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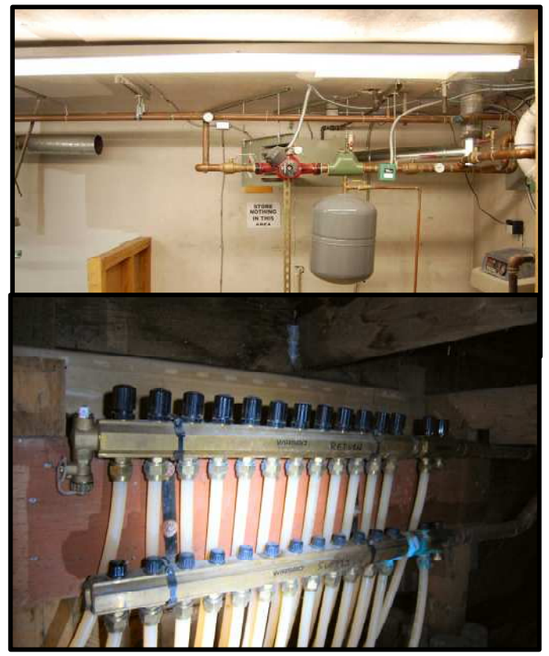
REVERSE ENGINEERING & REDESIGN OF EXISTING UNDERSIZED MALFUNCTION SNOW MELT SYSTEM

AFTER

AFTER
NOVEMBER 23, 2015



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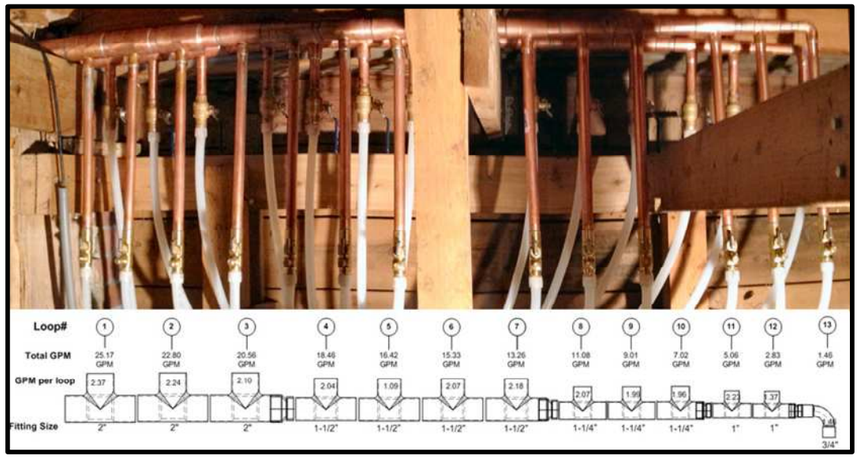

AFTER

AFTER

PROJECT: Analysis of Existing Snow Melt System
OWNER: Roger Kimura
SYSTEM: Ultra | Snow Melt System

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Date: 3/20/14
Job# Rog.3.20.14
Conts: Snow Melt

Category: COVER
Sheet:

REVERSE ENGINEERING OF EXISTING SNOW MELT SYSTEM

UPONOR (Wirsbo) Snow and Ice Design Analysis Manual used as source of calculations

Project Name: Roger Kimura Snow Melt System

Existing

SUMMARY 1-½" SUPPLY AND RETURN MAINS are UNDERSIZED
24.28 gpm are required to supply the loops. The Mains are rated at 22gpm which are undersized for this application. Source B&G System Syzer Calculator.

		Loop 1	Loop 2	Loop 3	Loop 4	Loop 5	Loop 6	Loop 7	Loop 8	Loop 9	Loop 10	Loop 11	Loop 12	Loop 13
A	Design temperature (°F)	5F												
B	Wind speed (mph)	10												
C	Differential temperature (°F)	25F												
D	Surface temperature (°F)	38F												
E	BTU/h/ft²	132												
F	Supply fluid temperature (°F)	140F												
G	Tubing o.c. distance	9"+												
H	Area to be heated (ft²)	1900 ⊕	38ft x 50ft											
I	Type of tubing	hePex												
J	Tubing size	5/8"												
K	Active loop length	260'	246'	231'	224'	210'	228'	240'	228'	219'	215'	245'	150'	160'
L	Leader loop length	10'												
M	Total loop length	270	256	241	234	220	238	250	238	229	225	255	160	170
N	Percentage of glycol (%)	40%												
O	Flow per foot	0.0085												
P	Flow per loop (gpm)	2.21	2.09	1.96	1.90	1.79	1.94	2.04	1.94	1.86	1.83	2.08	1.28	1.36
Q	Head pressure drop/ft (ft of hd)	0.08095												
R	Head pressure drop/loop (ft of hd)	21.86	20.72	19.51	18.94	17.81	19.27	20.24	19.27	18.54	18.21	20.64	12.95	13.76
S	Loop balancing turns													

Page 65&66 System Performance & Flow Charts

132 BTU/h/ft is based on the existing boiler size & placement of loops set at a distance of 9"+ center to center

Manifold exceeds loops per manufacturer of 8 only versus existing 13 loops

Manifold Totals

T	Supply fluid temp. (°F)	140F
U	Manifold flow (gpm)	24.28
V	Highest pressure head (ft)	21.86

Do not exceed 8 loops per manifold when using the 1 1/4" brass manifold.

A Select the outdoor design temperature from **Appendix C**.
B Select the wind speed in mph from **Appendix C**.
C Enter the differential temperature (25°F).
D Select the desired surface temperature from **Appendix C**.
E Enter the BTU/h/ft² based on the climatic conditions and the surface temperature. Refer to **Appendix C**.
F Enter the supply fluid temperature from **Appendix C** based on the climatic conditions and value in row **G**.
G Enter the tubing on-center (o.c.) distance.
H Enter the square footage of area to be heated by this loop.
I Select the type of tubing to be used.
J Select the size of tubing to be used.
K Multiply the value in row **H** with the appropriate o.c. multiplier (6" = 2.0; 9" = 1.33; 12" = 1.0)
L Enter the distance from the slab area to the manifold x 2 (supply and return).
M Add rows **K** and **L** together.
N Enter the percentage of glycol/water solution to be used.
O Using the information in rows **E**, **G** and **N**, go to **Appendix C** and select the flow per foot.
P Multiply the value in row **K** by the value in row **O**.
Q Use the information in rows **F**, **I**, **J**, **N** and **P** with the appropriate Appendix (either **D** or **E**) to obtain the head pressure drop per foot.
R Multiply row **M** by the value in row **Q**.
S These cells are calculated after the design is completed. Use the balancing information for the respective manifold used as shown in **Chapter 3**.
T Enter the highest value from row **F**.
U Enter the total of all values from row **P**.
V Enter the highest value from row **R**.

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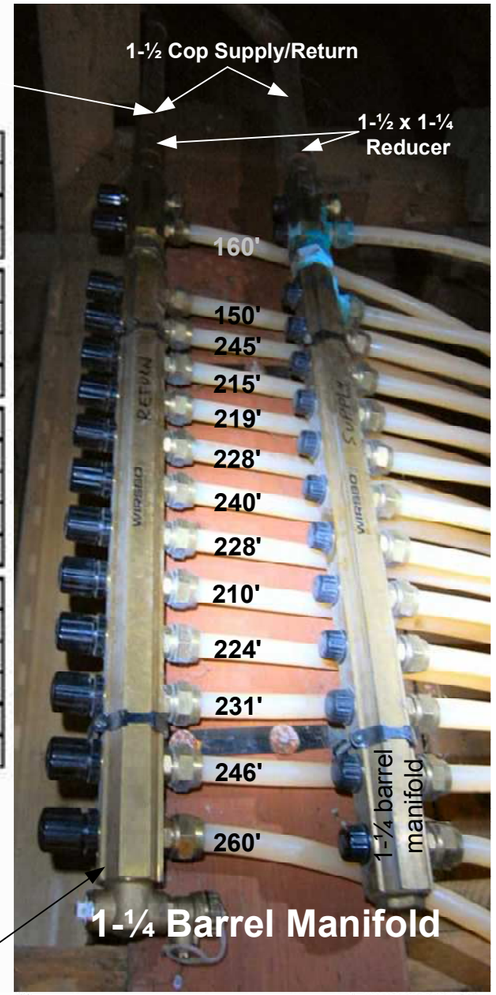
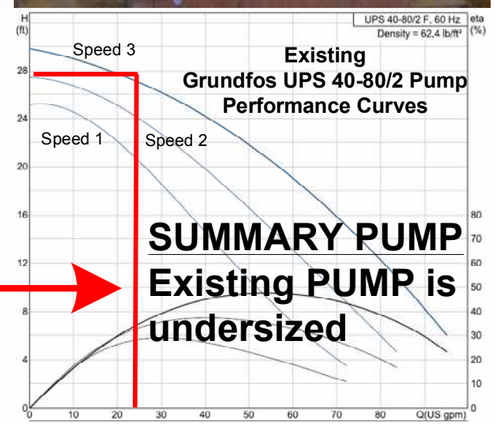
Gallons in Loops
1.34 gal per 100'
2865/100=28.56x1.34=
38.27 total gallons



SUMMARY MANIFOLD UNDERSIZED
Manifold exceeds loops per manufacturer of 8 only versus existing 13 loops

Maximum flow rate of 1-¼" Truflow Classic Manifold installed is 21.0 gpm
Which exceeds the total flow (24.28 gpm) of existing loops

(Source Uponor Submittal dated Sept 2012 part # A2611200 12 LOOP & A2610200 2 loop)



SUMMARY PUMP
Existing PUMP is undersized

Performance curve chart for existing pump Head: 21.86+5.4= 27.86 – GPM 24.28

1-½ Cop Supply/Return Mains
Calculating for Head Pressure
90'x50% fittings x 0.04= 5.4 Added Head
Source of Calculation – B&G Pumps

Notes: (1) Item K is using existing active loop length – omit multiplier
(2) Existing system glycol tested to -10 below (40%)
(3) The 5/8" hepPlex loops should have been ¾"

Analysis of Existing Snow Melt System

PROJECT: **Roger Kimura**
OWNER: **Snow Melt System**
SYSTEM: **Ultra Boiler**

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Date: 3/20/14
Job# Rog.3.20.14
Conts: Snow Melt

Category: **M**
Sheet: **1** Of 4

Project: Roger Snow Melt System

After Photo of Redesign of Manifolds – 50% Glycol

UPONOR (Wirsbo) Snow and Ice Design Analysis Manual used as source of calculations

NEW 2" COPPER MANIFOLD with NEW 2" COPPER SUPPLY/RETURN MAINS TO BOILER

		Loop 1	Loop 2	Loop 3	Loop 4	Loop 5	Loop 6	Loop 7	Loop 8	Loop 9	Loop 10	Loop 11	Loop 12	Loop 13
A	Design temperature (°F)	5F												
B	Wind speed (mph)	10mph												
C	Differential temperature (°F)	25F												
D	Surface temperature (°F)	38F												
E	BTU/h/ft²	132												
F	Supply fluid temperature (°F)	140F												
G	Tubing o.c. distance	9"+												
H	Area to be heated (ft²)	1900 ⊕	38ft x 50ft											
I	Type of tubing	hePex												
J	Tubing size	5/8"	→	→	→									
K	Active loop length	260'	246'	231'	224'	210'	228'	240'	228'	219'	215'	245'	150'	160'
L	Leader loop length +sup/rt 80'	10'	→	→	→									
M	Total loop length	270'	256'	241'	234'	220	238'	250	238	229'	225'	255'	160'	170'
N	Percentage of glycol (%)	50%	→	→	→									
O	Flow per foot	0.0091	→	→	→									
P	Flow per loop (gpm)	2.37	2.24	2.10	2.04	1.91	2.07	2.18	2.07	1.99	1.96	2.23	1.37	1.46
Q	Head pressure drop/ft (ft of hd)	0.09060	→	→	→									
R	Head pressure drop/loop (ft of hd)	24.46	23.19	21.83	21.20	19.93	21.56	19.93	21.56	20.75	20.39	23.10	14.50	15.40
S	Loop balancing turns													

Page 65&66 System Performance & Flow Charts

107 BTU/h/ft is based on the existing placement of loops set at a distance of 12"+ center to center

Manifold Totals

T	Supply fluid temp. (°F)	140F
U	Manifold flow (gpm)	25.99
V	Highest pressure head (ft)	24.46

A Select the outdoor design temperature from **Appendix C**.
B Select the wind speed in mph from **Appendix C**.
C Enter the differential temperature (25°F).
D Select the desired surface temperature from **Appendix C**.
E Enter the BTU/h/ft² based on the climatic conditions and the surface temperature. Refer to **Appendix C**.
F Enter the supply fluid temperature from **Appendix C** based on the climatic conditions and value in row **G**.

G Enter the tubing on-center (o.c.) distance.
H Enter the square footage of area to be heated by this loop.
I Select the type of tubing to be used.
J Select the size of tubing to be used.
K Multiply the value in row **H** with the appropriate o.c. multiplier (6" = 2.0; 9" = 1.33; 12" = 1.0)
L Enter the distance from the slab area to the manifold x 2 (supply and return).
M Add rows **K** and **L** together.
N Enter the percentage of glycol/water solution to be used.
O Using the information in rows **E**, **G** and **N**, go to **Appendix C** and select the flow per foot.
Page 70

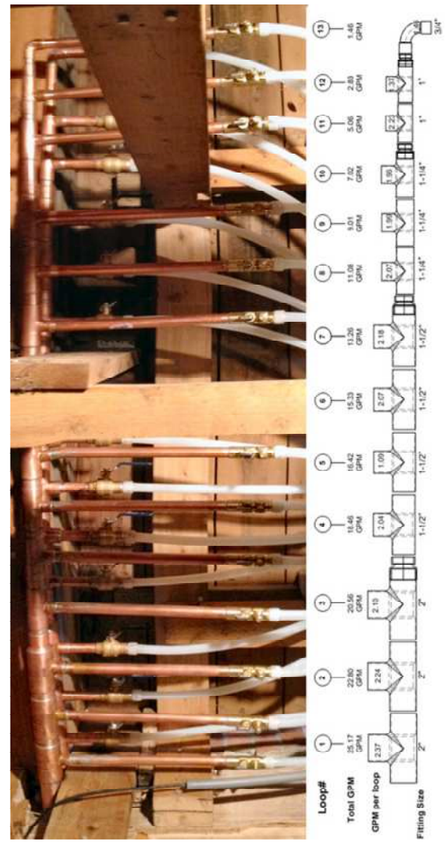
P Multiply the value in row **K** by the value in row **O**.
Q Use the information in rows **F**, **I**, **J**, **N** and **P** with the appropriate Appendix (either **D** or **E**) to obtain the head pressure drop per foot. Page 79
R Multiply row **M** by the value in row **Q**.
S These cells are calculated after the design is completed. Use the balancing information for the respective manifold used as shown in **Chapter 3**.
T Enter the highest value from row **F**.
U Enter the total of all values from row **P**.
V Enter the highest value from row **R**.

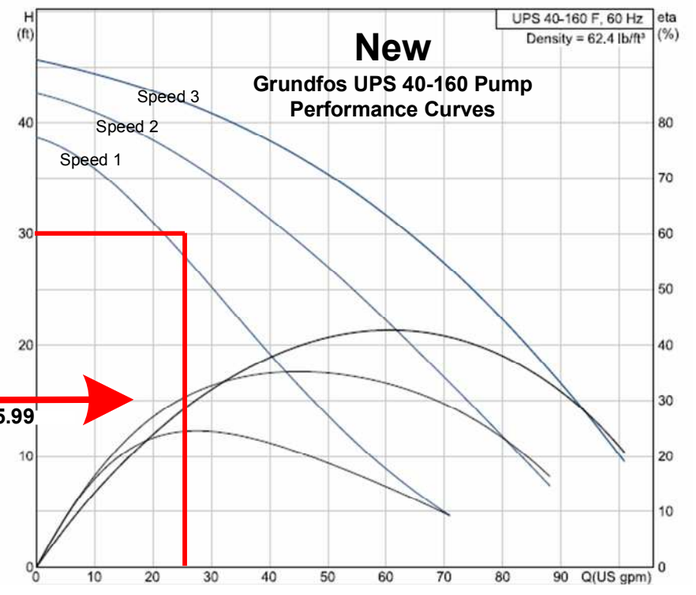
2" Cop Supply/Return Mains
Calculating for Head Pressure
90'x50% fittings x 0.04= 5.4 Added Head
Source of Calculation – B&G Pumps

Performance curve chart for existing pump Head: 24.46+5.4= 29.86 – GPM 25.99

Note: Item K is using existing active loop length – omit multiplier

Gallons in Loops
1.34 gal per 100'
2865/100=28.56x1.34= 38.27 total gallons





Redesign of Existing Snow Melt System

Roger Kimura

Snow Melt System

Weil Mclain Ultra 310

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Date: 3/20/14

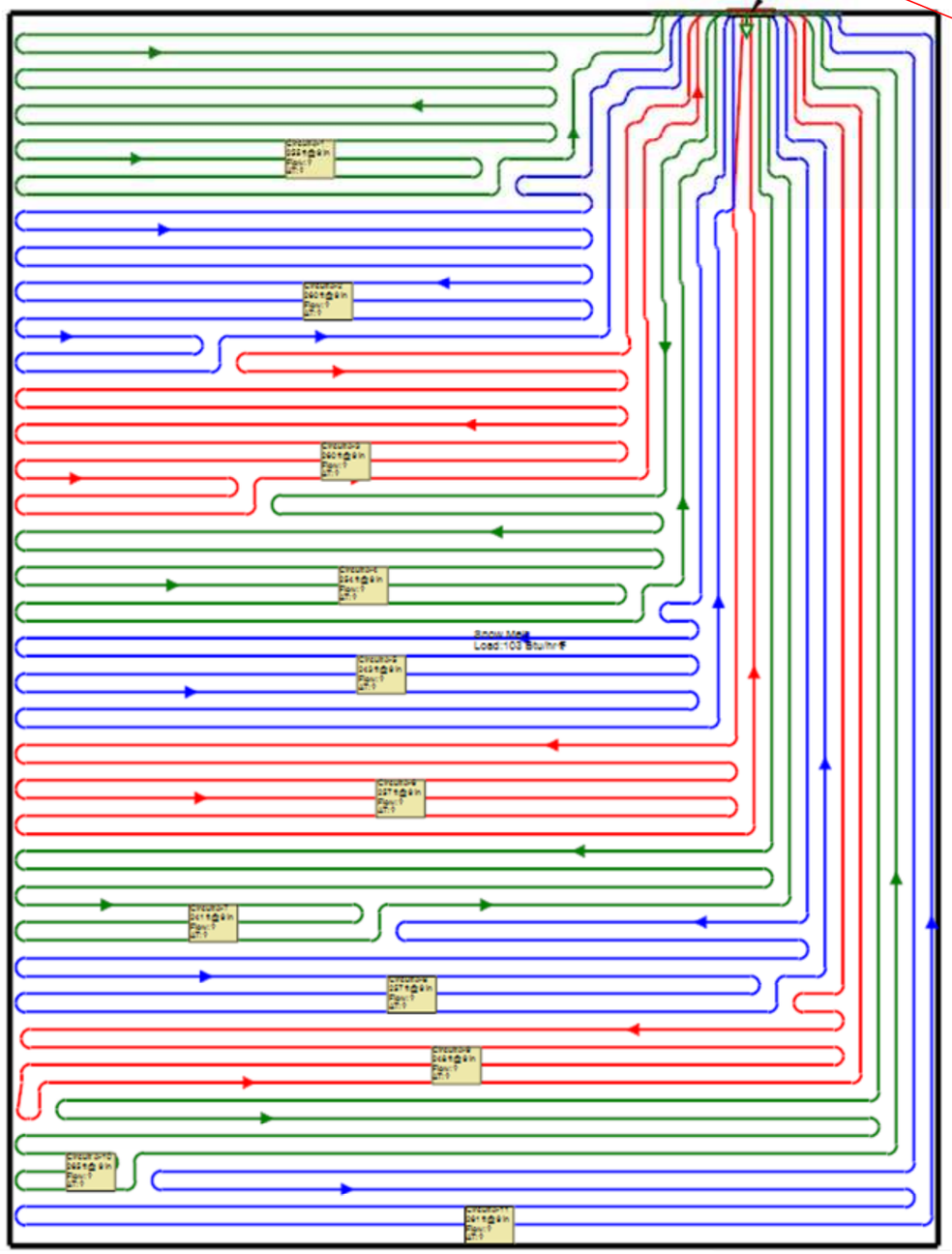
Job# Rog.3.20.14

Conts: Snow Melt

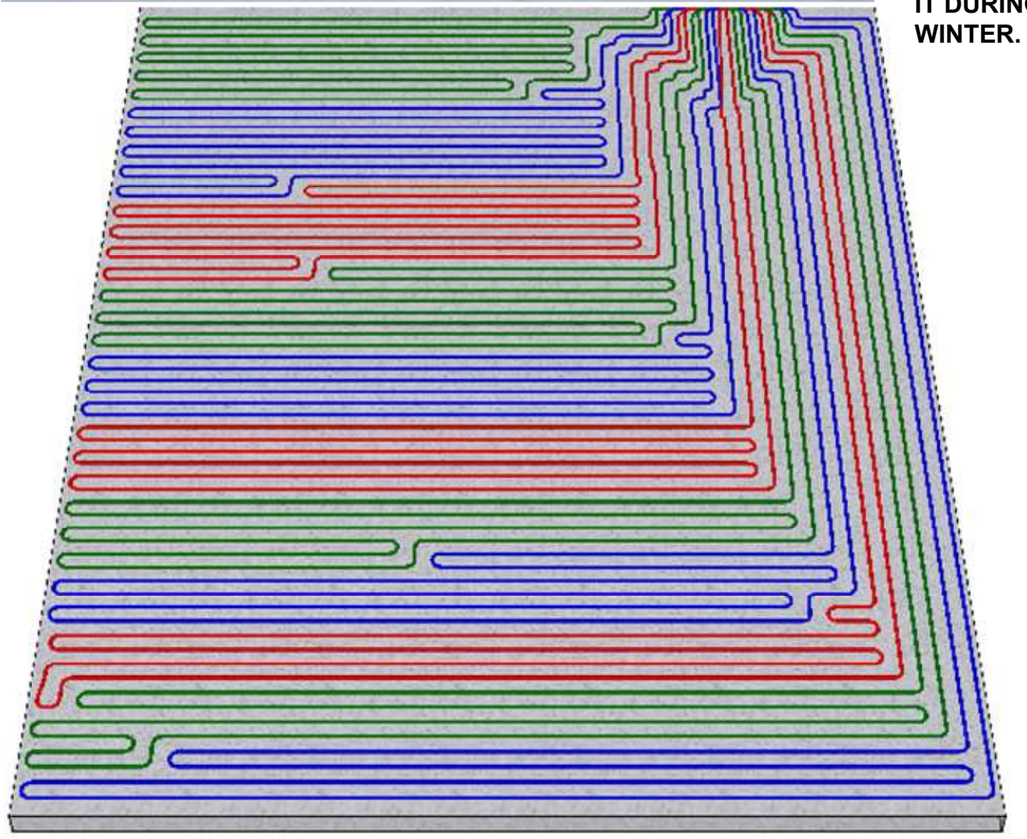
Category M

Sheet 2 Of 4

Manifold under Stairwell



2D layout of driveway



3D layout of loops in concrete

NOTE: SENSOR WAS INSTALLED IN WRONG LOCATION COULD NOT BE CORRECTED WITHOUT DEMOLITION OF CONCRETE. THEREFORE VEHICLES ARE NOT PARKED OVER IT DURING WINTER.

ESTIMATED LAYOUT OF EXISTING LOOPS FROM VISUAL OF WATCHING SNOW MELT

PROJECT: Analysis of Existing Snow Melt System
OWNER: Roger Kimura
SYSTEM: Snow Melt System
Ultra

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Category: M
Sheet: 3 Of 4

I THANK MY BROTHER STEVE FOR THIS TOUR

ZONE 2

Snowmelt System

The snowmelt system shall be controlled in three possible control modes which shall be operator selectable from the DDC control station.

OFF:

The control valves will remain closed.

ON:

The control valve will modulate to maintain a slab temperature of 45 deg F (adjustable). To prevent shocking the slab, the valve will ramp open slowly over a period of 30 minutes by ramping the return temperature set point from 40 deg F to 115 deg F for the first 30 minutes.

AUTO:

Outside air temperature above 36 deg F (adjustable)
The snowmelt system shall be disabled, the control valve will close.

Outside air temperature below 34 deg F (adjustable)
The snowmelt system shall be enabled, and shall be controlled as follows:

Idle Mode:
When no moisture is detected by the slab sensor, the control valve will modulate to maintain a slab temperature of 25 deg F (adjustable).

Snowmelt Mode:
On a call for snowmelt from the slab moisture sensor, the control valve will modulate to maintain a slab t emperature of 45 deg F (adjustable). To prevent shocking the slab, the valve will ramp open slowly over a period of 30 minutes by ramping the return temperature set point from 40 deg F to 115 deg F for the first 30 minutes.

Minimum runtime:
Snowmelt system will remain enabled at minimum user adjustable value to ensure complete snow melting.

Tour of Snow Melt Systems

Alaska Native Medical Center

PROJECT | OWNER | SYSTEM: Ultra | Snow Melt System

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Category: M

Sheet: 4 Of 4