



KEE 'HR' UNIT – OPERATION & MAINTENANCE GUIDELINES

APPENDICES:-

G/A drawing, Wiring Loom, Control panel wiring diagram, S/R Pump timer details, Greasomatic data sheet, Gearbox manual, Sludge return pump manual
 (Appendices MUST be read in conjunction with these O&M Guidelines)

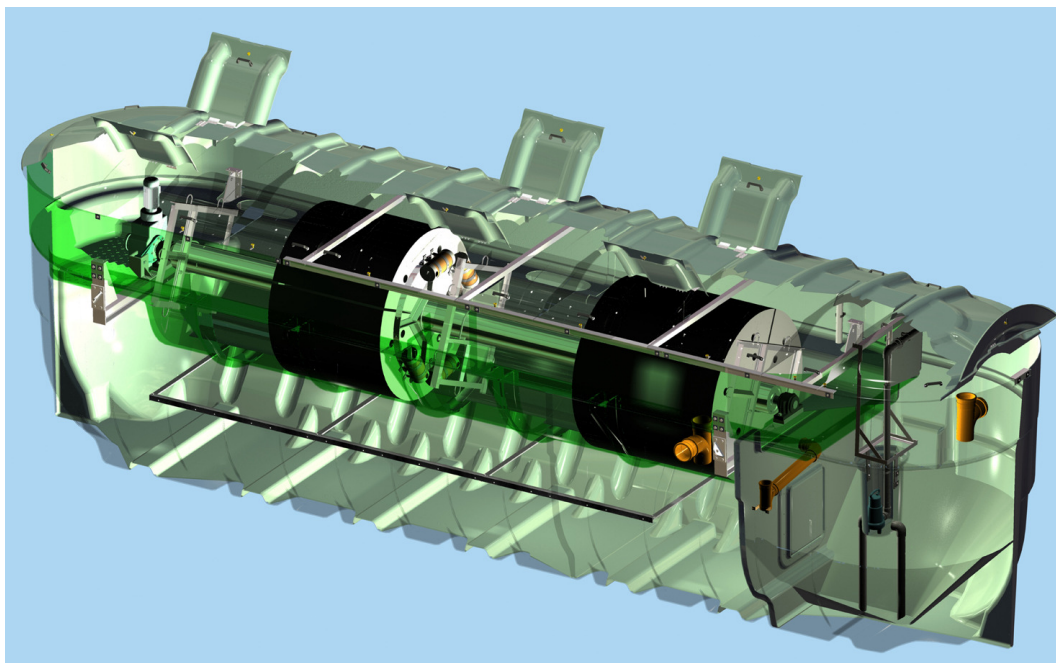


Fig.1 - 'TYPICAL' KEE 'HR' UNIT – INTERNALS VIEW

INTRODUCTION + HEALTH & SAFETY GENERAL

- These Guidelines are 'general guidelines'. It is the responsibility of others to ensure that the site-specific requirements (particularly those relating to site specific Health & Safety) are incorporated into the Site Master Operation & Maintenance Manual. Risk Assessments and Method Statements must be produced for all Servicing, Operation & Maintenance requirements / procedures.
- All current, local, national, and international Health and Safety Guidelines relating to Environmental, Civil, Mechanical and Electrical works must be adhered to in the Operation, Servicing and Maintenance of the unit supplied by KEE Process Ltd.
- Sewage and sewage effluent can carry microorganisms harmful to human health. Any persons carrying out maintenance on the equipment must wear suitable protective clothing.
- KEE RBC units contain rotating machinery, power must be isolated and locked off before lifting off the covers and / or entering the RBC unit.
- Use only the designated access / maintenance walkway platforms.

PROCESS DESCRIPTION

- Sewage enters the Primary Settlement Tank (PST). Solid matter is settled out and retained in the PST for periodic de-sludging.
- The settled liquor passes into the Biozone (1st Stage RBC) through a submerged transfer slot.
- The Biozone contains the Rotating Biological Contactor (RBC). The RBC consists of polypropylene segmented 'media' mounted on a horizontal shaft, supported by a bearing at each end. The RBC is rotated by a shaft mounted Gearbox.
- The surface of the media gradually becomes colonised by naturally occurring microorganisms, which form a visible coating called Biomass. The Biomass will efficiently break down the pollutants in the sewage.
- The Biozone and RBC are divided into two main stages, separated by a fixed baffle. The first stage Biozone is hydraulically linked to the PST via the submerged transfer slot and the liquid level within these linked compartments will fluctuate with variations in incoming flows.
- The 2nd stage Biozone / RBC is hydraulically sealed from the 1st stage and maintains a constant liquid level set by the outlet invert level of the treatment plant.
- Liquid is transferred from the 1st stage RBC to 2nd stage via a bucket lift system located at the area of the Biozone fixed baffle.
- Liquid passes from the 2nd stage Biozone / RBC to the Final Settlement Tank (FST) through a submerged transfer pipe.
- Solid matter within the FST settles out and is periodically returned to the PST and/or 1st stage RBC by a timer controlled pump system. The pump system is also designed to return any floating scum residing within the FST.
- Fully treated liquid exits the FST via an outlet Tee pipework arrangement.

INITIAL START-UP PROCEDURE / COMMISSIONING

(FOLLOW THE STEPS BELOW IN STRICT ORDER)

- Handling of the unit during transportation and installation may result in the movement of components and a subsequent need to re-adjust prior to starting the unit. If, on inspection, you consider that any component requires adjustment, please contact KEE Process Ltd.
- Check that the unit is surcharged with water.
- Check that all electrical components are correctly connected.
- Check that the greasomatic cartridges (one connected to each bearing housing at the each end of the rotor) is set to 12 months and then activated.
- Check that the LOR sensor and Magnet (located at the non drive end of the rotor) are correctly 'spaced-apart' when the magnet passes the face of the sensor. Set at a distance of 5 to 10mm max.
- Re-check the unit to ensure that there are no obvious obstructions preventing the RBC from rotating.
- **SWITCH-ON** – Prior to switching to 'on' the main panel isolator, make sure that both the geared motor and sludge return pump overload devices are depressed to 'on'. Turn the main panel isolator to 'on'. The rotor (RBC) should start turning and the sludge return pump should 'run' for its timed cycle.
- Check that the rotor is running smoothly and in the correct direction of rotation. If direction of rotation needs to be adjusted, refer to the geared motor manual appendices.
- Check that the sludge return pump is lowering the top surface (10 – 15mm) water level of the FST and then drawing up and returning lower level liquid from the base of the FST. The pump should switch on and off via its integral float approximately 3 to 5 times during its timer controlled 'run' cycle.
- Check that the Loss or Rotation (LOR) device operates correctly by switching to 'off' the geared motor overload device in the control panel. The rotor will stop turning and in approximately 2 – 3 minutes the LOR flashing beacon will activate.
- Check and record industry standard electrical readings of the geared motor and sludge return pump.

PROCESS INITIATION

- During installation, the unit will have been filled with clean water to prevent floatation. On sewage flow diversion to the new equipment, sewage will enter the system and gradually displace the clean water.
- The colonisation by microorganisms onto the RBC media will commence naturally and a full Biomass will establish itself in approximately 4 – 6 weeks depending on in-flow load conditions.

PROCESS INHIBITION

- The biological treatment process of the KEE equipment is self regulating, however, it is important that you are aware of the following:-
- Many chemicals used in households and commercial establishments can inhibit or kill the microorganisms within the system, especially if used excessively.
- Treatment plants serving small populations do not have the benefit of the dilution rates that occur at large sewage works. A bottle of bleach tipped down the toilet of a household linked to a large municipal sewage works would be 'lost' amongst the millions of gallons of sewage arriving at the works, whereas a bottle of bleach in a plant serving a small population could be severely detrimental to the process performance of the plant.
- Damaged Biomass will usually recover in time, however, interim symptoms will occur such as un-pleasant odour emission from the plant. It is therefore in the Operators interest to educate the occupants of households who deliver flow to the works on what should and should not be 'put down the system'.
- Generally speaking all common household cleaning fluids are acceptable, provided they are used in accordance with the manufacturer's instructions and stipulated concentrations.
- The following list is not 'exhaustive', if in doubt – DO NOT discharge down to the treatment works:-
 - o Washing machine / Dishwasher detergents / Washing up liquids:- Generally acceptable in normal concentrations found in domestic housing applications.
 - o Floor cleaners / Disinfectants / Bleaches:- Generally acceptable following the manufacturers guidelines. DO NOT pour neat disinfectant / bleach down sinks, toilets, outside gullies etc. If these receivers are 'smelly' it normally indicates a build up of decaying material and/or a plumbing / drainage run problem and must be dealt with accordingly.
 - o Nappy disinfectants / Bottle sterilising fluids:- Dispose of these items in a well diluted form with large quantities of water. Flushing down the toilet is acceptable.
 - o Waste disposal (WD) units:- These present the treatment plant with considerable 'extra' load, which can lead to the process becoming un-balanced. DO NOT use WD units, compost as an alternative.
 - o Home beer and wine making:- This presents a similar problem to WD units. DO NOT use / make.
 - o The following MUST NOT be discharged down the drains:-
 - Motor oil, engine fuels, grease, anti-freeze, brake fluid, cooking oils, cooking fats, weed killers, insecticides, fungicides, all other gardening chemicals, paint, thinners white spirit, turpentine, creosote, medicines, photographic fluids, nappies, sanitary towels, rags, soft toys, tennis balls, (any other items with potential to cause pipework blockages).

AUTOMATIC RE-START AFTER POWER FAILURE

- KEE 'HR' RBC's are designed to re-start automatically when power is resumed following a power failure at site, however, the re-start may not succeed in some circumstances, such as extended power cuts as the RBC shaft can become 'out of balance' (typically 8 hours or longer). This will result in the Loss of Rotation alarm activating when power is re-established. To rectify this condition, rotate the RBC 180 degrees. While it is being rotated, hose off some of the Biomass now exposed to the air. Once the RBC has been rotated the full 180 degrees, lock the shaft in position and leave for approximately 12 hours. This will give the wet Biomass a chance to dry slightly and the dry Biomass to become wet. Re-start the RBC, the Biomass will now regenerate naturally and evenly across the RBC media.

MAINTENANCE

- The KEE equipment is engineered for the minimum possible maintenance requirements. However, it is important that suitably qualified and trained personnel are tasked with carrying out routine maintenance of the equipment.

PERIODIC MAINTENANCE TASKS

- **Observation & Check Tasks:-** (to be carried out at a maximum interval of **every 3 months** unless stated otherwise)
 - o RBC unit covers are fitted with observation / inspection hatches to assist with the performing of these tasks.
 - o Check appearance of Biomass. The 1st stage RBC media (closest to the geared motor) should be light grey, gradually changing to brown and then dark brown at the final end of the RBC media adjacent to the FST. If the Biomass growth is excessively thick and / or the colour is predominantly grey throughout the complete RBC media, then an 'overload' condition is indicated.
 - o Check bucket lift system is 'picking-up' and 'discharging' correctly.
 - o Check rotor shaft bearing 'Greasomatic' cartridges (replace if fully discharged).
 - o Inspect geared motor drive arrangement (audible / visual check). (Refer to Gearbox / Motor Manual).
 - o Check sludge return pump is operating for pre-set timed period and is discharging correctly from FST to PST and/or 1st stage RBC. Lift out pump from FST **every 6 months** and clear / clean around impeller intake (Refer to Pump Manual).
 - o Check all unit covers are secure and all locks are operational.
 - o Check all pipe orifices for blockages.
 - o Observe for any 'unusual' mechanical noises.
 - o Perform electrical checks on Geared Motor and Sludge Return Pump within the unit (continuity, insulation, running current).
 - o Check operation of RBC Loss of Rotation sensor / magnet.
 - o Check flow hydraulics through complete system, from unit inlet to site exiting manhole chamber.
 - o Rotor bearings (2 off per RBC unit) to be internally inspected **every 24 months** and re-packed with 'W' Grease if required.
- **Consumables Replacement Schedule:-**
 - o Bearing Greasomatics (2 off per RBC unit) - Change **every 8-12 months** - KEE Part Number = G699W
 - o Gearbox Oil - Change **every 24 months** (check oil level **every 12 months**)

(IMPORTANT:- refer to Gearbox / Motor manual for oil volumes and all other Gearbox / Motor maintenance / servicing requirements that need to be undertaken)
- **Life Expectancy of RBC Mechanical Components (Guideline Only):-**
 - o Gearbox Motor - 10 years
 - o Gearbox - 10 years
 - o RBC Bearings - 10 years
 - o Sludge Return Pump - 5 years

SLUDGE / SCUM REMOVAL - QUANTITY AND FREQUENCY

<u>ITEM</u>	<u>Removal Frequency</u>	<u>Sludge / Scum Volume to be Removed</u>
KEE 40HR Unit	Every 60 days	4000 Gallons

DESLUDGING / DESCUMMING METHODOLOGY

(FOLLOW THE STEPS BELOW IN STRICT ORDER)

- Switch off power to the unit by isolating at the control panel.
- Undo all the desludge hatch covers located within the main cover sections.
- Dedicated desludge ports are located in the GRP flat surfaces either side of the main rotor. These ports give direct access to the Primary Settlement Tank (PST).
- Remove all surface scum from all the desludge ports in the PST.
- Remove settled sludge from the base of the PST through all the desludge ports. It is essential that the tanker hose is 'worked' into all the areas at the base of the PST.
- Remove any remaining surface scum from the PST.
- Remove any surface scum from the Final Settlement Tank (FST). The FST is the 'open' chamber at the opposite end of the unit from the gearbox.
- Lower the tanker hose to the bottom of the FST and remove 0.5m water depth of the FST contents.
- Secure and lock all desludge hatch covers.
- Switch on the unit.
- **IMPORTANT:-** (a) Do not attempt to remove any liquid from the biozone. This is the dedicated GRP chamber that the rotor sits in. (b) Do not attempt to clean off the gelatinous growth (biomass) on the rotor. (c) The Sludge and Scum removal regime will need to be monitored closely on site to ensure that Sludge and Scum is not allowed to accumulate to the detriment of the system hydraulics and/or the final effluent quality. If system hydraulics and/or final effluent quality are affected then suitable regime adjustment will need to be made.