

Advanced Guide to Rotating Biological Contactors (RBC's)

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Introduction

- An RBC is an aerobic system that treats biological waste water (sewage) using fixed biofilm that grows on plastic media known as contactors.
- The biofilm treats dissolved BOD and Ammonia through Nitrification
- Some De-nitrification can happen in the lower layers of the Biofilm
- The active bacteria breathe 21 percent Oxygen when the biofilm carrying media is in the air and chomp on BOD and Ammonia when under water
- The heart of the RBC is a solid steel rotor carrying plastic media corrugated sheets, which is rotated slowly using a low-power consuming motor/gearbox.
- The rotor is held in place using robust low friction bearings

Example of RBC Rotor in GRP Tank



RBC Rotor Outside the Tank



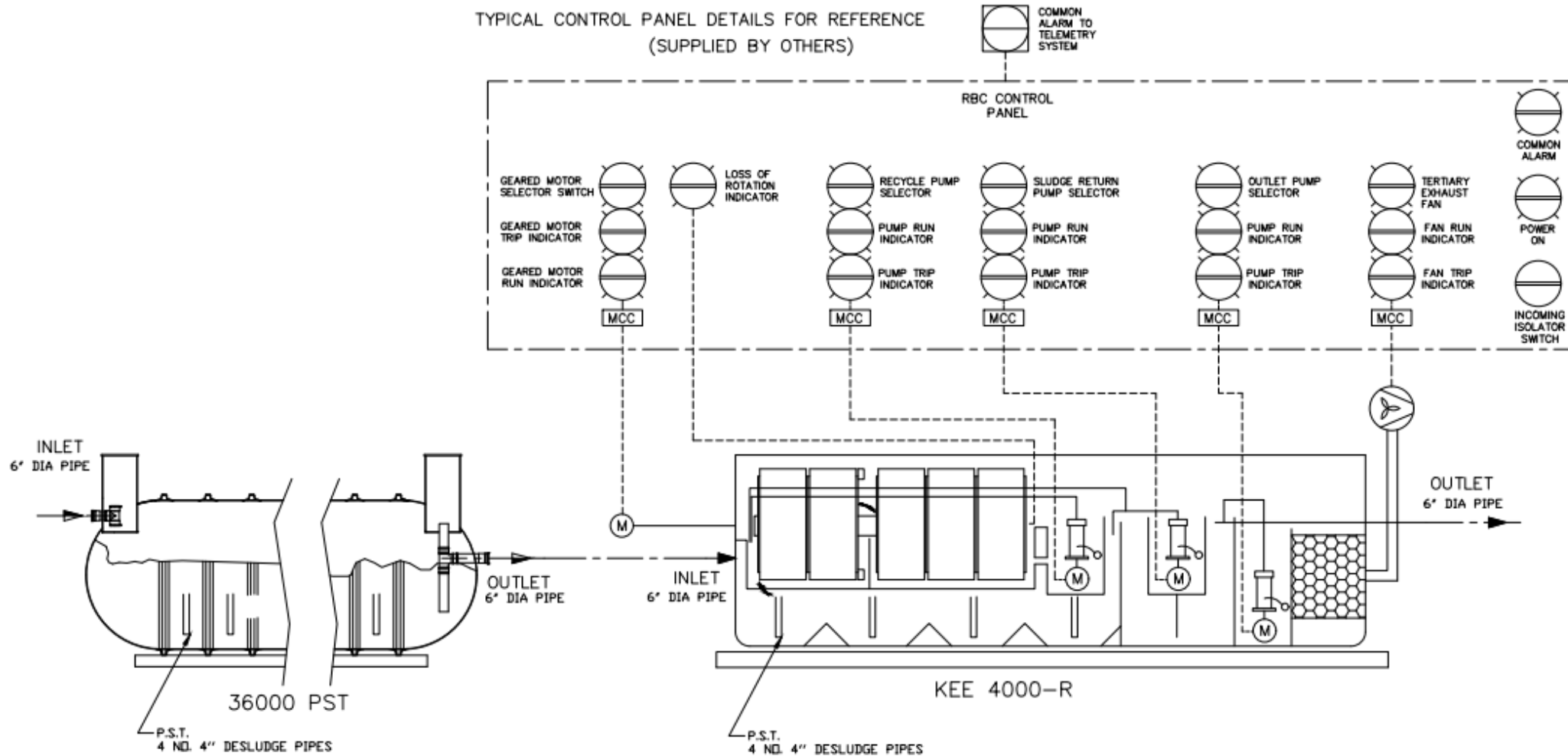
Designing an RBC

- The waste water flow and organic load (BOD and Ammonia) need to be established
- The effluent treatment parameters are defined
- A Specific load requires a certain surface area of media to treat it
- BOD removal requires approximately 3 hours of Hydraulic Retention Time
- Calculations are made to size the RBC and define pre and post treatment steps
- Low Ammonia requires dense De-nitrification stage as Ammonia nitrifying bacteria are slow to grow and form less dense biofilm
- Low Phosphate requires dosing of chemicals such as Poly Aluminium Chloride
- Low TVC's (Total Viable Count) i.e low bacterial levels in the effluent require a disinfection stage using chlorine or UV

Designing an RBC - II

- The dry weight of the rotor + biomass is calculated and the required torque to rotate this wet live rotor defines the size of the gearbox
- It is a very good idea to oversize the rotor gearbox.
- Lower ammonia effluent parameters may require a second pass of the effluent water in which case an effluent recycling pump is designed
- Amounts of sludge generated are used to size the sludge recycling pump and the define the desludging/descumming periods

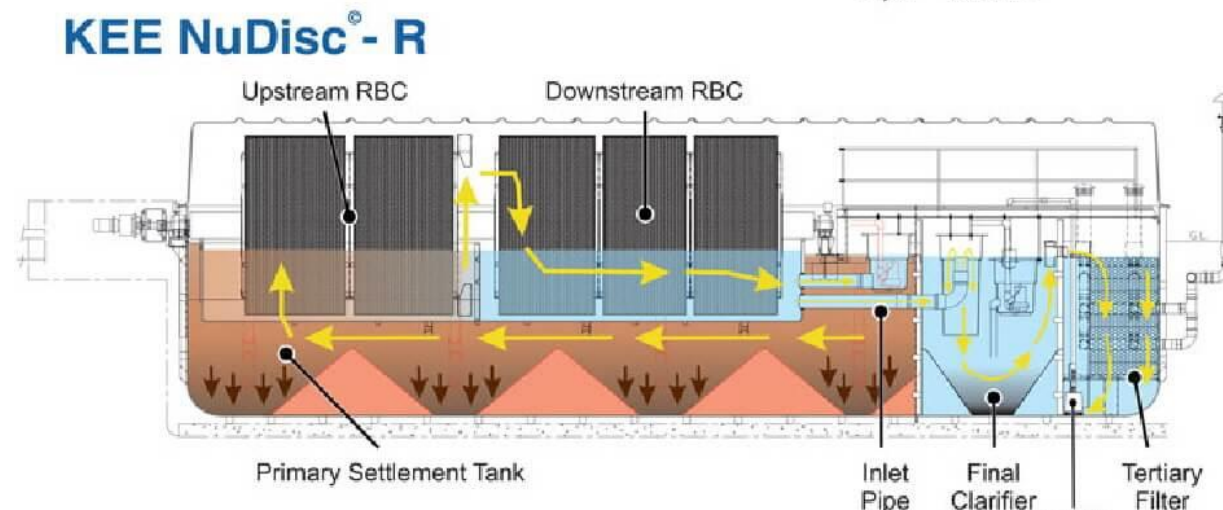
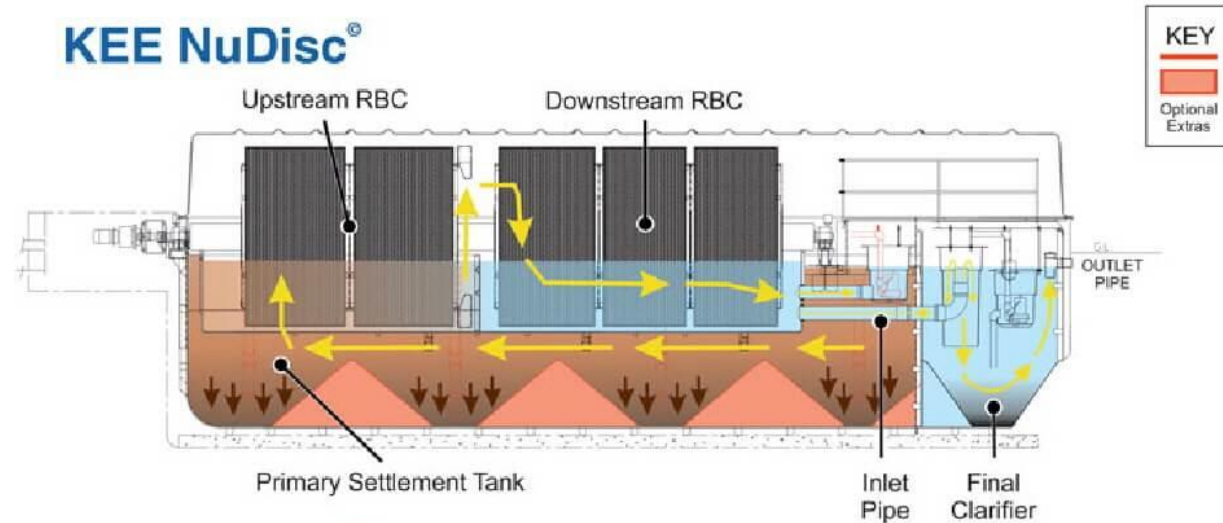
Process/Piping Instrumentation Diagram



4-In-1 RBC Packaged Systems

- Pre-Settling tank + RBC secondary stage + Final Settling tank + Trickling Filter
- 20-30-5 BOD : SS : Ammonia easily achievable

3-In-1 and 4-In-1 Packaged RBC's Schematic



Commercial Suppliers

- [Kingspan](#) – home of the “Klargester” aka the Shit chopper
- KEE Process: www.keeservices.com
- Evoqua: www.Evoqua.com
- Mecana: <https://www.mecana.ch/en/technologies/rotating-biological-contactor>
- Jacopa <https://jacopa.com/rbc/>



Installation and Commissioning

- Must be installed level and square on concrete slab in the excavation if underground model
- Connect piping
- While backfilling with concrete must fill up PST and FST equally with water to prevent internal hydraulic pressures on GRP walls and uplift forces from liquid concrete
- Avoid sharp objects that can puncture the GRP tank
- Do Rotation check on Rotor and the pumps

Operation and Maintenance

- Must be on all the time 24/7 otherwise the load gets unbalanced
- Keep bearings well greased
- Make sure media are tight and no bolts are loose
- Keep FOG away from the biofilm which can choke it
- Desludge/descum when sludge level gets high and scum gets deep
- Keep the gearbox nice, dry and well oiled/greased
- Respond immediately when rotation is interrupted
- Remove any solid waste such as paper towels lodged in the RBC media
- No harsh chemicals allowed down the drain

Advantages

- Low Energy Consumption Gearbox
- No noisy expensive blowers
- Self Regulating: more food more biofilm, less food less biofilm
- No smell, no little annoying flies as most RBC's are covered
- Simple, robust, proven design
- Low sludge production as biofilm that sloughs off is already held together by bacterial slime
- Underground designs are very unobtrusive visually
- Modular and can be installed in Parallel to treat up to PE=5000

Advantages-II

- No seeding required biomass grows naturally in 4-6 weeks
- Can last up to 40 years design life
- Damaged GRP sections can be repaired using fiberglass and resin
- Packaged Units can be shipped world wide on flat open containers
- GRP shells are water and corrosion proof

Examples of Underground Designs



A Smaller Modular Unit with External Gearbox



Massive Modular GRP Tank Unit



Massive 4-in-1 Packaged RBC



Disadvantages

- Any maintenance on the RBC rotor (which is rare) requires a crane lift
- Rotor must be level when it leaves the factory and checked with Site Acceptance check otherwise stress on gearbox
- Replacement media can be expensive
- Not suitable for areas prone to flooding unless an IP68 gearbox is chosen.
- Sites with high ground water level can push the RBC out of the ground if not properly fastened

DIY Low Cost RBC Construction Manual

- Low Cost DIY RBC from EAWAG

[https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/schwe rpunkte/ewm/STUN/Nitrogen_pdfs/STUN_RBC_construction_manual.p df](https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/schwe rpunkte/ewm/STUN/Nitrogen_pdfs/STUN_RBC_construction_manual.pdf)

Low Cost DIY RBC



Decarbonization of the System for NetZero

- A solar powered RBC system can be designed to reduce the CO₂ impact of an RBC
- Onsite sludge treatment with flocculant can reduce the water content of the sludge and hence reduce desludging frequency

Comments/Suggestions

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