



# Falling Film Evaporator Facilities Guide



## Delta Separations

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# 1 Safety

Read and follow all safety and use instructions.

ONLY TRAINED PROFESSIONALS WITH A COMPLETE OPERATIONAL UNDERSTANDING OF THE EQUIPMENT—AND A FULL UNDERSTANDING OF THE RISKS ASSOCIATED WITH ALCOHOL USE—SHOULD BE AUTHORIZED TO USE THE EQUIPMENT. THE USE OF ALCOHOL HAS RISKS. ANY MISUSE OF THIS EQUIPMENT CAN RESULT IN SEVERE INJURY, INCLUDING BUT NOT LIMITED TO DEATH, DISABILITY AND PROPERTY DAMAGE.

## 1.1 Safety Notices

A **DANGER** notice indicates an immediate hazard which, if not avoided, will result in death or serious injury.

### **WARNING**

A **WARNING** notice indicates a hazardous situation which, if not avoided, could result in death or serious injury.

### **CAUTION**

A **CAUTION** notice indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or damage to the equipment. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

IT IS THE OPERATOR'S SOLE RESPONSIBILITY TO USE EQUIPMENT IN A SAFE MANNER. OPERATOR ASSUMES ALL RISK ASSOCIATED WITH THE USE OF THIS EQUIPMENT AND AGREES THE EQUIPMENT IS ONLY TO BE UTILIZED FOR LAWFUL PURPOSES.

Table 1-1: Dangers, Warnings, and Cautions



## DANGER

This equipment uses high-proof alcohol. Alcohol is a flammable liquid. Improper use may cause alcohol to discharge, resulting in an unsafe work environment. Use a properly-rated CFM fume hood, personal protective equipment (PPE), and appropriate detectors as required.

Inhalation of high concentrations of alcohol vapor may affect the central nervous system. This is characterized by nausea, headache, dizziness, unconsciousness and coma. It may cause respiratory tract irritation. In high concentrations, it may cause narcotic effects. Please read the Ethyl Alcohol Material Safety Data Sheet (MSDS) for further safety information.



## WARNING

Operator must follow all precautions and safety guidelines to ensure their own safety, the safety of other personnel, and the protection of property.

Always visually monitor fill levels, tanks, valves, and hoses for leakage. While the system is protected with pressure relief valves, care should be taken to ensure overfilling does not occur.

All hoses may contain alcohol under slight pressure. Wear proper personal protective equipment (PPE) such as safety goggles and gloves when disconnecting hoses and working around alcohol.

Component wear varies depending on the amount of usage. Inspect all nuts, bolts, and gaskets before each use. If there is any question about the integrity of a component, replace it immediately.



## CAUTION

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Make certain all safety devices are functioning properly before operating the equipment.

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The alcohol detector must be used always in and around the extraction zone.

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Never apply pressure or vacuum to the system chamber.

---

Never apply more than 10 psi and 15 mmHg to the system jacket.

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It is important to have the manual relief valve open during filling to allow the displacement of the head pressure.

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The facility must provide adequate ventilation/exhaust, as determined by the Engineer of Record, to maintain the local atmosphere below 25% of the Lower Flammability Limit (LFL).

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Alcohol vapor is heavier than air and can settle in low places.

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DO NOT use or store equipment or containers where they could be exposed to high temperatures. Relief valves can open allowing alcohol to escape. DO NOT artificially heat equipment or containers above 125°F.

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This system is NOT equipped with an overfill prevention device. Ensure proper fill levels prior to operation.

---

All system containers must be checked for accidental pressurization. Depressurize prior to opening.

---

DO NOT allow children to tamper with or play near the equipment.

---

DO NOT stand on the unit for any purpose.

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Slip-resistant footwear is highly recommended.

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## 1.2 Ethyl Alcohol Safety Information

### 1.2.1 Emergency Overview

**OSHA Vacated PELs:** Alcohol: 1000 ppm TWA; 1900 mg/m<sup>3</sup> TWA

**Flash Point:** 16.6° C (61.88° F)

**Auto-ignition Temperature:** 363° C (685.40° F)

**Explosion Limits, Lower:** 3.3 vol %

**Explosion Limits, Upper:** 19.0 vol %

**NFPA Rating:** (estimated) Health: 2; Flammability: 3; Instability: 0

### 1.2.2 Personal Protective Equipment

**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin:** Wear appropriate protective gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

**Respirators:** A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

### 1.2.3 First Aid Measures

**Eyes:** Get medical aid. Gently lift eyelids and flush continuously with water for at least 15 minutes.

**Skin:** Get medical aid. Wash clothing before reuse. Flush skin with plenty of soap and water.

**Ingestion:** Do not induce vomiting. If victim is conscious and alert, give 2-4 cups of milk or water. Never give anything by mouth to an unconscious person. Get medical aid.

**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid. **DO NOT** use mouth-to-mouth resuscitation.

### 1.2.4 General Information

Containers can build up pressure if exposed to heat and/or fire. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Vapors can travel to a source of ignition and flash back. Vapors will burn if involved in a fire. Flammable liquid can release vapors that form explosive mixtures at temperatures above the flashpoint. Use water spray to keep fire-exposed containers cool. Containers may explode in the heat of a fire.

### 1.2.5 Extinguishing Media

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. For large fires, use water spray, fog, or alcohol-resistant foam. Use water spray to cool fire-exposed containers. Water may be ineffective. Do NOT use straight streams of water.



## 2 Facilities Guide

The Falling Film Evaporator (FFE) consists of several major processes: unprocessed botanical tincture feed, concentrated botanical oil collection, ethanol vapor collection, and ethanol vapor condensation and recovery. This guide outlines the basic facilities requirements.

The Delta Separations Falling Film Evaporator is designed for installation in a facility rated as a UL C1D2 hazardous location. The customer is responsible for following all local, state, and federal regulations. The customer is responsible for all electrical and plumbing connections to the system.

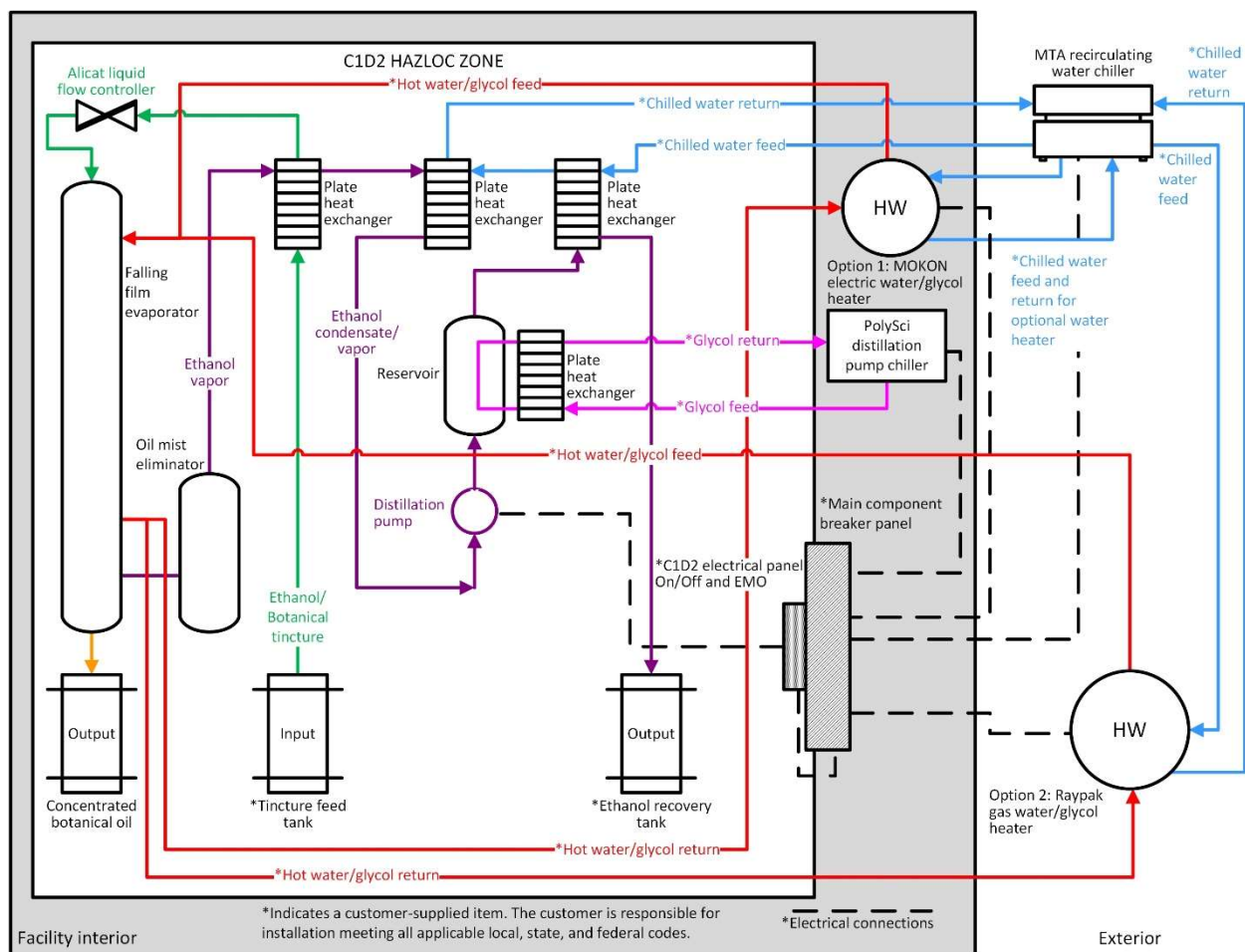
**NOTE: All electrical wiring and connections must be installed by a fully-certified electrician.**

**NOTE: All plumbing must be installed by a fully-certified plumber.**

### 2.1 Falling Film Evaporator Overview

Figure 2-1 provides a system diagram of the Falling Film Evaporator.

**Figure 2-1: Falling Film Evaporator System**



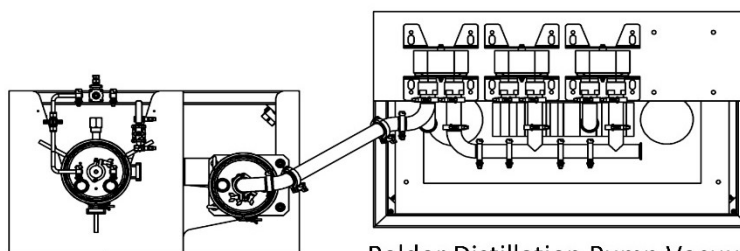
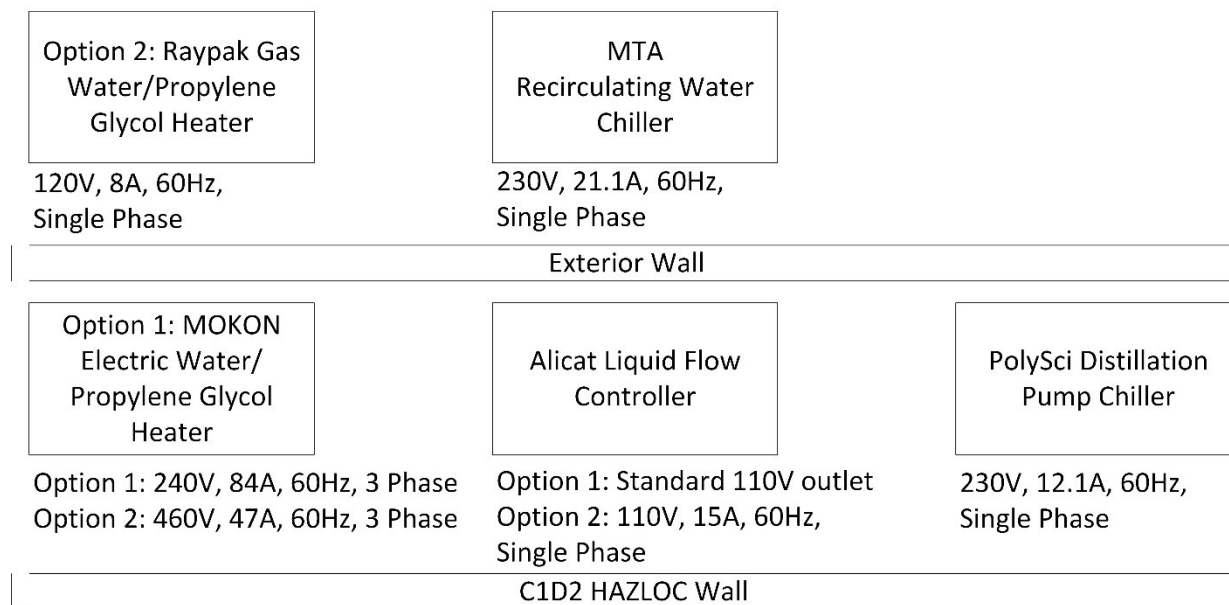
# FACILITIES GUIDE

Figure 2-2 summarizes basic electrical requirements. **All electrical wiring and connections must be installed by a fully-certified electrician.**

Refer to Table 2-1 and manufacturer user manuals for additional information.

**Figure 2-2: Electrical Layout**

## Electrical



Baldor Distillation Pump Vacuum Motor  
230V, 14.5A, 60Hz, Single Phase or  
115V, 29A, 60Hz, Single Phase

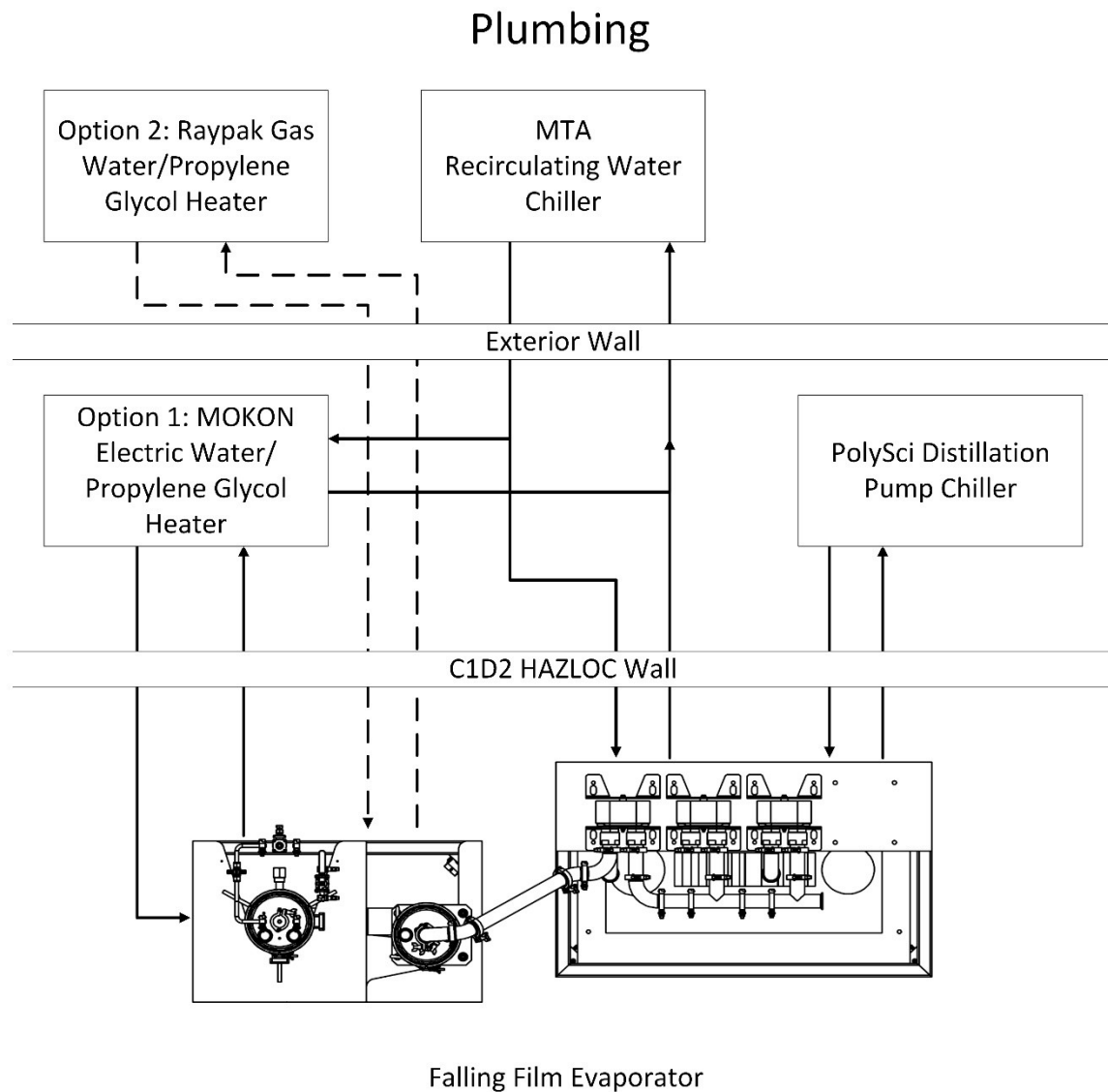
Falling Film Evaporator

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Figure 2-3 provides a basic plumbing layout. **All plumbing must be installed by a fully-certified plumber.**

Refer to Table 2-1 and manufacturer user manuals for additional information.

Figure 2-3: Plumbing Layout



# FACILITIES GUIDE

**Table 2-1: Customer-Provided Facilities Requirements**

Facility	Item	Component Connection Point	Customer-Provided Connections
<b>Tincture Feed –Connected by Delta Separations</b>			
Plumbing	Tincture input		Kit provided and connected by Delta Separations
AC	24 VDC power supply for Alicat liquid flow controller		Standard 110V outlet (outside C1D2 HAZLOC zone) or 110V, 15A, 60hz, Single Phase
<b>Recirculating Heater – Propylene Glycol/Water</b>			
<b>Option 1: Internally Located (Outside of HAZLOC) Electric Liquid Heater (MOKON)</b>			
Plumbing	<u>Falling Film Evaporator</u> Supply line Return line	1" FNPT	1" SST MNPT (hose ends of the heater connections)
	<u>MOKON</u> Supply line Return line Drain line	1" FNPT	<ul style="list-style-type: none"> <li>1" SST MNPT</li> <li>1" diameter hose compatible with propylene glycol, 25 PSI @ 121.1°C (250°F)</li> </ul>
AC	240V, 84A, 60Hz, 3 phase or 460V, 47A, 60Hz, 3 phase	Terminal block	Use circuit breaker size recommend by a certified electrician
Liquid	80% water, 20% propylene glycol	Open circuit 3 gallons	Customer to supply
<b>Option 2: Externally Located Gas Liquid Heater (RayPak)</b>			
Contact RayPak for the proper size unit to supply 90°C at the FFE. Contact RayPak for installation or installation instructions for a certified gas plumber.			
Liquid	Water/Propylene Glycol	See manual	90°C (194°F) at FFE

# FACILITIES GUIDE

Facility	Item	Component Connection Point	Customer-Provided Connections
<b>Recirculating Water Chiller (MTA)</b>			
Plumbing (See Figure 2-3)	<u>MTA</u> Supply line Return line Drain line	1" FNPT	<ul style="list-style-type: none"> <li>1" SST MNPT</li> <li>1" diameter hose compatible with propylene glycol, 25PSI @ 121.1°C (250°F)</li> </ul>
	<u>Heat Exchange Plate</u> Supply line Return line	1" FNPT	1" SST MNPT (hose ends of the heater connections)
	<u>MOKON (if using Option #1 in Figure 2-3)</u> Supply line Return line Drain line	1" FNPT	1" SST MNPT (hose ends of the heater connections)
AC	230V, 21.1A, 60 Hz, Single Phase	Terminal block	Use circuit breaker size recommend by a certified electrician Customer supplies cable from circuit breaker to chiller
Liquid	Water (tap water is OK) min 20% propylene glycol, Dow Frost or equivalent	30 Gallons	Customer provides
<b>Distillation Pump Vacuum Motor (Baldor)</b>			
AC	230V, 14.5A, 60Hz, Single Phase or 115v, 29A, 60Hz, Single Phase	Terminal block	<ul style="list-style-type: none"> <li>Use circuit breaker size recommend by a certified electrician</li> <li>Cable between circuit breaker and Falling Film Evaporator</li> </ul>

# FACILITIES GUIDE

Facility	Item	Component Connection Point	Customer-Provided Connections
<b>Distillation Pump Chiller (PolySci)</b>			
Plumbing	<u>PolySci</u> Supply line Return line	½" FNPT 3.5GPM @ 100PSI	<ul style="list-style-type: none"> <li>• ½" brass MNPT</li> <li>• ½" diameter hose rated for &gt;-10°C @ 100PSI</li> </ul>
	<u>Heat Exchange Plate</u> Supply line Return line	½" FNPT	<ul style="list-style-type: none"> <li>• ½" brass MNPT</li> <li>• ½" diameter hose rated for &gt;-10°F @ 100PSI</li> </ul>
AC	230V, 12.1A, 60Hz, Single Phase,	Terminal block	<ul style="list-style-type: none"> <li>• Use circuit breaker size recommend by a certified electrician</li> <li>• Customer supplies cable from circuit breaker to chiller</li> </ul>
Liquid	80% water, 20% propylene glycol	3.5 gallons	Customer provides
<b>Ethanol Recovery</b>			
Ethanol recovery	Ethanol collection container	15-gallon or 50-gallon FDA approved stainless-steel container	Kit provided and connected by Delta Separations
	Ethanol delivery tube	½" FDA-approved hose	Kit provided and connected by Delta Separations
<p><b>SHOPPING LIST – This list is a guide to provide the quantities needed in this Site Prep Guide. Quantities may vary depending on alternative setups.</b></p> <p><b>Confirm the needed quantities based on the OEM manuals before purchasing. Contact Delta Separations with any questions 800-837-1333</b></p>			
Plumbing	1" SST MNFT Hose connectors	10	Mokon and MTA
	½" Brass MNFT Hose connectors	4	PolySci
AC	Use circuit breaker size recommend by a certified electrician	5	Alicat (Optional), Distillation motor, Mokon, MTA and PolySci
Liquid	Review OEM Manuals for need volumes	3	Mokon, MTA and PolySci

# FACILITIES GUIDE

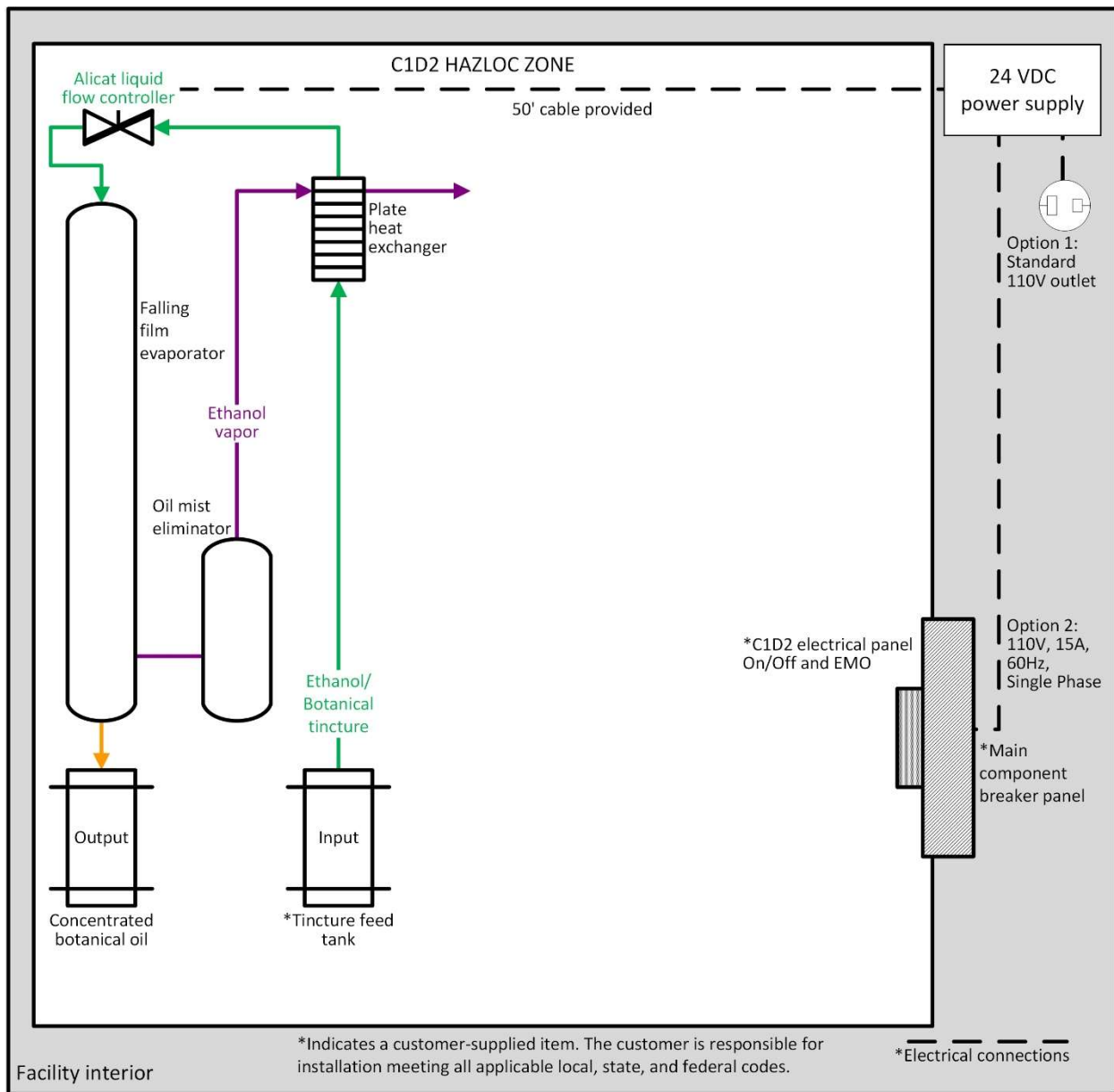
## 2.2 Tincture Feed

The tincture feed system delivers the unprocessed tincture to the falling film vessel.

Flexible tubing is provided. The customer supplies the tincture container to contain the botanical tincture solution and a dip tube compatible with the tincture container.

See Figure 2-4 and Table 2-2.

Figure 2-4: Tincture Feed



# FACILITIES GUIDE

Table 2-2: Tincture Feed Requirements

Tincture Feed –Connected by Delta Separations			
Facility	Item	Component Connection Point	Customer-Provided Connections
Plumbing	Tincture input		Kit provided and connected by Delta Separations
AC	24 VDC power supply for Alicat liquid flow controller		Standard 110V outlet (outside C1D2 HAZLOC zone) or 110V, 15A, 60hz, Single Phase

## 2.3 Recirculating Water/Propylene Glycol Heater

The falling film evaporator vessel requires a hot water/glycol delivery and return. The customer supplies the electrical and plumbing connections between the water/glycol heater and the Falling Film Evaporator system.

There are two possible options for the water/glycol heater.

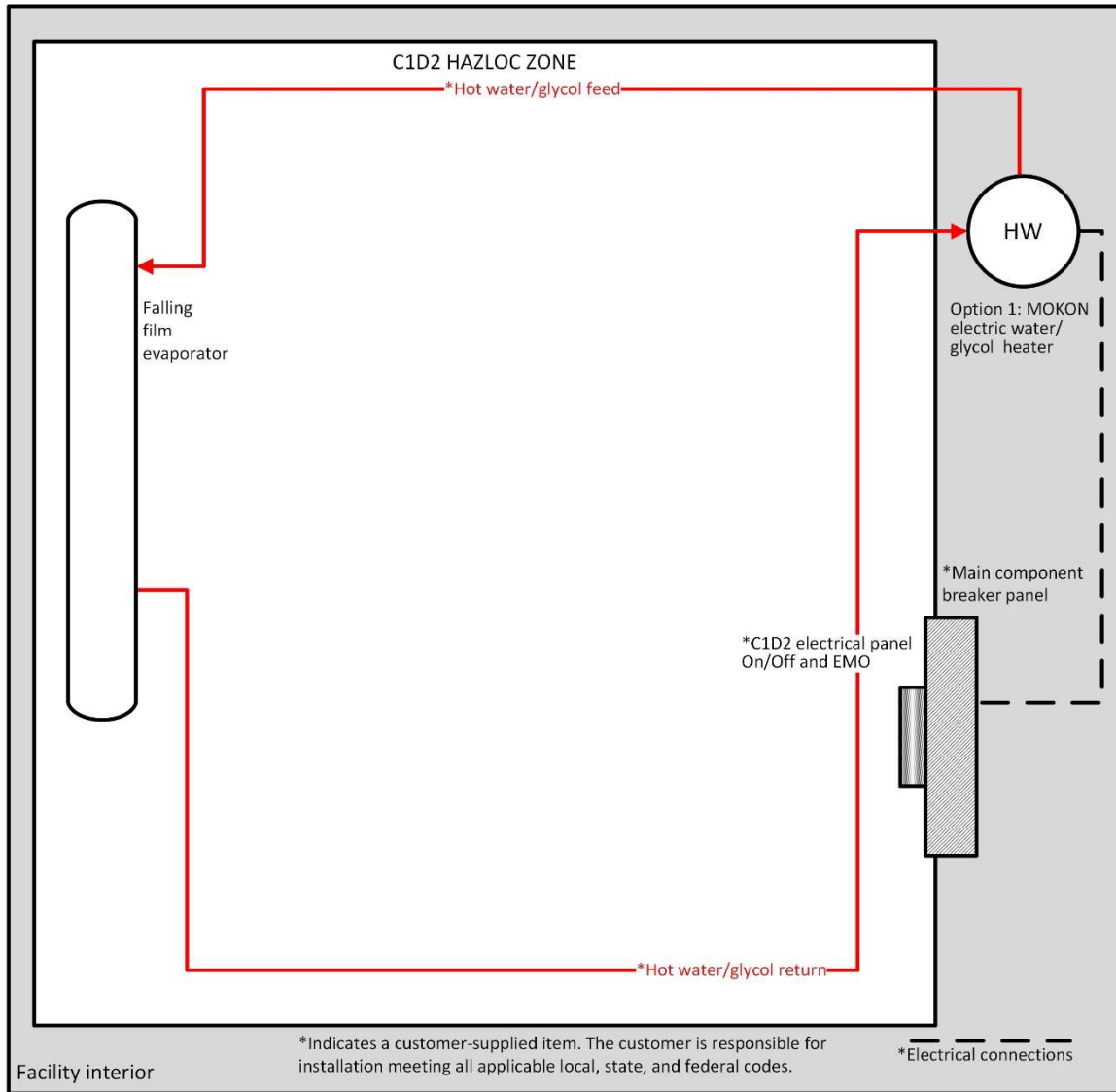
- MOKON electric water/glycol heater located within the facility, but external to the C1D2 HAZLOC zone
- RayPak gas water/glycol heater located externally

See Figure 2-5, Figure 2-6, and Table 2-3.



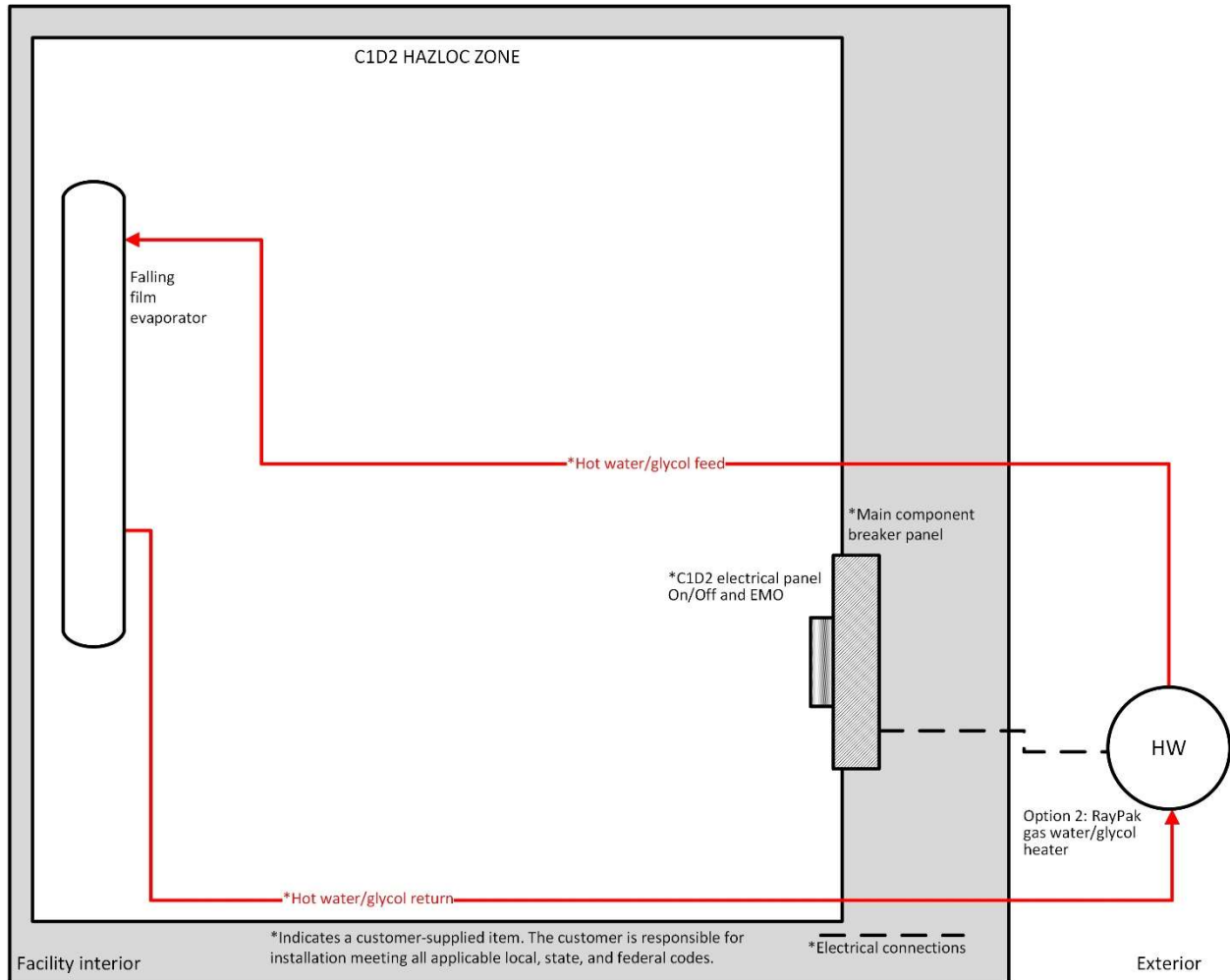
# FACILITIES GUIDE

Figure 2-5: Option 1: MOKON Electric Water/Glycol Heater



# FACILITIES GUIDE

Figure 2-6: Option 2: RayPak Gas Water/Glycol Heater



# FACILITIES GUIDE

**Table 2-3: Recirculating Water/Glycol Heater Requirements**

<b>Recirculating Heater – Propylene Glycol/Water</b>			
<b>Facility</b>	<b>Item</b>	<b>Component Connection Point</b>	<b>Customer-Provided Connections</b>
<b>Option 1: Internally Located (Outside of HAZLOC) Electric Liquid Heater (MOKON)</b>			
Plumbing	<u>Falling Film Evaporator</u> Supply line Return line	1" FNPT	1" SST MNPT (hose ends of the heater connections)
	<u>MOKON</u> Supply line Return line Drain line	1" FNPT	<ul style="list-style-type: none"> <li>• 1" SST MNPT</li> <li>• 1" diameter hose compatible with propylene glycol, 25 PSI @ 121.1°C (250°F)</li> </ul>
AC	240V, 84A, 60Hz, 3 phase or 460V, 47A, 60Hz, 3 phase	Terminal block	Use circuit breaker size recommend by a certified electrician
Liquid	80% water, 20% propylene glycol	Open circuit 3 gallons	Customer to supply
<b>Option 2: Externally Located Gas Liquid Heater (RayPak)</b>			
Contact RayPak for the proper size unit to supply 90°C at the FFE. Contact RayPak for installation or installation instructions for a certified gas plumber.			
Liquid	Water/Propylene Glycol	See manual	90°C (194°F) at FFE

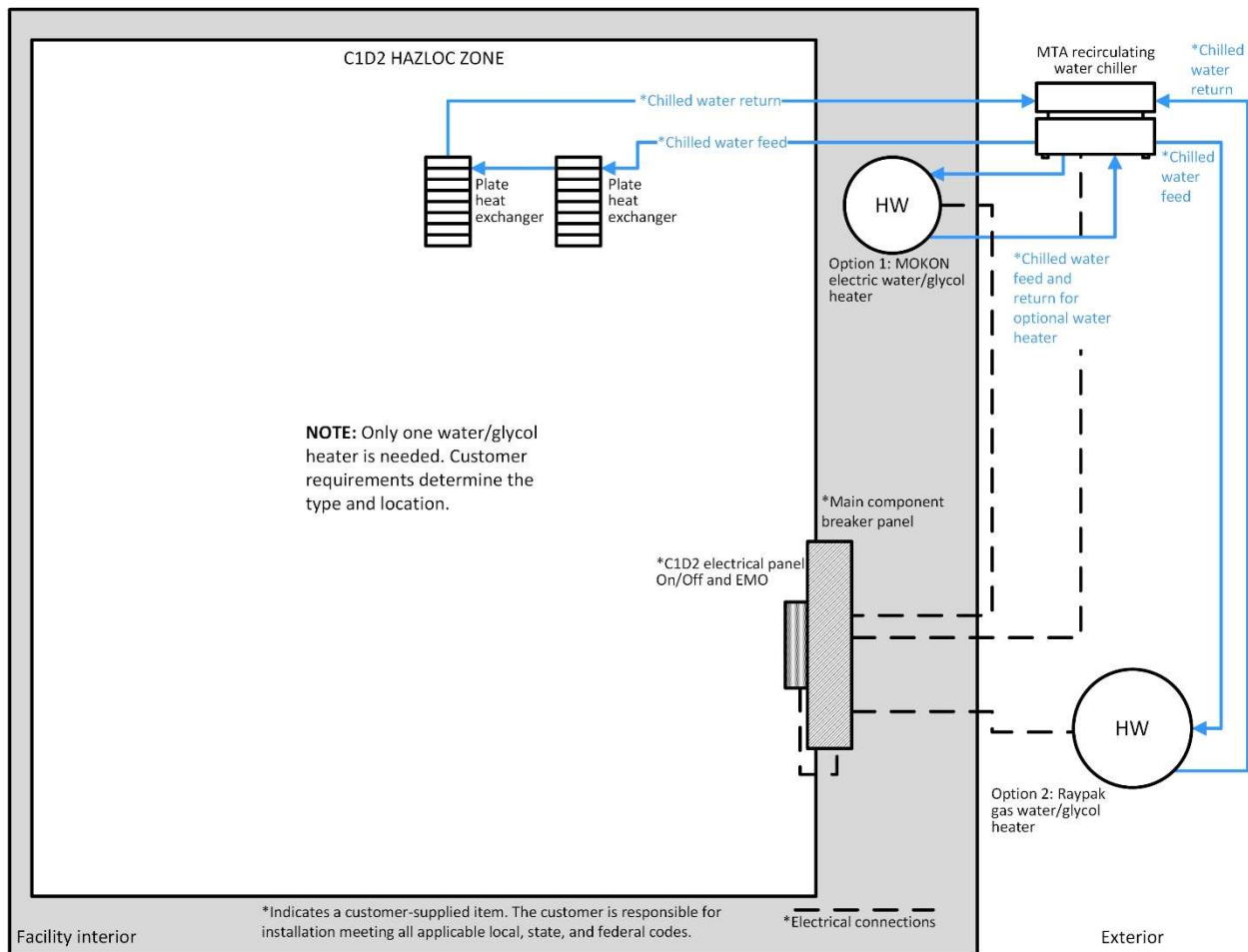
# FACILITIES GUIDE

## 2.4 Recirculating Water Chiller

The recirculating water chiller is located outside of the facility. It provides chilled water to the heat exchangers and to the water heater.

See Figure 2-7 and Table 2-4 for facilities requirements.

**Figure 2-7: Recirculating Chilled Water**



# FACILITIES GUIDE

**Table 2-4: Recirculating Chilled Water Requirements**

Recirculating Water Chiller (MTA)			
Facility	Item	Component Connection Point	Customer-Provided Connections
Plumbing (See Figure 2-3)	<u>MTA</u> Supply line Return line Drain line	1" FNPT	<ul style="list-style-type: none"> <li>1" SST MNPT</li> <li>1" diameter hose compatible with propylene glycol, 25PSI @ 121.1°C (250°F)</li> </ul>
	<u>Heat Exchange Plate</u> Supply line Return line	1" FNPT	1" SST MNPT (hose ends of the heater connections)
	<u>MOKON (if using Option #1 in Figure 2-3)</u> Supply line Return line Drain line	1" FNPT	1" SST MNPT (hose ends of the heater connections)
AC	230V, 21.1A, 60 Hz, Single Phase	Terminal block	30A circuit breaker Customer supplies cable from circuit breaker to chiller
Liquid	Water (tap water is OK) min 20% propylene glycol, Dow Frost or equivalent	30 Gallons	Customer provides

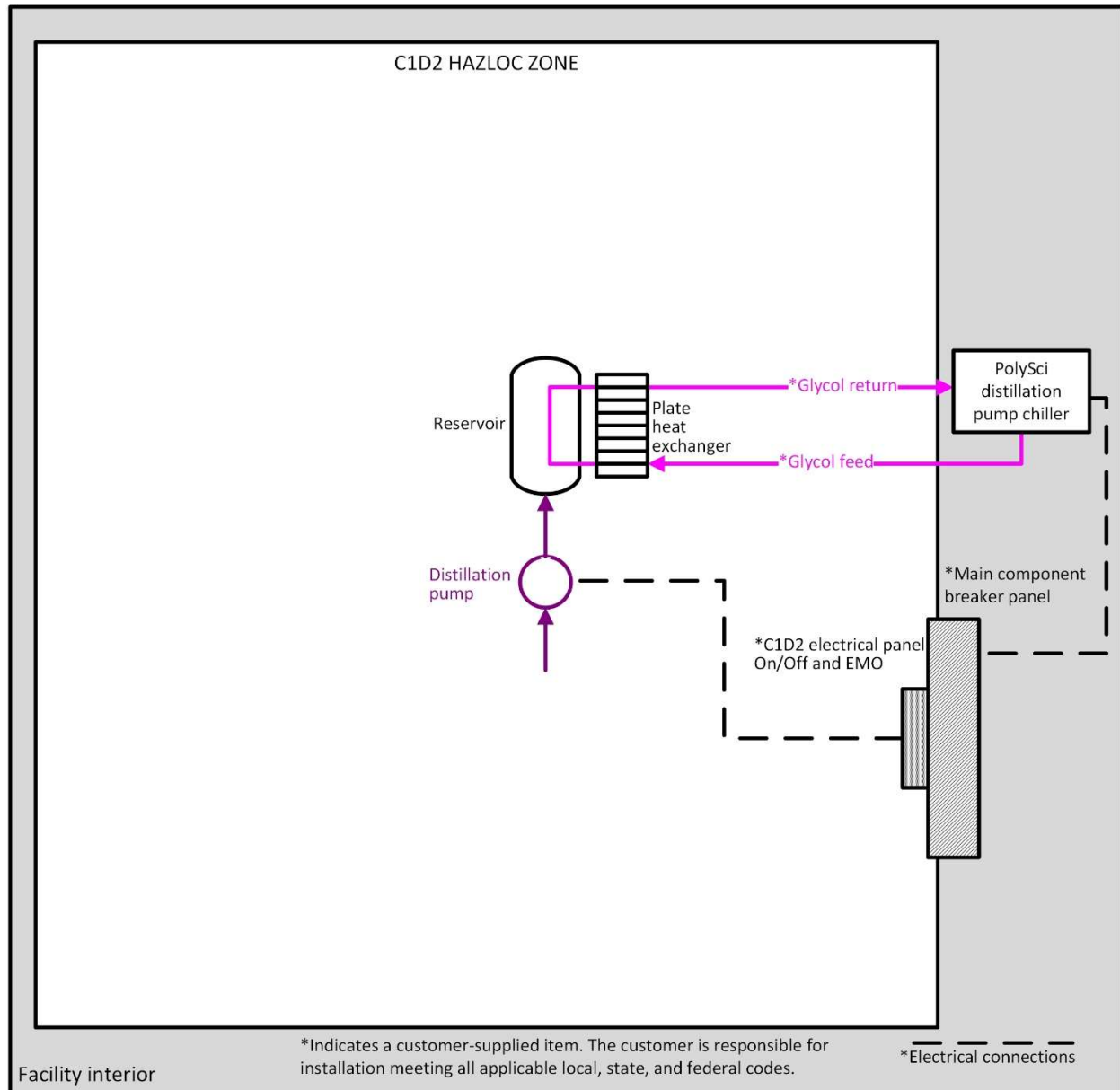
# FACILITIES GUIDE

## 2.5 Distillation Pump Chiller

The distillation pump chiller is located within the facility, but outside of the C1D2 HAZLOC zone. It provides chilled glycol to the distillation pump heat exchanger.

See Figure 2-8 and Table 2-5.

**Figure 2-8: Distillation Pump Chiller**



# FACILITIES GUIDE

**Table 2-5: Distillation Pump Chiller Requirements**

Facility	Item	Component Connection Point	Customer-Provided Connections
<b>Distillation Pump Vacuum Motor (Baldor)</b>			
AC	230V, 14.5A, 60Hz, Single Phase or 115v, 29A, 60Hz, Single Phase	Terminal block	<ul style="list-style-type: none"> <li>• Use circuit breaker size recommend by a certified electrician</li> <li>• Cable between circuit breaker and Falling Film Evaporator</li> </ul>
<b>Distillation Pump Chiller (PolySci)</b>			
Plumbing	<u>PolySci</u> Supply line Return line	½" FNPT 3.5GPM @ 100PSI	<ul style="list-style-type: none"> <li>• ½" brass MNPT</li> <li>• ½" diameter hose rated for &lt;41°F @ 100PSI</li> </ul>
	<u>Heat Exchange Plate</u> Supply line Return line	½" FNPT	Hose ends from PolySci
AC	230V, 12.1A, 60Hz, Single Phase,	Terminal block	<ul style="list-style-type: none"> <li>• Use circuit breaker size recommend by a certified electrician</li> <li>• Customer supplies cable from circuit breaker to chiller</li> </ul>
Liquid	80% water, 20% propylene glycol	3.5 gallons	Customer provides

# FACILITIES GUIDE

## 2.6 Ethanol Recovery

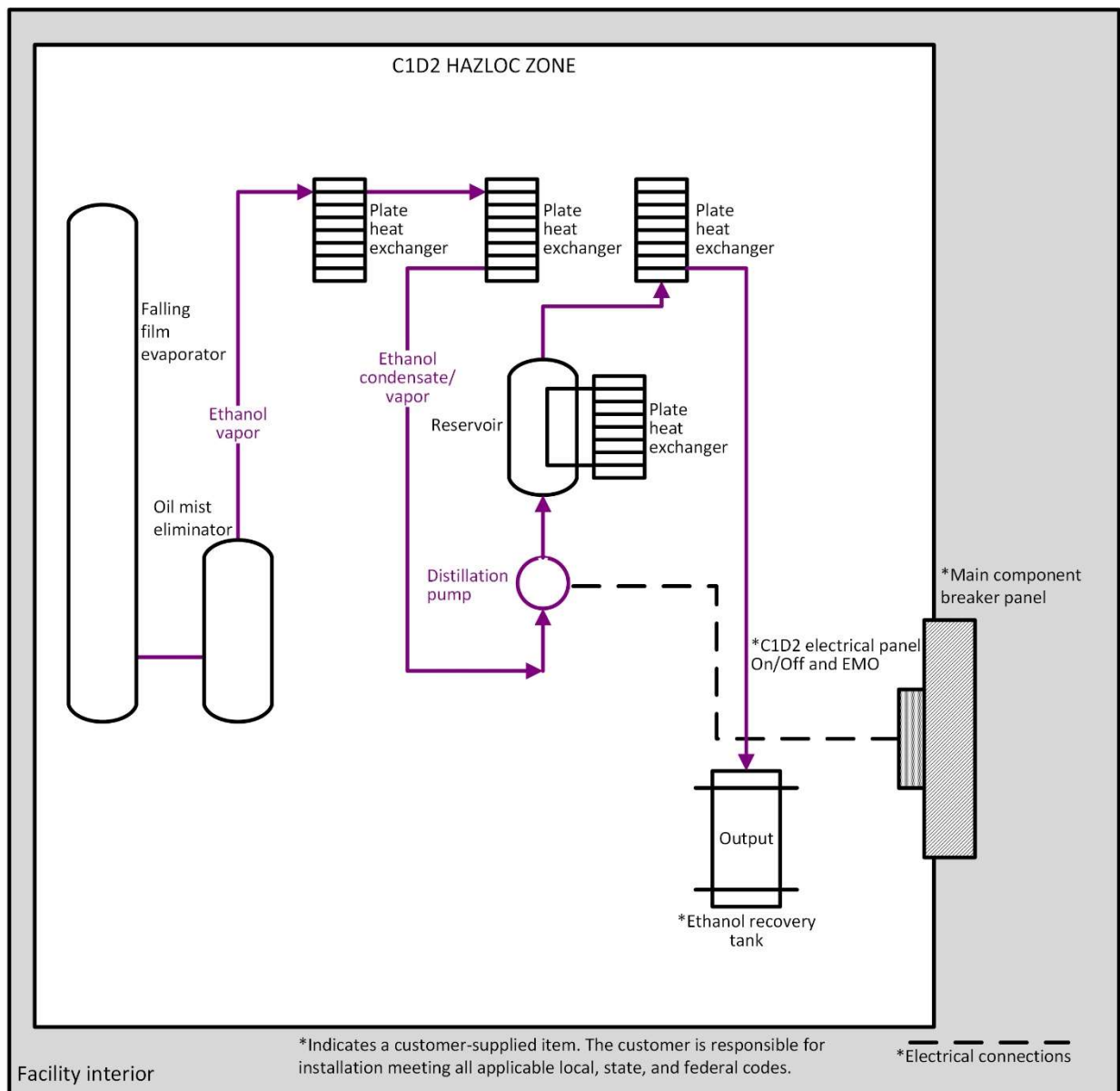
The ethanol recovery system delivers the condensed liquid ethanol to a collection container. See Table 2-6 for facilities requirements.

Flexible tubing is provided. The customer supplies the ethanol collection container and a delivery tube compatible with recovery container.

The ethanol recovery process uses a C1D2 distillation pump. The customer is responsible for providing power to the pump.

See Figure 2-9 and Table 2-6.

**Figure 2-9: Ethanol Recovery System**





# FACILITIES GUIDE

**Table 2-6: Ethanol Recovery Requirements**

<b>Ethanol Recovery</b>			
<b>Facility</b>	<b>Item</b>	<b>Component Connection Point</b>	<b>Customer-Provided Connections</b>
Ethanol recovery	Ethanol collection container	15-gallon or 50-gallon FDA approved stainless-steel container	Kit provided and connected by Delta Separations
	Ethanol delivery tube	½" FDA-approved hose	Kit provided and connected by Delta Separations

# Appendix A. Glossary

The Glossary contains definitions of terms, acronyms, and initialisms commonly used in Delta Separations technical documentation. Although these are preferred terms, the list is not exhaustive.

## A

- AHJ** Authority having jurisdiction
- ANSI** American National Standards Institute

## C

- CFM** Cubic feet per minute
- CFR** Code of Federal Regulations
- CUP** Centrifuge Utility Platform

## E

- EMO** Emergency off button

## F

- FDA** Food and Drug Administration
- FFE** Falling Film Evaporator
- FLA** Full load amps
- FNPT** Female National Pipe Thread
- FSE** Field service engineer

## H

- HAZLOC** Hazardous location
- HE** Heat exchanger
- HEPA** High efficiency particulate air (filter)
- HMI** Human/machine interface
- HVAC** Heating, ventilation, and air conditioning

## J

- JIC** Joint Industry Council

## L

- LFL** Lower flammability limit

# GLOSSARY

## M

- MFL** Male flare fitting
- MSDS** Material Safety Data Sheet
- MSHA** Mine Safety and Health Administration

## N

- NEC** National Electric Code
- NEMA** National Electrical Manufacturers Association
- NFPA** National Fire Protection Association
- NIOSH** National Institute for Occupational Safety and Health

## O

- OSHA** Occupational Safety and Health Administration

## P

- PPE** Personal protective equipment

## R

- RMA** Return Material Authorization

## T

- TEFC** Totally enclosed, fan-cooled
- TSE** Technical support engineer

## U

- UL** Underwriters Laboratories