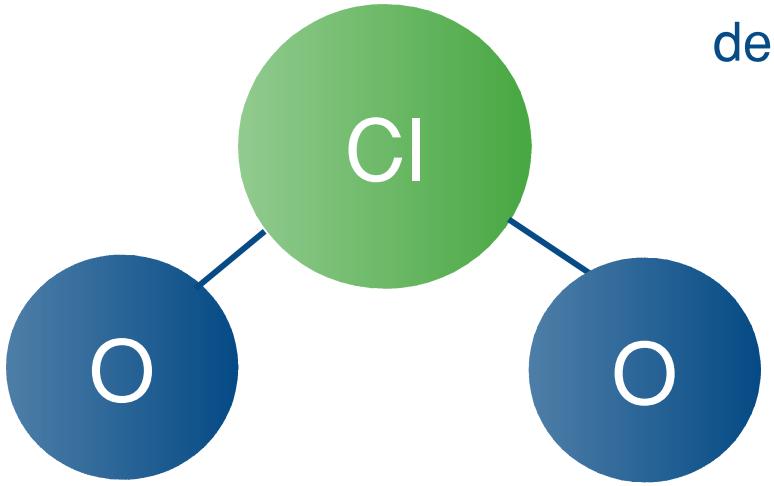
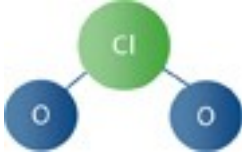
DEZINFECTIE
cu dioxid de clor

Dioxidul de clor – ClO_2

"Folosit la tratarea apei de peste 60 de ani."



Nume	Dioxid de clor
Sinonime	"clor-O-2", clor dioxid, peroxid de clor
Formula	ClO_2
Greutate moleculara	67.4518
CAS No.	10049-04-4

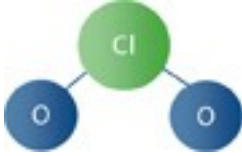


Proprietati fizice

Aspect	Gaz galben verde spre orange-rosu. Solid cristalin rosu
Mod de livrare	Generat on-site; transportul nu este permis
Punct de topire/inghet	-59.5°C (-75.1°F)
Punct de fierbere	10.9°C (51.6°F) la 760 mmHg / 9.9°C (49.8°F) la 731 mmHg
Temperatura critica	192°C (377.6°F)
Presiune critica	8621.6kPa (1250.6 psia)
Det. Temp. punct triplu	-59.5°C (-75.1°F)
Det. Pres. Punct triplu	1.2544 kPa (9.4 mmHg abs)

Proprietati in functie de temperatura

Capacitate calorica a gazului	0.0408 kJ/(gm-mol K) la 0°C 0.0417 kJ/(gm-mol K) la 20°C 0.0425 kJ/(gm-mol K) la 40°C
Caldura de vaporizare	26.937 kJ/gm-mol la 0°C 25.825 kJ/gm-mol la 20°C 24.629 kJ/gm-mol la 40°C

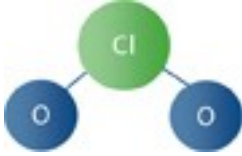


Densitati

Gaz	3.09 g/l la 11°C
Lichid	1.773 g/mL la -55°C 1.640 g/mL la 0°C 1.614 g/mL la 10°C

Proprietati termodinamice

Caldura de formare	24.50 kcal/gm-mol
Energia Gibbs de formare	28.80 kcal/gm-mol
Entropie ideala a gazului	0.257kJ/gm-mol K
Caldura neta de combustie (gaz)	-24.50 kcal/Gm-mol
Caldura de dizolvare in apa	6.6 kcal/gm-mol
Volum lichid molar	4.1852x10-2 m3/kmol



Structura

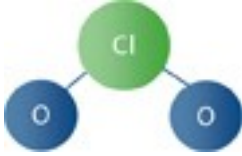
Unghi de legatura	117.5°
Lungime de legatura	0.147 nm
Moment dipol	5.95x10-30 C*m
Factor acentric	0.35638
Raza de rotire	2.8030x10-10 m
Structura	

Proprietati fizice ale dioxidului de clor

- Gaz galben-verde
- Nu poate fi comprimat sau depozitat
- Se va evita depozitarea in spatii deschise a solutiilor concen
- Solubilitate in apa mai buna decat ozonul si clorul (20 litri ClO_2 in 1 litru apa)
- Solutia apoasa este stabila cateva zile
- Dixidul de clor se descompune la temperaturi inalte si dupa expunere la UV
- Reactivitate superioara pt. oxidare si dezinfectie

Dioxidul de clor este instabil si are tendinta, in faza de gaz, de a se descompune in amestecuri explozive la o concentratie de peste 10 % vol(=300 g/m3).

O explozie este inca posibila dupa 15 sau 30 minute.

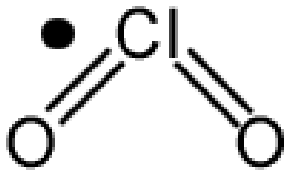


Reactii cu substante organice

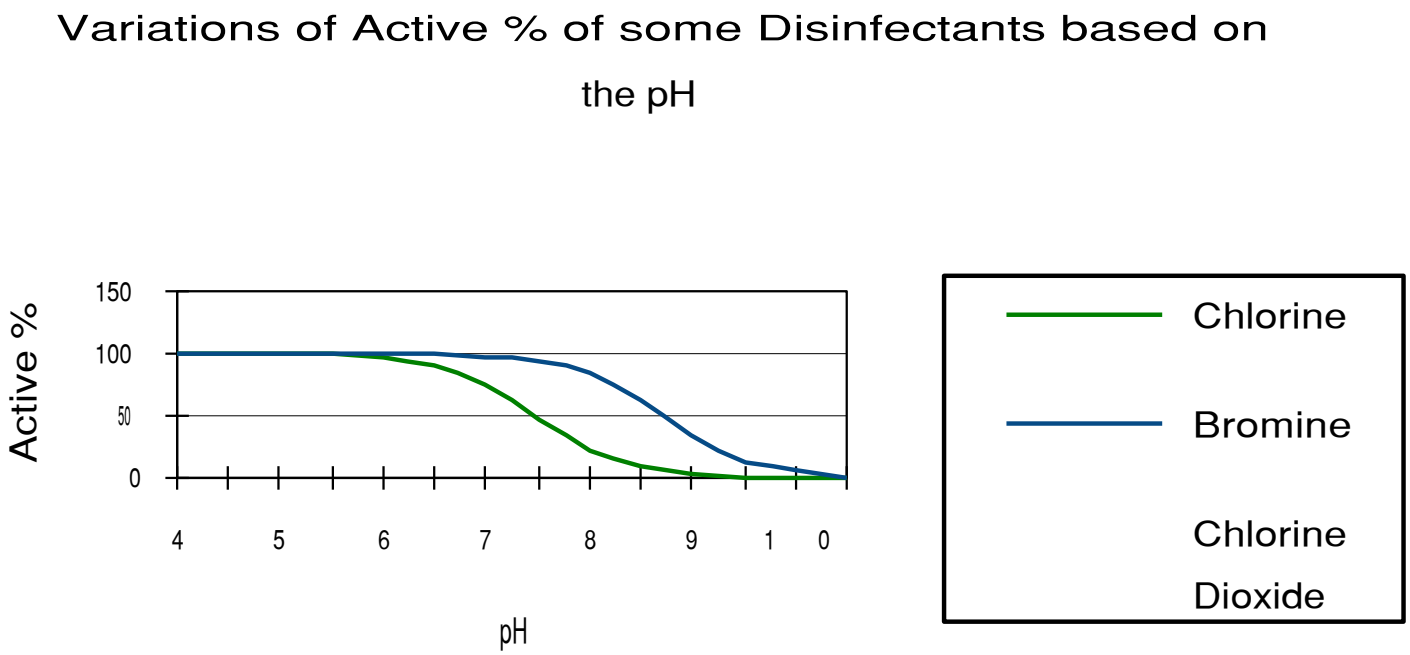
Datorita structurii sale dioxidul de clor reactioneaza doar ca un oxidant; dioxidul de clor nu clorineaza

- Scazuta capacitate de formare de THM (Trihalometan, ex. Cloroform)
- Nu formeaza clorofenoli
- Nu formeaza AOX
- Nu reactioneaza cu Amoniacul

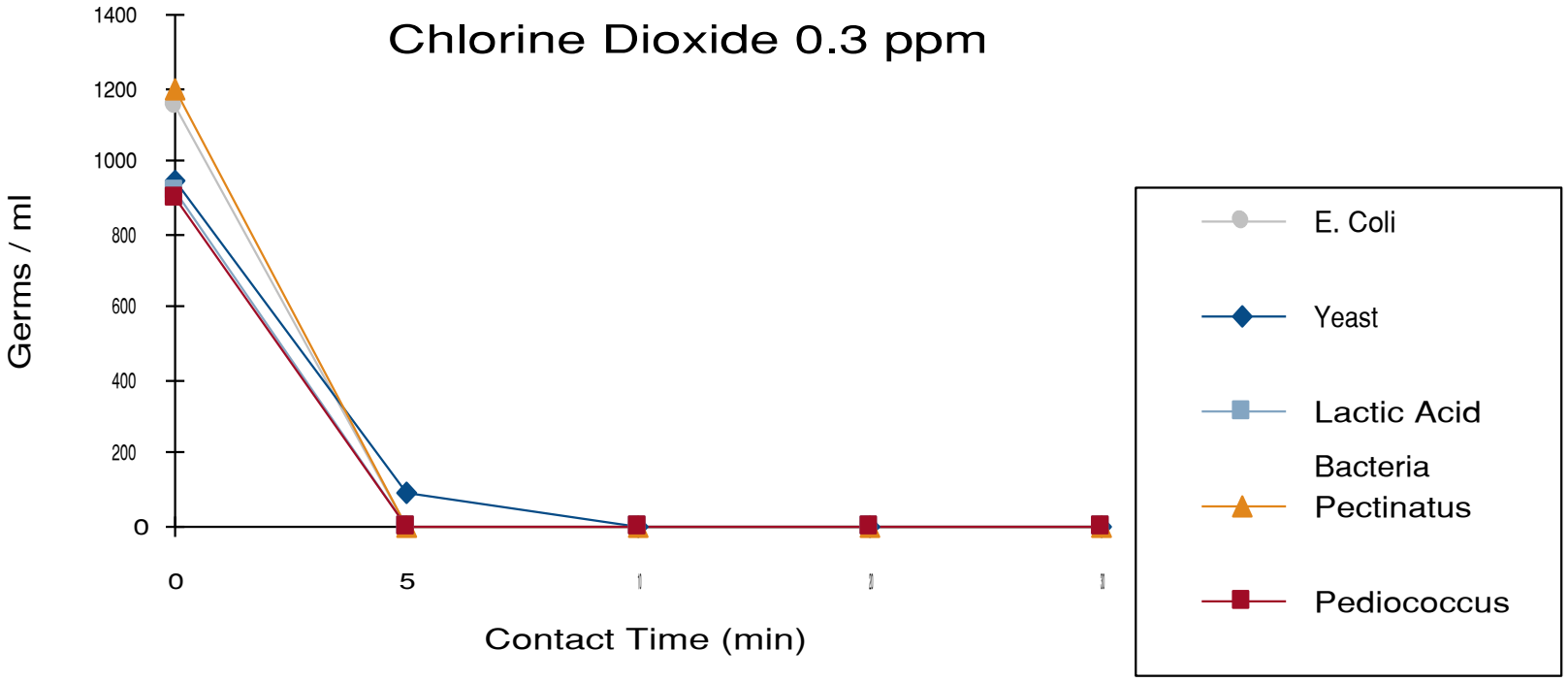
  (Important in special la tratamentul apelor reziduale cu mare incarcare organica – tipic pt. continut important de amine)

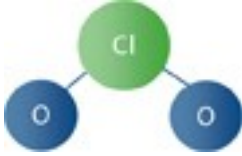


Dependenta de variatia valorii pH



Eliminarea bacteriilor





ClO_2

Concluzii:

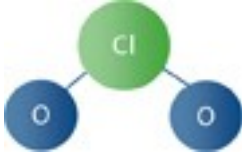
- Inalta reactivitate pt. dozare si dezinfectie
- Dar: limitari pt. folosirea directa
  - Gazul nu poate fi comprimat sau stocat
  - Solutia apoasa este stabila doar cateva zile
  - Dioxidul de clor se descompune la temperaturi inalte si expunere la UV

SI

- Transportul nu este permis !

Intrebare:

Cum se foloseste practic ClO_2 ca dezinfectant?



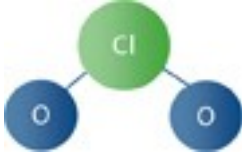
ClO_2

ClO_2 este generat si utilizat on-site (in locul de dozare)

" in situ nascendi"

Chimie & tehnologie

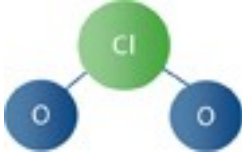
Reactie chimica & reactor (generator ClO_2)



Dioxidul de clor stabilizat

- Cateva companii ofera solutii apoase cu continut de circa 5% dioxid de clor
- Aceste companii isi aroga meritul de a fi gasit o cale de stabilizare a dioxidului de clor
- Acest fapt nu este in natura lucrurilor
- Uzual se ofera o solutie de clorit de sodiu ($NaClO_2$) care are o eficienta mult inferoara celei a dioxidului de clor (ClO_2)

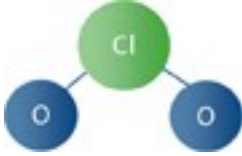
Nu este adevarat ca solutia de ClO2 este stabila!



Metode de producere a dioxidului de clor

Metode/Reactii chimice:

- 1. Metoda : Clorit ($NaClO_2$) – Clor(Cl_2)
- 2. Metoda : Clorit ($NaClO_2$) – Acid (HCl)



1. Metoda Clorit – Clor

Substante chimice: Clorit de sodiu $NaClO2$ (24,5%)

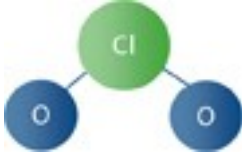
Clor gazos $Cl2$ (amestec cu apa 3 g/l)

Reactie: $\mathbf{NaClO_2 + Cl_2 \rightarrow 2\ ClO_2 + 2\ NaCl}$

(181g $NaClO_2$ + 71gCl_2 -> 135g ClO_2 + 117g NaCl)

Pt. 1 kg ClO2 avem nevoie de 525 g Cl2 si 1340 g clorit de sodiu

Clorul (Cl2) este utilizat, in principal, in aplicatii pentru apa potabila si retele de alimentare si distributie cu apa.



2. Metoda Clorit – Acid

Solutii diluate

Substante chimice: Clorit de sodiu $NaClO_2$ (7,5%)

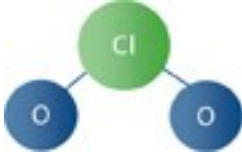
Acid clorhidric HCL (9,0%)

Reactia: **$5\ NaClO_2 + 4\ HCl \rightarrow 4\ ClO_2 + 5\ NaCl + 2\ H_2O$**

(452g $NaClO_2$ + 146g HCl -> 270g ClO_2 + 292g NaCl + 36g H_2O)

Pt. 1000g ClO2 avem nevoie de: 1647g clorit and 541 g HCl (+300%)

-> pur stoechiometric (referitor la reactia chimica)



2. Metoda Clorit – Acid

Solutii concentrate

Substante chimice: Clorit de sodiu $NaClO_2$ (24,5%)

Acid clorhidric HCL (30%)

Apa H_2O

In aceleasi conditii ca si in cazul solutiilor diluate:

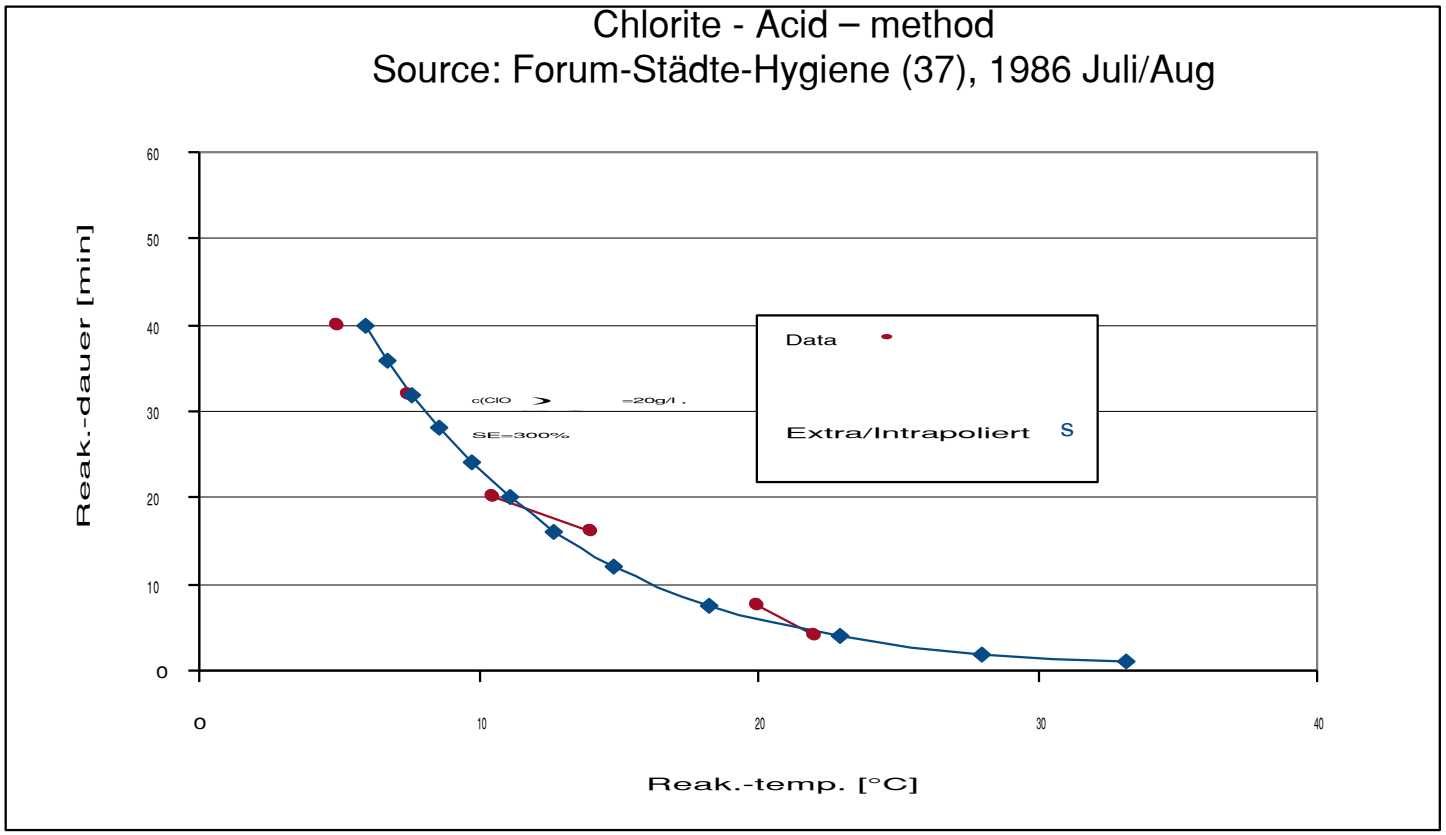
Reactie: $\mathbf{5\ NaClO_2 + 4\ HCl \rightarrow 4\ ClO_2 + 5\ NaCl + 2\ H_2O}$

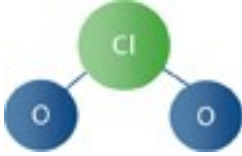
HCl este diluat cu apa inainte de reactor.

Atentie: Apa este folosita pt. diluarea acidului si nu se adauga in clorit pt. a evita precipatarea datorita duritatii (>4° dH)

Reactia chimica

Viteza de reactie depinde de temperatura (cu acid in exces de 300%)





Generatorul de ClO_2

Echipament automat cu:

- Linii de dozare pt. 2 (3) substante chimice
- Reactor tip tank flow, unde are loc reactia de formare a ClO2
- Unitate de control

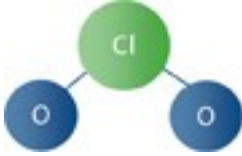
ClO2 este produs in reactor ca solutie apoasa (circa 2%).

Generatorul poate functiona:

- "on-line"
- "batch"

Generatorul tip **ON-LINE**: solutia 2% din reactor este imediat diluata pana la 1-3,3 g/l solutie ClO_2 si este transferata in apa care se dezinfecteaza (spre punctul de dozare).

Generatorul tip **BATCH**: solutia 2% din reactor este imediat diluata pana la 1-3,3 g/l solutie ClO_2 si este colectata in intr-un rezervor special.



Generatorul de ClO_2

Linia de produse Alldos pt. generatoare de ClO2: **Oxiperm®**

2 linii:

1) (cu clorit de sodiu si acid clorhidirc)

Oxiperm® 16**4** reactie: Clorit ($NaClO_2$) – Acid (HCl)

Oxiperm® 16**4 D** substante diluate

Oxiperm® 16**4 C** substante **c**oncentrate

Oxiperm® Pro 16**2**

2) (cu clorit de sodiu si clor gazos)

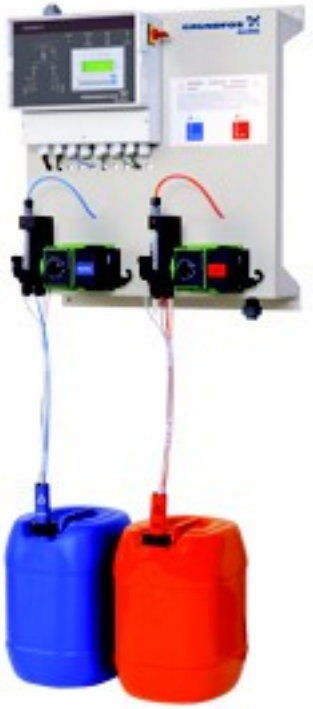
Oxiperm® 16**6** reactie: Clorit ($NaClO_2$) – Clor (Cl_2)

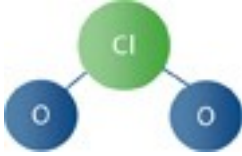
Generatorul de ClO_2

Oxiperm® 164 pt. reactia Clorit – Acid

Oxiperm® 164 **D** pt. substante **d**iluate

$5\ NaClO_2 + 4\ HCl \rightarrow 4\ ClO_2 + 5\ NaCl + 2\ H_2O$





Oxiperm® 164

Model Order No.	Capacitate ClO_2 g/h	Consum componente l/h				
		HCl	$NaClO_2$	H_2O contin.	H_2O batch	
					3,3 g ClO_2/l	2g ClO_2/l
164-005D	5	0.12	0.12	150	-	-
164-010D	10	0.23	0.23	150	-	-
164-030D	30	0.7	0.7	420	6	14
164-120D	120	2.9	2.9	420	25	55
164-220D	220	5.2	5.2	420	45	100
164-350D	350	8.3	8.3	420	70	160
164-700D	700	16.5	16.5	900	140	320
164-1000D	1000	24	24	900	200	450
164-1500D	1500	35	35	900	300	680
164-2000D	2000	48	48	900	400	900

P max: 10 bar (pt. 5-1500) si 9 bar (pt. 2000)

Generatorul de ClO_2

Oxiperm® 164 pt. reactia Clorit – Acid

Oxiperm® 164 **C** pt. substante **c**oncentrate

$5\ NaClO_2 + 4\ HCl \rightarrow 4\ ClO_2 + 5\ NaCl + 2\ H_2$

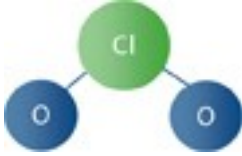
Generatorul de ClO_2

Oxiperm® 164 pt. reactia Clorit – Acid

Oxiperm® 164 **C** pt. substante **c**oncentrate

Tip "batch"

$5\ NaClO_2 + 4\ HCl \rightarrow 4\ ClO_2 + 5\ NaCl + 2\ H_2$



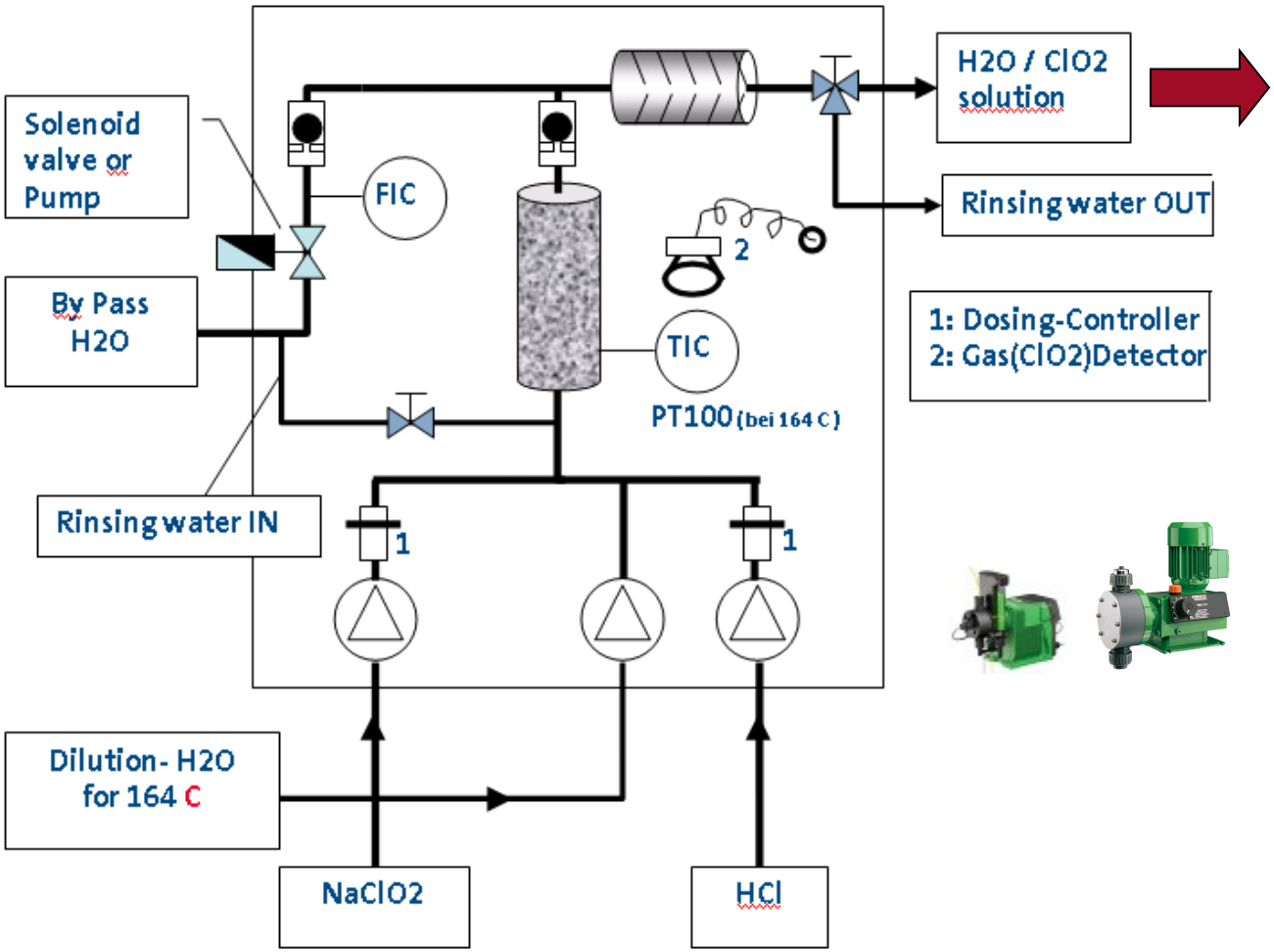
Oxiperm® 164

Model Order No.	Capacitate ClO_2 g/h	Consum componente l/h					
		HCl	$NaClO_2$	H_2O dil.	H_2O bypass	H_2O batch	
						3.3g ClO_2/l	2g ClO_2/l
164-150C	150	1.0	1.0	5.5	420	30	70
164-450C	450	2.8	2.8	16	420	90	200
164-750C	750	4.8	4.8	27	900	150	340
164-1300C	1300	8.2	8.2	46	900	260	590
164-2500C	2500	16.0	16.0	90	900	510	1150
Sisteme pt 3 g/l tip "batch" cu dozare in afara tancului buffer integrat cu extragere din faza gazoasa				H_2O Bypass si diluare		H_2O Extractie, injector buffer tank	H_2O total
164-4000C	4000	24	24	1290		1400	2690
164-6000C	6000	37	37	1965		1900	3865
164-7500C	7500	46	46	2415		2300	4715
164-10000C	10000	63	63	3215		3100	6315

Pmax : 9 bar (pt 150 -1300) si 10 bar (pt 2500)

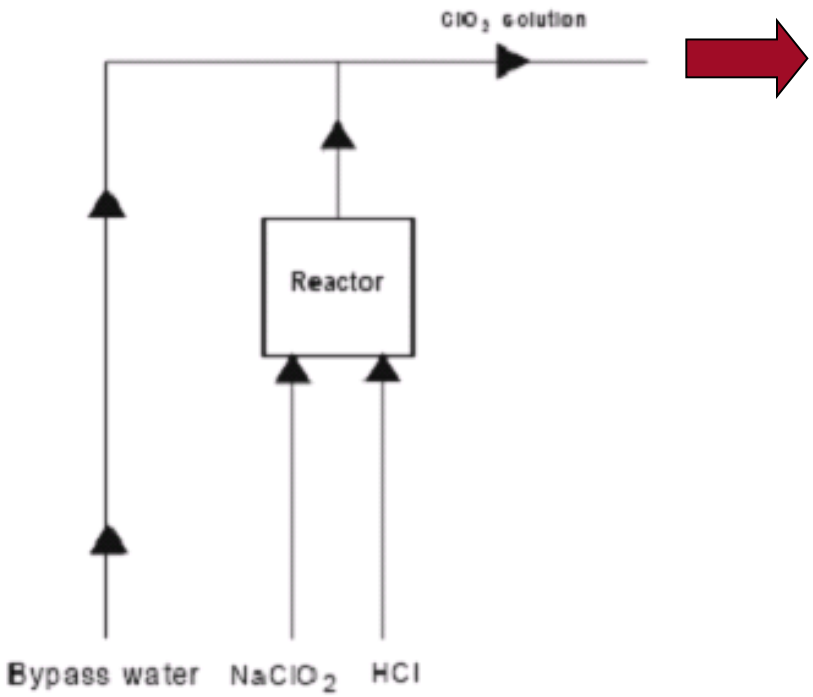
Generatorul de ClO_2

Oxiperm® 164
Oxiperm® 164 **D**
Oxiperm® 164 **C**

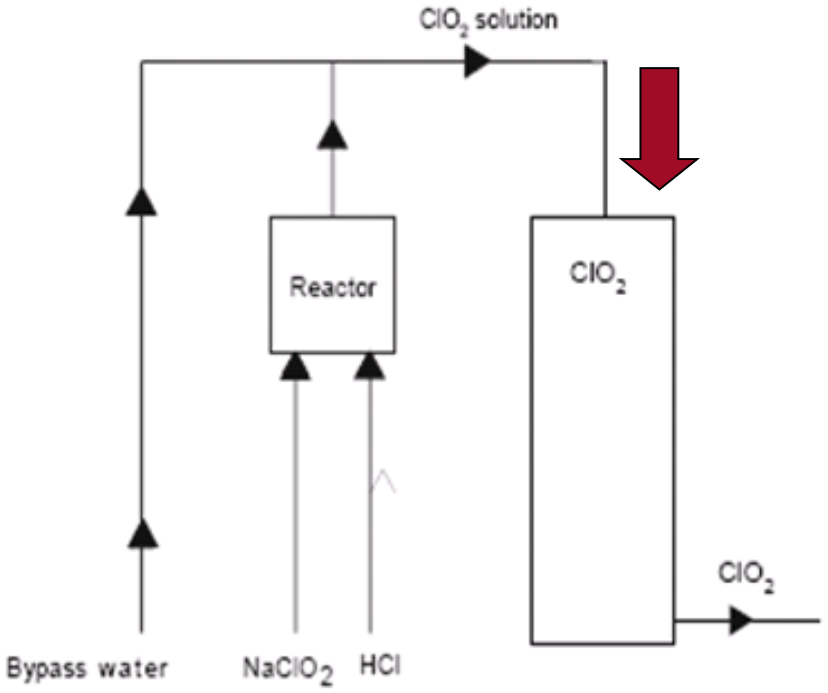


Tip de functionare

"on-line"



"batch"



Oxiperm® 164 C pentru substante chimice concentrate

Tip “batch”

Proiect nou pt. 4.000 – 10.000 g/h

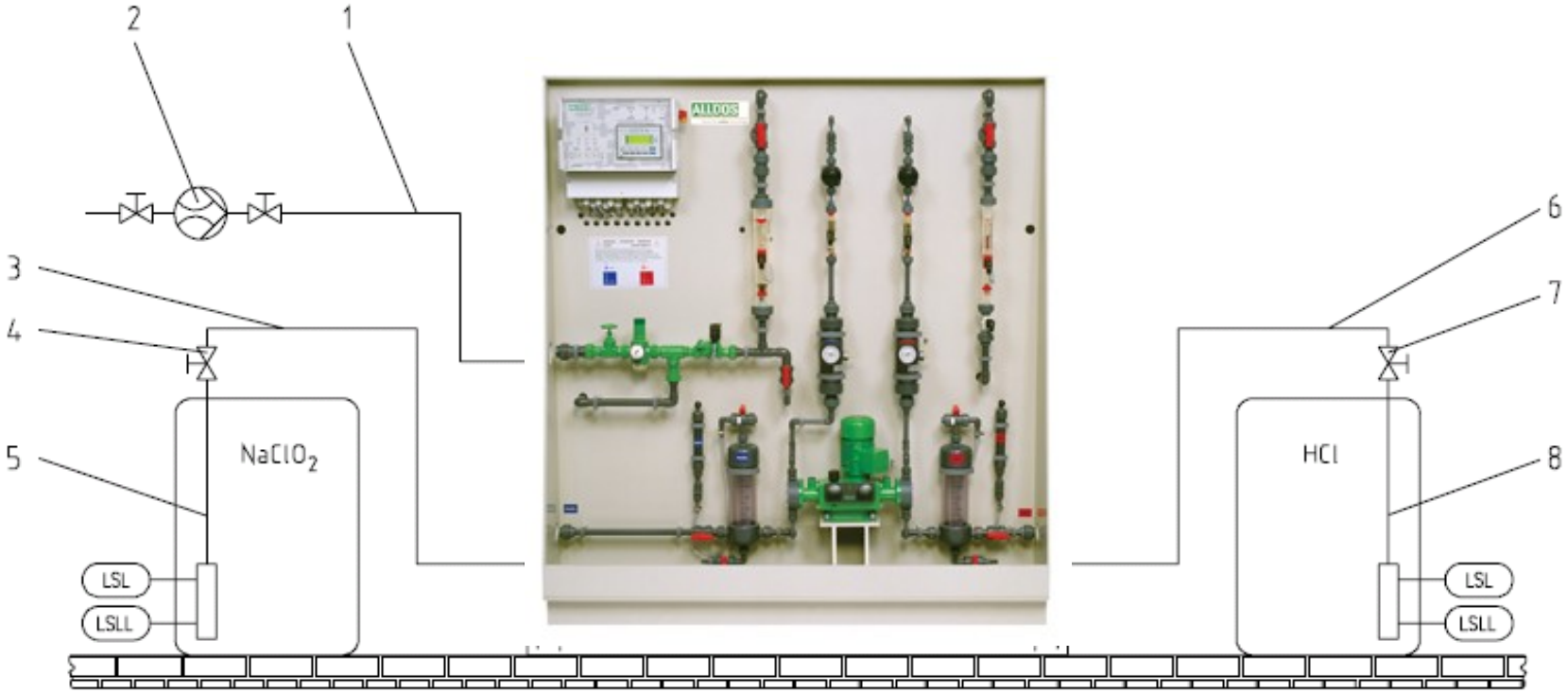
Caracteristici:

Se aplica in general in sistemele mari de alimentare cu apa (conc. Injectie = 0.4 g/m^3 -> 10.000 pana la 25.000 m^3/h -> 2,7 to 6,9 m^3/sec.)

Supapa de presiune este in linie cu “batch tank” pt. a evita curgerea amestecului in directia valvei solenoide.

Oxiperm® 164 C pentru substante chimice concentrate

Tip “batch”



Oxiperm® 164 C pentru substante chimice concentrate

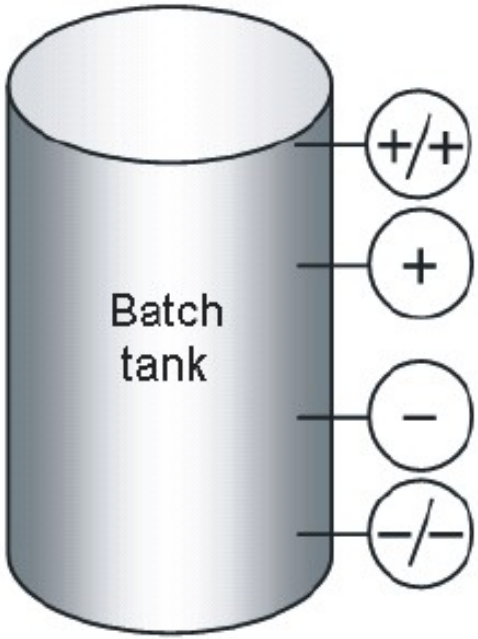
Tip "batch"

- Concentratie reglabila in domeniul 2 – 3,3 g/l
- Rezervorul de apa si "buffer tank" incluse
- Aceleasi aspecte legate de siguranta cu PT 100 la reactor, indicatii de la toate componentele
- Vasul de absorbtie a ClO2 gazos cu carbune activ instalat la "buffer tank" pt. ventilare

Oxiperm® 164 C pentru substante chimice concentrate

Tip “batch”

The batch tank has four level switches.

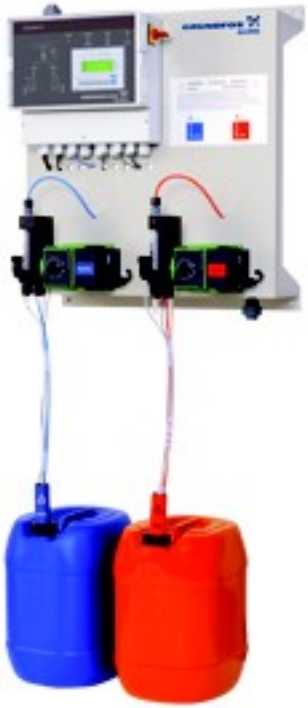


Max/Max: Overflow protection (alarm)

Max: Filling - Oxiperm STOP

Min: Filling - Oxiperm START

Min/Min: Dry running protection (alarm)

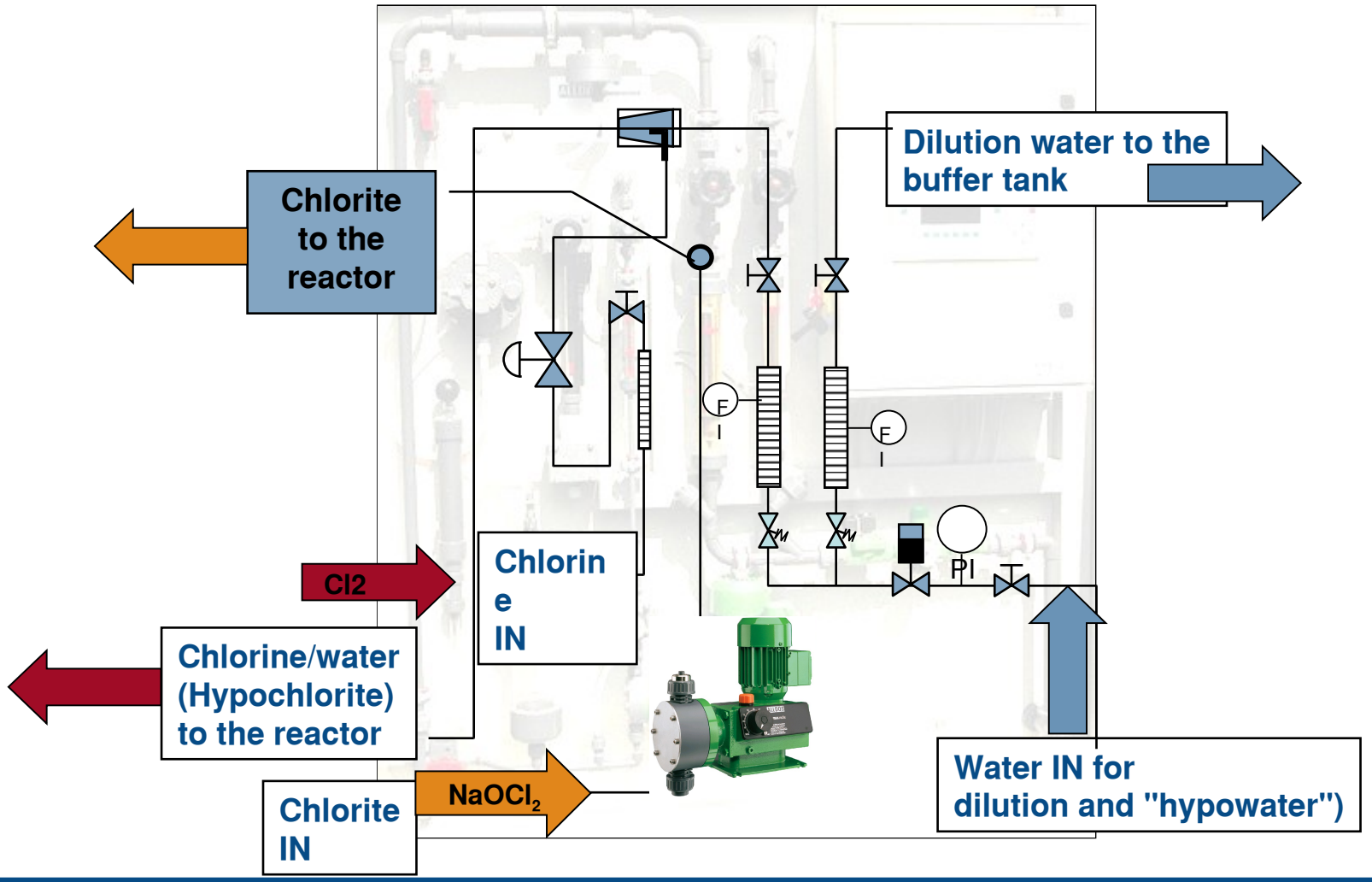


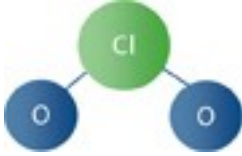
Generatoare de ClO_2

Oxiperm® 166 reactia: Clorit ($NaClO_2$) – Clor (Cl_2)

$NaClO_2 + Cl_2 \rightarrow 2\ ClO_2 + 2\ NaC$

Generatoare de ClO_2





Oxiperm® 166

Model Order No. (A or G)	Capacitate ClO_2 g/h	Consum componente				
		Clor gazos (kg/h)	$NaClO_2$ (l/h)	H_2O (l/h) Chlorine injector and dilution	H_2O (l/h) Gas suction injector	H_2O (l/h) total
166-007 A/G	750	0.5	3.6	240	700	940
166-015 A/G	1500	1.0	7.2	480	1100	1580
166-025 A/G	2500	1.65	12	800	2400	3200
166-050 A/G	5000	3.3	24	1590	2200	3790
166-075 A/G	7500	4.9	36	2400	3400	5800
166-100 A/G	10000	6.6	48	3200	4200	7400

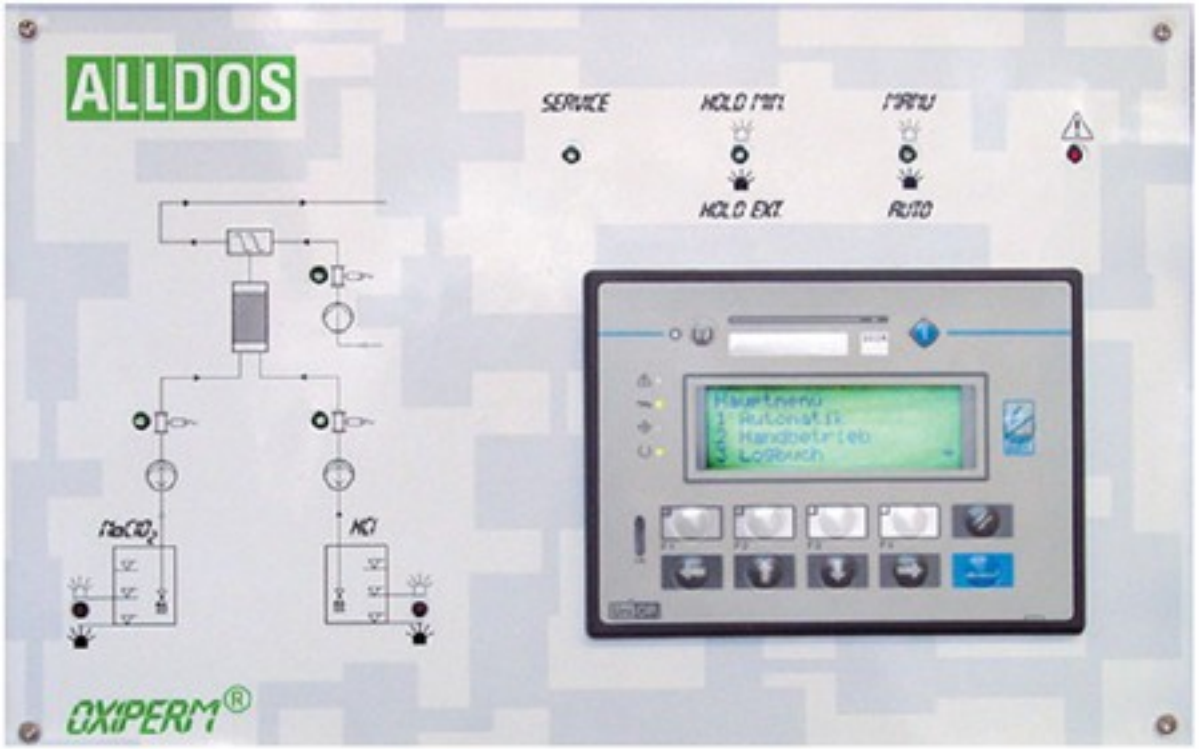
Presiune de lucru 5 bar

Concentratie in batch tank 3 g/l

Reactor

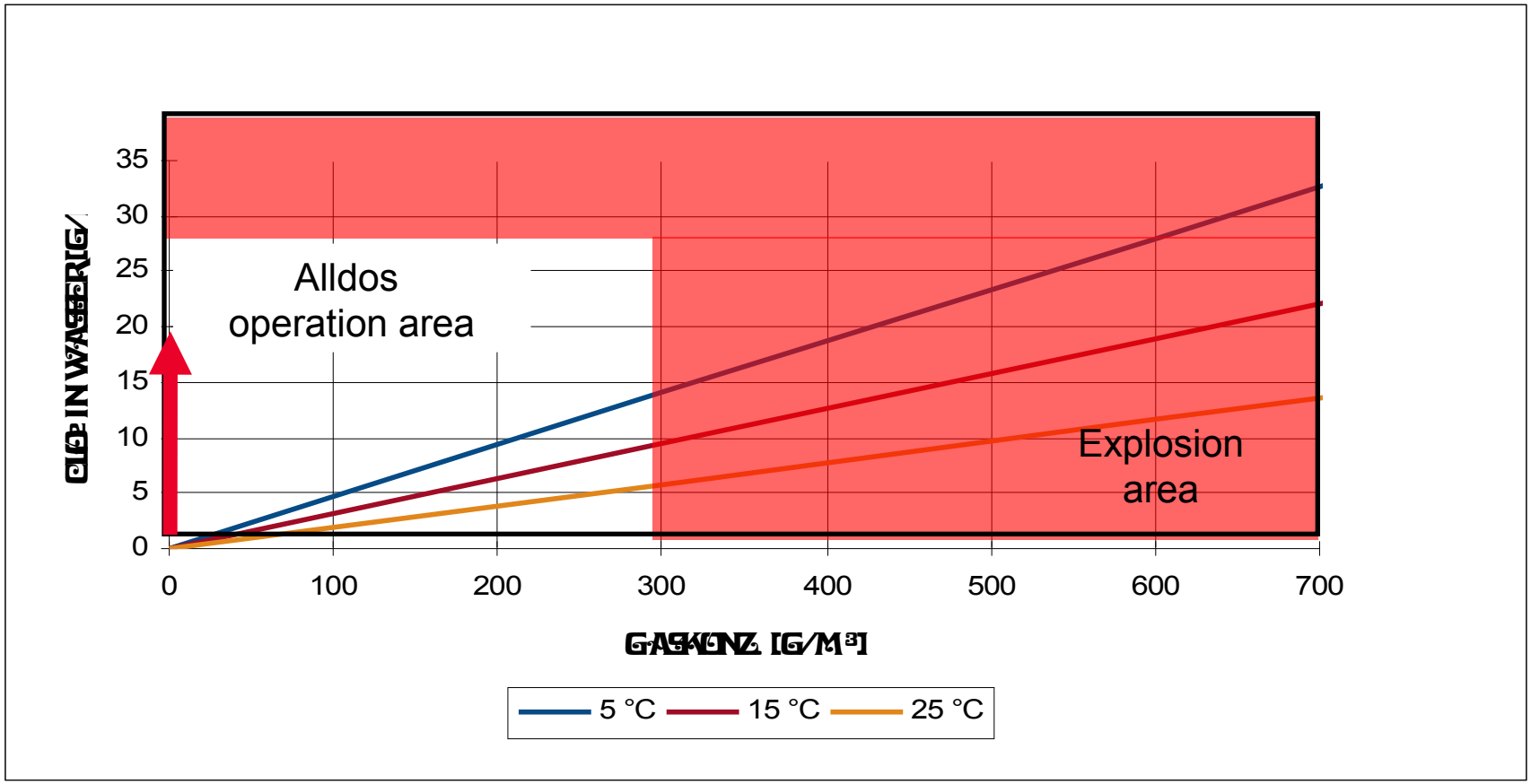
In reactor se produce solutia apoasa de dioxid de clor (2% = 20 g/l = 20,000 ppm)

Panoul de comanda / Unitatea de control



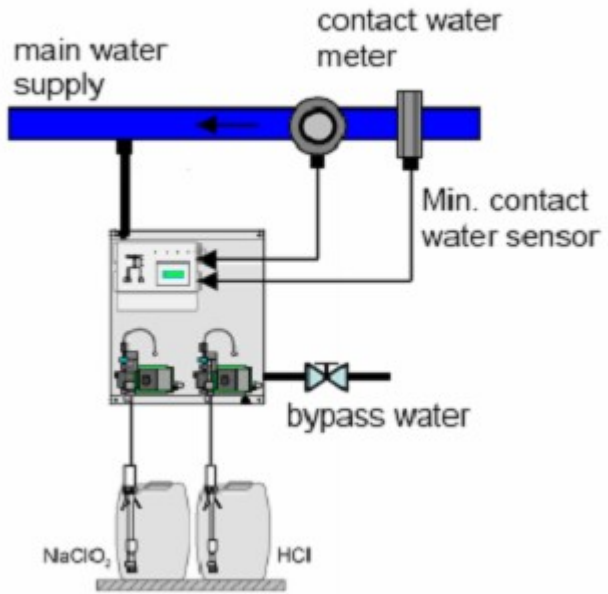
Potential exploziv

Gazul ClO_2 este instabil si are tendinta de a se descompune exploziv in faza gazoasa la o concentratie de peste 10 vol% (= 300 g/m3)

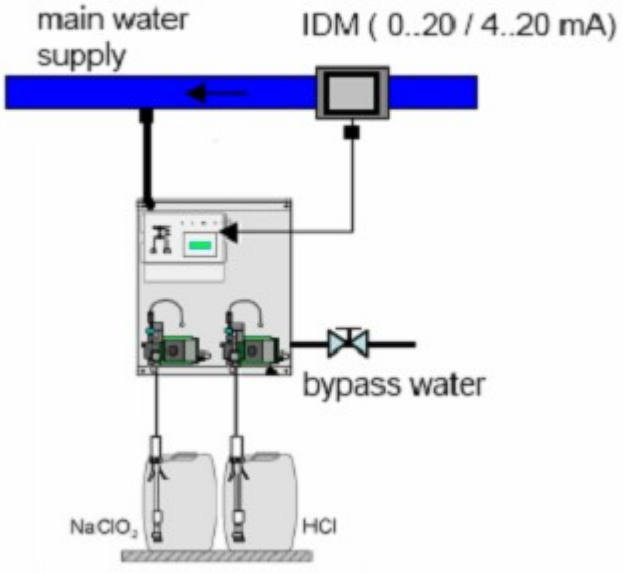


Instalarea On-line

Control by measurement of the main water flow by contact water meter
(!! not more than 50 imp./sec. !!)

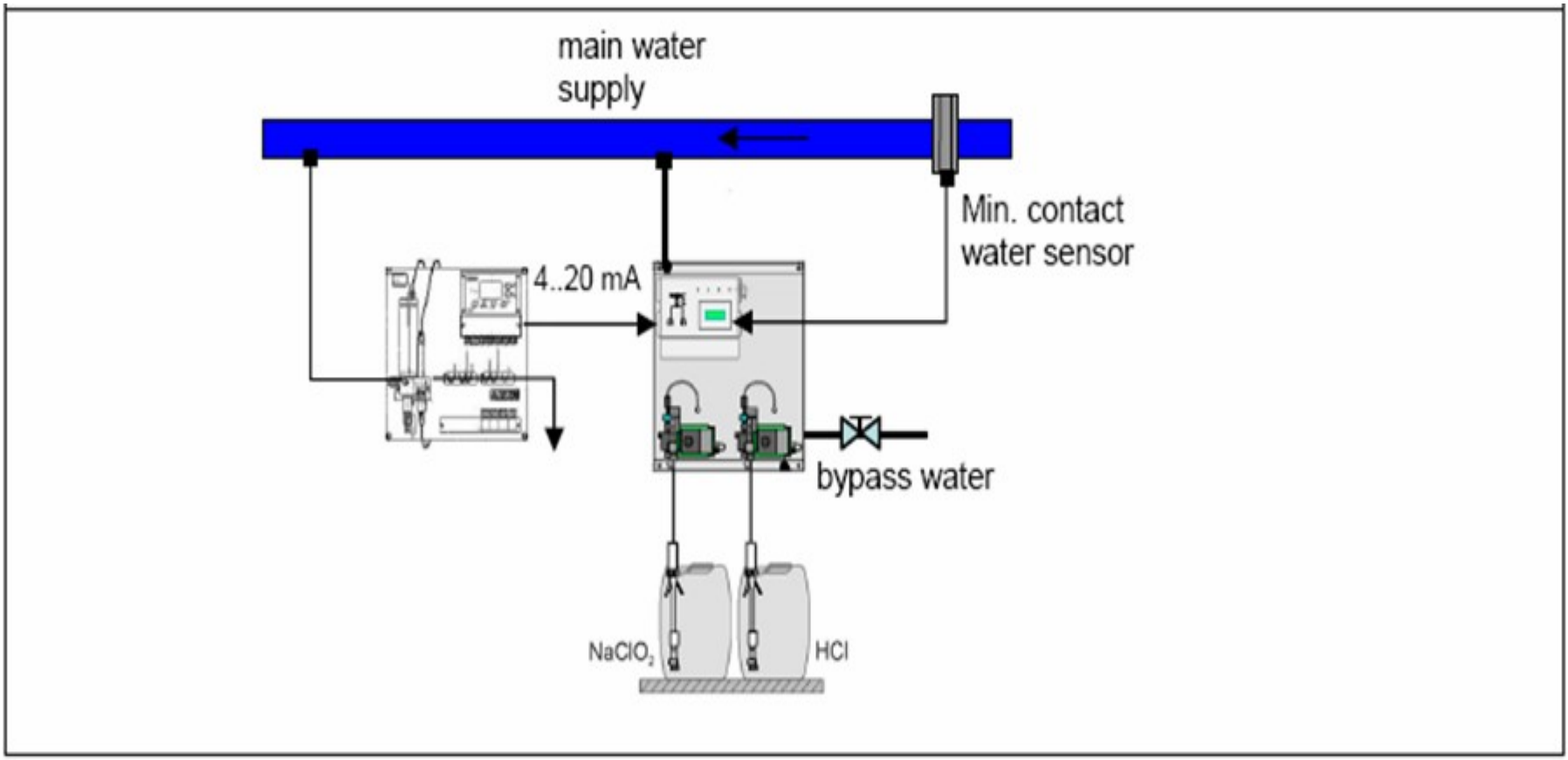


... by mag. inductive flowmeters (IDM)



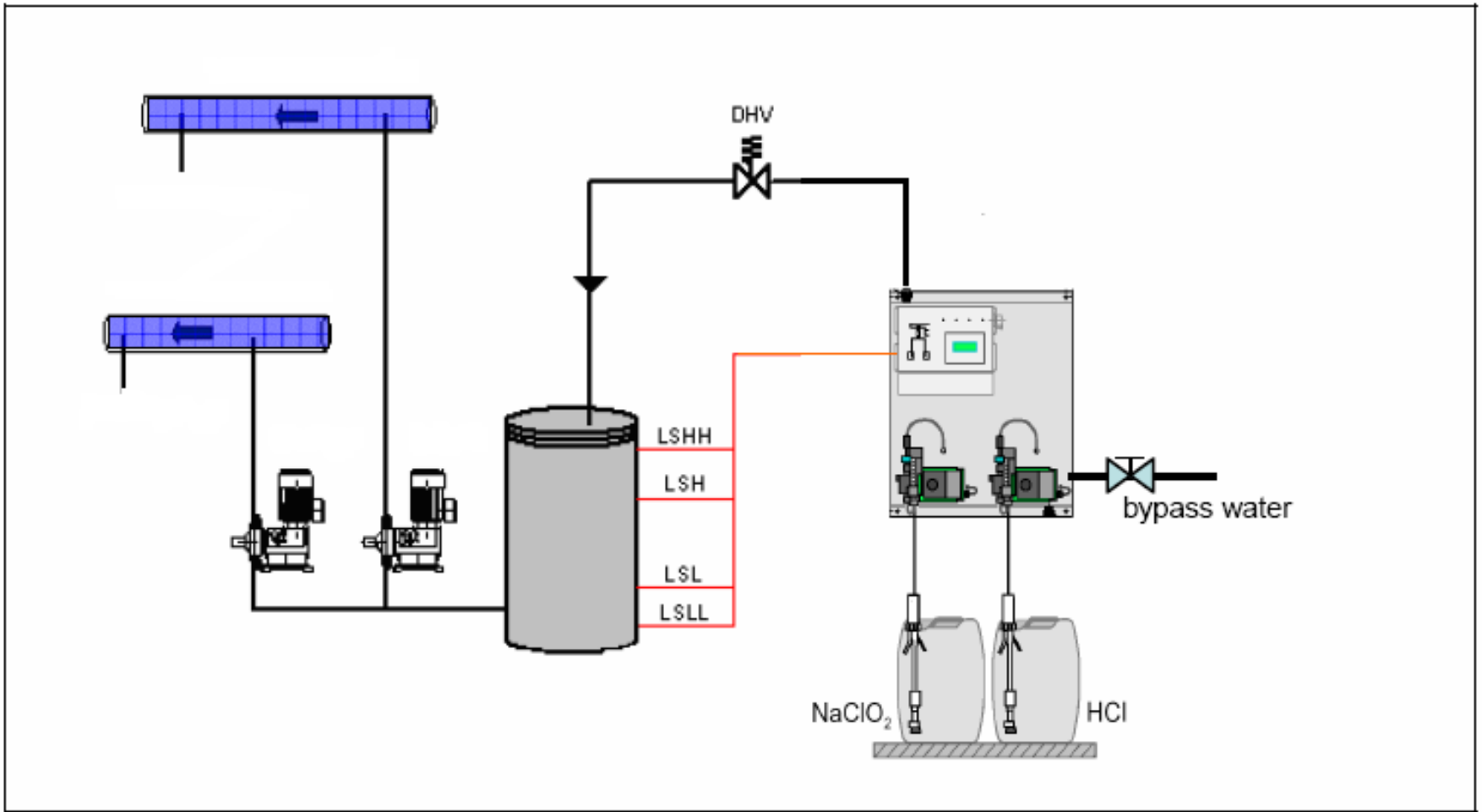
Dozarea proportionala - **RECOMANDATA !**

Instalare On-line

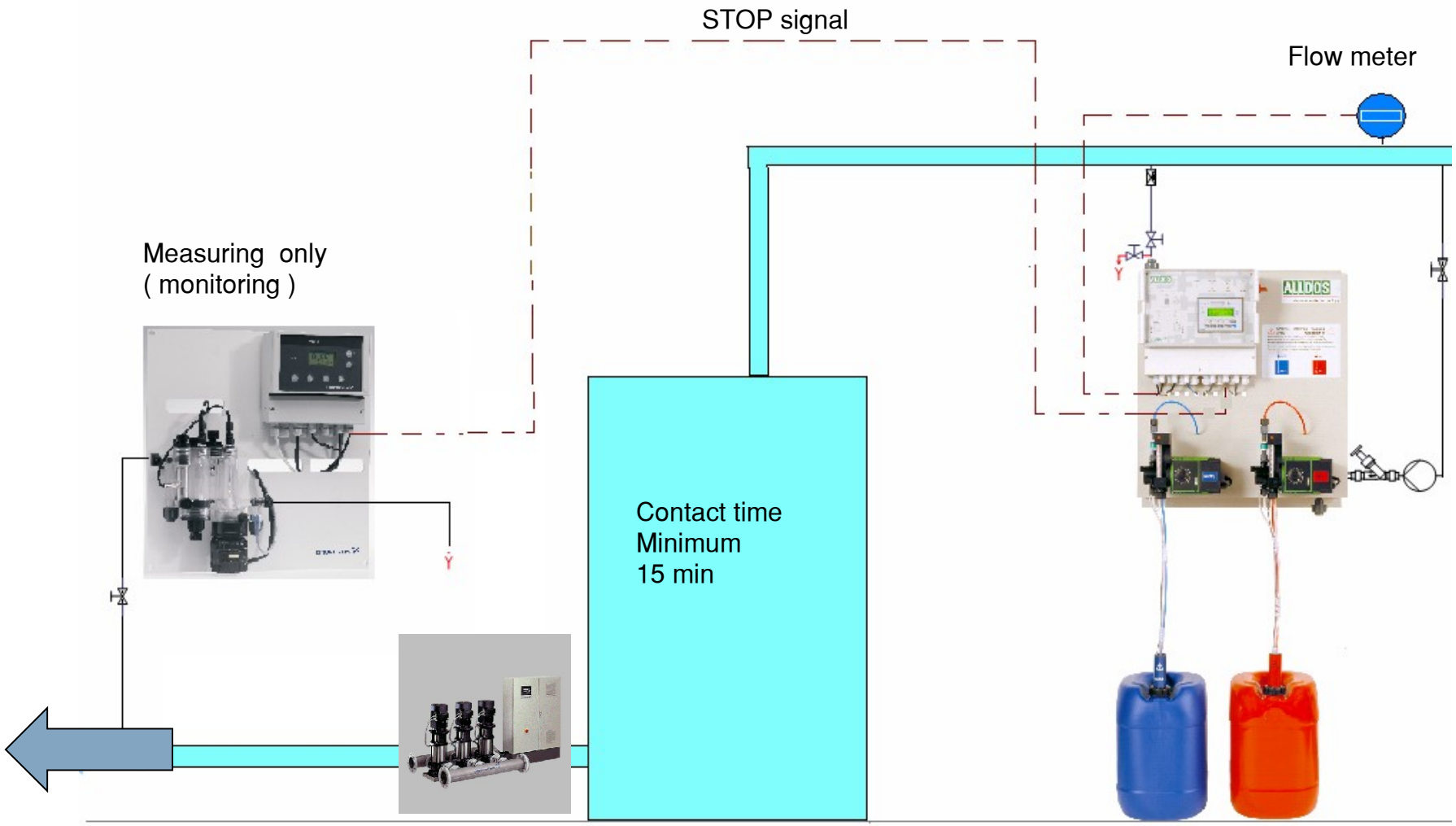


Dozare controlata – **NERECOMANDATA !**

Instalare Batch

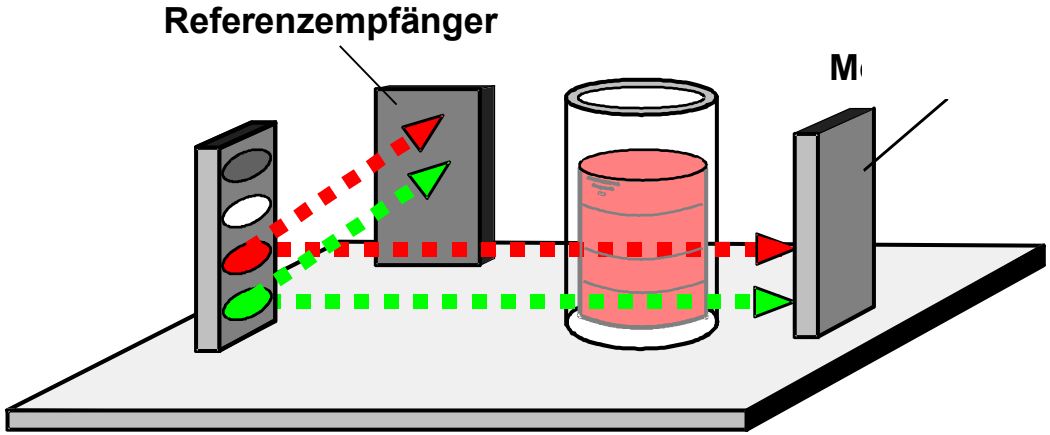


Oxiperm with batch unit, two dosing cycles with residual regulation


STOP signal
Flow meter
Measuring only
(monitoring)
Contact time
Minimum
15 min

DIT

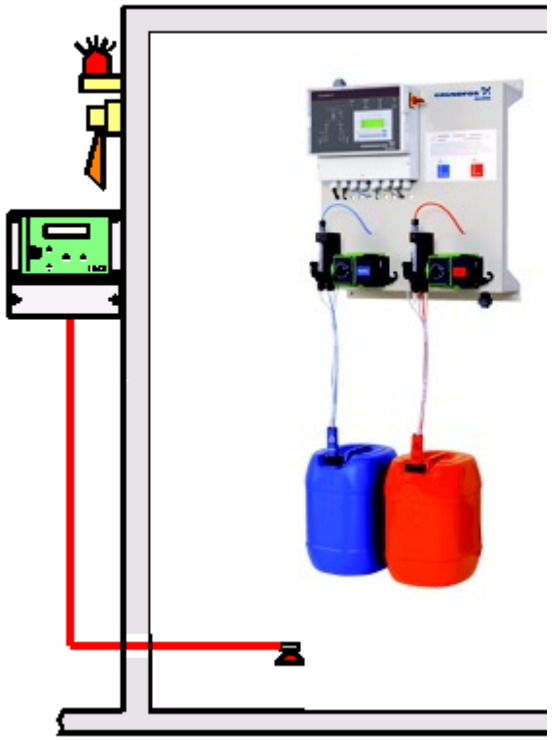
- Fotometru compact controlat de microprocesor
- Tehnologie bazata pe efectul a 2 raze
- Compensarea turbulentelor
- Acuratete si stabilitate pe termen lung pt. valorile mas
- Nu necesita calibrare dupa fiecare masurare
- Instructiuni clare, usor de folosit
- Tastatura fina cu display LCD
- Masoara pana la 17 parametri

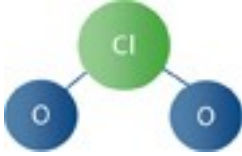


Conex

Detector de Gaz

Sistem de avertizare a scurgerilor de gaz pt. clor, dioxid de clor si ozon



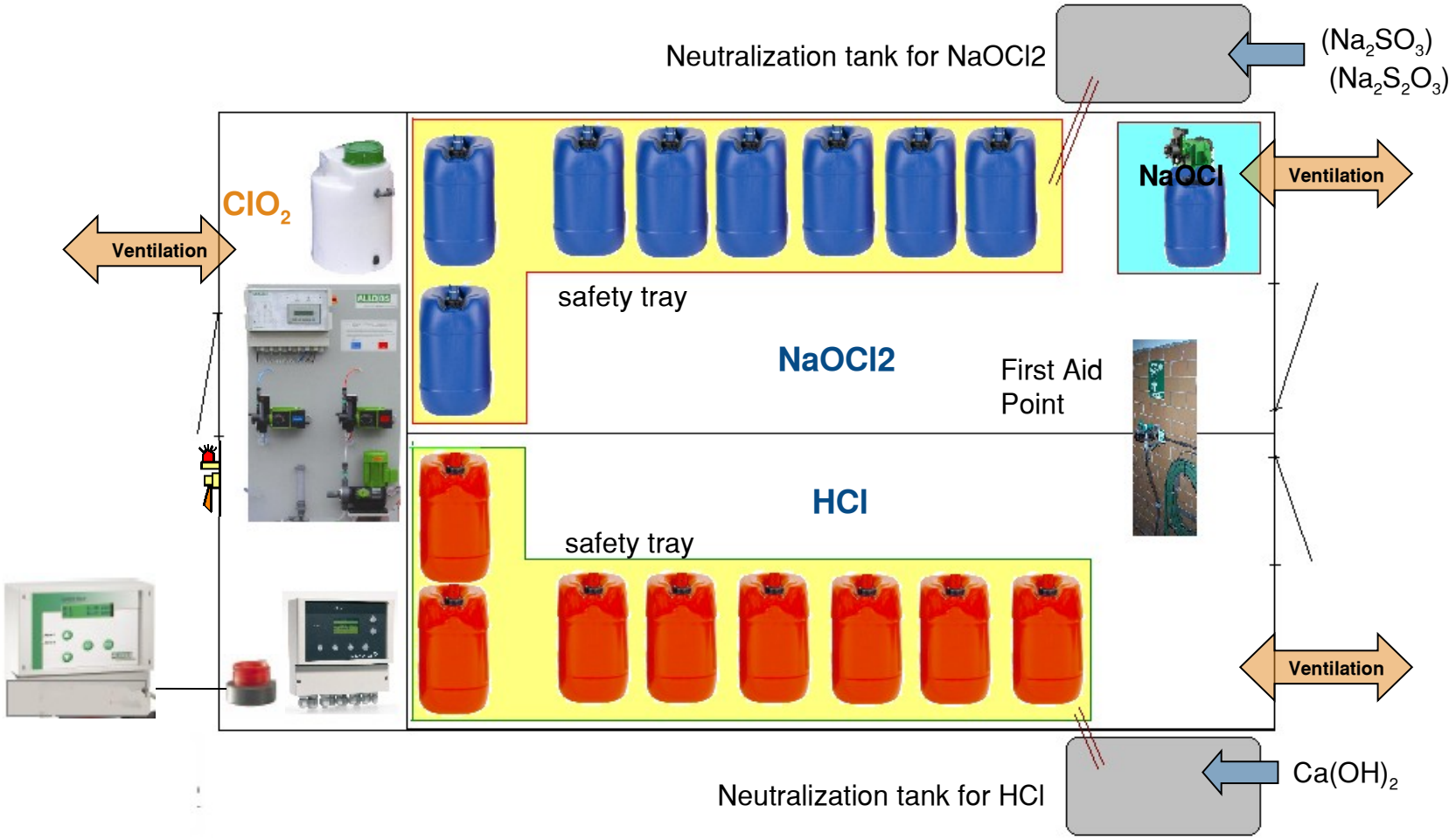


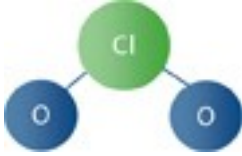
Norme, regulamente si standarde

- Substante chimice
- Depozitarea substantelor chimice
- Apa potabila
- Procese de dezinfectie
- Protectia mediului

Trebuie raportate la normele in vigoare in fiecare tara.

Model de instalare sistem ClO_2





Referinte

- 2 Oxiperm 166 in orasul Essen (GER), alimentare cu apa à un proiect de succes
- 1 Oxiperm 164-450 gr. Südzucker (industria zaharului) à dezinfectia condensatului
- 1 Oxiperm 164-120 gr. pt. tratarea apei potabile in Canada
- 2x 164-6000C + 1 164-450C in Rafinaria LOTOS , Gdansk, Polonia
- 2 x 164-450 gr. In configuratie duty/stand-by la Novy Targ, Polonia
- 2x 164-120D la InBev, Ploiesti, Romania
- 1x 164-1300C la Centrala Energetica, Varsovia, Polonia
- 1x 166-070 (750gr/h) in Kielce la Staia de tratare a apei, Polonia
- 1x 164-120D in Fabrica de bere Staropramen Brewery Praga, Cehia
- 1x164 120D in INDYKPOL (industria alimentara), Olsztyn, Polonia
- 1x164 700 la statia de tratare a apei Gorzów Wlkp, Polonia

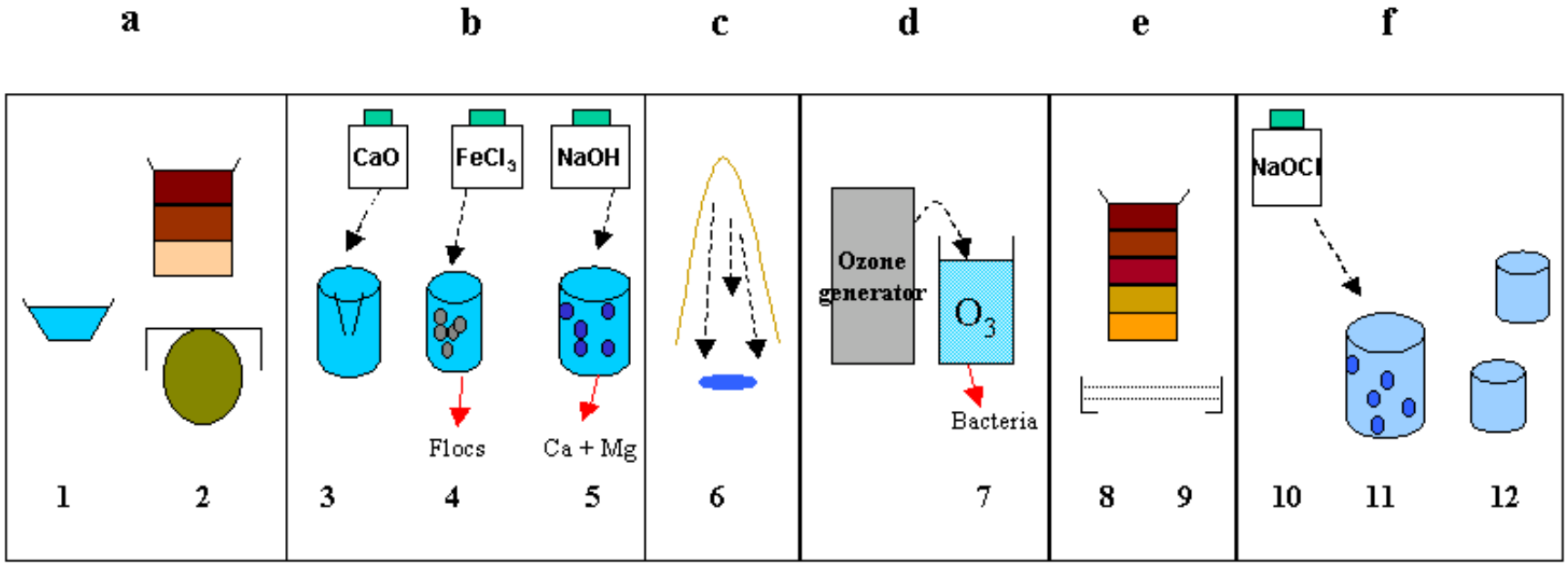
Proiecte in derulare

- 1 x 164-120 gr. pt. dezinfectie abator pui in USA
- 1 x 166-070 pt. tratarea apei in CZ
- 1 x 164-1300C pt. NALCO PL, circuit de racire a apei
- 1 x 164-2500C pt. NALCO PL, circuit de racire a apei
- 1 x 164 – 6000 pt. SODA-JANIKO / BRENTAG , Polonia

Apa potabila
Dezinfectie cu ClO_2

Reprezentarea schematica a procesului de tratare a apei

a) Aspiratie si pre-filtrare
b) dozare chimicale (pH)
c) Filtrare si aerare
d) oxidare
e) Filtrare fina (carbune activ)
f) depozitare si **dezinfectie**



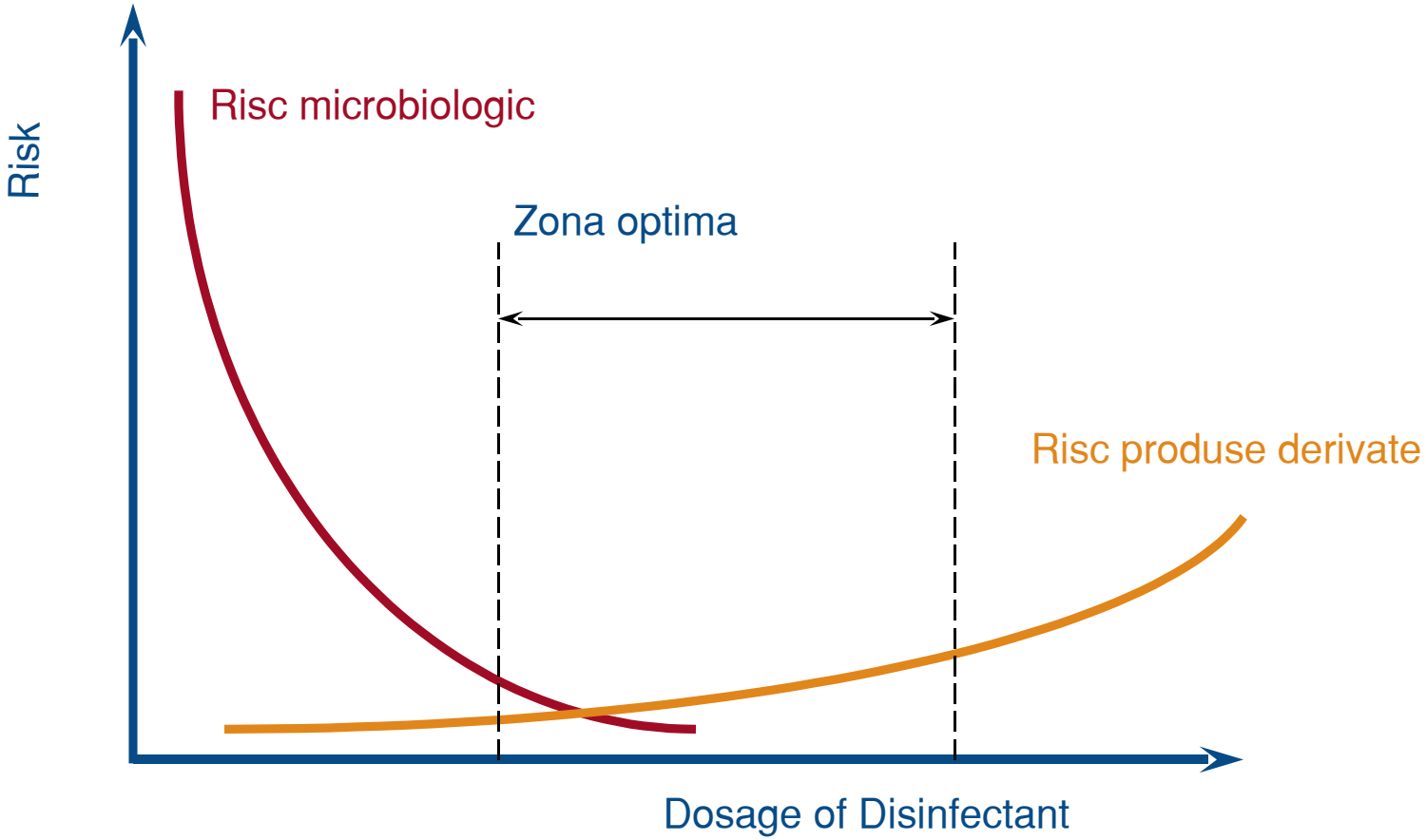
Vedere generala a procesului de dezinfectie a apei potabile

Capacitate	Clor	ClO_2	Ozon	UV
Dezinfectie	Medie	Puternica	Cea mai puternica	Medie
Timp de stocare	Ore	Zile	Minute	N.A.
Dependenta de Ph	Extrema	Non	Medie	Non
Compusi secundari	THM, AOX	Clorit	Posibil Bromat	Posibil Nitriti
Investitie	Mica-mare	Medie	Medie-mare	Medie
Cost intretinere	Mediu	Mediu	Scazut	Scazut

Beneficiile clientilor

- Agent eficient de dezinfectie, pe un domeniu larg de variatie a pH
  - Bacterii, Virusi, Alge , Legionella, Pseudomonas, ...
- Curatarea conductelor, fara formarea de bio-film
- Conductele raman foarte curate
- Lung timp rezidual intr-o larga gama de variatie a pH, chiar la doze mici
- Protectie sporita impotriva reinfectarii in sistemul de distributie
- Aproape exclude formarea THM si a altor compusi organici
- Usor si sigur de operat, in special in comparatie cu sistemele de clor gazos
- Fara consum de Amoniac, NH4+

Beneficii pentru sanatate – riscul produselor derivate



Concentratia maxima in apa potabila

Intr-o apa fara substante de reducere (fier, mangan, substante organice)
si de aici fara cerinte de oxidare, dioxidul de clor hidrolizeaza dupa urmatoarea ecuatie:

$$2\ ClO_2 + H_2O \qquad HClO_2 + HClO_3$$

Asa ca, teoretic, dioxidul de clor dispare si 50% se transforma in **clorit** si **clorat**, relativ
fata de cantitatea initiala.
Practic, in generatoare se formeaza doar **clorit** (95%).

Concentratii maxime in apa potabila

In trecut, s-a stabilit urmatorul criteriu de calitate pt. dioxidul de clor ca agent dezinfectant:

Doza max.: 0.4 ppm ClO_2 (ex. in Germania)

Acum (in Polonia):

ClO_2^- + ClO_3^- ≤ 0.7 ppm

clorit clorat

Practic: doza max.: 1,0 ppm

Limitari de aplicabilitate

1 mg **Fe** consuma1.2 mg ClO_2

$Fe^{2+} + ClO_2$ Û $Fe^{3+} + ClO^{2-}$

Si ...

Limitari de aplicabilitate

1 mg Mn consuma cca. 2.5 mg ClO2

$Mn^{2+} + 2\ ClO_2$ Û $Mn^{4+} + 2\ ClO^{2-}$

Ele trebuie reduse inainte de dezinfectie.

Se poate folosi orice oxidant obisnuit in aceste procese, ex. aer, ozon, peroxid de hidrogen, permanganat de ppotasiu, **dar nu clor sau dioxid de clor.**

Limitari de aplicabilitate

Chiar daca se urmaresc cu atentie Hidrogenul **Sulfurat (H_2S)** sau **Sulfurile (S2-)**, in apa se va sesiza un miros neplacut, ca de oua stricate.

Deoarece pentru eliminarea sulfurilor este necesara o cantitate relativ mare de dioxid de clor (5.2 mg ClO_2 for 1 mg S^{2-}), acestea trebuie **eliminate** inainte de dezinfectie prin mijloace fizice (stripping) sau chimice (oxidare) .

Limitari de aplicabilitate

Apa potabila contine doar urme de **Nitriti**, (NO^{2-}) .

Dar conform reactiei :

$$NO^{2-} + 2\ ClO_2 + H_2O \hat{U} NO^{3-} + 2\ ClO_2^{(-)} + 2\ H^{+}$$

0.1 mg de Nitrit reduc 0.3 mg dioxid de clor la $ClO_2^{(-)}$ (Clorit)

Limitari de aplicabilitate

Substantele organice reactioneaza cu formare de ClO_2 si $ClO_2^{(-)}$.

Substantele organice in apa se disting prin:

- Consumul biochimic de oxigen - valoare permanganat/oxygen, ($KMnO_4$, O_2)
- Carbon organic dizolvat (DOC),
- Consumul chimic de oxigen (CCOCr).

Dar la substantele organice:

NICIUN agent de clorinare nu reactioneaza cu fenoli si alte sustante aromatice

- Doar agentii de oxidare – chiar daca clorofenolii produsi de actiunea precedenta a clorului sunt descompusi in componente fara gust sau miros
- Se formeaza doar clorit ($ClO_2^{(-)}$)

Limitari de aplicabilitate

Pretratare inainte de dezinfectie in conformitate cu calitatea apei brute ex.:

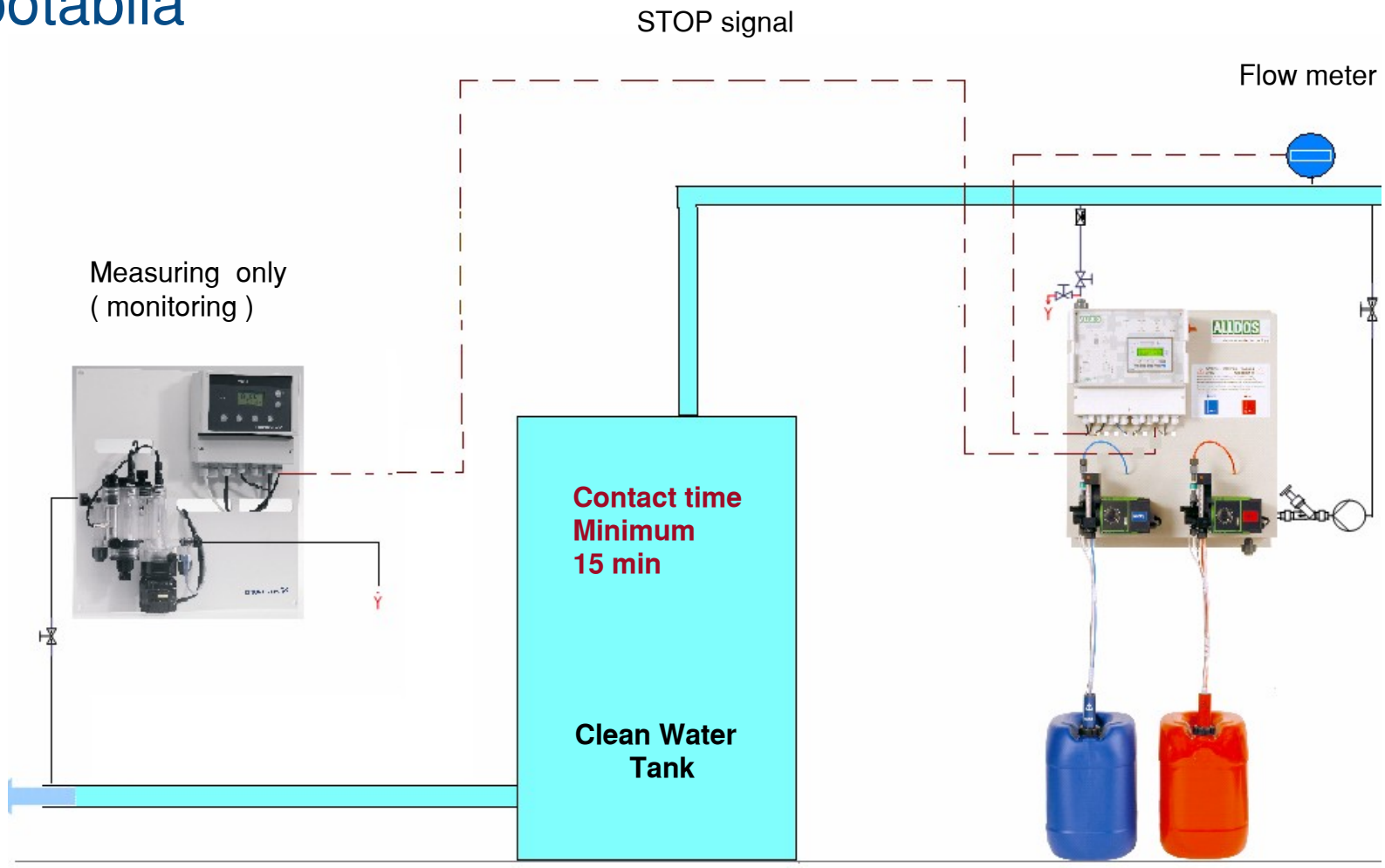
- oxidare,
- flocculare,
- sedimentare
- filtrare

	Dezinfectie cu ClO_2	**Limita WHO**
Fe^{2+}	< 0.1 ppm	(0.2)
Mn^{2+}	< 0.05 ppm	(0.05)
S^{2-}	= 0	(0)
NO^{2-}	<< 0.1 ppm	(0.5)
Subst. organice	< 1.5 mg O_2	(5.0)

Sugestii

- Dozarea de dioxid de clor se face de regula intre 0.2-0.4 ppm ClO2 (max. 1,0 ppm)
- Dioxidul de clor rezidual trebuie sa fie cat mai scazut cu putinta -
  de preferat intre 0.05 - 0.2 ppm ClO_2
- Cloritul $ClO_2^{(-)}$ rezidual trebuie sa fie si el cat mai scazut

Sistem standard de dezinfectie cu ClO2 pt. apa potabila



Sugestii pentru aceste aplicatii

Foarte important!

Daca s-a folosit clor in trecut pentru o lunga perioada de timp ca dezinfectant – doar o schimbare treptata la sistemele de dioxid de clor va permite sa evitam probleme ca:

- gust
- miros
- turbiditate

Aspecte legate de coroziune

In generatorul de ClO2 are loc urmatoarea reactie:

$5\ NaClO_2 + 4\ HCl \quad \hat{U} \quad 4\ ClO_2 + 5\ NaCl + 2\ H_2O$

Ca urmare, solutia de ClO2 contine per litru

- 20 g dioxid de clor
- 36 g acid clorhidric
- 23 g clorura de sodiu

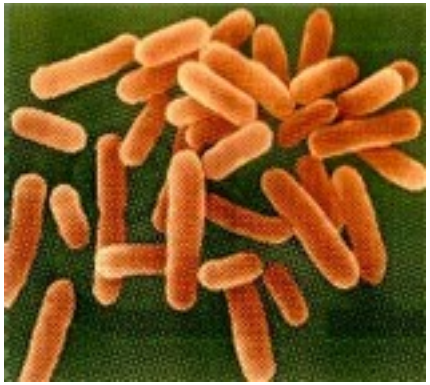
In consecinta, sistemele cu un singur ciclu:

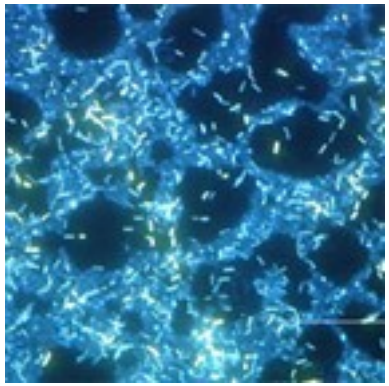
Cand se injecteaza 0.2 ppm de ClO2, 0.36 ppm de HCl si continutul de clor din apa va creste cu 0.5 ppm. Teoretic, HCl va fi capabil sa scada pH-ul apei deionizate de la 7 la 5. La **apa naturala** : scade alcalinitatatea cu cel putin 0.5 ppm precum CaCO3.

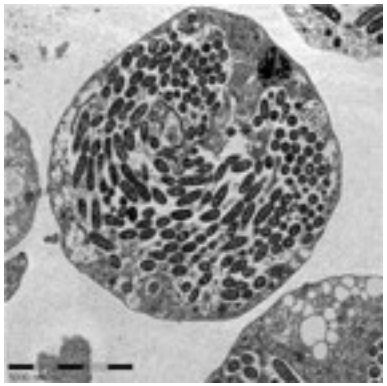
Nici o problema in deschiderea sistemelor cu un singur ciclu; in sistemele cu circulatie inchisa – atentie (acumulare de acid!)

Dezinfectia impotriva Legionellae cu dioxid de clor

Ce este Legionella?







- Nu se transmite intre oameni, nici prin sange sau stomac
- Prezinta risc de contaminare prin respiratie (particule, aerosol < 5 mm)
- Mai multi agenti patogeni precum bacteria coli sau Legionella traiesc in biofilm
- Biofilmul este extrem de rezistent la actiunea dezinfectantilor
- Reproducerea Legionella in amoeba

Infectia cu Legionellae

- Dusuri in hoteluri, spitale, case batranesti, piscine si alte facilitati pt. activitati sportive
- Sisteme de ventilare cu curatire prin aer
- Turnuri de racire
- Oriunde apa este pulverizata in scop de racire sau dezumidificare:
  - Agenti de racire sau lubrifianti in procesul de aschiere
  - Umidificarea superficiala a prafului de carbune
  - Instalatii de irigare

Sarcini

Posibile metode de dezinfectie

- Tratament termic
- Solutie de hipoclorit
- UV
- Dioxid de clor

Particularitati deosebite in spitale

Descrierea metodelor de dezinfectie

Metoda : dioxid de clor

Instalarea unui generator automat de ClO_2 on-site.

Avantaje

- Germenii rezistenti la clor sunt afectati.
- Biofilmul, amoeba sunt degradate, ca si stratul de coroziune.
- Recontaminarea este evitata datorita degradarii biofilmului.
- Produse derivate in cantitate neglijabila.

[Puternicul efect remanent previne de asemenea recontaminarea in cazul lipsei curentului de apa in conducta !

Descrierea metodelor de dezinfectie

NOUA generatie de echipamente pt. dioxid de clor

Metoda clorit - acid (solutii diluate):

5 $NaClO_2$ + 4 HCl D 4 ClO_2 + 5 NaCl + 2 H_2C

Conceptul Grundfos Alldos de dezinfectie impotriva Legionellae cu Oxiperm Pro

- Generarea ClO_2 generation dupa metoda clorit de sodiu / acid clorhidric
- Capacitate 5 g/h, varianta si pt. 10 g/h
- Operare tip batch cu o concentratie de 2 g/l (2000 ppm)
- Pompa dozatoare integrata cu conexiune in punctul de injectie
- Am plificator de masura integrat pt. masurarea concentratiei de ClO2

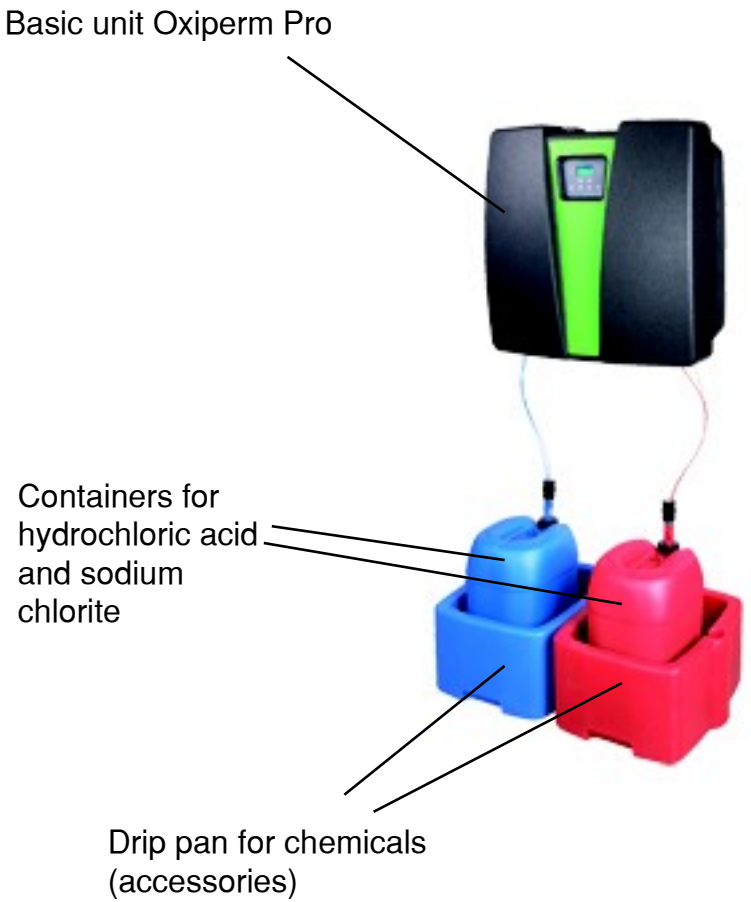
Important

- **Mixarea suficienta trebuie asigurata intre punctul de injectie si cel de masura**, curgerea turbulenta, prin "T"-uri, conducte inclinate pt. dozare directa direct dosing; utilizarea dozarii in bypass
- **Dozarea se face cu controlul debitului.** Concentratia controlata a dozarii se poate folosi in aplicatii din afara domeniului apei potabile (**masurare doar pt. monitorizare!)**

Structura de baza a Oxiperm

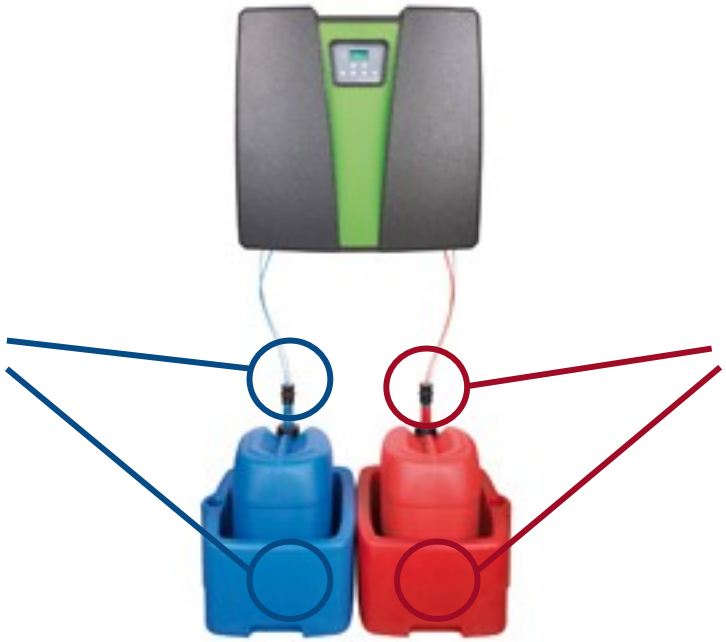
Variante

- Capacitate ClO_2- 5 si 10 g/h
- Cu si fara pompa dozatoare
- 110 and 230 V



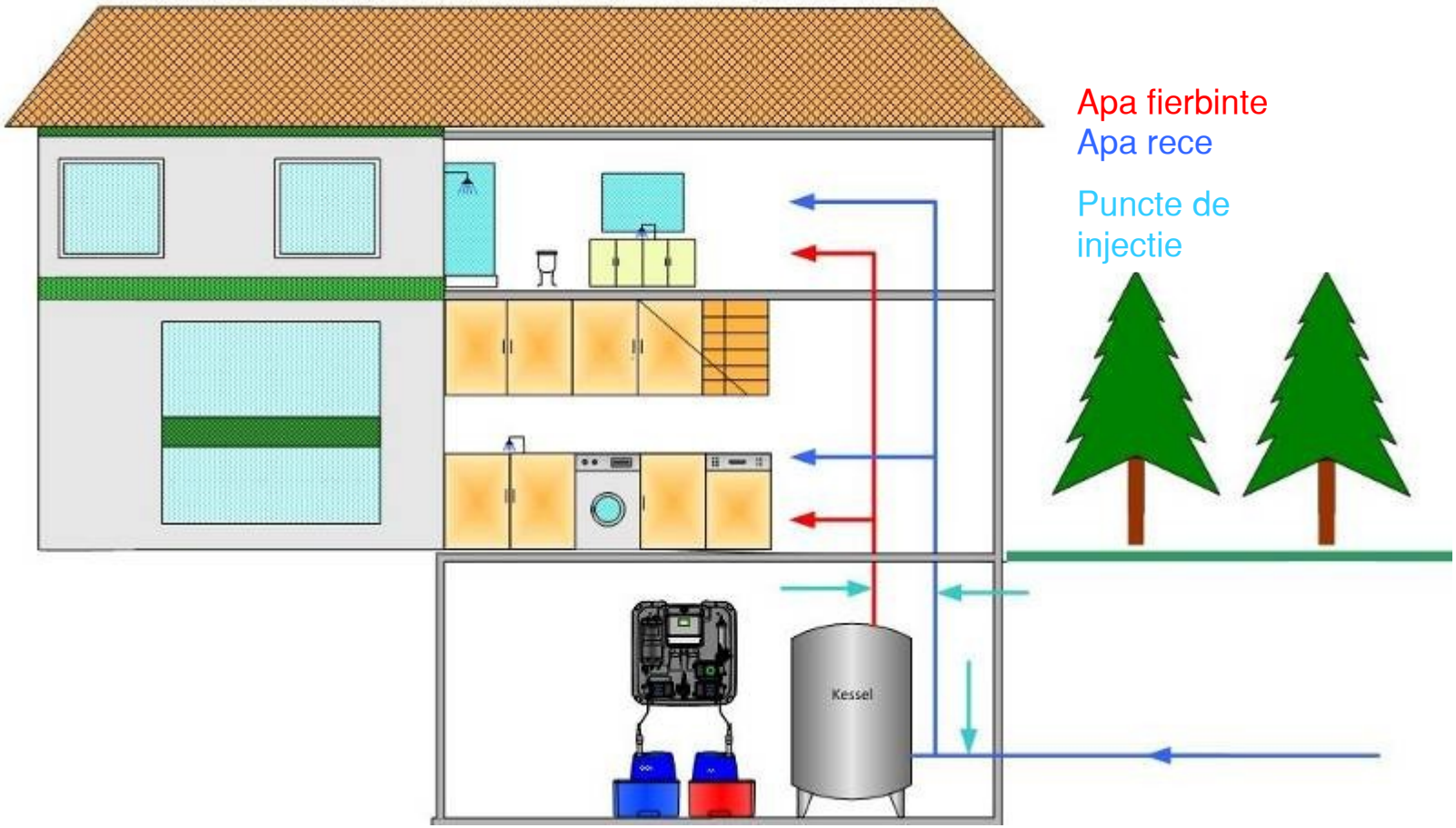
Protectia substantelor chimice impotriva amestecarii

Cod **ALBASTRU** pt. clorit de sodiu

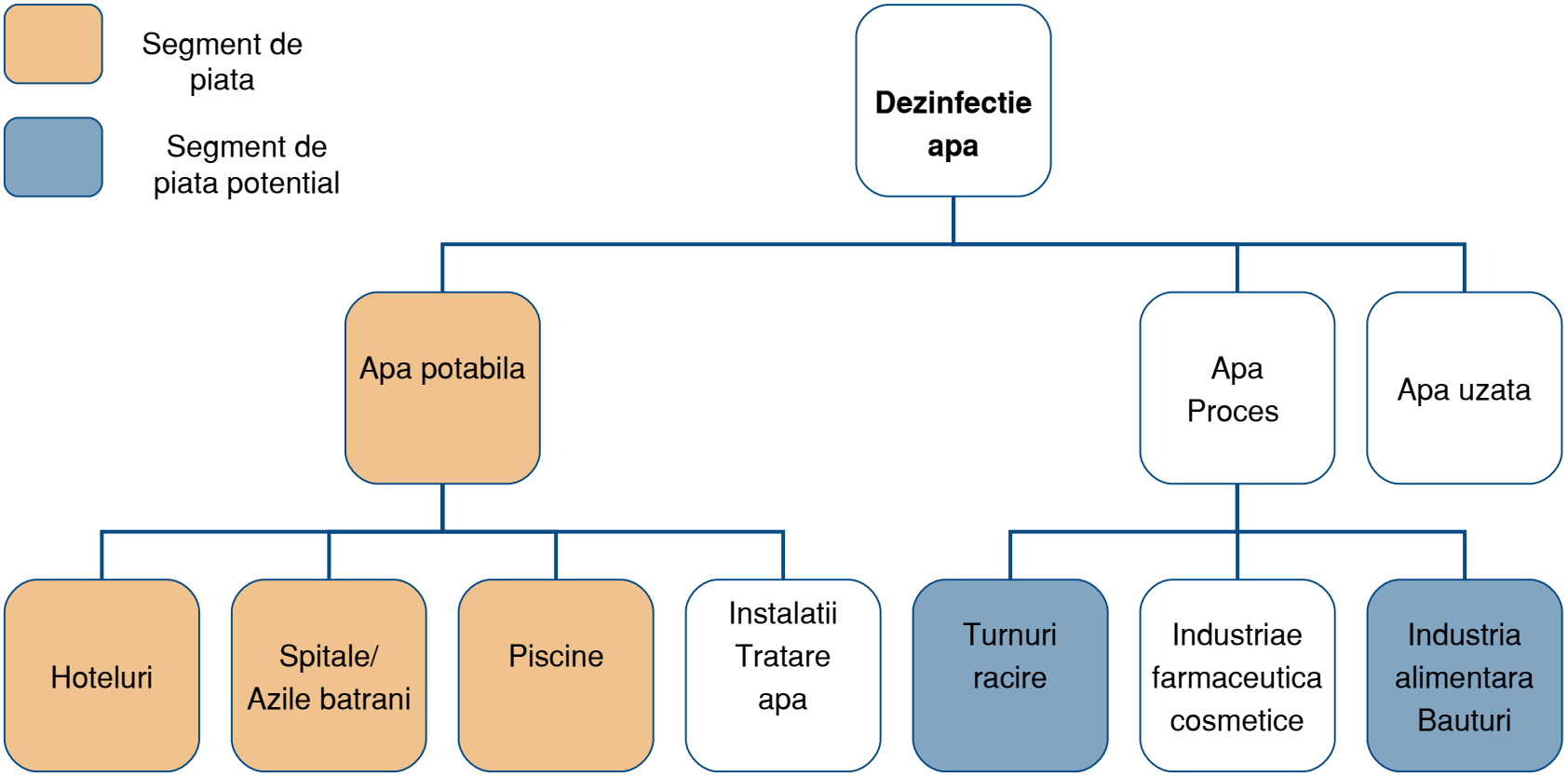


Cod **ROSU** pt. acid clorhidric

Instalarea punctelor de injectie

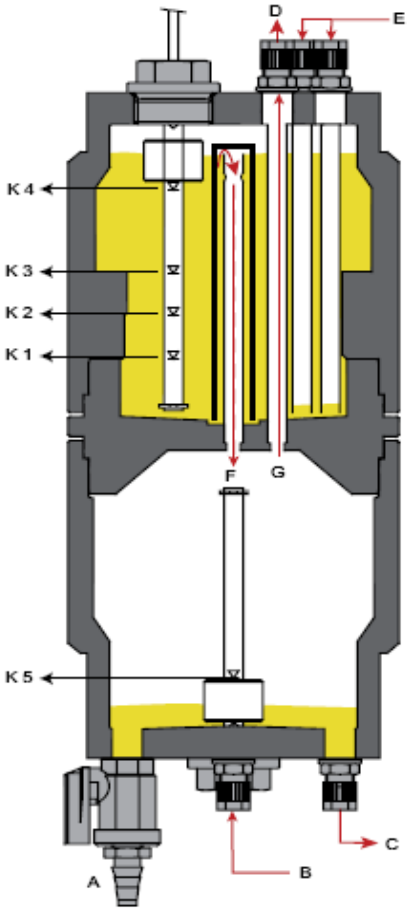


Segmentarea pietei



Vedere generala asupra sistemului

Reactor compact



Secventele operatiunilor

Pasul 1

Curgerea apei in reactor pana la nivelul **K1**

Secventele operatiunilor

Pasul 2

Dozarea de HCl in reactor pana la nivelul **K2**

Secventele operatiunilor

Pasul 3

Dozare de clorit de sodiu in reactor pana la nivelul **K3**

Pasul 4

15 min timp de reactie

Secventele operatiunilor

PASUL 5

Admisie apa in reactor pana la semnalde supra-plin K4

->scurgerea solutieiproduse in batch tank

Secventele operatiunilor

Pasul 6

Dozare cu pompa de dozare integrata

Ventilare

Volum variabil de gaz pe durata umplerii si scurgerii reactorului

-> compensare in rezervorul de expansiune

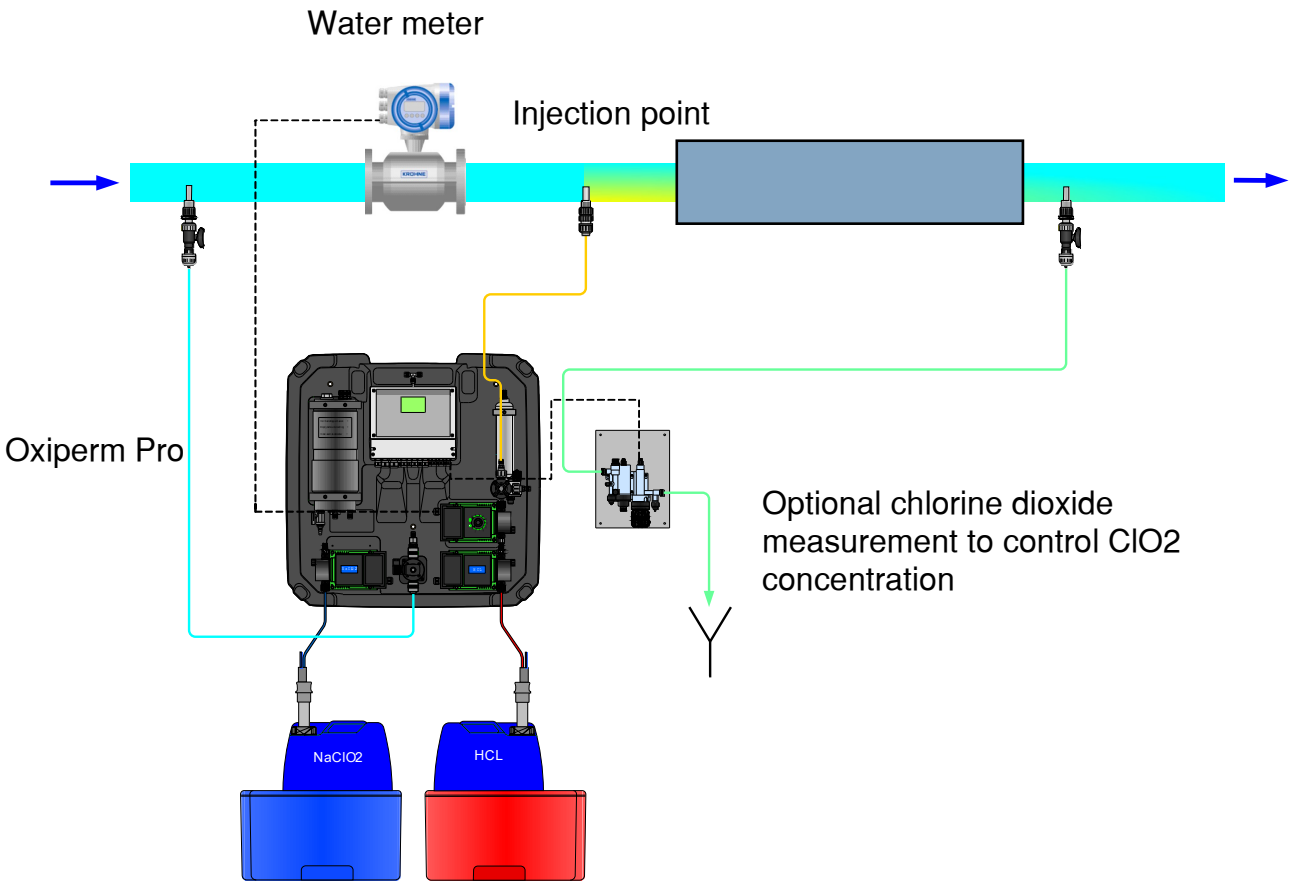
- Sistem nepresurizat
- Filtru de carbon ca legatura spre mediul ambiant

Afisajul unitatii de masura

- Afiseaza toti parametrii de operare
- Afiseaza mesajele de eroare
- Limbi:

deutsch
english
français
español
italiano
nederlands
português
русский
polski

Schema de instalare



Conditii de instalare

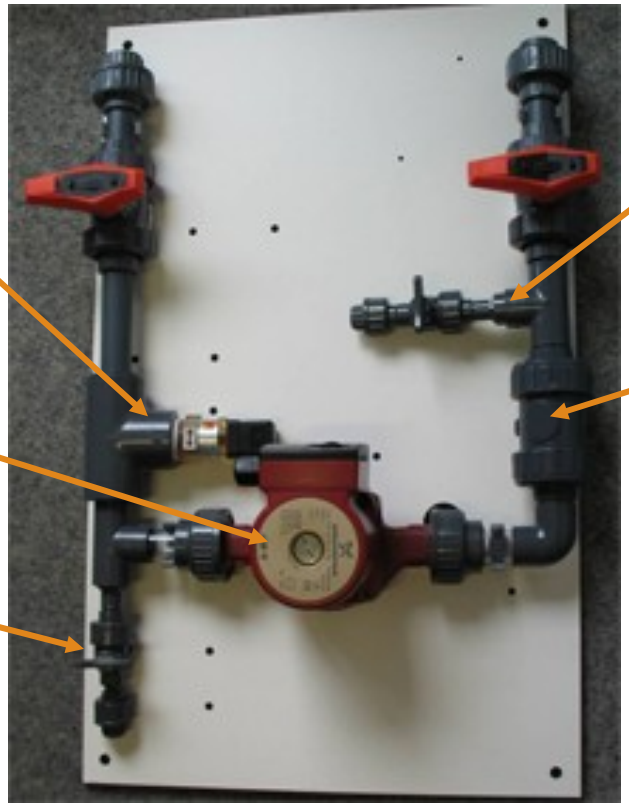
- Nu se permite instalarea exterioara
- Protectia contra accesului neautorizat
- Locul unde se instaleaza echipamentul trebuie sa fie ferit de soare si inghet si sa fie bine ventilat
- Temperatura apei de dilutie 10 - 35 °C
- Vasele componente trebuie plasate sub unitate
- Unitatea trebuie montata pe perete in pozitie verticala
- Presiunea apei 3-6 bar, scurgere si sursa de curent disponibile

Accesorii

Vasele recuperatoare sunt din PP albastru si rosu.

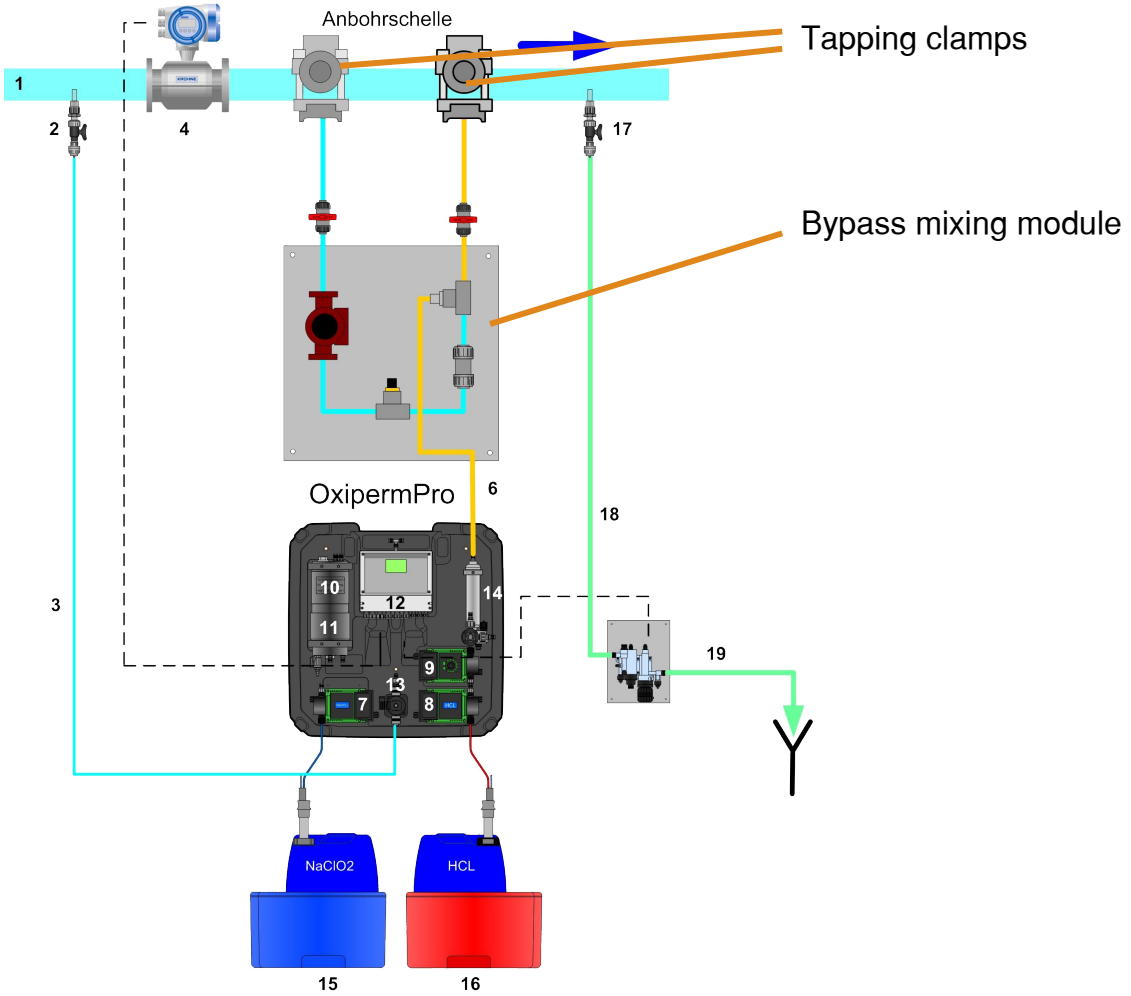
Accesorii

Bypass mixing modul (draft)



Accesorii

Installation bypass mixing module

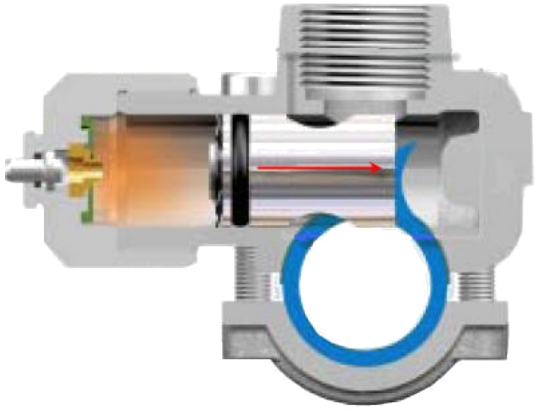


Accesorii

Avantajele modulelor de amestecare

- prevenirea coroziunii in punctul de injectie, deoarece dioxidul de clor concentrat se adauga in conducta de PVC
- Recirculare continua, chiar la debite mici pe perioada noptii
- Independenta fata de pozitia liniei principale
- Supapa de sens pt. a evita curgerea inversa a solutiei corozive in pompa de circulatie si controllerul de debit
- In anumite cazuri nu se permite folosirea tubing-ului de plastic pe linia principala, folosirea modulului de amestecare indeplineste toate cerintele

Accesorii



Tapping clamps ½" up to DN 42 for steel tubing or thin stainless steel tubing

Accesorii

Debitmetru ultrasonic in 2 variante (DN 15-100 si DN 50-400)
Debitmetru inductiv in 5 variante (DN 15-40)

Cost de operare

Presupunem:

1 litru $NaOCl_2$	7.5%	€ 2.30
1 litru HCl	9%	€ 0.80

1 g ClO_2 costa in jur de € 0.08

Dozare 0.2 ppm ClO_2

< 0.02 €/m³ apa

Comparatii cu competitorii

Manufacturer	Grundfos Alldos	Prominent	Siemens (W&T)	Severn Trent
System	Oxiperm Pro 5	LegioZon	DIOX-A 3 and –A 10	Capital Controls™ T70GS4000
Performance	0 – 5 or 0 – 10 g/h	0 – 5 & 0-10 g/h	0 - 3 or 0 - 10 g/h	2 g/day - 10 g/h
Principle	Sodium chlorite (7.5 weight %) / hydrochloric acid (9 weight %) method			
Features	▪ compact front installation ▪ chemical mixture ratio 1:1 ▪ integrated measured value acquisition	▪ high HCl consumption due to 3times acid surplus (costs!) ▪ instable product solution ▪ no integrated measured value acquisition ▪ front and back installation	▪ high HCl consumption due to 3times acid surplus (costs!) ▪ complex technology ▪ high price	▪ dosing pump not integated ▪ mounted on PVC plate ▪ chemicals low level switch-off as option! ▪ no integrated measured value acquisition ▪ ClO_2 concentration 1g/l
Picture				

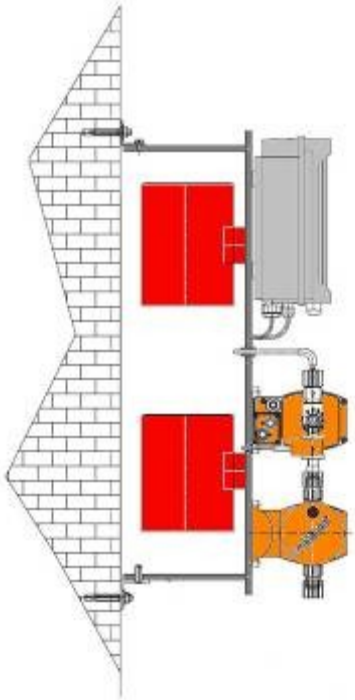
Principal competitor

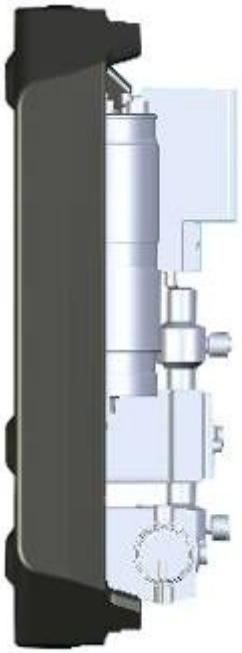
ProMinent

Legio Zon 5 & 10 g/h cu solutii diluate

Avantajele noastre evidente

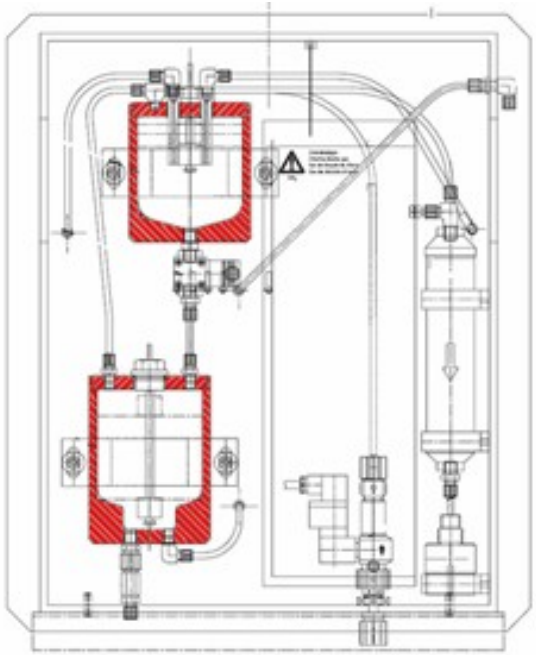
Instalare frontala – mentenanta simpla!

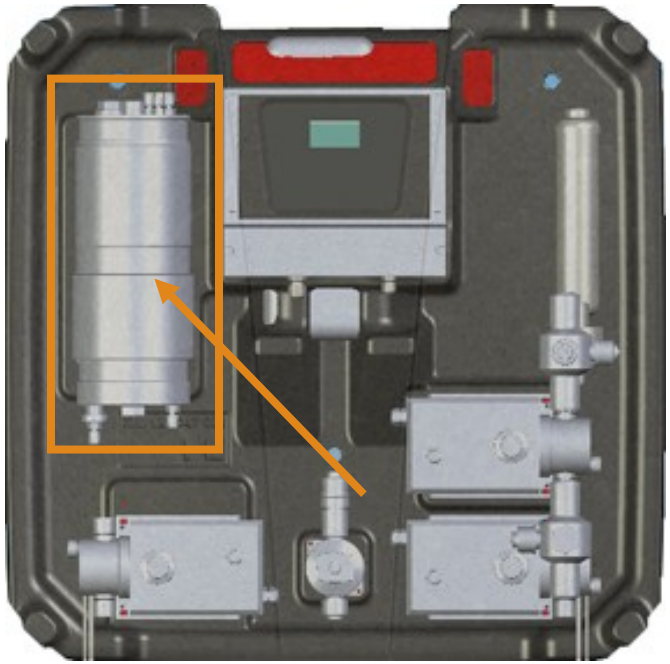




Avantajele noastre evidente

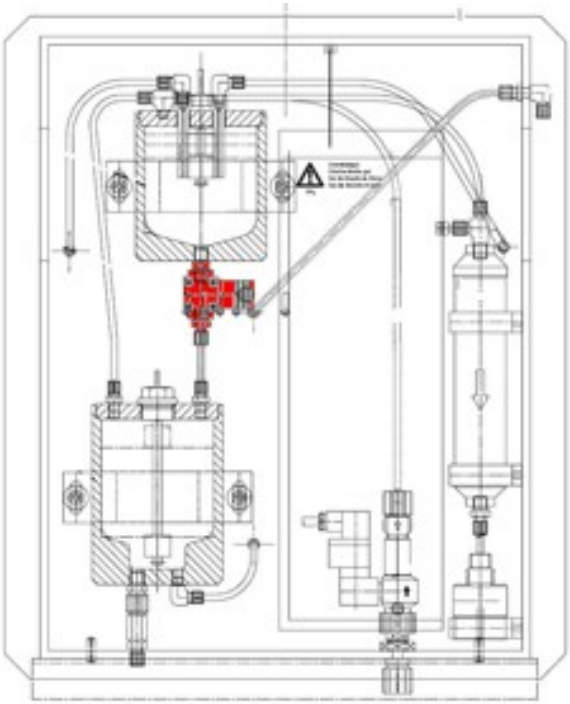
Un reactor compact

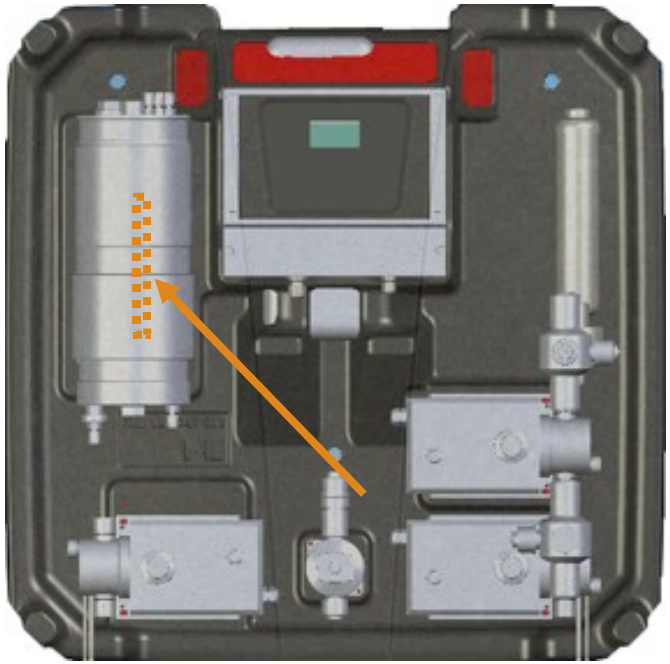




Avantajele noastre evidente

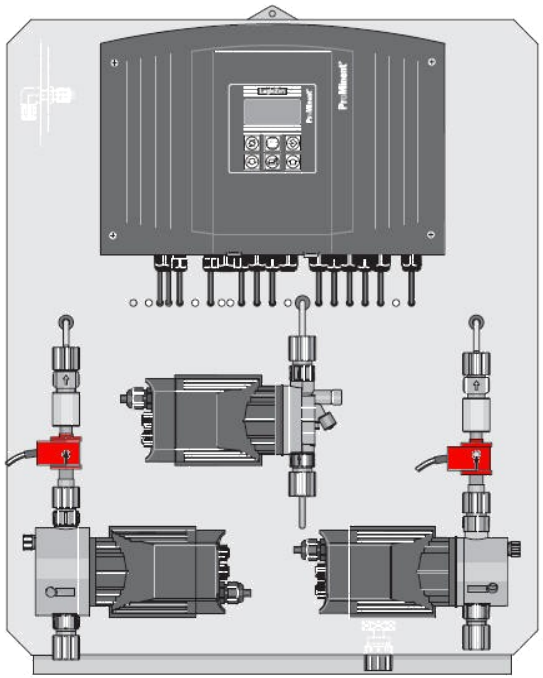
Batch tank se umple **prin valva solenoida**





Avantajele noastre evidente

Monitorizare **simpla** a consumului de substante chimice in camera de reactie



Avantaje mai putin vizibile

- Acelasi volum dozat din ambele substante chimice (Grundfos Alldos 1:1, Prominent 1:3) -> 40-50% costuri mai mari cu consumurile
- Semnificativa reducere a consumului de HCl la Oxiperm Pro (Grundfos Alldos 1:2,5, Prominent 1:7,5) -> dezavantaj pt. Prominent in apa cu pH scazut (risc de coroziune/ corectie pH necesara)
- Amplificator de masura integrat cu 2 puncte pt. control PID fara alterarea semnalului

Legionella in circuitele de apa rece

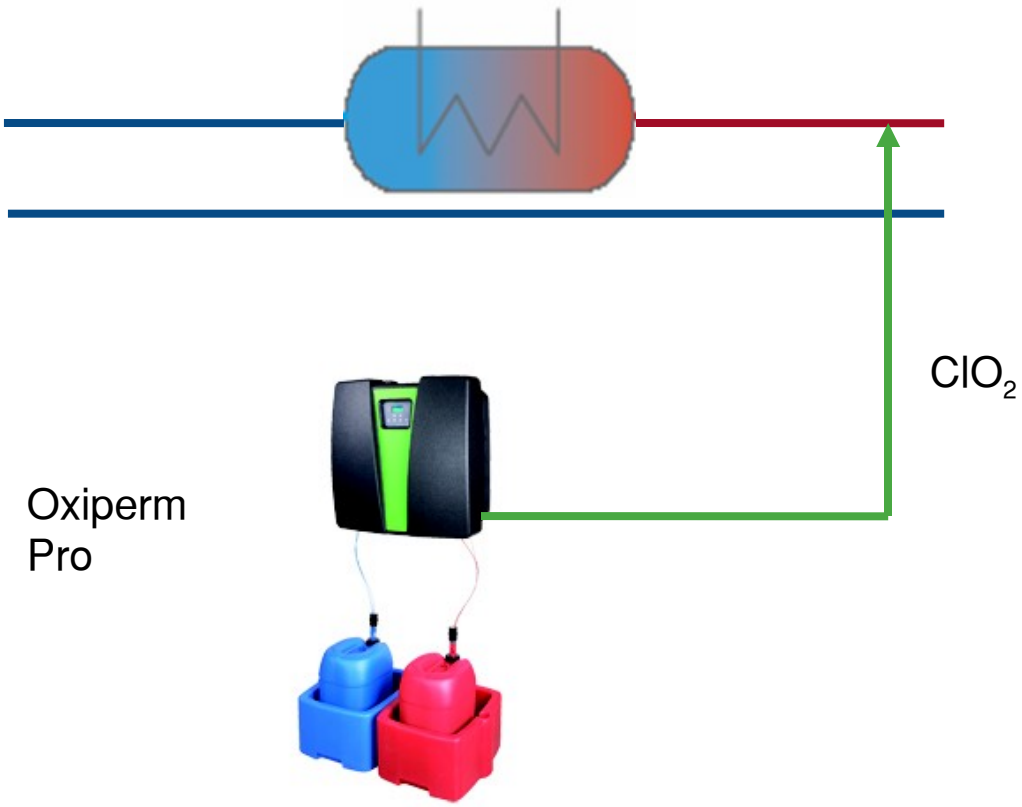
Contaminarea este posibila daca se ating temperaturi in jur de 25°C .

- Apa de robinet
- Linii paralele de apa calda/ rece fara izolatie

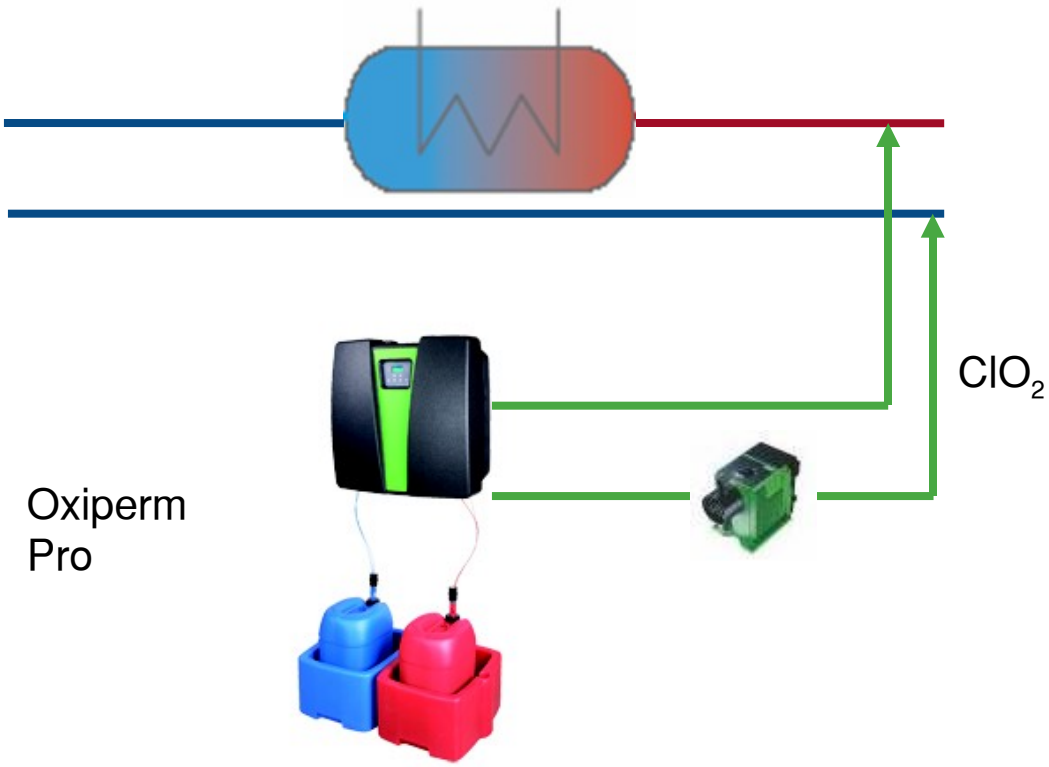
In general acest fenomen apare in zone cu debite mici.

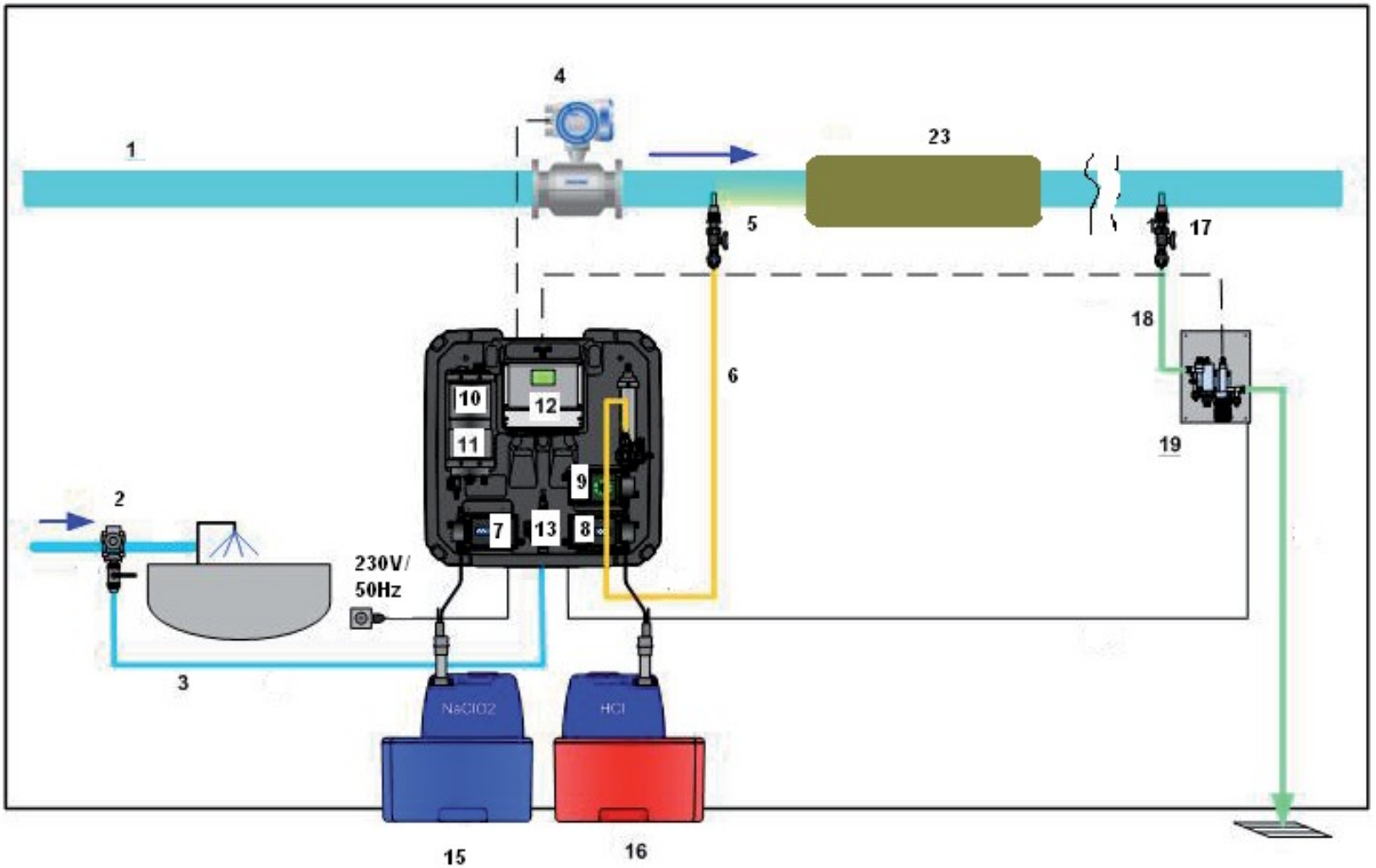
De aceea se poate instala Oxiperm chiar descentralizat, ex. nu doar in camera de incalzire.

Conceptul Grundfos Alldos pt. dezinfectia Legionella
Dozare directa intr-un singur punct de injectie



Conceptul Grundfos Alldos pt. dezinfectia Legionella
Dozare directa in puncte de injectie diferite




4
1
23
5
17
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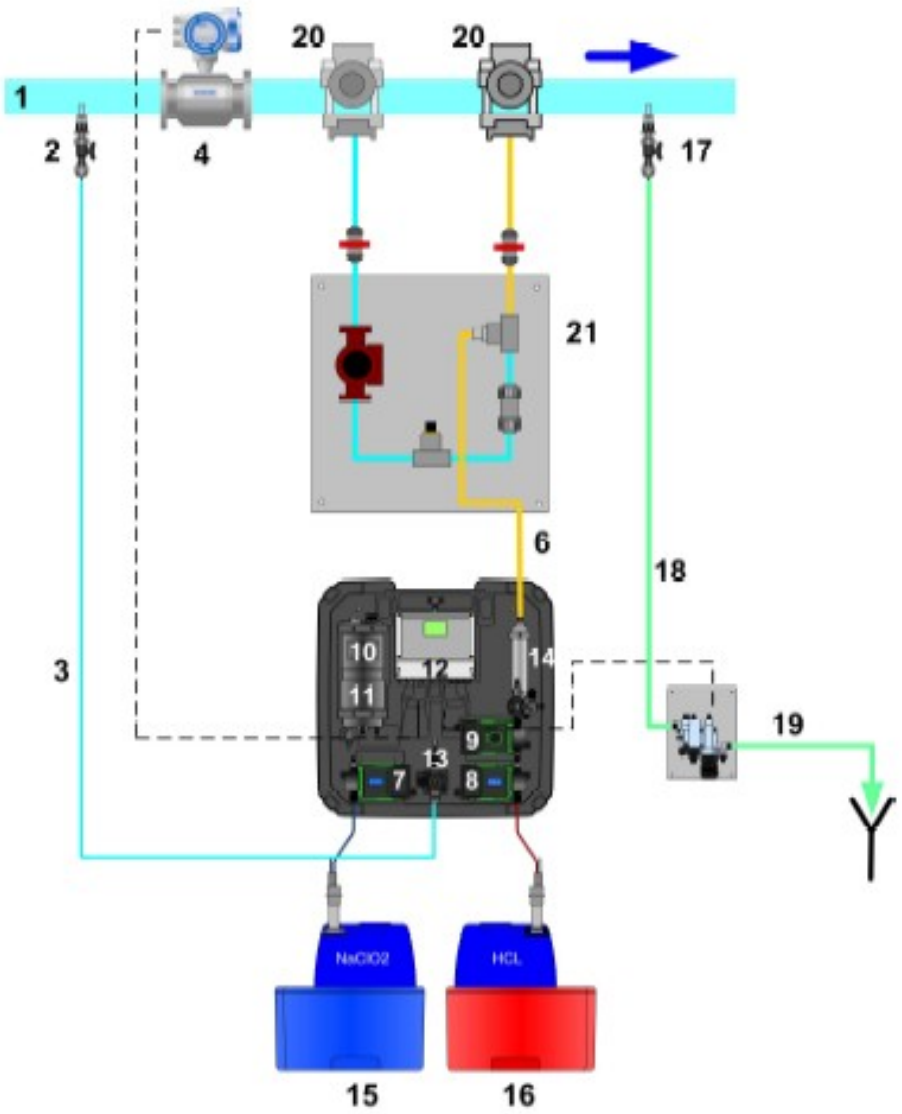
12
11
9
7
13
8
19
2
230V/
50Hz
3
NaClO2
HCl
15
16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NaClO2
HCL
15
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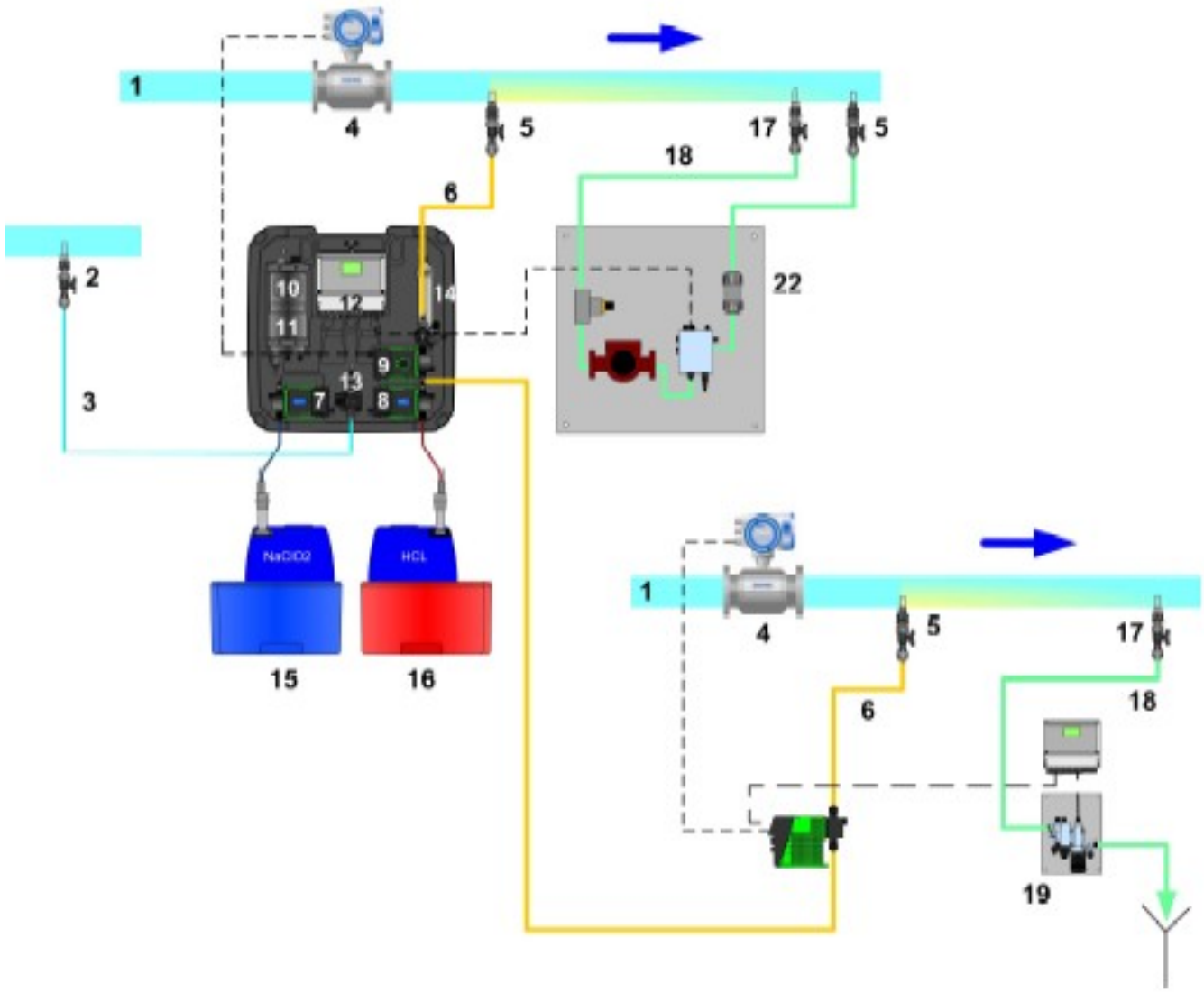
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NaClO2
HCL
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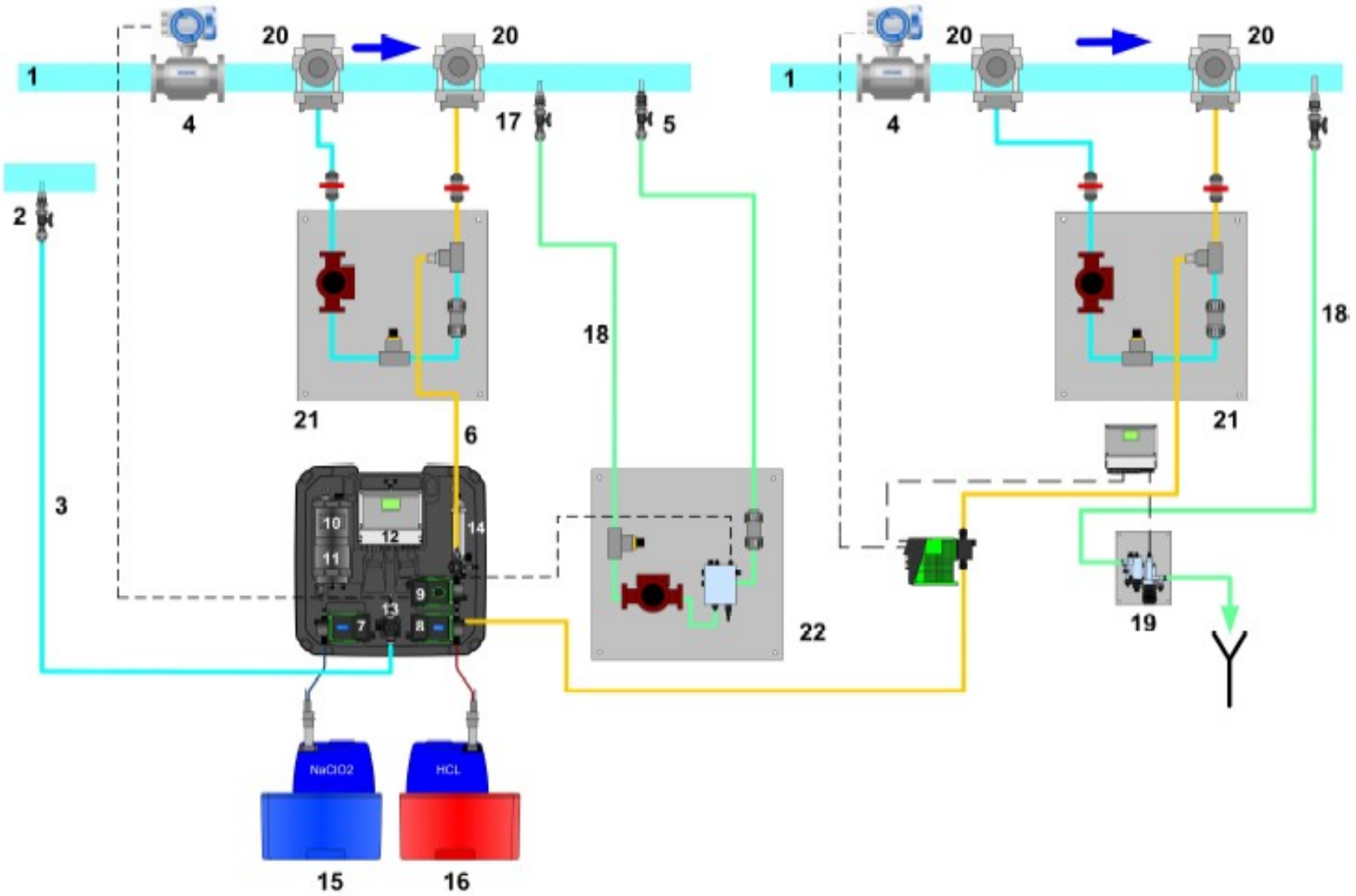
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NaClO2
HCL
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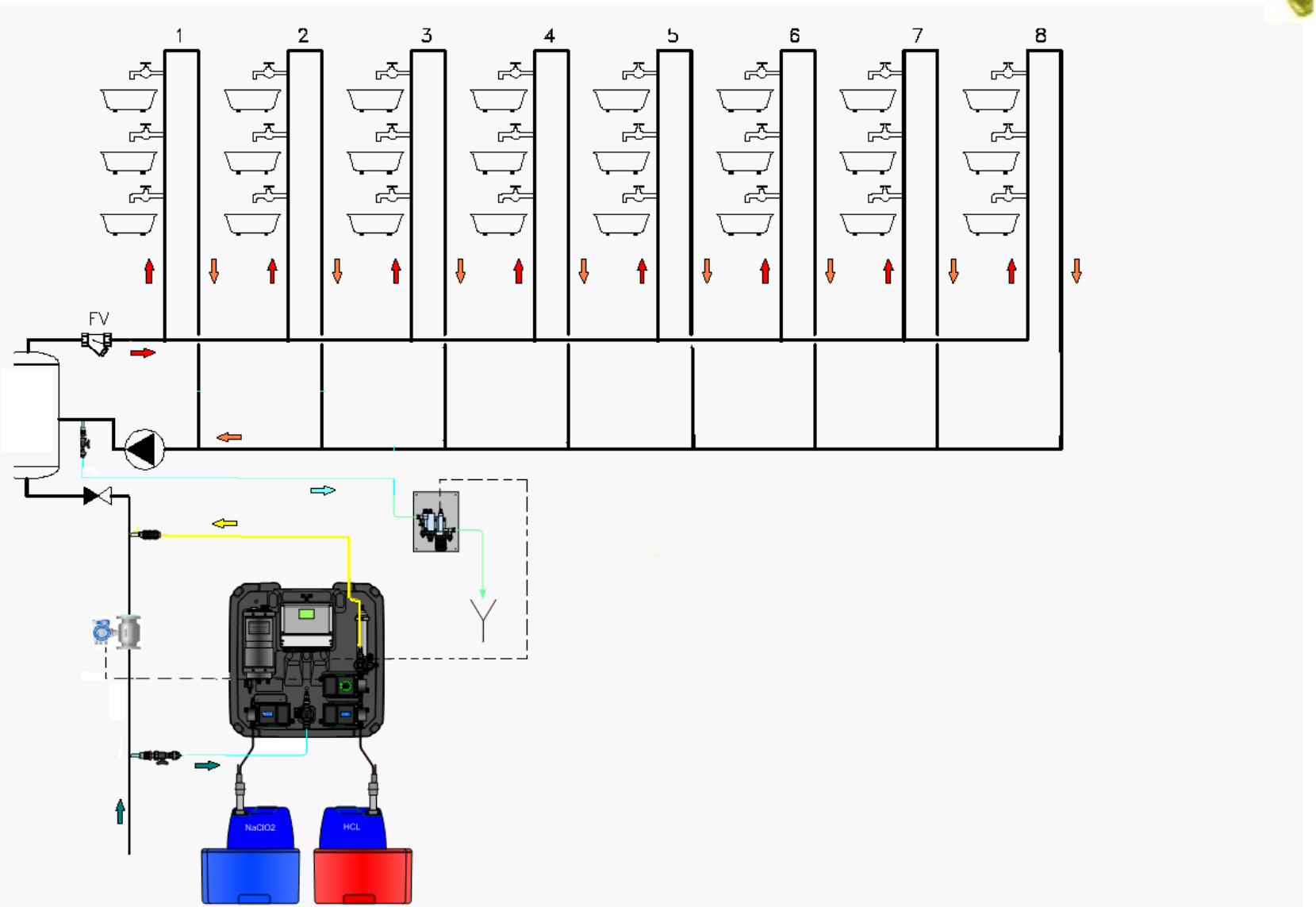
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7
8
FV
NaClO2
HCL

Va multumim pentru atentie!