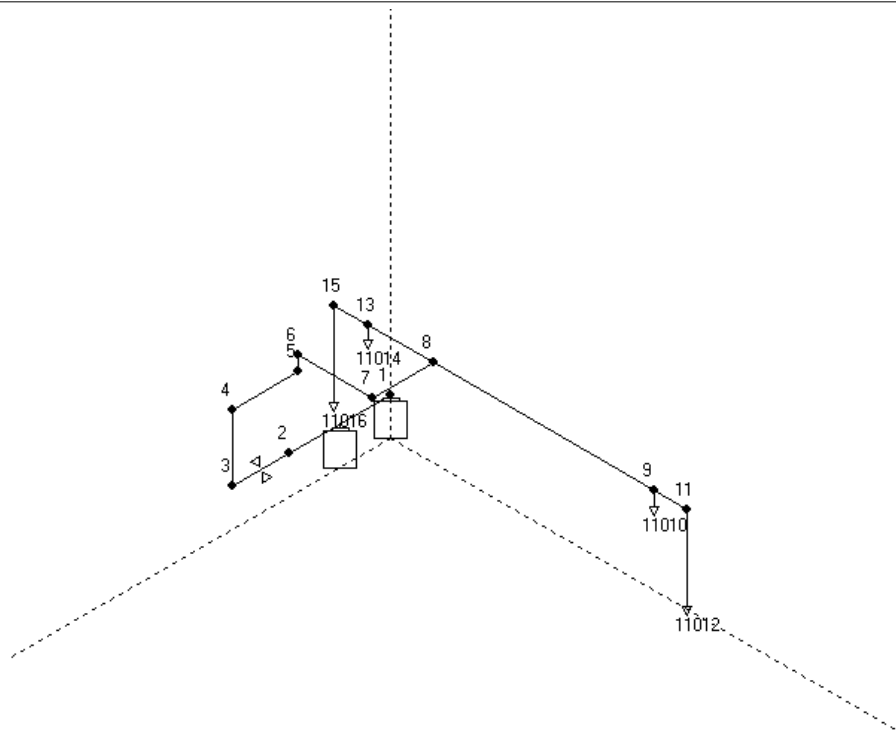




Project: TWR
Project-No:
Building: Pomieszczenie techniczne 6/12
Object:
Contractor:
Owner:
Project engineer:
Date: 21/03/2012
Altitude above sealevel: 120 m
Regulation rule for calculation of Nitrogen quantities: ISO 14520-1, Edition 2000

Pipe catalogue: LPGDiametros.rkl
Component catalogue: LPGComponentes.arm
Nozzle catalogue: LPGDifusores.noz





Pipesystem data:

Section- No:	Starting- node	Endnode Nozzle	Length [m]	Height [m]	Pipetype	Diameter [mm] **	Fitting *	code	Component coefficient	Nb of containers Nitrogen quantity
1	0	1	0,400	0,400	22	18,8	C	128	9,000	2,0
2	1	2	1,075	0,000	33	34,0	E	-	-	0,0
3	2	3	0,600	0,000	13	52,5	R	-	-	0,0
4	3	4	0,700	0,700	13	52,5	E	-	-	0,0
5	4	5	0,700	0,000	13	52,5	E	-	-	0,0
6	5	6	0,150	0,150	13	52,5	E	-	-	0,0
7	6	7	0,780	0,000	13	52,5	E	-	-	0,0
8	7	8	0,650	0,000	13	52,5	E	-	-	0,0
9	8	9	2,350	0,000	13	40,9	T-90°	-	-	0,0
10	9	11010	0,150	-0,150	13	20,9	T-90°	-	-	0,0
11	9	11	0,350	0,000	13	35,0	T-0°	-	-	0,0
12	11	11012	0,900	-0,900	13	35,0	E	-	-	0,0
13	8	13	0,700	0,000	13	40,9	T-90°	-	-	0,0
14	13	11014	0,150	-0,150	13	20,9	T-90°	-	-	0,0
15	13	15	0,350	0,000	13	35,0	T-0°	-	-	0,0
16	15	11016	0,900	-0,900	13	35,0	E	-	-	0,0

* C=Component, B=Bend, T=T-Piece, E=Elbow, R=Restrictor

** If a pipe diameter is equal zero see the extra table of the calculated diameters

Legend of pipetypes

Type Pipeclass

Pipe roughness

22	SCH 160/80	hose
33	SCH 160/80 300 bar	black pipe
13	SCH 40	black pipe

Legend of components

Code Type

Resistance coefficient

128	LPG 128	9,000
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Nozzle data:

No.	Calculation zone	Diameter [mm]
11016	pg	11,7
11012	pg	11,7
11010	pn	6,5
11014	pn	6,5

Legend of nozzles and restrictor:

Type	Number of orifices	C1	C2	C3	C4	C5	C6
1 Nozzle 1	1	-0,183	0,031	0,000	0,000	0,000	0,000
Restrictor		-0,131	0,008	0,000	0,000	0,000	0,000



Calculation zone data:

Calculation of design quantity:

Zone	Total volume [m3]	Volume of building parts [m3]	Calculated volume [m3]	Max. Over-pressure [mbar]	Design temp. [°C]	Extinguish-conc. [% Vol]	Design factor	Design conc. [% Vol]	Design quantity [kg]
1 pg	89,9	0,0	89,9	7,000	20,0	34,8	1,30	45,2	63,02
2 pn	27,3	0,0	27,3	7,000	20,0	34,8	1,30	45,2	19,13

Regulation rule for calculation of Nitrogen quantities: ISO 14520-1, Edition 2000

Altitude above sealevel: 120,0 m

Nitrogen storage input data:

Container volume: 140,0 l
Container pressure: 300,0 bar abs
Storage temperature: 15,0 °C
Supplement factor: 1,00
Minimum storage quantity: 82,15 kg
Number of containers: 2

Discharge time (input value): 60,0 s
Pressure downstream restrictor: 60,0 bar

Further information:

Design with predetermined restrictor diameter



Calculation results:

Nitrogen design data:

Design quantity:	82,15
Supplement factor:	1,00
Minimum storage quantity:	82,15
Container volume:	140,0 l
Container pressure:	300,0 bar abs
Nitrogen-mass in one container:	43,5 kg
Number of containers:	2
Actual storage quantity:	87,1 kg
Storage temperature:	15,0 °C
Starting container pressure:	300,0 bar abs

Discharge time:

Total discharge time of air and Nitrogen:	57,7 s
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System information:

Restrictor diameter:	9,2 mm
Container working pressure:	196,1 bar abs
Total network volume:	15,2 l



Pipe system:

Section- No:	Starting- node	Endnode Nozzle	Pressure [bar abs]	Temperature [°C]	Flowrate [kg/s]	Pipedimension Di [mm]	DN
1	0	1	192,39	0,05	1,20	18,8	3/4
2	1	2	192,14	0,03	2,40	34,0	1 1/2
3	2	3	44,00	-23,48	2,40	52,5	2
4	3	4	43,88	-23,53	2,40	52,5	2
5	4	5	43,76	-23,58	2,40	52,5	2
6	5	6	43,66	-23,62	2,40	52,5	2
7	6	7	43,54	-23,67	2,40	52,5	2
8	7	8	43,42	-23,72	2,40	52,5	2
9	8	9	43,18	-23,75	1,20	40,9	1 1/2
10	9	11010	43,05	-23,75	0,28	20,9	3/4
11	9	11	43,13	-23,76	0,92	35,0	1 1/4
12	11	11012	43,02	-23,80	0,92	35,0	1 1/4
13	8	13	43,24	-23,73	1,20	40,9	1 1/2
14	13	11014	43,11	-23,73	0,28	20,9	3/4
15	13	15	43,19	-23,73	0,92	35,0	1 1/4
16	15	11016	43,08	-23,78	0,92	35,0	1 1/4



Nozzle data:

Calculation- zone no:	Nozzle no.	Nozzle type	Number of orifices	Pipeconnection Di [mm]	DN	Orifice [mm]	Nitrogen out- put [kg]
1	11016	1	1	35,0	1 1/4	11,0	31,5
1	11012	1	1	35,0	1 1/4	11,0	31,5
2	11010	1	1	20,9	3/4	6,1	9,6
2	11014	1	1	20,9	3/4	6,0	9,6

MAX. TRANSPORT TIME DIFF. BETWEEN NOZZLES: 11014./ 11012. IS 0.18 S



Concentrations:

Calculation- **Gascomposition after the discharge of the design quantity [%]**
zone no: **O2** **CO2** **AR** **N2**

1	11,3	0,0	0,5	88,2
2	11,3	0,0	0,5	88,2

Total flooded design quantity within discharge time: 82,15 kg

Calculation- **Gascomposition after total discharge [%]**
zone no: **O2** **CO2** **AR** **N2**

1	10,9	0,0	0,5	88,6
2	10,9	0,0	0,5	88,6

Total flooded Nitrogen mass: 86.7 KG

Pressure relief opening:

Calculation- **Recommended area against overpressure**
zone no: **Area [m²]** **Overpressure [mbar]** **Max. flow [kg/s]**

1	0,114	7,0	3,03
2	0,034	7,0	0,92



Component list:

Nozzle-type	Number	C1	C2	C3	C4	C5	C6
1	4	-0,183	0,031	0,000	0,000	0,000	0,000
Restrictor	1	-0,131	0,008	0,000	0,000	0,000	0,000

Pipe-type	Di [mm]	DN	Length [m]
22	18,80	3/4	0,400
33	34,00	1 1/2	1,100
13	52,50	2	3,600
13	40,90	1 1/2	3,100
13	20,90	3/4	0,200
13	35,00	1 1/4	2,400

Number of bends (+) and elbows (-)

Bend-type	Di [mm]	DN	Number
-90	34,00	1 1/2	1
-90	52,50	2	5
-90	35,00	1 1/4	2

Number of T-distributors (in- and outdiameter)

Number	Input	90-out	90-out	0-out
1	52,5	40,9	40,9	0,0
2	40,9	20,9	0,0	35,0

Dynamic flooding results

The calculation bases on a mean nozzle pressure!

Flooding time [s]	Storage mass [kg]	Flooded ratio [%]	Flow [kg/s]	Storage pressure [bar]	Pressure downstream restrictor [bar]	Pressure at nozzle [bar]
0,0	87,1	0,0	0,00	300,0	1,0	1,0
1,7	69,1	20,7	3,09	227,4	58,1	56,8
1,9	68,3	21,6	3,04	220,5	56,2	54,8
2,2	67,6	22,4	2,96	214,6	54,5	53,1
2,4	66,8	23,2	2,89	209,3	53,0	51,7
2,7	66,1	24,0	2,82	204,5	51,7	50,5
2,9	65,4	24,8	2,76	200,1	50,6	49,3
3,2	64,8	25,6	2,71	196,0	49,5	48,3
3,4	64,1	26,4	2,66	192,2	48,5	47,3
3,9	62,8	27,9	2,61	186,5	47,5	46,4
4,4	61,5	29,3	2,54	180,6	46,1	45,0
4,9	60,3	30,8	2,47	174,7	44,7	43,6
7,4	54,6	37,3	2,21	150,8	39,6	38,7
9,4	50,5	42,0	1,98	133,4	35,1	34,3
11,0	46,8	46,3	1,82	118,2	32,0	31,2
16,0	39,0	55,2	1,40	89,9	24,1	23,6
21,0	32,9	62,3	1,15	71,1	19,5	19,1
26,0	27,8	68,1	0,93	57,7	15,8	15,4
31,0	23,6	72,9	0,78	47,9	13,1	12,8
36,0	20,1	76,9	0,65	40,4	11,0	10,7
41,0	17,2	80,3	0,55	34,5	9,4	9,2
46,0	14,6	83,2	0,47	29,7	8,0	7,9
51,0	12,5	85,7	0,41	25,7	7,0	6,8
56,0	10,6	87,8	0,35	22,4	6,1	5,9
61,0	9,0	89,6	0,30	19,6	5,3	5,2
66,0	7,7	91,2	0,26	17,2	4,6	4,5
71,0	6,5	92,5	0,22	15,0	4,1	4,0
76,0	5,5	93,7	0,19	13,1	3,6	3,5
81,0	4,6	94,7	0,16	11,5	3,1	3,0

Discharge meantime at nozzle:

57,7 s

