

ARCADIS

Appendix G

Purifics O&M Manual

Model: Photo-Cat®
Serial: 5P1203

Purifics
ES Inc.

Operation & Maintenance Support Information Manual



Project Number: 5P1203
Lockheed Martin
1600 Tallevast Road
Tallevast, FL 34243

Unique Technologies ... Achieve Solutions ... Eliminate Problems

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Preface

INTRODUCTION

Operation and Maintenance Support Information (OMSI) was prepared for this project to help you operate, maintain, and repair the facility over its life cycle. OMSI manuals provide a comprehensive, organized library of as-build materials, equipment and systems. Use the OMSI manuals as the first step in solving your operation, maintenance or repair problems. Your comments or suggestions are welcome and should be forwarded to:

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CONTENTS

The first portion of the OMSI manual (sections 1 through 9) consists primarily of equipment inventory description and assembly drawings of all major components of the installation, including a delineation of the safety hazards. The second portion of the OMSI manual (sections 10 through 14) provides detailed operation, preventive maintenance, repair, and manufacturer's data for the system. This information includes items such as normal and emergency operating procedures, flow diagrams, preventive maintenance (PM) requirements, spare parts, troubleshooting, repair procedures, and warranty provisions. You can expect better PM, faster repairs, and reduced down time by using information in this part of the OMSI manual. The third and final portion of the OMSI manual (sections 15 through 19) consists of information such as manufacturer's catalogue data, shop drawings, test data, certifications, and Operation and Maintenance Data not included in the second portion of the manual.

UPDATING

The OMSI manuals must reflect the facility's existing components; therefore, you must continually update the manuals. When equipment or components are replaced, add pertinent new information to each manual set. Be sure to update all sections of the OMSI manuals that reference the replaced item. Purge all information on the replaced item to prevent confusion.

Note:

Review Safety Hazards (Section 1) and Disclaimers (Section 18) before operating.

System Requirements

- No hydrogen peroxide or ozone will be used.
- The system shall be intrinsically safe.
- The system will draw and treat water from a variety of wells.
- Integration: The operation of the upstream groundwater well pumps, tank levels can be integrated into the Photo-Cat[®] controls.
- Durability: The system will have greater than 95% uptime and can be serviced by readily available local trades.

Treatment Requirements

Duty Requirements		
Equipment Life	25 years	
Operating Duty	100%	
Design Flow Rate	283 lpm [75 gpm]	
Average Flow Rate	189 lpm [50 gpm]	
Treatment Requirements	Influent [ppm]	Effluent [ppb]
1,4-Dioxane	0.75	< 0.003
Trichloroethylene	10.0	< 0.003
pH	Neutral	6-9
Iron	< 5	N/A
Chlorides	100	N/A

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1 SAFETY HAZARDS

This section lists potential hazards associated with the installation and provides recommended precautions and safeguards for each identified hazard.

This section must be read by anyone working at the facility.

1.1 UV Radiation Hazard

The UV lamps are totally encased in the photocatalytic cells and no UV Hazard issues arise as long as the lamps are enclosed. Direct exposure to the lamps will burn unprotected skin and eyes in less than one minute. This may cause serious and possibly permanent damage. Do not operate the lamps unless the lamps are positioned in the photocatalytic cells and the lamp plug is installed. UV light will also produce ozone that can be a health hazard. This is another reason why the lamps should not be operated unless they are installed in a sealed cell.

1.2 Electrical Hazard

Make sure that all power supplied to the cabinets is off when working inside the cabinet. Certain components in the cabinets can retain a charge for prolonged periods. Ensure that all electrical grounds are installed and that all electrical inspections and requirements are met prior to operation or servicing.

1.3 Compressed Air Hazard

Compressed air at pressures of 868 kPa (120 psig) or greater are fed to the backpulse system. Be sure to relieve pressure to the system prior to disconnecting the air line or servicing any pneumatic components. Periodic air pulses from components such as valves may pose an eye hazard.

1.4 Chemical Hazards

It is good practise to treat all liquid material of unknown origin as concentrated chemicals and handle accordingly. Never assume a liquid is water or else accidents may occur. Chemical storage and feed systems may pose a chemical hazard. Read and understand MSDS before working in the vicinity of chemicals.

There are 2 chemicals that provide a potential hazard:

- Sulphuric Acid (93%)
- Sodium Hydroxide (35%)

All chemicals are contained in plastic totes comprised of compatible materials of construction and each has secondary containment.

1.4.1 Sulphuric Acid

Concentrated sulphuric acid is very corrosive and will cause serious burns to the skin and eyes. All personnel handling sulphuric acid should read Material Safety Data Sheets before working with this chemical.

1.4.2 Sodium Hydroxide

Concentrated sodium hydroxide is very corrosive and will cause serious burns to the skin and eyes. All personnel handling sodium hydroxide should read Material Safety Data Sheets before working with this chemical.

1.5 Titanium Dioxide

Titanium dioxide is an inert powder form that can pose a dust hazard. All personnel handling titanium dioxide should read the appropriate Material Safety Data Sheets or equivalent safety data supplied by the vendor before working with this chemical.

1.6 Thermal Hazard

The Photo-Cat[®] system (PCS) is designed to operate with a working fluid nominally 40°C. Consequently exposed piping will have a temperature in the 40°C plus range. Also, stainless steel exposed to direct sunlight could become hot enough to burn unprotected skin.

1.7 Noise Hazard

The facility pumps may generate enough noise in close quarters that hearing protection should be worn while in the facility building.

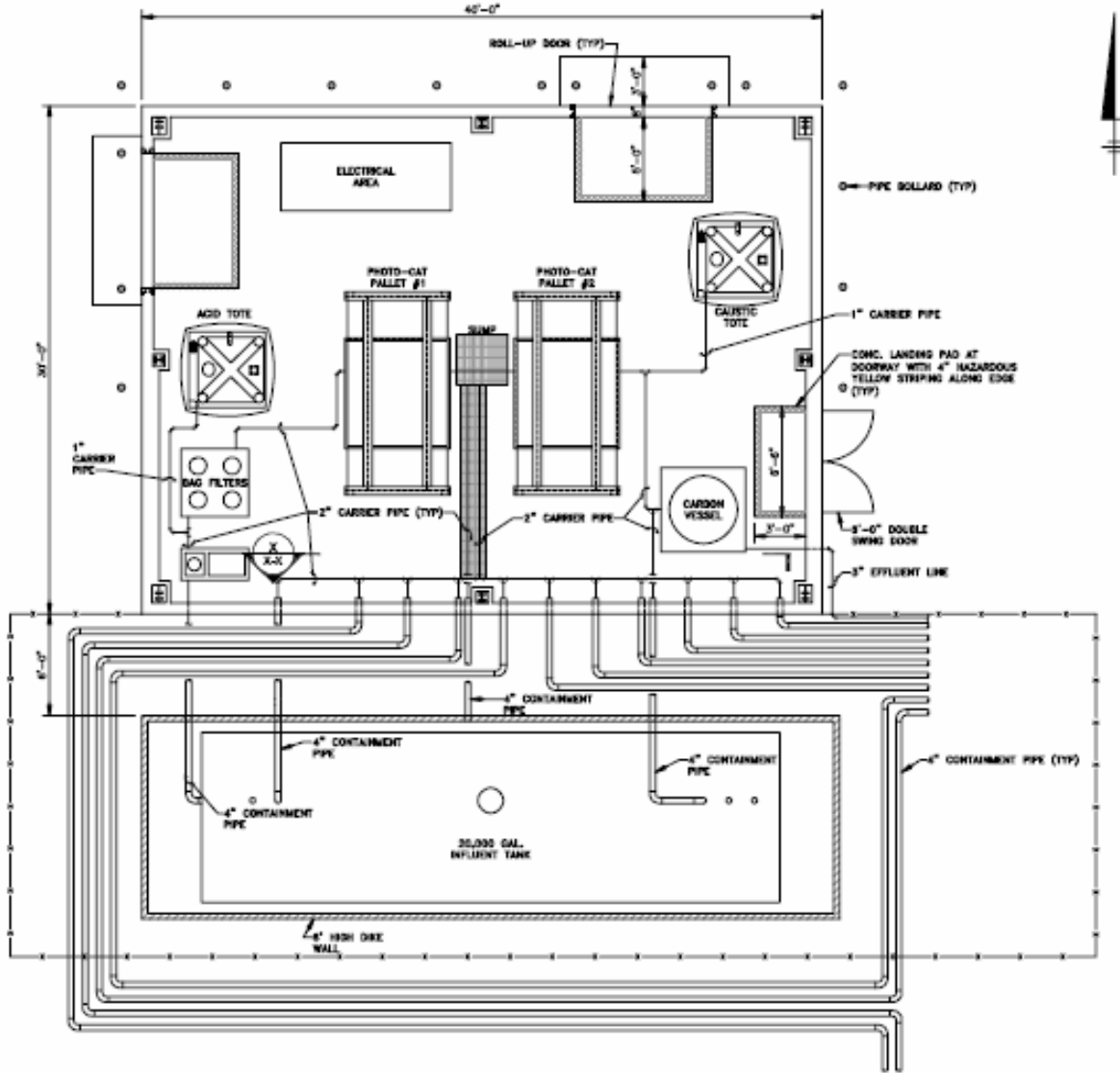
1.8 Glass Hazard

The Photo-Cat[®] reactor utilizes quartz glass within the reactor flow path. On-site spares may also include quartz tube replacements. Handling quartz glass poses a potential cut hazard. Protective equipment must be worn at all times when handling or working near exposed glass. Some maintenance procedures require working within the vicinity of glass.

2 SYSTEM LAYOUT

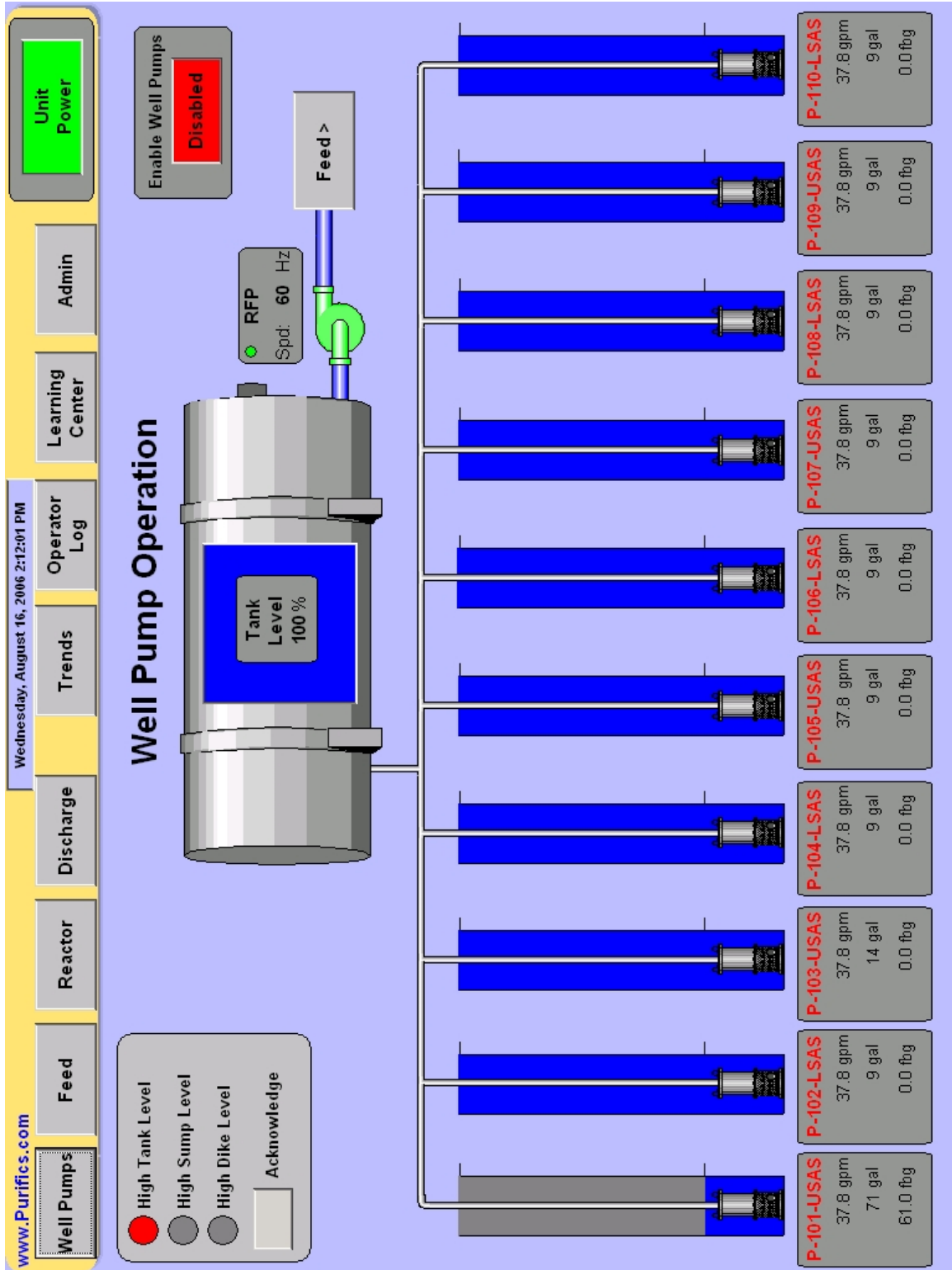
This section provides information regarding the layout of operations in the facility.

2.1 Pictorial Drawing

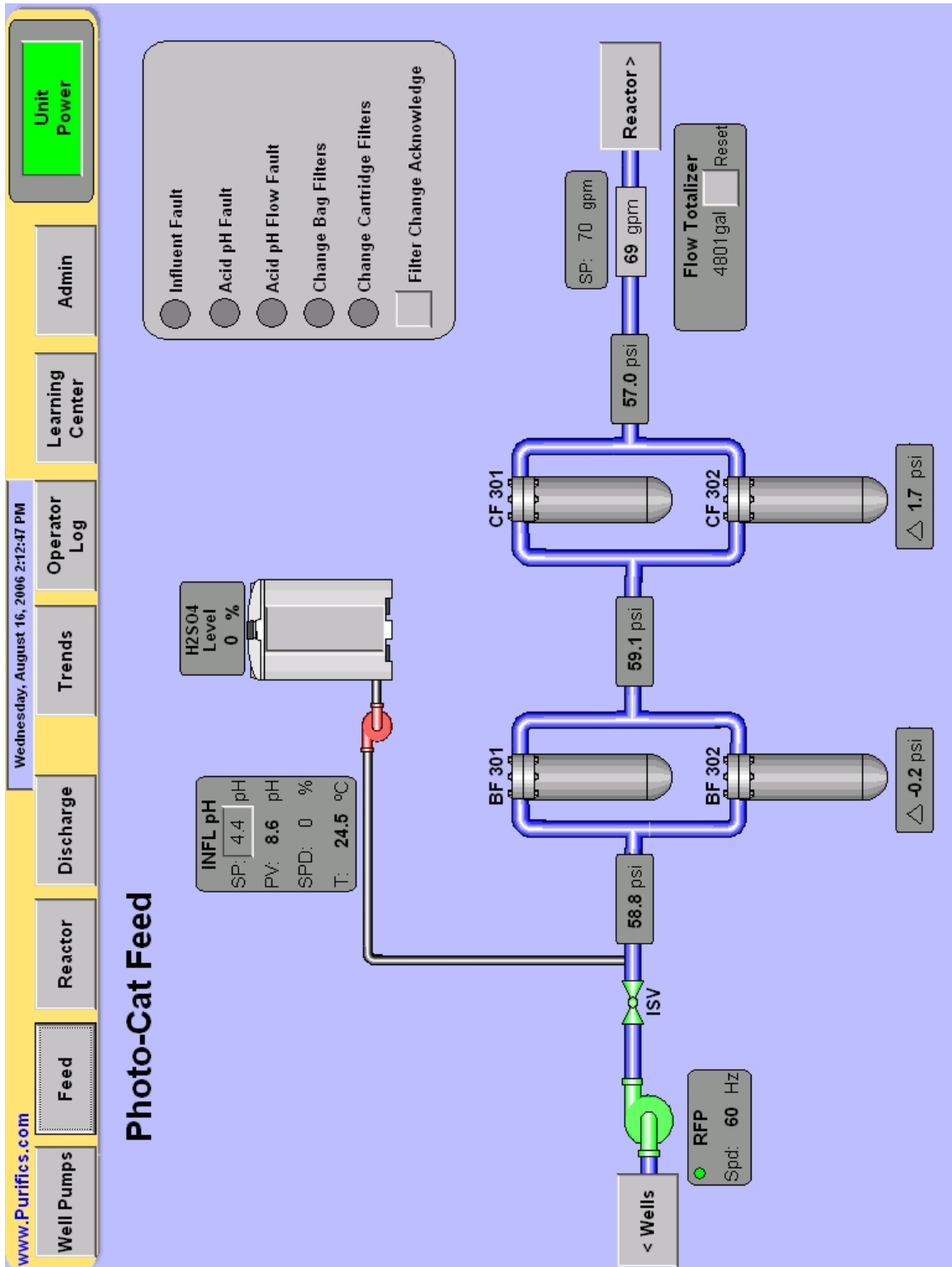


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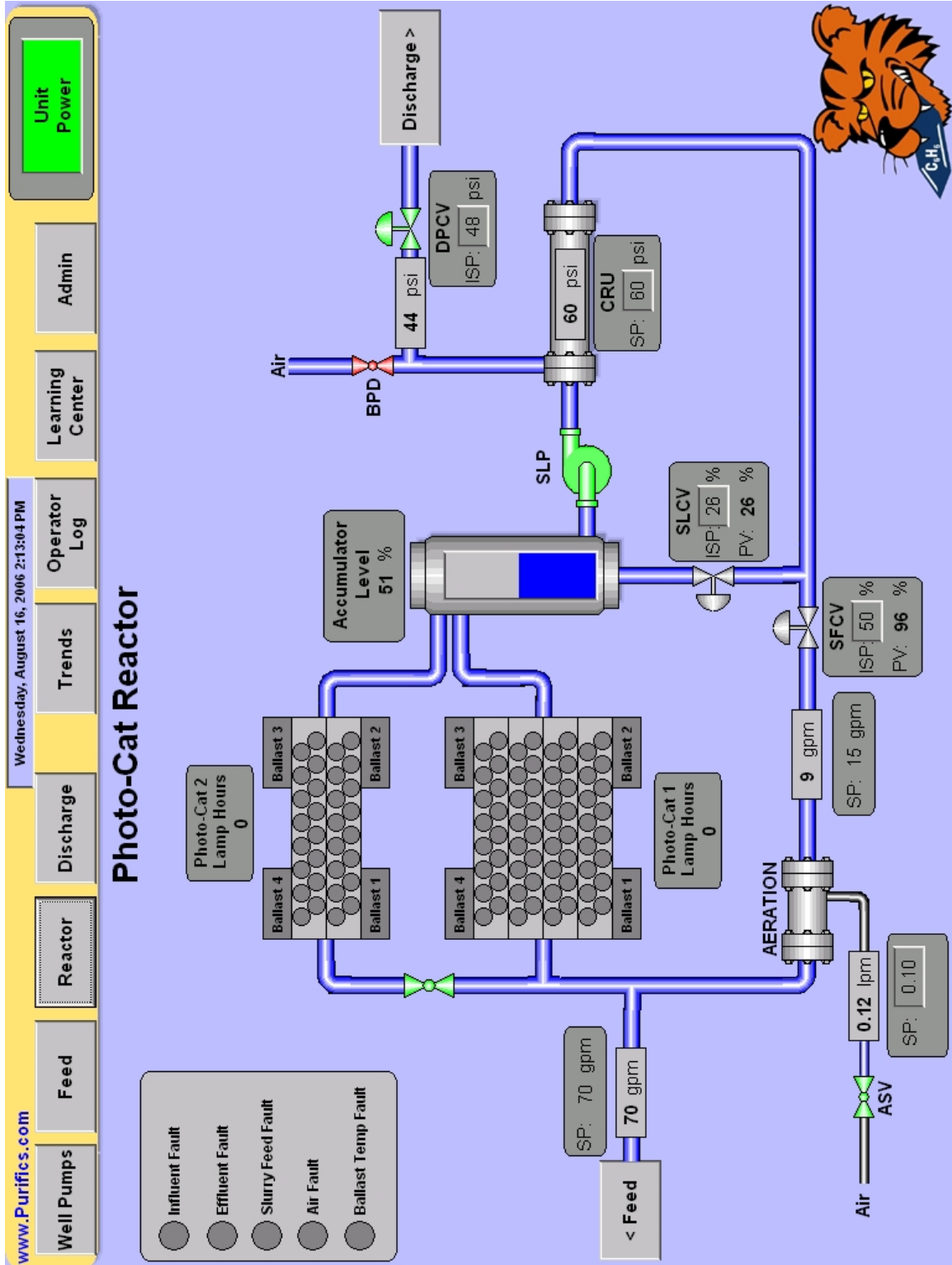
2.2 System Schematic



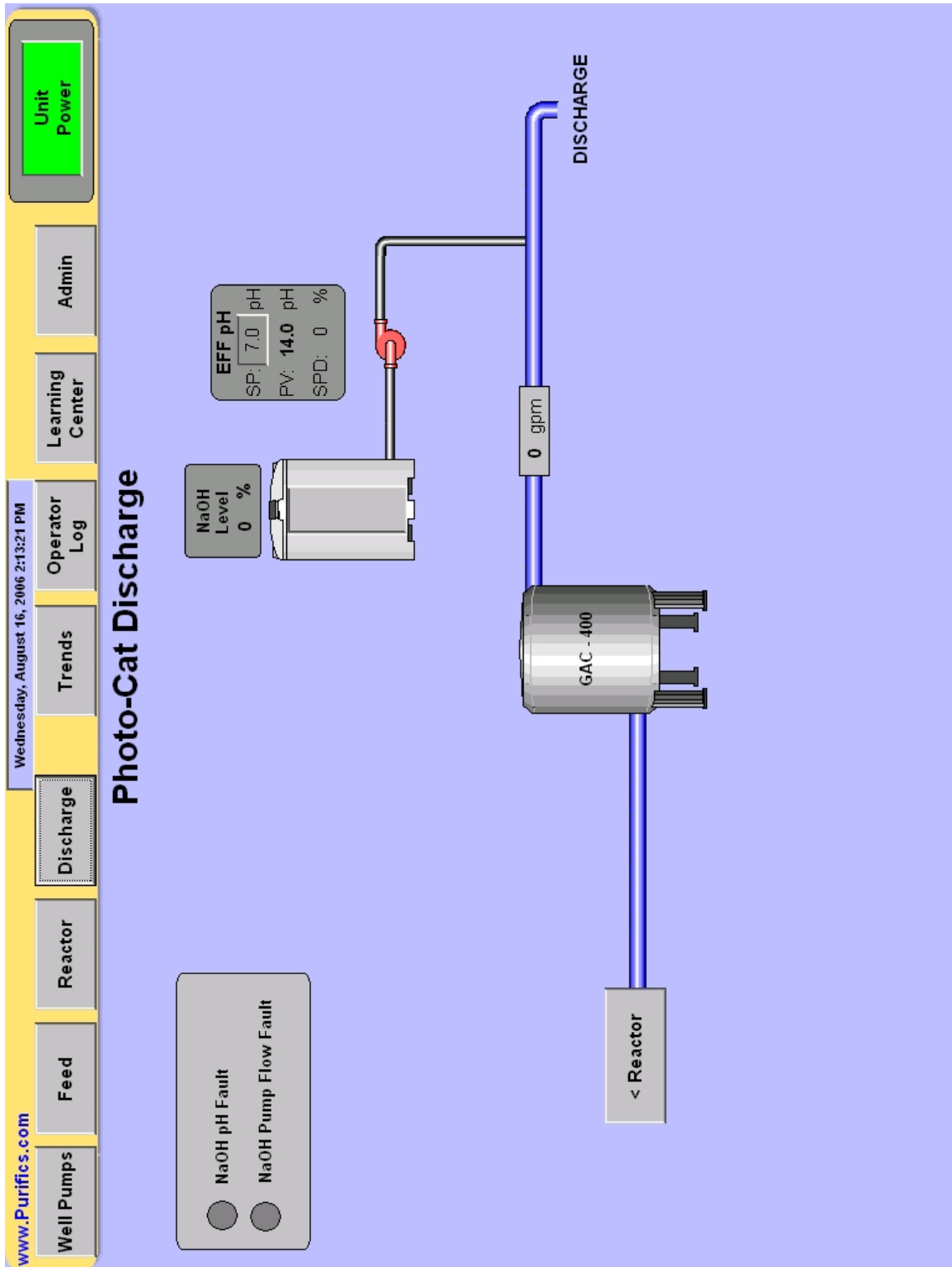
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3 FACTORY ACCEPTANCE TESTING

This section contains the Factory Acceptance Testing checklist. Factory Acceptance Testing is performed at the Purifics® facility prior to shipment of the system. This is an opportunity for the client to run and verify the operation of the system prior to shipment. This is also an opportunity for the client to receive two days of Photo-Cat® training for up to four people. Additional training and World Wide Support is available at the client's cost.

3.1 Factory Acceptance Checklist Summary

Model # 230-0832-070 Serial #: 5P1203

	CHECK	INITIALS
• Leak Test Wetted Components	<input type="checkbox"/>	_____
• Leak Test Air System	<input type="checkbox"/>	_____
• Software Verification	<input type="checkbox"/>	_____
• Performance Verification	<input type="checkbox"/>	_____
• Control Panel Verification	<input type="checkbox"/>	_____

Client Acceptance: _____

Date: _____

Notes: _____

Training Completed: _____ Date: _____

Released for Shipment: _____

Date: _____

3.2 Detailed System Check List

Model # 230-0832-070

Serial #: 5P1203

ELECTRICAL

- Verify grounds – Doors
- Verify voltage _____
- Verify phase currents balanced
- Verify no in-rush faults
- Approval _____
- Verify power ground to all back planes and racks
- Verify in-rush rating matches fusing

CHECK INITIALS DATE

<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		

CABINETS

- Verify each ballast rack drives lamps
- Set cooling thermostat for 25° C
- Verify cooling fan rotation or valve travel & flow direction
- Verify cooling fan rotation & flow direction
- Verify contactors are working when energized
- Verify contactors are sequenced
- Verify system shuts down when turned off by switch
- Verify flow meter calibration
- Verify instrument ground to all level probes
- Verify VFD programming & Profibus operation

<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		

ACCUMULATOR

- Ensure level probe is calibrated prior to initial start-up
- Verify high level cut out ____ %
- Verify low level cut out ____ %
- Verify vent cap is vented sufficiently
- Verify flow reduction at ____ %

<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		

PIPING

- Leak check water
- Leak check air

<input type="checkbox"/>		
<input type="checkbox"/>		

- Verify system will not start without air pressure
- Verify element function

ACIDIFICATION AND NEUTRALIZATION

- Verify power to acid and caustic pump
- Verify voltage to pH transmitters _____
- Verify signal and polarity to metering pump (black to white, white to black)
- Verify static mixer sufficient size for flow rate
- Verify isolation valves
- Verify probes installed properly with Teflon ferrules
- Verify proper output is used on transmitter
- Verify speed output calibrated
- Verify pH probes calibrated
- Verify acidification fault shutdown in ____ min. (____ min. startup & ____ min. low or high by \pm ____ pH)
- Verify neutralization fault shutdown in ____ min. (____ min. startup & ____ min. low or high by \pm ____ pH)

SCADA

- Verify system shut down when turned off by SCADA
- Verify system cannot be activated by SCADA when switch is in off position (Allen-Bradley)
- Verify Tags function
- Verify CRU Δ P cannot exceed 20 psi with setpoints
- Verify correct slurry feed flow setpoint calculated by PLC
- Verify feed flow setpoint + slurry feed flow setpoint = Rack design total
- Verify slurry feed flow setpoint minimum enforced
- Verify remote monitoring
- Verify pcAnywhere connection with all lamps on

4 INSTALLATION

4.1 Tools

The installation and start up of Photo-Cat[®] System requires only basic hand tools and equipment to position the unit such as basic electrical and piping tools.

4.2 Positioning

The initial step of the installation of the Photo-Cat[®] system is to position the unit for easy access and to facilitate the fluid and power connections. A system schematic is shown in Section 2.

4.3 Fluid & Power Connections

After positioning the unit, the fluid and power connections are to be completed as per the drawings of Section 2.3.

- Do not pressurize the system at this time.
- Do not energize the power supply at this time.

4.4 Safety

Read Safety Hazards (Section 1) before powering up the system.

4.5 TiO₂ Addition

Do not add TiO₂ slurry to the unit, as the system is shipped precharged. See section 14.3.9 for the TiO₂ additions and change out procedure.

4.6 PH Control Set-up

The pH probes are shipped with rubber caps filled with buffer to ensure the pH sensors remain saturated. Remove rubber caps and follow pH Sensor/Transmitter Set-up and Calibration Procedure outlined in Section 14.3.10.

5 COMMISSIONING

1. Before initial operation review the checklist in Section 5.1 on the following pages.
2. Before initial operation, ensure that the chemical reservoirs are full, connected, and that the pumps are primed. Refer to the manufacturer's data in Section 19.5 for priming instructions.
 - The acid should be industrial grade Sulphuric Acid (H₂SO₄ - 93%).
 - Caustic should be Sodium Hydroxide (NaOH - 35%).
 - These concentrations are commercially available from chemical vendors.

Note:

There is no requirement for the dilution of chemicals. Do not dilute chemicals. Chemical dilution is a dangerous activity due to heat generation and reactions.

5.1 Photo-Cat® System Check List

Model # 230-0832-070

Serial #: 5P1203

ELECTRICAL	CHECK	INITIALS	DATE
• Verify grounds – Doors	<input type="checkbox"/>	_____	_____
• Verify voltage _____	<input type="checkbox"/>	_____	_____
• Verify phase currents balanced	<input type="checkbox"/>	_____	_____
• Verify no in-rush faults	<input type="checkbox"/>	_____	_____
• Approval _____	<input type="checkbox"/>	_____	_____
• Verify power ground to all back planes and racks	<input type="checkbox"/>	_____	_____
• Verify in-rush rating matches fusing	<input type="checkbox"/>	_____	_____
CABINETS			
• Verify each ballast rack drives lamps	<input type="checkbox"/>	_____	_____
• Set cooling thermostat for 25° C	<input type="checkbox"/>	_____	_____
• Verify cooling fan rotation or valve travel & flow direction	<input type="checkbox"/>	_____	_____
• Verify cooling fan rotation & flow direction	<input type="checkbox"/>	_____	_____
• Verify contactors are working when energized	<input type="checkbox"/>	_____	_____
• Verify contactors are sequenced	<input type="checkbox"/>	_____	_____
• Verify system shuts down when turned off by switch	<input type="checkbox"/>	_____	_____
• Verify flow meter calibration	<input type="checkbox"/>	_____	_____
• Verify instrument ground to all level probes	<input type="checkbox"/>	_____	_____
• Verify VFD programming & Profibus operation	<input type="checkbox"/>	_____	_____
ACCUMULATOR			
• Ensure level probe is calibrated prior to initial start-up	<input type="checkbox"/>	_____	_____
• Verify high level cut out _____ %	<input type="checkbox"/>	_____	_____
• Verify low level cut out _____ %	<input type="checkbox"/>	_____	_____
• Verify vent cap is vented sufficiently	<input type="checkbox"/>	_____	_____
• Verify flow reduction at _____ %	<input type="checkbox"/>	_____	_____
PIPING			
• Leak check water	<input type="checkbox"/>	_____	_____
• Leak check air	<input type="checkbox"/>	_____	_____

Use or disclosure of data contained on this sheet is subject to the restrictions stated by Purifics® on the cover page.

- Verify system will not start without air pressure _____
- Verify element function _____

ACIDIFICATION AND NEUTRALIZATION

- Verify power to acid and caustic pump _____
- Verify voltage to pH transmitters _____ _____
- Verify signal and polarity to metering pump (black to white, white to black) _____
- Verify static mixer sufficient size for flow rate _____
- Verify isolation valves _____
- Verify probes installed properly with Teflon ferrules _____
- Verify proper output is used on transmitter _____
- Verify speed output calibrated _____
- Verify pH probes calibrated _____
- Verify acidification fault shutdown in ___ min. (___ min. startup & ___ min. low or high by ± ___ pH) _____
- Verify neutralization fault shutdown in ___ min. (___ min. startup & ___ min. low or high by ± ___ pH) _____

SCADA

- Verify system shut down when turned off by SCADA _____
- Verify system cannot be activated by SCADA when switch is in off position (Allen-Bradley) _____
- Verify Tags function _____
- Verify CRU ΔP cannot exceed 20 psi with setpoints _____
- Verify correct slurry feed flow setpoint calculated by PLC _____
- Verify feed flow setpoint + slurry feed flow setpoint = Rack design total _____
- Verify slurry feed flow setpoint minimum enforced _____
- Verify remote monitoring _____
- Verify pcAnywhere connection with all lamps on _____

6 EQUIPMENT INVENTORY



Figure 1: Photo-Cat System

6.1 Pumps

6.1.1 Slurry Loop Pump (SLP) (Quantity: 2)

Manufacturer: G&L Pumps
 Model/Order #: Model: SSH
 Cat. #: 4SH1K5B0
 Serial #: 1) F0603112375
 2) F0604034010
 Location: 1) CRU at base of accumulator
 2) Filter Pallet before static mixer and filters
 Purpose/Description:

- Multi-stage, stainless steel.
- 240V/3/60, 3/4HP, 3450RPM TEFC motor.
- Provides discharge pressure.

 Cross-references: For Manufacturer's Data, see Section 19.1.

6.2 Valves

6.2.1 Discharge Pressure Control Valve (DPCV) (Quantity: 1)

Manufacturer: Burkert
 Model/Order #: Cat. #: CD05722
 Type: 2632
 Serial #: 1010
 Location: Catalyst Recovery Unit discharge manifold.

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- Purpose/Description:
- Controls the CRU flowrate to match influent setpoint.
 - Fast closing, slow opening
 - ¾" Piston valve for discharge pressure control, fast closing (on Discharge Manifold).
 - TopControl for PID pressure regulation, mates with Type 2632 (on Discharge Manifold).
- Cross-references: For Manufacturer's Data, see Section 19.2.

6.2.2 Slurry Loop Control Valve (SLCV) (Quantity: 1)

- Manufacturer: Burkert
 Model/Order #: Cat. #: CD05723
 Type: 2731
 Serial #: 16131
 Location: Photo-Cat® Catalyst Recovery Unit slurry loop line.
- Purpose/Description:
- Controls the catalyst slurry loop pressure.
 - Maintains CRU element housing pressure drop in tandem with the DPCV.
 - 1" Diaphragm valve for slurry loop pressure control (on slurry loop line).
 - TopControl for slurry loop pressure control, mates with Type 2031 (on slurry loop line).
- Cross-references: For Manufacturer's Data, see Section 19.2.

6.2.3 Slurry Feed Control Valve (SFCV) (Quantity: 1)

- Manufacturer: Burkert
 Model/Order #: Cat. #: CD05174
 Type: 2731
 Serial #: 16239
 Location: Photo-Cat® Catalyst Recovery Unit slurry feed line.
- Purpose/Description:
- ½" Diaphragm valve for recycle slurry feed flow control (on slurry feed line).
 - TopControl for recycle slurry feed flow control, mates with Type 2031 (on slurry feed line).
 - Controls the catalyst slurry recycle feed to the reactor racks.
- Cross-references: For Manufacturer's Data, see Section 19.2.

6.2.4 Backpulse Device (BPD) (Quantity: 1)

- Manufacturer: Burkert
 Model/Order #: Type 5282
 Location: Photo-Cat® Catalyst Recovery Unit.
- Purpose/Description:
- Controls the CRU element housing dynamic membrane.
 - ¼ in. FNPT, 24VDC
 - ¾ in. Solenoid valve for high frequency use.
 - 2/2-Way
 - 3-Way Pilot Valve

Cross-references: For Manufacturer's Data, see Section 19.2.

6.2.5 Influent Solenoid Valve (ISV) (Quantity: 1)

Manufacturer: Burkert
 Model/Order #: Series 2000
 Location: Photo-Cat[®] reactor influent manifold.
 Purpose/Description:

- Isolates the influent flow.
- Actuator: 1" angle seat piston valve
- 3/2 way solenoid valve Type 6012

 Cross-references: For Manufacturer's Data, see Section 19.2

6.3 Sensors

6.3.1 Slurry Feed Flow Meter (Quantity: 1)

Manufacturer: Burkert
 Model/Order #:

- Transmitter: Cat. #CD04687, Type SE32
- Fitting: #424030Q, Type S030

 Serial #:

- Transmitter: 3576
- Fitting: 1426

 Location: Located on slurry feed line to control the total mass balance in the reactor racks.
 Purpose/Description:

- 4-20 mA analog output to PLC.
- 1" Body
- 8032 Flow Rate Controller

 Cross-references: For Manufacturer's Data, see Section 19.3.

6.3.2 Influent Flow Meter (Quantity: 1)

Manufacturer: Burkert
 Model/Order #:

- Transmitter: Cat. #CD04687, Type SE32
- Fitting: #424033F, Type S030

 Serial #:

- Transmitter: 3578
- Fitting: 1108

 Location: Located on the influent line to control the feed rate in the reactor racks.
 Purpose/Description:

- 4-20 mA analog output to PLC.
- 2" Body
- 8032 Flow Rate Controller

 Cross-references: For Manufacturer's Data, see Section 19.3.

6.3.3 Accumulator Level Sensor (Quantity: 1)

Manufacturer: Endress + Hauser
 Model/Order #: Model: PMC131-C22F1S4N
 Serial #: 7B11DA01052

Location: Installed on Accumulator as a level sensor.
 Purpose/Description:

- Cerabar T Pressure Transducer
- ½” MNPT
- 0-50 in. H₂O.
- 2-wire 4-20 mA signal.

 Cross-references: For Manufacturer’s Data, see Section 19.3.

6.3.4 Pressure Transducer (Quantity: 5)

Manufacturer: Burkert
 Model/Order #: Type: 8311
 Part #: 00444642
 Serial #:

- 1) 1029
- 2) 1038
- 3) 1027
- 4) 1028
- 5) 1042

 Location:

- 1) CRU slurry return
- 2) CRU discharge manifold
- 3) Upstream from bag filters
- 4) Downstream from bag filters
- 5) Downstream from cartridge filters

 Purpose/Description:

- 0-10 bar
- Pressure transducer on discharge manifold.
- Used to measure the pressure drop across a component.
- 4-20mA signal with LCD programmable display

 Cross-references: For Manufacturer’s Data, see Section 19.3.

6.3.5 Air Pressure Sensor (Quantity: 1)

Manufacturer: ASCO
 Model/Order #: JC38A214C
 Serial #: A482422
 Location: Located in the Photo-Cat[®] control cabinet.
 Purpose/Description: Pressure switch measures 75-85 psig on compressed air line.
 Cross-references: For Manufacturer’s Data, see Section 19.3.

6.3.6 Influent Tank Level Sensor (Quantity: 1)

Manufacturer: Endress + Hauser
 Model/Order #: PMC131-C22F1Q4F
 Serial #: 87134601052
 Location: Influent Tank
 Purpose/Description:

- Cerabar T Pressure Transducer
- ½” MNPT
- 0-5psig
- 2-wire 4-20 mA signal

 Cross-references: For Manufacturer’s Data, see Section 19.3.

6.4 PLC, Power Supply, and Other Electronics

6.4.1 Overview

Manufacturer:	Purifics [®]
Serial Number	5P1203
Purpose/Description:	<ul style="list-style-type: none">• One main control cabinet, 240V, 3-phase, mounted on the Photo-Cat[®] reactor.• Main processor Siemens CPU 315-2 DP 128 KB Memory with Profibus DP port.• Main feed pumps controlled by Siemens Micromaster 420 1hp/240V variable frequency drive (VFD) Profibus input signal.• All controls, instruments, and contactors will operate using 24VDC power.• All instrument signals are shielded/twisted pair.• Cabinets are painted steel (NEMA 4).• Instrumentation in SI units.• HMI menu driven (three levels of password protection, operator and supervisor's have defined menus).• One colour display screen dedicated for the feed system, reactor, and discharge system.
Cross-references:	For Manufacturer's Data, see Section 19.4

6.4.2 Control Cabinet

Manufacturer:	Purifics [®]
Model/Order #:	230-0832-070
Serial #:	5P1203
Location:	Between the ballast cabinets on the Photo-Cat [®] reactor pallet

- Purpose/Description:
- All electrical components constructed of UL/CSA approved components and housed in a painted steel NEMA 4 cabinet.
 - The system is powered by a 240V, 3-phase Delta.
 - External control wiring is 24 VDC or 4-20 mA signals.
 - Fused disconnects. The following Siemens PLC hardware:

6EP1 333-2BA00	SITOP POWER 5 Stabilized Power Supply Input: 120/230 VAC Output: 24VDC, 5A, 35mm DIN	3
6ES7 953-8LG11-0AA0	Simatic S7 Micro Memory Card, 3.3V Nflash, for S7300/ET 200S	1
6GK1561-1AA01	CP5611 PCI card for PROFIBUS	1
6ES7 151-7AA11-0AB0	Simatic DP, IM151-7 CPU for ET200S, 64kB Work Memory	1
6ES7 138-4HA00-0AB0	SIMATIC DP, DP Master Interface for IM 151-7 CPU (ET200S)	1
6ES7 151-1AA04-0AB0	SIMATIC DP, Interface Module IM151 FOR ET200S; Profibus DP Slave	2
6ES7 138-4CA01-0AA0	SIMATIC DP, Power Module PM-E for ET 200S	3
6ES7 131-4BD01-0AA0	24V DC with Diagnostics SIMATIC DP, 4 DI Standard for ET 200S	4
6ES7 132-4BD01-0AA0	24V DC with Diagnostics, 15mm SIMATIC DP, 4 DO Standard for ET 200S	10
6ES7 134-4GB01-0AB0	24V DC with Diagnostics, 15mm SIMATIC DP, 2 AI Standard w/ diag. I-2DMU for ET 200S, 15mm	11
6ES7 134-4GB11-0AB0	SIMATIC DP, 2 AI Standard w/ diag. I-4DMU for ET 200S, 15mm	7
6ES7 135-4GB01-0AB0	SIMATIC DP, 2 AO Standard w/ diag. I-2DMU for ET 200S, 15mm	2
6ES7 193-4CE00-0AA0	SIMATIC DP, Terminal Module TM-P 15S22-01for ET 200S Power Module	3
6ES7 193-4CB20-0AA0	SIMATIC DP, Terminal Module TM-E 15S24-01for ET 200S	34
6ES7 972-0BB50-0XA0	SIMATIC DP, 90deg Fastconnect Profibus Connector with PG socket	2
6ES7 972-0BA50-0XA0	SIMATIC DP, 90deg Fastconnect Profibus Connector	2
6SE6400-0BP00-0AA0	Micromaster 4 Basic Operator Panel (BOP)	1
6SE6400-1PB00-0AA0	Micromaster 4 PROFIBUS Module	1
6SE6420-20C25-5CA1	Micromaster 420 Variable Frequency Drive S/N XAU405-001293	1
6AV78220AB201AC0	Simatic Panel PC 577 - 15" touchscreen TFT - 1024 x 768 (40GB HD, 230VAC, P4 2.4 GHz, 1 GB DDR, DVD-ROM, Win XP Pro)	1
6AV6 623-2BA00-0AA0	128 Tag WinCC Flexible SCADA system RT bundle with Panel	
3RT1026-1B	24V Operated Contactors	21
3RH1921-1EA11	24V Operated Auxiliary Contacts	8
3RT1015-1BB41	24V Operated Contactors	10
3RU1116-1GB0	4.5-6.3 Amps Max Contactor Overload	10
3RU-1126-4CB0	17-22 Amps Max Contactor Overload	1

6.4.3 Ballast Cabinets (Quantity: 4 per reactor pallet, 8 Total)

Manufacturer: Purifics®
 Model/Order #: Part: ESN-1120-006
 Location: One on each corner of both reactor pallets
 Purpose/Description:

- NEMA 4 cabinet with Ambient Air Fan Cooling.
- Ballast cabinets are 240V, 3-phase.
- Non-locking doors and no disconnects.

6.4.4 Human Machine Interface (HMI) (Quantity: 1)

Manufacturer: Siemens
 Model/Order #: Simatic Panel PC 577 (6AV7822-0AB20-1AC0)
 Serial #: Ser SVP4006312
 Mod: AUSG/AEND
 Mech: 08
 SV: 07
 GIRBG: C2y
 FW: 15
 Location: Photo-Cat® Right Ballast Cabinet
 Purpose/Description:

- Windows XP Professional.
- Panel PC with CP5611 Profibus DP link to PLC. 2.4 GHz, Pentium IV, 40 GB hard drive, DVD-ROM.

 Cross-references: For Manufacturer's Data, see Sec 19.4

Manufacturer: Siemens, Microsoft
 Model/Order #: SIMATIC WinCC Flexible V1.0 SP1, Windows XP Professional Embedded
 Serial #: Win CC Flexible 2005, 128 Tag RT Lic-No: 00401000038050353358
 Win CC Flexible 2005 Recipes/Archives for RT Lic-No : 0040100003905333496
 Windows Product Key: VQVY3-BKQJB-RXQPP-CJ72F-MKK9Y
 Location: Photo-Cat® Right Ballast Cabinet Touch screen
 Purpose/Description:

- All system operations are performed through the HMI.
- HMI software supplied to monitor and control the system. All programming is complete.
- The HMI also has automated compliance monitoring capability. A 128-tag system is standard and can be upgraded to handle additional tags.
- Software –Windows XP Professional, WinCC Flexible Version 1.0 SP1
- Software equipped with **remote** access for control, data transfer, and compliance monitoring.

Cross-references: For License Data, see Section 16.2.
For Manufacturer's Data, see Section 19.4.

Manufacturer: Symantec
Model/Order #: pcAnywhere Version 11.5
Location: HMI Touch screen
Purpose/Description: Remote connections for support.
Cross-references: For License Data, see Section 16.2.

6.5 Acidification & Neutralization Equipment

6.5.1 General

Purpose/Description: • The system is equipped with 2 pH Control Systems to regulate influent and effluent pH requirements.
• Each acid and caustic feed system is comprised of a pH probe, NEMA 4 rated pH transmitter with LED readout and self diagnostics, PID control by the PLC for precise pH setpoint control, and a 110V diaphragm metering pump for addition of the acid and caustic.

Cross-references: For Manufacturer's Data, see Section 19.5

6.5.2 pH Probe Holder (Quantity: 2)

Manufacturer: Purifics®
Model/Order #: Model: ESN-1250-001-006
Location: pH probe holders mounted on the Photo-Cat® influent and discharge manifolds
Purpose/Description: Holds the probe that measures the liquid pH level.
Cross-references: For Manufacturer's Data, see Section 19.5

6.5.3 pH Probe (Quantity: 2)

Manufacturer: Endress+Hauser
Model/Order #: • Order Code: CPS11D-7BA21
• Material Number: 58019494
Serial #: 8202B905E00, 820F1205E00
Location: Mounted on the static mixer on the filter pallet, and the discharge manifold
Purpose/Description: The probe measures the pH level.
Cross-references: For Manufacturer's Data, see Section 19.5.

6.5.4 pH Probe Cable (Quantity: 2)

Manufacturer: Endress+Hauser

Model/Order #: Order Code: CYK10-A051
 Location: Between pH probes and transmitters.
 Purpose/Description: Connects pH probes to transmitters.
 Cross-references: For Manufacturer's Data, see Section 19.5

6.5.5 Influent pH Transmitter (Quantity: 1)

Manufacturer: Endress+Hauser
 Model/Order #: Liquisys M, Order Code: CPM223-MR2105
 Serial #: 840C3B05G00
 Location: Mounted on Filter Pallet control cabinet.
 Purpose/Description:

- Designed to digitize the output of a pH probe with a glass electrode.
- 230V AC power supply.
- Outputs pH, HART®, and temperature as 0/4-20mA signal.

 Cross-references: For Manufacturer's Data, see Section 19.5.

6.5.6 Discharge pH Transmitter (Quantity: 1)

Manufacturer: Endress+Hauser
 Model/Order #: Liquisys M, Order Code: CPM253-MR3010
 Serial #: 850F2405G00
 Location: Mounted on facility wall near discharge manifold
 Purpose/Description:

- Designed to digitize the output of a pH probe with a glass electrode.
- 230V AC power supply.
- Outputs pH, HART®, and temperature as 0/4-20mA signal.

 Cross-references: For Manufacturer's Data, see Section 19.5.

6.5.7 Caustic Container Influent Pump (Quantity: 1)

Manufacturer: Graco
 Model/Order #: D52966
 Serial #: 17C06D
 Location: Front of caustic overflow container
 Purpose/Description:

- To pump caustic from drum into caustic container
- Husky 515 Polypropylene Pump
- Max Temperature 66 °C

 Cross-references: For Manufacturer's Data, see Section 19.5.

6.5.8 Acid Container Influent Pump (Quantity: 1)

Manufacturer: Graco
 Model/Order #: D55A11
 Serial #: 16B06D
 Location: Front of acid overflow container

- Purpose/Description:
 - To pump acid from drum into acid container
 - Husky 515 Kynar NPT Pump
 - Max Temperature 107 °C
- Cross-references: For Manufacturer's Data, see Section 19.5.

6.5.9 Caustic Dosing Pump (Quantity: 1)

- Manufacturer: Grundfos
Model/Order #: Type: DME2-18 A-PP/E/C-F-21RRB
Model: C96470128P305420028
- Location: Front of caustic overflow container
- Purpose/Description: To pump caustic into system for pH adjustment
- Cross-references: For Manufacturer's Data, see Section 19.5.

6.5.10 Acid Dosing Pump (Quantity: 1)

- Manufacturer: Grundfos
Model/Order #: Type: DME8-10 A-PV/V/C-F-21RRB
Model: B96470217P305250218
- Location: Front of acid overflow container
- Purpose/Description: To pump acid into system for pH adjustment
- Cross-references: For Manufacturer's Data, see Section 19.5.

6.5.11 Sulphuric Acid/Caustic Level Sensor (Quantity: 2)

- Manufacturer: Endress & Hauser
Model/Order #: FMU231A-NA21
Serial #: 86020C01097 (Acid), 86020B01097 (Caustic)
- Location: Located on top of the Sulphuric Acid and Caustic containers
- Purpose/Description:
 - Prosonic T Ultrasonic Level Measurement Device
 - Measures levels of Sulfuric Acid and Caustic
- Cross-references: For Manufacturer's Data, see Section 19.5.

6.6 Oxidant Equipment

6.6.1 Aeration System – Diffusion Module (Quantity: 1)

- Manufacturer: Purifics
Model/Order #: ESN 1640-010
- Location: Optional snap-in on slurry feed line
- Purpose/Description: Diffusion of compressed air for stoichiometric oxygen needs
- Cross-references: DWG P4A-333

6.6.2 Aeration System – Mass Flow Controller (Quantity: 1)

- Manufacturer: Burkert
Model/Order #: 167830V 8712
Serial #: 1007
- Location: Mounted inside the control cabinet

- Purpose/Description: • Regulation of stoichiometric oxygen
• 0-2 l/min compressed air @100 psi
- Cross-references: For Manufacturer's Data, see Section 19.6

6.7 Auxiliary Equipment

6.7.1 TiO₂ Catalyst

- Manufacturer: Degussa
Model/Order #: P25
Purpose/Description: • 2 kg supply (\cong 20 L/vol).
• Sufficient quantity for 20 years at an annual replacement rate.
- Cross-references: See MSDS accompanying TiO₂ Catalyst Container

6.7.2 Instrument Air Filter (Quantity: 1)

- Manufacturer: Norgren
Model/Order #: F07-200-A1TA
Serial #: N/A
Location: Discharge Manifold air inlet tee
Purpose/Description: • Particulate, oil, and condensate removal
• Automatic purge
- Cross-references: For Manufacturer's Data, see Section 19.7

6.7.3 Bag Filter Housing (Quantity: 2)

- Manufacturer: Fil-Trek
Model/Order #: S6EB112-2P-VB
Serial #: V-3094
Location: Influent feed line on Filter Pallet
Purpose/Description: 1 micron nominal bag filters
- Cross-references: For Manufacturer's Data, see Section 19.7

6.7.4 Cartridge Filter Housing (Quantity: 2)

- Manufacturer: Fil-Trek
Model/Order #: S6EF7-4-2P-VB
Serial #: V-3093
Location: Influent feed line on Filter Pallet
Purpose/Description: • 10 micron ABS particulate filtration
• Type R4F100 cartridge filters
• MAP 150psi @ 250°F
- Cross-references: For Manufacturer's Data, see Section 19.7

7 SUPPLY INVENTORY REQUIREMENTS

The supply inventory requirement is a list of maintenance and repair supplies required to ensure continued operation without unreasonable delays.

For spares inventory cost and purchase sheet, see Section 7.2 on page 32 and Section 0 on page 32 respectively.

7.1 Recommended Spares Inventory

The following is the recommended spares inventory:

Order Code	Description	Qty
1280-001	Quartz Glass Tubes	1 box
1190-001	Lamps	1 box
1110-004-001	Ballasts	2
#ATDR-10	10A Fuses (Ballast)	10 pcs
#ATDR-15	15A Fuses (Control Equipment Circuit)	3 pcs
#ATQR-30	30A Fuses (Contactors)	10 pcs
#AJT-100	100A Fuses (Filter Pallet Main Power)	3 pcs
#AJT-200	200A Fuses (Photo-Cat [®] Main Power)	3 pcs
6EP1 333-2BA01	24VDC Supply	1 pcs
6ES7134-4GB01-0AB0	2 Wire Analog Input Card	1 pcs
6ES7134-4GB11-0AB0	4 Wire Analog Input Card	1 pcs
6ES7135-4GB01-0AB0	Analog Output Card	1 pcs
6ES7131-4BBO1-0AA0	Digital Input Card	1 pcs
6ES7132-4BBO1-0AB0	Digital Output Card	1 pcs
423914E	Burkert Hall Sensor for Flow Meter	1 pcs
130428U	Burkert 4-20mA Transmitter for Flow Meter	1 pcs
1250-001-001	pH Probe	1 pcs
1320-004-002	Pressure Transducer (Photo-Cat [®] CRU)	1 pcs
1320-006-002	Photo-Cat [®] DPCV	1 pcs
1320-006-001	Photo-Cat [®] SLCV	1 pcs

7.2 Spare Parts Price List

SPARE PARTS PRICE LIST

Description	ESN#	Lot Size	USD Price
UV Lamps	1190-001-001	1	86.80
		30	1278.30
Quartz Tube	1280-001	1	75.00
		24	1017.40
Stainless Seal Plug	1310-001-001	1	60.90
O-Ring: Seal Plug	1310-001-007	1	1.50
O-Ring: Tube Seal	1310-001-006	1	1.50
O-Ring: Quartz	1310-001-005	1	1.50
Seal Plug Puller	1600-010	1	499.00
Lamp Cable Harness - Transparent	1210-002	1	156.00
Ballast Cable Harness	1210-003	1	104.40
Standard Ballast	1110-004-001	1 to 3	260.00
		4 to 11	173.10
		12	1282.70
High Efficiency Ballast		1	277.60
Catalyst (5 kg)	1130-001	1	173.10
pH Probe Sensor	1250-001-001	1	308.70
CRU Element	1320-005-001	1	921.50
Bag Filters, 1um 32" (Box 100)	1160-001-001	1	655.70
Cartridge Filters 10um	1160-002-001	1 to 9	136.00
		10 >	110.00
		100 >	98.00
pH (0-14) Indicator Sticks	1185-001	1	43.50
Manuals	1620-010	1	369.60
PD Pump Repair Kit	1270-002-007	1	159.40
Ballast Rack Fuses (ATQR-I0A)	1120-002-002	1	15.40
Lamp Contactor Fuses (ATQR-30A)	1120-002-003	1	15.40
Control and Motor Circuit fuses (ATDR-15)	1120-002-004	1	15.40
Pressure Sensor	1320-020-002	1	362.90
Backpulse Valve - 3-19 Element Housing	1320-020-003	1	409.30

Prices Effective to August 2006. FOB London: tax & duty extra - Revised 31/10/05

Use or disclosure of data contained on this sheet is subject to the restrictions stated by Purifics® on the cover page.

7.3 Spare Parts Order Form

SPARE PARTS ORDER FORM			<i>Date:</i>		
			<i>Purchaser:</i>		
			<i>Project #:</i> 5P1203		
			SPARES ORDER #:		
VENDOR			SHIP TO		
Purifics ES Inc.					
340 Sovereign Road					
London, Ontario, Canada N6M 1A8					
Tel: (519) 473-5788 Fax: (519) 473-0934					
Email: techsupport@purifics.com					
Attn: Purchasing					
ITEM	QTY	PART NO.	DESCRIPTION	UNIT PRICE	TOTAL
				TOTAL CURRENCY	

Terms of Payment	
	Cheque - Net 30 Days
	Cash
	Credit Card
	Money Order

Shipping Date and Company Requested

NOTE:
For current pricing or quotes, please contact Purifics.

APPROVAL GIVEN BY: (Signature Please)

Note: Freight, Insurance, Customs & Duty extra.

8 ASSEMBLY DRAWING LIST

This section provides a list and copy of assembly drawings.

Drawings:

P6S-1295 PHOTO-CAT OUTLINE AND INTERFACE DRAWING

P6A-404 FILTER SKID INLET MANIFOLD

P6A-405 PHOTO-CAT DDL REACTOR MANIFOLDS

P6A-407 2.5" pH CONTROL DISCHARGE MANIFOLD

P6A-408 2" PHOTO-CAT INLET MANIFOLD

P6A-402 19 ELEMENT CRU PIPING AND INTERFACE DRAWING

P6A-406 1.5" DISCHARGE MANIFOLD

9 TRAINING REQUIREMENTS

Recommended training related to the operation, maintenance, and repair of the Purifics® ES Inc. system is included in the training requirements section. This training is intended to familiarize personnel with the equipment—It does not grant personnel any form of qualification nor certification. Purifics recommends that all personnel be fully trained as proper maintenance operations affect the warranty provided for the installed equipment.

9.1 Point of Contact for System Training:

Purifics® ES Inc.
340 Sovereign Road
London, Ontario, Canada N6M 1A8
Tel: (519) 473-5788
Fax: (519) 473-0934
Email: techsupport@purifics.com
Website: www.purifics.com

9.2 Training Materials

Training materials include handouts (provided at the end of this section) and a PowerPoint presentation on CD. Remote instruction is also available via Purifics World Wide Support (WWS).

9.3 Modes of Training

Four modes of training are available:

- Factory Acceptance
Purifics provides training in the factory setting where the equipment is manufactured.
- On-Site Training Program
Purifics provides training at the client facility.
- Remote/Interactive/Real Time Training
Purifics provides training remotely as part of the World Wide Support program by using the remote monitoring capabilities of the SCADA software and a telephone.
- Self Taught via Sections 11, 12, 13 & 14.

9.4 Training Program

The Photo-Cat® Training program is provided as a PowerPoint presentation on the OMSI Manual CD. Those individuals who will be attending a training session should review this OMSI manual, training program handouts, and the website “www.purifics.com” prior to the training program. This review will help to familiarize the attendee with the process and equipment, and provide a solid base before the training.

Figure 2 below is the Photo-Cat Training program agenda slide, providing an overview of the topics covered in the training program.

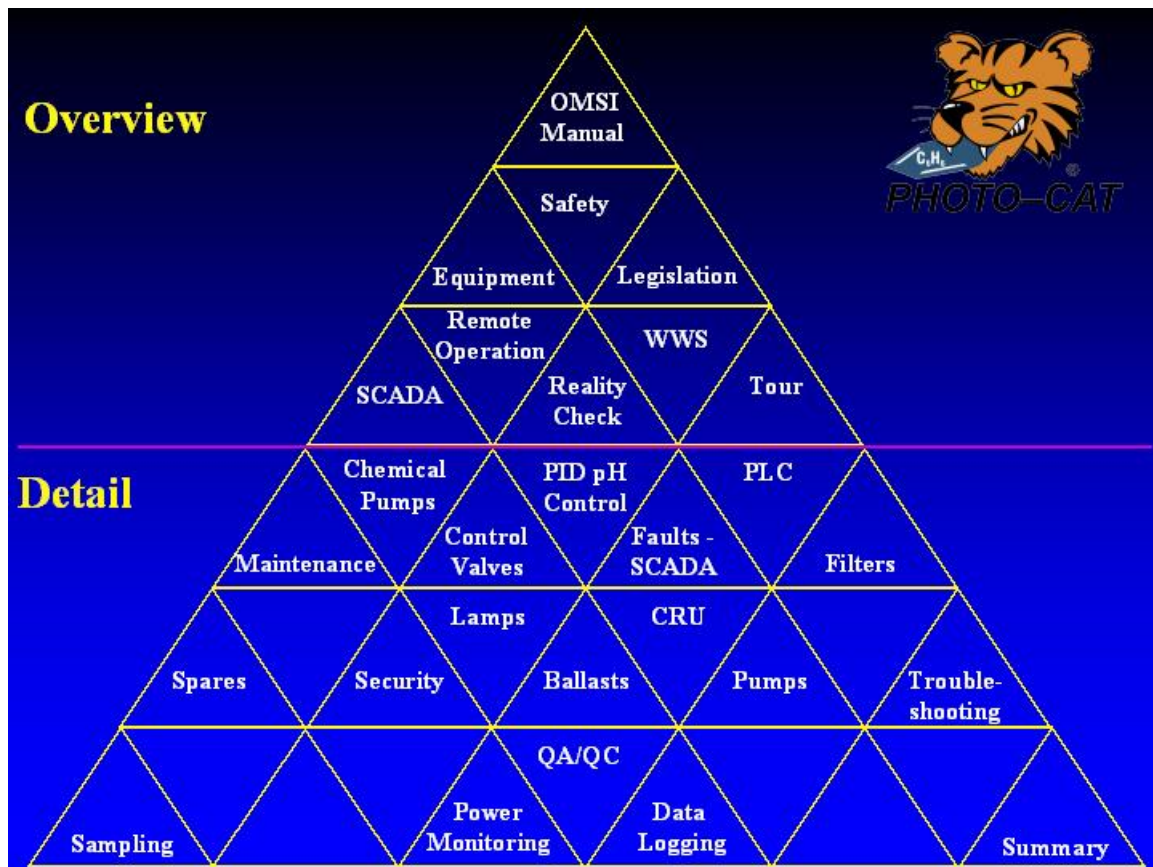


Figure 2: Training Program Agenda

To print handouts for the presentation, open the PowerPoint file entitled “Photo-Cat Training Program” and use the printing instructions listed below. One copy should be printed for each attendee and distributed prior to the formal training session.

For printing presentation handouts, print the title page first as a full page, followed by all other slides as handouts.

To Print the Title Page:

- Print range = Slides, 1
- Print what = Slides
- Number of copies = # attendees
- Check the “Collate” box
- Check the “Pure black & white” box

To Print Remaining slides:

- Print range = All
- Print what = Handouts
- Handouts – Slides per page = 3
- Number of copies = # attendees
- Check the “Collate” box
- Check the “Pure black & white” box

Printing the slides as handouts creates a column for notes beside each slide. This will help the attendee to follow along with the presentation, and make notes on any items that require particular attention. This will also give each attendee a hard copy of the entire presentation.

10 GLOSSARY

The level of organic contaminants in water can be measured by several different parameters and chemical tests. Similarly, there are important differences between destruction, removal and purification when it deals with water treatment. Consequently, confusion between these terms sometimes leads to a misunderstanding when evaluating the merits or cost benefits of various treatment systems. Therefore, a working knowledge of the following terms is important.

10.1 Total Organic Carbon (TOC)

TOC is a measure of all the organic contaminants in the fluid (both dissolved and solid). In loose terms it is the sum of all specific individual contaminants that are organic. When you are removing TOC you are purifying the water and generally reducing the toxicity of the water. If all the TOC is removed, then the water is free of all toxic organics.

10.2 Biochemical Oxygen Demand (BOD)

BOD measures the amount of oxygen that is depleted by the biochemical constituents in a water sample (usually measured in a five-day test called BOD₅). This test is important for discharges of process effluents in order to evaluate the degree of oxygen that the effluent will deplete in the receiving water body.

The BOD can be negligible in a sample yet the TOC levels can still be several hundred parts per million.

10.3 Dissolved Oxygen (DO)

DO is a measurement of the dissolved oxygen in the water. Factors that affect the level of DO are temperature and pressure. The maximum DO level at standard temperature and pressures is approximately 50 mg/L. DO is very important to the Photo-Cat[®] system as it is essential to maintain oxidation and mineralization. For large DO requirements, other forms of oxygen with increased solubilities can be added, such as hydrogen peroxide.

10.4 Specific Contaminant Concentration

The concentration of a specific compound is typically measured in parts per million, or parts per billion.

It is possible to reduce the concentration of a specific contaminant without altering the TOC or BOD levels.

Units

1 ppm = 1 mg/L

1 ppb = 1 ug/L

1 ppt = 1 ng/L

1% = 10g/L = 10,000 mg/L = 10,000 ppm

1,000 L = 1 m³ = 264 US Gal

10.5 Turbidity / UV Absorbance

Turbidity relates to a solution containing solid particulates / species. The particulates scatter light in the solution, creating a milky or 'turbid' appearance. Turbid solutions will absorb UV light, making them virtually untreatable by photolysis type technologies unless drastic pre-treatment is performed (such as reverse osmosis) to reduce the turbidity.

The turbidity levels and UV absorbance level has no impact on the Photo-Cat[®]'s performance. Concentrated dye from a nanofiltration process as well as turbid condensate has been effectively treated directly with the Photo-Cat[®]. This allows for much simpler treatment trains and lower O&M costs.

10.6 Catalyst

Catalysts are materials that increase the rate of a process without themselves being consumed. As well, catalysts can decrease the energy required for the process.

10.7 Titanium Dioxide

Titanium Dioxide (TiO₂) is the catalyst utilized in the Photo-Cat[®] process. TiO₂ is a semiconductor that readily adsorbs low energy UV light. TiO₂ is a true catalyst, as it increases the rates of destruction, lowers the activation energy of the contaminant destruction, and it is not consumed in the process. TiO₂ is continually circulated within the Photo-Cat[®] process.

10.8 Additives

In order to sustain photocatalytic oxidation, dissolved oxygen must be provided to the Photo-Cat[®] process. Oxygen can be added directly through this aerating technology, or else can be added in the form of hydrogen peroxide (H₂O₂). Oxygen and H₂O₂ are referred to as "Additives" because they are consumed in the Photo-Cat[®] process. Other additives can be used which will involve photocatalytic reduction (as opposed to oxidation). This

treatment approach is used for heavy metal removal and destruction of refractive organic contaminants.

10.9 HMI

Human Machine Interface. Sometime referred to as a SCADA. It is essentially the operator control system which consist of the touch screen computer

10.10 SCADA

System Control and Data Acquisition. Sometime referred to as an HMI. It is essentially the operator control system which consists of the touch screen computer.

11 PRINCIPLES OF OPERATION

This section provides background material required for proper understanding of the installed facility by presenting the theoretical basis for its unit operations. Each unit is discussed separately with special emphasis on the means by which it functions.

11.1 Photocatalysis

Photocatalytic oxidation and reduction is a flexible remediation technology that destroys organic pollutants in water at ambient temperatures. The technology utilizes an illuminated or light activated titanium dioxide (TiO_2) catalyst. The treatment process functions in a manner similar to other catalyst processes such as the catalytic converter on automobiles. The major difference (in TiO_2 photocatalytic oxidation) is that the TiO_2 catalyst uses light energy for activation of the catalyst rather than heat energy, as is the case with conventional catalyst technologies. Essentially, the only input to the photocatalytic technology is electric power required to produce light.

Unlike photolytic technologies, H_2O_2 or O_3 is not required to generate hydroxyl radicals. Photolytic technologies such as UV- H_2O_2 generate hydroxyl radicals by cleaving the peroxide molecule: $\text{H}_2\text{O}_2 + \text{UV} \rightarrow 2\bullet\text{OH}$ (75% of which recombine to form H_2O_2).

In the Photo-Cat[®] process, ultraviolet light activates a slurry catalyst as opposed to cleaving chemical bonds. The UV light photo-generates electrons into the conduction band of the catalyst semiconductor and positive "holes" at the surface of the TiO_2 . Electron accepting species (i.e. O_2) are reduced by reacting with the electrons in the conduction band, while either adsorbed water molecules or hydroxyl ions are oxidized at the corresponding hole. The result of the two reduction/oxidation reactions is the production of two hydroxyl radicals ($\bullet\text{OH}$). The hydroxyl radicals, which are very strong oxidizing agents, rapidly break down and mineralise the organic molecules into CO_2 , water, and halide ions (if the organic molecule is halogenated). Two hydroxyl radicals are generated per photon of light, as shown below in Figure 3.

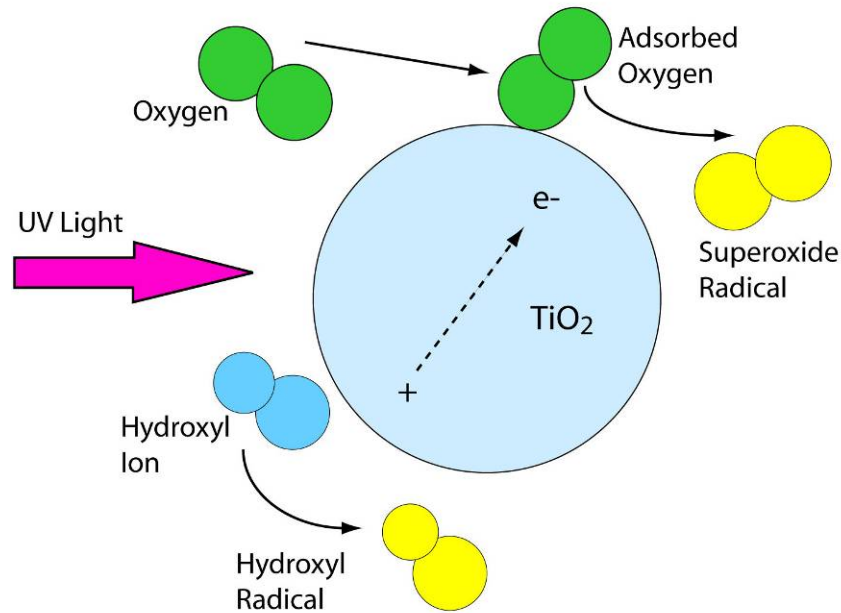


Figure 3: Aqueous Phase Photochemistry

11.2 Controls

The SCADA system is the heart of the control network from the operator's perspective. The SCADA is a machine interface system for all system functions, including process setpoints, operation, and monitoring functions. This is the first point of contact for the operator. All automated PLC controls are supervised from the SCADA.

The central PLC (located in the Photo-Cat[®] reactor control cabinet) commands and controls the site instrumentation and equipment. The PLC in turn is managed from a system control and data acquisition system (SCADA). The SCADA software provides operators with a human machine interface (HMI) for monitoring and control on an integrated touchscreen panel PC (PC) located at the site. The PC runs SCADA software as well as a remote communications package. The remote communications package enables password-protected remote control of the SCADA, typically over a telephone line. With this remote service, Purifics[®] ES Inc. provides its World Wide Support (see Section 17 beginning on Page 105).

12 OPERATING INSTRUCTIONS

This section provides information for bringing the system to operational state, maintaining normal operations, bringing the system offline, and responding to upset conditions. The system operation is discussed from a systems perspective providing a background to operations for each process unit.

12.1 Facility Operation

Operation of the facility is performed through the System Control and Data Acquisition (SCADA) system. The SCADA system is a human machine interface between the operator the PLC. All process inputs and system monitoring is performed through the SCADA system.

The SCADA software is a PC-based software that permits monitoring, control, data-logging, and trending of key variables.

The SCADA system is comprised of one main SCADA Screen for the Photo-Cat[®] Reactor. This provides operator control over the destruction of contaminants collected from the feed system.

Detailed operating procedures for the facility are provided in Section 12.5 starting on Page 47.

12.2 Safety Precautions

All of the safety hazards and their respective precautions are discussed in Sections 1.1 – 1.8. All of these sections must be read prior to any operations being performed at the facility.

12.3 Operator Prestart

Prior to starting equipment, the operator should first check the maintenance logs to ensure that the relevant procedures have been properly followed. See Section 12.6 starting on Page 52 and Section 13.1 starting on Page 57.

12.4 Start-up, Shutdown, and Post Shutdown Procedures

12.4.1 Start-up

All systems are operated through the SCADA. To start up any individual system, ensure that the “Global Enable” pushbutton on the status bar is set to on (it will be green when on). Enter the appropriate operator setpoints for equipment operation and click on the equipment “Activation” or “On/Off” pushbutton for the corresponding equipment. See Section 12.5 for specific operating procedures. Start the system by pushing the “Global Enable” pushbutton.

12.4.2 Shutdown

All equipment may be shutdown with the appropriate “Activation” or “On/Off” pushbuttons located on the equipment SCADA screen. The facility may be globally shutdown by clicking on the “Global Enable” pushbutton on the status bar of all SCADA screens. Opening the main disconnect at Photo-Cat[®] reactor or the main facility disconnect will also shut down the system if the SCADA computer is unavailable.

12.4.3 Post Shutdown

If the system is shutdown for a long period of time then measures must be taken to prevent freezing in the Photo-Cat[®] reactor. To this end the operator must ensure that the building is heated during the winter, as the reactor will contain sealed water.

12.5 Normal Operations

All operations of the facility are performed through the System Control and Data Acquisition (SCADA) system. The SCADA system is a human machine interface between the operator and the PLC. All process inputs and system monitoring is performed through the SCADA system. The equipment is not configured to run manually (i.e., without the SCADA system).

Referring to the key SCADA screens, the following sections describe normal operations of the entire facility. The SCADA uses animation, text, and colour to convey the operational state of the facility. Each screen provides a status bar that is resident in all SCADA screens. The status bar displays a “Global Shutdown” pushbutton for the entire facility and navigation buttons for the facility screens. The mouse is used to navigate to these screens by clicking on the labelled buttons.

12.5.1.1 Well Pumps

The well pumps are automatically started by the PLC when the well levels are high enough to support pumping. If the inlet tank reaches its high level the pumps will be automatically stopped until the inlet tank reaches its nominal operating level. The pumps will be green when active, and red when stopped.

12.5.1.2 Acid Injection System

The acid injection pH setpoint (SP) may be configured by the operator. The measured process value (PV) is displayed above the setpoint. The current pump speed is shown above the pH status box. The pump will be green when running and red when stopped.

12.5.1.3 Reactor Feed Pump (RFP)

The pump is automatically controlled to maintain the operator selected flow setpoint. The measured flow rate and pump speed are displayed on screen. The pump will stop if the inlet tank reaches a low level, or if the reactor accumulator reaches a high level. If the inlet tank reaches a low level then the flow setpoint may be too high for the wells. The operator should adjust the system flowrate to compensate for this situation.

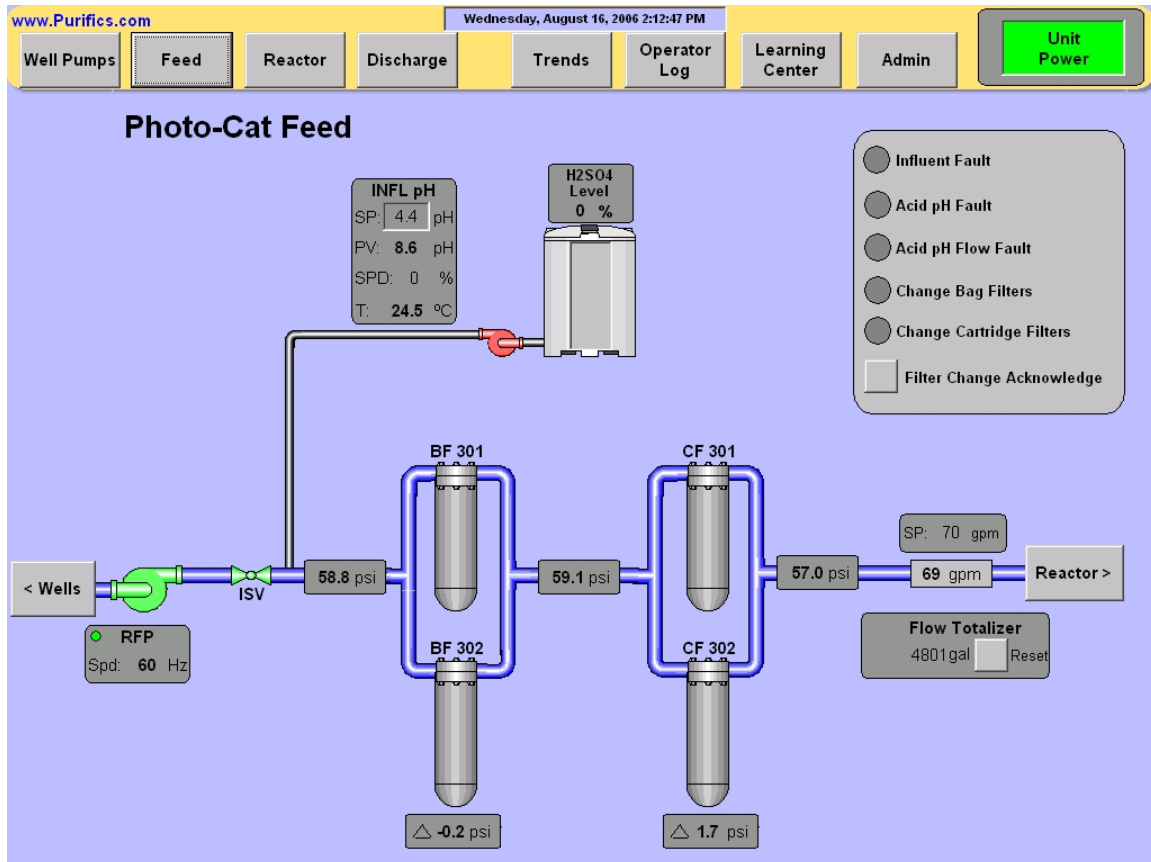


Figure 4: Inlet System Screen

12.5.2 Photo-Cat[®] Reactor

The Photo-Cat[®] reactor consists of an influent flow meter, photocatalytic racks, accumulator, accumulator level sensor, slurry loop pump (SLP), element housing, backpressure sensor, discharge pressure control valve (DPCV), slurry loop pressure sensor, slurry loop control valve (SLCV), slurry feed control valve (SFCV), and slurry feed flowmeter. See Figure 5.

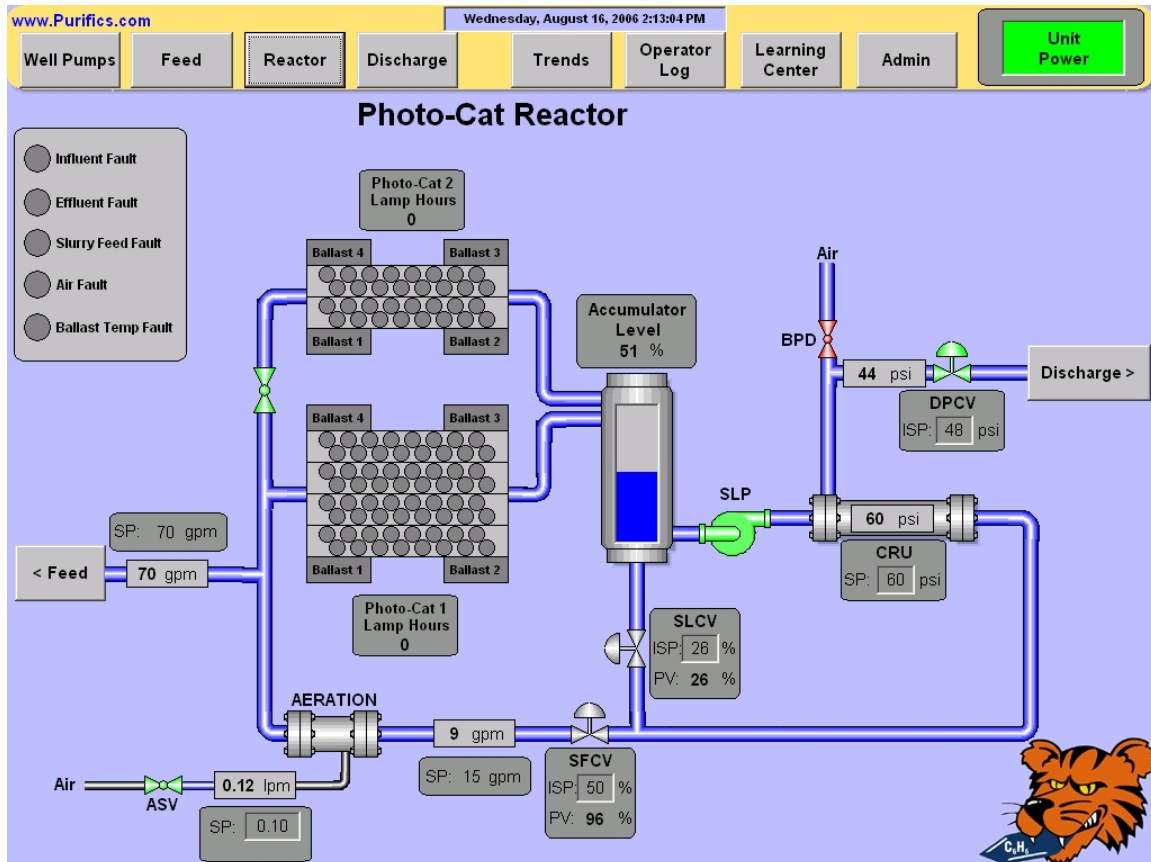


Figure 5: Photo-Cat Reactor

The Reactor screen displays the racks and Catalyst Recovery Unit (CRU) of the Photo-Cat® system. User inputs for this screen include the initial pressure setpoints (i.e., steady-state values), and system flowrate. Key parameters to monitor are accumulator level, lamp hours, CRU pressure and control valve position. The slurry feed flowrate is calculated automatically to maintain a constant flowrate through the racks.

The normal operating range of the accumulator level is between 55% – 75%. If there is frequent steady-state operation outside of this operating region, consult Purifics®.

The fluid temperature should be less than 40°C. If the system exceeds this temperature then vent the building to cool the ambient air temperature.

The reactor system will shutdown on the following faults:

- Loss of air pressure for at least 15 seconds – ensures aeration and valve control,
- High ballast temperature – protects the ballasts/HMI from overtemperature,
- Influent Fault (i.e., Low accumulator level) – protects the SLP from cavitation,

- Effluent Fault (i.e., High accumulator level) – prevents overflow,
- Slurry Feed Flow Fault – ensures adequate catalyst circulation,

12.5.2.1 Accumulator

The accumulator level is managed by both the feed pump and the element housing pressure drop. The nominal operating level of the accumulator is 60% (with a low-nominal range of 55% and a high-nominal range of 75%), a low level of 35-45% and a high level of 86%. The low-low level is set at 35% and the high-high level at 95%.

The pressure drop across the catalyst recovery unit (CRU) is automatically controlled to maintain a discharge flowrate equal to the system influent flowrate. If this becomes unbalanced, a high or low level will occur in the accumulator and a system shutdown will follow.

12.5.2.2 Slurry Loop Pump (SLP)

The slurry loop pump is controlled by digital logic. SLP is started when the accumulator level is nominal. It is stopped if the accumulator reaches a low-low level or if the reactor is shut down from the SCADA.

12.5.2.3 Slurry Loop Control Valve (SLCV)

The slurry loop control valve is automatically controlled to maintain the desired slurry loop pressure in the catalyst recovery unit as set by the operator. The SLCV returns to its initial setpoint (ISP) when the reactor is shut down.

12.5.2.4 Slurry Feed Control Valve (SFCV)

The slurry feed control valve is automatically controlled to maintain a slurry feed flowrate setpoint. The slurry feed control valve returns to its initial setpoint when the reactor is shut down.

12.5.2.5 Discharge Pressure Control Valve (DPCV)

The discharge pressure control valve automatically adjusts the pressure drop across the CRU in order to maintain the desired flowrate through the reactor. Control actions are based on rising or falling accumulator levels. Once each minute the CRU is pulsed with backpressure. This is accomplished by closing the DPCV, briefly opening the backpulse device (BPD), and returning the DPCV to the open position. The DPCV pressure is automatically adjusted with every other backpulse event as needed. The DPCV returns to its initial pressure setpoint when the reactor is shut down.

12.6 Operator Service Requirements

Please review the safety information in Section 1 (beginning on page 1) and Section 12.2 (beginning on page 46) before performing any maintenance on the Photo-Cat[®] system.

12.6.1 Weekly Inspection

On a weekly basis, a walk around inspection of the Photo-Cat[®] equipment should be performed. The following is a list of recommended inspections.

- Check lamp status visually. If there are lamps not working, see Section 14.1.1 on Page 59 for troubleshooting procedures and Section 14.3.2 on Page 68 for installation / replacement procedures.
- Check for leaks or loose fittings.
- Ensure TiO₂ concentration by sampling from the accumulator on the CRU. Compare the sample opacity to the sample concentration jar provided by Purifics[®]. If the sample colour is weak check the troubleshooting section (Section 14.1.1 on Page 59) for action steps.
- Verify that all fluid levels in the chemical reservoirs are sufficient to last until next inspection.
- Verify that the pH of the slurry (i.e. from accumulator) is less than 3.5.
- Measure pH downstream of the probe (possibly at the accumulator). This measurement is necessary due to a possible lag in response to acid.
- Check the status of the influent filter.
- Vent air compressor tank of condensate.
- Make log book entries for any pertinent information or data and fill out scheduled log sheets.

12.6.2 Monthly Service

- Check calibration of pH probes by testing the water and comparing to the probe reading. If calibration is required, see Section 14.3.10.
- Clean cabinet air filters.

12.6.3 Annual Service

- Replace TiO₂. See Section 14.3.9 for proper procedures.
- Test lamps for UV output; replace if necessary. See Section 14.3.2 for proper procedures.
- Inspect and/or replace pump impellers.
- Inspect seals on the Photo-Cat[®] slurry feed control valves (SFCV) and discharge pressure control valves (DPCV). See Figure 22 on Page 81 for valve locations.

12.8 Operating Log

12.8.1 SCADA Log

The SCADA system records data on a continual basis. Process values of interest are maintained as historical data on the SCADA computer for a set period of time. This data can be used to analyse both historical and real-time performance of the system.

12.8.2 Log Book

The Photo-Cat[®] system has a log book that remains with the equipment at all times. It is available for both Purifics[®] staff and system operators to record site conditions and events as they occur. These include but are not limited to maintenance operations (both preventive and repair), facility status and anything else of note.

Every entry in the log book is to be both dated and signed and an index entry created in the index pages provided. The index entry must contain a description of the record as well as the page numbers used for the record.

12.8.4 Weekly Checklist

Photo-Cat On-Site Checklist

Model #: 230-0823-070/ Serial #: 5P1203

Month Of: _____

Year: _____

Date					
Time					
Initials					
Flow [L/min]					
Air Filter					
Ballast Cabinet Filters					
Bag Filter	In [psi]				
	Out[psi]				
Cartridge Filter	In [psi]				
	Out[psi]				
Acid	Influent pH				
	Trend				
	Pump Stroke				
pH Control	Pump Speed				
	Effluent pH				
Caustic	Trend				
	Pump Stroke				
	Pump Speed				
pH Probe Calibration					
CRU Pressure [psi]					
DPCV Pressure [psi]					
Accumulator Trend					
Lamp Hours					
Reactor Leaks [y/n]					
Lamps [# off]					
Ballasts [# bad]					
Acid Volume [L]					
Caustic Volume [L]					
Chemical Leaks [y/n]					
TiO ₂ Status					
Effluent pH Check	1.				
	2.				
	3.				
Inventory Check					
SCADA Log Updated					

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13 PREVENTIVE MAINTENANCE

The Preventive Maintenance section provides information required to complete preventive maintenance on the Purifics® ES Inc. equipment. This section includes the Preventive Maintenance Plan and Schedule, Lubrication Data, Preventive Maintenance Procedures, and Preventive Maintenance Log.

13.1 Preventive Maintenance Plan and Schedule

Preventative Maintenance for Photo-Cat® Treatment system

Task	Frequency	Description of Task
Visual Inspection for Leaks		
Photo-Cat® DDL	Weekly	Look for water or air leaks, note location
Calibration of pH probes		
Acidification pH probe	Quarterly	See Section 14.3.10 for procedure
Neutralization pH probe	Quarterly	See Section 14.3.10 for procedure
Autotune Control Valves		
Discharge Pressure Control Valve	Quarterly	See Section 14.3.11 for procedure
Slurry Loop Control Valve	Quarterly	See Section 14.3.11 for procedure
Slurry Feed Control Valve	Quarterly	See Section 14.3.11 for procedure
UV Lamps on Photo-Cat®		
Visual inspection for lamps out	Weekly	Look for lamp plugs that are dark, not purple
UV output test	Annually	See Section 14.3.2 for procedure
Pumps		
Inspect impellers and seals	Annually	

14 CORRECTIVE MAINTENANCE (REPAIR)

The Corrective Maintenance (Repair) section provides information required to complete corrective maintenance on the Purifics® ES, Inc. equipment. This section includes Troubleshooting Guides and Diagnostic Techniques, Repair Procedures, and Removal and Replacement Instructions.

14.1 Troubleshooting Guides and Diagnostic Techniques

The troubleshooting guides provide step-by-step instructions for identifying and solving problems. Special tools are identified where needed. References are given for manufacturer's troubleshooting procedures where needed.

14.1.1 Photo-Cat®

If the system shuts down, refer to the SCADA alarm screen first to identify the problem.

PROBLEM	ACTION
Influent Fault	<ol style="list-style-type: none"> 1. Check feed pump operation including proper rotation. Ensure that the pump is running and sufficient pressure is being developed. 2. Visually ensure that no valves are closed upstream of the reactor. 3. Check raw sample and possible plugged filters.
Effluent Fault	<p>Check the status of the CRU and control valves.</p> <ol style="list-style-type: none"> 1. Visually ensure that no valves are closed downstream of the reactor. 2. The ΔP (pressure drop) across the element housing should be 1-20 psi, no more. Verify this from the SCADA screens. <ol style="list-style-type: none"> a. If the ΔP is low and no water is getting out: <ol style="list-style-type: none"> i. Ensure that the discharge pressure control valve (DPCV) is holding its setpoint. b. If the ΔP is high and no water is getting out: <ol style="list-style-type: none"> i. Ensure that the slurry loop control valve (SLCV) is operating properly. ii. Ensure that the discharge pressure control valve (DPCV) is holding its setpoint.
Air Fault	<ol style="list-style-type: none"> 1. Check the air compressor status and pressure regulator. <ol style="list-style-type: none"> a. Ensure there is air pressure of 100 psi available. b. Ensure that other equipment is receiving pressure. 2. Check for air leaks in the air lines.
Fuse Blown	<ol style="list-style-type: none"> 1. Check for any shorts using multi meter. 2. If no shorts are found, replace with fuse as specified in electrical drawings. Electrical drawings are located in the main control panel. <p>Note: Purifics® should be contacted for spares as some suppliers substitute non-compatible fuses.</p>

PROBLEM	ACTION
System Off With No Alarms on Screen (Siemens PLCs)	SCADA not communicating with PLC: <ol style="list-style-type: none"> 1. Ensure SCADA is “initialized”. Check the “Operator Log” screen for confirmation of PLC communication. 2. Restart the SCADA PLC or Bus fault: <ol style="list-style-type: none"> 1. Check the Profibus connection. All “Bus Fault” LEDs on Profibus nodes should be off. 2. Ensure 24V DC power supply is on and working properly. Call Purifics® for service.
System Off With No Alarms on Screen (Allen Bradley PLCs)	PLC has faulted. <ol style="list-style-type: none"> 1. Ensure the SCADA is “initialized”. Click “Special” then “Initialize” on the SCADA pull down menu. 2. If Red fault (FLT) light is <i>on</i>, the PLC must be reset. <ol style="list-style-type: none"> a. Open the electrical cabinet and turn key on SLC 5/03 CPU to RUN, then PROG, then back to REM. If Red fault (FLT) light is <i>flashing</i> , it is a hardware fault. Refer to Manufacturer’s Data in Section 19.4.
Slurry Not Being Re- Injected to Inlet	<ol style="list-style-type: none"> 1. Open Slurry Return Valve. 2. Verify flow on SCADA.
Slurry Concentration Is Weak	<ol style="list-style-type: none"> 1. Shut off reactor for ten minutes and restart. 2. Not enough TiO₂ in system. Mix water to 25 mL of catalyst and add to the accumulator.
Single Lamp Failure	<ol style="list-style-type: none"> 1. Locate defective lamp by viewing lamp status indicators on the lamp plugs. 2. Replace the failed lamp as per the Lamp Installation / Replacement Procedure in Section 14.3.3 on Page 68.
16 Lamps at One End of a Rack Fail	The corresponding ballast cabinet fuses have blown in the main control cabinet. <ol style="list-style-type: none"> 1. Replace the blown fuses with Purifics® recommended replacement parts.
Two Adjacent Lamp Failure	The corresponding lamps have been disabled in the Reactor Setup screen. Check the SCADA configuration for these lamps. <ol style="list-style-type: none"> 1. Check the lamps and/or gaynor connector according to the UV Lamp Output Testing Procedure in Section 14.3.2 on page 68 2. Replace corresponding ballast according to the Ballast Installation/ Replacement Procedure in Section 14.3.1 on page 62.
Two Adjacent Lamp Failure (Diagonally Adjacent)	If the two failed lamps are diagonally adjacent, then the corresponding ballast has failed and must be replaced. Replace corresponding ballast according to the Ballast Installation/ Replacement Procedure in Section 14.3.1 on page 62.

PROBLEM	ACTION
High Acid Consumption	Recalibrate the probe on the influent. Refer to the pH Sensor/Transmitter Set-up and Calibration Procedure in Section 14.3.10 on Page 82. or Check for possible lag in effectiveness of acid.
High Caustic Consumption	Recalibrate the probe on the effluent. Refer to the pH Sensor/Transmitter Set-up and Calibration Procedure in Section 14.3.10 on Page 82. or Check for possible lag in effectiveness of caustic. Iron build-up on probes will cause a lag.

14.2 Wiring Diagrams and Control Diagrams

All electrical wiring diagrams are resident in the corresponding control cabinets as per the Electrical Code.

14.3 Maintenance and Repair Procedures

This section provides instructions required to restore equipment to proper operating standards. References are specific as to location within the equipment.

14.3.1 Ballast Installation/ Replacement Procedure

Warning:

Risk of electrical shock. Do not add or remove a ballast unless the power to that ballast rack has been turned off.

1. Open the fuse block for the ballast rack (Figure 7: Ballast Cabinet & Figure 8: Ballast Fuses).
2. Disconnect lamp and ballast harnesses starting away from the lamps (Figure 9: Unclipping Lamp Harness Detail & Figure 10: Unclipping Ballast Harness Detail).
3. Remove retaining screw and pull out old ballast (Figure 11: Unscrewing Ballast Card & Figure 12: Removing Ballast Card).
4. Slide new ballast into the slot and insert retaining screw (Figure 13: Ballast Seat Groove Detail).
5. Replace ballast harness.
6. Close fuse block.



Figure 7: Ballast Cabinet

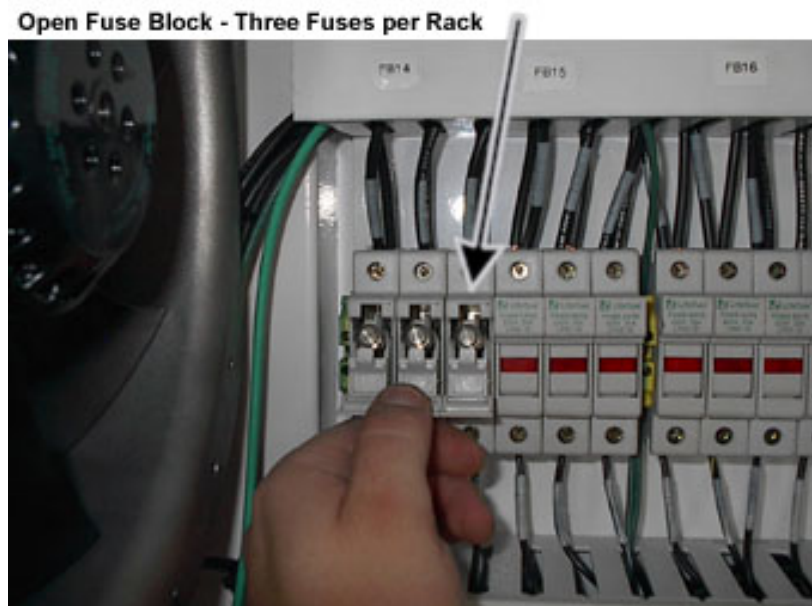


Figure 8: Ballast Fuses

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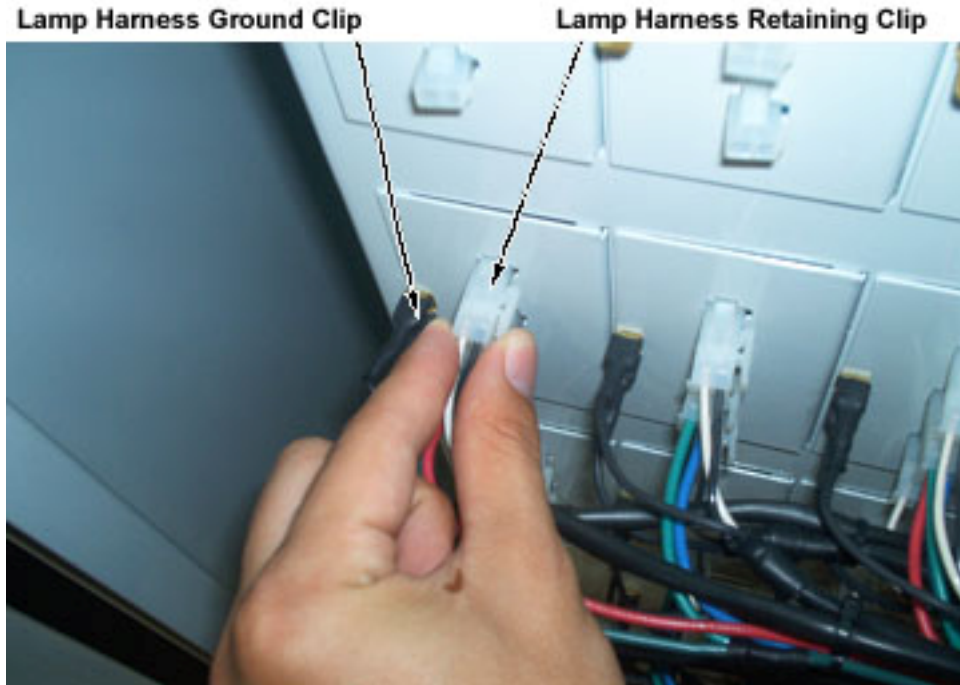


Figure 9: Unclipping Lamp Harness Detail

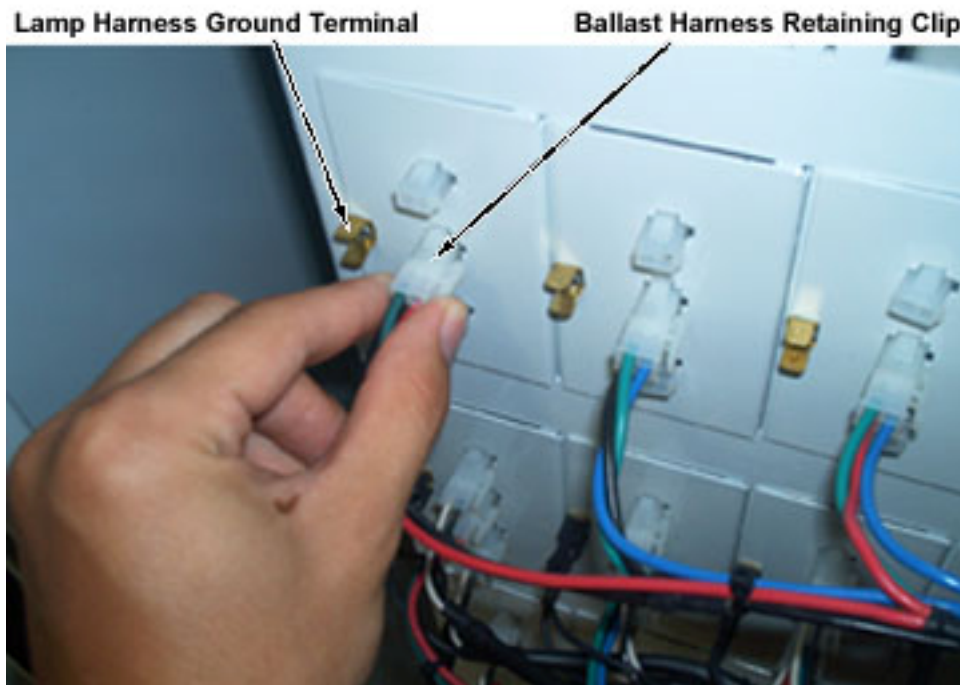


Figure 10: Unclipping Ballast Harness Detail

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Figure 11: Unscrewing Ballast Card

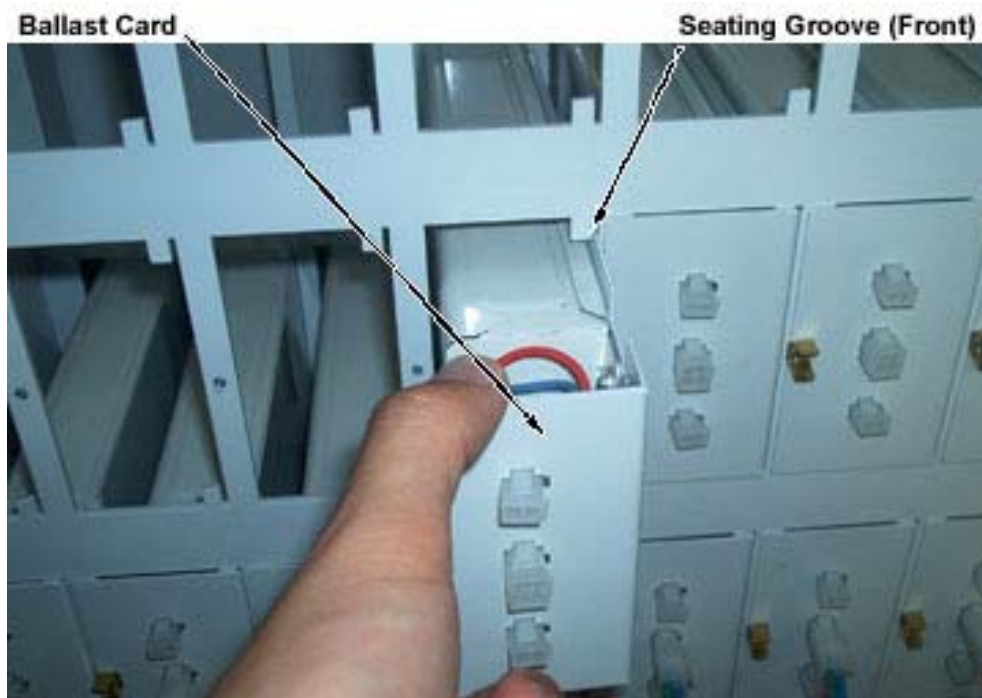


Figure 12: Removing Ballast Card

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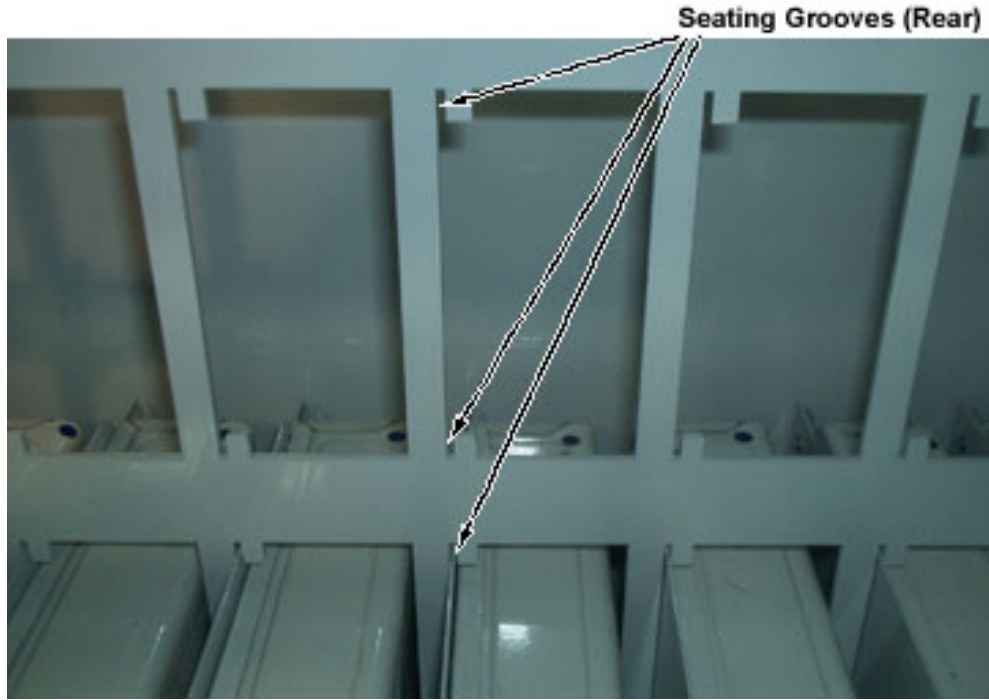


Figure 13: Ballast Seat Groove Detail

14.3.2 UV Lamp Output Testing Procedure

UV lamp output tester is available for lease from Purifics® ES Inc. Purifics® can supply a lamp test kit to verify lamp status. The test kit is available from Purifics® for a rental fee.

Caution:

Long sleeves, safety glasses, and a full plastic face shield are required for UV protection.

1. Select 2 lamps from each rack in the system.
2. Insert the lamps into the lamp test unit and attach the electrical connectors.
3. Ensure lamps are fully inserted in the tester so that no UV escapes.
4. Following the instructions on the meter and with the probe cap on, zero the UV meter.
5. Place the probe over one of the UV measuring ports and the probe cap over the other port.
6. Press and hold the power button on for 1 minute.
7. After 1 minute, record the meter reading.
8. Repeat Steps 6-8 for the other lamp.

An acceptable lamp will have a UV output of 45 uW/cm². If the lamp output is below this amount then it will need to be replaced by following the installation / replacement procedure in Section 14.3.2. This degradation will take approximately 17000 hrs. All lamps should be replaced at once.

14.3.3 Lamp Installation / Replacement Procedure

The SCADA will track the hours of operation of the lamps. Use the UV Lamp Output Testing Procedure (section 14.3.2 on page 68) to check the UV output of the lamps. If the lamps' output has degraded by 30% then they need to be changed. Lamp change out can be performed while the system is flooded.

1. Open the fuse block for the affected rack (Rack 1 shown - Figure 14: Lamps, Seal Plug).
2. Remove the lamp plug snap ring (Figure 15: Lamp Snap Ring).
3. Pull the lamp plug out of the retainer bushing by the strain relief, NOT the wire (Figure 16: Lamp Seal Plug Removed).
4. Remove the lamp connector.
5. Gently pull out the old lamps from the reactor cells (Figure 17: Handling Lamp).
6. Slide the new lamp into the photocatalytic cell.
7. Connect the four pin electrical connector to the new lamp.
8. Replace snap ring.
9. Perform the identical operation on the other lamps of the rack.
10. Close the fuse block and inspect operation of all new lamps by viewing the visual indicators on the lamp plugs.
11. Perform the identical operation for the remaining racks.
12. Keep an eye on the lamp status for the first 100 hours of operation. If a lamp is going to fail, it typically fails in the first 100 hours.

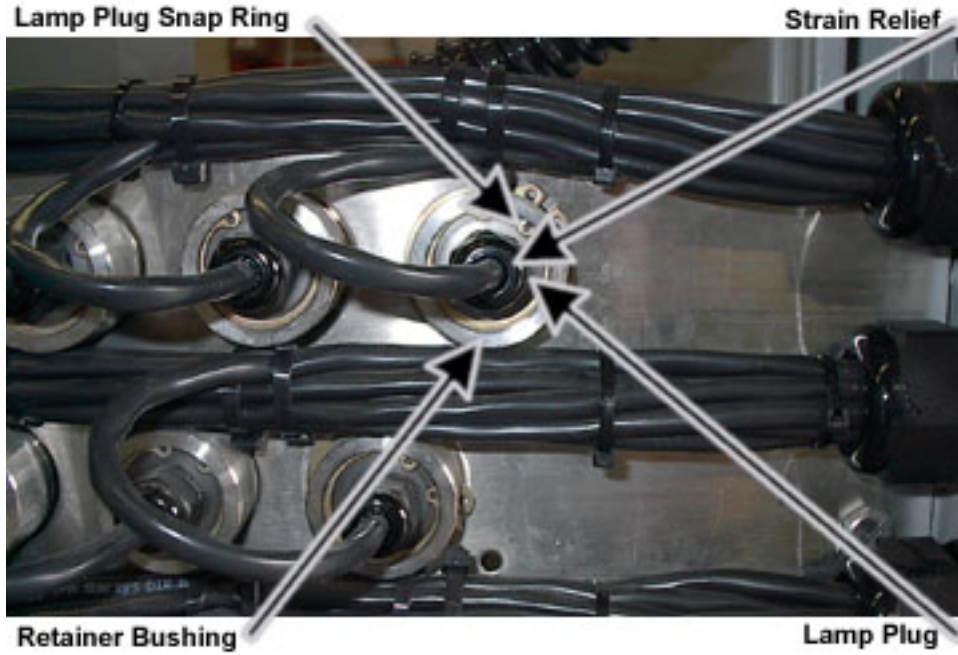


Figure 14: Lamps, Seal Plug



Figure 15: Lamp Snap Ring

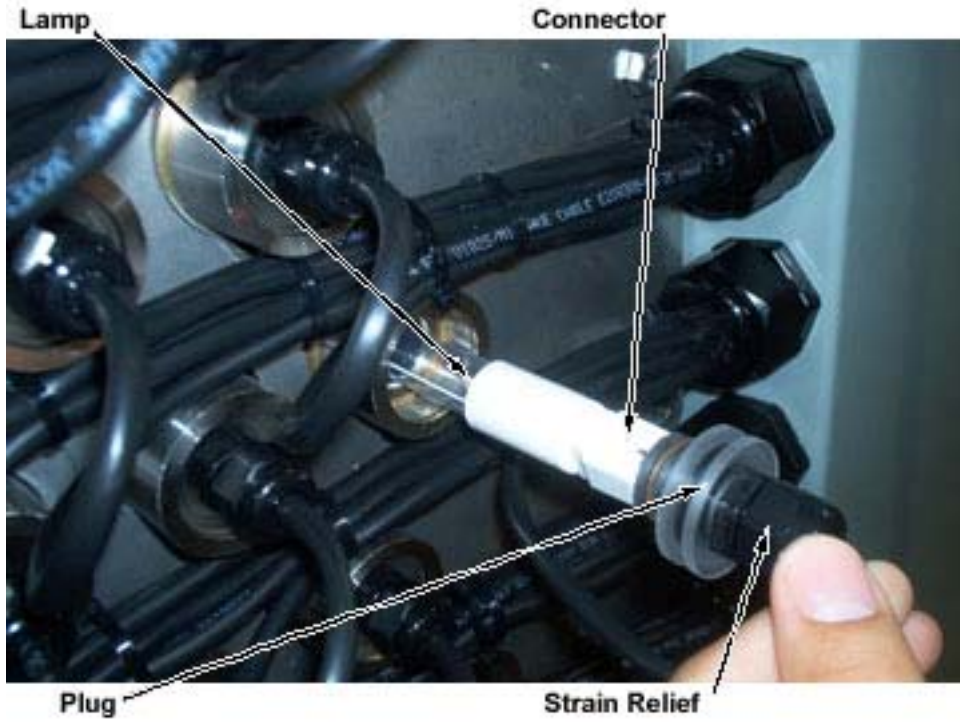


Figure 16: Lamp Seal Plug Removed



Figure 17: Handling Lamp

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14.3.4 Glass Sleeve Installation / Replacement Procedure

To install quartz glass sleeves (part #P6C-001), be sure to follow the points listed below to ensure safe and efficient installation.

1. See Lamp Installation / Replacement Procedure in Section 14.3.3 on Page 69.
2. Assemble a new seal plug on a new glass sleeve using a twisting motion. Use warm soapy water to lubricate o-rings. DO NOT use any other lubricant. (Figure 18: Lubricating Seal Plug O-Rings (Quartz Shown Installed)).
3. Remove snap ring in front of seal plug (Figure 19: Lamp Removed - Quartz Annulus).
4. Using the seal plug removal tool supplied, pull the seal plug out with a twisting motion (Figure 20: Seal Plug Removal Tool and Figure 21: Seating / Unseating Quartz Seal Plug).
5. Quickly but carefully insert the new glass sleeve assembly and press in using seal plug insertion tool provided.
6. Replace seal plug snap ring if corroded.
7. Reinstall lamp and seat the lamp plug.



Figure 18: Lubricating Seal Plug O-Rings (Quartz Shown Installed)

Quartz Glass Seal Plug Snap Ring

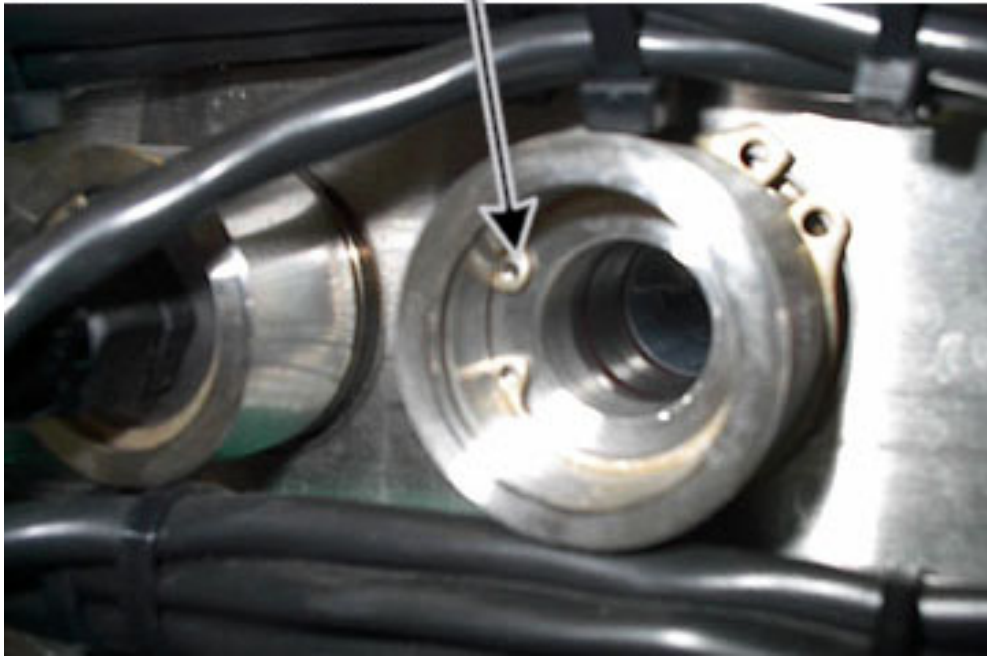


Figure 19: Lamp Removed - Quartz Annulus

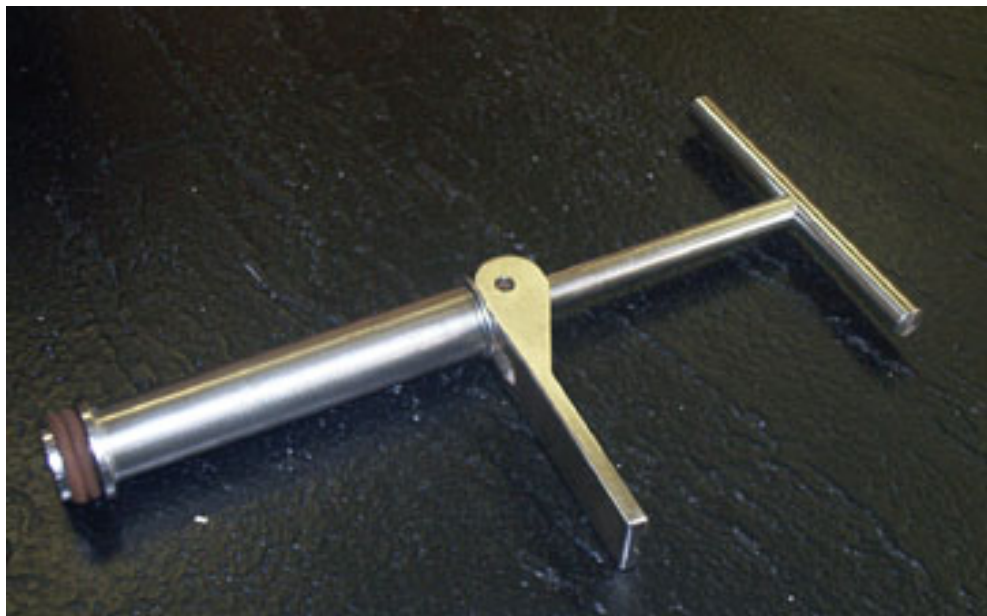


Figure 20: Seal Plug Removal Tool

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Figure 21: Seating / Unseating Quartz Seal Plug

14.3.5 Single Bag Filter Replacement Procedure

Caution:

Ensure proper PPE is worn during replacement procedure (i.e., eye protection, gloves, respirator, etc.).

Note:

The bag filter housing lid should be HAND TIGHTENED ONLY to avoid damaging the O-Ring seal.

1. Redirect flow through bypass isolation or shut system down:
 - a. Close inlet and outlet valves to isolate bag filter housing,
 - b. Open drain valve on lowest point of housing.
2. Purge water from the bag filter housing:
 - a. Connect air hose to valve connection on top of filter housing,
 - b. Slowly open air valve and allow air to push and purge water out of housing,
 - c. When all of the water is removed from the housing, turn off air valve inlet and disconnect airline.
3. Open bag filter housing lid:
 - a. Loosen off round I-bolts on top of housing lid and flip open top of housing,
 - b. Remove round handle clamp that holds the bag filter down.
4. Lift the spent filter out of the housing by gripping the fabric handle on the bag.
5. DO NOT REMOVE the mesh basket.
6. Properly dispose of the spent bag filter.
7. Push the new bag filter into the mesh basket.
8. Reinstall handle clamp on top of bag filter ring.
9. ENSURE SEAL O-RING of bag filter is clean and free of debris.
10. Close lid and **HAND TIGHTEN** I-Bolts in a diagonal sequence.
11. Close bottom drain.
12. Open isolation valves and place bag filter back on-line.
13. **PURGE AIR OUT** of bag filter housing by opening air vent until all air is expelled and only water exits the port.

14.3.6 Single Cartridge Filter Replacement Procedure

Caution:

Ensure proper PPE is worn during replacement procedure (i.e., eye protection, gloves, respirator, etc.).

1. Redirect flow through bypass isolation or shut system down:
 - a. Close inlet and outlet valves to isolate cartridge filter housing,
 - b. Open drain valve on lowest point of housing.
2. Drain all water from the housing through the drain valve on the bottom of the housing.
3. Loosen ring clamp at top of the housing.
4. Lower the housing from the rest of the cartridge filter assembly.
5. Remove and properly dispose of the spent cartridge filter.
6. Install a new cartridge in the housing:
 - a. Slide the new cartridge filter over the metal mounting rod and place in the proper groove at the bottom of the filter housing,
 - b. Ensure the O-ring seal is clean and free of debris,
 - c. Slide the housing over the seal O-ring,
 - d. With the housing in place, tighten the ring clamp to secure the filter housing.
7. Close bottom drain.
8. Open isolation valves and place cartridge filter back on-line.
9. PURGE AIR OUT of cartridge filter housing by opening air vent until all air is expelled and only water exits the port.

14.3.7 Multiple Cartridge Filter Replacement Procedure

Caution:

Ensure proper PPE is worn during replacement procedure (i.e., eye protection, gloves, respirator, etc.).

Note:

The cartridge filter housing black cross nut should be HAND TIGHTENED ONLY to avoid damaging the O-Ring seal.

1. Redirect flow through bypass isolation or shut system down:
 - a. Close inlet and outlet valves to isolate cartridge filter housing,
 - b. Open drain valve on lowest point of housing.
2. Purge water from the housing:
 - a. Connect air hose to valve connection on top of filter housing.
 - b. Slowly open air valve and allow air to push and purge water out of housing.
 - c. When all of the water is removed from the housing, turn off air valve inlet and disconnect the airline.
3. Loosen off the T-bolt and remove the band clamp around the filter housing.
4. Remove the bell cap from top of the housing.
5. Loosen the black cross nut on the inner lid and remove assembly.
6. Remove the spent filters from the housing.
7. Properly dispose of the spent cartridge filters.
8. Install new cartridges in the housing:
 - a. Slide the new cartridges over the fixing rods and place the inner lid back on top of the filters,
 - b. Ensure that a proper seal is made on the cartridge filter face,
 - c. **HAND TIGHTEN** the black cross nut,
 - d. Ensure O-ring seal of cartridge filter is clean and free of debris,
 - e. Reinstall the bell cap housing,
 - f. Fix the band clamp over the seam of the housing and the bell cap and hand tighten down using the T-bolt.
9. Close bottom drain.

10. Open isolation valves and place the cartridge filter back on-line.
11. PURGE AIR OUT of cartridge filter housing by opening air vent until all air is expelled and only water exits the port.

14.3.8 Short & Long Term Storage and Freeze Protection Procedure

14.3.8.1 Separation Systems

Once the modules have been properly cleaned an aqueous solution of 60% ethylene glycol (antifreeze) and 1,000 ppm glutaraldehyde (biocide) should be permeated through the ceramic elements. Pour the solution into the accumulator and run the system for 3 minutes to ensure that the solution has permeated through the elements. Another possible biocide that may be used is a 0.1% sodium bisulphate solution. These solutions should also be made with DI water. The permeate ports and retentate outlets of the modules should be capped and all valves must remain closed. The modules should be drained of the spent solution and replaced with a fresh chemical solution once a month. If these chemicals are unavailable, substitutes must be water-soluble in order to permeate through the elements. The biocide is to prevent bacterial growth on the membranes and the antifreeze is used to prevent the ceramic elements from freezing and cracking.

14.3.8.2 Photocatalytic Racks

The following procedure must be followed when there is a possibility of freezing during shipment or storage of a photocatalytic system:

Note:

The separation device must be full of water at all times. Do not dry the device by blowing air through it. A glycol solution must be used.

1. Ensure that the photocatalytic racks are flushed thoroughly and that the racks are full of clean water.
2. Add sufficient ethylene glycol into suitable reservoir. Circulate this mixture through the photocatalytic racks, until the glycol is thoroughly mixed and allow the glycol mixture to fill the accumulator.

14.3.8.3 pH Probes

pH probes cannot be freeze-protected due to internal fluids. Exposure to temperatures below 0° C will destroy the probe. They must be maintained at temperatures above 0° C at all times. The probe is equipped with a cap and pH solution. When the probe is not immersed in the water, this cap must be reinstalled. Failure to do so will cause the probe to dry out and fail.

14.3.9 TiO₂ Catalyst Replacement Procedure

Refer to Figure 22 and Figure 23 for the location of equipment in this procedure.

1. Manually turn off the slurry feed control valve.
2. Wait 5 minutes, and then turn off the Photo-Cat[®] system (through the SCADA system). At this point all of the TiO₂ will be in the accumulator.
3. Drain the CRU loop by opening the valve located on the bottom of the slurry tank. This is the lowest point on the system and virtually all slurry will be drained.
4. Flush and thoroughly drain the remaining TiO₂ from the accumulator tank by adding some additional fresh water into the top of the tank.
5. Use the SCADA to fill the accumulator up to approximately 60% full.
6. Add new TiO₂ in the accumulator tank. Pre mix 30g of TiO₂ in a small beaker of water, and pour into the accumulator tank through the vent port on top.
7. Turn the Photo-Cat[®] system on.
8. Ensure that the slurry pump is primed by inspecting the CRU pressure. If there is no pressure, shut off the Photo-Cat[®] system for 10 seconds, and restart the system. Once there is pressure in the CRU, let the Photo-Cat[®] system operate for 10 minutes to allow the slurry to mix throughout the Photo-Cat[®].
9. After 10 minutes of operation, sample the slurry concentration downstream of the photocatalytic racks and compare the slurry concentration (i.e. colour intensity) with the standard. If the concentration is weaker than the standard, add 10 mL of TiO₂ (mixed with tap water) into accumulator and wait 10 minutes. Re-check the concentration and repeat if necessary. If the concentration is the same or even higher, the procedure is finished.

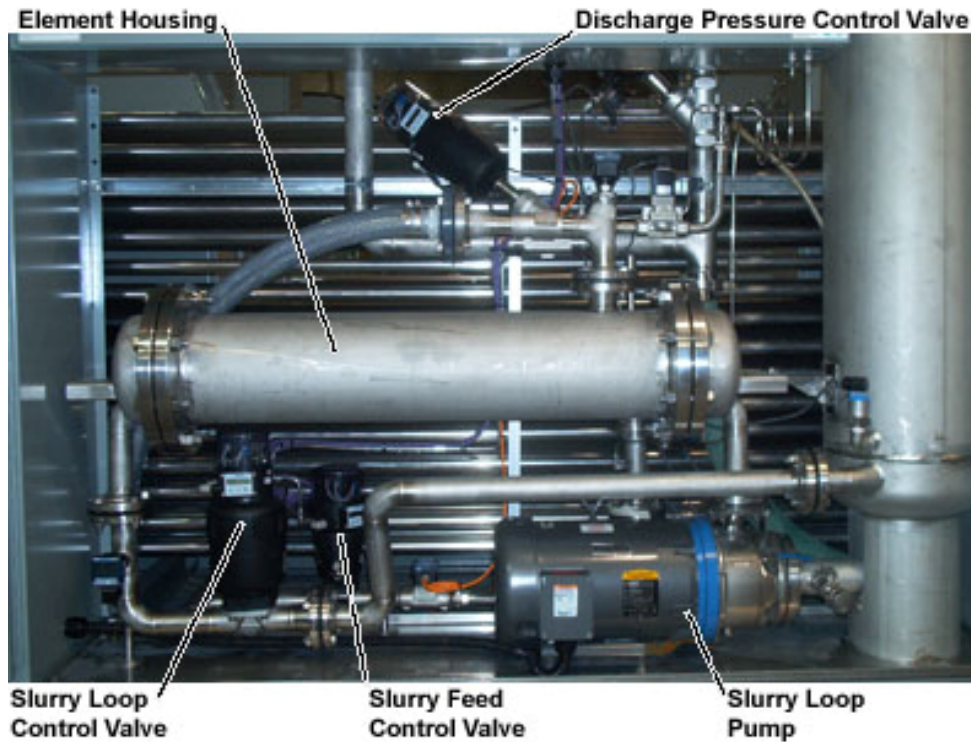


Figure 22: Photo-Cat[®] Catalyst Recovery Unit

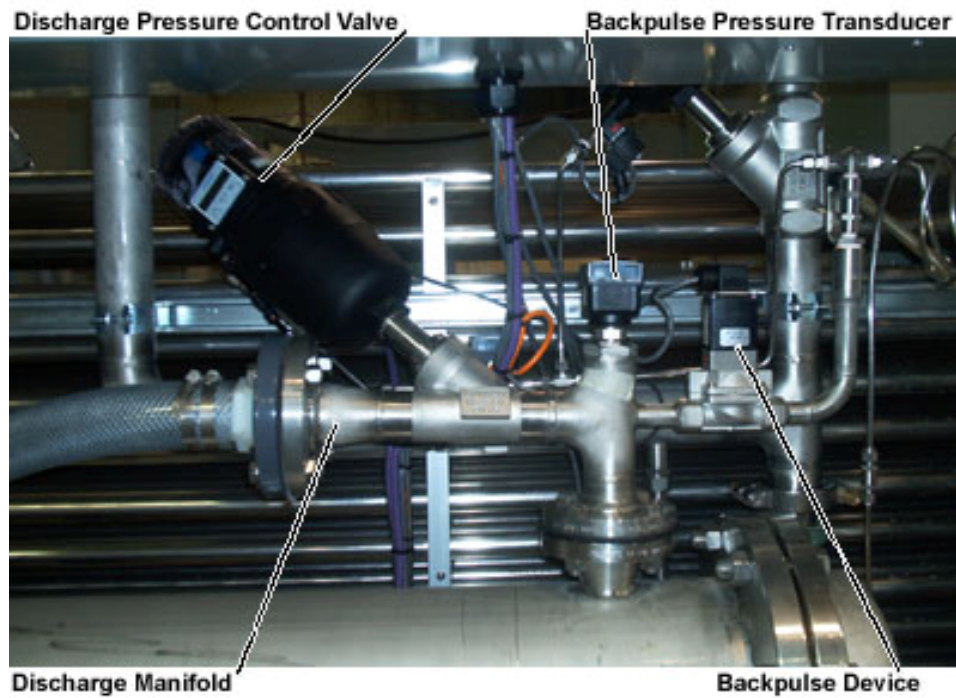


Figure 23: Discharge Manifold Assembly

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14.3.10 pH Sensor/Transmitter Set-up and Calibration Procedure

Prior to operation, or after fouling, the pH probe will require calibration. The transmitter will also require configuration and calibration.

This procedure is valid for: Endress+Hauser pH probe Model CPS 11-2BA2ESA or ORBINST CPS11D-7BA21 and Endress+Hauser transmitter Model Liquisys M CPM 223 or CPM 253.

Tools:

This procedure requires buffer solution pH 4.01 and 7.00, water, three glass beakers, gloves suitable for handling buffer solution, manufacturer's manual for the transmitter.

Caution:

The unit will remain powered during this procedure. Ensure that power wires are avoided. Ensure that moisture does not enter the unit.

To configure the transmitter, proceed as follows:

1. To allow set-up 1 (system configuration) enter the enabling code:
 - a. Refer to the Manufacturer's manual, sections 4.5.1 and 4.5.2
 - b. From the measurement screen on the transmitter press the "E" key. The screen will display "Code"
 - c. Use the "+" and "-" keys to choose code 22 and press "E" to accept the code
2. Press "E" to begin set-up 1. The display will read "Set-up 1" and allow you to configure the variables A1 through A5
 - a. Refer to the Manufacturer's manual, section 5.2.1
 - b. Configure each variable by selecting the correct value with the "+" and "-" keys and storing the value with the "E" key.
 - c. A1 = pH
 - d. To check the connection mode, open the connection panel under the display by removing the screws. Locate the brown wire. Compare the field wiring to figure 3.18 to determine Asymmetrical or Symmetrical connection mode. Set A2 accordingly.
 - e. A3 = 1 (no damping)
 - f. A4 = glass, A5 = Pt100 (for pH probe CPS 11-2BA2ESA)
3. Save and exit set-up 1 by pressing "E". The display will return to the measurement screen. Replace the cover, and proceed to the output configuration.

To configure the transmitter output, proceed as follows:

1. To allow output configuration, enter the enable code:
 - a. Refer to the Manufacturer's manual, sections 4.5.1 and 4.5.2
 - b. From the measurement screen on the transmitter press the "E" key. The screen will display "Code"
 - c. Use the "+" and "-" keys to choose code 22 and press "E" to accept the code
2. Use the "+" and "-" keys to select "O" and press "E" to accept. The display will read "OUTPUT"
 - a. Refer to the Manufacturer's manual, section 5.3
 - b. Configure each variable by selecting the correct value with the "+" and "-" keys and storing the value with the "E" key.
 - c. O1 = Out1, O2 = lin, O311 = 4-20
 - d. O312 = 0.00 pH (This is the value at 4mA current output)
 - e. O313 = 14.00 pH (This is the value at 20mA current output)
3. Save and exit the output configuration by pressing "E". The display will return to the measurement screen. Proceed to the calibration procedure.

To calibrate the probe and transmitter, proceed as follows:

1. Prepare the buffer solutions
 - a. Pour enough liquid from the first buffer (pH 4.01) to immerse the probe tip to about half way up the glass. Prepare a beaker of the second buffer (pH 7.00) in the same manner
 - b. Fill the third beaker $\frac{3}{4}$ full of water
2. To allow calibration enter the enabling code:
 - a. Refer to the Manufacturer's manual, sections 4.5.1 and 4.5.2
 - b. From the measurement screen on the transmitter press the "CAL" key. The screen will display "Code"
 - c. Use the "+" and "-" keys to choose code 22 and press "CAL" to accept the code
3. The display will read "CALIBRAT" and allow you to configure variables C12 through C19. Press "E" to begin. The display will read "Buffer 1"
 - a. Refer to the Manufacturer's manual, section 5.9
 - b. Remove the pH probe from the holder. Swirl the probe in the water beaker to clean it off. Immerse the probe in the first buffer solution
 - c. Enter the pH value of 4.01 on the transmitter (use the "+" and "-" buttons). With the pH probe in the buffer solution, press the "CAL" button and wait for calibration.
 - d. When the display reads "Buffer 2" clean the probe in the water beaker and re-immerses in the second buffer.
 - e. Enter the pH value of 7.00 on the transmitter. With the pH probe in the buffer solution, press the "CAL" button and wait for calibration.
4. Press "E" four times to review the calibration and re-install the probe into the process. The display will return to the measurement screen.

14.3.11 Valve Positioner Configuration Procedure

Prior to operation, or after maintenance, the valve positioner may need to be configured. You will require a copy of the Manufacturer's manual to perform this procedure.

This procedure is valid for: Burkert *TopControl* valve positioner Type 8630

Basic Configuration (for all *TopControl* positioners)

1. The positioner has two process modes and a configuration mode. The process modes are manual and automatic. When in automatic mode, the LED on the MANUAL/AUTOMATIC key will blink. To change modes, press the MANUAL/AUTOMATIC key. See sections 6.6.1 and 6.6.2 in the Manufacturer's manual. From either of the process modes, pressing and holding the MANUAL/AUTOMATIC key for 5 seconds will enter the main menu of the configuration mode. See section 6.4.2 and figure 5.6 in the Manufacturer's manual.
2. From the main menu, use the ARROW keys to select "ACT FUNC" to configure the pneumatic actuator. See section 6.3 and figure 6.3 in the Manufacturer's manual to determine which setting to use.
3. Use the ARROW keys to select "INPUT" from the main menu. See section 6.3 in the Manufacturer's manual to determine which option to choose.
4. Use the ARROW keys to select "END" from the main menu and press the MANUAL/AUTOMATIC key to finish basic configuration. The display will read "EEPROM" while the settings are saved and then return to automatic mode.

Positioner autotuning (for all *TopControl* positioners)

1. From the main menu (see Basic Configuration), select the "X.TUNE" function.
2. Autotune the positioner pressing and holding the MANUAL/AUTOMATIC key for 5 seconds. The positioner will finish with a blinking display that reads "X.TUNE.END". If the display reads "X.ERR X.X" look up the error code X.X in the Manufacturer's manual in section 7.1.
3. Return the positioner to automatic mode **or** configure the positioner as a process controller.

Configuring the positioner as a process controller (for Photo-Cat® discharge pressure control valve, DPCV, *TopControl* positioners only)

1. From the main menu (see Basic Configuration), select "ADDFUNCT" with the ARROW keys and press the MANUAL/AUTOMATIC key to enter the additional functions menu.
 - a. Refer to the Manufacturer's manual Figure 6.5 and section 6.4.3 for theory of operation.

- b. Add the following additional functions to the main menu by scrolling to the function name using the ARROW keys, and confirming the selection with the MANUAL/AUTOMATIC key: “CUTOFF”, “DIR.CMD”, “DIR.ACT”, “P.CONTRL”, and “BIN-IN”
 - c. End the additional functions submenu and return to the main menu by selecting “ENDFUNCT” and pressing the MANUAL/AUTOMATIC key.
 2. In the “CUTOFF” menu, set the “CUT” floor value to 01 (1%) and the “CUT” ceiling value to 100 (inactive).
 3. In the “DIR.CMD” submenu, select “DIR.CFALL” and return to the main menu.
 4. In the “DIR.ACT” submenu, select “DIR.ARISE” and return to the main menu.
 5. In the “P.CONTRL” submenu, configure the PID controller parameters:
 - a. Refer to the P.CONTROL function in the Manufacturer’s manual in section 6.4.3.
 - b. Configure “P.CO DBND” = 1.0.
 - c. Enter the “P.CO PARA” submenu and configure the PID controller parameters: “KP” = 01.00, “TN” = 001.0, “TV” = 0, and “XO” = 20. Note: “XO” is the operating point of the process controller. This value can be adjusted after accumulating experience. Return to the “P.CONTRL” submenu.
 - d. Configure “P.CO SETP” = “EXT”, “P.CO INP” = “4’20A”
 - e. Enter the “P.CO SCAL” submenu and configure the process variable and setpoint parameters: “DP” = 1, “PV” (floor) = 0, “PV” (ceiling) = 50, “SP” (floor) = 0, “SP” (ceiling) = “50”. Return to the “P.CONTRL” submenu.
 - f. End the process controller submenu and return to the main menu by selecting “P.CO END” and pressing the MANUAL/AUTOMATIC key.
 6. In the “BIN-IN” submenu, configure the positioner’s response to the PLC binary input:
 - a. Refer to the BIN-IN function in the Manufacturer’s manual in section 6.4.3.
 - b. Configure “BIN FUNC” = “SPOS”. The display will then read “SPOS XXX”. Use the ARROW keys to set “SPOS” = 000.
 - c. Configure “BIN TYPE” = “NORM OPN”
 - d. End the binary input submenu and return to the main menu by selecting “BIN END” and pressing the MANUAL/AUTOMATIC key.
 7. Use the ARROW keys to select “END” from the main menu and press the MANUAL/AUTOMATIC key to finish basic configuration. The display will read “EEPROM” while the settings are saved and then return to automatic mode.

14.3.12 Flowmeter Configuration Procedure

Prior to operation, or after maintenance, flowmeters may need to be configured. You will require a copy of the Manufacturer's manual to perform this procedure.

This procedure is valid for: Burkert Flow Sensor with integrated display and 4-20mA Output.

Flowmeter Configuration

1. Ensure the flowmeter has correct field wiring. The control unit requires loop power from the PLC.
2. Review the Manufacturer's manual on commissioning
3. Enter Programming Mode:
 - a. Press and hold the ENTER and DOWN arrow keys for 5 seconds to begin configuration. The display will read "UNIT".
4. UNIT menu: Set the measurement units the Litres per Minute
 - a. From the "UNIT" display, press ENTER
 - b. Press the DOWN arrow until "L/MN" is displayed; press ENTER
5. KFAC menu: Adjust the fitting factor
 - a. From the "KFAC" display, press ENTER twice. The display will read "###.#"
 - b. Set the correct K Factor (see the manufacturer's manual) by using the keys as follows:

UP arrow:	increase the number under the cursor
DOWN arrow:	shift the cursor left
UP+DOWN together:	shift the decimal place left
 - c. Press ENTER when complete
6. FILT menu: Adjust the output smoothing
 - a. Press the DOWN arrow until the display reads "FILT"; press ENTER
 - b. Adjust the filter to 2; press ENTER
7. BRGR menu: Adjust the bargraph display scale
 - a. The display will read "BRGR"; press ENTER
 - b. The display will read "BGLO". Adjust the value to 0 and press ENTER
 - c. The display will read "BGHI". Adjust the value to 80 and press ENTER
NOTE: the Influent flowmeter should be adjusted to 120
8. EXT menu: Set the external signal type

- a. The display will read “EXT”, press ENTER.
 - b. Adjust the display to read YES; press ENTER
 - c. Press the DOWN arrow until the display reads “OUT”; press ENTER
 - d. Adjust the 4MA to 0; press ENTER
 - e. Adjust the 20MA to 80.0; press ENTER
NOTE: the 20MA setting should match the BGHI setting above
9. Save the configuration:
- a. Press the DOWN arrow until the display reads “END”; press ENTER.
10. Verify the flowmeter output with the SCADA if possible. Repeat from Step 4 if outputs are mismatched.

14.3.13 Pressure Transmitter Configuration Procedure

Prior to operation, or after maintenance, pressure transmitters may need to be configured.

This procedure is valid for: Burkert Pressure Transmitter with integrated display and 4-20mA Output.

Pressure Transmitter Configuration

1. Ensure the pressure transmitter has correct field wiring. The control unit requires loop power from the PLC.
2. Review the Manufacturer's manual on commissioning
3. Enter Programming Mode:
 - a. Press and hold the ENTER and DOWN arrow keys for 5 seconds to begin configuration. The display will read "UNIT".
4. UNIT menu: Set the measurement units the Litres per Minute
 - a. From the "UNIT" display, press ENTER
 - b. Press the DOWN arrow until "PSI" is displayed; press ENTER
5. FILT menu: Adjust the output smoothing
 - a. Press the DOWN arrow until the display reads "FILT"; press ENTER
 - b. Adjust the filter to 3; press ENTER
 - c. Adjust the filter until "FAST" is displayed; press ENTER
6. MA meun: Adjust the transmitter loop output
 - a. From the "MA" display, press ENTER
 - b. Adjust 4MA to 0 PSI; press ENTER
 - c. Adjust 20MA to 50 PSI; press ENTER
7. BRGR menu: Adjust the bargraph display scale
 - a. The display will read "BRGR"; press ENTER
 - b. The display will read "BGLO". Adjust the value to 0 PSI and press ENTER
 - c. The display will read "BGHI". Adjust the value to 50 PSI and press ENTER
8. Save the configuration:
 - a. Press the DOWN arrow until the display reads "END"; press ENTER.
 - b. The display will read "SAVE". Press the DOWN arrow to select YES; press ENTER.

Verify the flowmeter output with the SCADA if possible. Repeat from Step 4 if outputs are mismatched.

14.3.14 Variable Frequency Drive (VFD) Configuration Procedure

Prior to operation, or after changing pump motors, the VFD will require calibration. The transmitter will also require configuration and calibration.

This procedure is valid for: Siemens Micromaster 440 series VFD.

To Configure the VFD proceed as follows:

1. Remove the status display panel (or operator panel). Remove the VFD power and set the appropriate DIP switch for use in 60Hz and display in HP. Reconnect power to the VFD. See the Manufacturer's Operating Instructions manual, figure 3-2.
2. Install an operator panel (basic or advanced) and proceed to configure the pump motor:
 - a. Refer to the Manufacturer's Getting Started Guide. Record the rated motor voltage, current, power, frequency, and speed (as RPM) from the rating plate.
 - b. Start quick commissioning by setting parameter P0010 = 1
(Note: if P0010 will not give 1, set P0003 = 1 or 2 and retry)
 - c. Set P0100 = 1 (for HP and 60Hz)
 - d. Set Set P0304 to the Rated motor voltage (V)
 - e. Set P0305 to the Rated motor current (A)
 - f. Set P0307 to the Rated motor power (hp)
 - g. Set P0310 to the Rated motor frequency (hz)
 - h. Set P0311 to the Rated motor speed (rpm)
 - i. Set P0700 = 2, P1000 = 2
 - j. Set P1080 to the minimum motor frequency (probably 15 – 20 Hz for most motors)
 - k. Set P1082 to the maximum motor frequency (probably 60 Hz)
 - l. Set P1120 = 10, P1121 = 5
Note: the ramp down time is shortened for process safety.
 - m. End commissioning by setting parameter P3900 = 1. This will set parameter P0010 = 0 and enable motor operation. The display will show "P----" while the motor is recalculated.
3. If the VFD is a Profibus node, enable commands from the PLC:
 - a. Set parameter P0003 = 3 in order to access the necessary configuration parameters.
 - b. Scroll to parameter P0719, press "P". The display will read "in00", press "P". The display will now read a two-digit number, e.g., 00. Scroll to 66 and press "P".
 - c. The display will return to P0719. Press "Fn" to return to r0000, then press "P" to return to Hz display mode.
4. Remove the operator panel and replace with the original panel if necessary.

14.4 System Control and Data Acquisition (SCADA) Software Installation

This section is provided as a means to replace or reinstall the HMI computer in case of failure. These instructions are not intended to grant license for multiple concurrent installations of the SCADA software without authorization from the software manufacturer.

14.4.1 Installing IL77 Touch Panel

Tools:

Before starting these instructions, power down the computer, plug in a PS/2 Keyboard, and restart.

Read the Manufacturer's data included in Section 19.4. The IL77 is pre-installed. In case of operating system loss, insert the CD labelled "Restore-CD 1-4 Panel PCIL77", reboot, and follow the instructions.

1. Windows XP Professional Setup.
"Regional and Language Options" window:
Select **Customize**
Under "Standards and Formats" select **English (Canada)**
Under "Location" select **Canada**
Select **OK** to return to Language Options
Select "**Details**"
Under default input language select **English (Canada) – US**
Select **OK** to return to Language Options
Select **Next**
2. "Personalize Your Software" window:
Name: Photo-Cat
Organization: Purifics ES Inc.
3. Setup Wizard completes and Simatic Panel Wizard is shown:
Select "**Touch Panel**"
Select "**15**"
Un-Check the box under "OSKGina" and select **Finish**
Popup will request that the touch screen be calibrated. Select "**OK**" and follow instructions
4. Skip "New Hardware Found" by pressing cancel. This will only appear if a CP5611 (Profibus) card is installed.

Continue with Windows XP Professional Configuration in Section 14.4.3.

14.4.2 Installing Transduction (TR-5001)

The TR-5001 is pre-installed. In case of operating system loss, insert the Windows XP CD, reboot, and follow the instructions.

1. Remove “TouchMon” from startup:
 - a. Start → Programs → Accessories → Windows Explorer
 - b. My Computer → c: → Documents and Settings → All Users → Start Menu → Programs → Startup; delete “TouchMon” shortcut

Continue with Windows XP Professional Configuration in Section 14.4.3.

14.4.3 Windows XP Professional Configuration

Tools:

Before starting these instructions, power down the computer, plug in a PS/2 Keyboard, and restart.

1. Remove superfluous software:
 - a. Start → Settings → Control Panel → Add or Remove Programs
 - b. Select Add/Remove Windows Components
 - i) Accessories and Utilities → **Details** → Uncheck “Games” → **OK**
 - ii) Uncheck MSN Explorer
 - iii) Uncheck Windows Messenger
 - iv) Select **Next**
 - v) Select **Finish**
2. Configure Networking:
 - a. Start → Settings → Control Panel → System; Select “Computer Name” tab → Select “**Change**”
 - b. Set computer name to serial “5P1203”
 - c. Set workgroup to “Purifics”
 - d. Select **OK**; “Welcome to the Purifics Workgroup” is shown – select “**OK**”; “Restart” popup is shown, select **OK** to return to the System Properties Window
 - e. Select **OK**, Select **No** to reboot
3. Configure Users:
 - a. Start → Settings → Control Panel → User Accounts

- b. “User Accounts” window is displayed, select **Change an Account**, select Computer Administrator, select **Create a password**, type in new supervisor password; select **Create Password**; select **Yes, Make Private**
 - c. Select **Create new account** under “Related Tasks”
 - d. Type the name “Operator”; select **Next**; select “Computer Administrator”; select **Create Account**
 - e. Change password for “Operator” to system serial number → follow step “b”.
 - f. Close “User Accounts” window
4. Configure Automatic Logon
- a. Start → Run, type “control userpasswords2”, press **OK**
 - b. Check the “Users must enter a password...” box if unchecked
 - c. Select the newly-created “Operator” user from the list of users
 - d. Clear the “Users must enter a user name and password to use this computer” check box, then click **Apply**
 - e. In the “Automatically Log On” window, type the password for the “Operator” user, then retype the password in the “Confirm Password” box.
 - f. Click **OK** to close the “Automatically Log On” window, click **OK** to close the “User Accounts” window.
5. Configure Login Screen
- a. Start → Settings → Control Panel → User Accounts
 - b. Select “Change the way users log on or off”
 - c. Deselect “Use the Welcome Screen”, click **Apply Options**, close “User Accounts” window.
6. Reboot for changes to take effect and to log on as the operator
7. Set the screen resolution: navigate Start → Settings → Control Panel. Select **Display**. Open “Settings” tab. Adjust “Screen Resolution” slider to read 1024 by 768”. Select **OK**, Select **Yes**

14.4.4 Install & Configure WinCC Flexible Runtime

Tools:

Before starting these instructions, power down the computer, plug in a PS/2 Keyboard, and restart.

1. Login as the Administrator user.
2. Insert WinCC Flexible Runtime CD in drive.

3. From the setup Welcome window select “**Next**”, “**Yes**”, select “**English**”, “**Next**”
 - a. Change the “Name” to “Photo-Cat”
 - b. Change “Company” to “Purifics”
 - c. Enter the “Serial” number located on the activation floppy or as recorded in Section 6.4.4 starting with “ID:KHE...”
 - d. Select “**Next**”
4. From the “Authorization” window select “Yes”, insert the Runtime activation floppy and select “Next”
 - a. If the touch panel does not have a floppy then select “No” and press “Next”. After installation, follow procedure Offline WinCC Flexible Activation (Authors W)in Section 14.4.12.
5. Accept the defaults by pressing “Next” until installation begins.
6. In the “Installing / Uninstalling Interfaces” select CP5611, select “Install”, select “Close”
7. In the “Set PG/PC Interface” window, select “CP5611 (PROFIBUS)”
 - a. Select “Properties”
 - b. Uncheck “PG/PC is the only master on the bus”
 - c. Set the “Address” = 124
 - d. Set the “Transmission Rate” to 12 Mbps
 - e. Set the “Highest Station Address” to 126
 - f. Set the “Profile” to “Standard”
 - g. Select “Close” on the “Properties” window
 - h. Select “OK” on the “Set PG/PC Interface” window
8. Select “Finish”
9. Do not reboot. Select “No...” and “Finish”
10. Activate WinCC Flexible if skipped earlier and activate WinCC Flexible Archives (if provided)
11. Create SCADA Directories in D:\ drive.
 - a. Create D:\logs.
 - b. Create D:\Purifics.
 - c. Copy the SCADA runtime files from the OMSI Manual CD into the D:\Purifics directory.
 - d. Create a symbolic link of the .fwx SCADA runtime file into C:\Documents and Settings\All Users\Start Menu\Programs\Startup

14.4.5 Install & Configure ProTool/Pro Runtime

1. Login as the Administrator.
2. Insert ProTool/Pro CD in drive.
3. Select Language → English
Select Installation → ProTool/Pro RT
Insert activation floppy (the activation serial # is recorded in Section 6.4.4).
 - a. Accept default installation directory of C:\Siemens\PTPro Run.
 - b. Follow prompts.
 - c. Do not reboot.
4. Select Installation → ProAgent (if Authorized)
Insert activation floppy.
 - a. Follow prompts.
 - b. Exit.
5. Create SCADA Directories in D:\ drive.
 - a. Create D:\logs.
 - b. Create D:\Purifics.
6. Logoff as Administrator, login as the Operator and Reboot from Operator account.

14.4.6 Configure PG/PC Interface for CP5611 Card

1. Open Start → Settings → Control Panel → Set PG/PC Interface
Interface Parameter Assignment Used: Select CP5611 (PROFIBUS)
Access Point of the Application: Changes to S7ONLINE (Step 7) → CP5611 (PROFIBUS)
2. Select **Properties**.
3. PG/PC is the only master on the bus: Uncheck
Address: 124
Timeout: 1s
Transmission Rate: 12 Mbps
Highest Node Address: 126
Profile: standard
Select **OK** to close Properties window.
4. Select **OK** to close “Set PG/PC Interface” window.

14.4.7 Install & Configure Step 7 programming software

1. Login as the Administrator.
2. Insert Step 7 CD to begin installation.

- a. Setup language: English, select Next
 - b. Choose Programs to Install:
Step 7
Automation License Manager
 - c. Select Next.
3. Step 7 Setup Commences
- a. Select next 2 times, agree to license.
 - b. Enter name / Company.
 - c. Accept default directory of installation directory.
 - d. Select “Typical” install, accept the default installation directory. Select Next.
 - e. Select only English language, Select Next.
 - f. Authorization step:
Insert activation floppy, press “Authorize”
OR
Press “Skip”
 - g. Select Install.
 - h. Select Finish.
 - i. On the “Memory Card Parameter Assignment” select Interface “None”, press OK.
 - j. Do not reboot when prompted. Logoff Administrator, logon as Operator and Reboot.
4. Configure Simatic Workspace
- a. Start → Simatic → STEP 7 → Configure SIMATIC Workspace
 - b. Under “Workstation Configuration” tab
Select “Single Node System”
Apply
Stop Server
Press OK, press Yes

14.4.8 Install Standard PID Control Tool (Optional)

1. Insert “Standard PID Control Tool V5.0” CD.
2. Open Windows Explorer, explore CD-Drive (drive E).
 - a. Launch “Setup” from “Disk 1” directory.
 - b. Next, Next, Next, Yes, Next, Next.
 - c. Authorization. Either:
Insert activation disk, press “Authorize”.

OR
Press “Skip”.

d. Finish.

14.4.9 Install pcAnywhere Remote Control software (Optional)

Note: Must be logged in as Administrator to perform installation and configuration.

1. Insert CD and follow prompts to install pcAnywhere
2. Cancel LiveUpdate
 - a. Select “Cancel” from “LiveUpdate” window.
3. Perform Registration
 - a. Follow prompts
OR
Press Skip, Press Yes
4. Finish
 - a. Press “Finish”, Reboot by pressing “Yes”
5. Configuring Host:

Note: Must be logged in as Administrator.

- a. Start → Programs → Symantec pcAnywhere.
- b. Right click “Network, Cable, DSL” in the Hosts window and select “Properties”
- c. Connection Info Tab
Device List: Select TCP/IP for Ethernet connection, or installed modem for phone line connection.
- d. Settings Tab
Host Startup: Check “Run Minimized”, “Run as a service”.
- e. Callers Tab
Authentication type: Windows
Caller List: use the “New Item” button to add Administrator & Operator from the “5P1203” domain.
- f. Encryption Tab
Encryption Level: select pcAnywhere
- g. Protect Item Tab
Enter Administrator password
Check the box labelled “Required to modify properties”.
- h. Select OK to create Host profile.
- i. Name the host profile “Photo-Cat Ethernet” or “Photo-Cat Modem”.

- j. Start the new profile by double-clicking.
- k. Configure Windows to automatically start the pcAnywhere service:
Start → Settings → Control Panel → Administrative Tools → Services
Open “pcAnywhere Host Service”
Change Startup type to “Automatic”
Press OK
- l. Logoff Administrator, login as Operator.
- m. Reboot.

14.4.10 Installing Wonderware InTouch

1. Exit all Windows applications.
2. Insert INTOUCH 7.1/7.11 into CD drive.
3. Follow installation instructions as they appear on the monitor.
 - Install “INTOUCH 7.1”
 - Follow on-screen prompts
4. After successful installation, remove the CD. Insert the license software (3 1/2” floppy) into the drive.
5. Copy the file “*wwsuite.lic*” into the
6. c:\Program Files\FactorySuite\Common\License directory.
7. Install the Softnet software, which is the driver software for the SCADA system.

14.4.11 Installing Siemens Softnet

1. Install PB Softnet – S7 V5.3
 - a. For Windows 2000 Professional, insert the Softnet CD, install through Start / Run, and Browse through the following path:
D:\sw\sn_pb_s7\disk1\setup
hit enter.
2. Run COML S7:
(Start→ Programs→ simatic.net→ coml S7)
Simatic \ simatic net \ PB softnet S7 \ coml S7
 - a. Change remote TSAP from 01.00 to 03.02
Get device ID:03 Rack 0 Slot 2
 - b. Remote address = 2
 - c. Hit insert
 - d. Hit File \ Generate Binary DB A....
 - e. Give Filename and Save (i.e. S7Setup.1db), then close.
3. Go to Control Panel or Simatic Net, select PG/PC Interface

- a. Access Point of the Application = CP_L2_1
 - b. Interface Parameter Assignment Used = PC Adapter (MPI)
 - c. Properties – select PG/PC is the only master
 - d. Local Connection
Com port = 1
Transmission Rate = 38400
 - e. SAPI S7
Link the S7setup.1db file through search
i.e. C:\siemens\simatic.net\coms7.w95\s7setup.1db
hit OK, and again.
4. Install “Siemens SIMATIC NET S7 V7,5,0,3” from Wonderware Factory Suite I/O servers CD
 - a. Ensure Wonderware license “wwsuite.lic” is installed, or use the Demo Mode (Start→ Programs→ Wonderware Factory Suite→I/O Servers→Siemens SIMATIC NET S7)
 5. Open S7 IO Server Program
 - a. Hit Configure \ Topic Definition \ New
 - b. Topic Name = S7
CP_Name = CP_L2_1
VFD = VFD1
Connection = S7_connection_name1
Update Interval = 100ms
Hit OK
 - c. Save as ioserver.cfg
c:\Program Files\Factory Suite\IOServer\S7\ioserver.cfg
 6. Reboot Computer

14.4.12 Offline WinCC Flexible Activation (Authors W)

This process requires a second “source” computer from which the activation will be transferred to the “target” (HMI) computer. Both computers must be active on the same network.

1. Move the activation from the floppy to the source computer
 - a. Insert the floppy into the floppy drive
 - b. On the source computer open Authors W: Start → Simatic → AuthorsW → AuthorsW
 - c. In Authors W select the “Move Authorization” tab. The widow will be divided into “3 ½” Floppy (A:)” on the left and “C:” on the right
 - d. On the left side under “3 ½” ...” select the product activation to transfer

- e. Drag the activation from “3 ½” ...” to “C:”
2. Map the Source computer drive onto the Target computer.
 - a. On the target computer open Windows Explorer: Start → Programs → Accessories → Windows Explorer
 - b. In the “Address” box in Windows Explorer type “\” followed by the network name of the source computer, followed again by “c\$” and press enter. The entire address will look something like: \\SourceComputer\c\$. Alternatively browse for the source computer by expanding My Network Places → Microsoft Windows Networks
 - c. When prompted, enter a username and password with access to the source computer (e.g. the username/password combination used to transfer the activation in Step 1).
NOTE: The username must be preceded by the login domain e.g. UserName: “PURIFICS\Operator” where “PURIFICS” is the login domain.
 - d. Under the “Folders” view in Windows Explorer right click on the “c\$” folder attached to the source computer and select “Map Network Drive ...”
 - e. A window titled “Map Network Drive” appears. The “Folder” is already selected as \\SourceComputer\c\$. Set “Drive:” to “S:” or an unused letter. Select “Finish”.
 3. Start AuthorsW on the Target computer following steps 1. b).
 - a. On the target computer open Authors W: Start → Simatic → AuthorsW → AuthorsW
 - b. In the “Manage Authorizations” tab expand “My Computer” to reveal the local drives, including the newly mapped “S:” drive
 - c. Select the “S:” drive. A list of authorizations installed on the source computer is shown on the right
 - d. Select the desired authorization from the right and drag the authorization to the “C:” drive under “My Computer” on the left
 - e. The activation is now transferred to the target computer
- Repeat steps 1 and 3 for additional authorizations.

15 RECORD OF MATERIAL AND EQUIPMENT

The Record of Material and Equipment is identified below. Manufacturer's catalogue data, instructions, test reports, warranties and shop drawings are found in other sections.

15.1 Photo-Cat[®] Reactor

Item: Photo-Cat[®] Reactor
Type: Model: 230-0832-070
Quantity: 1
Cross-references: For details, see Section 6.

15.2 Control System

Item: HMI
Type: Simatic Panel PC IL70 (6AV7501-0AA00-0AF0)
Quantity: 1
Cross-references: For details, see Section 6.4.4.

Item: Software on CD-ROM
Type:

- Microsoft Windows XP Professional Recovery CD's (Siemens)
- Siemens Panel PC IL77 Documentation & Drivers 04/2005
- WinCC Flexible 2005 Runtime 06/2005
- Simatic Net Networking for Industry Edition 2005
- Micromaster Profibus Documentation Issue: 11/05
- Micromaster 420 Documentation Issue: 07/05
- pcAnywhere V11.5
- Simatic WinCC Flexible 2005 Authorization Disk Runtime, 128 PowerTags
- Simatic WinCC Flexible 2005 Authorization Disk Recipes for PC
- Simatic WinCC Flexible 2005 Authorization Disk Archives for PC
- PLC & SCADA Configuration Backup CD

Quantity: 1 each
Cross-references: For details, see Section 6.4.4.

16 WARRANTIES AND CERTIFICATIONS

This section contains copies of the Purifics® ES Inc. warranty, component warranties, and certifications.

16.1 Purifics® Photo-Cat®

Subject to the exclusions provided below, Purifics® ES Inc. warrants the new Photo-Cat® System is free from defects in material and workmanship at the time of delivery. Its sole liability is to replace, free of charge for parts and labour, *any part that*, within the one-year period following the date of installation of the Photo-Cat® System, is returned to Purifics® ES Inc., prepaid to its facilities in London, Ontario. The part(s) must be accepted as having been defective in material or workmanship. The defective part shall be exchanged for a new or comparable *rebuilt* part and shall be warranted until the end of the warranty period calculated from the date when the Photo-Cat® System was originally installed. The warranty applies only to defects arising out of the normal and ordinary use of the Photo-Cat® System.

This warranty is specific to the site location and application indicated in Proposal 5P1203 Warranty is void if the Photo-Cat® System is moved from the location or used in an application other than that specified in the proposal.

This warranty does not apply to:

- a) Travel and accommodation expenses incurred by Purifics® ES Inc. for work performed at the installation site;
- b) Fracture of glass lamps and glass sleeves;
- c) Use of parts or supplies other than O.E.M;
- d) Loss or damage to the Photo-Cat® System due to misuse, abuse, alteration, accident, failure to follow operating or maintenance instructions prescribed in the maintenance manual;
- e) Any Photo-Cat® System from which Purifics® ES Inc. identification number has been removed or which Purifics® ES Inc. considers in its discretion has been repaired, altered, neglected or used in any such way as to affect the Photo-Cat® System adversely (reasonable wear and tear accepted) and without limiting the generality of the foregoing. This warranty does not apply to any spare or replacement part used in any Photo-Cat® System for which it was not designed; and
- f) Modifications to the control system and/or its software.

This warranty is void if the client chooses to decline the recommended customer support and training identified in proposal 5P1203.

THIS WARRANTY IS GIVEN EXPRESSLY IN PLACE OF AND EXCLUDES ALL OTHER WARRANTIES AND CONDITIONS EXPRESSED OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHETHER UNDER COMMON LAW, STATUTE OR OTHERWISE. THERE IS ALSO EXCLUSION IN EVERY FORM OF LIABILITY FOR LOSS OR DAMAGE, DIRECT OR CONSEQUENTIAL, RESULTING FROM DEFECTIVE MATERIAL, FAULTY WORKMANSHIP, OR OTHERWISE.

16.2 Component Warranties

See component literature in manual hardcopy.

16.3 Certifications

See component literature in manual hardcopy.

17 WORLD WIDE SUPPORT (WWS)

Purifics® ES Inc. designs and builds durable, compact and highly automated solutions that destroy chemical contaminants found in water, air, and soil. Photo-Cat® systems are controlled by a highly flexible, secure, and functional control system.

17.1 Start-up Remote Monitoring & Support

Upon the purchase and installation of a Photo-Cat® system, Purifics® provides, for two months following start up, a limited version of its remote World Wide Support program to appraise and support the client's operations. This service is also available on a full time basis and is detailed below.

17.2 World Wide Support (WWS)

World Wide Support (WWS) is supplied via our remote monitoring and control centre at our London facility. A limited version of this support is provided, as noted above, during the first two months following system installation. Depending on contractual requirements, WWS can consist of:

- Real time remote monitoring of process variables on an intermittent basis.
- Real time remote video of the installation for inspection.
- Real time remote training of on-site personnel.
- Real time remote software modification.
- Real time text linkage for answers to site personnel questions or concerns during system operation or maintenance procedures.
- Automated computer log and feedback to site personnel.
- Automated compliance monitoring and report generation.
- Automated updates and downloads of bulletin or manual updates.
- Varying levels of security to limit access and control.
- Simple, direct and immediate spares ordering.

For inquiries about this option, please feel free to contact Purifics® ES Inc.



18 DISCLAIMERS

PURIFICS® IS NOT THE OPERATOR AND WILL NOT OPERATE THE EQUIPMENT; PURIFICS® WILL PROVIDE TECHNICAL SUPPORT WHEN CLEARLY REQUESTED. PURIFICS® MAKES NO REPRESENTATION CONCERNING THE NEED FOR A CERTIFICATE OF APPROVAL OR OTHER FORMS OF LICENSE TO OPERATE THE PHOTO-CAT® TREATMENT SYSTEM. The client must determine for itself whether a certificate of approval or other form of license or permit is required in the applicable jurisdiction before operation of this equipment commences. Purifics® makes no representation concerning the safety, handling or regulated use of chemicals. The client must ensure that the safety, use and storage of chemicals comply with all regulations within the jurisdiction.

19 COMPONENT DATA

Use or disclosure of data contained on this sheet is subject to the restrictions stated by Purifics® on the cover page.

19.1 Pumps

See component literature in manual hardcopy.

19.2 Valves

See component literature in manual hardcopy.

19.3 Sensors

See component literature in manual hardcopy.

19.4 PLC, Power Supply, and Other Electronics

See component literature in manual hardcopy.

19.5 Acidification & Neutralization Equipment

See component literature in manual hardcopy.

19.6 Oxidant Equipment

See component literature in manual hardcopy.

19.7 Auxiliary Equipment

See component literature in manual hardcopy.

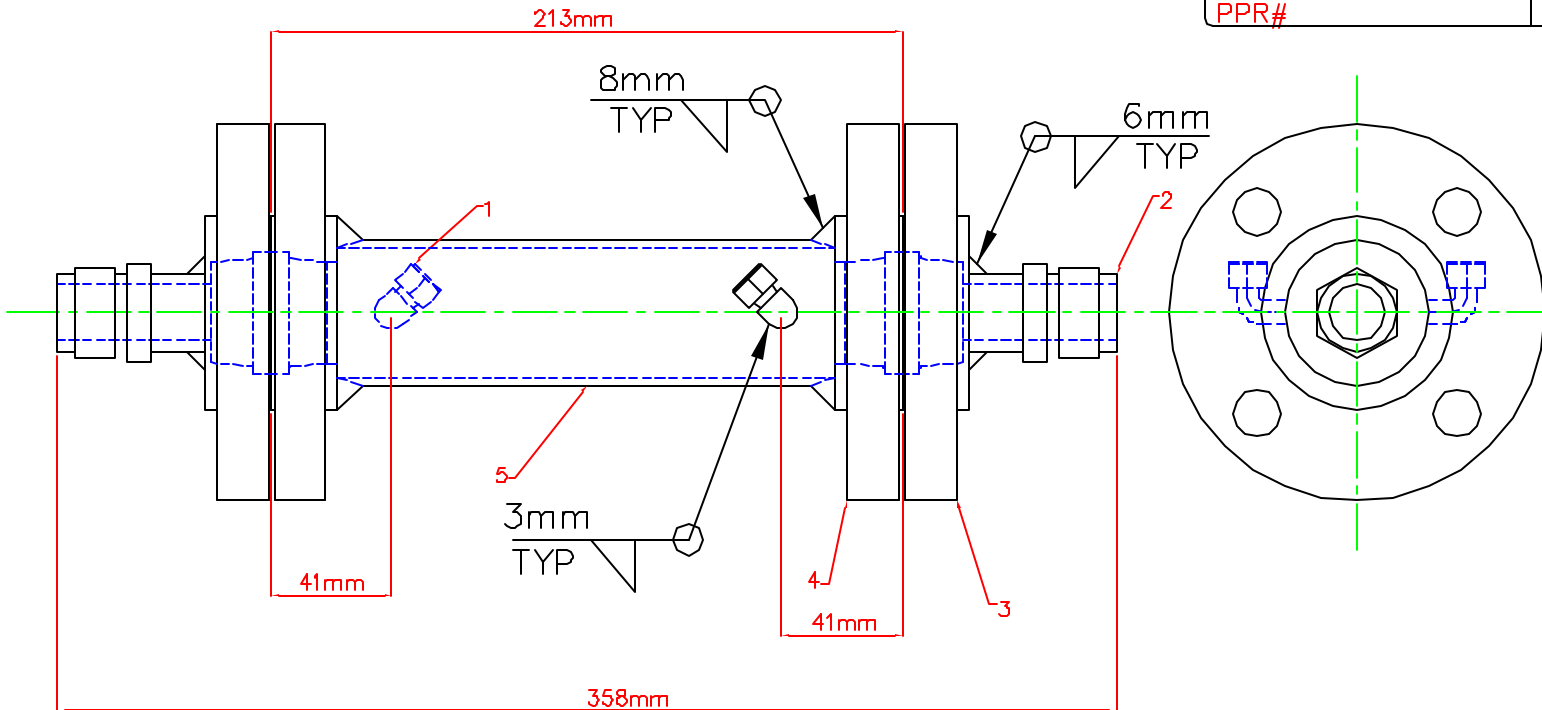
20 BULLETINS

BILL OF MATERIAL

ITEM #	DESCRIPTION	MANUFACTURER	PART#	MATERIAL	GRN#
1	1/4" COMP X 1/4" BW EL	HAMLET	769LNSS-1/4-1/4	SA182-316	-
2	3/4" COMP X 3/4" BW PIPE	HAMLET	769LNSS-3/4-3/4	SA479-T316	-
3	OUTBOARD FLANGE	MAASS	DWG# P2C-30D	SA182-T316	-
4	INBOARD FLANGE	MAASS	DWG# P2C-30D	SA182-T316	-
5	1 1/2" SCH 10 WLD PIPE	TBD	-	SA312-T316	-
6	1/2" X 50mm HEX BOLTS	TBD(PINACLE)	N/A	18-8 GRD S-	-

DESIGNED TO ASME VIII DIV.1 2003 EDITION, 2003 ADDENDA
 SERVICE: WATER, NON LETHAL

DESIGN PRESSURE	1030 kPa
DESIGN TEMPERATURE	80 DEG C.
MDMT	-29 DEG C.
PWHT	N/A
COROSION ALLOWANCE	0%
RADIOGRAPHY	NONE
HYDROSTATIC TEST	1550 kPa FOR 1HR
PPR#	PENDING



NOTES

R625-OMM-000439-1

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LONDON, ONTARIO, CANADA
 www.purifics.com

DESIGN: PURIFICS		SCALE: N.T.S.	TYPED
DRAWN: JAY PEARCE C.E.T.	SHEET No: 01-BH-AD1	FABRICATION	P.E.S. JOB No. WO 413
CHECKED:	DATE: 2002/10/22	REVISED BY:	REV. DATE:

PHOTO-CAT L
 AERATION HOUSING

P4A-333

REVISION CLIENT JOB No.
 N/A