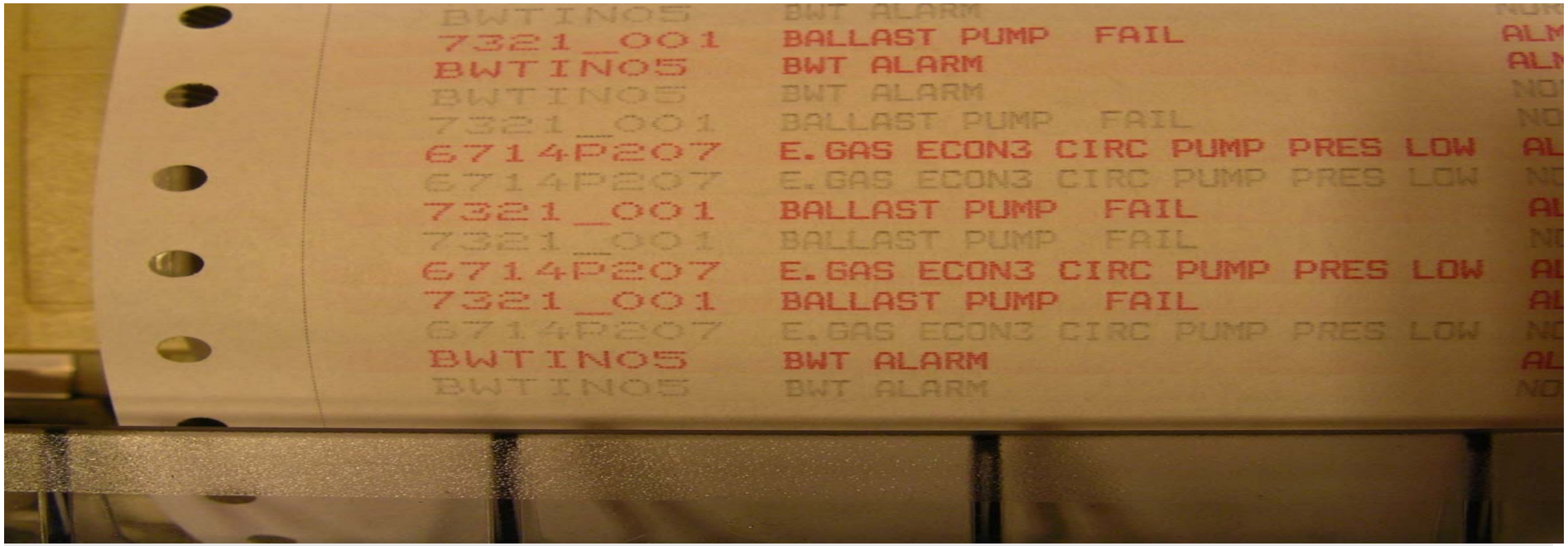


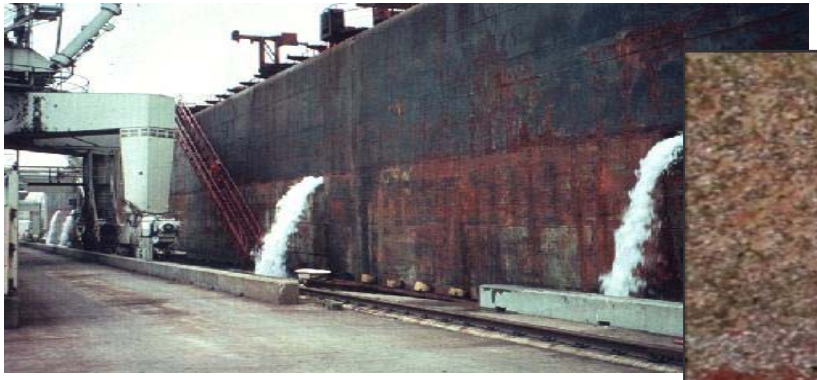
6.BALLASTWASSER WORKSHOP 05/2018

EINBAU UND TECHNIK

OLAF DREWS

DNV GL © 2017

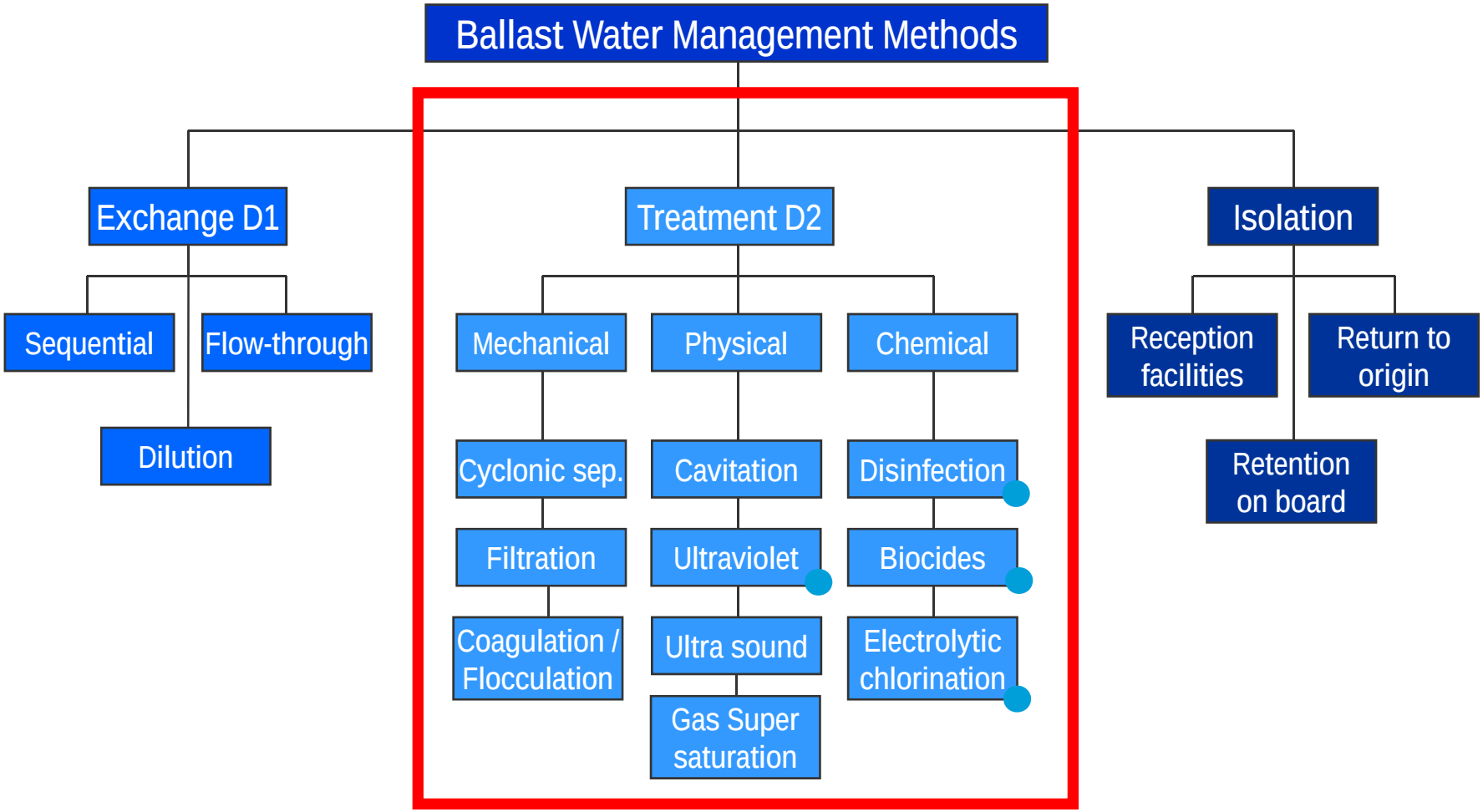
Role of shipping



- Shipping most important source of marine invasive species
- Species introduced via ballast water and sediments - about 30%

- Species introduced via biofouling - about 40%
- but this is not in scope of international regulations yet!

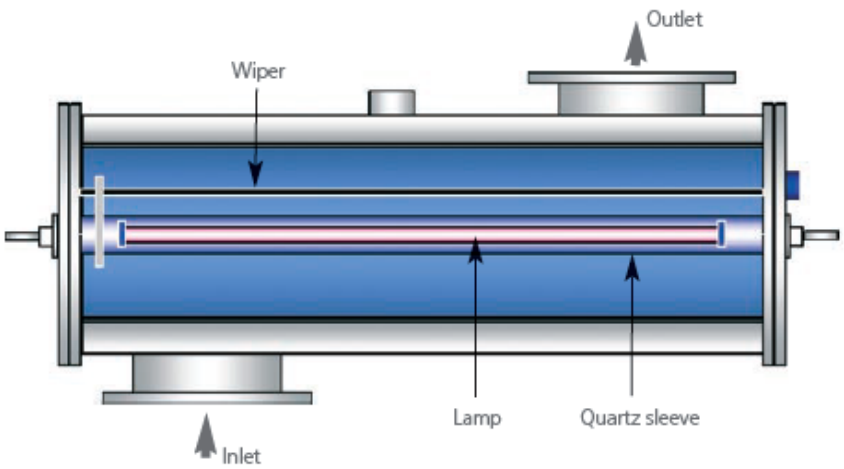
Overview


Ballast Water Management Methods
Exchange D1
Sequential
Flow-through
Dilution
Treatment D2
Mechanical
Physical
Chemical
Cyclonic sep.
Filtration
Coagulation / Flocculation
Cavitation
Ultraviolet
Ultra sound
Gas Super saturation
Disinfection
Biocides
Electrolytic chlorination
Isolation
Reception facilities
Return to origin
Retention on board

Filter + UV

Filter + UV
Background

- Filters used: 20-50 µm mesh, screen filters, placed in drum or candles. Automatic backwashing
- UV technology from the municipal water treatment industry
- Treatment needed on intake and discharge
- Typically used for vessels with needed treatment capacity from 100-1000 m3/h (can be delivered up to 3000 m3/h as parallel installations)
- Often seen on low ballast dependent ships
  - Passenger ships
  - PSV/ OSV
  - Fishing vessels



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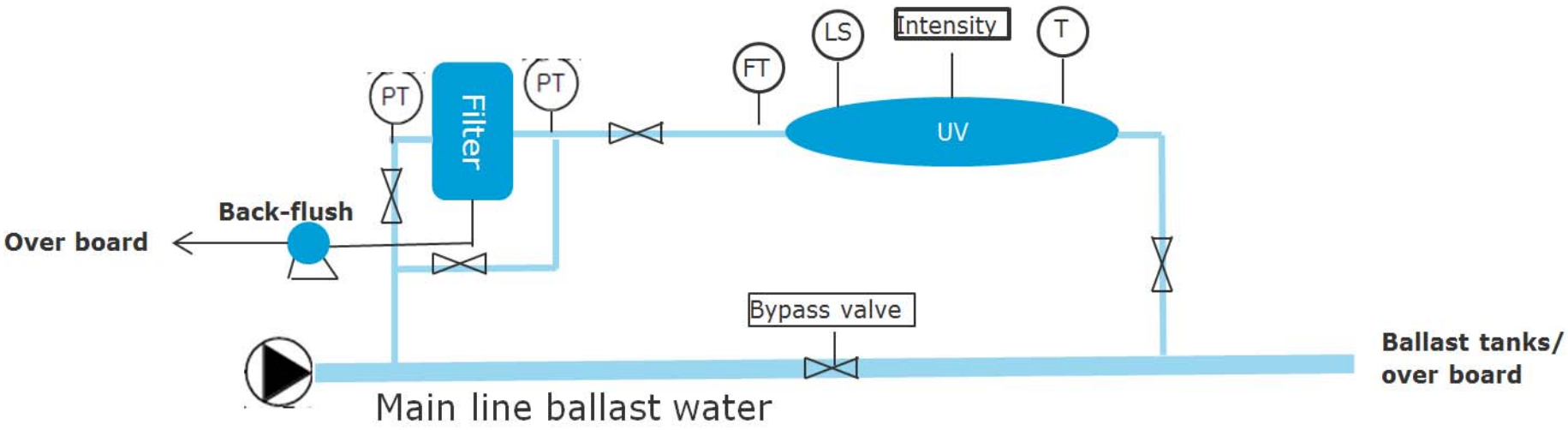
Filter + UV
Typical flow chart



Filter + UV Considerations

Why ship-owners would install a filter + UV BWTS

- Simpler to operate
- Simpler to install
- No by-products produced
- Lowest CAPEX for small flow capacity installations

Considerations

- Treatment needed on ballast and de-ballast
- Might have problems with USCG TA compliance
  (live/dead rather than viable/non viable, capable of reproduction)
- Dependent on water transmittance > 40-60% (>80 for USCG compliance)
- Most systems tested for several days hold time
- 0,05-0,3 kw/m3 treated water (both on intake and discharge)

Filter+ electrolysis

Filter + electrolysis
Background

- Filters used: 20-50μm mesh, screen filters, placed in drum or candles, automatic backwashing
- On board production of active substance from sea water
- Sodium hypochlorite is an excellent disinfectant widely used in water treatment
- Treatment on intake, neutralization on discharge
- Two types inline (on ballast line) and slip stream
- Often seen on high ballast dependent ships (1000-8000 m3/h) such as:
  - Tankers for oil/chemicals
  - Bulk carriers

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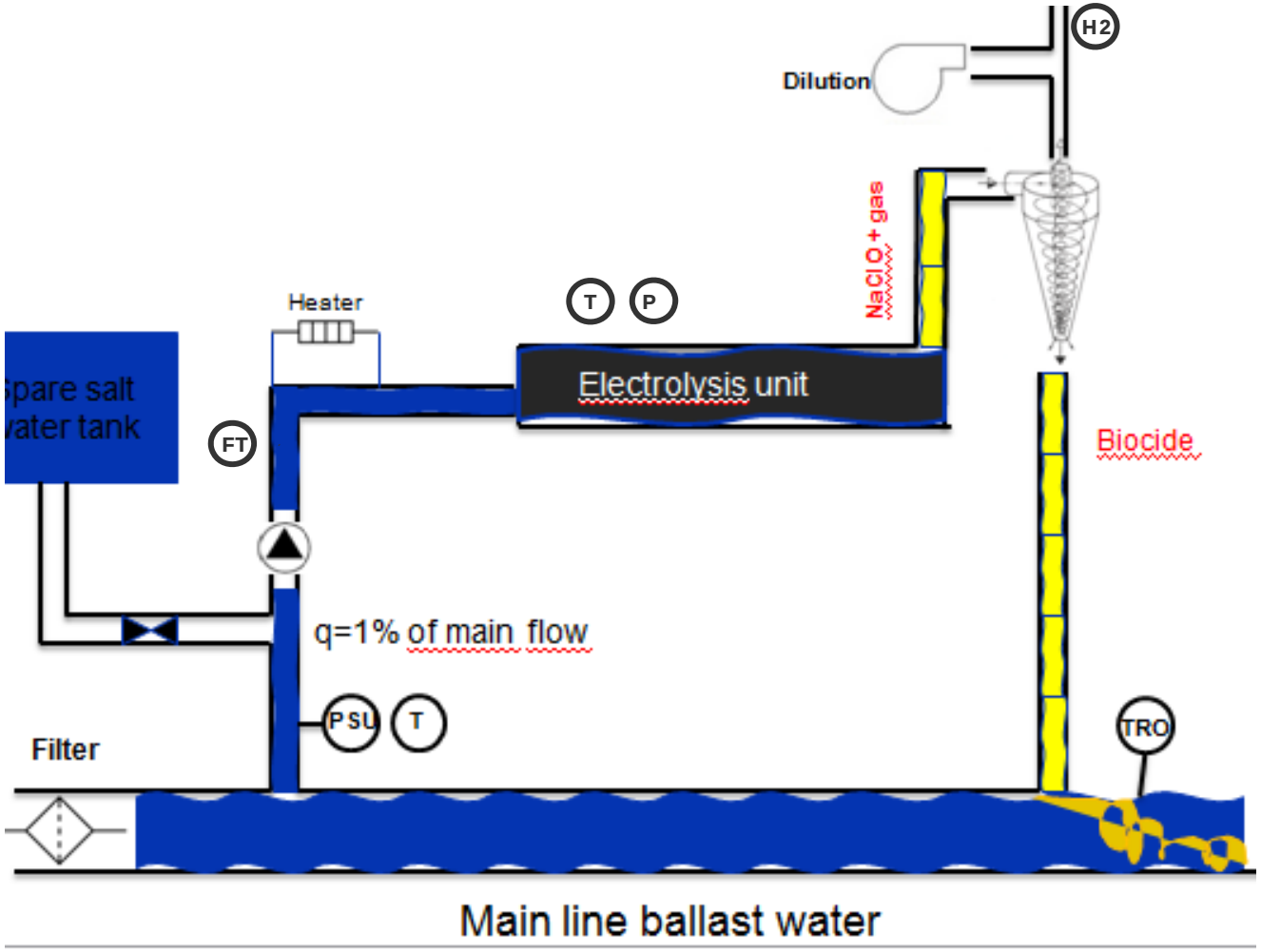
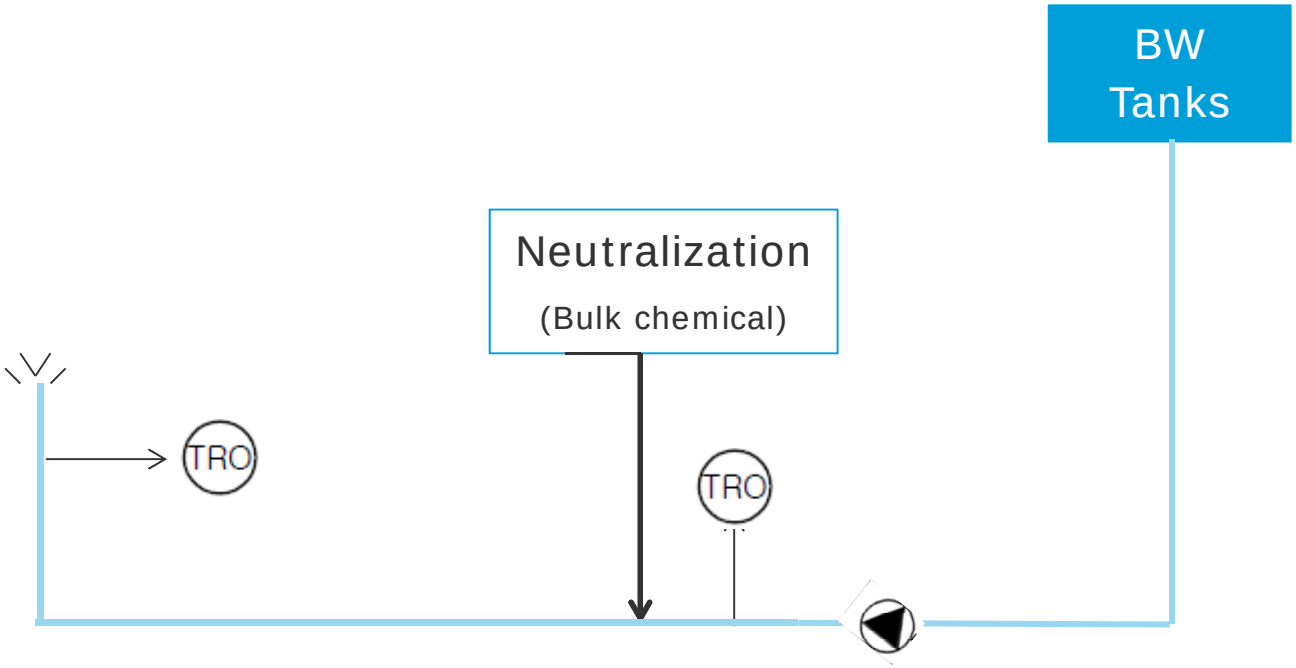
Filter + electrolysis
Typical flow chart (ballast)



Filter + electrolysis
Typical flow chart (de-ballast)



Filter + electrolysis
Considerations

Why ship-owners would install a filter + electrolysis BWTS

- CAPEX compensative on the high capacity range
- Only treatment on intake – free generator capacity on de-ballast
- Possibilities for gravity discharge
- 1 BWTS can cover several BW lines by injection of the biocide
- Can treat residual water in tanks (remaining after local operations)

Considerations

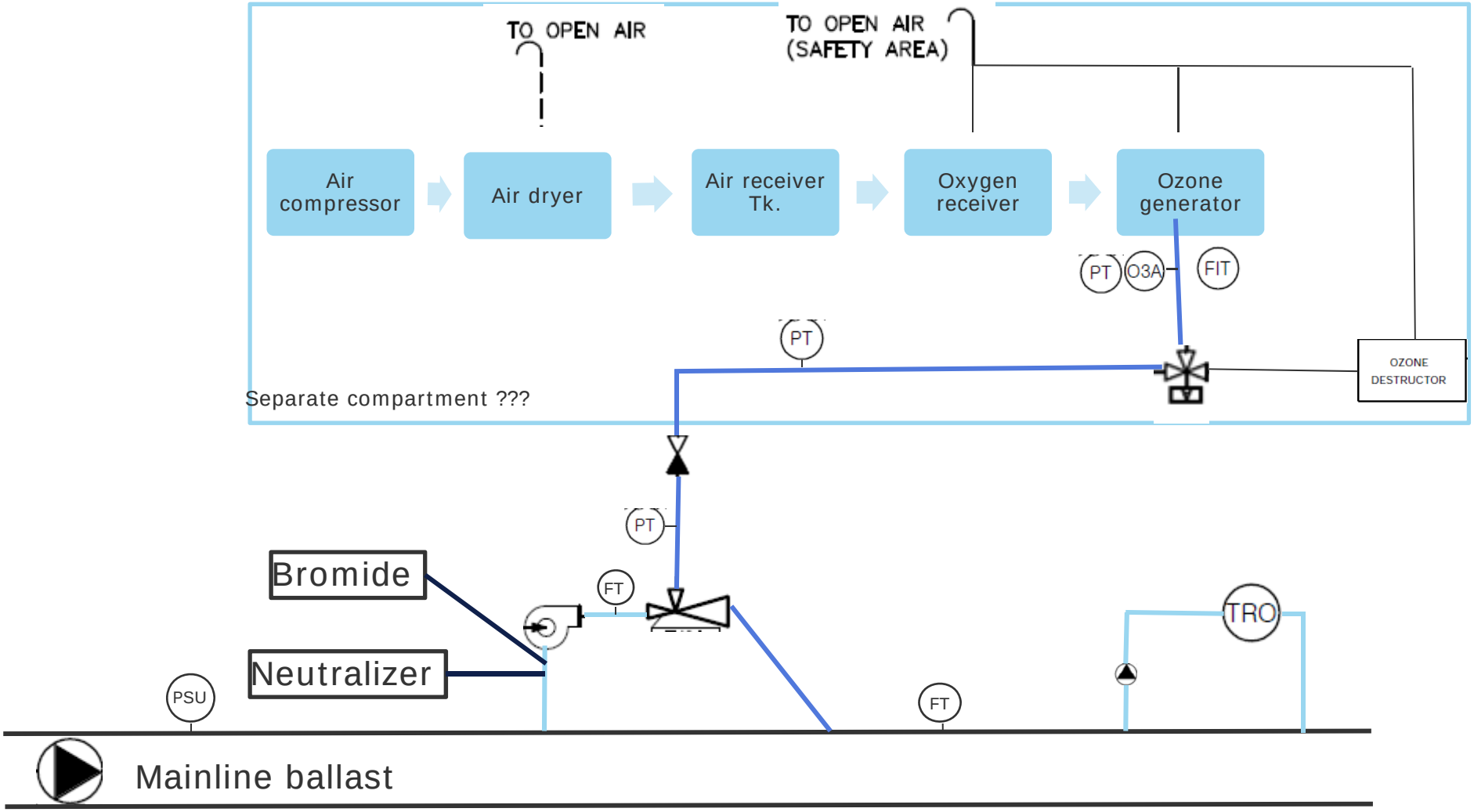
- Hydrogen gas management (slip stream type)
- Complex installations and operation
- Salinity dependence (inline type)
- Typically 0,1-0,2 kw/m3 treated water

Ozone gas

Ozone gas
Background

- Originally applied for municipal water treatment
- Produced in situ on the ship by separating nitrogen from air and applying current to the concentrated oxygen
- Treatment on intake, neutralization on discharge
- Is very reactive and oxidise microorganisms, it is also a biocide (by-product of reaction with seawater).
- Often seen on high ballast dependent ships such as:
  - Tankers for oil/chemicals
  - Bulk carriers

Ozone gas
Typical flow chart



Ozone gas
Considerations

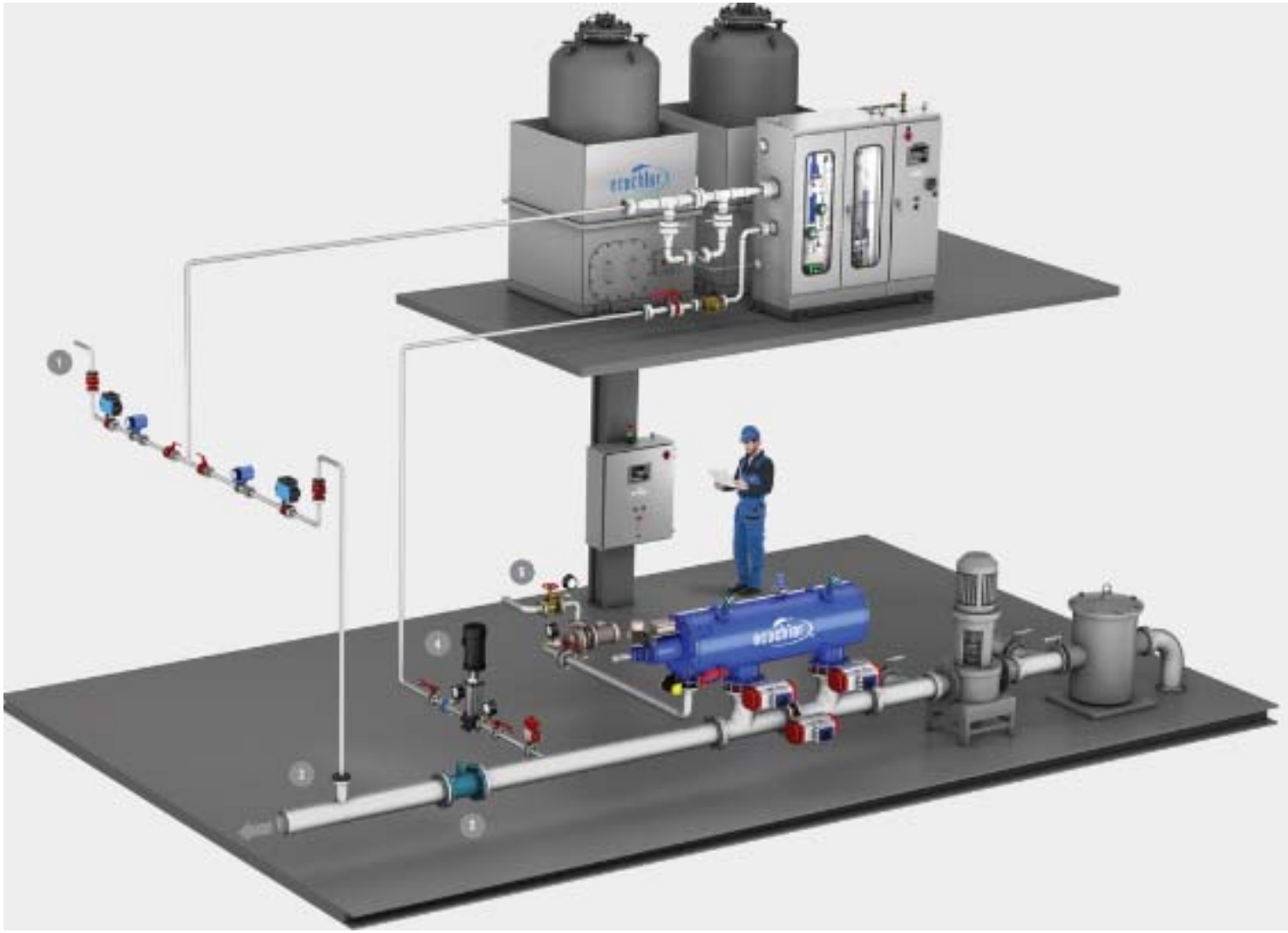
Why ship-owners would install a ozone BWTS

- CAPEX competitive on the high capacity range
- 1 BWTS can cover several BW lines by injection of the biocide
- Some systems using O_3 are type approved without a filter - no clogging of filters
- Only treatment on intake – free generator capacity on de-ballast
- Can treat residual water in tanks (remaining after local operations)

Considerations

- Complex to install and operate
- Typically 0,2 KW/m3 treated water
- Ozone is hazardous

Chemical injection



Chemical injection
Background

- Treatment on intake, neutralization on discharge
- Filters used: 20-50μm mesh, screen filters, placed in drum or candles, automatic backwashing
- NaOCl and ClO_2 typically used as chemical
- Covers the whole capacity range 100-8000 m3/h
- Often seen on medium/ high ballast dependent ships such as:
  - Tankers for oil/chemicals
  - Bulk carriers

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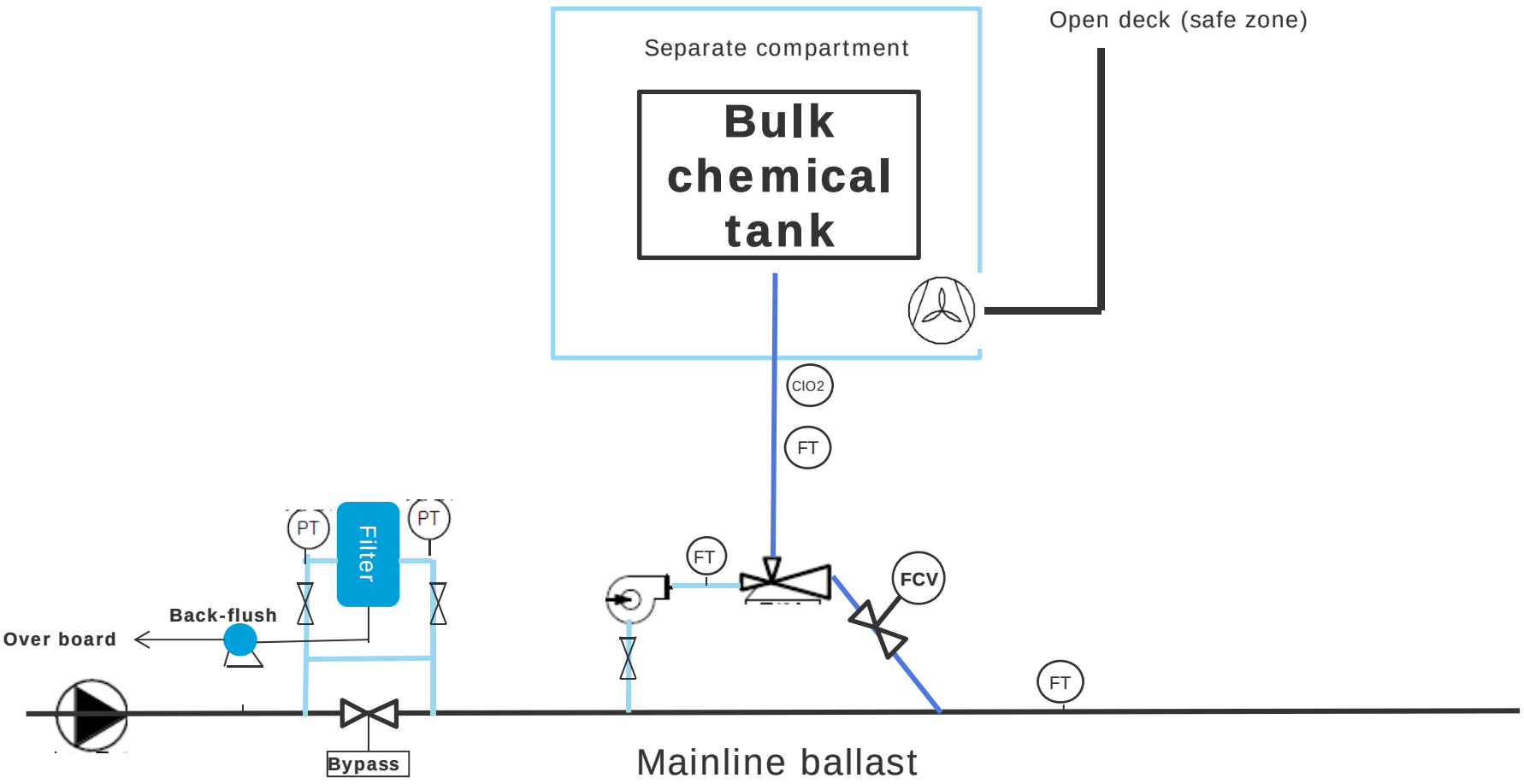
Chemical injection
Typical flow chart



Chemical injection
Considerations

Why ship-owners would install a chemical injection BWTS

- 1 BWTS can cover several BW lines by injection of the biocide
- Does not require generator capacity on ballast or de-ballast.
- Can treat residual water in tanks (remaining after local operations)

Considerations

- Cost ca.0,1 dollars /m3 treated water
- Need supplies of bulk chemical on the trading route.
- Complex system to install, control and maintain

DNV·GL

Summery
Treatment Methods

- lower CAPEX
- works in all salinities
- Simple installation
- No chemical by-product

- Treatment at discharge

FILTER + UV

- Low power consumption
- one system- several injection points

- higher CAPEX
- dependent on salinity
- Hydrogen by-product

FILTER + ELECTROLYSIS

- no filter
- Low power consumption

- needs separate treatment room
- higher CAPEX
- complex

OZONE

- no power consumption

- bulk cost
- needs separate treatment room

Chemical injection

Summery
Practical Aspects for Retrofit

- TRC of the BWMS fits to the pump capacity
- Use of one or two pumps to be described in the BWM Plan
- By-pass of the system shall give an alarm and must be logged, no matter if its from valves as part of the BWMS or ships valves
- Sampling points to be arranged before BWMS and before discharge (acc. G2 guidelines)
- Means to discharge untreated water to be included in the BWM Plan
- Pay attention to stripping
- Flag acceptance of the type approval is to be provided

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