Glycol Piping for Breweries 25 minute crash overview

Dan Strömberg

GF Piping Systems

The basic facts

- Your inhibited propylene glycol media's main task is to remove heat from you fermentation tanks, brite tanks, cold liquor tanks, worth chiller and also in some installations your walk in cooler
- Normal temperature range for the media are 20F to 28F. (the bigger ΔT the easier the exchange)
- Media pressure 15 to 60 psi
- Recommended velocity below 5 ft./s (without variable speed pumps) to 7.5 ft. /s (with variable speed pumps) ASHRAE 90.1-2010
- Goal is to do this with as low running cost as possible

What size pipe to use?

- To size the pipe right you need to know how much flow of glycol that will be needed.
- This is determined by the fermenters. Normally your tank manufacturer can tell you the needed flow/jacket for your fermenters and the bright tanks.
- You then add up all the flow for all tanks and your now have a total.
- Now you need to ask yourself how many of the tanks/ jackets will be calling for flow at the same time? (for example maybe only 60% is calling for cooling at the same time) This will get you an actual need.
- It is also very wise to calculate and add for future expansion.
- With the total needed flow we can now help you to pick the right pipe size. The golden rule is (and this is even an ASHRAE standard) to keep the velocity in the pipe **to 5 ft./s** or less and if you have variable speed pumps you can go up to **7.5 ft./s.**

Higher velocity = higher pressure drop (in fact if your velocity doubles your pressure drop quadruples) and noise and water hammer effect also increases.

For example if you **increase** the **velocity** with **50%** from 5 ft./s to 7.5 ft./s your **pressure drop increases** with **225%** and now your pumps need work harder (or you need bigger pumps) and consume more energy.

Max flow rates
ASHRAE standard 90.1

Maximum flows in nominal pipe sizes.

Table 1. Piping System Design Maximum Flow Rate in GPM (IP) (ASHRAE Standard 90.1-2010 Table 6.5.4.5)

Operating hours/yr	≤2000 hours/yr		>2000 and ≤4400 hours/yr		>4400 hours/yr	
Nominal pipe size (in.)	Other	Variable flow/ Variable speed	Other	Variable flow/ Variable speed	Other	Variable flow/ Variable speed
2 1/2	120	180	85	130	68	110
3	180	270	140	210	110	170
4	350	530	260	400	210	320
5	410	620	310	470	250	370
6	740	1100	570	860	440	680
8	1200	1800	900	1400	700	1100
10	1800	2700	1300	2000	1000	1600
12	2500	3800	1900	2900	1500	2300
Maximum velocity for pipes over 12" size	8.5 fps	13.0 fps	6.5 fps	9.5 fps	5.0 fps	7.5 fps

Piping Material

- Use piping material that can handle the media and also the media temperature. Example on suitable piping materials: COOL-FIT ABS Plus (pre-insulated), COOL-FIT ABS Lite (pre-insulated), COOL-FIT ABS, ecoFIT (PE100), iFIT (multi layer pipe), PEX, Copper, Stainless Steel schedule 10 and Carbon steel schedule 40

- PVC and CPVC can not be used because the lowest temperature limit for PVC and CPVC is 32F (some manufactures set the limit to 40F) and you normally run your glycol below 32F, they are also not resistant to propylene glycol and that is a huge problem.

- Make sure your piping is properly insulated and preferable with a jacketed insulation (for wash-downs). Every time you see piping or equipment ice up or condensate you loose money and It is also a source for mold. Pre-insulated piping give you the highest quality and the most energy efficient solution, it is also easy to install.

Example of suitable piping material

- Copper  Expensive, very desirable for thieves, insulation needed
- Carbon steel  Need to be painted to prevent corrosion, heavy, time consuming to install, insulation needed
- Stainless steel  Need to be painted to prevent corrosion, heavy, time consuming to install, insulation needed
- COOL-FIT ABS  Solvent cemented, quick install, low cost, insulation needed
- PE100  Welded, low cost, more expansion and contraction than other plastics, insulation needed
- PEX  Only mechanical connections, hard to install straight, limited size range, more expansion & contraction, insulation needed

Pre-insulated piping

- COOL-FIT ABS Lite  No hard jacket, budget solution, only up to 6”
- COOL-FIT ABS Plus  Maintenance free, energy efficient, easy to install, can be power washed and chemical washed, very low expansion and contraction

MASTER BREWERS ASSOCIATION OF THE AMERICAS EST 1887

UNITED WE BREW.

Daily problems in glycol Applications with Metal Piping Systems - CORROSION

Stainless Steel

Copper

Carbon Steel

Daily problems in glycol Applications with Metal Piping - Incrustations

Do piping system need to be insulated?

Minimum Pipe Insulation Thickness from ANSI/ASHRAE/IES Standard 90.1-2010: Energy Standard

TABLE 6.8.3A Minimum Pipe Insulation Thickness
Heating and Hot Water Systems [a,b,c,d]
(Steam, Steam Condensate, Hot Water Heating and Domestic Water Systems)

	Insulation Conductivity		Nominal Pipe or Tube Size (in)				
Fluid Operating Temperature Range (°F) and Usage	Conductivity Btu·in./(h·ft²·°F)	Mean Rating Temperature, °F	<1	1 to <1-1/2	1-1/2 to <4	4 to <8	≥8
			Insulation Thickness (in)				
>350°F	0.32–0.34	250	4.5	5.0	5.0	5.0	5.0
251°F–350°F	0.29–0.32	200	3.0	4.0	4.5	4.5	4.5
201°F–250°F	0.27–0.30	150	2.5	2.5	2.5	3.0	3.0
141°F–200°F	0.25–0.29	125	1.5	1.5	2.0	2.0	2.0
105°F–140°F	0.22–0.28	100	1.0	1.0	1.5	1.5	1.5

TABLE 6.8.3B Minimum Pipe Insulation Thickness
Cooling Systems (Chilled Water, Brine, and Refrigerant) [a,b,c]

	Insulation Conductivity		Nominal Pipe or Tube Size (in)				
Fluid Operating Temperature Range (°F) and Usage	Conductivity Btu·in./(h·ft²·°F)	Mean Rating Temperature, °F	<1	1 to <1-1/2	1-1/2 to <4	4 to <8	≥8
			Insulation Thickness (in)				
40°F–60°F	0.21–0.27	45	0.5	0.5	1.0	1.0	1.0
<40°F	0.20–0.26	50	0.5	1.0	1.0	1.0	1.5

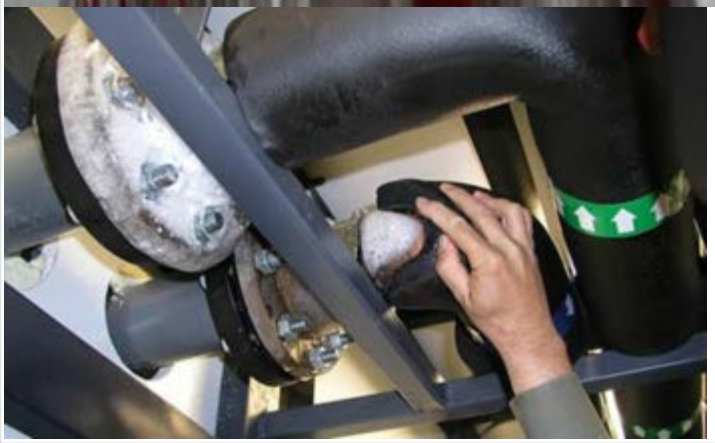
Source: *ANSI/ASHRAE/IES Standard 90.1-2010—Energy Standard for Buildings Except Low-Rise Residential Buildings*

Daily problems in glycol piping Systems – Ice Build up

Why insulation and vapor barrier is important

- Water vapor is always present in the air. When this vapor comes close to colder surfaces it condensates. This condensation could happen either on uninsulated parts, or inside the insulation layer. A good vapor barrier outside the insulation layer is therefore important.
- If condensation is allowed to happen, the water (or ice) will:
- Increase energy losses
- **Water** has a **20x** higher thermal conductivity than air & Ice has a **100x** higher thermal conductivity than air
- Cause damage to the insulation material, corrosion to pipes, vessels & cladding
- Cause structural problems for the installation (due to the extra weight)
- Cause inoperable valves, engines, pumps (ice build-up)
- Cause electrical shortcuts, make control panels brake down
- Cause **mold** growth (mold can grow when the humidity is above 50%)
- dripping condensation can also lead to unsafe conditions on the floor, where the moisture can collect and cause a slipping hazard.

Don’t flush money down the drain!



Do it right the first time

Insulation

- How thick insulation do I need?
- This is depending on following factors:
- Piping material
- Media temperature
- Ambient temperature
- Humidity
- Type of insulation
- Wind speed
- Jacket material

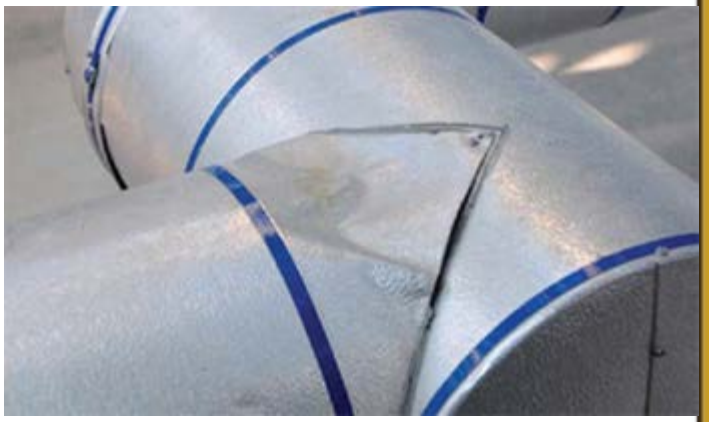
Daily problems in glycol Application piping - Condensation

Daily problems glycol Applications – Mold

MASTER BREWERS ASSOCIATION OF THE AMERICAS EST 1887

UNITED WE BREW.

Daily problems with Post insulated systems – Insulation Damaged



Benefits with a hard jacketed insulated piping system

Hard jacketed piping systems can be washed
A very few can even be power washed


MASTER BREWERS
ESTD
1887
ASSOCIATION OF THE AMERICAS
UNITED WE BREW.

Dan Strömberg
Cooling Market Segment Manager
Georg Fischer LLC
Phone: +1 714 368 4196
Fax: +1 714 368 4197
Mobile: +1 951 642 2339
Dan.Stromberg@georgfischer.com

GF Piping Systems
9271 Jeronimo Road,
Irvine, CA. 92618
United States
www.gfps.com/us