Glycol Chiller Systems in Breweries

The basics that every brewer should know, and more.

PRESENTED BY
PRO REFRIGERATION INC

Perspective:
The less you worry about cooling,
the more you can focus on
making great beer.

1. What is a Chiller System, how does it work?
2. Piping in your Brewery Chiller System
3. Proper Care and Feeding of your Chiller System
4. Calculating your Brewing Cooling Loads

Conclusion :

Your Chiller System is much more Important part of your brewery than you realized.

GLOSSARY

CHILLER SYSTEM: Mechanical Refrigeration System designed to cool a fluid, that is then used to cool product, place, or person.

GLYCOL: Propylene Glycol is a food safe antifreeze that we mix with water, enabling us to chill the fluid to lower temperatures.

COMPRESSOR: Instrument or device used to compress something.

EVAPORATOR: A key component within a refrigeration system where liquid is expanded and evaporated into a vapor.

CONDENSER: Where high pressure vapor is condensed to a liquid

PUMP: Device used to move or transfer fluids within the chiller system.

- REFRIGERATION SYSTEM
- INSULATED STORAGE TANK
- GLYCOL PUMPS
- CONTROLS

Breweries require a 25-28 F Fluid to service their loads. To accomplish this we mix a Food Safe Anti Freeze called Propylene Glycol with water.

What does the Chiller System do?

TRANSFERS HEAT

If you can't destroy it, transfer it…

Heat is a form of energy, you can't destroy it or modify it- all you can do is transfer from one place to another. Your chiller system is a mechanical system that enables this.

BREWERY

REFRIGERANT

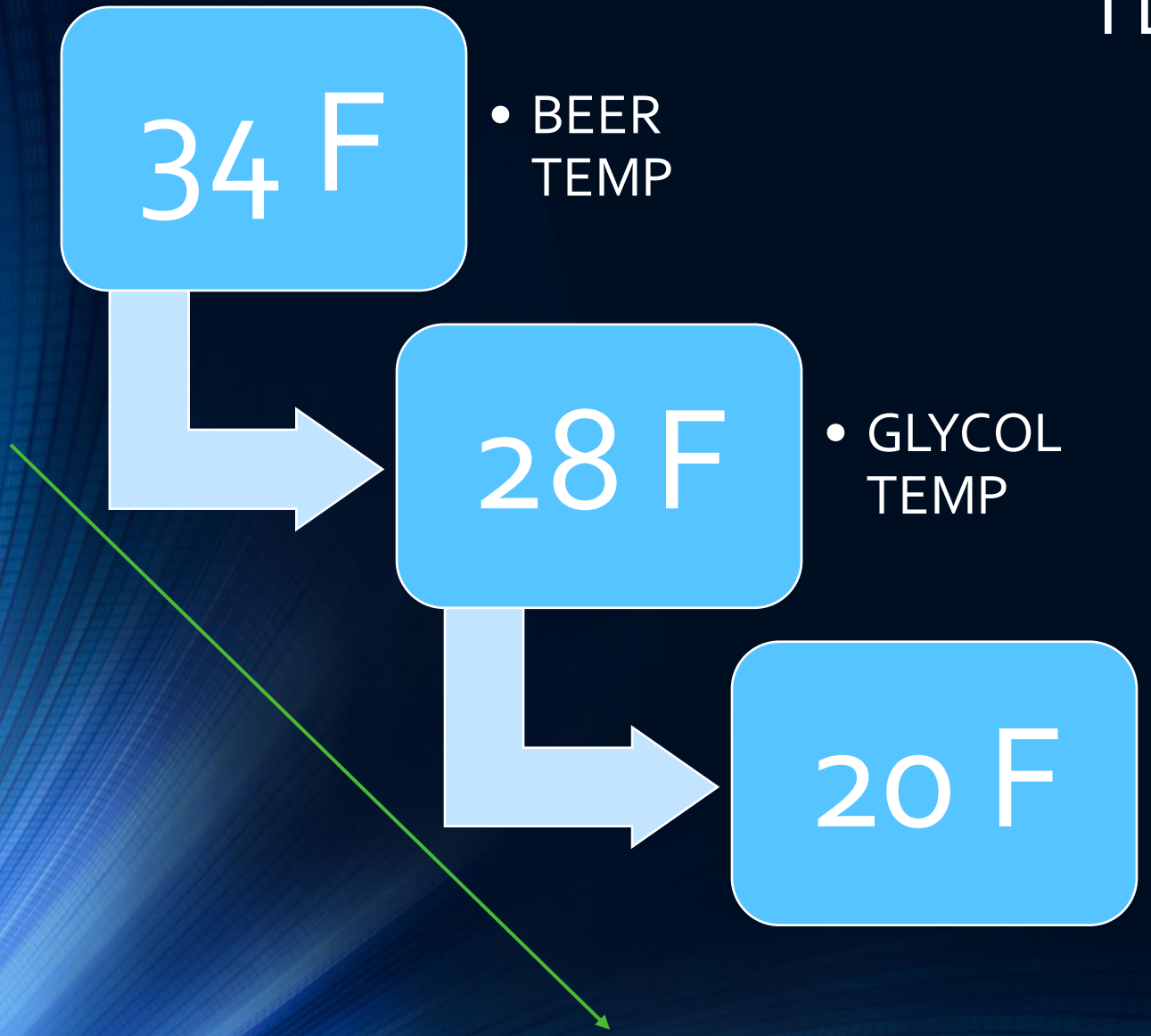
GLYCOL

ATMOSPHERE

GLYCOL COOLED VESSELS OR HEAT EXCHANGERS

- FERMENTERS — keeping tanks at optimum fermenting temps
- BRITE BEER TANKS — holding them at optimum temps
- WORT HEAT EXCHANGER — second stage cooling
- COLD LIQUOR TANK — chilling well water to 35 F, used cool wort
- YEAST BRINK — storing yeast at cold temperatures
- ROOM HX — using chilled glycol to service cold room
- PACKAGING HX — temp control for machine
- CENTRIFUGE HX — centrifuge will increase beer temp 2-10 F

HEAT TRANSFER



TD is your friend

- The greater the Temperature Difference, the faster the heat transfer
- The higher Glycol Temperature = Increased System Efficiency and Cooling Capacity

Heat Exchange Efficiency

System Design Goals

Operate at highest glycol temperature possible, to achieve the required End Product Temperature.

The higher the Refrigerant Temperature, the higher your BTU Cooling Capacity of your chiller system

To rate Chiller System efficiency, we us an EER Energy Efficiency Ratio

EER = BTU-HR Cooling Capacity / Watts used

CHILLER SYSTEM- 20 HP

20 F GLYCOL/90 F Cond

147,740 BTU/HR EER 11.86 kW 12.46

21%

30 F GLYCOL/90 F Cond

186,051 BTU/HR EER 13.81 kW 13.89

11%

20%

40 F GLYCOL/90 F Cond

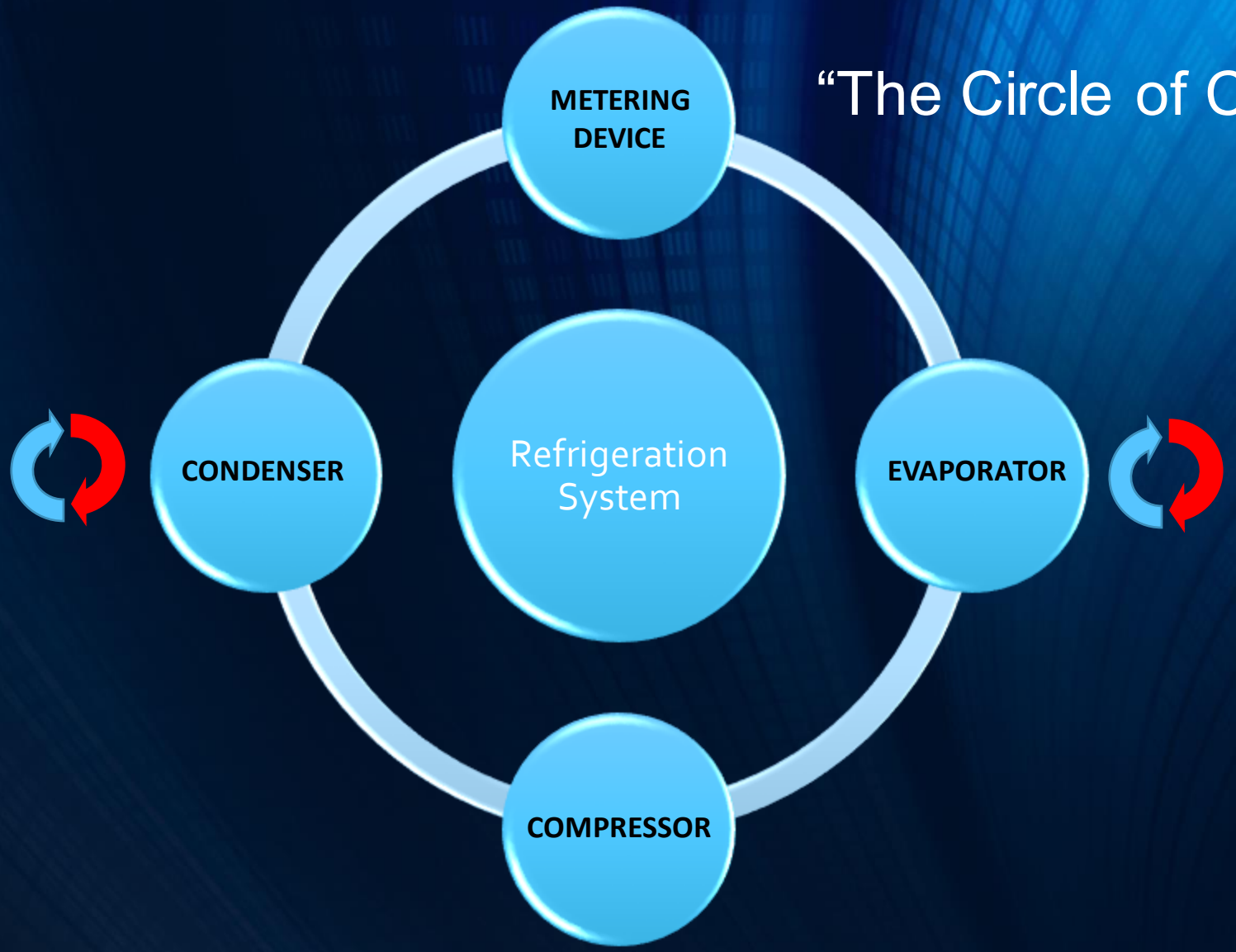
231,494 BTU/HR EER 16.25 Kw 14.25

3%

YOUR CHILLER COOLING CAPACITY INCREASES

AS YOUR GLYCOL OPERATING TEMPERATURE INCREASES

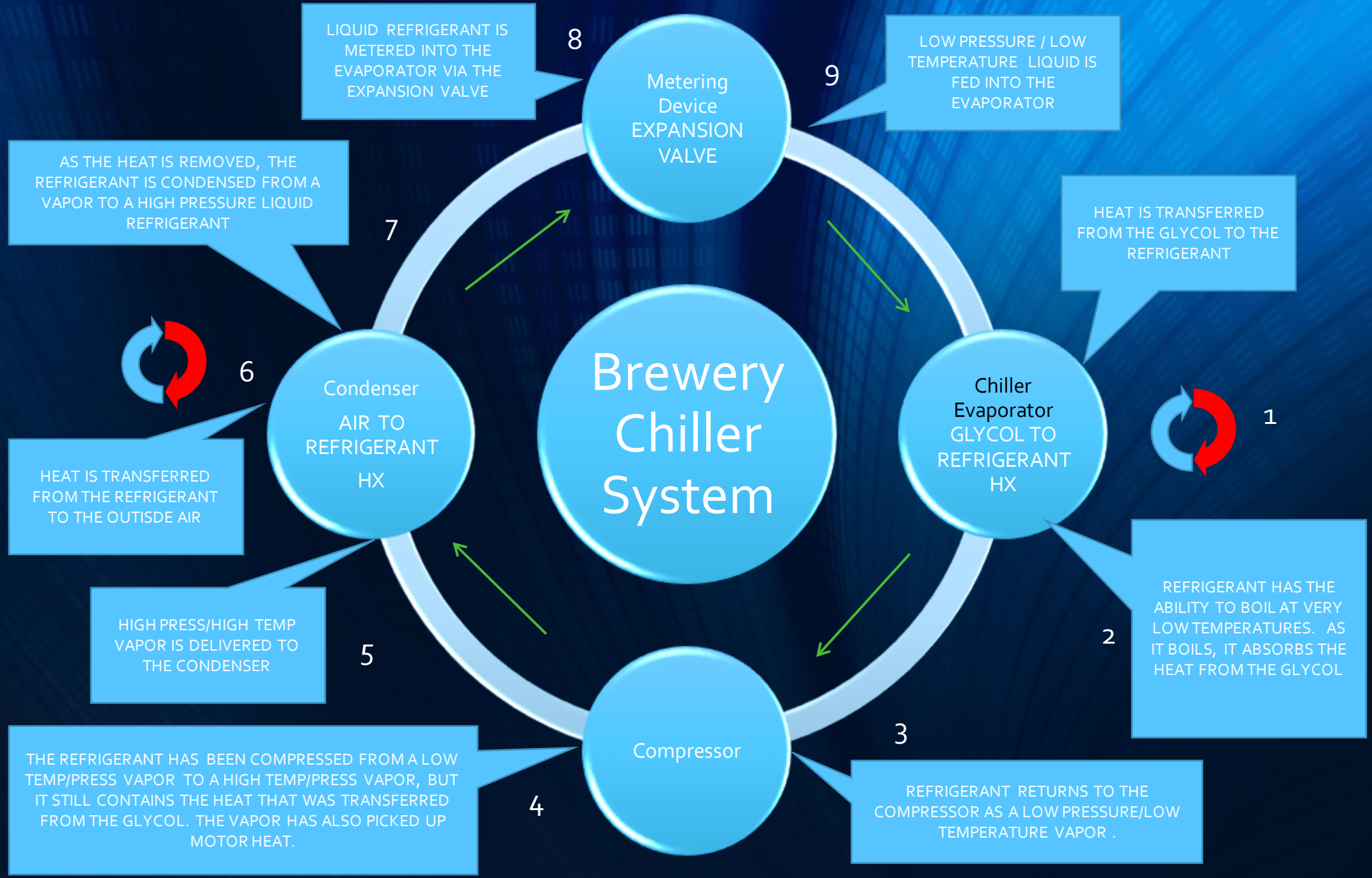
MECHANICAL REFRIGERATION SYSTEM



"The Circle of Cool"

4 COMPONENTS IN EVERY REFRIGERATION SYSTEM

Brewery Chiller System



DUAL PUMP GLYCOL SYSTEM

Supply to Chiller Evaporator

GLYCOL RESERVOIR

CIRCULATION PUMP

WARM GLYCOL RETURN FROM BREWERY

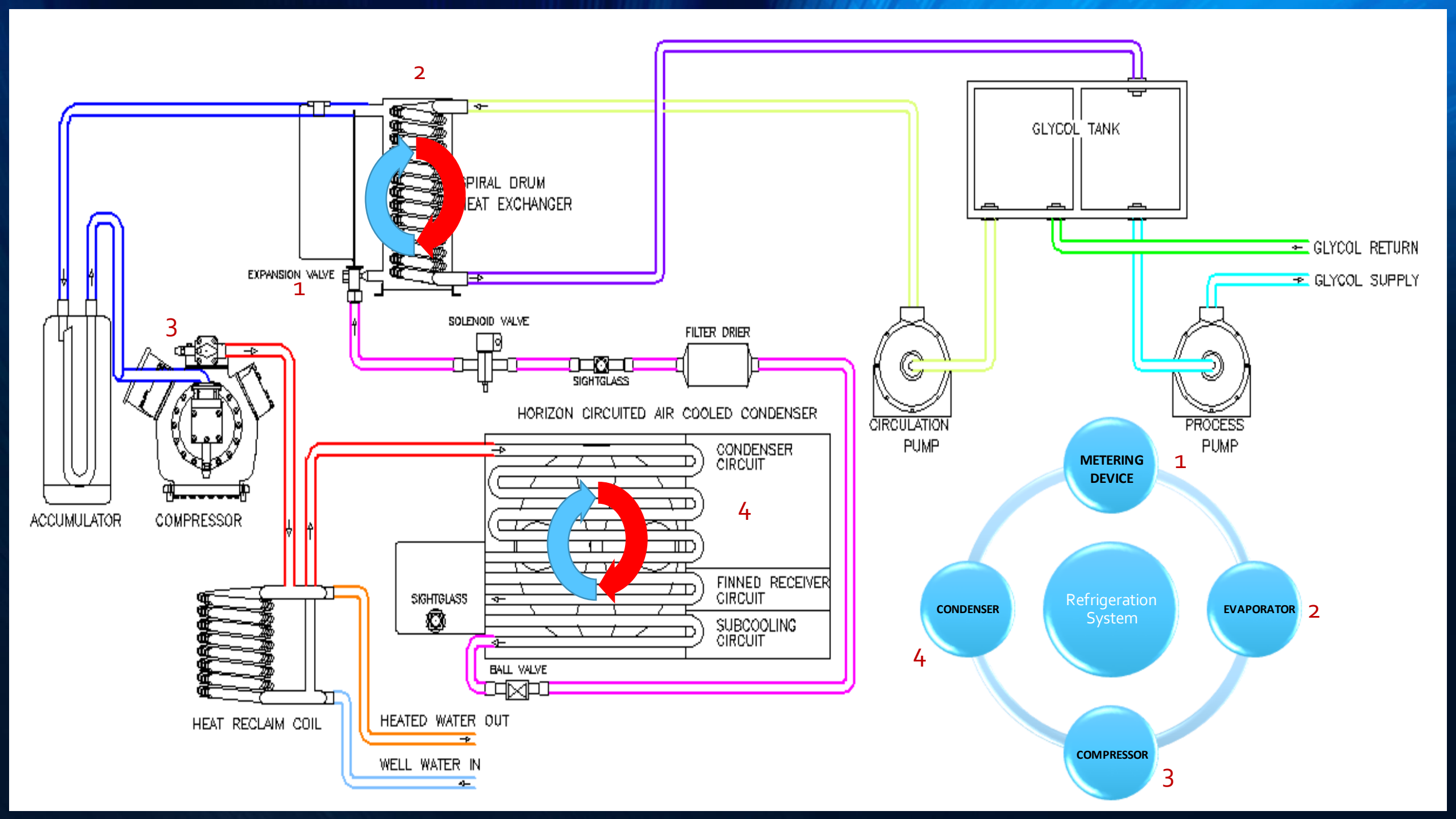
Return from Process Loop

COLD GLYCOL RETURN FROM EVAPORATOR

Return from Chiller Evaporator

PROCESS PUMP

Supply to Process Loop


2
SPIRAL DRUM
HEAT EXCHANGER
GLYCOL TANK
GLYCOL RETURN
GLYCOL SUPPLY
EXPANSION VALVE
1
3
SOLENOID VALVE
FILTER DRIER
SIGHTGLASS
CIRCULATION
PUMP
PROCESS
PUMP
HORIZON CIRCUITED AIR COOLED CONDENSER
CONDENSER
CIRCUIT
4
FINNED RECEIVER
CIRCUIT
SUBCOOLING
CIRCUIT
SIGHTGLASS
BALL VALVE
ACCUMULATOR
COMPRESSOR
HEAT RECLAIM COIL
HEATED WATER OUT
WELL WATER IN
METERING
DEVICE
1
CONDENSER
Refrigeration
System
EVAPORATOR
2
4
COMPRESSOR
3

SECTION REVIEW

HEAT TRANSFER

TEMPERATURE DIFFERENCE

4 COMPONENTS

THE CHILLER SYSTEM

BREWERY GLYCOL PIPING OPTIONS

BREWERY PIPING DESIGN

SPEARS® MANUFACTURING COMPANY
CORPORATE OFFICE
15853 OLDEN STREET • SYLMAR, CALIFORNIA 91342
MAILING ADDRESS: P.O. BOX 9203 • SYLMAR, CALIFORNIA 91392
Telephone (818) 364-1611 • Fax (818) 364-6945
www.spearsmfg.com

Minimum Temperature Limitations

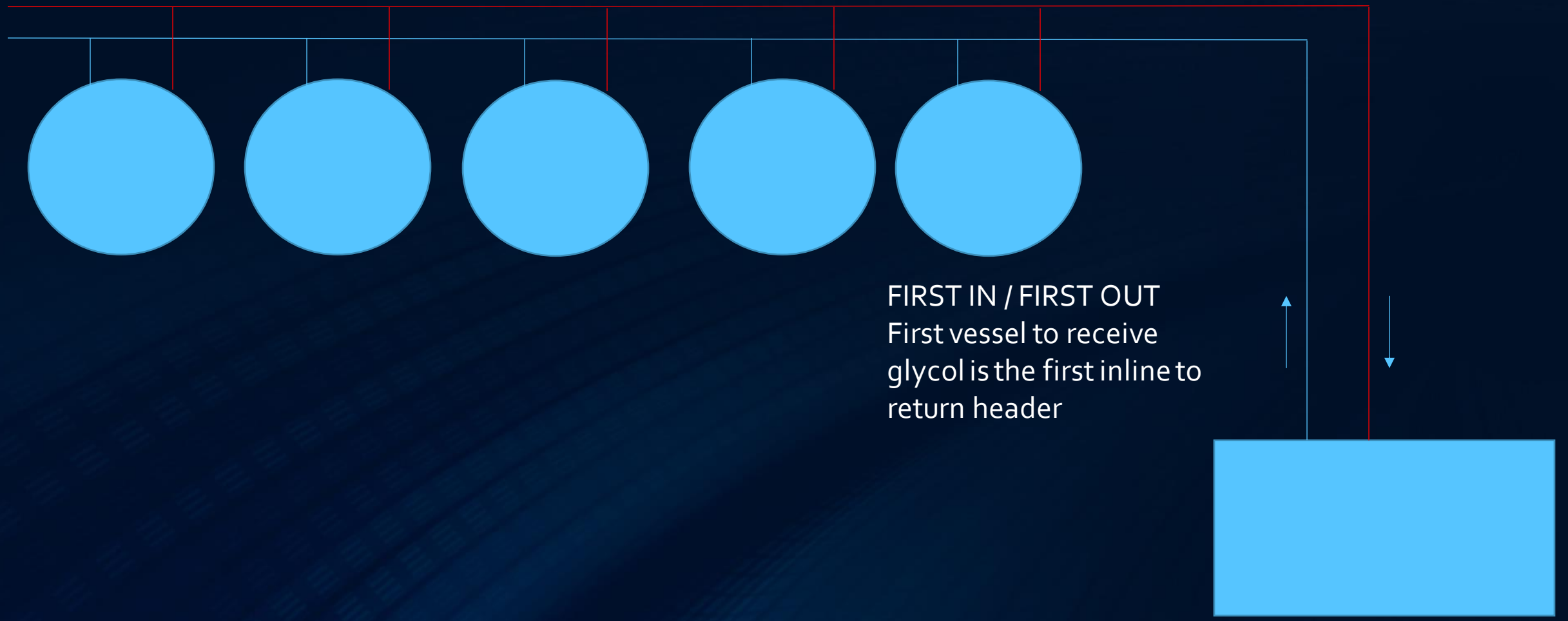
The Spears® Polyvinyl Chloride (PVC) and Chlorinated Polyvinyl Chloride (CPVC) Valves can be used at temperatures to a minimum of 40°F (4.44°C), consideration to expansion and contraction, and system operation should be given.

Gregory Peak
Director, Technical Services

BREWERY PIPING DESIGN

Don’t cut corners on Insulation or Pipe Supports

BREWERY PIPING DESIGN FIRST IN / FIRST OUT



FIRST IN / FIRST OUT
First vessel to receive glycol is the first inline to return header

BREWERY PIPING DESIGN FIRST IN / LAST OUT

FALL BREWING

SAN DIEGO, CA

SECTION REVIEW

COPPER / STAINLESS STEEL/ ABS

PVC – USE AT YOUR OWN RISK

HANGERS AND INSULATION ARE IMPORTANT

FIRST IN / LAST OUT PIPING

PROPER CARE AND FEEDING OF A CHILLER SYSTEM

PREVENTIVE MAINTENANCE AND SERVICE

- IN HOUSE VS. SERVICE CONTRACTOR
- DAILY / WEEKLY/MONTHLY/ANNUALLY

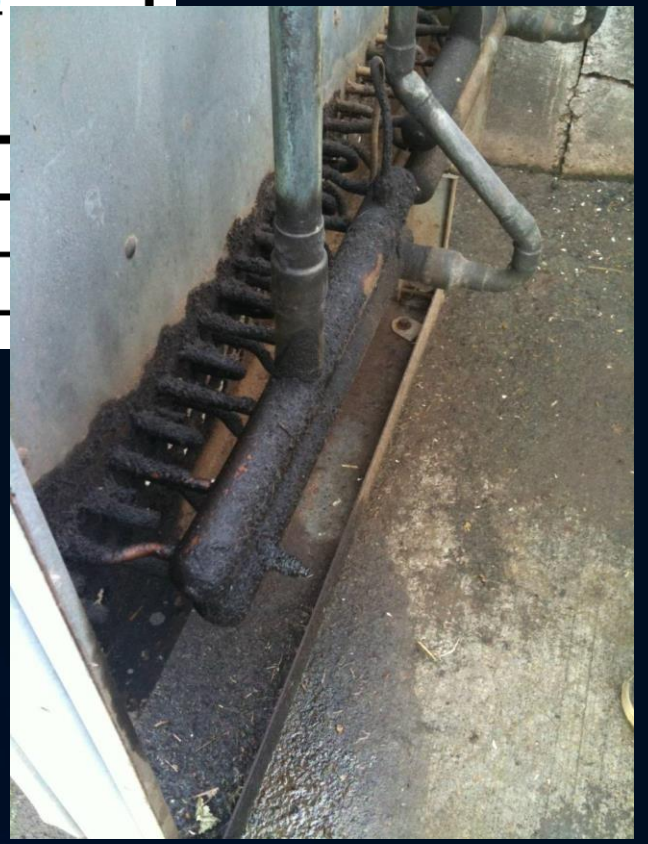
"How long will my chiller system last?"

PREVENTIVE MAINTENANCE AND SERVICE

DAILY

Date		Date	
	Air Cooled Condenser Clear of Obstruction		Chiller System Setpoint
	Glycol Inlet Temp		Glycol Outlet Temp
	Check for Audible or Visual Alarms		Inspect for glycol leaks
	Refrigerant Sight Glass Inspection		

Daily Inspection Notes:



PREVENTIVE MAINTENANCE AND SERVICE

WEEKLY

Date		Date	
	Suction Pressure		Proper Glycol Reservoir Level
	Discharge Pressure		Compressor Superheat

Weekly Inspection Notes:

PREVENTIVE MAINTENANCE AND SERVICE

MONTHLY

Date		Date	
	Glycol Freeze Concentration		Check Compressor Amps
	Check Pump Amperage		Check Condenser Fan Amps
	Clean Air Cooled Condenser		Check System Amps

Monthly Inspection Notes: _____

PREVENTIVE MAINTENANCE AND SERVICE

YEARLY

Date		Date	
	Replace Condenser Fan Contactor		Replace Liquid Line Filter
	Replace Pump Contactor		Replace Comp. Contactor

Yearly Inspection Notes: _____

1. Purchase direct from Manufacturer
2. Reduce / eliminate Motor Failures
3. $70 for Compressor Contactor VS $3000 for new compressor

PREVENTIVE MAINTENANCE AND SERVICE

SIZING THE CHILLER SYSTEM

- Determining the Cooling Loads
  - Expansion Plans
  - Managing your cooling load
- Chiller Design
  - Redundancy
  - Oversizing and Undersizing
- Glycol Pumps & Flow Requirements
- Glycol Storage Tank
- Controls
- Warranty and Serviceability

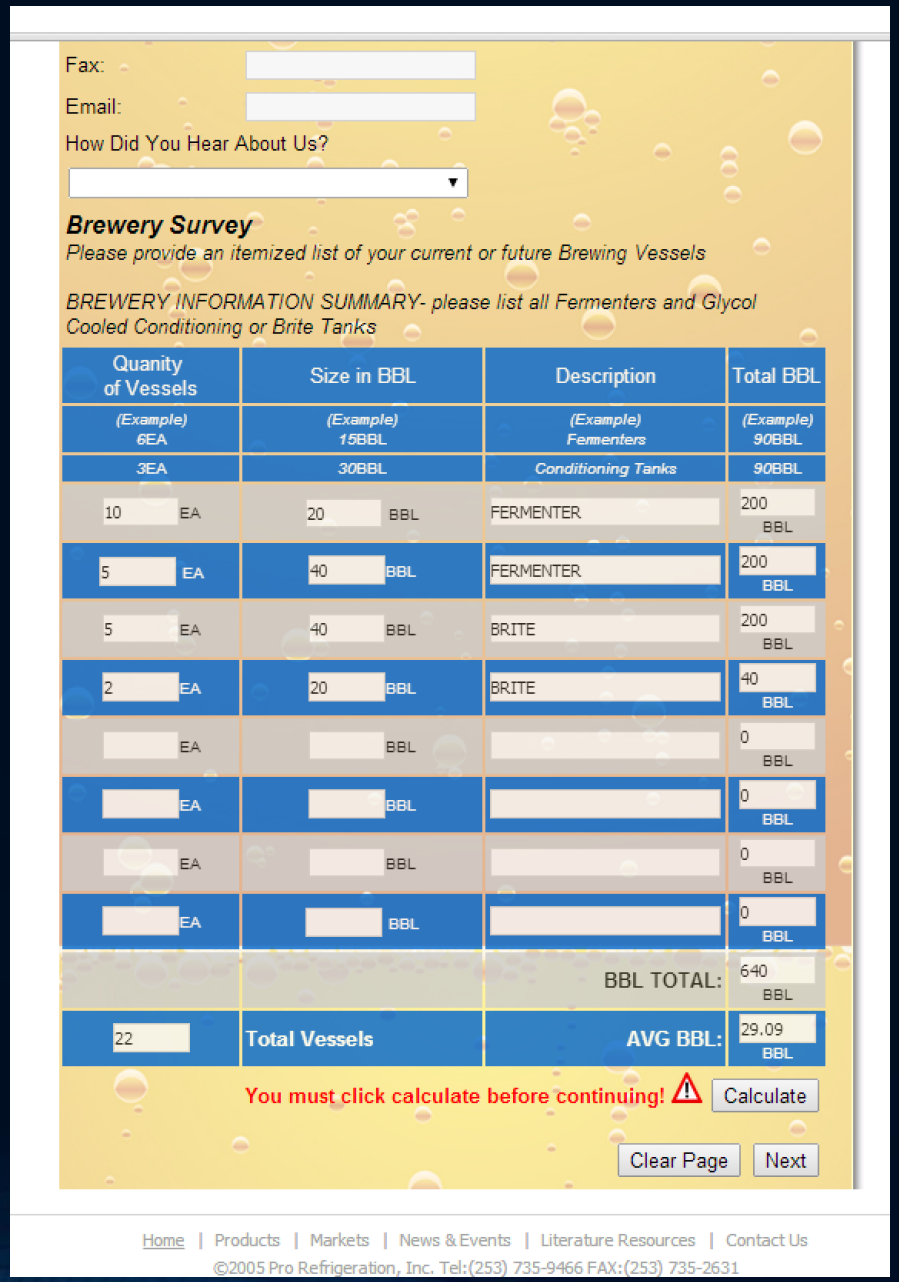
SIZING THE CHILLER SYSTEM

CELLAR COOLING LOAD

FERMENTATION
CONDITIONING
BRITE
LAGERING

TAKE A CELLAR CENSUS

www.prochiller.com/brewload.htm



Fax:

Email:

How Did You Hear About Us?

Brewery Survey

Please provide an itemized list of your current or future Brewing Vessels

BREWERY INFORMATION SUMMARY- please list all Fermenters and Glycol Cooled Conditioning or Brite Tanks

Quanity of Vessels	Size in BBL	Description	Total BBL
(Example) 6EA	*(Example) 15BBL*	*(Example) Fermenters*	*(Example) 90BBL*
3EA	*30BBL*	*Conditioning Tanks*	*90BBL*
10 EA	20 BBL	FERMENTER	200 BBL
5 EA	40 BBL	FERMENTER	200 BBL
5 EA	40 BBL	BRITE	200 BBL
2 EA	20 BBL	BRITE	40 BBL
EA	BBL		0 BBL
EA	BBL		0 BBL
EA	BBL		0 BBL
EA	BBL		0 BBL
		BBL TOTAL:	640 BBL
22	Total Vessels	AVG BBL:	29.09 BBL

You must click calculate before continuing! Calculate

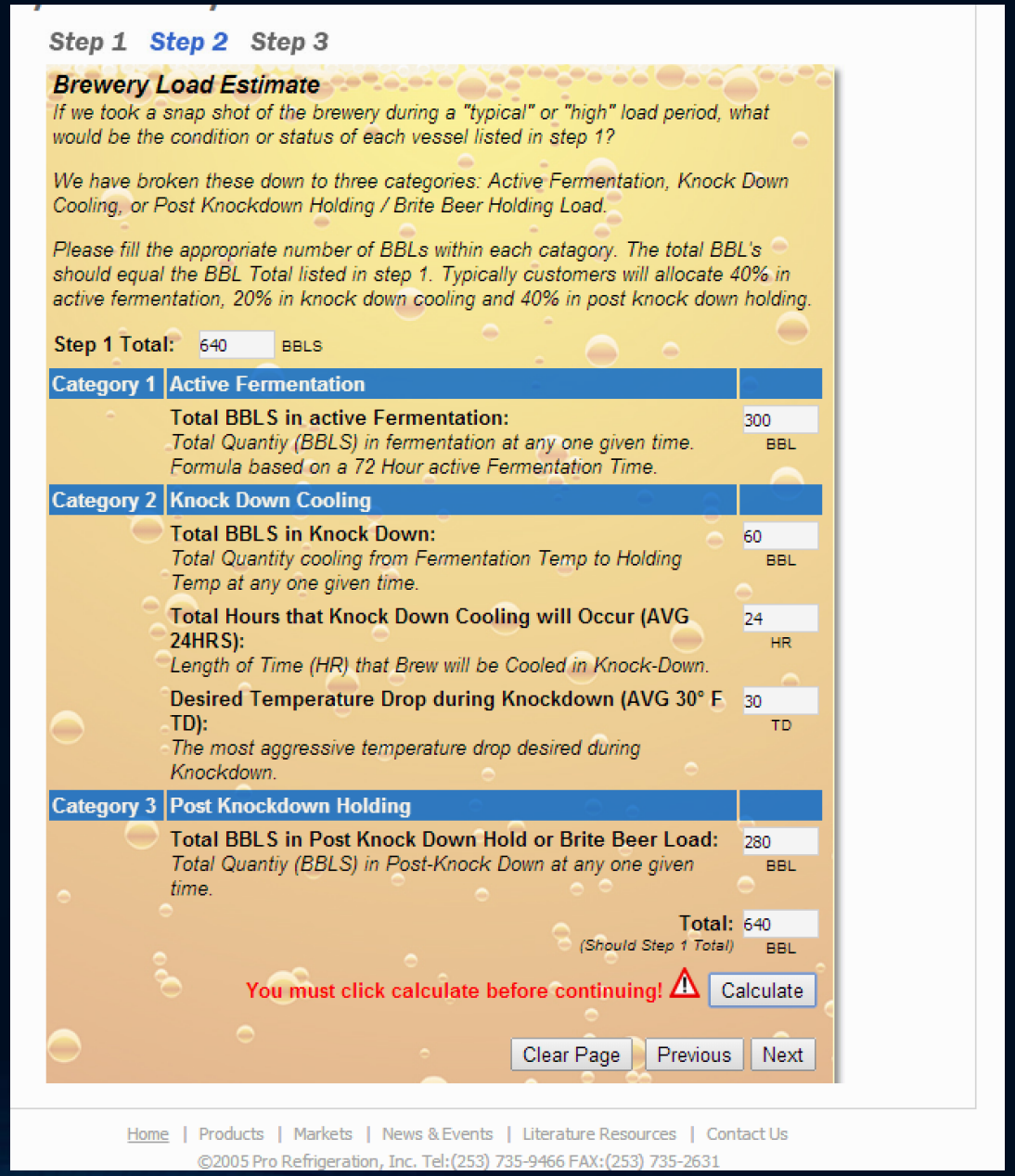
Clear Page Next

Home | Products | Markets | News & Events | Literature Resources | Contact Us

SIZING THE CHILLER SYSTEM

CELLAR COOLING LOAD

DETERMINE "AVERAGE" TO "HIGH" LOAD CONDITION BASED ON YOUR ESTIMATED OPERATING LOADS



Step 1 Step 2 Step 3

Brewery Load Estimate

If we took a snap shot of the brewery during a "typical" or "high" load period, what would be the condition or status of each vessel listed in step 1?

We have broken these down to three categories: Active Fermentation, Knock Down Cooling, or Post Knockdown Holding / Brite Beer Holding Load.

Please fill the appropriate number of BBLs within each catagory. The total BBL's should equal the BBL Total listed in step 1. Typically customers will allocate 40% in active fermentation, 20% in knock down cooling and 40% in post knock down holding.

Step 1 Total: 640 BBLS

Category 1	**Active Fermentation**	
	Total BBLS in active Fermentation: *Total Quantiy (BBLS) in fermentation at any one given time. Formula based on a 72 Hour active Fermentation Time.*	300 BBL
Category 2	**Knock Down Cooling**	
	Total BBLS in Knock Down: *Total Quantity cooling from Fermentation Temp to Holding Temp at any one given time.*	60 BBL
	Total Hours that Knock Down Cooling will Occur (AVG 24HRS): *Length of Time (HR) that Brew will be Cooled in Knock-Down.*	24 HR
	Desired Temperature Drop during Knockdown (AVG 30° F TD): *The most aggressive temperature drop desired during Knockdown.*	30 TD
Category 3	**Post Knockdown Holding**	
	Total BBLS in Post Knock Down Hold or Brite Beer Load: *Total Quantiy (BBLS) in Post-Knock Down at any one given time.*	280 BBL
	Total: *(Should Step 1 Total)*	640 BBL

You must click calculate before continuing! Calculate

Clear Page Previous Next

Home | Products | Markets | News & Events | Literature Resources | Contact Us

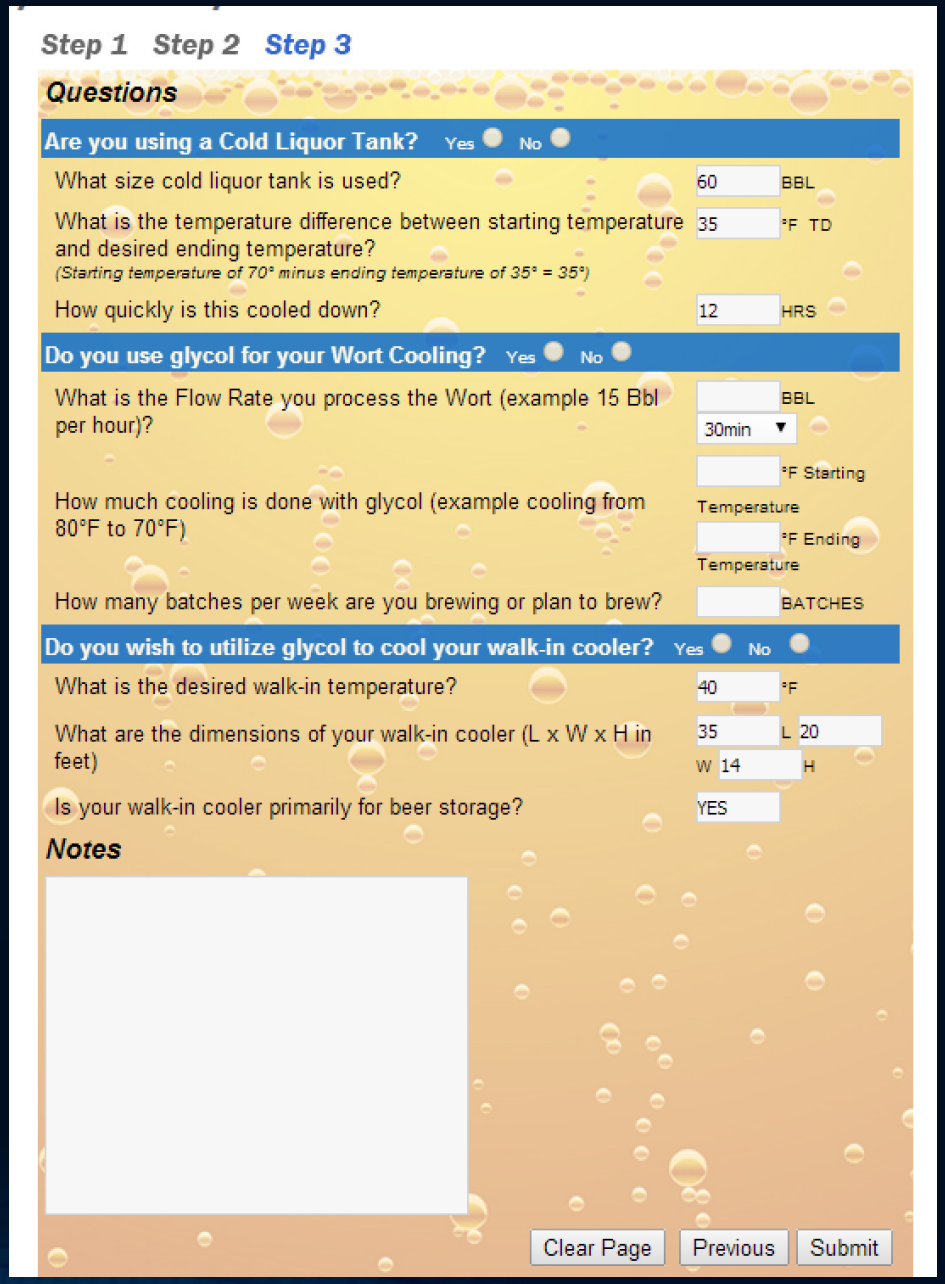
SIZING THE CHILLER SYSTEM

REVIEW ADDITIONAL COOLING LOADS

COLD LIQUOR TANK

WORT COOLING

COLD ROOM COOLING



SIZING THE CHILLER SYSTEM

CALCULATING THE CELLAR LOADS

	BREWERY LOAD CONDITIONS*			ACTIVE FERMENTATION			
11	Total BBLS in active Fermentation:	300	BBL	0	0	BBL	FERMENTER
	Total Quantiy (BBLS) in fermentation at any one given time.			0	0	BBL	FERMENTER
	DON'T ENTER DATA IN BOXES ABOVE AND BELOW			0	0	BBL	FERMENTER
	ENTER DATA IN GREEN HIGHLIGHTED BOXES→			0	0	BBL	FERMENTER
				KNOCKDOWN			
12	Total BBLS in Knock Down:	60	BBL	0	0	BBL	FERMENTER
	Total Quantity cooling from Fermentation Temp to Holding Temp at any one given time.			0	0	BBL	FERMENTER
13	Total Hours that Knock Down Cooling will Occur	24	HR	0	0	BBL	FERMENTER
	Length of Time (HR.) that Brew will be Cooled in Knock-Down			0	0	BBL	FERMENTER
				POST KNOCK DOWN / BRITE			
14	Total BBLS in Post Knock Down Hold or Brite Beer Load:	280	BBL	0	0	BBL	
	Total Quantiy (BBLS) in Post-Knock Down at any one given time.			0	0	BBL	
				0	0	BBL	
15	Total BBLS of Cold Liquor:	0	BBL				
	Total Quantity (BBLS) of Cold Liquor						
16	Total Hours that Cold Liquor Cooling Will Occur.	1	HRS				
	Length of time (HR.) that Cold Liquor will be cooled.						
17	Total Cold Liqiuor Tank temperature drop	0	F				
	Starting Water Temp minus the final Cold Liquor Temp. Example starting @ 71 F, cooling to 35 F = 36 F TD						
18	Walk-In Cooler Load (BTU/HR)	0	BTU/HR	←CALCULATE ON "WALKIN, WORT COOLING,			
	Cooling Load from Coil in Walk In Cooler in BTU/HR						
19	Wort Cooling Load (BTU/HR)	0	BTU/HR	←CALCULATE ON "WALKIN, WORT COOLING,			
	Two Stage Plate Cooler- Chiller Water Section Load(Estimated)						
20	Prepackaging line Heat Exchanger	0	BTU/HR	←CALCULATE ON "WALKIN, WORT COOLING,			
	Plate Heat Exchanger to chiller beer prior to bottling/canning (Estimated)						
	ESTIMATED BTU LOAD (BTU/HR):	**75,937**					

SIZING THE CHILLER SYSTEM

CALCULATING THE COLD LIQUOR TANK

COLD LIQUOR LOAD								
Cold Liquor Tank Size		60	BBLS	starting temp		70		
batch size								
60	BBLS	every	720	MINUTES				
STARTING TEMP		70	F					
ENDING TEMP		35	F	FLOW	2.583333	GPM		
TEMP DROP		35	F					
LOAD		45,208	BTU/HR					

SIZING THE CHILLER SYSTEM

CALCULATING THE COLD ROOM LOAD

		LOAD - MULTIPLIER METHOD					
L	35		LIGHT	12	X	ENVELOPE AREA	35,280
W	20		MED	14	X	ENVELOPE AREA	41,160 TYPICAL
H	14		HEAVY	16	X	ENVELOPE AREA	47,040
	40		HEAVY	20	X	ENVELOPE AREA	58,800
			WINE STORAGE	10	X	ENVELOPE AREA	29,400
			PREP AREA L X W X 70				49,000

SIZING THE CHILLER SYSTEM

CELLAR COOLING LOAD	75,937 BTU/HR
COLD LIQUOR TANK LOAD	45,208 BTU/HR
COLD ROOM LOAD	41,160 BTU/HR
ESTIMATED COOLING LOAD	162,305 BTU/HR

SECTION REVIEW

“How long will my chiller system last?”

Why is the CHILLER SYSTEM such an important piece of equipment in your Brewery?

- You only have one, and it ties into all aspects of the brewing process.
- Chiller System never sleeps or rests, so that you can.
- You can’t have consistent product without adequate cooling.
- There are various ways to save costs when putting together your brewery- don’t compromise on cooling capacity or on chiller system quality.

RESOURCES:

WWW.PROCHILLER.COM

WWW.MYCHILLER.COM

WWW.PROBREWER.COM

www.brewersassociation.org

www.mbaa.com