IONPURE® MX CEDI Modules

Operation & Maintenance Manual

IP-MAN-MX-Rev F
October 2019

Manual Covers Part #:

- **IP-MXM30-2**
- **IP-MXM60-2**
- **IP-MXM125-2**
- **IP-MXM250-2**
- **IP-MXM500-2**

IONPURE®

Evoqua Water Technologies, LLC
558 Clark Road
Tewksbury, Massachusetts 01876, USA
ionpure@evoqua.com (email)
www.ionpure.com (web)

Visit web site to find local Ionpure contact

TABLE OF CONTENTS

DISCLAIMER STATEMENT

The operation and maintenance manual should provide complete and accurate information to meet your operating and/or service requirements based on the information available at the time of publication. The information in this manual may not cover all operating details or variations or provide for all conditions in connection with installation, operation and maintenance. Should questions arise which are not answered specifically in this manual, contact your water system supplier.

IONPURE reserves the right to make engineering refinements that may not be reflected in these manuals. The material in these manuals is for informational purposes and is subject to change without notice.

PROPRIETARY RIGHTS STATEMENT

This manual discloses information in which IONPURE has proprietary rights. Neither receipt nor possession of this manual confers or transfers any right to the client, and by its retention hereof, the client acknowledges that it will not reproduce or cause to be reproduced, in whole or in part, any such information except by written permission from IONPURE. The client shall have the right to use and disclose to its employees the information contained herein for the purpose of operating and maintaining the IONPURE equipment, and for no other purpose.

In the event the content of this manual is altered or section/items are omitted during a reproduction, in whole or in part, and instructions or definitions within the reproduction result in personal injury to those who follow the altered instructions, the burden of responsibility for personal injury falls solely on the party who effects the reproduction.

MANUAL USER'S GUIDE

This manual describes the procedures necessary to install, operate, and maintain your IONPURE Continuous Electrodeionization modules. Please read this manual carefully before installing and operating your modules. The module warranty may be voided if installation or operation instructions are not followed correctly.

Notes, Warnings, Cautions are used to attract attention to essential or critical information in a manual. Warnings and Cautions will appear before the text associated with them, and notes can appear either before or after associated text.

NOTE: *Notes are used to add information, state exceptions, and point out areas that may be of greater interest or importance.*

CAUTION **Cautions indicate a situation that may cause damage or destruction of equipment or may pose a long term health hazard.**

WARNING **Warnings indicate condition, practices, or procedures which must be observed to avoid personal injury or fatalities.**

IONPURE continually strives to provide safe, efficient, trouble-free equipment using the optimum technology for your application. If problems should develop, IONPURE's worldwide network of technical support will be available to provide assistance. For service, sales, parts, or additional manual copies, please visit the website: www.ionpure.com.

OPERATING MANUAL REVISION HISTORY

Event	Date	Description
First publication	07-2004	Operation & Maintenance Manual
Revision A	11-2005	Phone number revised
Revision B	07-2007	Additional MX sizes added
Revision C	07-2014	Rebranding, flow rate edit, formatting
Revision D	10-2015	Revised maximum DC voltage
Revision E	02-2018	Updated Installation and Maintenance sections
Revision F	09-2019	Added electrode post torque specification to 3.3.2; Revised 4.2 Estimating DC Current Table 6-5 corrected H_2O_2 amounts Updated 8.3 Disposal flush duration

1. INTRODUCTION

1.1. MX Module Overview

MX modules use ion exchange resins, ion exchange membranes and a DC potential to produce high purity deionized water without the need for chemical regeneration. Their compact state-of-the-art design assures ease of installation, maintenance, and service. MX modules are available in the following sizes:

Model	Nominal Flow	Description
IP-MX030	30 LPH (0.13 GPM)	2 cell-pair CEDI module with vessel
IP-MX060	60 LPH (0.26 GPM)	4 cell-pair CEDI module with vessel
IP-MX125	125 LPH (0.55 GPM)	8 cell-pair CEDI module with vessel
IP-MX250	250 LPH (1.1 GPM)	16 cell-pair CEDI module with vessel
IP-MX500	500 LPH (2.2 GPM)	32 cell-pair CEDI module with vessel

For more information on the MX module specifications and flow rates, see Sections 2.3 and 2.4 and Appendix A of this Manual.

Figure 1-1: View of MX module ends (cathode end on left, anode end on right)

1.2. Using This Manual

- Service technicians should review this manual prior to going to the site. It lists tools and materials needed to install the modules. It also outlines the site information required to prepare for installation.

- **NOTE***: The warranty may be void if installation or operation instructions contained in this manual are not followed exactly.*
- This manual describes the installation, operation, and routine maintenance of the MX module. It also contains information on basic troubleshooting (Section 7).
- IONPURE strongly recommends all users read the entire contents of the manual. If the MX module is not operating properly after going through the basic troubleshooting exercises, contact your Local Service Provider.

1.3. Installation Precautions ⚠CAUTION

- Do not open the MX CEDI module. Opening the module will void the warranty and do irreversible damage
- During operation, the electrode wiring inside the module junction boxes may be at high voltage and present a shock hazard. Therefore, before opening the junction box, confirm that DC power has been disconnected and locked out according to standard lockout/tagout procedures.
- To eliminate the possibility of electric shock, confirm that all ground wires are properly connected. Thoroughly read all the information in this manual before operating the MX module.
- The module must be operated within its design specifications for temperature and humidity.
- Metal piping should never be connected directly to the module. Non-metallic piping or tubing adapters are required.
- Pipe sections prepared for installation must be inspected, and be free of debris from storage or cutting tool particles. This must be done before installation.
- Because MX modules have narrow flow distribution channels, plugging by particles can cause permanent damage. Always install pressure gauges, sampling ports, sensors, etc. in tee fittings. Do not drill or tap into piping. After installing gauges, sampling ports, sensors, etc., always flush out the piping before connecting to the MX module to remove any debris.
- Installation of the MX module must be completed in accordance with the procedures outlined in this manual. If deviations from the prescribed procedures are deemed necessary to achieve the desired performance, consult your local Service Provider.

1.4. Operating Precautions ⚠CAUTION

- Do not apply DC power to the MX module until proper product and reject flows and pressures have been checked and verified.
- Never block-off (dead-head) the MX outlets. Dead-heading the outlets can result in over-pressurization, causing permanent damage to the module.
- Do not operate the module under conditions other than those stated in the module manual. The prescribed feed water and electrical requirements, and flow configurations, must be followed at all times. If the feed water quality or the product

water requirements change, contact the IONPURE Technical Support department for assistance.

- Once every six months:
  - Make sure all wiring connections are tight
  - Test safety interlocks such as flow switches or connections to upstream equipment

1.5. Shutdown Precautions

- Confirm that the pressure in the unit is relieved until all pressures inside the unit are atmospheric. (i.e., all pressure gauges should read zero).
- Drain standing water and plug all inlets and outlets.

2. PRE-INSTALLATION: PREPARATION & REQUIREMENTS

2.1. Tools and Equipment

The following items are required to unpack, position, and install the MX module:

- Slip joint pliers (to tighten plumbing fittings).
- Wire cutters/strippers (to prepare wires for DC power connections).
- Phillips head screwdriver (to remove junction box cover).

2.2. Electrical and Plumbing Connection Requirements

- The amounts, sizes, and types of these supplies will vary based upon system size. Check beforehand to determine the system needs.
- Conduit, wires and appropriate conduit connectors to run the DC power and ground from the DC power controller to the module. The module includes a terminal ring for 14-16 AWG wire. It is always important to size wire in accordance with local electrical code.
- Use non-metallic, 3/8” BSPTM adapter fittings (not supplied with module) to connect ports on the module to the system plumbing.

⚠WARNING

- To avoid the risk of electrical shock, some form of grounding must be used on any stream where there is metallic plumbing or accessories (such as sample ports or instrumentation) in close proximity to the module.

2.3. Inspect the Module

Do not uncrate the module prior to moving it into its final location. After uncrating it, inspect it for any signs of damage. If damage is apparent, immediately notify your Local Service Provider and the carrier.

2.4. Operating Requirements

In order to operate to specification, the MX module must have the following conditions present. If any of these conditions are unmet, do not attempt to install the MX module without specific instructions from your Local Service Provider Technical Support.

2.4.1 Operating Environment

⚠CAUTION

The MX module requires indoor installation out of direct sunlight. The maximum ambient room temperature should not exceed 113 °F (45° C). The module can tolerate humidity of up to 90%, as long as condensation does not occur.

2.4.2 Space Requirements

The physical dimensions of the MX Module are given in section A.2 In addition to the size of the module itself, the site-specific arrangement of the piping and electrical connections determines the amount of space the module needs to operate.

2.4.3 Electrical Requirements

The table below provides DC voltage required by MX modules. The DC amperage is 0-2.5A* (see Section 4.2). In all cases the cathode must be at ground potential.

Table 2-1. Electrical requirements for the MX Modules

Model	Nominal Flow Rate	Maximum Required VDC
IP-MXM030-2	30 LPH	27
IP-MXM060-2	60 LPH	53
IP-MXM125-2	125 LPH	106
IP-MXM250-2	250 LPH	213
IP-MXM500-2	500 LPH	426
* Depends on application, calculate using IP-PRO projection tool		

2.4.4 Feed Water Requirements

Feed water for the MX module must always meet the requirements outlined in Table 2-2.

Table 2-2. Feed Water Requirements for the MX Modules

Parameter	Specification
Feed water type	RO permeate
Feed conductivity equivalent	≤ 40 µS/cm
Silica	≤ 1 ppm as SiO_2
Iron, manganese, sulfide	≤ 0.01 ppm
Total chlorine	≤ 0.02 ppm as Cl_2
Total hardness	≤ 1.0 ppm as $CaCO_3$
Total organic carbon (TOC)	≤ 0.5 ppm as C
Operating pH range	4 - 11
Operating temperature	41 – 113°F (5 – 45°C)
Inlet pressure	≤ 75 psi (5 bar)

In most cases, pre-treating MX module feed water with reverse osmosis (RO) will bring it within these specifications. Depending on the conditions, however, some sites may require additional pretreatment. To determine if additional pretreatment is required, compare the MX feed water (RO Permeate) on site with the feed water requirements listed below.

Note: *Recycling the MX reject to the RO feed will cause the CO_2 load on the MX to increase, and may have an impact on the product water quality.*

2.4.5 Drain Requirements

Place the MX module near a drain that can accommodate at least 100% of the total feed flow.

2.5. Flow Rates and Pressure Drops

See Appendix A.

3. MX MODULE INSTALLATION

3.1. Moving the MX Module Into Place

Confirm that the pre-installation requirements outlined in Section 2 are met and the system is ready for MX Module installation.

- Remove any packaging materials and move the module to its operating location. (See section 2.1.1). Use safe lifting practices when moving the module.
- Remove the plug caps that seal the inlet and outlet ports on the cathode end.

3.2. Connect Plumbing Fittings ⚠CAUTION

- Make sure all upstream pretreatment equipment and piping have been thoroughly flushed with particle-free water before connecting them to the MX module.
- Flushing removes any particles left in the piping from cutting and assembly. If particles remain, they could plug the passages inside the MX Module.
- Figure 3-1 and the drawing in Appendix B show the location of the module plumbing connections. The product and reject ports in the endblock are all 3/8" BSP tapered female. MX modules are shipped with male plugs installed in the plumbing ports.
- These connections are British Standard Pipe thread which is NOT the same as National Pipe Thread (NPT) !!! For more information on BSP thread, go to the web site www.britishfasteners.com/threads/bsp.html.
- Non-metallic fittings are required - do not connect metal fittings directly to MX module.
- Do not over tighten the fittings. Over tightening can result in damage to the module that can only be fixed in the factory. Teflon® tape may be used on the threads to ensure a good seal.
- All plumbing connections are made to the cathode end (low voltage). The anode end does not have plumbing ports.

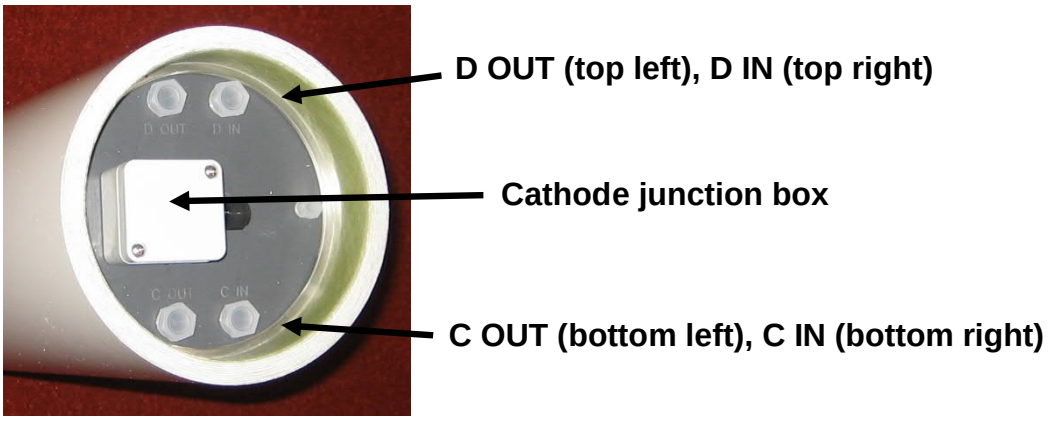


Figure 3-1: MX plumbing connections – cathode end

3.3. Electrical Connections

3.3.1 General guidelines

- Do not run AC and DC wiring within the same conduit. This may cause interference and lead to malfunctions.
- Connect wires to module first before connecting to DC power supply.
- Make sure that DC power supply is de-energized before opening its enclosure and follow accepted Lockout/Tagout procedures when working on the system.

- All wiring done in the field must conform to local electrical codes. Consult your Local Service Provider if there is a conflict between the instructions in this manual and the local codes.

3.3.2 Module connections

- NOTE: maximum torque for the MX electrode post nut is 20 lb_f-inch. (2.3 N-m). Overtightening can damage the electrode.

- Connect wire rated for 2.5 amps to MX module anode (+) post. Connect other end of wire to power supply DC positive (+) terminal.
- Connect wire rated for 2.5 amps to MX module cathode (-) post. Connect other end of wire to power supply DC negative (-) terminal.
- Ensure that polarity of DC connections is correct before applying DC power. Operation with polarity reversed will permanently damage the cathode.

4. PREPARATION FOR STARTUP

4.1. Verify Quality Meets MX Feed Water Requirements

Test the MX feed water quality by running the RO system to drain and testing to make sure the feed water quality meets all the feed water requirements given in Table 2.2. Below are some of the test kits or devices that may be useful:

Table 4-1 Useful Equipment for Feed Water Testing

Analyte	Model	Minimum Increment
Conductivity	Myron L Ultrameter II 4P	0.1 µS/cm
CO_2	Hach CA-23 (#143601)	1.25 mg/l
Cl_2	Hach CN-70 (#1454200)	0.02 mg/l
Hardness	Hach HA-71A (#145201)	1.0 mg/l
Silica	Hach SI-7 (#2255000)	0.05 ppm

4.2. Estimate DC Current Required

An important part of the startup process for the MX module is setting the operating current correctly for each application.

The amount of DC current required depends on the following site-specific conditions:

- Flow rate per module
- CEDI feed water conductivity equivalent (FCE)
  - Measured feed water conductivity (may require a portable conductivity meter)
  - Feed water carbon dioxide concentration (requires test kit such as above)
  - Feed water silica concentration (usually low enough to be neglected)
- Product water quality required

The best way to determine the amount of DC current required is to use the Ionpure projection tool, IP-PRO: https://ippro.evoqua.com/

Alternatively, it can be estimated using the equation below (based on Faraday's Law). **NOTE:** *Contact local Ionpure Technical support for assistance.*

DC amps = (1.31)(product flow, L/min/cell)(FCE, µS/cm)/current efficiency, %

Where FCE = measured µS/cm + (ppm CO_2)(2.79) + (ppm SiO_2)(2.04)

See Section 1.1 for number of cells per module. Typical current efficiency is 10%.

5. START-UP PROCEDURE

5.1. Test Interlocks

- Test flow switches and other interlocks, including the RO interlock if applicable
- Test pressure relief if applicable
- Set alarm points

5.2. Startup of MX Modules

- Make sure that modules are correctly connected to the DC power source.
- Make sure that the MX product line is directed to drain.
- Turn on the feedwater. Adjust valves to obtain the desired flows and pressures in the product and reject streams. The reject flow is typically set at about 11% of the product flow (this gives a water recovery of 90%)*****. Valves are adjusted so the product outlet pressure is about 2 to 5 psig (0.1 to 0.3 bar) higher than the reject outlet pressure at the desired flow rates.
- Adjust the DC power supply to the current setting calculated in section 3.4.3
- Test all flow switches and interlocks to ensure MX DC power is shut off when flow is interrupted.
- Continue to direct the product water to drain until it reaches the desired quality.
- Once product reaches the desired quality, connect to process. Readjust pressures as required to maintain product outlet pressure 2 to 5 psi (0.1 to 0.3 bar) above the reject outlet pressure.
- When the system is at steady state (quality in specification and stable operation), record operating data on the data sheet provided at the end of section 4.0.

5.3. Additional Notes

- MX recovery of 95% is limited to systems with feed water total hardness of less than or equal to 0.2 ppm as $CaCO_3$. Reduction of hardness is normally accomplished with ion-exchange softening or with 2 pass RO.
- There is a minimum MX reject flow of:
    - 2.5 lph for each MX30
    - 5.0 lph for each MX60
    - 10 lph for each MX125
    - 19 lph for each MX250
    - 36 lph for each MX500
- Therefore, 95% recovery may not be attainable below nominal product flow.
- For operation at 95% recovery, feed water silica must be $\leq$ 0.5 ppm as SiO_2

6. MAINTENANCE

The following section details the maintenance procedures for the MX module. It contains general maintenance information and specific maintenance information for cleaning and sanitizing the modules.

The cleaning chemical volumes & flows detailed in this section are for a single MX module. Multiply chemical volumes by number of modules in system.

This section also lists possible problems and troubleshooting procedures for the MX module. All operators and personnel involved with the module should read and become familiar with all maintenance and troubleshooting procedures.

6.1. General Maintenance Guidelines

6.1.1 Operating Data Log Sheet

MX system log sheets should be filled out daily to provide early detection of problems that could jeopardize the warranty and potentially damage the module. A typical log sheet is included in Section 7. Because instrumentation may vary depending on the type of system the module is installed into, this log sheet may not apply to your particular system. The system manual should contain log sheets more appropriate for your particular system. **However, the items in bold must be filled out to maintain module warranty.**

6.1.2 Periodic Maintenance

Perform the following tests at least once every six months.

- Check for any water leakage from the module. If leakage is observed, see the Troubleshooting subsection for possible solutions.

- Periodically tighten all electrical connections (first make sure that the DC power is off)
- Check calibration of instrumentation
- Test function of critical interlocks such as low flow protection

6.2. Approved Cleaning Procedures

Periodically, the MX module may need cleaning or sanitization. Cleaning the module removes scale and resin/membrane foulants. The MX modules can be cleaned and sanitized with five (5) different solutions, depending on what needs to be removed:

- Hydrochloric acid (2%) – for removing scale and metal foulants.

- Sodium chloride/sodium hydroxide (5% brine/1% caustic) – for removing organic foulants and biofilm.
- Sodium percarbonate – for removing organic foulants, reducing pressure drop, and sanitizing.
- Peracetic acid – used for routine sanitizing to discourage the growth of bacterial films.
- Aggressive multi-agent cleaning – this sequential cleaning protocol of acid, caustic and percarbonate is recommended for heavily biofouled systems.
- *If you are unsure whether the module is scaled or organically fouled, flush first with brine, then clean with brine/caustic followed by brine followed by hydrochloric acid.*

6.3. Cleaning and Sanitization Prompts

The module may need CLEANING if:

- The product differential pressure increases by 50% without a change in temperature and flow, or
- The reject differential pressure increases by 50% without a change in temperature and flow, or
- The product quality declines without a change in temperature, flow, or feed conductivity, or
- The module's electrical resistance increases by 25% without a change in temperature.
- The above factors may indicate module fouling or scaling. Contact your Local Service Provider to determine if the module needs cleaning or for the best cleaning procedure.

The system may require periodic SANITIZATION if

- The product water calls for low levels of bacteria (a user-specific requirement).

6.4. Clean-In-Place (CIP) System Construction

The main components of a clean-in-place (CIP) system are a tank, circulating pump, cartridge filter, and various valves and hoses for connection to the CEDI system and control of flows and pressures. The following general guidelines apply to CIP systems:

- Typical CIP system is shown in Figure 6.1

⚠WARNING

- All components of CIP system must be constructed of material compatible with the cleaning solutions listed in Section 6.2. Plastics generally work well with most cleaning chemicals.

- The tank should be large enough to accommodate solution volumes shown in Section 6.7.
- It is best if the tank is fully drainable (false or conical bottom).
- Thoroughly flush all plumbing and other equipment before cleaning or sanitization to remove debris that might damage the CEDI system.
- Flexible hose is ideal for connecting cleaning equipment to the system.

- The CIP pump must provide a minimum discharge pressure of at least 30 psig (2 bar) and maximum pressure of 75 psig (5.2 bar) at the flow rate given in Table 6-1, below.

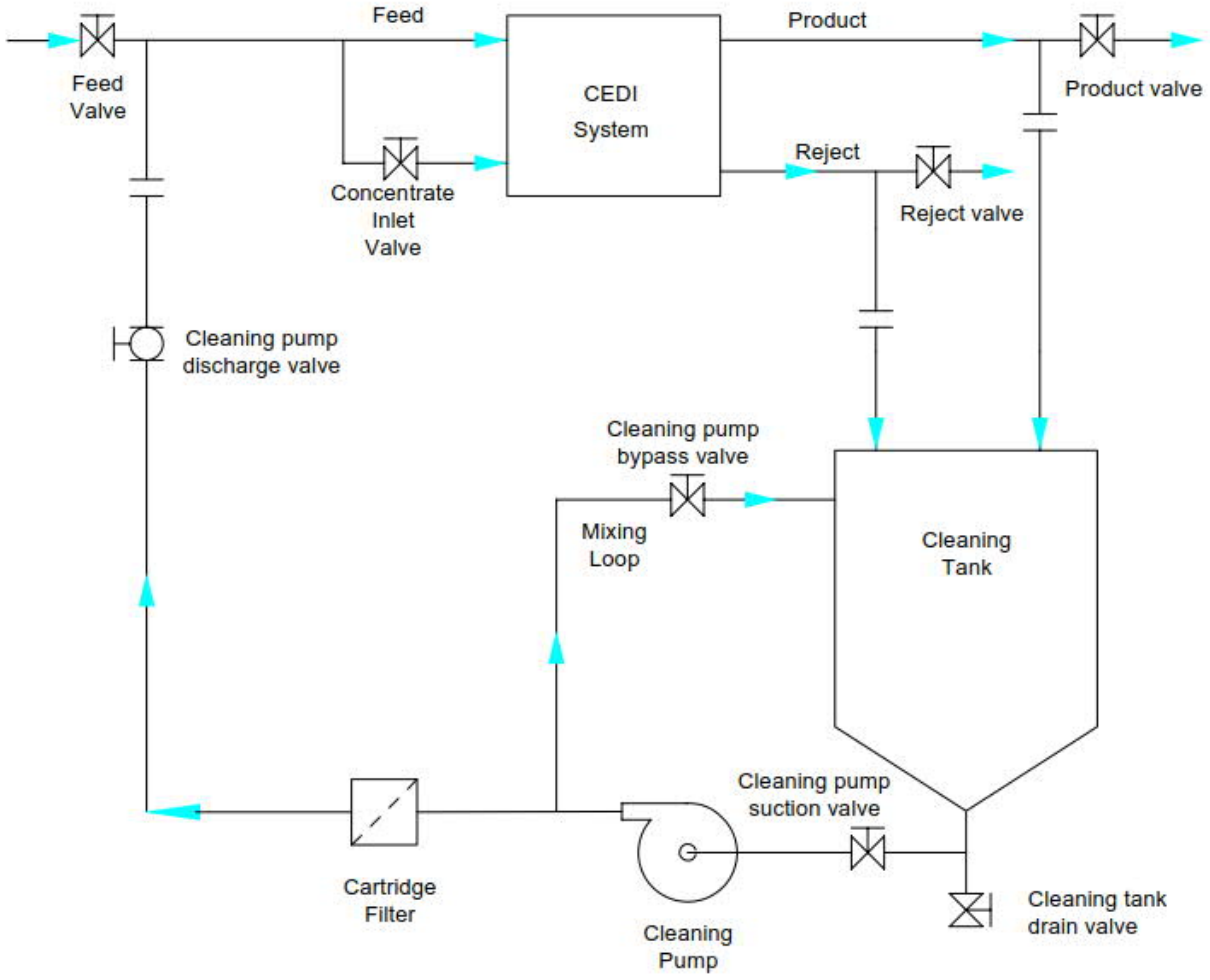


Figure 6-1: Typical CEDI CIP System

Table 6-1 MX CEDI Cleaning Flow Rates (liters/hr per module) *

	IP-MX30	IP-MX60	IP-MX125	IP-MX250	IP-MX500
Product	15-30	30-60	62-125	125-250	250-500
Reject	7.5-15	15-30	31-62	62-125	125-250
Pump Capacity	45	90	187	375	750

* The preferred cleaning flow rates are nominal product flow and reject flow of 0.5 x product flow. The same pressure should be applied to the dilute inlet and concentrate inlet, with minimal backpressure on the outlets.

6.5. Chemical Cleaning and Sanitization Precautions

WARNING

- Avoid direct skin contact with cleaning chemicals. Use appropriate Personal Protective Equipment (PPE), such as safety glasses, gloves and protective clothing.
- Flush all hoses and tank with clean water BEFORE adding chemicals.
- Pressure-test CIP system and connecting hoses with water before adding chemicals to tank.
- To reduce the possibility of chemical sprays, relieve the pressure in chemical lines before disassembly.
- Do not run a cleaning solution through the system when DC power is applied to the module. Make sure the DC power is off before cleaning.

CAUTION

- Follow the manufacturer's chemical safety instructions on the container labels.
- Check the pH level in any solution before letting it flow to the drain. Follow all discharge limitations.

6.6. Typical Procedure for Cleaning or Sanitization

NOTE: *The following cleaning procedure is based on the CIP system shown in Figure 6-1. If your CIP system is different, you may need to adapt this procedure.*

6.6.1 Preparation

- Turn off the DC power supply.
- Drain most of water from the CEDI system.
- Close the CEDI system feed valve and product valve.
- Connect the discharge of the cleaning pump to the MX system feed CIP connection.
- Connect the CEDI system reject and product CIP connections to the cleaning tank.
- Verify that all piping connections are secure.
- Close cleaning pump discharge valve until ready to pump the cleaning solution into the MX system.

6.6.2 Cleaning

- Follow the instructions in Section 6.6.1 (above) to prepare the MX system for chemical cleaning.
- Make sure the tank drain valve is closed.
- Fill the tank with the required amount of water, according to the applicable solution recipe in Section 6.7.
- Circulate water through the CEDI system, check CIP apparatus for leaks, fix any leaks if present.

- Mix the required amount chemical (from the recipe in Section 6.7) with the water in the tank. In the case of HCl, additional acid may be required during the recirculation period.
- Open the pump suction and pump bypass valves.
- Start the cleaning pump and circulate the solution through the pump bypass to mix the contents of the tank.
- When the solution is well mixed, gradually open the pump discharge valve while closing the pump bypass valve to adjust the product and reject flow rates to the values given in Section 6.4, Table 6-1.
- Recirculate the solution through the module for 30-60 minutes. Longer contact time may be desirable in some instances. See Ionpure Service Bulletin 2007-02b. Contact Ionpure Technical Support if you have further questions.

6.6.3 Return to service

- Turn off the cleaning pump.
- Check pH of solution in tank. Neutralize if necessary, then drain the CIP system tank.
- Refill the tank with water.
- Optional step: make brine solution, circulate through CEDI and then drain tank. This helps remove chemicals from CEDI and may speed rinse up to quality.
- Refill tank with water, circulate through CEDI and then drain tank.
- Close the cleaning pump discharge valve. Keep product and reject lines directed to drain and disconnect the CIP equipment from the CEDI system.
- Turn on the feed water supply to the CEDI system. Gradually allow RO product water to flow through the module to drain.
- Flush residual cleaning solution from the CEDI system for five minutes, then apply the DC power.
- Flush water to drain with DC power on until reaching desired CEDI product water quality, then send product water to use.

6.7. Cleaning Solution Recipes

⚠WARNING

Use appropriate PPE when using any of below chemicals for cleaning CEDI modules. Consult SDS from chemical supplier, or International Chemical Safety Card if available. See https://www.ilo.org/safework/info/publications/WCMS_113134/lang--de/index.htm .

Table 6-2 Sodium chloride, 5%					
	IP-MX30	**IP-MX60**	**IP-MX125**	**IP-MX250**	**IP-MX500**
Water	0.53 gal (2.0 L)	1.1 gal (4.0 L)	2.1 gal (8.0 L)	4.2 gal (16.0 L)	8.5 gal (32.0 L)
NaCl, solid	0.23 lbs (0.105 kg)	0.46 lbs (0.21kg)	0.92 lbs (0.42 kg)	1.85 lbs (0.84 kg)	3.65 lbs (1.67 kg)
Best use: displacement of hardness before high pH cleaning NOTES: once-through preferred					

Table 6-3 Hydrochloric acid, 2%					
	IP-MX30	**IP-MX60**	**IP-MX125**	**IP-MX250**	**IP-MX500**
Water	0.3 gal (1.1 L)	0.6 gal (2.3 L)	1.2 gal (4.5 L)	2.4 gal (9.1 L)	4.8 gal (18.2 L)
HCl, 36.5%	0.015 gal (57 mL)	0.03 gal (114 mL)	0.06 gal (227 mL)	0.12 gal (454 mL)	0.24 gal (908 mL)
Best use: removal of scale or metal fouling NOTES: [1] use brine flush and water rinse between low pH and high pH cleaning [2] add acid as required to maintain pH of 0.5-1.0					

Table 6-4 Sodium chloride (5%)/sodium hydroxide (1%) mixture (brine/caustic)					
	IP-MX30	**IP-MX60**	**IP-MX125**	**IP-MX250**	**IP-MX500**
Water	0.53 gal (2.0 L)	1.1 gal (4.0 L)	2.1 gal (8.0 L)	4.2 gal (16.0 L)	8.5 gal (32.0 L)
NaCl	0.23 lbs (0.106 kg)	0.46 lbs (0.21kg)	0.92 lbs (0.42 kg)	1.85 lbs (0.84 kg)	3.70 lbs (1.68 kg)
NaOH pellets	0.048 lbs (0.022 kg)	0.097 lbs (0.044kg)	0.19 lbs (0.088 kg)	0.39 lbs (0.176 kg)	0.77 lbs (0.352 kg)
or 50% NaOH	0.008 gal (29 mL)	0.015 (58 mL)	0.03 (113 mL)	0.06 (232 mL)	0.12 (458 mL)
Best use: removal of organic fouling NOTE: must be preceded by salt flush					

NOTE: quantities for chemicals used to prepare sodium percarbonate solutions in Table 6.5 (below) are based on the formula $2Na_2CO_3 \bullet 3H_2O_2$.

Table 6-5 Sodium percarbonate (1.5%) – mix sodium carbonate & hydrogen peroxide					
	IP-MX30	**IP-MX60**	**IP-MX125**	**IP-MX250**	**IP-MX500**
Water	0.3 gal (1.1 L)	0.6 gal (2.3 L)	1.2 gal (4.5 L)	2.4 gal (9.1 L)	4.8 gal (18.2 L)
Na_2CO_3, solid	0.025 lbs (0.011 kg)	0.05 lbs (0.023 kg)	0. 10 lbs (0.045 kg)	0.20 lbs (0.09 kg)	0.40 lbs (0.18 kg)
H_2O_2, 30%	0.0044 gal (17 mL)	0.0088 gal (34 mL)	0.0176 gal (67 mL)	0.035 gal (134 mL)	0.070 gal (268 mL)
Best use: for sanitization and biofilm removal NOTE: must be preceded by salt flush and water rinse					

Table 6-6 Peracetic acid, 0.04% (100:1 dilution)					
	IP-MX30	**IP-MX60**	**IP-MX125**	**IP-MX250**	**IP-MX500**
Water	0.3 gal (1.1 L)	0.6 gal (2.3 L)	1.2 gal (4.5 L)	2.4 gal (9.1 L)	4.8 gal (18.2 L)
Peracetic acid	0.003 gal (0.011 L)	0.006 gal (0.023 L)	0.012 gal (0.045 L)	0.024 gal (0.091 L)	0.048 gal (0.182 L)
Best for disinfection/bacteria control (not very effective for biofilm removal) NOTE: [1] Quantity based on Minncare: 20% Hydrogen Peroxide & 4% peracetic acid. [2] Dilute 120:1 for Oxonia P3 [3] Must be preceded by salt flush and water rinse					

Table 6-7 Sodium hydroxide (2%)					
	IP-MX30	**IP-MX60**	**IP-MX125**	**IP-MX250**	**IP-MX500**
Water	0.53 gal (2.0 L)	1.1 gal (4.0 L)	2.1 gal (8.0 L)	4.2 gal (16.0 L)	8.5 gal (32.0 L)
NaOH pellets	0.092 lbs (0.042 kg)	0.185 lbs (0.084kg)	0.370 lbs (0.168 kg)	0.739 lbs (0.336 kg)	1.461 lbs (0.664 kg)
or 50% NaOH	0.014 gal (55 mL)	0.029 (110 mL)	0.058 gal (220 mL)	0.116 gal (439 mL)	0.229 (868 mL)

Table 6-8 Water for initial post-cleaning flush					
	IP-MX30	**IP-MX60**	**IP-MX125**	**IP-MX250**	**IP-MX500**
Water	0.53 gal (2.0 L)	1.1 gal (4.0 L)	2.1 gal (8.0 L)	4.2 gal (16.0 L)	8.5 gal (32.0 L)

7. TROUBLESHOOTING

The troubleshooting chart in this Section is a diagnostic guide. If the MX system does not respond to the recommended solutions, **do not attempt further repairs.** Call your Local Service Provider.

Before calling:

- Become thoroughly familiar with the module and all troubleshooting procedures.
- Prepare a list of all problems encountered while operating the equipment.
- Have your monitoring log sheets at hand.
- Have your module's model and serial numbers at hand. This information can be found on the end plate on the non-plumbing side (anode). See Figure 1-1.

Table 7-1: Troubleshooting Procedures for MX modules

PROBLEM	CAUSE	SOLUTION
Module leaks	Feed pressure high	Contact Ionpure Technical support
	Module is faulty	Contact your Local Service Provider
Plumbing leaks	Module adapters or plugs are loose	Tighten adapters and plugs, retape with Teflon tape
Poor water quality with power ON to unit	Operating current incorrectly set	Measure feed conductivity and CO_2. Recalculate current according to Section 4 and adjust as necessary
	Bad electrical connection or power supply issue	Check power supply connection and operation
Loss of flow and/or increase in feed pressure	Module is fouled, scaled, or oxidized	See Troubleshooting chart at the end of this section.
	Obstruction downstream	Check if a downstream valve is inadvertently closed
	System is plugged with particulate matter or fouled	See Troubleshooting Flow Chart at the end of this section
	Loss of feed flow	1. Check if an upstream valve is inadvertently closed 2. Check for leaks or if an upstream bypass valve is inadvertently open 3. Check feed source output (for example, a pump)

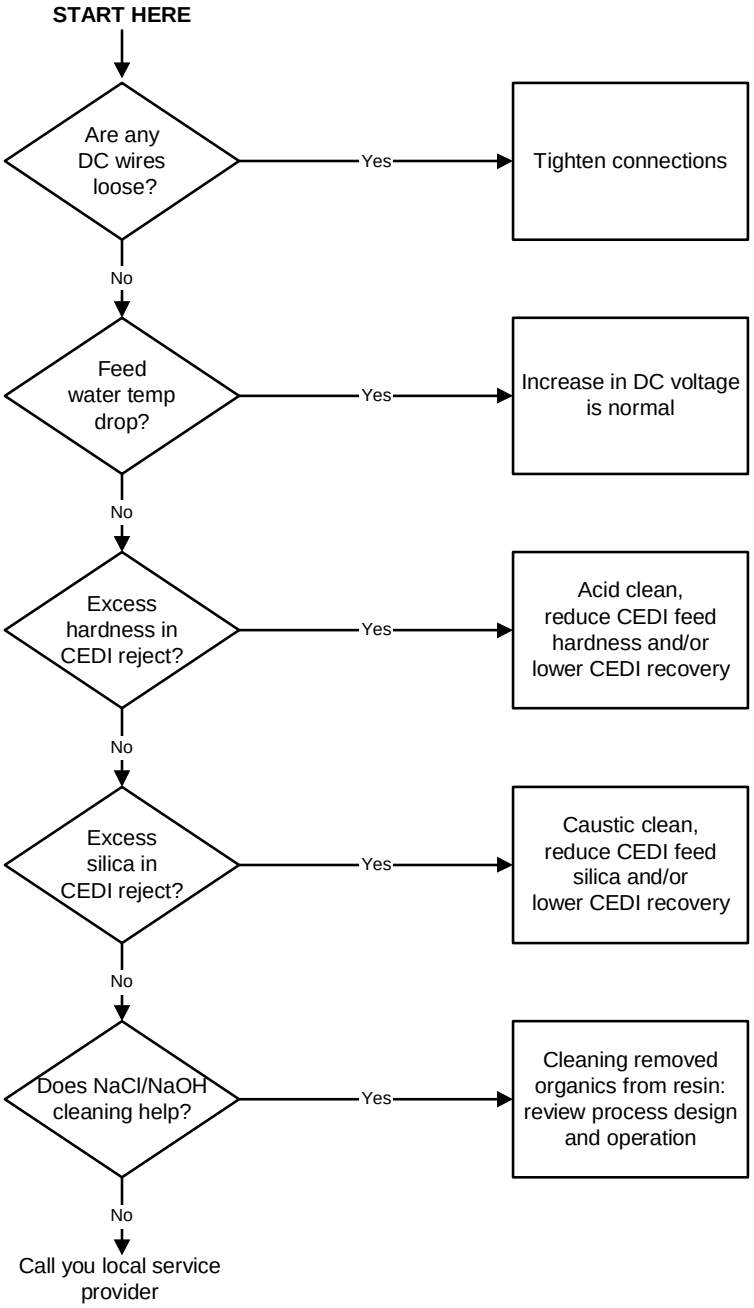
MX MODULE LOG SHEET (TYPICAL)

Installation Name: _____ **Module Serial Number:** _____

DATE						
TIME OF DAY						
FEED WATER TEMPERATURE	**°F or °C**					
FEED WATER TOTAL HARDNESS	**ppm $CaCO_3$**					
FEED WATER TOTAL CHLORINE	**ppm as Cl_2**					
FEED CARBON DIOXIDE	ppm as CO_2					
FEED CONDUCTIVITY	µmho/cm					
PRODUCT RESISTIVITY	MΩ-cm					
DC VOLTAGE	volts					
DC CURRENT	amps					
MODULE RESISTANCE (volts/amps)	ohms					
PRODUCT FLOW	gpm or L/h					
REJECT FLOW	gpm or L/h					
DILUTE INLET PRESSURE	**psig or bar**					
DILUTE OUTLET PRESSURE	psig or bar					
PRODUCT DP (Dilute $_{IN}$ – Dilute $_{OUT}$)	psig or bar					
CONCENTRATE INLET PRESSURE	**psig or bar**					
CONCENTRATE OUTLET PRESSURE	psig or bar					
CONCENTRATE DP (Conc $_{IN}$ – Conc $_{OUT}$)	psig or bar					
COMMENTS:						

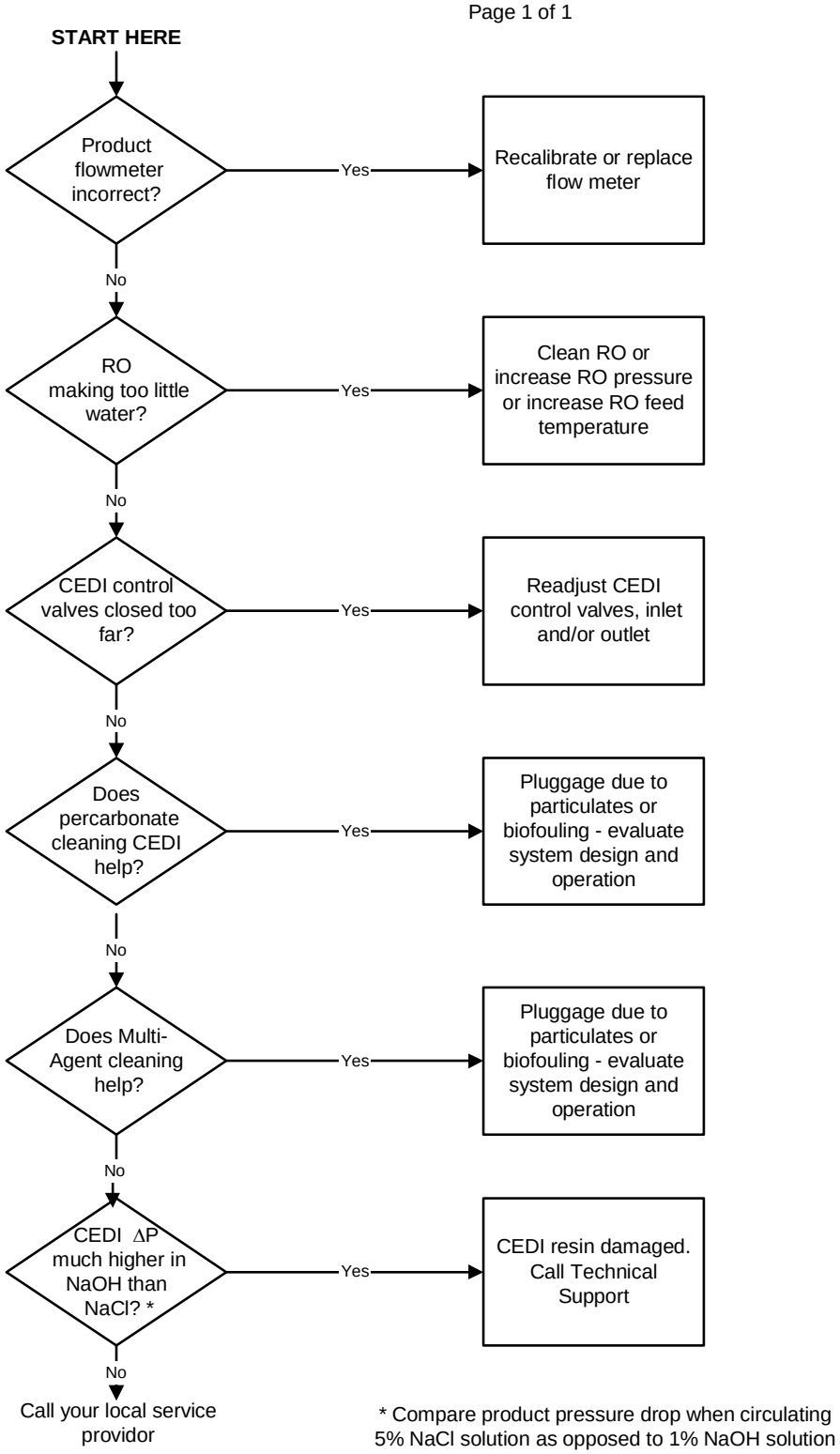
Troubleshooting Flow Chart - Increase in DC Volts

Page 1 of 1



Troubleshooting Flow Chart - Low CEDI Product or Reject Flow

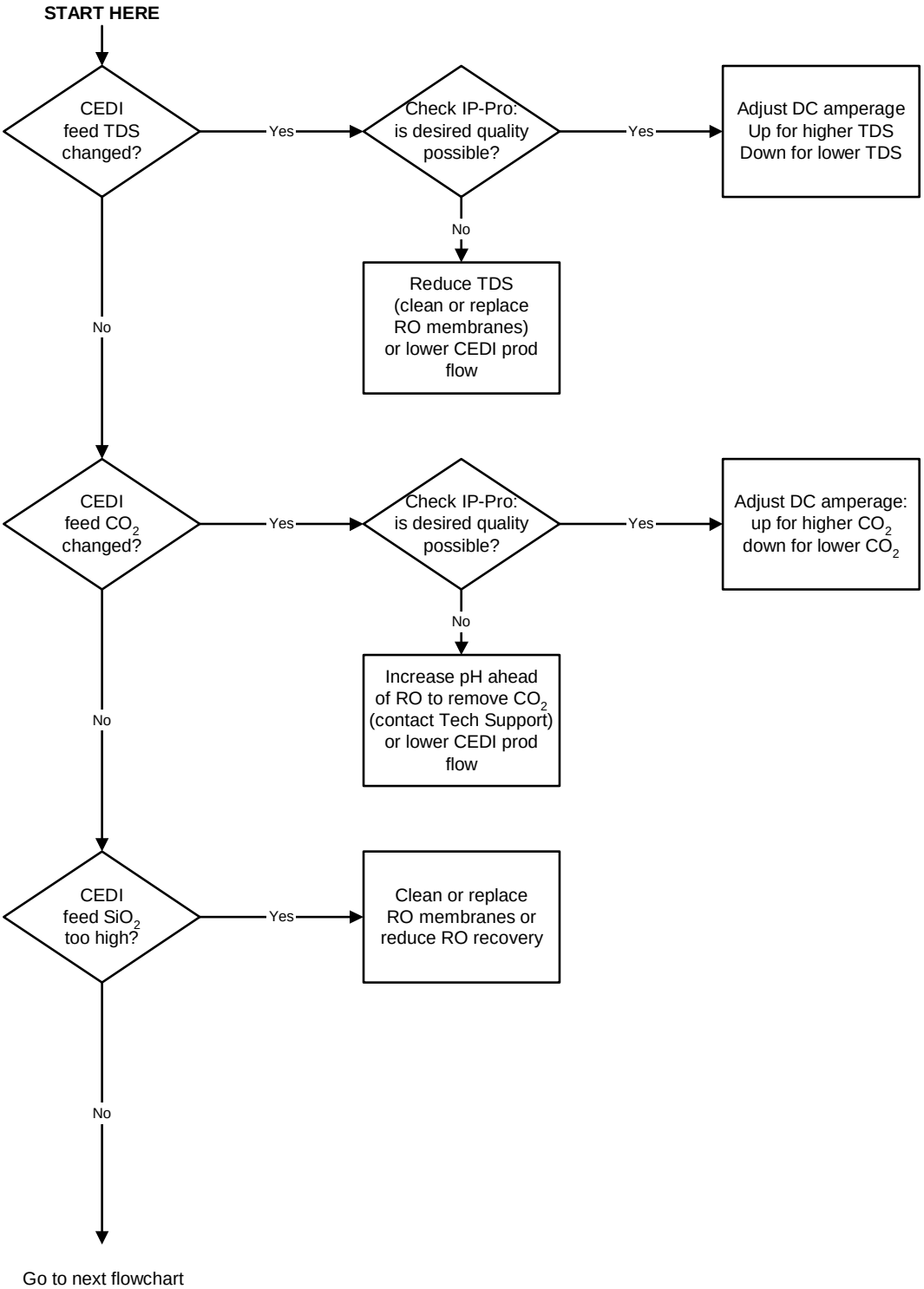
Page 1 of 1



* Compare product pressure drop when circulating 5% NaCl solution as opposed to 1% NaOH solution

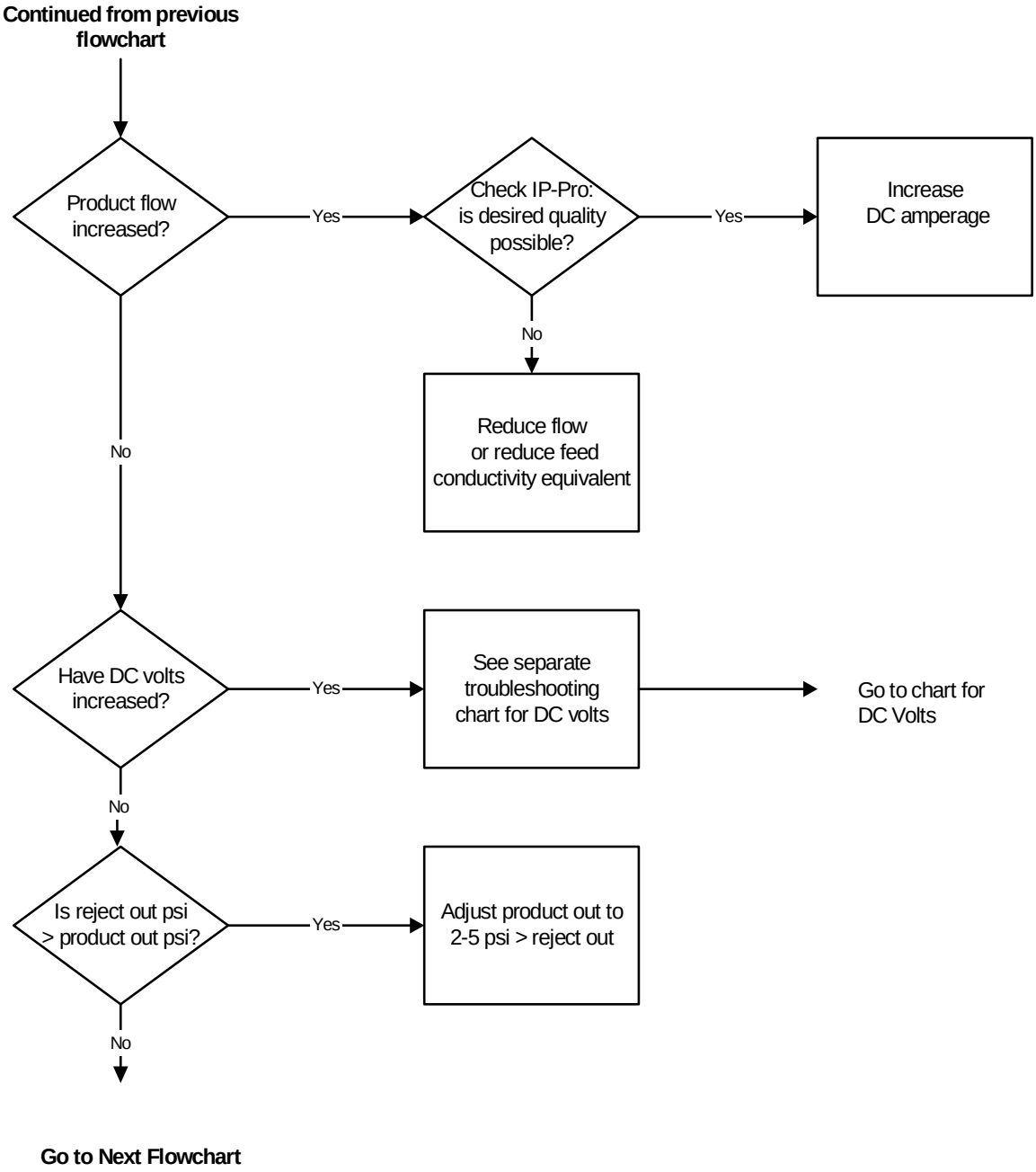
Troubleshooting Flow Chart - Low CEDI Product Water Quality

Page 1 of 3



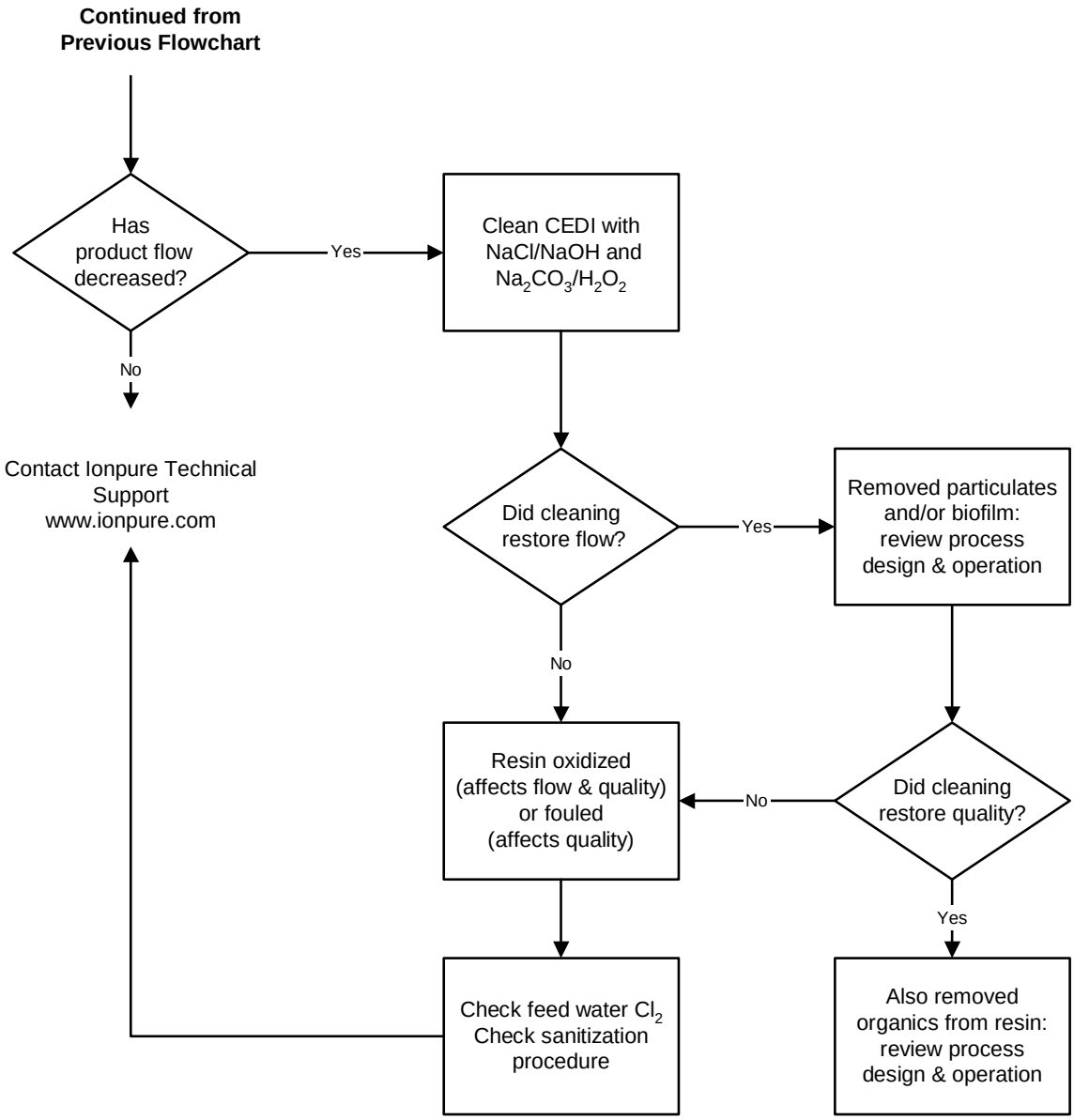
Troubleshooting Flow Chart - Low CEDI Product Water Quality

Page 2 of 3



Troubleshooting Flow Chart - Low CEDI Product Water Quality

Page 3 of 3



8. SHUTDOWN AND STORAGE

This section contains shutdown procedures for a MX module. Under certain circumstances, bacterial growth can occur quickly in water left stagnant within each module and the overall system.

8.1 System Shutdown (for periods exceeding 7 days)

- Shut off feed water to MX module(s)
- Drain standing water out of MX module(s)
- Close isolation valves to prevent evaporation of water in membranes and resins.

8.2 Startup After Shutdown

- Divert product outlet to drain.
- Turn on feed water to MX module(s)
- If desired, sanitize MX module(s).
- Operate unit with DC power on, flushing to drain.
- Send to use point when desired product water quality achieved.

8.3 Disposal

- It is not practical to rebuild MX modules
- At end-of life they can be disposed of as normal (non-hazardous) waste
  - First flush with 5% NaCl for about 5 minutes at minimum to nominal product flow rate and 90% recovery
  - Then flush with tap water for 10-30 minutes
  - Both steps with DC power off.

APPENDIX A: IP-MX MODULE SPECIFICATIONS

Table A-1 IP-MX Module Dimensions and Weights

Parameter	IP-MX30	IP-MX60	IP-MX125	IP-MX250	IP-MX500
Diameter, in (cm)	7.0 (17.78)	7.0 (17.78)	7.0 (17.78)	7.0 (17.78)	7.0 (17.78)
Length, in (cm)	7.25 (18.41)	8.83 (21.27)	10.77 (27.37)	15.45 (39.23)	24.79 (62.9)
Operating weight, lbs (kg)	10 (4.5)	13 (5.9)	23 (10.45)	31 (14.09)	47 (21.36)
Shipping weight, lbs (kg)	12 (5.4)	16 (6.8)	21 (9.55)	28 (12.73)	43 (19.55)

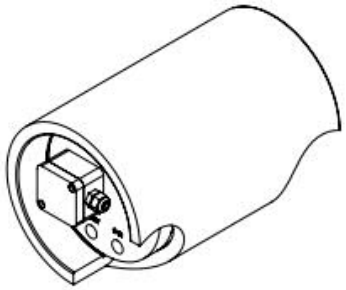
Table A-2 IP-MX Module Product Flow Rates and Pressure Drops

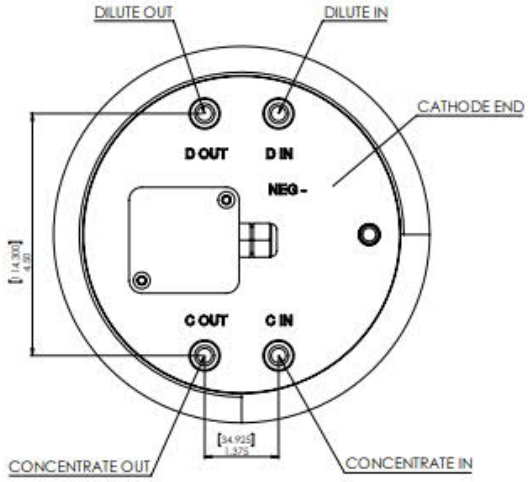
Module	IP-MX30 LPM (GPM)	IP-MX60 LPM (GPM)	IP-MX125 LPM (GPM)	IP-MX250 LPM (GPM)	IP-MX500 LPM (GPM)	ΔP PSID (BAR)
Minimum flow	0.25 (0.06)	0.5 (0.13)	1.05 (0.27)	2.1 (.55)	4.15 (1.1)	5-10 (0.3-0.7)
Nominal flow	0.5 (0.13)	1.0 (0.26)	2.1 (0.55)	4.2 (1.1)	8.3 (2.2)	10-20 (0.9-1.5)
Maximum flow	0.75 (0.19)	1.5 (0.39)	3.15 (0.8)	6.3 (1.62)	12.45 (3.3)	30-40 (1.8-2.8)
Recovery:	85-95 % NOTE: 95% recovery requires ion exchange softening or 2 pass RO. For 95% recovery, feed hardness must be ≤ 0.2 ppm as $CaCO_3$ and feed silica must be ≤ 0.5 ppm as SiO_2					

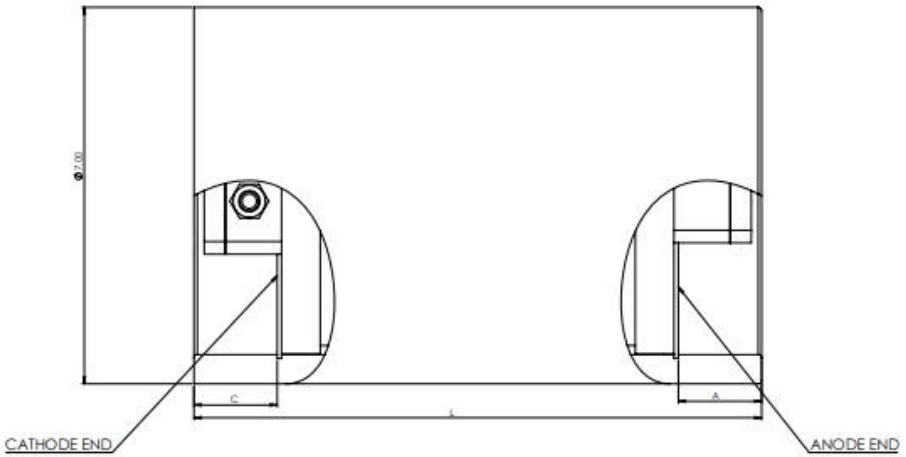
APPENDIX B: MX LAYOUT & ELEVATION DRAWING B-1

DESCRIPTION	OVERALL LENGTH(L)
IP-MX30	7.25 IN (18.41CM)
IP-MX60	8.83 IN (21.27CM)
IP-MX125	10.77 IN (27.37CM)
IP-MX250	15.45 IN (39.23CM)
IP-MX500	24.79 IN (62.96CM)

A	C
1.55 IN (3.94 CM)	1.55 IN (3.94 CM)







NOTES:
1. ALL PLUMBING PORTS ARE 3/8" BSPT
2. ALL 'A' AND 'C' DIM ARE SAME FOR ALL MX VARIANTS

IP- MX SERIES LAYOUT AND ELEVATION

IONPURE® EVOQUA WATER TECHNOLOGIES TEWKSBURY, MA