### NIBBLER® DESIGN MANUAL
#### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIBBLER® Design Overview</td>
<td>1</td>
</tr>
<tr>
<td><strong>Commercial Application</strong></td>
<td></td>
</tr>
<tr>
<td>• Process Description</td>
<td></td>
</tr>
<tr>
<td>• NIBBLER® Flow Process/ NIBBLER® Unit-drawing</td>
<td></td>
</tr>
<tr>
<td>• Tanks Description</td>
<td></td>
</tr>
<tr>
<td>• Panels, Timers &amp; Floats</td>
<td></td>
</tr>
<tr>
<td>• Putting It All Together</td>
<td></td>
</tr>
<tr>
<td><strong>NIBBLER® DESIGN CHECKLIST</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>NIBBLER® SIZING CHART</strong></td>
<td>3</td>
</tr>
<tr>
<td>Designing the NIBBLER® in residential applications</td>
<td>4</td>
</tr>
<tr>
<td>• Design Overview</td>
<td></td>
</tr>
<tr>
<td>• Sizing Chart</td>
<td></td>
</tr>
<tr>
<td>• Tank Inspection</td>
<td></td>
</tr>
<tr>
<td>• Residential Questionnaire</td>
<td></td>
</tr>
<tr>
<td><strong>DESIGN DRAWINGS</strong></td>
<td>5</td>
</tr>
<tr>
<td>• Single NIBBLER® Flow Plan</td>
<td></td>
</tr>
<tr>
<td>• Single Surge tank</td>
<td></td>
</tr>
<tr>
<td>• 2 NIBBLER® Unit Flow Plan</td>
<td></td>
</tr>
<tr>
<td>• Single NIBBLER® Air and Vent</td>
<td></td>
</tr>
<tr>
<td>• NIBBLER® Tank Lid Detail</td>
<td></td>
</tr>
<tr>
<td>• Clarifier Tank</td>
<td></td>
</tr>
<tr>
<td>• NIBBLER® CBP</td>
<td></td>
</tr>
<tr>
<td>• 1 Unit</td>
<td></td>
</tr>
<tr>
<td>• 2 Units</td>
<td></td>
</tr>
<tr>
<td>• 3 Units</td>
<td></td>
</tr>
<tr>
<td><strong>BLOWER SPECIFICATIONS</strong></td>
<td>6</td>
</tr>
<tr>
<td><strong>PUMP SPECIFICATIONS</strong></td>
<td>7</td>
</tr>
<tr>
<td><strong>NIBBLER® Monitoring Checklist</strong></td>
<td>8</td>
</tr>
</tbody>
</table>
SECTION 1

NIBBLER® SBP & CBP
(Square Back-flush Pod)

(Cylinder Back-flush Pod)

Design overview
NIBBLER® SBP and CBP
High Strength Wastewater Pretreatment System

DESCRIPTION

The NIBBLER® POD models are a wastewater pretreatment system designed to reduce high strength wastewater to levels comparable to that of residential septic tank effluent. The NIBBLER® does this through a patented process which injects air into the wastewater and creates a turbulent aerobic environment that supports a diverse microorganism population. This microbial population naturally biodegrades and digests the organic materials contained in wastewater. The NIBBLER® SBP is a square POD utilized in large systems. Whereas the NIBBLER® CBP boast a cylinder shape to the POD engineered for retrofitting into existing systems. This is feasible for use in small gravity flow systems; typical of high strength residential systems.

APPLICATION

The NIBBLER® SBP is designed for use with commercial facilities such as restaurants, supermarkets, food processing plants, golf courses, mini-marts, prisons or other facilities where food is prepared. Wastewater from such facilities are typically characterized by high BOD₅ (Biological Oxygen Demand 5 day) and high Fats, Oils and Greases. NIBBLER® pretreatment may be utilized where site conditions permit the use of an on-site disposal system or where pretreatment is appropriate prior to discharge into a public sewer system.

DESIGN CAPACITY

Each NIBBLER® SBP UNIT contains a specified number of pods designed to match the hydraulic and biological loading of the system. NIBBLER® SBP Pods are PVC plastic cages (27” X 27” X 18”) containing buoyant media with an air lift pump mounted in the center. NIBBLER® CBP UNIT are PVC plastic cylinders (18” X 18” x 24”) containing the same buoyant media and air lift pump in the center. The media provide a high surface area that is well aerated for efficient microbial growth. Each pod is capable of treating 0.81 lbs/day of BOD₅ loading and a maximum 137.5 gallons per day for wastewater composed of ≥ 50 mg/L or 200 gpd per pod for wastewaters with < 50 mg/L Oil and Grease. Depending on the volume of flow and wastewater strength, NIBBLER® SBP units may contain as few as 3 to 8 pods or may be designed utilizing hundreds of pods. NIBBLER® CBP units can be sized starting from 1 unit and more, depending on site needs.

TYPICAL NIBBLER® SBP FLOW PROCESS

A typical NIBBLER® SBP system has a Grease Trap, Surge Tank, NIBBLER® Unit and Clarifier. The Surge Tank is a single compartment tank sized with a two (2) day capacity. A time controlled pump mounted in the Surge Tank curbs peak flows and allows for even dosing of the NIBBLER® Unit, A Clarifier tank follows the NIBBLER® Unit for settling of remaining solids before discharge.

NIBBLER® SBP SYSTEM CONSIDERATIONS

1. NIBBLER® SBP Control Panel
   To manage peak flows, each NIBBLER® SBP system requires a control panel. Metering of the
   AQUA TEST INC
   P.O. BOX 1116  BLACK DIAMOND, WA 98010
   1.800.221.3159
   WWW.AQUATESTINC.COM
influent employs a submersible pump, a float assembly, timer, cycle counters and hour meters, all connected and operated through the control panel. The pump timer is set to deliver a specific volume of wastewater on a uniform basis. The cycle counter and hour meter record the time the pump has run. Therefore, the volume of wastewater treated can be determined by a simple calculation. *The control panel for Minnesota projects will be duplex, intrinsically safe, with a non mercury float configuration.*

2. NIBBLER® SBP Tank

A typical tank used for housing the NIBBLER® SBP pods is a single compartment concrete tank of approximately 1,000 to 10,000 gallon capacity. For larger systems, tanks with much greater capacity, either precast or poured in place, may be used. The tank is installed so that the top is exposed at the ground level. The top of a typical tank is equipped with large rectangular air-tight locking lids (3’ X 4’”) which allow the pods to be easily maintained. Any tank used to house the NIBBLER® pods must be approved by AQUA TESTINC.

3. Aeration System

The NIBBLER® PODS utilize a regenerative air blower which provides the required air flow and turbulence. The blower is housed in a separate vault to protect it from moisture and weather. Air, forced by the blower through a pipe manifold, flows through the airlift pumps located in the center of each pod. The air lift pump consists of a one inch airtube which delivers air to the center of the 6” draft tube approximately 14’ below the liquid surface, the liquor inside the draft tube is displaced and forced out the top, where it splashes and mixes with the liquor at the top of the pods. This area around the top of the pod is very turbulent and provides for constant mixing of liquor in the upper zone of the tank.

**SYSTEM PERFORMANCE**

1. Mixing
As air combines with liquor flow in the draft tubes, considerable turbulence is created causing rapid mixing within the top 20’ of the unit. As depth increases below the pods, turbulence decreases, hence mixing also decreases.

2. Microbial Oxygen Uptake

By virtue of its design, oxygen diffusion occurs in the upper zone of the tank. This upper zone also contains the buoyant media, which support the highest concentration of aerobic organisms.

In an active NIBBLER® system, the dissolved oxygen concentrations are highest at the top of the tank and decrease with the increase of liquor depth. The DO concentration at any point in the NIBBLER® tank is dynamic, depending upon the liquor’s temperature, influent waste strength, volume, and time since the last dose.

3. Dissolved Oxygen Profile:

Because dissolved oxygen concentration decreases with increased liquor depth, the NIBBLER® generally exhibits three different aeration zones. The uppermost mixing zone, is aerobic and turbulent. This typically constitutes the upper 1/3 of the tank. The transition area between the
aerobic and the anaerobic zones (zone of least mixing) is the facultative zone. The lowest portion of the tank, where solids settle (sludge), is the anaerobic zone (zone of no mixing). The actual formation and depth of these three zones depends upon the system’s age, the hydraulic and waste strength loading, and the mixing and oxygen diffusion characteristics of the system. A system will typically contain these three zones, once sludge begins to accumulate at the bottom of the tank, The NIBBLER® Unit typically requires cleaning every 2 to 5 years.

4. Output Characteristics
The performance of NIBBLER® systems is measured by the discharge waste-strength. Parameters used to determine performance, include: Biochemical Oxygen Demand- 5 Day (BOD₅), Total Suspended Solids (TSS), Fats. Oil & Grease (O&G), Dissolved Oxygen (DO), pH and temperature. Waste strength reductions typically range from 80 to 90%.

DESIGN OF DISPOSAL SYSTEM

The NIBBLER® PODS can be configured for compatibility with most any disposal system. Since the NIBBLER® SBP system curbs peak flows, the disposal system can often be own-sized to match average daily flows. A licensed NIBBLER® dealer sizes the NIBBLER® system and may consult on the design of the treatment process, process compatibility and other system components.

PERFORMANCE MONITORING

Monitoring of the flow rate and waste strength should be performed monthly at regular intervals during the first six months of operation for the NIBBLER® systems. If, during the first six months, the measured parameters are consistently at or below design parameters, monitoring frequency shifts to quarterly intervals. Later, if any of the design parameters are exceeded, monitoring may revert back to a more frequent schedule until the cause of the problem is alleviated. NIBBLER® residential systems should be monitored every 6 months indefinitely.

O&M
Consistent maintenance and monitoring is required for the life of the system. The monitoring entity reports to the owner, AQUA TEST INC. and the appropriate health agency. It is important that the monitoring entity be qualified to monitor the system and must attend and pass an approved AQUA TEST INC. training workshop.

PERFORMANCE WARRANTED
NIBBLER® systems are warranted to meet treatment specifications which are typically 125 CBOD₅ / 175 mg/L BOD₅ or less and FOG of 20 mg/L or less

For further information, please contact:
AQUA TEST INC.
(800) 221-3159
Tanks Descriptions

Grease Trap

Function
The primary function of a grease trap (more aptly called a grease tank) is to remove the floatable fats, oils, greases, soap scum, etc., and the settleable solids from the greywater flow.

A grease trap should not be confused with a kitchen grease separator or interceptor, which is generally a small unit placed under the sink, that removes some of the greases and oils that are not emulsified. Such devices can only reduce the amount of oil and grease concentrations if cleaned and maintained daily. Problems arise from lack of maintenance. A grease trap is really a large tank, usually over 1,000 gallons, similar to a septic tank, but with a different baffle configuration.

A grease trap does not require daily maintenance. Quarterly inspections by an outside contractor are generally sufficient to identify the required pumping frequency and to keep the unit operating efficiently. Though similar to a standard septic tank in appearance, there are differences. The grease trap is intended for the greywater flow only. Grease traps remove some of the fats, oils and greases as well as most of the settleable solids. They allow for biological action but are generally not sufficient to protect a drainfield. High temperatures, soaps that emulsify oils and greases, pH, and peak flows all affect the performance of a grease trap. Grease traps also do very little to reduce the BOD₅, of high strength waste.

Sizing
Grease trap sizing is based on the hydraulic flow of the facility, the characteristics of the peaks in the flow, and the proportion of the grey and blackwater flow. Collecting and reviewing this information is discussed in the section Gathering Background Data.

Generally grease traps are sized to handle three (3) times the peak flow depending on the daily flow patterns.

Configuration
Grease trap configurations vary. Their design is generally based on flow volume and flow characteristics. Generally two different tank configurations are used in NIBBLER® systems.

Standard Two Compartment
This tank is similar to a two-compartment septic tank with a 2/3 (first compartment) 1/3 (second compartment) split. The primary difference is the length of the outlet baffle between the two compartments. The baffle of the grease trap is extended to maximize the separation of floatable materials (fats, oils & grease). The attached figure details a typical example of this configuration. This tank configuration is used on most designs.

Multiple Tank Configuration
As flows increase (peak or average), the size of the grease trap also increases. A cast in-place tank may be used to accommodate the increased size, or a multiple tank configuration can be incorporated into the design. The multiple tank layout is simply a series of single compartment tanks configured to provide the necessary detention time. The next figure details a two-tank grease trap set up with the first tank having 2/3 of the total grease trap capacity.
The distance between the facility and the grease trap will reduce the temperature of the waste flow, which in turn will increase the effectiveness of the grease trap. However, this advantage can be offset by having to clean this line periodically.

**Surge Tank**

**Function**

An important aspect of every wastewater treatment system is the ability to handle peak flows. One method is by using a surge tank. In the NIBBLER® system, the surge tank is a single compartment tank equipped with a time controlled Duplex pumps that feeds the NIBBLER® unit(s) evenly over a 24 hour period. This even, consistent feeding is fundamental to proper operation. The table below shows how a surge tank works to regulate flow from a restaurant where 50% of the business occurs in a two-day period. The maximum flow through the system is 1,000 gallons per day.

<table>
<thead>
<tr>
<th>Day</th>
<th>Flow into Surge Tank from Facility (gallons)</th>
<th>Volume held in surge tank (gallons)</th>
<th>Flow into drainfield (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday</td>
<td>550</td>
<td>0</td>
<td>550</td>
</tr>
<tr>
<td>Friday</td>
<td>1,500</td>
<td>500</td>
<td>1,000</td>
</tr>
<tr>
<td>Saturday</td>
<td>1,750</td>
<td>1,250</td>
<td>1,000</td>
</tr>
<tr>
<td>Sunday</td>
<td>1,000</td>
<td>1,250</td>
<td>1,000</td>
</tr>
<tr>
<td>Monday</td>
<td>475</td>
<td>775</td>
<td>1,000</td>
</tr>
<tr>
<td>Tuesday</td>
<td>650</td>
<td>425</td>
<td>650</td>
</tr>
<tr>
<td>Wednesday</td>
<td>575</td>
<td>0</td>
<td>575</td>
</tr>
</tbody>
</table>

**Average** 928

Surges flow through the grease trap and into the surge tank. Downstream components only receive the timed flows and are protected from hydraulic overload. The time controlled pump will pass the daily flow up to the design flow only. Any amount above the design capacity is held in the surge tank. Other advantages to utilizing a surge tank include:

- Detects major changes in flow patterns, by holding excess volume and activating the alarm.
- Hydraulic overloads due to excessive flows are contained. Excessive flows can be a result of leaky fixtures, ground water infiltration, and/or high water use in the facility. In one case, toilet leaking at 1.74 gallons per minute discharged over 2,500 gallons of water into a system in one day.
- Provides a uniform feed to the treatment system to promote sustainable microbiological growth, particularly the higher life forms.
- Identifies plugging of discharge orifices in the discharge system which lower system flow causing an accumulation causing the alarm to activate.
Sizing
Like the grease trap the surge tank must be sized based on the hydraulic flow of the facility, the characteristics of the peaks in the flow, and the proportion or the grey and blackwater flow. Collecting and reviewing this information is discussed in the section Gathering Background Data. Knowledge of the size and duration of the flow events will maximize the effectiveness of the surge tank. Once the maximum accumulating volume has been estimated (1,250 gallons in the previous table) the surge tank can be sized to handle at least that volume within the working zone. In this instance, sizing the surge tank based on Three (3) times the peak flow will not allow for sufficient capacity. Be aware that averages based on longer time frames (an average based on water meter readings once every month for example) may not point out the intensity of the flows, nor the total residual accumulating or being held for disposal.

There are three areas in the tank, the dead zone or volume required to keep the pump submerged, the working zone where volumes are held pending discharge, and the emergency storage where sewage is contained while pumping problems are corrected. The volumes are determined by the system designer.

The transition from the dead zone to the working zone is set by the on/off float, which activates the timer. The transition from the working zone to emergency storage is set by the 90% alarm float. Often a 50% alarm is installed and set at the one day's flow volume within the upper level of the working zone to provide water use information and warning of a potential problem. Emergency storage may also include flood space above the inlet to the surge tank. Increasing the size of the surge tank must be balanced with the increase in cost.

Configuration
Depending on the tank volume required and the local availability of tanks, it may be necessary to connect several tanks or cast a tank in place, to provide the desired capacity. When multiple tanks are installed to meet the needed surge volume, the tanks are placed on a common concrete slab and interconnected near the bottom to respond as a single tank. Interconnection at the top for common venting must be considered. This configuration is a cost effective method of handling the surge capacity of a larger system without going to a cast-in-place design.

The figures on the following pages show an individual surge tank and two interconnected surge tanks. Since the surge tanks can flood to the lid, the flood volume rates the tank’s capacity. Most NIBBLER® surge tanks have four floats. The top float activates the 90% alarm, which notifies the facility manager that the surge tank is nearly full. The next lower float activates the 50% alarm which notifies the facility manager that the surge tank is half full. The next float down activates the timer. The lowest float is the redundant off float, which ensures the pump is off during low water conditions.

Control Panel and Metering Devices
A submersible pump is used to transport liquid front the surge tank to the NIBBLER® unit. The pump is controlled through the control panel from signals sent by the floats in the surge tank. In the “auto mode,” the timer within the control panel regulates the pump. The cycle counters and hour meters within the control panel monitor system operation. The timer is calibrated based on actual pump discharge and set for equal doses every thirty minutes. The volume of wastewater processed by the Nibbler® for any period can be determined by multiplying the number of cycles in that period by the number of gallons per cycle or by multiplying the pump run time on the hour meter by the flow output of the pump for the period.
It is important that all electrical installations are performed by a qualified electrician. Also, the control box and blower should be installed in a separate building to protect them from the weather.

**Clarifier Tank**

**Function**
The final component in the NIBBLER® treatment process is called a clarifier. The clarifier allows suspended solids in the NIBBLER® effluent to settle, assists in killing off higher aerobic life—forms in the NIBBLER® unit effluent, and acts as a protection device in case of bulking from the NIBBLER® unit. Occasionally the sludge layer in the bottom of the Nibbler® unit will build up gases. As the gas bubbles release, a zone of poorly settled flocculated material is created, which may leave the tank. The clarifier settles this material to the bottom of the first compartment, protecting the downstream components.

**Sizing**
Clarifier tanks are generally sized at one day’s detention time as a general rule and never less than 1.0 days detention time. A larger size clarifier tank will not harm system performance.

**Configuration**
The clarifier configuration is much like a two-compartment septic tank installed backwards. The first compartment contains 1/3 of the total volume. Unlike a septic tank, the wall between the two compartments has a centrally located 12” x 24” opening at the bottom. This forces all flow to the bottom of the tank, where the oxygen level is lowest. This lower oxygen zone kills off the higher life-forms propagated in the NIBBLER® unit.
The clarifier must have a minimum operating depth of 48 inches. A 60” to 80” operating depth is recommended. The first compartment of the clarifier is equipped with a 1/3 hp sludge return pump that returns sludge back to the grease trap. This pump can be setup to run either manually or automatically (time controlled). Set automatically, the sludge return should not exceed 5% of the average daily flow, which must be figured into the daily system flow and the controls for the pump in the surge tank. Run manually, the sludge return pump should operate long enough to pump out the accumulated sludge in the first compartment.

The second compartment of the clarifier (with 2/3s of the tank volume) allows for final settling and is equipped with an effluent filter on the outlet baffle. Flow through this filter should be limited to 30 GPM or 3,000 GPD. Increasing the loading on the filter will reduce the effectiveness of the screen and increase the cost of system maintenance. The figure attached depicts a standard two-compartment clarifier.
Panels, Timers & Floats

Panels
The NIBBLER® system uses two panels to control flow. The main NIBBLER® panel controls the flow from the surge tank to the NIBBLER® unit by controlling the Duplex feed pumps. The sludge return panel controls the flow from the clarifier to the grease trap by controlling the sludge recirculation pump. The sludge return pump control panel is not mandatory.

NIBBLER® SBP Panel
This panel controls the flow from the surge tank to the rest of the system. Correct operation is critical. Flows previous to this point are variable, with highs and lows based on use. By controlling the on and off functions of the pump, units downstream from this point receive regular uniform doses. A specification sheet is provided at the end of the section. The panel can be located inside or outside, as the box meets NEMA 4X specifications. It is a gray box with a red or an amber light on the front, access is restricted by a lock. The horn function can be silenced through the red button. All further functions are accessed inside the panel. Some of the more pertinent panel features include:

- Duplex time controlled and intrinsically safe,
- The alarm system and the pump are separately fused so that tripping the pump circuit breaker does not activate the alarm system.
- The control switch for this panel has three settings, “Auto”, “Manual” and “Off”. The “Auto” mode is for normal system operation and controls the feed pump through the panel’s timers. In the “Manual” mode the power bypasses the floats and timers and powers the feed pump and the pump will continue to run when the liquid level drops below the “off” floats. The timers will continue to operate in the manual mode but will have no effect on the operation of the pump. The “off” mode shuts off power to the timer which when in “Auto” will stop the feed cycles until more sewage is generated at the site.
- This panel includes programmable Omron H Digital cyclic timer which control the doses to the NIBBLER® unit(s). Timer specifications and instructions are provided under “Component Spec. Sheets”. If your panel has a different timer see the manufacturer’s specification sheet for details regarding operation. The “off” time determines the number of doses per day (usually 48 for an “off” time of 29 minutes). The “on” time is determined by the flow capacity of the pump (in gallons per minute) divided into the gallons per dose (daily gallons divided by 48 doses).
- The elapsed time meter in the panel, measures the total accumulated time the pump has run in hours which must be converted to minutes. Multiplying the elapse time by the output of the pump in Gallons Per Minute (GPM), and dividing by the number of days since the last site visit will calculate the average daily flow through the system.
- There are two cycle counters. The “On” counter tracks the accumulated number of cycles the pump has run. Multiplying the cycle counts since the last site visit by the calculated Gallons Per Cycle (GPC) calculates the average daily flow (GPD) through the system. Compare it to the flow volume derived from the elapse time meter.

The “Off” counter keeps track of the number of times the “off” float activates, i.e. how many times the surge tank was empty since the last site visit.
**Floats**
Two models of floats are used in the NIBBLER® system. The control floats in the surge tank (on/off) are SJ Electro’s “Pumpmaster Plus with no mercury” pump switch. This float is “normally open” so as the float drops down the circuit is “opened” and the power to the pump is shut off. The alarms for the NIBBLER® system are controlled by a “normally open” SJ. Electro “sensor float” so as the liquid level in the tank rises, the float circuit closes and the alarm activates.

**Alarms**
The two alarm floats mounted in the surge tank are wired to the alarm panel. They report excessive accumulating volumes in the surge tank.

**Amber light — 50% Alarm**
This light activates when the surge tank is 50% full. This light is a warning that sewage is accumulating. If water use and activity is normal, this may indicate a pumping problem. Since the timer function only allows a fixed flow from the surge tank, flows in excess of that amount are held in the tank. Continued high flows will raise this level triggering the alarm. Reducing use should allow the system to catch up correcting the situation and deactivating the light.

**Red light — 90% Alarm**
Indicates the surge tank is 90% full. An audible alarm will sound when this light comes on. The audible alarm can be silenced by pressing the red light on the panel. Typically the tank is full due to problems with the pump operation. The owner should be instructed to contact the maintenance company immediately. Troubleshooting the problem is covered in later sections.

**Location**
There is at least one alarm light located with the horn on the control panel. If there are two lights, the second is the 50% light. This may be of limited value if the panel is not in a very visible location. In such instance, or where the treatment system is remote from the facility, a second set of alarm lights (with a horn) is mandatory. These lights can be located in the facility manager’s office or some other extremely visible location. The lights should be clearly labeled, and a silence button for the alarm included.
Designing a NIBBLER® System:

Putting it all together

Deciding to incorporate a NIBBLER® system in a design means: you have a good understanding of the anticipated waste strength and volume, have decided that a NIBBLER® system is necessary, and are aware of the basic components making up such a system. When it comes to the size and number of the various NIBBLER® components, much of the information has been presented. What remains is to decide on the system's configuration and location. A discussion of the components necessary after the NIBBLER® system is beyond the scope of this manual.

Tank Location

There are two schools of thought on the proximity of the system to the facility. If the first stage of the treatment process is placed as close as possible to the building, then treatment begins immediately and limits the amount of line maintenance. The other side finds that treatment in the line to the first component may be beneficial, particularly with hot wastes such as dishwasher discharges. The liquid cools off and is less likely to liquefy greases in the first treatment tank. Obviously this must be balanced against the potential for increased maintenance. Finally the close proximity may entail traffic-bearing tanks, risers, and lids all at an increased cost in materials and maintenance problems. Placing the tanks at a more remote location may mean extremely deep tanks. In such cases, it may be better to pump to the remote location by installing a surge tank with pump to feed the system, or placing the main surge tank at the lower

Tank Depth

While risers on tanks are necessary for maintenance, accessibility is a concern, particularly for depths greater than three feet. In deeper situations, it may be necessary to install a larger riser (in some instances even with a ladder). In a case like this, it may be wise to install a bottomless tank on the top of the lower tank for access. This may be a less expensive and more practical than large diameter riser. The accumulation of gases may be a concern requiring venting of the chamber.

Graywater and Blackwater Separation

Another major consideration is the viability of separating the plumbing. Separating blackwater and greywater may lower the installation price by reducing the size of the NIBBLER® components. The retained matter in the grease trap (tank) may be collected by a renderer. However if greywater is a small portion of the flow, then separation may not be advantageous. Further, the redundancy in separating flows may increase the cost due to essentially duplication in tanks.

Consider that the NIBBLER® system is a timed system. Flows previous to the surge tank are peak but beyond the surge tank are time or averaged. In a separated system, the blackwater may not be timed unless a surge tank is added after the septic tank. Without such additions, the commingled waste is no longer timed, and the advantage may be lost. Finally separation of wastes may create disposal problems. Most local treatment plants will accept pumped matter from a septic tank, but not from a grease trap. In that case, it can be advantageous to combine the waste, and have the accumulated matter removed by a pumper and disposed of in a conventional manner. The concept of separation of flows can extend to various sewage generation sources within the facility. Frequently, grocery stores may have several greywater discharge lines emanating from various waste sources such as the bakery, meat market, deli, pharmacy, and produce departments. Such segmentation increases the need for monitoring flexibility and proper configuration of tanks to allow the routing of a particular source to a specific treatment unit. When flows are segmented, pay
particular attention to which components will experience peak flows and which receive average flows. Consider where segmented flows can be recombined, to offer the most system flexibility. Blackwater will commonly receive treatment through a septic tank and then discharge to the common pump tank. A sideline with a valve, which allows diversion of the septic tank effluent to the NIBBLER® system enhances system flexibility.

**Design with Future Use in Mind**

Each component in the total system: treatment and disposal, segmented or combined, should be viewed with the type of flow and possibility for future expansion or growth in mind. Start with the estimate for sewage flow. If the estimated figure is accurate, how much volume is available for expansion? The food service establishment business can be volatile, though most seem to enjoy continued growth. Anticipating growth, what changes call be incorporated now to allow for future growth? What increases in flow or waste strength can be tolerated with minor additions to the system? When does continued growth translate into significant improvements in the sewage system? Can modifications be incorporated now, which will lessen the cost impact in the future? Consider increase not only in volume but waste strength. Often the tavern with food as a sideline becomes a tavern with a restaurant, a brewing house, or a restaurant with a cocktail lounge.

**Keep in Contact with Client**

The sections presented previously should lead you though the design development beginning with a logical estimate of waste flow and strength, and ending with a plan for the layout and sizing of the sewage treatment system. Along the way, your client must be involved in the need for the various components making up the system, understand the monitoring and maintenance requirements, and for the NIBBLER®, acknowledging the licensing nature of the system. The prospective owner needs to understand the advantage of a system that allows them to operate a business without the problems and concerns for the sewage system.
SECTION 2

NIBBLER® Design Checklist
For Commercial Applications

Minnesota
NIBBLER® Commercial Application Design Checklist

_For Minnesota_

1. Design Flows - Consult _Aqua Test for assistance_ in estimating flows
   - Average Daily Flows=___________ Gallons Per Day
     Peak Flows = ___________ Gallons Per Day
   - Greywater (kitchen waste) _______ %
     Average Daily Flows= _______ Gallons Per Day Greywater
     Peak Flow = ___________ Gallons Per Day Greywater
   - Blackwater (toilet waste) _______ %
     Average Daily Flows= _______ Gallons Per Day Blackwater
     Peak Flow = ___________ Gallons Per Day Blackwater

2. Septic Tank Sizing - Select larger of
   - Average Blackwater Flows___________(GPD) x 2 Days Retention Time
     = ___________ Gallons Septic Tank Capacity
   - Peak Blackwater Flows ______ GPD x 1.5 Days Retention Time
     = ___________ Gallons Septic Tank Capacity

3. Grease Trap Sizing - Select larger of
   - Average Greywater Flows_______ GPD x 2 Days Retention Time
     = ___________ Gallons Septic Tank Capacity
   - Peak Greywater Flows_______ GPD x 1.5 Days Retention Time
     = ___________ Gallons Septic Tank Capacity
   *Note Aqua Test does not recommend use of effluent filters in grease traps proceeding NIBBLER® systems.

5. Surge Tank Sizing - Select larger of
   - Average Flows __________ GPD x 2 Days Retention Time
     = ___________ Gallons Surge Tank Capacity
   - Peak Flows __________ GPD x 1.5 Days Retention Time
     = ___________ Gallons Surge Tank Capacity

6. NIBBLER® Sizing
   - Average Daily Flows________GPD x________ mg/L800₃ x 0.00000834
     constant conversion factor = ______________ Mass Load (lbs/day BOD₅)
   - Mass load ______ /0.81 lbs/day BOD₅/Pod = __________ NIBBLER® Pods
     Maximum hydraulic loading per pod:
     137.5 GPD/Pod if FOG>50 mg/L. or 200 (GPD/Pod if FOG <50 mg/L)
7. NIBBLER® Tank Sizing Criteria Pre-cast or Cast In Place Tanks

   Minimum liquid level 62”
   Minimum air space between liquid level and inside top of lid ~12”
   Note: 14” provides optimum spacing for ease of maintenance and access to NIBBLER® pod air manifolds
   Minimum width (inside tank) 56” to fit two pods wide
   Note: each NIBBLER® pod is 27” x 27” wide
   Maximum width (inside tank) = 140” to fit five pods wide
   Minimum length 56” to fit two pods deep
   Maximum length none

   Note: any exceptions to the above criteria must be reviewed and approved by AQUA TEST INC. before design acceptance.

8. Clarifier Two Compartment Tank Sizing

   Minimum tank size = 1 day average flow = ______________________ gallons
   Clarifier tank should have 1/3 capacity in the first compartment and 2/3 in the second compartment.
   Clarifier baffle wall should have a 12” x 24” opening at the baffle base separating the two compartments
   Minimum clarifier tank operating liquid depth is 48”

9. NIBBLER® Control Panel and 50%/90% Alarm Panel

   The NIBBLER® Control Panel is specified as duplex for Minnesota approvals, and will include:
   ◦ Timer set for 48 doses per day, dosing the Nibbler® tank every 30 minutes
   ◦ Hour meter
   ◦ Pump On Cycle Counter
   ◦ Pump Off Cycle Counter
   ◦ Audible & Visible High Water Alarm
   ◦ 50% Alarm
   ◦ Redundant Off
   ◦ The NIBBLER® Control panel will also include terminal connections for a 50% / 90% Alarm panel. AQUA TEST recommends that this alarm panel be located inside the nearest office to alert local site management to high water conditions.

   Note: To meet conditions of the AQUA TEST INC. NIBBLER® Performance Warranty, the Control Panel for all NIBBLER® Systems must be supplied by AQUA TEST INC.
10. Blower Specifications

Each NIBBLER® pod must be supplied with minimum continuous free airflow of 6.5 cubic feet per minute at the air discharge level 18” below the surface. To meet the terms of the AQUA TEST INC. NIBBLER® performance warranty, all blowers For NIBBLER® systems must he approved for use and supplied by AQUA TEST INC.

AQUA TEST INC. will specify the following GAST Regenair blower model numbers for NIBBLER® systems (blower specifications attached):

- 1 to 2 pods R1102 – 1/8 hp single phase
- 3 to 4 pods R2103 – 1/3 hp single phase
- 4 to 10 pods R4110-2 1 hp single phase

NOTE: All blower specifications are to be approved by Aqua Test.

11. NIBBLER® Feed Pump Specifications

NIBBLER® feed pumps must be capable of dosing NIBBLER® units 48 doses per day at a minimum 30 GPM for nozzle feed or 5 GPM for basin feed. Typically, a Zoeller N152 or equivalent centrifugal pump is adequate. Duplex pumps are recommended for dosing all NIBBLER® systems with flows exceeding 10,000 gallons per (lay.

12. NIBBLER® Feed System

- To equalize flow distribution to multiple NIBBLER® tanks a NIBBLER® feed basin is the preferred flow distribution method for dosing each tank containing NIBBLER® pods.
- An equal number of NIBBLER® pods should be located in each NIBBLER® tank.

13. NIBBLER® Air Manifold

To equalize airflow to each NIBBLER® pod, an air distribution manifold is required (design drawings - for several alternative manifold configurations are attached). Minimum air manifold diameter for alternative blower sizes is as follows:

- R1102 1/8 hp 1” if blower located within 20’
- R2103 1/3 hp 1” if blower located within 20’
- R4110-2 1 hp 3” if blower located within 20’

If the blower is located > 20’ from the air manifold, increase blower feed line and manifold diameter by 1”.

AQUA TEST INC. recommends that the blowers be located in a enclosed temperature compensated housing in cold climates.
14. NIBBLER® Air Vent Specifications

Each NIBBLER® tank must be vented to prevent back-pressure build-up. As a rule of thumb, the vent opening should be at least 25% larger than the air manifold in-feed pipe but no less than 4 inches.

15. NIBBLER® Tank Lids

AQUA TEST INC. supplies 3’ x 4’ x ¾” aluminum lids with gaskets to provide easy access to the NIBBLER® Pods for servicing. Access lids should be placed on the tank so that each air feed line can be easily reached for servicing by maintenance providers.

16. Clarifier Sludge Return Pump & Panel Specifications

The purpose of sludge return line is to reduce maintenance by returning accumulated sludge build-up back to the primary tanks (grease trap or septic tank) for further solids settling and treatment. The sludge return pump should have a designed manual on/off switch for the O&M provider to control. The clarifier sludge return pump should be the same specification as the NIBBLER® feed pump — providing a quick and easy replacement should the NIBBLER® feed ever fail.

The sludge return panel, if used, should include:
  • Timer set for 4 doses per day with a maximum 5% of average daily flow returned to the primary tanks
  • Visible and audible alarm

11. Clarifier Effluent Filter Specifications

  • An AQUA TEST INC. Effluent Filter must be specified for all NIBBLER® installations.
  • Each AQUA TEST INC. Effluent Filter is capable of handling flows up to 3000 gallons per day. Multiple Filters should be used for flows > 3,000 gallons per day.
  • 1” flex line with ball valve should be utilized to divert from the NIBBLER® air manifold to the AQUA TEST INC. Effluent Filter. Opening the ball valve will permit air injection and cleaning of filter without removing the filter.
SECTION 3

NIBBLER® Sizing Chart
**NIBBLER® Sizing Standards**

NIBBLER® units are sized to accommodate a maximum biological and hydraulic load, not to exceed 137.5 GPD or 0.81 pounds of BOD₅ per day, per pod when the Oil and Grease concentration is < 50 mg/L or 200 GPD when the Oil and Grease Concentration is < 50 mg/L. When used in residential application, hydraulic loading increases to 300 GPD or .81 pounds of BOD₅ per day per pod when the Oil and Grease concentration is < 30 mg/L.

**The Pounds of BOD₅ Per Day (PPD) equation is:**

\[ \text{GPD (gal/day)} \times \text{BOD}_5 \text{ (mg/L)} \times 0.00000834 = \text{PPD} \]

**Example:**

Facility sized for 1400 GPD with a maximum BOD₅ of 1000 mg/L.

\[ 1400 \text{ GPD} \times 1000 \text{ mg/L BOD}_5 \times 0.00000834 = 11.7 \text{ PPD} \]

**Example:**

To calculate the number of pods a system will require, divide the GPD by 137.5 and the PPD of BOD₅ by 0.71. The larger of the two numbers will be the minimum number of pods required for the system.

**Example:**

\[ 1400 \text{ GPD/137.5} = 10.2 \text{ pods and } 11.7 \text{ lbs. / 0.81 lb./pod} = 14.4 \text{ pods} \]

Therefore, this system would be sized to contain at least 16 pods. The actual number of pods a system will contain is influenced by the tanks locally available. For example, a 2000 gallon tank may hold eight pods. Therefore, this example system would incorporate a two tank, 16 pod unit.

The range of hydraulic flows and BOD₅ values is typically formulated for each system before the design proceeds. An example sizing chart is shown below.

**Example NIBBLER® Sizing Chart**

<table>
<thead>
<tr>
<th>% Treated</th>
<th>Flow (GPD)</th>
<th>BOD₅ (mg/L)</th>
<th>Total PPD</th>
<th># Pods</th>
<th>PPD/Pod</th>
</tr>
</thead>
<tbody>
<tr>
<td>157%</td>
<td>2200</td>
<td>709</td>
<td>12.96</td>
<td>16</td>
<td>0.81</td>
</tr>
<tr>
<td>100%</td>
<td>1400</td>
<td>1113</td>
<td>12.96</td>
<td>16</td>
<td>0.81</td>
</tr>
<tr>
<td>64%</td>
<td>900</td>
<td>1733</td>
<td>12.96</td>
<td>16</td>
<td>0.81</td>
</tr>
<tr>
<td>50%</td>
<td>700</td>
<td>2226</td>
<td>12.96</td>
<td>16</td>
<td>0.81</td>
</tr>
</tbody>
</table>

The 100% flow figure is the anticipated average daily flow rate to be treated by the NIBBLER® unit. This chart demonstrates some acceptable ranges of biological & hydraulic loading compatibility. The variations are shown only to demonstrate the relationship between PPD & GPD. If the GPD decreases, the system can tolerate a higher BOD₅ loading and if the GPD increases, the BOD₅ loading must be decreased.
SECTION 4

Designing the NIBBLER®
For Residential Applications
Design Overview

Either the NIBBLER® SBP or CBP may be used in residential applications however often is the case that the CBP’s cylindrical shape lends itself as the preferred model to be specified. The NIBBLER® CBP is a wastewater pretreatment system designed to reduce high strength wastewater to levels comparable to that of residential septic tank effluent. The NIBBLER® CBP does this through a patented process which injects air into the wastewater and creates a turbulent aerobic environment that supports a diverse microorganism population. This microbial population naturally biodegrades and digests the organic materials contained in wastewater. The NIBBLER® CBP POD boasts a cylinder shape for retrofitting into existing systems. This is feasible for use in small gravity flow systems; typical of high strength residential systems where the organic load will not exceed 2.5 pounds per day BOD5.

NIBBLER® CBP SIZING

With the NIBBLER® CBP product line for residential high strength waste treatment, there is a unique flow and a waste strength associated with each site which prohibits us from identifying a static flow rate for design purposes. For reference, the table below indicates various flows and waste strengths, while the ultimate organic load remains constant. The procedure for sizing would be to match the flow and waste strength at the site with the table below to specify the number of NIBBLER® CBP pods

<table>
<thead>
<tr>
<th>Organic Load per POD, #s per day BOD5</th>
<th>BOD5 Prior to Treatment</th>
<th>Corresponding Flow Rate GPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.81</td>
<td>277</td>
<td>350</td>
</tr>
<tr>
<td>0.81</td>
<td>324</td>
<td>300</td>
</tr>
<tr>
<td>0.81</td>
<td>388</td>
<td>250</td>
</tr>
<tr>
<td>0.81</td>
<td>486</td>
<td>200</td>
</tr>
<tr>
<td>0.81</td>
<td>647</td>
<td>150</td>
</tr>
</tbody>
</table>

TANK INSPECTION

Before ordering a NIBBLER® CBP it is very important that the existing tank be uncovered and the following measurements be taken. If this is a new installation, consider these factors for the tank to be used. This will minimize the time required to install the unit.

(1) Depth of cover over the tank __". This is from the top of the tank to the existing grade. To facilitate maintenance, the distance from the top of the NIBBLER® CBP unit to the top of the riser should not be more than 24”.

(2) Diameter of the access opening over the outlet of the tank where the NIBBLER® CBP is to be installed __". A minimum diameter of 22” will work, but the diameter should ideally be 24” to 28”. A 30” diameter riser and lid is recommended over the NIBBLER® CBP.

(3) Liquid depth from the invert of the outlet to the bottom of the tank __". This should be
approximately 48". The minimum allowable liquid depth is 38" for a two-compartment tank and 42" for a single compartment tank. The minimum unit height from the bottom of the legs to the top of the NIBBLER® CBP is 48".

(4) Collection of an effluent sample is recommended to determine the organic loading to the unit.

(5) Complete the enclosed residential evaluation checklist for proper sizing.

(6) Designate the daily flow as the model is factory shipped with the appropriate discharge spoons preinstalled.

**ELECTRICAL REQUIREMENTS**

<table>
<thead>
<tr>
<th>Blower</th>
<th>Horsepower</th>
<th>Motor Specs</th>
<th>Full Load Amps</th>
<th>Locked amps</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAST</td>
<td>1/8hp</td>
<td>115’208-230-60-1</td>
<td>2.0/1.1-1.0</td>
<td>8.5 @ 115V</td>
</tr>
<tr>
<td>Model R1102</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**BLOWER LOCATION**

- Must be protected from the environment in an enclosure with sufficient ventilation for continuous supply of fresh air.

- If mounted in a sealed structure, a 2” (minimum) air supply vent is required.
Some examples of blower locations include:

**Exterior Enclosures**

- Inside a bark filter chamber
- Inside an access riser with lid, that is properly vented
- Inside a plastic dog house

**Existing Structures**

- Inside a well-ventilated garage or in a shed. The blower makes some noise, so the unit may be insulated to provide a sound barrier if necessary. A factory muffler is available or 4’’ of fiberglass insulation located approximately 6’’ away from the blower will provide a good sound barrier. *Do not restrict airflow to the blower.*

**CAUTION:** *Locating the blower within a basement or other home living area is not recommended. Any potential risk of creating a furnace or other heating appliance airflow back draft should be avoided.*

**COLD WEATHER CONSIDERATIONS**

If the unit is installed in an extreme cold climate, the unit will perform better if the air is drawn from a source that is warm such as a crawl space, garage or burying the blower vault and insulating it.

**VENTILATION**

- **Bark Filter**
  To minimize any potential risk of odor, it is recommended that a NIBBLER® CBP be vented through a bark filter. Bark filters are typically one or two sections of gravel less chamber covered with 2’’ to 4’’ of coniferous bark. The NIBBLER® CBP unit vents into the chamber and the bark filters out potential odors.

When installing a natural bark filter, additional holes should be drilled on top of the chamber to maximize airflow and exposure to the bark. The holes should be at least 1’’ in diameter

- **Carbon Filter**
  If having a bark filter is not feasible, the NIBBLER® CBP could be vented through a carbon filter. The carbon filter is approximately 12’’ long and not more that 4’’ in diameter. It is plumbed to the NIBBLER® CBP riser using 2’’ PVC (minimum).

- **Building Vent**
  The NIBBLER® CBP may be vented through the existing building plumbing via the inlet plumbing. A visual observation of the property is necessary to ensure that trees do not create negative wind patterns that will create a down draft which would force the exhaust air back down to inhabited areas. One method of determining this is to smoke bomb the tank which will give you a visual smoke plume out the building vent stack to determine the flow pattern. This will also assist in determining whether or not the plumbing backpressure is slowing down.
RESIDENTIAL EVALUATION CHECKLIST

NAME ____________________________  DATE ____________________________
ADDRESS ____________________________  PHONE ____________________________
____________________________________  DESIGNER ____________________________
____________________________________  INSTALLER ____________________________

1. NO. OF PEOPLE LIVING IN HOUSE: __ADULTS: ___M ___F  ___CHILDREN / TEENS: ___M ___F

2. LAUNDRY HABITS: MAX. ___ LOADS/DAY  CONSECUTIVE LOADS: YES / NO  TOTAL ___ LOADS/WEEK

3. BRAND OF LAUNDRY DETERGENTS USED: ____________________________  POWDER / LIQUID

4. BLEACH USED: YES / NO  POWDER / LIQUID  USE: ___ CUPS/LOAD  ___ LOADS/WEEK

5. HOT OR COLD WATER USED: ____________________________

6. GARBAGE DISPOSAL: YES / NO  USE: ___ TIMES/DAY  ___ TIMES/WEEK

7. DISHWASHER: YES / NO  USE: ___ TIMES/DAY  ___ TIMES/WEEK

8. IS A WATER SOFTENER USED: YES / NO  SALINE CHLORINATION: YES / NO

9. IS A DRAIN CLEANER USED: YES / NO  TYPE: _____________  USE: _____________

10. NUMBER OF TOILET PAPER ROLLS USED PER WEEK: ____________________________

11. IS ANY RESIDENT USING A (LONG TERM) PRESCRIPTION DRUG OR ANTIBIOTICS: YES / NO

12. IS THIS THE FIRST HOME YOU HAVE LIVED IN THAT HAS A SEPTIC SYSTEM: YES / NO

13. HOW OLD IS SYSTEM: ___________ YEARS  DATE OF LAST PUMP OUT: ___________

14. HAS THE SYSTEM EVER BACKED UP: YES / NO  ____________________________

15. HAVE THE BAFFLES EVER BEEN PLUGGED: YES / NO  ____________________________

16. HAS THE SYSTEM EVER BEEN REPAIRED: YES / NO  ____________________________

17. HAS EFFLUENT EVER SURFACED: YES / NO  ____________________________

18. HAS THE ALARM EVER GONE OFF: YES / NO  ____________________________

19. SOIL TYPE - AT DRAINFIELD DEPTH OR LOWER: ____________________________

20. TYPE OF SYSTEM: Gravity / PD / Mound / Sand Filter  Other ____________________________

21. CONTROL SYSTEM: DEMAND / TIMED

AQUATEST INC
P.O. BOX 1116  BLACK DIAMOND, WA 98010
1.800.221.3159
WWW.AQUATESTINC.COM
22. DESIGN RATE FOR SYSTEM: __________ GPD
23. SEPTIC TANK SIZE: __________ GALLONS           PUMP TANK: __________ GALLONS
24. IS THE PUMP WORKING:                     YES / NO
25. SLUDGE LEVELS IN SEPTIC TANK:
  1ST COMP. ACCUM.: _____"          FLOATING MAT: _____"
  2ND COMP. ACCUM.: _____"          FLOATING MAT: _____"
26. SLUDGE LEVELS IN PUMP TANK:
  ACCUM.: _____"          FLOATING MAT: _____"
27. DURATION OF PUMP CYCLE: _______ MINUTES      PUMP DRAWDOWN: _____"

WATER USE:
ACTUAL WATER USE (GPD):          AVERAGE: __________                  HIGH: __________           LOW: __________
DATA FROM:                      CYCLE COUNTER
  _____ HOUR METER ON PUMP
  _____ WATER METER ON WATER
  OTHER

EFFLUENT SAMPLE:
COLLECTED FROM: ____________________________ DATE: ___________ TIME: ___________

LABORATORY RESULTS:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD&lt;sub&gt;5&lt;/sub&gt;</td>
<td>mg/L</td>
<td>________</td>
</tr>
<tr>
<td>TSS</td>
<td>mg/L</td>
<td>________</td>
</tr>
<tr>
<td>O&amp;G</td>
<td>mg/L</td>
<td>________</td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td>________</td>
</tr>
<tr>
<td>TEMP</td>
<td>°C</td>
<td>________</td>
</tr>
<tr>
<td>DO</td>
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<td>________</td>
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<tr>
<td>SS</td>
<td>mg/L</td>
<td>________</td>
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<tr>
<td>FC</td>
<td></td>
<td>________ MPN/100 mL</td>
</tr>
<tr>
<td>TKN</td>
<td>mg/L</td>
<td>________</td>
</tr>
<tr>
<td>NH-3</td>
<td>mg/L</td>
<td>________</td>
</tr>
<tr>
<td>NO&lt;sub&gt;2&lt;/sub&gt;</td>
<td>mg/L</td>
<td>________</td>
</tr>
<tr>
<td>NO&lt;sub&gt;3&lt;/sub&gt;</td>
<td>mg/L</td>
<td>________</td>
</tr>
</tbody>
</table>

DO ________ mg/L (of water supply - if a chemical analysis of the tap water has been performed, please provide test data)

MICROSCOPIC EXAMINATION: ____________________________

AQUA TEST INC
P.O. BOX 1116  BLACK DIAMOND, WA 98010
1.800.221.3159
WWW.AQUATESTINC.COM
SECTION 5

NIBBLER® Design Drawings
SYSTEM DESIGNED IN CONSIDERATION OF AVERAGE AND PEAK DAILY FLOW

SYSTEM DESIGNED FOR AVERAGE DAILY FLOW

INVERT OF SEPTIC TANK OUTLET IS 6" HIGHER THAN INVERT OF SURGE TANK INLET.

24" Ø RISER (TYP.)
FROM BUILDING

24" Ø RISER (TYP.)
FROM BUILDING

24" Ø RISER
30" Ø RISER

SURGE TANK

SEPTIC TANK

GAL.

GAL.

SURGE TANK VOLUME MAY BE COUNTED TO FLOOD VOLUME.

NIBBLER® SBP TANK

NIBBLER® SBP TANK LID
2" ABOVE FINISHED GRADE

BLOWER HOUSING

VENT STACK

SLUDGE RETURN TO SEPTIC TANK

30" Ø RISER (TYP.)

INVERT OF NIBBLER® SBP TANK OUTLET IS 6" HIGHER THAN INVERT OF CLARIFIER TANK INLET.

CLARIFIER TANK
SIZED AT AVERAGE DAILY FLOW
GAL.

ELEVATION

TANKS SHOWN INLINE FOR ELEVATION CLARITY - SEE PLAN VIEW FOR FLOW AND TANK ARRANGEMENT

NOTE:
ALL NIBBLER® SBP COMPONENTS SHALL BE OBTAINED AS A PACKAGE FROM AquaTest Inc. 1-800-221-3159

The NIBBLER® SBP
MANUFACTURED BY AQUA TEST INC. ONLY

AQUA TEST INTEGRATED
1-800-221-3159

DESIGNER:
PROJECT:
ADDRESS:

TITLE: OVERALL PLAN & PROFILE
NO SCALE DATE: NOV. 2008 SHEET: 1 OF 1

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Nothing is to be scaled, cast or manufactured from this set of drawings until you are authorized to proceed in writing with a document listing the identified shop drawings to be used.
GENERAL NOTES FOR NIBBLER® SBP WASTEWATER TREATMENT SYSTEM

GENERAL PROJECT NOTES
1. ALL CONSTRUCTION TO MEET COUNTY HEALTH DEPARTMENT REGULATIONS.
2. TANK BEDDING SHALL BE PEA GRAVEL.
3. SITE PLAN AND SURVEY ARE FOR THE ONSITE SEWAGE SYSTEM INSTALLATION ONLY. NOTHING SHALL BE SCALED OR INSTALLED OTHER THAN THE ONSITE SEWAGE SYSTEM FROM THESE DRAWINGS.
4. DO NOT DRIVE, PAVE OVER, EXCAVATE, CONSTRUCT UTILITIES, OR REMOVE SOILS IN PRIMARY OR RESERVE DRAINFIELD AREAS.
5. FOLLOW MANUFACTURER'S RECOMMENDATIONS FOR PLACEMENT AND TESTING OF TANKS AND ASSOCIATED EQUIPMENT.
6. PRIOR TO SYSTEM INSTALLATION, THE PARTY OR PARTIES RESPONSIBLE FOR FUTURE MAINTENANCE AND OPERATION OF THE WASTEWATER SYSTEM SHALL BE SPECIFIED IN WRITING BY CONTRACTUAL DOCUMENTATION.
7. PRIOR TO SYSTEM INSTALLATION, THE SYSTEM DESIGNER, SYSTEM INSTALLER, AND PROJECT CONTRACTOR SHALL HOLD A PRE-CONSTRUCTION CONFERENCE.
8. EXCEPT WHERE NOTED, TIMER "ON" SETTINGS WILL BE DETERMINED IN THE FIELD AFTER INSTALLATION AND CALIBRATION OF EQUIPMENT.
9. ALL NIBBLER® EQUIPMENT SHALL BE PURCHASED AS A PACKAGE FROM AQUATEST-NO EQUIVALENT
10. TO MEET CONDITIONS OF THE AQUA TEST INC. NIBBLER® PERFORMANCE WARRANTY, THE FOLLOWING CONDITIONS MUST BE MET: 
   1. THE NIBBLER® CONTROL PANEL MUST BE SUPPLIED BY AQUA TEST INC.
   2. OTHERWISE AGREED IN WRITING.
   3. THE BLOWER FOR THE NIBBLER® SYSTEM MUST BE APPROVED AND SUPPLIED BY AQUA TEST INC.
   4. ALL PENETRATIONS THROUGH THE RISER SHALL BE GROMMETED TO PRESERVE THE WATER TIGHT INTEGRITY.
   5. ALL CROSS OVER BAFFLES ON SEPTIC TANKS AND GREASE TRAPS WILL HAVE 8" RISER TO GRADE WITH SLIP CAP FOR ACCESS.
11. DESIGN FLOWS ARE AS SHOWN IN 'BASIS OF DESIGN' 
   1. THE NIBBLER® SYSTEM IS DESIGNED TO TREAT COMINGLED BLACKWATER & GREYWATER.

NOTE:
ALL NIBBLER® SBP COMPONENTS SHALL BE OBTAINED AS A PACKAGE FROM AQUATEST INC. 1-800-221-3159

System Specifications
1. NIBBLER® SBP SYSTEM: SEE ALSO NIBBLER® SBP SPECIFICATION AND NOTES SUPPLIED BY AQUATEST 1-800-221-3159.
2. BASIS OF DESIGN: _______ GPD AVERAGE FLOW _______ BOD 5 mg/L.
3. TRANSPORT LINE FROM SATELLITE PUMP TANK TO SURGE TANK 2" SCH 40.
4. SLUDGE RETURN LINE FROM CLARIFIER TO GREASE TRAP 2" SCH 40.
5. ALL GRAVITY COLLECTION LINES BETWEEN TANKS MIN. 4" SEWER PIPE.
6. FEED LINES TO NIBBLER® SBP SPLITTER BASIN 2" SCH 40.
7. SEPTIC TANKS: TWO COMPARTMENT ___________________ (BLACK WATER TANKS)
8. GREASE TRAP: TWO COMPARTMENT ___________________ (GRAY WATER TANK)
9. SURGE TANKS SINGLE COMPARTMENT ___________________ TANK
10. ALL SEPTIC TANKS AND GREASE TRAPS HAVE CONTINUOUS ULTRA RIB RISERS TO GRADE.
11. ALL RISERS TO GRADE WILL HAVE ORENCO FIBERGLASS LOCKING LIDS, NO EQUIVALENT.
12. SCREWS THROUGH RISER LIDS WILL BE STAINLESS STEEL ALLEN HEAD SELF TAPPING.
13. DESIGN FLOWS ARE AS SHOWN IN 'BASIS OF DESIGN' 
   1. THE NIBBLER® SYSTEM IS DESIGNED TO TREAT COMINGLED BLACKWATER & GREYWATER.

21. DOSE & TIMER SETTINGS: FIELD DETERMINE "ON" TIMER SETTING BASED ON ACTUAL PUMP RATE. NIBBLER® SBP DOSE PUMP-SET FOR _______ DOSES OF _______ GALLONS EACH PER DAY. PUMP "ON" TIME SET IN FIELD.
TWO SURGE TANKS
MODIFIED TO ACCOMMODATE MINNESOTA NON MERCURY FLOAT REGULATION
WITH DUPLEX INTRINSICALLY SAFE CONTROL PANEL
AquaTest SURGE COMPONENTS 1-800-222-3159

NOTE:
ALL NIBBLER® SBP COMPONENTS SHALL BE OBTAINED AS A PACKAGE FROM AquaTest Inc. 1-800-222-3159

TANK AND PUMP SYSTEM NOTES:
1. SELECTING AND CHOOSING THE TANKS SHALL BE DONE IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS.
2. POWER TO ALARMS MUST BE PROVIDED BY A DEDICATED ALARM ONLY CIRCUIT.
3. THE REMOTE NIBBLER® ALARM MUST BE LOCATED IN THE BUILDING.
4. INSTALLER SHALL TEST PUMPING SYSTEM PRIOR TO CALLING DESIGNER FOR AS-BUILT INSPECTION.
5. PRIOR TO TESTING ALL NECESSARY POWER, WATER, HEAT TO PERFORM ALL TESTING.
6. DISCONNECT AND PRESSURE TESTING OF SYSTEM COMPONENTS.
7. ALL PUMP DISCHARGE LINE ARMS TO WASTE UNIONS AND BRASS CHECK VALVES.
8. ALL PUMPS ARE TO BE INSTALLED IN SUCH A FASHION THAT THEY MAY BE EASILY REMOVED BY STANDING DIRECTLY OVER THE RISER.

AquaTest SUPPLIED SURGE COMPONENTS

<table>
<thead>
<tr>
<th>GRAY</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>1</td>
<td>PUMP BASKET</td>
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<tr>
<td>2</td>
<td>INLET VALVE</td>
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<td>3</td>
<td>BRASS CHECK VALVE</td>
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<td>4</td>
<td>PVC ADAPTOR</td>
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<tr>
<td>5</td>
<td>T-FITTING</td>
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<tr>
<td>6</td>
<td>FLOAT TUBE WITH WATERTIGHT SEAL</td>
</tr>
<tr>
<td>7</td>
<td>INLET VALVES</td>
</tr>
<tr>
<td>8</td>
<td>SQUARE PIPE Fittings</td>
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</table>

CUSTOM INTEGRATED CONTROL PANEL USES DUPLEX INTRINSICALLY SAFE CONTROL PANEL

SWITCH PLACED HERE

PUMP BASKET

WASTEWATER TANK NOTES:
1. FOLLOW MANUFACTURERS RECOMMENDATIONS FOR PLACEMENT AND TESTING OF TANKS.
2. WHERE ADEQUATE COMPATIBILITY OF BIMETAL CANNOT BE ACHIEVED BY STANDARD METHODS THE USE OF PIA VALVES FOR MERCURY IS REQUIRED.
3. TANKS SHALL BE RATED IN POF OF COMPACTED PIA GRANUL.
4. INSTALLER SHALL TEST TANK TO ENSURE IT IS WATER TIGHT AFTER INSTALLATION AND PRIOR TO APPROVAL OF THE SYSTEM FOR USE. TANK SHALL BE TESTED BY FILLING WITH WATER TO THE BOTTOM OF THE TANK AND ALLOWING IT TO SIT FOR 24 HOURS THEN REFLUSHING THE TANK, ALLOWING IT TO SIT FOR AN ADDITIONAL 48 HOURS AND CHECKING LEAKS TO VERIFY IT HAS NOT LEAKED.
5. ANY TANK NOT TO HAVE MORE THAN 3 FEET OF COVER OVER THE LID.
6. TANKS SHALL BE CLEARLY MARKED WITH ENGAGING AND REFLECTIVE MATERIALS.
7. ALL PUMP DISCHARGE LINE ARMS TO WASTE UNIONS AND BRASS CHECK VALVES.
8. ALL UNDIS/her PIPES AND OUTLET PIPES SHALL BE CAST IN PLACE AND PUMP BASKET IS REQUIRED.
9. ALL DISCHARGE PIPES AND OUTLET PIPES SHALL BE CONNECTED TO THE TANK.
10. TANK MUST BE LOCATED OUTSIDE OF THE BUILDING.

SINGLE COMPARTMENT CONCRETE TANKS
SHOWN WITH 6" PVC PIPE CONNECTIONS WHEN USED AS SURGE TANKS

Nothing is to be scaled, cast or manufactured from this set of drawings until you are authorized to proceed in writing with a document listing the identified shop drawings to be used.
SINGLE SURGE TANK
MODIFIED TO ACCOMMODATE MINNESOTA NON MERCURY FLOAT REGULATION
WITH A DUPLEX INTRINSICALLY SAFE CONTROL PANEL
AquaTest SURGE COMPONENTS 1-800-221-3159

NOTE:
ALL NIBBLER® SBP COMPONENTS SHALL BE OBTAINED AS A PACKAGE FROM AquaTest Inc. 1-800-221-3159

AquaTest SUPPLIED SURGE COMPONENTS

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<td>PUMP BASIN</td>
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<tr>
<td>2</td>
<td>CT DRAIN PUMP</td>
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<tr>
<td>1</td>
<td>2&quot; GROMMET</td>
</tr>
<tr>
<td>1</td>
<td>3&quot; DRAIN</td>
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<tr>
<td>1</td>
<td>FLOAT TREE WITH SUPER SINGLE 2 SENSOR FLOATS AND 3 FLOAT CLIPS - NO MERCURY</td>
</tr>
<tr>
<td>1</td>
<td>FLOAT TREE WITH DISCHARGE PIPE ADAPTOR</td>
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<tr>
<td>1</td>
<td>SAFETY ASSIST CONTROL PANEL</td>
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<tr>
<td>1</td>
<td>SAFETY ALARM PANEL</td>
</tr>
<tr>
<td>1</td>
<td>2&quot; GROMMET</td>
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TANK AND PUMP SYSTEM NOTES
1. BEDDING AND BACKFILLING OF TANKS SHALL BE DONE IN ACCORDANCE WITH MANUFACTURERS REQUIREMENTS.
2. POWER TO ALARMS MUST BE PROVIDED BY A DEDICATED ALARM ONLY CIRCUIT.
3. THE REMOTE NIBBLER® ALARM MUST BE LOCATED IN THE BUILDING.
4. INSTALLER SHALL TEST PUMPING SYSTEM PRIOR TO CALLING DESIGNER FOR AS-BUILT INSPECTION. INSTALLER TO PROVIDE ALL MATERIALS NECESSARY (POWER, WATER HOSE) TO PERFORM ALL CALIBRATION AND PRESSURE TESTING OF SYSTEM COMPONENTS.
5. ALL PUMP DISCHARGE LINES ARE TO HAVE UNIONS AND BRASS CHECK VALVES.
6. ALL PUMPS ARE TO BE INSTALLED IN SUCH A FASHION THAT THEY MAY BE EASILY REMOVED BY STANDING DIRECTLY OVER THE RISER.

WASTEWATER TANK NOTES:
1. FOLLOW MANUFACTURERS RECOMMENDATIONS FOR PLACEMENT AND TESTING OF TANK.
2. WHERE ADEQUATE COMPACTION OF BACKFILL CANNOT BE ACHIEVED BY STANDARD METHODS THE USE OF PEA GRAVEL FOR BACKFILL IS REQUIRED.
3. TANKS SHALL BE BEDDED IN 8" OF COMPACTED PEA GRAVEL.
4. INSTALLER SHALL TEST TANK TO ENSURE IT IS WATER TIGHT AFTER INSTALLATION AND PRIOR TO APPROVAL OF THE SYSTEM FOR USE. TANK SHALL BE TESTED BY FILLING WITH WATER TO THE BOTTOM OF THE PIPE INVERT AND ALLOWING IT TO SIT FOR 24 HOURS THEN REFILLING THE TANK, ALLOWING IT TO SIT FOR AN ADDITIONAL 24 HOURS AND RECHECKING LIQUID LEVEL TO VERIFY IT HAVE NOT DROPPED.
5. TANK SHALL NOT HAVE MORE THAN 3 FEET OF COVER OVER THE LID.
6. TANK SHALL HAVE THE ACCESS MANHOLES EQUIPPED WITH RISERS AND LOCKING LIDS AT FINISHED GRADE. ALL RISER LID BOLTS WILL BE STAINLESS STEEL ALLEN SOCKET.
7. RISERS SHALL BE CAST INTO TANK LID FOR WATER TIGHTNESS. FURTHERMORE INLET AND OUTLET PIPE STUBS SHALL BE CAST INTO TANK WITH SAND COLLARS, CAST IN BOOTS OR OTHER LOCALLY APPROVED METHOD.
8. ALL UNUSED PORTS AND/OR LIDS, AND THE INLET AND OUTLET PIPES SHALL BE GROUT-SEATED INTO TANK FOR WATER TIGHTNESS.
9. I.E. SURGE TANK INLET 6" LOWER THAN I.E. OUTLET OF PREVIOUS TANKS.
10. NIBBLER® CONTROL PANEL AND 50%-90% ALARM PANEL
    - A DUPLEX CONTROL PANEL IS SPECIFIED
    - THIS PANEL SHALL BE INTRINSICALLY SAFE
    - THE ALARM PANEL SHALL BE LOCATED INSIDE THE BUILDING
    - FLOATS ARE NON MERCURY
11. NIBBLER® FEED EQUIPMENT
    - FEED PUMPS SHALL BE ZOELLER B/N152 OR EQUIVALENT CENTRIFUGAL PUMPS.
    - FEED PUMPS MUST BE CONNECTED TO PUMP BASINS PROVIDED BY AQUA TEST

Nothing is to be scaled, cast or manufactured from this set of drawings until you are authorized to proceed in writing with a document listing the identified shop drawings to be used.

The NIBBLER® SBP
MANUFACTURED BY AQUA TEST INC. ONLY

AQUA TEST INCORPORATED 1-800-221-3159

DESIGNER:

PROJECT:

ADDRESS:

TITLE: SINGLE SURGE TANK
SHEET
NO SCALE: DATE: DEC. 2009 1 OF 1
FLOW AND TAKE MANAGEMENT

SINGLE FLOW MANAGEMENT CONNECTION (B.gif)

Four Super Tanks

Modified to accommodate Minnesota non-mooring float regulation

With duplex intrinsically safe control panel
SPLITTER BASE FOR 1 NIBBLER TANK

SPLITTER BASE FOR 2 NIBBLER TANKS

SPLITTER BASE FOR 3 NIBBLER TANKS

SPLITTER BASE FOR 4 NIBBLER TANKS

SPLITTER BASE FOR 5 NIBBLER TANKS

SPLITTER BASE FOR 6 NIBBLER TANKS

TOP - 24" RISER LID

24" RISER

BASE - 24" RISER LID

IN

OUT

IN

OUT

IN

OUT

IN

OUT

IN

OUT

IN

OUT

2" PVC TEE

2" PVC TEE

2" PVC COUPLING (TYP.)

2" PVC NIPPLE (TYP.)

2" PVC COUPLING (TYP.)

(SEE DETAIL FOR NUMBER OF TANKS)

TYPICAL RISER AND LIDS FOR
OFF CENTER FEED SPLITTER BASINS

NTH
AIR FLOW TO AND VENTING FROM FOUR NIBBLER® SBP TANKS & CLARIFIER TANK

AquaTest NIBBLER® SBP COMPONENTS 1-800-221-3159

NOTE:
ALL NIBBLER® SBP COMPONENTS SHALL BE OBTAINED AS A PACKAGE FROM AquaTest Inc. 1-800-221-3159

1. ADDITIONAL TANK NOTES:
- TOP OF NIBBLER® TANK SHALL BE 2" ABOVE FINAL GRADE IN TANK AREA.
- NIBBLER® TANK TOP MUST ACCOMMODATE NIBBLER® LESS THAN 2".
- NIBBLER® TANK LESS ARE CONSTRUCTED OF ALUMINUM AND SUPPLIED BY AQUA TEST INC. AND MEASURING 32X 12X 12" WITH GASKETS SHALL BE INSTALLED TO THE FACT THAT EACH AIR FEED LINE CAN BE EASILY REACHED FOR SERVICING BY MAINTENANCE PROVIDERS.
- NIBBLER® TANK TOP IS TO BE AT LEAST 2" ABOVE FINAL GRADE

2. REGENERATIVE BLOWERS:
- SINGLE STAGE GAST REGENERATOR BLOWERS ARE SPECIFIED. FOUR R4110 OR TWO R5125A-2.
- THE AIR DISTRIBUTION MANIFOLD LINE SIZE NO XL 40 PIPE WITH A MANDREL DIAMETER IS TO BE GREATER THAN 2".
- NIBBLER® TANK MUST BE VENTED. THE VENT OPENING SHOULD BE AT LEAST 25% LARGER THAN THE AIR MANIFOLD PIPE SIZE BUT NO LESS THAN 4 INCHES.
- VENT PIPING MUST EXTEND A MINIMUM OF 15 FT ABOVE THE TANK OR TO TOP OF BUILDING WHICH EVER IS HIGHER.

AquaTest SUPPLIED AIR / VENTING COMPONENTS

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<tr>
<td>4</td>
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<tr>
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<td>BLOWER HOUSING</td>
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<tr>
<td>4</td>
<td>BLOWER INLET SCREEN ASSEMBLY</td>
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<tr>
<td>2</td>
<td>ALUMINUM ACCESS COVER WITH HANDLES</td>
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<td>GASKET FOR ALUMINUM ACCESS COVER</td>
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<tr>
<td>1</td>
<td>4&quot; PSM OUTLET VALVE</td>
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<td>NIBBLER® SBP</td>
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<td>8</td>
<td>B PORT AIR MANIFOLD ASSEMBLY</td>
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<tr>
<td>36</td>
<td>1&quot; PVC UNION</td>
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<td>3</td>
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<tr>
<td>3</td>
<td>1&quot; PVC REDUCER BUSHING</td>
</tr>
<tr>
<td>2</td>
<td>1&quot; PVC REDUCER BUSHING</td>
</tr>
<tr>
<td>2</td>
<td>1&quot; PVC COUPLING</td>
</tr>
<tr>
<td>2</td>
<td>1&quot; PVC 45° ELBOW</td>
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<tr>
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<td>1&quot; PVC COUPLING</td>
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<td>3</td>
<td>1&quot; PVC FLEX LINE</td>
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<td>8</td>
<td>PSM CAP</td>
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<td>PSM WYE</td>
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<td>1&quot; PVC 45° ELBOW</td>
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<td>64</td>
<td>1&quot; PVC PIPE Nipple, 2&quot; Long</td>
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<td>NIBBLER® NIPPLE FOR FOUR TANKS</td>
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<tr>
<td>6</td>
<td>3&quot; PVC BALL VALVE, OPTIONAL</td>
</tr>
<tr>
<td>6</td>
<td>VALVE BOX FOR 3&quot; PVC BALL VALVE, OPTIONAL</td>
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</tbody>
</table>

DESIGNER: AQUA TEST INCORPORATED 1-800-221-3159
PROJECT: ADDRESS:

TITLE: AIR FLOW TO VENT STACK SHEET
NO SCALE DATE: NOV. 2008 1 OF 1

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2-CBP
AquaTest NIBBLER® CBP COMPONENTS 1-800-221-3159

NOTE:
ALL NIBBLER® CBP COMPONENTS SHALL BE OBTAINED AS A PACKAGE FROM AquaTest Inc. 1-800-221-3159

The NIBBLER® CBP
MANUFACTURED BY AQUA TEST INC. ONLY

AIR MANIFOLD
AIR MANIFOLD VALVE BOX

BLOWER HOUSING
FLOW

FLOW

TWO NIBBLER® CBP CYLINDER PODS (MEDIA SPHERES NOT SHOWN FOR CLARITY)

PLN VIEW
NTS

BLOWER HOUSING
AIR MANIFOLD VALVE BOX

FLOW

POLYLOCK FILTER

TWO NIBBLER® CBP CYLINDER PODS (MEDIA SPHERES NOT SHOWN FOR CLARITY)

ELEVATION
NTS

AIR MANIFOLD VALVE BOX DETAIL

1" PVC UNION
1" PVC UNION (TYP.)
1" PVC PIPE NIPPLE (TYP.)
1" PVC BALL VALVE (TYP.)

AIR FROM BLOWER

AQUTEST NIBBLER® CBP COMPONENTS

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<tr>
<td>2</td>
<td>SET NIBBLER® CBP LEGS</td>
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<td>NIBBLER® CBP STABILIZER</td>
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<td>CBP PORT MANIFOLD - 4 PORTS</td>
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<tr>
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<tr>
<td>30 FT.</td>
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<td>BLOWING BLOWER R1110</td>
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<td>BLOWER HOUSING</td>
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<td>1</td>
<td>BLOWER FILTER SCREEN ASSEMBLY</td>
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<td>1&quot; MALE ADAPTOR</td>
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<td>4</td>
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<td>MANIFOLD VALVE BOX</td>
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SECTION 6

NIBBLER®
Blower Specifications
Blower System Design Tips

In order to utilize your regenerative blower most efficiently, proper system design is essential. The most important thing to recognize is that by utilizing large diameter plumbing, friction losses in plumbing can be greatly reduced. Here are some guidelines to use when setting up your blower system:

1. The plumbing should at least be the same size as the blower port or ideally one size larger (example - blower has ports that are 1-1/2’ NPT, plumbing should be 2’ NPT). The plumbing should remain this size until it has reached the location of the work area.

2. Plumbing for Separate Drive Blowers operating above 3500 RPM should be at least one pipe size larger than the blower ports.

3. Elbows create additional friction which causes pressure loss and back pressure. Plumbing at least one pipe size larger than the blower pipe ports minimizes the friction loss they create.

4. The pressure/vacuum relief valve should be installed in a “T” which is at least one pipe size larger than that of the exhaust of the blower. To properly protect a large horsepower blower, set the relief value to limit the blowers duty to 5 in. H₂O below its continuous duty rating.

5. Operating the blowers at high altitude decreases their maximum pressure or vacuum duty rating. If this is a consideration, review the information on Fan Laws in the Application Engineering section of this catalog.

6. The exhaust air temperature of the blowers increases with increasing duty. At duties over 70 in. H₂O it is too hot for most plastic pipe. Metal pipe must be considered. To prevent danger of burns, access to these pipes should be limited, guarded or marked "Danger Hot."

Performance Data

The performance data shown in this catalog was determined under the following conditions:

- Line voltage @ 60 Hz. 230V or 460V for three-phase units. 115V or 230V for single-phase units.
- Line voltage @ 50Hz. 220V for three-phase or single-phase units.
- Units in a temperature stable condition.
- Delivery measurements made with output port throttled.
- Suction measurements made with input port throttled.
- Test Conditions: Inlet air density at 0.075 lbs. per cu.ft. [20°C (68°F), 29.92 in. Hg (14.7 PSIA)].
- Normal performance variations on the resistance curve within ±10% of supplied data can be expected.

Pictorial and dimensional data is subject to change without notice.

The information presented in this catalog is based on technical data and test results of nominal units. It is believed to be accurate and is offered as an aid in the selection of Gast products. It is the user’s responsibility to determine suitability of the product for intended use and the user assumes all risk and liability whatsoever in connection therewith.

Gast can also provide CE compliant blowers with BSP threads, as well as customized blowers for specific applications. Consult a Gast Representative/Distributor for more information.

Environmental and application conditions may affect advertised life.

Warning:

Models Without Explosion-Proof Motors Should Not Pump Combustible Gases or Be Used In Combustible Ambients
# Performance Table

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<tr>
<th>MODEL/ SERIES</th>
<th>POWER RATING @ 60 Hz hp</th>
<th>FREE AIR FLOW cfm 50 Hz 60 Hz m³/h 50 Hz 60 Hz</th>
<th>MAXIMUM PRESSURE 50 Hz 60 Hz mbar H₂O 50 Hz 60 Hz mbar</th>
<th>MAXIMUM VACUUM 50 Hz 60 Hz mbar H₂O 50 Hz 60 Hz mbar</th>
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<td>R3*</td>
<td>1/6</td>
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<td>43-44             52-53</td>
<td>73-75             88-90</td>
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<td>0.75</td>
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<td>1.1</td>
<td>110               127</td>
<td>187               216</td>
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<td>1.86</td>
<td>133               160</td>
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<tr>
<td>R6*</td>
<td>3/7</td>
<td>1.86-5</td>
<td>180               207</td>
<td>306               375</td>
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<td>R6P*</td>
<td>3 1/2-5</td>
<td>2,6-3</td>
<td>225-265           290</td>
<td>416               493</td>
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<td>R6PP*</td>
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<td>225-265           290</td>
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<td>7.46</td>
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<td>595               714</td>
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<td>688               795</td>
<td>1132              1351</td>
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<td>11.3</td>
<td>585               680</td>
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<td>22.4</td>
<td>1140              1330</td>
<td>1837              2294</td>
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<td>R4H*</td>
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<td>4.5</td>
<td>107               128</td>
<td>182               217</td>
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<td>R6PS*</td>
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<td>8.2</td>
<td>230               280</td>
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<td>180               215</td>
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<td>R9355N-50</td>
<td>6</td>
<td>4.5</td>
<td>232               280</td>
<td>394               476</td>
</tr>
<tr>
<td>R7100R-50</td>
<td>10</td>
<td>7.5</td>
<td>350               425</td>
<td>595               722</td>
</tr>
</tbody>
</table>

*Models equipped with UL and CSA certified motors. (except R1102K (12v DC))

Separate Drive Models

| SDR4         | 4                       | 3.0                                      | 147               | 250                           | 110               | 110                         | 274               | 90                            | 224                          |
| SDR5         | 10                      | 7.5                                      | 240               | 408                           | 152               | 152                         | 379               | 120                           | 299                          |
| SDR6         | 15                      | 11.2                                     | 300               | 510                           | 155               | 155                         | 386               | 135                           | 336                          |

5
Performance Curves - Low Range for Pressure/Vacuum
Motor mounted series R1, R2, R3, R4, R4P, R5
Performance at 60 Hz

Gast advertises blower performance in Free Air Flow, or air subjected to only atmospheric pressure. (See above curves)
Some blower manufacturers advertise vacuum performance in CFM Inlet Air - measurement of the suction of air at a specific temperature at the inlet port and a specific discharge pressure at the exhaust port, which can be perceived as enhanced performance over Free Air Flow rated blowers. Therefore, we are also providing the following vacuum performance for Gast blowers in CFM Inlet Air for comparison to other blower manufacturer’s advertising.
**R4 Series**

**Models R4110-2, R4310A-2, R4310B-1**

**Max. Pressure** - 52"H₂O (60 Hz), 38"H₂O (50 Hz)
**Max. Vacuum** - 48"H₂O (60 Hz), 35"H₂O (50 Hz)
**Max. Air Flow** - 92 CFM (60 Hz), 75 CFM (50 Hz)

**Product Features**
- Rugged construction, low maintenance
- Oilless operation
- UL and CSA approved TEFC motors with permanently sealed ball bearings
- Automatic restart thermal protection on single phase motors
- Aluminum blower housing, impeller and cover
- Can be operated with no air flow through unit
- Can be mounted in any plane
- Inlet and outlet have internal muffling

**Recommended Accessories**
- Pressure gauge AJ496
- Inlet filter AJ126D (pressure)
- Vacuum gauge AJ497
- Inline filter AJ151D (vacuum)
- Muffler AJ121D
- Relief valve AG258
- Liquid separator RMS160 (vacuum)
- Foam replacement kit K902

---

**Product Dimensions (in. mm)**
### Product Specifications

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>R4110-2</th>
<th>R4310A-2</th>
<th>R4310B-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Enclosure</td>
<td>TEFC</td>
<td>TEFC</td>
<td>TEFC</td>
</tr>
<tr>
<td>HP/kW</td>
<td>60 Hz</td>
<td>1.0/0.75</td>
<td>1.0/0.75</td>
</tr>
<tr>
<td></td>
<td>50 Hz</td>
<td>6.0/0.45</td>
<td>-</td>
</tr>
<tr>
<td>Voltage</td>
<td>60 Hz</td>
<td>115/208-230-1</td>
<td>208-230/460-3</td>
</tr>
<tr>
<td></td>
<td>50 Hz</td>
<td>110/220-240-1</td>
<td>190-220/380-415-3</td>
</tr>
<tr>
<td>Amps</td>
<td>60 Hz</td>
<td>9.8/5.2-4.9</td>
<td>3.4-3.2/1.6</td>
</tr>
<tr>
<td></td>
<td>50 Hz</td>
<td>9.0/4.5-5.7</td>
<td>2.6-3.3/1.3-1.4</td>
</tr>
<tr>
<td>Starting Amps</td>
<td>60 Hz</td>
<td>31.2 @ 230V</td>
<td>26.5 @ 230V</td>
</tr>
<tr>
<td></td>
<td>50 Hz</td>
<td>34 @ 220V</td>
<td>28.4 @ 220V</td>
</tr>
<tr>
<td>Insulation Class</td>
<td>B</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>Recommended NEMA Starter Size</td>
<td>0/00</td>
<td>00/00</td>
<td>00</td>
</tr>
<tr>
<td>Net Weight (lbs/kg)</td>
<td>41/18,6</td>
<td>41/18,6</td>
<td>41/18,6</td>
</tr>
</tbody>
</table>

### Product Performance

![Pressure Graph](image1)

![Vacuum Graph](image2)

![Power Input Watts Graph](image3)

![Blower Air Temp Rise Graph](image4)
SECTION 7

NIBBLER®
Pump Specifications
ZOEIIE ON-SITE WASTEWATER PRODUCTS

INTRODUCING ZOEIIE ON-SITE “DOSE-MATE” PUMPS

COMPARE THESE FEATURES

• Durable cast iron construction.
• Model 151 comes standard with a glass-filled polypropylene base.
• Corrosion resistant powder coated epoxy finish.
• Stainless steel lifting handle.
• Assembled with stainless steel bolts.
• Non-clogging engineered thermoplastic vortex impeller design.
• Model 151 - 1/3 HP passes ½” spherical solids.
• Model 152 - .4 HP passes ¾” spherical solids.
• Model 153 - 1/2 HP passes ¾” spherical solids.
• Motor - 60 Hz, 3450 RPM, oil-filled, hermetically sealed, automatic reset thermal overload protected.
• Carbon/Ceramic seals.
• Upper sleeve bearing and lower ball bearing running in bath of oil.
• 20 ft. UL Listed power cord with molded 3-wire plug.
• 1½” NPT vertical discharge.
• BN and BE standard models include a 20 ft. variable level float switch.
• Operates at temperatures to 130°F (54°C) in effluent applications.
• All models include a 1½” x 2’ PVC adapter fitting.

Note: The sizing of effluent systems normally requires variable level float(s) controls and properly sized basins to achieve required pumping cycles or dosing timers with nonautomatic pumps.

151/152/153 EFFLUENT SERIES
(For Pump Prefix Identification see News & Views 0052)

“DOSE-MATE” FOR SEPTIC TANK - LOW PRESSURE PIPE (LPP)
AND ENHANCED FLOW STEP SYSTEMS

EFFLUENT
SUBMERSIBLE
1½” NPT DISCHARGE

Model N152/N153
High Head
Effluent

Model BN152/BN153
High Head
Effluent

Manufacturers of . . .

"Quality Pumps Since 1939"

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CONSULT FACTORY FOR SPECIAL APPLICATIONS

- Timed dosing panels available.
- Electrical alternators, for duplex systems, are available and supplied with an alarm.
- Variable level control switches are available for controlling single phase systems.
- Double piggyback variable level float switches are available for variable level long and short cycle controls.
- Sealed Qwik-Box available for outdoor installations. See FM1420.
- Over 130°F (54°C) special quotation required.

### 151/152/153 Series

<table>
<thead>
<tr>
<th>151/152/153 MODELS</th>
<th>Control Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Volts-Ph</td>
</tr>
<tr>
<td>N151</td>
<td>115</td>
</tr>
<tr>
<td>BN151</td>
<td>115</td>
</tr>
<tr>
<td>E151</td>
<td>230</td>
</tr>
<tr>
<td>BE151</td>
<td>230</td>
</tr>
<tr>
<td>N152</td>
<td>115</td>
</tr>
<tr>
<td>BN152</td>
<td>115</td>
</tr>
<tr>
<td>E152</td>
<td>230</td>
</tr>
<tr>
<td>BE152</td>
<td>230</td>
</tr>
<tr>
<td>N153</td>
<td>115</td>
</tr>
<tr>
<td>BN153</td>
<td>115</td>
</tr>
<tr>
<td>E153</td>
<td>230</td>
</tr>
<tr>
<td>BE153</td>
<td>230</td>
</tr>
</tbody>
</table>

**CAUTION**

All installation of controls, protection devices and wiring should be done by a qualified licensed electrician. All electrical and safety codes should be followed including the most recent National Electric Code (NEC) and the Occupational Safety and Health Act (OSHA).

### RESERVE POWERED DESIGN

For unusual conditions a reserve safety factor is engineered into the design of every Zoeller pump.
SECTION 8

NIBBLER® DUPLEX
CONTROL PANEL
SPECIFICATIONS
Custom NIBBLER® Minnesota Duplex Control Panel
P.O. Box 1116
Black Diamond, WA 98010

Ref: DUPLEX NIBBLER SYSTEM (NON-MERCURY FLOATS - MN)
FOR 240 VAC SINGLE PHASE PUMPS

PANEL DESCRIPTION:

DUPLEX CONTROL
2 SINGLE PHASE INCOMING POWERS
- 240 VAC PUMP VOLTAGE
- 120 VAC CONTROL/ALARM VOLTAGE
NEMA 4X ENCLOSURE
- FIBERGLASS
- 24" X 20" X 12"
- 2 PAD-LOCKABLE LATCHES
ALARM OPTIONS
- 15 WATT RED FLASHING ALARM BEACON
- 83-85 dB ALARM HORN
STANDARD TOGGLE SWITCHES
- 2 HAND-OFF-AUTOMATIC SWITCHES (INTERNAL BRACKET MOUNTED)
- ALARM TEST/NORMAL/SILENCE SWITCH (PANEL SIDE MOUNTED)
CONTROL/ALARM FUSE
AUXILIARY ALARM FUSE
2 IEC RATED CONTACTORS
- 18 AMP RATING
2 PUMP CIRCUIT BREAKERS
- TWO POLE 20 AMP
CUSTOMER SUPPLIED REPEAT CYCLE TIMER
N.O. AUXILIARY 50% LEVEL CONTACTS (120 VAC POWERED)
N.O. AUXILIARY HIGH LEVEL CONTACTS (120 VAC POWERED)
2 ELAPSED TIME METERS
2 PUMP EVENT COUNTERS
TIMER OFF COUNTER
PUMP RATINGS: 240 VAC, 7-15 FLA
2 NORMALLY OPEN NARROW ANGLE MECHANICAL FLOATS (PIPE CLAMP MOUNT)
1 NORMALLY OPEN WIDE ANGLE MECHANICAL FLOAT (PIPE CLAMP MOUNT)
3 FLOAT CONTROL: TIMER ENABLE - 50% LEVEL - HIGH LEVEL ALARM

THE 3-YEAR WARRANTY DOES NOT APPLY TO THE CUSTOMER SUPPLIED TIMER.
AQUA TEST INC. MAKES NO WARRANTIES OF ANY TYPE WITH RESPECT TO COMPONENTS
SUPPLIED BY A CUSTOMER.

WARRANTY – 3 YEAR LIMITED
FIELD WIRING SECTION

Temperature rating of field installed conductors must be at least 140 deg. F. (60 deg. C.).
Field wiring terminals and ground lugs will accept copper conductors only. Torque ratings
of field wiring terminal clamping screws is 7.1-8.9 in/lbs for TB1 & TB2, 10.6-12.3 in/lbs for TB3,
and 50 in/lbs for ground lugs.
SECTION 9

NIBBLER®
Example Monitoring Checklist
Commercial Applications
EXAMPLE MONITORING CHECKLIST
Site Identification
City, State

MAX. INFLUENT DESIGN RATE: GPD XXXX / BOD₅ XXX mg/L
MAX. EFFLUENT LEVELS: CBOD₅ 120 mg/L, TSS 80 mg/L & O&G 20 mg/L

DATE ____________ TIME ____________ INSPECTION ID ____________

DATE LAST CHECKED ____________ DAYS THIS PERIOD ____________ INSPECTED BY ____________

Surge Tank Calibration:
Tank Size: _______ Gallons  No. of Tanks: _______ Capacity: flood / working  Gal. Per Inch (GPI): _______

Pump Drawdown Time: _______ Minutes  Drawdown: _______ Inches  Convert to decimal _________

______ Inches x _______ GPI x _______ No. of Tanks = _______ Gallons ÷ _______ Minutes = _______ GPM

XXXX GPD/ _______ No. of Cycles = _______ GPC (48, 72, or 96 to get Gal.Per Cycle. Min gal should be 25 and max gal should be 100)

Gal. Per Cycle (GPC): _______ at _______ Cycles Per Day (CPD) 1440 / _______ CPD = _______ Min. per cycle

______ GPC/ _______ GPM = _______ On time per cycle _______ Min per cycle - _______

On Time = _______ Off Time

Nibbler Feed Pump Settings:

Run time: _______ Sec / Min  Off time: _______ Min / Hr

On time set at: _______ mode  Dial set at: _______

Off time set at: _______ mode  Dial set at: _______

Set for _______ pump cycles per day & _______ GPD

HOUR METER (______ GPM):
ACCUM. HRS ________ - LAST READING ________ = HRS THIS PERIOD ________

_____ HRS x 60 min x _______ GPM / _______ Days in period = GPD ________

CYCLE COUNTER @ SURGE TANK: (______ GPC)
ACCUM. CYCLES ________ - LAST READING ________ = CYCLES THIS PERIOD ________

GPC X CYCLES = _______ GPD

DAYS THIS PERIOD

OFF COUNTER:
ACCUM. COUNTS ________
PREVIOUS ________
COUNTS ________
NIBBLER FEED ORIFICES:  CLEAN  CLOGGED / WERE CLEANED

VERIFY NIBBLER SETTINGS: CORRECT  INCORRECT

CHECK ALARM FLUTS 50 / 90 LIGHTS & AUDIBLE  OK  YES / NO

<table>
<thead>
<tr>
<th>BOD₅</th>
<th>TSS</th>
<th>O&amp;G</th>
<th>pH</th>
<th>TEMP</th>
<th>DO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SURGE TANK -
NIB INFLUENT: ______  ______  ______  ______  ______  ______

CLARIFIER IN -
NIB EFFLUENT: ______  ______  ______  ______  ______  ______

SLUDGE RETURN PUMP IN AUTO OPERATION (WE0311M 1/3 HP):  YES / NO

MANUALLY RECIRCULATED SLUDGE:  YES / NO APPROX. _______ GALS

VERIFY FEED SETTINGS:  CORRECT  INCORRECT

EXHAUST VENT:  VISIBLE FOAM RESIDUE?  YES ______  NO ______
IF 'YES' CHECK FOR CLOGGED MEDIA AND SLUDGE LEVELS IN TANK

ODORS  NONE____  SLIGHT____  OBNOXIOUS____

AIR INTAKE FILTER:  CLEAN____  NEEDED CLEANING/WAS CLEANED____

AIR PUMPS IN NIBBLER:

UNIT #X: WORKING____  NOT WORKING____  HIGH____  LOW____  NORMAL____
UNIT #X: WORKING____  NOT WORKING____  HIGH____  LOW____  NORMAL____
VELOCITY OF AIR PUMPS:

FOAMING ACTION:

UNIT #X: ______  ______
UNIT #XX: ______  ______

SLUDGE LEVELS:

XXX GAL. GREASE TRAP  "  "  "  "
XXX GAL. SURGE TANK  "  "  "  "
NIBBLER #X  "  "  "  "
NIBBLER #X  "  "  "  "
XXX GAL. 2 COMP. CLARIFIER:
1ST COMP.  "  "  "  "
2ND COMP.  "  "  "  "

CHECK BAFFLE IN CLARIFIER:  CLEAN____  CLOGGED / WAS CLEANED____