



# Eco-Tec MicroPur Acid Purification System *for Stainless Steel Pickling*

**INFORMATION PACKAGE**



**Steelmaking**

Metal Finishing

Water Treatment

Pulp and Paper

Petrochemicals

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## Introduction

When stainless steel is pickled, some of the base metal is dissolved by the hydrofluoric acid. This metal gradually accumulates in the pickling solution. Periodically, the bath must be dumped, the tank cleaned and a fresh pickling solution reformulated. This makes stainless steel pickling an expensive process to operate.

Costs can include several items:

- Nitric and Hydrofluoric acid
- Neutralization with caustic or lime
- Solid waste disposal (including tank sludge)
- Lost productivity while dumping and reformulating the pickling tank
- Rework caused by under and over-pickling
- Fines for waste discharge

Since 1982, stainless steel mills around the world have used a system called the APU to purify stainless steel pickling acid. Benefits include reductions in all operating costs associated with the pickling.

The MicroPur System now provides these same benefits to smaller pickling operations in a cost-effective, pre-engineered design. This package provides information on the MicroPur System and useful guides for selecting the right components.

## What is a MicroPur System?

A MicroPur System continuously removes suspended solids and dissolved metals from pickling solutions. With periodic acid replenishment, the pickling bath can be used indefinitely. A MicroPur System for stainless steel pickling acid, consists of a MicroPur unit and support components, such as:

- a Cooling System
- a Prefiltration Unit
- a Feed Tank

The heart of the MicroPur unit is a column of ion exchange resin that can absorb acid while rejecting metal salts to waste. The acid is recovered from the resin using a simple water wash.

## How the MicroPur System works

A diaphragm pump transfers pickle solution from the bath. (MicroPur can be connected to multiple baths, if needed.) If the bath temperature exceeds 40°C/104°F, a Cooling System must be used. This system uses plant or cooling water in a heat exchanger to cool the acid whenever the pump is on. A temperature monitor, supplied with the MicroPur unit, will shut the system down if the temperature of the acid leaving the Cooling System exceeds the recommended range. A conductivity monitor on the outlet cooling water ensures that it can be recycled or used elsewhere in the plant.

Cooled acid is then filtered. Normally, a Prefiltration Unit is used. If suspended solids levels are very low, the cartridge filters mounted on the MicroPur unit may provide adequate filtration on their own. When a Cooling System or Media Filter is used, acid is stored in a Feed Tank before processing in the MicroPur unit.

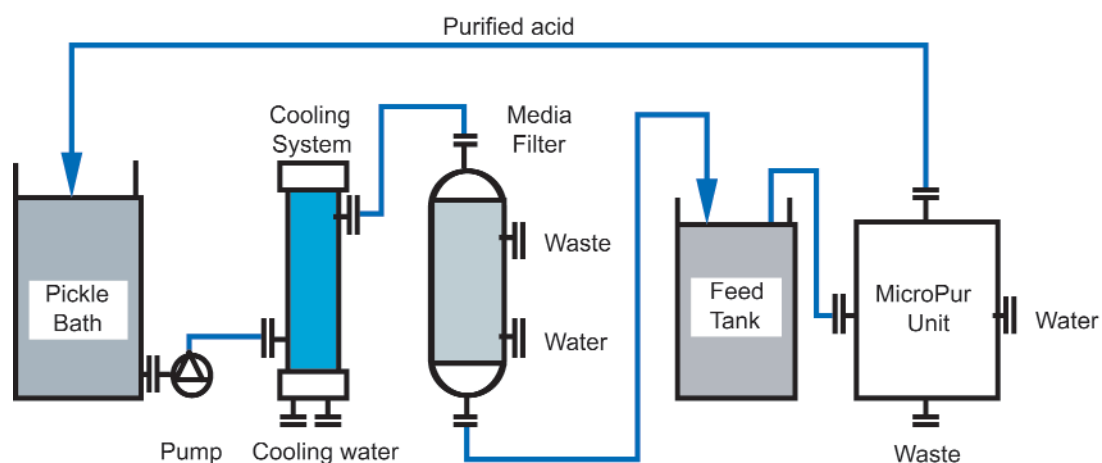
A MicroPur unit cycle consists of two basic steps.

Step 1: Filtered acid is pumped through the resin column. While the acid is absorbed by the resin, metal salt solution passes through the column to waste.

Step 2: Water is pumped down through the column, removing the acid. This acid stream is returned to the bath being treated. The total cycle lasts two to five (2-5) minutes.

If the MicroPur system is left to run continuously it will maintain the lowest possible level of dissolved metals into the acid bath. As a small amount of the acid is lost in the system waste, it can be more effective to start and stop the system, as required, to maintain a desired metal level.

Control panels with simple PLCs (programmable logic controllers) employ graphical displays that indicate what the System is doing at all times. The panels have provisions for remote on/off switching and an RS232 port for data interchange.

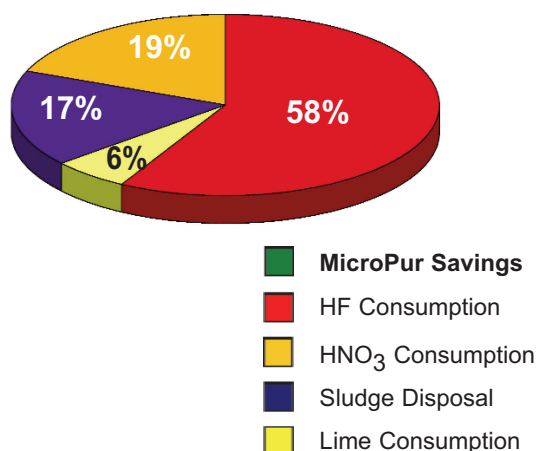


## Cost Savings

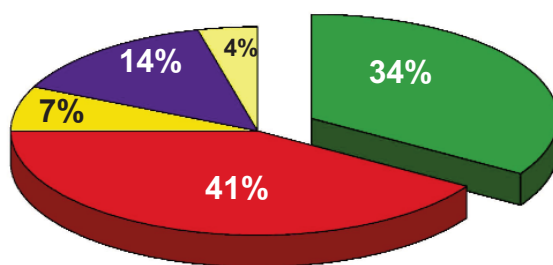
The charts below show how costs can be reduced with a MicroPur System. Savings depend on a number of factors such as operating hours, chemical costs, and waste treatment methods.

The MicroPur Savings Calculator makes it easy to estimate the savings you can expect.

### Pickling costs



### Pickling with MicroPur



#### Basis:

- a) Bath composition maintained with MicroPur:
- |                  |   |         |
|------------------|---|---------|
| HNO <sub>3</sub> | = | 150 g/l |
| HF               | = | 30 g/l  |
| Metal            | = | 35 g/l  |
- b) Lime neutralization waste treatment system used.

Prior to shipment of the System, detailed operating manuals will be mailed out. These manuals include easy to understand installation instructions that offer helpful details on locating the System, piping and wiring. Installation and startup of a MicroPur System is simple and straightforward.

- Remove the crate and packing materials.
- Move the MicroPur System into position.
- Attach any pipework that has been removed for shipping purposes and install filter media.
- Connect single phase electrical supply, 5.5 bar/80 psig air supply and water supplies.
- Install supplied level monitors (where required).
- Install piping
  - to and from the acid bath or pickle tank.
  - between MicroPur components.
  - for the waste line.
- After hookup is complete, the System can be started. The manual includes checklists and troubleshooting guides.
- No special adjustments are required as the system is fully tested and calibrated prior to shipment.

Routine monitoring is recommended and log-sheets are provided for this purpose. Preventative maintenance schedules are also included in the manual.

Regular maintenance primarily involves filter cartridge replacement. The replacement frequency is difficult to predict as solids levels vary from plant to plant. The System is supplied with a replacement parts kit that includes a supply of cartridge filters.

MicroPur Systems also include access to 24 hour per day customer service hotline. Onsite training and assistance are available, and a full stock of replacement parts can normally be shipped within twenty-four hours.

## Selecting MicroPur Components

It is simple to select the right MicroPur components for your needs.

1. Determine the metal buildup rate. This can be done using the guide provided in Appendix A.
2. Select a MicroPur unit from the performance specifications chart in the Application Data Sheet. Choose a unit that provides enough metal removal capacity to offset the buildup rate. Note that the MicroPur unit capacity depends on the metal level that you maintain in the bath.
3. If the bath operating temperature exceeds 40°C/104°F, a Cooling System will be required. Refer to the Application Data Sheet and Cooling System Component Sheet for more details.
4. Prefiltration may be recommended. Refer to the Application Data Sheet. The prefiltration component sheet provides more information on this unit. If the suspended solids level in the acid is less than 10 ppm, then the cartridge filters on the MicroPur unit may provide adequate capacity.
5. When a Cooling System or Media Filter is chosen, select a Feed Tank/pump module from the component sheet to match the MicroPur unit you have chosen.

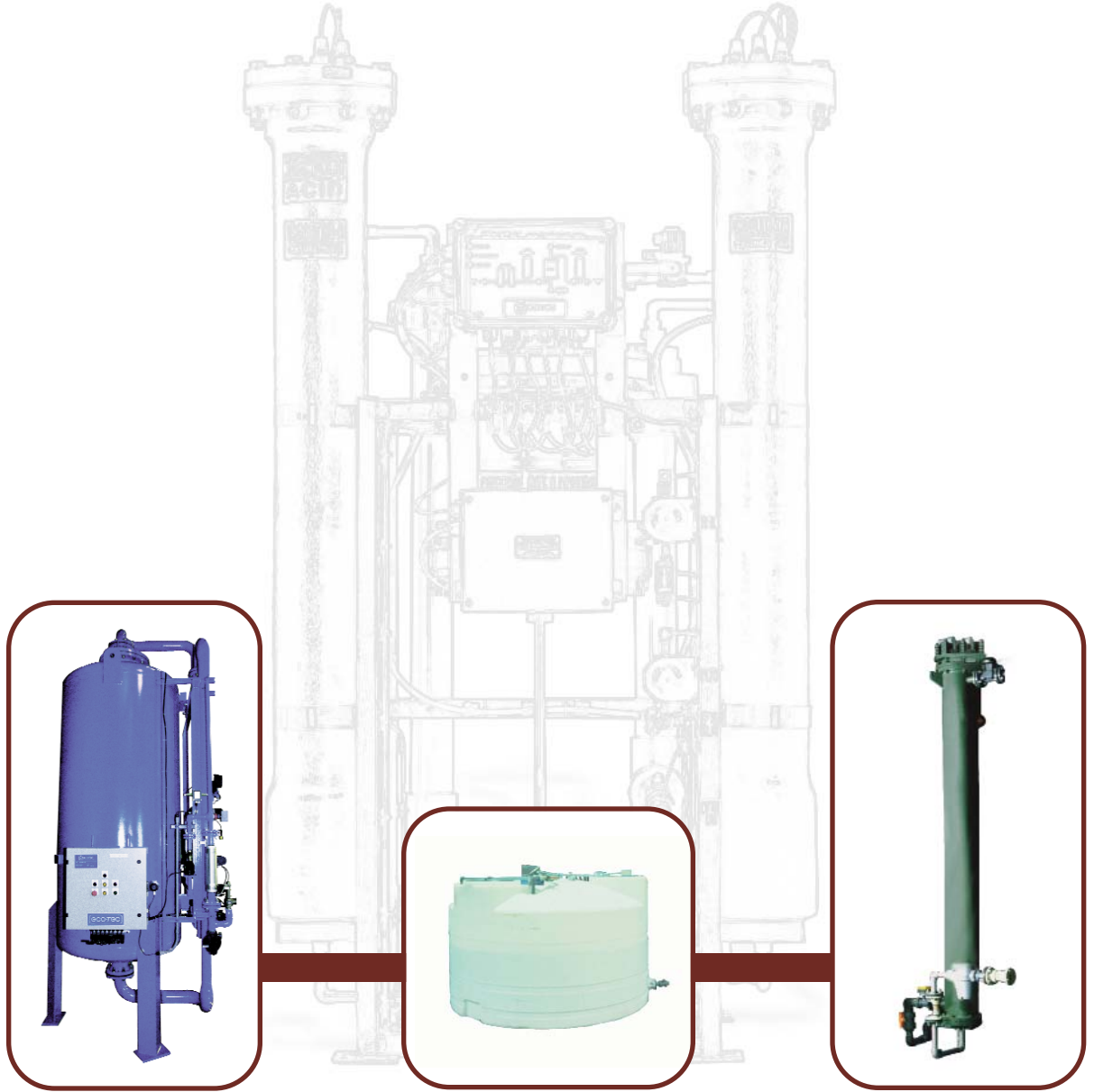
If a Cooling System is required, and a Media Filter is not required, a control panel for the Cooling System must be ordered.

## MicroPur - Performance Specifications

Typical Unit Capacities				
Model Number	Metal Removal (kg/h)			Flowrates (l/h)
	@ 30 g/l	@ 35 g/l	@ 40 g/l	Feed/Product/Waste
ST6 - NL	1.8	2.1	2.4	75
ST8 - NL	3.2	3.7	4.2	132
ST10 - NL	5.0	5.8	6.6	208
ST11 - NL	7.2	8.4	9.6	300
ST13 - NL	12.8	14.9	17.1	535
ST15 - NL	20.0	23.4	26.7	835

Typical Stream Compositions Chart							
Stream	Composition (g/l)						
	Nitric Acid		Hydrofluoric Acid		Metal		
Feed	130	200	10	40	30	35	40
Product	122	188	9	36	6	7	8
Waste	7.8	12	1	4	24	28	32

# Appendices



## Sections

- Appendix A: Estimating Metal Buildup Rate .....8
- Appendix B: Component Data Sheet - Cooling System .....9
- Appendix C: Component Data Sheet - Prefiltration Options .....10
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## Estimating metal buildup rate

<p><b>Required Information</b></p> <p>a) Operating hours per week _____</p> <p>b) Waste acid composition _____</p> <ul style="list-style-type: none"> <li>• Acid concentration (g/l) _____</li> <li>• Metal level (g/l) _____</li> </ul> <p>c) Average dumping rate (l/week) _____</p>	<p><b>Production Tonnage Method</b></p> <p>This method provides a first estimate of metal buildup. It is based on the assumption that 0.3% of the weight of 300 series steel (0.5% for 400 series) pickled is dissolved in the pickling acid. This method should be used as a back up check only.</p> <p>Production rate (metric tons/week) _____</p> <p>X 0.003 (300 series) _____</p> <p>÷ Operating hours per week _____</p> <p>÷ 1000 (kg/metric ton) _____</p> <p>= <b>Metal Build Up Rate (kg/h)</b> _____</p>									
<p><b>Waste Acid Method</b></p> <p>This method is the most reliable way to determine buildup rate. Remember to include the total volume of all acid solution(s) that may be sent to waste simultaneously.</p> <p>Average dumping rate (l/week) _____</p> <p>X Metal concentration in waste (g/l) _____</p> <p>÷ Operating hours per week _____</p> <p>÷ 1000 (g/kg) _____</p> <p>= <b>Metal Build Up Rate (kg/h)</b> _____</p>	<p><b>Surface Area Method</b></p> <p>This method provides an accurate estimate of metal buildup for <u>strip lines</u> based on the area of metal pickled. Accuracy relies on a careful assesment of the product mix to be pickled.</p> <p>Typical strip speed (m/min) _____</p> <p>X Typical stripwidth (m) _____</p> <p>X 60 (min/h) _____</p> <p>X Metal dissolution factor (g/m<sup>2</sup>) _____</p> <p>÷ 1000 (g/kg) _____</p> <p>= <b>Metal Build Up Rate (kg/h)</b> _____</p> <table border="1"> <thead> <tr> <th>Description (Series)</th> <th>Cold Rolled (g/m<sup>2</sup>)</th> <th>Hot Rolled (g/m<sup>2</sup>)</th> </tr> </thead> <tbody> <tr> <td>200/300</td> <td>13.8</td> <td>26.0</td> </tr> <tr> <td>400</td> <td>27.6</td> <td>52.0</td> </tr> </tbody> </table>	Description (Series)	Cold Rolled (g/m <sup>2</sup> )	Hot Rolled (g/m <sup>2</sup> )	200/300	13.8	26.0	400	27.6	52.0
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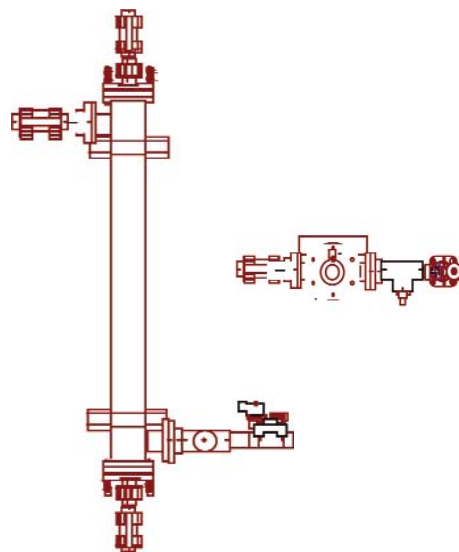


## Appendix B: Cooling System

1. Choose the Cooling System required for the appropriate MicroPur from the Application Data Sheet.
2. If the pickle bath temperature is greater than 65°C/150°F - consult Eco-Tec.
3. If the cooling water temperature is above 28°C/82°F, a water chiller must be used.
4. The Cooling System can be bolted to the Media Filter or wall mounted.
5. If a Media Filter is not required, the Cooling System will require a separate control panel.

The Cooling System includes:

- chemically resistant shell and tube heat exchanger
- cooling water inlet valve (solenoid-type)
- cooling water outlet valve and conductivity monitor
- mounting brackets
- acid inlet and outlet valving



### Cooling System Data

Model	Dimensions (cm/inch)			Cooling Water
	Length	Width	Height	(18°C/65°C) m <sup>3</sup> /h / USGPM
CS - 24LT	61/24	20/8	229/90	0.64/2.8
CS - 30LT	61/24	20/8	274/108	1.14/5.0
CS - 41LT	71/28	25/10	183/72	1.77/7.8
CS - 55LT	71/28	25/10	229/90	2.55/11.2
CS - 69LT	71/28	25/10	274/108	4.53/19.9
CS - 118LT	81/32	30/12	274/108	7.07/31.1
Model	Length	Width	Height	(19°C-28°/65°C-80°C) l/h / USGPM
CS - 55LT (w/Model D6-NL)	71/28	25/10	229/90	0.71/3.1
CS - 55LT (w/Model D8-NL)	71/28	25/10	229/90	1.26/5.6
CS - 69LT	71/28	25/10	274/105	1.97/8.6
CS - 94LT	81/32	30/12	229/90	2.83/12.5
CS - 142LT	81/32	30/12	320/126	5.03/22.2
CS - 255LT	102/40	60/24	229/90	7.85/34.6

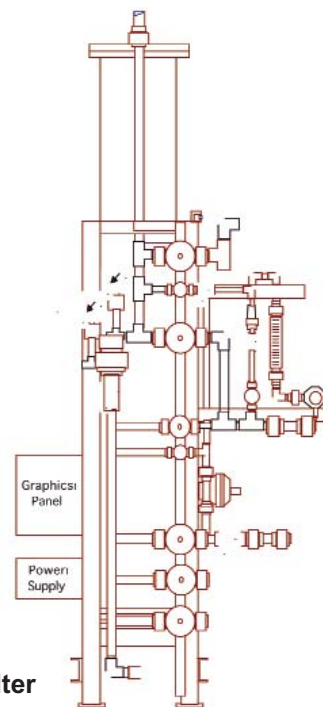
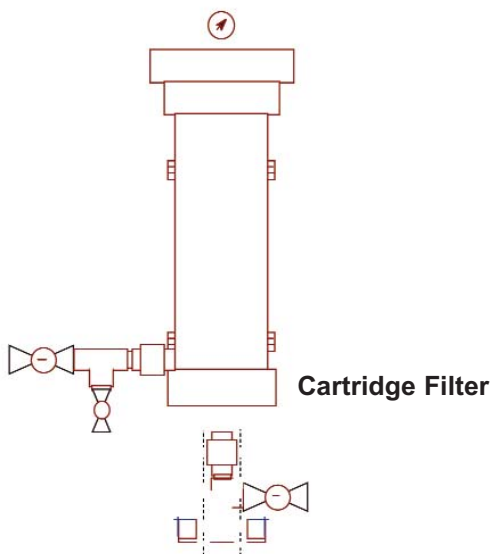
## Appendix B: Prefiltration Options

Prefiltration is recommended for many acid processing applications. Refer to the Application Data Sheets for more information.

### Media Filter

The MicroPur Media Filter, recommended when solids levels exceed 100 ppm in the acid, includes:

- lined steel vessel with two types of specially graded media
- control panel with programmable logic controller and graphics display
- automatic backwash valves
- replacement parts kit



### Cartridge Filter

The MicroPur Cartridge Filter is recommended for D6 - D13 models when suspended solids are in the 10-100 ppm range. The Cartridge Filter includes:

- CPVC vessel (lined steel vessel for F930)
- epoxy coated steel frame
- manual inlet, outlet and air bleedoff valves
- pressure gauge

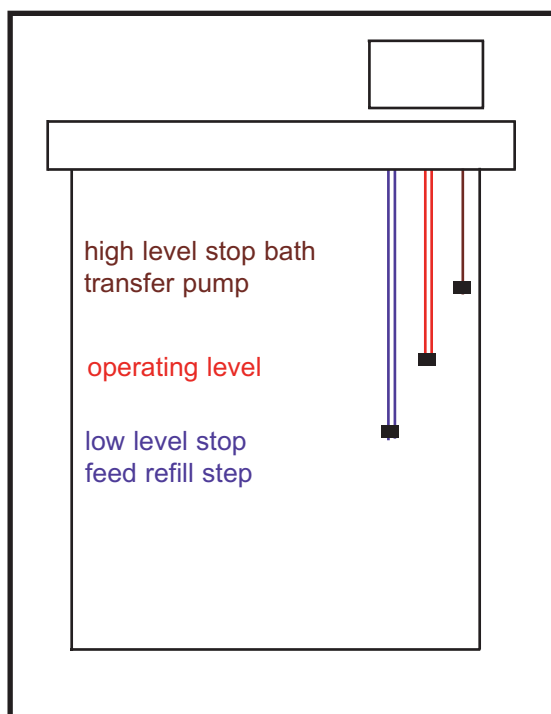
Model Number	Dimensions (cm/inch)			Electricity (110/220, 1, 50/60)	Comp. Air (m <sup>3</sup> /h / SCFM) (5.3 bar/80 psig)	Water (m <sup>3</sup> /h / USGPM) (3.0 bar/45 psig)
	Length	Width	Height			
MFCN1696	130/50	140/55	305/120	5 amps	6.8/4.0	2.8/12
Cartridge Filter	66/26	51/20	152/60	n/r	n/r	n/r

## Appendix C: Feed Tank

When a Cooling System and/or a Prefiltration Unit are used, a Feed Tank is required. The Feed Tank assembly includes:

- a bath transfer pump
- tank
- lid
- level controls
- replacement parts kit

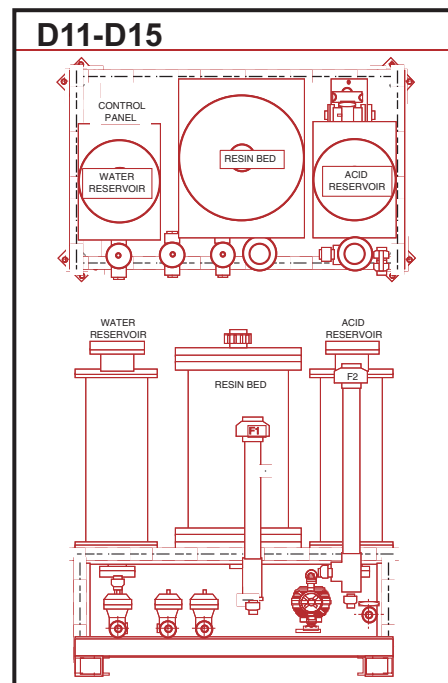
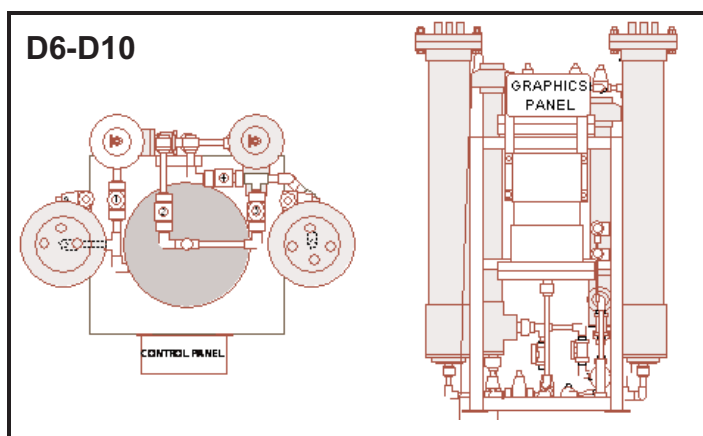
Model	Dimensions (cm/in.)	
	Diameter	Height
TA-110	41/16	89/35
TA-270	57/22.5	114/45
TA-320	61/24	122/48
TA-450	77/30	107/42
TA-680	91/36	107/32
TA-1090	107/42	122/48



## Appendix D: MicroPur Unit Specifications

### The Eco-Tec MicroPur Unit includes:

- frame mounted, dual stage cartridge filters and feed pump
- 24V control panel with graphics
- skid-mounted design with all piping and valves on a steel frame (stainless steel for models D6-D10)
- operating & maintenance manuals (3 copies)
- replacement parts kit
- remote start/stop (24v signal required)
- temperature monitor



### Notes:

- No provision has been made for the removal of oil, grease or sub-micron particles from the pickle bath solution or water fed to the MicroPur unit.
- Air must be clean, dry, oil free and filtered to 40 microns. Air filters can be supplied, if required, at an additional cost.
- Water should contain less than 200 mg/L Total Dissolved Solids, 135 ppm Total Hardness (as CaCO<sub>3</sub>) and must be clean (ie: municipal source filtered to one micron)

Model	Dimensions (cm/inch)			Electricity	Peak Air Cons	Peak Water Cons
	Length	Width	Height	(110/220,1,50/60)	@5.3 bar/80 psig (m <sup>3</sup> /h / SCFM)	@2 bar/30 psig (m <sup>3</sup> /h / USGPM)
D6	127/50	81/32	163/69	5 amps	8.5/5	0.3/1.3
D8					10/6	0.5/2.2
D10					15/9	0.75/3.3
D11	180/71	110/43	204/80		46/27	1.1/4.8
D13					58/34	2.0/8.5
D15					78/46	3.0/13.1