



# ARS1500



## Operation & Maintenance Manual

# NOTICE TO USER

The user is expressly warned to consider and adopt all safety precautions that might be indicated by the activities described herein and to avoid all potential hazards. By following the instructions contained herein, the user willingly assumes all risks in connection with such instructions.

All rights reserved. No part of this work may be reproduced or used in any form or by any means - graphic, electronic, or mechanical, including photocopying, recording, taping, or information storage and retrieval systems - without written permission of United Surface Solutions, LLC.

COPYRIGHT © 2014

BY UNITED SURFACE SOLUTIONS, LLC

# Table of Contents

1.0 Introduction .....	4
1.1 Method 1 .....	4
1.2 Method 2 .....	4
1.3 Safety .....	5
2.0 Overview .....	6
2.1 Components .....	6
2.2 Electrical Panel Overview .....	7
2.3 Pumps .....	8
2.X Specifications .....	10
3.0 Setup .....	11
3.1 Placement .....	11
3.2 Connections .....	11
3.2.1 Water & Air .....	11
3.2.2 Electrical .....	11
4.0 Operation .....	12
4.1 Auto Operation .....	12
4.2 Manual Operation .....	13
5.0 Cleaning .....	13
5.1 Valves .....	13
5.2 Tanks .....	13
6.0 Process Troubleshooting .....	14
6.1 Problem: Solution won't floc .....	14
6.2 Problem: Floc won't float .....	15
6.3 Problem: Sludge clogs filter. ....	16
6.4 Problem: Sludge seeps through filter .....	17
7.0 Preventive Maintenance .....	18
7.1 Shift Inspections .....	18
7.2 Weekly Maintenance .....	18
7.3 Bi-Weekly Maintenance .....	19
7.4 Monthly Maintenance .....	20

# 1.0 Introduction

All Advanced Water Recycling Systems offered by United Surface Solutions use a chemical process to remove unwanted contamination from your water so it may be safely recycled. This is different from purely physical pre-treatments such as clarifiers or osmosis-type systems because we are actually affecting a chemical change that transforms heavy metals and other toxic substances back into safe solids, much as they normally occur in nature. Wastewater is comprised of a wide variety of substances in many different states. Most of these can be determined by looking at the source of the water. If you are in a deburring shop that is finishing products made of chrome, zinc, and nickel, then you will have those metals in your wastewater.

United's ARS units typically use a floc and drop system. A flocculent agent clumps together the solids floating in the process tank and drops it to the bottoms of the tank for easy removal.

United Surface Solutions uses 2 methods of treating the dirty water to be recycled.

## 1.1 Method 1

A dry agent "GR-20" is automatically metered into the processing tank for a simple, and single, automated process. This is the recommended method of wastewater recycling.

Wastewater treatment with GR-20 takes only minutes, yet several complex chemical reactions occur. First, the acidic component of the GR-20 causes oily contaminants to coalesce and separate from the wastewater. Next, the polymeric cationic portion of the formulation attracts any remaining oils and larger, more highly charged anions. Finally, the basic component activates, precipitating metallic hydroxides and driving the system to a fully flocculated condition where the cationic polymer molecules (with any adsorbed oil), metallic ions, and positively charged contaminants are attracted to the GR-20's clay particles. Heavy metal cations remaining in solution will exchange with the sodium on the clay and will bond to the clay platelets by electrostatic forces. The fully reacted mass is a complex mixture of encapsulated contaminants and waste solids held together by Van der Waals (weak), as well as electrostatic (strong) forces. The clay particles agglomerate, entrapping and surrounding suspended solids completely. Pozzolan reactions also occur, forming cementitious particles which settle to the bottom of the vessel. The entire microencapsulation process is completed in just minutes, leaving clear and in most cases sewerable, water.

## 1.2 Method 2

Method 2 uses any of the Product A100 solutions or any of the Product B100 solutions to bring the pH level to the preset limit. Only one of the products is used, depending on the pH level starting point. Then a coagulant is added and finally a flocculent to separate the impurities.

## 1.3 Safety

Except where clearly noted, most of the products used in the treatment of wastewater with our system are safer than most household cleaners. We use the same chemicals that go into the processing of foods such as pickles, tacos, and hot dogs. Contact with all but the most sensitive skin will cause no harm, but as with all chemicals, avoid contact with your eyes and mouth. This means washing your hands thoroughly before eating and whenever leaving the work area.

The influent you are treating is probably fairly safe also. However, always know what is in the water you are treating. You have a legal right for this information to be disclosed to you. Regardless of the dirty water you are working with, remember these few points:

- Know where Emergency Eyewash Stations and Drench Showers are located.
- Know where a fully charged "B" Class (Flammable Liquids) fire extinguisher is located.
- Always wear protective clothing.
- Never take chances with your health - If you are concerned with a safety issue, ask your supervisor or call the Product Support Team at United Surface Solutions **(562) 693-0202**.

# 2.0 Overview

## 2.1 Components

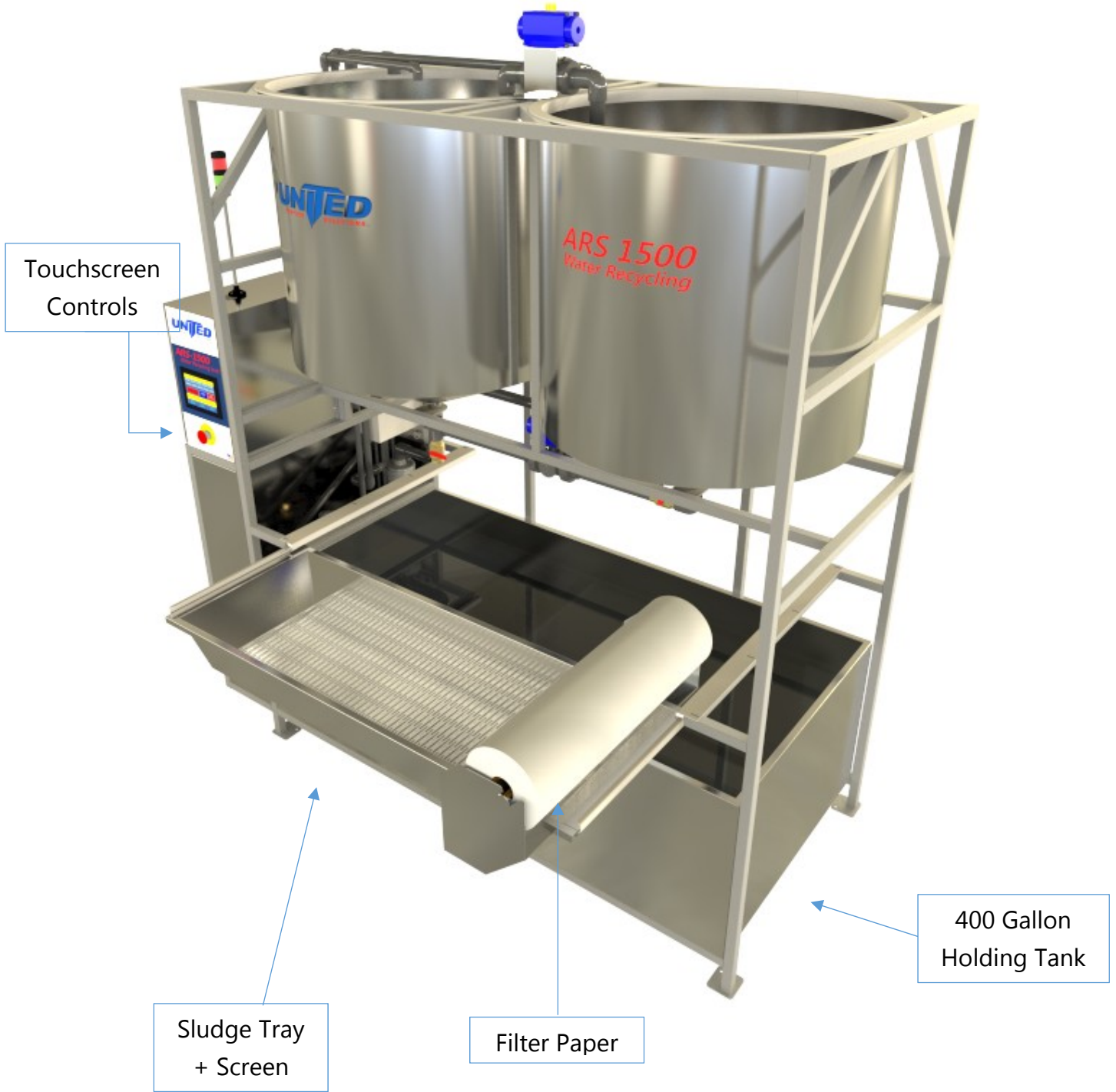


Figure 1 Main Overview

## 2.2 Electrical Panel Overview

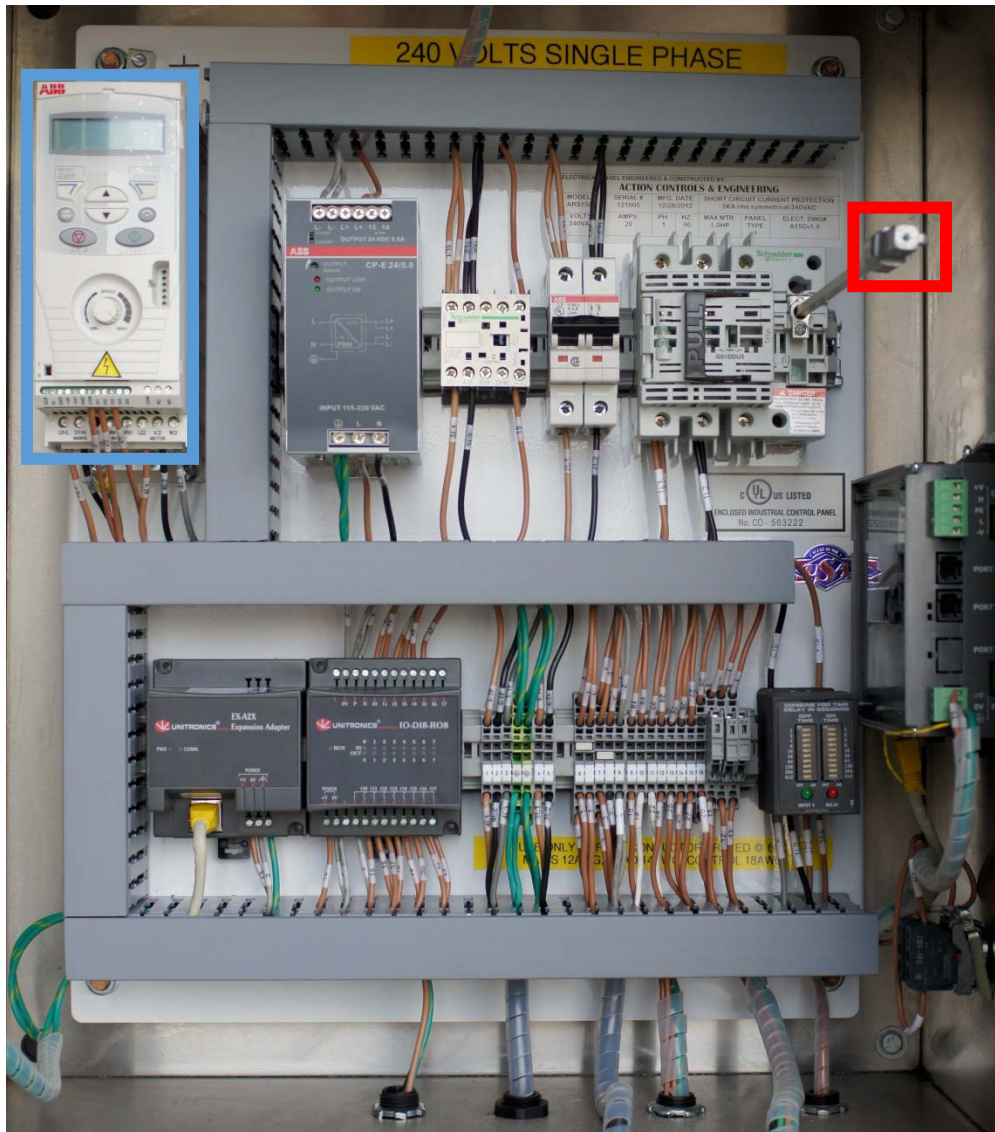


Figure 2 Electrical Box & Panel

The ARS1500 features a custom-made UL-approved electrical panel. This panel should not be opened under any circumstance.

- Inverter
- Shut-Off Switch: Panel will be switched off when it is opened.

## 2.3 Pumps

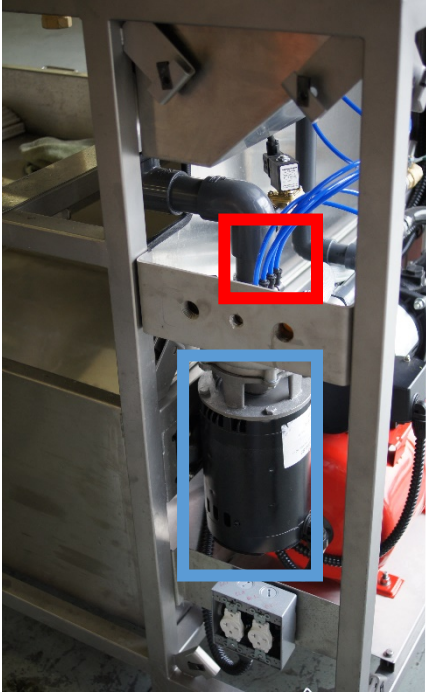


Figure 3 External Connections

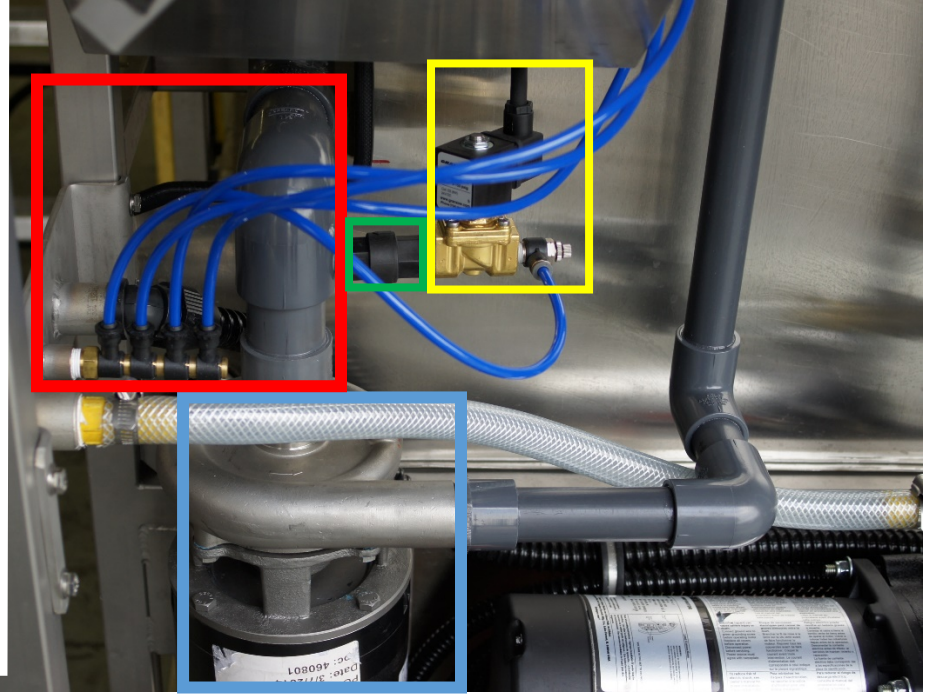


Figure 4 Circulation Pump and Air Lines

### ● Circulation Pump

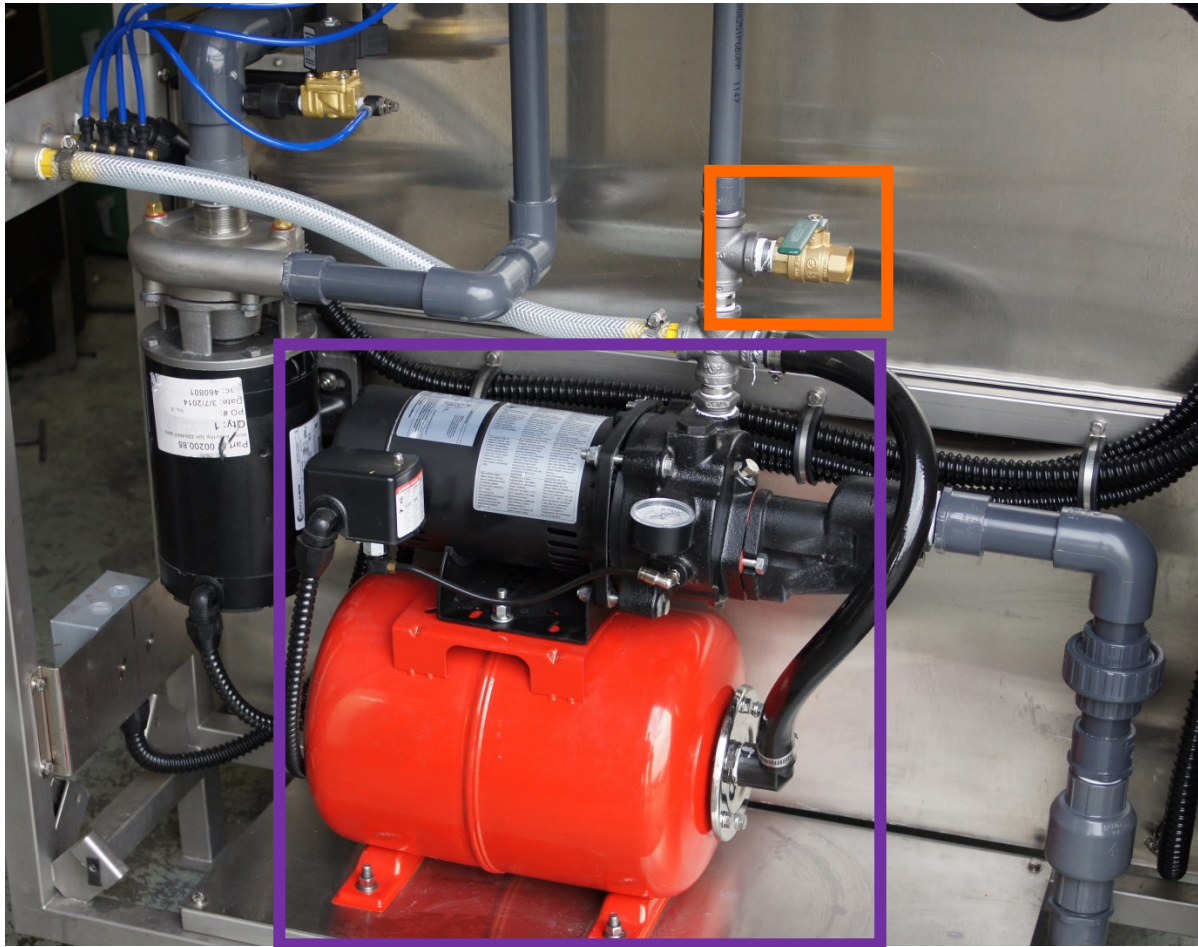
- The circulation pump circulates wastewater throughout each process. This is done automatically.
- It is also used to pump wastewater from the holding tank to the process tank.

### ● Air manifold for aeration, valves (2), and GR20

### ● One-way check valve.

### ● Aeration solenoid with flow control (on right).

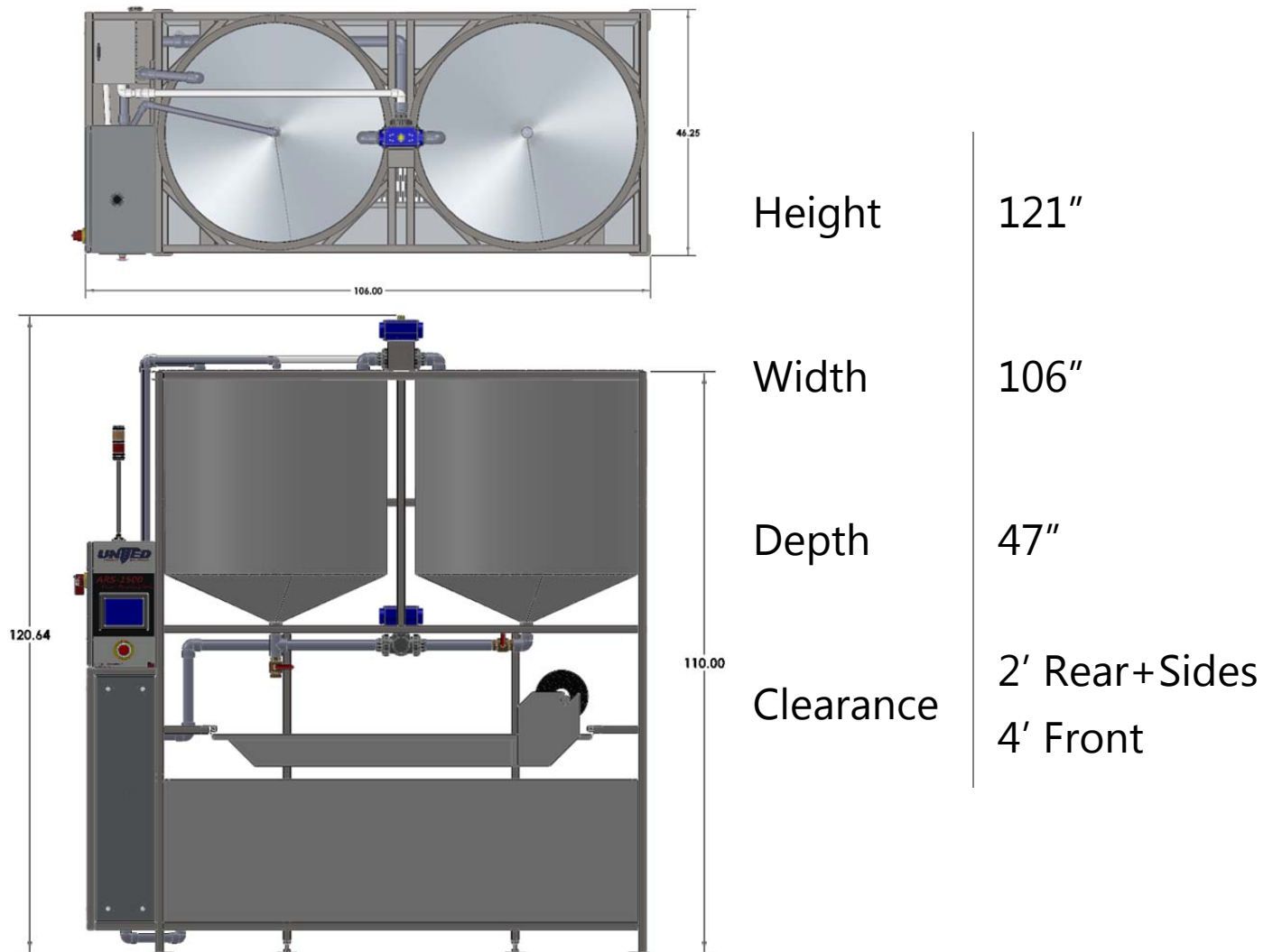




- Well Pump
- Optional shut-off valve for drainage.
- One-way check valve.
- Aeration solenoid with flow control (on right).

## 2.X Specifications

<b>Model</b>	ARS1500
<b>Description</b>	Closed-loop automated water recycling system.
<b>Maximum Capacity</b>	400 Gallons (1500 Liters)
<b>Process Capacity</b>	200 Gallons (750 Liters)
<b>Controls</b>	Touchscreen controls with memory.
<b>Average Process Time</b>	40 Minutes
<b>System Type</b>	Closed-loop.
<b>Sewer Connection</b>	Not required.
<b>Machine Construction</b>	304 Stainless steel.
<b>Power Requirements</b>	208/230VAC   Single-Phase   20 Amps
<b>Compressed Air</b>	80 psi (550 kPa)
<b>Country of Origin</b>	USA
<b>Warranty</b>	Up to 3 years, determined by component type.



Height

121"

Width

106"

Depth

47"

Clearance

2' Rear+Sides  
4' Front

## 3.0 Setup

### 3.1 Placement

1. Ensure there is enough space for the system including clearances: W: 130" x D: 120" x H: 121"  
The unit should be placed 2 feet away from all walls with a 4 foot clearance in the front for operation.
2. The unit must only be lifted from underneath the large holding tank (lowest point on system). Forks must clear the insides of each support by at least 4 inches.
3. Level the unit once it is placed.

### 3.2 Connections

#### 3.2.1 Water & Air

1. Attach incoming wastewater line to tank #2 (right side).
2. Attach outgoing water line if necessary.
3. Attach incoming compressed air line.
4. Fill clean water holding tank with 400 gallons of water – roughly 4 inches below top of tank.

#### 3.2.2 Electrical

- All electrical connections should be made by qualified electrical maintenance personnel with knowledge of local electrical code requirements. The use of 10-gauge wire on a 30 Amp circuit is required for warranty purposes.
- Three wires plus a ground wire connection to the electrical control box is accomplished by bringing the power supply wires through the back of the machine fitting, then through the conduit into the electrical box. These four wires are the only electrical connections required. Any modification to the manufacturer's installed circuitry may void the warranty.
- The master power switch is operated by a handle that when turned, will cut power to the unit and open the door to the electrical control box. To padlock the handle in the "off" position, pull out the padlock plate and insert the padlock through the slot. It is possible to defeat the interlock on the handle so the door can be opened without cutting power, but this procedure should only be performed by qualified maintenance personnel and only after positioning the appropriate warnings for a live electrical panel.
- For safety reasons, the unit is shipped with a red/amber beacon assembly and the Holding Tank High and Low Limit Switches disconnected, lowered, and secured. It is necessary for your maintenance department to install these items before operating the unit.

### 3.3 Sludge Tray

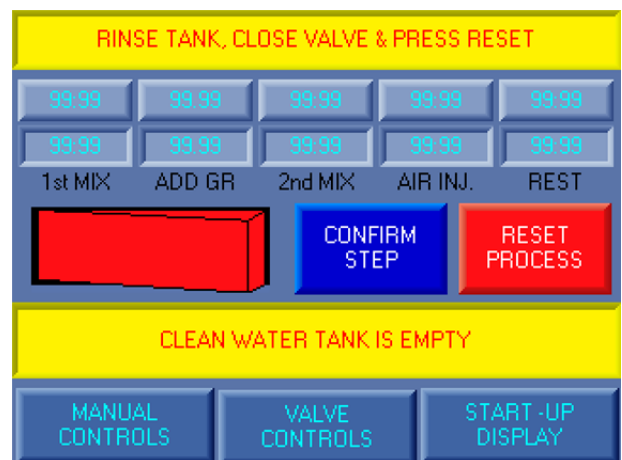
The Sludge Tray should be placed on the support brackets above the Clean Water Reservoir and the Filter roll needs to be hung in the dispenser on the side of the unit to complete the assembly.

## 4.0 Operation

Processing the wastewater with the ARS1500 is easy and requires very little operator time. Processing a batch of wastewater is done automatically, except for the quality check and the manual draining sequence.

### 4.1 Auto Operation

Wastewater pumps directly into the wastewater holding tank. The system then pumps wastewater into the adjacent process tank. When the process tank reaches capacity, the process tank fill valve closes, and incoming wastewater will be held in the holding tank until the next cycle begins. The system alerts the operator that the process is ready to begin by illuminating its notification beacon. The operator must now press the switch on the touchscreen to begin the automatic process. The right holding tank may continue to fill with wastewater during this process. If the holding tank fills to capacity, the external pump will stop functioning as long as its power source is the ARS1500 itself (though not necessary for operation, this is the recommended configuration). The system will begin circulating the wastewater while pumping in the required compounds and adjusting the air and pump flow to separate all suspended and dissolved solids from the water (this process takes 15-20 minutes).



The system will notify the operator once the process is complete. At this point, it is time to drain the process tank.

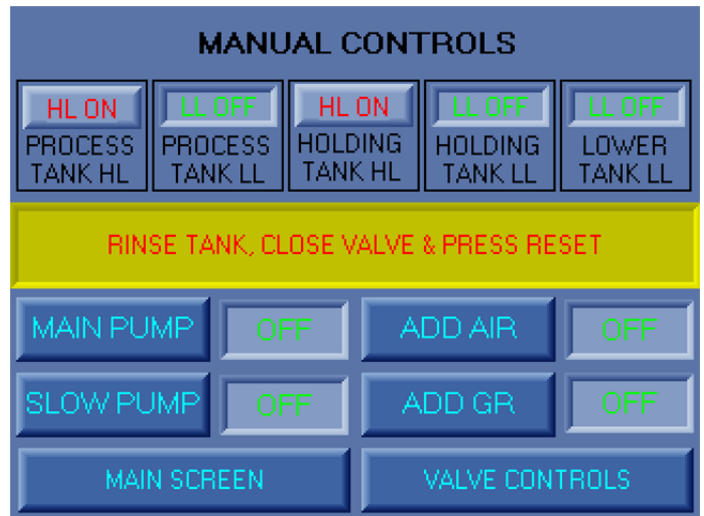
1. Ensure filter paper is in place in the sludge tray.
2. Open the valve underneath the process tank to the half-way point.
3. Slightly dirty water may flow before clean water.
4. After clean water finishes flowing, sludge begins to flow.
5. Fully open the valve and allow the tank to empty into the sludge tray.
6. Open sprinkler valve in process tank to rinse excess dirt.
7. Close all valves.
8. Press Reset Process on the main screen. Holding tank will begin pumping wastewater into the process tank and the external pump will resume functioning.

Once the sludge has dewatered enough, fold the filter paper and dispose of the waste.

The clean water holding tank continuously supplies clean water to other equipment during the process.

## 4.2 Manual Operation

An operator can choose to process a batch of wastewater manually. The process remains the same as in the automatic mode, except the operator must initiate and control the duration of each step. Actual operation of the unit components is controlled through the touchscreen. The Valve Control and Manual Control keys grant the operator access to individual component controls.



## 5.0 Cleaning

### 5.1 Valves

Valves can be flushed out by inserting a hose into a valve and opening it as water flows through. Valves can also be removed at unions and cleaned manually.

### 5.2 Tanks

The process tank should be rinsed after every process through the use of the clean water valve located to the left of the tank. Due to the stainless steel construction, the ARS1500 will not corrode due to moisture. Tanks can be rinsed periodically.



## 6.0 Process Troubleshooting

If you are having trouble processing your water, please refer to the following troubleshooting guide.

### 6.1 Problem: Solution won't floc.

If you are having problems getting a floc, lowering or raising the pH will help resolve the issue. For best results, the PH level should be between 5 and 9 pH. Levels can be adjusted by adding pH+ or pH- compounds (consult with your United representative). However, if you have determined that you have a stubborn batch that does not allow easy adjustment of pH, and are having additional difficulties with the floc, it is likely your wastestream will need re-evaluation by our laboratory. Please follow these steps.

Cause	Insufficient quantities of GR-20.
Verification	Experimentation.
Correction	Add more GR-20.
Cause	Not enough, or poor mixing.
Verification	Check the bottom of the Process Tank for buildup of excess dry product.
Correction	<ol style="list-style-type: none"><li>1. Clean bottom of Process Tank.</li><li>2. Allow batch to mix longer.</li><li>3. Always add GR by sprinkling into turbulent water, not on top of foam or into still water.</li></ol>

## 6.2 Problem: Floc won't float.

If you have acceptable floc size, but the flakes do not rise to the surface within the usual amount of time (averages 30 minutes), the following steps may be taken:

Cause	Improper air mixture, or air inlet clogged.
Verification	Disassemble the air intake located next to the pH probe. Always have the recirculating pump running while the intake is removed to prevent water from shooting out.
Correction	Clean and inspect the ball check valve, spring and housing for damage or clogging. Rebuild if able or replace the unit.
Cause	Air Injector solenoid inoperative or clogged.
Verification	Ensure the solenoid valve is operational. Check for intake.
Correction	Clean the solenoid intake or replace the solenoid valve.
Cause	High volume of sludge. If you had to add more product to adjust the pH levels, or if your waste stream is unusually full of contamination, you may have simply produced more sludge than usual.
Verification	Visual inspection.
Correction	Give the solution additional time to float. If practical, leave overnight.

### 6.3 Problem: Sludge clogs filter.

When you begin to drain the clean water, it is important to drain the first 1-3 gallons into a bucket. A certain amount of floc is trapped in the recirculation piping and must be drained into a bucket before draining the process tank. By draining this water off, you reduce the danger of clogging the filter and will increase the amount of time required to drain the entire system. If you have done this and the Filter still clogs, or you still have dirty water after draining 3 gallons, please read the following suggestions:

Cause	Attempting to drain before the floc has had a chance to float.
Verification	Visual inspection.
Correction	Experimentation. Allow an additional 15 minutes after addition of flocculent before attempting to drain.
Cause	Solution did not break completely.
Verification	Observe the water drained into the bucket. If you do not see an identifiable floc, or the water around the floc looks dirty, then the batch did not break completely.
Correction	See "Solution won't floc."
Cause	Solution did not floc completely.
Verification	Check the water drained into the bucket. If you did not get mostly clear water, then part of the floc did not float. Check again to ensure water around the floc is clear.
Correction	If water around the flock is not clear, see "Solution won't floc." If water looks clear, but there seems to be too much floc on the bottom, see "Floc won't float."
Cause	Attempting to use a filter more than once.
Verification	Visual inspection. Does the Filter look used?
Correction	Replace the filter. One use per filter is recommended.
Cause	Using a filter device other than one recommended by United Surface Solutions.
Verification	Check with your purchasing department or contact United Surface Solutions.
Correction	Order supplies from United Surface Solutions or its distributors.



## 6.4 Problem: Sludge seeps through filter.

There will usually be a small amount of floc collecting on the sides of the recycling reservoir; should this amount become excessive, or if the sludge is moving through the filter, follow these steps:

Cause	Solution did not break completely.
Verification	See "Solution won't floc."
Correction	See "Solution won't floc."
Cause	Filter damaged.
Verification	Visual inspection. Look for tears, leaks, or other deficiencies.
Correction	Replace filter.
Cause	Incorrect filter.
Verification	Check with your purchasing department or contact United Surface Solutions.
Correction	Order supplies from United Surface Solutions or its distributors.
Cause	Attempting to drain too quickly.
Verification	If the solution has broken well and the filter is in good condition, you may be draining too quickly and forcing the sludge through the filter.
Correction	Reduce the flow by closing the drain valve to approximately 15 degrees.
Cause	Excessive oil content in wastewater and sludge. An oil content of over 2% is NOT acceptable and will not process.
Verification	Inspect the sludge for "soupy" or oily appearance and consistency. Inspect dirty water for oils floating on the surface.
Correction	Install or repair your oil separator device prior to treatment in United Surface Solutions Advanced Water Recycling Systems, or contact United Surface Solutions for feasibility of emulsifying oils more completely.  WARNING: This will involve a decrease in the safety of the system due to powerful acid-base reactions needed for emulsification. If possible, eliminate the oils before treating.

## 7.0 Preventive Maintenance

The Advanced Water Recycling System, like all other state-of-the-art piece of equipment, requires some periodic preventive maintenance. The preventive maintenance can be performed by the operator assigned to the equipment or by the maintenance department. Only simple hand tools are required to perform the required maintenance and it will not be necessary to remove electrical power from the unit.

The one major pre-inspection requirement is that the Process Tank be empty of all water.

There are several specialty items that will be required to perform some of the inspections and tests. Those items will be listed with the inspection and test requirements.

This manual is broken down by time inspection and maintenance requirements: at the beginning of each shift, the weekly, the twice-monthly, and the monthly cleanings, inspections and tests.

### 7.1 Shift Inspections

1. Check products in each of the containers.

Do not allow the unit to run out of liquid products in mid-process. Always have a spare container of each type of liquid or dry products on hand so your operation will not have to be halted while another container is procured.

2. Check all of the product pick-up tubes.

Check for twisted, kinked, or deteriorated tubing. Also, check for signs of leakage or blockage. Replace any tubing that is suspect.

### 7.2 Weekly Maintenance

1. Inspect each limit switch for freedom of movement.

The Holding Tank has a High Level Limit Switch and a Low Level Limit Switch. The Process Tank has a High Level Limit Switch, and the clean water reservoir has a Low Level Limit Switch. If needed, clean any residue from the float mechanism and insure there is complete freedom of movement.

2. Inspect for sludge buildup on bottom of tanks.

All three tanks (the Holding Tank, the Process Tank and the Clean Water Tank) will need to be empty for this inspection. The sludge buildup can affect the pH Probe and the Recirculation Pumps. If needed, clean this sludge residue from all tanks using fresh water only. DO NOT use any type of liquid or paste cleaners.

## 7.3 Bi-Weekly Maintenance

The Process Tank will need to be empty for these maintenance procedures, therefore it is recommended that all of the inspections and cleaning be accomplished simultaneously. Before any disassembly, lay out clean Filter paper over the Sludge Tray to catch any small parts that may be dropped.

1. Clean and Inspect the pH Probe

Remove the pH Probe from the Process Tank Manifold. Clean the pH Probe with fresh water and a soft non-abrasive cloth. DO NOT use any type of liquid or paste cleaners. Inspect for cracks or any other damage.

2. Calibrate the pH Meter.

Remove the pH Probe lead from the BNC connector. Install the BNC connector cap. With the cap installed, push ON the TEMP button on the face of the meter. The pH Meter should read between 20° to 30° C. Push OFF the TEMP button. With the cap installed the pH Meter should read between 6.8 and 7.2 pH. If the reading is not within this range, contact United Surface Solutions.

3. Calibrate the pH Probe.

After the pH Meter has passed calibration, it is safe to calibrate the pH Probe. To calibrate the pH Probe, you will need the following supplies: (1) A three foot length of wire, striped back 1 inch on each end. (2) 7 pH buffer solution. (3) 4 pH buffer solution. (4) A bottle of clean fresh water.

- a. Install the pH Probe lead wire back onto the BNC fitting. Temporarily attach the three-foot wire to the frame of the unit, ensuring a good ground connection. Place the other end of the three-foot wire into the 7 pH buffer. Insert the pH Probe into the 7 pH buffer with the wire. The pH Meter should read 7 pH. If not, adjust the "CALIB" set screw on the face of the meter until you get a 7 pH reading. If the probe cannot be adjusted to get a 7 pH reading, contact United Finishing Systems for assistance.
- b. After the adjustment, remove the probe and wire from the 7 pH buffer. Clean both the probe and wire with clean fresh water. Leave the wire temporarily attached to the unit.
- c. Insert the pH Probe and the wire into the 4 pH buffer. The pH Meter should read 4 pH. If not, adjust the "SLOPE" set screw on the face of the meter until you get a 4 pH reading. If the probe cannot be adjusted to get a 4 pH reading, contact United Finishing Systems for assistance.
- d. After the adjustment, remove the probe and wire from the 4 pH buffer. Clean both the probe and wire with clean fresh water. This concludes the pH Meter and Probe calibration. Remove the temporarily attached wire from the unit frame. Save the three foot wire, and the 4 and 7 pH buffers for use during the next scheduled maintenance.

4. Clean and Inspect the Ball Check Valves (5)
  - a. The five Ball Check Valves are screwed into the Process Tank Recirculation Manifold. The four product and one air tube are connected to these valves. They are exposed to the Process Tank water and therefore will have a tendency to get dirty.
  - b. The Ball Check Valve can be disassembled without removing it from the manifold. The tube-check valve connector fitting can be unscrewed from the manifold fitting, leaving the manifold fitting installed in the manifold. This is recommended to prevent wear on the fitting and possible leakage. The cap, spring and ball are installed within the tube-connector check valve fitting.
  - c. When the tube-connector check valve fitting is loosened and removed, the cap, spring and ball can be removed from the fitting for easy inspection and cleaning. Cleaning is done with only clean fresh water and a soft non-abrasive cloth. Also inspect and clean the o-ring inside and the o-ring on the outside of the tube - connector check valve fitting.
  - d. The tube cap can be loosened to inspect the tube end if signs of leakage are present. As corrective action, the tube can be trimmed and reinstalled.

## **7.4 Monthly Maintenance**

1. Tank Cleaning

All of the tanks need to be rinsed at least monthly to remove any residue on the bottom and sides of the tanks. The Clean Water Reservoir drain has a screen installed that needs to be cleaned monthly to ensure sufficient flow of clean water. The pressure from a water hose is sufficient to clean the tanks. Do not use any type of liquid or paste cleaners.
2. Clean Water Reservoir Pressure Pump Check Valve

The check valve can be removed from the unit by loosening the two couplings, one up-stream and one down-stream of the check valve. Flush the valve with fresh water to clean and ensure good flow. Also, inspect to ensure that a back-flow of water will push the check valve close and not allow the water to pass.