



GeoDesignPro

Motivation

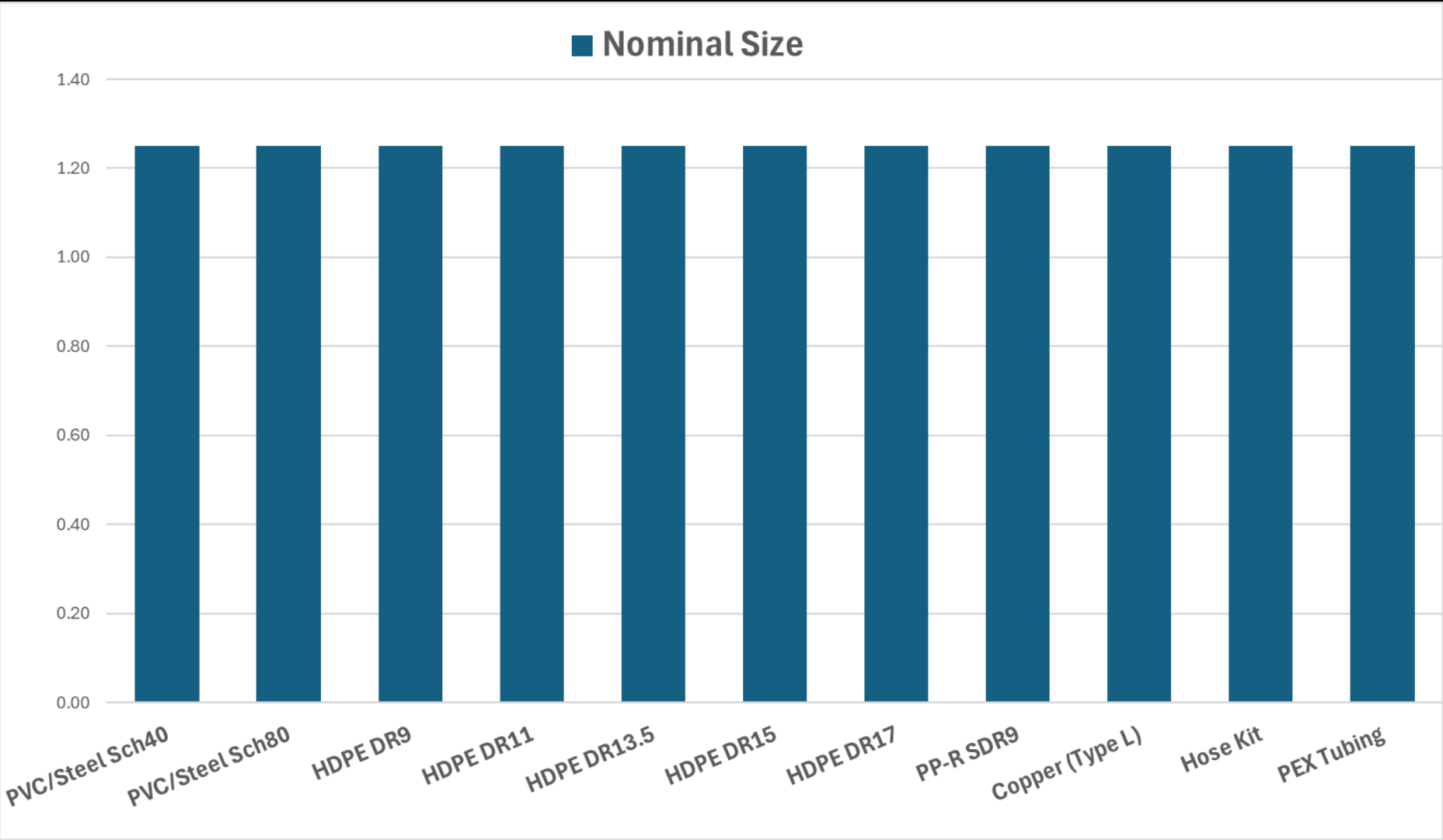
"There's never enough time to do it right, but there's always enough time to fix it"

Delusion of Precision

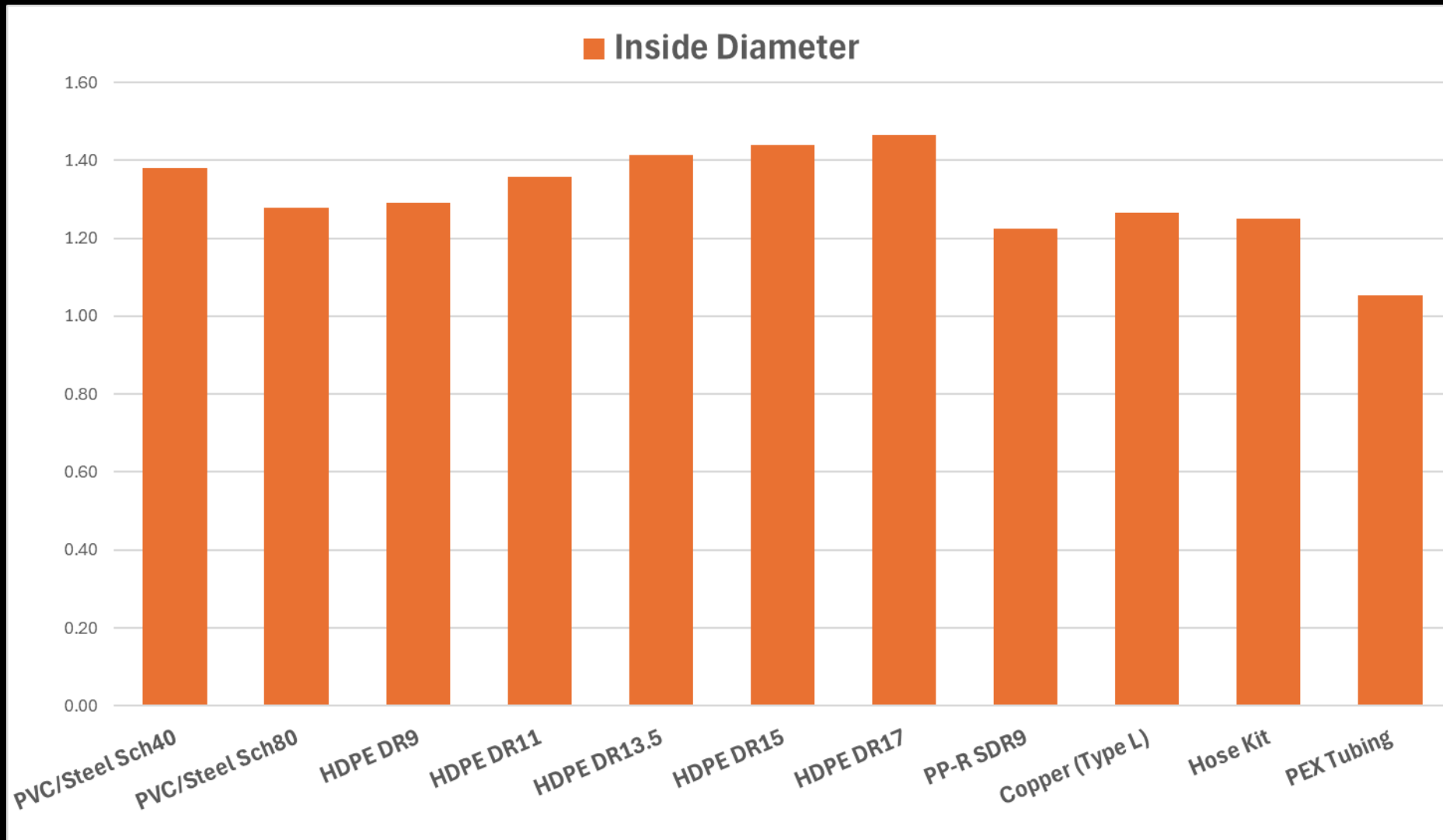
- We calculate loads to the nearest BTU/hr
- We calculate loop lengths to the nearest foot
- We express both as if they are extremely accurate
- We calculate pressure drop and select pumps by wetting our finger and holding up in the air



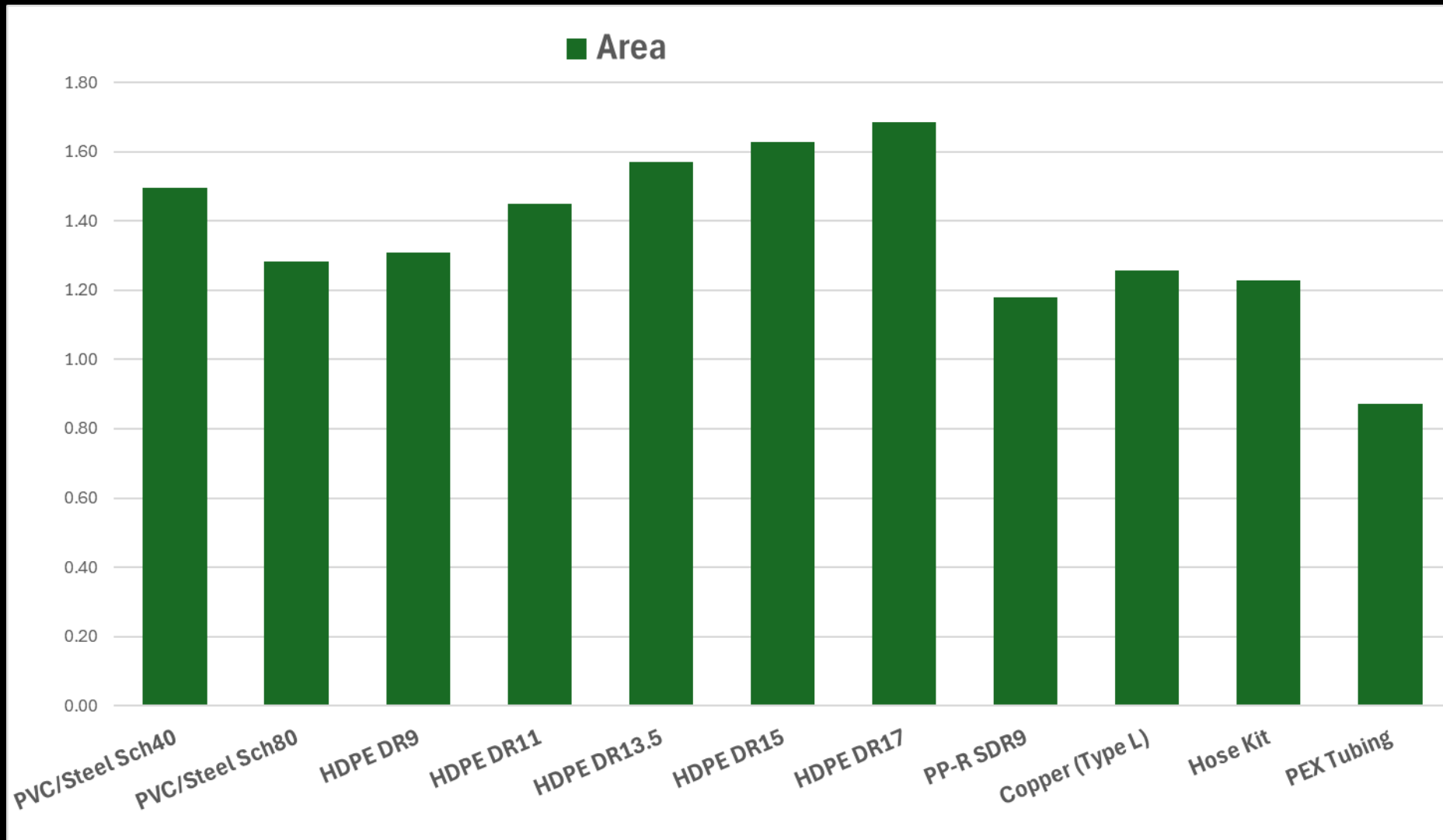
When Does 1-1/4" \neq 1-1/4"?



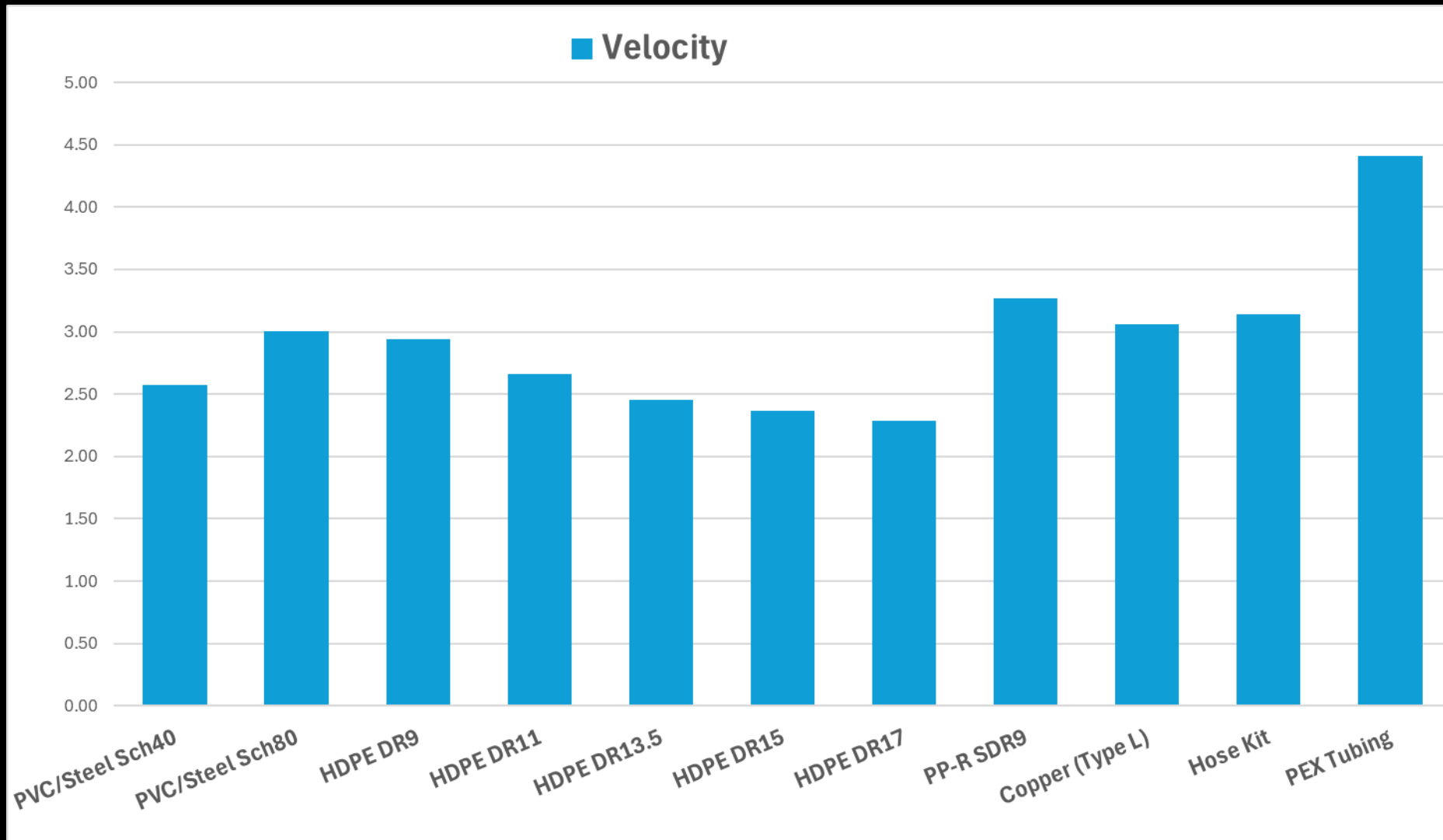
When Does 1-1/4" \neq 1-1/4"?



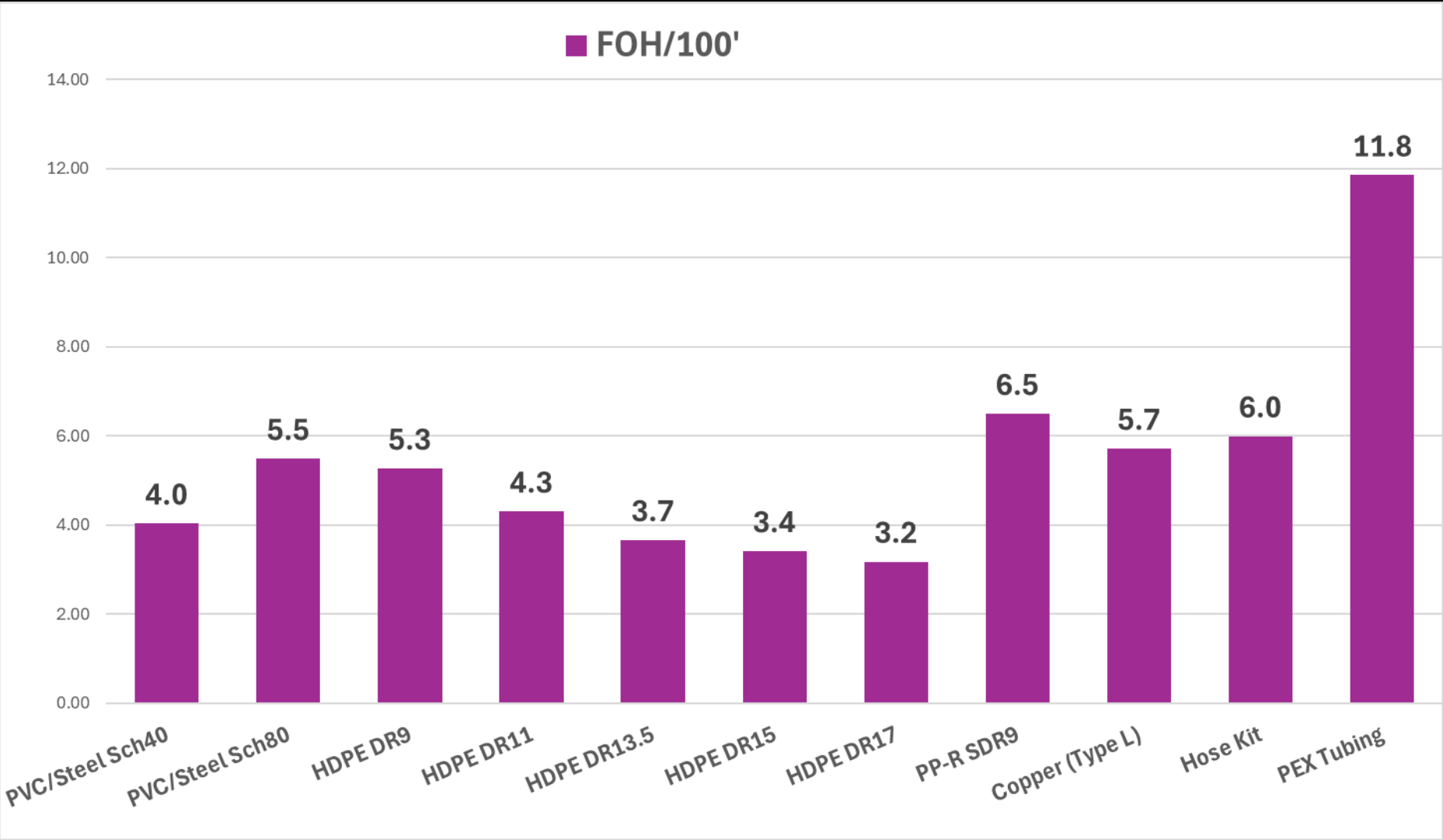
When Does 1-1/4" \neq 1-1/4"?



When Does 1-1/4" \neq 1-1/4"?



When Does 1-1/4" \neq 1-1/4"?



Mission

- Accurate
- Comprehensive
- Fast

Accurate

- Darcy-Weisbach equation
 - The Gold Standard

$$\Delta P = \rho g h_f = f \cdot \frac{L}{D} \cdot \frac{\rho v^2}{2}$$

Accurate

- Extensive Pipe Material Library
 - (13) Unique Dimensional Materials
 - (16) Sizes from $\frac{3}{4}$ " to 24"
 - Each with their unique Inside Diameter and Roughness Factor
 - Essential for both Pressure Drop and Internal Volume Calculations
 - Fittings are incorporated with equivalent length in feet for pressure drop, but not volume

Accurate

- Antifreeze Impact
 - Calculated based on actual fluid properties at the specified concentration and minimum operating temperature
 - Accurately converts specified freeze point to required volume expressed in gallons
- Pipe Size Selection
 - Algorithm suggests the proper sizing based on velocity criteria that can be overridden by user with immediate feedback of resulting velocity and pressure drop

Comprehensive


- Pressure Drop at Diversified Flow Rate
- Internal Volume & Antifreeze Amount
- Diameter Size of Reverse-Return Manifold
- Pipe & Fittings Required for R-R Manifold
- Create & Export CAD Drawing of R-R Manifold
- Balance Loop Field Flow (w/o Balance Valves)
- Flush and Purge Flow and Head Requirements
- Optimize Valved Manifold Design
- Select Flow Center from Many Types
- Select & Fully Configure Heat Pumps
- Create Schedule of Heat Pumps
- Export Schedule to Spreadsheet
- Generate Major Item Bill of Materials
- Generate & Export AI Generated Design Report
- Save Hours (possibly Days) of Design Time




Design Geothermal Systems 10x Faster

Professional hydraulic design software optimized for geothermal applications. Calculate pressure drops, internal volume, size heat pumps, and generate reports in minutes

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Accurate Calculations
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Project

Project Information

Project Name

Client Name

Address

Contact Name

City

State

Zip Code

Phone Number

Email

Min EWT (°F)

Max EWT (°F)

Flow (gpm/Ton)

Diversity (%)

Antifreeze Type

Freeze Point (°F)

Default Manufacturer

Default Series

Fluid Properties

[Reset to Calculated Values](#)

Concentration (%)

Density (lb/ft³)

Viscosity (ft²/s)

Heat Pumps available from **Phoenix ENERGY SUPPLY**

RESIDENTIAL



COMMERCIAL



Heat Pumps available elsewhere



LIVE RESULTS

FLOW (GPM) **0.0**

EXT. HEAD REQ. **0.0**

LOOP DROP (FT) **0.0**

INT. DROP (FT) **0.0**

ZONE	DIST	CMN
0.0	0.0	0.0

Worst:

HEATING (BTU) **0**

COOLING (TON) **0.0**

LOOP (FT/TON) **0**

LOOP VOL (GAL) **0**

INT. VOL (GAL) **0**

EST. COST **\$0**





jmanning's Workspace / No project open

- New
- Open
- Save
- Book Tech Support
- Email Tech Support

Auto-saved 10:53 AM

Docs

Order Materials

John D. Manning, PE

LOCAL

- Project
- Zones**
- Loop Field
- Distribution
- Flow Center
- Schedule
- BOM
- Report
- Contact

Zone Specification & Hydraulics

Loop Field Analysis ONLY

Enable Template Method

Import Zones

Template

+ Manage Custom

+ Add Zone

TAG	ZONE NAME	HEAT	COOL	MFG	SERIES	MODEL	GPM	PIPE MAT	DIA	LEN(FT)	ELBOWS	CV VALUES	EQ. CV	PRESS. DROP BREAKDOWN	ACTIONS
No zones defined.															

NOTE: The sizing selection is strictly based on the AHRI Ground Loop Rating (32 F EWT for Heating & 77 F EWT for Cooling). Verify selection for your application.

TOTAL HEATING LOAD 0.0 kBtu	TOTAL INST. CAP. (HEAT) 0.0 kBtu @ 30°F EWT	PEAK BLOCK LOAD <input type="text" value="Enter Load"/> kBtu	ESTIMATED DIVERSITY - %
--	---	--	-----------------------------------

TOTAL COOLING LOAD 0.00 Tons (0.0 kBtu)	TOTAL INST. CAP. (COOL) 0.00 Tons @ 90°F EWT	PEAK BLOCK LOAD <input type="text" value="Enter Load"/> Tons	ESTIMATED DIVERSITY - %
---	--	--	-----------------------------------

LIVE RESULTS

FLOW (GPM)
0.0

EXT. HEAD REQ.
0.0

LOOP DROP (FT)
0.0

INT. DROP (FT)
0.0

ZONE	DIST	CMN
0.0	0.0	0.0

Worst:

HEATING (BTU)
0

COOLING (TON)
0.0

LOOP (FT/TON)
0

LOOP VOL (GAL)
0

INT. VOL (GAL)
0

EST. COST
\$0



Zones

Zone Specification & Hydraulics

Loop Field Analysis ONLY Enable Template Method

Import Zones Template Manage Custom Add Zone

TAG	ZONE NAME	HEAT	COOL	MFG	SERIES	MODEL	GPM	PIPE MAT	DIA	LEN(FT)	ELBOWS	CV VALUES	EQ. CV	PRESS. DROP BREAKDOWN	ACTIONS
HP-1	Main Living Area	38	24	GeoStar	R-Sycamore (R-4)	SYC048-B (4 T)	12.0	HDPE_DR11	1.25"	20	4	19	18.7	16.1 ft	[Icons]
HP-2	Primary Suite													6.0 GPM	[Icons]
HP-3	Kids Bedrooms													9.0 GPM	[Icons]
HP-4	Guest Suite													4.5 GPM	[Icons]
HP-5	Garage & DHW													20.0 GPM	[Icons]

Template + Manage Custom + Add Zone

ES	EQ. CV	PRESS. DROP BREAKDOWN	ACTIONS
	18.7	16.1 ft 12.0 GPM	[Icons]
	18.7	8.8 ft 6.0 GPM	[Icons]
	18.7	13.7 ft 9.0 GPM	[Icons]
	9.8	14.7 ft 4.5 GPM	[Icons]
	29.5	38.0 ft 20.0 GPM	[Icons]

TOTAL HEATING LOAD
151.0 kBtu

ESTIMATED DIVERSITY
34.9%

LIVE RESULTS

FLOW (GPM)
51.5

TOT. DROP (FT)
38.2

LOOP DROP (FT)
0.2

INT. DROP (FT)
38.0

ZONE	DIST	CMN
38.0	0.0	0.0

Worst:

HEATING (BTU)
151,000

COOLING (TON)
6.3

LOOP (FT/TON)
0

LOOP VOL (GAL)
0

INT. VOL (GAL)
25

EST. COST
\$0





Zone Specification & Hydraulics

Loop Field Analysis ONLY

Enable Template Method

Import Zones

Template

Manage Custom

Loop Field Analysis ONLY Mode Active

Data entry for Heat Pumps and Interior Piping is bypassed. Please provide the manual system design flow rate and interior volume as % of loop-field volume. Typical 5-20%.

Design Flow Rate (gpm) 80

Design Int. Drop (FOH) 25

Est. Int. Volume (%) 10

Typical: 5-20%

NOTE: The sizing selection is strictly based on the AHRI Ground Loop Rating (32 F EWT for Heating & 77 F EWT for Cooling). Verify selection for your application.

Summary cards for Heating: TOTAL HEATING LOAD 0.0 kBtu, TOTAL INST. CAP. (HEAT) 0.0 kBtu @ 30°F EWT, PEAK BLOCK LOAD 112 kBtu, ESTIMATED DIVERSITY -%

Summary cards for Cooling: TOTAL COOLING LOAD 0.00 Tons (0.0 kBtu), TOTAL INST. CAP. (COOL) 0.00 Tons @ 90°F EWT, PEAK BLOCK LOAD 5 Tons, ESTIMATED DIVERSITY -%

LIVE RESULTS sidebar: FLOW (GPM) 80.0, TOT. DROP (FT) 25.1, LOOP DROP (FT) 0.1, INT. DROP (FT) 25.0, HEATING (BTU) 0, COOLING (TON) 0.0, LOOP (FT/TON) 0, LOOP VOL (GAL) 1, INT. VOL (GAL) 0, EST. COST \$0



Loop Field

Site & Geological Parameters

Please enter for reference the assumed or measured bore hole characteristics.

Formation Cond. BTU/(hr-ft ² -F)	Formation Diff. ft ² /day	Deep Earth Temp °F	Bore Diameter in	Grout Cond. BTU/(hr-ft ² -F)
1.4	0.9	55	5	0.88

Loop Field Pipe Sizing Mode

All runout pipes are continuously optimized based on system flow.

Auto Size Manual Size

Total System Flow: **80.0 GPM** | Total Bore Footage: **2,250 ft** | Calc. Flow / 100 ft: **3.56 GPM** | Loop Pressure Drop: **36.7 ft. hd.** | Loop Volume: **269.7 gal**

Group 1 | Group 1 | HORIZONTAL

NO. BORES	LOOP DIA / DR	AVG DEPTH	MANIFOLD TYPE	TAP SPACING	TOTAL LEN (FT)	SEC A DIA/DR	SEC B LEN (FT)	SEC B DIA/DR	FLOW	VELOCITY	VOL*			
5	0.75" HDPE	DR11	150	Reverse Return	15	100	2"	DR11	0	2"	DR11	26.7 gpm	2.89 ft/s	15.4 gal

DROP*
2.8 ft

* Runout Vol and Drop results display 1-way value. Automatically doubled in system totals to account for return.

SUPPLY HEADER HYDRAULICS

Target Velocity: ≥ 1.5 ft/sec

SEG	FLOW (GPM)	LEN (FT)	DIA (IN)	TYPE / DR	VEL (FT/S)	HEAD (FT)
1	21.3	15	2"	DR11	2.31	0.29
2	16.0	15	2"	DR11	1.73	0.18
3	10.7	15	1.5"	DR11	1.80	
4	5.3	15	0.75"	DR11	2.95	

Render the Reverse-Return manifold drawing; export as .dxf.

Generate CAD Manifold

LIVE RESULTS

FLOW (GPM) **80.0**

TOT. DROP (FT) **62.7**

LOOP DROP (FT) **37.7**

INT. DROP (FT) **25.0**

ZONE DIST CMN
0.0 0.0 0.0

Worst:

HEATING (BTU) **0**

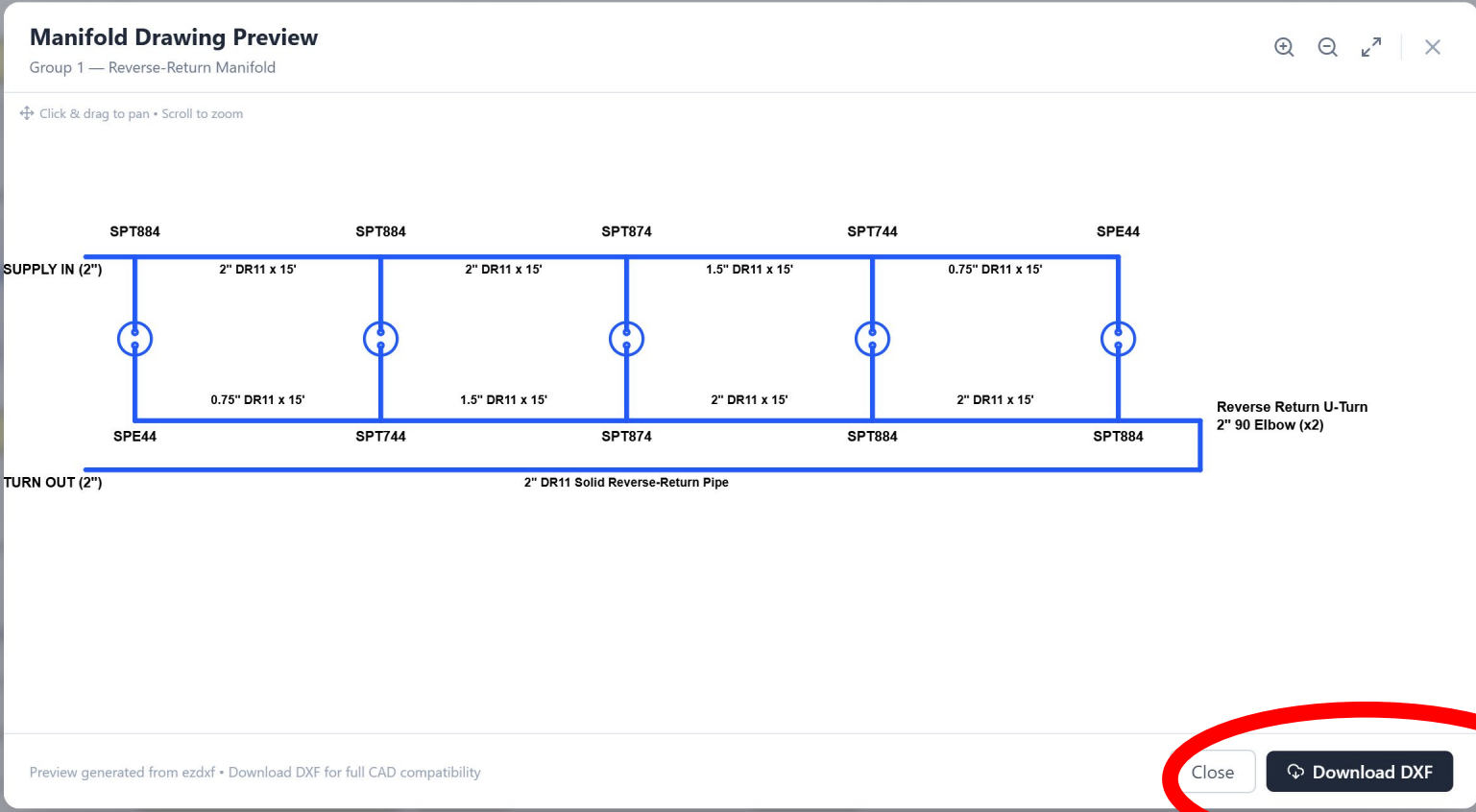
COOLING (TON) **0.0**

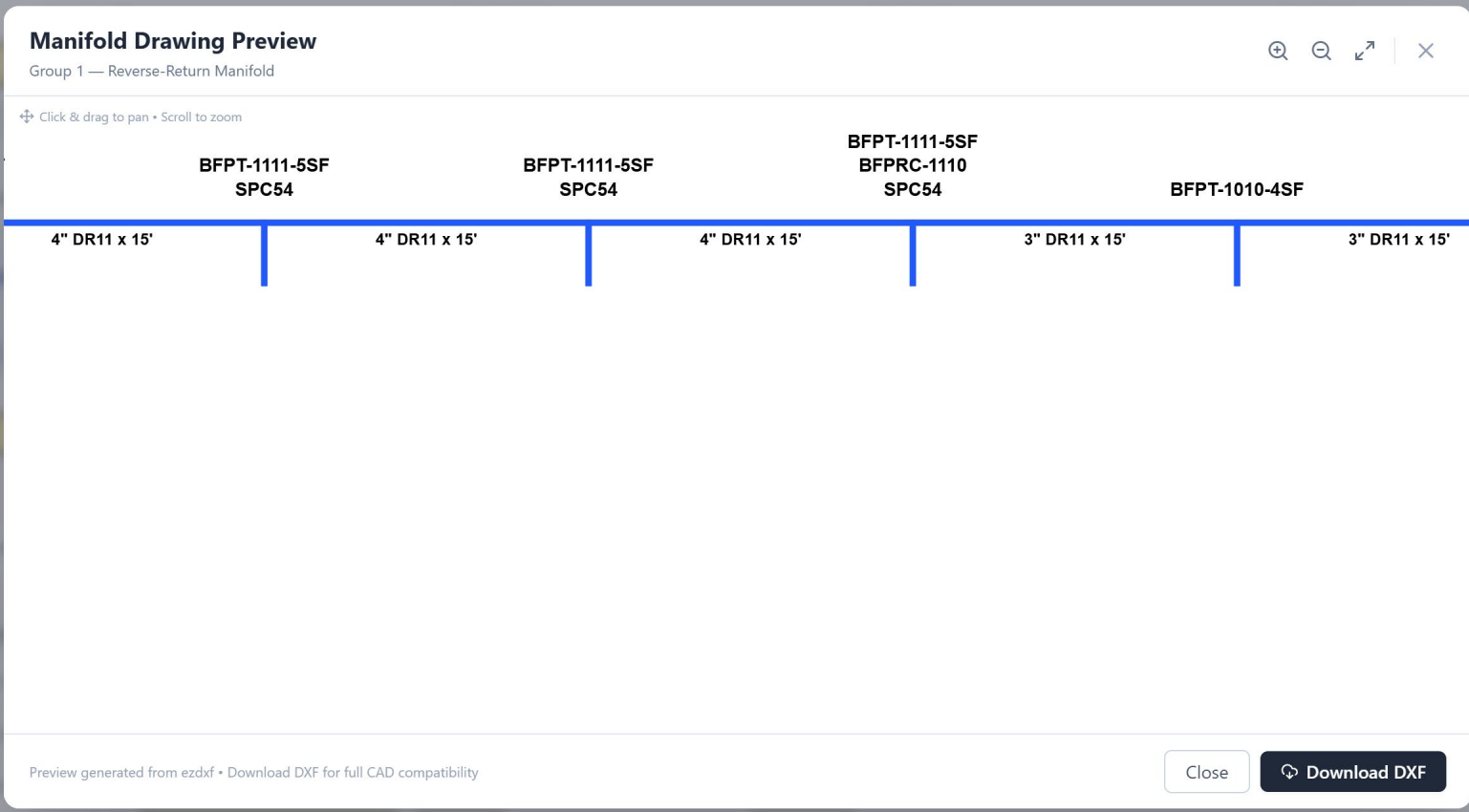
LOOP (FT/TON) **0**

LOOP VOL (GAL) **270**

INT. VOL (GAL) **27**

T. COST **\$5,418**





Loop Field

Site & Geological Parameters

Please enter for reference the assumed or measured bore hole characteristics.

Formation Cond. BTU/(hr-ft ² -F)	Formation Diff. ft ³ /day	Deep Earth Temp °F	Bore Diameter in	Grout Cond. BTU/(hr-ft ² -F)
1.4	0.9	55	5	0.88

Loop Field Pipe Sizing Mode

All runout pipes are continuously optimized based on system flow.

Auto Size Manual Size

Total System Flow: **80.0 GPM** Total Bore Footage: **4,050 ft** Calc. Flow / 100 ft: **1.98 GPM** Loop Pressure Drop: **21.4 ft. hd.** Loop Volume: **419.2 gal**

Group 1

Total System Flow: **80.0 GPM** Total Bore Footage: **4,050 ft** Calc. Flow / 100 ft: **1.98 GPM** Loop Pressure Drop: **21.4 ft. hd.** Loop Volume: **419.2 gal**

*Runout Vol and Drop results display 1-way value. Automatically doubled in system totals to account for return.

SUPPLY HEADER HYDRAULICS

Target Velocity: ≥ 1.5 ft/sec

SEG	FLOW (GPM)	LEN (FT)	DIA (IN)	TYPE / DR	VEL (FT/S)	HEAD (FT)
1	24.5	15	2" ↓	DR11 ↓	2.65	0.28
2	21.0	15	2" ↓	DR11 ↓	2.27	0.21
3	17.5	15	2" ↓	DR11 ↓	1.89	0.15
4	14.0	15	1.5" ↓	DR11 ↓	2.36	0.30
5	10.5	15	1.5" ↓	DR11 ↓	1.77	0.18
6	7.0	15	1" ↓	DR11 ↓	2.46	0.52
7	3.5	15	0.75" ↓	DR11 ↓	1.93	0.46

LIVE RESULTS

FLOW (GPM)
80.0

TOT. DROP (FT)
47.1

LOOP DROP (FT)
22.1

INT. DROP (FT)
25.0

ZONE DIST CMN
0.0 0.0 0.0

Worst:
HEATING (BTU)
0

COOLING (TON)
0.0

LOOP (FT/TON)
0

LOOP VOL (GAL)
419

INT. VOL (GAL)
42

EST. COST
\$8,848

Loop Field

Loop Field Pipe Sizing Mode

All runout pipes are continuously optimized based on system flow.

Auto Size

Manual Size

Manning, PE

LOCAL

Project Zones **Loop Field** Distribution Flow Center Schedule BOM Report Contact

5	127	15	2"	DR11	137	0.09
6						0.17
7						0.11
8						0.30
9						0.26

By adjusting runout pipe diameters a balance of +/- 3% was obtained while also reducing pressure drop to 15.1 FOH from 21.4

Generate CAD Manifold

Batch Duplicate

Balance
0' of 1"
" & 72' of 1.5"

Group	Bores
1	8
2	9
3	10

1.5" Ball	Drop: 0.4 ft
Cv: 206.96	

LIVE RESULTS

FLOW (GPM) **80.0**

TOT. DROP (FT) **47.1**

LOOP DROP (FT) **22.1**

INT. DROP (FT) **25.0**

ZONE DIST CMN
0.0 0.0 0.0

Worst:

HEATING (BTU) **0**

COOLING (TON) **0.0**

LOOP (FT/TON) **0**

LOOP VOL (GAL) **419**

INT. VOL (GAL) **42**

EST. COST **\$8,848**

Purging Requirements (Worst Case Group)			
TARGET VELOCITY	WORST CASE	REQUIRED FLOW	REQUIRED HEAD
2.0 ft/s (Pure Water)	Group 1 (Copy 2)	39.4 GPM	26.5' / 11.5 psi

Distribution



GeoDesignPro

jmanning's Workspace / NY-GEO

- New
- Open
- Save
- Book Tech Support
- Email Tech Support

Auto-saved 01:24 PM

Docs

Order Materials

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LOCAL

- Project
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- Distribution**
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- Schedule
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- Report
- Contact

NO. CIRCUITS: 1
MIN VEL (FT/S): 1.5
MAX VEL (FT/S): 7
SYSTEM TYPE: **via Distr Circuits** Homerun
DEFAULT PIPE MAT.: HDPE_DR11

MECHANICAL ROOM AND COMMON PIPING

MATERIAL	SIZE	LEN (FT)	ELBOWS	BYPASS (GPM)	CV VALUES (COMMA SEPARATED)
HDPE_DR11	3"	0	0	0	e.g. 15.5, 12, 100

MECHANICAL ROOM AND COMMON PIPING

V: 1.55 ft/s H: 4.9 ft

MATERIAL	SIZE	LEN (FT)	ELBOWS	BYPASS (GPM)	CV VALUES (COMMA SEPARATED)
HDPE_DR11	4"	20	6	0	40,120,120

36.2

	Rm #	MATERIAL	SIZE	LEN (FT)	ELBOWS	LEN (FT)	ELBOWS	LEN (FT)	ELBOWS
HP-2 Primary Suite (SYC024-B)		HDPE_DR11	3"	20	3"	1.97	0.1		
HP-3 Kids Bedrooms (SYC036-B)		HDPE_DR11	3"	20	3"	1.67	0.1		
HP-4 Guest Suite (AST018-B)		HDPE_DR11	2"	20	2"	2.65	0.4		
HP-5 Garage & DHW (G5WZ060)		HDPE_DR11	2"	20	2"	2.16	0.3		

* Zones ordered from First Fed (largest upstream pipe) to Last Fed.

LIVE RESULTS

- FLOW (GPM): 51.5
- TOT. DROP (FT): 42.3
- LOOP DROP (FT): 11.6
- INT. DROP (FT): 30.7
- HEATING (BTU): 151,000
- COOLING (TON): NaN
- LOOP (FT/TON): 322
- LOOP VOL (GAL): 483
- INT. VOL (GAL): 86
- EST. COST: \$9,685



Expansion Tank Sizing

Seasonal Anchors

System Volume:	580.4 gal
Summer Target (Max+5°):	95.0 °F
Winter Boundary (Min-5°):	25.0 °F

System Pressures (psi)

Minimum Allowable Pressure

Maximum Allowable Pressure 16 psi



STARTUP PRESSURE

TARGET MIDPOINT STARTUP PRESSURE
19.9 PSI

When ground loop temperature is near 60.0°F, do NOT set startup pressure to the 15 PSI minimum. If loop is hotter, lower startup pressure accordingly to prevent winter relief valve blowoff.

OPTIMIZED TANK SIZE
24.6 GAL
EXPANSION TANK SIZING

Flow Center Selection

FILTER FLOW CENTER TYPES

Pressurized (1)

Non-pressurized (1)

NP Dual Circuit
Unavailable (Requires 2 HP)

Pressurized (multi)

LIVE RESULTS

FLOW (GPM)	51.5	
TOT. DROP (FT)	47.1	
LOOP DROP (FT)	11.6	
INT. DROP (FT)	35.5	
ZONE	DIST	CMN
28.8	1.9	4.9
Worst:		
HEATING (BTU)	151,000	
COOLING (TON)	NaN	
LOOP (FT/TON)	322	
LOOP VOL (GAL)	483	
INT. VOL (GAL)	97	
EST. COST	\$9,901	



Equipment Schedule

Export to Excel

TAG	ZONE NAME	HEAT (KBTU)	COOL (KBTU)	MANUFACTURER	SERIES	MODEL	MODEL NUMBER	FLOW (GPM)	HEAD (FT)	MCA	MOP	RATED VOLTS	MIN/MAX V	COMP MRC	COMP MOC	COMP MCC	COMP RLA	COMP LRA	DRIVE RLA	DRIVE FUSE	PUMP FLA	LOOP FLA	BLOWER FLA	TOT. FLA
HP-1	Main Living Area	38	24	GeoStar	R-Sycamore (R-454B)	SYC048-B	G7AV048BV1*12CTL2D10	12.0	12.1	47.8	50	208-230/60/1	187/253	28	22	-	-	-	28	35	0.4	5.4	7	40.
	IntelliZone2 Config	Stats: 4 Total		Dampers: 2x 16x8" rectangular (533 CFM), 2x 20x8" rectangular (667 CFM)																				
HP-2	Primary Suite	22	12	GeoStar	R-Sycamore (R-454B)	SYC024-B	G7AV024BV1*02CTR2D10	6.0	6.9	37.3	40	208-230/60/1	187/253	22	17	-	-	-	22	30	0.4	5.4	4	31.
HP-3	Kids Bedrooms	30	24	GeoStar	R-Sycamore (R-454B)	SYC036-B	G7AV036BV1*02CTL2D10	9.0	10.1	37.3	40	208-230/60/1	187/253	22	17	-	-	-	22	30	0.4	5.4	4	31.
HP-4	Guest Suite	14	15	GeoStar	R-Aston W/A (R-454B)	AST018-B	G5AV018BD1*02CTL2D00	4.5	10.8	21.8	35	208-230/60/1	187/253	-	-	15	9.6	52	-	-	0.4	5.4	4	19.
HP-5	Garage & DHW	47	NaN	GeoStar	R-Aston Optiheat W/W (R-454B)	G5WZ060	G5WZ060BE1*0RCFFFD10	20.0	28.8	39.5	60	208-230/60/1	198/254	-	-	40.3	25.8	178	-	-	-	5.4	0	33

LIVE RESULTS

FLOW (GPM) **51.5**

TOT. DROP (FT) **47.1**

LOOP DROP (FT) **11.6**

INT. DROP (FT) **35.5**

ZONE 28.8 DIST 1.9 CMN 4.9

Worst:

HEATING (BTU) **151,000**

COOLING (TON) **NaN**

LOOP (FT/TON) **322**

LOOP VOL (GAL) **483**

INT. VOL (GAL) **97**

EST. COST **\$123,397**

Design Report

Generate AI Narrative Export PDF Export Excel

Smith Residence

Geothermal System Design Report
Generated 2026-05-09

1 Executive Summary

The geothermal design for the Smith Residence, located at 1 Geothermal Lane, Clean Energy, NY 14567, addresses a total heating load of 151 kBtuh and a total cooling load of 76 kBtuh. The system is designed to extract 113.25 kBtuh of heat and reject 95 kBtuh of heat, utilizing GeoStar R-Sycamore (R-454B) heat pumps across five zones.

The ground heat exchanger consists of 27 vertical bores, totaling 4050 feet, providing a design ratio of 639 feet per ton. This bore field is engineered to maintain entering water temperatures within the specified range of 30°F to 90°F. The hydraulic system is designed for a total flow rate of 51.5 GPM and a total system head of 47.1 feet, managed by a GX8AHD-22 flow center.

While the system components are adequately sized to meet the thermal demands, a caution regarding the flow center's capacity has been identified, as the total system head of 47.1 feet is within 10% of its rated capacity of 47.6 feet. Despite this, the overall design is viable for implementation.

2 Project Information

Table with 4 columns: Field Name, Value, Field Name, Value. Includes Project Name (Smith Residence), Client (Robert Smith), Designer, Manufacturer / Series (GeoStar — R-Sycamore (R-454B)), Antifreeze (Methanol), Flow Rate (3 GPM/ton), Location, Client Contact, Design Date (2026-05-09), EWT Range (30°F – 90°F), Diversity Factor (1.00).

3 Thermal Load Analysis

LIVE RESULTS sidebar with metrics: FLOW (GPM) 51.5, TOT. DROP (FT) 47.1, LOOP DROP (FT) 11.6, INT. DROP (FT) 35.5, HEATING (BTU) 151,000, COOLING (TON) 6.3, LOOP (FT/TON) 322, LOOP VOL (GAL) 483, INT. VOL (GAL) 97, EST. COST \$133,691



Questions

