1 Utilities

This chapter describes the available utilities at PlantOne (the intended location for the installation of the system). Extra requirements can be supplied in agreement.

- Cooling water
- Potable water
- Demi water
- Process water
- Compressed (instrument) air
- Nitrogen
- Natural gas
- Flue gas
- CO, CO_2 and H_2 supply
- Steam
- Electricity
- Flares and vents
- Drains
- Facilities and General Information

1.1 Cooling water

Table 1 Specification of the cooling water available at PlantOne

Description	Value	Units	Comments
Pressure	4	barg	
Temperature	25 (max)	°C	• Max temp. diff 10°C • During the hot days, PlantOne cannot guarantee the given T
Number of pumps	1	-	• Additional units can be installed
Duty	150	kW	
Maximum flowrate	-	Nm^3/h	
Composition			
Silica	0.82	µg/l	
TOC	21.28	mg/l C	
Hydrogen Carbonate	1794.84	mg/l	
Calcium	1.93	mg/l	
Chlorides	18.63	mg/l	
Sulphates	21.24	mg/l	
Iron	3.04	mg/l	
Zink	211.92	µg/l	
Copper	99.97	µg/l	
Legionella	<100	KVD/l	
Legionella pneu	<100	KVD/l	
Legionella non-pnue	<100	KVD/l	
Physical and Chemical Properties			
Physical state at 20 °C	liquid	-	

Relative molecular weight	18.02	u	
Specific density	1.032	g/cm^3	
Melting point	0	^{o}C	
Boiling point	100	^{o}C	
Turbidity	33.85	FTE	
Acidity	9.93	pH	
Conductivity at 20 ^{o}C	496.04	µS/cm	

1.2 Potable water

Table 2 Specification of the potable water available at Plant one

Description	Value	Units	Comments
Pressure	3	barg	
Temperature	-	°C	
Maximum flowrate	-	Nm^3/h	
Composition			
Oxygen	8.5	mg/l	
Hydrogen Carbonate	130	mg/l	
Sodium	42	mg/l	
Calcium	45	mg/l	
Chlorides	56.3	mg/l	
Sulphates	49	mg/l	
Magnesium	7	mg/l	
Ammonium	<0.05	mg/l	
Nitrate	9.2	mg/l	
Iron	1.5	µg/l	
Aluminium	3.1	µg/l	
Fluoride	0.19	mg/l	
Trihalomethanes	1.6	(sum) µg/l	
Bacteria coli group	<1	KVD/100ml	
Escherichia coli	<1	KVD/100ml	
Enterococci	<1	KVD/100ml	
Clostridium perf. (incl tracks)	<1	KVD/100ml	
Physical and Chemical Properties			
Physical state at 20 ^{o}C	liquid	-	
Relative molecular weight	18.02	u	
Specific density	0.99823	g/cm^3	
Melting point	0	^{o}C	
Boiling point	100	^{o}C	
Turbidity	0.03	FTE	
Acidity	9.03	pH	
Conductivity at 20 ^{o}C	46	mS/m	
Hardness	8.5	^{o}DH	

Potable water specification for Rotterdam Rijnmond area:

Additional potable water specification in the area of PlantOne (Rotterdam Botlek) is available on their website https://www.evides.nl/drinkwater/waterkwaliteit-en-hardheid

1.3 Demi water

Table 3 Specification of the demi water available at Plant one

Description	Value	Units	Comments
Pressure	5	barg	This is the guaranteed minimum pressure
Temperature	0-30	°C	
pH	6-7		Pure demi water is neutral (pH=7), but always sone CO_2 is dissolved, leading to a somewhat lower pH
Electric conduction– from storage tanks	0.2	µS/cm	Some CO_2 dissolved in storage tanks, so conductivity is usually around 0,2
EGV – degasified	<0.06	µS/cm	Produced water has conductivity of 0,055 , a small amount of CO_2 can still be dissolved, resulting in a somewhat higher conductivity
Silica	<5	$\mu g_{SiO2}/l$	
TOC	<10	ppb - C	Total Organic Carbon, is practically completely removed by RO (Reverse Osmosis)
TDS	0	mg/l	
Ammonium	o.d.g Aqualab	µg/l	Is being detected as monitoring, but is always below detection limit of Aqualab
Calcium	o.d.g Aqualab	µg/l	“
Chloride	o.d.g Aqualab	µg/l	“
Iron	o.d.g Aqualab	µg/l	“
Kalium	o.d.g Aqualab	µg/l	“
Copper	o.d.g Aqualab	µg/l	“

1.4 Process water

Table 4 Specification of the process water at PlantOne

Description	Value	Units	Comments
Pressure	3	barg	
Temperature	-	°C	
Maximum flowrate	-	Nm^3/h	
Composition			
Oxygen	8.5	mg/l	
Hydrogen Carbonate	130	mg/l	
Sodium	42	mg/l	
Calcium	45	mg/l	
Chlorides	56.3	mg/l	
Sulphates	49	mg/l	
Magnesium	7	mg/l	
Ammonium	<0.05	mg/l	
Nitrate	9.2	mg/l	
Iron	1.5	µg/l	
Aluminium	3.1	µg/l	
Fluoride	0.19	mg/l	

Trihalomethanes	1.6	(sum) µg/l	
Bacteria coli group	<1	KVD/100ml	
Escherichia coli	<1	KVD/100ml	
Enterococci	<1	KVD/100ml	
Clostridium perf. (incl tracks)	<1	KVD/100ml	
Physical and Chemical Properties			
Physical state at 20 ^{o}C	liquid	-	
Relative molecular weight	18.02	u	
Specific density	0.99823	g/cm^3	
Melting point	0	^{o}C	
Boiling point	100	^{o}C	
Turbidity	0.03	FTE	
Acidity	9.03	pH	
Conductivity at 20 ^{o}C	46	mS/m	
Hardness	8.5	^{o}DH	

1.5 Instrument (compressed) air

Table 5 Specification of the instrument (compressed) air available at PlantOne

Description	Value	Units	Comments
Pressure	7.5	barg	• Minimum pressure is 6 barg
Temperature	-	°C	
Maximum flow-rate	-	Nm^3/h	
Composition			
O_2	12	%	• Air can include humidity and oil, but it is of high quality (open air impurities)
H_2O	79	%	

1.6 Nitrogen for support (at PlantOne)

Support Nitrogen, available at location, is used for unit SAT, commissioning, start-up, shutdown, and emergency shut-down. Moreover, N_2 may be needed for start -up/commissioning of the electrolyser. Nitrogen will be available at the PlantOne location with the following specifications:

Table 6 Specification of the Nitrogen available at PlantOne

Description	Value	Units	Comments
Pressure	8.7	barg	• Minimum pressure of 6 barg
Temperature		°C	
Normal flow-rate	1000	Nm^3/h	
Impurities			
H_2O	10	ppm (max)	
O_2	10	ppm (max)	
Hydrocarbons	0.1	ppm (max)	

1.7 Natural gas

Table 7 Specification of the Natural gas available at PlantOne

Description	Value	Units	Comments
Pressure (outside)	6-8	barg	• For inside, pressure is available at 300 mb
Temperature	-	°C	
Maximum flow-rate	-	Nm^3/h	
Calorific value	48.3	MJ/m^3	
Composition			
Gas Condensate	≤ 5	mg/m^3	
Oxygen	≤0.5	mol%	
Carbon monoxide	≤2900	mg/m^3	
Carbon dioxide	≤3.2	mol%	
Hydrogen	≤0.02	mol%	
Chlorine	≤5	mg/m^3	
Fluorine	≤5	mg/m^3	
Pathogen microbe	≤500	n/m^3	
Dust particles bigger than 5µ	≤100	mg/m^3	
Sulphur based on inorganic bonds	≤5	mg/m^3	
Sulphur based on alkythiols	≤6	mg/m^3	
Total sulphur bef. odorization	≤30	mg/m^3	
Total sulphur after odorization	≤41	mg/m^3	
THT – content (odorant)	0	mg/m^3	• in HTL: odourless
	0/10-40	mg/m^3	• in RTL: odourless/odourable gas
	10-40	mg/m^3	• in HTL: odourless
Silicon content	≤0.1	mg/m^3	
Physical and chemical properties			
Physical state at 20 ^0C	Gas	-	
Relative molecular weight	17.4	u	
Melting point	-183	^oC	
Boiling point	-161	^oC	
Auto-ignition temperature	670	^oC	
Dew points	≤-8	^oC	

1.8 Flue gas

Currently there is no available flue gas on the site. It is possible to access the flue gas, but it needs to be discussed with the companies around the site, or from the current innovations at the PlantOne.

1.9 CO_2, H_2 and CO supply

CO2, H2 and CO can be provided in bottles on the site, and conditions will be determined on the case to case basis.

1.10 Steam

Plant one can provide saturated steam at given conditions. PlantOne wants to receive the condensate back (not a requirement)

Table 8 Saturated steam specification available at PlantOne

Description	Value	Units	Comments
Pressure	18.8 - 22.3	barg	
Temperature	210 – 255	°C	
Maximum flowrate	-	Nm^3/h	
Composition			
Oxygen	8.5	mg/l	
Hydrogen Carbonate	130	mg/l	
Sodium	42	mg/l	
Calcium	45	mg/l	
Chlorides	56.3	mg/l	
Sulphates	49	mg/l	
Magnesium	7	mg/l	
Ammonium	<0.05	mg/l	
Nitrate	9.2	mg/l	
Iron	1.5	µg/l	
Aluminium	3.1	µg/l	
Fluoride	0.19	mg/l	
Trihalomethanes	1.6	(sum) µg/l	
Bacteria coli group	<1	KVD/100ml	
Escherichia coli	<1	KVD/100ml	
Enterococci	<1	KVD/100ml	
Clostridium perf. (incl tracks)	<1	KVD/100ml	
Physical and Chemical Properties			
Physical state	Gas	-	
Relative molecular weight	18.02	u	
Specific density	0.99823	g/cm^3	
Melting point	0	^oC	
Boiling point	100	^oC	

1.11 Electricity

Electricity supply

Table 9 Normal low voltage at PlantOne

Description	Value	Units	Comments
Voltage	380/220	V_{AC}	•

Number of phases	3	-	•
Frequency	50	Hz	•

Table 10 Available medium voltage

Description	Value	Units	Comments
Voltage	10.4	kV	•

Table 11 Instrumental signalling

Description	Value	Units	Comments
Voltage	220	V	•
Frequency	50	Hz	•

Table 12 Control instrumentation, signalling

Description	Value	Units	Comments
Voltage	24	V_{DC}	•

PlantOne will do the installation of the electrical system to the BL of the plant. Plant one claims that electrical power supply is very reliable and power failures are exceptional. No emergency power grid is available

Earthing connection will be made available by PlantOne.

1.12 Flare and vents

- Emergency flaring: permit allows for use of 500 hrs per year.
- Currently there is no flare installed. It is likely that separate exhaust with the afterburner will be required. Depending on the size, outside air or air from the hall could be used
- Vent could be made through the ceiling
    - Roof outlet (1,5 inch line)

1.13 Drains

PlantOne only contains storm drains. Drain system does not exist currently. If additional drains are required, PlantOne can create them.