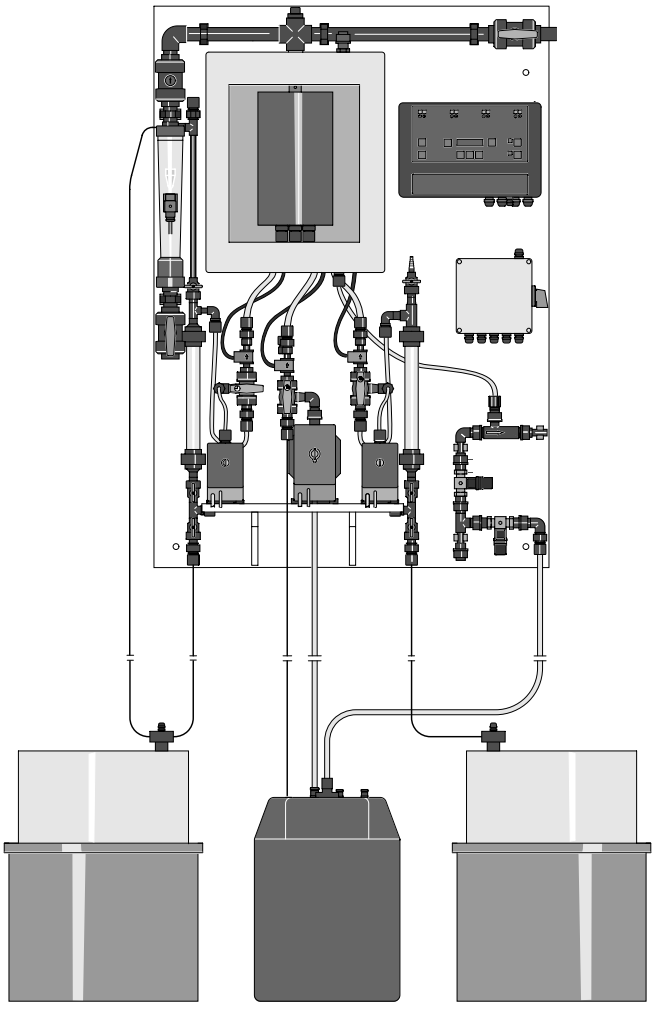
Operating Instructions

Bello Zon® Type CDKa for Concentrated Chemicals



CDKa ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Please enter identity code of the device here.

Please read through these operating instructions in full before use. Do not discard!

Damage caused by incorrect operation will invalidate the guarantee.

The manufacturer is not liable for any damage caused by failure to follow operating instructions.

Publishing details:
Operating Instructions Bello Zon® Type CDKa
for Concentrated Chemicals

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Subject to technical alterations.

page

General instructions for use

Please read through these instructions for use carefully. They will enable you to make the best possible use of this operating instructions manual.

The following sections are highlighted in the text:

- Enumerated points
- Instructions

Working instructions:

IMPORTANT

Guidelines are intended to make your work easier.

and safety instructions:

DANGER

Describes a potentially dangerous situation.
Non-observance can lead to personal injury or damage to property.

CAUTION

Describes a potentially dangerous situation. If not avoided, could cause slight or minor injury or damage to property.

NOTICE

Describes a potentially dangerous situation.
Non-observance can lead to damage to property.

A Instructions for regulation use

A.a. Regulation Use

Chlorine Dioxide systems are made only for the disinfection of water and may not be used for any other purpose.

IMPORTANT

Chlorine dioxide (ClO_2) is an extraordinarily reactive gas that cannot be stored because of its instability. It should only be produced as needed in special enclosures at the place of use.

The amount of chlorine dioxide necessary depends on the particular need. For drinking water a concentration of 0.1–0.2 mg/l is sufficient. For industrial use (e.g. rinse water) higher concentrations are often used.

The Drinking Water Ordinance in the version of 5 December 1990 provides for doses of up to 0.4 mg/l, whereby detectable amounts of up to 0.2 mg/l of chlorine dioxide and chlorite are allowed as by-products of the reaction.

A.b Non-regulation use

CAUTION

Under no circumstances should chlorine dioxide systems be used for the treatment of gaseous substances.

B Obligations of the user

This operating manual should be available to all supervisors and operating personnel and kept readily accessible near the chorine dioxide system.

The user must ensure that chlorine dioxide systems are only used and operated by specially trained, expert persons. It is recommended to have operators confirm that they have been trained and introduced to the system.

The user must ensure that only authorised persons have access to the system and chemicals needed for its use.

The manufacturer should be notified immediately in the event of technical problems that could effect the health of persons having contact with water treated by the system.

After installation of the system by trained personnel, the system must be tested and approved for use by an expert authorised by ProMinent.

C Instructions for introducing operators to chlorine dioxide system

AIt is mandatory that all chapters of this operating manual, especially those describing the chlorine dioxide system and their commissioning be carefully read.

An expert from ProMinent must give operators a detailed introduction as part of the commissioning of the system.

This manual will provide enough information to answer almost all questions arising from malfunctioning. Questions necessitating more detailed information should be addressed to the manufacturer of the system.

D Information on general safety

NOTICE

This operating manual is to be made available to all operating personnel and kept readily accessible near the chorine dioxide system (see ch. B).

D.a Relevant guidelines and regulations

Bello Zon®-Systems are manufactured in compliance with DVGW Guidelines W 224 (chlorine dioxide in treatment of water) and with the accident prevention regulations “Chlorination of Water” GUV 8.15 and VGB 65.

NOTICE

- **When installing and using chlorine dioxide systems, the following regulations and ordinances must be observed and the systems operated in accordance thereof:**

a) Accident prevention regulation “Chlorination of Water” GUV 8.15 and VGB 65 (in the version of 1 Sep. 79)

- **§ 12 (1–5) prescribes personal protective gear that the user must provide.**

b) Ordinance on dangerous working materials (Arb-StoffV), in the version of 11 Feb. 1982 BGBI/p. 145.

D.b Requirements for starting components in the production of chlorine dioxide in Bello Zon® CDKa Systems

For process safety reasons, use only chemical components of prescribed concentrations and with a tolerable level of recycled material (for details, see ch. 1.2.10).

NOTICE

- **After finishing treatment of water for drinking purposes there may not be any impurities left in concentrations dangerous to human health. In this respect see “Act governing contact with food and public sale thereof (Food Act)”.**
- **Production using concentrations of starting chemicals exceeding those specified is permissible only with the expressed consent of the manufacturer.**

D.c Additional information on safety

NOTICE

- **All rooms used in connection with chemicals must be locked when not in use. Any such room may not be used as lounge. It must be adequately ventila-ted and protected against frost. No one should come in contact with concentrated chemicals. Protective clothing (goggles and protective gloves) must be provided for working with chemicals (see section D.a.a (“Note”)).**
- **Rooms containing chlorine dioxide systems must be separated by fire walls from all other rooms.**

NOTICE
ACCIDENTS WITH CHEMICALS:

In case of contact with chemicals used in chlorine dioxide systems, observe safety instructions in the chemical brochures when taking action.

CAUTION

There is danger of caustic injury (burning) in contacting the chemicals hydrochloric
- acid HCl 30–33% and
- sodium chlorite $NaClO_2$ 24,5 %.

Flush immediately with large amounts of water and call medical doctor.

DANGER

The intake lance “acid” belongs to the acid tank and the intake lance “chlorite” belongs to the chlorite tank.

The intake lances and storage tanks for concentrated sodium chlorite and hydrochloric acid must be clearly identified and under no circumstances exchanged.

Never place both intake lances together or successively in the same bucket.

Exchanging the two intake lances when they contain chemical residues will cause gaseous chlorine dioxide to form (poisonous, caustic, strongly oxidizing).

For all Bello Zon® systems in which the reactor cannot be flushed in mounted position:

- **Before maintenance flush the reactor thoroughly with water. Empty reactor only outdoors or at least in an extremely well-ventilated room, e.g. in a laboratory beneath a fume hood or in front of open window.**
- **When emptying, wear protective gear such as gloves and goggles (see ch. D.a.a); observe all local regulations.**

The system must be installed so that a vacuum cannot occur in the bypass line under any circumstances (including operational standstills). If this cannot be insured, an anti-vacuum device must be installed.

CAUTION

- **It must be ensured that any chemicals spilt will be safely disposed of, e.g. by hosing the chemicals into a floor drain.**
- **Suitable precautions (e.g., installing an anti-vacuum device) must be taken to avoid any vacuum at the point of metering.**
- **In the event that water to be treated should fail to flow, it must be ensured that the metering of chlorine dioxide solution will be automatically stop.**
- **The maximum allowable pressure for the system (see ch. 1.2.2) is not to be exceeded under any operational conditions.**
- **Disconnect all electric power when mounting system.**

NOTICE

- **The complete system, including pipes, must be free of leaks at maximum operating pressure (see ch. 1.2.2)**
- **Mount signs informing of danger according to GUV 8.15 Annex 2 and 3 (see also ch. 1.2.11)**

IMPORTANT

- Deliveries to Israel:
  Only fluorine-free chemicals may be used there.
- When water to be treated is enriched with ClO_2, the turbine wheel flow meter may not be used as bypass monitor (see ch. 1.4.2).
- The system may be operated only within the conditions specified herein (see ch. 1.2.5).
- The reactor of the Bello Zon® CDKa systems is subject to the Ordinance on Pressurised Containers and is marked accordingly.
  The user must see to it that regulations applying are met.

D.d Warning signs

NOTICE

Five warning signs (see fig. 6–10, ch. 1.2.11) must be hung up during installation.

E Emissions

During normal usage there are no emissions from chlorine dioxide systems Bello Zon® Type CDKa. For further information on possible emission dangers, see Ch. D “Information on general safety”.

F Terms and abbreviations used

bl	blue
br	brown
ca.	approx.
CDK	chlorine dioxide system for concentrated chemicals
Ch.	chapter
ClO_2	chlorine dioxide
fig.	figure
gb	yellow
gn	green
h	hour
HCl	hydrochloric acid
Hz	Hertz (cycles per second)
kg	kilogram
l	litre
LED	light emitting diode
max.	maximum
mA	milliampere
mg	milligram
min.	minute
ml	millilitre
$NaClO_2$	sodium chlorite
sec.	second
sw	black
Tab.	table
V	Volt
w/o	without
ws	white

1 Description of chlorine dioxide system, chemical principle and functional mode of system

Chemical principle of system

Hydrochloric acid chlorite process:

Sodium chlorite + hydrochloric acid → chlorine dioxide + sodium chloride + water

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

The Bello Zon® CDKa systems generate a 2 % chlorine dioxide solution (20 g/l ClO_2) by combining concentrated hydrochloric acid and concentrated sodium chlorite together with water (see ch. 1.2.10). Immediately after production, the sodium chloride is fed to the water to be treated. The dosage can be set both manually (internal control) or automatically (external control), by using a flow signal and/or control setting.

Function of the system:

Three metering pumps driven by a programmed microprocessor control feed the components acid, chlorite and water by way of hoses and three-way valves to the reactor. There they mix and react, forming a 2 % chlorine dioxide solution. The feeding of the components to the reactor is checked by flow monitors.

The chlorine dioxide solution flows through the metering valve into the bypass. From there the pre-diluted ClO_2 is fed to the metering station.

Control of the metering pumps is carried out in the order “water” - “acid” - “chlorite”; the three pumps work independently of each other and do not have to be adjusted for equal rates of metering.

Flow monitors register when the metering pumps start stroking and this is indicated at the control. If the flow monitor pulses fail, this is indicated after eight successive strokes and metering is stopped. Should high excess pressure occur during correctly functioning flow monitoring, the metering rate decreases and the system switches to “fault”.

Changes in parameters relevant to operation such as stroke length, pressure at metering valve, etc. necessitate re-calibrating the rate of flow of the metering pumps.

Metering can be arrested at the control. Input signals are ignored in the arrest position “Standby”, the pumps are not driven, and it is possible to change settings.

The intake lances or intake fittings (referred to below as “intake lances” in either case) leading from the acid and chlorite tanks are equipped with a two-stage level switch. If the level of one of the components falls, then a float in the level switch sinks to the middle position, and the control displays the message “acid level low” or “chlorite level low”. If the float sinks to the lowest position, then the system shuts down, and the control displays the message “Acid Cont. EMPTY” or “Chlorite Cont. EMPTY”. In addition, there is a hose connected between the intake lance “acid” and the reactor housing for venting (option: CDKa xA...). In this way acid fumes are conducted to the reactor housing and do not pollute room air.

For the water supply tank there are two one-stage level monitoring devices. The refill time is entered into the configuration menu. The level monitoring device “FULL” serves as a safety device. After the level monitor switch “EMPTY” activates the refilling of water, there is a five-second span of time until the system shuts down. This is a safety factor, in case, for example, water fails to flow or the float gets caught.

There is an optional flow rate monitor built into the bypass (turbine wheel flow meter or variable-area flow meter). If the rate of flow sinks below a minimal level, metering is stopped until the rate of flow again exceeds the minimum rate. In case the system delivered does not contain a bypass monitor (see ch. 1.1.1 “Identification code”), the user must ensure that during metering a sufficient rate of flow through the bypass is guaranteed.

An optional pump in the bypass is regulated to start up and stop simultaneously with the metering. If a turbine wheel flow meter has been installed as bypass monitor, metering will also be stopped when the bypass flow rate exceeds the average rate in the main line.

A static mixer (premixer) to improve mixing can be delivered as an accessory.

An automatic discharge device, consisting of an injector and a solenoid valve, turns on periodically for a few seconds to extract liquids or fumes in the event of possible leakage from the reactor housing. These are then conducted safely to waste water.

1.1 Detailed description of system

Series CDKa chlorine dioxide systems are completely assembled installations ready for connection.

An accessory set containing diverse small parts is part of delivery for each Bello Zon® System.

1.1.1 Identification code

The system configuration is determined by the identification code used for configuring Bello Zon® Systems

Nr.	1	2	3	4	5	6	7	8	9	10
	CDKa	**x**	**X**	**x**	**x**	**x**	**x**	**X**	**x**	**x**

N.B.
X is place marker for a letter and
x is place marker for a number

Enter identification code here:

CDKa _ _ _ _ _ _ _ _ _ _

Bello Zon® chlorine dioxide generating system for concentrated chemicals (CDK), series a — CDKa

Type of system: ClO_2 metering rate:
1 = **CDKa 150** = 150 g/h
3 = **CDKa 420** = 420 g/h
4 = **CDKa 750** = 750 g/h
5 = **CDKa 1500** = 1500 g/h
7 = **CDKa 6000** = 5900 g/h
8 = **CDKa 10000** = 9800 g/h — **1**

A = with installed calibration vessels
B = without installed calibration vessels — **2**

Operating voltage:
0 = 230 V, 50/60 Hz
1 = 115 V, 50*/60 Hz
* CDKa 420, 750 and 1500 not deliverable with 115 V, 50 Hz — **3**

Intake lance chemicals:
0 = no intake lances
1 = variable intake lances for 60 l container (height 500–700 mm)
2 = flexible intake fittings up to 5 m with two-stage level switch — **4**

Bypass construction:
0 = without bypass monitor
1 = with turbine wheel flow meter*
2 = with variable area flow meter* — **5**

control-variable input:
for connecting controller to flow rate dependent metering)
0 = none
1 = contact, pulse range 0–4 Hz
2 = analog (0/4–20 mA) and contact (reversible) — **6**

Flow input (for connecting water meter)	
0 = none	
1 = contact, pulse range 0–4 Hz contact water meter	
2 = frequency 0–10 Hz	
3 = analog (0/4–20 mA) and contact (reversible)	**7**

Language default:	
E = English	
D = German	
F = French	
I = Italian	
S = Spanish	**8**

Analog outputs:	
0 = none (standard setting)	
1 = analog (0/4–20 mA) for recorder	**9**

Remote control input:	
0 = none	
1 = contact (pause function)	
2 = analog (0/4–20 mA)	
3 = contact and analog (0/4–20 mA)	**10**

NB:

System options are set in grey areas

The hardware and software version numbers are displayed on the control panel (hardware version before the slash, software version after the slash, e.g. 01/01.1). Version numbers should be given in the event of complaints or when expanding a previously installed system.

An operating code simplifies the setup of the system on location. This code enables activation of the various options available.

1.1.2 Operating code “Aktiv”

Bello Zon® systems are delivered with a factory-set “identification code”. The identification code is a result of the composition of the system as determined by the user’s order, e.g., whether flow rate metering or reading-dependent metering is desired. Should application needs change, control defaults can be altered within limits, depending on the hardware. The operating code “active” serves this purpose. Models with the identification code CDKaxAxxx11Dxx contain both control variants for contact signals. If there is a “0” in the identification code at the corresponding position, then this variant in the active code cannot be activated. The access code is entered to set the operating code.

Nr.	1	2	3	4	5	6	7	8
AKTIV	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**

N.B.:

x is place marker for a letter

Enter operating code here:

AKTIV _ _ _ _ _ _ _ _

Control for bypass pumps	
N = control inactive	
P = control activated	**1**

Flow rate monitoring in bypass	
N = inactive	
T = turbine	
O = contact input (Normally open)	
C = contact input (Normally closed)	**2**

Control variable
N = inactive
K = contakt (0–4 Hz)
0 = analog 0–20 mA
4 = analog 4–20 mA
3

Flow input
N = inactive
K = contakt (0–4 Hz)
F = frequency
0 = analog 0–20 mA
4 = analog 4–20 mA
4

Language

E = English	S = Spanish
D = German	H = Hungarian
C = Czech	R = Rumanian
F = French	B = Portuguese
I = Italian	N = Dutch
P = Polish	

5

Analog output
N = inactive
0 = 0–20 mA
4 = 4–20 mA
6

Remote control input: contact (pause function)
N = inactive
O = NO, Normally open
C = NC, Normally closed
7

Remote control input: analog
N = inactive
0 = 0–20 mA
4 = 4–20 mA
8

The possibilities for making settings using the function keys of the control panel are explained in connection with operating the system (see ch. 5 ff.).

1.1.3 Construction: Description of the system and its construction groups

Bello Zon®-CDKa systems (see fig. 1) are chlorine dioxide generating and metering systems that work with concentrated chemicals. They are completely assembled ready for connection. Performance ranges from 150 g/h to 10.000 g/h of chlorine dioxide.

Fig 1: Schematic drawing of chlorine dioxide systems CDKa 150–1500

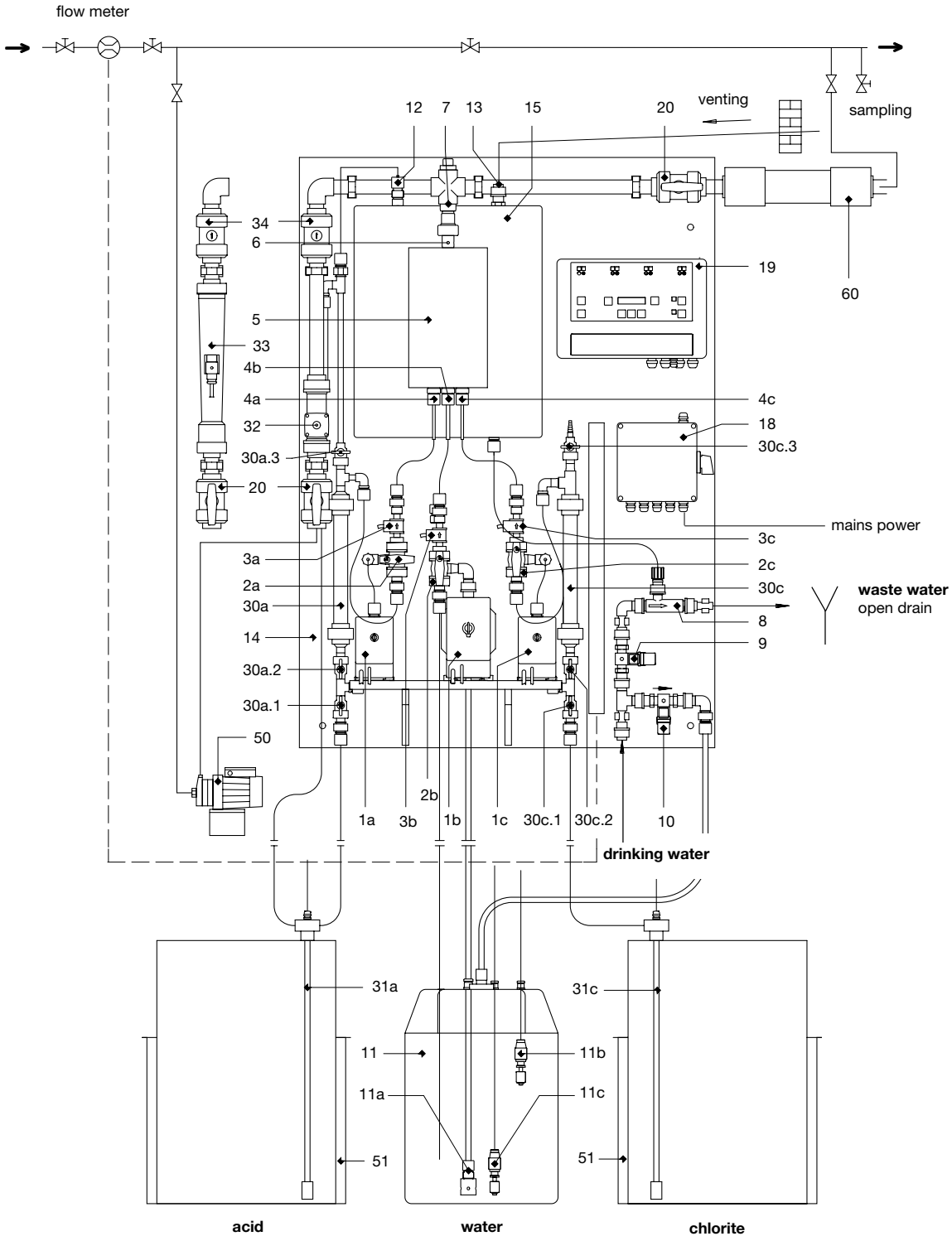


Table 1:
Components of Bello Zon® Systems CDKa 150–1500

1 a	metering pump acid
1 b	metering pump water
1 c	metering pump chlorite
2 a	air bleed tap acid
2 b	air bleed tap water
2 c	air bleed tap chlorite
3 a	flow monitor acid
3 b	flow monitor water
3 c	flow monitor chlorite
4 a	reactor input valve acid
4 b	reactor input valve water
4 c	reactor input valve chlorite
5	reactor
6	observation window
7	metering valve (1.5 bar)
8	injector
9	solenoid valve for discharge system
10	solenoid valve for water supply
11	water supply tank 35 l
11 a	foot valve
11 b	level monitoring device “FULL“
11 c	level monitoring device “EMPTY“
12	venting hook-up acid
13	venting hook-up reactor housing
14	support bracket
15	reactor housing
18	distribution box
19	control
20	stop valve in bypass line
not illus.	graduated cylinder (CDKa 150: 500 ml, CDKa 420: 1000 ml)
not illus.	set of danger signs (see ch. 1.2.11)
not illus.	supplementary set CDKa (small parts)

Table 2: Options

30 a	calibrating vessel acid
30 a.1-3	ball valve acid
30 c.1-3	ball valve chlorite
30 c	calibrating vessel chlorite
31 a	variable intake lance acid for 60 l tank
31 c	variable intake lance chlorite for 60 l tank
not illus.	flexible intake fittings 5 m

Table 3: Bypass construction

32	flow rate monitor with turbine wheel flow meter
33	flow rate monitor with variable area flow meter
34	back stroke valve (spring loaded, 0.06 bar)

Accessories, see table 4: or descriptions, see section 1.5 ff.

Table 4: Accessories

50	bypass pump with wall support bracket
51	safety collection tub (without leakage warning) 70 l
60	pre-mixing
not illus.	safety collection tub (with leakage warning) 70 l
not illus.	comparator for chlorine dioxide measurement
not illus.	venting valve for reactor housing
not illus.	Cabinets for systems CDKa 150 and 420 (on request)
not illus.	DULCOFILT® G1" filter with 100 µm mesh

1.1.3.1 Reactor

The **reactor** is isolated in a closed reactor housing (15) with a *discharge device.* There is a *observation window* (6) in the line above the reactor. The reaction can be observed here in the form of a slight yellow discoloration.

The chlorine dioxide solution flows through the *metering valve* (7) into the bypass. Here it is mixed into the bypass water flow.

1.1.3.2 Exhaust system

The **exhaust system** for gases and liquids from the reactor housing consists of an *injector* (injector) (8) and a solenoid valve (a). The injector runs on a water line with a minimal pressure of 1 bar.

The solenoid valve is activated ca. six times an hour by way of the control so that the air in the reactor housing is regularly renewed. Any possible leakage is thus removed safely as waste water. Since chlorine dioxide is heavier than air, leakage collects in the lower portion of the housing and is removed by the exhaust system.

Fresh air is fed into the reactor housing either via a *venting valve* or via a line leading in outdoor air. The venting valve is available as an accessory (see ch. 1.5.5).

The tank for acid is also ventilated by way of the reactor housing. Corrosive acid fumes are thus removed by the exhaust system.

1.1.3.3 Metering Pumps

The **metering pumps** for the chemicals acid (1a), water (1b) and chlorite (1c, see fig. 1) are mounted at the bottom end of the support bracket. A hose leads from the intake lances to the liquid end of the pumps. A rotary knob on the metering pumps can be used to adjust the stroke length.

The stroke frequency is calculated by the control and sent by way of pulses to the pumps.

Each pump operates at its own independent stroke frequency. The respective delivery rate is determined by gauging (calibration, see ch. 2.2.3). These rates are entered into the control. The control then calculates the necessary frequency so that both chemical pumps deliver the same quantity.

The water pump delivers 5.5 times as much as the chemical pumps.

The stroke lengths of the pumps must agree within a tolerance of ±20 %. The liquid ends are made of acrylic glass. Various pumps are used depending on the capacity of the chlorine dioxide system (see Table 6, ch. 1.2.2).

From the liquid end of the pumps *PTFE-hoses* lead to the *three-way valves* (2a–c). These can be set in the positions “bleed” or “feed”. Next in line are the *flow monitors* (3a–c) and then the *reactor* (5). At the entrance to the reactor are three vertically arranged *ball valves* (4a–c).

1.1.3.4 Calibration vessels (vacuum tanks)

In version **CDKa**x**A**xxxxxXx, **optional calibration vessels** can be arranged next to the pumps (30a, 30c). These are used when calibrating the pumps and serve during normal usage as **vacuum tanks** to collect gas pockets from the suction lines.

A short hose on the intake end of the pumps for acid and chlorite leads to a T between two stop *valves*. The corresponding *suction line* is connected to the bottom of the stop valves (30a.1, 30c.1). The calibration tanks are mounted above the stop valves (30a.2, 30c.2).

1.1.3.5 Flow monitors (ring initiators)

The task of the **flow monitor** (3a–c) is to ensure that both chemicals and water flow in the right relationship during system operation.

If the volumetric flow of a component is reduced by more than 30 %, the flow monitor triggers an alarm and switches off the system after eight missing pulses in a row.

The operating point must be set correctly by means of vertical adjustment of the sensors (ring initiators) in order to ensure proper functioning of the flow monitors. From software version 3.13, the dosing monitors are also active during calibration and start up.

1.1.3.6 Metering valve

The **metering valve** (7) is located in the bypass line, installed in a *four-way piece*. The valve opens at a reactor internal pressure of ca. 1.5 bar.

1.1.3.7 Bypass line

The chlorine dioxide solution produced (concentration = 20 g/l) is diluted in **the bypass line** and fed to the main flow of water.

In the standard equipment of the system there are *ball valves* (20) but no bypass monitor. Various **options** for the bypass line are available (see fig. 22, ch. 9) according to the identification code (see also ch. 1.1.1 Identification Code and ch. 1.4.2 Bypass Monitoring):

- Bypass (33) with *variable-area flow meter* and *minimum contact* to signal a minimum of flow.
- Bypass with *turbine wheel flow meter* and minimum contact (see ch. 1.1.3.9).
- *Non-return valve* (34)
- *premixing device* (60).

IMPORTANT

- The turbine flow meter cannot be used if the bypass water is enriched with chlorine dioxide (e.g. in circuit systems).
- If a turbine wheel flow meter is used and bypass water is not free of solid particles, a protective filter should be connected before the turbine flow meter (see ch. 1.5.4).

1.1.3.8 Systems without bypass monitoring

If the system **does not include bypass monitoring (33)**, the user must ensure that the system will always shut down automatically and immediately when there is no flow of bypass water.

1.1.3.9 Systems with bypass monitoring

The control has an input for a **bypass monitor**. This ensures that no chlorine dioxide can be fed without a flow of water in the bypass.The response value of minimal contact in conjunction with the turbine wheel flow meter is set in the configuration menu (see ch. 5.2.4 “Bypass options”).

1.1.3.10 Component tanks, intake lances and intake fittings

The **component containers for chemicals** (e.g. 60 l drum) stand on the floor in front of the system. The chemicals are fed by way of **intake lances** (31a, 31c). The length of the intake lances must correspond to the size of the tanks, the diameter of the suction lines, and to the capacity of the system (see table 20, ch. 1.5.7).

The intake lances contain a *two-stage level monitoring device*. If the amount of one of the chemicals sinks to the first level, then the warning “acid level low” or “chlorite level low” lights up on the control panel. A red LED “alarm” also lights up as warning (8, see fig. 11). The system continues to run, and the relay “warning” is activated. In the second stage of the level monitoring,

the system shuts down, the message “acid tank empty” or “chlorite tank empty” lights up on the control panel, the alarm-LED (8) flashes and the alarm-relay is activated. In case a horn is connected to the system, it sounds a signal.

Dilution water is pumped from the **water tank** (11) by way of a *suction hose* with a *foot valve* (11a). The suction hose is connected to an *metering pump for water* (1b), the second hose is connected to a three-way valve on the water intake pump. The container for water has level monitoring devices for each of the two conditions “full” (11b) and “empty” (11c). The *solenoid valve* is activated by the lower monitoring switch to refill the dilution water. After several seconds, the position of the float is checked; if it has not reached the upper position, then the system shuts down because of insufficient dilution water. The upper monitor switch serves as *overflow protection*. Both level monitors are connected to the same controller input and trigger the message "Water tank!" in the event of a fault.

Instead of intake lances, flexible **intake fittings**, five meters in length, can be installed.

1.1.3.11 Control

The **control** (19) is mounted to the right of the reactor housing (see fig. 1, ch. 1.1.3). The number of inputs and outputs varies according to the configuration of the system (ch. 1.1.1).

Control options

Part of standard equipment is an input for a **contact water meter** (flow meter). The rate of intake can be controlled according to the flow of water in the main water line. When connecting the contact water meter it should be noted that the maximum permissible frequency is 4 Hz. An optional analog flow meter (0/4–20 mA) can be connected.

There is also the possibility of regulating the *quantity of ClO_2* in relation to readings. The **control variable** can be either a pulse signal (max. 4 Hz), or an analog current signal (0/4 - 20 mA). Control by way of pulse signal is part of **standard equipment**.

There is an **hardware option** for locking the ClO_2 system per remote control **(pause function)**. The system can be turned on or off by way of a *voltage-free* contact.

A further **hardware option** makes it possible to check the momentary operating capacity (*ClO_2 g/h*) and, in case in operation, to read the water flow meter as analog output signal (**analog output**).

1.1.3.12 Distribution box

The **distribution box** (18) is mounted beneath the control and serves to power the *metering pumps*; in addition, it contains an *emergency shutdown switch* and a mains filter.

For the electrical connections to the distribution box, see fig. 5, ch. 1.2.7.2.

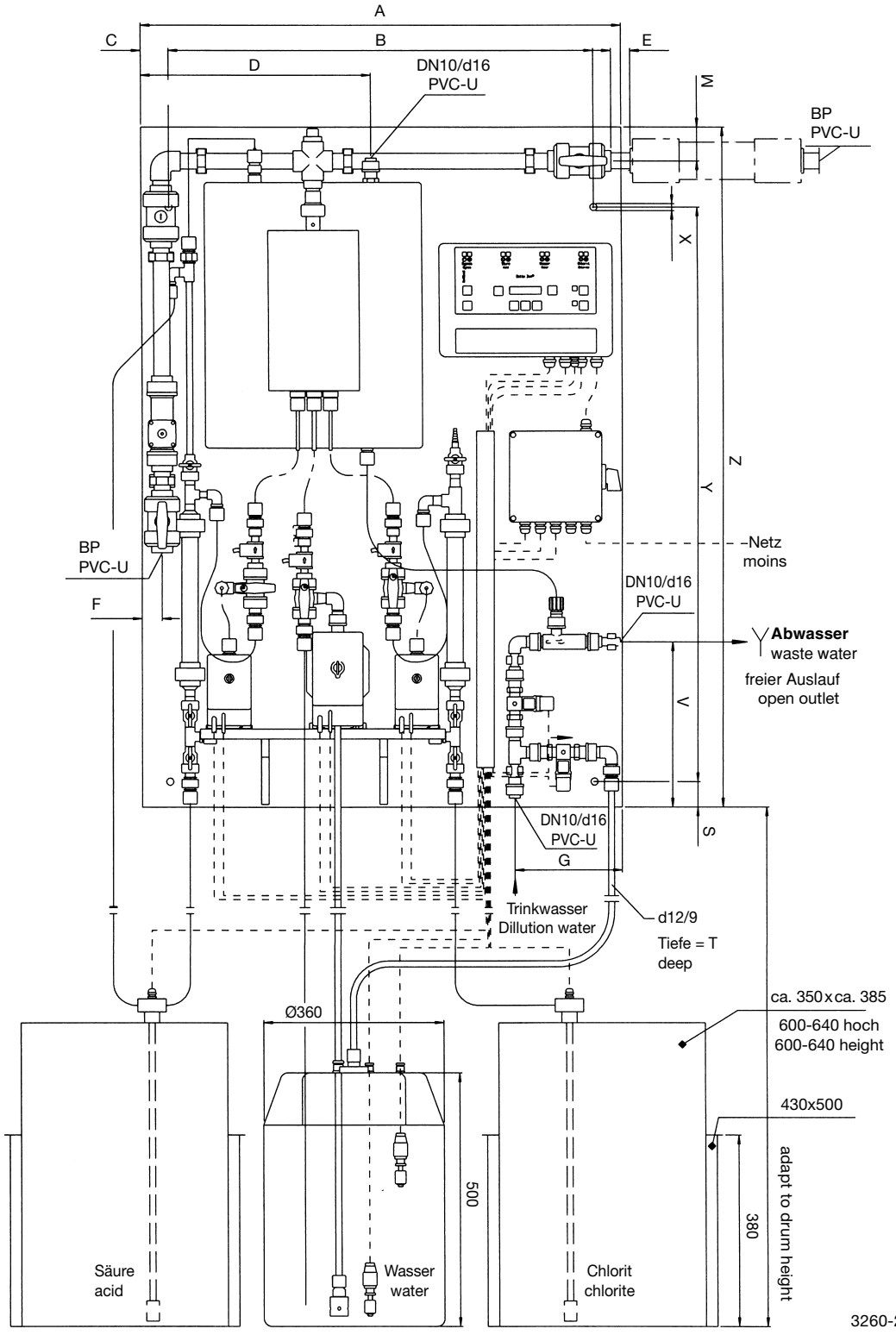
1.2. Technical specifications

The following chapters include the technical specifications necessary for mounting, installing and operating the system and its essential components. Enquiries for further information should be directed to the manufacturer.

1.2.1 Technical features of the system

The dimensions of the chlorine dioxide system are given below (fig. 2).

Fig. 2: Dimensions of Bello Zon® CDK 150–1500 System



CDK	A	B	C	D	E	F	G	BP	W	V	T	S	Z	Y	X
150-420	950	840	55	455	38	40	212	DN 25/d 32	68	324	380	50	1350	1140	ø 14
750	1100	990	55	533	38	55	212	DN 32/d 40	113	322	380	50	1610	1447	ø 14
1500	1300	1190	55	755	38	60	212	DN 40/d 50	108	272	430	190	1850	1422	ø 14

Fig. 2a: Dimensions of Bello Zon® CDK 6000-10.000

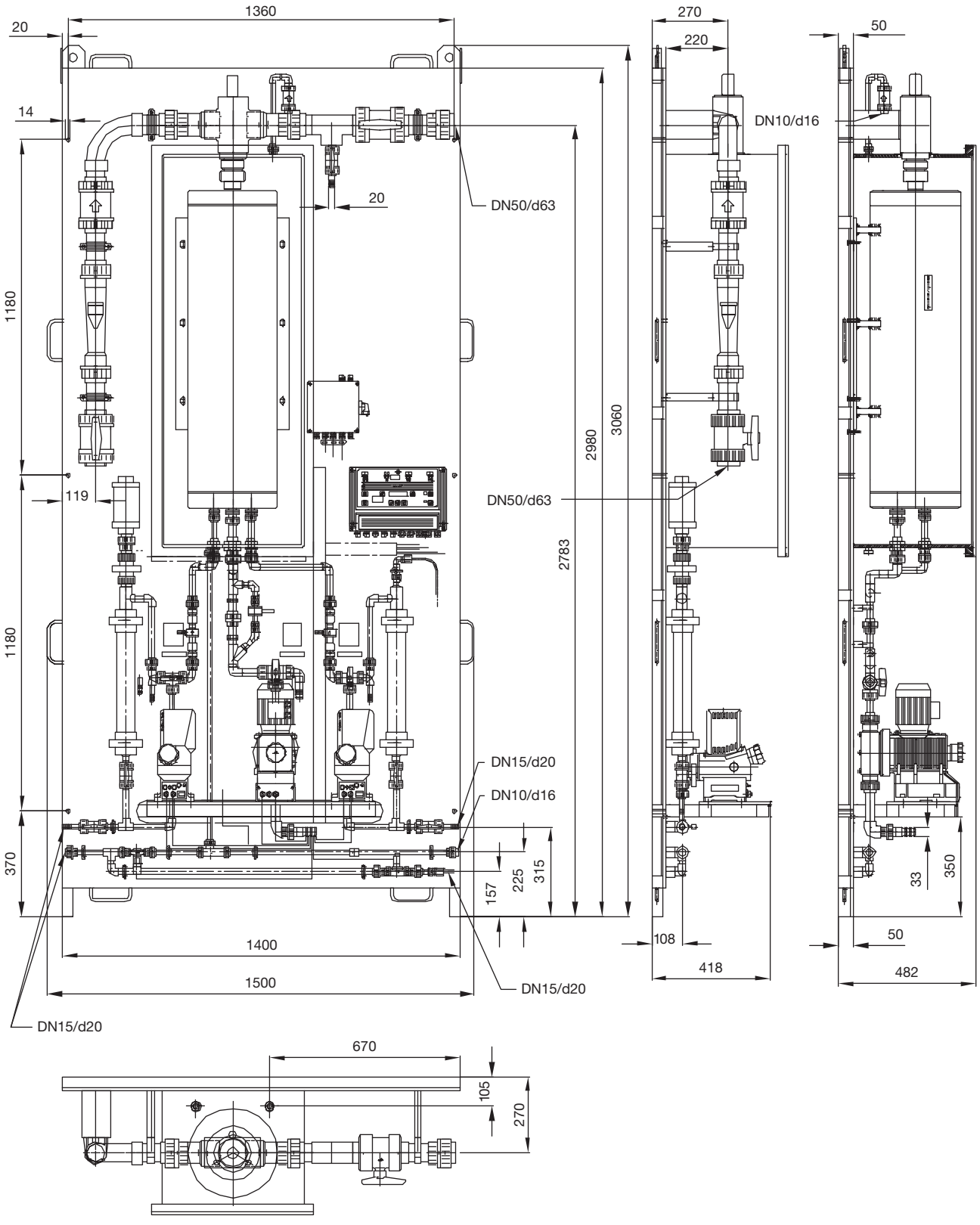


Table 5: Technical specifications, chlorine dioxide systems CDKa 150 – CDKa 1500

System type	CDKa 150	CDKa 420	CDKa 750	CDKa 1500
type chemical pump	G/4	G/4	G/5	G/5
size chemical pump	1601	1002	1605	1310
type water pump	G/5	Vario	Vario	SICA
size water pump	1605	12017	12026	12090
pump connection chemicals liquid end	6/4	6/4	8/5	8/5
water connection liquid end	8/5	20/15	20/15	27/19
flow monitor chemicals	B	C	D	D
flow monitor water	D	G	H	K
net reactor content	1.85 l	1.85 l	3.1 l	6.5 l
net premixer content	1.5 l	3.5 l	7 l	13.4 l
bypass connection	DN25/d32	DN25/d32	DN32/d40	DN40/d50

1.2.2 Performance data

* "The specified metering rates are referred to a mean operating pressure of 5 bar and an ambient temperature of 20 °C and determined with the pump at operating temperature (at least 3 h at maximum frequency).

In case of deviating conditions, these values can vary within a range of +30 % depending on the system configuration.

** Intake height with clean, damp valves and at 100 % stroke.

Table 6: System performance data of Chlorine Dioxide-System CDKa 150–1500

System	metering Chlorine dioxid*	max. operating pressure	operating temp.	meter-pumpe	max. stroke frequency	metering rate per component*		max. intake head metering pump**
Type	**g/h**	**mg/stroke**	**bar**	**°C**		**strokes/h**	**l/h**	**ml/stroke**	**m wc**
CDKa 150	150	21	10	10–40	acid chlorite	7200	1	0.139	1.65
					water	6000	5.5	0.916	1.3
CDKa 420	420	60	8	10–40	acid chlorite	7200	2.9	0.396	0.9
					water	6000	15.7	2.61	7
CDKa 750	750	125	8	10–40	acid chlorite	6000	5.0	0.84	1.3
					water	7320	27.7	3.78	7
CDKa 1500	1500	250	8	10–40	acid chlorite	6000	10.0	1.66	1.9
					water	4380	55.0	12.55	7

Table 6a: Technical Data Bello Zon® 6000–10000

Type	CDKa 6000	CDKa 10000
metering Chlorine Dioxide	5900 g/h 806 mg/stroke	9800 g/h 1533 mg/stroke
maximum operating pressure	2 bar	2 bar
operating temperature	10–40 °C	10–40 °C
type chemical pump	Vario 09039	Vario 05075
type water pump	Sica 07220	Sica 04350
pump connection chemical suction side	DN10 / d16	DN15 / d20
Pump connection water suction side	DN20 / 1 ½"	DN25 / d32
chemical pump		
maximum frequency	7320 strokes/h	6393 strokes/h
metering	39.3 l/h / 5.37 ml/stroke	65.5 l/h / 10.2 ml/stroke
maximum suction height	4 m	3 m
water pump		
maximum frequency	7920 strokes/h	11880 strokes/h
metering	216.3 l/h / 27.3 ml/stroke	360 l/h / 30.3 ml/stroke
maximum suction height	5 m	5 m

1.2.3 Reactor specifications

Table 7: Reactor specifications

	150	420 750	1500	6000	10000
part number	**791690**	**741106**	**741176**	**1002899**	**1003927**
reactor input connection	3 x G ¾ inside	3 x G ¾ inside	2 x G ¾ inside 1 x G 1 inside	2 x G ¾ inside 1 x G 1 ½ inside	2 x G 1 inside 1 x G 1 ¼ inside
reactor output connection	G 3/4 inside left	G 1 inside left	G 1 inside left	G 1 ¾ inside left	G 1 ¾ inside left
max. operating pressure	11.5 bar	8.5 bar	8.5 bar	3.5 bar	3.5 bar
max. operating temperature	40 °C	40 °C	40 °C	40 °C	40 °C

1.2.4 Weight

Table 8: Transport weight, net (w/o packing material)

System	CDKa 150	CDKa 420	CDKa 750	CDKa 1500	CDKa 6000	CDKa 10000
system with bypass	60 kg	62 kg	82 kg	135 kg	420 kg	450 kg
bypass pump with support bracket	12 kg	12 kg	14 kg	14 kg		
premixer	2.4 kg	5.5 kg	10 kg	20 kg		

1.2.5 Temperature

Maintaining temperatures within the ranges shown in table 9 will allow optimal use of system.

Table 9: Acceptable range of temperatures

item	temperature range
water to be treated	+2 °C to +40 °C
components	+10 °C to +40 °C

IMPORTANT

For chlorine dioxide systems, operating temperatures ≤ 15 ºC and a rate of flow with 100 % stroke and maximum frequency result in a chlorine dioxide yield of less than 90 %.

At low temperatures, the chemicals can be preheated via the heating systems of the intake lines. In this way, operation at ambient temperatures from 2–15 °C can be realised with optimum yield.

1.2.6 Climate and environment

Concerning climate and environmental parameters:

- the maximum acceptable humidity is 92 % (non-condensing)
- Install the systems only in frost-protected closed rooms and protect from direct sunlight.

1.2.7 Specifications of electrical components

For electrical connections to the control, see fig. 3 and table 12, section 1.2.7.1. For those to the distributor box, see fig. 5, section 1.2.7.2.

1.2.7.1 Control

Electrical specifications of control:

Table 10: Supply voltage, supply frequency

Supply voltage	supply frequency
230 V (+10 %, -6 %)	50 / 60 Hz
115 V (+10 %, -6 %)	50*/ 60 Hz

* CDKa 420–CDKa 1500 are not deliverable for 115 V, 50 Hz

The fuse is in a holder with bayonet catch located in the terminal box of the control. Specifications and part numbers below.

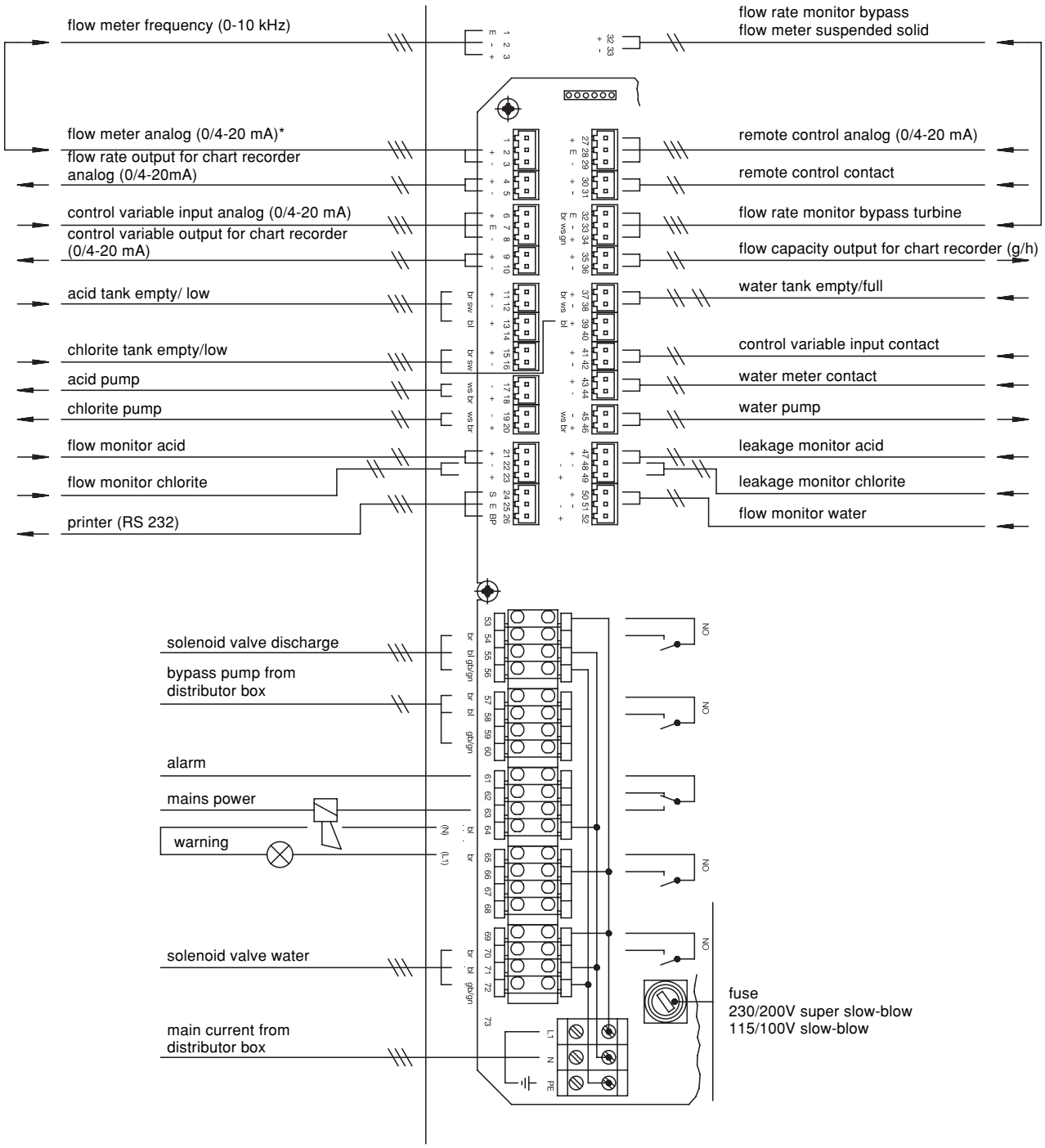
Table 11: Fine-wire fuses and current

fine-wire fuse 5 mm x 20 mm

voltage	current	part number
230 V (+10 %, -6 %)	0.2 A super slow-blow fuse	712057
115 V (+10 %, -6 %)	0.4 A slow-blow fuse	712021

For the configuration of the control terminals, see fig. 3 and table 12.

Fig. 3: Electrical wiring diagram for Bello Zon® CDK



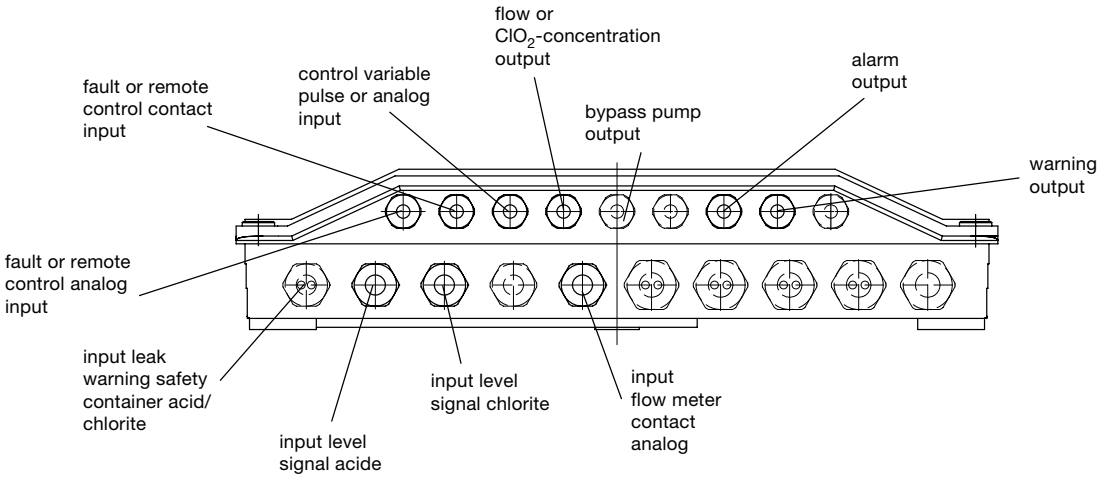
* Analog inputs offer two possible connections
Instruments supplying current (active transmitters) are connected to terminals 2 (+) and 3 (-)
Terminal 1 is a 20 V terminal provided for passive instruments

Table 12: Configuration of control terminals

terminal	connection	socket configuration	insert card
standard equipment			
L1 (br), N (bl), PE (gb/gn)	distribution box voltage		
54 (br), 55 (bl), 56 (gb/gn)	control solenoid discharge valve		
70 (br), 71 (bl), 72 (gb/gn)	control solenoid water valve		
17 (- ws), 18 (+ br)	control acid pump		
19 (- ws), 20 (+ br)	control chlorite pump		
45 (- ws), 46 (+ br)	control water pump		
21 (+ br), 22 (- bl)	signal flow monitor acid	plug-in 12	order no. 725275
22 (- bl), 23 (+ br)	signal flow monitor chlorite	insert card digital input Bello Zon®	
51 (- bl), 50 (+ br)	signal flow monitor water		
51 (- bl), 52 (+ br)	signal flow monitor water		
11 (+ br), 12 (- sw)	level switch acid tank EMPTY		
13 (+ bl)	level switch acid INITIAL WARNING		
15 (+ br), 16 (- sw)	level switch chlorite tank EMPTY		
39 (+ bl)	level switch chlorite INITIAL WARNING		
37 (+ br), 38(- ws)	level switch water tank EMPTY		
37 (+ br), 38 (- ws)	level switch water tank FULL		
61, 63	output alarm signal		
64 (bl, N), 65 (br, L1)	output warning signal		
43 (+), 44 (-)	contact input flow		
41 (+), 42 (-)	contact input control variable		
options			
2 (+), 3 (-)	Analog input	Plug-in slot 1	order no.: 725236
	Flow	Plug-in card, current input B	
1 (+), 2 (-), 3 (V+)	Frequency input	Plug-in slot 1	order no.: 725321
	Flow	Plug-in card, three-conductor digital input	
6 (V+), 7 (+)	Analog input	Plug-in slot 3	order no.: 725236
	Controlled variable	Plug-in card, current input B	
30 (+), 31 (-)	Contact input	Plug-in slot 6	order no.: 725321
	Remote control	Plug-in card, three-conductor digital input	
27 (V+), 28 (+), 29 (-)	Analog input	Plug-in slot 5	order no.: 725236
	Remote control	Plug-in card, current input B	
32(E)(br),33(-)(w),34(+)(gn)	Flow monitor	Plug-in slot 7	order no.: 725321
	Bypass turbine flow meter	Plug-in card, three-conductor digital input	
32 (+), 33 (-)	Flow monitor	Plug-in slot 7	order no.: 725321
	Bypass, variable-area flow meter	Plug-in card, three-conductor digital input	
4 (+), 5 (-)	Analog output, flow value	Plug-in slot 2	order no.: 725240
		Plug-in card, current output B	
9 (+), 10 (-)	Analog output, controlled variable value	Plug-in slot 4	order no.: 725240
		Plug-in card, current output B	
35 (+), 36 (-)	Analog output, output value	Plug-in slot 8	order no.: 725240
		Plug-in card, current output B	
accessories			
47 (+ br), 48 (- w)	leakage check acid	plug-in 9	order no.: 725275
49 (+ br), 48 (- w)	leakage check chlorite	insert card digital input Bello Zon®	
57 (br), 58 (ws)	bypass pump distribution box		

Configuration of **control inputs and outputs** (Pg-screw fittings) for mounting by customer (Fig. 4, below)

Fig. 4: Control CDK, inputs and outputs (customer mounting)

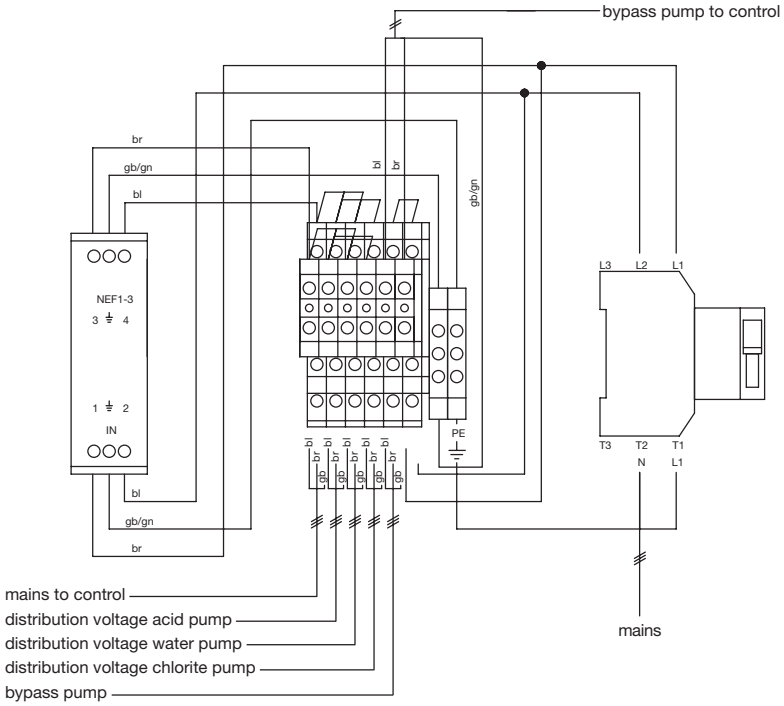


— — — factory-mounted cable connections (depending on identification code)
_____ available as accessory
cable unions enclosed separately

1.2.7.2 Distribution box

Terminal configuration of distribution box, see Fig. 5, below.

Fig. 5: Electrical configuration of distribution box CDK



1.2.7.3 Metering pumps

Table 13: Fuses for metering pumps:

fine-wire fuse	6.3 mm 32 mm
voltage	current
230 V ~	0.25 A slow-blow
115 V ~	0.5 A slow-blow

1.2.8 Shock and moisture protection (IP)

The system is shock-proof and moisture-proof in accordance with the following standards and guidelines:

- IP 65 under DIN VDE 0470 Part 1, corresponding to EN 60 529 and IEC 529

1.2.9 Supplementary kit

The supplementary kit is included with the delivery of each Bello Zon® system. It contains parts necessary for the customer to install the system. It also contains the Pg screw fittings for on-site mounting.

1.2.10 Chemical components

Chemical components must meet the following requirements:

- **Hydrochloric acid (HCl)**
  used must be fluoride-free and of industrial purity in accordance with DIN 19610 with a weight of 30–33 percent.
- **Sodium chlorite solution ($NaCl_2$)**
  used must have strength of solution of 300 g/l (24.5 %) in accordance with DIN 19617.
- **Water**
  used must be of drinking water quality and comply to following standards:
  - pH-value 6–9
  - Fe < 0.2 mg/l
  - Mn < 0.1 mg/l

1.2.11 Warning signs

The two warning signs shown below must be displayed together at entrances to rooms in which Bello Zon® chlorine dioxide systems are installed.

Fig. 6

Fig. 6:
Warning sign “toxic substances” TN: 607324

Fig. 7:
Warning sign “Chlorine dioxide system access for authorised persons only",

Fig. 8

Chlorine dioxide system access for authorised persons only

The two signs shown below (fig. 8 and fig. 9) must be displayed together at entrances to rooms in which sodium chlorite is stored or used.

Fig. 8:
Prohibitive sign “No fire, flame or smoking“ TN: 607323

Sodium chlorite $NaClO_2$

Fig. 9

Fig. 9:
Information sign “Sodium chlorite $NaClO_2$”

Do not use containers and equipment alternatively
Sodium chlorite + acid = highly toxic chlorine dioxide gas
DANGER TO LIFE

Fig. 10

The sign shown below must be displayed in rooms for storing and transfering chemicals as well as rooms in which tanks connected to Bello Zon® chlorine dioxide systems are set up.

Fig. 10: Warning sign

1.3 Operating elements and indicators, tap positions

There are essentially two groups of operating elements for Bello Zon® chlorine dioxide systems: first, electrical *buttons and switches* at the *control and distributor box*; second, manually operated ball valves in lines for liquids.

The **indicators** are the electrical elements of the control (display and luminous indication).

1.3.1 Electrical operating elements and indicators

Fig. 11 (below) is an overview of the control and its operating buttons and indicators.

Fig. 11: Bello Zon® Control CDK/CDV, Operating elements and indicators

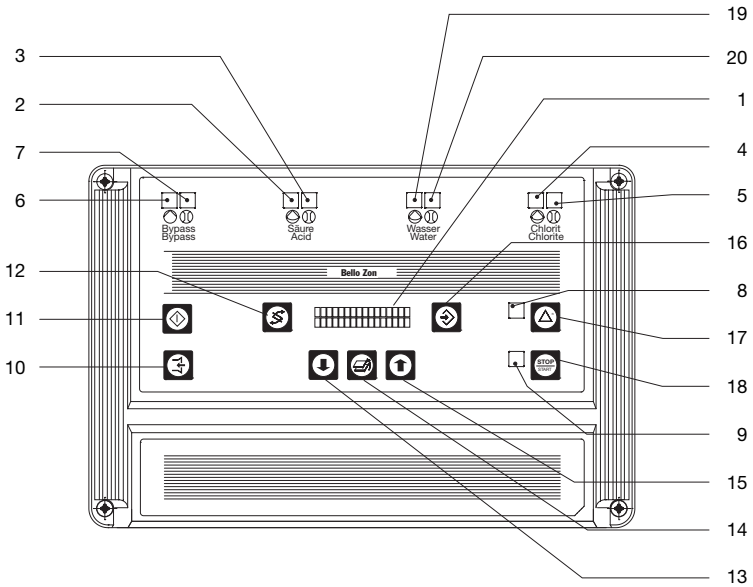


Table 14: List of control operating elements and indicators

1	indicator	(LCD)
2	LED	“acid pump” operating: yellow, red for alarm
3	LED	“flow monitor acid” operating: green
4	LED	“chlorite pump”operating: yellow, red for alarm
5	LED	“flow monitor chlorite” operating: green
6	LED	“bypass pump” operating: yellow, red for alarm
7	LED	“flow monitor bypass“ operating: green
8	LED	“alarm”: red
9	LED	“operating”: green
10	push-button	“discharge“
11	push-button	“start up“
12	push-button	“change indicator“
13	push-button	“lower“
14	push-button	“back“
15	push-button	“higher“
16	push-button	“save“
17	push-button	“clear alarm“
18	push-button	“start/stop“
19	LED	“water pump” in operation: yellow, red for alarm
20	LED	“flow monitor water“ in operation: green

1.3.1.1 Indicators

The central indicator element of the control is the **display** (1), which displays the operating mode, chlorine dioxide capacity and with water meter connected the flow in the main water line. The individual menus (see ch. 5.1 ff.), program steps and input data are shown with the help of the display.

Yellow LED's (2) **"acid pump**" and (4) "**chlorite pump**" on the top of the control signal the operating status of the pumps by blinking; in case of failure they light up red.

Next in line, **green LED's** (3) " **flow monitor acid**" and (5) " **flow monitor chlorite**" show the operating status of the flow monitors.

If a *bypass water pump* is connected, a **yellow LED** (6) indicates the operating status of the "**bypass pump**"; during alarm this LED (6) lights up red. A **green LED (7)** signals the optional "**flow monitor bypass**".

Red LED (8) "alarm" lights up in the event the control triggers an alarm; the **green LED** (9) "operating" indicates trouble-free operating status.

Yellow LED (19) indicates "**water pump**" in operation, during alarm it lights up red. The **green LED** (20) is responsible for the "**water flow monitor**".

1.3.1.2 Buttons and switches

With **button** (18) "**start/stop**", the system can be started from any program level, or metering can be stopped. Settings can be changed in the holding position "STANDBY"

With **button** (10) "**discharge**", the solenoid discharge valve opens and gas is sucked out of the reactor housing. Discharge lasts 5 minutes after pressing button.

Button (11) "**start up**" sets off a certain number of strokes at maximum stroke frequency. This function is necessary for calibrating and venting the pumps (see section 2.2.3).

Button (12) "**change**" shifts back and forth between functional and operating modes.

Button (13) "**lower**" decreases a setting while indicated.

With **button** (14) "**back**" it is possible to exit the operating menu one level at a time.

Button (15) "**higher**" increases a setting while indicated.

With **button** (16) "**save**" a setting or position indicated is taken over.

With **button** (17) "**clear**" alarm and error messages are deactivated.

The **off-switch on the distributor box** can be used to turn off the electricity in emergencies or to shut down the system.

1.3.2 Ball valves

There are essentially two groups of ball valves in Bello Zon® chlorine dioxide systems:

1) **ball valves** (20, see fig. 8) in the bypass line to turn the bypass on and off

and

2) **ball valves** in the vicinity of the metering pumps and calibrating vessels to set the flow direction for acid (2a, 30a, 1–3), chlorite (2c, 30c, 1–3) and water (2b, see fig. 1). These can be used to calibrate the metering pumps without the danger of contact with chemicals. Furthermore, they enable using the calibrating vessels as vacuum tank vessels. These valves are also used for venting.

For the positions of the nine relevant ball valves (chlorite, water and acid) in the setting "venting", see fig. 12; in the setting "calibrate", see fig. 13; in the setting "operating", see fig. 14. For significance of these valves, see fig. 1, ch. 1.1.3.

Fig. 12:
Ball valve CDKa, position “venting”

two-way ball valve suction line	two-way ball valve calibration vessel below	two-way ball valve calibration vessel above	three-way ball valve pressure line
acid (30a.1)	acid (30a.2)	acid (30a.3)	acid (2a)
chlorite (30c.1)	chlorite (30c.2)	chlorite (30c.3)	chlorite (2c)
open	closed	open	metering pump ⇒ calibration vessel

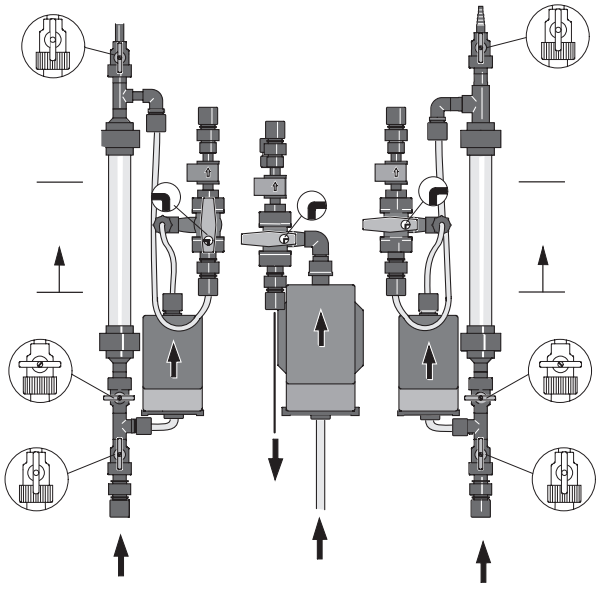


Fig.13:
Ball valve CDKa, position “calibrate”

two-way ball valve suction line	two-way ball valve calibration vessel below	two-way ball valve calibration vessel above	three-way ball valve pressure line
acid (30a.1)	acid (30a.2)	acid (30a.3)	acid (2a)
chlorite (30c.1)	chlorite (30c.2)	chlorite (30c.3)	chlorite (2c)
closed	open	open	metering pump ⇒ reactor

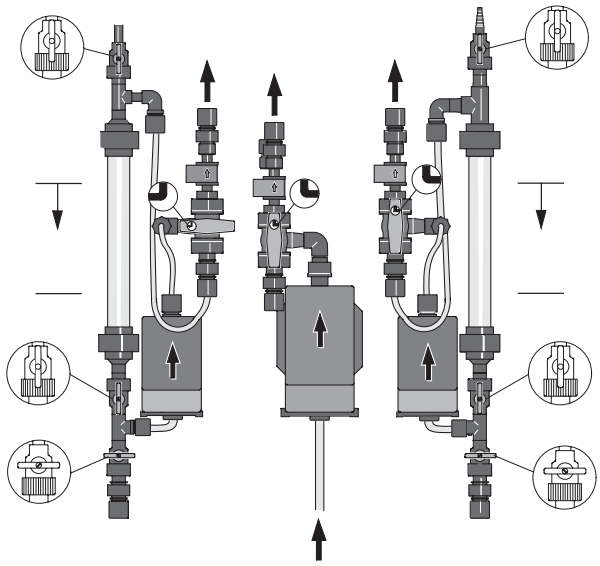
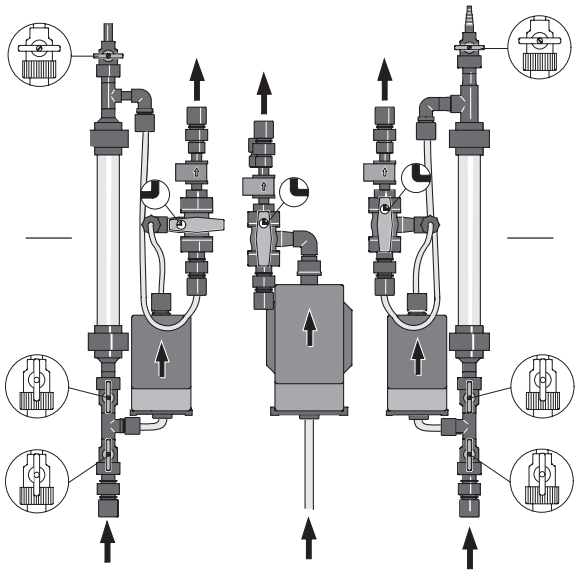


Fig. 14:
Ball valve CDKa, position “operating”

two-way ball valve suction line	two-way ball valve calibration vessel below	two-way ball valve calibration vessel above	three-way ball valve pressure line
acid (30a.1)	acid (30a.2)	acid (30a.3)	acid (2a)
chlorite (30c.1)	chlorite (30c.2)	chlorite (30c.3)	chlorite (2c)
open	open	closed	metering pump ⇒ reactor



1.4 Safety measures

1.4.1 Flow monitors

The metering pumps are operated by pulses from the control which induce pump strokes. The resulting movement in the line of flow is registered by the flow monitor and sent as a signal to the control. Should this feedback to the control stop, then the system shuts down after eight missing pulses in series and a corresponding error message appears in the display. At the same time the red light “alarm” (8, see fig. 11) flashes. The system can be restarted by pressing the “clear alarm” button (17).

From software version 3.13 the function has been adapted as follows. After pressing the "Start" button (see ch. 1.3.1) the pump performs 20 strokes in normal operating mode.

If the dosing monitor fails to feed back to the acid pump, the chlorite pump stops after 8 strokes, the acid and water pumps continue to run.

If the dosing monitor fails to feed back to the water pump, both chemical pumps stop and only the water pump continues to run.

If the dosing monitor fails to feed back to the chlorite pump all three pumps continue to run.

The dosing monitors function in the same way at system start up.

If a dosing monitor fails during calibration the whole process will be cancelled.

1.4.2 Bypass monitor

A bypass monitor as option is available in two versions: with *variable area flow meter* or with turbine wheel flow meter. Both have a *minimum contact device* which registers a minimum rate of flow. If the flow falls below the minimum rate, the control shuts off metering (for additional information, see section 1.1.3.7).

1.4.3 Level switch

The *intake lances from the chemicals* contain **two-stage level monitoring devices**. If the level drops to the first stage, this results in the message “chemicals at low level”; at the second stage (empty), the system is shut down and alarm is activated.

The water storage tank has **level monitoring devices** for “full” and “empty”. The lower monitor is a switch which lets dilution water refill the tank; a float reading position shuts the system down if there is insufficient dilution water. The upper monitor is a switch protecting against overflow. For details, see section 1.1.3.10.

1.4.4 Exhaust

A injector is used to extract gases and liquids from the reactor housing. The air in the reactor housing is renewed regularly (approx. once per hour) by way of a solenoid valve driven by the control. Any possible leaks are thus removed safely as waste water. For further details, see section 1.1.3.2.

1.5 Chlorine dioxide system accessories

The following **accessories** are available (see fig. 1 and table 4):

1.5.1 Bypass pump with wall bracket

The **bypass pump** (50) (see fig. 1) serves to raise pressure to ca. 2 bar. It is available in cast iron or in stainless steel, but only for 230 V.

Both bypass pump versions meet the criteria for shock protection and moisture protection set down by the standards of DIN 40050; the stainless steel version in accordance with IP 54, the cast iron version in accordance with IP 44.

Table 15: Part numbers for bypass pumps

item	part number
bypass pump cast iron for CDKa 150-420	791389
bypass pump stainless steel for CDKa 150-420	791535
bypass pump cast iron for CDKa 750	740829
bypass pump stainless steel for CDKa 750	740830
bypass pump cast iron for CDKa 1500	1000842
bypass pump stainless steel for CDKa 1500	1000843
support bracket for bypass pump	791474

1.5.2 Safety trays 70 l

Safety trays (51a, 51c, see fig. 1) are available with (no illustration) and without leakage warning. The trays are compatible with plastic containers in accordance with DIN 6131 parts 1 and 2.

The dimensions of the safety trays 70 l:
length = 500 mm, width = 430 mm, height = 380 mm.

Table 16: Part numbers for safety trays

safety tray	part number
w/o leakage monitor 70 l	740309 *
with leakage monitor 70 l	740308 **

* one tray

** two trays incl. electronics

1.5.3 Premixing (static mixer)

For more effective premixing, static mixers (60, see fig. 1) are available. For part numbers and characteristics, see table 17 below.

Table 17: Premixing specifications

system type	**CDKa 150**	**CDKa 420**	**CDKa 750**	**CDKa 1500**
part number	**740649**	**740650**	**740832**	**1001000**
net volume	1.5 l	4.5 l	7 l	13.4 l
connection for premixer input/ output	DN25/ d32	DN25/ d32	DN32/ d40	DN 40/ d50
maxi. operating excess pressure	10 bar	8 bar	8 bar	8 bar
maxi. operating temperature	40 °C	40 °C	40 °C	40 °C
transport weight	2.4 kg	5.5 kg	10 kg	20 kg

1.5.4 Protective filter

If a turbine wheel flow meter is used and the bypass water is not free of solid particles, a protective filter (no illustration) should be installed in front of the flow meter.

CDKa 150 - the filter can e.g.:

DULCOFILT® protective filter	G1",
mesh size	100 µm
PN	791547

be installed. In the case of larger systems, filter types are chosen depending on the level of contamination.

1.5.5 Ventilation valves

item	**part number**
Ventilation valve for reactor housing (can be used instead of a ventilation line which leads into atmosphere)	791801
Ventilation valve for bypass line (to prevent breakthrough of chemicals in longer bypass lines or under vacuum conditions)	1001260
Slanted seat valve, DN 25 (for setting the bypass flow with the bypass pump installed)	1001877
Flushing device (installed in the bypass line for discharging the reactor prior to maintenance work)	1000525

1.5.6 Set for determining chlorine dioxide

The chlorine dioxide concentration can be determined easily and reliably with the DPD method (see ch. 5.3). Use the comparator listed below.

Table 18:
Part number set for determining chlorine dioxide

item	**part number**
measuring set comparator	505509
photo meter DULCOTEST® DT 11	914902

1.5.7 Intake lances, intake fittings

IMPORTANT

To ensure faultless functioning, use only ProMinent® intake lances with two-stage level monitoring devices.

For the functioning of the level monitoring devices, see ch. 1.1.3.10.

Table 20: Specifications for intake lances, intake fittings.

CDKa	intake hose outside -ø/inside-ø	intake lance container contents 60 l	intake fittings length 5m
150 420	6 mm/4 mm	PN 740049	PN 740661
750 1500	8 mm/5 mm	PN 740049	PN 1000132

In the text below, only intake lances will be referred to; this includes, however, also intake fittings.

1.5.8 Spare part sets

Complete spare part sets can be ordered using the identification code.
The code starts with BSKa ... and is otherwise identical to the identification code of the system.

1.5.9 Part number table for spare parts and spare part sets

System Type CDK 150

spare parts set, complete		230 V 115 V	740740 740741
spare parts set, liquid end	acid/chlorite water		791659 740738
spare parts set, metering line			740739
fuses, pump	acid/chlorite	230 V 115 V	712040 712051
	water	230 V 115 V	712051 712038

System Type CDK 420

spare parts set, complete		230 V 115 V	740743 740744
spare parts set, liquid end	acid/chlorite water		791661 740742
spare parts set, metering line			740739
fuses, pump	acid/chlorite	230 V 115 V	712040 712051
	water	230 V 115 V	712032 712033

System Type CDK 750

spare parts set, complete		230 V 115 V	1000172 1000173
spare parts set, liquid end	acid/chlorite water		740738 740742
spare parts set, metering line			1000171
fuses, pump	acid/chlorite	230 V 115 V	712051 712038
	water	230 V 115 V	712032 712033

System Type CDK 150, 420, 750

fuses, control		230 V 115 V	712057 712021
spare part pipe section bypass with monitor			740697
spare part pipe section bypass w/o monitor			740696
spare part connection piece turbine flow meter/ non-return valve			740695
spare part connection piece turbine flow meter/ ball valve			740694
spare part connection piece variable area flow meter/non-return valve and ball valve			740693

System Type CDK 1500

Spare parts set, complete		230 V 115 V	1000856 1000855
Spare parts set, liquid end	acid/chlorite water		740820 1000854
Spare parts set, metering line			1000171
fuses, pump	acid/ Chlorite	230 V 115 V	712051 712038
	water	230 V 115 V	712027 712070

1.6 Heating systems for chemical lines

(at ambient temperature below 10 °C)

Intake hose diameter 6/ 4 mm	1001636
Intake hose diameter 8/ 5 mm	1001637
Intake hose diameter 12/ 9 mm	1001638
Intake hose diameter 19/16 mm	1001639

1.7 Metering systems

Metering pipe, DN 25, PVC (suitable for pipe diameter up to DN 80)	1001823
Immersion tube, DN 25, PVC (suitable for use as from pipe diameter of DN 100)	1001822

1.8 Spare parts lists

CDVa 7–600	987902
CDKa 150–1500	987903

2 Commissioning

The following sections should be read carefully before the commissioning of the chlorine dioxide system.

2.1 Information on current regulations

As stipulated in the current accident prevention regulations of Germany, chlorine dioxide systems may not be placed in operation before a qualified expert has certified that they are in proper working condition. Inspections by a qualified expert must take place at least every 12 months and before each restarting of operation.

Only specially instructed persons who can be expected to perform their work reliably are permitted to operate and maintain chlorine dioxide systems and handle chemicals (see Accident Prevention Regulations “Chlorination of Water” GUV 8.15 and VGB 65).

For this reason, commissioning is carried out by ProMinent Service or by specially trained experts. Instruction for operating and maintenance personnel of the chlorine dioxide system is part of the commissioning procedure.

2.2 Initial operation of the system type CDKaxAxxxxxXxx (with calibration vessels)

2.2.1 Airing and starting

- make all necessary hydraulic connections (see ch. 8, mounting)
- secure all necessary electrical connections
- connect system to mains power
- stop system by pressing “STOP” button: status “STANDBY”
- open configuration menu at control display
- set operating code
- set configuration parameters (e.g. pulse rate for water meter at flow input contact)
- place intake lances (31a, 31c, see fig. 1) and intake hose with foot valve for water storage tank in bucket filled with water
- turn ball valve taps to “venting” position (see fig. 12)
- set menu at “start up 10 minutes” and press “start up” button
- set stoke length of all pumps at 100 %

IMPORTANT

Change stoke length of pumps only while in operation.

- run pumps until suction lines and liquid ends are free of bubbles and both calibration pipes are filled (level 0 ml)
- end procedure by pressing “start up” button
- turn ball valve taps to “operating” position (see fig. 14)
- open stop valves in bypass
- set “start up” for 60 minutes; press “start up” button to operate system until all lines and the reactor are completely filled with water and are working against the normal operating pressure.

2.2.2 Leak test

- check system parts while running to ensure system is watertight; in case leaks are found, take appropriate, immediate action to repair.
- end procedure by pressing “start up” button.

2.2.3 Setting flow monitors

IMPORTANT

Make these settings only while at normal operating pressure.

- in menu position “STANDBY” turn the ring initiators of the flow pulse monitors (3a-3c, see fig. 1) to the top position using adjusting discs.
- start pumps with “start up” button
- turn ring initiators slowly downwards until LED 3 “ flow monitor acid” (see fig 11), LED 5 “flow monitor chlorite” and LED 20 “flow monitor water” light up green with each stroke; there should be no missing pulses
- after this, turn ring initiators ca. another 1mm downwards; then they are correctly set

NOTICE

Never set the ring initiators in the lowermost position; in this position safe functioning of the system is not ensured!

- bring system to standstill by pressing “start up” button
- start metering by pressing “start” button

The system is now operating (with water only) at the desired metering rate.

2.2.4 Setting parameters and calibration

- fill water pump calibration cylinders with water exactly to 1000 or 2000 ml mark
- take foot valve for water metering pump out of bucket and dip in calibration cylinder
- turn ball valve taps to “calibrating” position (see fig.13)
- note if levels of acid and chlorite calibration vessels deviate from zero ml
- activate parameter level on control display
- set operating parameters (e.g. reference concentration of ClO_2 at maximum water flow; see ch. 5.2 ff.)
- in menu position “water”, press “higher” button until minimum parameter setting appears
- Press “start” button: Depending on the capacity, the system switches off again between 2–5 minutes
- take suction hose with foot valve out of metering cylinder and place back in bucket
- note level reading on metering cylinder
- calculate difference between 1000 or 2000 ml and new reading in ml
- reading in ml must lie in range between 1.0 and 1.3 of the minimum parameter setting; enter reading into control using “higher” button and secure by pressing “save” button

IMPORTANT

If it is not possible to enter the reading determined in this way, then correct by raising or lowering the amount of ClO_2 metering in g/h (or maximum rate of flow in m^3/h).

If reading is greater than 30 % of parameter minimum in display: lower setting of stroke length (both must be the same) and repeat measurement. Stroke lengths may not be less than 50 %.

- move to menu position “acid”
- read level of acid calibration vessel in ml; in case level at beginning of gauging procedure was not equal to zero, correct present reading by amount of initial deviation
- enter corrected reading into display using buttons “higher” or “lower” and confirm with “save” button
- move to “chlorite” position in menu
- read level of chlorite calibration vessel in ml; in case level at beginning of gauging procedure was not equal to zero, correct present reading by amount of initial deviation

- enter corrected reading into display using buttons “higher” or “lower” and confirm with “save” button
- enter all metering rates in commissioning protocol; turn ball valve taps to “venting” position (see fig. 12)
- press “start up” button
- fill calibration vessels for acid and chlorite to ca. 50 % and end procedure by pressing “start up” button
- turn ball valve taps to “operation” position (see fig. 14)

2.2.5 Safety checks

Checks are made while system is in operation; the green LED 9 is lit up.

2.2.5.1 Intake lances for acid and chlorite

- raise intake lances up slowly in bucket, thus causing floats to move to middle (warning) position; “acid level low” or “chlorite level low” must appear as message in control display; LED 8 flashes red, the system continues to run
- remove intake lances entirely from bucket; floats are thus in the lower position; the system must now turn off; “acid cont. empty” or “chlorite cont. empty” appears as message in the display, LED 8 flashes red
- place intake lances back in bucket; after pressing “confirm alarm”, the system starts up once again

2.2.5.2 Water container monitor and solenoid valve for reserve water

- Water shortage simulation: move float in water level monitoring device “FULL” (grey cable) and float in water level monitoring device “EMPTY” (orange cable) to lower position; the system shuts down, LED 8 flashes red, display “Water tank!”
- Water top-up simulation: move float in water level monitoring device “FULL” and float in water level monitoring device “EMPTY” to lower position and then within 5 seconds to uppermost position; water reserve solenoid valve opens and closes after 8 seconds (pre-setting)
- Overfill simulation: move float in water level monitoring device “FULL” and float in water level monitoring device “EMPTY” to upper position; water reserve solenoid valve classes; the system shuts down, LED 8 flashes red, display “Water tank!”

2.2.5.3 Discharge system

- press “discharge” button to open solenoid valve and the injector discharges continuously (time length of 5 minutes)
- end discharge process by re-pressing “discharge” button.

2.2.5.4 Connecting acid and chlorite component containers

- stop system by pressing “stop” button
- place component containers under system (view from front: acid on the left, water in the middle and chlorite on the right)
- adjust suction tubes of intake lances to necessary length and immerse into corresponding container (observe labels on intake lances and containers; see also ch. 8.1.2), leaving foot valve suspended just above bottom of container
- replace cover and screw tightly

2.2.5.5 Adjusting supply from water tank

- take foot valve with suction hose from bucket and place down into water supply container, leaving it suspended just above bottom of tank
- call up configuration menu “water tank filling time” and set time in seconds necessary for the container to fill up to just under the level monitoring device “FULL”
- set system in operation by pressing “START” button

2.2.5.6 Checking reaction and taking chlorine dioxide sample

- let system run for some time; the production of chlorine dioxide results in slight yellow discoloration which can be observed (with the help of a light) in the inspection window of the reactor outlet.
- a sample should be taken from the main water line approx. one hour after reaction has taken place
- examine water sample for surplus chlorine dioxide (colorimetric analysis of DPD method, see ch. 5.3)
- change operating parameters of the system until surplus chlorine dioxide reaches desired level

IMPORTANT

Each adjustment of stroke length makes it necessary to properly calibrate (in accordance with ch. 2.2.3) and readjust the ring initiators (in accordance with ch. 2.2.4). The stroke length must not fall below 50 % otherwise the reliability of the monitoring system is not ensured.

2.3 Commissioning system type CDKaxBxxxxxXxx (w/o calibrating vessels)

Venting and running of metering pumps is carried out analogous to the system type CDKax**A**xxxxx**X**xx (see ch. 2.2). Graduated 500 ml cylinders are used for calibrating the chemical pumps instead of built-in calibrating vessels.
A hose is attached to the venting port of each of the three-way chemical valves. Each hose is connected to one of the enclosed bleeder bottles (500 ml PE bottle). The venting vessel should be placed on the floor or on the corresponding safety tub.

DANGER

Collect each chemical in its own bleeder bottle. Do not exchange bottles. Do not mix contents.

3 Shutting down chlorine dioxide system

When shutting down system (e.g. for servicing it), observe the safety instructions in section D.

3.1 Placing out of operation for a short period of time

If the chlorine dioxide system is to be placed out of operation for a short period of time, the system can be simply switched off with the “start/stop” button. The power supply to the system control or to a chlorine dioxide measuring point should not be interrupted.

3.2 Placing out of operation for a longer period of time

Chlorine dioxide is an unstable compound that breaks down over a prolonged period. If the chlorine dioxide system is to be placed out of operation for a longer period of time (several days), it is therefore recommended to flush the reactor with water.

- Shut down system by pressing the “STOP” button: Green LED 9 “Operation” goes out
- Open the configuration menu on the control display
- Set the start-up time parameter to minimum 30 minutes in the “Start-up” menu.
- Remove the intake lance from the chemical tank and place separately in a bucket filled with water.
- Press “Start” button and set the stroke length of both metering pumps to 100%.
- Allow system to operate until the pump heads, reactor and lines up to the metering valve are completely filled with water (this prevents chlorine from flowing out from the reactor during disassembly).
- Disconnect system from power supply.
- Refer to Ch. 7 for system maintenance
- Refer to Ch. 2 for resuming system operation

3.3 Placing Out of Operation and Frost-Proof Storage

If the chlorine dioxide system is to be made winter-safe, it will be necessary to completely discharge the reactor and drain off the bypass line. After flushing with water, the system can be drained off at the underside of the reactor by opening the pressure retention valve on the reactor output/bypass and by removing the inlet valves.

- Switch on the extraction system by pressing the “Extraction” push-button before dismantling the reactor inlet valves.

4 Replacing acid and chlorite component tanks

- shut system down by pressing “STOP” button
- place component tanks under the system (view from front: acid on left, chlorite on right, water supply tank in the middle)
- immerse intake lances into corresponding tank, leaving foot valve suspended just above bottom of tank
- replace cover and screw tightly
- start up system again

5 Operation of chlorine dioxide system

Directly after starting the system by way of the “start/stop” button, the system identification code in shown in the top line of the display. It begins with CDKa. Below this the hardware/software version presently used is shown on the left and the operating code on the right (see ch. 1.1.2). The operating code is adapted to the system (and its extensions) as part of the commissioning procedure. After 30 seconds, the display switches over to normal operating status.

5.1 Setting ball valves

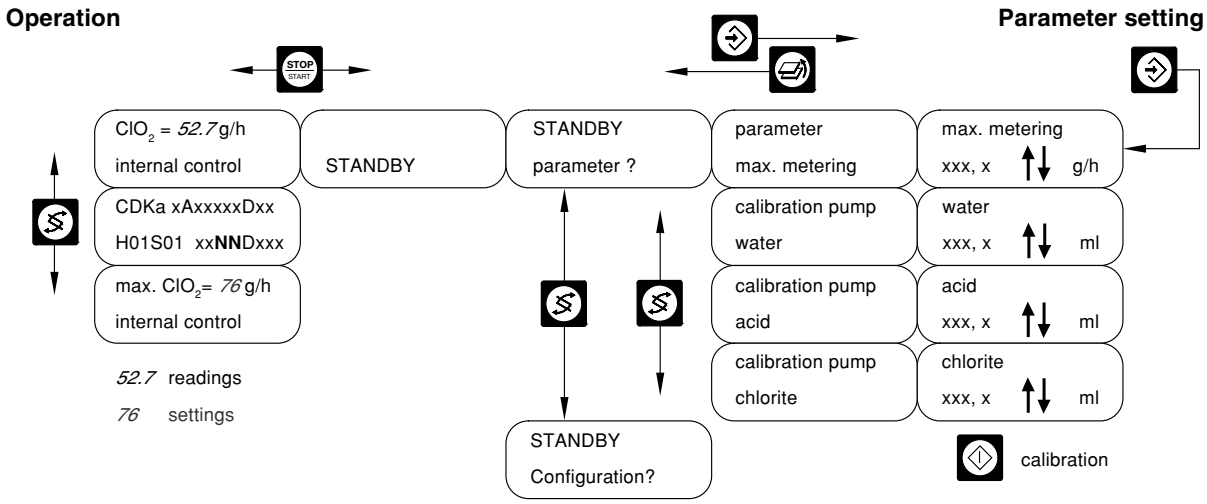
For position of ball valves in the three operating modes “venting”, “calibrating” and “operating”, see ch. 1.3.2 ball valves.

5.2 Setting the metering rate

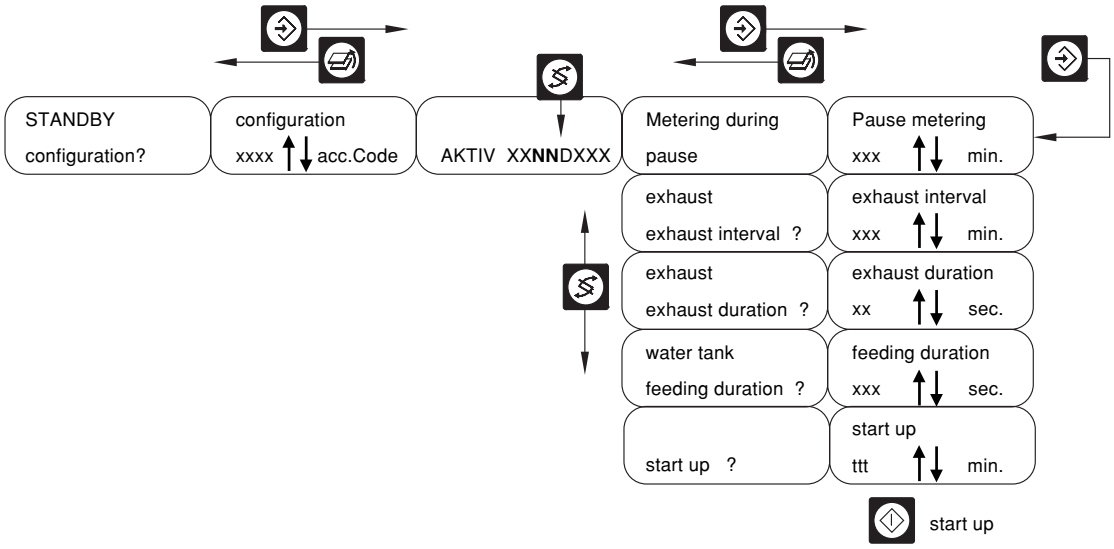
The system must be shut down for making entries in the control. See the following sections for further details on setting the metering rate.

5.2.1 Menu sequence “internal control”

Fig. 15: Menu “internal control”

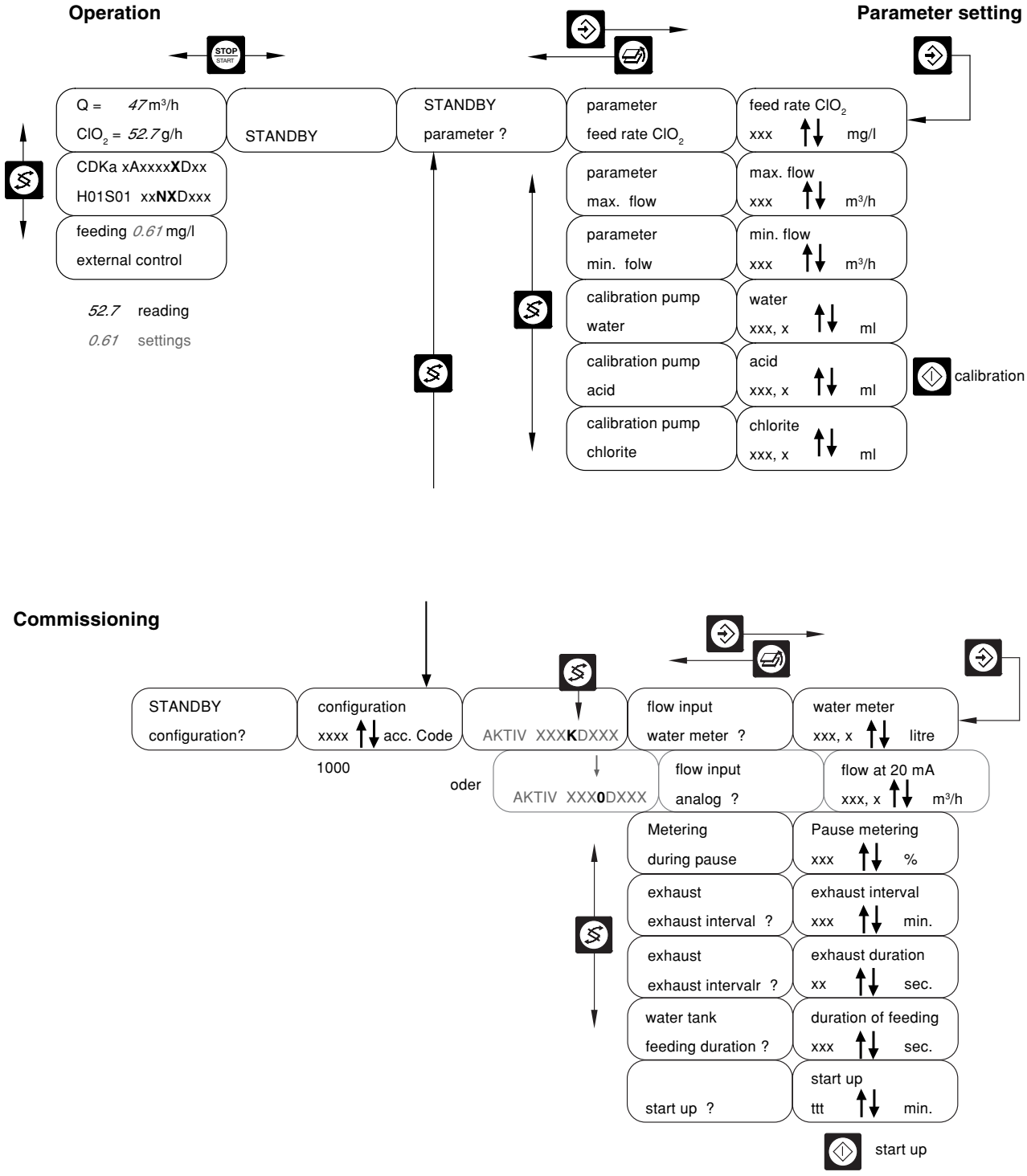


Commissioning



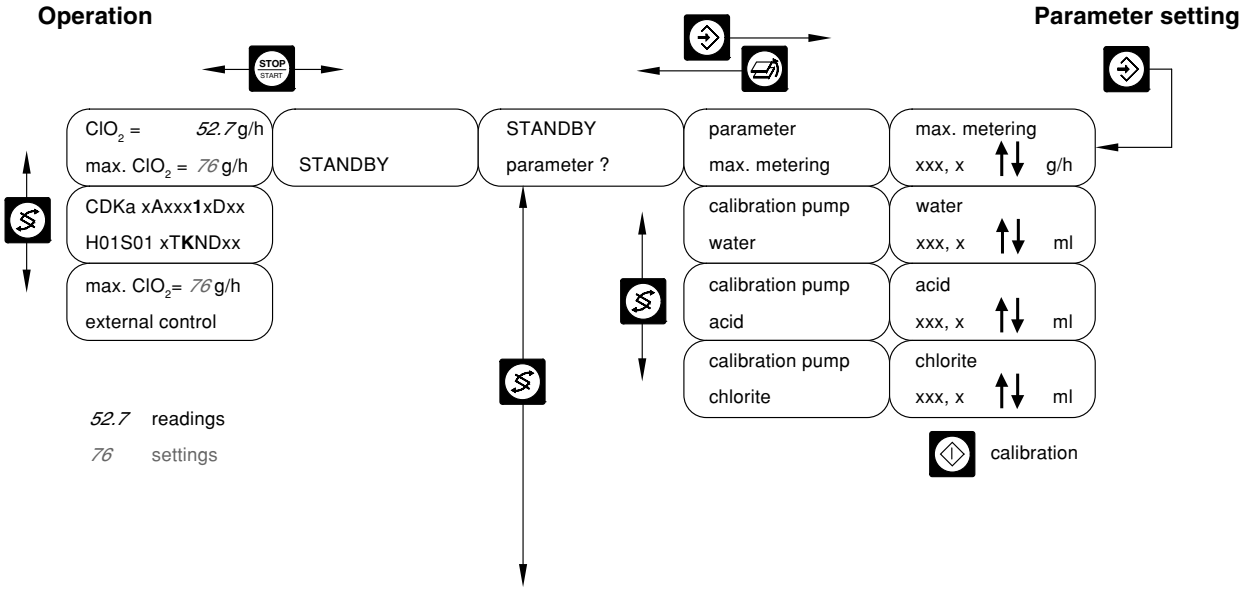
5.2.2 Menu sequence “flow dependent metering”

Fig. 16: Menu “flow dependent control”

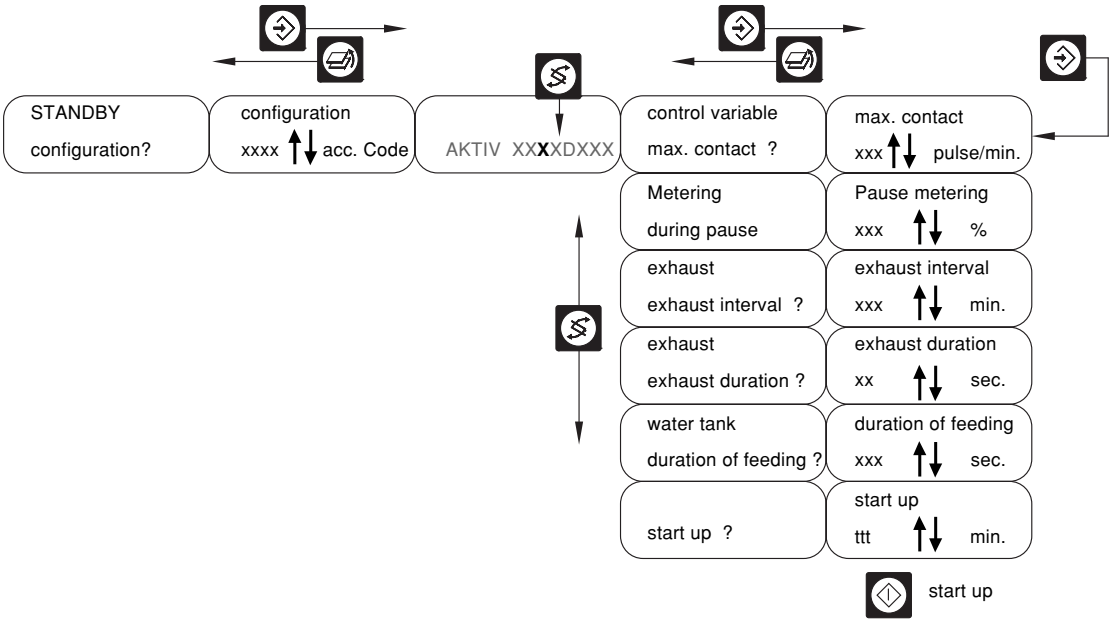


5.2.3 Menu sequence “control variable dependent metering”

Fig. 17: Menu “control variable dependent control”

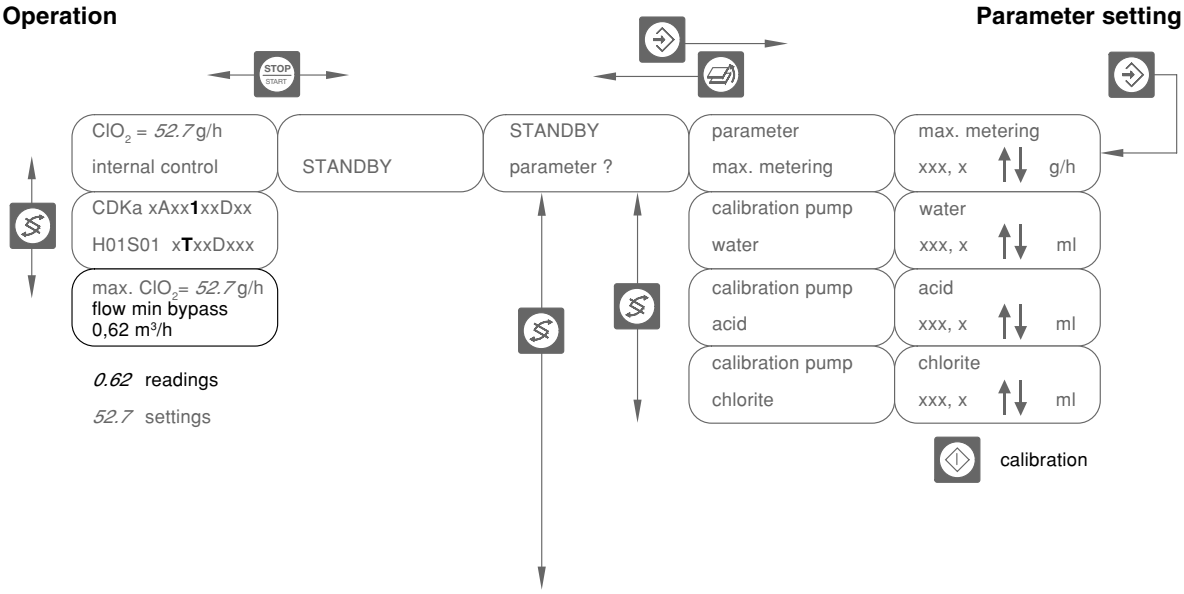


Commissioning

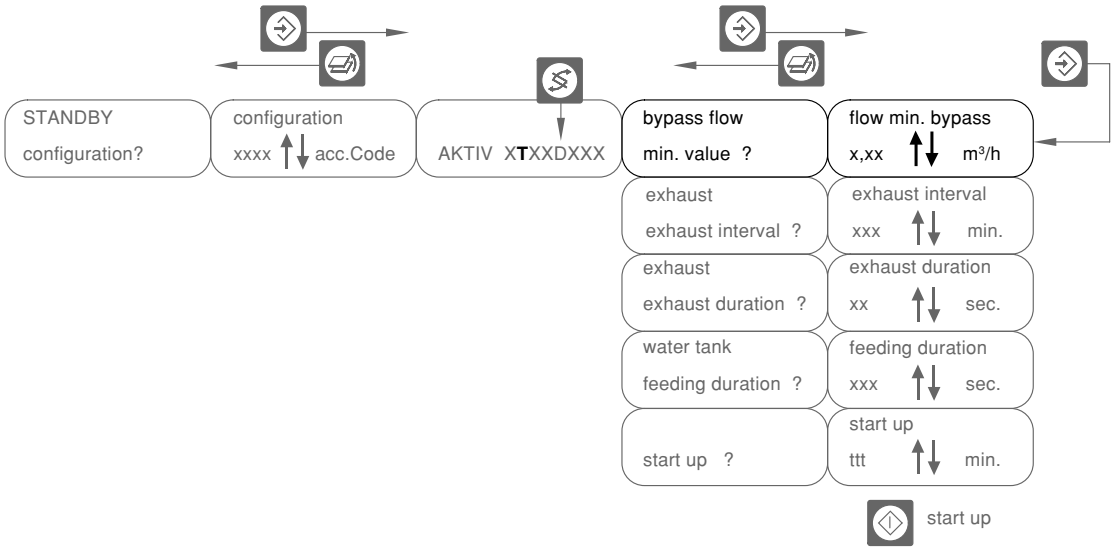


5.2.4 Menu sequence for “bypass options”

Fig. 18: Menu “bypass options”



Commissioning



5.3 Accuracy of metering rate

The accuracy of the metering rate depends on following parameters:

- counterpressure in bypass
- intake head
- stroke length and frequency of pump
- pump temperature
- pumping medium: its concentration, density, vapour pressure

The meter pumps reach their operating temperature after about one hour of running; they deliver less at this temperature than when cold.

5.4 Determining chlorine dioxide concentration

First, a sample of water containing chlorine dioxide should be taken from the main water line (see also section 2.2.5.6). The concentration of chlorine dioxide can be determined easily and reliably using the DPD method. For this purpose:

the DT 1 manual photometer can be used

The chemicals are in tablet form or are prepared in liquid form and added to a defined volume of test water. The resulting red coloration is evaluated by measurement in the photometer.

Measurement with DPD 1 tablets detects following substances:

- chlorine dioxide (ClO_2) and
- free chlorine and chlorine radicals (Cl_2, HOCl, OCl^-).

Stable chlorine compounds (e.g. chloramines), chlorite (ClO^-_3) and chlorine (Cl-) are not detected by this method.

5.5 Chlorine dioxide metering rate

Since chlorine dioxide systems are used for a variety of purposes, it is not possible to make a universally acceptable recommendation as to metering rates.

In treating drinking water, the total chlorine dioxide metering rate may not exceed the 0.4 g/m³ limit. The overall strategy for treating drinking water is a consequence of the metering rate of chlorine dioxide. Higher metering rates (approx. 1–2 ppm) can be used for industrial water treatment (e.g. in bottle cleaning machines).

6 Operating errors, help, troubleshooting

6.1 Consequences of operating errors

6.1.1 Incorrect setting of metering pumps

- **wrong stroke length (does not agree with gauging):**

Consequence:

There is an increased feeding of acid, chlorite or water leading to the production of an unacceptable amount of chlorine dioxide.

- An increase in acid raises the excess of acid already existing and there are minor consequences.
- An increase in chlorite can impair the production process and endanger health.
- An increase in water dilutes the concentration of ClO_2 and weakens the effects of disinfection.
- If the amount of feed water is too low (relation of chlorite to water: 1 to 5.5), then there is an increased concentration of ClO_2, strengthening disinfection but leading to possible endangering of the environment and health.
  A ClO_2 concentration of 28 g/l or more in the reactor can result in an explosion (through spontaneous decomposition).

> ***IMPORTANT***
>
> If it is necessary to change the stroke length of a metering pump, then
>
> - repeat gauging for all pumps
> - set ring initiators correctly (see ch. 2.2.4)

6.1.2 Incorrect setting of flow monitor (ring initiators)

- **Incorrect setting of the ring initiators:**

Consequences:

The monitoring function no longer detects a increase in the rate of flow of > 30 % and the system continues to operate.

- here is an increased feeding of acid, chlorite or a decreased feeding of water leading to the production of an unacceptable amount of chlorine dioxide (for consequences, see ch. 6.1.1).

> ***IMPORTANT***
>
> Set ring initiators correctly (see ch. 2.2.4)

6.1.3 Incorrect setting of air bleed taps (acid, chlorite and water)

- **Ball valve is set to “bleeding” position during operation**

Consequences:

The flow monitor sends no signal since there is no flow of chemicals past the three-way valve (bleeder valve). The system shuts down after 8 missing pulses from the flow rate monitor.

IMPORTANT

Observe symbol on air bleed tap.

6.1.4 Incorrect use of control

IMPORTANT

Unexpected operational conditions or messages could lead to repeated pressing of “START/STOP” button; system then jumps to original “STANDBY” status. If malfunction continues, then the system should be switched off and back on, using the main switch. Parameters and configuration readings are saved in the system memory and will not be lost.

6.2 Malfunctions

6.2.1 Malfunctioning of metering pumps

- **Metering pump does not feed although yellow “metering pump” LED flashes.**
- Air may be enclosed in liquid end. Vent as explained in “Commissioning” (see ch. 2.2.1).

- **Suction action of metering pump missing despite full stroke movement and valves in bleeding position**

  Crystalline deposits on ball seat due to valve drying out.
- Lift up intake hose briefly, flush pump adequately; if not successful remove valves and clean.

- **Metering pump in operation over longer period of time and suddenly no longer delivers**
- Bleed metering line, check level in container.

- **Liquid escaping from head disc of pump:**
- Diaphragm is leaking:
- Re-tighten socket head cap screws on liquid end. If tightening screws does not remedy problem, then the diaphragm is ruptured.

- **Limit contact fails to turn off metering pump at minimum level:**

  Float is blocked.
- Remove any deposits and clean float. Check if connecting cable is correctly attached.

6.2.2 Error messages at control

- Red “alarm” LED lights up:
  Regard error message in display (see table 21, below)

Table 21: Error messages

malfunction	message	effekt	delay	red LED	clear	warn. relay	Alarm relay	corrective action
flow monitor acid pump	Acid pump ERROR	metering stops	after 8 strokes	flashes	man.	on	on	bleed or set monitoring element
flow monitor chlorite pump	Chlorite pump ERROR	metering stops	after 8 strokes	flashes	man.	on	on	bleed or set monitoring element
flow monitor water pump	Water pump ERROR	metering stops	after 8 strokes	flashes	man.	on	on	bleed or set monitoring element
acid level initial warning	acid level low	metering continues		on	man.	on		change container
chlorite level initial warning	chlorite level low	metering continues		on	man.	on		change container
acid level	acid tank EMPTY	metering stops		flashes	man.	on		change container
chlorite level	chlorite tank EMPTY	metering stops		flashes	man.	on	on	change container
level monitoring device “EMPTY”	Water tank!	metering stops		on	man.	on	on	** find cause
level monitoring divice “FULL”	Water tank!					on		water feeding too long
bypass flow insufficient	bypass FAULT	metering stops	0.7 sec.	on	auto.	on		* find cause
bypass flow less than main water flow[1]	bypass FAULT	metering stops		on	auto.	on		* find cause
pc-board fault or 3.7 mA > current signal > 23 mA	flow input FAULT	metering stops	5 sec.	flashes	man.	on	on	check pc-board check signal
pc-board fault or 3.7 mA > current signal > 23 mA	Rem.ctr.anlg. FLT	metering stops	5 sec.	flashes	man.	on	on	check pc-board check signal
pc-board fault	Rem.ctr.anlg. FLT	metering stops	5 sec.	flashes	man.	on	on	check pc-board
pc-board fault	Dos.ctr.inp. FLT	metering stops	5 sec.	flashes	man.	on	on	check pc-board
pc-board fault	Byp.ctr.inp. FLT	metering stops	5 sec.	flashes	man.	on	on	check pc-board
supply voltage vailure	-	metering stops	-	off		off	an	find cause

*
- check if function plug is plugged in and if cable is correctly connected
- mini-contact has been altered re-adjust
- check position of stop valves in bypass.

**
- check solenoid valve “water feed”
- check level monitoring device float “EMPTY”
- check water feeding
- pc-board, check signal

[1] when using turbine flow meter

7 Inspection and maintenance

For the most part, maintenance means doing what is necessary to keep the system running properly. Maintenance includes replacing maintenance parts, making the ensuing leakage check and setting the system back into operation.

IMPORTANT

Only a qualified expert or the ProMinent Service may carry out servicing of the chlorine dioxide system.

7.1 Safety requirements, safety information

NOTICE

- **In accordance with Accident Prevention Regulations GUV 8.15 and VGB 65 §19 (2), the safety of chlorine dioxide systems must be checked by a qualified expert regularly at least once a year and each time before resuming operation.**
- **Keep all chemical tanks closed, whether full or empty.**

CAUTION

- **Before unscrewing the cover to open the reactor housing, discharge all liquid and gaseous material. Press "discharge" button (note symbol) to do so. The reactor housing can be opened after ca. 10 min.**
- **Always flush out system to remove all traces of chemicals before starting any maintenance work (replacing parts, etc.) on it.**

NOTICE

- **Turn off mains power to chlorine dioxide system before starting any maintenance work.**
- **Control lines or mains power connection lines may only be installed by authorised service technicians. Only the appropriate special connecting lines may be used.**

7.2 Maintenance of overall system

Maintenance consists of:

- Checking lines mounted to the system, including reactor housing and pumps for leakage.
- Replacing the 60 l one-way containers. After replacing containers for CDKa xB... systems, bleeding may be necessary. Dilute all liquids that exit out the bleeder valves **with plenty of water and pour out liquids separately.**

NOTICE

Do not pour chemicals back into supply drums!

- Make daily checks of used chemical solutions.

DANGER

When replacing both component containers at the same time, make sure not to confuse the two. Always give strict attention to the label markings.

7.2.1 Maintenance and service for the Bello Zon® Reactor; removing and detoxifying reactor content

- Flush system with water (see ch. 2.2.1) for approx. 30 min.
- Close stop valves in bypass.
- Release all pressure from bypass line by slowly opening compression spring centring of the metering valve.
- After servicing the system, restore previous status.

DANGER

Before maintenance flush the reactor thoroughly with water. Empty reactor only outdoors or at least in an extremely well-ventilated room, e.g. in a laboratory beneath a fume hood or in front of open window. When emptying, wear protective gear such as gloves and goggles; observe any local regulations.

The following applies to all Bello Zon® Systems in which the reactor cannot be flushed while in mounted position (see also Section D, “Information on general safety”):

CAUTION

There is danger of caustic injury (burning) by contacting the chemicals
-hydrochloric acid HCl 30–33 %
-sodium chlorite $NaClO_2$ 24.5 %
Flush immediately with large amounts of water and call medical doctor.

Emptying:

- fill bucket or plastic vessel with five times as much water as volume of reactor
- disconnect Bello Zon® System from mains power and block passage of water to system
- dismantle reactor, submerge in vessel of water and release reactor content into water; unscrew reactor input and output valves as well
- carry out detoxification, for instructions, see below
- carry out maintenance or service; replace worn-out parts such as O-rings and valve springs
- re-assemble reactor and re-install.

Detoxification of diluted reactor content in water vessel:

- for each litre of reactor material, stir in 50 ml of a 50 % sodium hydroxide (NaOH) solution; test pH value (> pH 4!); if necessary, add additional sodium hydroxide
- the solution of reactor content is now yellow; mix in and stir ca. 23g (about a heaping tablespoon) of sodium-perborate-tryhydrate ($NaBO_2 \cdot H_2O_2 \cdot 3H_2O$) per litre of reactor material until the yellow coloration disappears; the powder dissolves very slowly, but the reaction itself is very quick
- empty contents of bucket or plastic vessel into the recipient tank of a neutralisation system; otherwise correct pH to 6 > pH > 10 and empty into sewer drain; add twice the amount of water to rinse and dilute solution disposed of.

7.2.2 Maintenance of metering pumps

Metering pumps run practically without wear.

Check following points during maintenance:

- firm fit of liquid end screws
- firm fit of metering lines (delivery side and intake end)
- firm fit of pressure valve and of intake valve
- check leakage hole on back plate for moisture (indication of possible diaphragm rupture)
- run pump continuously for short period of time and check for correct delivery performance

7.3 Maintenance intervals, lifetime of system

For operational and safety reasons, maintenance intervals of one-half year are prescribed for the metering section (from the delivery side of metering pumps up to the bypass).

The system should be serviced every six months by the user’s customer service, with a complete check of the system’s functioning and replacement of worn-out parts. A shorter maintenance interval for the metering pumps is advisable in case the system operates at maximum stroke frequency, maximum operating pressure and using stroke lengths of 100 %. If the system is only used occasionally, then maintenance of the metering pumps in yearly intervals can be sufficient.

The lifetime of the system depends on the operating parameters.

Completing a customer service agreement is to be recommended.

8 Mounting and dismantling chlorine dioxide systems

Chlorine dioxide generating systems Bello Zon® CDKa are transported in sealed one-way wooden packages.

When storing chlorine dioxide generating systems, environmental conditions must be taken into account (see ch. 1.2.5 “Temperature and 1.2.6 “Climate and environment”).

The chlorine dioxide system must be emptied before storage or transportation.

8.1 Mechanical and hydraulic installation of system

- The wall bracket should be mounted on a suitable place as close as possible to the metering point (see schematic drawing, fig. 1, ch. 1.1.3 and fig. 19 below).

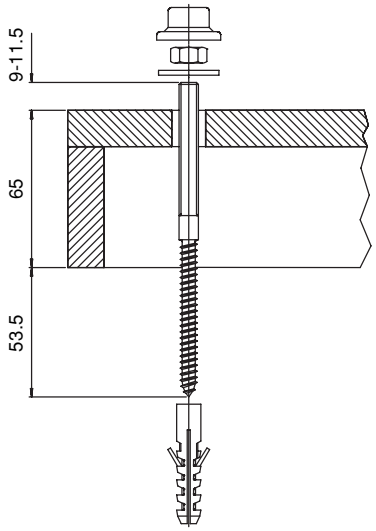


Fig. 19: Wall mounting of CDK support bracket

- After mounting, treat metal fastening parts with Vaseline to protect against corrosion.
- A mounting height should be selected that leaves sufficient room under the system and makes it convenient to read the control display. Keep the distance between pumps and supply drums as short as possible; take the drum height into consideration for replacing drums (for a 60 l drum a height of ca. 600–650 mm is necessary; for water supply tank, ca. 550 mm).
- Do not exceed the maximum allowable suction height (see ch. 1.2.2)
- Set up warning signs at suitable places (see ch. D.d).

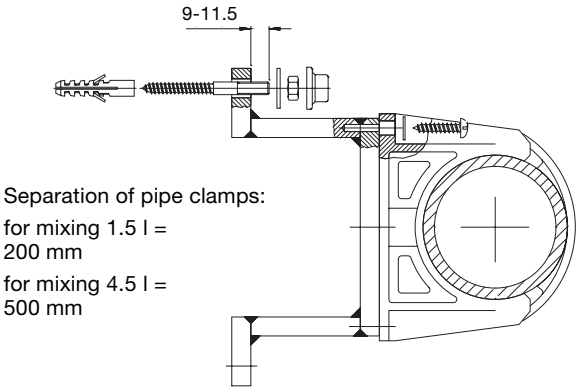
8.1.1 Hydraulic connections

DANGER

The system must be installed so that a vacuum cannot occur under any circumstances (including operating standstill) in the bypass line. If this is not possible, an anti-vacuum device must be added to the line.

- Set the premixer higher than the bypass line (DN25 made of PVC); provide screw fittings in the bracket to the left and right of the system for possible dismantling.
- Pre-assemble pipe clamps to the wall bracket for securing the bypass pipes (see fig. 20, below)

Fig. 20: Mounting premixer



- Lay pressurised water line with nominal diameter DN 10 (separate from the bypass line) to the discharge device (minimum pressure 1 bar); provide screw fittings just before the system for possible dismantling of wall bracket.
- Lay PVC-pipes from the discharge device to the sewer (provide separable connection just after the system); steady downward inclination, free flow-off.
- Lay venting line from reactor housing to outside reaching upwards to outdoor area and as short as possible; or use a venting valve (accessory).

8.1.2 Metering pump intake lances or intake fittings for acid and chlorite

- Use only two-stage intake lances as provided.
- Mount screw caps d67/57 on the intake lances for the 60 l component containers; should the openings of the component containers be smaller, mount the additionally provided screw caps d55/d47 on the intake lances
- Set intake lances outside the drums to suitable length (foot valve should hang just above container bottom).
- Attach labels provided to the intake lance heads or intake hoses so that the chemical designations “acid” and “chlorite” are clearly visible.
- Cut intake hoses to length (note permissible intake height and intake pressure; see ch. 1.2.4 “Specifications of system”), making sure that they constantly ascend to the pumps in order to counteract gasification.

IMPORTANT

The intake hoses must be connected in such a way as to ensure that they are free of mechanical stress at the liquid end.

Use only the intake hose intended for each intake lance.

For the acid intake lance, connect the intake line in direction pump to the connection with the arrow pointing away from the cap.

- Attach the intake lines to the lower suction port; if necessary, cut hose; slide union nut and clamping ring over the hose, then slide end of hose **as far as it will go** over the connection sleeve; slightly widen hose end, if necessary.
- Lay venting line from the acid intake lance (connecting point is marked by arrow pointing to the cap) to the ball valve by way of the optional calibration vessel on the left side of the reactor housing.

NOTICE

Use only the clamp-rings as provided for each hose diameter, use only hose nozzles and original hoses of prescribed hose diameter and thickness (as built into the intake lances), otherwise the durability of the connection is not ensured. The clamping effect is achieved by firmly tightening the nut while pressing down the hose at the same time. To obtain a firm hose connection, briefly pull the line attached to the liquid end and then tighten the union nut once again.

8.1.3 Dilution water tank and water metering pump

IMPORTANT

Use only the designated water supply tank for water.

- Attach the intake hose with foot valve to the inside of the container using Pg-screw connection so that the foot valve is left hanging just above the bottom.
- Attach the level monitoring device “EMPTY” (orange cable) to the inside of the container using Pg-screw connection so that it is left hanging just above the bottom.
- Insert the level monitoring device “FULL” (grey cable) just under the container opening, so that water cannot flow out of it under any circumstances.

IMPORTANT

Do not confuse the two level switches; observe the cable colours. The level monitoring device “FULL” is an overflow protection; if the two monitors are exchanged, no dilution water will refill the container.

- Connect the water tap of the supply tank to the hose connection (to the right of the solenoid valve) using a soft 12/9 mm PVC hose.
- Cut the 8/5 mm hose to a length equalling the distance from the air bleed tap for water to the halfway point inside the water supply tank. Then insert through the hole on the top of the tank (still open).

8.1.4 Reactor space venting

- In mounting the venting valve (provided as accessory) keep the lines as short as the given space permits (observe the direction of the arrow on the valve).

8.2 Electrical installation of the system

NOTICE

- **Make installation in accordance with the relevant regulations.**
- **It is absolutely necessary to provide the system with a circuit breaker protecting against overload and short-circuit.**
- **Use flexible cables for all optional lines (alarm, water contact meter, etc.).**
- **Strictly observe electrical wiring diagram (see figs. 3 and 5).**

8.2.1 Control

For electrical installation or maintenance, the upper section of the control can be placed in the installation position, the so-called “park position”. Terminal box and terminals are accessible in this position.

NOTICE

- **Only a qualified electrician should open the control.**
- **Before opening the unit ensure that the power supply to the unit is disconnected and that it cannot be switched on during the work.**

Installing the control

- Loosen the four countersunk screws to open the housing.
- To open the housing: press index finger on the front edge of the upper section. Unlock retaining hooks by pulling them forward. (The retaining hooks lock the upper and lower sections together.)
- Detach entire upper section by pulling it forward.
- With the aid of the two guide rails, fit the upper section into the ca. 80mm high slide-in unit, the park position. In the park position the two lower mounting holes and all connecting terminals are freely accessible. Do not loosen the electrical connections (ribbon cable).

For wiring of control, see fig. 3, ch. 1.2.7.1.

8.2.1.1 Changing mains fuse

- Turn off mains power to the control.
- The mains fuse is located in a fuse holder in the terminal box of the control; fuse can be reached by opening the control and lifting up the upper portion (see ch. 8.2.1).
- After releasing the bayonet catch of the fuse holder, take out the defective fuse and replace with new one.
- Fasten bayonet catch again and close housing.

For specifications of required fuses, see ch. 1.2.7.1.

8.2.1.2 Installation of cable connections

Sealed holes are provided on the underside of the control to be broken out for the electrical installation (see fig. 4, ch. 1.2.7.1).

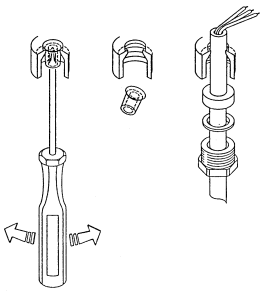


Fig. 21 :
Assembly of Pg screw fittings

- Break out passages for mains power and level monitoring devices, and further passages according to configuration of the system (see fig. 21 below).
- Attach the cables in the back row first for reasons of space.
- A screwdriver or drift with a maximum diameter of 3.5 mm is required for breaking out the holes in the back row (Pg 9 and Pg 11). Use the tools recommended to avoid damage to the PC- board and threadings.
- For the leakage warning (double passage), slide the screw fitting (if necessary with O-ring) onto the cable, place in the Pg 9 threaded hole and tighten; be careful not to squeeze the O-ring out by tightening too much.
- The nine passages in the front row are for Pg 7 screw fittings. For best results, use water pump pliers to break out the holes, and place a flat brace (e.g. a coin) under the hole to protect the outer edges and especially the raised faces of the threadings.
- When using a Pg 7 screw fitting, slide (do not twist or stuff) cable through opening carefully.
- Secure Pg 7 screw fittings with a lock nut (SW 15).
- Trim flex to the exact length, remove approx. 7 mm insulation and run these to the terminals according to the wiring diagram; use end sleeves.
- In order to distinguish between two identical cables (e.g. power supply), each cable is fitted with a different identification ring (“S” for acid German “Säure”, “C” for chlorite and “W” for water).

8.2.2 Connections at distributor box

- Setting the distribution voltage for the metering pumps and the control is carried out at the factory.
- Wiring the bypass pump to the distributor box and from there on to the control is carried out by the customer on location.
- Attach the mains power connection (T1 brown, T2 blue and yellow/green) to the shut-off switch and to the ground terminal.

For pin configuration, see fig 5, ch. 1.2.7.2.

8.3 Dismantling the chlorine dioxide system

First shut down the chlorine dioxide system (see Ch. 3 “Shutting down chlorine dioxide system”).

See section D for general safety information.

Close the stop valves located in the bypass.

Flush the system thoroughly with water and empty.

8.4 Disposal of used parts

Plastic material is hazardous waste and must be recycled. For this reason it is necessary when returning the system to clean it thoroughly of chemicals. Used parts will normally be accepted at collection sites of cities and communities or at any ProMinent outlet.

9 List of Illustration

EC Declaration of Conformity

We, **ProMinent Dosiertechnik GmbH**
Im Schuhmachergewann 5 - 11
D - 69123 Heidelberg

hereby declare that, on the basis of its functional concept and design and in the version brought into circulation by us, the product specified in the following complies with the relevant, fundamental safety and health stipulations laid down by EC regulations.

Any modification to the product not approved by us will invalidate this declaration..

Product description:	***Chlorine dioxide generator***
Product type:	***CDK ...***
Serial number :	***see type identification plate overleaf and on device***
Relevant EC regulations:	***EC - machine regulation (89/392/EEC) subsequently 93/44/EEC*** ***EC -low voltage regulation (73/23/EEC)*** ***EC - EMC - regulation 89/336/EEC subsequently 92/31/EEC*** ***EC - pressure vessel - regulation (87/404/EEC) subsequently 90/48/EEC***
Harmonised standards used, in particular:	***EN 292-1, EN 292-2, EN 286-1*** ***EN 60335-1 A6, EN 60335-2-41, EN 61010-1, EN 60204-1*** ***EN 50081-1/2, EN 50082-1/2, EN 60801-2, EN 55011*** ***EN 60555-2, EN 60555-3***
National standards and other technical specifications used, in particular:	***DIN VDE 0700 T1*** ***DIN VDE 0110*** ***DIN VDE 0700 T41*** ***DIN VDE 0106*** ***DIN VDE 0700 T500*** ***DVGW - compilation of rules , job sheet W224***
Date/manufacturer's signature:	19.07.1996
The undersigned:	*Herr Manfred Hüholt, factory manager*

Subject to technical alterations.

Adresses and delivery information from the manufacturer:

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