DRYDEN AQUA DISTRIBUTION | SUSTAINABLE WATER QUALITY

DRYDEN POOL ACADEMY
KNOWLEDGE IS POWER!

10 HIGH-LEVEL TRAINING SESSIONS

Live Zoom

Dryden Pool Academy
SESSION 3

CORRECT PIPE DIMENSIONS & OVERFLOW POOLS

1

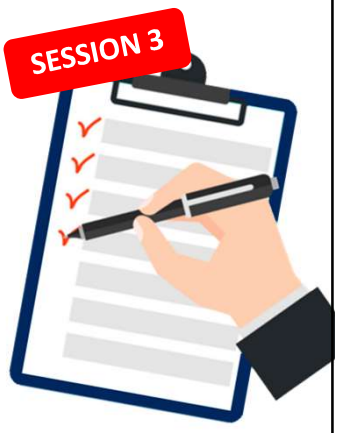
FEBRUARY 5th 2021

zoom

DRYDEN POOL ACADEMY
KNOWLEDGE IS POWER!

SESSION 3 : PIPING & OVERFLOW POOLS

- Well dimensioned hydraulics
- Pipe diameter calculation - the magic Dryden ruler
- Overflow pools: The right size of the balance tank
- How to backwash an overflow pool best
- Eco Mode: How to reduce energy consumption in all overflow pools



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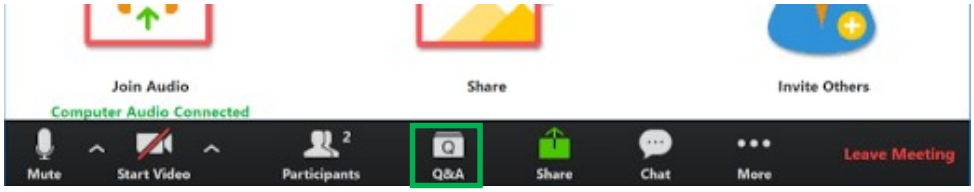
2

Questions & Answers



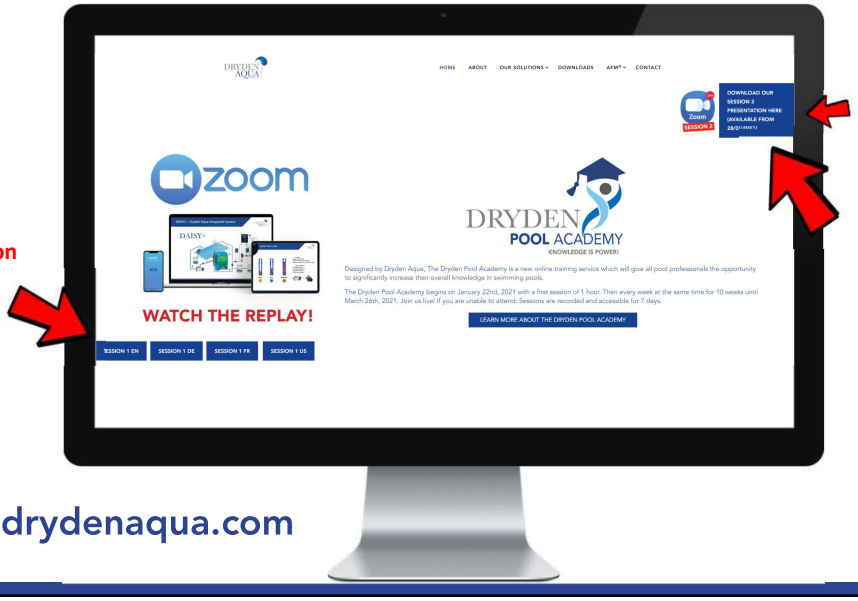
Prepare and send us your questions during the meeting using the "Q&A" feature

Use "Chat" for suggestions and feedback

3

Dryden Pool Academy presentations and replays

Replay available for 7 days after each session (EN, DE, FR, US)



www.drydenaqua.com

Program

PDF Presentation available for download 24 hr before each session (every Thursday)

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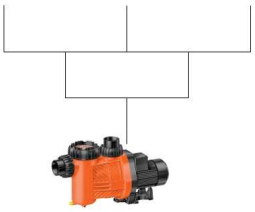
3 simple steps! SESSION 1

DRYDEN POOL ACADEMY

1

Turnover time : 3 to 4 hrs
Min. 3 to 4 cycles per day
24h filtration
(Day 1-2 cycles / Night 2-3 cycles at reduced speed)

2



Always have an equal flow distribution to avoid dead zones

3

Control and adjust your flowrates using a flowmeter

5

3 simple steps! SESSION 2

DRYDEN POOL ACADEMY

1

The lower the filtration velocity, the better the filtration performance
Day < 30m/h / Night 15-20 m/h

2

Make sure to use a reasonnable hardware. And don't undersize your filter!

3

You need minimum 15% bed expansion (ideally 25%) for a proper backwash!
AFM >40m/h / Sand >50-60m/h

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DRYDEN AQUA DISTRIBUTION SUSTAINABLE WATER QUALITY

DRYDEN POOL ACADEMY KNOWLEDGE IS POWER!

DRYDEN POOL ACADEMY

PRESSURE LOSSES IN PIPES => CORRECT PIPE SIZING & OVERFLOW POOLS

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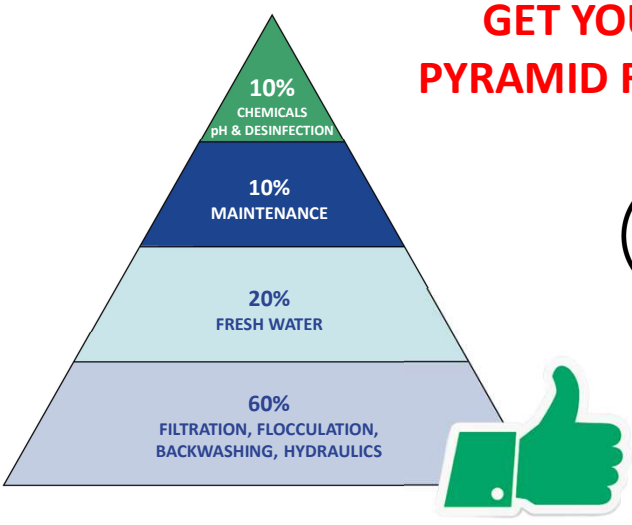
DRYDEN AQUA DISTRIBUTION SUSTAINABLE WATER QUALITY

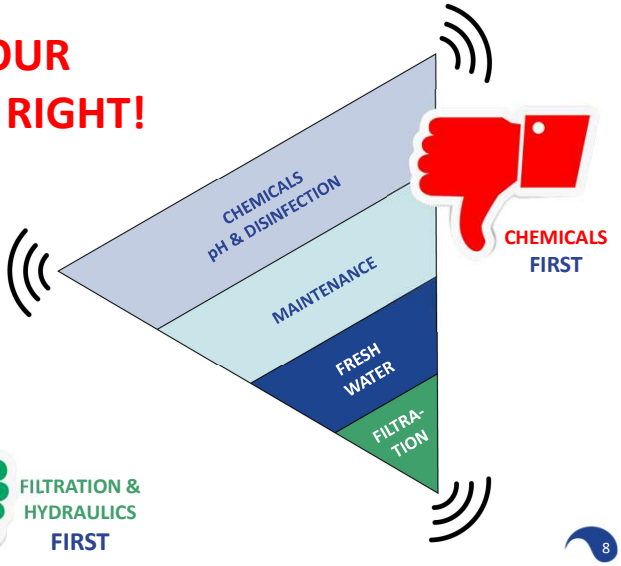
Hydraulics and filtration always first!

DRYDEN POOL ACADEMY KNOWLEDGE IS POWER!

GET YOUR PYRAMID RIGHT!



FILTRATION & HYDRAULICS FIRST



CHEMICALS FIRST

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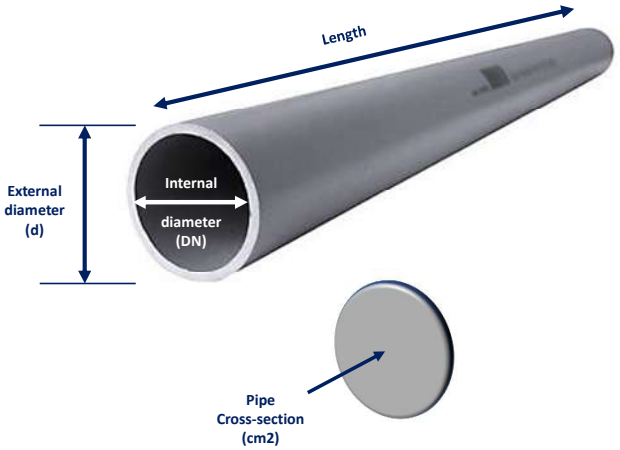
Pipe diameter calculation

- d = External diameter (mm)
- DN : Internal diameter (mm)
- Pipe cross-section (cm2)
- Pipe speed in meters / second (m/s)

DN40=d50mm
Pipe Cross-section = 13cm2
@2.0m/s => 9m3/h flowrate

DN50=d63mm
Pipe Cross-section = 20cm2
@2.0m/s => 14m3/h flowrate



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What happens when pipe diameter is too small

Consequences
Too small diameter => Too high speed => Too high resistance

- **Too high pressure loss**
- **Backwash speed will be too low**
- **High energy consumption**

e.g. + 0.2kW x 24h = 4 kW = 1€ per day
Pay back 1 year (63mm instead of 50mm)

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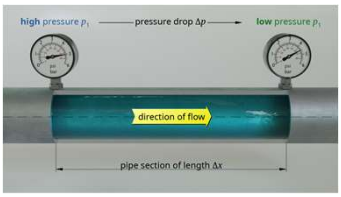
Pipe sizing => 3 key factors

Many people think it is the «bottleneck» which gives the sizing

1 **Length**

2 **Speed**

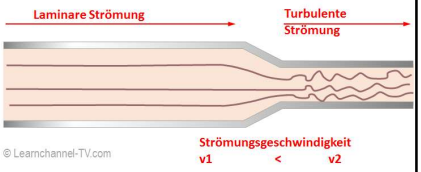
3 **Turbulence**



Suction side: 1.0 – 1.5 meters/second

Pressure side: 1.5 – 2.0 meters/second

Overflow return: 0.5 meters/second



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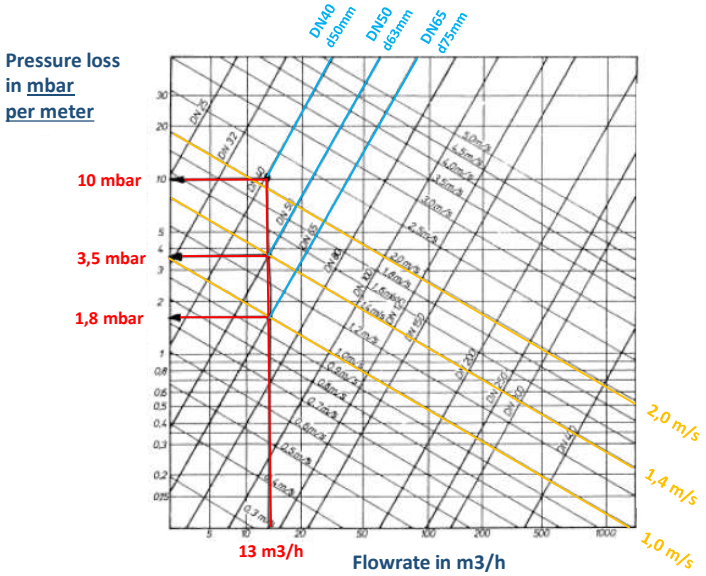
Pressure loss diagram for PVC pipes without individual resistances => speed & length



Ex. Flowrate 13m3/h

DN40/d50mm: 2.2m/s
⇒**10mbar (0.01bar) per m**

DN50/d63mm: 1.4m/s
⇒**3.5mbar (0.0035 bar) per m**

DN65/d75mm: 1.0m/s
⇒**1.8mbar (0.018) per m**

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Let's have a look at speed & turbulence

velocity in m/s	pressure drop in mbar
0.1	0.1
0.2	0.2
0.3	0.5
0.4	0.8
0.5	1.3
0.6	1.8
0.7	2.5
0.8	3.2
0.9	4.1
1	5
1.1	6.1
1.2	7.2
1.3	8.5
1.4	9.8
1.5	11.3
1.6	12.8
1.7	14.5
1.8	16.2
1.9	18.1
2	20
2.1	22.1
2.2	24.2
2.3	26.5
2.4	28.8
2.5	31.3

$\zeta = 1$

If you double the speed pressure drop increases by a factor of 4!

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Speed & turbulence according to fittings
More or less "friction" according to fittings

		Pressure loss coefficient ζ	Pressure drop [mbar]		
			v = 1,5 m/s Mbar	v = 2,0 m/s mbar	v = 2,5 m/s mbar
	Angle 90°	0,8	9	16	25
	Elbow 90°	0,5	5.65	10	15
	T-Stück (Stromaufteilung)	1,5	17	30	47
	Winkel 45° (1 Dimension)	0,3	3.4	6	9.4

Ex.	ζ=1	ζ=0.8	ζ=0.5	ζ=1.5
1m/s	5mbar	4mbar	2.5mbar	7.5mbar
2m/s	20mbar	16mbar	10mbar	30mbar

velocity in m/s	pressurde drop in mbar
0.1	0.1
0.2	0.2
0.3	0.5
0.4	0.8
0.5	1.3
0.6	1.8
0.7	2.5
0.8	3.2
0.9	4.1
1	5
1.1	6.1
1.2	7.2
1.3	8.5
1.4	9.8
1.5	11.3
1.6	12.8
1.7	14.5
1.8	16.2
1.9	18.1
2	20
2.1	22.1
2.2	24.2
2.3	26.5
2.4	28.8
2.5	31.3

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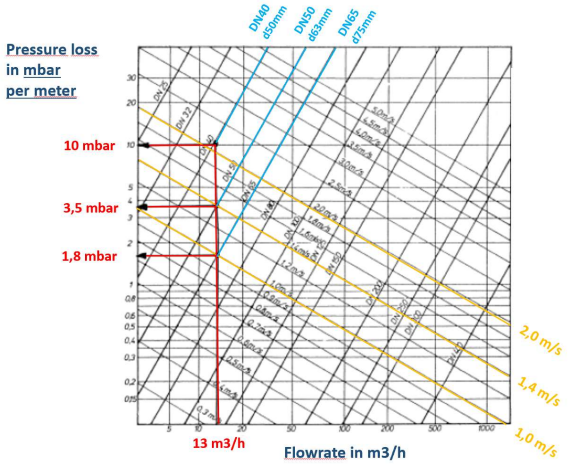
Example : Flowrate 13m3/h
30m piping with 10 x 90° angle (0.8 ζ)

Length, speed and turbulence!



DN40 (d50mm):
Speed: 2m/s
Length: 30m x 10mbar = 300 mbar
Turbulence: (20 x 0.8) x 10 = 160 mbar
Total: 460 mbar

DN50 (d63mm):
Speed: 1.4m/s
Length: 30m x 3.5mbar = 105 mbar
Turbulence: (9.8 x 0.8) x 10= 80 mbar
Total: 185 mbar

DN65 (d75mm):
Speed: 1 m/s
Length: 30m x 1.8mbar= 54 mbar
Turbulence: (5 x 0.8) x 10 = 40 mbar
Total: 94 mbar

velocity in m/s	pressurde drop in mbar
0.1	0.1
0.2	0.2
0.3	0.5
0.4	0.8
0.5	1.3
0.6	1.8
0.7	2.5
0.8	3.2
0.9	4.1
1	5
1.1	6.1
1.2	7.2
1.3	8.5
1.4	9.8
1.5	11.3
1.6	12.8
1.7	14.5
1.8	16.2
1.9	18.1
2	20
2.1	22.1
2.2	24.2
2.3	26.5
2.4	28.8
2.5	31.3

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Pressure loss with DN100 (d110mm)
Flowrate 72m3/h => speed 2,5 m/s

Fitting	Descripción	Coef. ζ
	Codo 90º	0,8
	Curva 90º	0,5
	odo 45º	0
	Red 2-3	0,8
	esviación	1,3
	Te Unión	0,9
	Te División	1,5

Velocity in m/s	pressure drop in mbar
0.1	0.1
0.2	0.2
0.3	0.5
0.4	0.8
0.5	1.3
0.6	1.8
0.7	2.5
0.8	3.2
0.9	4.1
1	5
1.1	6.1
1.2	7.2
1.3	8.5
1.4	9.8
1.5	11.3
1.6	12.8
1.7	14.5
1.8	16.2
1.9	18.1
2	20
2.1	22.1
2.2	24.2
2.3	26.5
2.4	28.8
2.5	31.3

Ex. 1 :
Flowrate 72 m³/h
30 meter piping
Pipe size DN100
10* 90º angles

Speed: 2,5 m/s

Length: 30 meters x 5 mbar = 150 mbar

Turbulence: (0,8 x 31,3) x 10 angles = 250 mbar

150 mbar + 250 mbar
= 450 mbar

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Pressure loss with DN150 (d160mm) Flowrate 72m3/h => speed 1,2 m/s

Fitting	Description	Coef. ζ
	Codo 90º	0,8
	Curva 90º	0,5
	Codo 45º	0,3
	Reduc 2-3	0,8
	T iación	1,3
	Te Unión	0,9
	Te División	1,5

velocity in m/s	pressure drop in mbar
0.1	0.1
0.2	0.2
0.3	0.5
0.4	0.8
0.5	1.3
0.6	1.8
0.7	2.5
0.8	3.2
0.9	4.1
1	5
1.1	6.1
1.2	7.2
1.3	8.5
1.4	9.8
1.5	11.3
1.6	12.8
1.7	14.5
1.8	16.2
1.9	18.1
2	20
2.1	22.1
2.2	24.2
2.3	26.5
2.4	28.8
2.5	31.3

Ex. 2 :
Flowrate 72 m³/h
30 meter piping
Pipe size DN150
10* 90º angles

Go for lower speed!

Speed: 1,2 m/s

Length: 30 meters x 0,9 mbar = 27 mbar

Turbulence: (0,8 x 7,2) x 10 angles = 57,6 mbar

27 mbar + 58 mbar
= 85 mbar

DN150 instead of DN100
⇒ 5x less pressure drop!

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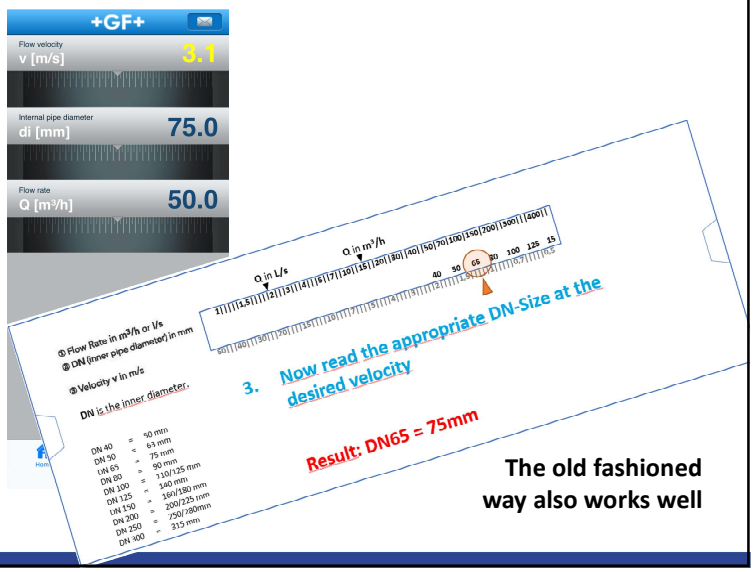
Pipe diameter calculators

Standard tools for pipe velocity calculation now include simple Apps such as the Flowcalc app from GF

There is no excuse for not doing the calculation!



The old fashioned way also works well

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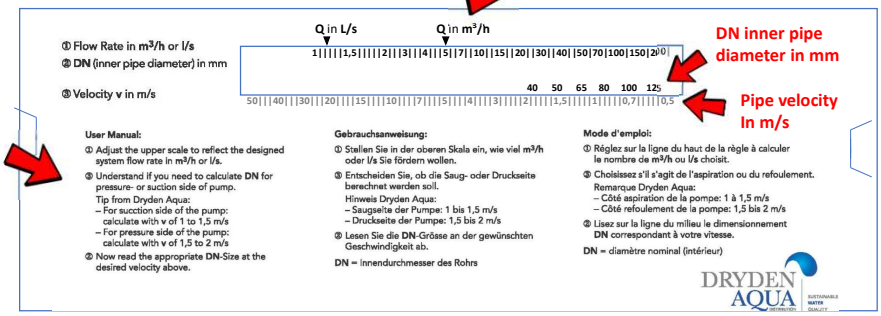
Dryden magic ruler => Pipe diameter calculator

Pipe Diameter

Dryden Aqua Calculator:

Flowrate in m3/h or l/s



DN inner pipe diameter in mm

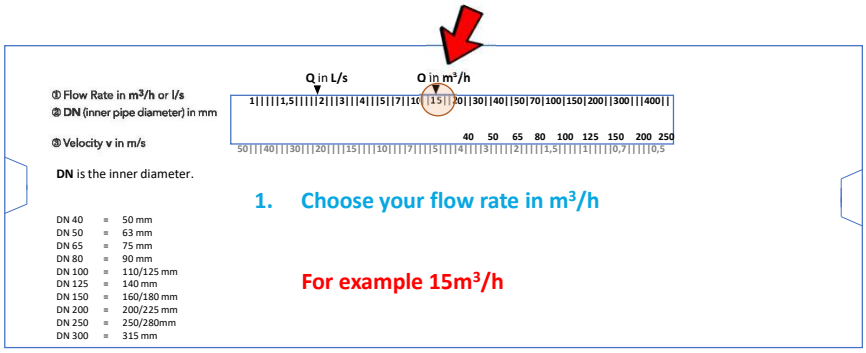
Pipe velocity In m/s

User manual in 3 languages (EN, DE, FR)

Dryden magic ruler => Pipe diameter calculator

Pipe Diameter

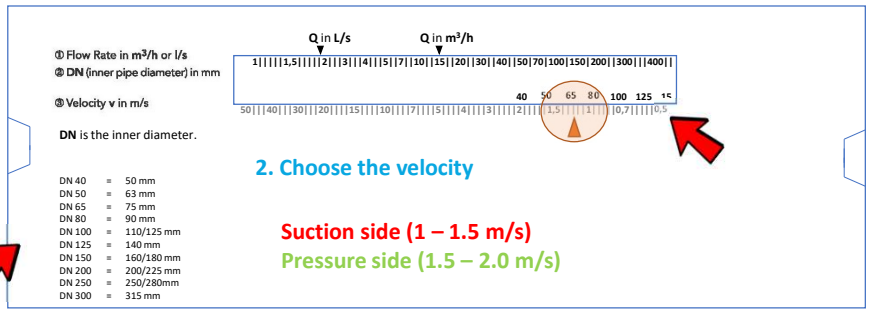
Dryden Aqua Calculator:



Dryden magic ruler => Pipe diameter calculator

Pipe Diameter

Dryden Aqua Calculator:



2. Choose the velocity

Suction side (1 – 1.5 m/s)
Pressure side (1.5 – 2.0 m/s)

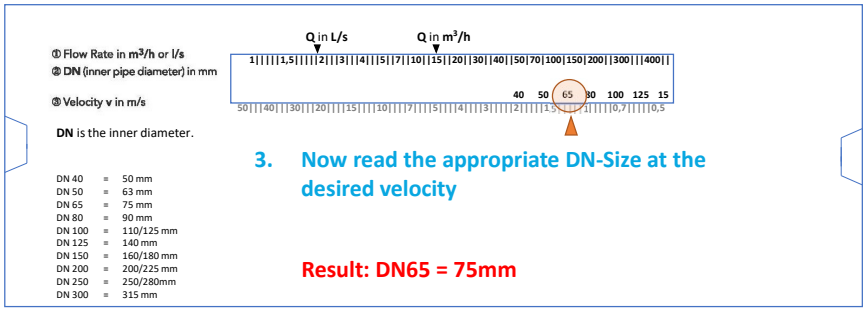
DN 40	=	50 mm
DN 50	=	63 mm
DN 65	=	75 mm
DN 80	=	90 mm
DN 100	=	110/125 mm
DN 125	=	140 mm
DN 150	=	160/180 mm
DN 200	=	200/225 mm
DN 250	=	250/280mm
DN 300	=	315 mm

Reminder

Dryden magic ruler => Pipe diameter calculator

Pipe Diameter

Dryden Aqua Calculator:

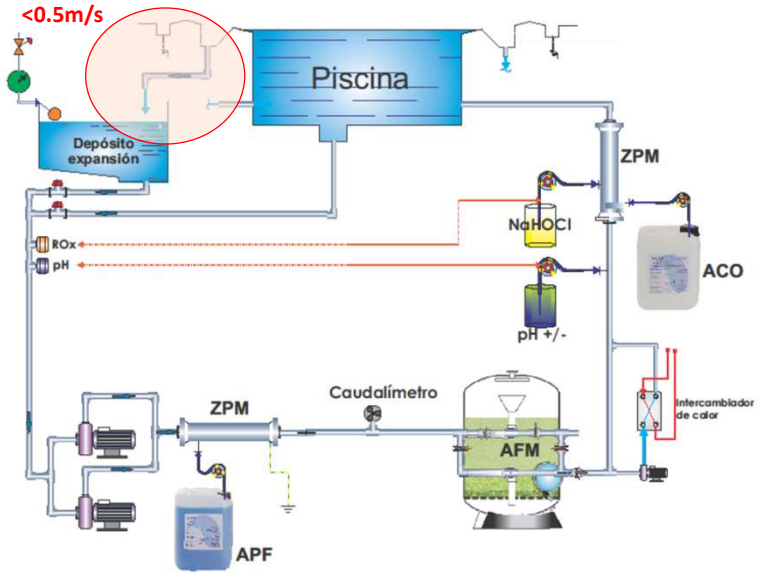


3. Now read the appropriate DN-Size at the desired velocity

Result: DN65 = 75mm

DN 40	=	50 mm
DN 50	=	63 mm
DN 65	=	75 mm
DN 80	=	90 mm
DN 100	=	110/125 mm
DN 125	=	140 mm
DN 150	=	160/180 mm
DN 200	=	200/225 mm
DN 250	=	250/280mm
DN 300	=	315 mm

GRAVITY RETURN LINE TO THE BALANCE TANK: < 0.5m/s



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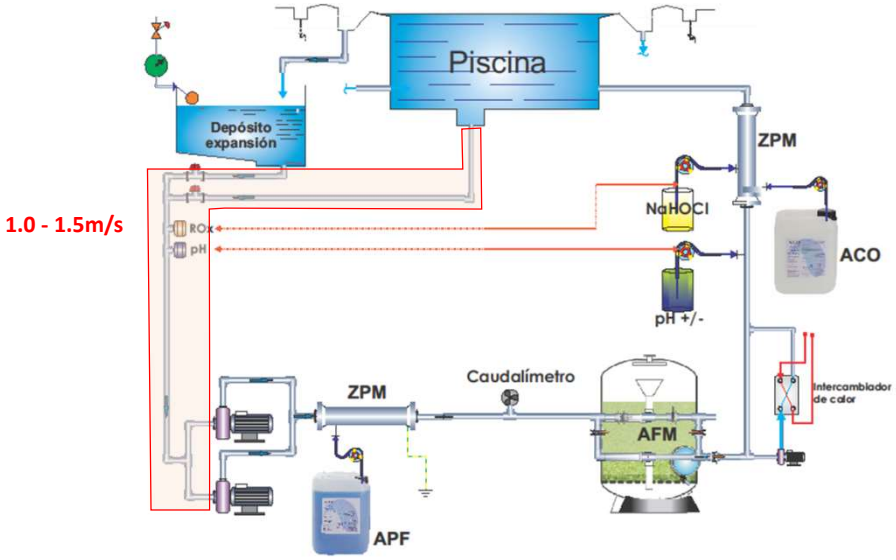
Suction pipe => 1,0 – 1,5 m/s



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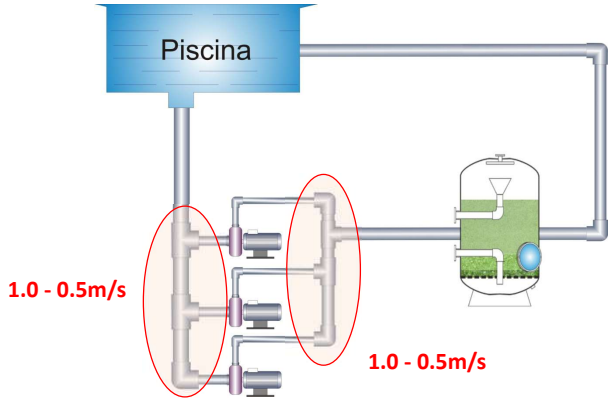
Collector manifolds both sides: 1.0 - 0.5m/s



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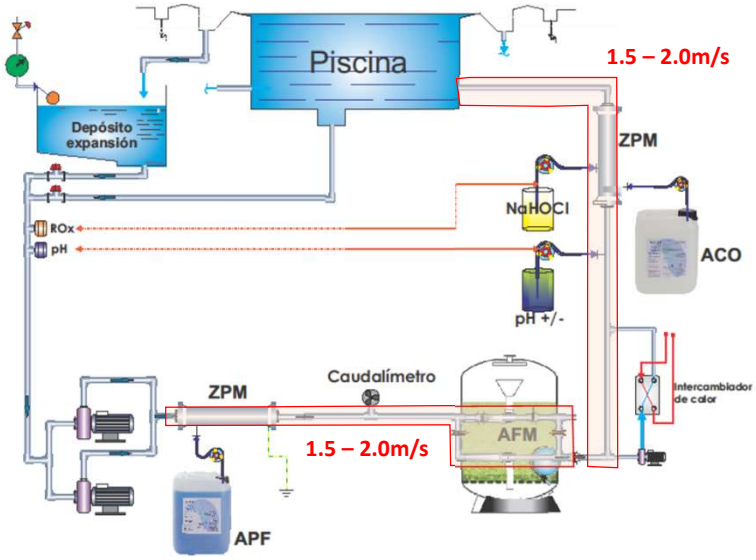
PIPE ON THE PRESSURE SIDE: 1.5 – 2.0m/s



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Conclusion on pressure loss

- If you double the speed => pressure loss increases by a factor of 4
- 4 x more energy consumption if you double the speed.

x 2 → x 4

Pipe Speed

Energy consumption

- Higher investment pays for the customer in 1 year

Optimal design criteria are:

=> Overflow return line:	0.5 m/s
=> Suction pipe:	1.0 – 1.5 m/s
=> Pressure pipe:	1.5 - 2.0 m/s

- Avoid fittings with high speeds – especially T-fittings and 90° elbows

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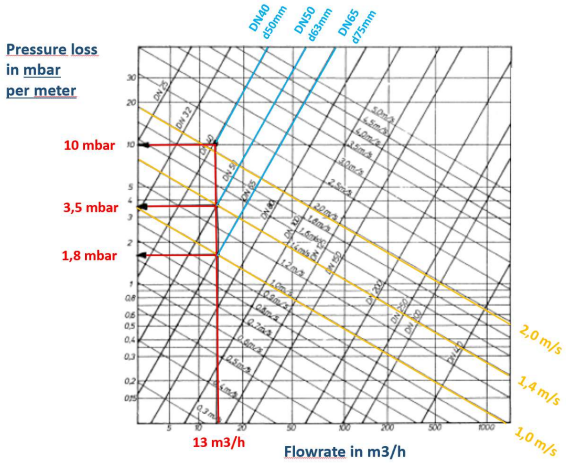
Return on investment – 1 year
DN40 vs DN50 => pressure loss difference



Flowrate 13m3/h

DN40 (d50mm):
Speed 2m/s
Length: 30m x 10mbar = 300 mbar
Turbulence: (20 x 0.8) x 10 = 160 mbar
Total: 460 mbar

DN50 (d63mm):
Speed 1.4m/s
Length: 30m x 3.5mbar = 100 mbar
Turbulence: (9.8 x 0.8) x 10= 80 mbar
Total: 180 mbar

Diff: 280 mbar = 0.3 bar

velocity in m/s	pressurde drop in mbar
0.1	0.1
0.2	0.2
0.3	0.5
0.4	0.8
0.5	1.3
0.6	1.8
0.7	2.5
0.8	3.2
0.9	4.1
1	5
1.1	6.1
1.2	7.2
1.3	8.5
1.4	9.8
1.5	11.3
1.6	12.8
1.7	14.5
1.8	16.2
1.9	18.1
2	20
2.1	22.1
2.2	24.2
2.3	26.5
2.4	28.8
2.5	31.3

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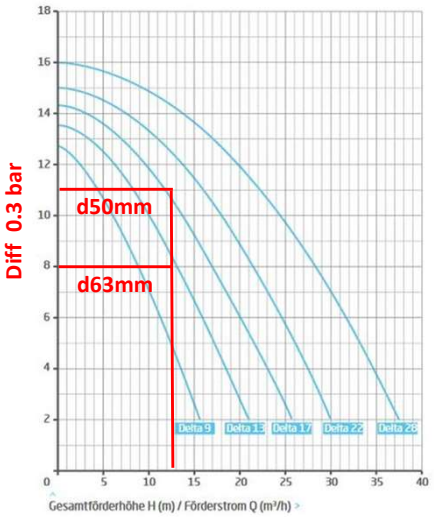
Return on investment – 1 year
DN40 vs DN50 => price difference

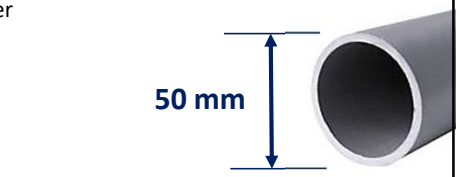


Piping
d50mm to d63mm= 4€ per meter
30 meters => 120€

Angles
90° angles d63mm: +2€
10 x 2€ = 20€
Total: 140 € (extra investment)

Pump needed
With d63mm Delta 13: 630W
With d50mm Delta 17: 870W

Diff: 240W x 24h x 150 days
=> 864kWh x 0.2€ = 173€



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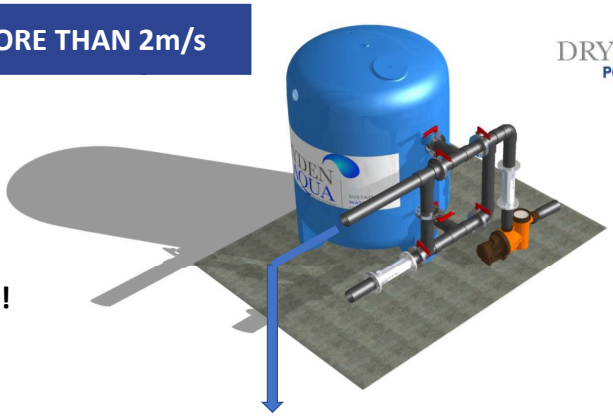
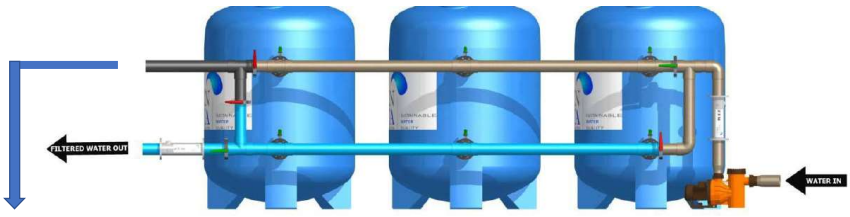
BACKWASH PIPE VELOCITY NEVER MORE THAN 2m/s

Backwash piping

- **Speed < 2m/s**
- **Never go up, always GO DOWN!**





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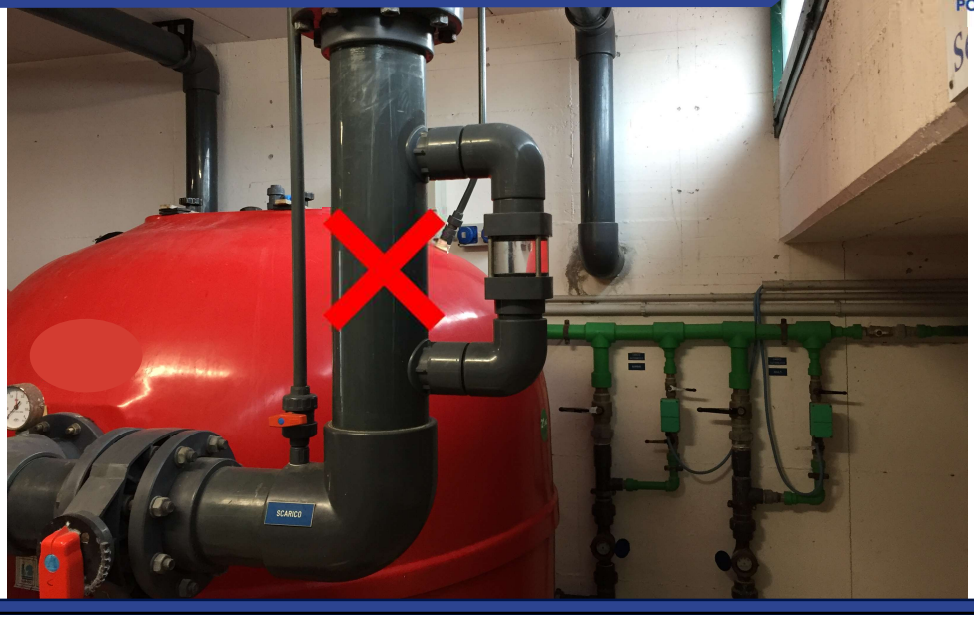
Never go up – ALWAYS GO DOWN!



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Proper backwash control with sightglass

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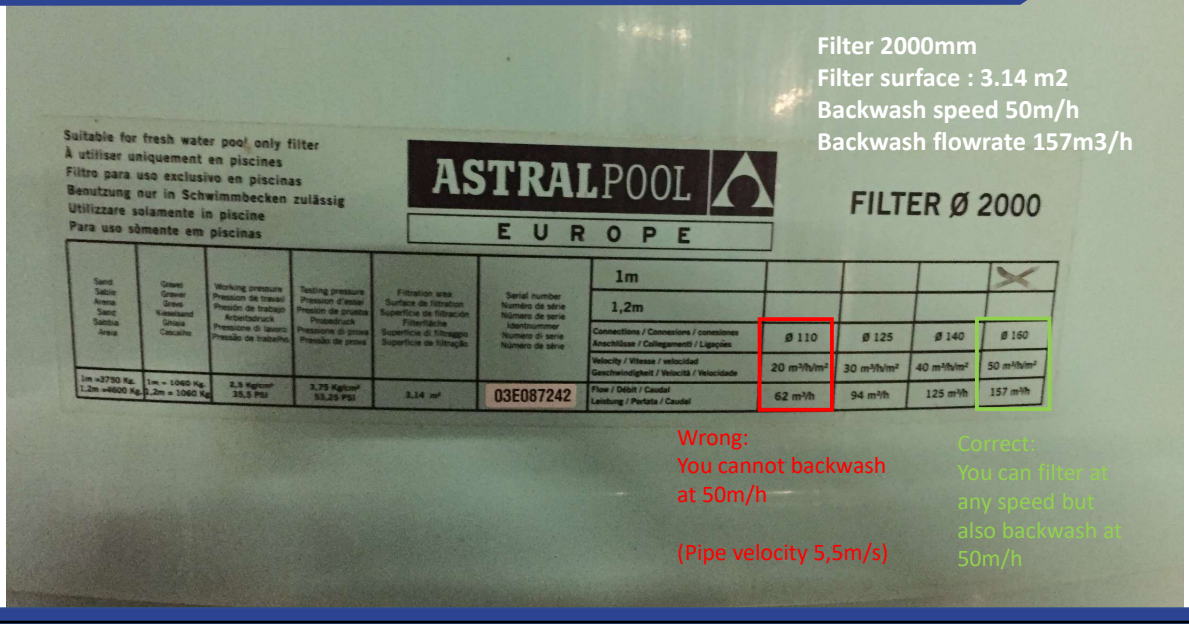
Connections must always be adapted to backwash velocity!!



Filter 2000mm
Filter surface : 3.14 m2
Backwash speed 50m/h
Backwash flowrate 157m3/h

Wrong:
You cannot backwash at 50m/h

(Pipe velocity 5,5m/s)

Correct:
You can filter at any speed but also backwash at 50m/h

Connections must always be adapted to backwash velocity!!

Filter surface : 3.14 m2
Backwash speed 50m/h
Backwash flowrate 157m3/h
with DN250 => pipe speed = 0,9 m/s

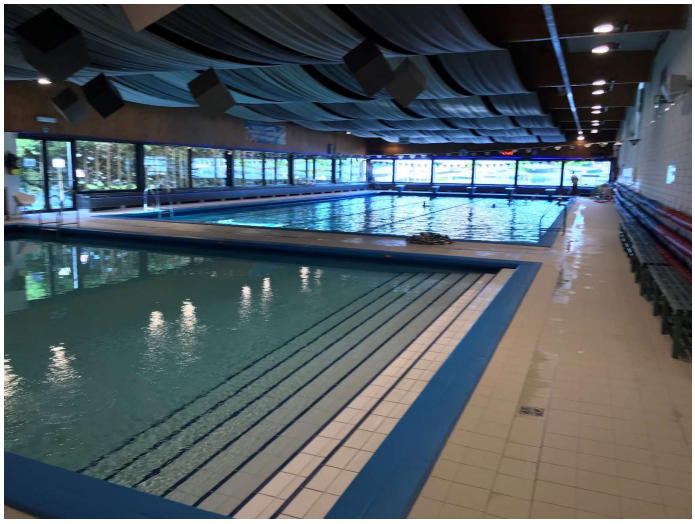
DN250

Filter 2000mm

DN200

Ø mm innen	Höhe mm	Rohranschluss	Filterleistung (m³/h) bei 30 m/h Fließgeschwindigkeit	Gewicht kg	Art.-Nr.	GR	€ ohne MwSt.	€ mit MwSt.
800	2570	DN80 / DN65	15	196	801 008 00	4	6.960,00	8.282,40
1000	2600	DN125 / DN100	24	318	801 010 00	4	8.055,00	9.585,45
1200	2760	DN125 / DN125	34	479	801 012 00	4	10.780,00	12.828,20
1400	2770	DN150 / DN125	46	517	801 014 00	4	12.700,00	15.113,00
1600	2880	DN200 / DN150	60	638	801 016 00	4	17.030,00	20.265,70
1800	2850	DN200 / DN150	76	813	801 018 00	4	20.660,00	24.585,40
2000	2980	DN250 / DN200	94	1138	801 020 00	4	28.300,00	33.677,00
2200	3200	DN300 / DN250	115	1270	801 022 00	4	33.640,00	40.031,60

Zembad Lebbeke – Belgium
Problem => Too high combined chlorine (0.8ppm)

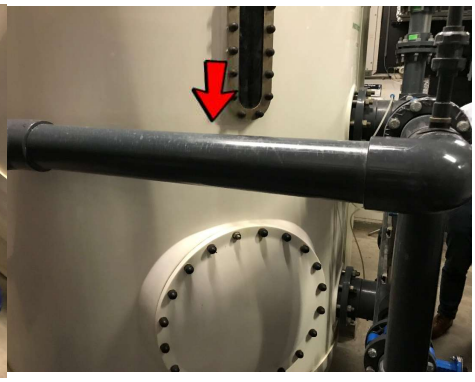


35

Zembad Lebbeke – Belgium
Pumps are more than OK – Piping is wrong

2 pumps 5,5kW
2 x 50m3/h min => 100m3/h

Filter d1600mm: 2m²
Piping DN100/d110mm
Speed @ 100m3/h =4m/s



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Zembad Lebbeke – Belgium

Problems:
1. Too small strainer
2. To high speed
3. To many fittings

Result:
Flow with 1 pump: 50m3/h
Flow with 2 pumps: 54m3/h

DN100
120mbar
@ 4m/s

DN150
30mbar
@ 2m/s

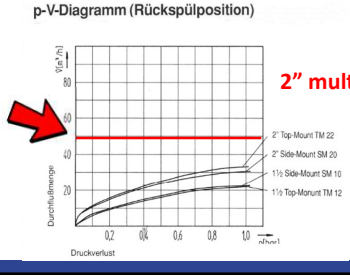
37

This filter cannot be backwashed

With the 1.2mØ Chinese filter in the picture:

- pipe connection Ø are DN50 (63mm)
- Backwash velocity 45m/h => flowrate 50m3/h
- pipe velocity at 50m3/hr is 7m/s!!
- Too small diameter =>Too high resistance

....backwash is impossible!



2" multiport valve

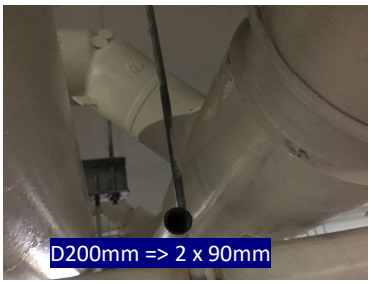
38

Singapore: With 22kW => 48m3/h!!!

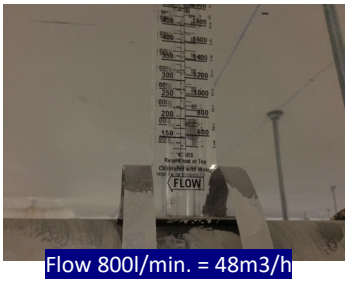

Nice pool


4 pumps, 5.5kW each – 200m3/h


4 filters d1200mm
1 collector d200mm


D200mm => 2 x 90mm


Return line 4x d63mm



Flow 800l/min. = 48m3/h

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DRYDEN AQUA DISTRIBUTION
SUSTAINABLE WATER QUALITY

DRYDEN POOL ACADEMY

OVERFLOW POOLS and BALANCE TANK

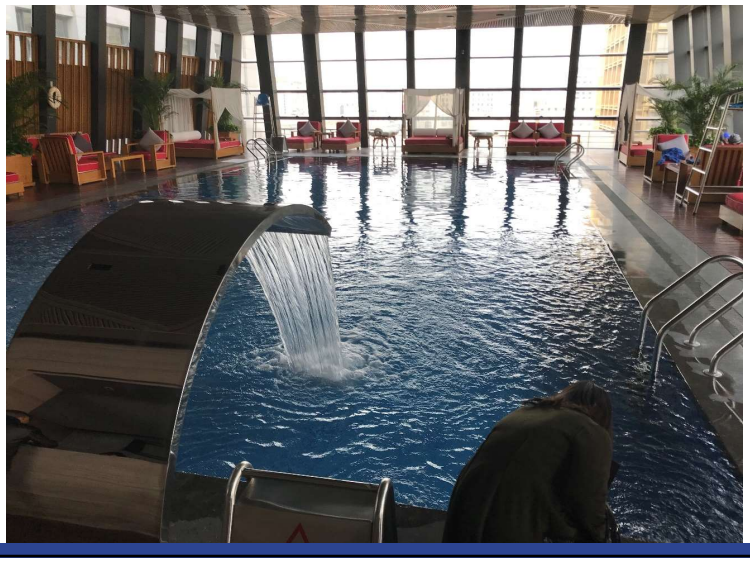
40

Hotel Hilton Bejing (20 x 8m)
Turnover-time: 8 hours

Complain 1:

There is always foam and skin oils on the water surface. Especially if the guests are using the pool after the sauna without showering

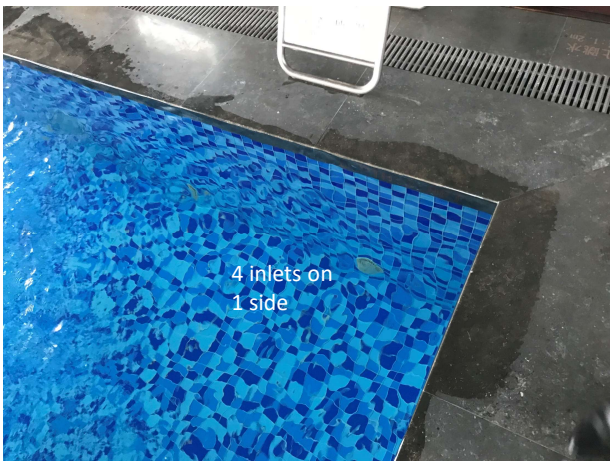
We thought with AFM we have perfect water

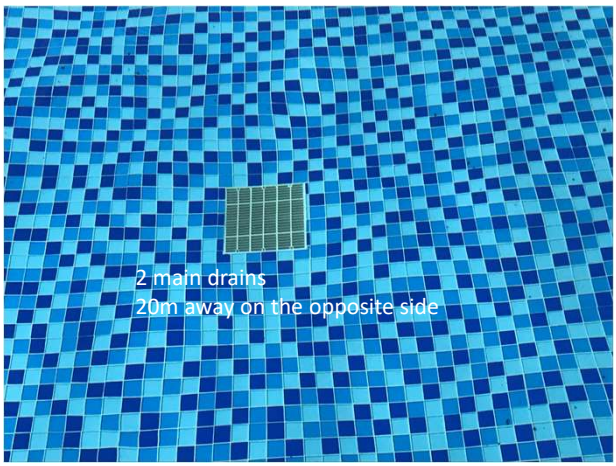


Complain 2:

There is always over- and undershooting of chlorine and pH although there is a automatic dosing. Is AFM changeing the values?

Hydraulic system





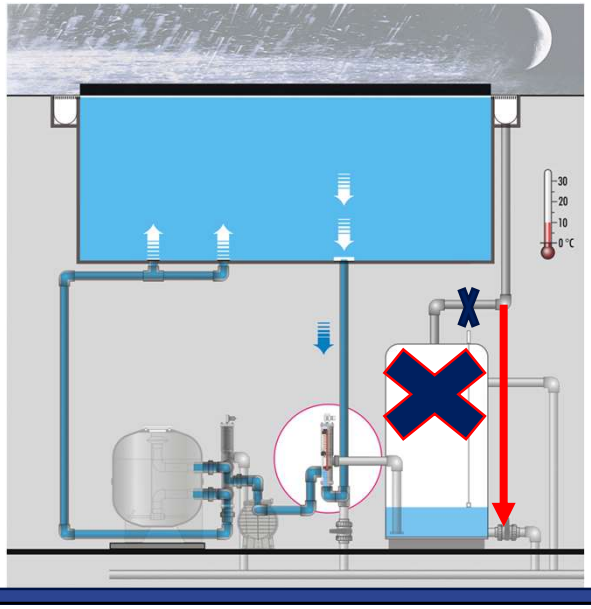
Reaction time: Minimum 8 hours – probably more because of bad pool hydraulic system

No balance tank!!

Answer:

No balance tank because there was no space

⇒ **No overflow**
⇒ **No filtration of the most polluted water: the surface water**



The channel only dumps the splash water to the drain

In this case skimmers are always much better because 70% of the pollution is in the top 30cm

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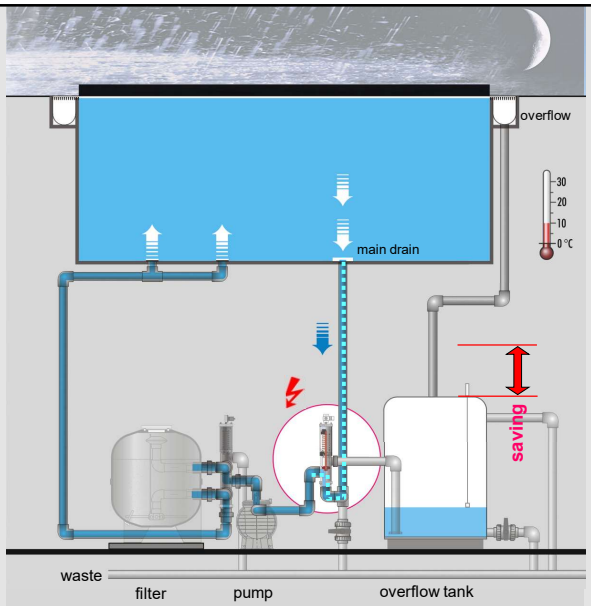

economising with besgo:

- a smaller temperature loss during the night or on cold days reduces heating costs (approx. 50%)
- lower investment costs – thanks to a smaller overflow tank

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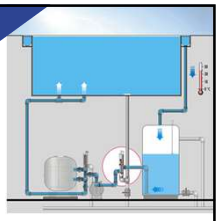
Calculating the size of the balance tank
Backwash water from balance tank



Backwash from Balance tank

Simple rule:

- 10cm (100l/m2) of the water surface

Pool 10.0 x 5.0 m – Filter 800mm

10cm (100l) x 50m² = 5,000 Litres (Net)
x 1,3 Safety margin
= ca. 6,500 Litres Gross

Exact calculation (for verification):

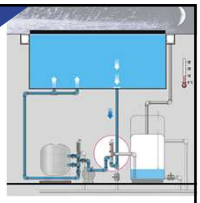
- V = Vr + Vv + Vw + Vb
- Vr: Backwash water 1m³/m²/min (60m/h backwash velocity)
- Vv: Water displacement from bathers = 75l per person
- Vw: Displacement from blowers and water attractions= 40l/m²
- Vb: Water displacement from cover = 10l/m²

• Vr: 5 Minutes Back wash: 5m³ / 0.5m² filter surface (5min)	2,500 Litres
• Vv: Water displacement from bathers (for 4 persons)= 4 x 75l	300 Litres
• Vw: Losses from waves and blowers = 40l/m²	2,000 Litres
• Vb: Volume cover: 50m² * 0.01m	500 Litres

TOTAL 5,400 Litres (net)
x 1,3 = ca. 7,000 Litres (gross)

45

Calculating the size of the balance tank
Backwash water not from balance tank



Backwash from bottom drain

Simple rule:

- 6cm (60l/m2) of the water surface

Pool 10.0 x 5.0 m – Filter 800mm

6cm (60l) x 50m² = 3,000 Litres (Net)
x 1,3 Safety margin = ca. 3,900 Litres (Gross)

Exact calculation (for verification):

- V = Vr + Vv + Vw + Vb
- Vr: Backwash water 60m³/m²/min
- Vv: Water displacement from bathers = 75l per person
- Vw: Losses from waves and water attractions = 40l/m²
- Vb: Water displacement from cover = 12l/m²

• Vr: 5 Minutes Backwash: 5m³ / 0.5m² filter surface	0 Litres
• Vv: Water displacement from bathers (for 4 persons)= 4 x 75l	300 Litres
• Vw: Losses from waves and blowers = 40l/m²	2,000 Litres
• Vb: Volume cover: 50m² * 0.01m	500 Litres

TOTAL 2,800 Litres (net)
x 1,3 = 3,640 Litres (gross)

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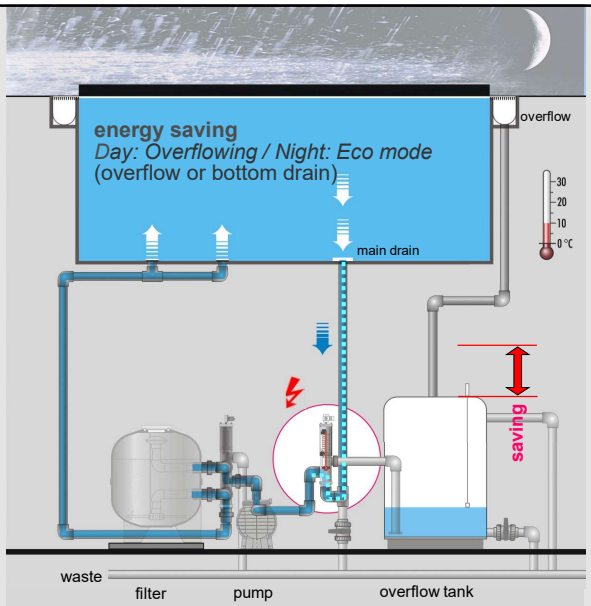

economising with besgo:

- a smaller temperature loss during the night or on cold days reduces heating costs (approx. 50%)
- lower investment costs – thanks to a smaller overflow tank

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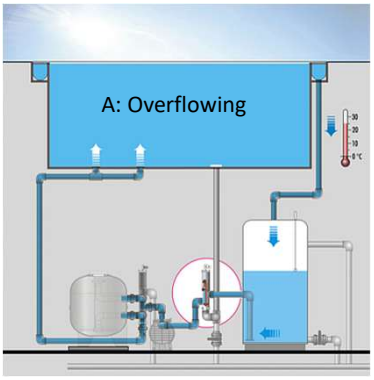
DRYDEN AQUA

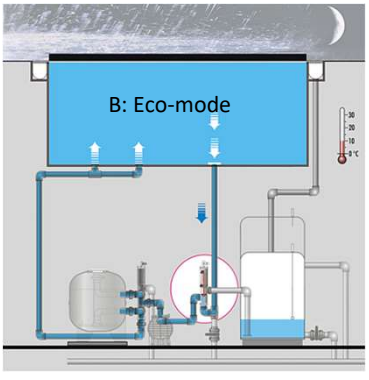
Make energy savings with the ECO MODE

DRYDEN POOL ACADEMY

Pool with overflow:
day: when you use the pool
Circulation through Overflow. **Pump on medium Speed.**
=> Perfect hydraulic



Night, cover closed:
Circulation via floor drain. No cooling of the water through the overflow channel -> saving a lot of energy. **Pump on low Speed.**
=> Compromised hydraulic



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Make energy savings with the ECO MODE

Economy mode in overflow pools: Saving of > 10'000kWh per season

For outdoor AND indoor pools

Outdoor pools:
Air 10° - water 30°
The cover protects the pool but not the channel
Usually 20% of the pool surface

Indoor pools:
You deshumidifier has no work in the economy mode

Important: Every pool must run at least for 1 cycle in the normal mode (A) to move the water in the pool and in the balance tank

Goal: avoid evaporation

YOU need 1kcal of energy to heat up 1 l of water by 1 degree
YOU need 540 kcal of energy to evaporate 1 l of water

This is why you feel chilly after showering ☺

49

3 simple steps! SESSION 3

1

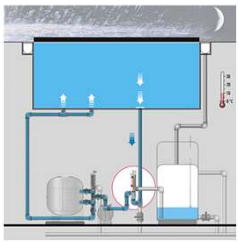
Length – Speed – Turbulence

If you slow the speed by a factor of 2, the pressure loss goes down by a factor of 4

2

Use the magic ruler
Suction side : 1,0 – 1,5 m/s
Pressure side : 1,5 – 2,0 m/s

3



Make smart energy savings with an eco mode!

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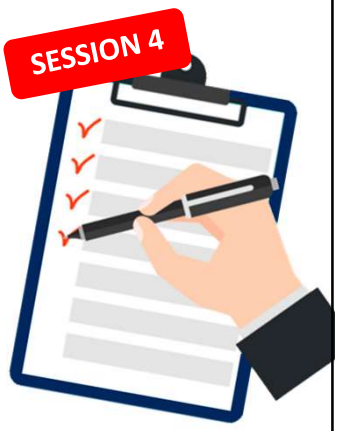
FEBRUARY 12th 2021

zoom

DRYDEN POOL ACADEMY
KNOWLEDGE IS POWER!

SESSION 4 : BIOLOGY IN FILTERS AND DISINFECTION BY-PRODUCTS



- The biology of sandfilters
- The problems with biofilm in sandfilters
- The formation of trichloramines and THM's
- The problem of chlorates and how to solve it

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DRYDEN POOL ACADEMY
KNOWLEDGE IS POWER!

DRYDEN POOL ACADEMY

Questions / Answers

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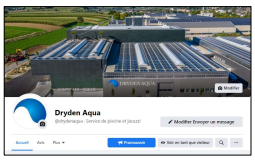
POOL ACADEMY
KNOWLEDGE IS POWER!



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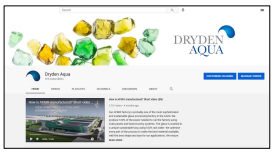

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Berechnung des Grösse des Ausgleichsbehälters Spülung aus AGB:

Überlaufrinne

Einfache Regel:

- 10 cm (100l) der Wasseroberfläche

10cm von 50m² = 5,000 Liter (Netto)
x 1,4 Reserve-Zuschlag
= ca. 7000 Liter Brutto

Exakte Berechnung (zur Überprüfung):

- V = Vr + Vv + Vw + Vb
- Vr: Spülwasser für Filter 60m3/m2/min
- Vv: Wasserverdrängung durch Badegäste = 75l pro Person
- Vw: Wellenaustrag und Schwallwasser von Wasserattraktionen= 40l/m2
- Vb: Verdrängung durch Abdeckung = 12l/m2

• Vr: Rückspülleistung für 5 Minuten 5m3 / 0,5m2 Filterfläche	2,500 Liter
• Vv: Wasserverdrängung pro Person (für 4 Personen)= 4 x 75l	300 Liter
• Vw: Wellenaustrag = 40l/m2	2,000 Liter
• Vb: Volumen Abdeckung: 50m2 * 0.012m	600 Liter
TOTAL	**5,400 Liter (netto)**
	x 1,4 = 7560 Liter (brutto)

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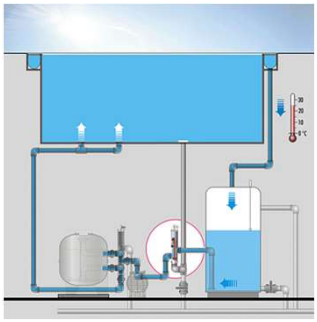
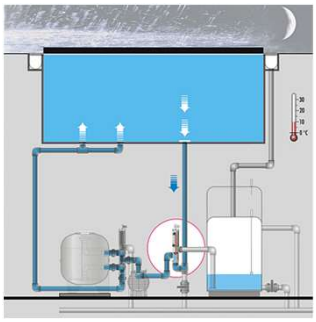
Besgo 3-Wege-Ventil

Becken mit Überlaufrinne:

Während dem Badebetrieb :
Umwälzung über Überlaufrinne. **Pumpe auf mittlerer Drehzahl.**

Nach dem Schwimmen, Abdeckung geschlossen:
Umwälzung über Bodenablauf. Keine Abkühlung des Wassers in der Rinne, wodurch viel Energie gespart werden kann. **Pumpe auf niedriger Drehzahl.**





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Überlaufrinne

Berechnung des Grösse des Ausgleichsbehälters Spülung aus Schwimmbad nicht aus AGB:

Einfache Regel:

- 5cm (50l) der Wasseroberfläche

5cm (50l/m2) von 50m² = 2,500 Liter (Netto)
x 1,4 Zuschlag (nach oben und nach unten)
= ca. 3,500 Liter Brutto

Exakte Berechnung (zur Überprüfung):

- V = Vr + Vv + Vw + Vb
- Vr: Spülwasser für Filter 60m3/m2/min
- Vv: Wasserverdrängung durch Badegäste = 75l pro Person
- Vw: Wellenaustrag und Schwallwasser von Wasserattraktionen= 50l/m2
- Vb: Verdrängung durch Abdeckung = 12l/m2

Vr: Rückspülleistung für 5 Minuten 5m3 / 0,5m2 Filterfläche	0 Liter
Vv: Wasserverdrängung pro Person (für 4 Personen)= 4 x 75l	300 Liter
Vw: Wellenaustrag und Wasserattraktionen = 40l/m2	2,000 Liter
Vb: Volumen Abdeckung: 50m2 * 0.012m	600 Liter
TOTAL	**2,900 Liter (netto)**
	x 1,4 = 4000 Liter (brutto)

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Überlaufrinne

Besonderheiten der Hydraulik bei Überlaufrinnenbecken:

- ***Grösse Rinnenleitung:*** Wasser im freien Fall (Gravitation) = **0.5 m/s*.***
- ***Gefälle Rinnenleitung:*** 1% - max. 2,5%. Grössere Neigungen fördern mehr Wasser, führen aber zu Geräuschproblemen.
- ***Geräuschminimierung durch schräge Rinnenkanten 12°***
- ***Be- und Entlüftung. Keine Engpässe einbauen (Bögen statt Winkel).*** *Bei Hallenbädern Rinnenreinigung - bei Freibädern Laubfänger einbauen.*
- ***Rinnenquerschnitt:*** *> 180cm2. Bei kleineren Rinnen mehr Abläufe und grössere Rinnenleitungen vorsehen. Abläufe mit 45° in Rinnenleitung einführen.*
- ***Anzahl Abläufe:*** *Alle 2,5 – 3m ein Abfluss DN50 - DN80. Bei offenen (flachen) Rinnen mit wenig Rückhaltevolumen muss entsprechend grösser und mehr dimension*

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Überlaufrinne

Besonderheiten der Hydraulik bei Überlaufrinnenbecken:

- ***Grösse Ausgleichstank***: Richtwert: 50 – 100l pro m2 Becken = Nettovolumen Nettovolumen x 1,4 = Bruttovolumen. AGB muss entleerbar sein (Reinigung)
- ***3-Weg-Ventil*** (Besgo) in den Ansaugbereich montieren um zwischen Rinnenbetrieb und Sparbetrieb zu wechseln. Einsparung > 10’000kWh/Saison
- **Rückspülwasser am besten aus dem Becken** nehmen (geostatische Höhe, sauberes Spülwasser, AGB kleiner). Ansaugungen müssen nach **DIN EN 13451: 0,5m/s** sicher ausgelegt werden. Immer mindestens 2 Bodenabläufe oder Ansaugungen verwenden
- ***Drehzahlgeregelte oder frequenzgesteuerte Pumpe verwenden***
- ***Rinnenbetrieb*** *muss* ***mindestens für 1 ganzen Umwälzzyklus*** *pro Tag gewährleistet sein. (bspw. 4 Stunden) => Sicherstellung Beckenhydraulik und Wasserniveau*

AQUA SOLAR

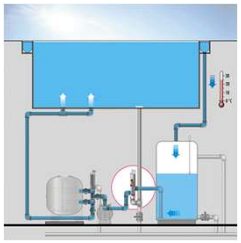
58

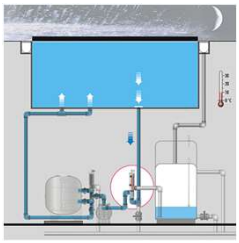
Besgo 3-Way Valves

Pool with overflow:

During bathing:
Circulation through Overflow. **Pump on medium Speed.**

After bathing, cover closed:
Circulation via floor drain. No cooling of the water through the overflow channel -> saving a lot of energy. **Pump on low Speed.**





59

Calculating the size of the expansion tank
Bach wash water from expansion tank

Overflow

Simple rule:

- 10cm (100l) of the water surface

Pool 10.0 x 5.0 x 1.5 m (75m³)
10cm (0,1m) from 50m² = 5,000 Litres (Net)
x 1,3 Safety margin
= ca. 6,500 Litres Gross

Exact calculation (for verification):

- V = Vr + Vv + Vw + Vb
- Vr: Backwash water 60m³/m²/min
- Vv: Water displacement from bathers = 75l per person
- Vw: Displacement from blowers and water attractions= 40l/m²
- Vb: Water displacement from cover = 12l/m²

• Vr: 5 Minutes Back wash: 5m³ / 0.5m² filter surface (5min)	2,500 Litres
• Vv: Water displacement from bathers (for 4 persons)= 4 x 75l	300 Litres
• Vw: Losses from waves = 40l/m²	2,000 Litres
• Vb: Volume cover: 50m² * 0.012m	600 Litres
TOTAL	**5,400 Litres (net)**
x 1,3 = ca. 7,000 Litres (gross)	

60

Calculating the size of the buffer tank
Backwash water not from buffer tank

Simple rule:

- 5cm (50l) of the water surface

Pool 10.0 x 5.0 x 1.5 m (75m³)
5cm (0,05m) von 50m² = 2,500 Litres (Net)
x 1,5 Safety margin = ca. 3,750 Litres (Gross)

Exact calculation (for verification):

- V = Vr + Vv + Vw + Vb
- Vr: Backwash water 60m³/m²/min
- Vv: Water displacement from bathers = 75l per person
- Vw: Losses from waves and water attractions = 40l/m²
- Vb: Water displacement from cover = 12l/m²

• Vr: 5 Minutes Backwash: 5m³ / 0.5m² filter surface	0 Litres
• Vv: Water displacement from bathers (for 4 persons)= 4 x 75l	300 Litres
• Vw: Losses from waves = 40l/m²	2,000 Litres
• Vb: Volume cover: 50m² * 0.012m	600 Litres
	_____
TOTAL	**2,900 Litres (net)**
	x 1,5 = 4,350 Litres

(gross)

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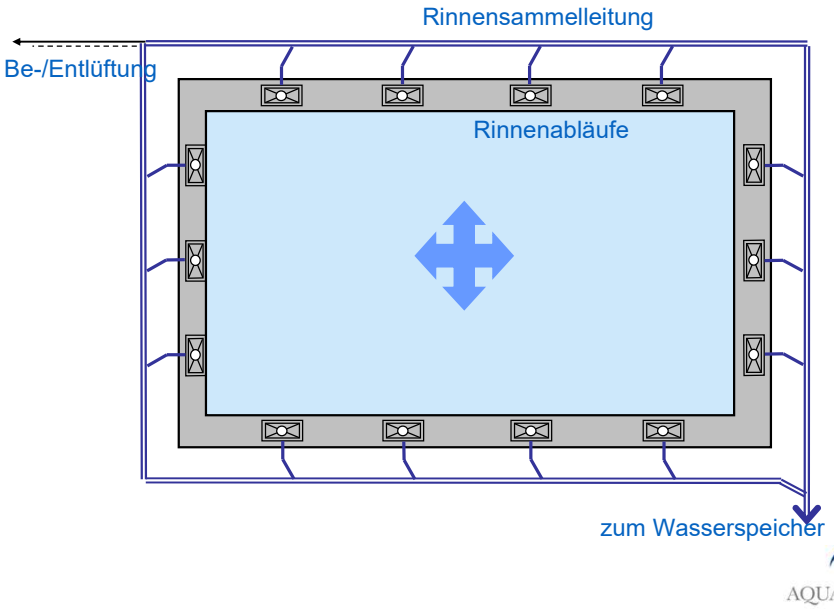
4.Rinnenbecken



AQUA SOLAR

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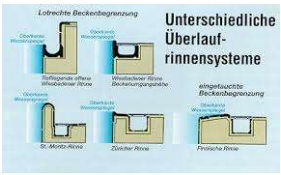
Rinnen sollten überall überlaufen



- Rinnen sollten +-1,5mm im Lot sein
- Mit viel Umwälzvolumen kann man Unebenheiten ausgleichen
- Finnische Rinnen sind ideal da wenig Ueberlauffläche
- St. Moritzrinnen sind schwierig
- 12° Neigung in der Rinne reduzieren Plätschergeräusche

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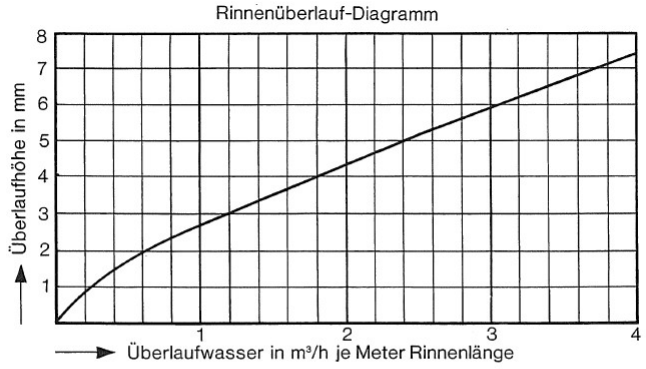

④ Rinnenüberlaufdiagramm nach Robeck; gilt nur für gleichmäßigen Wasserzufluß, bei Wellenbildung ist die tatsächliche Menge des Überlaufwassers wesentlich geringer → 438 ⑤, da mit wechselnden Höhen (Sinuskurve) gerechnet werden muß; 1 l/s ≙ 3,6 m³/h

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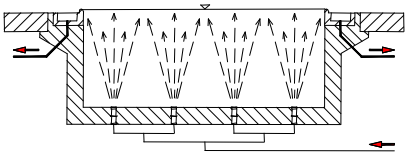
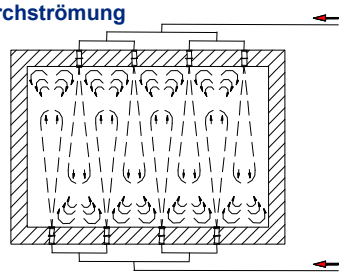
Reinwassereinströmung

Vertikale Durchströmung



Horizontale Durchströmung



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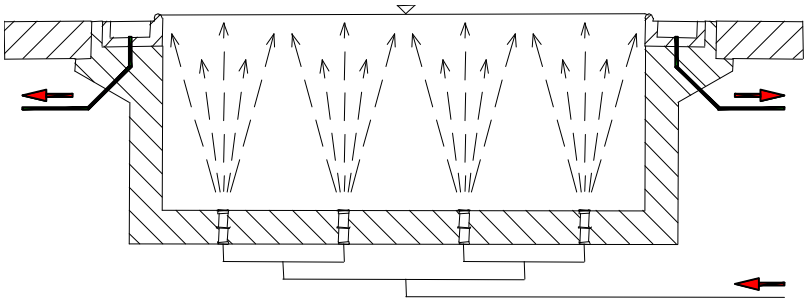
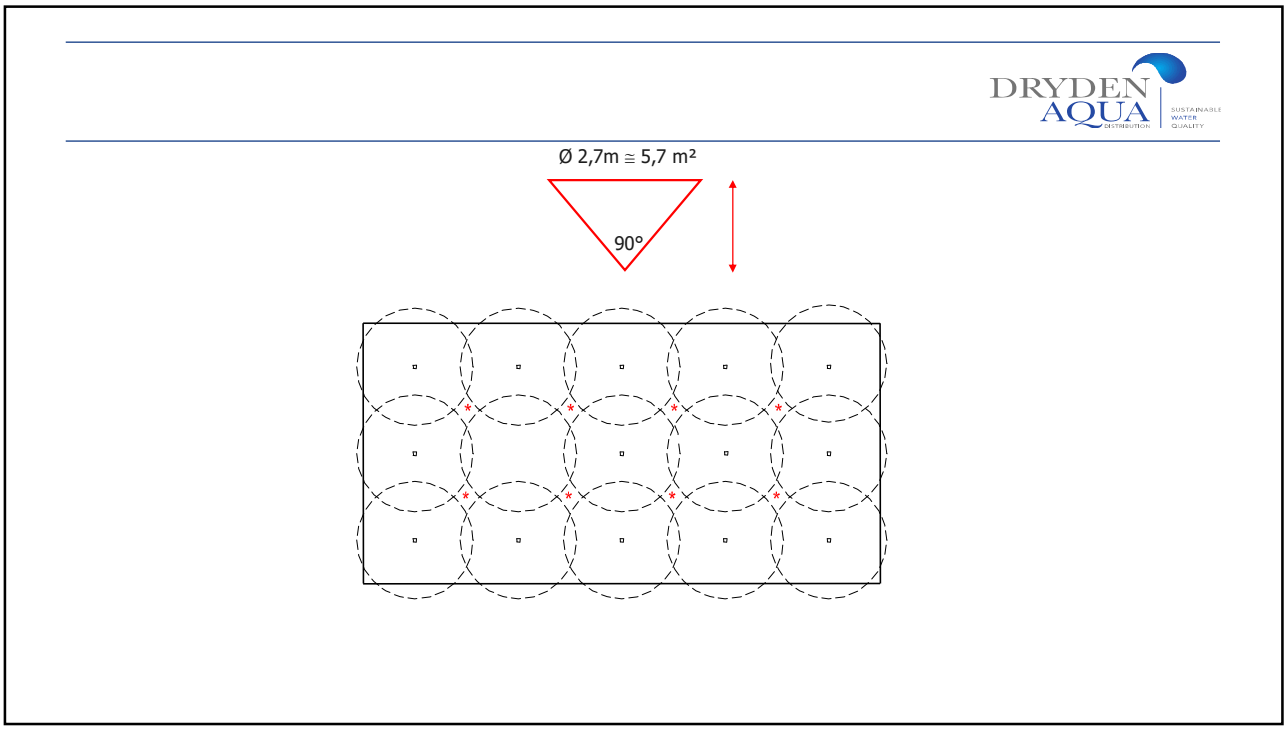


66



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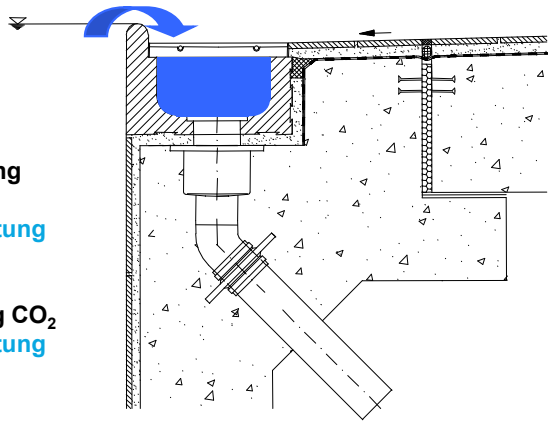
Nachteile von Rinnenbecken



- **Verdunstung (Wärme)**
  => Sparschaltung
- **Ausgasung CO_2**
  => Sparschaltung
- **Geräusche**
  => Sparschaltung

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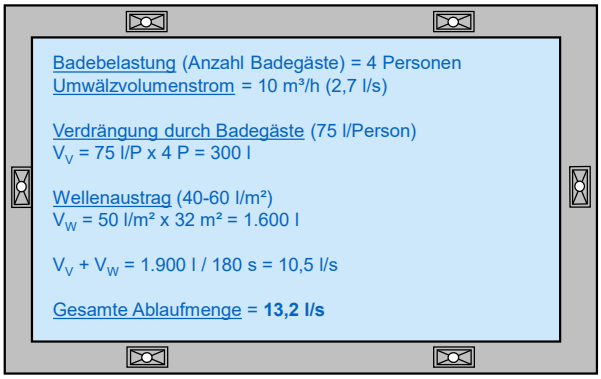
Rechenbeispiel: Schwimmbecken 8m x 4m (32m²)
Anzahl Abläufe – Grösse Rinnenleitung



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Rinnenabläufe: Anzahl und Grösse

Rinnenabläufe	DN	50	65	80	100	125	150	200	250	300	350	400	500
Ablaufvolumen ohne Sieb	l/s	1,4	2,5	5,3	9	14	18	34	50	80	130	190	310

Tabelle 83: Max. Abflußspende für Rinnenabläufe ohne Siebabdeckung

Die Nennbelastung für Rinnenabläufe mit Siebabdeckung beschränkt sich auf die Ablaufdurchmesser der Rinnensteine. Sie betragen ca. DN 50 = 1,0 - 1,2 l/s / DN 65 = 1,8 - 2,3 l/s / DN 80 = 4,0 - 5,0 l/s

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Ablaufdiagramm Rinnenleitung bei versch. Gefällen

	Gefälle															
	1%		2%		3%		4%		5%		10%		15%		20%	
	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
NW 50	1,1	0,56	1,6	0,84	2,0	1,04	2,4	1,21	2,7	1,36	3,8	1,96	4,7	2,42	5,5	2,80
80	3,9	0,77	5,8	1,15	7,2	1,42	8,3	1,65	9,3	1,86	13,4	2,66	16,5	3,28	19,1	3,80
100	7	0,89	10,5	1,33	12,9	1,65	15,0	1,91	16,9	2,15	24,1	3,07	29,7	3,78	34,4	4,38
125	12,7	1,04	18,9	1,54	23,3	1,90	27,1	2,21	30,4	2,48	43,4	3,54	53,4	4,35	61,8	5,04
150	20,6	1,17	30,6	1,73	37,8	2,14	43,8	2,48	42,2	2,78	70,1	3,97	86,2	4,88	99,8	5,65

③ Abflußmenge Q (l/s) und Wassergeschwindigkeit V (m/s) für glatte Abflußrohre (k = 0,1 mm) bei Vollfüllung für verschiedene Gefälle nach R. Lautrich; bei Teilfüllung h/D = 90% (z. B. Lufteinschlüsse von 1/10 Rohrdurchmesser-Höhe) praktisch keine Verringerung der Abflußmenge. Bei zusammenhängenden Rohrteilen (ohne Zwischenentlüftung) kann m. E. das durchschnittliche Gefälle zugrunde gelegt werden aus Leitungslänge und Höhenunterschied (Höhenverlust durch Krümmer etc.; durch ungeschickte Ausbildung der Einläufe und Leitungen (scharfkantig, Eckwinkel etc.) kann sich die tatsächliche Leistung bis auf 50% reduzieren. Näheres hierzu → Lautrich → Lit.

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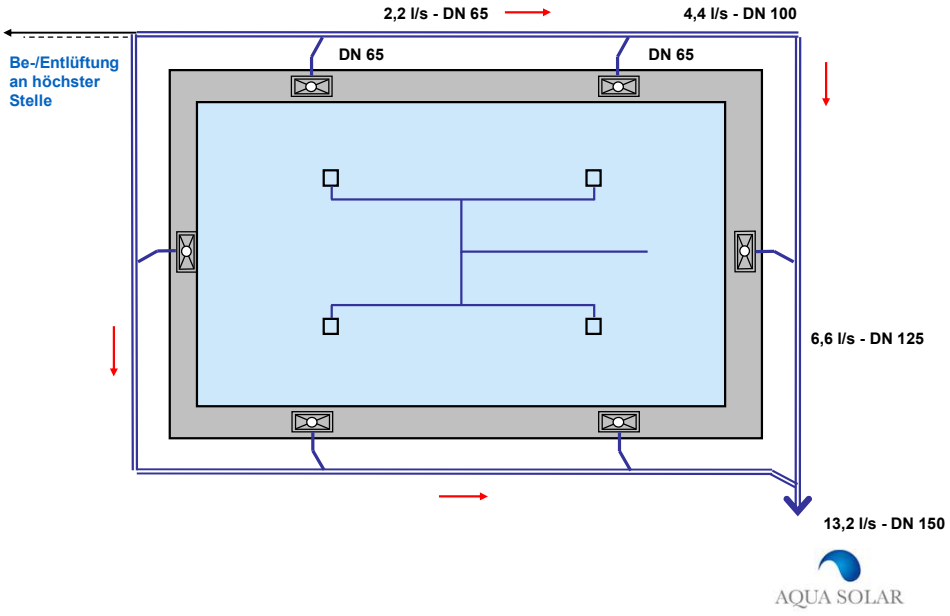
Rechenbeispiel: Schwimmbecken 8m x 4m = 32m2



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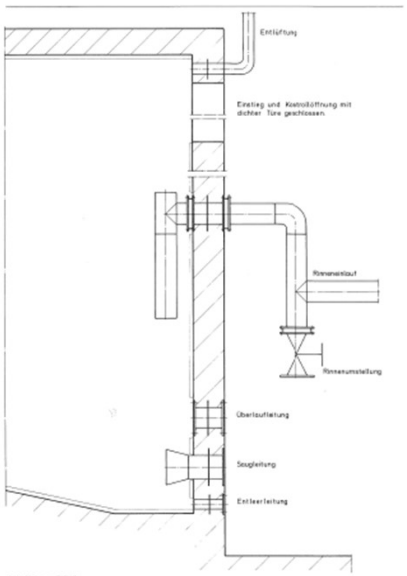

Abbildung 7.5.1.
Schnittzeichnung durch ein Ausgleichsbecken mit Rinneneinlaufleitung, Überlaufleitung, Saugleitung der Pumpen und Entleerung. Bei der Grössenbestimmung ist ausserdem zu berücksichtigen, dass ein minimaler Wasserstand notwendig ist zur Trockenlaufsicherung der Pumpen. Der max. Wasserstand ist durch die seitliche Einstiegöffnung gegeben.

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