	0
Pressure area of shell along Lb (APLS) (eq 9.6-6) .....	mm <sup>2</sup>	24293
Pressure area nozzle 1 (Ap1) .....	mm <sup>2</sup>	278
Pressure area nozzle 2 (Ap2) .....	mm <sup>2</sup>	655
Shell load capacity .....	N	52511
Nozzle 1 load capacity .....	N	4631
Nozzle 2 load capacity .....	N	3417
Total load capacity .....	N	60559
Total load .....	N	45406
Capacity/Load ratio .....	--	1,334

**Project : Tullis****Component : CAP DN500****ID No.: DIN2617/S3**

Fitting number .....	:	1
Fitting Code .....	--	DIN2617
Fitting type .....	--	Cap
Nominal diameter .....	--	DN500
Design / Bauart .....	--	--
Wall thickness series .....	--	Series 3
Calculation pressure (pc) .....	barg	18,0
Calculation temperature (tc) .....	°C	290,0
Material code .....	--	EN10216-2
Material grade .....	--	P235GH TC2
Material number .....	--	1.0345
Minimum tensile stress at 20°C (Rm) .....	N/mm <sup>2</sup>	360,0
Minimum proof stress at design temperature (Rp02) .....	N/mm <sup>2</sup>	135,6
Creep rupture stress 100.000 h (RmT100) .....	N/mm <sup>2</sup>	0,0
Creep rupture stress 200.000 h (RmT200) .....	N/mm <sup>2</sup>	0,0
Dimensioning stress .....	--	Rp02
Safety factor .....	--	1,50
Allowable stress (f) .....	N/mm <sup>2</sup>	90,4
Outside diameter (da) .....	mm	508,0
Nominal wall thickness cylindrical skirt(S1) .....	mm	11,0
Nominal wall thickness knuckle (S2) .....	mm	11,0
Inside diameter crown (r1) .....	mm	406,4
Inside diameter knucke (r2) .....	mm	78,2
Height (h) .....	mm	229,0
Efficiency / Ausnutzungsgrad .....	%	100,0
Minus tolerance on ordered wall thickness (C1p) .....	%	12,5
Minus tolerance on ordered wall thickness (C1) .....	mm	1,38
Allowance for metal wastage (C2) .....	mm	1,00
Required thickness for straight tube excl. allowance (e) (eq 6.1-1) .....	mm	5,01
Required thickness for fitting excl. allowance .....	mm	5,01
Actual thickness of fitting excl. allowance .....	mm	8,63
Required thickness for fitting incl. allowance .....	mm	7,38
Max allowable operation pressure .....	barg	31,2
Max allowable test pressure .....	barg	77,1