

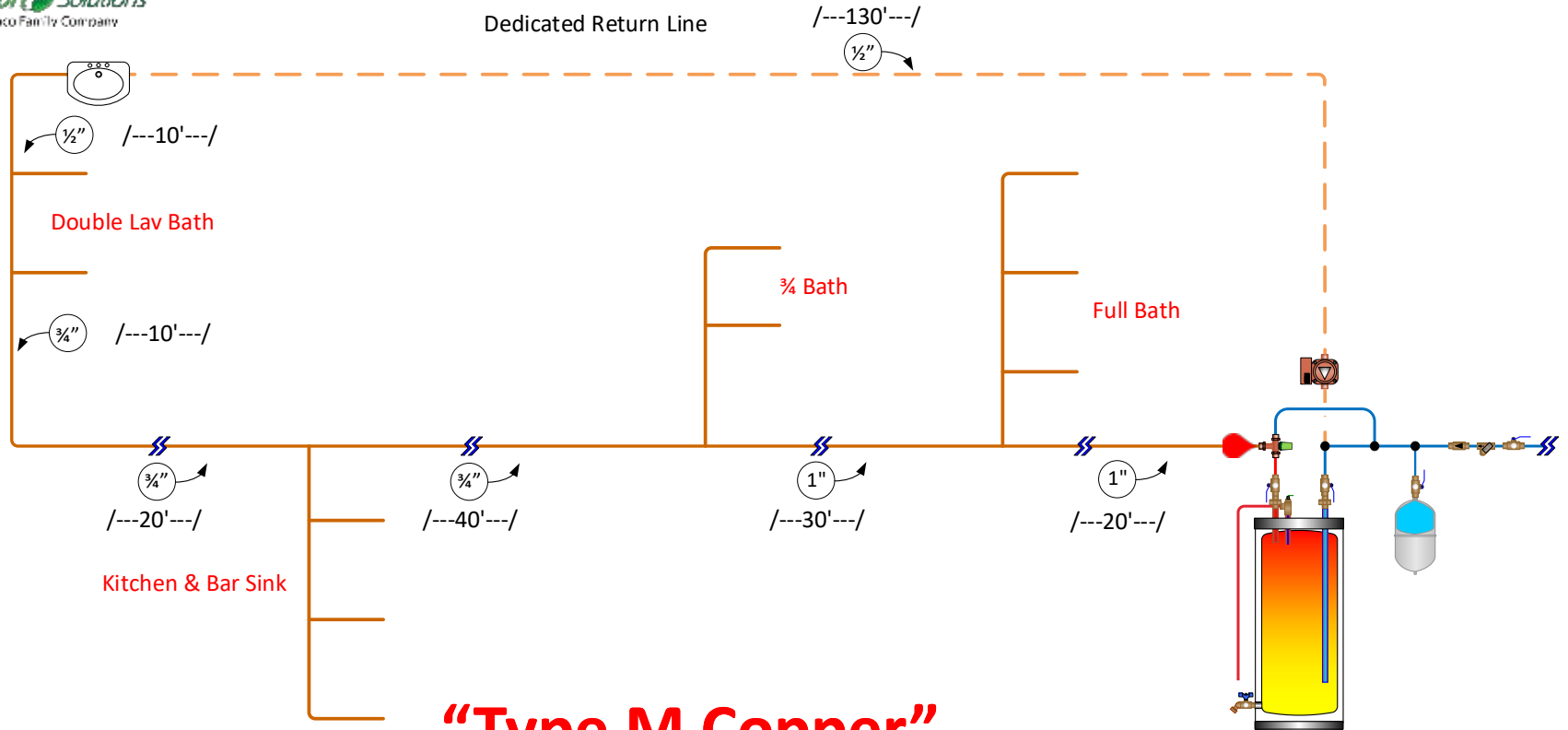


Welcome...

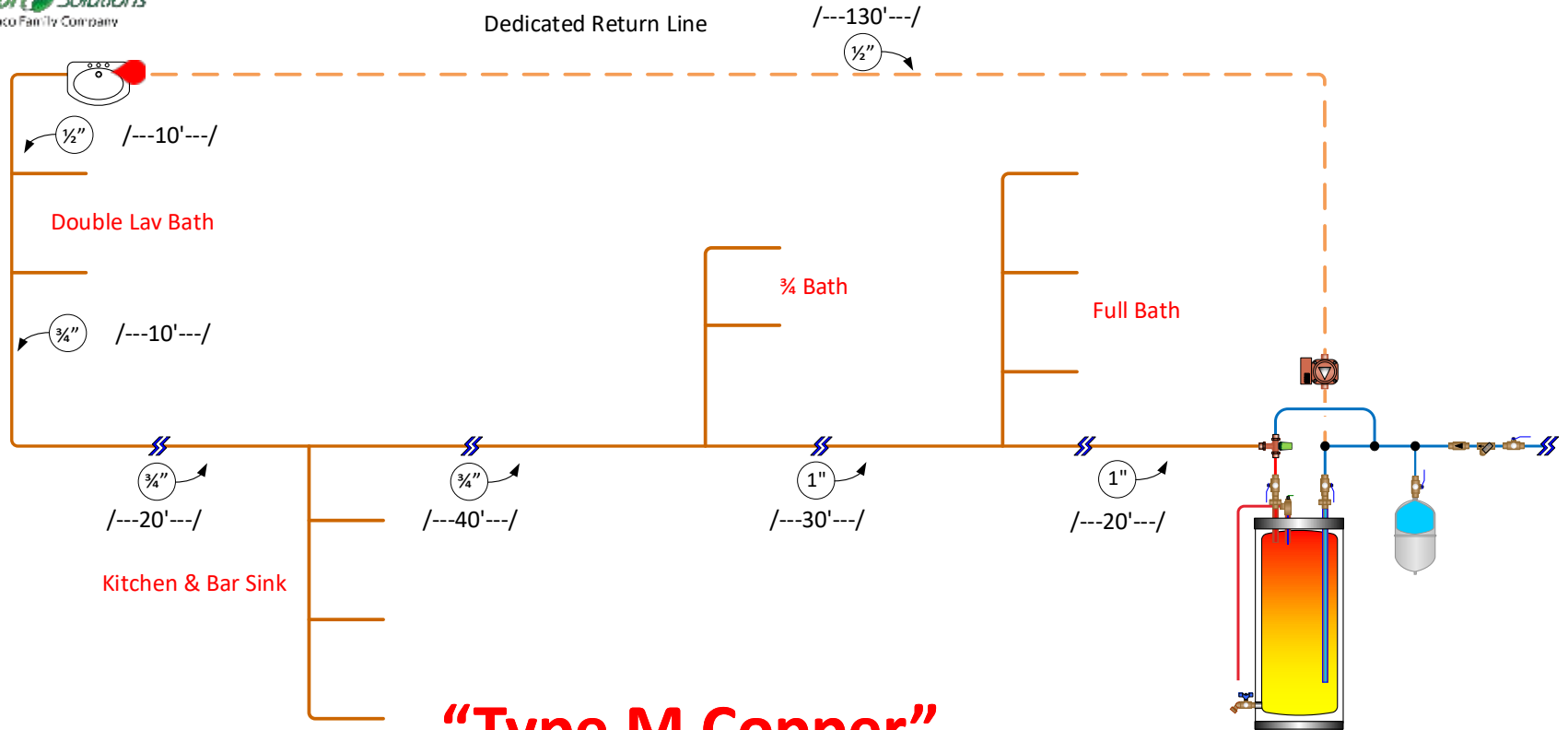
“You should do the MATH”



Supply Portion vs Dedicated Return



Supply Portion vs Dedicated Return



“Type M Copper”



DHW Re-Circ Worksheet

Check Boxes that apply

Water Heating Equipment Type: Tank Type: Tankless: Gas Fired: Electric: Indirect:

Piping Material:

Copper <input checked="" type="checkbox"/>	Type M <input checked="" type="checkbox"/>	Type L <input type="checkbox"/>	Type K <input type="checkbox"/>
PEX / PE-RT SDR 9		Galv. Steel Sch: 40	
PEX-AL-PEX		CPVC (CTS)	

Piping Scheme: (Please provide simple sketch of layout)

Trunk & Branch no Re-Circ:	<input type="checkbox"/>	Home Run:	<input type="checkbox"/>
Trunk & Branch w/ Re-Circ:	<input checked="" type="checkbox"/>	Other:	<input type="checkbox"/>
Full Sized (Intelligent) Loop:	<input type="checkbox"/>		

Piping Calculations:

Size of Pipe	Total Lineal Footage of Runs	Volume Data		P.D. Data	
		Gallons per/Ft.	Total Gallons per Run	Pressure Drop per foot Ft/Hd.	Total Pressure Drop Ft/Hd.
3/8"					
1/2"	10	.0132	.132	.037	0.37
3/4"	70	.0269	1.883	.007	0.49
1"	50	.0454	2.27	.003	0.15
1-1/4"					
1-1/2"					
2"					
3"					
* (1/2)"	130	.0132	<Not used>	.037	4.81
Total Gallons / Primary:			4.28	Valve & Fitting Factor X	7.28
Misc: (GPM / Cv sq. = psi x 2.31 = Ft.Hd.)					
* This line has a Maximum Velocity Limitation of (1.6) GPM, deduct from primary					
Total gallons in primary X 2 () / by MVL () GPM = () minutes to flush primary hot lines.					
			Estimated Re-Circ pump size:	GPM:	Ft/Hd.:
Additional Information Required:			Suggested Taco Re-Circ pump:		
Temperature of hot water supplied out to fixtures?		°F	Suggested Valve & Fitting Factor multipliers: <ul style="list-style-type: none"> Copper or outside fitting = X 1.25 PEX with F1960 or F2080= X 1.50 PEX with F1807 = X 2.00 		
Temperature of air around hot water & Re-Circ pipes?		°F			
Insulation R-Value installed on hot water & Re-Circ piping?		R-v			
Or; Thickness and type of Insulation on hot & Re-Circ piping?		"			
			Ins. type:		

5.82

“Cv” clarification...

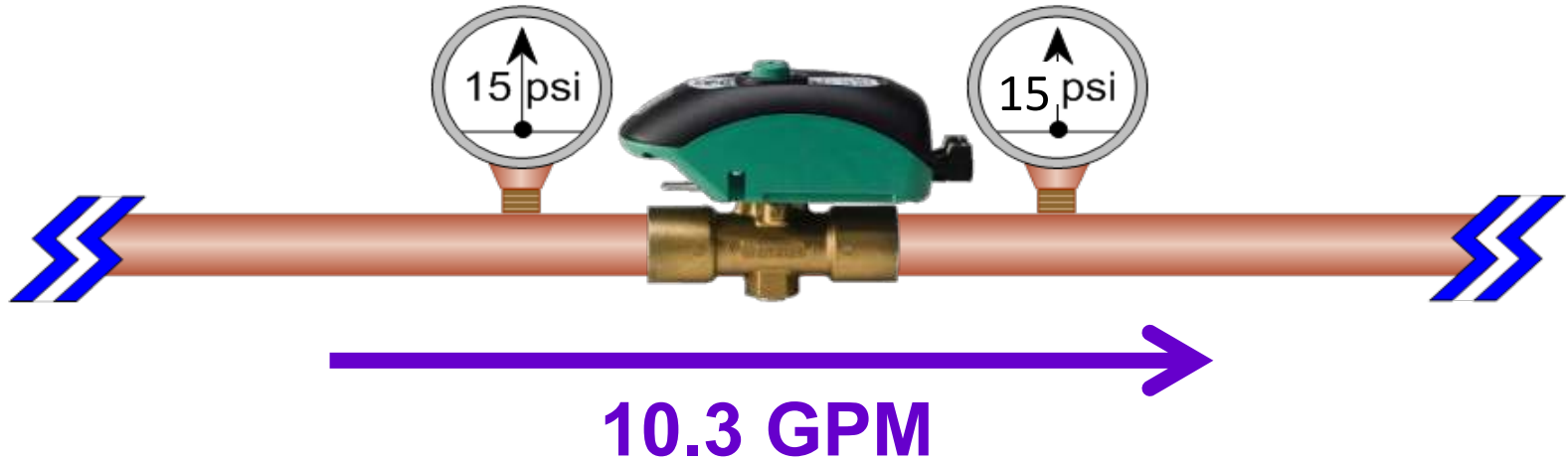


“Cv” clarification...

- ❑ “Cv”= Flow coefficient
- ❑ The point at which a particular device or *system*, will impart 1 psi of pressure drop on the fluid passing through it.
- ❑ This zone valve with a “Cv” of 10.3 will show a 1 psi drop once 10.3 gpm is flowing through it, (2.31 ft/hd.)



“Cv” clarification...



“Cv” of the 5120 series valve...

Performance

Cv:	1.8
Max. Flow:	14GPM (54 L/min) ¹
	<i>¹Flow should never exceed standards for pipe size</i>
Min. Flow:	1GPM (3.8 L/min) ¹
Hot Supply Temperature:	120-180°F (49-82°C)
Cold Supply Temperature:	39-80°F (5-27°C)
Max. Inlet Pressure:	200 psi (13.8 Bar)
Max. Variation in Supply Pressure:	20%
Min. Temperature Differential Between Hot Supply and Mixed:	10°F (5.6°C)
Outlet Temperature Range:	85-120°F (29-49°C)
Factory set to:	115-120°F (41-45°C)
Accuracy of Outlet Temperature:	(±) 3° F

Using Cv to solve for Head...



□ **Head** = gpm / Cv (sq.) = (psi) x 2.31

$$1.6 \text{ gpm} / 1.8 = .888 \text{ (sq)} = .789 \text{ psi} \times 2.31 = \mathbf{1.82' \text{ Hd.}}$$

OR

$$1.6 \text{ gpm} / 1.8 = .888 \text{ (sq)} = .789 \text{ psi} / .4332 = \mathbf{1.82' \text{ Hd.}}$$





DHW Re-Circ Worksheet

Check Boxes that apply

Water Heating Equipment Type: Tank Type: Tankless: Gas Fired: Electric: Indirect:

Piping Material:

Copper <input checked="" type="checkbox"/>	Type M <input checked="" type="checkbox"/>	Type L <input type="checkbox"/>	Type K <input type="checkbox"/>
PEX / PE-RT SDR 9		Galv. Steel Sch: 40	
PEX-AL-PEX		CPVC (CTS)	

Piping Scheme: (Please provide simple sketch of layout)

Trunk & Branch no Re-Circ: <input type="checkbox"/>	Home Run: <input type="checkbox"/>
Trunk & Branch w/ Re-Circ: <input checked="" type="checkbox"/>	Other: <input type="checkbox"/>
Full Sized (Intelligent) Loop: <input type="checkbox"/>	

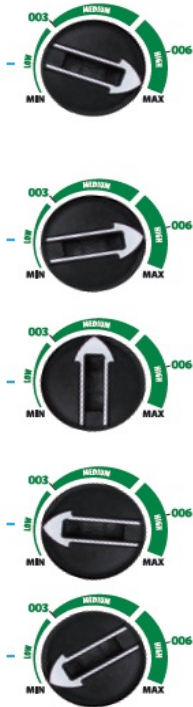
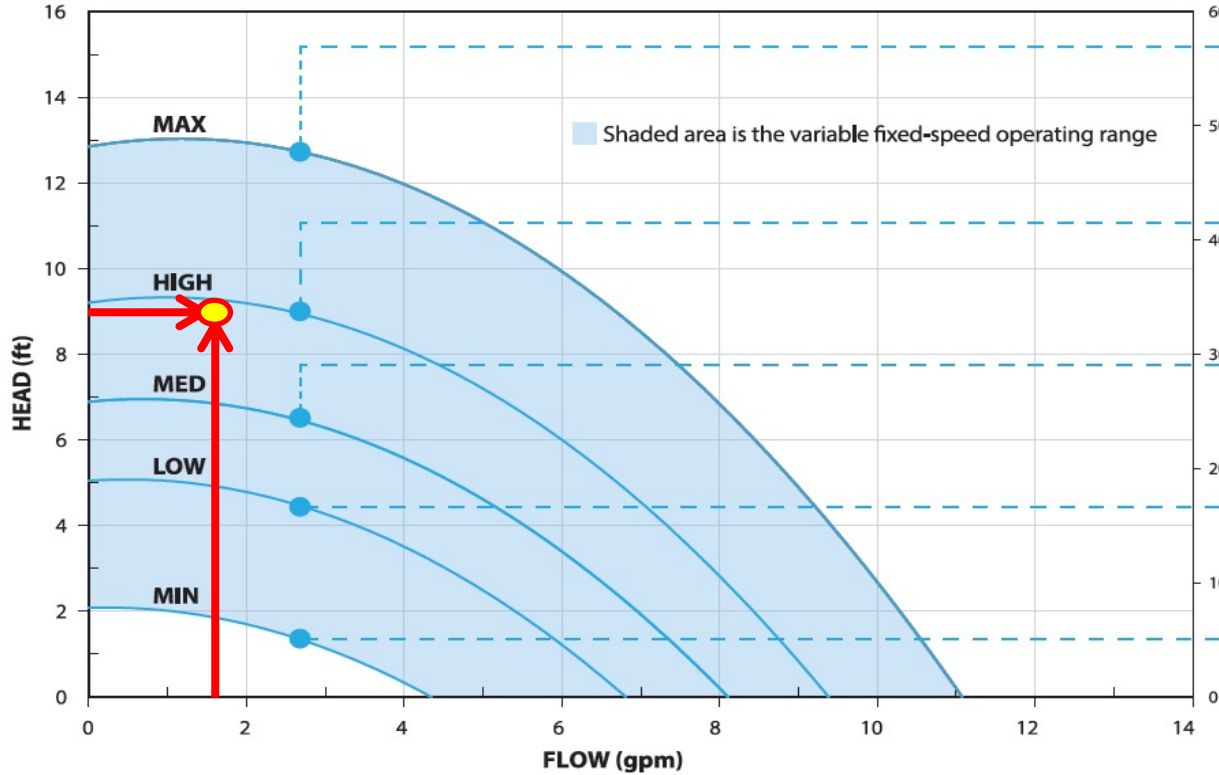
Piping Calculations:

Size of Pipe	Total Lineal Footage of Runs	Volume Data		P.D. Data	
		Gallons per/Ft.	Total Gallons per Run	Pressure Drop per foot Ft/Hd.	Total Pressure Drop Ft/Hd.
3/8"					
1/2"	10	.0132	.132	.037	0.37
3/4"	70	.0269	1.883	.007	0.49
1"	50	.0454	2.27	.003	0.15
1-1/4"					
1-1/2"					
2"					
3"					
* (1/2)"	130	.0132	<Not used>	.037	4.81
Total Gallons / Primary:			4.28	Valve & Fitting Factor X	7.28
Misc: (GPM / Cv sq. = psi x 2.31 = Ft.Hd.) 1.6/1.8 = .888 sq. = .789 X 2.31 =				Mix Vlv or Misc	1.82
* This line has a Maximum Velocity Limitation of 1.6 FPM, deduct from primary				Total PD:	9.00'
Total gallons in primary X 2 () / by MVL () GPM = () minutes to flush primary recirc lines.					

5.82

Estimated Re-Circ pump size:	GPM:	Ft/Hd.:
Suggested Taco Re-Circ pump:		
Temperature of hot water supplied out to fixtures?	°F	Suggested Valve & Fitting Factor multipliers: • Copper or outside fitting = X 1.25 • PEX with F1960 or F2080= X 1.50 • PEX with F1807 = X 2.00
Temperature of air around hot water & Re-Circ pipes?	°F	
Insulation R-Value installed on hot water & Re-Circ piping?	R-v	
Or; Thickness and type of Insulation on hot & Re-Circ piping?	"	

Taco's new 006e3 Variable Performance Curves





DHW Re-Circ Worksheet

Check Boxes that apply

Water Heating Equipment Type: Tank Type: Tankless: Gas Fired: Electric: Indirect:

Piping Material:

Copper <input checked="" type="checkbox"/>	Type M <input checked="" type="checkbox"/>	Type L <input type="checkbox"/>	Type K <input type="checkbox"/>
PEX / PE-RT SDR 9		Galv. Steel Sch: 40	
PEX-AL-PEX		CPVC (CTS)	

Piping Scheme: (Please provide simple sketch of layout)

Trunk & Branch no Re-Circ: <input type="checkbox"/>	Home Run: <input type="checkbox"/>
Trunk & Branch w/ Re-Circ: <input checked="" type="checkbox"/>	Other: <input type="checkbox"/>
Full Sized (Intelligent) Loop: <input type="checkbox"/>	

Piping Calculations:

Size of Pipe	Total Lineal Footage of Runs	Volume Data		P.D. Data	
		Gallons per/Ft.	Total Gallons per Run	Pressure Drop per foot Ft/Hd.	Total Pressure Drop Ft/Hd.
3/8"					
1/2"	10	.0132	.132	.037	0.37
3/4"	70	.0269	1.883	.007	0.49
1"	50	.0454	2.27	.003	0.15
1-1/4"					
1-1/2"					
2"					
3"					
* (1/2)"	130	.0132	<Not used>	.037	4.81
Total Gallons / Primary:			4.28	Valve & Fitting Factor X	7.28
Misc: (GPM / Cv sq. = psi x 2.31 = Ft.Hd.)			1.6/1.8 = .888 sq. = .789 X 2.31 =	Mix Vlv or Misc	1.82
* This line has a Maximum Velocity Limitation of (1.6) GPM, deduct from primary				Total PD:	9.00'
Total gallons in primary X 2 () / by MVL () GPM = () minutes to flush primary hot lines.					
			Estimated Re-Circ pump size:	GPM: 1.6	Ft/Hd.: 9.00'
Additional Information Required:			Suggested Taco Re-Circ pump: 006e3		
Temperature of hot water supplied out to fixtures?		°F	Suggested Valve & Fitting Factor multipliers: <ul style="list-style-type: none"> Copper or outside fitting = X 1.25 PEX with F1960 or F2080= X 1.50 PEX with F1807 = X 2.00 		
Temperature of air around hot water & Re-Circ pipes?		°F			
Insulation R-Value installed on hot water & Re-Circ piping?		R-v			
Or; Thickness and type of Insulation on hot & Re-Circ piping?		"			
			Ins. type:		

5.82



DHW Re-Circ Worksheet

Check Boxes that apply

Water Heating Equipment Type: Tank Type: Tankless: Gas Fired: Electric: Indirect:

Piping Material:

Copper <input checked="" type="checkbox"/>	Type M <input checked="" type="checkbox"/>	Type L <input type="checkbox"/>	Type K <input type="checkbox"/>
PEX / PE-RT SDR 9		Galv. Steel Sch: 40	
PEX-AL-PEX		CPVC (CTS)	

Piping Scheme: (Please provide simple sketch of layout)

Trunk & Branch no Re-Circ: <input type="checkbox"/>	Home Run: <input type="checkbox"/>
Trunk & Branch w/ Re-Circ: <input checked="" type="checkbox"/>	Other: <input type="checkbox"/>
Full Sized (Intelligent) Loop: <input type="checkbox"/>	

Piping Calculations:

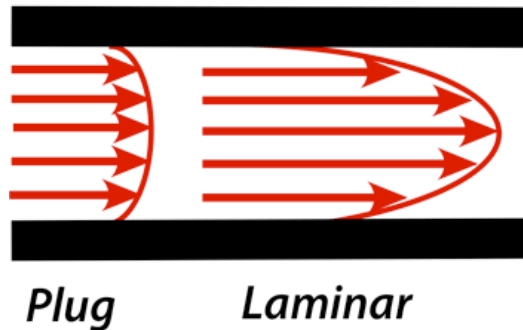
Size of Pipe	Total Lineal Footage of Runs	Volume Data		P.D. Data	
		Gallons per/Ft.	Total Gallons per Run	Pressure Drop per foot Ft/Hd.	Total Pressure Drop Ft/Hd.
3/8"					
1/2"	10	.0132	.132	.037	0.37
3/4"	70	.0269	1.883	.007	0.49
1"	50	.0454	2.27	.003	0.15
1-1/4"					
1-1/2"					
2"					
3"					
* (1/2)"	130	.0132	<Not used>	.037	4.81
Total Gallons / Primary:			4.28	Valve & Fitting Factor X	7.28
Misc: (GPM / Cv sq. = psi x 2.31 = Ft.Hd.) 1.6/1.8= .888 sq. =.789 X 2.31=				Mix Vlv or Misc	1.82
* This line has a Maximum Velocity Limitation of (1.6) GPM, deduct from primary				Total PD:	9.00'
Total gallons in primary X 2 () / by MVL () GPM = () minutes to flush primary hot lines.					
Additional Information Required:			Estimated Re-Circ pump size:	GPM: 1.6	Ft/Hd.: 9.00'
			Suggested Taco Re-Circ pump:	006e3	
Temperature of hot water supplied out to fixtures?		°F	Suggested Valve & Fitting Factor multipliers: <ul style="list-style-type: none"> Copper or outside fitting = X 1.25 PEX with F1960 or F2080= X 1.50 PEX with F1807 = X 2.00 		
Temperature of air around hot water & Re-Circ pipes?		°F			
Insulation R-Value installed on hot water & Re-Circ piping?		R-v			
Or; Thickness and type of Insulation on hot & Re-Circ piping?		"			
			Ins. type:		

5.82

Additional primary volume required to move...

Contrary to what seems intuitive to calculate;
*at flow rates of; 0.5 to 2 GPM it takes 1.5 to 2.5 times the volume in the primary tubing to deliver “usably warm” (105 °F) water to the fixture. **WHY ?***

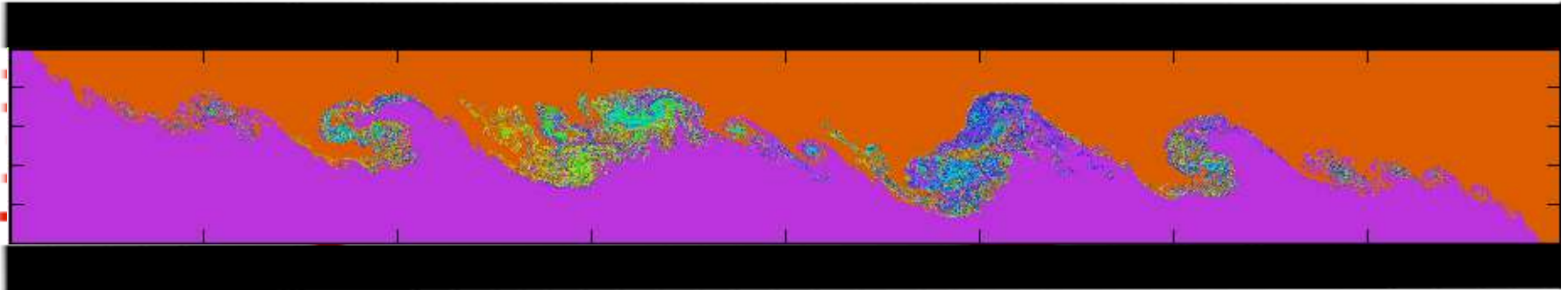
- 1- Piping “pick-up” = need to warm the surrounding pipe and fittings...
- 2- Mixing of the hot water with the cooler water already in the pipe...



Flows and Blending...

$\frac{3}{4}$ " Type L copper example:

- ✓ "Plug Flow" = > 5 GPM = > 3 feet per second
- ✓ "Long Bullet" = 1-3 GPM = > .6 to 2 feet per second
- ✓ "Stratification" (hot slides up to top of pipe) < 1 GPM = < .6 FPS



Plug

Laminar



DHW Re-Circ Worksheet

Check Boxes that apply

Water Heating Equipment Type: Tank Type: Tankless: Gas Fired: Electric: Indirect:

Piping Material:

Copper <input checked="" type="checkbox"/>	Type M <input checked="" type="checkbox"/>	Type L <input type="checkbox"/>	Type K <input type="checkbox"/>
PEX / PE-RT SDR 9		Galv. Steel Sch: 40	
PEX-AL-PEX		CPVC (CTS)	

Piping Scheme: (Please provide simple sketch of layout)

Trunk & Branch no Re-Circ: <input type="checkbox"/>	Home Run: <input type="checkbox"/>
Trunk & Branch w/ Re-Circ: <input checked="" type="checkbox"/>	Other: <input type="checkbox"/>
Full Sized (Intelligent) Loop: <input type="checkbox"/>	

Piping Calculations:

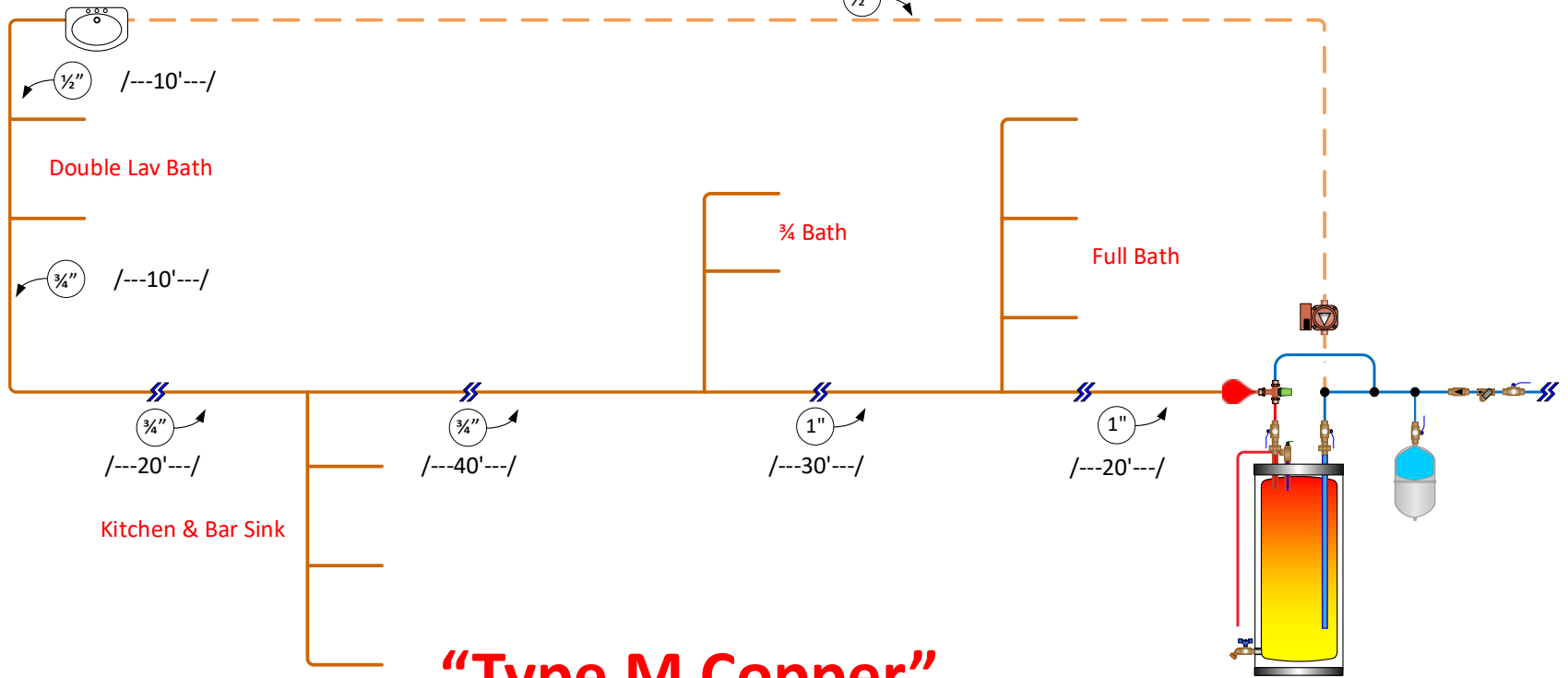
Size of Pipe	Total Lineal Footage of Runs	Volume Data		P.D. Data	
		Gallons per/Ft.	Total Gallons per Run	Pressure Drop per foot Ft/Hd.	Total Pressure Drop Ft/Hd.
3/8"					
1/2"	10	.0132	.132	.037	0.37
3/4"	70	.0269	1.883	.007	0.49
1"	50	.0454	2.27	.003	0.15
1-1/4"					
1-1/2"					
2"					
3"					
* (1/2)"	130	.0132	<Not used>	.037	4.81
Total Gallons / Primary:			4.28	Valve & Fitting Factor X	7.28
Misc: (GPM / Cv sq. = psi x 2.31 = Ft.Hd.) 1.6/1.8= .888 sq. =.789 X 2.31=				Mix Vlv or Misc	1.82
* This line has a Maximum Velocity Limitation of (1.6) GPM, deduct from primary				Total PD:	9.00'
Total gallons in primary X 2 (8.56) / by MVL (1.6) GPM = (5.3) minutes to flush primary hot lines.					
Additional Information Required:			Estimated Re-Circ pump size:	GPM: 1.6	Ft/Hd.: 9.00'
			Suggested Taco Re-Circ pump:	006e3	
Temperature of hot water supplied out to fixtures?		°F	Suggested Valve & Fitting Factor multipliers:		
Temperature of air around hot water & Re-Circ pipes?		°F	• Copper or outside fitting = X 1.25		
Insulation R-Value installed on hot water & Re-Circ piping?		R-v	• PEX with F1960 or F2080= X 1.50		
Or; Thickness and type of Insulation on hot & Re-Circ piping?		"	• PEX with F1807 = X 2.00		
			Ins. type:		

5.82

~5 minute trip to flush & fill Primary

Dedicated Return Line

/---130'---/



“Type M Copper”



DHW Re-Circ Worksheet

Check Boxes that apply

Water Heating Equipment Type: Tank Type: Tankless: Gas Fired: Electric: Indirect:

Piping Material:

Copper <input checked="" type="checkbox"/>	Type M <input checked="" type="checkbox"/>	Type L <input type="checkbox"/>	Type K <input type="checkbox"/>
PEX / PE-RT SDR 9		Galv. Steel Sch: 40	
PEX-AL-PEX		CPVC (CTS)	

Piping Scheme: (Please provide simple sketch of layout)

Trunk & Branch no Re-Circ: <input type="checkbox"/>	Home Run: <input type="checkbox"/>
Trunk & Branch w/ Re-Circ: <input checked="" type="checkbox"/>	Other: <input type="checkbox"/>
Full Sized (Intelligent) Loop: <input type="checkbox"/>	

Piping Calculations:

Size of Pipe	Total Lineal Footage of Runs	Volume Data		P.D. Data	
		Gallons per/Ft.	Total Gallons per Run	Pressure Drop per foot Ft/Hd.	Total Pressure Drop Ft/Hd.
3/8"					
1/2"	10	.0132	.132	.037	0.37
3/4"	70	.0269	1.883	.007	0.49
1"	50	.0454	2.27	.003	0.15
1-1/4"					
1-1/2"					
2"					
3"					
* (1/2)"	130	.0132	<Not used>	.037	4.81
Total Gallons / Primary:			4.28	Valve & Fitting Factor X	7.28
Misc: (GPM / Cv sq. = psi x 2.31 = Ft.Hd.)			1.6/1.8= .888 sq. =.789 X 2.31=	Mix Vlv or Misc	1.82
* This line has a Maximum Velocity Limitation of (1.6) GPM, deduct from primary				Total PD:	9.00'
Total gallons in primary X 2 (8.56) / by MVL (1.6) GPM = (5.3) minutes to flush primary hot lines.					

5.82

Estimated Re-Circ pump size:	GPM: 1.6	Ft/Hd.: 9.00'
Suggested Taco Re-Circ pump:	006e3	

Additional Information Required:	Suggested Valve & Fitting Factor multipliers:	
Temperature of hot water supplied out to fixtures?	140 °F	<ul style="list-style-type: none"> Copper or outside fitting = X 1.25 PEX with F1960 or F2080= X 1.50 PEX with F1807 = X 2.00
Temperature of air around hot water & Re-Circ pipes?	68 °F	
Insulation R-Value installed on hot water & Re-Circ piping?	R-v	
Or; Thickness and type of Insulation on hot & Re-Circ piping?	"	

DHW Re-Circ Line Loss Calculation Worksheet

Items we must know:

- ✓ Fluid type? Water
- ✓ Fluid temperature? 140 °F
- ✓ Fluid flow rate? 1.6 GPM
- ✓ Pipe/Tube type & size? Type M, 1", 3/4", 1/2"
- ✓ Pipe/Tube Length (Ft.)? 1"=50', 3/4"=70', 1/2"=10'
- ✓ Average temp around Pipes (°F)? 68°F
- ✓ Pipe insulation R value or, 1/2" Armaflex or Rubatex
type and thickness?



$$\left. \begin{array}{l}
 \frac{1}{2}' = 85 \text{ btu/hr} \\
 \frac{3}{4}'' = 735 \text{ btu/hr} \\
 1'' = 630 \text{ btu/hr}
 \end{array} \right\} = 1,450 \text{ btu/hr}$$

$$\frac{1,450}{10 \Delta T \times k 490} = 0.30 \text{ gpm}$$



Thank You...