

Using the Pall Aria™ AP Water Treatment System

Queensland Urban Utilities (QUU)

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Queensland Urban Utilities

Regional Lagoons Upgrade Project

Manual

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O&M Manuals

QPDocId	Region	Function	Title	Link
TMS311	Scenic Rim	General	Boonah STP ST56 Microfiltration (A090-0320-002 Pall Base Operations & Maintenance Manual OM Manual) General	TMS311
TMS312	Scenic Rim	General	Boonah STP ST56 Microfiltration (A090-0402-001 HMI Software Screens Appendix B) General	TMS312
TMS313	Scenic Rim	General	Boonah STP ST56 Microfiltration (A090-0321-001 System Functional Description Appendix C) General	TMS313
TMS314	Scenic Rim	General	Boonah STP ST56 Microfiltration (A090-0305-001 AP3 Installation Manual - Boonah Appendix D) General	TMS314
TMS315	Scenic Rim	General	Kalbar STP ST59 Microfiltration (A090-0320-002 Pall Base Operations & Maintenance Manual OM Manual) General	TMS315
TMS316	Scenic Rim	General	Kalbar STP ST59 Microfiltration (A090-0402-001 HMI Software Screens Appendix B) General	TMS316
TMS317	Scenic Rim	General	Kalbar STP ST59 Microfiltration (A090-0321-001 System Functional Description Appendix C) General	TMS317
TMS318	Scenic Rim	General	Kalbar STP ST59 Microfiltration (A090-0305-001 AP3 Installation Manual - Boonah Appendix D) General	TMS318
TMS319	Lockyer Valley	General	Forest Hill STP ST52 Microfiltration (A090-0320-002 Pall Base Operations & Maintenance Manual OM Manual)	TMS319
TMS320	Lockyer Valley	General	Forest Hill STP ST52 Microfiltration (A090-0402-001 HMI Software Screens Appendix B)	TMS320
TMS321	Lockyer Valley	General	Forest Hill STP ST52 Microfiltration (A090-0321-001 System Functional Description Appendix C)	TMS321
TMS322	Lockyer Valley	General	Forest Hill STP ST52 Microfiltration (A090-0305-001 AP3 Installation Manual - Boonah Appendix D)	TMS322
TMS323	Lockyer Valley	General	LaidleySTP ST53 Microfiltration (A090-0320-002 Pall Base Operations & Maintenance Manual OM Manual)	TMS323
TMS324	Lockyer Valley	General	LaidleySTP ST53 Microfiltration (A090-0402-001 HMI Software Screens Appendix B)	TMS324
TMS325	Lockyer Valley	General	LaidleySTP ST53 Microfiltration (A090-0321-001 System Functional Description Appendix C)	TMS325
TMS326	Lockyer Valley	General	LaidleySTP ST53 Microfiltration (A090-0305-001 AP3 Installation Manual - Boonah Appendix D)	TMS326

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Vendor Manuals

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VM213	ACP	A090-070404-001	Compressed Air Pipe Manual	x	x	x	x	VM213
VM256	Alpha	A090-070422-001	FXM650 1100 2000 UPS Installation & Operation Manual	x	x	x	x	VM256
VM214	Amiad	A090-070405-001	Filtomat M100-750 Series Brochure	x	x	x	x	VM214
VM215	Amiad	A090-070405-002	Filtomat M100-750 Series Maintenance Instructions	x	x	x	x	VM215
VM216	Amiad	A090-070405-003	Filomat Inspection Certificate	x	x	x	x	VM216
VM255	ARI	A090-070421-001	D-021 ARV Data Sheet	x	x	x	x	VM255
VM217	Asahi Kasei	A090-070406-001	UNA-620A MF Module Operating Instruction	x	x	x	x	VM217
VM257	Atlas Copco	A090-070423-001	FXE1 Refrigerant Compressed Air Dryers - Instruction Book	x	x	x	x	VM257
VM258	Atlas Copco	A090-070423-002	GX 2-5 FM. Dimension drawing (2202 2609 60 ed. 01)	x	x	x	x	VM258
VM259	Atlas Copco	A090-070423-003	GX2-GX3 Instruction Book	x	x	x	x	VM259
VM260	Atlas Copco	A090-070423-004	PD & DD Filters Instruction Manual	x	x	x	x	VM260
VM261	Atlas Copco	A090-070423-005	Receiver VAR565-1170WP. 9724-5037-52	x	x	x		VM261
VM262	Atlas Copco	A090-070423-006	GX2-5 electrical drw	x	x	x	x	VM262
VM263	Atlas Copco	A090-070423-007	Dryer FXe1-3 Service Diagram	x	x	x	x	VM263
VM264	Atlas Copco	A090-070423-008	Dryer Instruction Book FXe1-5 EN	x	x	x	x	VM264
VM265	Atlas Copco	A090-070423-009	Dryer Spare Parts Book FXe1-5	x	x	x	x	VM265
VM266	Atlas Copco	A090-070423-010	FX1 to 5 Dimension drawing	x	x	x	x	VM266
VM267	Atlas Copco	A090-070423-011	1000 L 10barg VAR STD	x			x	VM267
VM218	Aussie Pumps	A090-070407-001	B2KQ-A_EAR4 Data Sheet	x	x	x		VM218
VM219	Aussie Pumps	A090-070407-002	B3XR-A-ST_EAS1 Data Sheet	x			x	VM219
VM220	Aussie Pumps	A090-070407-003	GMP Pump Manual	x	x	x	x	VM220
VM221	Aussie Pumps	A090-070407-004	GMP Pump Operating Instructions	x	x	x	x	VM221
VM268	Bourke Valves	A090-070424-001	Certificate of Conformance	x	x	x	x	VM268
VM222	Bray Valves	A090-070408-001	S20 21 Data Sheet	x	x	x	x	VM222
VM223	Bray Valves	A090-070408-002	S30 31 Data Sheet	x	x	x	x	VM223
VM224	Bray Valves	A090-070408-003	S92-93 Data Sheet	x	x	x	x	VM224

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VM225	Bray Valves	A090-070408-004	S6A Dimensional Drawing	x	x	x	x	VM225
VM226	Bray Valves	A090-070408-005	S30-S92-S50 Dimensional Drawing	x	x	x	x	VM226
VM227	Bray Valves	A090-070408-006	S31-S92-S50 Dimensional Drawing	x	x	x	x	VM227
VM228	Bray Valves	A090-070408-007	Pneumatic Actuators Product Guide	x	x	x	x	VM228
VM229	Bray Valves	A090-070408-008	RSBV Product Guide	x	x	x	x	VM229
VM230	BVCI	A090-070409-001	2500L Round Squat Corrugated Tank	x	x	x	x	VM230
VM231	BVCI	A090-070409-002	5000L Round Corrugated Tank	x				VM231
VM232	Caps	A090-070410-001	SRV390 Conrader DataSheet	x				VM232
VM233	Caps	A090-070410-002	Equip - Air receiver -GA drawing	x				VM233
VM328	Cashco	A090-070439-001	Cashco - Installation Manual - Pressure Reducing Regulators - Models D & DL	x	x	x	x	VM328
VM330	Condamine Electric	A090-070441-002	Electrical Safety Compliance Certificate - Boonah	x				VM330
VM331	Condamine Electric	A090-070441-003	Electrical Safety Compliance Certificate - Kalbar		x			VM331
VM329	Condamine Electrical	A090-070441-001	Electrical Safety Compliance Certificate - Forest Hill			x		VM329
VM332	Condamine Electrical	A090-070441-004	Forrest Hill Electrical Certificate			x		VM332
VM333	Condamine Electrical	A090-070441-005	Laidley Electrical Certificate				x	VM333
VM209	Control IT	A090-070401-009	ITP	x	x	x	x	VM209
VM325	Danfoss	A090-070436-001	VLT Aqua Drive Operating Instructions	x	x	x	x	VM325
VM269	Emerson	A090-070425-001	Calibration Certificate - Serial 02813759	x				VM269
VM270	Emerson	A090-070425-002	Calibration Certificate - Serial 02813760	x				VM270
VM271	Emerson	A090-070425-003	Calibration Certificate - Serial 02832612	x				VM271
VM272	Emerson	A090-070425-004	Calibration Certificate - Serial 02832616	x				VM272
VM273	Emerson	A090-070425-005	3900 Manual	x	x	x	x	VM273
VM234	EzyStrut	A090-070411-001	ET3_ET5 Cable Tray Assembly Guide	x	x	x	x	VM234
VM294	Festo	A090-070431-001	Analog Modules	x	x	x	x	VM294
VM295	Festo	A090-070431-002	CPX - Pin Assignment Instructions	x	x	x	x	VM295
VM296	Festo	A090-070431-003	CPX IO and valve blocks - Analogue IO Modules	x	x	x	x	VM296
VM297	Festo	A090-070431-004	CPX IO and valve blocks - Digital IO Modules	x	x	x	x	VM297
VM298	Festo	A090-070431-005	CPX IO and valve blocks - Install & Commisisoning Manual	x	x	x	x	VM298
VM299	Festo	A090-070431-006	CPX IO and valve blocks - Manual	x	x	x	x	VM299

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QP	Vendor	File	Description	Boonah	Kalbar	Forest Hill	Laidley	Link
VM300	Festo	A090-070431-007	CPX Mounting - Data Sheet	x	x	x	x	VM300
VM301	Festo	A090-070431-008	CPX_EN	x	x	x	x	VM301
VM302	Festo	A090-070431-009	CPX-BG-RW-10X Assembly Instructions	x	x	x	x	VM302
VM303	Festo	A090-070431-010	CPX-FB32 IO and valve blocks - Electronics Manual	x	x	x	x	VM303
VM304	Festo	A090-070431-011	CPX-FEC IO and valve blocks - Electronics Manual	x	x	x	x	VM304
VM305	Festo	A090-070431-012	MSB Operating Instructions	x	x	x	x	VM305
VM306	Festo	A090-070431-013	MSF - MS6 Operating Instructions	x	x	x	x	VM306
VM307	Festo	A090-070431-014	MS-LFR Accessories - Data Sheet	x	x	x	x	VM307
VM308	Festo	A090-070431-015	MS-LFR Filter Regulator - Data Sheet	x	x	x	x	VM308
VM309	Festo	A090-070431-016	MS-W Operating Instructions	x	x	x	x	VM309
VM310	Festo	A090-070431-017	SDE1 Pressure Switch - Data Sheet	x	x	x	x	VM310
VM311	Festo	A090-070431-018	SDE1 Pressure Switch - Install Manual	x	x	x	x	VM311
VM312	Festo	A090-070431-019	SDE1 Pressure Switch - Manual	x	x	x	x	VM312
VM313	Festo	A090-070431-020	SDE1-SH Pressure Switch Protective Hood - Data Sheet	x	x	x	x	VM313
VM314	Festo	A090-070431-021	Universal Connecting Cables - Data sheet	x	x	x	x	VM314
VM315	Festo	A090-070431-022	VTSA Valve Terminal - Manual	x	x	x	x	VM315
VM316	Festo	A090-070431-023	QS Series Pneumatic Fittings	x	x	x	x	VM316
VM317	Festo	A090-070431-024	Silencers	x	x	x	x	VM317
VM274	GMP	A090-070426-001	Self Priming End Centrifugal Electric Pumps Installation Instructions	x	x	x	x	VM274
VM235	Grundfos	A090-070412-001	522 Injection Valve - Operation Manual	x	x	x	x	VM235
VM236	Grundfos	A090-070412-002	DD Chemical Tanks	x	x	x	x	VM236
VM237	Grundfos	A090-070412-003	Foot Valve IOM	x	x	x	x	VM237
VM238	Gruvlok	A090-070413-001	Fig 7305 HDPE Coupling	x	x	x	x	VM238
VM239	Gruvlok	A090-070413-002	Fig 7307 HDPE Transition Coupling	x	x	x	x	VM239
VM240	Gruvlok	A090-070413-003	HDPE Coupling Manual	x	x	x	x	VM240
VM275	Hach	A090-070427-001	Calibration Test Certificate - SC200 Controller - 1206C0043665	x				VM275
VM276	Hach	A090-070427-002	Calibration Test Certificate - SC200 Controller - 1210C0049992	x				VM276
VM277	Hach	A090-070427-003	FT660 SC User Manual	x	x	x	x	VM277
VM278	Hach	A090-070427-004	sc200 Controller User Manual	x	x	x	x	VM278

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VM279	Hach	A090-070427-005	1720E Users Manual	x	x	x	x	VM279
VM241	Harvel	A090-070414-001	Sch. 80 PVC-U Data Sheet	x	x	x	x	VM241
VM327	Hershey	A090-070438-001	Valve - Catalog 2011.05	x	x	x	x	VM327
VM242	Jaco	A090-070415-001	Compression Fittings Catalogue	x	x	x	x	VM242
VM212	Johnson Screens	A090-070403-001	S 12-69 Intake Screen Drawing	x	x	x	x	VM212
VM280	Kelco	A090-070428-001	F20 Modular Flow Switches Installation & Operating Guide Lines	x	x	x	x	VM280
VM243	Lowara	A090-070416-001	SHE Pumps Catalogue	x	x	x	x	VM243
VM244	Lowara	A090-070416-002	SHE Pumps Operating Instructions	x	x	x	x	VM244
VM245	Lowara	A090-070416-003	SV-CO-FH-FC-SH-CEF-COF - Safety Instructions	x	x	x	x	VM245
VM323	Maric	A090-070434-001	CFF Brochure	x	x	x	x	VM323
VM246	Merriman	A090-070417-001	Line Strainer 305	x				VM246
VM247	Merriman	A090-070417-002	Y-strainer	x				VM247
VM248	Pall	A090-070418-001	MF Fiber Information Sheet	x	x	x	x	VM248
VM322	Pall Beijing	A090-070433-001	Quality Documentation	x	x	x	x	VM322
VM318	Perfab	A090-070432-001	Material Data Record - Laidley				x	VM318
VM319	Perfab	A090-070432-002	Material Data Record - Forest Hill			x		VM319
VM320	Perfab	A090-070432-003	Material Data Record - Kalbar		x			VM320
VM321	Perfab	A090-070432-004	Material Data Record - Boonah	x				VM321
VM281	Rosemount	A090-070429-001	644H Temperature Transmitter with 4-20mA Hart Quick Start Guide	x	x	x	x	VM281
VM282	Rosemount	A090-070429-002	2088, 2090P & 2090F Pressure Transmitter with 4-20 mA Hart Quick Installation Guide	x	x	x	x	VM282
VM283	Rosemount	A090-070429-003	8700 Series Magnetic Flowmeter Sensors - Quick Intallation Guide	x	x	x	x	VM283
VM284	Rosemount	A090-070429-004	8732e Magnetic Flowmeter System - Quick Installaiton Guide	x	x	x	x	VM284
VM285	Rosemount	A090-070429-005	Declaration of Conformity	x	x	x	x	VM285
VM286	Rosemount	A090-070429-006	Magnetic 8732 Flowmeter Factory Configuration - Serial No 0354479	x	x	x	x	VM286
VM287	Rosemount	A090-070429-007	Magnetic 8732 Flowmeter Factory Configuration - Serial No 0354480	x	x	x	x	VM287
VM288	Rosemount	A090-070429-008	148TemperatureTransmitter_RevAA	x	x	x	x	VM288

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QP	Vendor	File	Description	Boonah	Kalbar	Forest Hill	Laidley	Link
VM289	Rosemount	A090-070429-009	644HeadandRailMountTemperatureTransmitters_RevJA	x	x	x	x	VM289
VM290	Rosemount	A090-070429-010	RTD&ThermcoupleAssemblies_RevBA		x	x	x	VM290
VM324	Solberg	A090-070435-001	F Series Filters	x	x	x	x	VM324
VM249	Spears	A090-070419-001	Saddle	x	x	x	x	VM249
VM250	Spears	A090-070419-002	Sch.80 Fittings	x	x	x	x	VM250
VM251	Spears	A090-070419-003	True Union Valves	x	x	x	x	VM251
VM252	Spears	A090-070419-004	Y-strainer	x	x	x	x	VM252
VM326	Spill Station Australia	A090-070437-001	Bunding Information	x	x	x	x	VM326
VM210	TEE	A090-070402-001	CIP Tank Heater - General Arrangement - TIH1001500	x			x	VM210
VM211	TEE	A090-070402-002	CIP Tank Heater - General Arrangement - TIH1001200	x	x	x		VM211
VM291	Vega	A090-070430-001	PLICCOM Operating instructions	x	x	x	x	VM291
VM292	Vega	A090-070430-002	Vegason 61 Operating Instructions	x	x	x	x	VM292
VM293	Vega	A090-070430-003	Vegason 61 Product Info	x	x	x	x	VM293
VM253	Wilden	A090-070420-001	P25 Manual	x	x	x	x	VM253
VM254	Wilden	A090-070420-002	Declaration of Conformity	x	x	x	x	VM254
VM334	Control IT	A0901-070401-001	Checklist MCP - Boonah	x				VM334
VM335	Control IT	A0901-070401-005	Commissioning MCP - Boonah	x				VM335
VM336	Control IT	A0901-070401-010	Compliance Certificate - Boonah	x				VM336
VM337	Control IT	A0902-070401-002	Checklist MCP - Kalbar		x			VM337
VM338	Control IT	A0902-070401-006	Commissioning MCP - Kalbar		x			VM338
VM339	Control IT	A0902-070401-011	Compliance Certificate - Kalbar		x			VM339
VM340	Control IT	A0903-070401-003	Checklist - MCP - Laidley				x	VM340
VM341	Control IT	A0903-070401-007	Commissioning MCP - Laidley				x	VM341
VM342	Control IT	A0903-070401-012	Compliance Certificate - Laidley				x	VM342
VM343	Control IT	A0903-070401-013	Cabinet & Panel Checklist - MCP - Laidley				x	VM343
VM344	Control IT	A0903-070401-014	Commissioning Checklist - MCP - Laidley				x	VM344
VM345	Control IT	A0904-070401-004	Checklist MCP - Forest Hill			x		VM345
VM346	Control IT	A0904-070401-008	Commissioning MCP - Forest Hill			x		VM346
VM347	Control IT	A0904-070401-015	Compliance Certificate - Forest Hill			x		VM347



IMPORTANT – READ THIS FIRST

Before attempting to operate or install this equipment, Pall Corporation requires all operators to read and understand this Operation and Maintenance manual and the proper Installation Manual for the system. Attempting to operate any Pall Corporation equipment without first reading the Operation and Maintenance manual may result in personal injury and/or product damage and may void any and/or all warranties.

Direct all questions and/or inquiries to Pall Technology Services:

Telephone: +612 4340 8900

Fax: +612 4340 8999

* The telephone number +612 4340 8900 from 9 A.M. to 4 P.M. Eastern Standard Daylight Savings Time. After 4 P.M., there is a service charge unless the customer has an existing Pall service contract.

Throughout this manual, the word “customer” refers to Queensland Urban Utilities (QUU).

THE PALL ARIA™ WATER TREATMENT SYSTEM

Revision History

Table A - Pall Revision History

Revision	Date	Originator	Description
0	May 2008	Pall Water Processing	Initial Document Release
A	March 2013	SB	Draft for Approval – Project Specific
0	July 2013	SB	Final (As-constructed incl. client comments)

THE PALL ARIA™ WATER TREATMENT SYSTEM

Table B - Operator Revision Sheet

Revision	Date	Originator	Description



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THE PALL ARIA™ WATER TREATMENT SYSTEM

1 SAFETY INFORMATION

1.1 USER'S RESPONSIBILITY

In keeping with its commitment to the safe operation of its equipment, Pall Corporation provides the information in this section as good working practice safety guidelines and a guide for safe operation of Pall equipment. Use of this information should be in conjunction with the safety procedures at the facility where the Pall system/equipment is located.

Personnel working with or around the equipment should read and understand **ALL** safety procedures before proceeding. Where there is conflict with existing safety procedures, the in-force local facility safety procedures take precedence. It is the buyer's responsibility to enforce the adherence to safe operating procedures.

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1.2 DOCUMENT SAFETY AND OPERATIONAL INDICATORS AND SYMBOLS



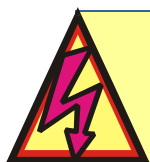
IMPORTANT

Important indicators identify that the product documentation contains important operating and maintenance instructions and/or information that can help in the efficient use of the Pall Aria™ Water Treatment System.



CAUTION

Caution indicators identify the potential for hardware or product damage and provide information for prevention.



This lightning symbol indicates that a dangerous voltage or other electrical hazard is present and may constitute a risk of electrical shock with the potential for **BODILY HARM**.



WARNING!

STOP WARNING SYMBOLS INDICATE THE SERIOUS POTENTIAL FOR **BODILY HARM** AND PROVIDE INFORMATION FOR PREVENTION.

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**IMPORTANT**

The symbols and their combinations in this section and throughout this manual provide emphasis to important aspects of both safety and the operation of this system. NOTE: ALL information contained in this manual is important for the safe and efficient operation of this system.

1.3 STATEMENT OF PROPER USE

The Pall Aria™ Water Treatment Systems are highly flexible membrane filtration systems designed and engineered by Pall Corporation for filtering ground and surface waters for water supply and industrial uses and filtering secondary wastewater effluent for reuse. The Pall Aria™ AP series systems separate particulate matter from soluble components and remove contaminants in water.

DO NOT convert or alter the Pall Aria™ Water Treatment System to any purpose other than its intended one without first contacting Pall Corporation. Pall Corporation is not responsible for any of its equipment altered by others without Pall Corporation's prior approval.

**IMPORTANT**

All Pall Aria™ Water Treatment System operators must be properly trained by Pall Corporation or someone authorised by Pall Corporation. Any damage to any part of the Pall Aria™ Water Treatment System caused by an untrained operator voids all warranties.

Any damage to any part of the Pall Aria™ Water Treatment System caused by the modifying or loading of computer software onto the Pall Aria™ Water Treatment System computers unauthorised by Pall Corporation voids all warranties.

THE PALL ARIA™ WATER TREATMENT SYSTEM

1.4 WARNINGS AND SAFETY INFORMATION



WARNING!

THE FOLLOWING MANUAL SECTIONS CONTAIN SAFETY INFORMATION, WARNINGS, AND CAUTIONS BOTH MECHANICAL AND ELECTRICAL THAT CAN RESULT IN BODILY HARM AND/OR EQUIPMENT DAMAGE IF IGNORED!

DO NOT OPERATE OR SERVICE THIS EQUIPMENT UNTIL YOU HAVE READ THIS OPERATION AND MAINTENANCE MANUAL AND THE SAFETY INFORMATION IT CONTAINS. WHEN INSTALLING, OPERATING, OR PERFORMING MAINTENANCE ON THIS EQUIPMENT, ALWAYS OBSERVE CAUTION AND WARNING NOTICES.

The design and manufacture of all Pall Corporation equipment is with due consideration and care for generally accepted safety standards. The proper and safe performance of this equipment depends on using sound and prudent operating, maintenance, and servicing procedures under properly trained supervision.

For your protection and the protection of others:

- Learn and follow the safety guidelines outlined in this manual.
- Form safe working habits by incorporating and abiding by these guidelines in the daily work routine.
- Keep this manual available for review.

Always operate the system within the safety operating guidelines of this manual and the facility where the system is located.

NEVER ASSUME... ALWAYS VERIFY!

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1.4.1 OBSERVE CAUTIONS AND WARNING NOTICES

Do not:

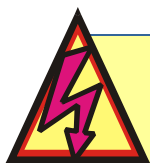
- Prevent the operation of any safety features.
- Start the machine until all personnel are clear.

Never:

- Remove the safety guards.
- Operate this equipment with any of the safety devices bypassed or the guards removed. Only qualified personnel should operate this machine.
- Perform service or maintenance procedures when the equipment/machine is running or toxic materials are present.

This equipment includes an electrical system. To avoid shock or serious injury, only qualified personnel should perform maintenance on the electrical system. For maximum protection, the power source should be **LOCKED OUT** using a lock for which only the operator has the key. This prevents anyone from accidentally turning on the power while the operator is servicing the equipment/machine.

All electric power must be **OFF** before servicing the equipment/machine. If applicable, turn the main disconnect switch to the **OFF (OPEN)** Position. If a main disconnect switch is not present, isolate (de-energise) the machine/equipment of all power sources before any service takes place. Refer to the section “Electrical Safety” on page 19 for more information.



CAUTION

If the main control panel is UPS protected, turning the disconnect switch to the off position does not fully de-energise the panel.

Refer to the panel electrical drawings and schematics for means to disconnect the UPS output power.



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1.4.2 ESTABLISH A SAFE OPERATING ZONE

Trained and authorised installation personnel only:

- Are required for the establishment of the operating zone.
- Should install power sources, including electrical, air (pneumatic), nitrogen, steam, and hydraulic.
- Should be within the operating zone when there is power applied to the equipment/machine control circuits or when the equipment/machine is in operation.

Use a brightly painted guardrail and/or warning strips to define an operating zone around all equipment/machines.

Always operate the filter system within the safety guidelines of the facility where the system is located.

Do not keep tools or other equipment within the operating zone.

Installations must comply with all applicable codes and standards, including those established by OSHA.

1.4.3 SAFETY INSPECTIONS

1.4.3.1 BEFORE A SYSTEM SHUTDOWN



IMPORTANT

Operators must close manual valve HV-5 BEFORE proceeding with a system shutdown.

1.4.3.2 AFTER SHUTDOWN

When the system is shut down, make sure that:

THE PALL ARIA™ WATER TREATMENT SYSTEM

- All utilities such as air and electrical power are turned off and disconnected, unless required.
- All pressure is relieved from any tanks, vessels, or other pressurised equipment.

1.4.3.3 BEFORE STARTUP OR RESTART

Before the startup or restart of the system, make sure that all:

- Guards and safety devices are installed and operative.
- Non-operating personnel are clear of the equipment/machine.
- Materials, tools, or other foreign objects that could cause bodily injury to personnel and/or damage the equipment/machine are removed from the operating zone.
- Equipment is in operating condition by checking that:
 - ✓ All gas and fluid connections are tight and leak free.
 - ✓ All moving components are properly lubricated.
 - ✓ All process monitoring lights, horns, pressure gauges, and safety devices or indicators are in good working order.

1.4.4 GENERAL OPERATING SAFETY

Do not:

- Operate any equipment until thoroughly trained in all facets of its operation.
- Operate faulty or damaged equipment. Make sure that the performance of proper service and maintenance procedures on all equipment is up to date.
- Start any equipment until issuing warnings to all non-essential personnel in the area. After issuing warnings, verify that all non-essential personnel have moved outside the operating zone.

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- Have loose clothing, neckties, necklaces, or unrestrained long hair near any operating equipment. These restricted items include rings, watches, bracelets, and other jewelry.
- Place fingers, hands, or any other part of your body on or into any equipment or near moving parts when the power is on.
- Touch surfaces that are in temperature ranges above 40° C or below - 10° C.

Never:

- Operate any equipment if the removal or disconnection of a safety device or guard has occurred.
- Operate any equipment above or below specified speeds, pressures, or temperatures.
- Remove warning labels or signs that appear on any equipment. Replace torn, worn, and unreadable warning markers immediately.
- Sit, stand, kneel, or lay on anything that may cause you to fall against the equipment.
- Perform any unauthorised activity around or on any equipment at any time. This is both dangerous and prohibited.

Always:

- Remove any tools or other unauthorised objects from the operating zone before starting the equipment.
- Keep the operating zone free of obstacles that could cause a person to trip or fall against the equipment.
- Keep alert and observe indicator lights, warnings, and alarms that display on any equipment.
- Wear required safety equipment.
- Know the **EMERGENCY** or **QUICK STOP** procedure for the system. Refer to the section “Stopping the Pall Aria™ System” on page 57.

THE PALL ARIA™ WATER TREATMENT SYSTEM

NOTE

Air, nitrogen, hydraulic, steam, and electrical power must be **OFF** when the equipment is not in use unless it is required for maintenance, testing, or troubleshooting purposes.

1.4.5 ELECTRICAL SAFETY

This equipment includes an electrical system. Only trained, qualified, and authorised personnel should perform:

- All electrical/electronic maintenance and service.
- Maintenance on the electrical system to avoid bodily harm to other personnel.

All electric power must be **OFF** before servicing the equipment unless required for maintenance, testing, or troubleshooting procedures.

- If power is required, EXTREME CAUTION must be observed by all personnel. If applicable, turn the **MAIN DISCONNECT** switch to the **OFF (OPEN)** position.
- If a main disconnect switch is not present, isolate (de-energise) the equipment of all power sources before any service takes place unless required for maintenance, testing, or troubleshooting procedures.

Under circumstances where maintenance, testing, or troubleshooting requires the power to be **ON**, make sure:

- ✓ Your tools and body are clear of the chassis.
- ✓ Proper grounding is in place.
- ✓ To take extra safety precautions in damp areas.
- ✓ To be alert and avoid outside distractions.
- ✓ To post proper **ELECTRICAL HAZARD** warning signs.
- ✓ To inform all personnel in the area that work is taking place with the electrical power turned **ON** and applied to the equipment.

Always assume that the power is **ON** and treat all conditions as live.

THE PALL ARIA™ WATER TREATMENT SYSTEM

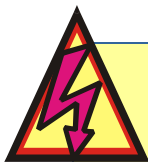
To remove the load from a circuit or equipment:

- **OPEN** the disconnect switch or the appropriate circuit breaker and **LOCK** it in the open position.

For maximum safety, the power source should be **LOCKED OUT** using a lock for which only the operator has the key. This prevents anyone from accidentally turning on the power while the operator is servicing the equipment/machine.

Always use standard OSHA Lockout/Tag-out procedures when servicing the equipment, or the appropriate procedures of the governing body in the country where the equipment is located.

- Make sure that the circuit is **OPEN** by using the proper test equipment. It is important to check test equipment at regular intervals for proper calibration and that it is functioning properly.



CAUTION

DANGER – Using a power source other than that specified in this manual or the system drawings can cause **BODILY HARM** and/or product damage. Make sure the power supply meets the requirements as specified.

Improper grounding can cause electrical shock hazards. Make sure that proper grounding, bonding, and overload protections are in force. Do not defeat the grounding or polarisation of the equipment/machine.

- Control panel doors should be open only when checking the electrical equipment wiring. When the panel door is closed, make sure that the disconnect handle mechanism (if applicable) is operating properly.
- Protect all electrical connections by confining them inside a sealed junction box. Close and secure all covers on electrical panels and junction boxes before leaving any job.
- Replace fuses only with those of a similar rating and only when the electrical power is **OFF**. If possible, the electrical power source should be **LOCKED OUT**.

THE PALL ARIA™ WATER TREATMENT SYSTEM

1.4.6 CLEANING SAFETY

Always:

- Turn **OFF** air (pneumatic), electric power, steam, and other utilities before cleaning the equipment.
- Keep electrical panel covers **CLOSED** and the power **OFF** when using liquids to clean the equipment.

For maximum safety, the power source should be **LOCKED OUT** using a lock for which only the operator has the key. This prevents anyone from accidentally turning on the power while the operator is cleaning the equipment/machine.

- Make sure that all connections in the cleaning circuit are tight to avoid contact with hot water or cleaning solutions during the Clean-In-Place (CIP) process. Information on this process is in Appendix C “System Functional Description”.
- Follow all site procedures regarding toxic, bio-hazardous, or corrosive process materials.

Never:

- Attempt to clean any equipment while it is in operation.
- Use toxic or flammable solvents to clean a machine.

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THE PALL ARIA™ WATER TREATMENT SYSTEM

2 PALL ARIA™ SYSTEM OVERVIEW



CAUTION

Do not install the Microza® modules in the rack or attempt to start a filtration cycle until the **Pall Aria™** Water Treatment System has been properly flushed using the included dummy module.

Do not install the Microza® modules until after an initial flush of the system has taken place. Always use a dummy module to perform the initial system flush (see page 50).

Using the **Pall Aria™** system before flushing may cause damage to the modules and other system components from debris that has inadvertently entered the system through fabrication, shipping, storage, and/or installation.

THE PALL ARIA™ WATER TREATMENT SYSTEM

2.1 SEQUENCE OF MODULE HANDLING

The following is a general sequence of module handling steps, starting with the commissioning of a new Pall Aria™ Water Treatment System to an incidence of module repair or replacement.

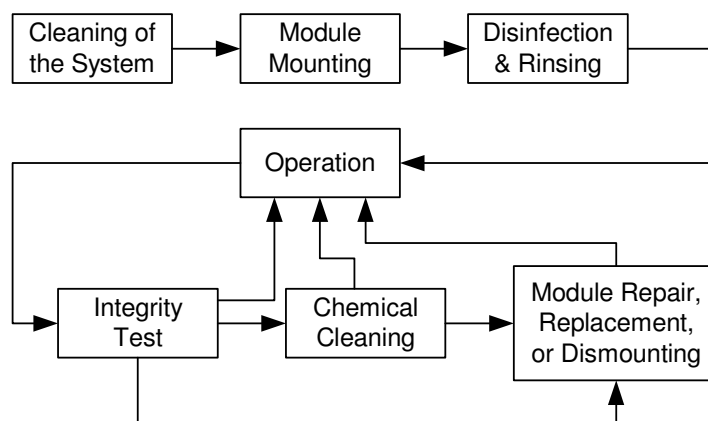


Figure 2-1: Module Handling Sequence

2.2 STORAGE AND PRESERVATION OF THE MICROZA® MICROFILTRATION MODULES



CAUTION

The Microza® microfiltration module membranes can dry out if left unattended. This adversely affects their performance. As a result, the modules are shipped containing a storage solution to preserve the membranes. This solution must be maintained in the modules until put into service. For that reason, after receiving the modules and before they are stored, the shipping containers must be opened and the modules inspected for leaks or damage of any kind. If any module leakage or damage is noticeable or suspected, contact Pall Technology Services immediately.

After inspection, reseal the modules in their containers and place them in an enclosed storage area that provides adequate protection from extreme heat (no exposure to direct sunlight) and cold (no temperatures below freezing). DO NOT STORE THE MODULES OUTSIDE.

FAILURE TO ADHERE TO THIS CAUTION RESULTS IN THE VOIDING OF ALL MODULE WARRANTIES!

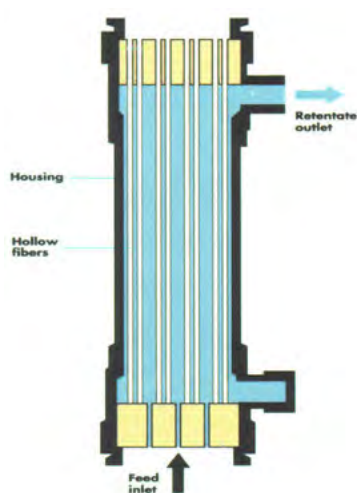
DO NOT drop or expose either the modules or their shipping containers to shock or impact. There may be damage to the membrane even if no visible damage to the module case is evident.

After system installation, if the system is to be shut down for a short time (less than 48 hours), the Microza® modules membranes must be kept wet with clear water. If the system is to be shut down for more than 48 hours refer to the section “Long-Term Shutdown and System Lay-Up” on page 70 for more storage procedures.

DO NOT move or in any way transport the Pall Aria™ Water Treatment System with the modules mounted on the skid. Any vibration or shock may damage the module membrane. Always dismount the modules and install dummy modules for system transportation.

THE PALL ARIA™ WATER TREATMENT SYSTEM

2.3 INTRODUCTION TO THE PALL ARIA™ WATER TREATMENT SYSTEM



Pall Aria™ Water Treatment Systems use uniquely designed hollow fibre microfiltration (MF) devices to remove turbidity, bacteria, cysts, and particles from ground and surface water supplies and secondary wastewater effluent. Membranes trap impurities by means of a fixed porous barrier. Membrane treatment performance is relatively insensitive to rapid changes in the feed water composition, unlike systems based on chemical addition and coagulation.

Microfiltration is ideal for removing suspended particles, bacteria, cysts, and oocysts. The Microza® Microfiltration membranes normally operate at pressures of between 69 and 310 kPa. Nano-filtration and reverse osmosis (RO) are practical in use to purify water even further, but the pressure required for the feed water to these systems

increases significantly as a result.

The Pall Aria™ Water Treatment System automates MF processes. This makes for a consistent performance and minimises labor.

For example, the Pall Aria™ system automatically sequences and completes MF process steps such as the following:

- Normal production
- Regeneration/Flux maintenance (air scrubbing, reverse filtration)
- Enhanced flux maintenance
- Integrity testing of the membranes

Each module has an active surface area of approximately 50 m².

Some of the features and benefits of the Pall Aria™ Water Treatment System include the following:

- Simplified, operator-friendly process and control design
- Use of long-service hollow fibre modules

THE PALL ARIA™ WATER TREATMENT SYSTEM

- Minimised cost of operation
- Compact system footprint
- Compatible with chlorine and other common treatment chemicals
- Unique Air Scrub and Reverse Feed/Filtration Flux Maintenance Procedures
- Automated Integrity Testing
- Easy installation

2.4 HOW THE PALL ARIA™ WATER TREATMENT SYSTEM OPERATES

Membrane filtration processes usually include many complex steps that may be sensitive to operator interaction. The Pall Aria™ Water Treatment System performs these complex steps automatically and consistently, reducing labor costs. The Pall Aria™ system also has options available to provide the customer with comprehensive process data and historical trending. The section “Operating Description” on page 41 provides process descriptions and information.

The Pall Aria™ Water Treatment System records, displays, and stores operating data for process control, troubleshooting, and diagnostics. This includes the following:

- Pressures, flows, temperatures, turbidities, and process volume measurements
- Membrane performance before and after cleaning
- Membrane and system integrity
- Run activity and operator input
- Alarms and alarm acknowledgements

THE PALL ARIA™ WATER TREATMENT SYSTEM

2.5 DESCRIPTION OF MAIN COMPONENTS

The Pall Aria™ Water Treatment System consists of several main components:

- Frame, enclosures, and filtration modules
- Computer/control system with touch screen monitor and custom system software
- Processing hardware and instrumentation (valves, pipes, pumps, sensors)

Refer to the System Functional Description included in Appendix C for further information.

2.6 FRAME AND ENCLOSURES

A welded, painted carbon steel frame supports the system's hollow fibre modules and the process equipment. This includes the piping, valves, sensors, pumps, tanks, monitoring instrumentation, and electrical enclosure.

The electrical enclosure houses the Pall Aria™ Water Treatment System controller, with a touch screen monitor, programmable logic controller (PLC), and other process control electronics.

Mounted on the skid outside of the enclosure are variable frequency drives (VFD's) for pump control.

2.7 PALL ARIA™ SYSTEM CONTROL

Refer to Section 5 "Operating Description", Appendix B "HMI Screens and Descriptions" and Appendix C - System Functional Description for more information on Pall Aria™ AP system control.

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2.8 PROCESSING HARDWARE

The Pall Aria™ Water Treatment System processing hardware consists of tanks, pipes, pumps, valves, sensors, and other equipment. Descriptions of some of the major system components follow.

2.8.1 THE FEED TANK

The Feed Tank is a rectangular welded Polypropylene (PP) tank. The Feed Tank includes the following:

- One (1) hinged lid access;
- One (1) pressure-type level transmitter for automatic monitoring of liquid level;
- One (1) removable strainer to protect the pump from large particles;

The purpose of the feed tank is to provide a reservoir for incoming raw feed and excess feed which recirculates. It also serves as the holding tank for the cleaning chemical solution used during the CIP operations. The removable strainer at the outlet of this tank prevents large particles from damaging the recirculation pump. The operator must periodically check and clean this strainer.

The Feed Tank has three (3) inlet lines:

- One (1) line from the primary feed water supply;
- One (1) line for recirculation of the excess feed (XR);
- One (1) line for recirculation of the Filtrate (as required).

The Feed Tank has two (2) outlet lines:

- One (1) line from the bottom of the tank is the primary feed water supply to the recirculation pump. A branch connection and hand valve is also included on this line for manually draining the Feed Tank;
- One (1) overflow line (directed to drain).

THE PALL ARIA™ WATER TREATMENT SYSTEM

2.8.2 RECIRCULATION PUMP

The Recirculation pump draws water from the feed tank to feed the Microza® hollow fibre module rack.

The Pall Aria™ Water Treatment System uses a centrifugal pump, controlled by a VFD through the Flow controller to feed the hollow fibre modules. Flow measurements taken from a flow indicating transmitter (FIT) determines automatic control of the pump speed.

2.8.2.1 REVERSE FILTRATION (RF) TANK

The reverse filtration tank is a rectangular welded Polypropylene (PP) tank, it includes:

- One (1) sealed cover with fasteners and one (1) EPDM gasket;
- One (1) actuated tank fill valve;
- One (1) pressure-type level transmitter for automatic monitoring of the liquid level;
- One (1) vent with filter designed to keep the tank contents clean while preventing the potential of the tank drawing a vacuum. The vent filter prevents bacteria, spores, and other contaminants from entering the tank when it is draining during **Reverse Filtration (RF)** or **Air Scrub (AS)**.

This vent filter requires regular maintenance. Operators must check and/or change the vent filter regularly. Pall Corporation recommends doing this every three (3) months to make sure that clogging does not occur.

The efficiency of this filter relates directly to the evacuation rate of the reverse filtration tank, which in turn affects module cleaning. Refer to the manufacturer's documentation in Appendix E for more information;

The reverse filtration tank provides a source of filtered water to use during the reverse flow process step.

The reverse filtration tank has one (1) inlet line:

- One (1) line from the filtrate side of the hollow fibre modules.

THE PALL ARIA™ WATER TREATMENT SYSTEM

The reverse filtration tank has two (2) outlet lines:

- One (1) line in the bottom of the tank that supplies the reverse filtration pump with filtrate. A branch connection and hand valve is also included on this line for manually draining the RF Tank;
- One (1) overflow line (directed to drain) with a check valve.

2.8.3 REVERSE FILTRATION (RF) PUMP

The Pall Aria™ Water Treatment System uses a centrifugal pump controlled by a VFD through a flow controller. Flow measurements determine automatic control of the pump. This pump provides the fluid flow into the top of the hollow fibre modules during the backwashing steps.

2.8.4 BACKWASHING STRAINER

Feed water from the Recirculation Pump outlet passes through a backwashing strainer before entering the hollow fibre modules. The strainer backwashes automatically based on time or differential pressure.

2.8.5 MODULE RACK AND FIBRE MODULES

The module rack holds the Microza® microfiltration modules. It is acceptable to cap off unused module spaces. Refer to the “Recommended Replacement Parts List” in Appendix A and Table 3.2 on page 34 for a detailed list of module parts and their appropriate Pall Corporation identification.

THE PALL ARIA™ WATER TREATMENT SYSTEM

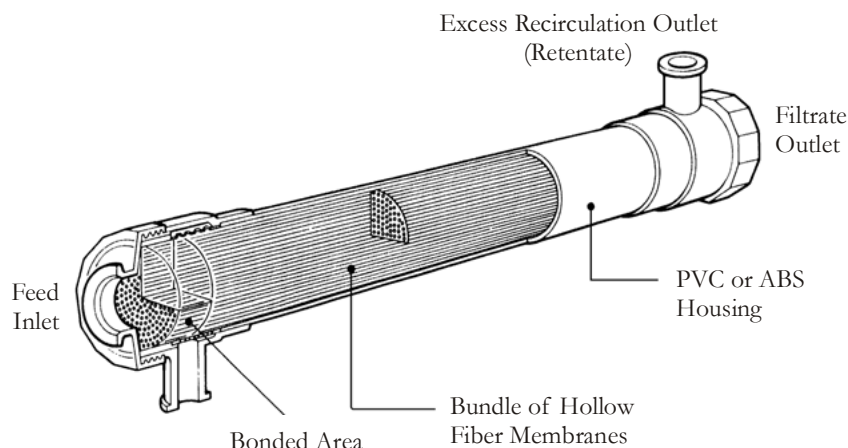


Figure 2-2: A Microza® Hollow Fibre Module

2.8.6 MICROZA® MODULE SPECIFICATIONS

The outer shell of each module is nominally 165 mm in diameter and 2 m in length, including the end caps. The weight of a new module is approximately 32 kg, of which 14 kg is the membrane preservative solution. The holdup volume of the module is 30 liters. Inside each module are thousands of thin, long fibres with a combined total exterior surface area of approximately 50 m². Each fibre has thousands of pores of approximately 0.1 micron in diameter. The pores prevent virtually all particulate matter from passing through the membrane surface. The membranes provide a barrier against all bacteria.

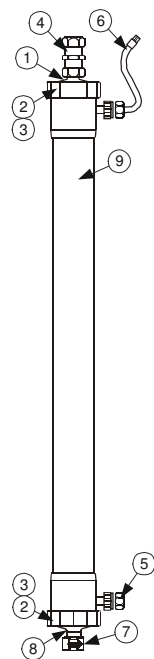
The fibre ends are potted in epoxy and arranged so that the feed flow enters the bottom of the module (sealed fibre ends) and flows on the outside of the fibres in the body of the module. Filtration occurs through an “outside-to-inside” flow path and the filtrate leaves from the top of the module (open fibre ends, sealed from interaction with the water in the module body).

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Table 2-1: Microza® Module Specification

Parameter	UNA Module
Membrane Inner Diameter	0.7 mm
Membrane Outer Diameter	1.3 mm
Membrane Area, based on fibre outer diameter	50 m ²
Membrane Length	2 m
Module Diameter	165 mm
Nominal Pore Size	0.1 µm
Water Flux @ 1.03 bar, 25° C field trial	440 lmh
Maximum Operating Temperature	40 °C
Maximum TMP Differential	3 bar
Maximum Inlet Pressure	3 bar
Maximum chlorine, Cleaning	Up to 5000 ppm
Maximum caustic, Cleaning	1 N
Maximum acid, Cleaning	1 N
Membrane	PVDF
Housing	ABS
Potting Material	Epoxy Resin
Gasket	NBR
Preservative	Calcium Chloride 30% (Refer to page 50 regarding flushing).

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Item	Description
1	Module Upper End Cap
2	Module End Nut
3	Module End Nut O-Ring
4	Adapter Coupling
5	XR Nut/Blind Plate/Gasket
6	XR Assembly
7	Clamp
8	Module Lower End Cap
9	MF Module

Figure 2-3: Microza® Module Exterior Parts

2.9 PALL ARIA™ WATER TREATMENT SYSTEM CONTROL

Refer to Section 4 “Operating Description” on page 41 and Appendix B “HMI Screens and Descriptions” for more information on Pall Aria™ AP system control.

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3 INSTALLATION, STORAGE, AND EQUIPMENT RETURNS

3.1 INTRODUCTION

Detailed system installation information for the Pall Aria™ Water Treatment System is included in the relevant AP Installation Manual, refer Appendix D.

Refer to Appendix C “System Functional Description” and the Pall Corporation drawings for piping connections, line sizes, and other specifications applicable to this system.



CAUTION

DO NOT Install the Microza® modules or attempt to operate the Pall Aria™ Water Treatment System until after the installation of all utilities, instruments, and interconnecting piping and the Pall Aria™ System has had an initial flushing.

(CONTINUED ON NEXT PAGE)

THE PALL ARIA™ WATER TREATMENT SYSTEM

The **Pall Aria™** Water Treatment System requires flushing (water and air) after these installations/connections are complete.

If a Pall Commissioning Engineer is not available to assist in this process, contact Pall Technology Services. Refer to the section “Initial Startup and Flush” on page 50 for further information.

The disks on elastomer-seated butterfly valves must be at least partially open when tightening flange bolts. Failure to perform this task causes premature failure and voids all warranties on the valve.

3.2 INSPECT CONTENTS OF ALL SHIPPING CONTAINERS

Unless otherwise agreed to, ownership of parts or equipment shipped Free On Board (F.O.B.) from Pall Corporation is transferred to the purchaser upon placement on board the carrier.

Inspect all of the following system components for any possible damage during shipping immediately upon arrival at the facility.

- ✓ **Pall Aria™** Water Treatment System (main unit(s) with enclosures and frame)
- ✓ Hollow fibre module manifold
- ✓ Module rack(s)
- ✓ Interconnecting piping
- ✓ Compressed air unit (if purchased)
- ✓ Other optional system components (if purchased)

If damage to any equipment is observed or suspected, contact Pall Water Processing Contract Administration immediately at +612 4340 8900. For more information on returning equipment to Pall Corporation, see Section “Returning Damaged Equipment” on page 38.

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3.3 STORAGE OF PARTS AND EQUIPMENT

After inspection, repackage any equipment that is to be stored and place it in a dry, temperature controlled, secure location. Make sure to adhere to the following:

- The site selected for storage must be inside and protected from extreme heating conditions (no direct sunlight) and temperatures below the freezing point of water (0 °C).
- Seal all nozzles and tap openings.
- Retain the original factory-supplied shipping materials.



CAUTION

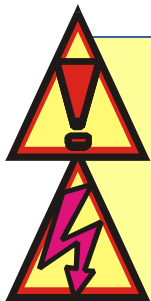
Failure to comply with these conditions voids all warranties.

3.3.1 MICROZA® MICROFILTRATION MODULES STORAGE

If the modules are to be stored before installation on the Pall Aria™ Water Treatment System, see the section “Storage and Preservation of the Microza® Microfiltration Modules” on page 25. After the modules have been installed and the system commissioned, see “Long-Term Shutdown and System Lay-Up” on page 70 for storage information and procedures.

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3.4 CONNECTING UTILITIES



CAUTION

To ensure safe and efficient operation of the equipment and compliance with applicable laws and regulations, only qualified personnel should make utility connections. Pall Corporation **REQUIRES** that certified electricians complete all wiring connections. Installation technicians should reference specification information in Appendix C “System Functional Description” and the Pall Corporation drawings.

If required, Ethernet cable run to and between Pall equipment must be Category 5 unshielded twisted pair data cable (Belden catalog # 1583B or equal). It is protected by installation in a PVC conduit or a suitable cable tray. **Do Not** use a metal conduit. Telephone lines connecting to **Pall Aria™** AP equipment must be surge protected.

The main control panel is UPS protected. Turning the disconnect switch to the off position does not fully de-energise the panel. Refer to the panel electrical drawings and schematics for means to disconnect the UPS output power.

If questions or problems arise during installation and a Pall representative is not on-site, contact Pall Technology Services.

3.5 RETURNING DAMAGED EQUIPMENT

- Contact PASS Contracts Administration at +612 4340 8900 before attempting to return any material to Pall Corporation. See the “Return Goods Authorisation” section next.
- All shipping claims must be owner-processed with the carrier and not by Pall Corporation.
- Pall Corporation will assist the owner in any way possible. The individual(s) receiving the shipment should note on the delivery receipt any indication of damage or careless handling by the carrier.

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- Obtaining the delivery person's signed agreement will facilitate future damage claims.

3.5.1 RETURNED GOODS AUTHORISATION

Before returning any equipment to Pall Corporation for any reason, the customer must obtain a Return Goods Authorisation by following these procedures:

1. Contact Pall Water Processing Contract Administration at +61 2 4340 8900 to discuss potential returns. Valid return situations are assigned an authorisation number. A Return Goods Authorisation Sticker is mailed to the contact name and location indicated by the customer.
2. Attach the Return Goods Authorisation Sticker received from Pall Corporation to the outside of the shipping container. If returning more than one container, clearly mark each additional container with the assigned authorisation number.
3. Return subject equipment or material to the address listed on the Return Goods Authorisation Sticker unless otherwise directed. Prepay all freight associated with returning the subject equipment or material to Pall Corporation.



IMPORTANT

When returning any equipment, it is the customer's responsibility to make sure those responsible follow proper packing and shipping procedures. For packaging assistance, contact Pall Water Processing Contract Administration at +612 4340 8900

A Return Goods Authorisation does not constitute in itself a guarantee of the issuing of credit by Pall Corporation. Final disposition of credit allowance rests with Pall Corporation after receipt and inspection of subject material or equipment. Pall Corporation does not accept returned material or equipment without proper authorisation. Pall Corporation returns any such shipments at the customer's expense.

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4 OPERATING DESCRIPTION

4.1 INTRODUCTION



IMPORTANT

This section contains a brief overview description of how the Pall Aria™ Water Treatment System operates. For detailed information on the operation of the purchased Pall Aria™ AP system, see Appendix C “System Functional Description”.

Examples of the HMI software screens and their descriptions are in Appendix B.

The engineering design of the Pall Aria™ Water Treatment System is to remove particulate down to 0.1 micrometer (μm) to produce a filtrate flow of clean water for municipal or industrial applications for the installation facility.

Operators should thoroughly understand the system design and how it works before running the system.

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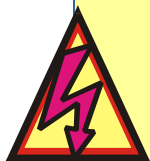


IMPORTANT

All Pall Aria™ Water Treatment System operators must be properly trained by Pall Corporation or someone authorised by Pall Corporation. Any damage to any part of the Pall Aria™ Water Treatment System caused by an untrained operator voids all warranties.

Any damage to any part of the Pall Aria™ Water Treatment System caused by modifying or loading computer software onto the Pall Aria™ Water Treatment System computers unauthorised by Pall Corporation voids all warranties.

This manual assumes that individuals assigned to operate and maintain this equipment are trained technicians with basic skills and assumes some knowledge of computerised machinery. This software package does not include online Help menus.



CAUTION

Pall Corporation's procedure for a power interruption is to power all systems down after power is restored, wait thirty (30) seconds, then power all systems back on.

4.2 PALL ARIA™ SKID AUTOMATED SYSTEM PROCESSES

The Pall Aria™ AP series packaged system design is as an independent entity and automates (if in **Auto** Mode) each of the following microfiltration process steps.

Detailed descriptions of these processes and their process and alarm setpoints are included in Appendix C "System Functional Description".

Parameters listed in the following descriptions are starting points for efficient system operation; however, these parameters may need to be

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modified due to changing system conditions. Contact Pall Technology Services for more information.

NOTE

Raw Water Supply

The customer typically provides water to the inlet connection at the desired flow rate and 14 - 207 kPa pressure. Supply water flow rate varies depending on the control mode selected and the process step in which the unit is operating.

1. Fill Process

The system starts the **Fill Process** when the on-skid feed tank reaches the operating level. This process pushes all air out of the feed side of the modules. When the **Fill Process** is complete, the system moves to **Forward Flow (FF)**, begins to produce filtrate, and fills the RF Tank as required.

2. Forward Flow (FF) Process

This process produces filtrate (filtered feed water for end use). Water from the on-skid Feed Tank feeds through an on-skid Feed Strainer that removes any large solids before reaching the filter membranes. Solids collected on the feed strainer discharge to drain during strainer backwash cycles. After the strainer, the water flows into the filter membranes, where it separates into filtrate and Excess Recirculation (XR). The filtrate discharges to downstream equipment. The XR flow, is returned to the on-skid Feed Tank.

3. Flux Maintenance (FM) Processes

The modules undergo a programmed regimen consisting of a combination of processes that recovers the TMP and removes any solids fouling the surface. **Flux Maintenance (FM)** cycles always begin with an **Air Scrub**, followed with either a **Feed Flush** or a **Reverse Filtration**. The operator can select which process follows the **Air Scrub**. **Flux Maintenance Processes** are started after either AP skid has processed a certain amount of filtrate volume or the AP skid has been filtering for a certain amount of time.

Typically, the **Flux Maintenance Processes** interrupt water production for two (2) minutes every twenty (20) minutes. The actual process settings vary between water sources and the volume of filtrate being produced.

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- **Air Scrub (AS) Process**

Air is introduced to the feed side of the membranes at a rate of 3 scfm/module (0.085 scmm/module). The RF Pump starts at a rate of 0.5 L/s/module. This reverse flow pushes filtrate back through the membranes and, while air continues to agitate the fibre bundle, carries any solids to drain. This lasts for about sixty (60) seconds.

The process is completed by the performance of either a **Feed Flush (FL)** process using the feed pump or a **Reverse Filtration (RF)** process using the RF Pump. This flushes the modules for about thirty (30) seconds. Any remaining solids are carried to drain.

- **Feed Flush (FL) Process**

If selected on screen after completion of the **AS**, a **Feed Flush** to drain occurs for approximately thirty (30) seconds. The feed Pump sends water through the modules, flushing to drain any remaining solids and air bubbles. The **FL** flowrate equals 1.1 L/s/module).

- **Reverse Filtration (RF) Process**

Under special circumstances (and if selected), after completion of the **AS**, a **Reverse Filtration (RF)** to drain occurs for approximately thirty (30) seconds. The **RF** pump sends water back through the modules, flushing any remaining solids and air bubbles to drain. The **RF** flowrate equals 0.88 L/s/module).

In addition to following an **AS**, the **RF** can be used instead of an **AS** by setting the **AS/RF** ratio greater than one (1). The system then performs an **RF** after only so many **AS** Processes. During **RF** only, the reverse filtrate and any solids removed from the membrane pores and surfaces are discharged to drain. This process step can be combined with sodium hypochlorite (NaOCl) injection to minimise biologicals in downstream equipment and to assist in solids removal.

Typically, the **AS** and **FL/RF** interrupt the supply water feed flow rate (upstream) for two (2) minutes and the filtrate flow rate (down-stream) for two (2) minutes every twenty (20) minutes. The actual process settings vary between water sources and the volume of water being produced.

Note: Only one skid may perform a FM at any one time.

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4. Integrity Test (IT)

The system undergoes an automatic five (5) minute **Integrity Test** based on a predetermined interval (runtime hours) in order to check for broken fibres in the modules. During the **IT**, interruption of **Feed Flow** and **Filtrate Flow** occurs. The customer can set the time of day to coincide with periods of low flow and has the option of performing an **IT** at any time the system is idle or in the **Forward Flow** process. The operator can set the system to “Warn on IT Failure” or “Warn and Shutdown.” The operator always has the option of continuing to produce water if the modules fail **IT**.

Note: Only one skid may perform a IT at any one time.

5. Feed Strainer Backwash (SBW)

The Feed Strainer is a self-cleaning type that requires a backwash at regular intervals to avoid clogging. The strainer backwash cycle can be triggered on time and/or differential pressure. The operator can also manually initiate a backwash whenever the system is running in **Forward Flow (FF)**.

During a feed strainer backwash, the strainer flushes any debris collected on the strainer to drain. This process lasts approximately thirty-five (35) seconds.

6. Clean-In-Place (CIP) Process

Periodically, cleaning solutions must be used to return the membranes to their original TMP. Typical compounds are Sodium Hypochlorite (NaOCl), caustic solutions, and acid solutions. Automated pumping cycles and durations take place according to operator-entered setpoints. The system prompts the operator to add the appropriate solution at the correct point and switch valves as necessary.

7. Enhanced Flux Maintenance (EFM)

The **AS** and **FL** processes can be enhanced by a regular program of processing with Sodium Hypochlorite (NaOCl) or other appropriate solution(s). This automatic process fills the system with the **EFM** additive and circulates the solution for fifteen to sixty (15 to 60) minutes. The use of this process can increase the time interval between **CIP** functions. The frequency of this process depends on the incoming water quality.

These process steps are programmed and controlled to allow the Pall Aria™ AP series systems to operate as a stand-alone water treatment system.

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4.3 PURCHASED OPTIONAL PROCESSES AND CONTROLS

See Appendix C “System Functional Description”.

4.4 PALL ARIA™ AP SYSTEM CONTROL

4.4.1 STANDARD CONTROL MODES

The Pall Aria™ AP Water Treatment System skid utilises custom-designed Pall Microza® Microfiltration System software to operate in either one of these modes:

- **Constant Filtrate Flow Control**
- **Constant Lagoon Level Control**

Refer to the section “System Startup” in Appendix C “System Functional Description” for more information on selecting the Pall Aria™ Water Treatment System Control Modes.

4.4.2 PALL ARIA™ OPERATIONAL SKID MODES

There are three (3) operational control modes for the skid: **Auto**, **Manual**, and **Disable**. Operators can change modes on the individual Pall Aria™ AP skid’s **AP Skid Control Screen** or the **System Modes Screen**. Access to the **System Modes Screen** is from the **Navigation Screen**. Access to the **AP Skid Control Screen** is from the **Navigation Screen** or on any screen where the **AP Skid Control** button appears.

See Appendix C “System Functional Description” for more information on the Pall Aria™ skid operational modes.

4.4.3 A PROGRAMMING OVERVIEW

This section introduces the philosophy of the general control system and details for some of the standard conventions and typical control functions used in the control system.

A list of common acronyms and abbreviations used throughout this process narrative is in Appendix C “System Functional Description”. Specific Pall Aria™ AP Water Treatment System control components and descriptions are in Appendix C “System Functional Description”.

4.4.3.1 CONTROL SYSTEM LEVELS

4.4.3.1.1 LEVEL 1 - PROCESS CONTROL

Programmable Logic Controllers (PLC) are intelligent units that control the plant process and equipment.

The PLC also perform all necessary mathematical calculations on collected data. These include flow totalisation, equipment run time, averages, maximums, minimums, and any other data format considered necessary by the operators.

4.4.3.1.2 LEVEL 2 - FIELD INSTRUMENTS

Various measuring devices monitor at all times the plant processes such as flows, levels, and pressures and send their data directly to the PLC. The PLC will then send the proper instructions, based on control logic, to controlled equipment such as pumps and valves.

4.4.3.2 STANDARD PROGRAMMING CONVENTIONS

In addition to the specific alarms and control functions described in this section, the system follows standard control and programming standards. The following is a list of these standard control functions.

Valves

All automatic valves receive a command to open or close.

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Pumps

All pumps that receive a command to start or stop must be checked within a specified time that they did start or stop. Failure of the pumps to respond to the commands results in an alarm.

Flow Meters

All flow meters have a normal operating range programmed into the PLC. The PLC checks the flow regularly to make sure that the flow is in the normal range. If the flow is out of the normal range, an alarm generates. Flows are displayed as both instantaneous and totalised flows.

Equipment Runtimes

All mechanical equipment started by the PLC have a consecutive equipment runtime recorded and displayed on an HMI screen beside the particular piece of equipment.

Alarm Setpoints

Alarms for indicators such as levels, pressures, and flows obtained from calculated or virtual setpoints are operator adjustable from the HMI.

4.4.3.3 PASSWORDS

The HMI system requires passwords in order to access the system and allow for manipulation of the parameters. The system incorporates the following three (3) levels of passwords:

Level 1 - Operator Only

A Level 1 password allows the user to start and stop equipment and perform basic control functions.

Level 2 - Engineer

A Level 2 password allows the user to perform all of the functions of Level 1 and change the Engineer setpoints.

Level 3 - Pall

A Level 3 password allows changes to the Pall Factory setup setpoints.

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4.4.3.4 ALARM HANDLING

The local HMI records all alarms and displays them on an alarm screen, complete with the time that the HMI recorded the alarm.

Classification of the alarms is in the following two (2) categories:

- Category 1 - Advisory
- Category 2 - Critical Alarm

An English description for the latest unacknowledged alarm displays continuously in a highlighted banner on all of the display screens.

All alarms require acknowledgement by the operator in the alarm screen. Once acknowledged, if the alarm is no longer active, it is reset in the PLC.

The alarm screen displays a minimum of ten (10) alarms in chronological order. The oldest alarm is removed from the display with the generation of a new alarm event.

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4.5 INITIAL STARTUP AND FLUSH



CAUTION

Always use the supplied dummy module(s) to perform the initial system flush. **Do not** install the Microza® modules in the rack or attempt to start a filtration cycle until the **Pall Aria™** Water Treatment System has been properly and completely flushed with fluid and air using the procedure outlined in the “Initial Flush Procedure” section, next. An initial system flush is necessary to remove debris and loose particles that may have accumulated inside the system piping during fabrication and installation. Using the **Pall Aria™** system before flushing may cause damage to the modules and other system components. Pall Corporation is not responsible for any damage to the **Pall Aria™** Water Treatment System caused by failure to provide sufficient protection of the system air components or caused by failure to sufficiently flush the system before installing the Microza® modules.

Pall Corporation recommends that a Pall Technology Services engineer be present at initial system startup to assist the operator in performing the system flush. If a Pall Technology Services representative is not on site for system commissioning, contact Pall Technology Services before initial system operation.

For the compressed air flush of the system, Pall Corporation strongly recommends the installation of a temporary 400-micron filter in the air line from the compressor to the skid to catch any construction debris. Failure to do this could result in premature module or instrument failures.

In addition to the system flush, during startup the Pall Technology Services engineer determines initial setpoints, tank fills, flow percentages, and other operating parameters for efficient system operation.

If the customer elects to perform startup and commissioning without the assistance or approval of a Pall Technology Services engineer, any damage resulting from not following required system startup procedures voids all warranties.

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4.5.1 INITIAL FLUSH PROCEDURE

The Initial Flush of the **Pall Aria™** AP system is generally, and preferably, performed by a Pall Technology Services engineer at system startup and commissioning. The following description is provided for reference. A more detailed description of this process appears in the separate manual *Installing the Pall Aria™ AP Water Treatment System from Pall Corporation*. Contact Pall Technology Services for more information.

1. Install the dummy module(s) included in the system startup kit in the rack and cap off all other module positions. Installation of the dummy module must be in the location that allows flow through the entire length of the manifold.

Never use actual Microza® modules for initial system flushing.

2. Fill the Feed Tank with filtrate quality water using an appropriate source.
3. The operator manually initiates the flushing cycle by selecting **Manual** Mode on the **Skid Control Menu** screen and setting the valves as indicated in the **Pall Aria™** Valve Truth Table included in Appendix C, "System Functional Description. It is necessary to flush all available components including the AP skid(s), and any purchased optional skids, e.g. Hot Water, CIP, and Neutralisation transfer systems.
4. The Pall Technology Services Engineer determines Feed Tank level and Feed Level Control Valve PID control loop settings.
5. The operator starts the on-skid Recirculation Pump and selects a speed that produces the correct filtrate flow, as determined by the Pall Technology Services Engineer, through the Flow Indicating Transmitter.
6. Manually flush the system for a minimum for fifteen (15) minutes. When the system has completed the startup flushing cycle, the operator must drain the system and clean the feed tank strainer.
7. When the operator has successfully completed the system startup flush and drain cycles, the system is ready to go into service. The operator can now remove the dummy module and install the Microza® MF modules. Module installation instructions are included in the separate manual:

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Installing the Pall Aria™ AP Water Treatment System from Pall Corporation

8. After installation of the Microza® modules is complete, another flush of the system is necessary to dispose of any storage solution potentially present in the modules (most of the solution is removed during module installation). The storage solution is a non-toxic antifreeze/bacteriostat fluid comprised of either sixty-five percent (65%) glycerin and two percent (2%) ethanol or a thirty percent (30%) calcium chloride solution.



IMPORTANT

It is the customer's responsibility to properly dispose of any solution if local regulations or site regulation prevent the type of solution from being directed to a common drain.



CAUTION

Each Microza® microfiltration module is inspected at its production facility and must conform to rigid specifications before shipment.

There remains a possibility, even when the standard operating conditions are followed, a breach of integrity may take place. Pall Aria™ AP system operators must perform regular system checks to ensure that system integrity is maintained.

In addition, operators must have adequate countermeasures in place to effectively prevent any damage that may occur by membrane failure. This includes appropriate equipment and quality assurance procedures.

Pall Corporation is not liable for any damage or loss caused by membrane failure resulting from disregarding this warning.

4.6 HMI SOFTWARE SCREENS

Graphic displays of the Human Machine Interface (HMI) software screens and their descriptions are included in Appendix B. Process descriptions are included in Appendix C, “System Functional Description”.

4.6.1 THE PALL ARIA™ AP SYSTEM OPERATOR INTERFACE

This Pall Aria™ Water Treatment System includes an Operator Interface Terminal (OIT) mounted on the master control panel door for controlling the Pall Aria™ AP system. The OIT enables the operator to interact with the software in controlling the Pall Aria™ Water Treatment System filtration skids and the off-skid components.

Throughout this manual, OIT refers to the VersaView

Through this interface, the operator can perform the many functions, including:

- Starting and stopping the system;
- Selecting system operational modes;
- Changing the operating parameter setpoints;
- React to alarm situations; and
- View process and historical data.



IMPORTANT

If required, Ethernet cable run to and between Pall equipment must be Category 5 unshielded twisted pair data cable (Belden catalog # 1583B or equal). It is protected by installation in a PVC conduit or a suitable cable tray. Do Not use a metal conduit for Ethernet cable. This installation, including material, is by others.

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4.6.2 OIT NAVIGATION

After logging in to the Pall Aria™ control system using the OIT, the Navigation Screen displays.

The Navigation Screen offers a starting point for the operator to easily and efficiently monitor and control the Pall Aria™ AP system.

Certain buttons access advanced features of the Pall Aria™ system and will only be available with a proper security level password login.

4.6.3 MANUAL CONTROL AND SETPOINT SCREENS

The Pall Aria™ Water Treatment System OIT allows access to operator and engineer adjustable setpoints screens and device manual control screens (only available when the Pall Aria™ AP system is in **Manual Mode**).

On the various Setpoints Screens, a valid security login determines an operator's ability to change operator or engineer setpoints. For example, operators are only able to change engineer setpoints if their login password is of the engineer security level. The setpoints displayed on the screen examples in this manual are for reference only. Actual system setpoints are described in Appendix C.



CAUTION

During system startup, Pall Technology Services engineers determine and set the operating parameters, such as setpoints and instrument scaling, to achieve the best results from the Pall Aria™ Water Treatment System.

To allow for flexibility in operation of the Pall Aria™ Water Treatment System, the control program, through the HMI, allows for operators with valid security login to “fine tune” system operations to achieve better efficiency or attain desired results.

(Continued On Next Page)

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This includes the ability to alter operational and alarm setpoints, scale ranges of instruments and other devices, set percentages on how far an automated valve opens or the speed of a pump motor, opening and closing a valve, or stopping or starting pump motors. Manual control of devices is only available in Manual Mode.

Pall Corporation emphasises that Manual Mode is NOT the preferred operating mode. Manual Mode overrides all of the automatic equipment functions and can adversely alter the process and the results of the process.

Pall Corporation is not responsible for the consequences of operators altering system parameters without direct input from Pall Technology Services engineers. Operators are solely responsible for results occurring from operating in Manual Mode and modifying system settings on their own initiative. For information or assistance, contact Pall Technology Services.

Pall Corporation requires that all Pall Aria™ Water Treatment System operators be properly trained by Pall Corporation representatives or someone authorised by Pall Corporation. Any damage to any part of the Pall Aria™ Water Treatment System caused by an untrained operator voids ALL warranties.

4.6.3.1 VIEWING AND CHANGING PROCESS SETPOINTS AND ENTERING DATA INTO DATA FIELD

The operator can view and alter, with valid security login, system process setpoints at any time by pressing any Setpoints button on any OIT screen it appears.

To control or access functions, the Pall Aria™ Water Treatment System filtration skid OIT has a on screen pop up keypad. To change a setpoint, press on the text in the setpoint data field. Using the keypad, enter the new setpoint. The change saves automatically as the new current setpoint.

The only values the control program accepts are those values within the factory setpoint ranges. If the operator enters a setpoint out of an acceptable range, a “This value is out of range” notice appears.

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4.6.4 MONITORING SYSTEM OPERATIONS

When **Auto Filter** is selected, the **Pall Aria™** Water Treatment System automatically sequences through the process steps required to produce filtered water (filtrate) and prompts the operator to take action when needed.

To monitor the active process, the operator can access the various Data Screens or Graphics Screens.

4.6.5 VIEWING THE PROCESS ON GRAPHICS SCREENS

From any **Graphics Screen**, the operator can observe the position of valves, the status of pumps and other devices, tank levels, and the flow of fluids.

Color-coding on the graphics screens are as follows:

- **Green** highlighting indicates when valves are open and pumps are running.
- **Red** indicates that the valves are closed and pumps stopped.
- **Blinking Yellow/Red** indicates active alarm condition is present.

4.7 WHEN AN ALARM SOUNDS

1. When an alarm occurs the **Alarm Banner** displays across the HMI screen.
2. To acknowledge an alarm, the operator clicks on the **Close Alarm Banner** button then presses the **Alarms Active** button on any screen it appears. This displays the **Alarms Active Screen**.
3. The **Alarms Active Screen** provides the operator with a list of alarms for troubleshooting and process control purposes. On the **Alarms Active Screen**, the operator acknowledges the alarm by pressing the **Acknowledge All** button and corrects the alarm if necessary before continuing.

4.8 STOPPING THE PALL ARIA™ SYSTEM



CAUTION

In cases other than an emergency shutdown, operators must close the turbidity meters manual isolation valve(s) before shutting the Pall Aria™ System down. In the case of an emergency shutdown, operators must close these valves as soon as possible.

4.8.1 STOPPING THE SYSTEM FROM THE HMI

The operator can stop an active process by pressing the **Skid Stop** button on any OIT screen that it appears. Follow the instructions in the section “System Startup” in Appendix C when restarting the system.

4.8.2 CONTROL PANEL QUICK STOP BUTTON

In the event of an emergency, press the red **Quick Stop** pushbutton located on the Pall Aria™ AP skid control panel door. This signals the PLC to cut power to the control outputs, which stops the pumps and places valves into their default positions (usually closed). This also cuts power to the digital outputs, but inputs remain powered for indicating purposes.

4.8.3 SYSTEM STARTUP AFTER A PLANNED OR EMERGENCY SHUTDOWN

Correct all alarm faults and/or other dangerous conditions to make sure it is safe and feasible to begin operating the system again. If the **Quick Stop** pushbutton on the control panel was pushed in to shut the system down, pull it out and follow the instructions in the section “System Startup” in Appendix C “System Functional Description”.



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5 MAINTENANCE

5.1 INTRODUCTION

This section describes a typical regimen of preventative and support activities to keep the **Pall Aria™** Water Treatment System operating effectively and efficiently. Performing maintenance involves checking instrument accuracy, lubricating components, refilling chemical reservoirs, and general housekeeping procedures.

The operating facility may have effective maintenance procedures already in place into which the **Pall Aria™** system can successfully integrate.

5.2 DAILY SUPPORT MAINTENANCE

To promote effective operation of the **Pall Aria™** Water Treatment System, Pall Corporation suggests the series of daily activities described in this section.

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5.2.1 DAILY INSPECTION

Table 5.2 on page 69 is an example of a Daily Inspection Form to guide the operator through a standard routine of visual checks to quickly assess the condition of the system and detect potential problems before they become critical. The operator should sign each completed Inspection Form and then file it with the system records.

5.2.2 MAINTAIN CHEMICAL STOCKS

The Pall Aria™ Water Treatment System consumes chemicals during treatment plant operation. The system requires the replenishment of these chemicals on a regular basis. It is the operator's responsibility to coordinate and confirm shipments, storage, and quality control of required chemicals. A list of chemicals is in the Spare Parts List in Appendix A.

5.2.3 SPARE PARTS INVENTORY

The Pall Aria™ Water Treatment System recommends Spare parts be stored at the water treatment plant for maintenance. It is the operator's responsibility to coordinate and confirm shipments, storage, and quality control of required system Spare parts. To keep track of equipment Spare parts, Pall Corporation recommends utilising an Equipment Spare Parts Inventory Record. Table 5.3 on page **Error! Bookmark not defined.** is an example of such a record.

5.2.4 UPDATE OPERATING RECORDS

Historical records of past maintenance activities and operator observations can be very useful to the operator in determining the cause for observed changes in treatment plant operation. Further discussion of record keeping is next.

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5.3 PREVENTIVE MAINTENANCE

The Pall Aria™ Water Treatment System equipment requires scheduled preventative maintenance. For the equipment to function properly over the life of the plant, it is vital to perform these maintenance activities when scheduled.

Pall Corporation suggests that operators record equipment maintenance information into individual Maintenance Summary Forms for the operator's benefit. An example of a Maintenance Summary Form appears in Table 5.5.

When service of equipment or machinery is necessary, operators should make an entry into an Equipment Service Record similar to the one shown in Table 5.4.



IMPORTANT

Specific maintenance requirements, including recommended frequency, are in the equipment manufacturers' component manuals located in Appendix E. In every maintenance situation, the manufacturer's recommendation takes precedence over the Pall recommendations and must be followed.

Table 5.1 provides general maintenance and timing information for the different system mechanical components.

During a long-term shutdown, different preventive maintenance may be applicable. See the Section "Long-Term Shutdown and System Lay-Up" on page 70 for more information on long-term shutdowns. Contact Pall Technology Services before instituting a long-term shutdown.

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Table 5-1: General Preventive Maintenance Activities

	Daily	Weekly	Monthly	Quarterly	Annually
Automatic Valves	Check for Leaks		Cycle if system is shutdown		
Hand Valves	Check for Leaks		Cycle		
Pumps	Check seals for leaks		Inspect mountings		Grease motor
Pipework	Check for leaks		Inspect flange and thread integrity		Check for signs of corrosion / degradation / de-rating.
General Instruments					Check calibration
Air Pressure Regulators	Check for “weeping”				Cycle regulator
Tanks	Check for Leaks		Inspect seams. Check internal vent filter (if applicable)	Replace internal vent filter (if applicable)	
Bunded Areas	Check for signs of loss of containment				Inspect bund integrity
Strainers	Check for Leaks				Inspect screen, check O-rings
Modules	Inspect site glass for air bubble		CIP		

5.3.1 SYSTEM COMPONENT MAINTENANCE

The Pall Aria™ Water Treatment System contains components manufactured by other suppliers. These component's maintenance requirements are located in the individual original equipment manufacturer's documentation in Appendix E. The Microza® microfiltration modules are maintained through their periodic cleanings. Refer to the section “Flux Maintenance (FM)” in Appendix C “System Functional Description” for details.

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5.3.2 EQUIPMENT MAINTENANCE SUMMARY FORM

Table 5.5 on page 76 is an example of an Equipment Maintenance Summary Form. Pall Corporation recommends that operators use this form or one similar to record and maintain information for each system device that requires periodic maintenance.

Some useful information includes the consolidation of maintenance tasks, schedule times, and intervals for all equipment requiring periodic service included in the system.

Pall Corporation further recommends the utilisation of this form for both Pall Corporation-supplied equipment and equipment supplied by others that interfaces with or operates in conjunction with the Pall Aria™ Water Treatment System.

5.4 SUPPLIES AND TOOLS

5.4.1 LUBRICANTS

Equipment with moving parts often requires periodic lubrication by the operator. To optimise the performance and service life of the equipment, the operator must provide the recommended lubricant type and frequency of lubrication specified by the equipment manufacturer. Usually the location of lubricant information is in the original equipment manufacturer's manual. That manual is in Appendix C of this manual.

5.4.2 SPARE PARTS

Equipment with fragile or moving parts often requires periodic replacement of those parts by the operator. To optimise the performance and service life of the equipment, the operator must maintain an on-site stock of Spare parts and replace certain parts within the schedule specified by the equipment manufacturer. Usually the location of lubricant and Spare parts information is in the original equipment manufacturer's manual, refer Appendix E of this manual. A system Recommended Spare Parts List is also included in Appendix A.

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5.4.3 TOOLS

System operators are required to perform preventive maintenance and minor corrective maintenance on a routine basis. Pall Corporation suggests the following tools, at a minimum, for use in maintaining the microfiltration system.

- **Microza® Module Wrench:** Supplied by Pall Corporation
- **Mechanic's Wrenches:** Several sizes of adjustable wrenches and/or sized wrench sets in both Imperial and Metric units
- **Multimeter:** Used to measure AC and DC voltages (600 VAC minimum) and currents (20 mA DC)
- **Pipe Wrenches:** One pair each of 36-inch (91 cm) and 18-inch (46 cm) pipe wrenches
- **Strap Wrenches:** One pair each of large 10-inch (25-cm) to 14-inch (36-cm) handle and small 6-inch (15-cm) to 8-inch (20-cm) handle strap wrenches
- **Bung Wrench:** To open chemical drums
- **Screwdrivers:** Several sizes of flat, Phillips, and Torx head styles
- **Hammers:** Claw, ball peen, and hand maul styles
- **Pliers:** Lineman's, locking, slip-joint, and needle-nose styles
- **Tape Measures:** 15-foot (4.5-metre) auto-returning and 50-foot (15-metre) winding type
- **Hacksaw**
- **Utility Hoses with Nozzles**
- **General Maintenance Liquids:** Spray lube, bolt-loosening fluid, silicone gasket gel, PVC joint prep, PVC solvent, Teflon pipe tape, epoxy
- **pH Meter or Litmus Paper**

5.5 REPAIRING THE MICROZA® HOLLOW FIBRE MODULES

If an **Integrity Test (IT)** Procedure indicates a faulty module in the system, the faulty module can be easily located and repaired while still installed. Detailed instructions for replacing the Microza® modules, including torque values for individual module components, is in the manual *Installing the Pall Aria™ AP Water Treatment System from Pall Corporation*.



CAUTION

Pall Corporation strongly recommends that two (2) people working together perform the module repair procedure. Wet working conditions exist during this procedure: TAKE APPROPRIATE SAFETY PRECAUTIONS.

The following tools are required to repair a module:

- Stepladder
- Flashlight
- Adjustable Pliers: VICE-GRIP® or equivalent
- Small Strap Wrench or Large Slip-Wrench
- Microza® Module Wrench: Supplied by Pall Corporation
- Module Repair Pin: Supplied by Pall Corporation

Pall Corporation recommends the following procedure for module repair:

1. With the piping full of water, place the system in **Manual Mode**.
2. Open both the Filtrate Valve and the Air Scrub Air Valve. This pressurises the feed side of the modules and displaces the water on the feed side, as in an **Integrity Test**.
3. Observe the transparent TP joint coupling at the top of each module (Figure 5.1). Use the ladder and flashlight if necessary. Any module with a damaged fibre has a stream of bubbles flowing up through the TP joint. This bubble stream is usually obvious.



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4. After identifying the damaged module, carefully loosen the TP joint of the module with the small strap wrench.

**IMPORTANT**

Be Prepared – the filtrate header is full of water, which starts to drain out when loosening the TP joint.

5. Remove the upper end cap nut and end cap using the module wrench. Do not misplace the O-ring.
6. The damaged fibre should be obvious by the stream of bubbles coming out of the end of the fibre. It may be necessary to pour a little water onto the top of the module to visualise the bubbles.
7. Using the adjustable pliers, push a repair pin about 0.5-inch (12.7 mm) into the leaking fibre. The flow of bubbles stops.
8. Reinstall the end cap and TP joint. Torque to recommended values. If replacement of the damaged module is necessary, follow the procedure outlined next.
9. Put the system back in **Auto** Mode and restart.
10. If additional assistance is required, contact Pall Technology Services.

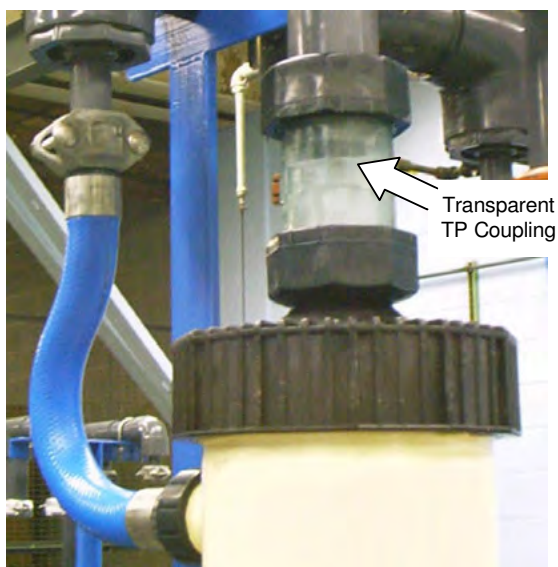


Figure 5-1: The TP Joint Coupling

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5.6 REMOVING A MICROZA® MODULE



CAUTION

Pall Corporation requires that two (2) people, working together, perform the module removal procedure.

BE PREPARED – wet working conditions exist during this procedure: TAKE APPROPRIATE SAFETY PRECAUTIONS!



WARNING!

To avoid personal injury or damage to equipment during the removal process, the module must be properly supported at all times.

The following equipment is required for removing a Microza® module:

- Clean Cloths
- Torque Wrench and Strap Wrench
- Microza® Module Wrench: Supplied by Pall Corporation
- A Replacement Microza® Module
- Other common repair tools such as screwdrivers, pliers, and channel locks

Follow this procedure for module removal:

1. Make sure that the modules and piping contain clean water. If the operator is uncertain, perform a system flush and cleaning before continuing.
2. Isolate and carefully drain all water from the selected module.



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3. Loosen and disconnect all module connections, beginning at the top. While loosening connections, it is essential to properly support the module.



CAUTION

BE PREPARED – when loosening the module connections, water may drain out.

4. Carefully remove the module from the rack.
5. Install the replacement Microza® module following the procedure for module installation. Module installation instructions are in the separate manual *Installing the Pall Aria™ AP Water Treatment System from Pall Corporation*.

Before module installation, check all connection surfaces for dirt or other debris that may affect module/system performance.

6. If a replacement is not available, remove the module and tightly cap all rack fittings to the module. Leave the rack with one less module until another one is obtained.
7. If additional assistance is required, contact Pall Technology Services.

5.7 RECORD KEEPING

Operations records, if collected consistently and effectively, can be extremely useful in the efficient operation of the Pall Aria™ Water Treatment System. Well-maintained records can help the operator to determine the causes of system changes, determine answers to system problems, and optimise the performance of the Pall Aria™ system.

Pall Aria™ Water Treatment System owners should refer to applicable water treatment regulations and/or permit conditions to determine if retaining operating records at the facility is required for a designated period. A typical requirement for an operations history is three (3) years.

5.7.1 DAILY OPERATIONAL RECORDS

Pall Corporation highly recommends that a log or journal of Daily Operations Records be established and maintained at the treatment plant.

The journal should be a bound book of sturdy construction with water-resistant or waterproof pages. All entries should be in pen on the day that the operations occur. Each page should be dated and the “end-of-day” entry signed or initialed by the operator. Instrument readings or other visual observations should include the time of day. For consecutive shifts, each arriving operator should review the entries from the previous shift.

Examples of useful information to include in the Daily Operations Records log include the following:

- Totaliser and instantaneous flow rate readings from local instrument displays
- Pressures, temperatures, pH, and chlorine readings from local instrument displays
- Tank levels
- Operator activities such as repairs, adjustments, instrument calibrations, and the replenishment of chemicals
- Unusual occurrences, mishaps, or system breakdowns
- Weather conditions
- Record the names of any visitors to the treatment facility and the purpose for their visit

5.7.2 LABORATORY DATA

The operator should refer to applicable water treatment regulations and/or permit conditions to determine the requirements for sampling and analysis of influent and effluent water.

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5.8 MAINTENANCE RECORD KEEPING

5.8.1 SPARE PARTS INVENTORY RECORDS

Spare parts required for preventive maintenance and repair should be kept on-site for immediate availability. The operator is responsible for maintaining an inventory record of Spare parts. Table 5.3 on page **Error! Bookmark not defined.** is an example of a form for this purpose.

5.8.2 SERVICE RECORDS

An evaluation of well-maintained service records could indicate to the operator if any equipment is not suited to its use, not performing to its specifications, or has not been adequately maintained. After any scheduled or unscheduled maintenance activity on any equipment, the operator, or other appropriate personnel, should update that equipment's service record. Table 5.4 on page **Error! Bookmark not defined.** is an example of a form for this purpose.

5.9 LONG-TERM SHUTDOWN AND SYSTEM LAY-UP



CAUTION

Operators must close the turbidity manual isolation valves BEFORE proceeding with a system shutdown. Pall Corporation recommends that operators refer to the component manuals in Appendix E for the required shut down procedure for a particular instrument/device.

As both Pall Corporation and the operator gains knowledge and experience through research in chemical processes and system operation, the procedures in this section may change.

The operator must contact Pall Technology Services before initiating a long-term system shutdown to determine any changes in procedure.

Failure to adhere to this procedure voids ALL warranties.

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5.9.1 INITIAL CONDITIONS

- The Pall Aria™ Water Treatment System is on and producing filtrate.
- The Pall Aria™ Water Treatment System's control system is on and the HMI is active.
- Operating conditions appear normal.

5.9.2 OPERATOR INSTRUCTIONS

1. Start a **CIP** Process. Instead of putting the system back into the **Auto Filter** Process, continue with the next steps.
2. Using a field instrument, measure the pH of the rinse water as the rinse period nears completion. When the **Rinse** cycle has completed and the tank used for the CIP solution and module rack drains, the OIT prompts the operator to either rinse again (the **Rinse** button) or finish the **CIP** Process (the **Done** button). Press the **Rinse** button as necessary to cause the pH to drop below 8.0.
3. When the pH has dropped below 8.0, select the **Rinse** button one (1) more time. It may be necessary to refill the tank with CIP make-up water to a pre-set level.
4. While the rinse water circulates through the system, take a sample of the rinse water and add hypochlorite as necessary to maintain a minimum of 1-2 mg/L in the rinse water for ten (10) minutes.
5. When the pH is below 8.0 and the free chlorine in the solution successfully adjusts to approximately 1-2 mg/L, stop the rinse process by pressing either the **Rack Stop** or **Process Stop** button.
6. The Pall Aria™ Water Treatment System is now prepared for long-term shutdown. Follow the other general procedures for facility shutdown as applicable.

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**IMPORTANT**

Chlorine Residual – If the system is going to be shut down for an extended period of time, it is important to leave a small chlorine residual in the piping to protect the stainless steel from a phenomenon known as Microbially Induced Corrosion (MIC).

In some waters, bacteria are present that can form colonies and excrete acid waste products that can corrode stainless steel piping. Water flow prevents these colonies from forming, as does maintaining a chlorine residual.

Under stagnant conditions, colonies can form in as little as seventy-two (72) hours and cause noticeable corrosion in one (1) week.

If the system is going to be shut down for longer than 48 hours, a chlorine residual of 1-2 mg/L free chlorine must be left in the piping and MF system. For long-term shutdowns, the operator should check the level of chlorine in the system weekly to maintain a level of 1-2 mg/L free chlorine in the system. If necessary to maintain residual, initial chlorine levels can be increased to 5 mg/L.

Operators should operate the feed pump briefly each week to circulate water inside the module rack to make sure that all piping, including the XR manifold, is exposed to fresh chlorinated solution. Once each month, operators should operate all pumps and valves to ensure correct operation.

7. Before restarting the **Pall Aria™** Water Treatment System, rinse and clean the entire system with clear water. Then follow the instructions in the section “Initial Startup and Flush” on page 50.

Contact Pall Technology Services for more information on the preservative solution and other questions concerning the long-term shutdown procedure.

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Table 5-2: Daily Inspection Form

Inspection Date: _____

Inspector Name: _____

Equipment	Inspection Results and Corrective Action Required
Water Leaks: Pre-Filters/Feed Tank/Feed Pump Area	
Pre-Filters: Differential Pressure Gauge Agrees with HMI?	
Feed Tank Level: OK?	
Feed Tank: Sediment Present?	
Microfiltration Rack Area: Water or Chemical Leaks?	
Chemical Day Tank/Spent FL and AS Tank Area: Water or Chem. Leaks?	
Chemical Day Tank/Spent FL and AS Tank Area: Tank Levels OK?	
Air Compressor System: Condensate Drained?	
Air Compressor System: Air Filters OK?	

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Table 5-3: Equipment Spare Parts Inventory Record

Pall Aria™ Water Treatment System Equipment / Tag #: _____

Order Date	Received Date	Cost	Invoice or P.O. Number	Qty	Item Description	Catalog Number	Location

Sources

Name	Address	Telephone/Fax

Notes

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Table 5-4: Equipment Service Record

Pall Aria™ Water Treatment System Equipment / Tag #: _____

Date	Maintenance or Repair Activity	System Effluent Totaliser Read @ Shutdown	System Downtime (Hours)	Parts Cost	Labor Cost	Labor Cost In Hours

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Table 5-5: Equipment Maintenance Summary Form

EQUIPMENT ITEM: _____
MANUFACTURER: _____
EQUIPMENT/TAG NUMBER(S): _____
PALL CATALOG NUMBER: _____
WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 LBS.): _____

NAMEPLATE DATA (Fill in as appropriate): _____

Model #: _____	Serial #: _____		
Catalog #: _____	Type: _____		
Other Unit ID#: _____	Mat'l of Constr: _____	Date of Mfr: _____	
Pump Size: _____	Imp. Dia: _____		
Rating GPM: _____	At TDH (psi): _____		
Max Pressure: _____	Max. Amb. Temp: _____		
Volts: _____	Hz: _____	Phase: _____	Amps: _____
HP: _____	RPM: _____	S.F.: _____	Ins. Class: _____
Frame: _____	End: _____		

MANUFACTURE'S LOCAL REP:

Company Name: _____
Address line 1: _____
Address line 2: _____
City, State, Zip: _____
Phone: _____ **Fax:** _____

MAINTENANCE REQUIREMENTS:

Maintenance Operation Comments	Frequency	Lube Code

LUBRICANT LIST:

Lube Code	Shell	Standard Oil	Gulf	Arco	Equivalent Other

RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY

Part #	Description	Unit of Measure	Quantity	Unit Cost

6 TROUBLESHOOTING AND TECHNICAL SUPPORT

6.1 INTRODUCTION

This section describes troubleshooting recommendations to complete before contacting your Pall representative or Pall Technology Services for assistance.

The control system for this Pall Aria™ Water Treatment System includes self-monitoring features that notify the operator (through the HMI) when either of the following situations occurs:

- Operating conditions are acceptable, but maintenance or adjustment is required in the near future (warning and continued operation)
- Operating conditions are not acceptable (alarm and shutdown) and the system requires immediate attention

In the event of an alarm, the operator must correct the alarm condition before the control system can reset and permit treatment operation.

This section contains tables with guidance for the operator's response to system **ALARM** messages. If the operator has followed the suggested

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evaluation and correction steps but the alarm condition persists, contact Pall Technology Services immediately.

6.2 OPERATOR RESPONSE TO SYSTEM ALARMS DURING FILTRATION

Warnings occur when the transmitters sense the preprogrammed setpoints for Low or High alarms above or below the required length of time.

The various alarm screens show all of the Low, Low-Low, High, and High-High conditions programmed into the Pall Aria™ Water Treatment System.

How to troubleshoot these conditions is included in Table 6.1.

- Low and High alarm conditions notify the operator of the presence of the condition. However, these conditions **DO NOT** stop the system operation.
- Low-Low and High-High alarms do immediately shut down the system.

If operators are still encountering problems after following the suggestions in the Troubleshooting Table, or are unsure on how to proceed, contact Pall Technology Services utilising the information in the Technical Support section following the table.

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Table 6-1: Troubleshooting Guide

Warning	Reason for the Alarm Message	Possible Causes	Operator Response
Feed Turbidity High at AIT-1 (If Applicable)	AIT-1 Exceeded the High Setpoint Level for the number of seconds on the Timer Preset.	<p>The Feed stream has changed.</p> <p>Malfunction of Turbidity Meter AIT-1</p> <p>Air bubbles in feed line</p>	<p>The microfiltration system can continue to operate with high levels of turbidity in the feed water.</p> <p>The operator must be aware that this may cause increased TMP at a faster than normal rate.</p> <p>Suggestion: Increase the frequency of Flux Maintenance cycles.</p> <p>Confirm that: Turbidity Meter sample flow rate is correct Test cell is clean Unit is properly calibrated</p> <p>Check: The feed lines to the Turbidity Meter for leaks. The suction side of the raw water pumps. The flow rate through the Turbidity Meter to make sure it is in the 12 gph (45.4 lph) range.</p> <p>Clean the bubble trap on Turbidity Meter.</p>
Filtrate Turbidity High at AIT-2 (If Applicable)	AIT-2 Exceeded the High Setpoint Level for the number of seconds on the Timer Preset.	<p>Malfunction of Turbidity Meter AIT-2</p> <p>The Filtrate stream has changed and the particle count is too high.</p>	<p>Confirm that: Turbidity Meter sample flow rate is correct Test cell is clean Unit is properly calibrated</p> <p>Check for sources of high turbidity. If membrane integrity is suspect, perform an integrity test. If necessary, perform an integrity test failure follow-up.</p>
Feed Tank Level Low at LIT-1	The Pall Aria™ Water Treatment System is processing water FASTER than the flow rate of raw water into the Feed Tank.	<p>Possible causes include:</p> <p>1) Operating problems with the pre-filtration pumps/ upstream process; or</p> <p>2) Valves in the wrong position – malfunction of V-1, the automated Feed Inlet line valve or HV-2 the Feed Tank (manual) Drain Valve; or</p> <p>3) Malfunction of the Level Indicator Transmitter LIT-1</p>	<p>1) Check that the upstream process system is working properly.</p> <p>2) Confirm that the tank drain valve is fully closed (HV-2) and that all of the flow control valves are in the correct OPEN/Closed positions. V-1 should be fully open to allow the feed flow to enter.</p> <p>3) Confirm that the level transmitter is working properly.</p>

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Warning	Reason for the Alarm Message	Possible Causes	Operator Response
Feed Tank Level High at LIT-1	V-1 is not closing when it should.	Possible causes include: 1) Level Transmitter LIT-1 problems; or 2) V-1 valve in the wrong position.	Check that the Tank High Level control system is working properly and that the automated valve V-1 closes when the tank reaches the FULL level.
Feed Pressure High at PIT-1	Excess pressure in the Feed Line downstream of the pressure transmitter. In the absence of high TMP, high feed pressure is being caused by some component of the system other than the modules. This causes excessive backpressure on the Recirculation Pump P-1 and / or reduced system flow.	Possible causes include: 1) Operating problems with valves such as CV-1, or V-4; or 2) There may also be a blockage in the piping between PIT-1 and the modules; or 3) Malfunction of Pressure Indicator Transmitter PIT-1.	1) Check feed pressure on the pressure gauge, PI-3 at the P-1 pump outlet. Complete a backwash cycle if there is a high differential pressure between PIT-1 and PI-3. 2) Check and eliminate any other line blockages. 3) Check the operation of the pressure transmitter.
Filtrate Pressure High at PIT-2	High pressure at PIT-2	Possible causes include: 1) Operating problems with valves such as CV-1, or V-4; or 2) There may also be a blockage in the piping between PIT-2 and the modules; or 3) Malfunction of Pressure Indicator Transmitter PIT-2; or 4) High backpressure on system.	1) Check feed pressure on the pressure gauge, PI-3 at the P-1 pump outlet. Complete a backwash cycle if there is a high differential pressure between PIT-2 and PI-3. 2) Check and eliminate any other line blockages. 3) Check the operation of the pressure transmitter. 4) Check downstream processes.
Feed Temperature High at TT-1	The feed temperature has exceeded the safe high temperature allowed during cleaning. The maximum allowable temperature is 104° F (40° C).	The cleaning make-up solution is too HOT!	Reduce the temperature of the cleaning solution to within the acceptable limits before continuing the cleaning cycle.
System TMP High	Differential pressure (PIT1 – PIT2) across the hollow fibre modules is too high.	1) Typically, high TMP is an indication that the membrane modules are fouling with collected solids, but effective module cleaning is no longer being achieved by the Flux Maintenance cycles. 2) This warning may also be a malfunction of Press. Ind. Trans.	1) Perform a CIP process. 2) Check operation of PIT-2.

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Warning	Reason for the Alarm Message	Possible Causes	Operator Response
		PIT-2.	
Filtrate High-High Turbidity	The microfiltration filtrate quality has become too poor.	Instrument is out of calibration Air bubbles in filtrate lines	Confirm that Turbidity Meter AIT-2 sample flow rate is correct, the test cell is clean, and the unit is properly calibrated. Investigate the cause of the poor filtrate quality. Loss of module integrity is suspected at this stage. Perform an integrity test. Perform an integrity test failure follow-up if necessary.
Feed Pump VFD-1 or VFD-2 Fault	There is a problem with the Variable Speed Drive (VSD) that controls Feed Pump P-1 or Pump P-2.	Multiple possible causes	Contact Pall Technical Support. Refer to supplied drives manual.
Fill Watchdog Fault	The microfiltration system piping and modules have not filled with water within the required time while preparing to return to forward flow after a draining event (such as after the IT process).	Incorrect valve positions or feed pump speed too low	Confirm that hand-actuated valves and check valves on the process water piping are fully open. Check feed pump fill speed.
“QUICK STOP” blinks across the top of the Operator Interface screen	Quick Stop button pressed. Power has been cycled. PLC communication error with I/O module on initialisation. Blown fuse	1) Quick Stop button pressed; or Power has been cycled; or PLC communication error with I/O module on initialisation. 2) Blown fuse	1) Pull out Quick Stop button, then press QSTOP RESET button. Press QSTOP RESET button. Cycle power, press QSTOP RESET button. 2) Determine cause and correct; replace fuse.
Transmitter Fault -AIT1 (If Applicable) -AIT2 (If Applicable) -FIT1 -TT1 -PIT1 -PIT2 -LIT1 -LIT2	Transmitter is no longer sending a signal to PLC input.	1) Blown fuse in instrument circuit 2) Disconnected wiring 3) Failed transmitter	1) Check for cause and replace fuse. 2) Check that all terminations are securely made and correct any that are loose. 3) Contact Pall Technical Support.
PSL-1	Air pressure is too low to operate system values.	Air compressor tripped out	Restart air compressor
PSL-2	Air pressure too low to perform AS	High demand on air compressor	Remove demand
T1 - Pause	Feed tank not filling	Raw water flow stopped	Reset raw water pumps, clean raw water strainers
CR120-1 Skid pauses (with UPS only)	Loss of AC Power	1) Loss of AC Power 2) Failed CR120 relay	1) Restore AC power 2) Replace relay

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T30/T50 off-skid tank(s) pause	External tank(s) Pause level indicated	Pause level reached, LIT-30/LIT-50 malfunction	Check LIT-50/LIT-30
TT-1 Effluent temperature high	Raw or CIP water exceeding recommended temperature limit	TT-1 malfunction	Drain system and refill. Check TT-1
T-2 level change during CIP	CIP solution leaking through HV-20 (Pause CIP/EFM)	HV-20 position wrong. LIT-2 malfunction	Check HV-20, LIT-2
T-2 not ready for FM	Tank T-2 level insufficient to perform a Flux Maintenance Process	Level setpoint too low Leaky pipe fittings Bad sensor	Manually fill T-2 to proper level. Lower T-2 FM level setpoint Check sensor
IT pressure decay High	Pressure loss during IT is close to failure	Module connections loose. PIT-1 malfunction	Check module connections. Check PIT-1
IT pressure decay High-High	Pressure loss during IT indicates leaks in piping or module	Module or piping connections loose; PIT-1 malfunction	Re-run IT test and look for air bubbles in module clear coupling. If bubbles not present, check module and piping connections. Check PIT-1
S1 strainer backwash failure	S1 unable to perform self- cleaning backwash	S1 filter screen clogged	Remove S1 strainer filter screen and clean or replace
IT cycle watchdog timer time out	Premature IT timer expiration aborts IT	Stabilisation pressure not reached	Perform a manual IT and check pressure stabilisation
EFM cycle abnormal shutdown	EFM termination before completion – skid shutdown	1) Chemical flow failure 2) Hot water failure	1) Rinse skid before restarting 2) Check chemicals
Rinse watchdog timer time out	CIP/EFM rinse premature end	No rinse water	Rinse system manually
EFM chemical transfer watchdog timer time out	Watchdog timer time out before completing chemical transfer	1) No chemical 2) Transfer rate too slow	1) Add chemicals to the drum 2) Clean suction strainer

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6.3 TECHNICAL SUPPORT

If issues or questions arise with system components not manufactured by Pall Corporation, utilise the component manuals in Appendix E before contacting Pall Technology Services.

When making inquiries provide the following system information:

- 1. The operating conditions**
- 2. The approximate time this unit has been in service**
- 3. Other applicable information**

To obtain technical support:

Pall Australia
6 Chivers Road
SOMERSBY NSW 2250
Australia
Telephone*:+612 4340 8900
Fax: +612 4340 8999

*** The telephone number (+612 4340 8900) is from 9 A.M. – 4 P.M. Eastern Standard Day Light Saving Time. After 4 P.M., there is a service charge unless the customer has an existing Pall service contract.**

Another excellent source of information is Pall Corporation's Internet site:
<http://www.Pall.com>

Customers may also want to contact their local Pall Corporation representative, if available.

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6.4 PALL SERVICE CONTRACT

A Pall Service Contract establishes and formalises a committed business relationship between Pall Corporation and the customer. Pall Technology Services is committed to providing customers with well-prepared, ongoing support at reduced cost. This allows the customer to remain focused on their core business, while Pall focuses its highly qualified skills and resources on the customer's system.

A Pall Service Contract allows Pall Technology Services to track, plan, and anticipate customer needs and commit resources, replacement parts and consumable stocks, maintain technical resources and services, and establish accommodating schedules.

A Pall Service Contract provides the customer with optimised system performance and reduced operating and maintenance cost by allowing Pall Technology Services to efficiently allocate resources, smoothly administrate all required services, and plan schedules and training.

Contact Pall Technology Services to review the service and system purchase options that can best serve your needs.

Pall Australia
6 Chivers Road
SOMERSBY NSW 2250
Australia
Telephone*:+612 4340 8900
Fax: +612 4340 8999

* The telephone number (+612 4340 8900) is from 9 A.M. – 4 P.M. Eastern Standard Day Light Saving Time. After 4 P.M., there is a service charge unless the customer has an existing Pall service contract.

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6.5 SYSTEM REPLACEMENT PARTS

Pall Corporation has After Market Sales Specialists who are dedicated to system replacement parts. Contact one of these specialists for information or a quotation for replacement parts.

Pall Australia**6 Chivers Road****SOMERSBY NSW 2250****Australia****Telephone*: +612 4340 8900****Fax: +612 4340 8999**

* The telephone number (02 4340 8900) is from 9 A.M. – 4 P.M. Eastern Standard Day Light Saving Time. After 4 P.M., there is a service charge unless the customer has an existing Pall service contract.

When contacting Pall After Market Sales, reference the system information listed in the previous section, “Technical Support”.

Refer to the Spare parts list in Appendix A to identify the part number and the quantity required for each component requested.

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7 GLOSSARY

Term	Description
ABS	Acrylonitrile Butadiene Styrene
Air Scrub (AS)	A membrane module cleaning technique, programmed to occur on a regular interval many times each day for Pall systems, in which air bubbles are blown around the exterior of the membrane fibres to shake contaminants loose from the filter surfaces and remove them from the modules.
AP	Pall Aria™ Package System
ASME	American Society of Mechanical Engineers
Backwash	In Pall's Microza® systems, backwash is used as a generic term for waste flow generated by the AS and FL cycles, as well as any pre-filter or strainer waste.
Backwash Recovery System	A filtration subsystem designed to re-filter backwash from the main plant so that it is not wasted.
CFF	Constant Flow Fitting
Clean-In-Place (CIP)	A chemical cleaning process performed while part or all of the microfiltration system is off-line, in which a rinse of caustic and acid solutions flow through the membrane modules to attack and dissolve stubborn contaminants from the filter surfaces and remove them from the modules.
Controlled Variable	The output signal from an automatic control loop. The CV is

THE PALL ARIA™ WATER TREATMENT SYSTEM

Term	Description
(CV)	applied to a device, like a valve or pump drive, to cause a Process Variable to match a setpoint.
DI Water	De-ionised water
Enhanced Flux Maintenance (EFM)	Automatic chemical wash of module membranes to remove deposits. Used to extend time between CIP Procedures.
Excess Recirculation (XR)	A fraction of the feed flow, typically equal to about ten percent (10%) of filtrate flow, which enters the membrane modules but bypasses the fibres. XR leaves the modules, unfiltered, through a separate port.
Feed	The unfiltered influent source water that is intended for microfiltration.
FIFO	First In, First Out.
Filtrate	Also called “permeate”; this is the filtered effluent water that has passed through the membrane modules.
FIT	Flow Indicating Transmitter
Flux	Refers to the filtered water flow through a “unit area” of membrane, typically expressed as either “gallons per square foot per day (gfd)” or “gallons per minute (gpm) per module.”
Flux Maintenance (FM)	This process consists of a programmed regimen of a combination of procedures that the modules undergo to recover the TMP and remove any solids fouling the surface.
F.O.B.	Free On Board. A type of product shipping.
Forward Flow (FF)	The normal mode of microfiltration system operation that produces filtered water.
HOA	Hands-Off-Auto: An HOA switch allows a device to be put into one of these three states.
HCS	Hydraulic Control Structure
HDPE	High Density Polyethylene
Human Machine Interface (HMI)	Generically, any control interface between operators and a process. In the case of Pall Microza systems, this term typically refers to a graphical control program used to interact with the filtration plant.
Integrity Test (IT)	A membrane module testing technique in which compressed air is introduced to the feed side of the modules and the modules are then isolated or “valved off” from the rest of the system piping. If the modules maintain pressure during the test period, then all membrane fibres in the modules have been confirmed to be intact.
Interlock	A process condition that causes the process to stop, with a message

THE PALL ARIA™ WATER TREATMENT SYSTEM

Term	Description
	posted to the operator indicating the fault.
LCV	Level Control Valve
MF Module	A group of microfiltration (MF) fibres encased in a housing.
MGD	Millions of Gallons per Day.
MIC	Microbially Induced Corrosion. In some waters, bacteria are present that can form colonies and excrete acid waste products that can corrode stainless steel piping. Water flow prevents these colonies from forming, as does maintaining a chlorine residual.
Microza®	The brand name of hollow fibre micro- and ultrafiltration modules manufactured by Asahi Chemical Company for exclusive license by Pall Corporation.
Microfiltration (MF)	The process of physical removal of suspended solids from a fluid, with a solids removal rating usually considered being in the range of 0.01 to 20 microns.
Micron	One one-millionth (1×10^{-6}) of one meter; usually represented by the Greek letter μ . A typical human hair is about 50μ in diameter.
NaOCl	Sodium hypochlorite
NBR	Nitrile-Butadiene Rubber
NEMA	National Electrical Manufacturers Association
NEMA 4 Specification	Enclosures constructed for either indoor or outdoor use to provide a degree of protection for personnel against incidental contact with the enclosed equipment and the elements.
OIT	Operator Interface Terminal
OSHA	Occupational Safety and Health Administration
pH	Potential of Hydrogen. The logarithm of the reciprocal of hydrogen-ion concentration in gram atoms per liter; provides a measure on a scale from 0 to 14 of the acidity or alkalinity of a solution, where 7 is neutral and greater than 7 is acidic and less than 7 is basic.
PID Control Loop	Proportional-Integral-Derivative. A type of control algorithm used to maintain control of a process variable such as flow or pressure at a particular value.
P&ID	Process and Instrumentation Diagram. A drawing used to represent the devices, piping, and instrumentation used in a process.
PLC	Programmable Logic Controller
Pre-filtration	In order to protect the microfiltration system from large chunks of solids suspended in the feed flow, pre-filtration is often used.

THE PALL ARIA™ WATER TREATMENT SYSTEM

Term	Description
Process Setpoint	Data in the MF system is characterised as either “process setpoints” or “process variables”. A process setpoint is a value that is used to specify the action of a control device.
Process Variable	Data in the MF system is characterised as either “process setpoints” or “process variables”. A process variable is a value that represents the status of a control device.
PVC	Polyvinyl Chloride
PVDF	Polyvinylidene Fluoride
Regeneration	Any of several methods of cleaning membranes.
Reverse Osmosis (RO)	A filtration process that uses pressure (above osmotic pressure) to force small molecular weight species (usually water) through a semi-permeable membrane against the concentration gradient (from the region of low concentration toward the region of higher concentration).
Sodium Hypochlorite	Chemical formula is NaOCl.
Supervisory Control and Data Acquisition (SCADA)	An HMI system that specifically includes Data Acquisition and control of lower level devices such as PLC's.
Transparent Plastic Joint (TP)	The slip coupling used on the filtrate connection of each MF module.
Transmembrane Pressure (TMP)	A measure of differential pressure across a membrane module or group of modules.
Ultrafiltration (UF)	A process that uses a semi-permeable membrane to separate relatively large molecular weight solutes from a feed stream.
Uninterruptible Power Supply (UPS)	An electrical system, which continues to provide power for a finite time period in the event that the power utility faults.
UNA-620A	Model numbers of Asahi's microfiltration modules used for potable and recovery water use. The chlorine-resistant modules have a nominal rating of 0.1μ, and contain 50 m ² of membrane area, based on the outside diameter of the hollow fibres.
Variable Frequency Drive (VFD)	An electrical device that allows motors to be run at variable speeds. Typically, in filtration plants, VFDs control flow through pumps. Also known as AFDs (adjustable frequency drives) or VSDs (variable speed drives).
WWTP	Waste water treatment plant



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Pall Replacement Parts List (OFF SKID PARTS)

Date Issued: 05/07/13

Revision: 0

Number of Units: 2

(Note: The quantities stated in the following list are for one site only)

(Note: The quantities stated in the following list are for one site only)			Items Per Skid	Suggested Spares		
P&ID Tag	Function	Equipment	QTY	QTY	Manufacturer	Part Number
Valves						
HV-2220-01	Feed Turbidity Isolation Valve	Ball Isolation Valve, Spears	1		SPEARS	2000 series, 3629-005C
CFF-2220-01	Feed Turbidity Constant Flow Fitting	Constant Flow Fitting	1		MARIC	6-FF-P-P-0.4
VLV-2240-50 (Boonah & Laidley)	Filtrate Isolation Valve	VALVE,BTFL,3.0IN, Fail Open	1		BRAY	S30 S93-83FO
VLV-2240-51	CIP / Neutralisation Tank Filling Valve	VALVE,BTFL,2.0IN, Fail Closed	1		BRAY	S30 S93-63FC
VLV-2240-50 (Kalbar & Forest Hill)	CIP / Neutralisation Tank Filling Valve	VALVE,BTFL,3.0IN, Fail Open	1		BRAY	S30 S93-63FC
VLV-2211/2212-60 (Boonah & Laidley)	CIP Return Drain (High Flow Gravity) Control Valve	VALVE,BTFL,3.0IN, Fail Closed	1		BRAY	S30 S93-83FC
VLV-2211/2212-61 (Boonah & Laidley)	RF/AS Drain (High Flow Gravity) Control Valve	VALVE,BTFL,4.0IN, Fail Closed	1		BRAY	S30 S93-83FC
VLV-2211/2212-60 (Kalbar & Forest Hill)	CIP Return Drain (High Flow Gravity) Control Valve	VALVE,BTFL,2.0IN, Fail Closed	1		BRAY	S30 S93-63FC
VLV-2211/2212-61 (Kalbar & Forest Hill)	RF/AS Drain (High Flow Gravity) Control Valve	VALVE,BTFL,2.0IN, Fail Closed	1		BRAY	S30 S93-63FC
Instruments						
AE-2220-01	Feed Water Turbidity Transmitter/Analyser (Common Feed turbidity instrument)	Turbidity Sensor, 1720e	1		HACH	60101-01
FITS: AE-2220-01	Feed Water Turbidity Transmitter/Analyser (Common Feed turbidity instrument) - Calibration Solution	Turbidity 20NTU stablcal 1L	1	1	HACH	Turbidity 20 stablcal 1L
PIT-2220-01	Feed Pressure Transmitter	Pressure Transmitter	1		Rosemount	2088G2S22B2M5Q4
LIT-2220-01	Lagoon Level Transmitter	Level Transmitter, Vega, Vegason61	1		Vega	SN61.XXAGHKMAX / MONTZUB-WS.GD / PLICSSH.A
Equipment						
PU-2220-01 (Boonah & Laidley)	Raw Water Feed Pump	Pump, B3XRA-ST	1	1	Aussie Pumps	EAS1
PU-2220-01 (Kalbar & Forest Hill)	Raw Water Feed Pump	Pump, B2KQA-ST	1	1	Aussie Pumps	EAR4
STR-2220-01	Raw Water Intake Strainer	Strainer	1	1	Johnson Screens	S12-267
CP-1012-70 (Boonah & Laidley)	Compressed Air System	Compressor Assembly, Inc. Dryer	1		Atlas Copco	GX-3P-10, FX1
CP-1012-70 (Kalbar & Forest Hill)	Compressed Air System	Compressor Assembly, Inc. Dryer	1		Atlas Copco	GX-2P-10, FX1
FLT-1012-70	Secondary Filter	Filter, compressed air	1		Atlas Copco	DDx11
FLT-1012-71	Hydrocarbon Filter	Filter, compressed air	1		Atlas Copco	PDx11
PV-1012-71 (Boonah & Laidley)	Compressed Air Receiver	Air Receiver, 1000L	1		Atlas Copco	VR1000
PV-1012-71 (Kalbar & Forest Hill)	Compressed Air Receiver	Air Receiver, 565L	1		Atlas Copco	VAR565
SRV-1012-71	Safety Release Valve	Safety Release Valve, Air Receiver	1		Atlas Copco	SV25/1034

Pall AP3 Replacement Parts List

Date Issued: 05/07/13
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Number of Units: 2
(Note: The quantities stated in the following list are for one skid only)

P&ID Tag	Function	Equipment	Items Per Skid QTY	Suggested Spares QTY	Manufacturer	Part Number
Valves						
LCV-2211/2212-01	MF Feed Tank Level Control Valve	PNEUMATIC BUTTERFLY REGULATING VALVE, DOUBLE ACTING, Seat: EPDM/disc: SS316	1		BRAY	S30/S92-0830/S6A,3",ASME16.5,Class 150
FITS: LCV-2211/2212-01		ACTUATOR,BRAY,3.0IN,DA	1	1	BRAY	S92-0830
FITS: LCV-2211/2212-01		POSITIONER	1	1	BRAY	S6A
VLV-2211/2212-02	XR Control Valve, On/Off	VALVE,BTFL,2.0IN	1		BRAY	S30/S92-063,2",ASME16.5,Class 150
FITS: VLV-2211/2212-02		ACTUATOR,BRAY,2.0IN DA		1	BRAY	S92-063
VLV-2211/2212-03	Upper Drain Valve, Used for CIP Air Scrub, RF, FL	VALVE,BTFL,4.0IN,DA	1		BRAY	S30/S92-083,4",ASME16.5,Class 150
FITS: VLV-2211/2212-03		ACTUATOR,BRAY,3.0IN & 4.0IN,DA		1	BRAY	S92-083
VLV-2211/2212-04	Lower Drain Valve, Skid Drains, RF Cycle	VALVE,BTFL,4.0IN,DA,TS	1		BRAY	S30/S92-083,Actuator W/travel switch,4",ASME16.5,Class 150
FITS: VLV-2211/2212-04		ACTUATOR,BRAY,3.0IN & 4.0IN,DA		1	BRAY	S92-083
VLV-2211/2212-05	Filtrate Outlet Valve, On/Off Fail Closed	VALVE,BTFL,3.0IN,Single Acting, TS, Air to open	1		BRAY	S30/S93-1192/FC, Actuator W/travel switch,3",ASME16.5,Class 150
FITS: VLV-2211/2212-05		ACTUATOR,BRAY,3.0IN,SR		1	BRAY	S93-1192/FC
VLV-2211/2212-06	RF Fill Valve/ Backwash Outlet Valve	VALVE,BTFL,3.0IN,DA	1		BRAY	S30/S92-083,3",ASME16.5,Class 150
FITS: VLV-2211/2212-06		ACTUATOR,BRAY,3.0IN & 4.0IN,DA		1	BRAY	S92-083
VLV-2211/2212-07	Air Scrub Control Valve, On/off	VALVE,BTFL,Air to open, single acting	1		BRAY	S30/S93-0833/FC,2",ASME16.5,Class 150
FITS: VLV-2211/2212-07		ACTUATOR, Air to open, single acting		1	BRAY	S93-0833/FC
VLV-2211/2212-14	Bypass Valve of XR Constant Flow Fitting for CIP Flow	VALVE,BTFL,AUTO,2.0IN	1		BRAY	S30/S93-0833/FC,2",ASME16.5,Class 150
VLV-2211/2212-20	CIP Block Valve	VALVE,BTFL,3.0IN,AUTO,EPDM/disc: SS316	1		BRAY	S30/S93-083/FO
HV-2211/2212-02	Hand Valve to drain tank TK-2211/2212-01	VALVE,BALL,2.0IN,PVC	1		HERSHEY	VP-640
HV-2211/2212-03	RF Tank Drain Valve	VALVE,BALL,2.0IN,PVC	1		HERSHEY	VP-640
HV-2211/2212-04	Filtrate Sample valve	VALVE,BALL,0.25IN,PVC	1		PRAHER	122355
HV-2211/2212-05	Hand Valve to Feed turbidity AE-2211/2212-02	VALVE,BALL,0.25IN,PVC	1		NANJING LUOKIA	AHMC0404
HV-2211/2212-07	Compressed Air Shut Off, Lock out/tag out capable	VALVE,1.5IN,SST	1		GUANGDE	BT-2F-1
HV-1012-13A/B	Air Scrub Throttle Valve Set manually	VALVE,GLOBE,1.50,200,FPT,304ST	1		GUANGDE	GBTL-150-1
HV-2211/2212-18	Backwash Drain sample Valve	VALVE,BALL,0.25IN,PVC	1		PRAHER	122355
NV-1012-1A/B	Strainer Clean Back Flow Control Valve	NEEDLE VALVE	1		FESTO	GRA-1/4-B, 6509
CV-2211/2212-01	Check Valve for PU-2211/2212-01	VALVE,CHECK,BTFL,3.0IN,PVC	1		GF	3",161562109,Type:562 PVC-U,SF
CV-1012-2A/B	Check Valve for Air Line	VALVE,CHECK,BALL,1.50IN,FPT,SST, Spring loaded	1		GUANGDE	SCT-200
CV-2211/2212-05	RF Tank Overflow check valve	VALVE,CHECK,2IN,200# PVC	1		GF	TYPE 562, 161562107
CFF-2211/2212-01	XR Constant Flow Fitting	VALVE,1.000,200,NPT,PV,1.0 LPS	1		PLAST-O-MATIC	FC100EP-015-PV
CFF-2211/2212-05	Turbidity Constant Flow Fitting	VALVE,1.000,200,NPT,PV (~300mL/min)	1		MARIC	6-FF-P-P-0.4
Instruments						
AIT-2211/2212-02, AE-2211/2212-02	Filtrate Water Turbidity Transmitter/Analyser	TURBIDITY TRANSMITTER,660sc,0-1 NTU,24V DC, SC200			HACH	660sc (6016000) sc200 (LXV404,99.70552)
FITS: AIT-2211/2212-02	Filtrate Water Turbidity Transmitter/Analyser - Calibration Solution	Turbidity .88 mNTU stablcal 1L	1	1	HACH	Turbidity .8 stablcal 1L
PIT-2211/2212-01	Strainer Outlet Pressure, Module Feed pressure, TMP Calc, Strainer DP	PRESS TRANS,ROSEMOUNT, 0-400kPa	1	1	ROSEMOUNT	2088G2S22B2M5Q4
PIT-2211/2212-02	Filtrate Pressure, Module outlet pressure, TMP Calc,	PRESS TRANS,ROSEMOUNT, 0-400kPa	1	1	ROSEMOUNT	2088G2S22B2M5Q4
PIT-2211/2212-03	Pump PU-2211/2212-01 Discharge Pressure, Used for Strainer DP and TMP Alarms	PRESS TRANS,ROSEMOUNT, 0-400kPa	1	1	ROSEMOUNT	2088G2S22B2M5Q4
LIT-2211/2212-01	Indicates and transmits Level in Tank TK-2211/2212-01, High/Low alarms for TK-2211/2212-01	PRESS TRANS, ROSEMOUNT, low range	1	1	ROSEMOUNT	2088G1S22B2M5Q4
LIT-2211/2212-02	TK-2211/2212-02 RF Tank Level, Alarms for CIP, Backwash	PRESS TRANS, ROSEMOUNT, low range	1	1	ROSEMOUNT	2088G1S22B2M5Q4
TT-2211/2212-01	Feed water/CIP water temperature, alarmed	Feed temperature with Thermowell	1		ROSEMOUNT	148HNNAU1XA // 0068N21N00A025T32XA
FIT-2211/2212-01	Filtrate Flow Rate	FLOW TRANSMITTER incl Flow Element, Magnetic Flow Meter, 3.0IN	1		ROSEMOUNT	8732EST2A2N0DA1M4D1 / 8711SSE030U1N0D1DW
PHC-1012-3A/B, PI-1012-3A/B	Air Pressure to Strainer backwash shuttle	REGULATOR, AIR PRESS,1/4",ADJ,ALUM	1		FESTO	MS4-LFR-1/4-D7-CRV-AS
PS-1012-1A/B	Pressure Switch, for Low/High Air Pressure, Low/High Air Scrub pressure	PRESSURE SENSOR	1	1	FESTO	SDE1-D10-G2-H18-C-P2-M8
PHC-1012-1A/B, PI-1012-1A/B, FLT-1012-1A/B	Pressure regulator, Gauge Filter to solenoid bank	ASSY,REGULATOR, 3/8 NPT,1 STAT W/FILTER	1		FESTO	MS6-LFR-1/2-D7-CRV-AS
FITS: PI-1012-1A/B	Replacement Pressure Gauge for Regulator	PRESSURE GAUGE,0-11 BAR		1		
FITS: PI-1012-1A/B	Replacement Pressure Gauge for Regulator	PRESSURE GAUGE,0-4 BAR		1		
FITS: FLT-1012-1A/B	Replacement Filters for Skid Regulator	FILTER ELEMENT,AIR,0.1MICRON		1		
PHC-1012-2A/B	Pressure regulator for Air scrub	REGULATOR, AIR PRESS,1.5IN,ADJ,W/GAGE	1		CASHCO	2H8-2B27-12000000A
FI-1012-2A/B	Air Scrub Air Flow Rate	FLOW INDICATOR,Stubbe,10-100SCFM,AIR	1	1	Stubbe	DFM350 DN40 PA/EPDM
Equipment						
TK-2211/2212-01	Feed/CIP tank (833 L)	ASSY,TANK,AP3,833L,FEED	1		NIUBAO	833L TANK
TK-2211/2212-02	Reverse Filtration Tank (1325 L)	ASSY,TANK,AP3,1325 L,RF	1		NIUBAO	1325 L TANK
PU-2211/2212-01	Recirculation PUMP	LOWARA, pump, 7.5KW	1	1	LOWARA	SHE50-160/75
PU-2211/2212-02	Reverse Filtration Pump	LOWARA, pump, 7.5KW	1	1	LOWARA	SHE50-160/75
STR-2211/2212-01	Membrane Pre-Strainer	STRAINER,AMIAD,3.0IN,CS,400 MICRON	1		AMIAD	FILTOMAT M103C-PTM
FITS: STR-2211/2212-01		PARTS,SPARE,400MICRON SCREEN,M102C&103C		1	AMIAD	#1150067 400 MICRON SCREEN M
FITS: STR-2211/2212-01		KIT,REPAIR Amiad STRAINER ,M102C & M103C		1	AMIAD	(EPDM LID SEAL & SCREEN SEAL,SCREEN PULLER)
FITS: STR-2211/2212-01		PARTS,SPARE,DIRT COLLECTOR M102C & M103C			AMIAD	#1400018 DIRT COLLECTOR
STR-2211/2212-02	Strainer inside tank TK-2211/2212-01 Outlet to Feed/Recirculation Pump	-	1		NIUBAO	In Tank Strainer
FLT-2211/2212-02	RF Tank 10 Micron Filter	FILTER INTAKE,AP3,RF,VENT	1		SOLBERG	F-19P-150, 10µm
FITS: FLT-2211/2212-02		AIR FIL ELEM,POLYESTER		4	SOLBERG	
VSD-2211/2212-01	VARIABLE-FREQUENCY DRIVE Feed for Pump PU-2211/2212-01 & PU-2211/2212-02	DANFOSS AQUA FC200 7.5KW	1	1	DANFOSS	FC202P7K5T4E66H2XGXXXXXXXAXBXXXXDX
FITS: VSD-2211/2212-01		SS Backplate for 7.5kW FC200, IP66	1		DANFOSS	SS Backplate for 7.5kW FC200, IP66
Module Parts						
MF Module	Microfiltration modules	MF MODULES			PALL/ASAHI	WH015807
Installation Kit, including the following:		INSTALLATION KIT FOR MF MODULES			PALL/ASAHI	WH061509
	Module XR Connection Gasket	GASKET		1	PALL/ASAHI	WH014325
	Module End Cap Nut	NUT		1	PALL/ASAHI	WH060417
	Module End Cap Gasket	O-RING B		1	PALL/ASAHI	WH014298
	Module End Cap, Top	6IN MDL END CAP,PL END,PVC		1	PALL/ASAHI	WH016474
	Module End Cap, Bottom	6IN MODULE ENDCAP, VIC END,		1	PALL/ASAHI	WH016475
	CLEAR COUPLING	COUPLING,ADAPTER,50MM,PVC,CLEAR		1	PALL/ASAHI	JP010030889
Spare wrench	Module Nut Wrench	MODULE WRENCH		1	PALL	WH060418
Repair Pins	Module Repair Pins	MODULE REPAIR PIN		10	PALL	WH014299
XR Hose (Boonah)	XR Hose, AP3 On Skid	ASSY,HOSE,1 IN FLEX HOSE, XR AP3 ONSKID		1	PALL	WH017202
XR Hose (Laidley)	XR Hose SHORT	ASSY,HOSE,1 IN FLEX HOSE, XR CONN,SHORT		1	PALL	WH014314

Pall AP2 Replacement Parts List

Date Issued: 05/07/13
Revision: 0
Number of Units: 2
(Note: The quantities stated in the following list are for one skid only)

P&ID Tag	Function	Equipment	Items Per Skid QTY	Suggested Spares QTY	Manufacturer	Part Number
Valves						
LCV-2211/2212-01	MF Feed Tank Level Control Valve	PNEUMATIC BUTTERFLY REGULATING VALVE, DOUBLE ACTING, Seat: EPDM/disc: SS316	1		BRAY	S30/S92-0630/S6A,2",ASME16.5,Class 150
FITS: LCV-2211/2212-01		ACTUATOR,BRAY,2.0IN,DA	1	1	BRAY	S92-0630
FITS: LCV-2211/2212-01		POSITIONER	1	1	BRAY	S6A
VLV-2211/2212-02	XR Control Valve, On/Off	VALVE,BTFL,2.0IN	1		BRAY	S30/S92-063,2",ASME16.5,Class 150
FITS: VLV-2211/2212-02		ACTUATOR,BRAY,2.0IN DA		1	BRAY	S92-063
VLV-2211/2212-03	Upper Drain Valve, Used for CIP Air Scrub, RF, FL	VALVE,BTFL,2.0IN,DA	1		BRAY	S30/S92-063,2",ASME16.5,Class 150
FITS: VLV-2211/2212-03		ACTUATOR,BRAY,2.0IN,DA		1	BRAY	S92-063
VLV-2211/2212-04	Lower Drain Valve, Skid Drains, RF Cycle	VALVE,BTFL,2.0IN,DA,TS	1		BRAY	S30/S92-063,Actuator W/travel switch,2",ASME16.5,Class 150
FITS: VLV-2211/2212-04		ACTUATOR,BRAY,2.0IN,DA		1	BRAY	S92-063
VLV-2211/2212-05	Filtrate Outlet Valve, On/Off Fail Closed	VALVE,BTFL,2.0IN,Single Acting, TS, Air to open	1		BRAY	S30/S93-0833/FC, Actuator W/travel switch,2",ASME16.5,Class 150
FITS: VLV-2211/2212-05		ACTUATOR,BRAY,2.0IN,SR		1	BRAY	S93-0833/FC
VLV-2211/2212-06	RF Fill Valve/ Backwash Outlet Valve	VALVE,BTFL,2.0IN,DA	1		BRAY	S30/S92-063,2",ASME16.5,Class 150
FITS: VLV-2211/2212-06		ACTUATOR,BRAY,2.0IN,DA		1	BRAY	S92-063
VLV-2211/2212-07	Air Scrub Control Valve, On/off	VALVE,BTFL,Air to open, single acting	1		BRAY	S20/S93-063/FC,1",ASME16.5,Class 150
FITS: VLV-2211/2212-07		ACTUATOR, Air to open, single acting		1	BRAY	S93-063/FC
VLV-2211/2212-14	Bypass Valve of XR Constant Flow Fitting for CIP Flow	VALVE,BTFL,AUTO,2.0IN	1		BRAY	S30/S93-0833/FC,2",ASME16.5,Class 150
VLV-2211/2212-20	CIP Block Valve	VALVE,BTFL,2.0IN,AUTO,EPDM/disc: SS316	1		BRAY	S30/S93-083/FO
HV-2211/2212-02	Hand Valve to drain tank TK-2211/2212-01	VALVE,BALL,0.5IN,PVC	1		HERSHEY	VP-640
HV-2211/2212-03	RF Tank Drain Valve	VALVE,BALL,0.5IN,PVC	1		HERSHEY	VP-640
HV-2211/2212-04	Filtrate Sample valve	VALVE,BALL,0.25IN,PVC	1		PRAHER	122355
HV-2211/2212-05	Hand Valve to Feed turbidity AE-2211/2212-02	VALVE,BALL,0.25IN,PVC	1		NANJING LUOKIA	AHMC0404
HV-2211/2212-07	Compressed Air Shut Off, Lock out/tag out capable	VALVE,0.5IN,SST	1		GUANGDE	BT-2F-1
HV-1012-13A/B	Air Scrub Throttle Valve Set manually	VALVE,GLOBE,0.5,200,FPT,304ST	1		GUANGDE	GBTL-150-1
HV-2211/2212-18	Backwash Drain sample Valve	VALVE,BALL,0.25IN,PVC	1		PRAHER	122355
NV-1012-1A/B	Strainer Clean Back Flow Control Valve	NEEDLE VALVE	1		FESTO	GRA-1/4-B, 6509
CV-2211/2212-01	Check Valve for PU-2211/2212-01	VALVE,CHECK,BTFL,2.0IN,PVC	1		GF	DN50,161562107,UPVC,Type 562
CV-1012-2A/B	Check Valve for Air Line	VALVE,CHECK,BALL,1.0IN,FPT,SST, Spring loaded	1		GUANGDE	SCT-200
CV-2211/2212-05	RF Tank Overflow check valve	VALVE,CHECK,2IN,200# PVC	1		GF	TYPE 562, 161562107
CFF-2211/2212-01	XR Constant Flow Fitting	VALVE,200,NPT,PV,0.3 LPS	1		PLAST-O-MATIC	FC100EP-005-PV
CFF-2211/2212-05	Turbidity Constant Flow Fitting	VALVE,1.000,200,NPT,PV (~300mL/min)	1		MARIC	6-FF-P-P-0.4
Instruments						
AIT-2211/2212-02, AE-2211/2212-02	Filtrate Water Turbidity Transmitter/Analyser	TURBIDITY TRANSMITTER,660sc,0-1 NTU,24V DC, SC200			HACH	660sc (6016000) sc200 (LXV404,99.70552)
FITS: AIT-2211/2212-02	Filtrate Water Turbidity Transmitter/Analyser - Calibration Solution	Turbidity 0.88 mNTU stablcal 1L	1	1	HACH	Turbidity .8 stablcal 1L
PIT-2211/2212-01	Strainer Outlet Pressure, Module Feed pressure, TMP Calc, Strainer DP	PRESS TRANS,ROSEMOUNT, 0-400kPa	1	1	ROSEMOUNT	2088G2S22B2M5Q4
PIT-2211/2212-02	Filtrate Pressure, Module outlet pressure, TMP Calc,	PRESS TRANS,ROSEMOUNT, 0-400kPa	1	1	ROSEMOUNT	2088G2S22B2M5Q4
PIT-2211/2212-03	Pump PU-2211/2212-01 Discharge Pressure, Used for Strainer DP and TMP Alarms	PRESS TRANS,ROSEMOUNT, 0-400kPa	1	1	ROSEMOUNT	2088G2S22B2M5Q4
LIT-2211/2212-01	Indicates and transmits Level in Tank TK-2211/2212-01, High/Low alarms for TK-2211/2212-01	PRESS TRANS, ROSEMOUNT, low range	1	1	ROSEMOUNT	2088G1S22B2M5Q4
LIT-2211/2212-02	TK-2211/2212-02 RF Tank Level, Alarms for CIP, Backwash	PRESS TRANS, ROSEMOUNT, low range	1	1	ROSEMOUNT	2088G1S22B2M5Q4
TT-2211/2212-01	Feed water/CIP water temperature, alarmed	Feed temperature with Thermowell	1		ROSEMOUNT	148HNNAU1XA // 0068N21N00A025T32XA
FIT-2211/2212-01	Filtrate Flow Rate	FLOW TRANSMITTER incl Flow Element, Magnetic Flow Meter, 2.0IN	1		ROSEMOUNT	8732EST2A2N0DA1M4D1 / 8711SSE020U1N0D1DW
PHC-1012-3A/B, PI-1012-3A/B	Air Pressure to Strainer backwash shuttle	REGULATOR, AIR PRESS,1/4",ADJ,ALUM	1		FESTO	MS4-LFR-1/4-D7-CRV-AS
PS-1012-1A/B	Pressure Switch, for Low/High Air Pressure, Low/High Air Scrub pressure	PRESSURE SENSOR	1	1	FESTO	SDEI-D10-G2-H18-C-P2-M8
PHC-1012-1A/B, PI-1012-1A/B, FLT-1012-1A/B	Pressure regulator, Gauge Filter to solenoid bank	ASSY,REGULATOR, 3/8 NPT,1 STAT W/FILTER	1		FESTO	MS6-LFR-1/2-D7-CRV-AS
FITS: PI-1012-1A/B	Replacement Pressure Gauge for Regulator	PRESSURE GAUGE,0-11 BAR		1		
FITS: PI-1012-1A/B	Replacement Pressure Gauge for Regulator	PRESSURE GAUGE,0-4 BAR		1		
FITS: FLT-1012-1A/B	Replacement Filters for Skid Regulator	FILTER ELEMENT,AIR,0.1MICRON		1		
PHC-1012-2A/B	Pressure regulator for Air scrub	REGULATOR, AIR PRESS,0.5IN,ADJ,W/GAGE	1		CASHCO	2B4-2B27-12000000B
FI-1012-2A/B	Air Scrub Air Flow Rate	FLOW INDICATOR,Stubbe,10-100SCFM,AIR	1	1	Stubbe	DFM350 DN40 PA/EPDM
Equipment						
TK-2211/2212-01	Feed/CIP tank (265 L)	ASSY,TANK,AP2,265L,FEED	1		NIUBAO	265L TANK
Tk-2211/2212-02	Reverse Filtration Tank (435 L)	ASSY,TANK,AP2,435 L,RF	1		NIUBAO	435 L TANK
PU-2211/2212-01	Recirculation PUMP	LOWARA, pump, 4KW	1	1	LOWARA	SHE32-200/40
PU-2211/2212-02	Reverse Filtration Pump	LOWARA, pump, 4KW	1	1	LOWARA	SHE32-200/40
STR-2211/2212-01	Membrane Pre-Strainer	STRAINER,AMIAD,2.0IN,CS,400 MICRON	1		AMIAD	FILTOMAT M102C-PTM
FITS: STR-2211/2212-01		PARTS,SPARE,400MICRON SCREEN,M102C&M103C		1	AMIAD	#1150067 400 MICRON SCREEN M
FITS: STR-2211/2212-01		KIT,REPAIR Amiad STRAINER ,M102C & M103C		1	AMIAD	(EPDM LID SEAL & SCREEN SEAL,SCREEN PULLER)
FITS: STR-2211/2212-01		PARTS,SPARE,DIRT COLLECTOR M102C & M103C			AMIAD	#1400018 DIRT COLLECTOR
STR-2211/2212-02	Strainer inside tank TK-2211/2212-01 Outlet to Feed/Recirculation Pump	-	1		NIUBAO	In Tank Strainer
FLT-2211/2212-02	RF Tank 10 Micron Filter	FILTER,INTAKE AP2,RF,VENT	1		SOLBERG	F-19P-150, 10µm
FITS: FLT-2211/2212-02		AIR FIL ELEM,POLYESTER		4	SOLBERG	
VSD-2211/2212-01	VARIABLE-FREQUENCY DRIVE Feed for Pump PU-2211/2212-01 & PU-2211/2212-02	DANFOSS AQUA FC200 4KW	1	1	DANFOSS	FC-202P4K0T4E66H2XGXXXXXXXAXBXXXXDX
FITS: VSD-2211/2212-01		SS Backplate for 4kW FC200, IP66	1		DANFOSS	SS Backplate for 4kW FC200, IP66
Module Parts						
MF Module	Microfiltration modules	MF MODULES			PALL/ASAHI	WH015807
Installation Kit, including the following:		INSTALLATION KIT FOR MF MODULES			PALL/ASAHI	WH061509
	Module XR Connection Gasket	GASKET		1	PALL/ASAHI	WH014325
	Module End Cap Nut	NUT		1	PALL/ASAHI	WH060417
	Module End Cap Gasket	O-RING B		1	PALL/ASAHI	WH014298
	Module End Cap, Top	6IN MDL END CAP,PL END,PVC		1	PALL/ASAHI	WH016474
	Module End Cap, Bottom	6IN MODULE ENDCAP, VIC END,		1	PALL/ASAHI	WH016475
	CLEAR COUPLING	COUPLING,ADAPTER,50MM,PVC,CLEAR		1	PALL/ASAHI	JP010030889
Spare wrench	Module Nut Wrench	MODULE WRENCH		1	PALL	WH060418
Repair Pins	Module Repair Pins	MODULE REPAIR PIN		10	PALL	WH014299
XR Hose	XR Hose, AP2 On Skid	ASSY,HOSE,1 IN FLEX HOSE, XR AP2 ONSKID		1	PALL	WH017200

Pall CHN System Replacement Parts List

Date Issued: 05/07/13
Revision: 0
Number of Units: 1
(Note: The quantities stated in the following list are for one site only)

P&ID Tag	Function	Equipment	Items Per Skid	Suggested Spares	Manufacturer	Part Number
QTY	QTY					
Valves						
VLV-2250-80	CIP / Neutralisation Tank Isolation Valve	VALVE,BTFL,2.0IN,AIR OPEN SPRING CLOSE	1		BRAY	S31, S93-063/4 FC
VLV-2250-81	CHN Discharge Valve	VALVE,BTFL,2.0IN,AIR OPEN SPRING CLOSE	1		BRAY	S31, S93-063/4 FC
VLV-2250-82	CHN Recirculation Valve	VALVE,BTFL,2.0IN,AIR OPEN SPRING CLOSE	1		BRAY	S31, S93-063/4 FC
VLV-2250-83	CHN Drain Valve	VALVE,BTFL,2.0IN,AIR OPEN SPRING CLOSE	1		BRAY	S31, S93-063/4 FC
VLV-2250-84	CHN Return Valve	VALVE,BTFL,2.0IN,AIR OPEN SPRING CLOSE	1		BRAY	S31, S93-063/4 FC
VLV-2250-85	Filtrate Rinse Tank Isolation Valve	VALVE,BTFL,2.0IN,AIR OPEN SPRING CLOSE	1		BRAY	S31, S93-063/4 FC
HV-2250-80	CIP / Neut. Tank drain valve	VALVE,BTFL,2.0IN,MANUAL	1		BRAY	S31, SERIES 1 LEVER OP
HV-2250-81	Filtrate Rinse Tank drain valve	VALVE,BTFL,2.0IN,MANUAL	1		BRAY	S31, SERIES 1 LEVER OP
HV-2250-87	Drain Sample Valve	VALVE, BALL, 0.5IN, MANUAL	1		SPEARS	2000 SERIES, 3629-005C
CV-2250-81	CHN Pump Discharge Non Return Valve	VALVE, CHECK, 2.0IN	1		SPEARS	2000 SERIES, 4529C-020
CV-2511-90A	NaOCl Pump Suction Check Valve	Flexible Foot Valve			GRUNDFOS	SERIES 522-95730920
CV-2532-91A	Acid Pump Suction Check Valve	Flexible Foot Valve			GRUNDFOS	SERIES 522-95730920
CV-2521-92A	Caustic Pump Suction Check Valve	Flexible Foot Valve			GRUNDFOS	SERIES 522-95730920
CV-2513-93A	SMBS Pump Suction Check Valve	Flexible Foot Valve			GRUNDFOS	SERIES 522-95730920
CV-2511-90B	NaOCl Dosing Check Valve	Injection Valve (Check Valve, Spring loaded)			GRUNDFOS	L05, 91835757
CV-2532-91B	Acid Dosing Check Valve	Injection Valve (Check Valve, Spring loaded)			GRUNDFOS	L05, 91835757
CV-2521-92B	Caustic Dosing Check Valve	Injection Valve (Check Valve, Spring loaded)			GRUNDFOS	L05, 91835757
CV-2513-93B	SMBS Dosing Check Valve	Injection Valve (Check Valve, Spring loaded)			GRUNDFOS	L05, 91835757
Instruments						
FS-2250-80	Hot Water Supply Flow Switch, detection of flow/supply of hot water, alarmed	Flow switch, Paddle	1	1	KELCO	F20-S-NPT
AIT-2250-80	Waste Water ORP/pH Transmitter	pH/ORP Display, 1056	1		ROSEMOUNT	1056-02-22-32-AN
AE-2250-80	Waste Water pH Sensor	pH Sensor and Cable (15ft cable with VP8 connector)	1	1	ROSEMOUNT	3900VP-01-10, 24281-00
FITS: AE-2250-80	Waste Water pH Sensor - pH Calibration solution	pH solution kit (pH 4, pH 7 & pH 10, 500 ml each)	1	1	Pall	P0012295
AE-2250-81	Waste Water ORP Sensor	ORP Sensor and Cable (15ft cable with VP8 connector)	1	1	ROSEMOUNT	3900VP-01-12, 24281-00
FITS: AE-2250-81	Waste Water ORP Sensor - ORP Calibration Solution	600 mV (500ml)	1	1	Pall	P0012296
PHC-1012-86, HV-1012-86, PI-1012-86, FLT-1012-86	CHN Skid Compressed Air Regulator	Combination Pressure Regulator Filter	1		FESTO	MSB6-1/2:C4J22-WPB
PSL-1012-86	CHN Skid Compressed Air Low Pressure Switch	Pressure Switch	1		FESTO	SDE1-D10-G2-H18-C-P2-M12
TT-2250-80	CIP / Neutralisation Tank Temperature Transmitter	TEMPERATURE TRANSMITTER	1		ROSEMOUNT	644HANAXAJ6M5Q4K1063 / 0065N31J0080J0150T44XA
LIT-2250-80	CIP / Neutralisation Tank Level Transmitter	Pressure Transmitter for Level, Hastelloy			ROSEMOUNT	2088G1S33B2M5Q4
LIT-2240-81	Filtrate Rinse Tank Level Transmitter	Pressure Transmitter for Level			ROSEMOUNT	2088G1S22B2M5Q4
Equipment						
PU-2250-80	CHN Recirculation Pump	PUMP, CENTRIFUGAL	1		LOWARA	SHE4 50-125/03
PU-2511-90	NaOCl Transfer Pump	DIAPHRAGM PUMP	1	1	WILDEN	P.025/KZPPP/TNL/TF/KTV
PU-2532-91	Acid Transfer Pump	DIAPHRAGM PUMP	1	1	WILDEN	P0.025/PPPP/WFS/TF/PWF
PU-2521-92	Caustic Transfer Pump	DIAPHRAGM PUMP	1		WILDEN	P0.025/PPPP/WFS/TF/PWF
PU-2513-93	SMBS Transfer Pump	DIAPHRAGM PUMP	1		WILDEN	P0.025/PPPP/WFS/TF/PWF
TK-2250-80 (Boonah & Laidley)	CIP/Neutralisation Tank	TANK, 5000L, LLDPE	1		BVCI	5000L
TK-2240-81 (Boonah & Laidley)	Filtrate Rinse Tank	TANK, 5000L, LLDPE	1		BVCI	5000L
TK-2250-80 (Kalbar & Forest Hill)	CIP/Neutralisation Tank	TANK, 2500L, LLDPE	1		BVCI	2500L
TK-2240-81 (Kalbar & Forest Hill)	Filtrate Rinse Tank	TANK, 2500L, LLDPE	1		BVCI	2500L
HE-2250-80 (Boonah & Laidley)	CIP/Neutralisation Heater	10W IMMERSION HEATER, TK-2250-80	1		TEE	TEE Custom
HE-2250-80 (Kalbar & Forest Hill)	CIP/Neutralisation Heater	7.5W IMMERSION HEATER, TK-2250-80	1		TEE	TEE Custom
STR-2250-80	CIP/Neutralisation Tank Strainer	Y TYPE STRAINER	1		SPEARS	Y TYPE SEDIMENT STRAINER - 30 MESH, 2" ANSI 150 FLG
TK-2511-90 (Boonah & Laidley)	200L Drum - NaOCl	200L Dosing Tank	1		GRUNDFOS	98150053
TK-2532-91 (Boonah & Laidley)	200L Drum - Acid	200L Dosing Tank	1		GRUNDFOS	98150053
TK-2521-92 (Boonah & Laidley)	200L Drum - Caustic	200L Dosing Tank	1		GRUNDFOS	98150053
TK-2513-93 (Boonah & Laidley)	200L Drum - SBS	200L Dosing Tank	1		GRUNDFOS	98150053
TK-2511-90 (Kalbar & Forest Hill)	100L Drum - NaOCl	100L Dosing Tank	1		GRUNDFOS	98150051
TK-2532-91 (Kalbar & Forest Hill)	100L Drum - Acid	100L Dosing Tank	1		GRUNDFOS	98150051
TK-2521-92 (Kalbar & Forest Hill)	100L Drum - Caustic	100L Dosing Tank	1		GRUNDFOS	98150051
TK-2513-93 (Kalbar & Forest Hill)	100L Drum - SBS	100L Dosing Tank	1		GRUNDFOS	98150051
Chemicals						
	NaOCl (12.5%) Chemical	Drum	1			
	Citric Acid (50%) Chemical	Drum	1			
	Caustic (25%) Chemical	Drum	1			
	SBS (12.5%) Chemical	Drum	1			