

**VI. SENSOR LOCATIONS AND INSTALLATIONS AT THE PASSIVE
COOLING EXPERIMENTAL FACILITY FOR A HOT/ARID ZONE**

Work Performed Under Contract No. AC03-80SF10816

**The University of Arizona
Environmental Research Laboratory
Tucson, Arizona**

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United States Department of Energy**

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Passive Cooling Experimental Facility

Hot/Arid Zone

DOE/SF/10816--T3

Contract No. DE-AC03-80SF-10816

DE84 002344

VI. SENSOR LOCATIONS AND INSTALLATION

at the

PASSIVE COOLING EXPERIMENTAL FACILITY

for a

HOT/ARID CLIMATE

THE UNIVERSITY OF ARIZONA
ENVIRONMENTAL RESEARCH LABORATORY
TUCSON INTERNATIONAL AIRPORT
TUCSON, AZ 85706

SENSOR LOCATIONS AND INSTALLATION

Ambient Conditions

and

Data Acquisition Building

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KEY TO SYMBOLS

- + Earth Temperature Array Thermocouple
- Surface Temperature Thermocouple or Thermocouples in Rakes
- Heat Flux Meter
- || Naturally Aspirated Air Temperature Thermocouple
- Comfort Sensor Station
- △ Wall Temperature Rake
- ⊙ Pyranometer
- ◈ □ Mechanically Aspirated Wet Bulb/Dry Bulb
- ⊗ Pyrgeometer

SENSOR READ OUT ABBREVIATIONS

- AT Earth Temperature Array Thermocouple
- BT Rockbed Thermocouple
- CT Comfort Sensor Station Thermocouple
- DT Dry Bulb Thermocouple
- ET Rock Embedded Thermocouple
- LT Liquid Wall Thermocouple
- NT Naturally Aspirated Air Temperature Thermocouple
- RT Wall Temperature Rake Thermocouple
- ST Surface Temperature Thermocouple
- TT Test Terminal Thermocouple
- WT Wet Bulb Thermocouple
- AZ Wind Direction
- HF Heat Flux Meter
- PG Pyrgeometer
- PM Pyranometer
- TM Test Terminal Millivolt
- VA Continuous Air Velocity Meter
- WS Wind Speed

SENSOR NAMES AND LOCATIONS — AMBIENT CONDITIONS

READ OUT NO.	LOCATION	FIGURE NO.
9WS001	WIND SPEED EAST	1
9AZ001	WIND DIRECTION EAST	
9WS002	WIND SPEED WEST	
9AZ002	WIND DIRECTION WEST	
9AT099		1 & 2
9AT100		
9AT101	WEATHER STATION EARTH TEMP ARRAY	
9AT102		
9AT103		
9AT104		
9WT006	WEATHER STATION WET BULB	1
9DT006	WEATHER STATION DRY BULB	

SENSOR NAMES AND LOCATIONS — DATA ACQUISITION BUILDING

READ OUT NO.	LOCATION	FIGURE NO.
OCT001	COMFORT SENSING STATION	3 & 10
OCT002		
OCT003		
OCT004		
OCT005		
OCT006		
OCT007		
OCT008		
OCT009		
OST001	FLOOR SURFACE TEMP-COMFORT STATION	3 & 16
OST002	CEILING SURFACE TEMP-COMFORT STATION	4
ORT001	EAST WALL-2 FT HEIGHT BLOCK CORE-TEMP RAKE	7 & 11
ORT002		
ORT003		
ORT004		
ORT005		
ORT006		
ORT007	EAST WALL-2 FT HEIGHT BLOCK WEB-TEMP RAKE	7 & 11
ORT008		
ORT009		
ORT010		
ORT011		
ORT012		
ORT013	EAST WALL-6 FT HEIGHT BLOCK CORE-TEMP RAKE	7 & 12
ORT014		
ORT015		
ORT016		
ORT017		
ORT018		

READ OUT NO.	LOCATION	FIGURE NO. .
ORT019		
ORT020		
ORT021	EAST WALL-6 FT HEIGHT	7 & 12
ORT022	BLOCK WEB-TEMP RAKE	
ORT023		
ORT024		
OST003	EAST WALL SURFACE TEMP-SOUTH SIDE-2 FT HEIGHT	7
OST004	EAST WALL SURFACE TEMP-SOUTH SIDE-6 FT HEIGHT	
OST005	EAST WALL SURFACE TEMP-NORTH SIDE-10 FT HEIGHT	
ONT001	AIR TEMP EAST WALL-6 FT HEIGHT	
ORT025		
ORT026		
ORT027	NORTH WALL-2 FT HEIGHT	6 & 13
ORT028	BLOCK CORE-TEMP RAKE	
ORT029		
ORT030		
ORT031		
ORT032		
ORT033	NORTH WALL-2 FT HEIGHT	6 & 13
ORT034	BLOCK WEB-TEMP RAKE	
ORT035		
ORT036		
ORT037		
ORT038		
ORT039	NORTH WALL-6 FT HEIGHT	6 & 14
ORT040	BLOCK CORE-TEMP RAKE	
ORT041		
ORT042		
ORT043		
ORT044		
ORT045	NORTH WALL-6 FT HEIGHT	6 & 14
ORT046	BLOCK WEB-TEMP RAKE	
ORT047		
ORT048		
ORT049		
ORT050	INTERIOR (STORAGE ROOM) WALL-4 FT HEIGHT	6 & 15
ORT051	BLOCK CORE-TEMP RAKE	
ORT052		
OST006	WEST WALL SURFACE TEMP-2 FT HEIGHT	9
OST007	WEST WALL SURFACE TEMP-4.5 FT HEIGHT	
OST008	WEST WALL SURFACE TEMP-7 FT HEIGHT	
OST009	FLOOR SURFACE TEMP-SOUTH	3
OST010	SOUTH WALL SURFACE TEMP-2 FT HEIGHT	8
OST011	SOUTH WALL SURFACE TEMP-4.5 FT HEIGHT	
OST012	SOUTH WALL SURFACE TEMP-7 FT HEIGHT	
OAT001		
OAT002		
OAT003	EARTH TEMP ARRAY-BELOW COMFORT STATION	3 & 16
OAT004		
OAT005		
OAT006		

READ OUT NO.	LOCATION	FIGURE NO.
OWT001	AIR CONDITIONER INTAKE-WET BULB	6
ODT001	AIR CONDITIONER INTAKE-DRY BULB	
OWT002	AIR CONDITIONER EXHAUST-WET BULB	
ODT002	AIR CONDITIONER EXHAUST-DRY BULB	
OHF001	HEAT FLUX-COMFORT STATION-FLOOR	3 & 16
OHF002	HEAT FLUX-COMFORT STATION-CEILING	4
OHF003	HEAT FLUX-EAST WALL-6 FT HEIGHT	7
OHF004	HEAT FLUX-NORTH WALL-6 FT HEIGHT	6
OPM001	LI-COR PYRANOMETER-SOUTH WINDOW	8
OPM002	LI-COR PYRANOMETER-SOUTH CLERESTORY	6
OPM003	LI-COR PYRANOMETER-NORTH WINDOW	
OPM004	PSP PYRANOMETER-ROOF	
OPM005	SHADOW-BAND SBS PYRANOMETER-ROOF	5
OPG001	TEST-PYRGEOMETER	
OPG002	PYRGEOMETER-ROOF	
OPG003	TEST-PYRGEOMETER	
OTM001	TEST MILLIVOLT	
OTT001	TEST THERMOCOUPLE	

8

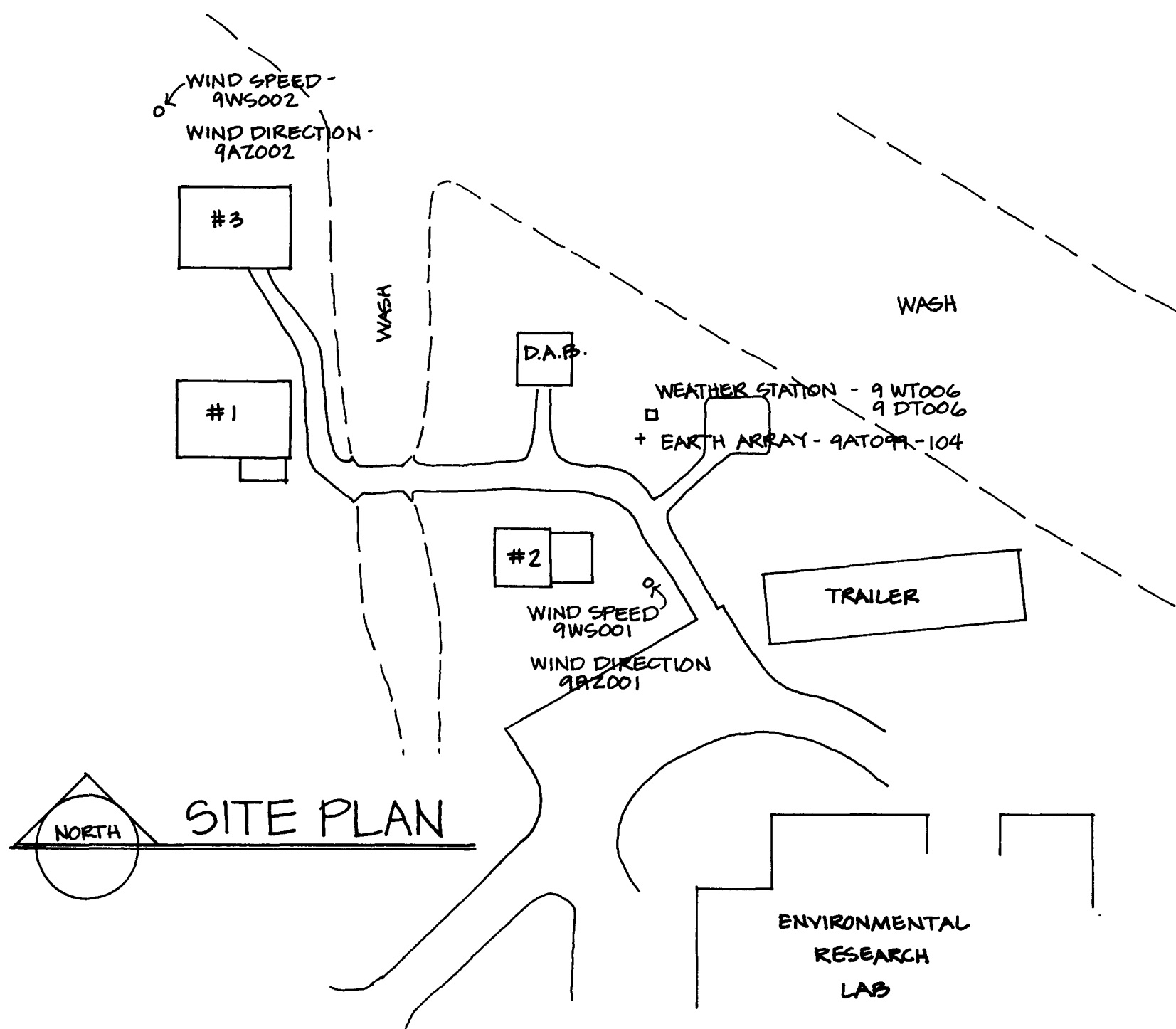
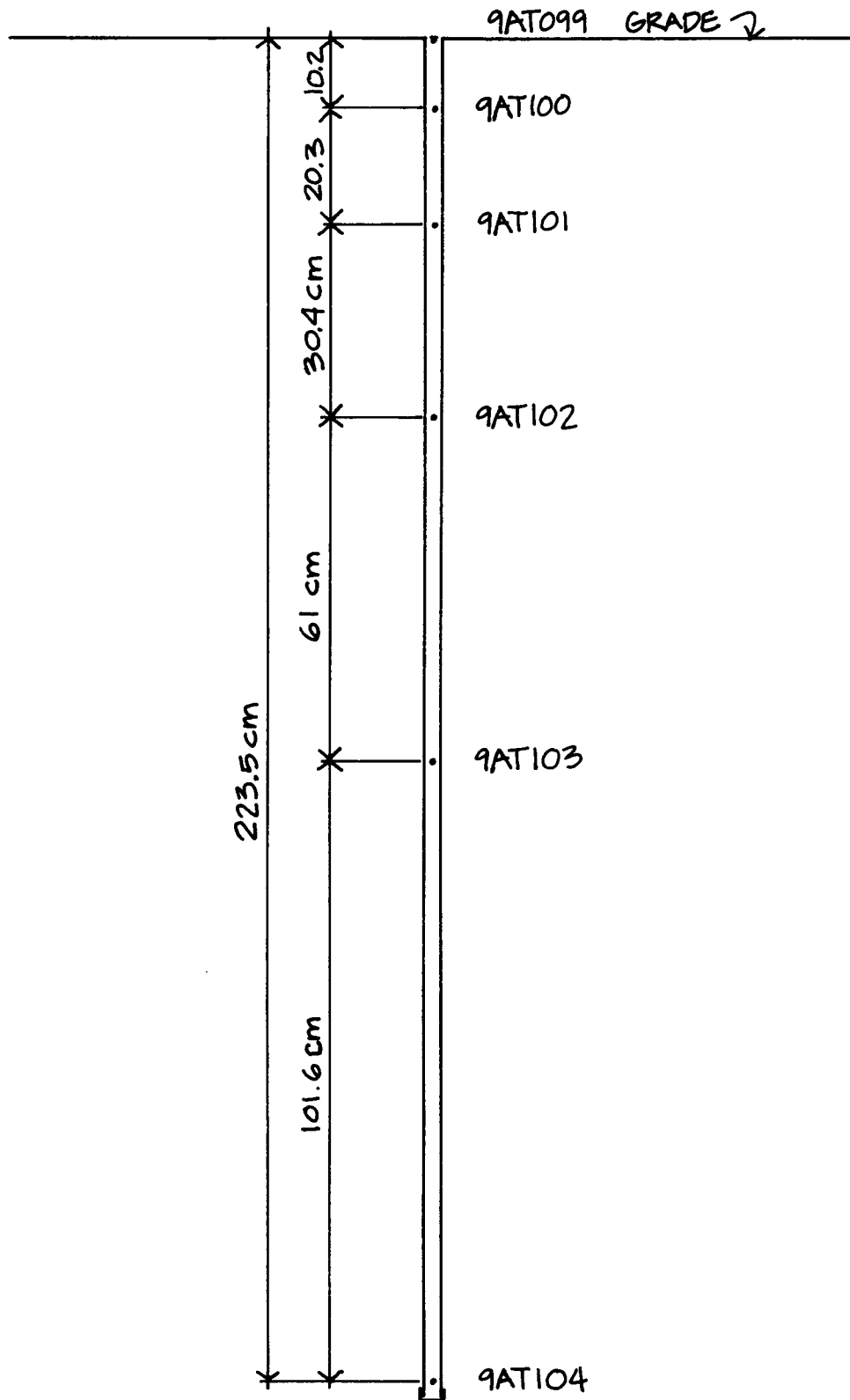


Fig. 1



EARTH ARRAY - WEATHER STATION

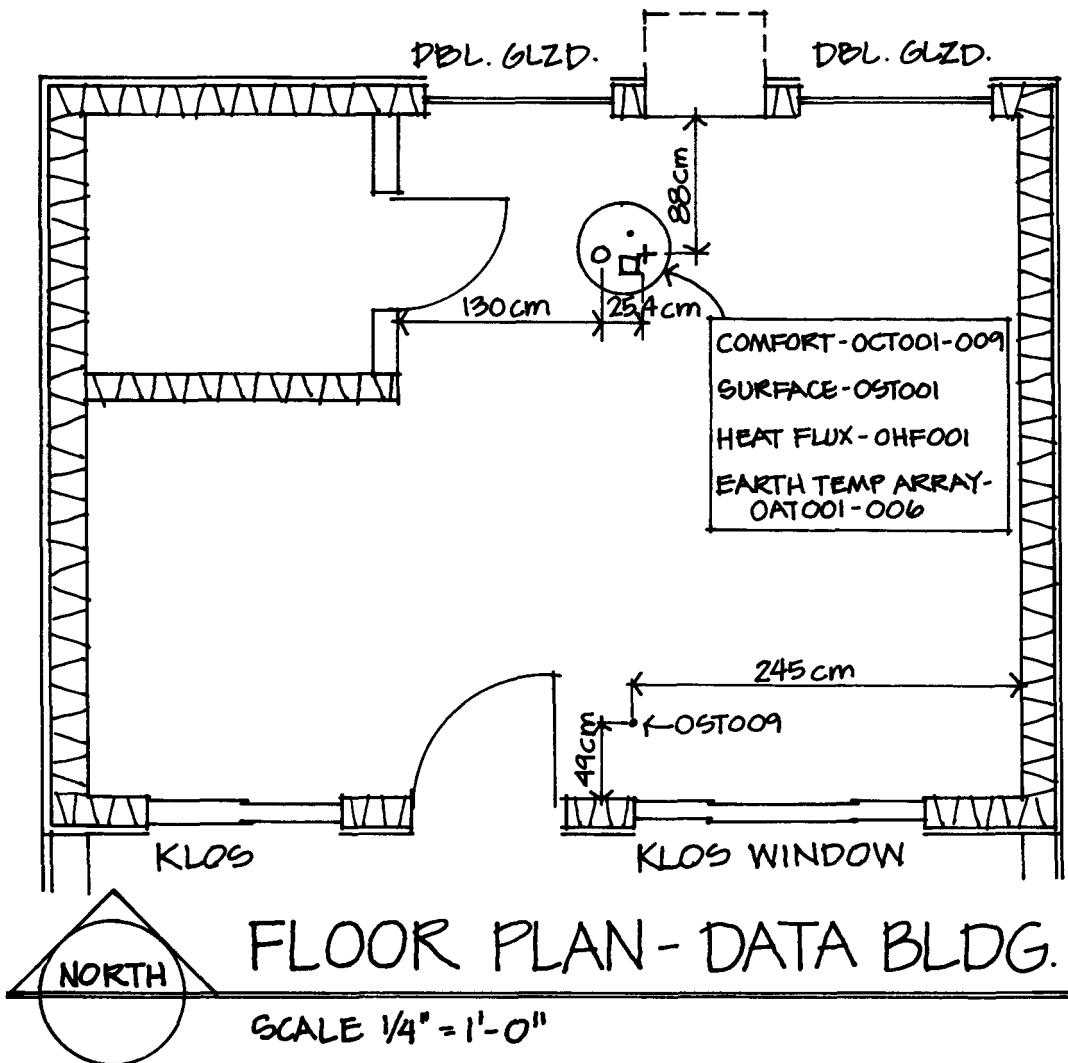


Fig. 3

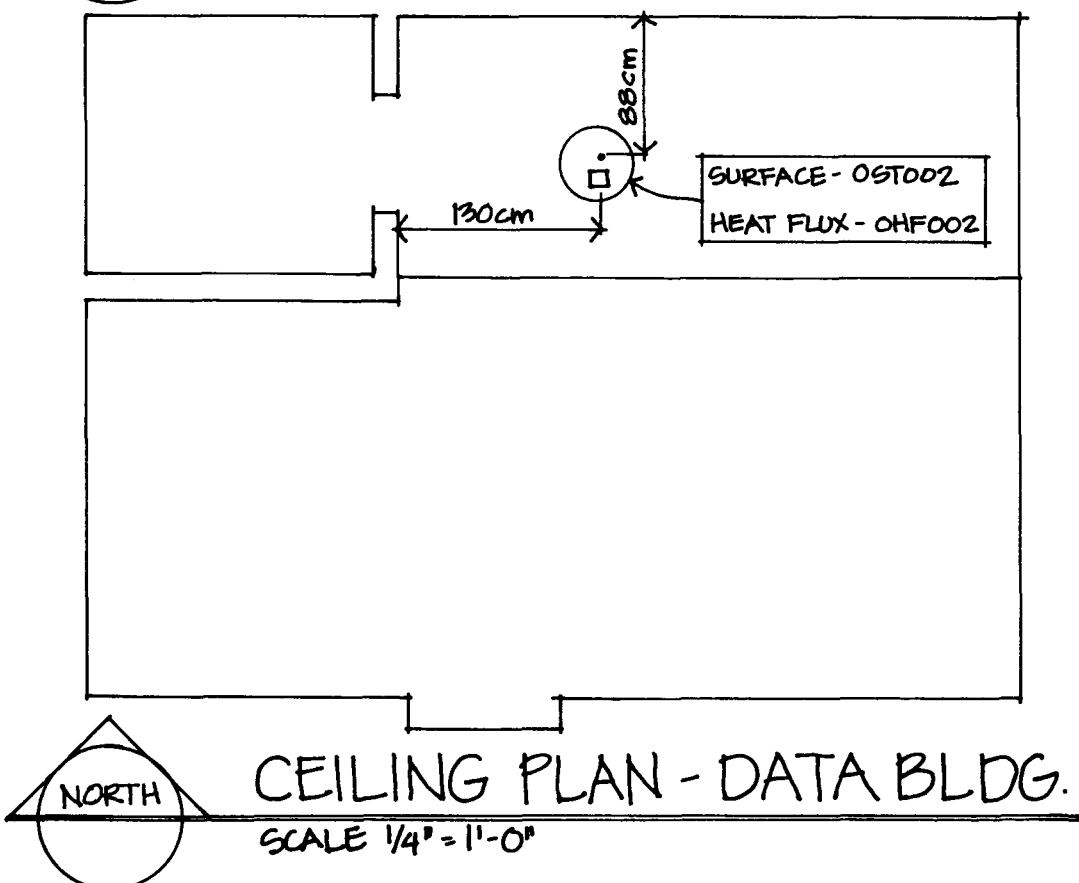


Fig. 4

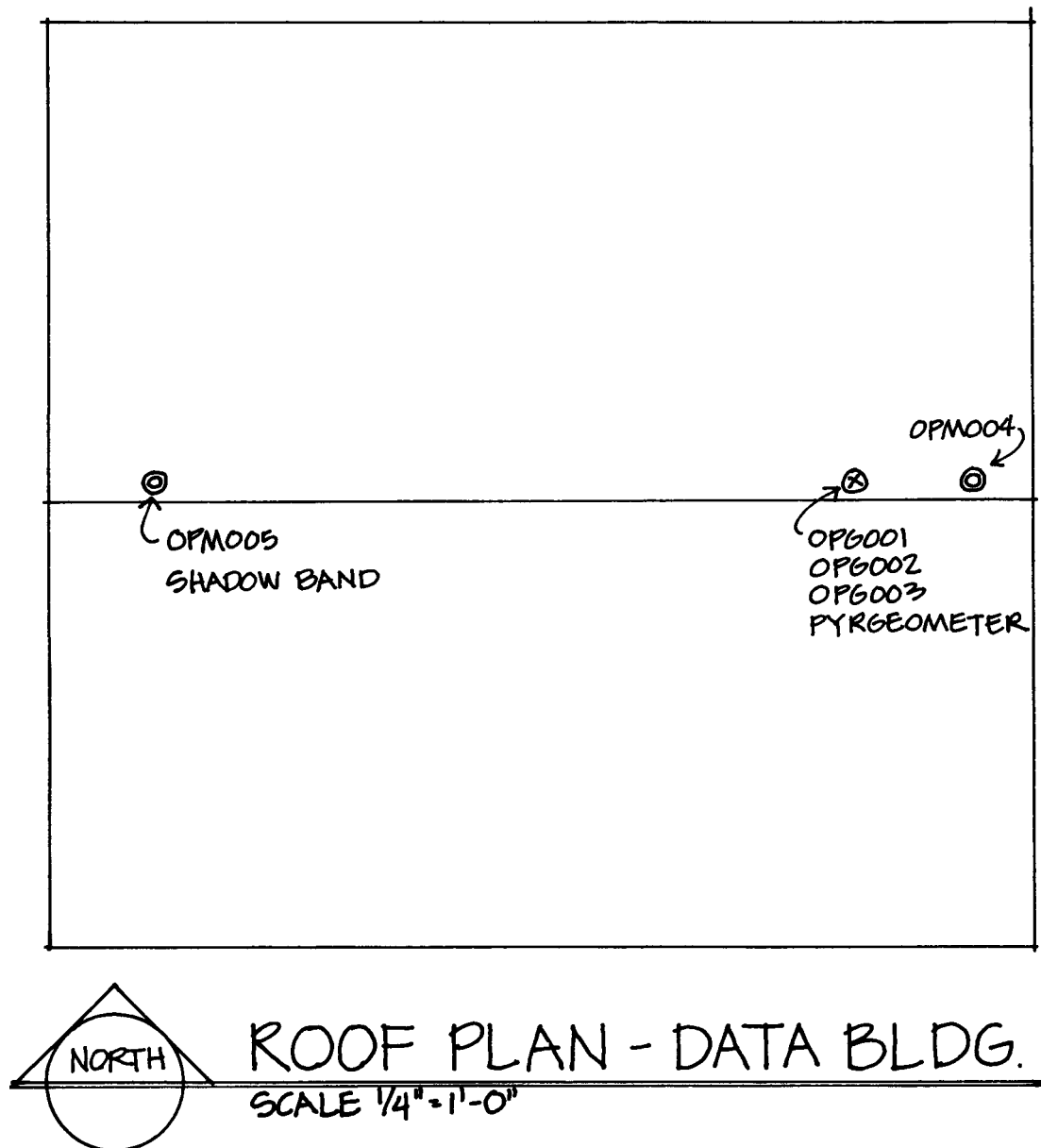
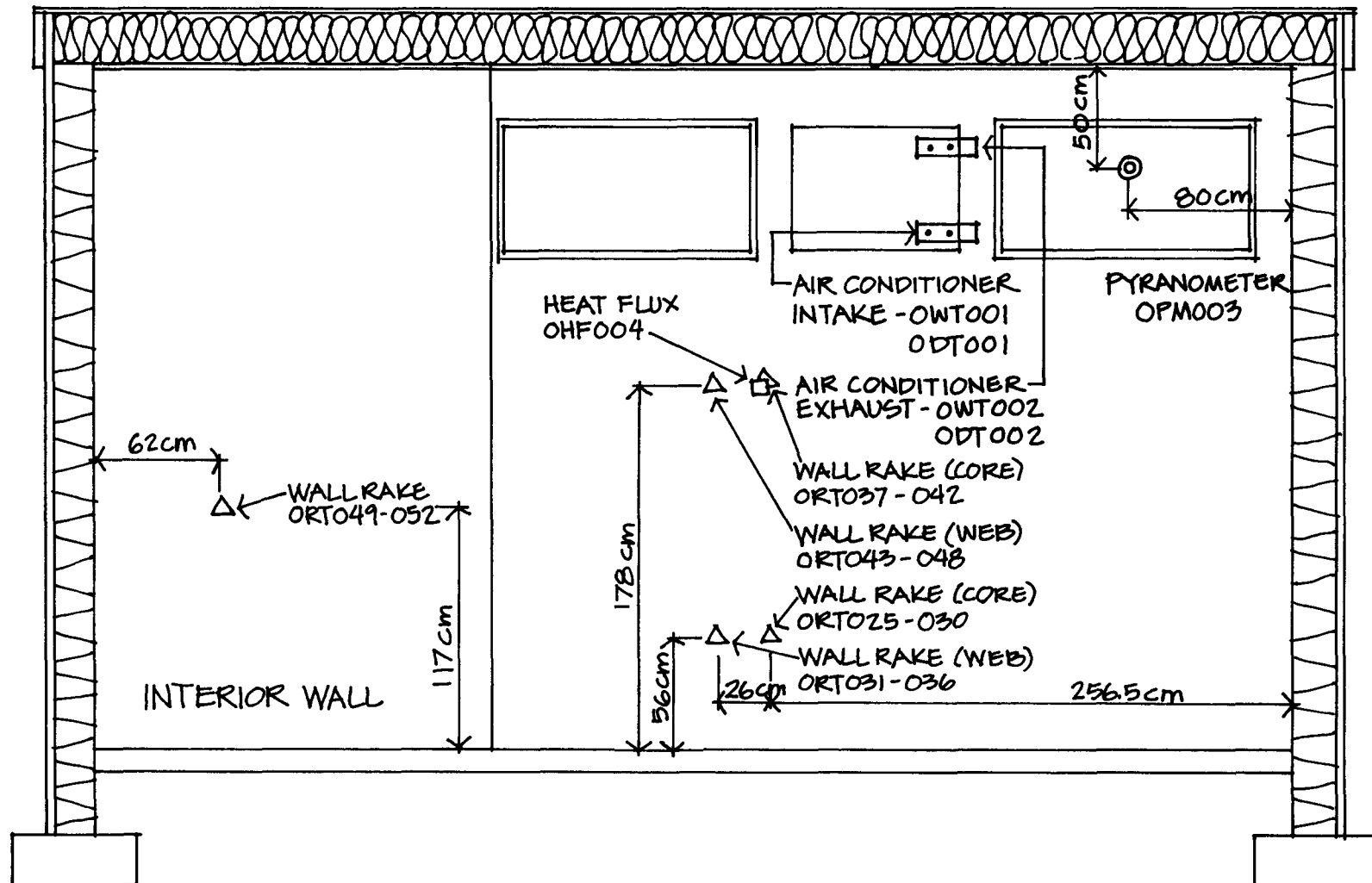
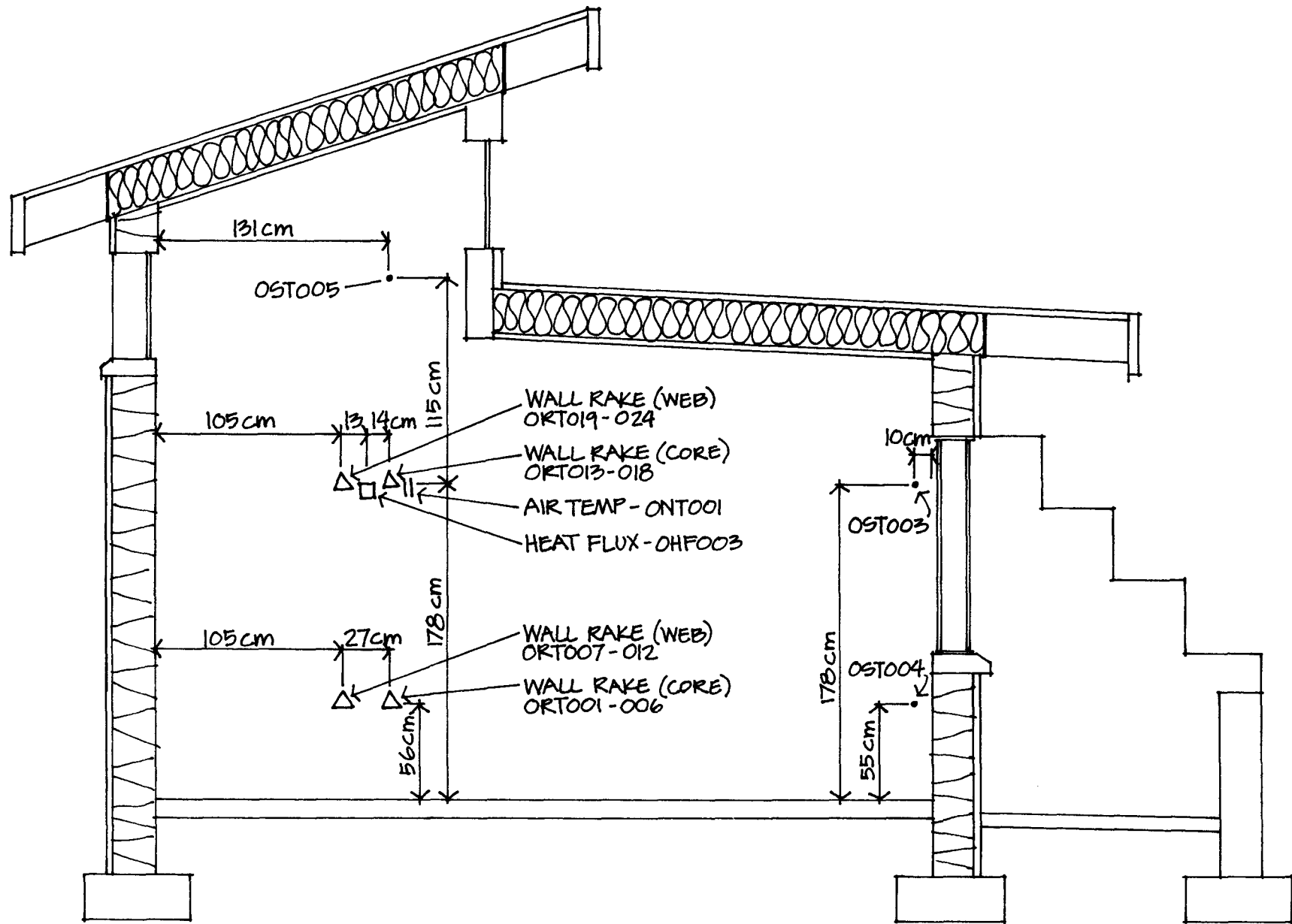


Fig. 5

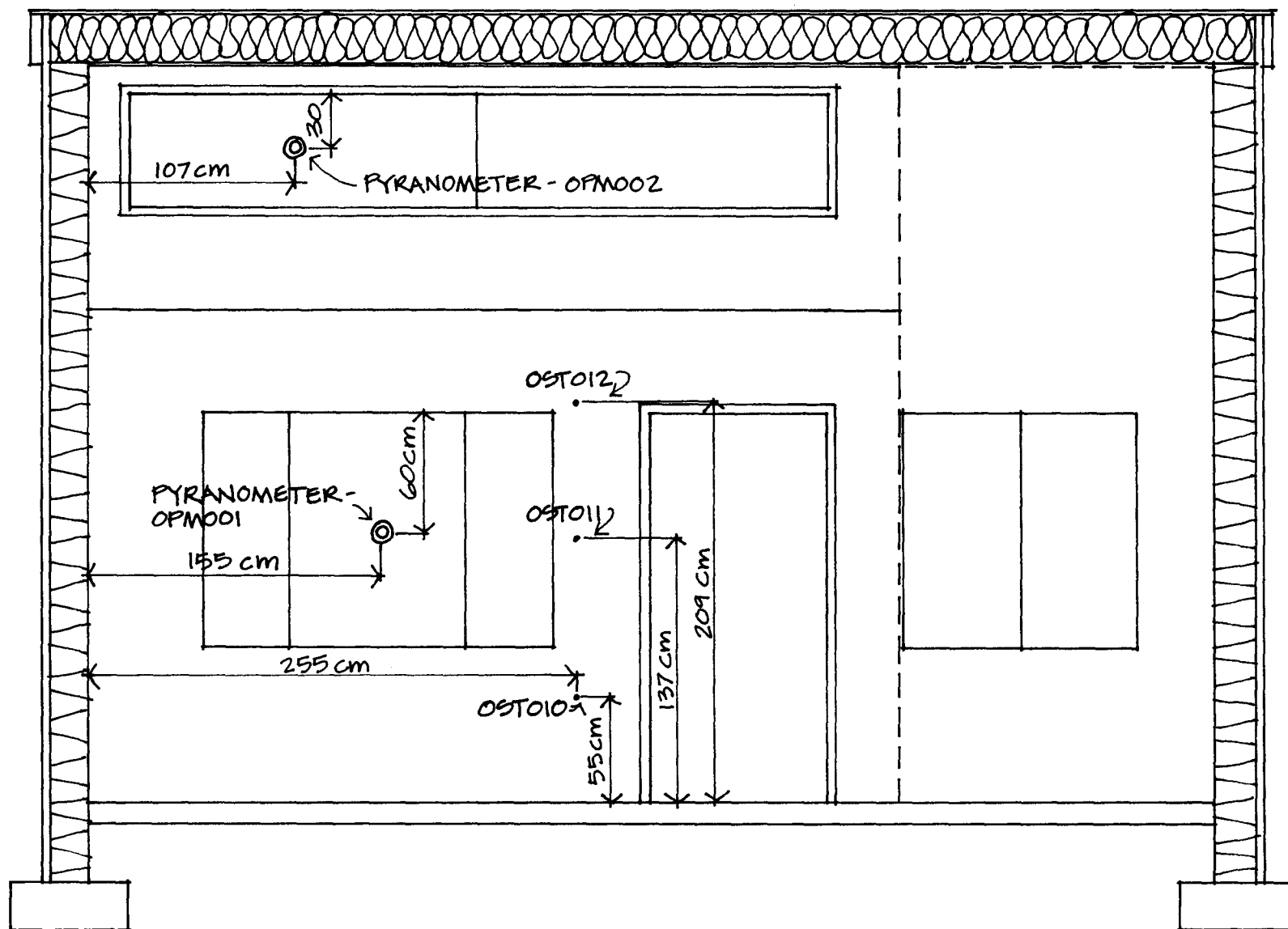


NORTH WALL INTERIOR ELEV. - DATA BLDG.

SCALE $\frac{3}{8}'' = 1'-0''$



EAST WALL INTERIOR ELEVATION -
DATA ACQUISITION BUILDING
SCALE $\frac{3}{8}'' = 1'-0''$



SOUTH WALL INTERIOR ELEVATION -
DATA ACQUISITION BUILDING
SCALE $\frac{3}{8}" = 1'-0"$

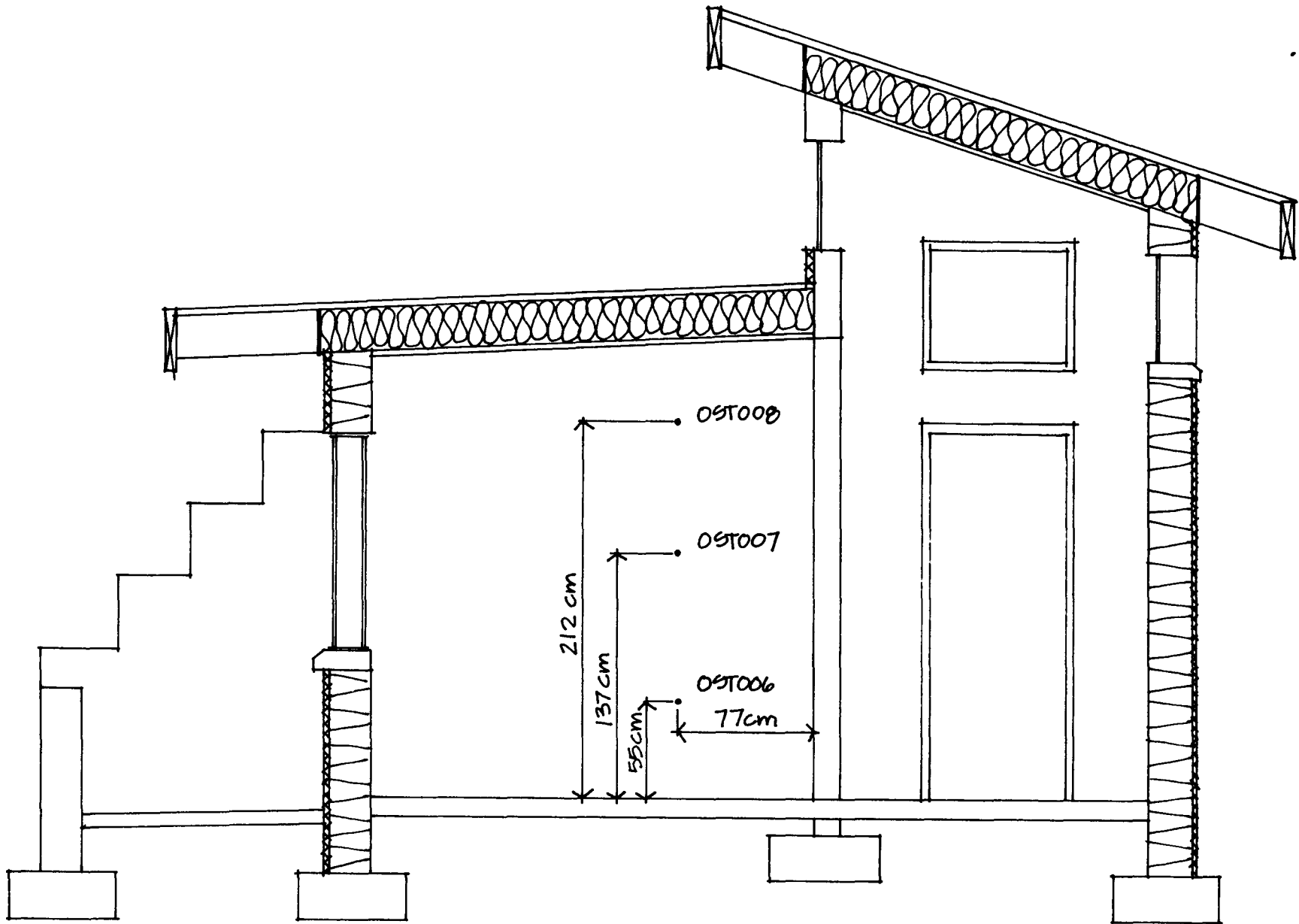
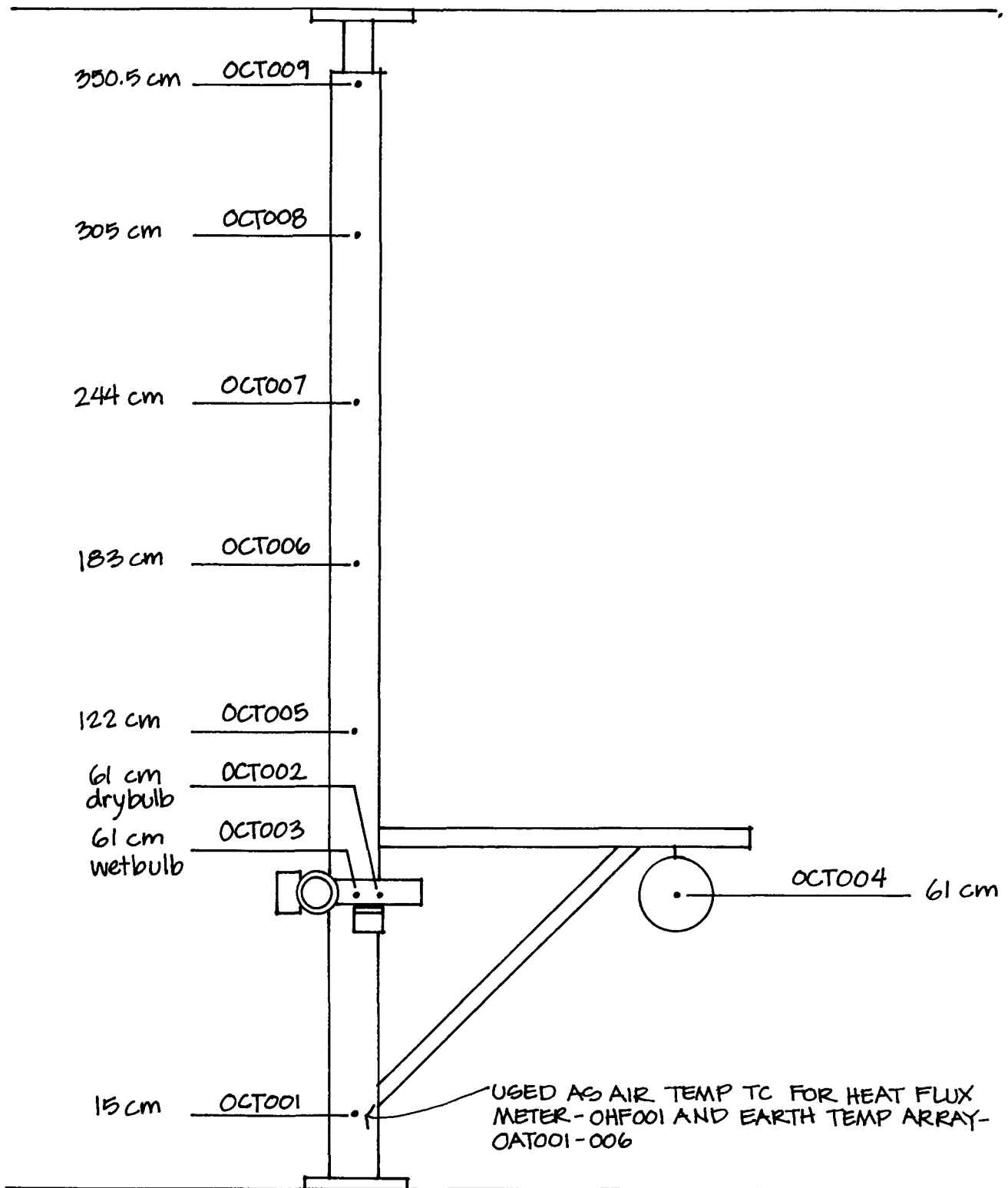
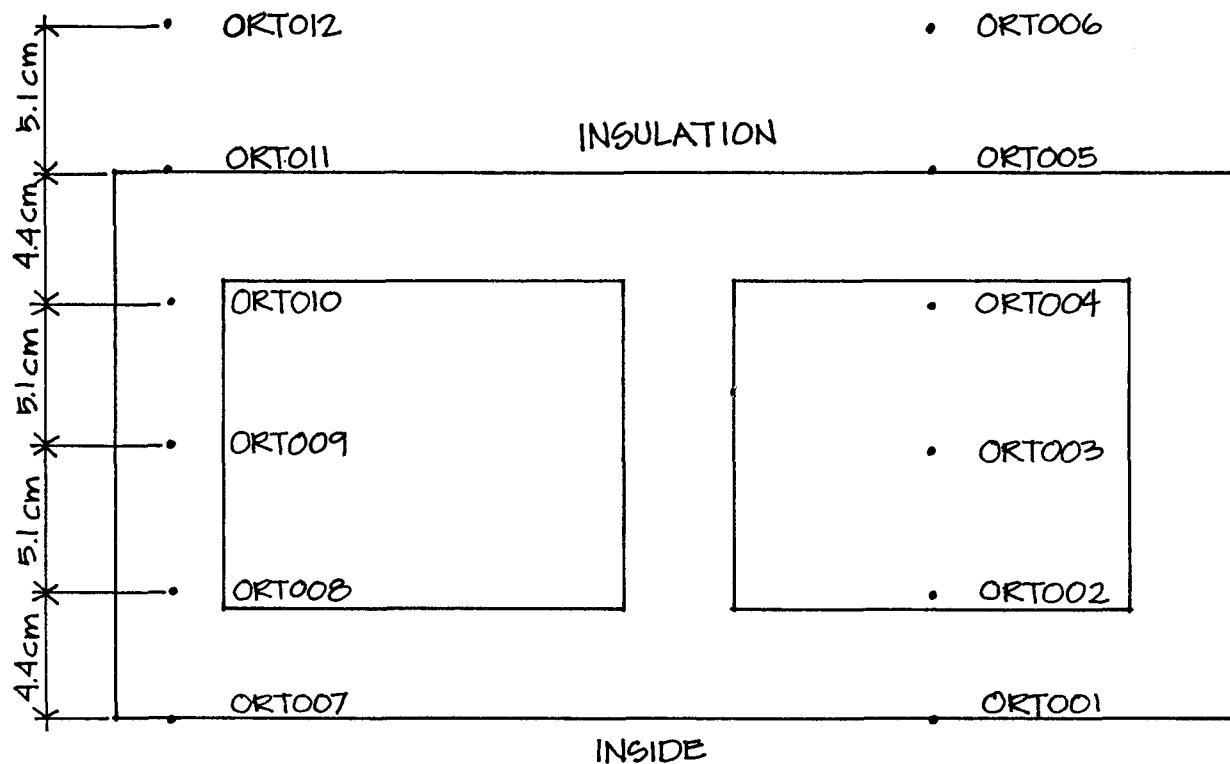


Fig. 9

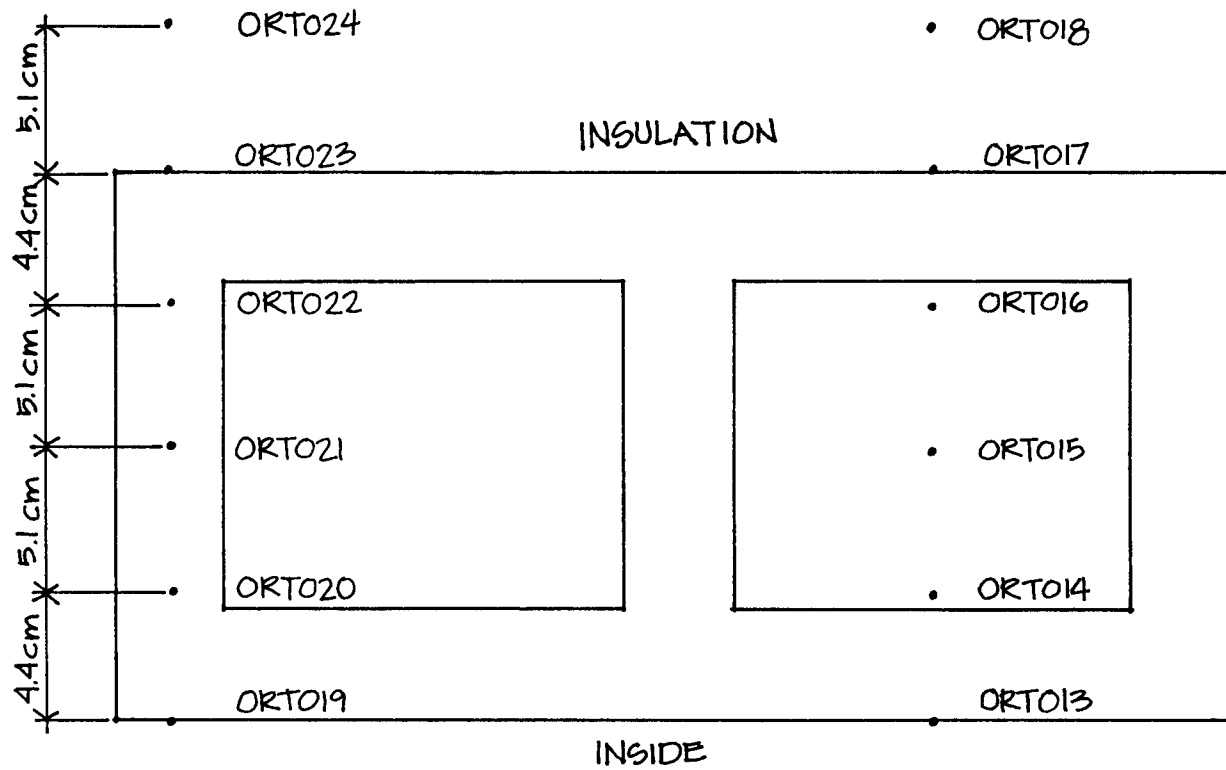
WEST WALL INTERIOR ELEVATION -
DATA ACQUISITION BUILDING
SCALE $\frac{3}{8}" = 1'-0"$



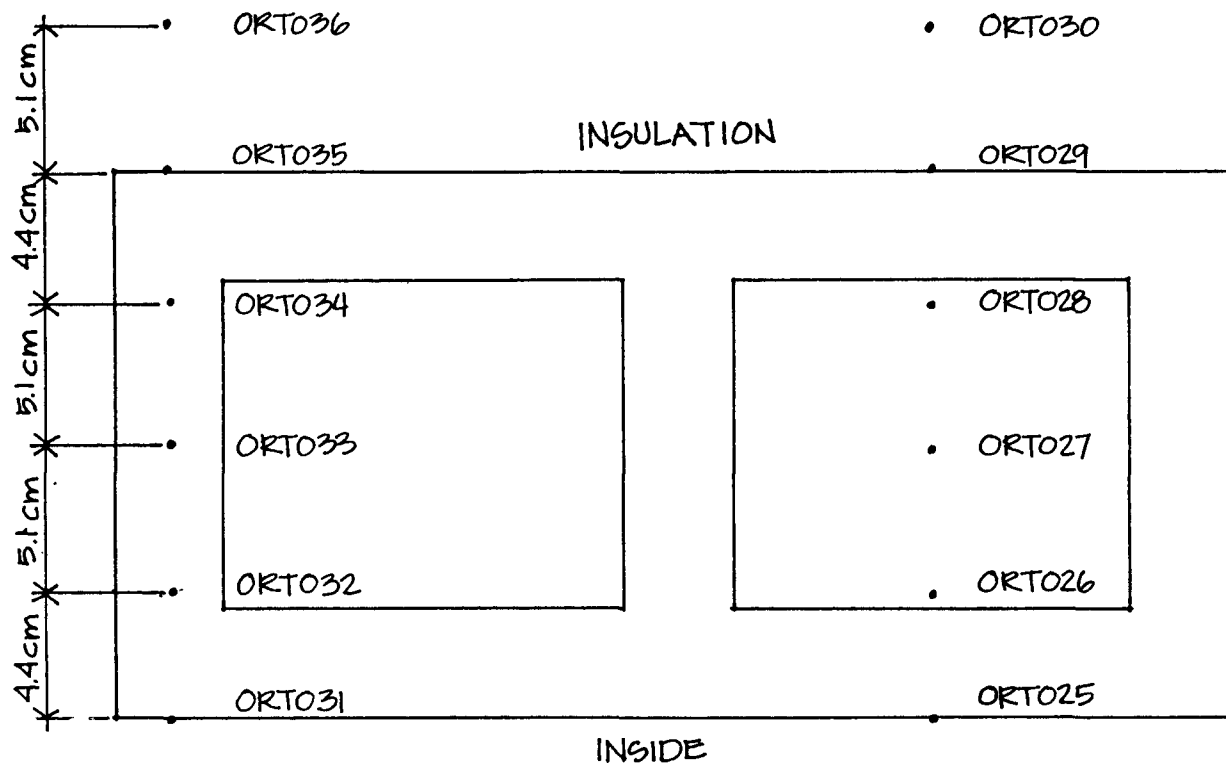
COMFORT SENSOR STATION DATA ACQUISITION BUILDING



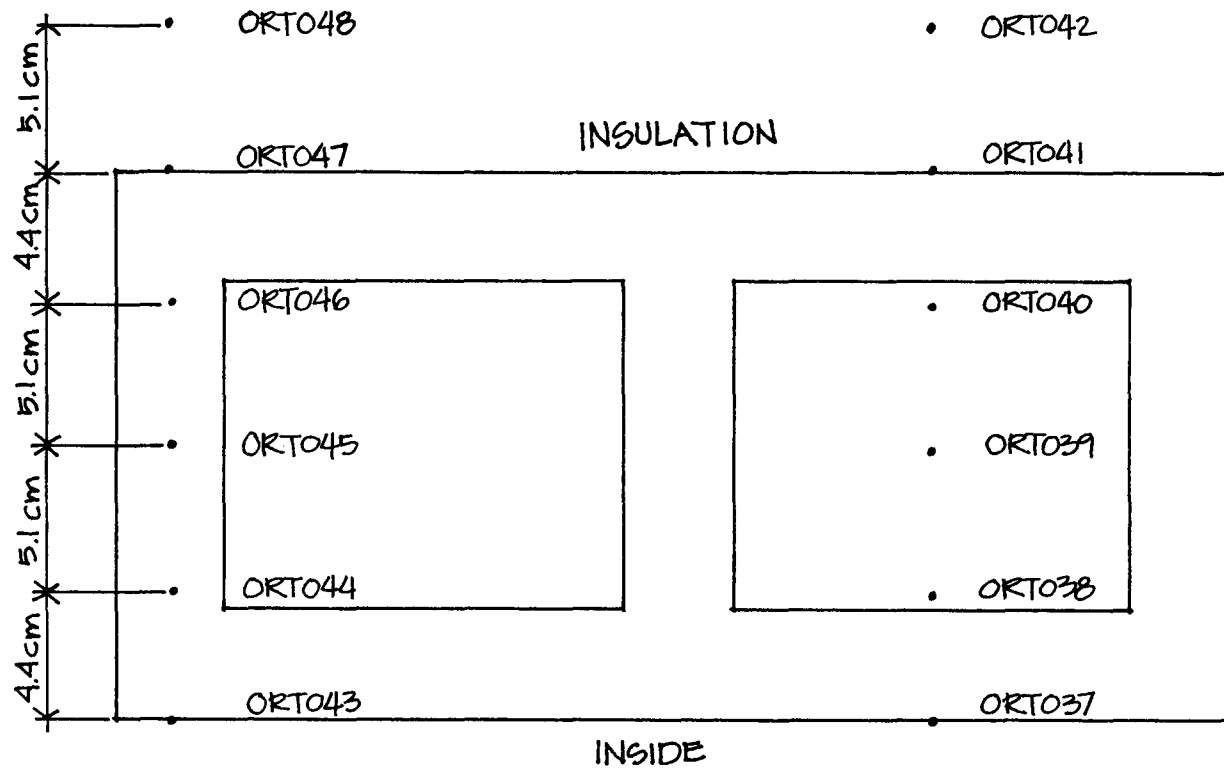
20.3 cm (8") BLOCK - EAST WALL
DATA ACQUISITION BUILDING



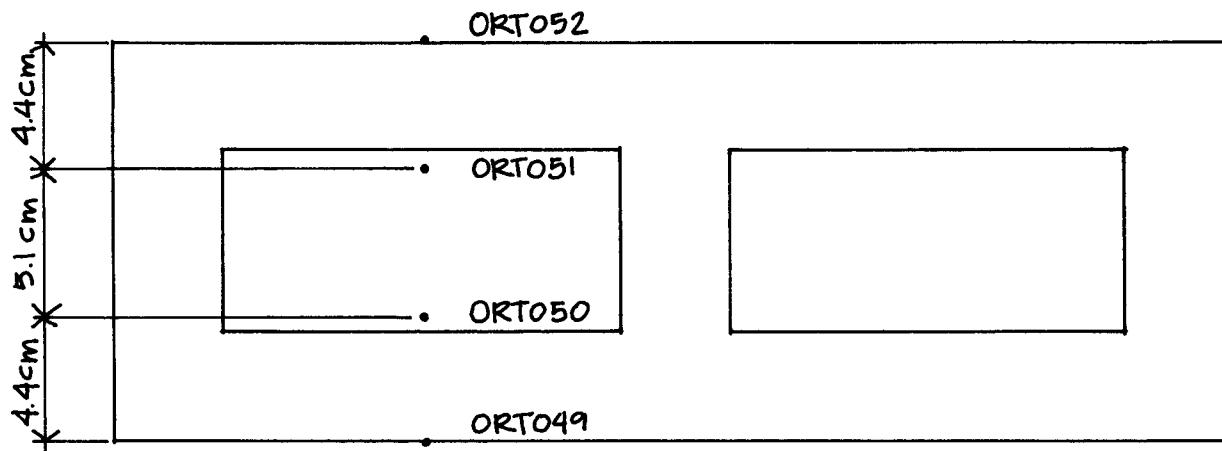
20.3cm (8") BLOCK - EAST WALL
DATA ACQUISITION BUILDING



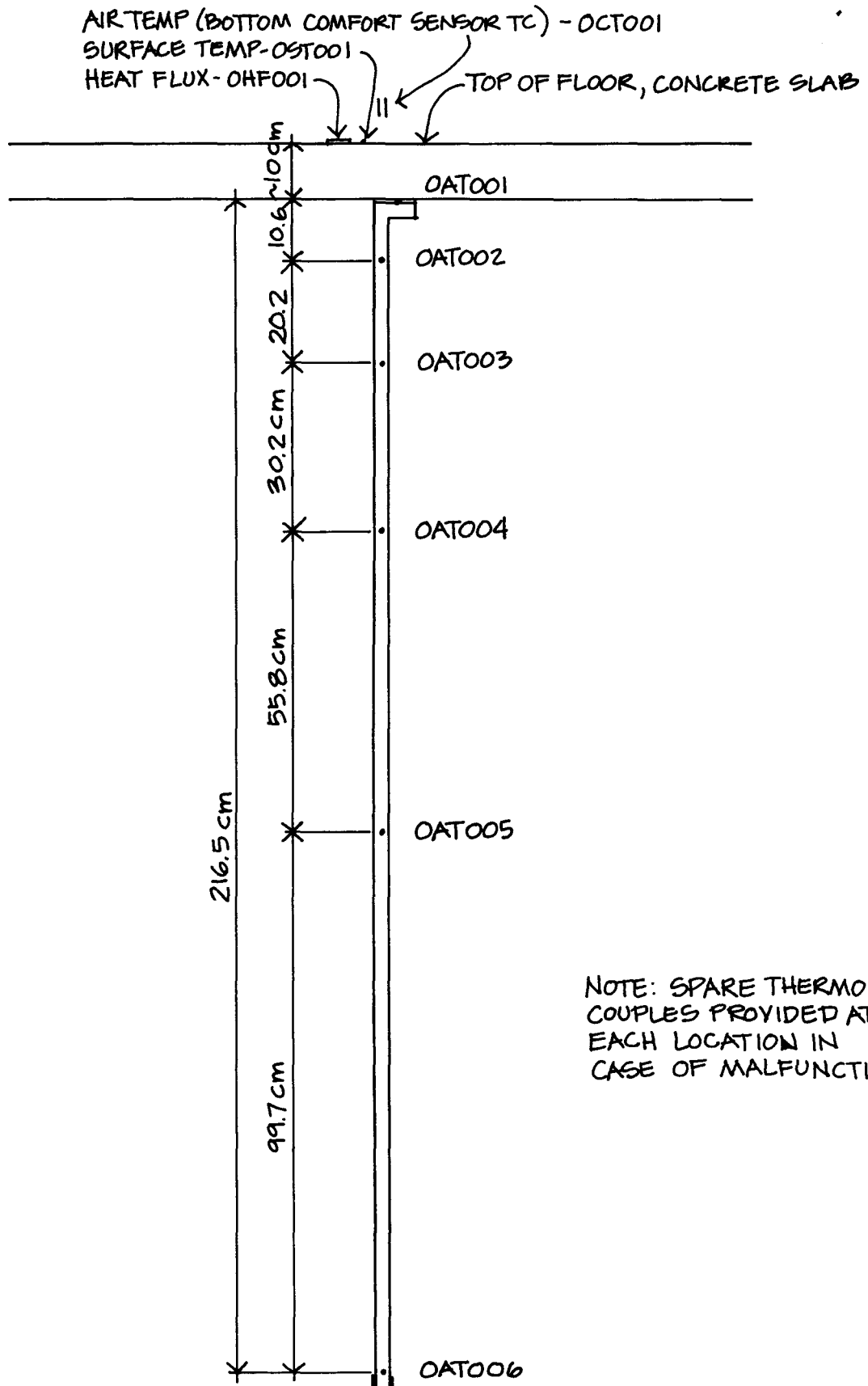
20.3cm (8") BLOCK - NORTH WALL
DATA ACQUISITION BUILDING



20.3cm(8") BLOCK - NORTH WALL
DATA ACQUISITION BUILDING

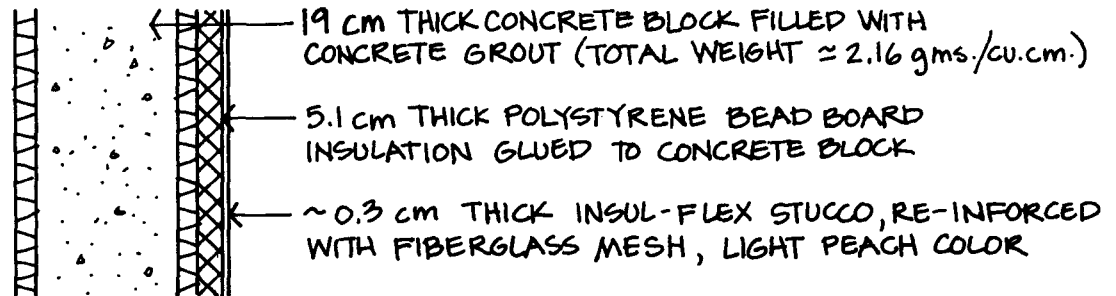


15.2cm(6") BLOCK- INTERIOR WALL
DATA ACQUISITION BUILDING

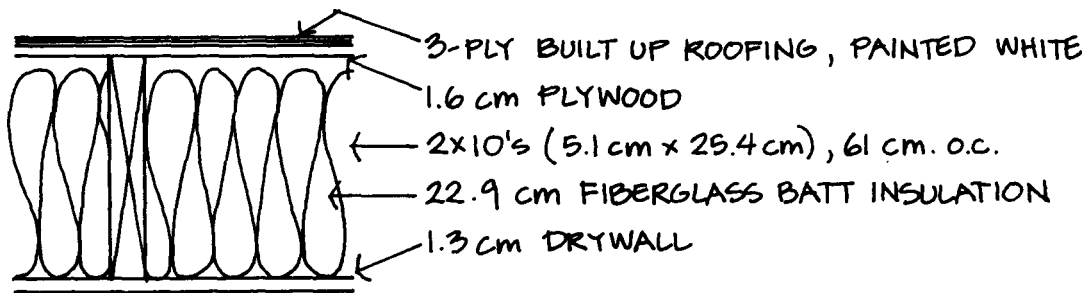


EARTH TEMP ARRAY DATA ACQUISITION BUILDING

BUILDING ENVELOPE DETAILS - DATA AQUISITION BUILDING



TYPICAL CONCRETE BLOCK WALL



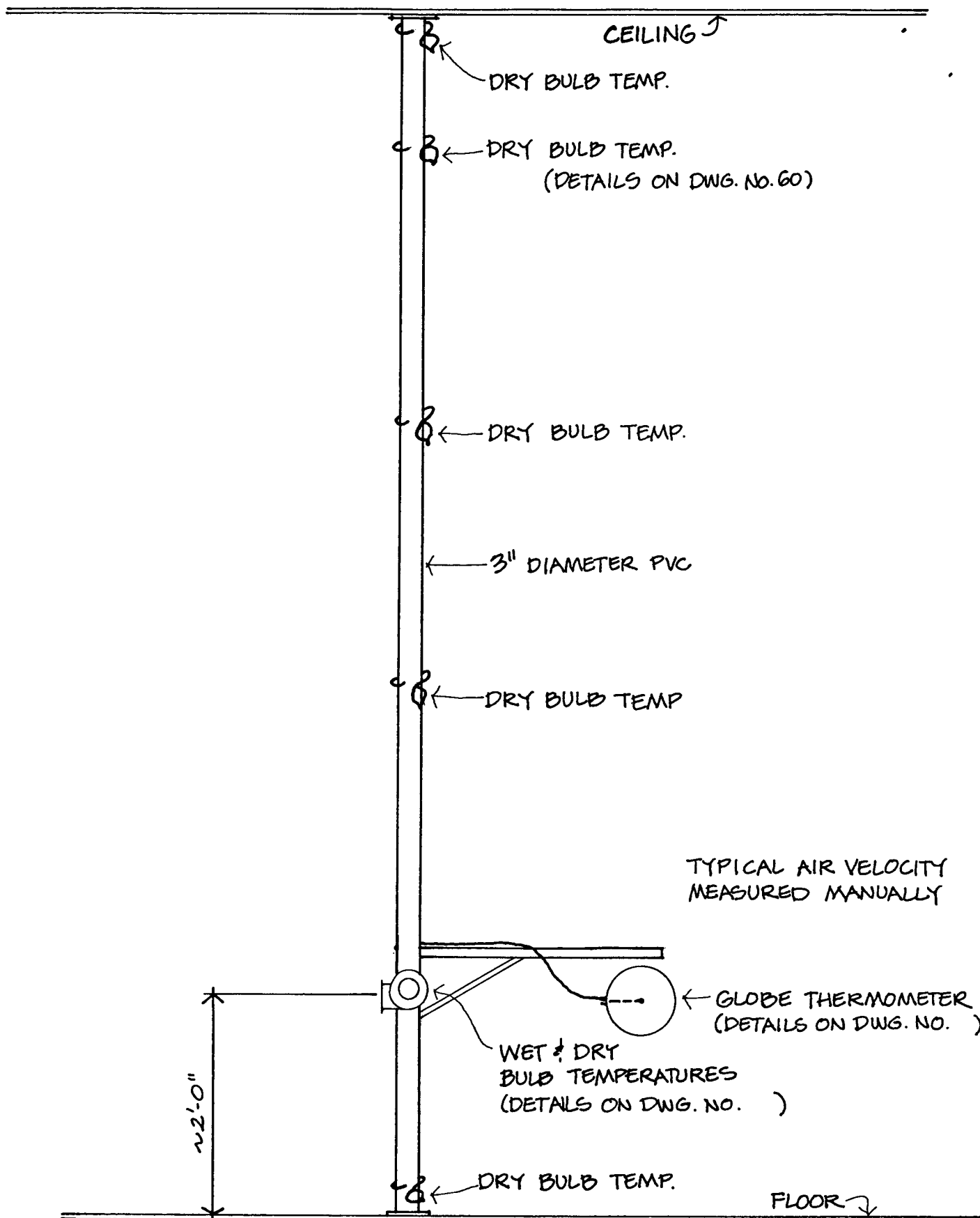
TYPICAL ROOF DETAIL

NOTE: EXTERIOR DOORS ARE SHEATHED IN METAL AND HAVE APPROXIMATELY $1\frac{5}{8}"$ (4.1 cm) URETHANE INSULATION IN CORE.

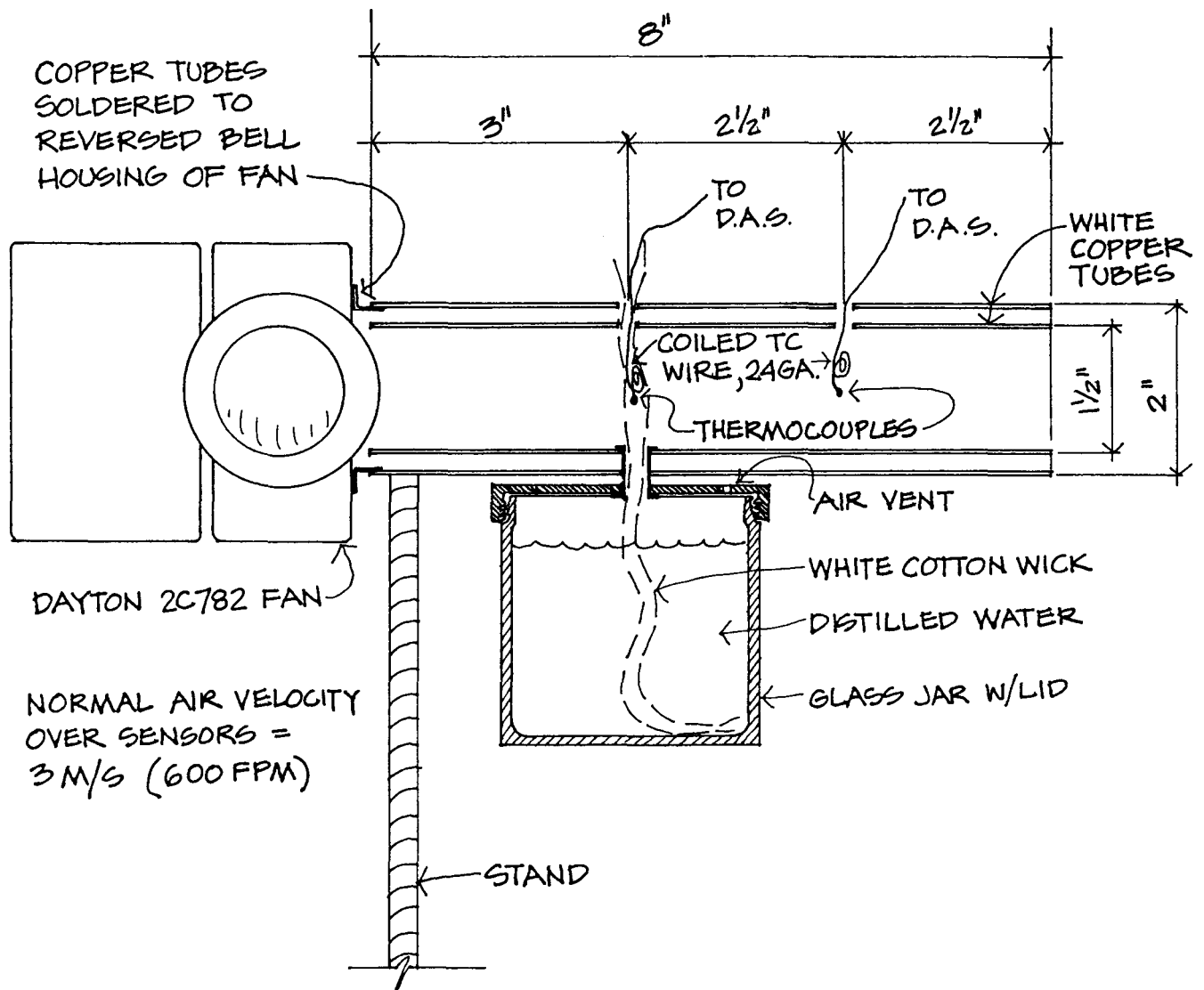
NORTH WINDOWS ARE WOOD FRAME, DOUBLE GLAZED

SOUTH FACING CLERESTORY WINDOWS ARE METAL FRAME, DOUBLE-GLAZED

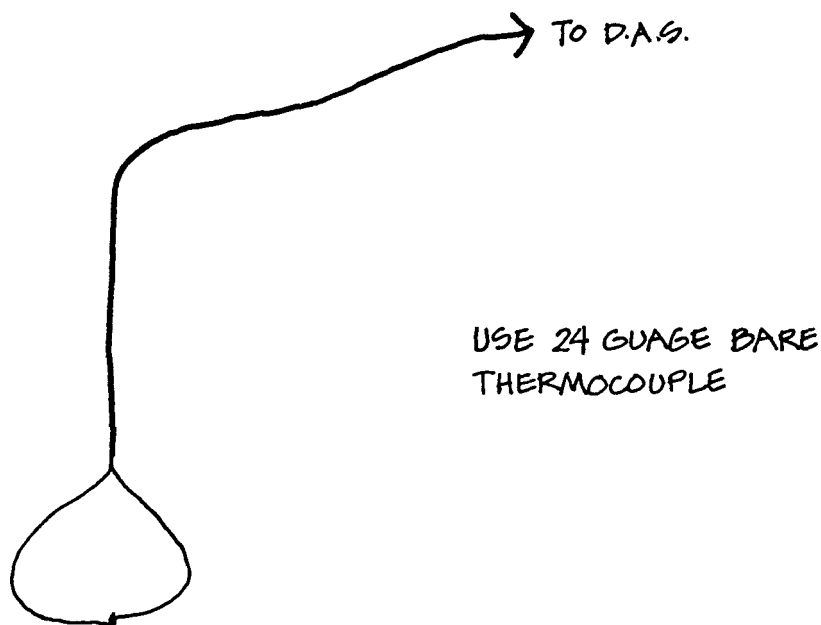
SOUTH FACING GROUND LEVEL WINDOWS ARE KLOS - 2-SINGLE-GLAZED WINDOWS LOCATED $\sim 6"$ APART IN SEPARATE METAL (ALUMINUM) FRAMES. DUO-TONE (DARK TOP, WHITE BOTTOM) BLINDS LOCATED BETWEEN WINDOWS.



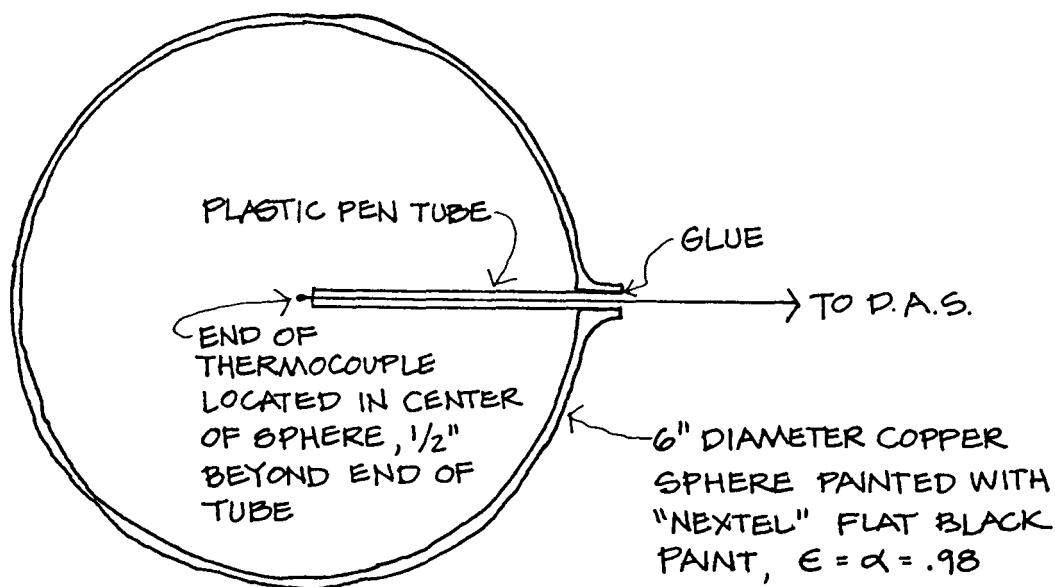
COMFORT SENSING STATIONS



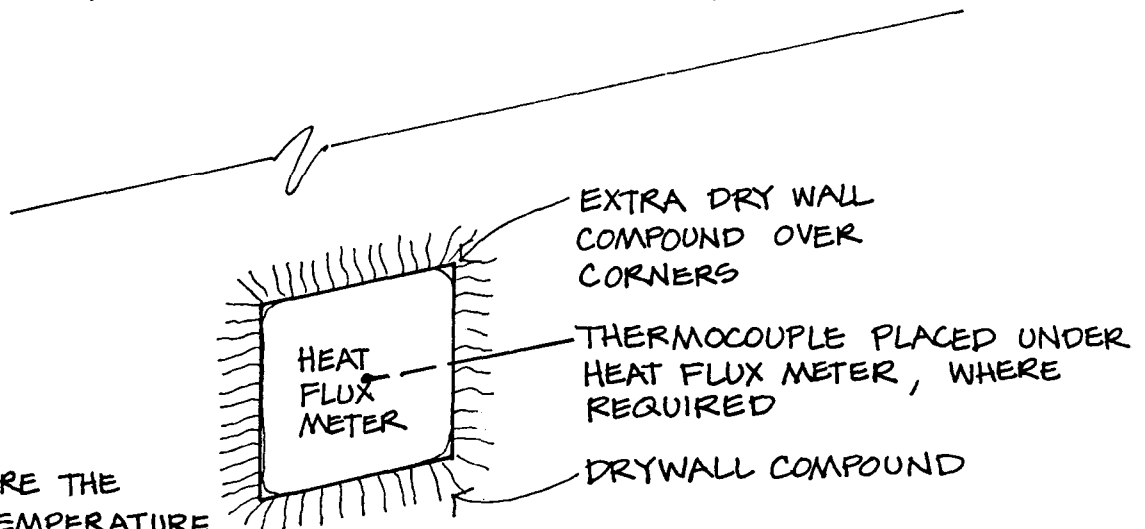
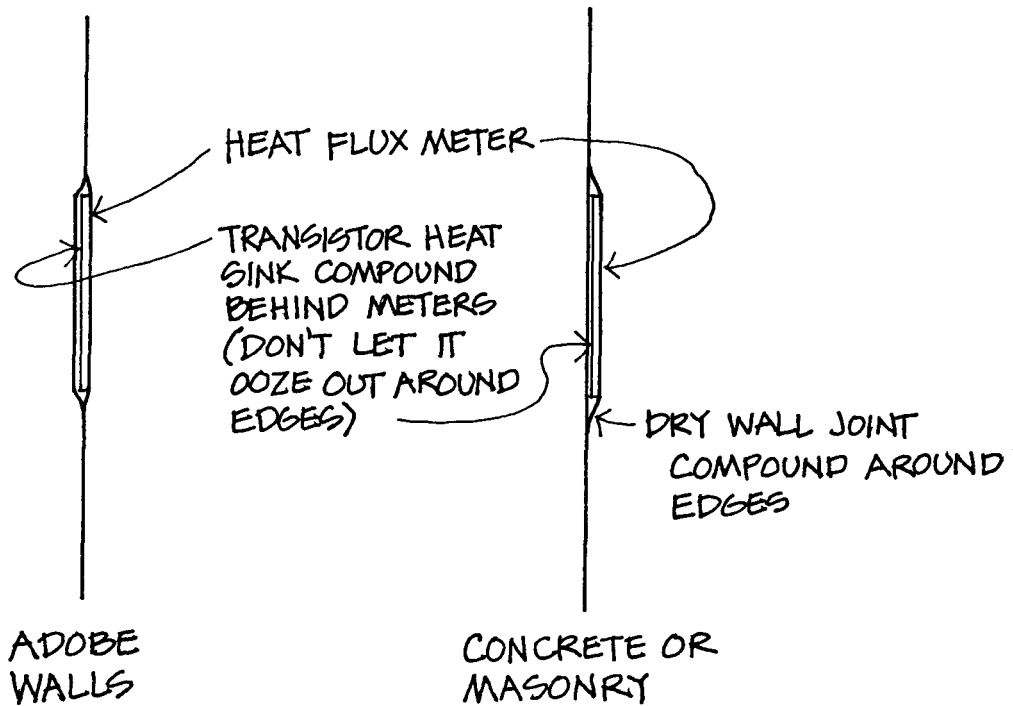
SINGLE POINT WET & DRY BULB TEMPERATURE STATION



DRY BULB TEMPERATURE STATION, NATURALLY ASPIRATED — USE ON FLOOR TO CEILING COMFORT STATIONS, AND ADJACENT TO ALL HEAT FLUX MTRS.



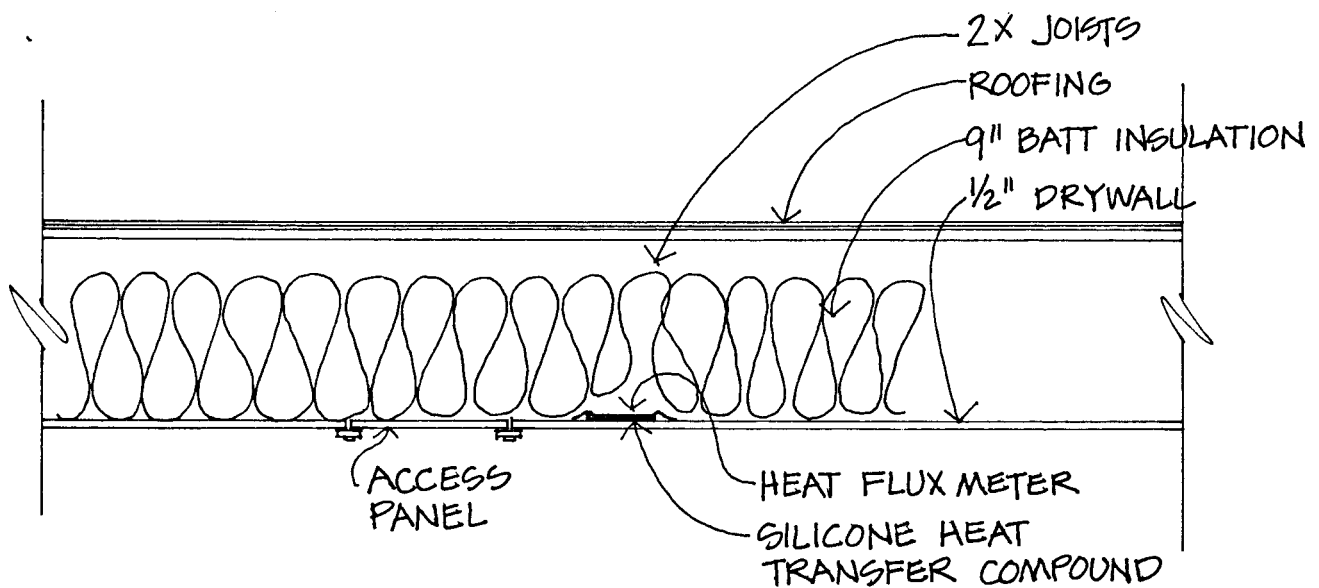
GLOBE THERMOMETER



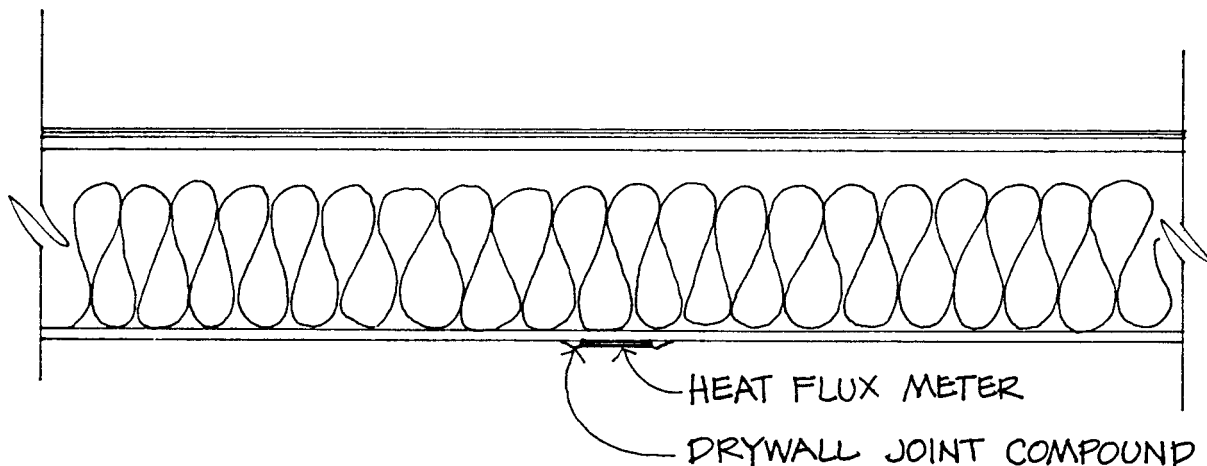
NOTE: MEASURE THE DRY BULB TEMPERATURE ADJACENT TO ALL HEAT FLUX METERS

PAINT HEAT FLUX METER SAME COLOR AS WALL OR FLOOR

WALL & FLOOR HEAT FLUX METER INSTALLATION



ALTERNATE #1

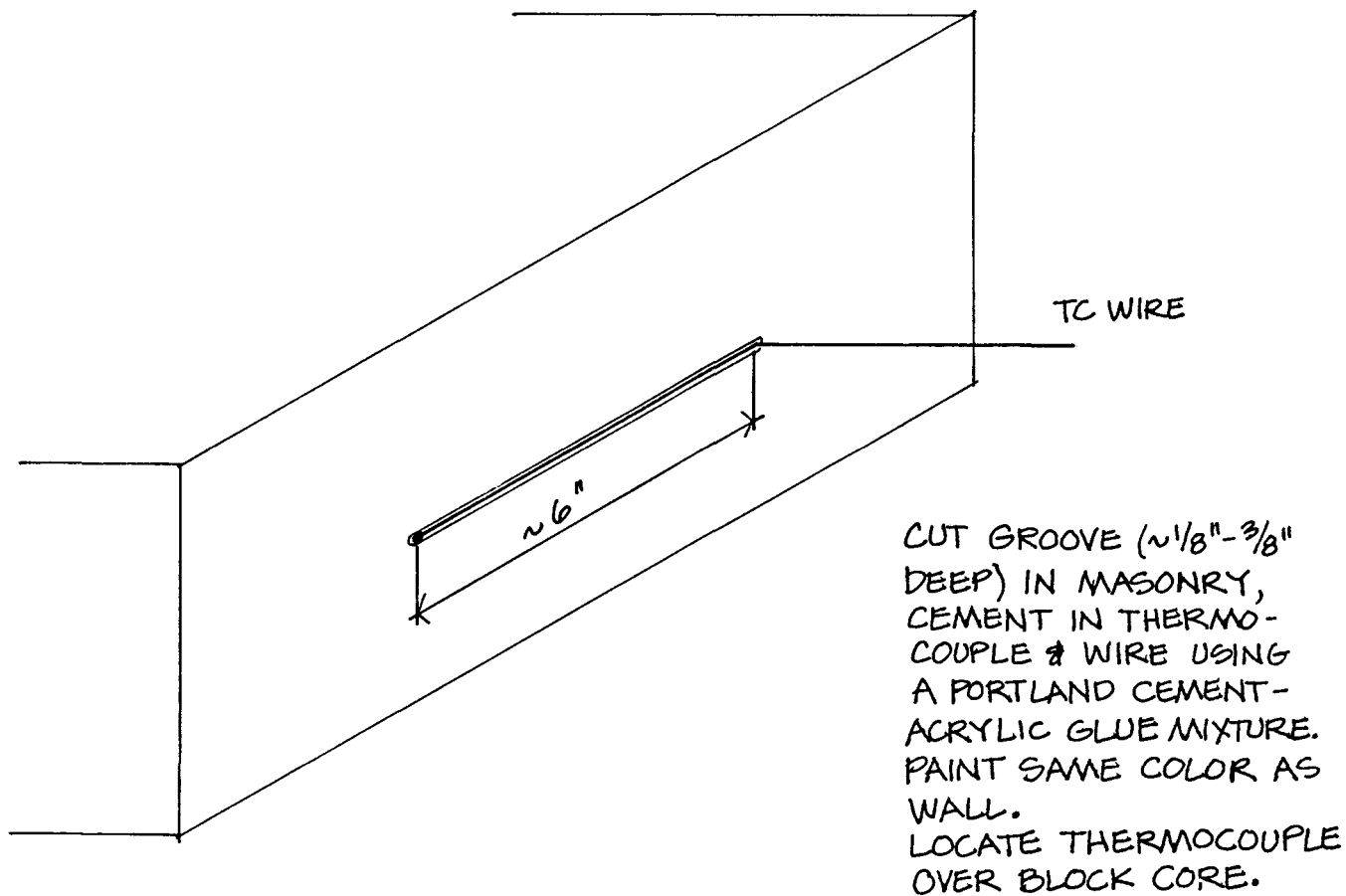


ALTERNATE #2

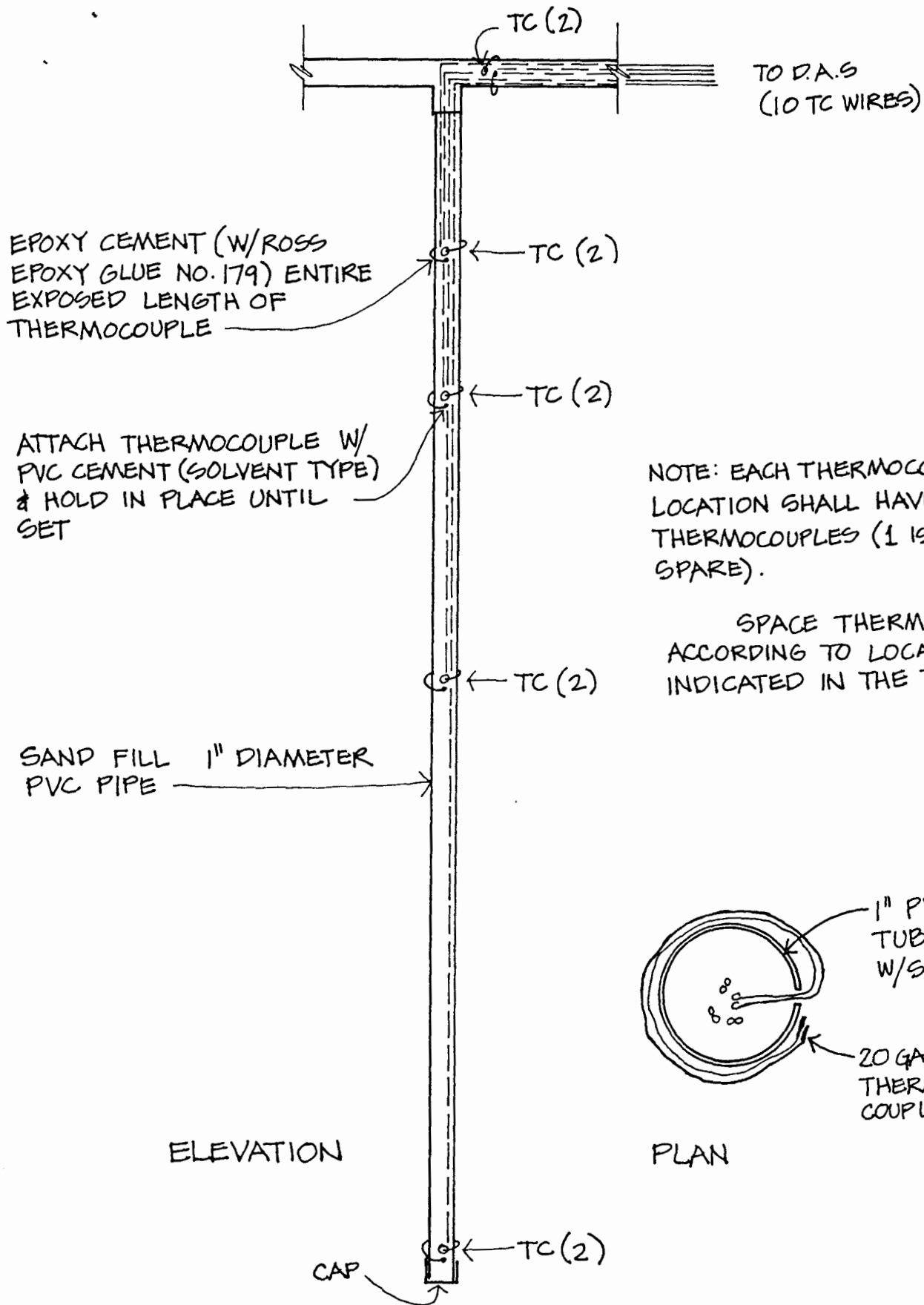
NOTES: APPLY SILICONE HEAT TRANSFER COMPOUND TO CEILING & TO METER. THEN PRESS TOGETHER AND SQUEEZE OUT EXCESS. SMOOTH JOINT BETWEEN METER & CEILING. APPLY DRYWALL COMPOUND AROUND EDGES OF METER.

TO REMOVE METER, GENTLY PRY OFF WITH DULL EDGED TOOL. IF DIFFICULT TO REMOVE, SAW OUT DRYWALL & PATCH HOLE.

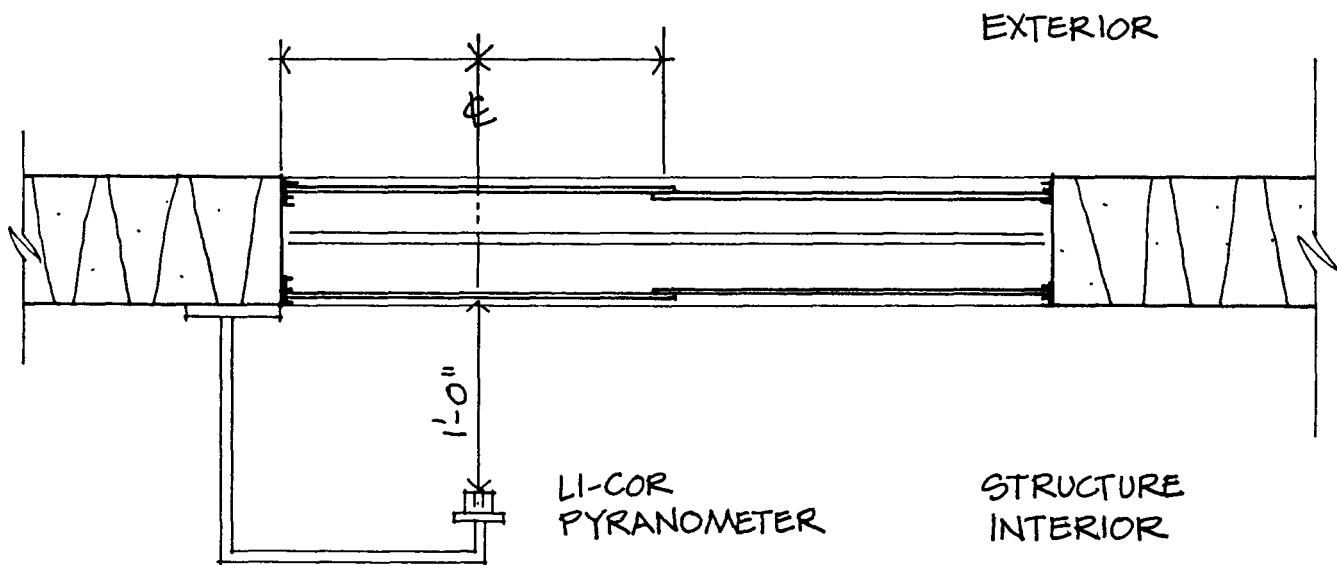
CEILING HEAT FLUX METER INSTALLATION



SURFACE TEMPERATURE THERMOCOUPLE INSTALLATION



EARTH TEMPERATURE SENSOR ARRAY (SIMILAR TO THOSE USED AT TRINITY UNIVERSITY)



PLAN VIEW

NOTE: LOCATE PYRANOMETER ONE FOOT FROM GLASS AND
AT THE MID-POINT OF A SINGLE PANE OF GLASS

LI-COR PYRANOMETER INSTALLATION

SENSOR LOCATIONS AND INSTALLATION

Structure One

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KEY TO SYMBOLS

- + Earth Temperature Array Thermocouple
- Surface Temperature Thermocouple or Thermocouples in Rakes
- Heat Flux Meter
- || Naturally Aspirated Air Temperature Thermocouple
- Comfort Sensor Station
- △ Wall Temperature Rake
- ⊙ Pyranometer
- ◈ □ Mechanically Aspirated Wet Bulb/Dry Bulb
- ∇ Continuous Air Velocity Meter
- Soil Moisture Sensors

SENSOR READ OUT ABBREVIATIONS

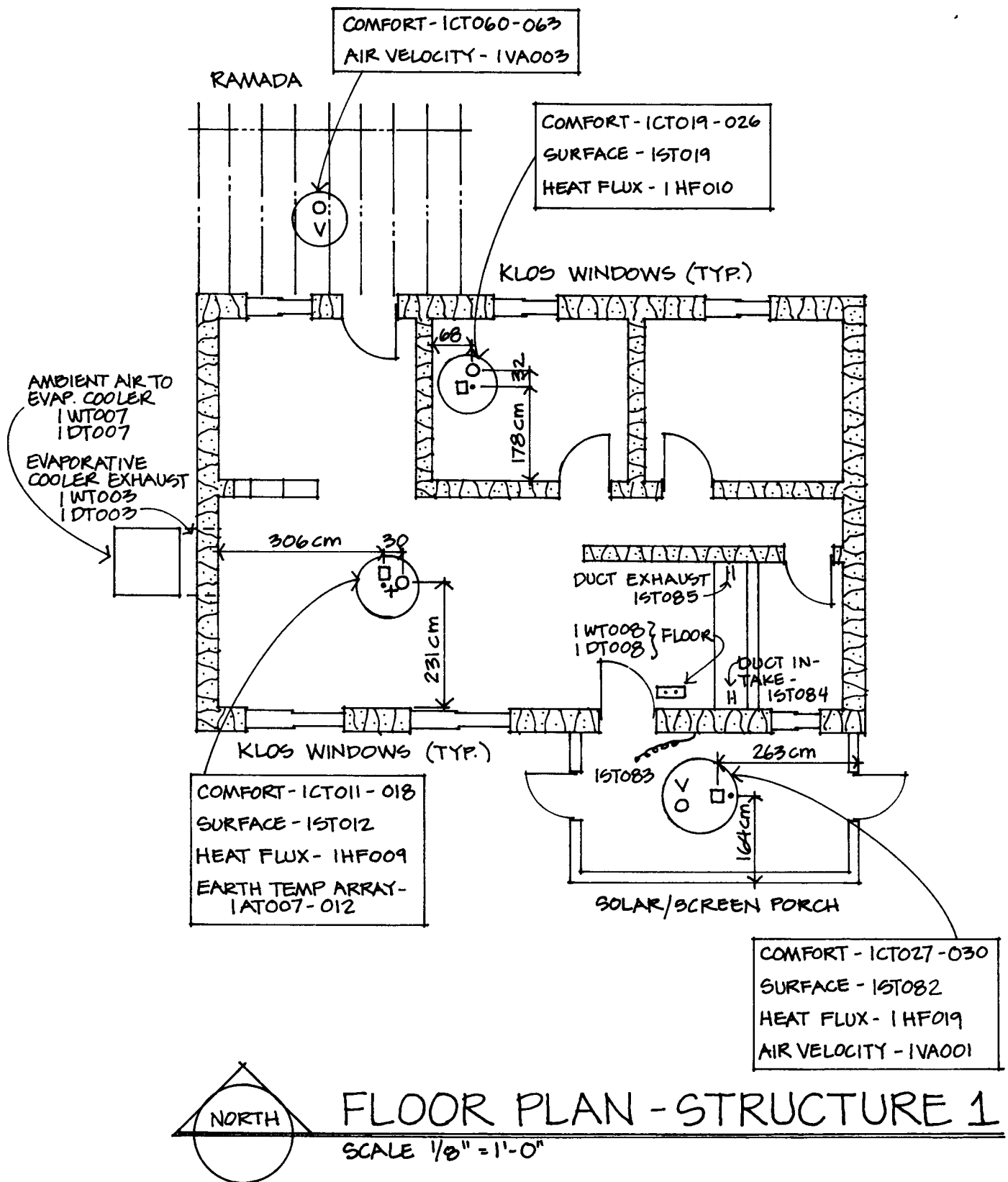
- AT Earth Temperature Array Thermocouple
- BT Rockbed Thermocouple
- CT Comfort Sensor Station Thermocouple
- DT Dry Bulb Thermocouple
- ET Rock Embedded Thermocouple
- LT Liquid Wall Thermocouple
- NT Naturally Aspirated Air Temperature Thermocouple
- RT Wall Temperature Rake Thermocouple
- ST Surface Temperature Thermocouple
- TT Test Terminal Thermocouple
- WT Wet Bulb Thermocouple
- AZ Wind Direction
- HF Heat Flux Meter
- PG Pyrgeometer
- PM Pyranometer
- TM Test Terminal Millivolt
- VA Continuous Air Velocity Meter
- WS Wind Speed

SENSOR NAMES AND LOCATIONS — STRUCTURE ONE

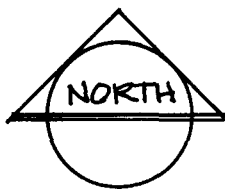
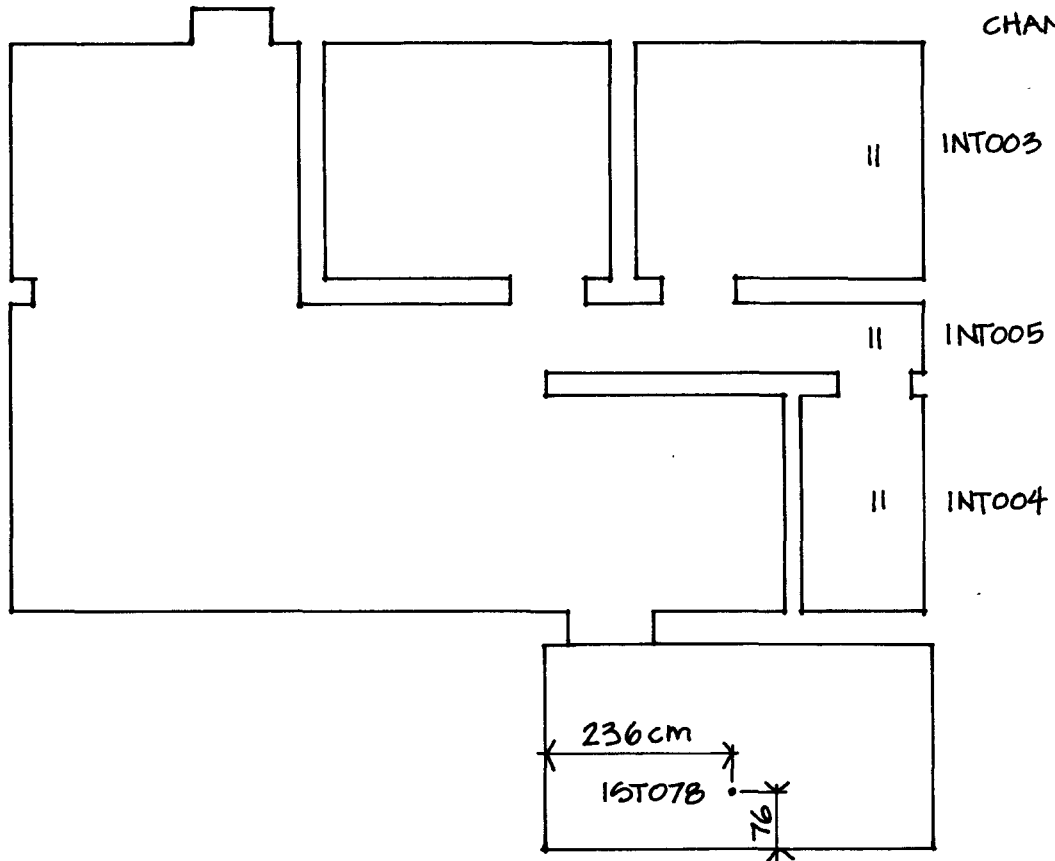
READ OUT NO.	LOCATION	FIGURE NO.
1CT011	COMFORT SENSING STATION-SOUTH ROOM	1 & 12
1CT012		
1CT013		
1CT014		
1CT015		
1CT016		
1CT017		
1CT018		
1NT002	AIR TEMP WEST WALL-4 FT HEIGHT	9
1RT053	WEST WALL-4 FT HEIGHT ADOBE-TEMP RAKE	9 & 16
1RT054		
1RT055		
1RT056		
1RT057		
1RT058		
1RT059		
1RT060		
1RT061		
1RT062		
1ST012	FLOOR SURFACE TEMP-SOUTH ROOM COMFORT STATION	1 & 20
1AT007	EARTH TEMP ARRAY-BELOW SOUTH COMFORT STATION	1 & 20
1AT008		
1AT009		
1AT010		
1AT011		
1AT012		
1ST013	WEST WALL SURFACE TEMP-SOUTH SIDE-2 FT	9
1ST014	WEST WALL SURFACE TEMP-SOUTH SIDE-6 FT	
1ST015	WEST WALL SURFACE TEMP-NORTH SIDE-4 FT	
1ST016	NORTH WALL SURFACE TEMP-WEST ROOM-2 FT	6
1ST017	NORTH WALL SURFACE TEMP-WEST ROOM-4 FT	
1ST018	NORTH WALL SURFACE TEMP-WEST ROOM-6 FT	
1CT019	COMFORT SENSING STATION-NORTH ROOM	1 & 13
1CT020		
1CT021		
1CT022		
1CT023		
1CT024		
1CT025		
1CT026		
1ST019	FLOOR SURFACE TEMP-NORTH ROOM COMFORT STATION	1
1RT063	NORTH WALL-4 FT HEIGHT ADOBE-WALL RAKE	6 & 17
1RT064		
1RT065		
1RT066		
1RT067		
1RT068		
1RT069		
1RT070		
1RT071		
1RT072		

READ OUT NO.	LOCATION	FIGURE NO.
1ST020	NORTH WALL SURFACE TEMP-MIDDLE ROOM-2 FT	6
1ST021	NORTH WALL SURFACE TEMP-MIDDLE ROOM-6 FT	
1RT073		
1RT074		
1RT075	INTERIOR WALL-MIDDLE ROOM-4 FT HEIGHT	10 & 18
1RT076	ADOBE-WALL RAKE	
1RT077		
1RT078		
1RT079		
1ST022	INTERIOR WALL SURF TEMP-MIDDLE RM-NORTH SIDE-2 FT	10
1ST023	INTERIOR WALL SURF TEMP-MIDDLE RM-NORTH SIDE-6 FT	
1RT080		
1RT081		
1RT082	INTERIOR WALL-EAST ROOM-4 FT HEIGHT	10 & 19
1RT083	ADOBE-WALL RAKE	
1RT084		
1RT085		
1RT086		
1ST024	INTERIOR WALL SURF TEMP-EAST ROOM-NORTH SIDE-2 FT	10
1ST025	INTERIOR WALL SURF TEMP-EAST ROOM-NORTH SIDE-6 FT	
1ST026	EAST WALL SURFACE TEMP-NORTH ROOM-2 FT	8
1ST027	EAST WALL SURFACE TEMP-NORTH ROOM-4 FT	
1ST028	EAST WALL SURFACE TEMP-NORTH ROOM-6 FT	
1NT003	AIR TEMP-NORTHEAST ROOM CEILING-RADIATING ROOF	2
1ST029	EAST WALL SURFACE TEMP-SOUTH ROOM-4 FT	8
1NT004	AIR TEMP-SOUTHEAST ROOM CEILING-RADIATING ROOF	2
1ST030	INTERIOR WALL SURF TEMP-EAST ROOM-SOUTH SIDE-2 FT	11
1ST031	INTERIOR WALL SURF TEMP-EAST ROOM-SOUTH SIDE-6 FT	
1ST032	INTERIOR WALL SURF TEMP-MIDDLE RM-SOUTH SIDE-2 FT	
1ST033	INTERIOR WALL SURF TEMP-MIDDLE RM-SOUTH SIDE-6 FT	
1NT005	AIR TEMP-HALL CEILING-RADIATING ROOF	2
1ST034	SOUTH WALL SURFACE TEMP-EAST SIDE-2 FT	7
1ST035	SOUTH WALL SURFACE TEMP-EAST SIDE-4 FT	
1ST036	SOUTH WALL SURFACE TEMP-EAST SIDE-6 FT	
1ST037	SOUTH WALL SURFACE TEMP-MIDDLE-2 FT	7
1ST038	SOUTH WALL SURFACE TEMP-MIDDLE-4 FT	
1ST039	SOUTH WALL SURFACE TEMP-MIDDLE-6 FT	
1ST040	ROOF SURFACE TEMP-NORTHEAST	3
1ST041	ROOF SURFACE TEMP-EAST	
1ST042	ROOF SURFACE TEMP-SOUTHEAST	
1WT003	EVAPORATIVE COOLER EXHAUST-WET BULB	1
1DT003	EVAPORATIVE COOLER EXHAUST-DRY BULB	
1CT027		
1CT028	COMFORT SENSING STATION-SOLAR/SCREEN PORCH	1 & 14
1CT029		
1CT030		
1NT010	AIR TEMP-INTERIOR WALL-EAST ROOM-NORTH SIDE-4 FT	10
1NT011	AIR TEMP-INTERIOR WALL-EAST ROOM-SOUTH SIDE-4 FT	11
1CT060		
1CT061	COMFORT SENSING STATION-RAMADA	1 & 15
1CT062		
1CT063		

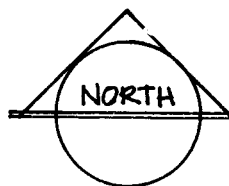
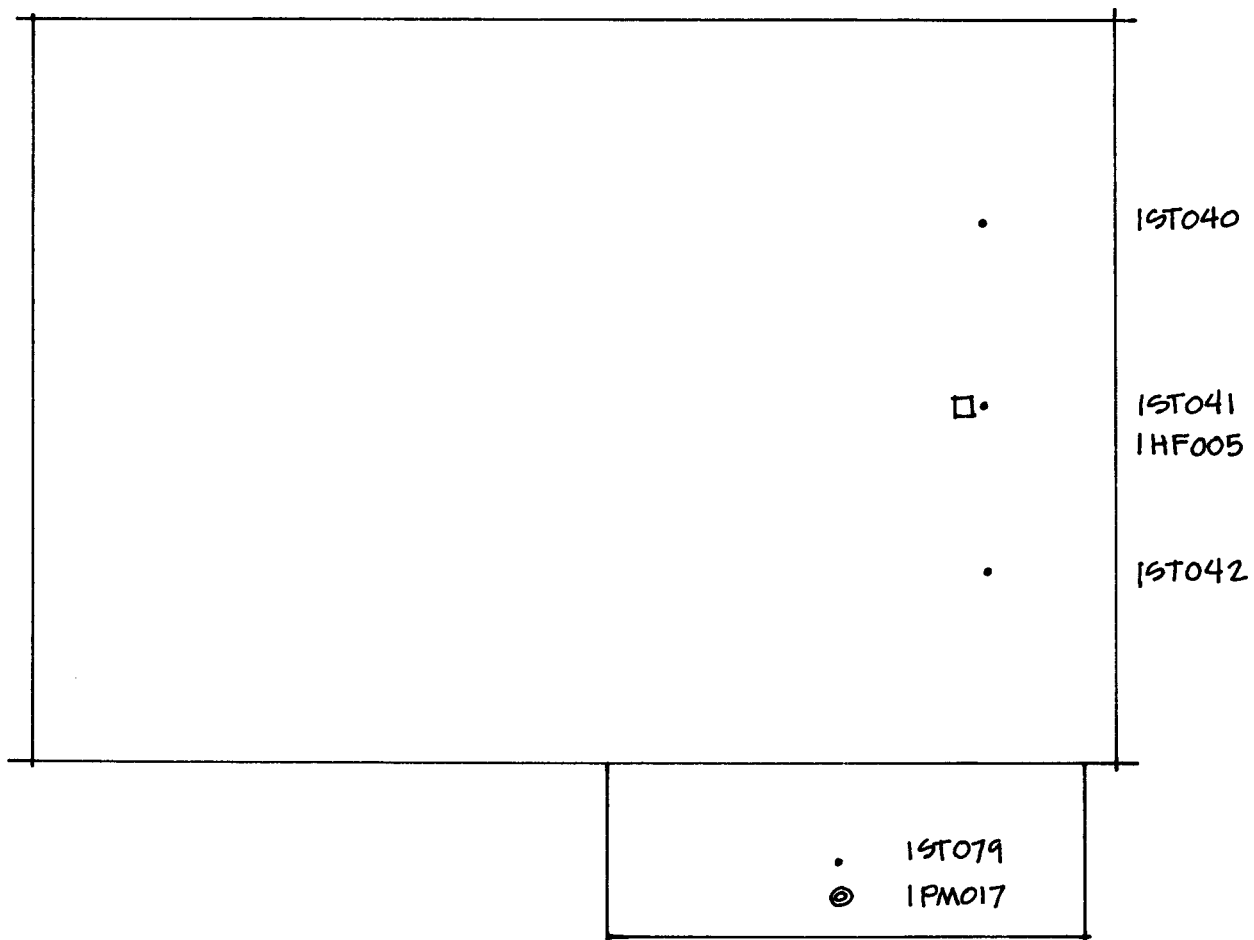
READ OUT NO.	LOCATION	FIGURE NO.
1WT007	EVAPORATIVE COOLER INTAKE-WET BULB	1
1DT007	EVAPORATIVE COOLER INTAKE-DRY BULB	
1ST078	PORCH CEILING SURFACE TEMP	2
1ST079	PORCH ROOF SURFACE TEMP	3
1ST080	NORTH WALL PORCH SURFACE TEMP-2 FT	4
1ST081	NORTH WALL PORCH SURFACE TEMP-4 FT	
1ST082	PORCH FLOOR SURFACE TEMP	1
1ST083	SPARE PORCH FLOOR THERMOCOUPLE	
1ST084	AIR TEMP-PORCH DUCT INTAKE	1
1ST085	AIR TEMP-PORCH DUCT EXHAUST	
1WT008	SOUTH FLOOR-WET BULB	1
1DT008	SOUTH FLOOR-DRY BULB	
1ST104	NORTH PLENUM SURFACE TEMP-EAST	
1ST105	NORTH PLENUM SURFACE TEMP-CENTER	6
1ST106	NORTH PLENUM SURFACE TEMP-WEST	
1ST107	SOUTH PLENUM SURFACE TEMP-EAST	
1ST108	SOUTH PLENUM SURFACE TEMP-CENTER	7
1ST109	SOUTH PLENUM SURFACE TEMP-WEST	
1HF005	HEAT FLUX-ROOF-EAST END	3
1HF006	HEAT FLUX-INTERIOR WALL-EAST END-NORTH SIDE-4 FT	10
1HF007	HEAT FLUX-INTERIOR WALL-EAST END-SOUTH SIDE-4 FT	11
1HF008	HEAT FLUX-WEST WALL-4 FT	9
1HF009	HEAT FLUX-FLOOR-SOUTH ROOM COMFORT SENSOR STATION	1 & 20
1HF010	HEAT FLUX-FLOOR-NORTH ROOM COMFORT SENSOR STATION	1
1PM011	LI-COR PYRANOMETER-SOUTH ROOM	7
1PM012	LI-COR PYRANOMETER-NORTH ROOM	6
1VA001	AIR VELOCITY-SOLAR/SCREEN PORCH	1
1VA003	AIR VELOCITY-RAMADA	
1HF019	HEAT FLUX-SOLAR/SCREEN PORCH FLOOR	1
1HF020	HEAT FLUX-NORTH WALL PORCH-4 FT	4
1PM015	LI-COR PYRANOMETER-SOUTH PORCH INTERIOR	5
1PM016	LI-COR PYRANOMETER-SOUTH PORCH EXTERIOR	
1PM017	LI-COR PYRANOMETER-PORCH ROOF	3
1PM018	LI-COR PYRANOMETER-EAST PORCH EXTERIOR	5
1PM019	LI-COR PYRANOMETER-WEST PORCH EXTERIOR	
1HF021	SPARE	
1HF022	SPARE	
1TM002	TEST MILLIVOLT	
1TT002	TEST THERMOCOUPLE	



NATURALLY ASPIRATED TC'S
LOCATED IN RADIATING ROOF
CHANNELS.

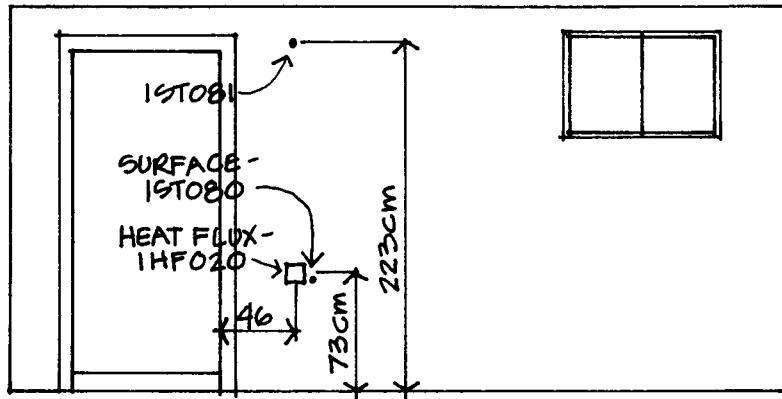


CEILING PLAN - STRUCTURE 1
SCALE 1/8" = 1'-0"



ROOF PLAN - STRUCTURE 1

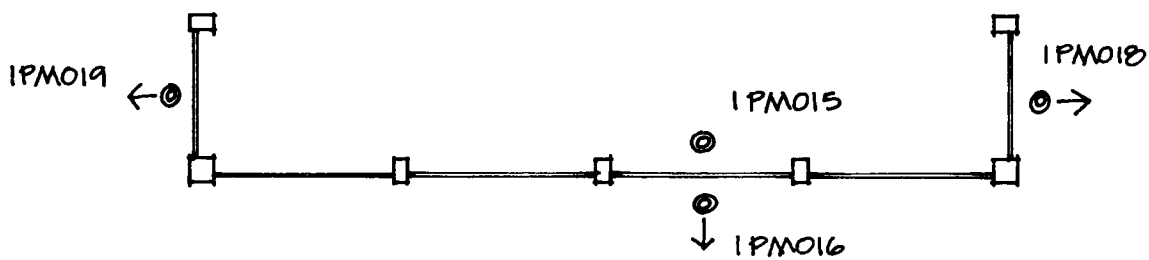
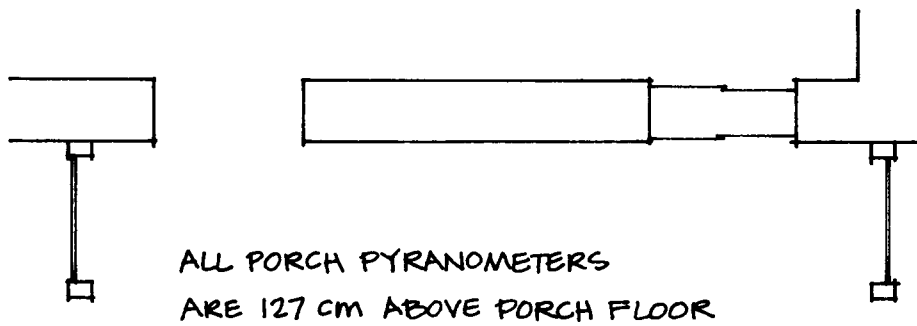
SCALE 1/8" = 1'-0"



PORCH WALL ELEVATION

SCALE 1/4" = 1'-0"

Fig. 4



PORCH FLOOR PLAN - STRUCTURE ONE

SCALE 1/4" = 1'-0"

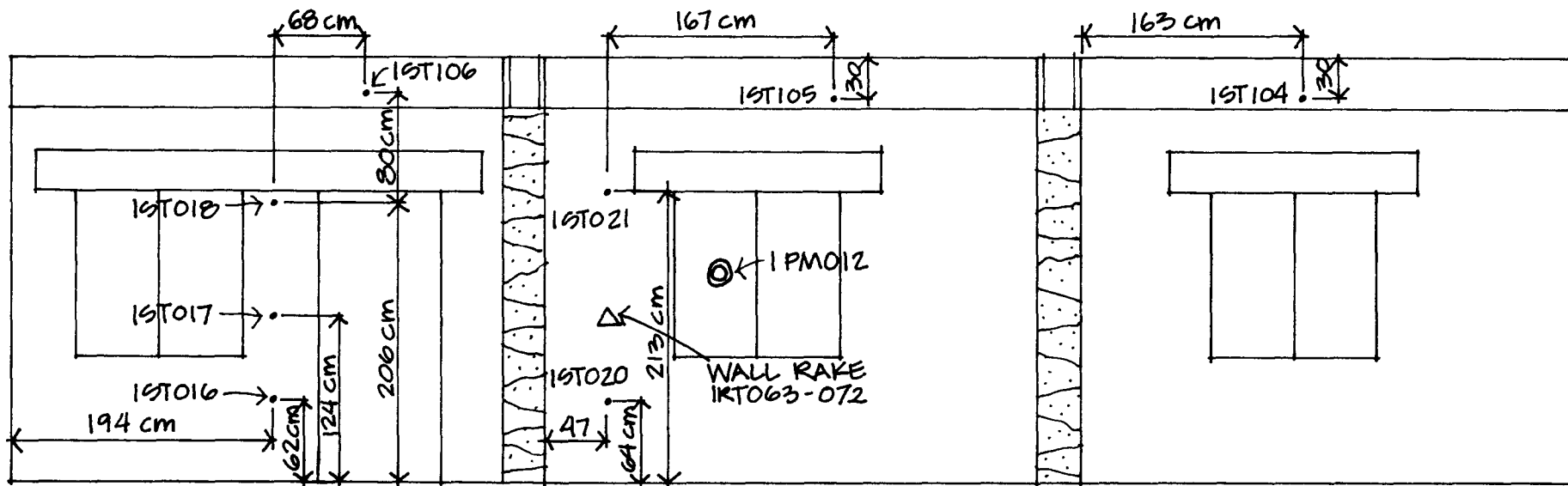


Fig. 6

44

NORTH INTERIOR WALL ELEVATION - STRUCTURE ONE

SCALE $\frac{1}{4}" = 1' - 0"$

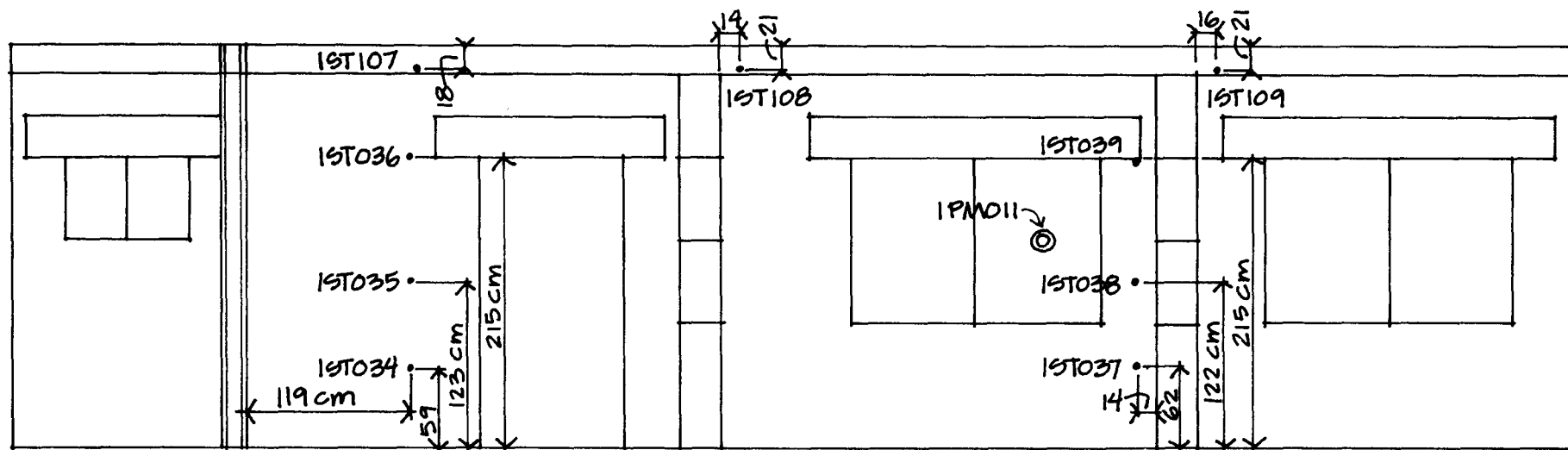
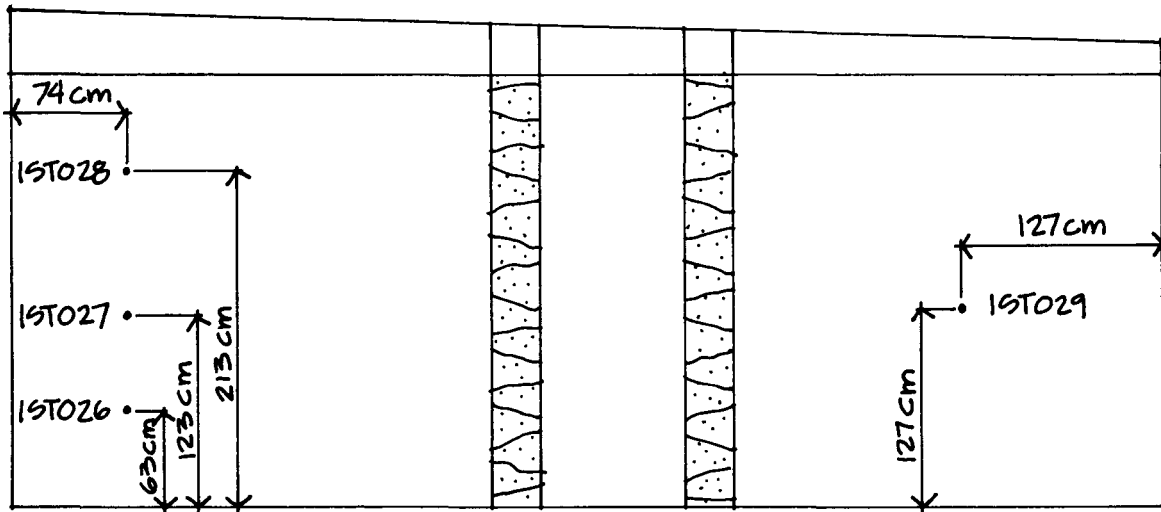


Fig. 7

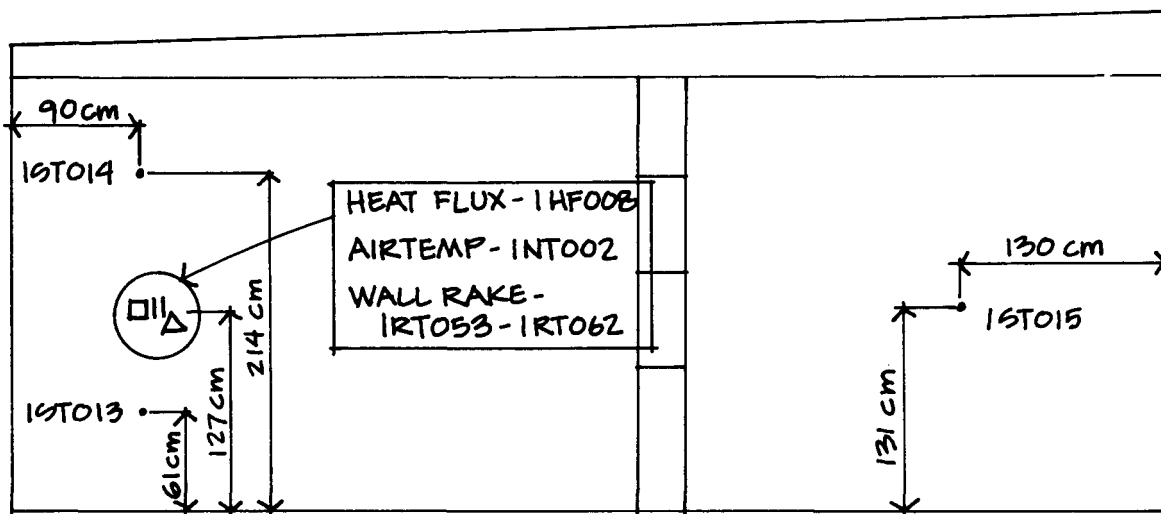
SOUTH INTERIOR WALL ELEVATION - STRUCTURE ONE

SCALE $\frac{1}{4}" = 1'-0"$



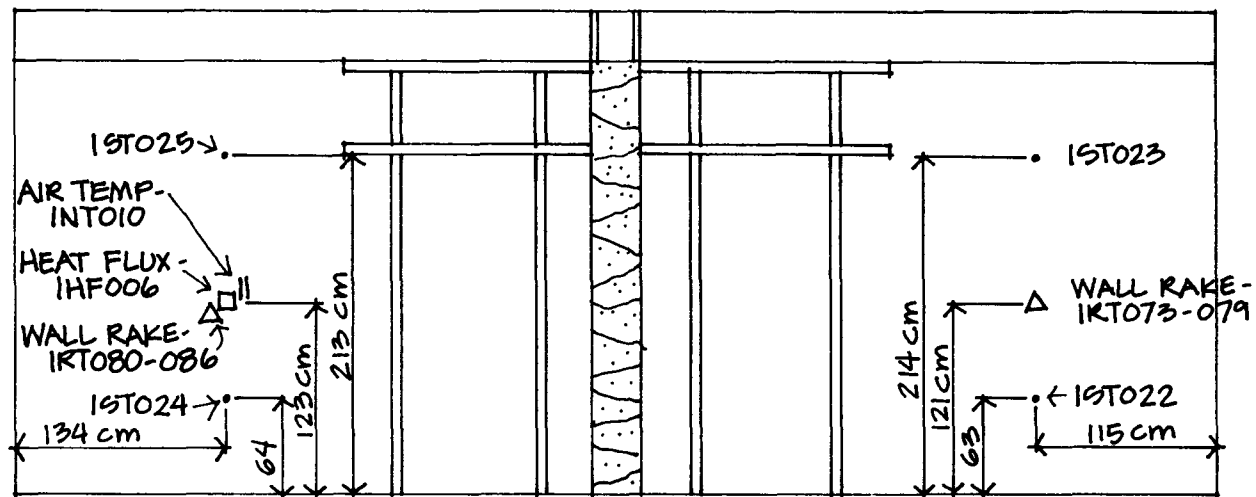
EAST WALL INTERIOR ELEVATION
SCALE $\frac{1}{4}" = 1'-0"$

Fig. 8



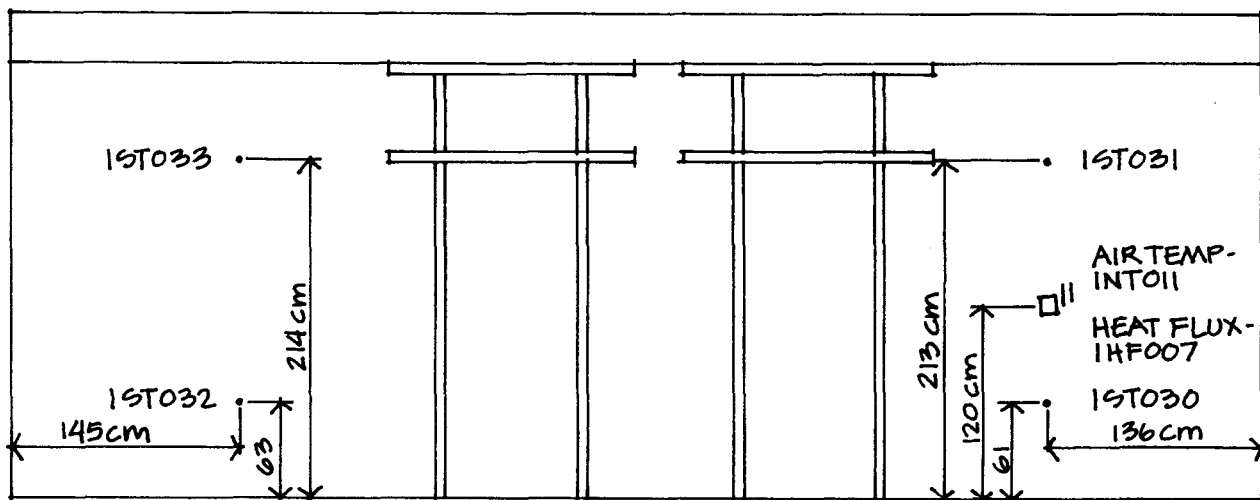
WEST WALL INTERIOR ELEVATION -
STRUCTURE ONE
SCALE $\frac{1}{4}" = 1'-0"$

Fig. 9



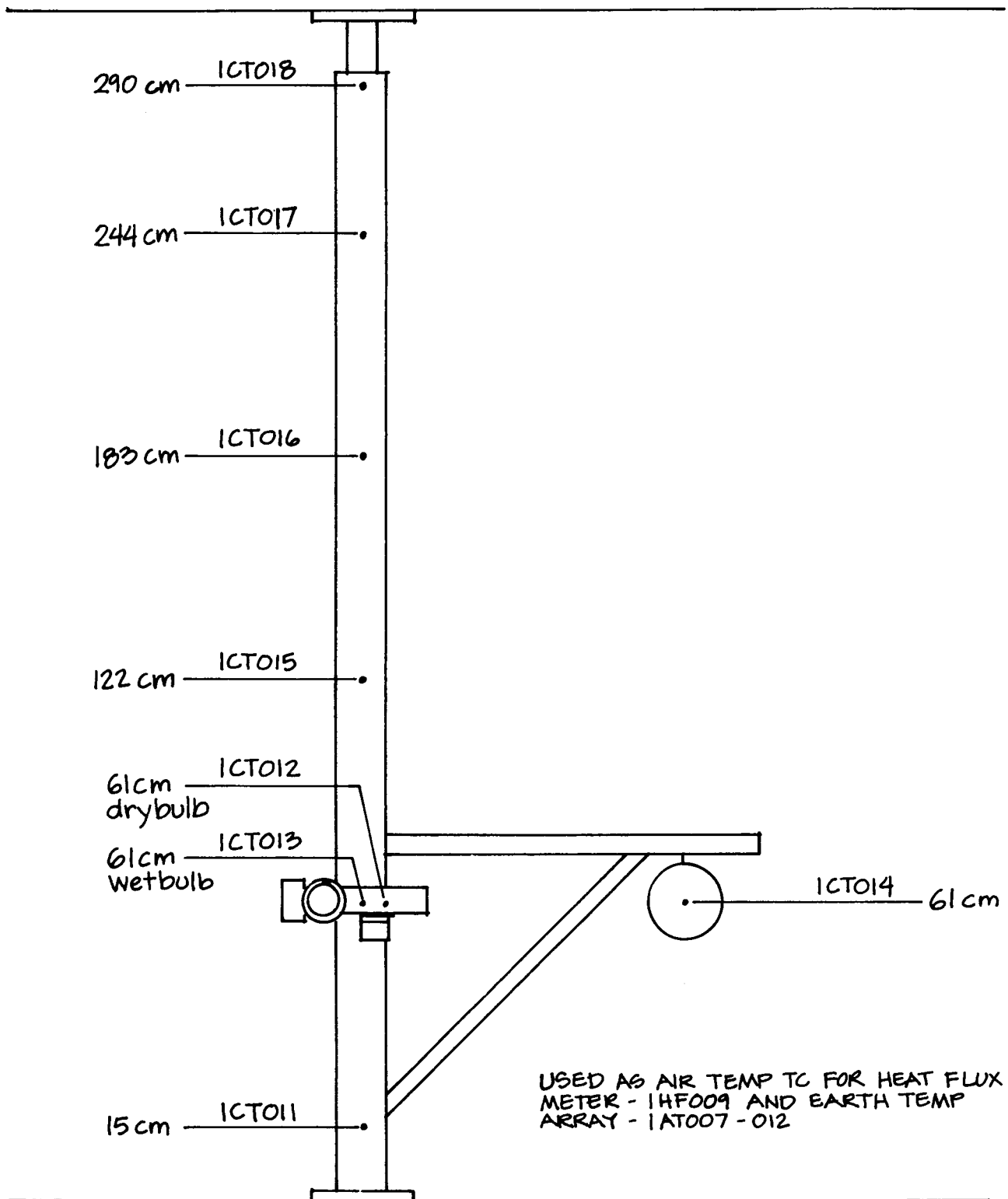
ELEVATION - INTERIOR WALL from
inside "bedroom"
SCALE $\frac{1}{4}" = 1'-0"$

Fig.10

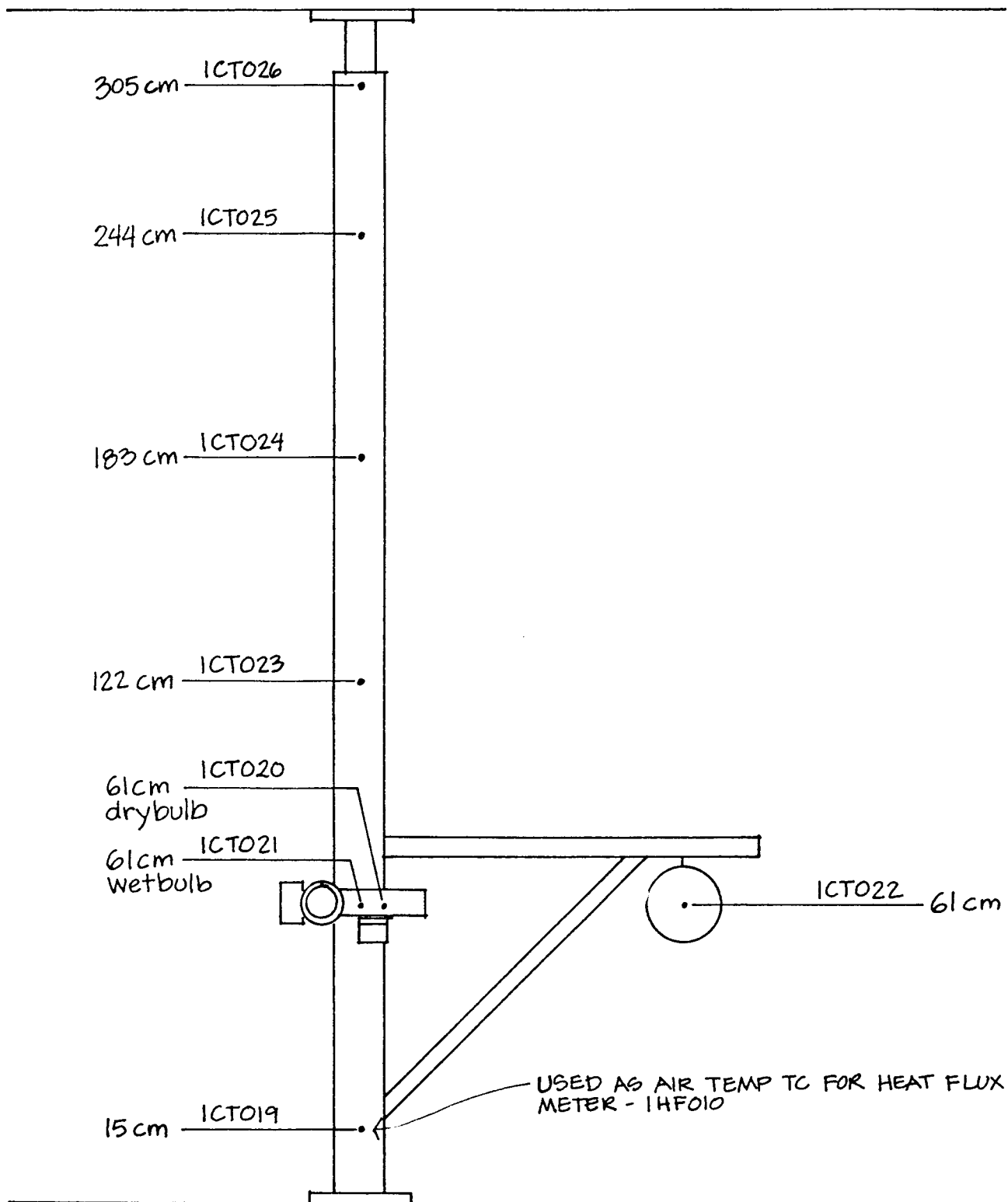


ELEVATION - INTERIOR WALL from hall
STRUCTURE ONE
SCALE $\frac{1}{4}" = 1'-0"$

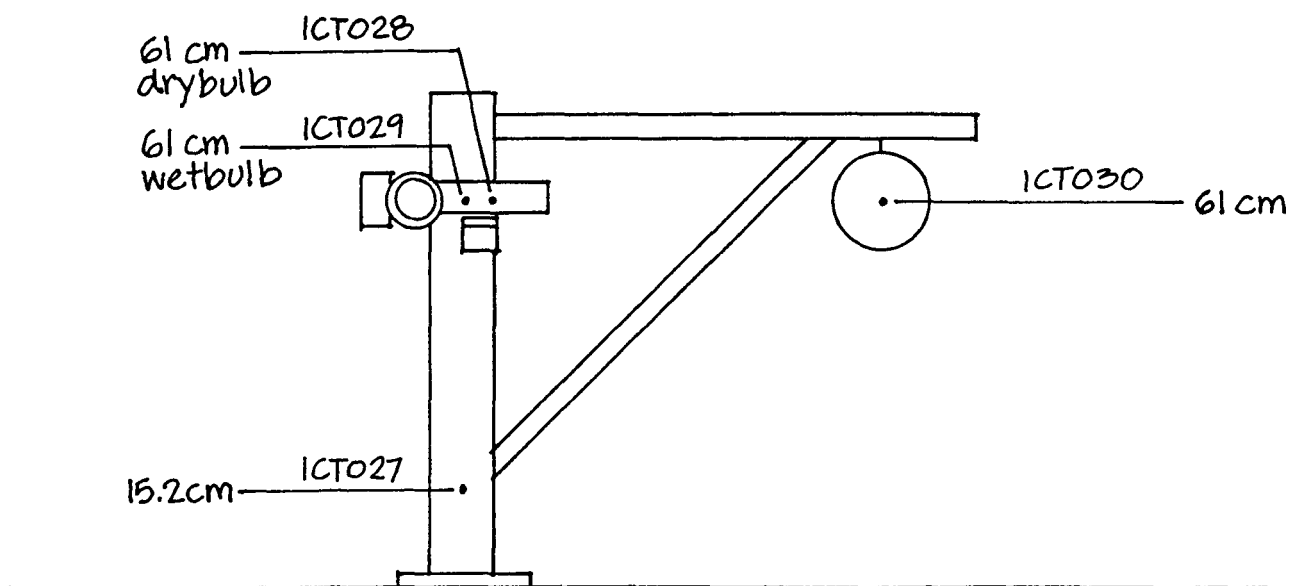
Fig.11



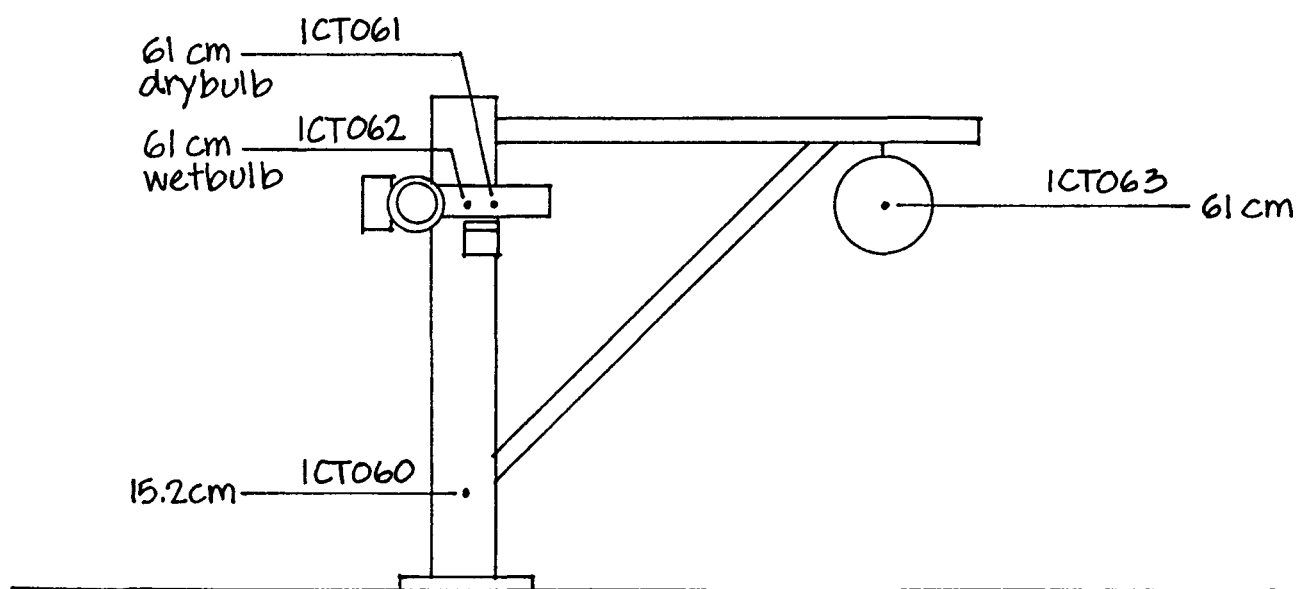
COMFORT SENSOR STATION
STRUCTURE 1 - SOUTH ROOM



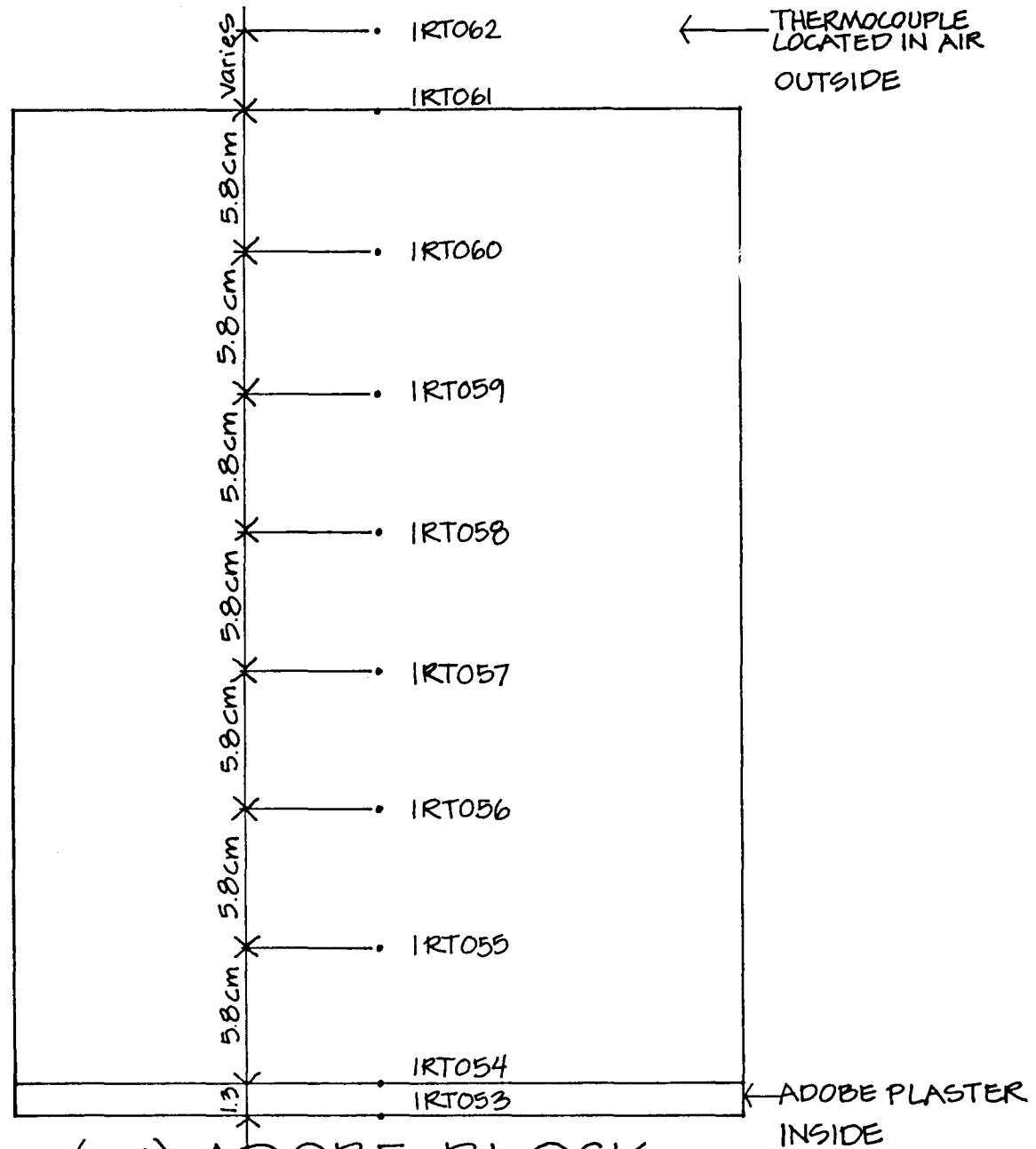
COMFORT SENSOR STATION
STRUCTURE 1 - NORTH ROOM



COMFORT SENSOR STATION
STRUCTURE ONE - PORCH



COMFORT SENSOR STATION
STRUCTURE ONE - RAMADA



40.6 cm (16") ADOBE BLOCK
STRUCTURE ONE - WEST WALL

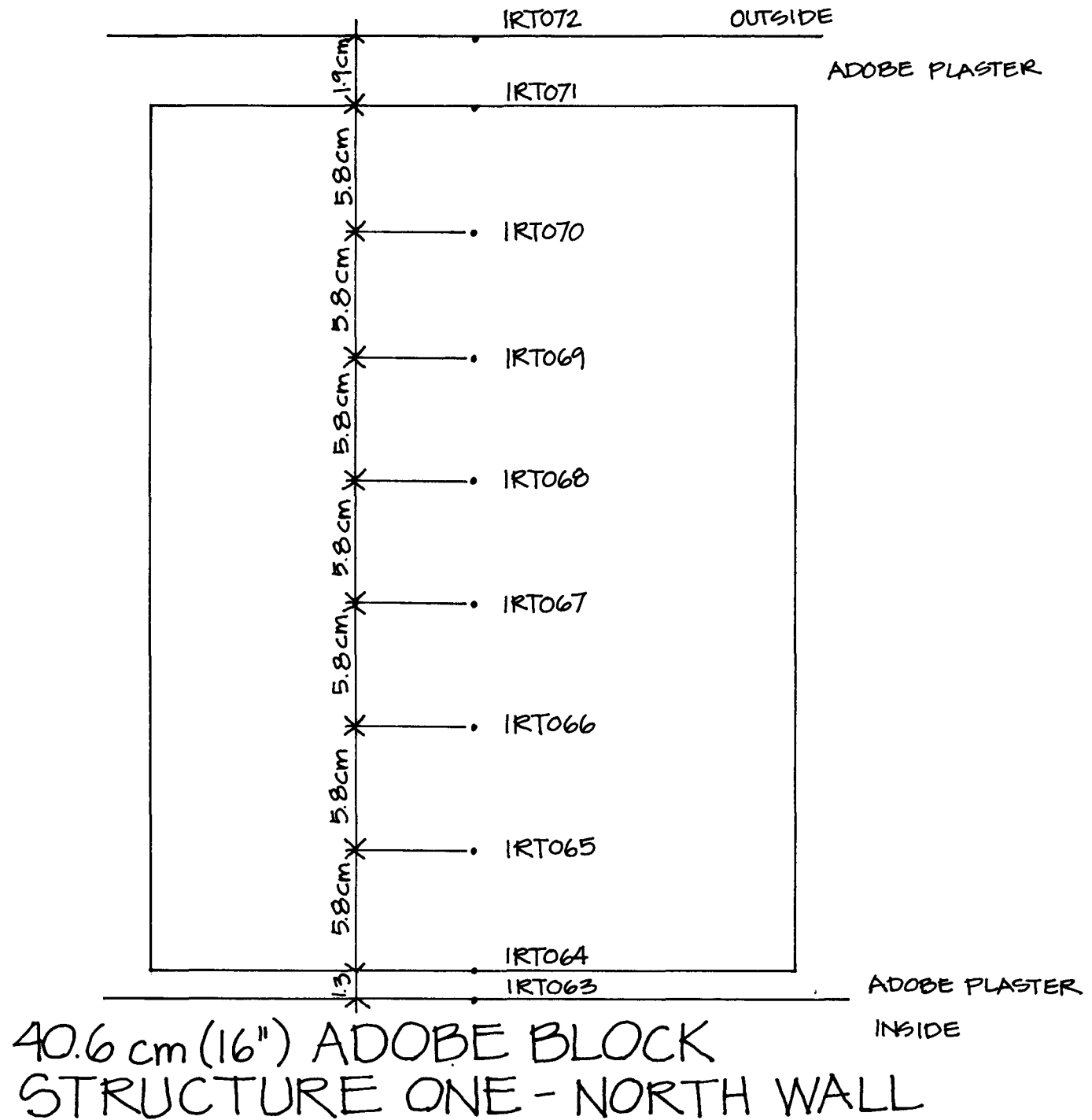
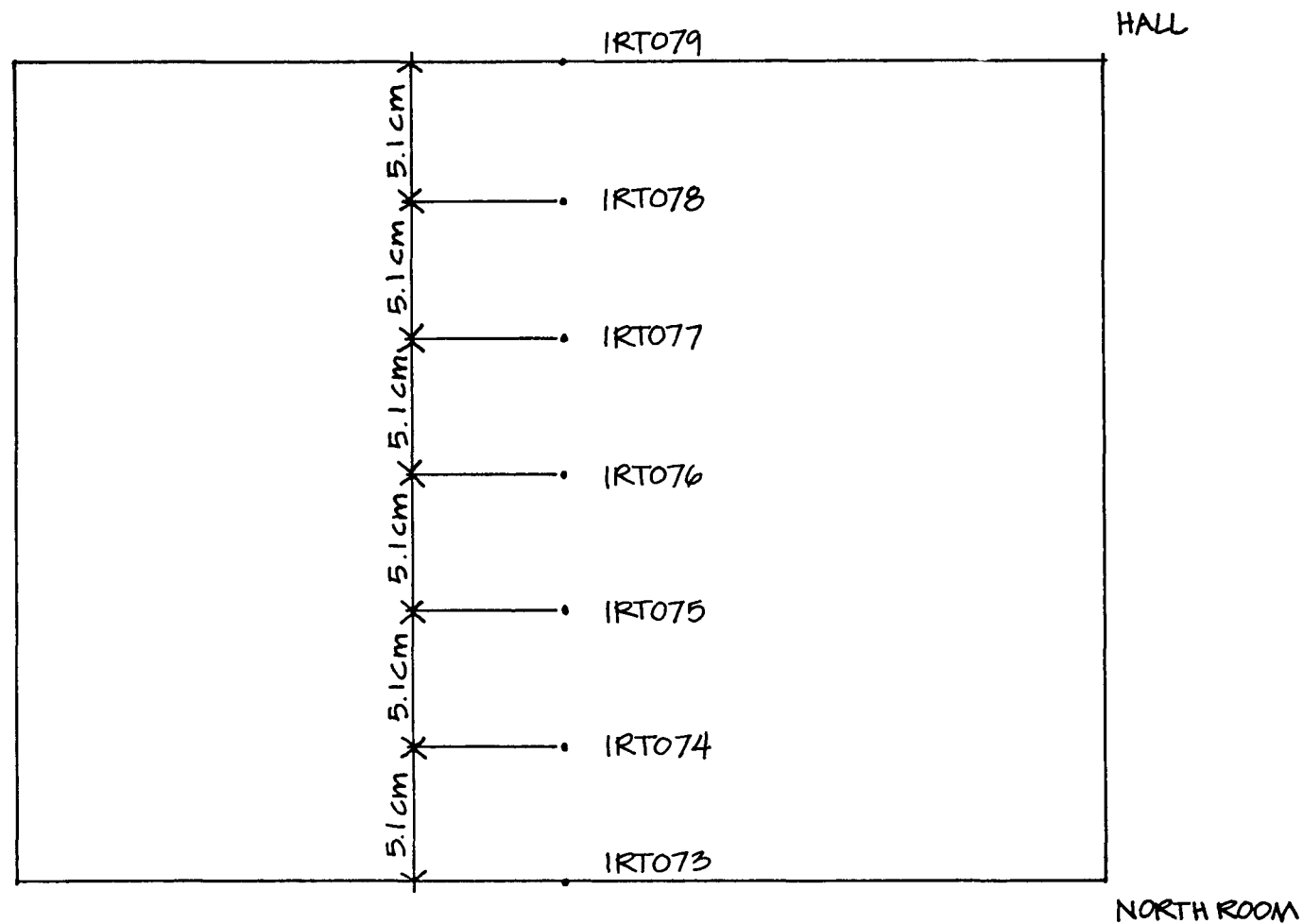
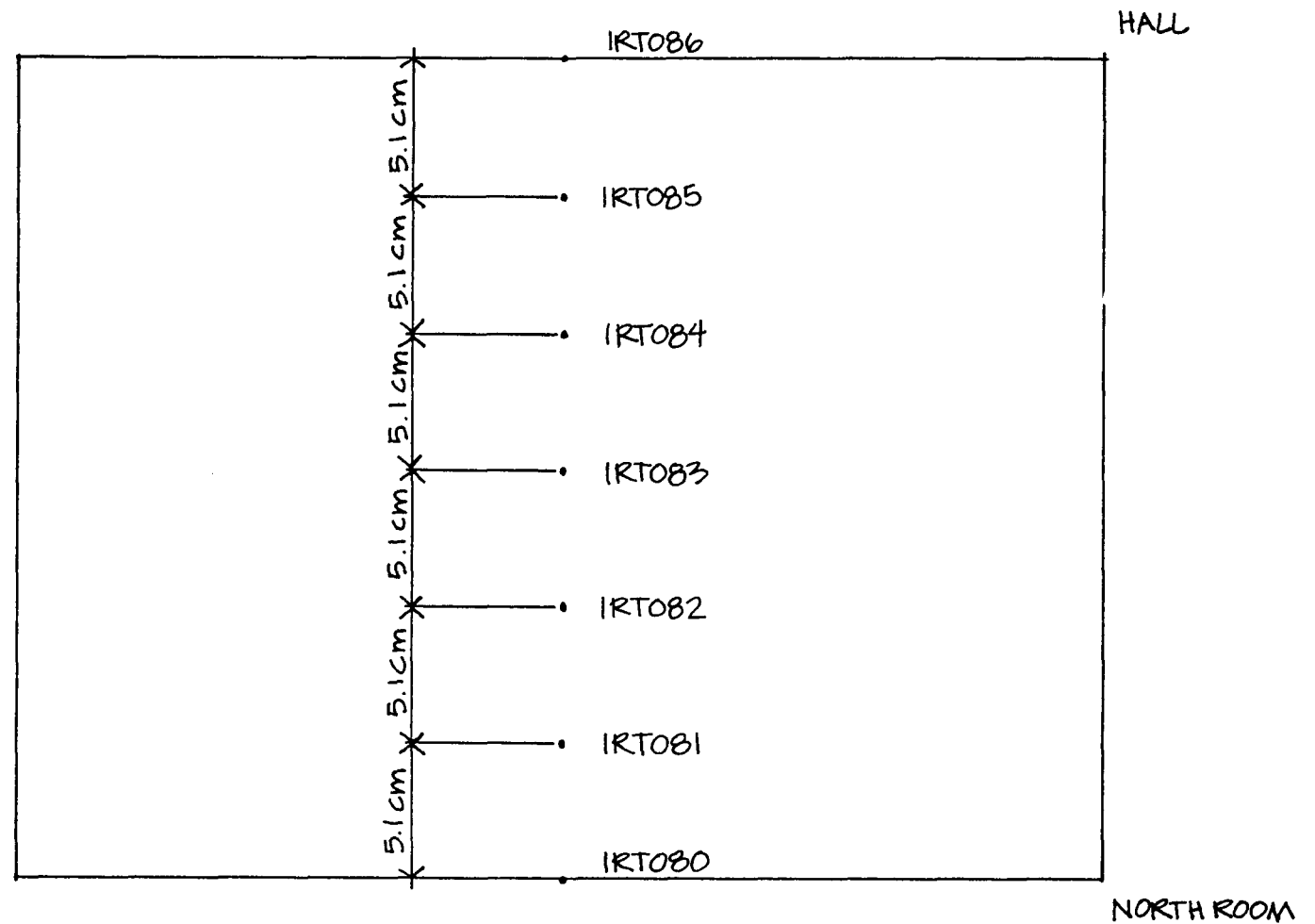


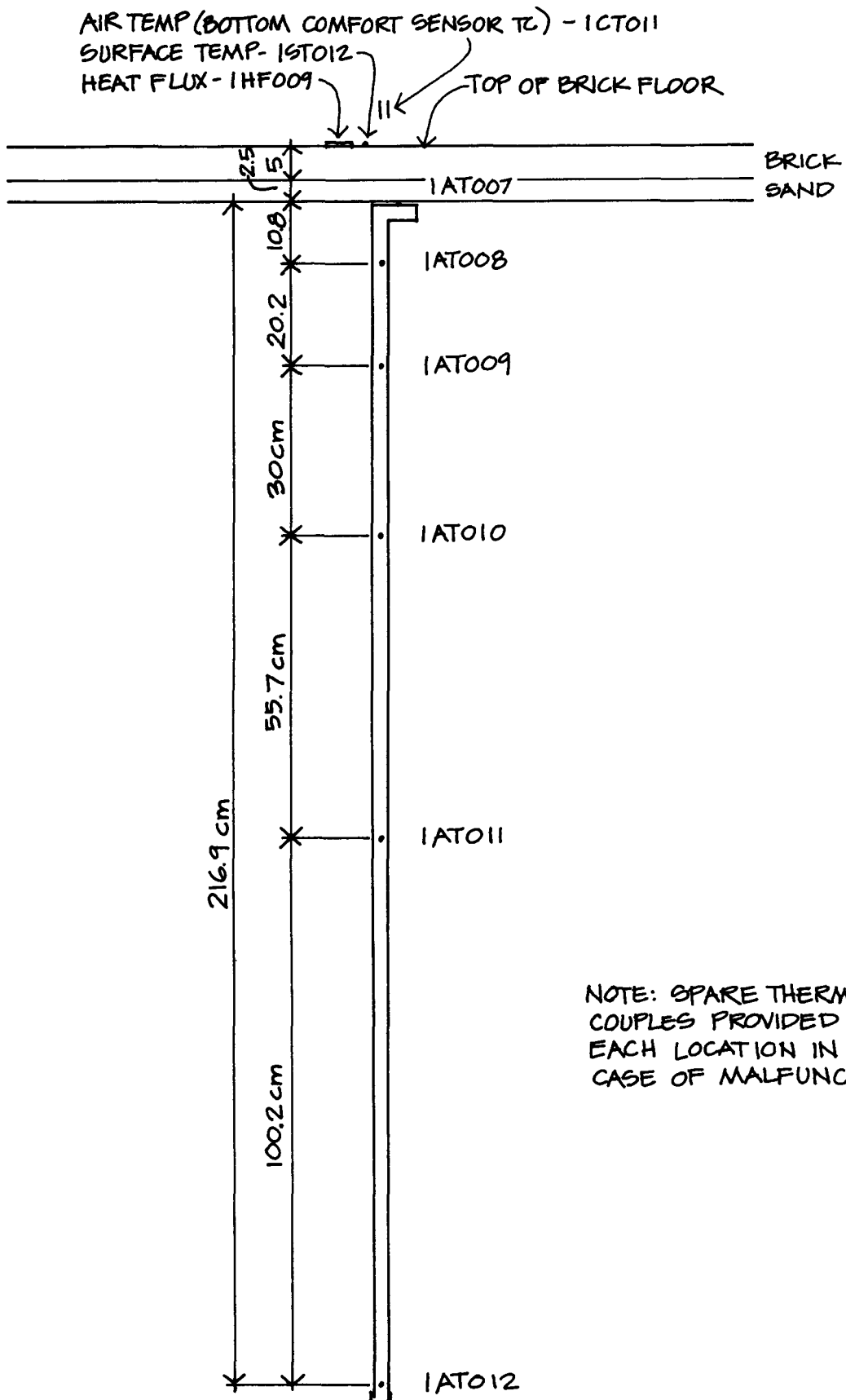
Fig. 17



30.5 cm (12") ADOBE BLOCK
STRUCTURE ONE - MIDDLE ROOM

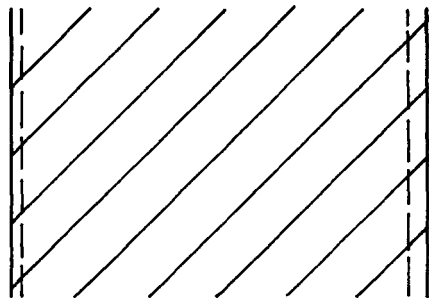


30.5 cm (12") ADOBE BLOCK
STRUCTURE ONE - EAST END ROOM



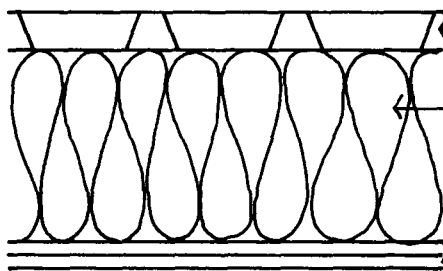
EARTH TEMP ARRAY
STRUCTURE ONE - SOUTH ROOM

BUILDING ENVELOPE DETAILS- STRUCTURE ONE



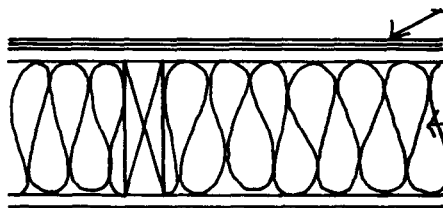
← ADOBE WALLS, 16" THICK (40.6 cm) +
~1.3 cm PLASTER INSIDE, ~1.9 cm
PLASTER OUTSIDE (NORTH & EAST
WALLS & BEHIND PORCH ON SOUTH)
(DARK BROWN COLOR)

TYPICAL ADOBE WALL



← 1 1/2" (3.8 cm) DEEP STEEL ROOF
DECKING WITH AIR PASSAGES, PAINTED WHITE
← 8" FIBERGLASS BATT INSULATION (20.3 cm)
← STRUCTURAL STEEL FRAME
← 5/8" (1.6 cm) PLYWOOD
← 1/2" (1.3 cm) DRYWALL

BUILDING ROOF DETAIL

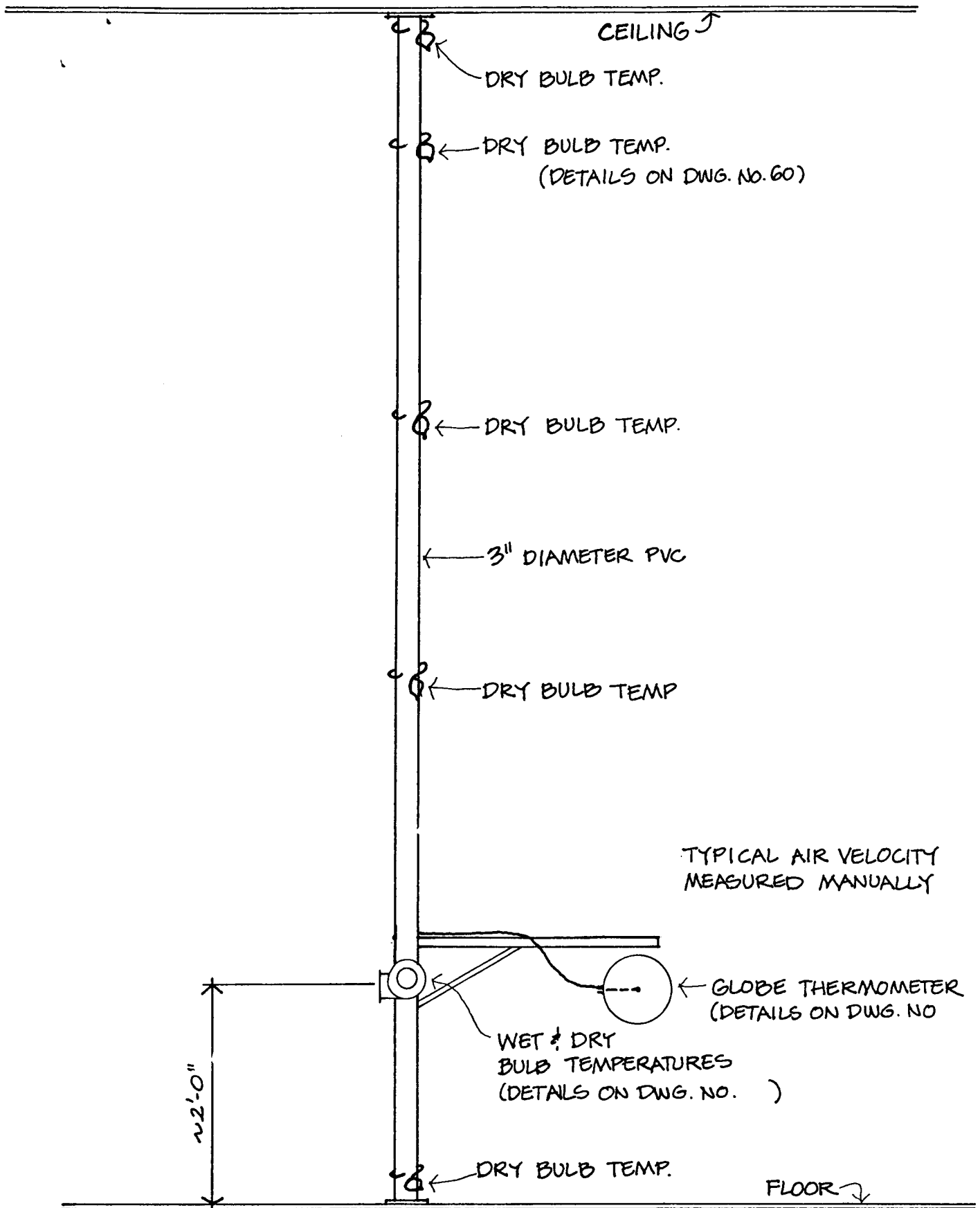


← 3-PLY BUILT-UP ROOFING, PAINTED WHITE
← 5/8" (1.6 cm) PLYWOOD
← 6" (15.2 cm) FIBERGLASS BATT INSUL.
← 2x6 (5.1 cm x 15.2 cm), 40.6 cm. o.c.
← 1.3 cm DRYWALL

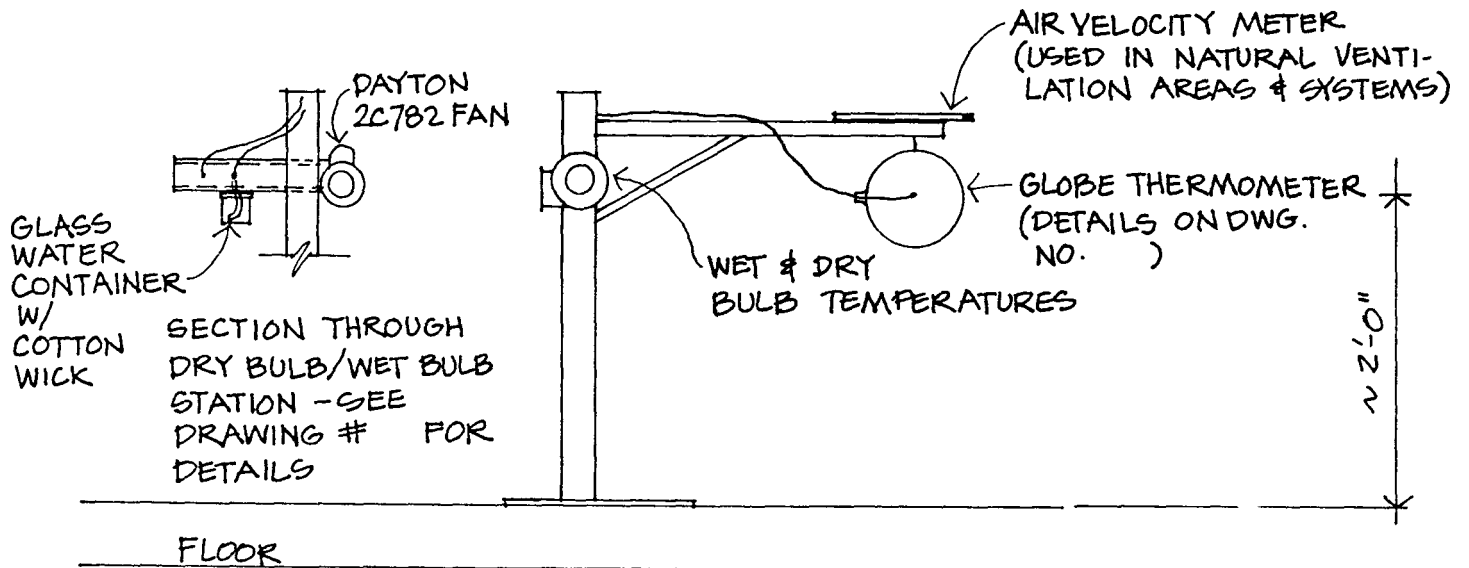
PORCH ROOF DETAIL

NOTE: EXTERIOR DOORS ARE SHEATHED IN METAL AND HAVE APPROXIMATELY
1 5/8" (4.1 cm) URETHANE INSULATION IN CORE.

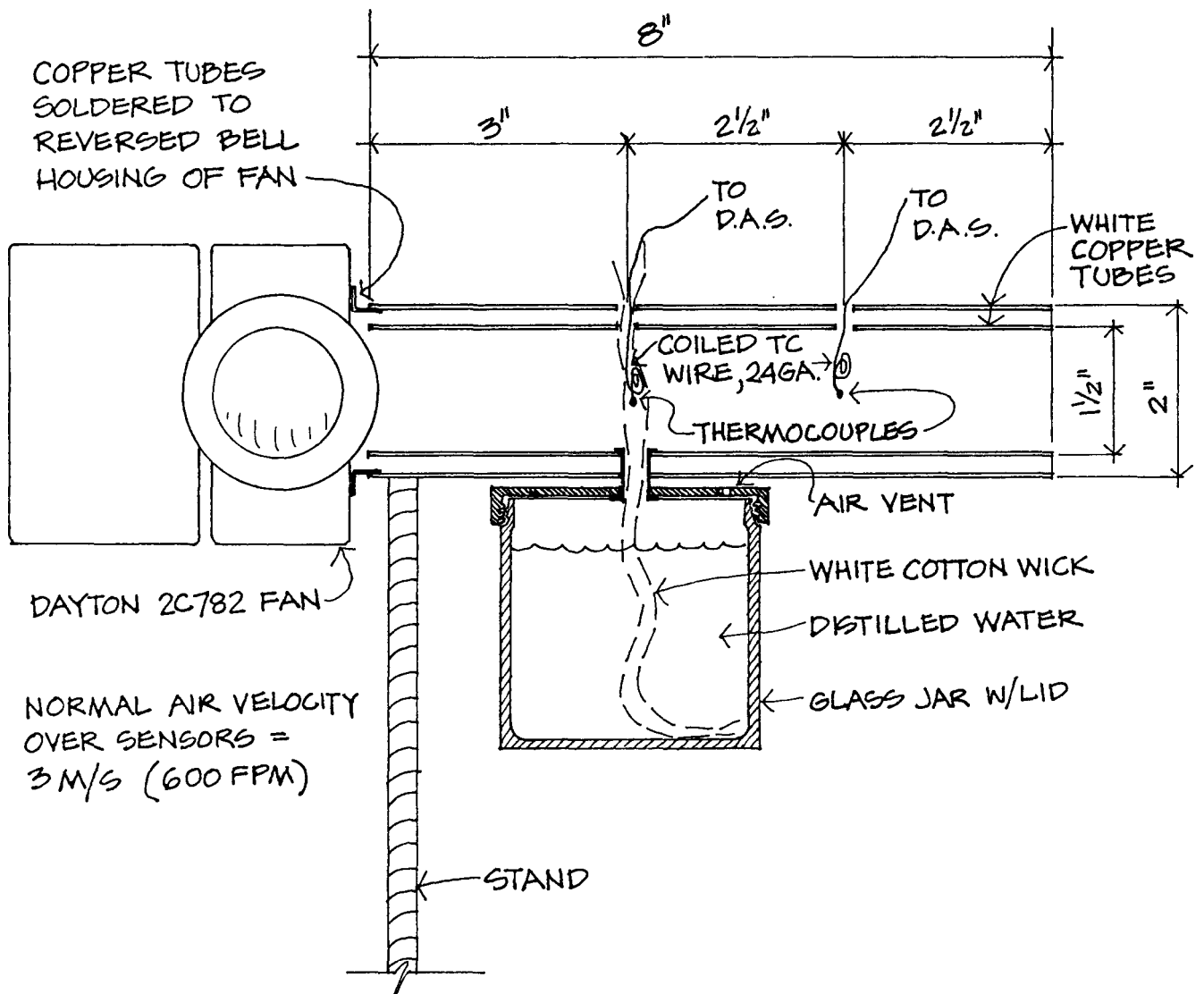
ALL WINDOWS ARE KLOS - 2 SINGLE-GLAZED WINDOWS LOCATED
~12" APART IN SEPARATE ALUMINUM FRAMES. DUO-TONE (DARK TOP,
WHITE BOTTOM) VENETIAN BLINDS LOCATED BETWEEN WINDOWS.



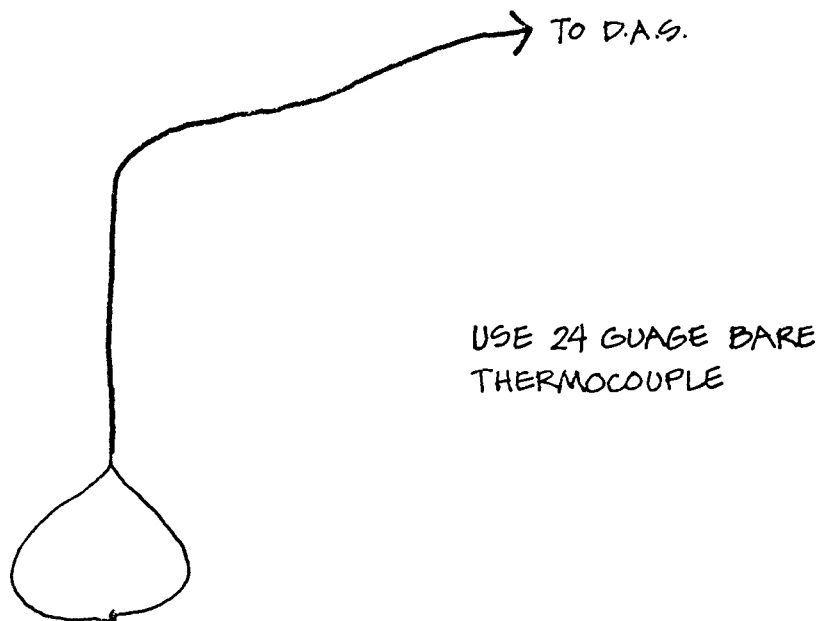
COMFORT SENSING STATIONS



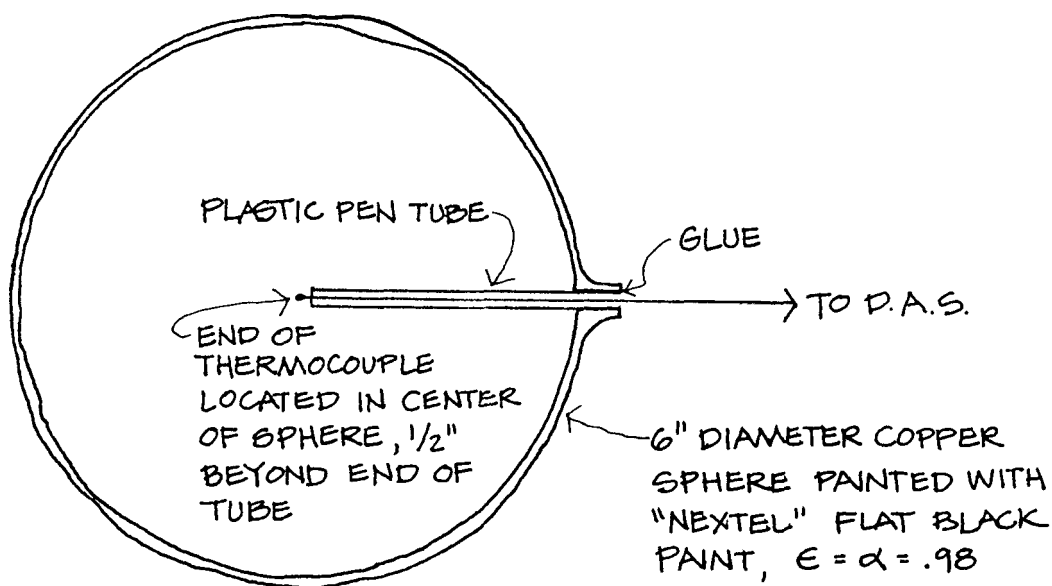
SINGLE POINT COMFORT SENSING STATION



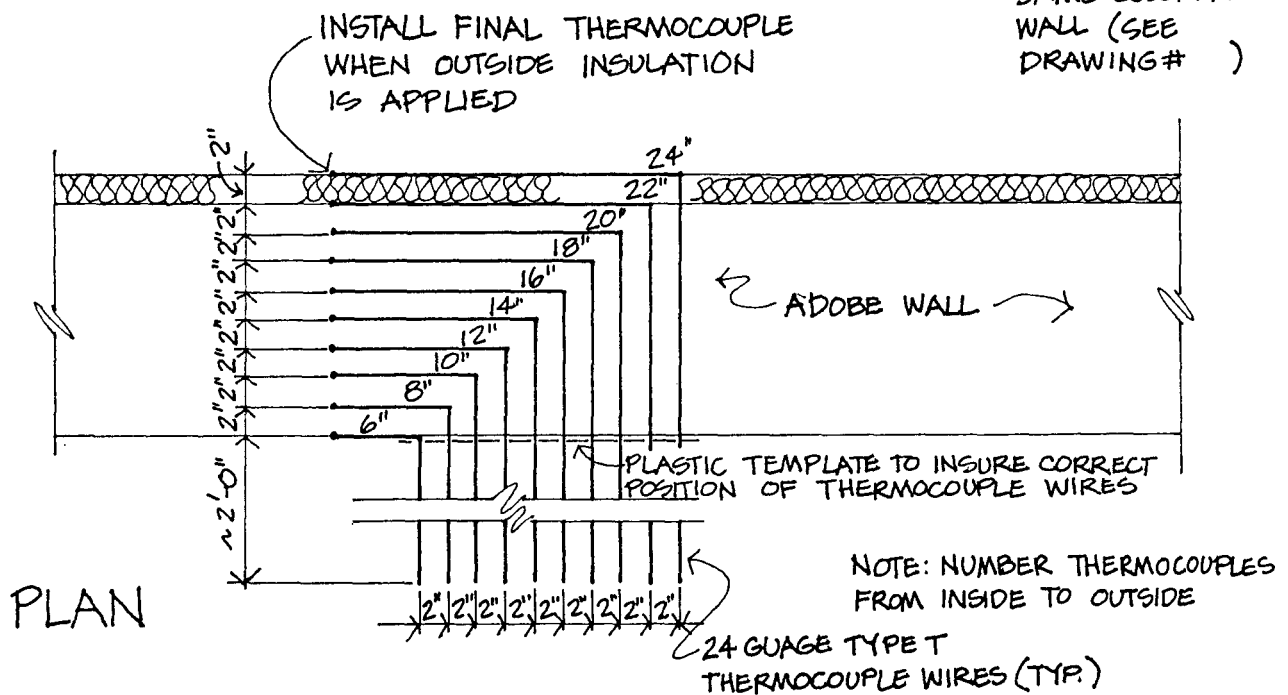
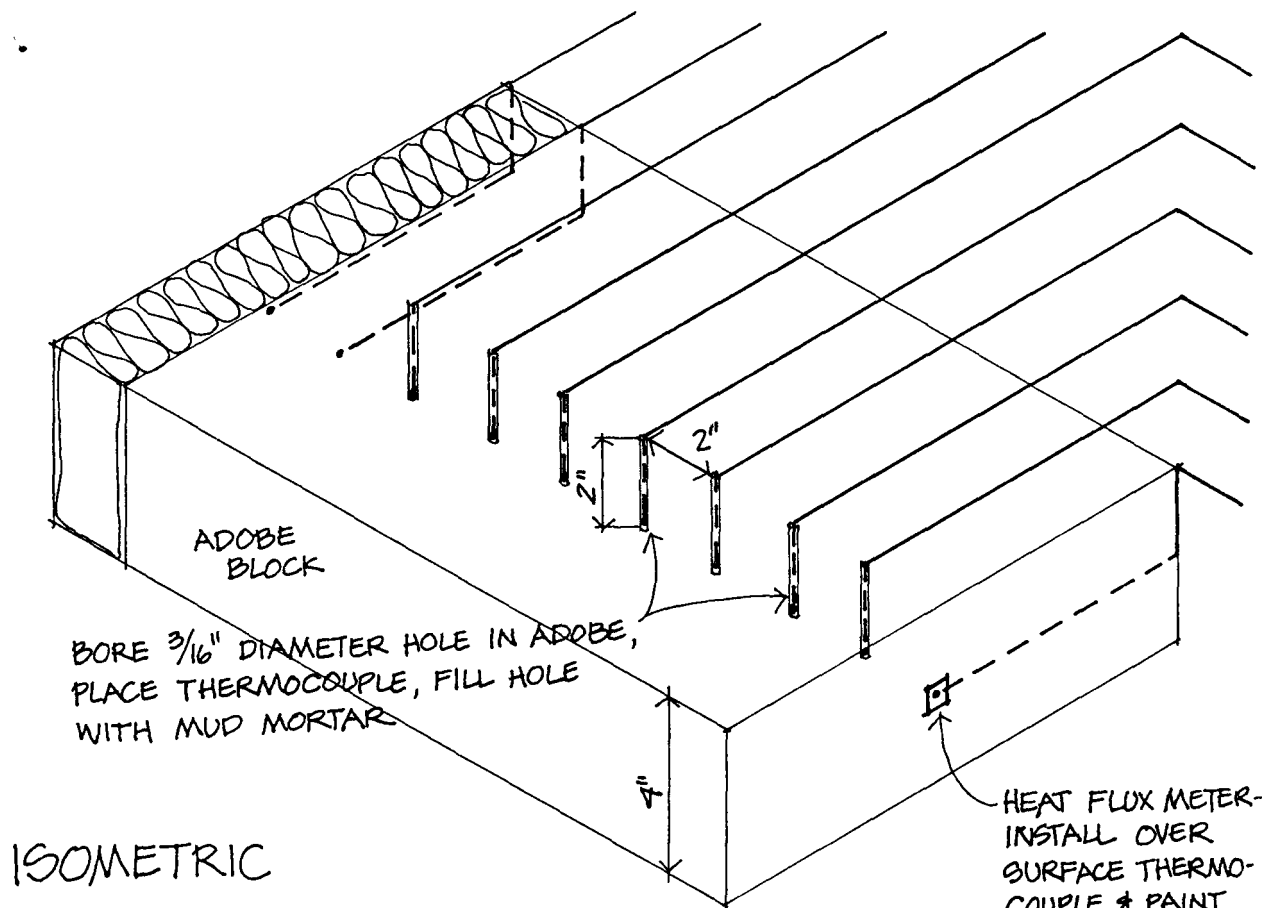
SINGLE POINT WET & DRY BULB TEMPERATURE STATION



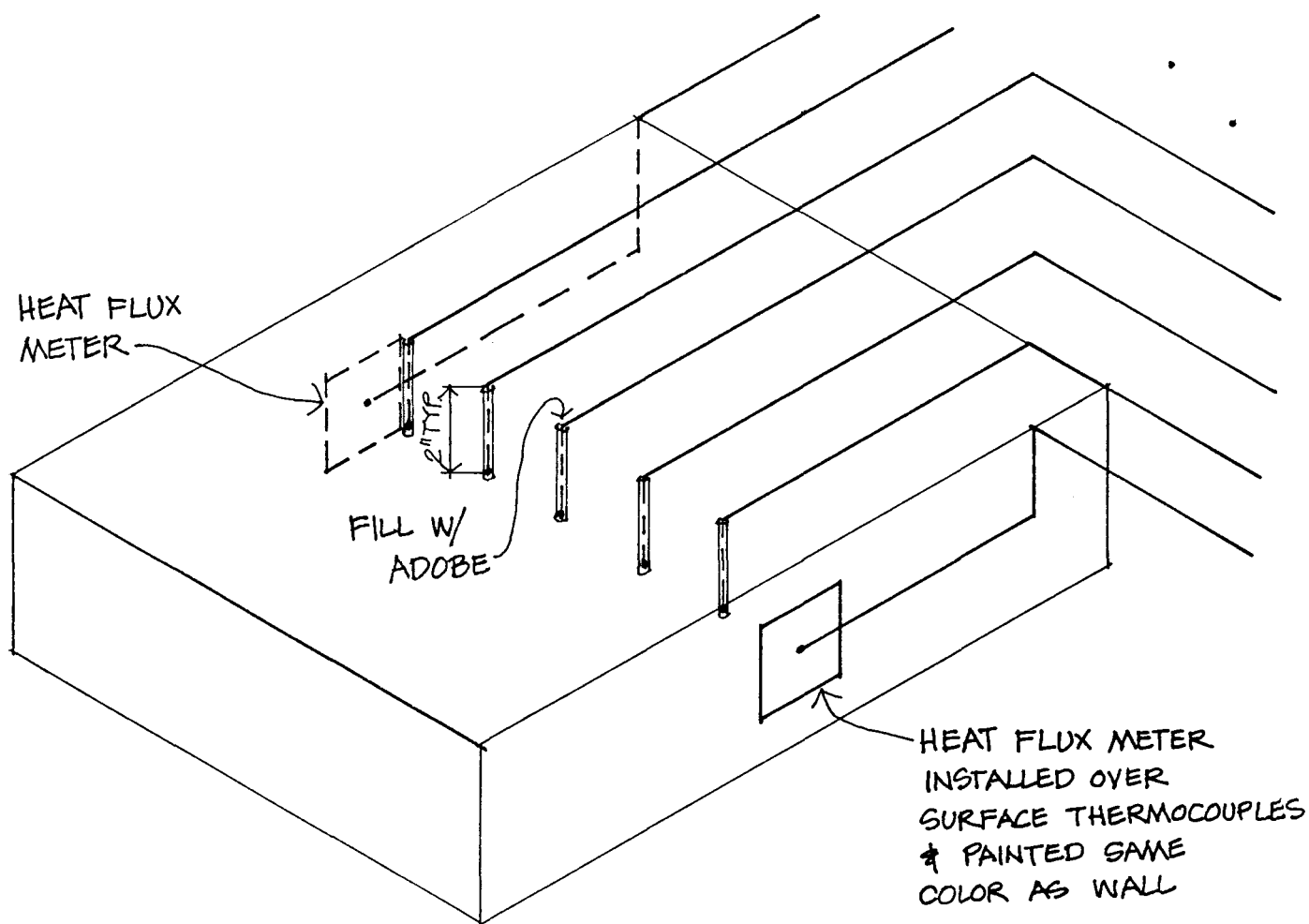
DRY BULB TEMPERATURE STATION, NATURALLY ASPIRATED — USE ON FLOOR TO CEILING COMFORT STATIONS, AND ADJACENT TO ALL HEAT FLUX MTRS.



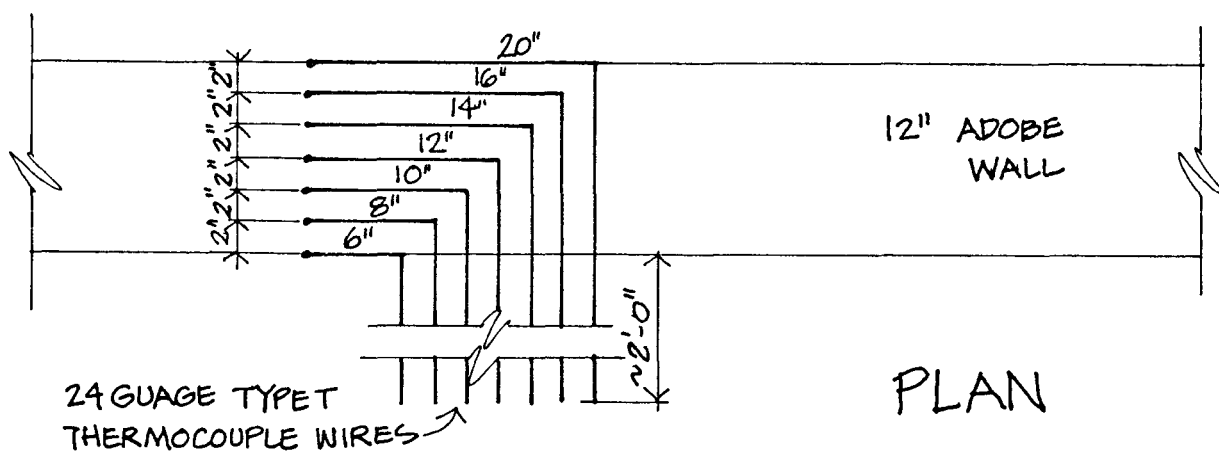
GLOBE THERMOMETER



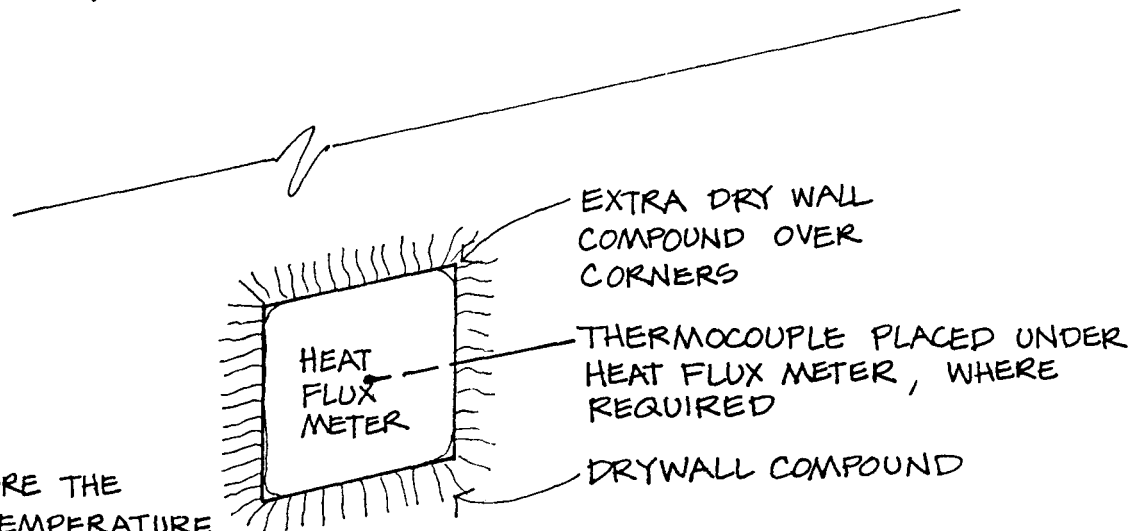
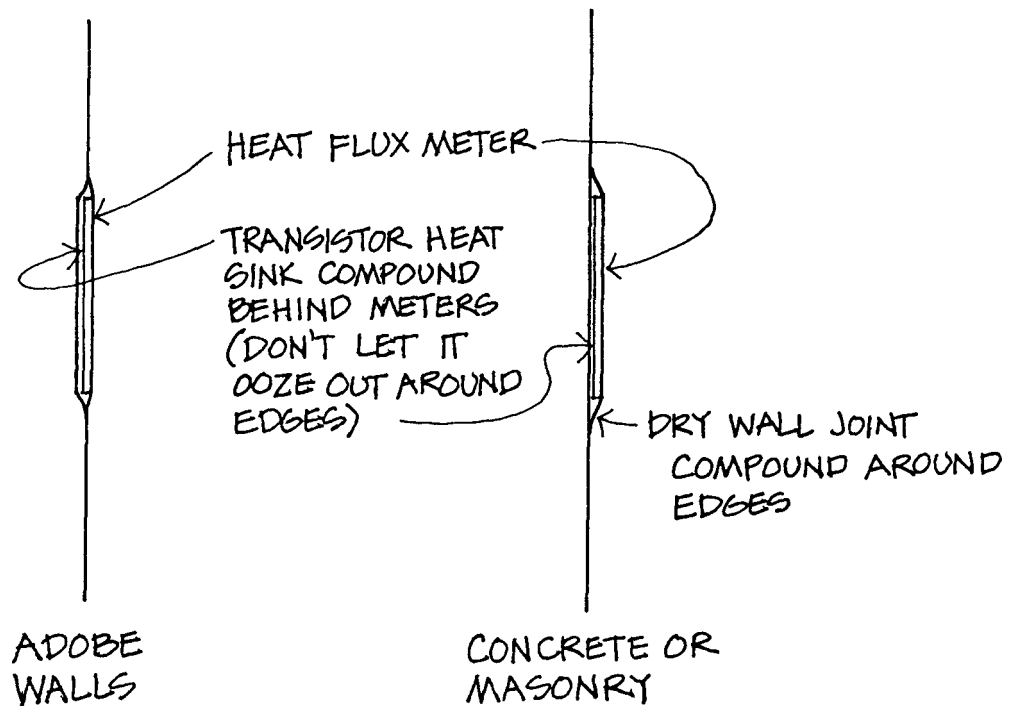
THERMOCOUPLE RAKE IN EXTERIOR ADOBE WALL WITH OUTSIDE INSULATION (NOTE: MEASURE DRY BULB TEMPERATURE ADJACENT TO ALL HEAT FLUX METERS)



ISOMETRIC



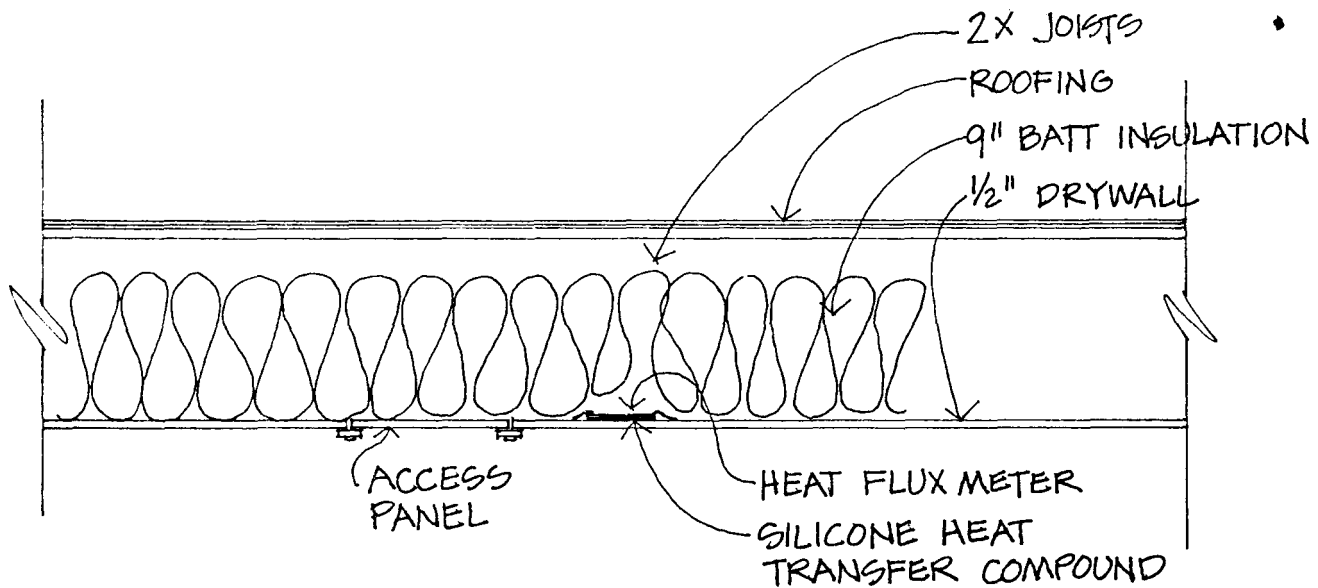
THERMOCOUPLE RAKE IN INTERIOR ADOBE WALL



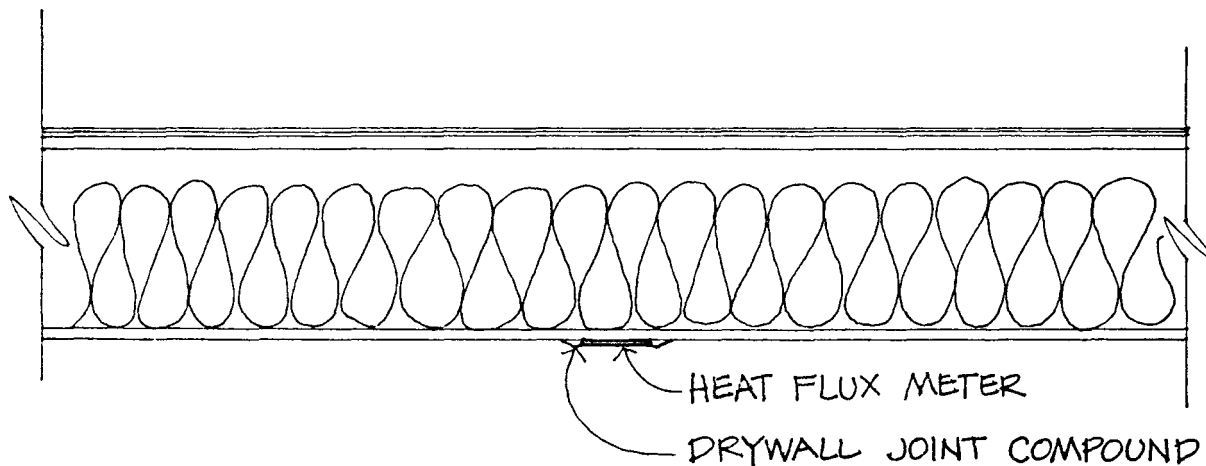
NOTE: MEASURE THE DRY BULB TEMPERATURE ADJACENT TO ALL HEAT FLUX METERS

PAINT HEAT FLUX METER SAME COLOR AS WALL OR FLOOR

WALL & FLOOR HEAT FLUX METER INSTALLATION



ALTERNATE #1

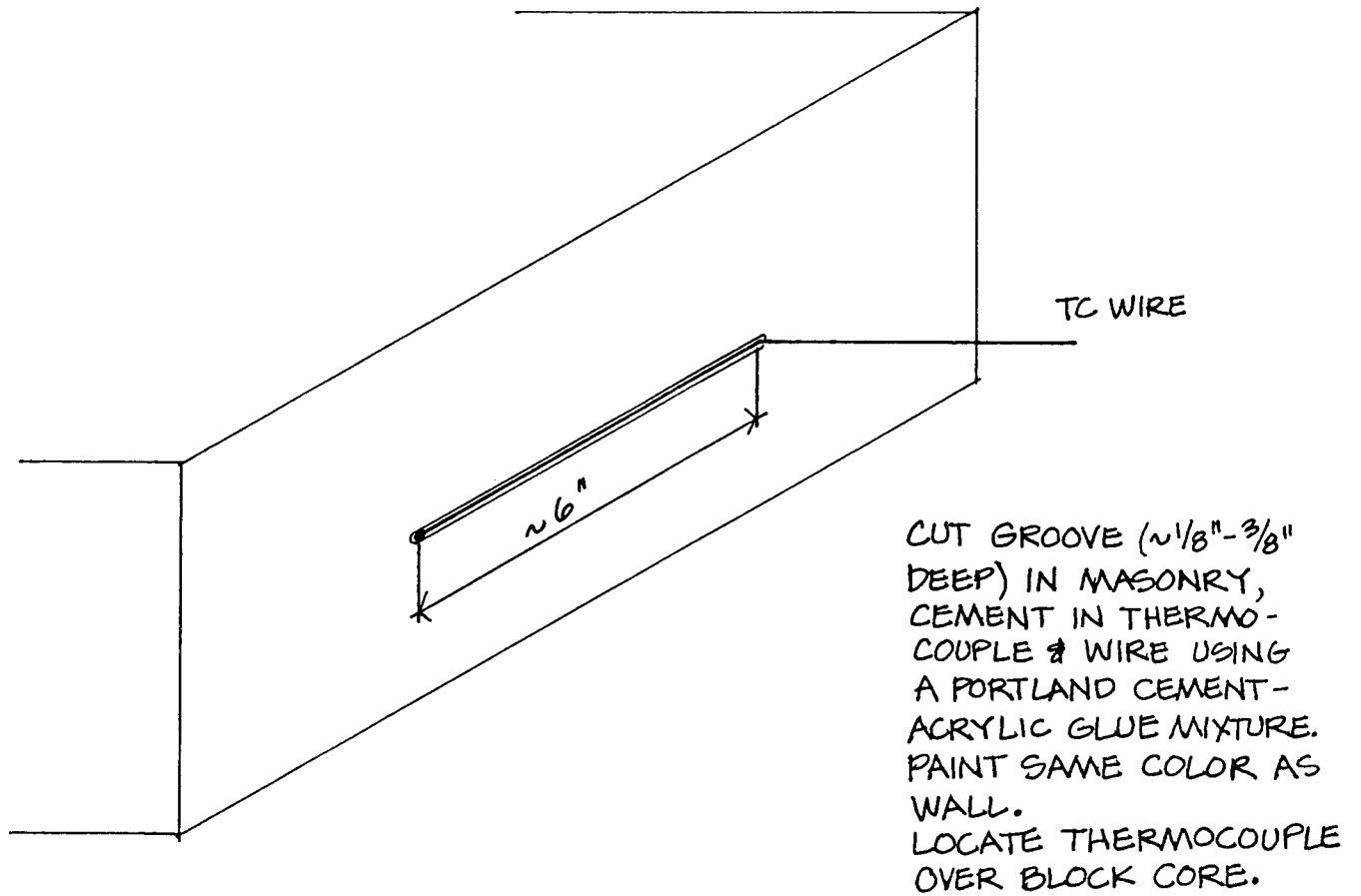


ALTERNATE #2

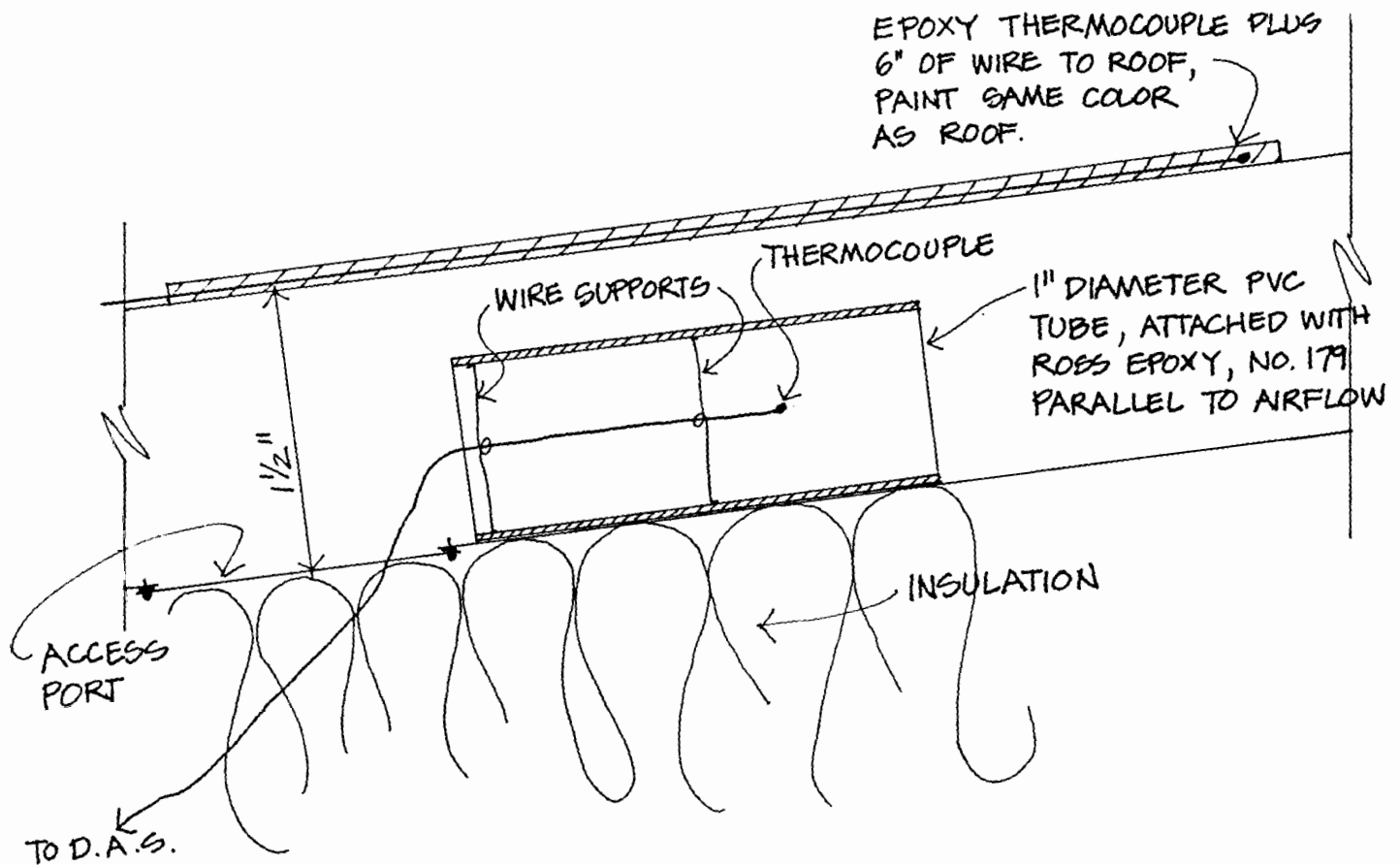
NOTES: APPLY SILICONE HEAT TRANSFER COMPOUND TO CEILING & TO METER. THEN PRESS TOGETHER AND SQUEEZE OUT EXCESS. SMOOTH JOINT BETWEEN METER & CEILING. APPLY DRYWALL COMPOUND AROUND EDGES OF METER.

TO REMOVE METER, GENTLY PRY OFF WITH DULL EDGED TOOL. IF DIFFICULT TO REMOVE, SAW OUT DRYWALL & PATCH HOLE.

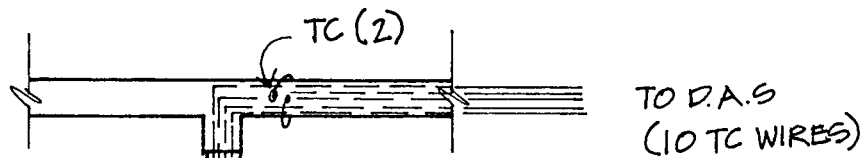
CEILING HEAT FLUX METER INSTALLATION



SURFACE TEMPERATURE THERMOCOUPLE INSTALLATION



INSTALLATION OF THERMOCOUPLES IN THE ROOF OF STRUCTURE #1



EPOXY CEMENT (W/ROSS EPOXY GLUE NO. 179) ENTIRE EXPOSED LENGTH OF THERMOCOUPLE

TC (2)

ATTACH THERMOCOUPLE W/ PVC CEMENT (SOLVENT TYPE) & HOLD IN PLACE UNTIL SET

TC (2)

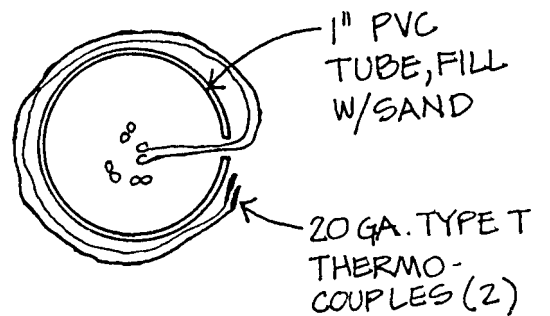
NOTE: EACH THERMOCOUPLE LOCATION SHALL HAVE 2 THERMOCOUPLES (1 IS A SPARE).

SPACE THERMOCOUPLES ACCORDING TO LOCATIONS INDICATED IN THE TEXT.

SAND FILL 1" DIAMETER PVC PIPE

TC (2)

ELEVATION

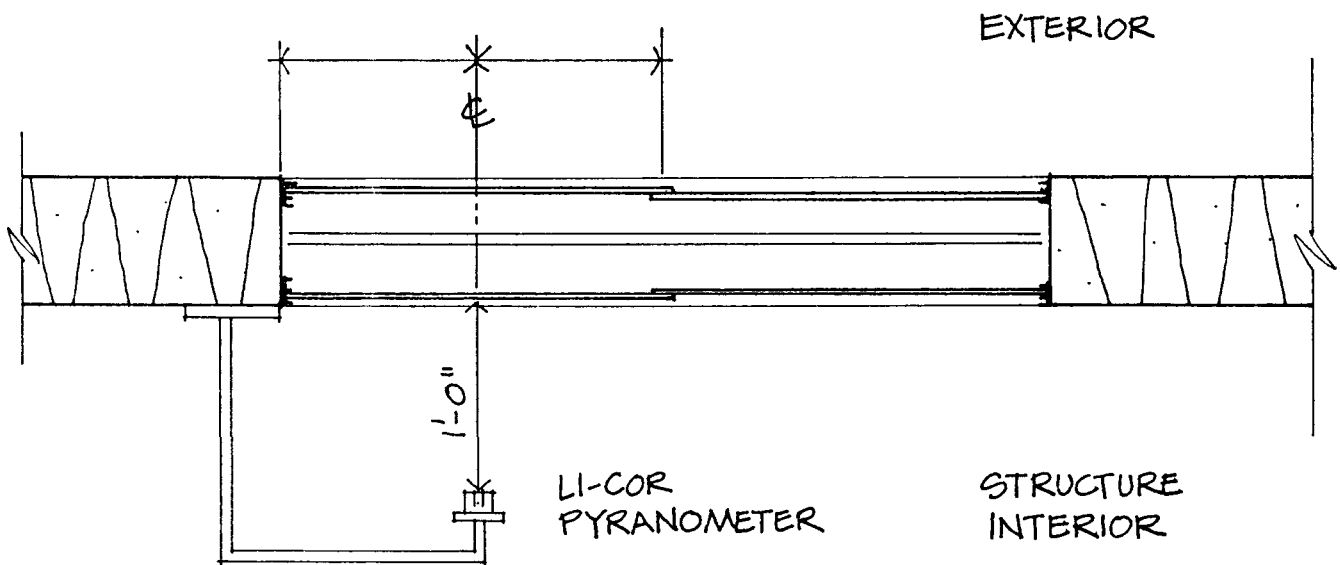


PLAN

TC (2)

CAP

EARTH TEMPERATURE SENSOR ARRAY (SIMILAR TO THOSE USED AT TRINITY UNIVERSITY)



PLAN VIEW

NOTE: LOCATE PYRANOMETER ONE FOOT FROM GLASS AND
AT THE MID-POINT OF A SINGLE PANE OF GLASS

LI-COR PYRANOMETER INSTALLATION

SENSOR LOCATIONS AND INSTALLATION

Structure 2

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KEY TO SYMBOLS

- + Earth Temperature Array Thermocouple
- Surface Temperature Thermocouple or Thermocouples in Rakes
- Heat Flux Meter
- || Naturally Aspirated Air Temperature Thermocouple
- Comfort Sensor Station
- △ Wall Temperature Rake
- ⊙ Pyranometer
- Soil Moisture Sensors

SENSOR READ OUT ABBREVIATIONS

- AT Earth Temperature Array Thermocouple
- BT Rockbed Thermocouple
- CT Comfort Sensor Station Thermocouple
- DT Dry Bulb Thermocouple
- ET Rock Embedded Thermocouple
- LT Liquid Wall Thermocouple
- NT Naturally Aspirated Air Temperature Thermocouple
- RT Wall Temperature Rake Thermocouple
- ST Surface Temperature Thermocouple
- TT Test Terminal Thermocouple
- WT Wet Bulb Thermocouple
- AZ Wind Direction
- HF Heat Flux Meter
- PG Pyrgeometer
- PM Pyranometer
- RD Radiometer
- TM Test Terminal Millivolt
- VA Continuous Air Velocity Meter
- WS Wind Speed

SENSOR NAMES AND LOCATIONS

READ OUT NO.	LOCATION	FIGURE NO.
2CT031	FULL BASEMENT COMFORT SENSING STATION	1, 11 & 18
2CT032		
2CT033		
2CT034		
2CT035		
2CT036		
2CT037		
2ST043	FULL BASEMENT FLOOR SURFACE TEMP-STAIR	1 & 18
2AT041	FULL BASEMENT GROUND ARRAY-CENTER	1 & 18
2AT042		
2AT043		
2AT044		
2AT045		
2AT046		
2ST044	FULL BASEMENT FLOOR SURFACE TEMP-EAST	1 & 19
2AT047	FULL BASEMENT GROUND ARRAY-EAST FOOTING	1 & 19
2AT048		
2AT049		
2AT050		
2AT051		
2AT052		
2ST045	FULL BASEMENT SURFACE TEMP-NORTH 2 FT HEIGHT	6
2ST046	FULL BASEMENT SURFACE TEMP-NORTH 6 FT HEIGHT	6
2ST047	FULL BASEMENT SURFACE TEMP-SOUTH 2 FT HEIGHT	8
2ST048	FULL BASEMENT SURFACE TEMP-SOUTH 6 FT HEIGHT	8
2RT087	FULL BASEMENT EAST WALL-2 FT HEIGHT BLOCK CORE-TEMP RAKE	7, 12 & 20
2RT088		
2RT089		
2RT090		
2RT091		
2RT092		
2RT093		
2RT094	FULL BASEMENT EAST WALL-2 FT HEIGHT BLOCK WEB-TEMP RAKE	7, 12 & 20
2RT095		
2RT096		
2RT097		
2RT098		
2RT099		
2RT100		
2RT101	FULL BASEMENT EAST WALL-2 FT HEIGHT BLOCK CORE-SINGLE TEMP RAKE	7 & 13
2RT102		
2RT103		
2RT104		
2RT105		
2RT106		
2RT107		

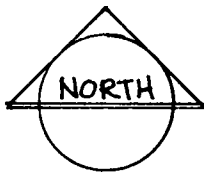
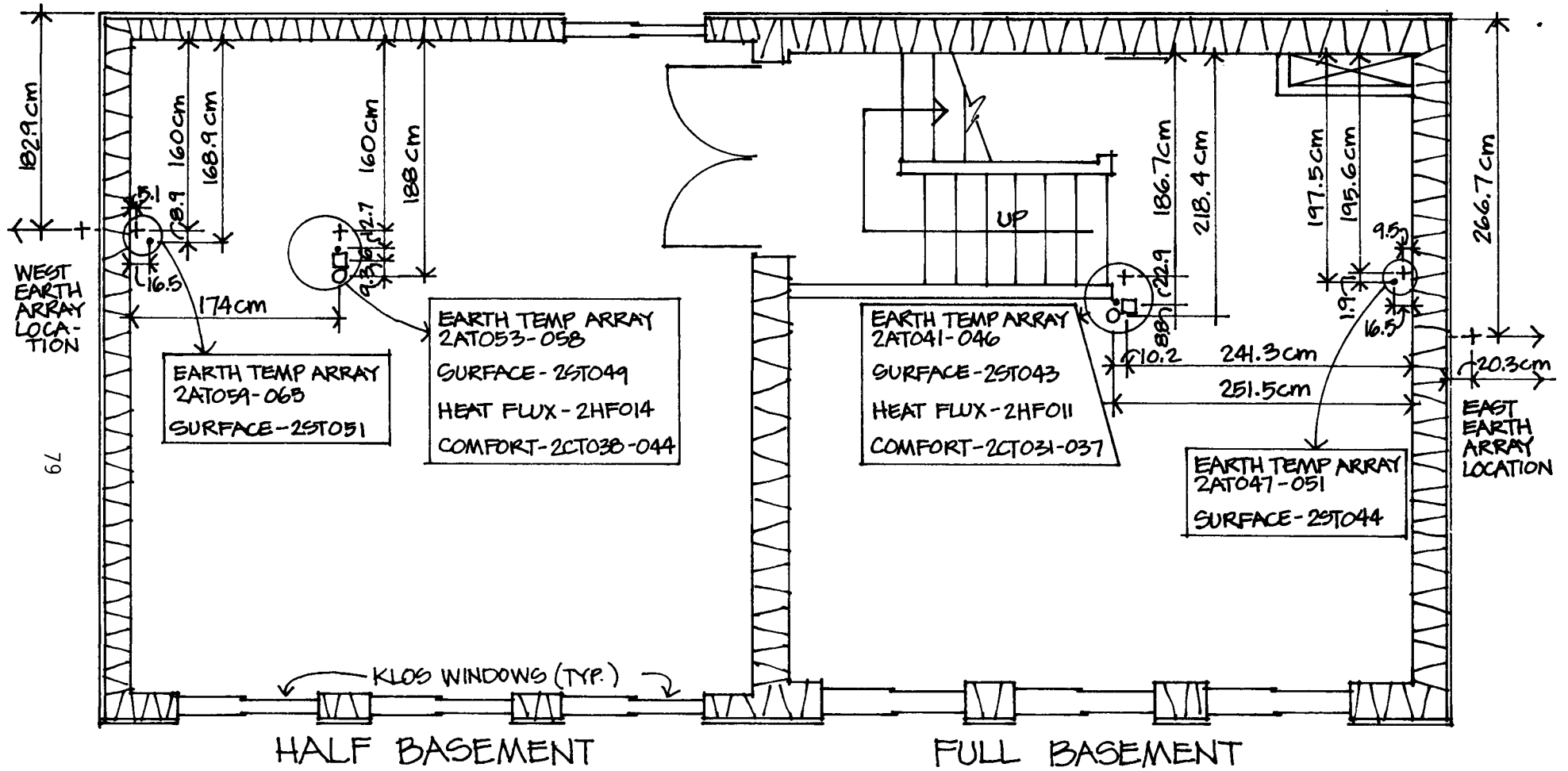
READ OUT NO.	LOCATION	FIGURE NO.
2RT108	FULL BASEMENT EAST WALL-6 FT HEIGHT BLOCK CORE-TEMP RAKE	7, 14 & 20
2RT109		
2RT110		
2RT111		
2RT112		
2RT113		
2RT114		
2RT115		
2RT116	FULL BASEMENT EAST WALL-6 FT HEIGHT BLOCK WEB-TEMP RAKE	7, 14 & 20
2RT117		
2RT118		
2RT119		
2RT120		
2RT121		
2RT122		
2RT123		
2RT124	FULL BASEMENT EAST WALL-6 FT HEIGHT BLOCK CORE-SINGLE TEMP RAKE	7 & 15
2RT125		
2RT126		
2RT127		
2RT128		
2RT129		
2RT130		
2RT131		
2NT006	FULL BASEMENT AIR TEMP-EAST 2 FT HEIGHT	7
2NT007	FULL BASEMENT AIR TEMP-EAST 6 FT HEIGHT	7
2RT132	FULL BASEMENT INTERIOR WALL WEST-2 FT HEIGHT BLOCK CORE-SINGLE TEMP RAKE	10 & 16
2RT133		
2RT134		
2RT135		
2RT136		
2RT137		
2RT138		
2RT139	FULL BASEMENT INTERIOR WALL WEST-6 FT HEIGHT BLOCK CORE-SINGLE TEMP RAKE	10 & 17
2RT140		
2RT141		
2RT142		
2RT143		
2RT144		
2RT145		
2CT038	HALF BASEMENT COMFORT SENSING STATION	1, 21 & 26
2CT039		
2CT040		
2CT041		
2CT042		
2CT043		
2CT044		
2ST049	HALF BASEMENT FLOOR SURFACE TEMP-CENTER	1 & 26

READ OUT NO.	LOCATION	FIGURE NO.
2AT053	HALF BASEMENT GROUND ARRAY-CENTER	1 & 26
2AT054		
2AT055		
2AT056		
2AT057		
2AT058		
2AT059	HALF BASEMENT GROUND ARRAY-WEST FOOTING	1 & 27
2AT060		
2AT061		
2AT062		
2AT063		
2AT064		
2AT065		
2ST050	HALF BASEMENT SURFACE TEMP-CEILING	2
2ST051	HALF BASEMENT SURFACE TEMP-FOOTING	1 & 27
2ST052	HALF BASEMENT SURFACE TEMP-NORTH 2 FT HEIGHT	6
2ST053	HALF BASEMENT SURFACE TEMP-NORTH 6 FT HEIGHT	6
2RT146	HALF BASEMENT WEST WALL-2 FT HEIGHT BLOCK CORE-TEMP RAKE	9 & 22
2RT147		
2RT148		
2RT149		
2RT150		
2RT151		
2RT152	HALF BASEMENT WEST WALL-2 FT HEIGHT BLOCK WEB-TEMP RAKE	9 & 22
2RT153		
2RT154		
2RT155		
2RT156		
2RT157		
2RT158	HALF BASEMENT WEST WALL-2 FT HEIGHT BLOCK CORE-SINGLE TEMP RAKE	9, 23 & 28
2RT159		
2RT160		
2RT161		
2RT162		
2RT163		
2RT164	HALF BASEMENT WEST WALL-6 FT HEIGHT BLOCK CORE-TEMP RAKE	9 & 24
2RT165		
2RT166		
2RT167		
2RT168		
2RT169		
2RT170	HALF BASEMENT WEST WALL-6 FT HEIGHT BLOCK WEB-TEMP RAKE	9 & 24
2RT171		
2RT172		
2RT173		
2RT174		
2RT175		

READ OUT NO.	LOCATION	FIGURE NO.
2RT176		
2RT177		
2RT178	HALF BASEMENT WEST WALL-6 FT HEIGHT	9 & 25
2RT179	BLOCK CORE-SINGLE TEMP RAKE	
2RT180		
2RT181		
2NT008	HALF BASEMENT AIR TEMP-WEST 6 FT	9
2ST054	HALF BASEMENT SURFACE TEMP-SOUTH 2 FT HEIGHT	8
2ST055	HALF BASEMENT SURFACE TEMP-SOUTH 6 FT HEIGHT	8
2CT045		
2CT046		
2CT047		
2CT048	GROUND LEVEL COMFORT SENSING STATION	3 & 29
2CT049		
2CT050		
2CT051		
2ST056	GROUND LEVEL SURFACE TEMP-CEILING	4
2ST057	GROUND LEVEL SURFACE TEMP-SOUTH 2 FT HEIGHT	8
2ST058	GROUND LEVEL SURFACE TEMP-SOUTH 6 FT HEIGHT	8
2ST059	GROUND LEVEL SURFACE TEMP-NORTH 2 FT HEIGHT	6
2ST060	GROUND LEVEL SURFACE TEMP-NORTH 6 FT HEIGHT	6
2RT182		
2RT183		
2RT184	GROUND LEVEL WEST WALL-2 FT HEIGHT	10 & 30
2RT185	BLOCK CORE-SINGLE TEMP RAKE	
2RT186		
2RT187		
2ST061	GROUND LEVEL SURFACE TEMP-WEST 6 FT HEIGHT	10
2RT188		
2RT189		
2RT190	GROUND LEVEL EAST WALL-4 FT HEIGHT	7 & 31
2RT191	BLOCK CORE-TEMP RAKE	
2RT192		
2RT193		
2RT194		
2RT195		
2RT196	GROUND LEVEL EAST WALL-4 FT HEIGHT	7 & 31
2RT197	BLOCK WEB-TEMP RAKE	
2RT198		
2RT199		
2RT200		
2RT201		
2RT202	GROUND LEVEL EAST WALL-4 FT HEIGHT	7 & 32
2RT203	BLOCK CORE-SINGLE TEMP RAKE	
2RT204		
2RT205		
2ST062	GROUND LEVEL SURFACE TEMP-EAST 2 FT HEIGHT	7
2ST063	GROUND LEVEL SURFACE TEMP-EAST 6 FT HEIGHT	7
2NT009	GROUND LEVEL AIR TEMP-EAST 4 FT HEIGHT	7

READ OUT NO.	LOCATION	FIGURE NO.
2CT052	PORCH COMFORT SENSING STATION	3 & 33
2CT053		
2CT054		
2CT055		
2ST064	PORCH SURFACE TEMP-CEILING	4
2CT056	ROOF DECK COMFORT SENSING STATION	5 & 34
2CT057		
2CT058		
2CT059		
2WT004	COOLER EXHAUST WET BULB-NORTH	6
2DT004	COOLER EXHAUST DRY BULB-NORTH	6
2WT005	COOLER INTAKE WET BULB-NORTH	6
2DT005	COOLER INTAKE DRY BULB-NORTH	6
2AT066	VERTICAL EARTH TEMP ARRAY WEST-13 CM FROM WALL	28
2AT067		
2AT068		
2AT069		
2AT070	VERTICAL EARTH TEMP-WEST FOOTING	28
2AT071	VERTICAL EARTH TEMP ARRAY WEST-33 CM FROM WALL	28
2AT072		
2AT073	VERTICAL EARTH TEMP ARRAY WEST-96 CM FROM WALL	28
2AT074		
2AT075	VERTICAL EARTH TEMP ARRAY WEST-108 CM FROM WALL	28
2AT076		
2AT077		
2AT078		
2AT079		
2AT080	VERTICAL EARTH TEMP ARRAY EAST-20 CM FROM WALL	20
2AT081		
2AT082		
2AT083		
2AT084		
2AT085		
2AT086	VERTICAL EARTH TEMP-EAST FOOTING	20
2AT087	VERTICAL EARTH TEMP ARRAY EAST-51 CM FROM WALL	20
2AT088		
2AT089		
2AT090	VERTICAL EARTH TEMP ARRAY EAST-114 CM FROM WALL	20
2AT091		
2AT092		
2AT093	VERTICAL EARTH TEMP ARRAY EAST-213 CM FROM WALL	20
2AT094		
2AT095		
2AT096		
2AT097		
2AT098		
2TT003	TEST TC	

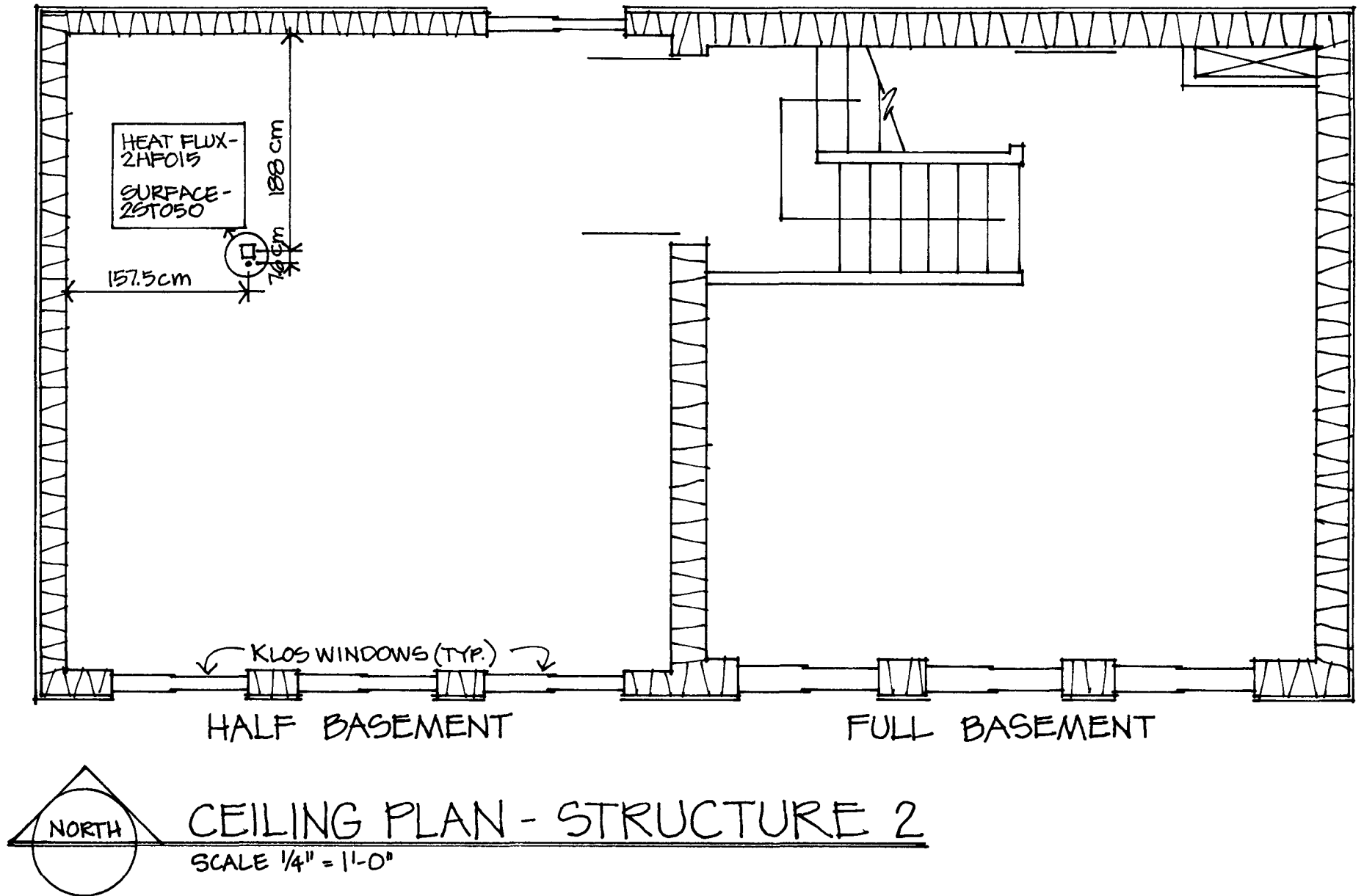
READ OUT NO.	LOCATION	FIGURE NO.
2HF011	FULL BASEMENT HEAT FLUX-FLOOR	1 & 18
2HF012	FULL BASEMENT HEAT FLUX-EAST WALL 2 FT HEIGHT	7
2HF013	FULL BASEMENT HEAT FLUX-EAST WALL 6 FT HEIGHT	7
2HF014	HALF BASEMENT HEAT FLUX-FLOOR	1 & 26
2HF015	HALF BASEMENT HEAT FLUX-CEILING	2
2HF016	HALF BASEMENT HEAT FLUX-WEST WALL 6 FT HEIGHT	9
2HF017	GROUND LEVEL HEAT FLUX-CEILING	4
2HF018	GROUND LEVEL HEAT FLUX-EAST WALL 4 FT HEIGHT	7
2PM013	HALF BASEMENT PYRANOMETER-SOUTH	9
2PM014	GROUND LEVEL PYRANOMETER-NORTH	6
2VA002	PORCH AIR VELOCITY	3
2MT003	TEST MILLIVOLT	

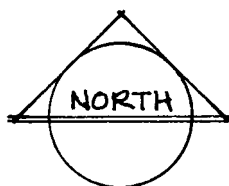
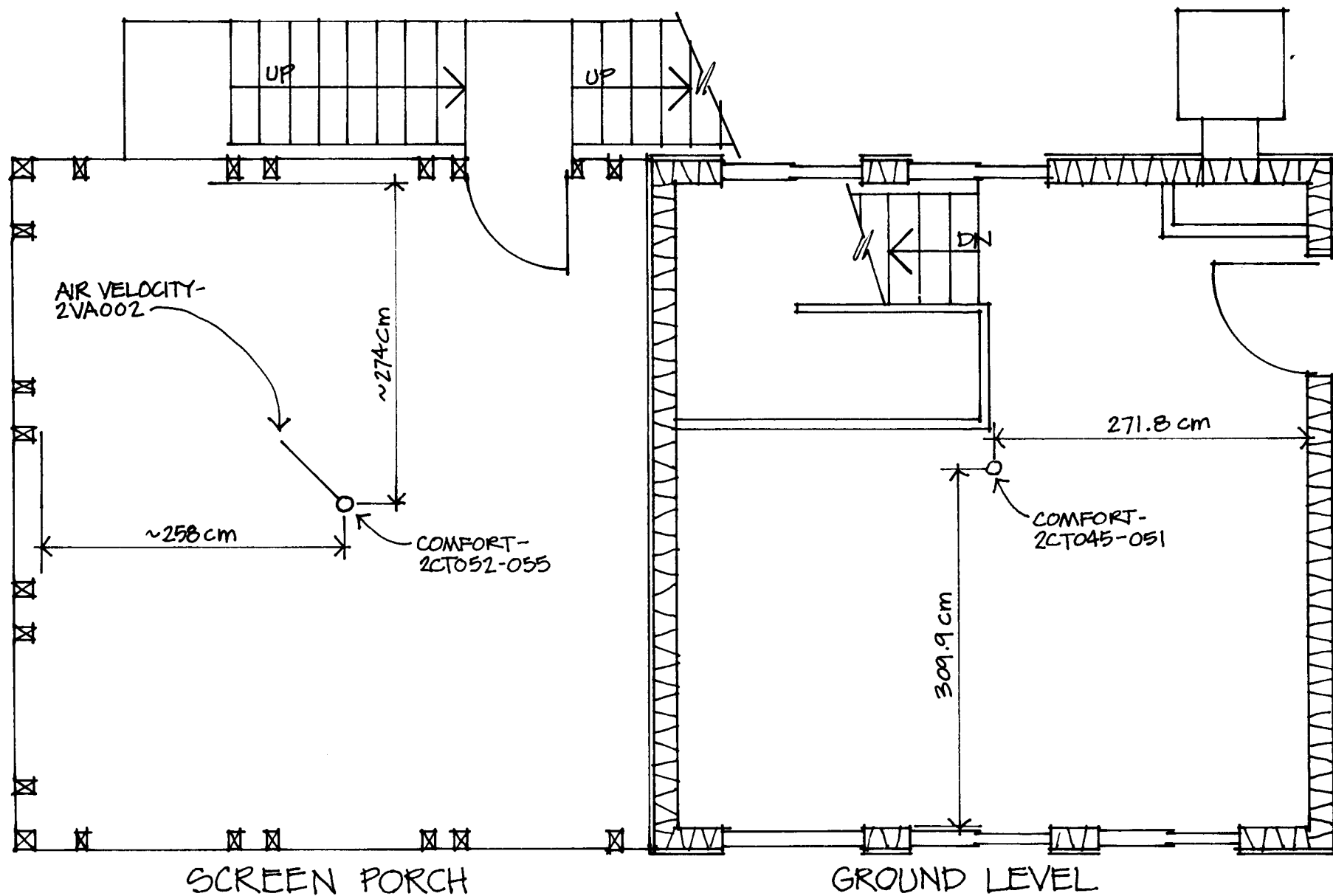


FLOOR PLAN - STRUCTURE 2

SCALE 1/4" = 1'-0"

Fig. 1





FLOOR PLAN - STRUCTURE 2

SCALE 1/4" = 1'-0"

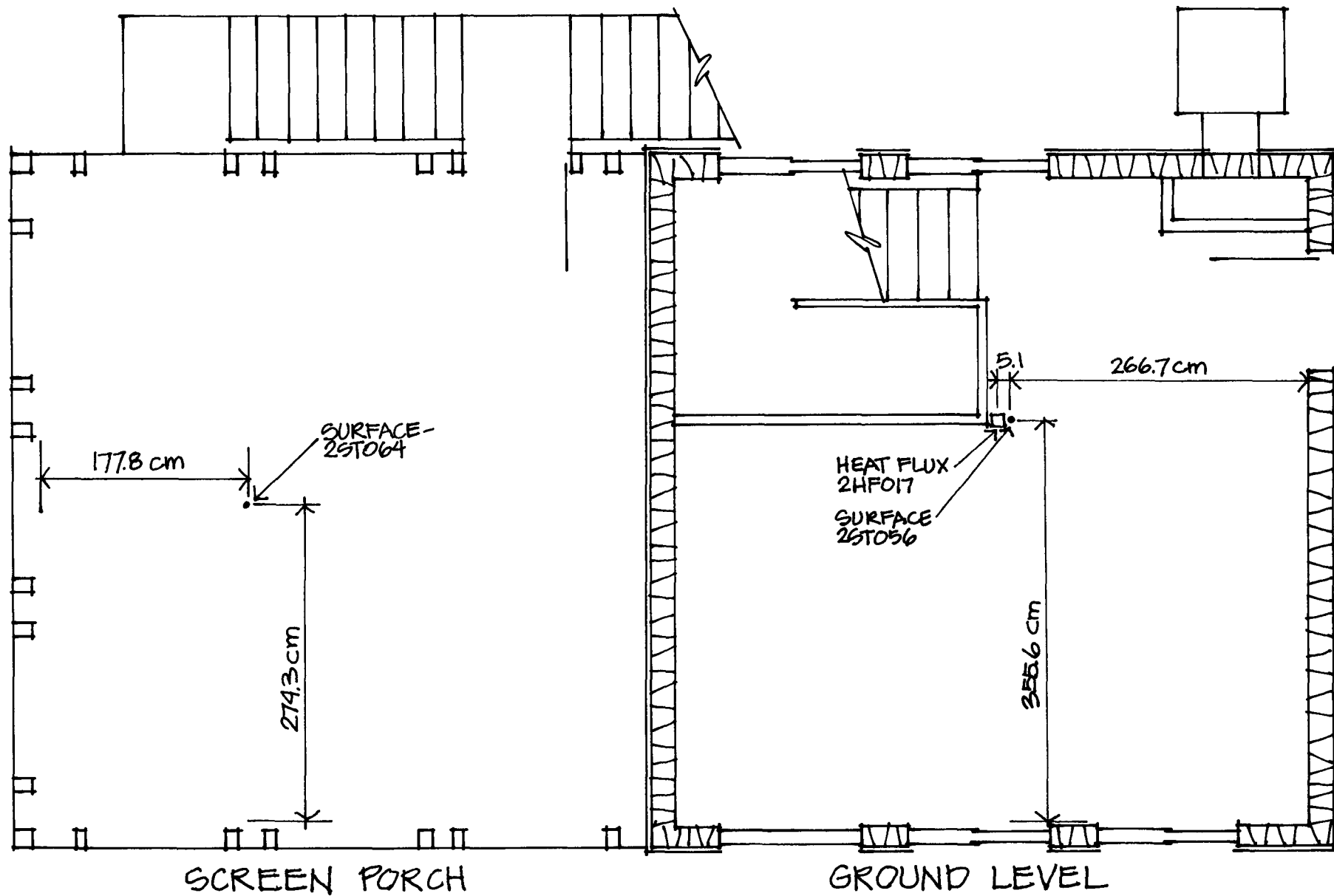
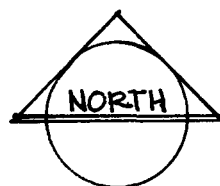


Fig. 4



CEILING PLAN- STRUCTURE 2

SCALE $\frac{1}{4}" = 1'-0"$

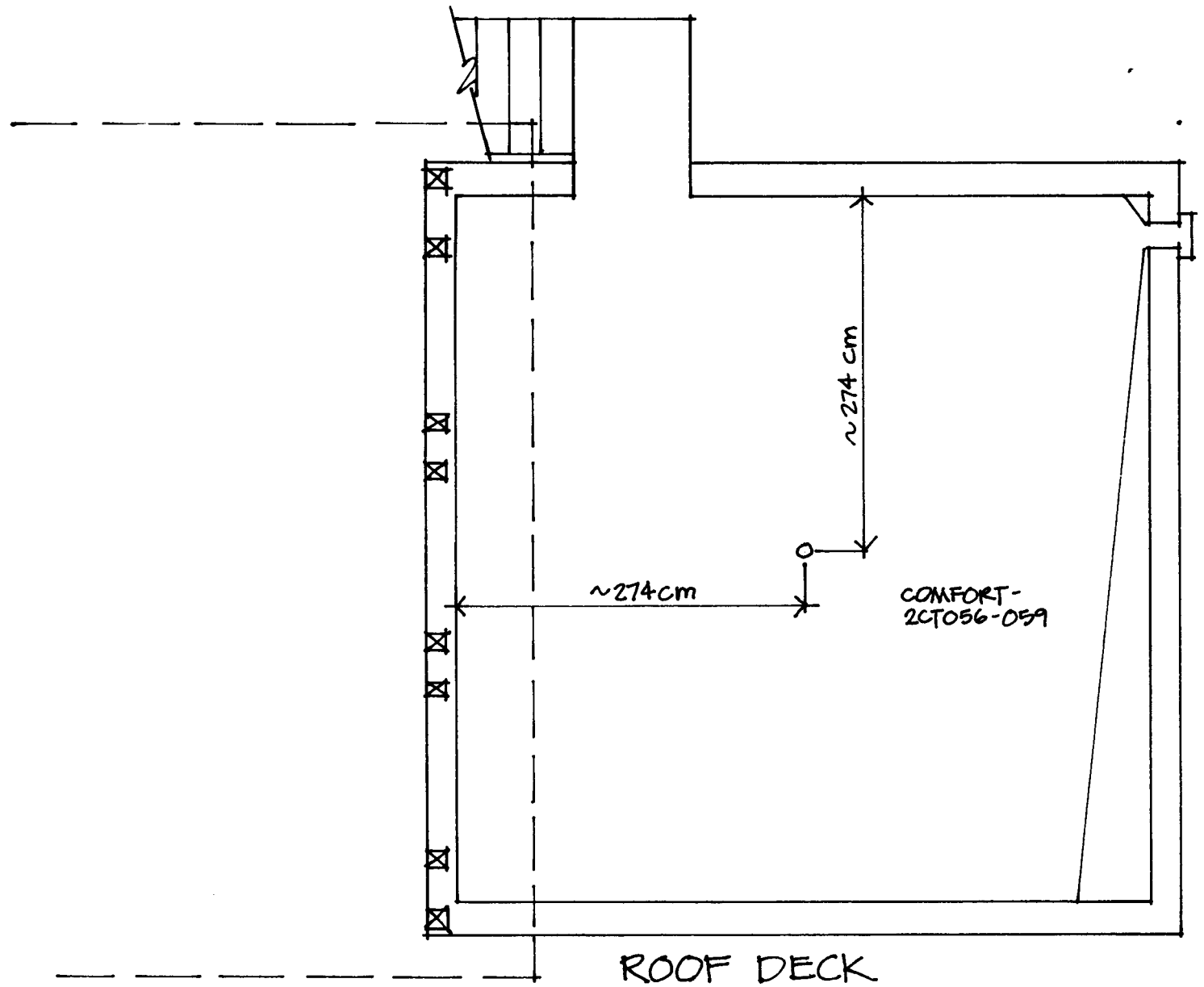
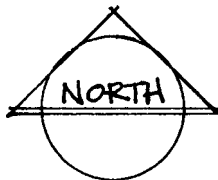
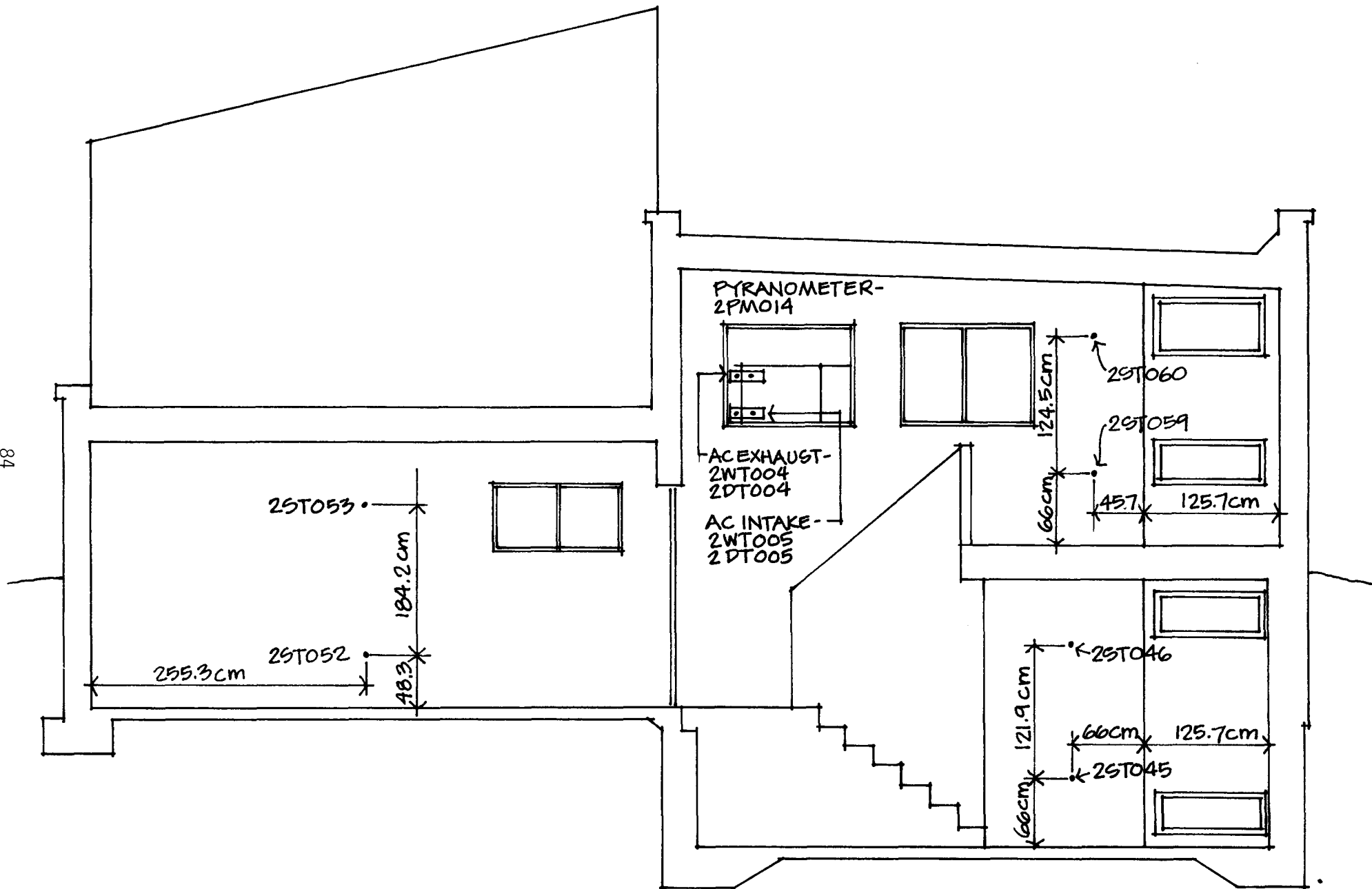


Fig. 5



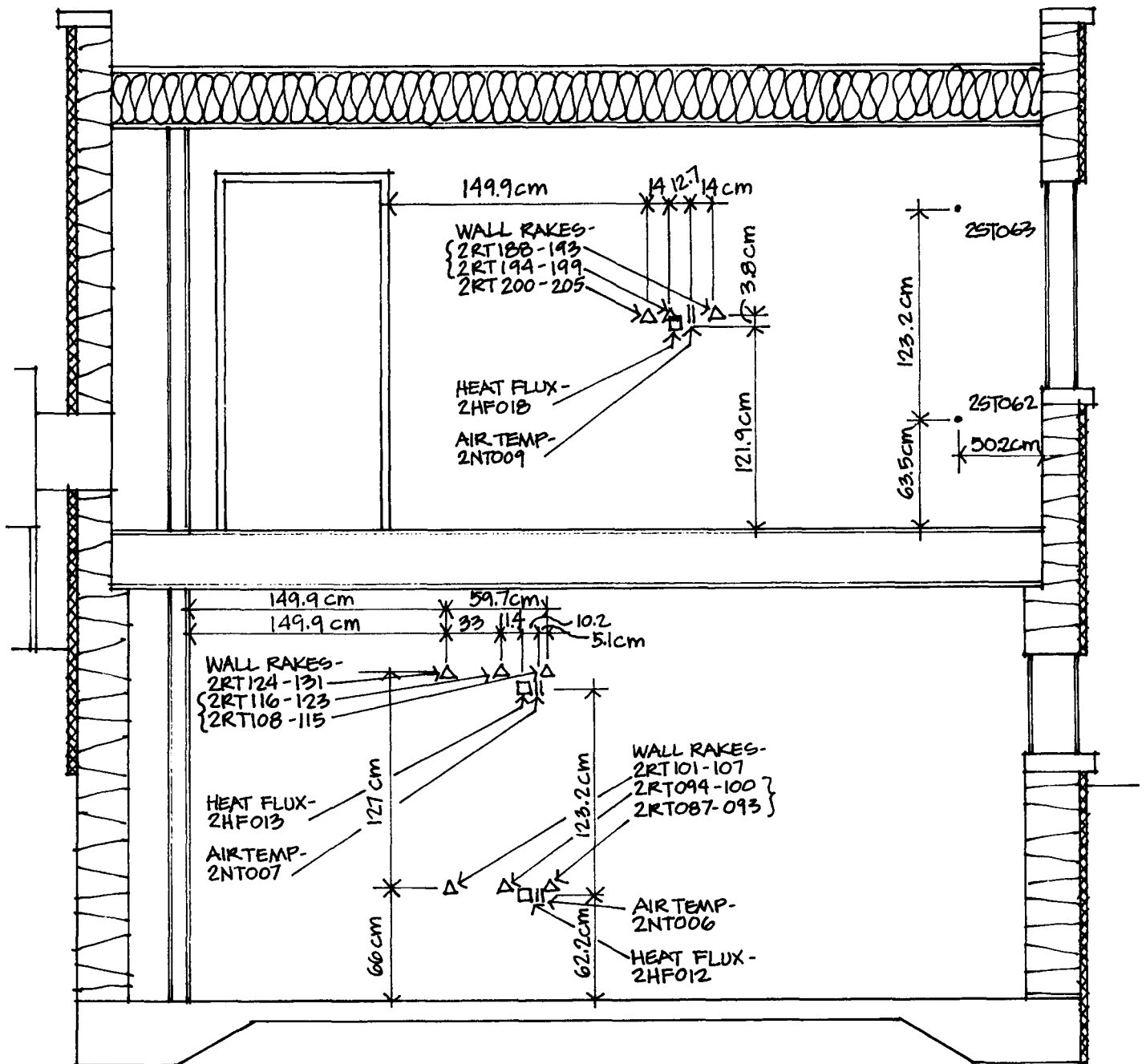
FLOOR PLAN - STRUCTURE 2

SCALE 1/4" = 1'-0"



NORTH WALL INTERIOR ELEVATION - STRUCTURE 2

SCALE 1/4" = 1'-0"



EAST WALL INTERIOR ELEVATION -
 STRUCTURE 2

SCALE $\frac{3}{8}'' = 1'-0''$

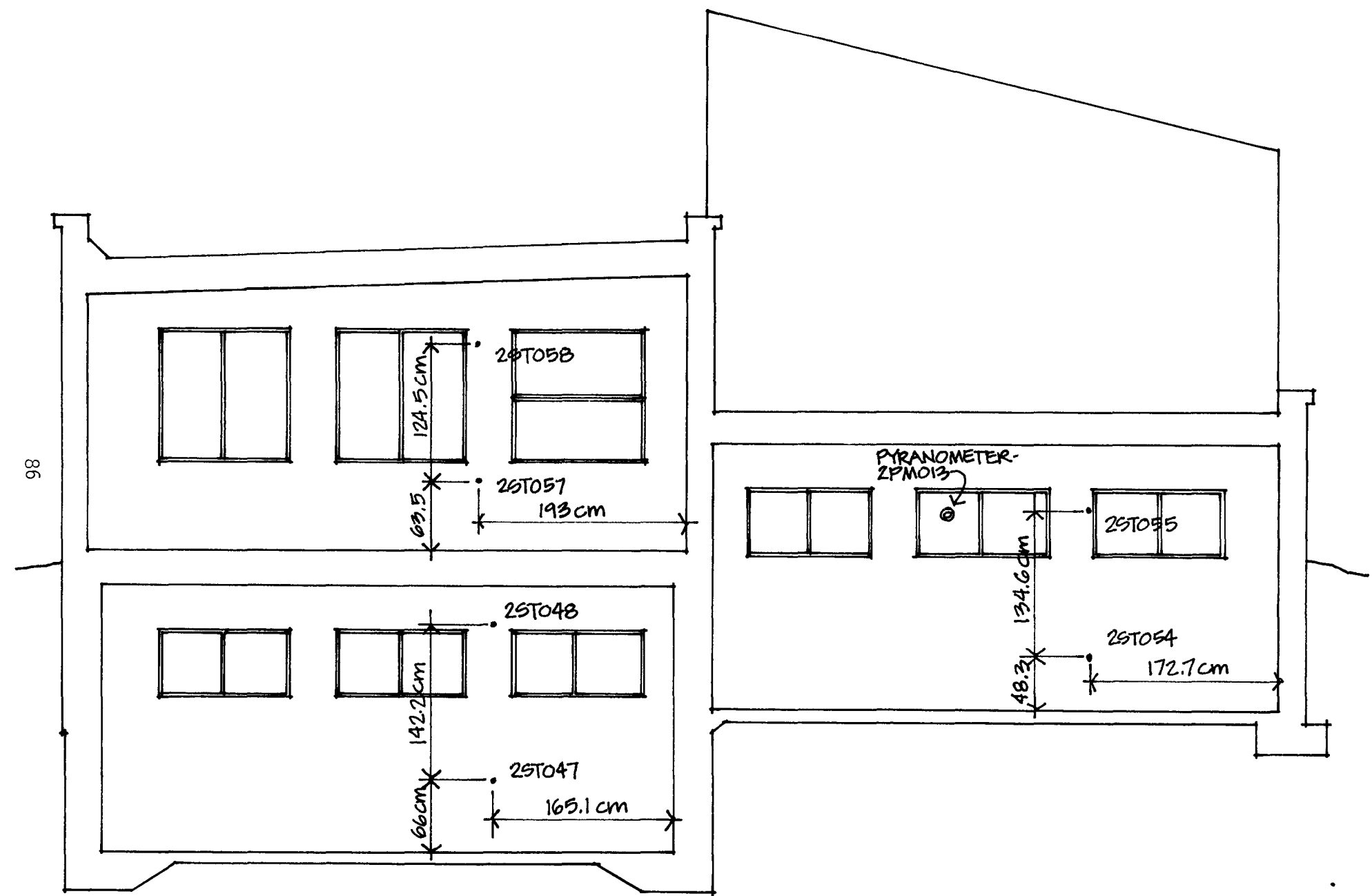
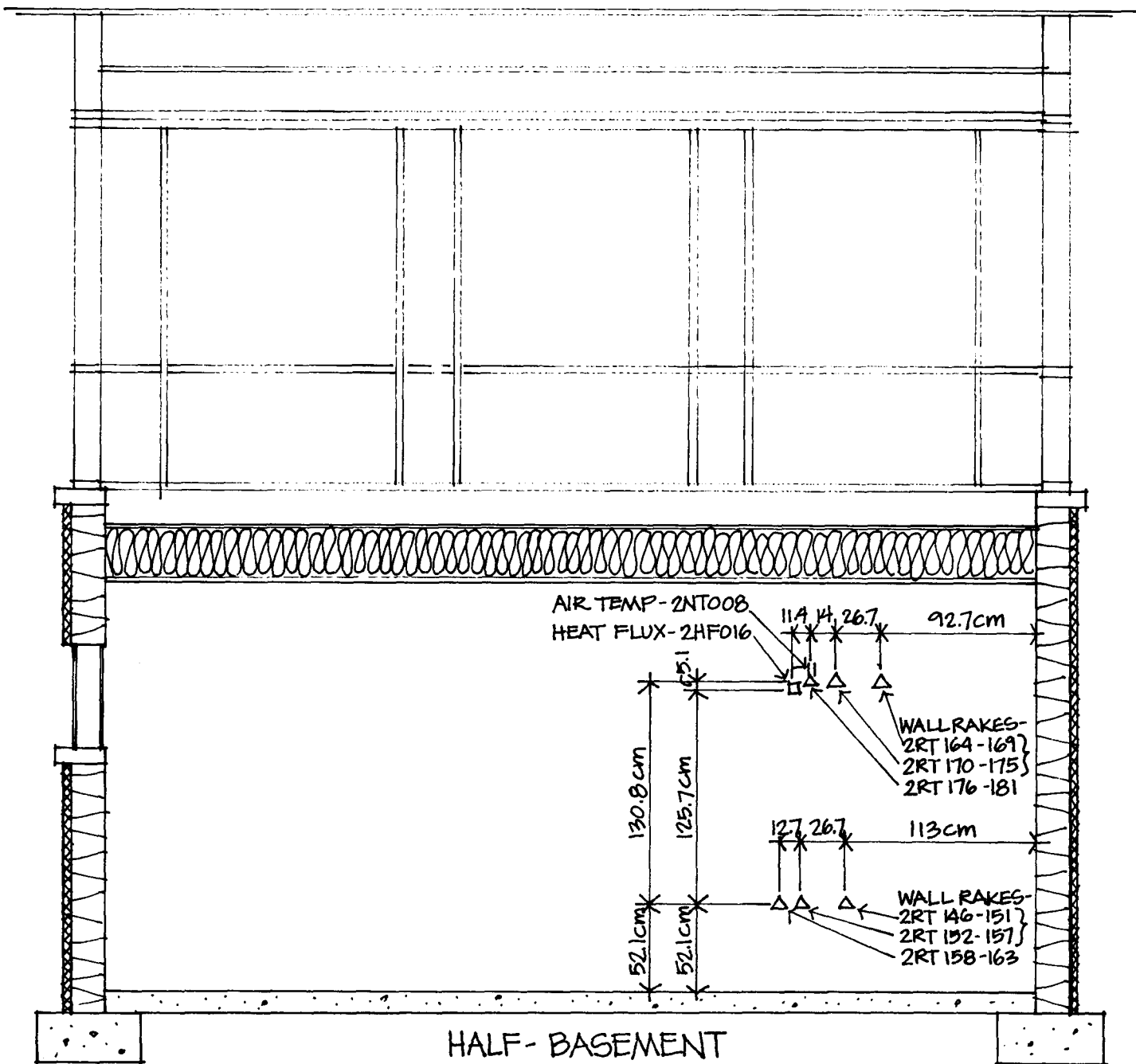


Fig. 8

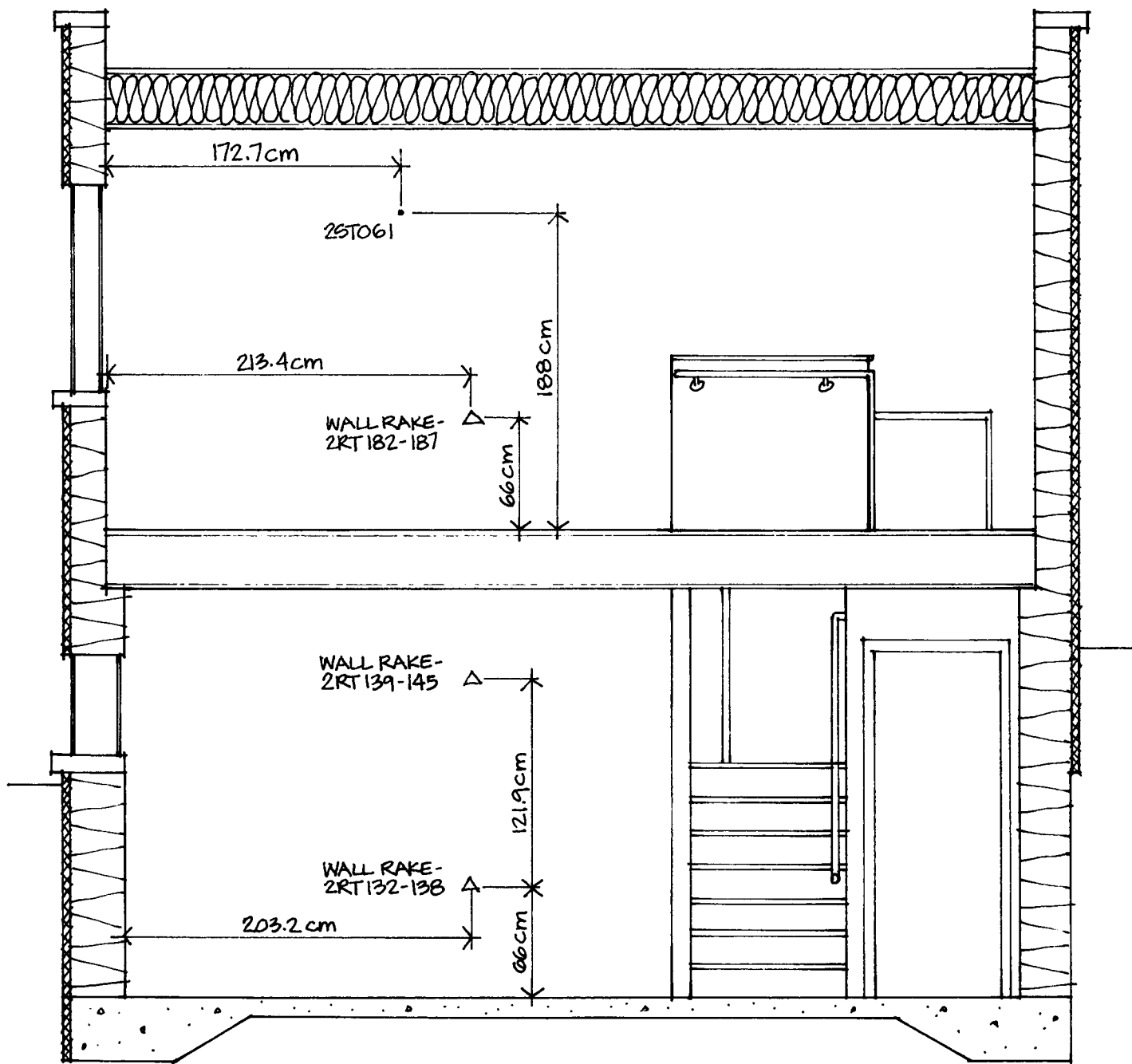
SOUTH WALL INTERIOR ELEVATION - STRUCTURE 2

SCALE $\frac{1}{4}" = 1'-0"$



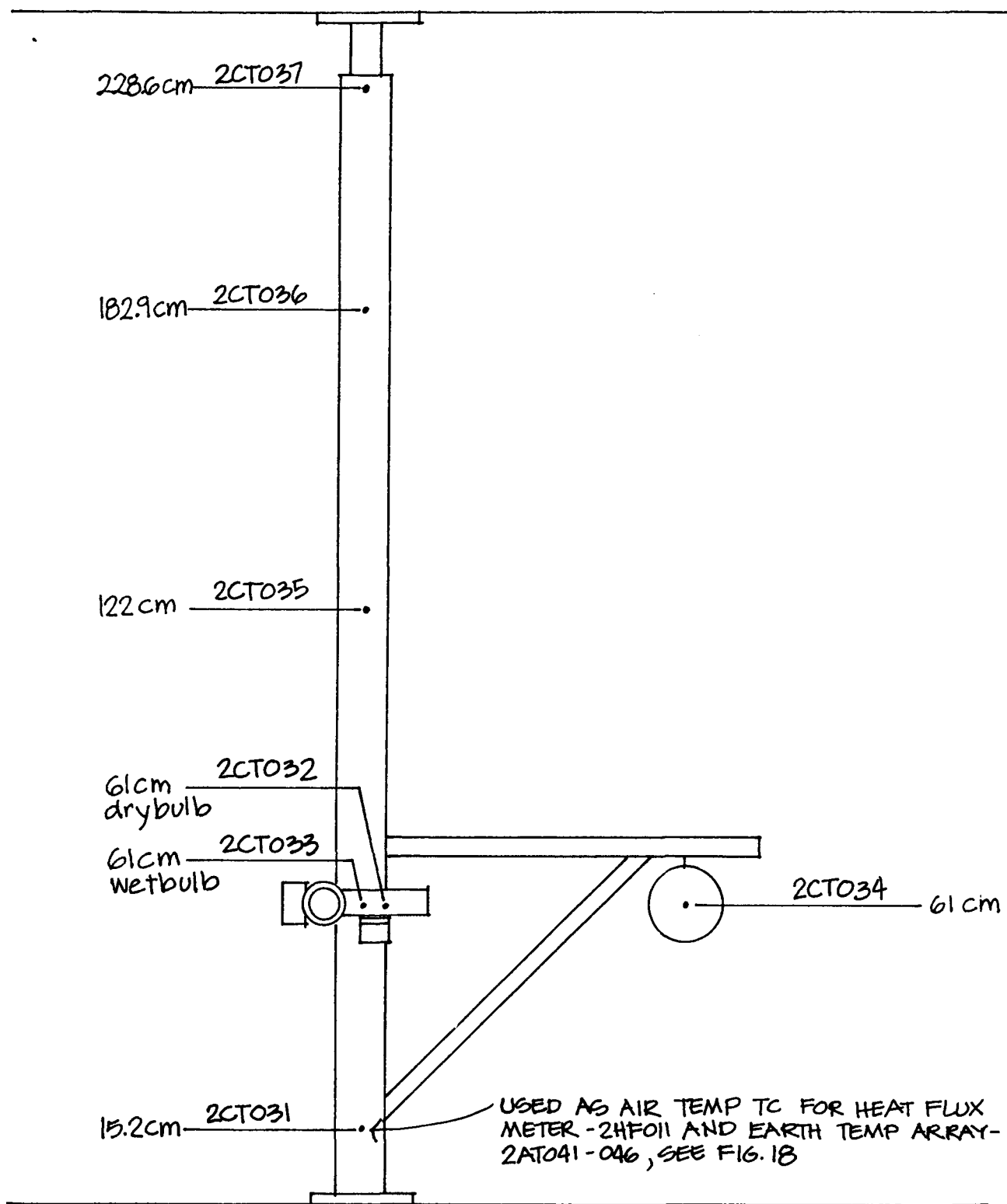
WEST WALL INTERIOR ELEVATION STRUCTURE 2

SCALE $\frac{3}{8}" = 1'-0"$

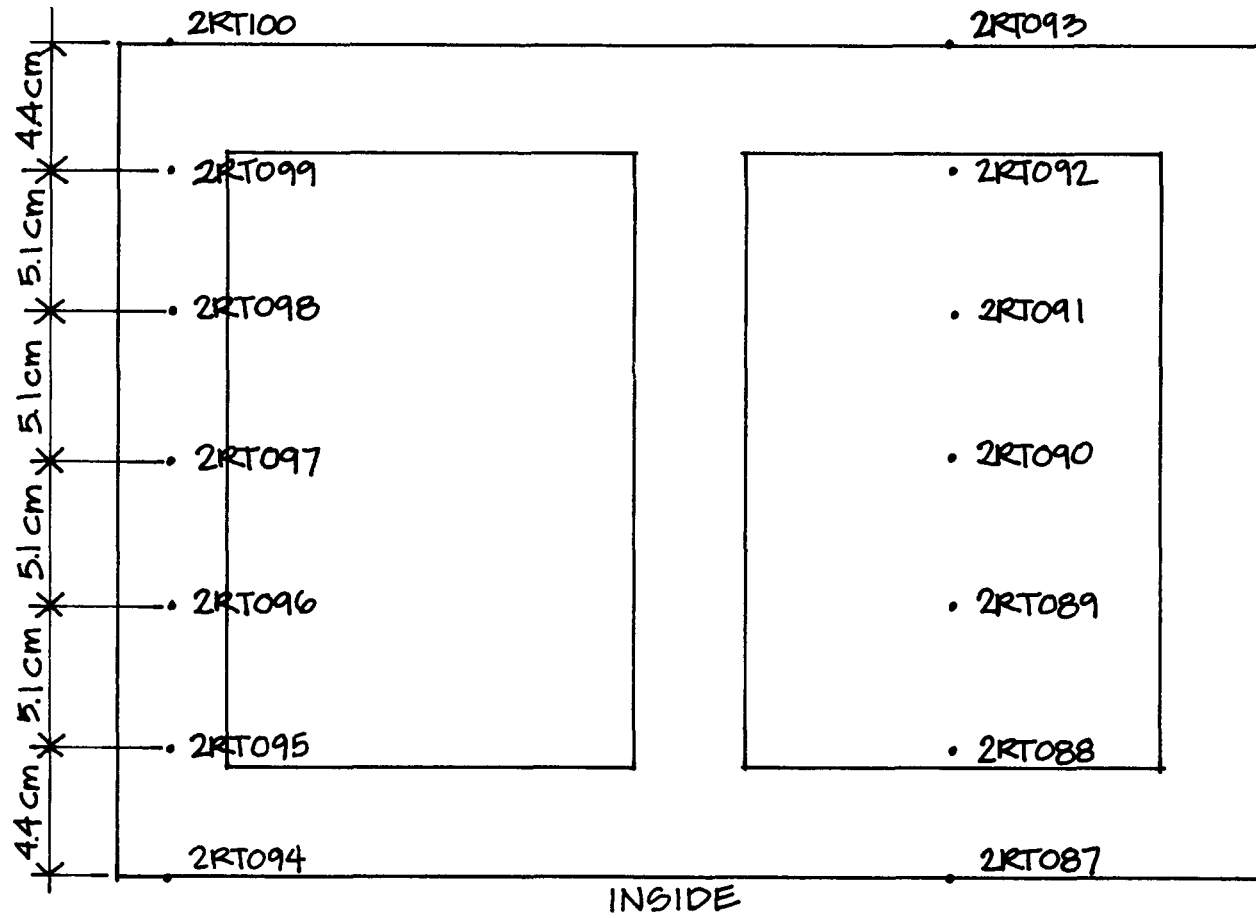


INTERIOR WALL - WEST ELEVATION STRUCTURE 2

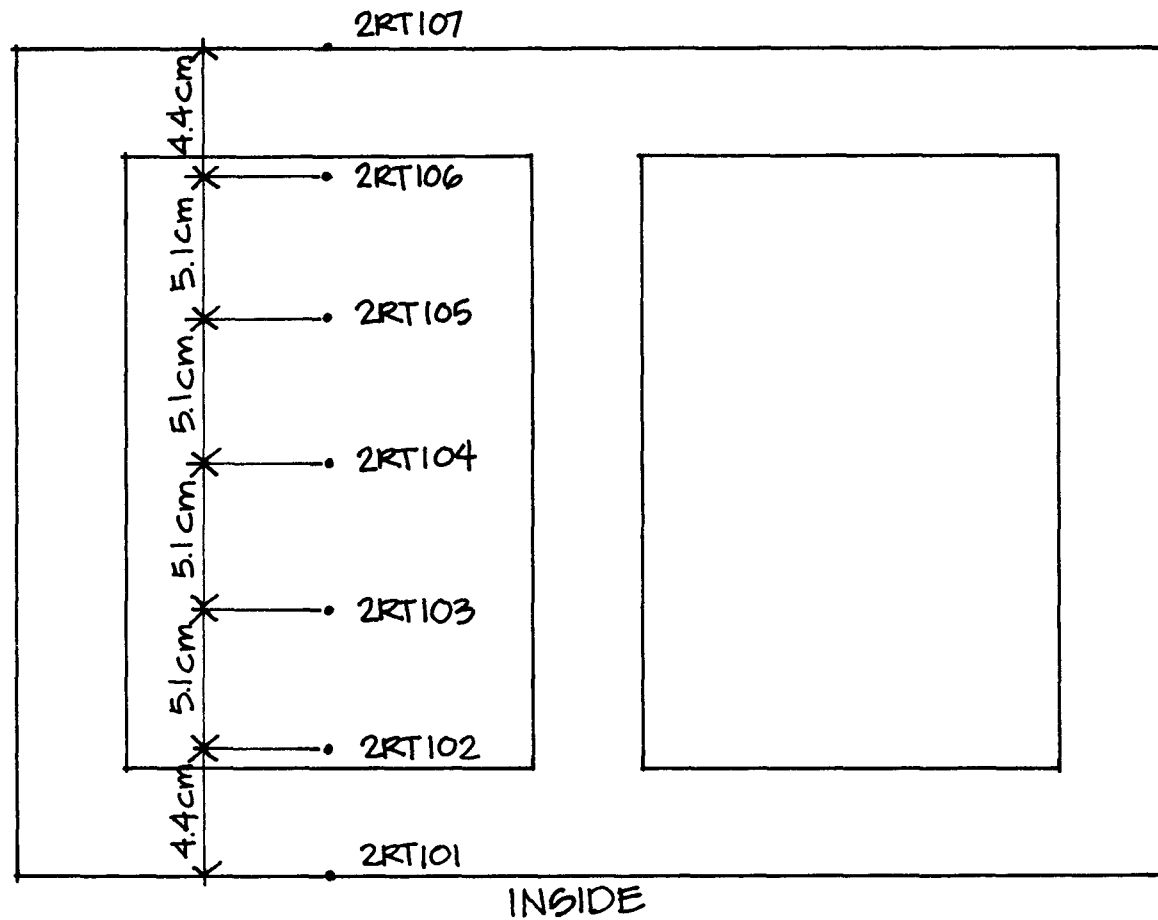
SCALE $\frac{3}{8}" = 1'-0"$



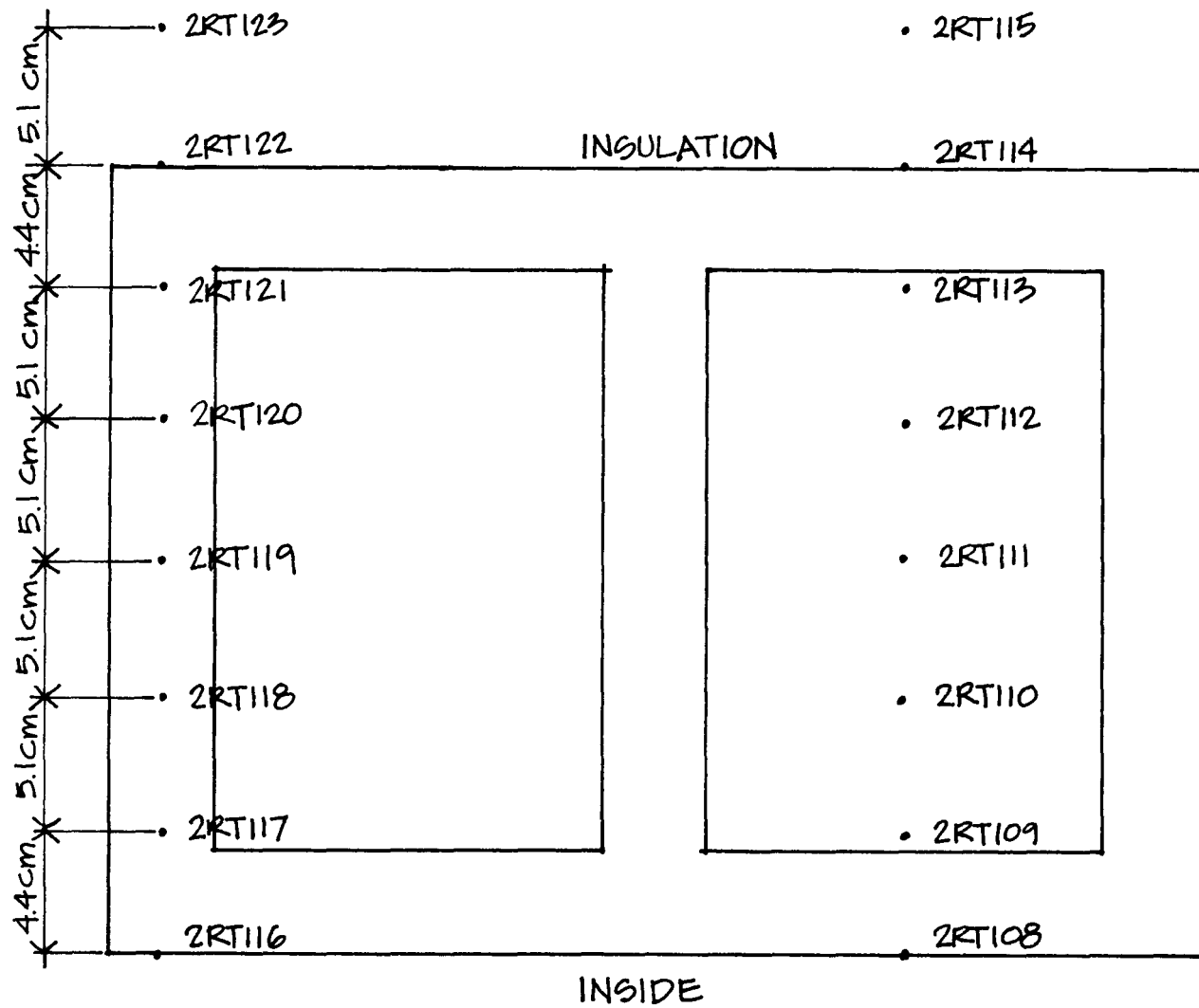
COMFORT SENSOR STATION
STRUCTURE 2 - FULL BASEMENT



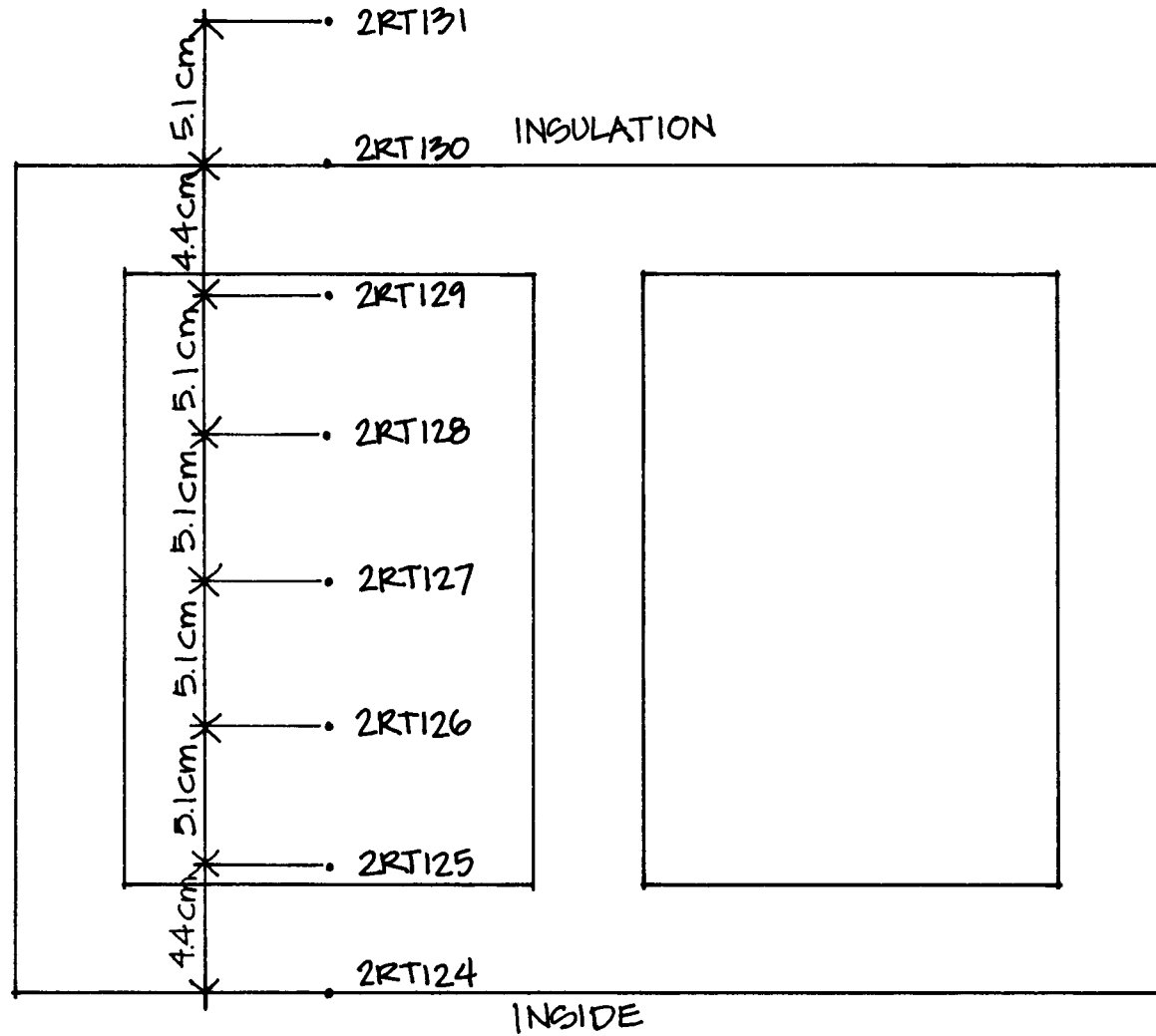
30.5 cm (12") BLOCK - FULL BASEMENT
EAST WALL - STRUCTURE 2



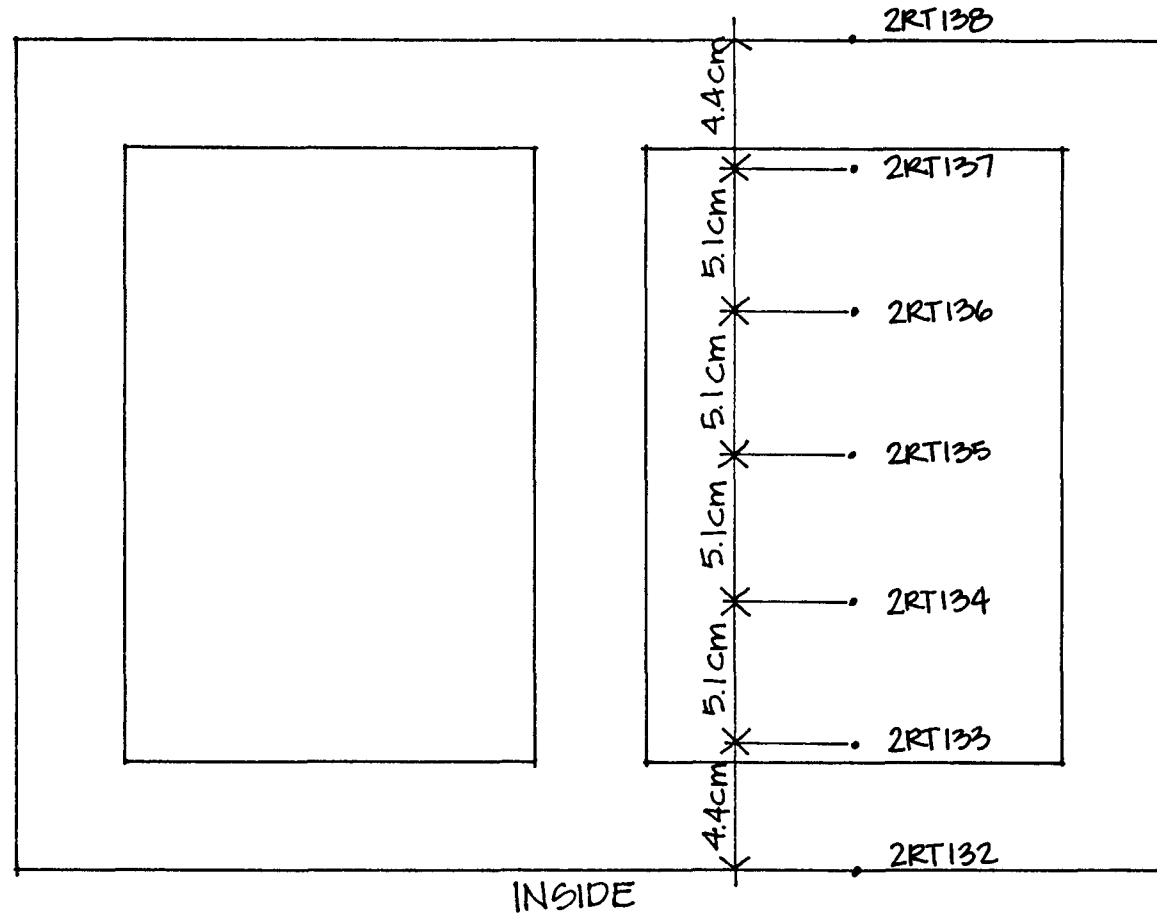
30.5 cm (12") BLOCK-FULL BASEMENT
EAST WALL - STRUCTURE 2



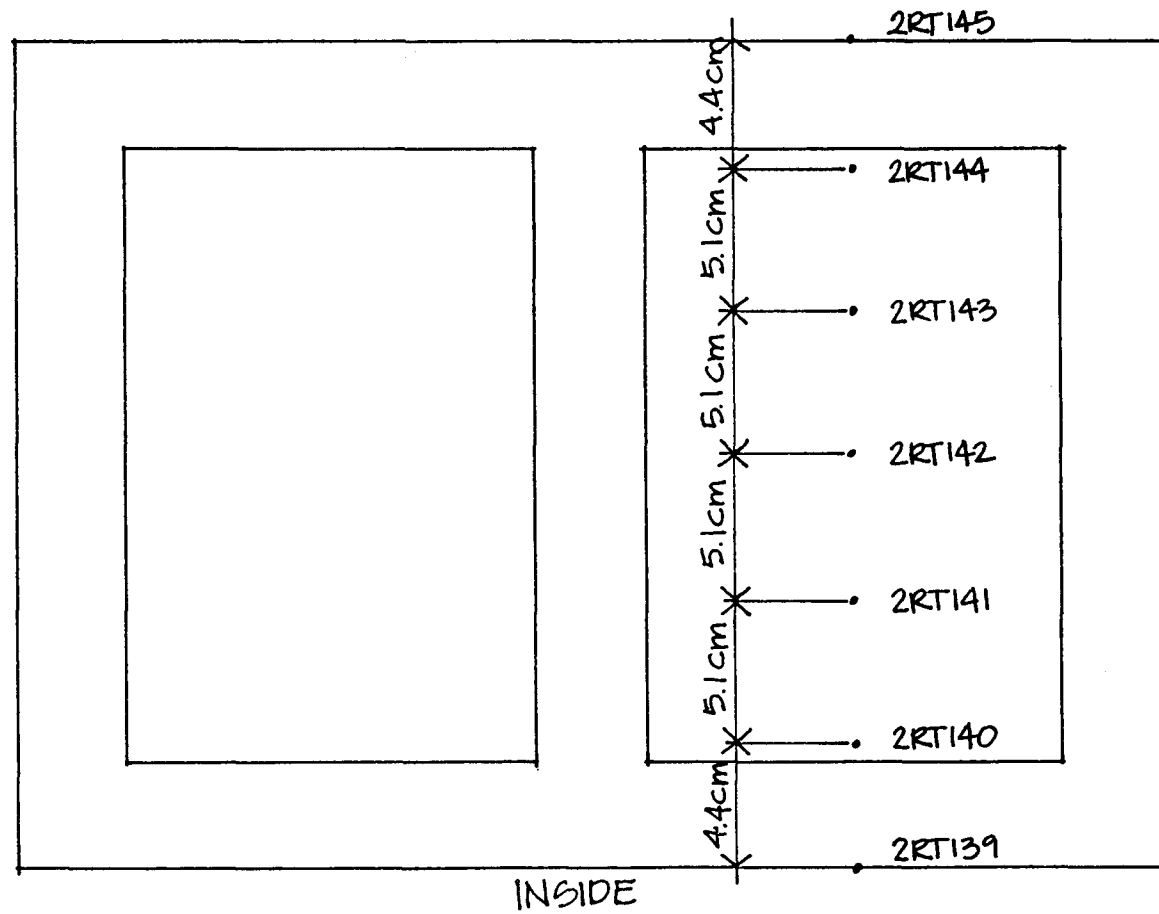
30.5 cm (12") BLOCK-FULL BASEMENT
EAST WALL - STRUCTURE 2



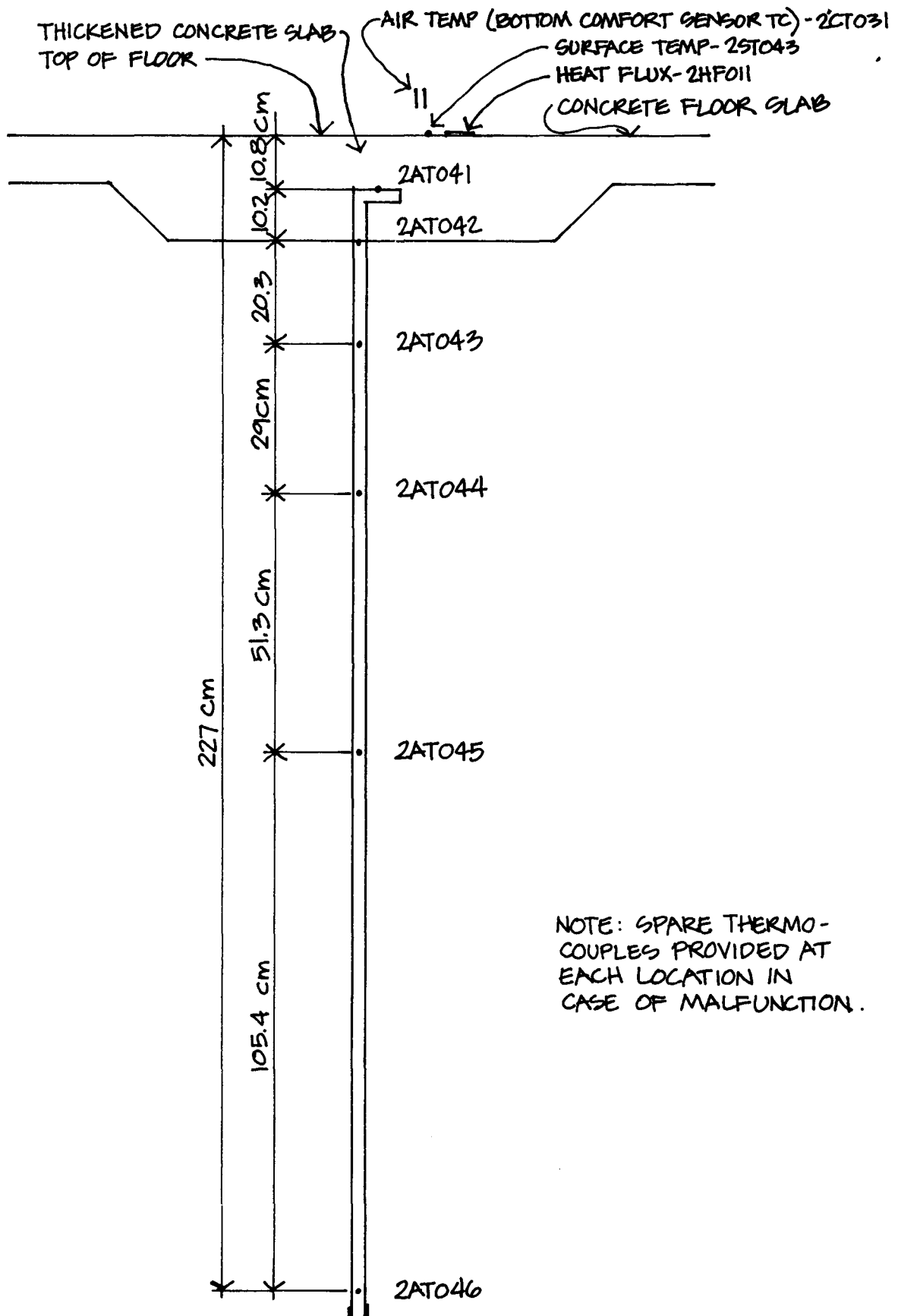
30.5 cm (12") BLOCK-FULL BASEMENT
EAST WALL - STRUCTURE 2



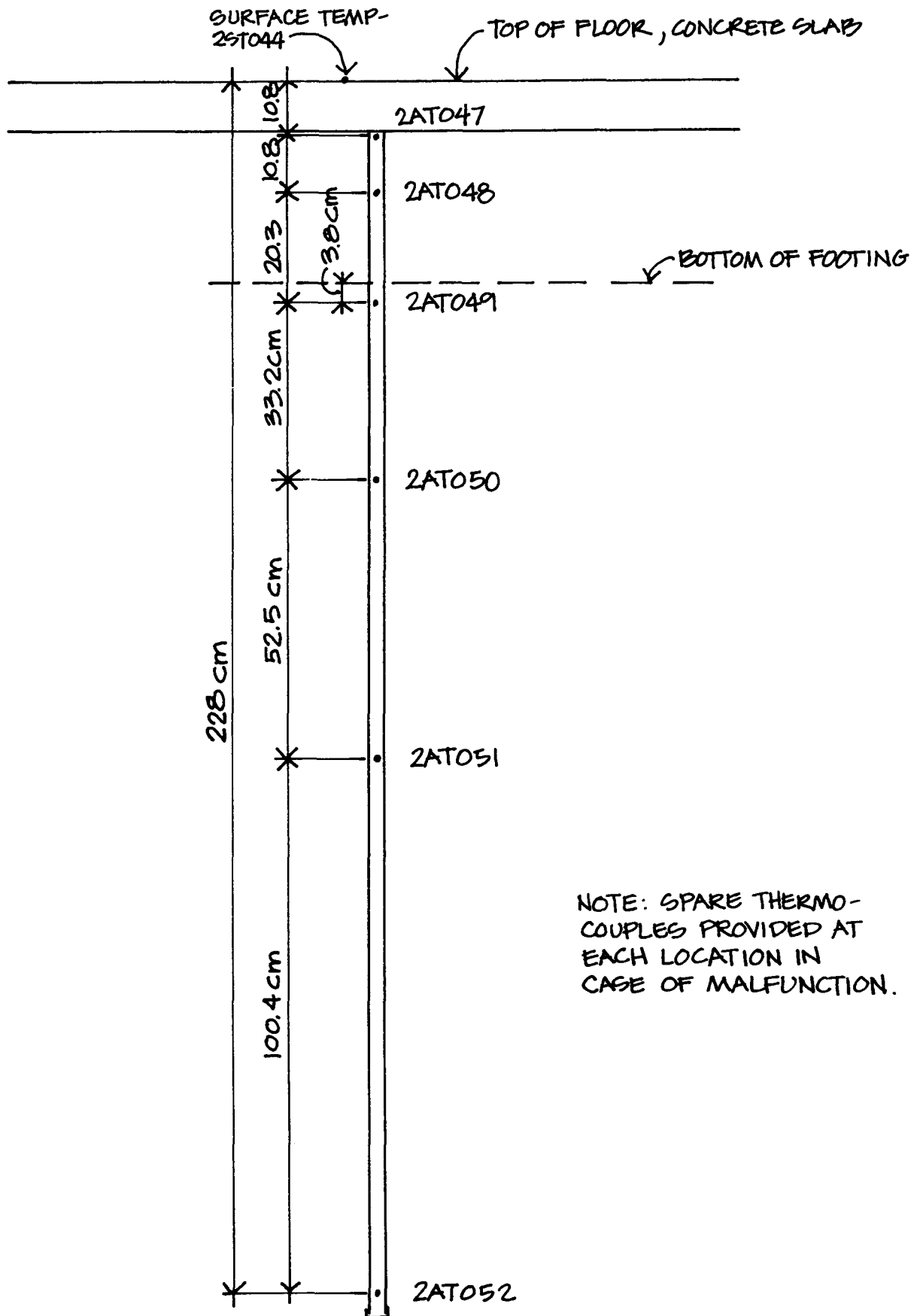
30.5 cm (12") BLOCK - FULL BASEMENT
INTERIOR WALL - STRUCTURE 2



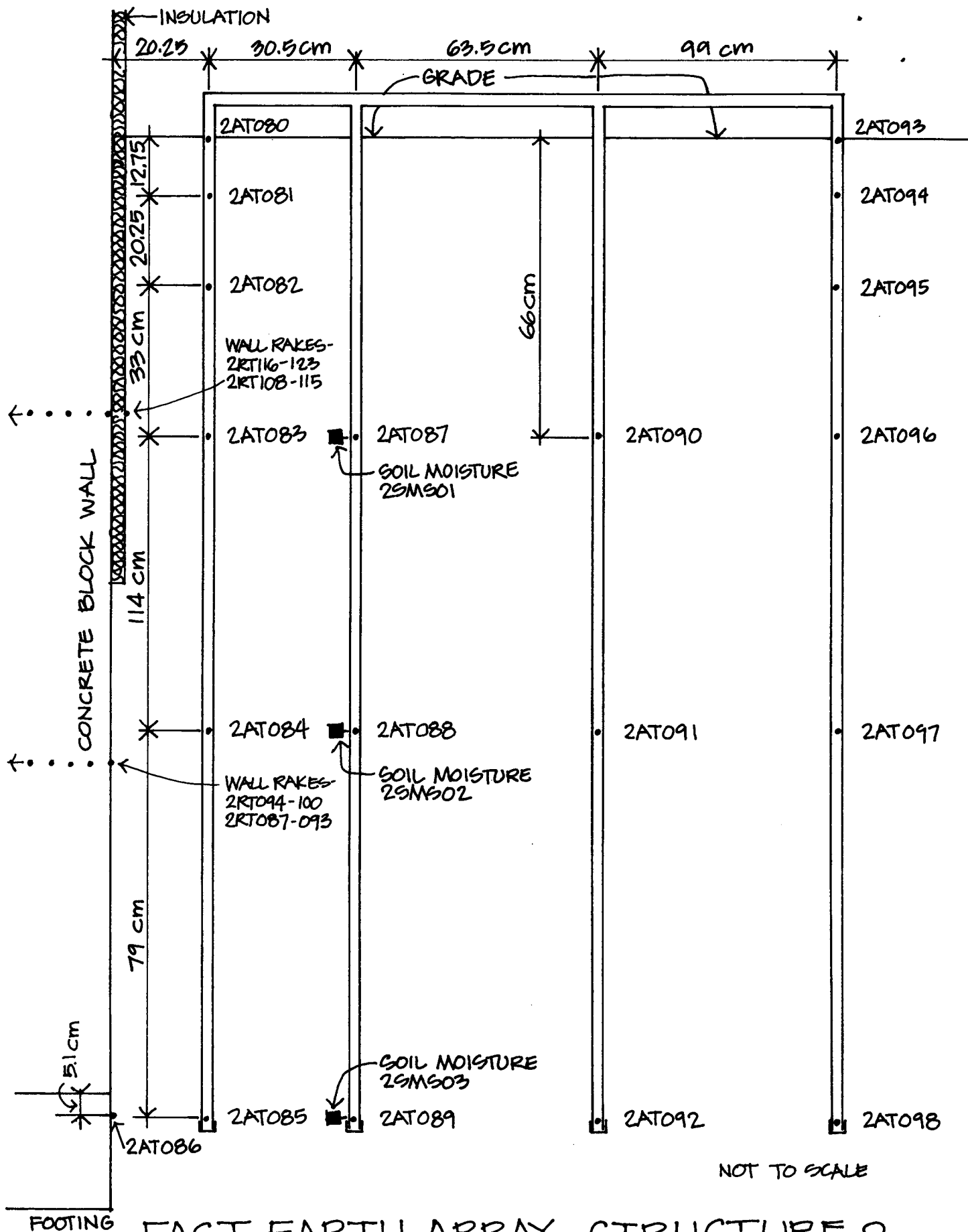
30.5 cm (12") BLOCK - FULL BASEMENT
INTERIOR WALL - STRUCTURE 2



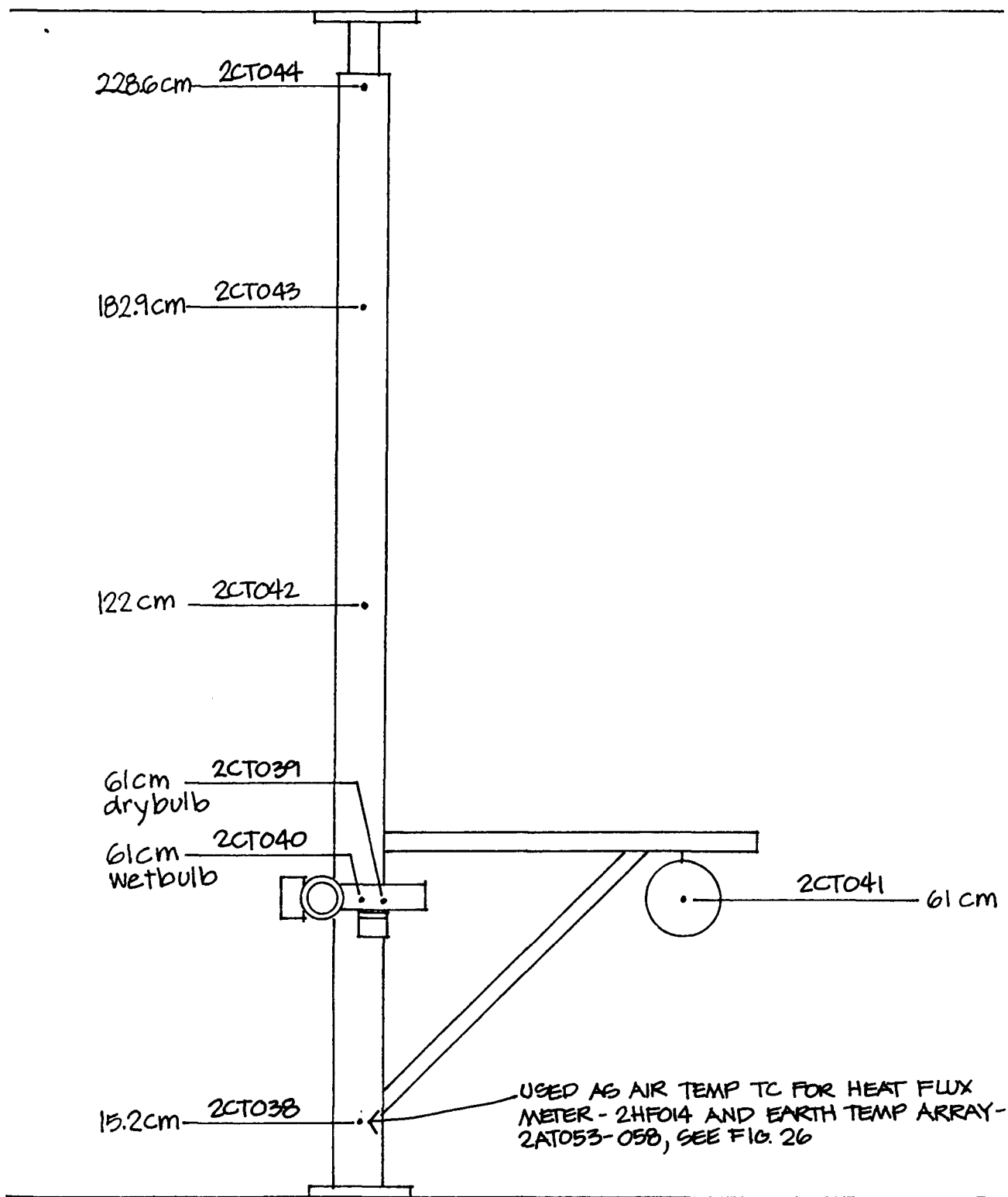
CENTER ARRAY- FULL BASEMENT
STRUCTURE 2



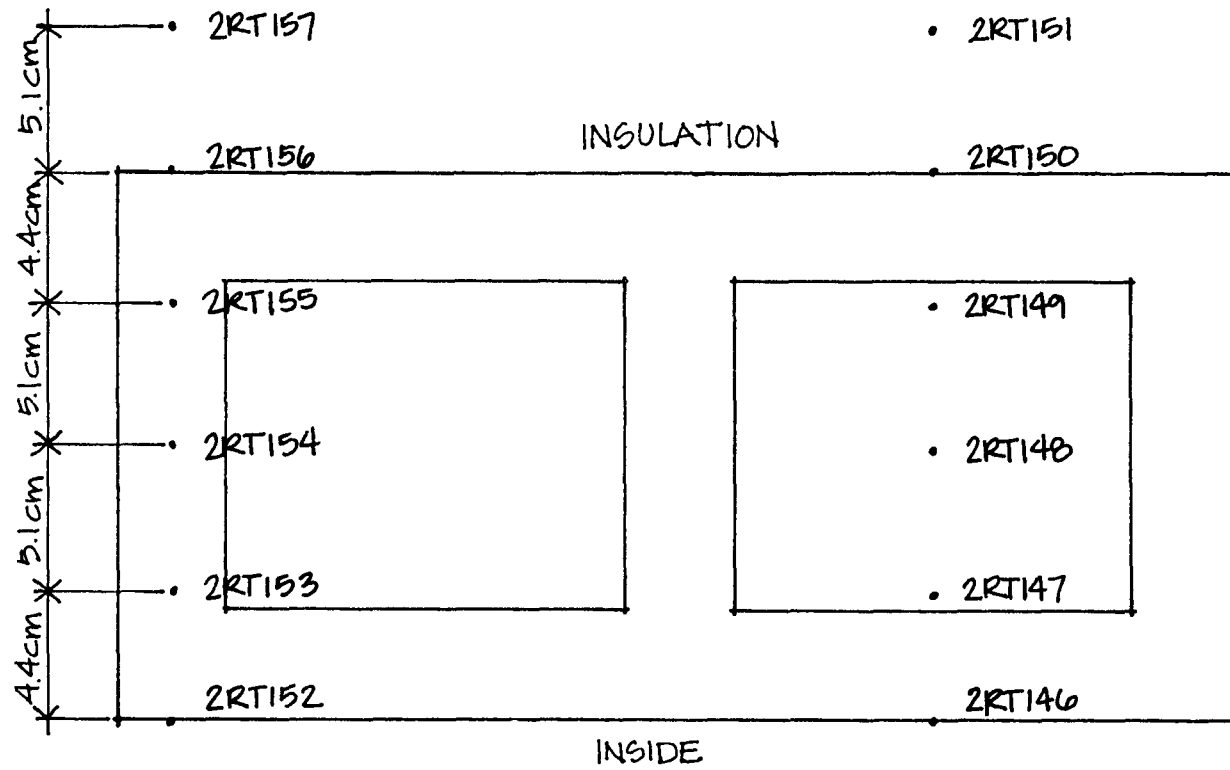
EAST FOOTING - FULL BASEMENT
STRUCTURE 2



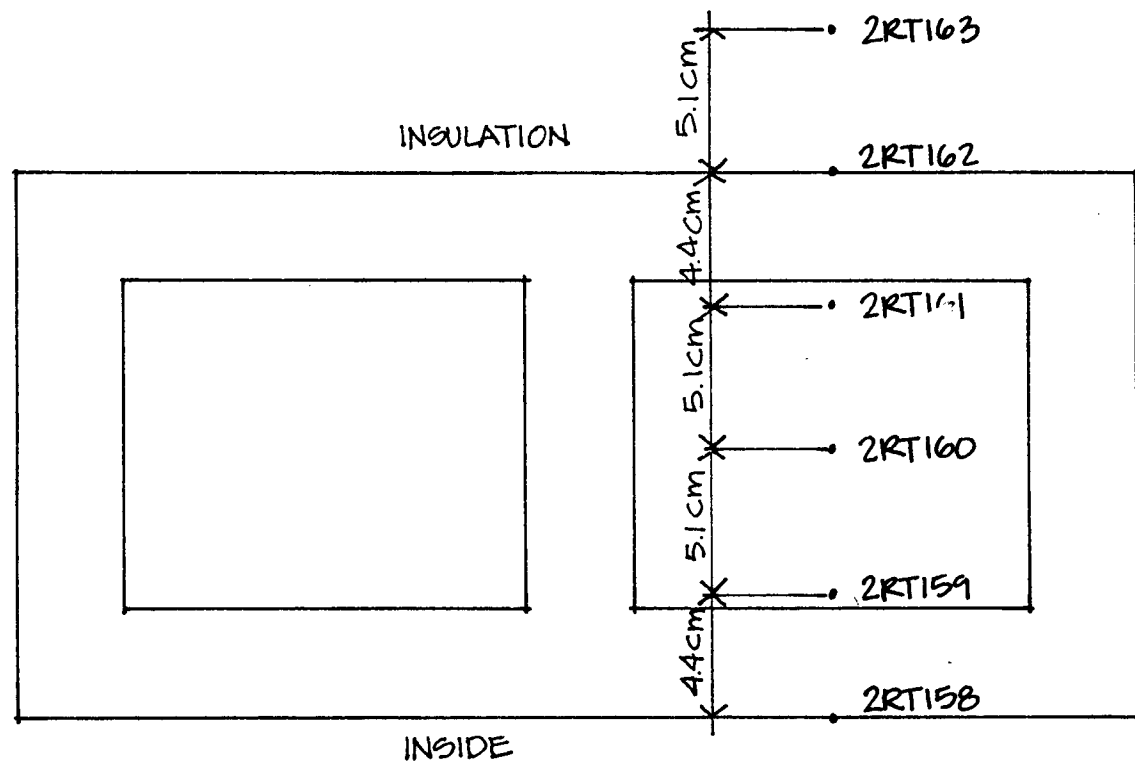
EAST EARTH ARRAY-STRUCTURE 2



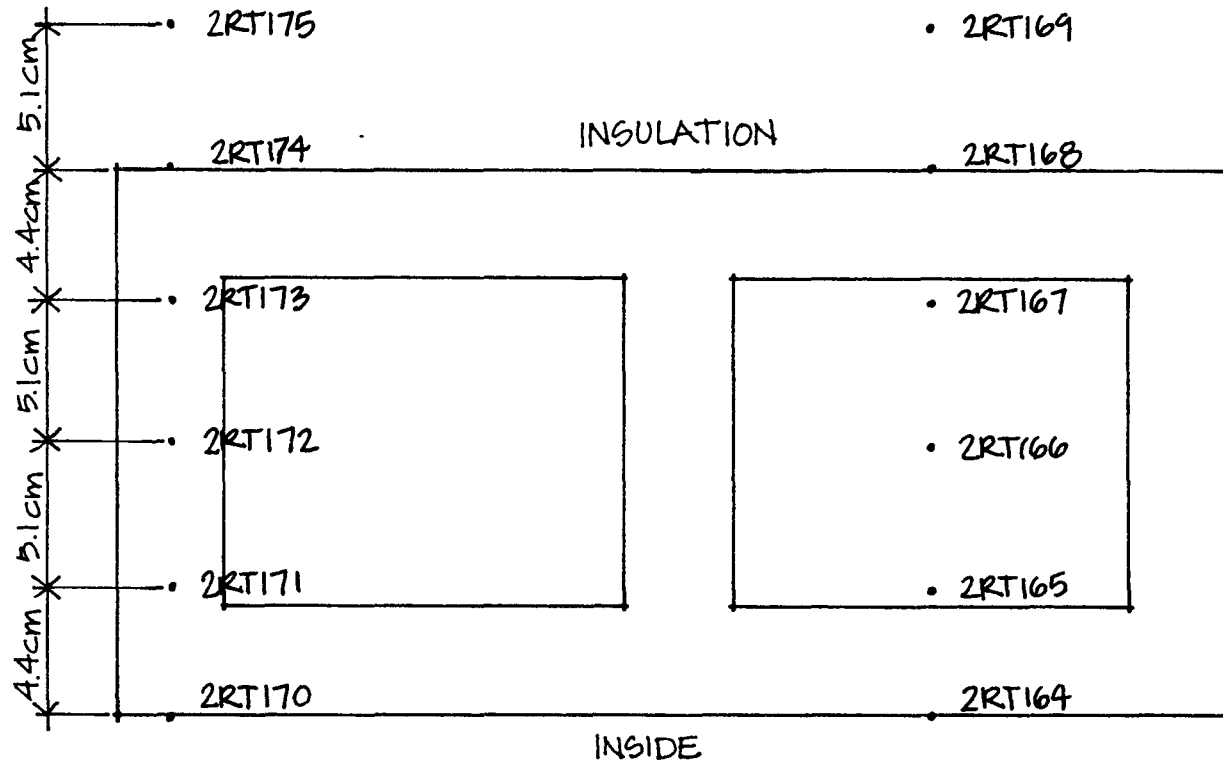
COMFORT SENSOR STATION
STRUCTURE 2 - HALF BASEMENT



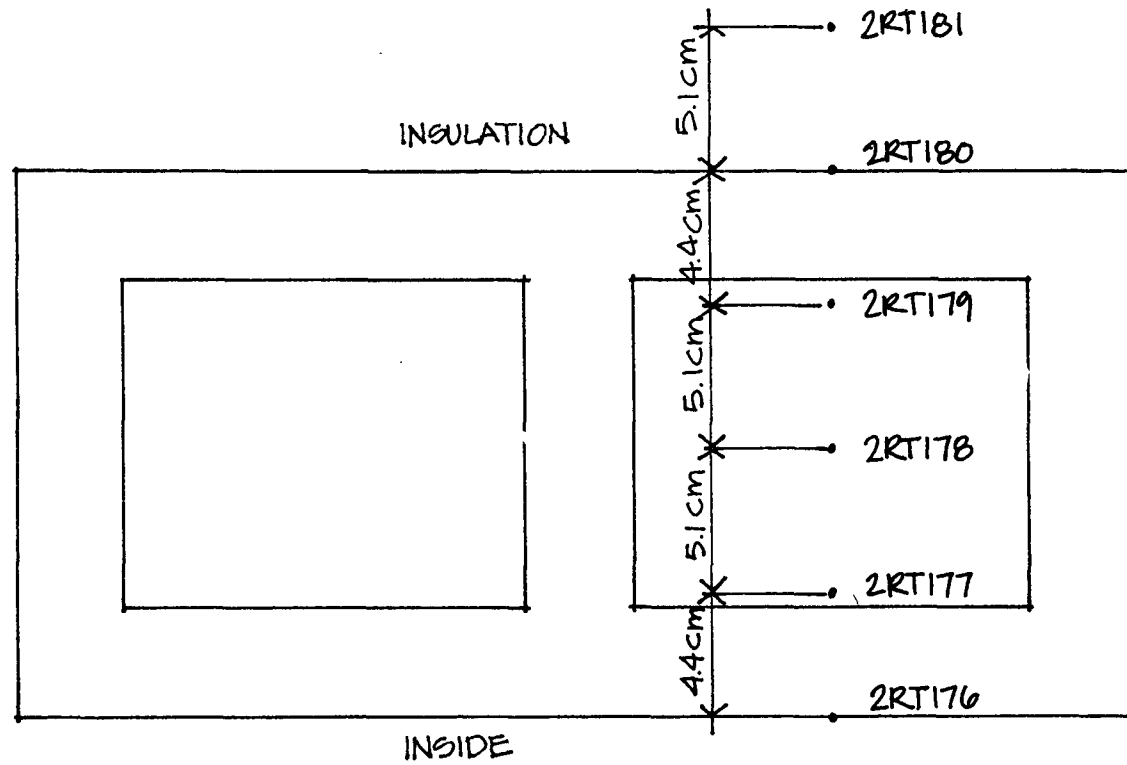
20.3 cm (8") BLOCK - HALF BASEMENT
WEST WALL - STRUCTURE 2



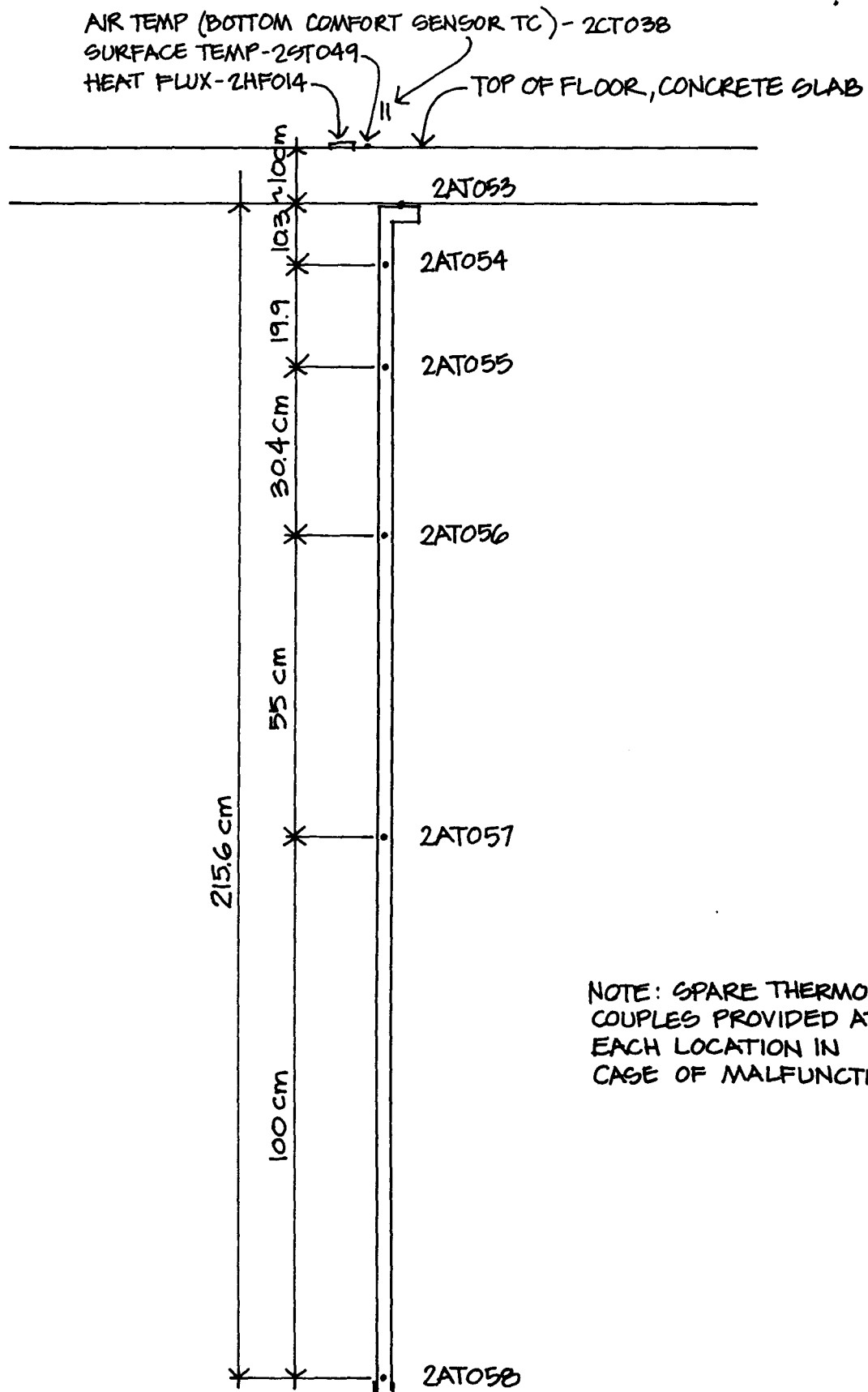
20.3cm(8") BLOCK - HALF BASEMENT
WEST WALL - STRUCTURE 2



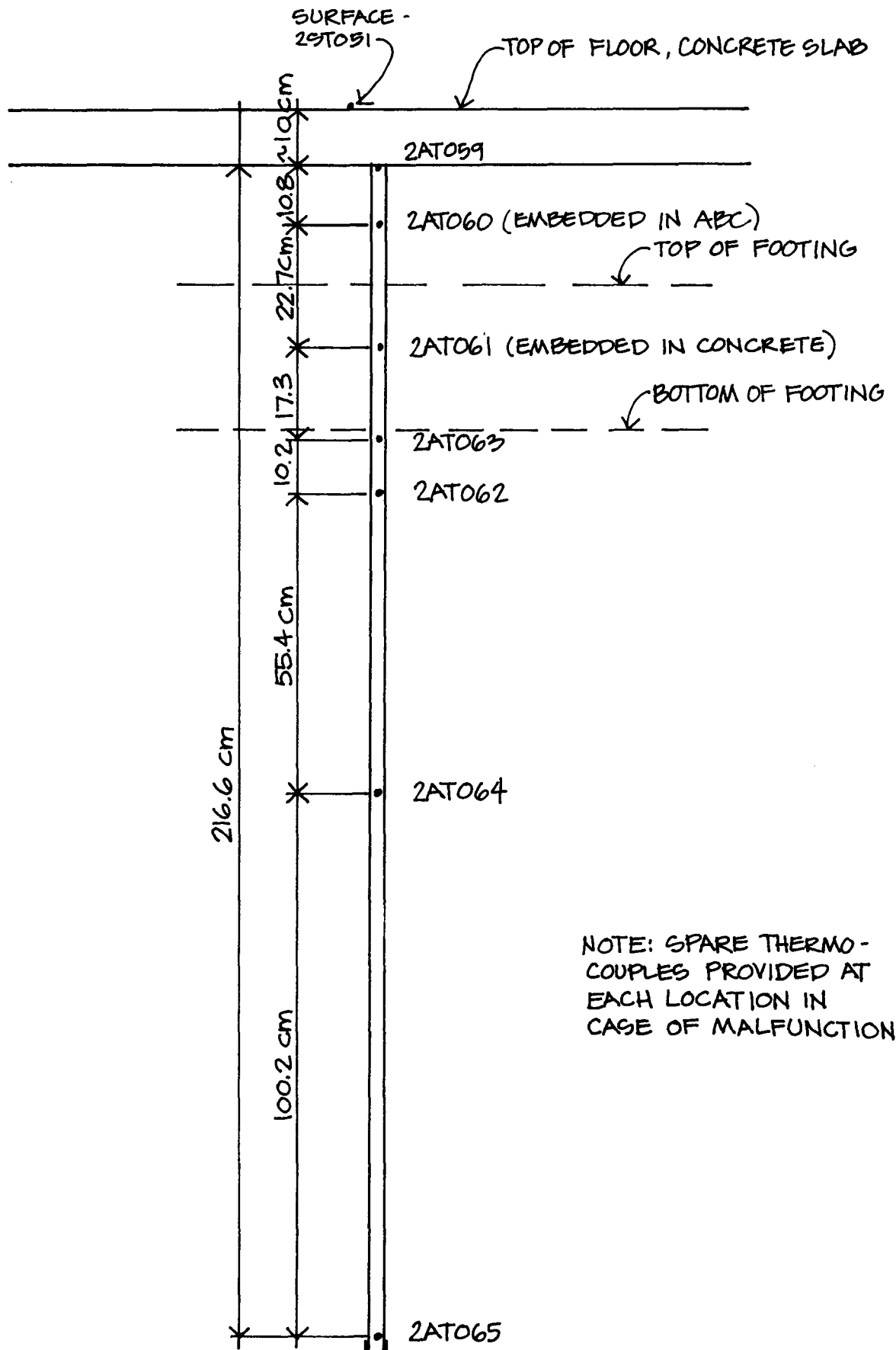
20.3 cm (8") BLOCK - HALF BASEMENT
WEST WALL - STRUCTURE 2



20.3cm(8") BLOCK - HALF BASEMENT
WEST WALL - STRUCTURE 2

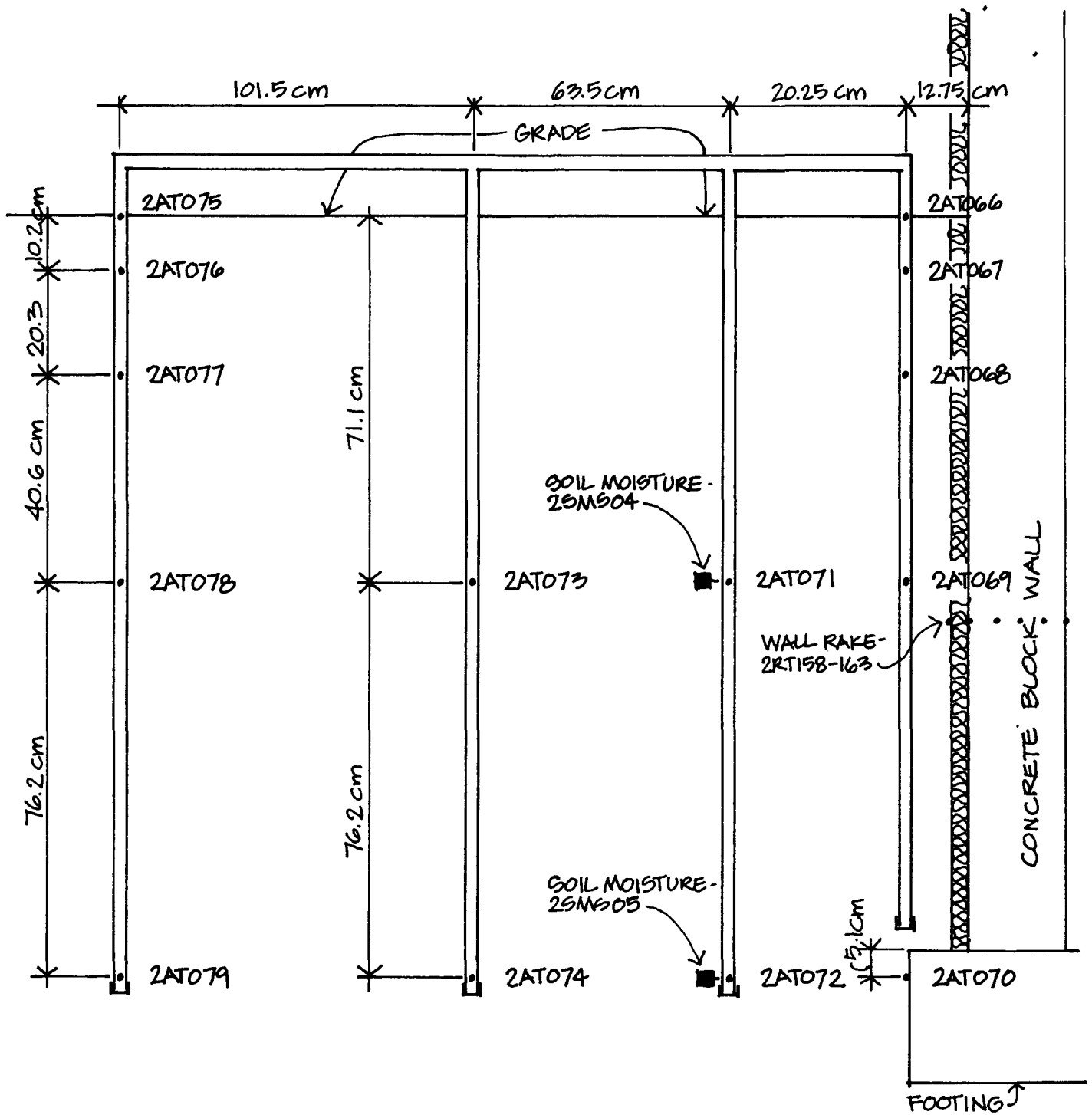


CENTER ARRAY- HALF BASEMENT
 STRUCTURE 2



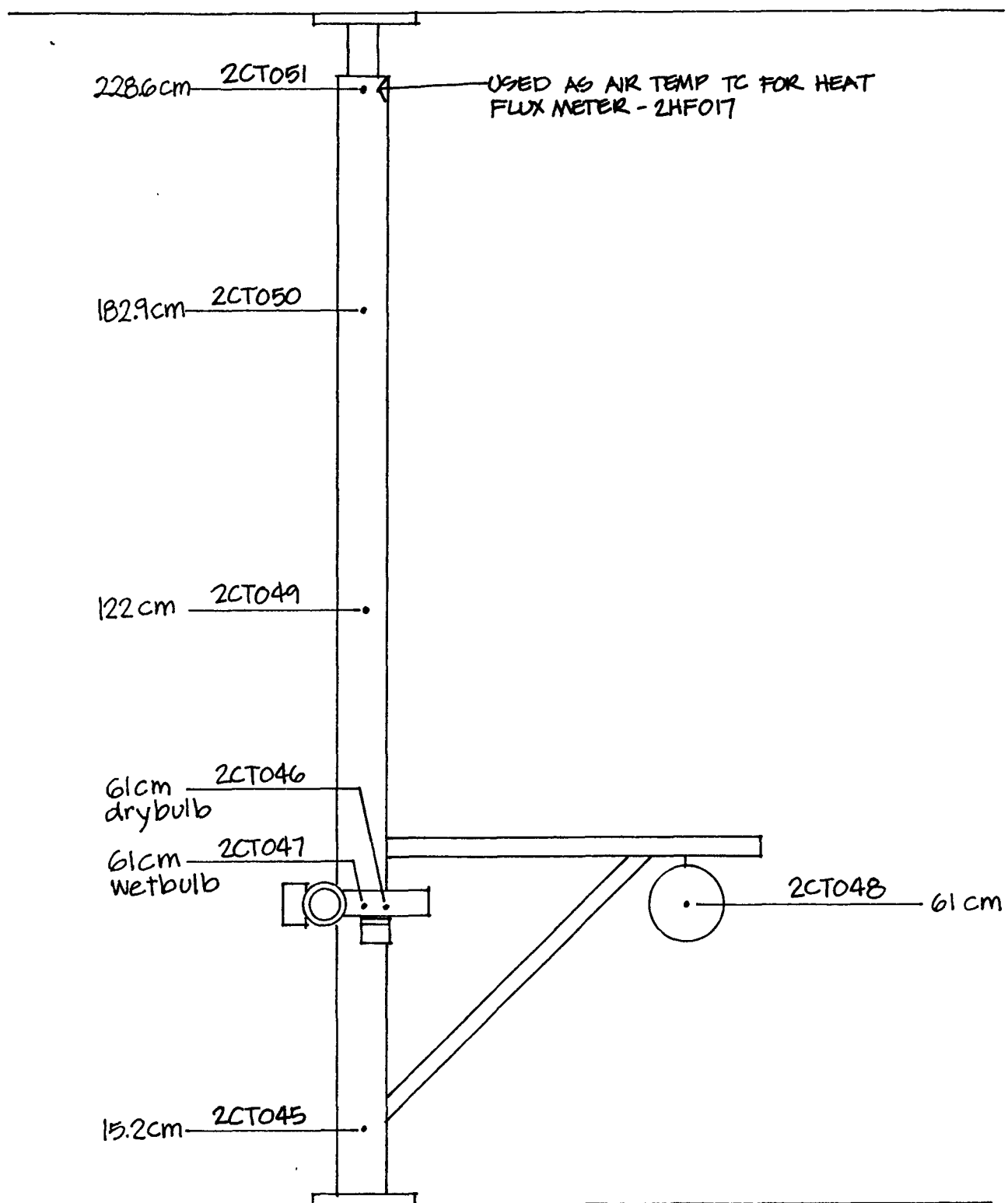
NOTE: SPARE THERMO-
COUPLES PROVIDED AT
EACH LOCATION IN
CASE OF MALFUNCTION.

WEST FOOTING - HALF BASEMENT
STRUCTURE 2

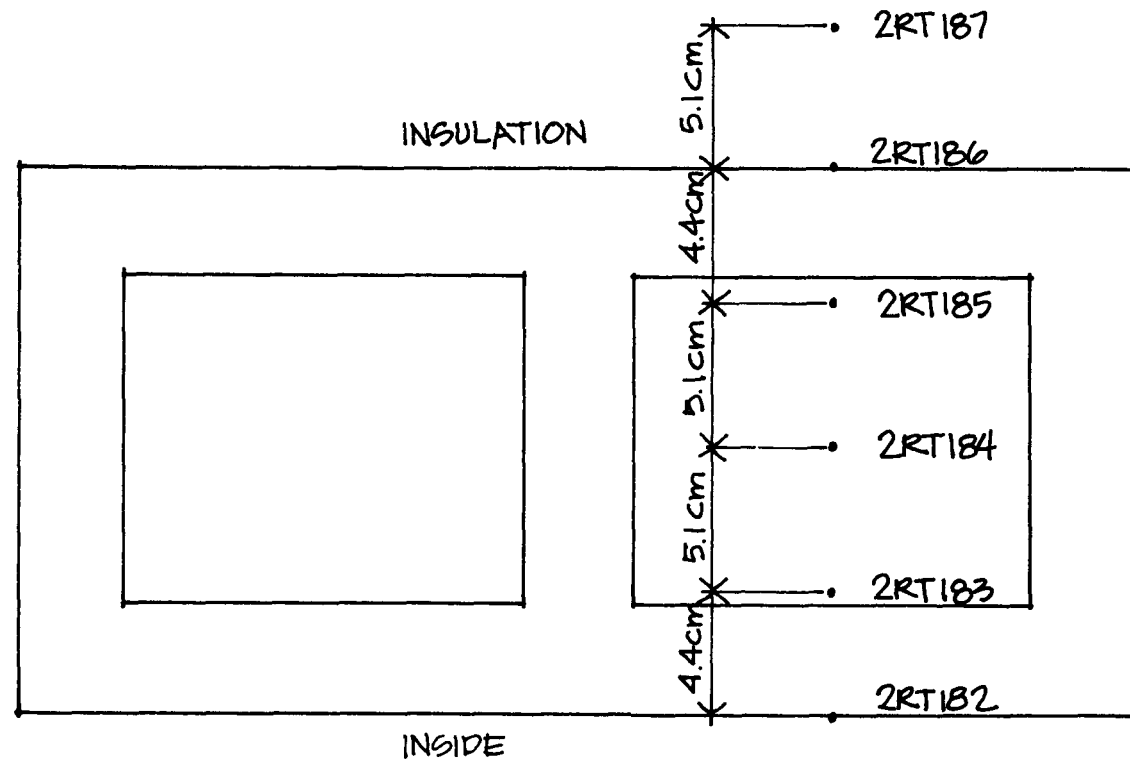


NOT TO SCALE

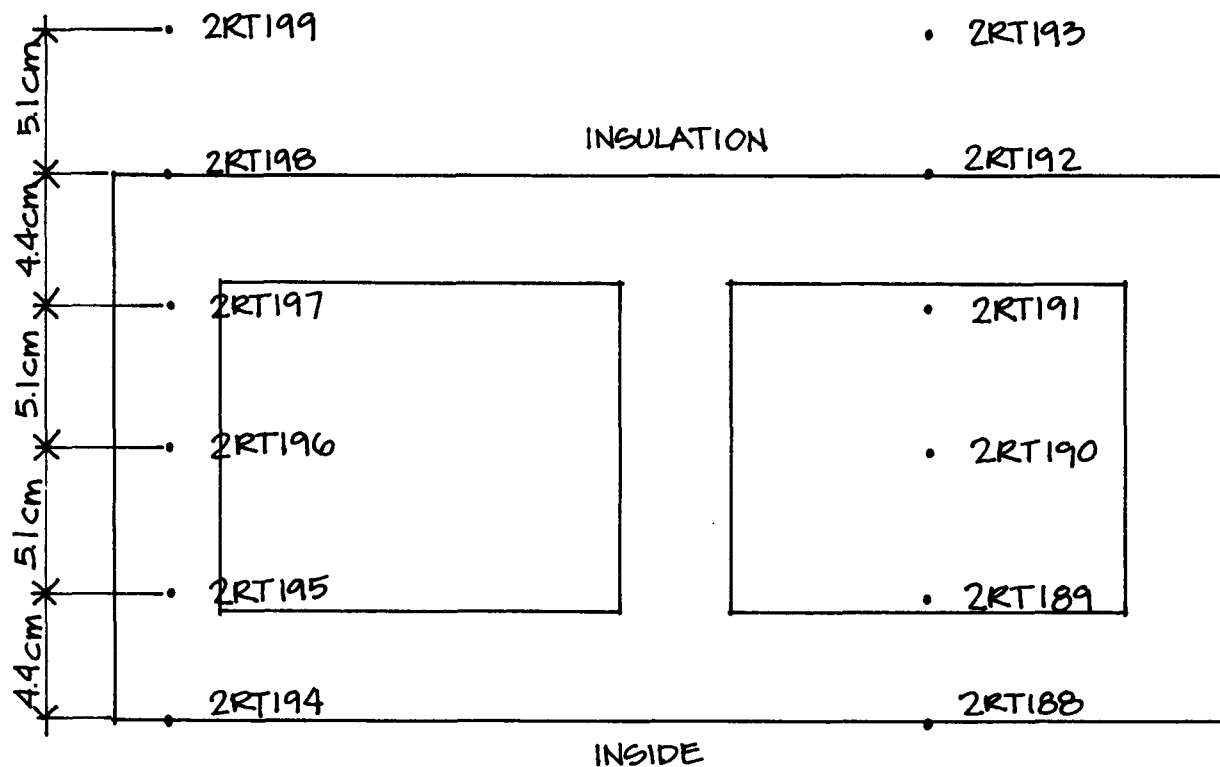
WEST EARTH ARRAY - STRUCTURE 2



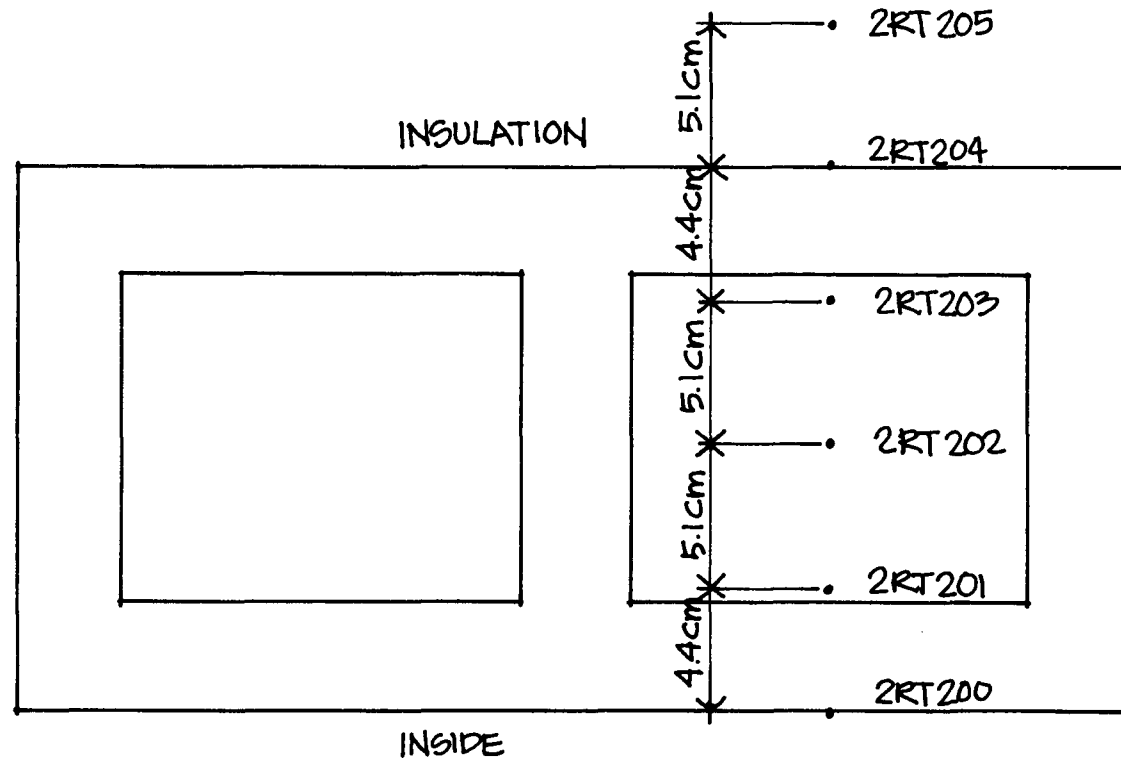
COMFORT SENSOR STATION
STRUCTURE 2 - GROUND LEVEL



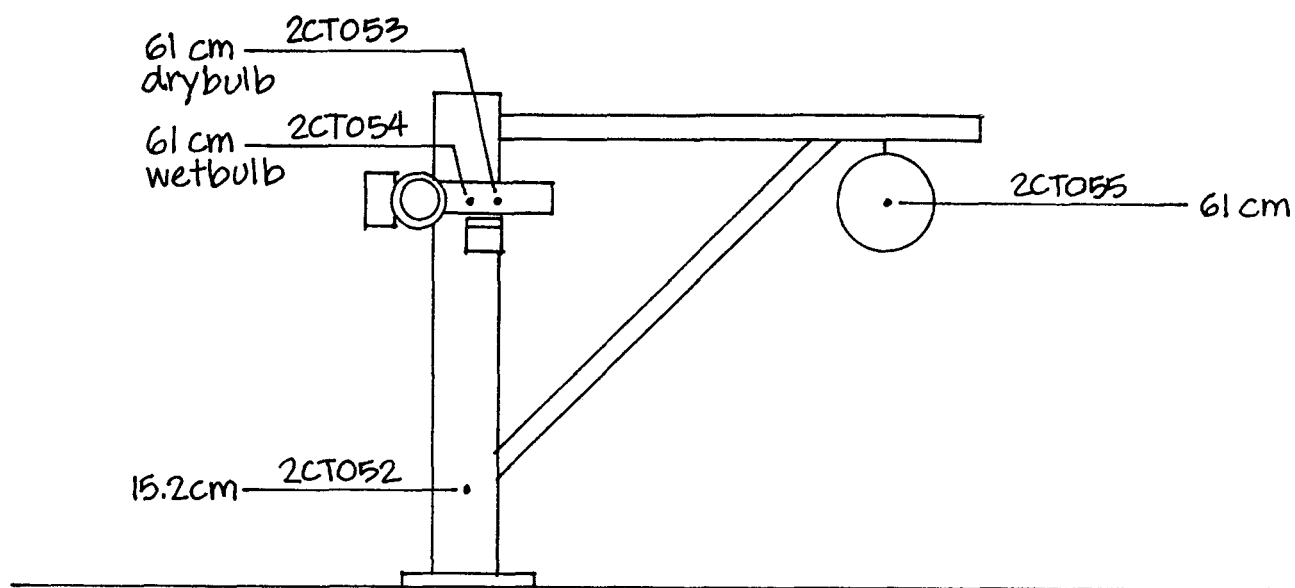
20.3cm(8") BLOCK - GROUND FLOOR
INTERIOR WALL - STRUCTURE 2



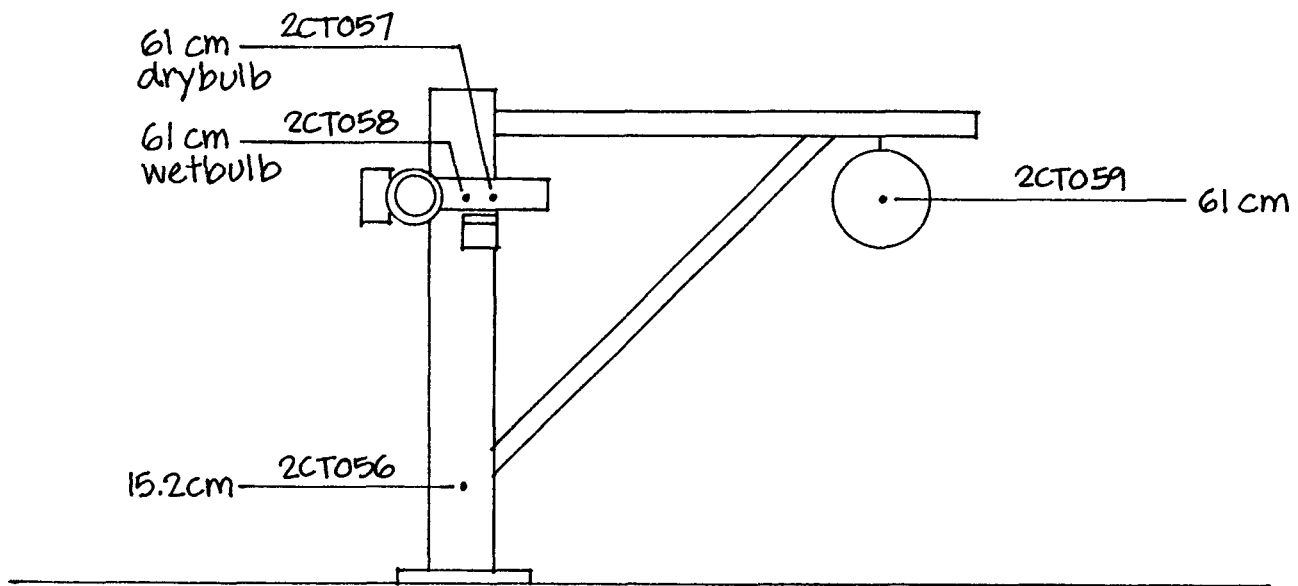
20.3cm (8") BLOCK - GROUND FLOOR
EAST WALL - STRUCTURE 2



20.3cm(8") BLOCK - GROUND FLOOR
EAST WALL - STRUCTURE 2

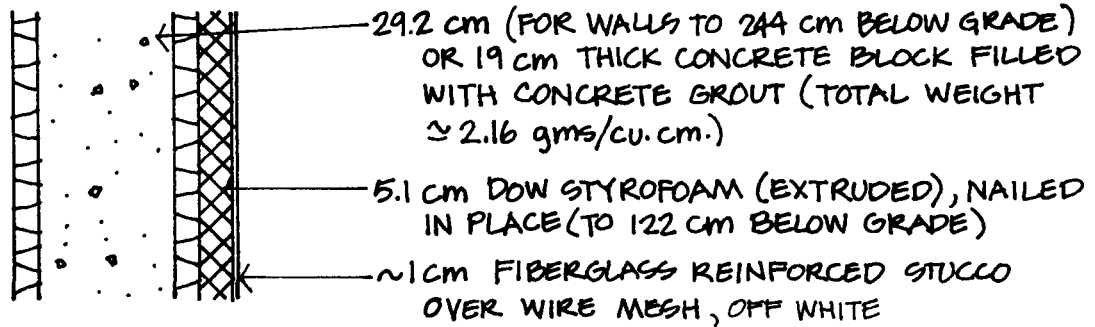


COMFORT SENSOR STATION
STRUCTURE 2- SCREEN PORCH

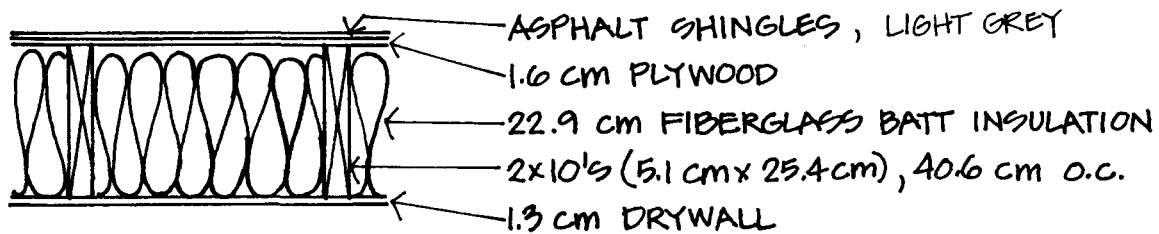


COMFORT SENSOR STATION
STRUCTURE 2 - ROOF DECK

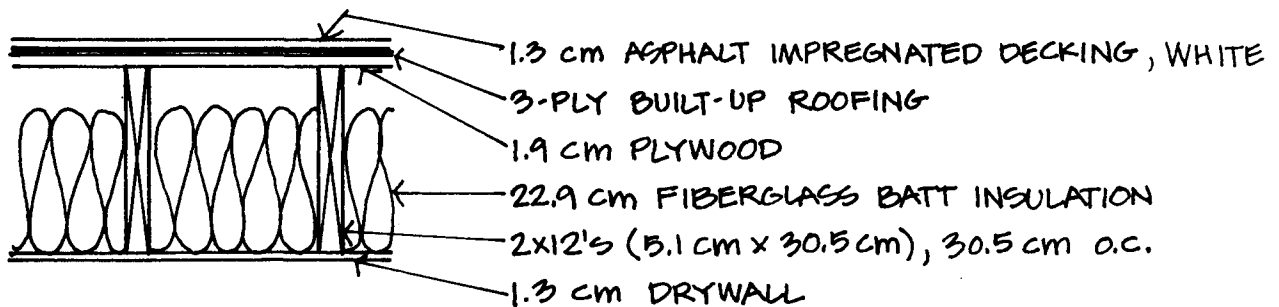
STRUCTURE 2- BUILDING ENVELOPE DETAILS



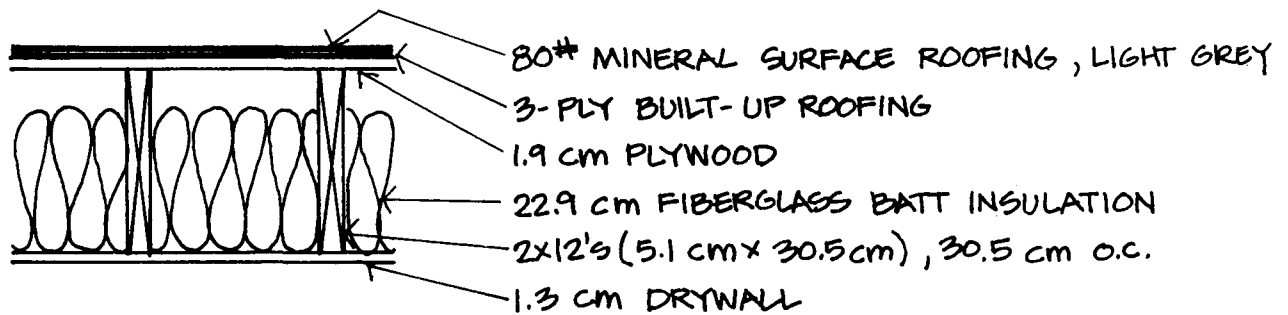
TYPICAL CONCRETE BLOCK WALL



SCREEN PORCH ROOF



ROOF DECK



PORCH FLOOR

NOTE: EXTERIOR DOORS ARE SHEATHED IN METAL AND HAVE APPROXIMATELY
1 5/8" (4.1 cm) URETHANE INSULATION IN CORE.

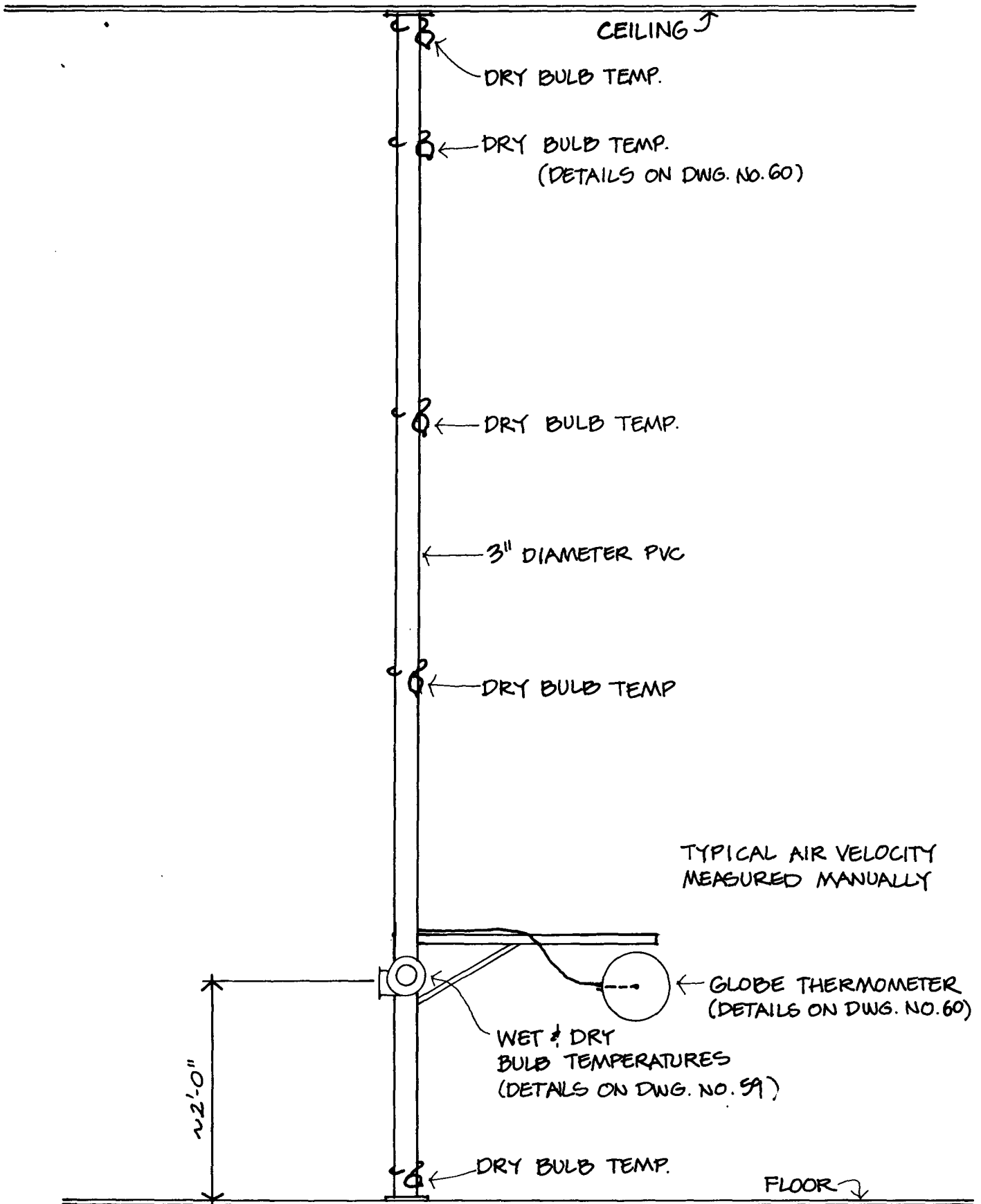
Klos Windows - Structure 2

All Klos windows consist of two single glazed windows with a duo-tone (dark brown top, white bottom) venetian blind between.

window (numbered from West to East)	window type	outside	inside	size	spacing between windows (glass to glass - approximate)
S-1	aluminum horiz. sliding	X0	XX	2'-0"X4'-0"	6 3/4", 5"
S-2	"	X0	XX	"	"
S-3	"	X0	XX	"	"
S-4GL	wood double hung			4'-0"X4'-0"	6", 6"
S-5GL	aluminum horiz. sliding	X0	XX	"	6 3/4", 5"
S-6GL	"	X0	0X	"	"
S-4B	"	X0	XX	2'-0"X4'-0"	10 3/8", 8 13/16"
S-5B	"	X0	XX	"	"
S-6B	"	X0	XX	"	"
N-1	"	X0	XX	2'-0"X4'-0"	6 3/4", 5"
N-2	"	X0	XX	3'-0"X4'-0"	"
N-3	"	X0	XX	"	"

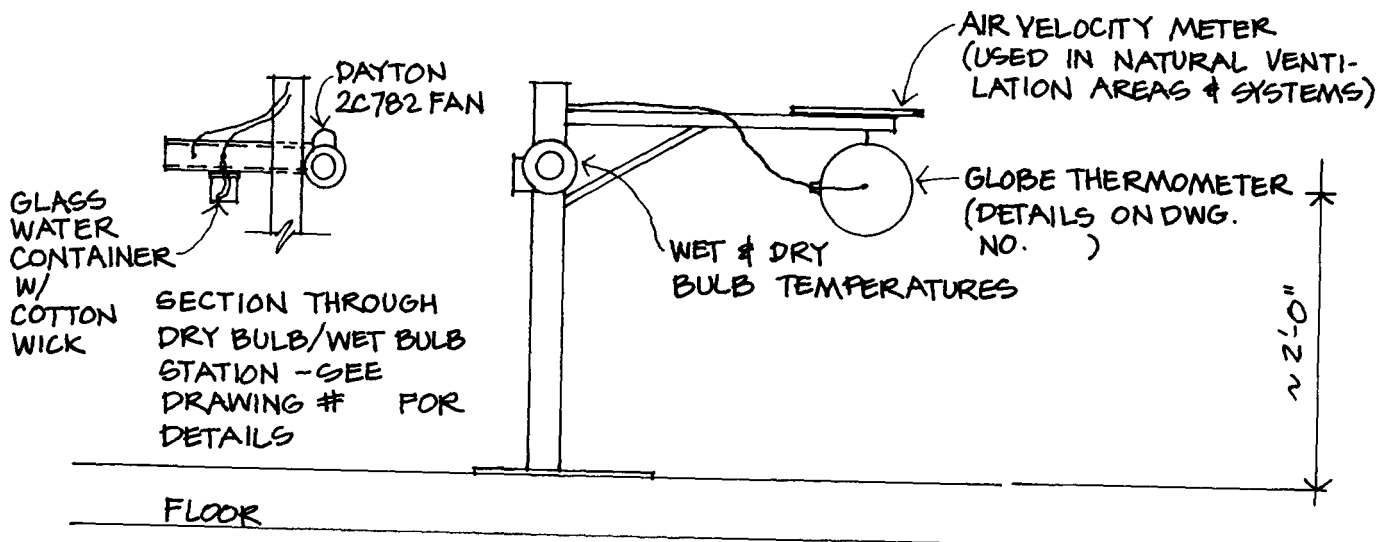
Sealed Window Configuration for Earth Contact Modeling

All windows except N-2 are sealed with 2" expanded polystyrene (white beadboard), painted the same color as the building exterior. N-2 has been replaced with a plywood plug and air conditioner.

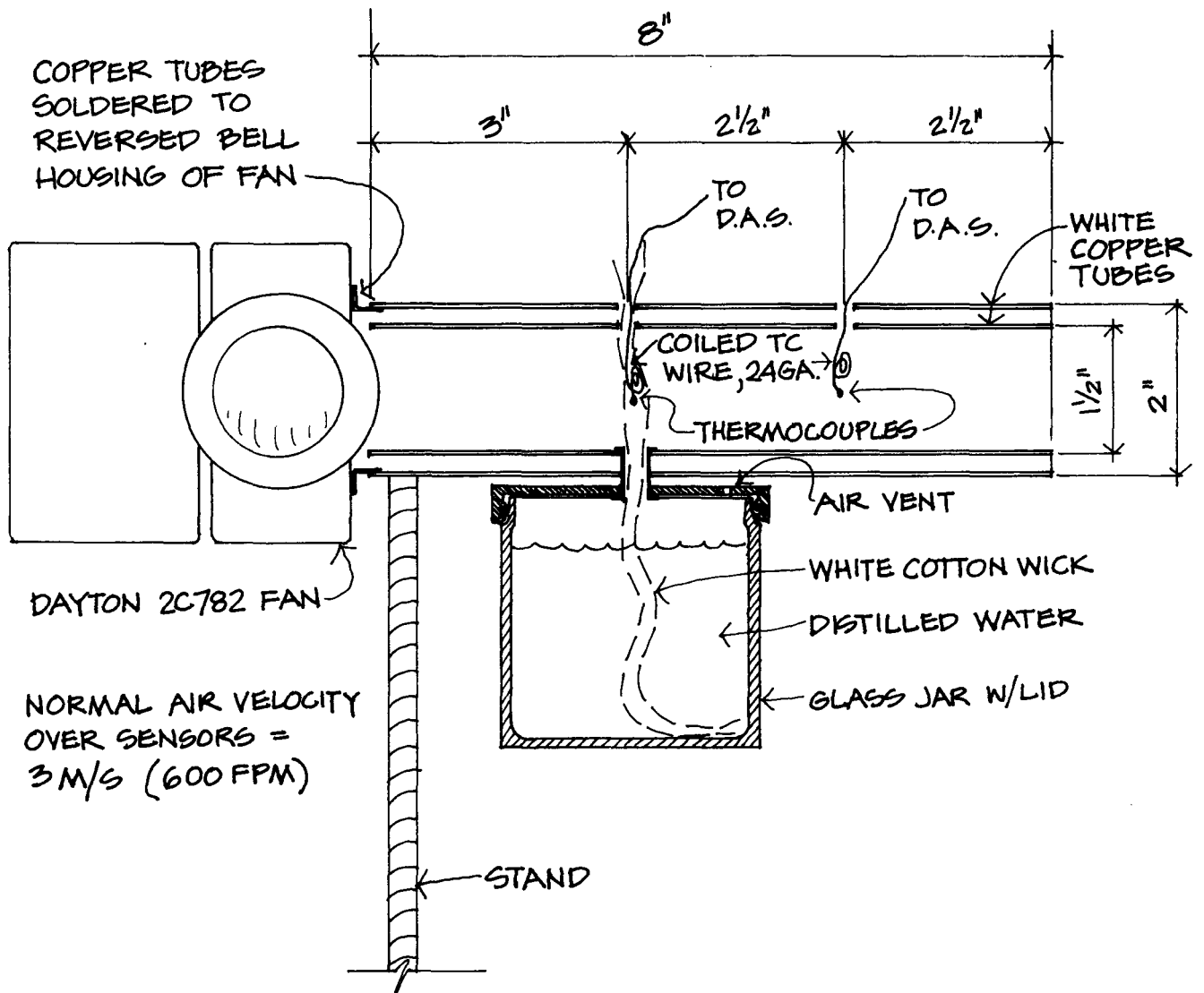


COMFORT SENSING STATIONS

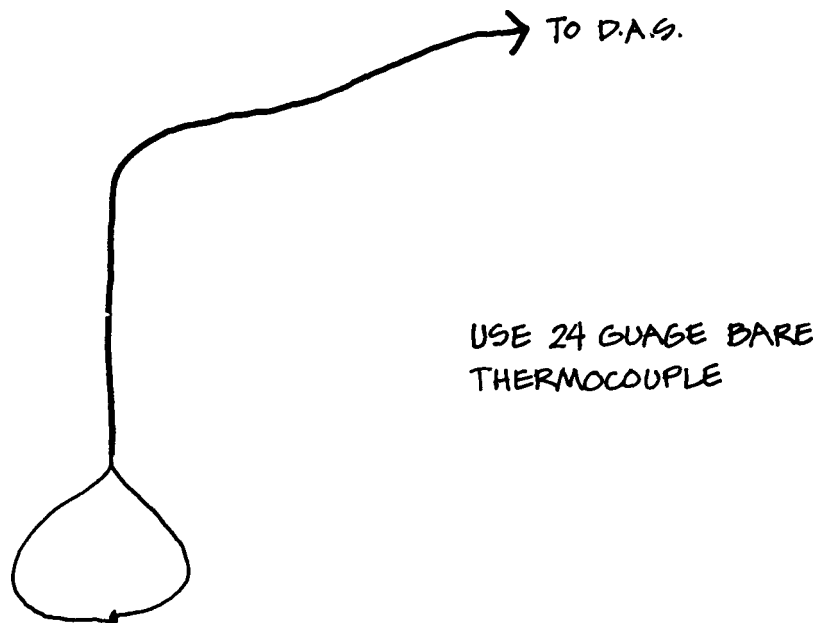
Drawing no. 43



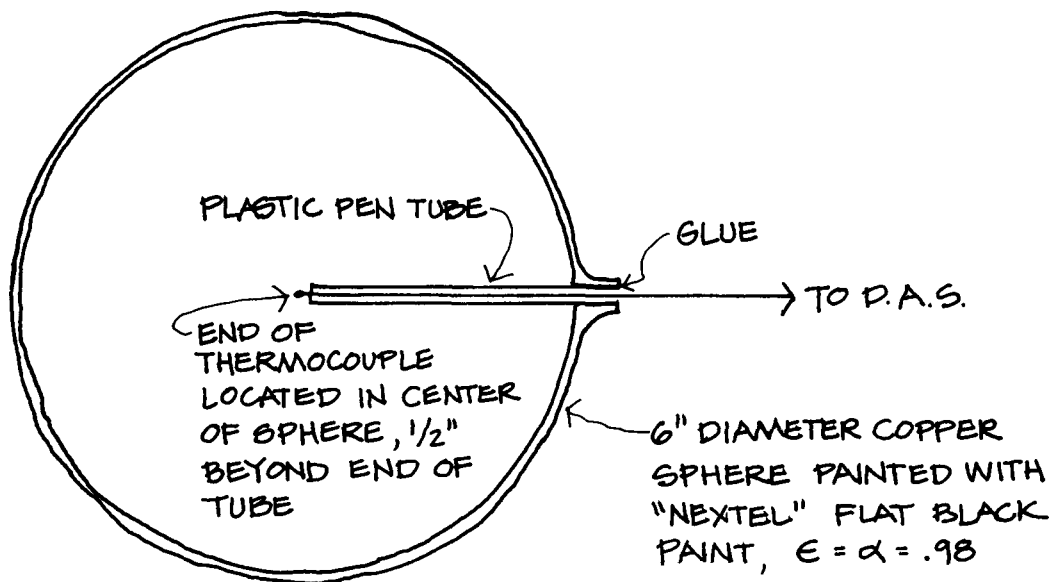
SINGLE POINT COMFORT SENSING STATION



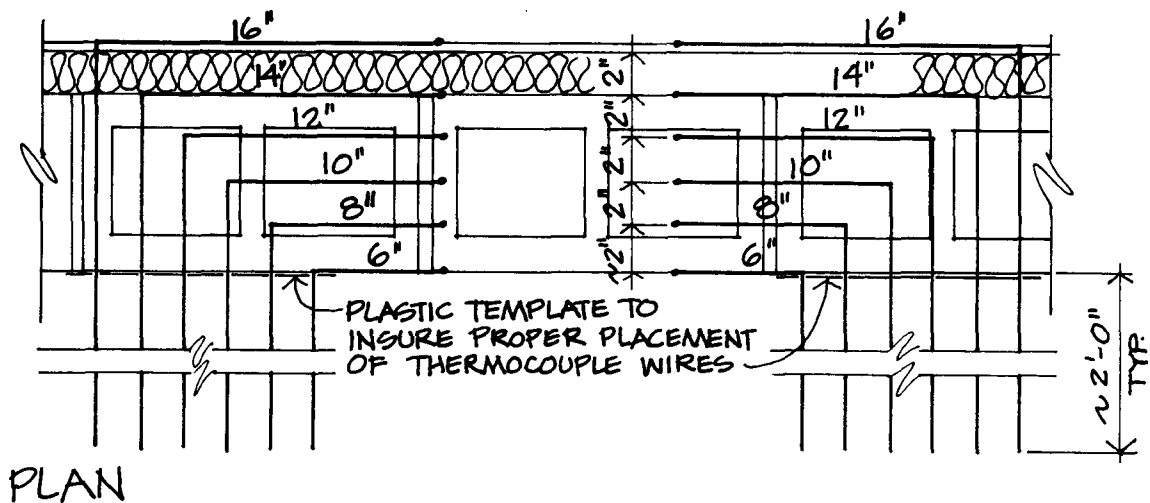
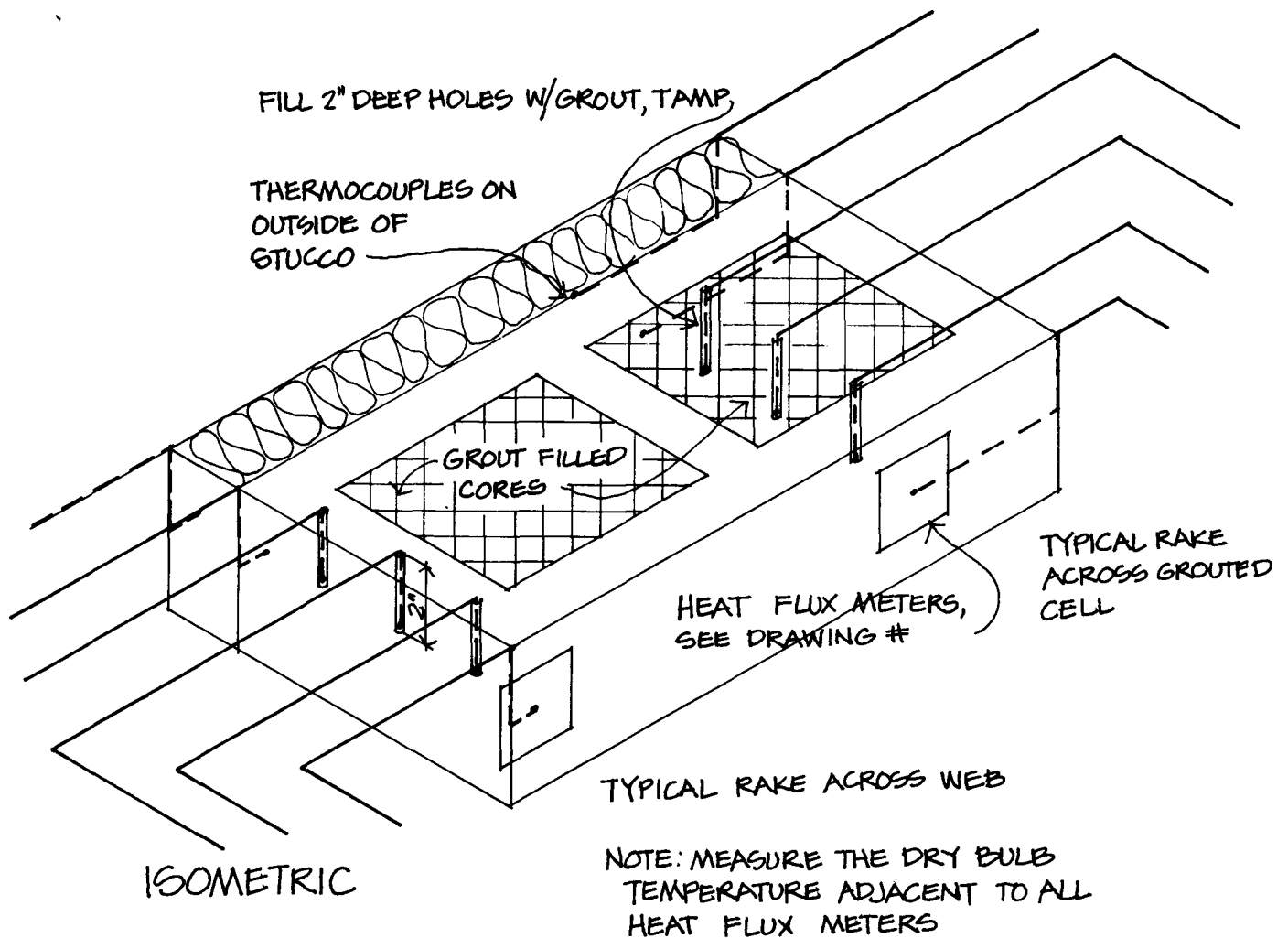
SINGLE POINT WET & DRY BULB TEMPERATURE STATION



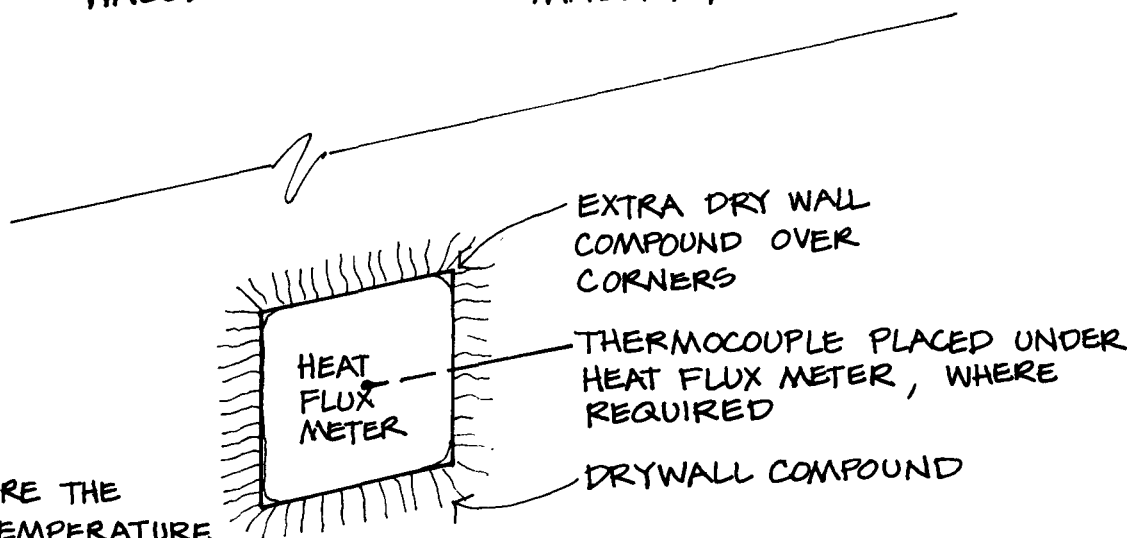
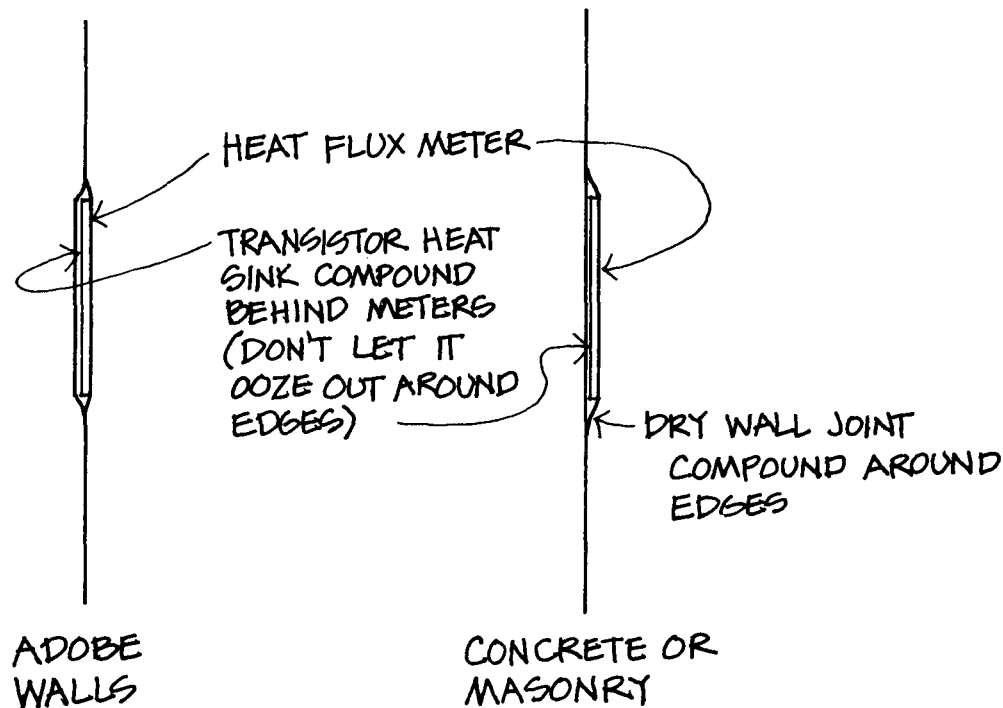
DRY BULB TEMPERATURE STATION, NATURALLY ASPIRATED — USE ON FLOOR TO CEILING COMFORT STATIONS, AND ADJACENT TO ALL HEAT FLUX MTRS.



GLOBE THERMOMETER



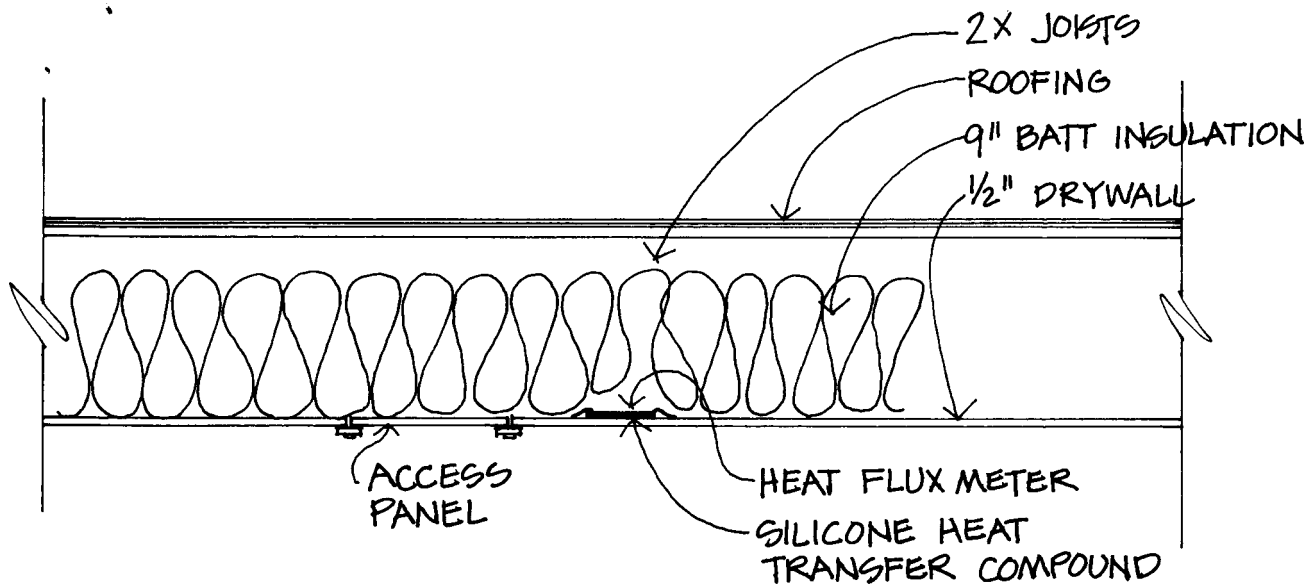
THERMOCOUPLE RAKE IN EXTERIOR
CONCRETE BLOCK WALL W/ OUTSIDE
INSULATION



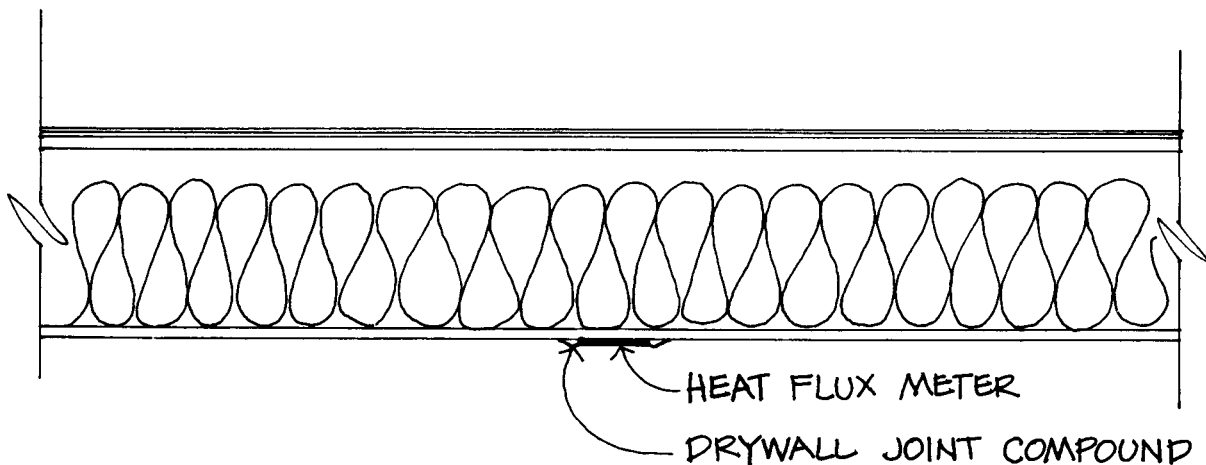
NOTE: MEASURE THE DRY BULB TEMPERATURE ADJACENT TO ALL HEAT FLUX METERS

PAINT HEAT FLUX METER SAME COLOR AS WALL OR FLOOR

WALL & FLOOR HEAT FLUX METER INSTALLATION



ALTERNATE #1

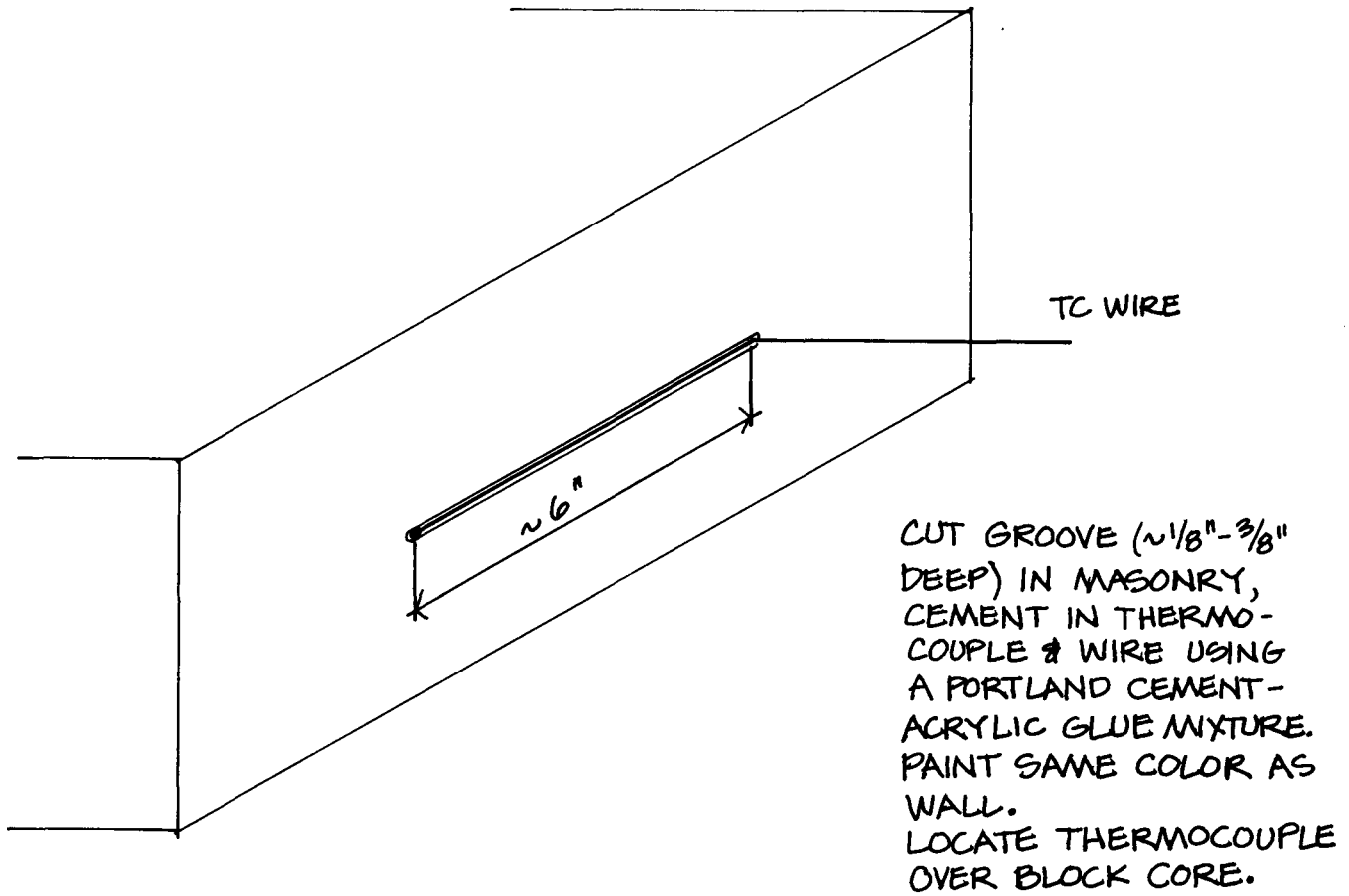


ALTERNATE #2

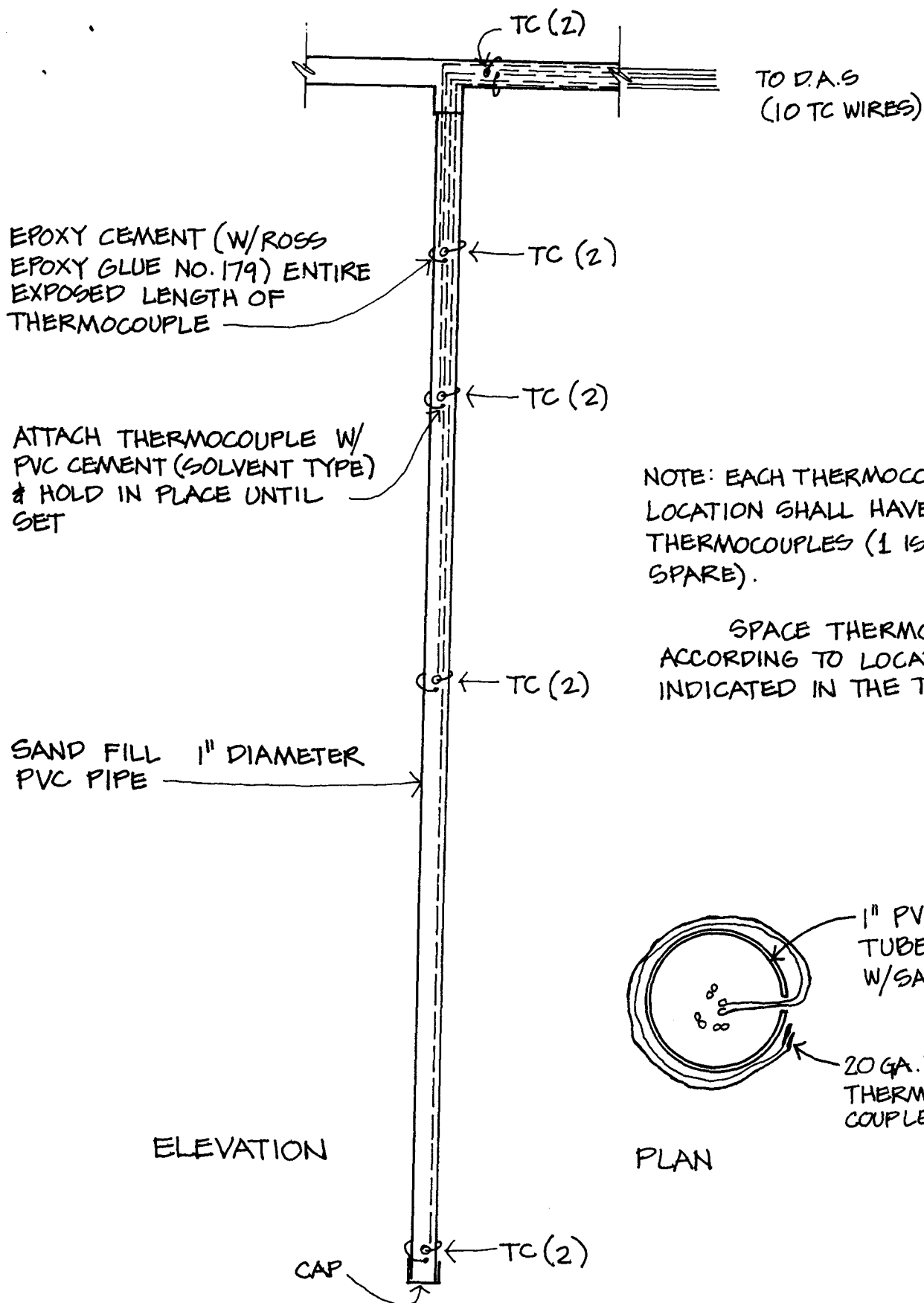
NOTES: APPLY SILICONE HEAT TRANSFER COMPOUND TO CEILING & TO METER. THEN PRESS TOGETHER AND SQUEEZE OUT EXCESS. SMOOTH JOINT BETWEEN METER & CEILING. APPLY DRYWALL COMPOUND AROUND EDGES OF METER.

TO REMOVE METER, GENTLY PRY OFF WITH DULL EDGED TOOL. IF DIFFICULT TO REMOVE, SAW OUT DRYWALL & PATCH HOLE.

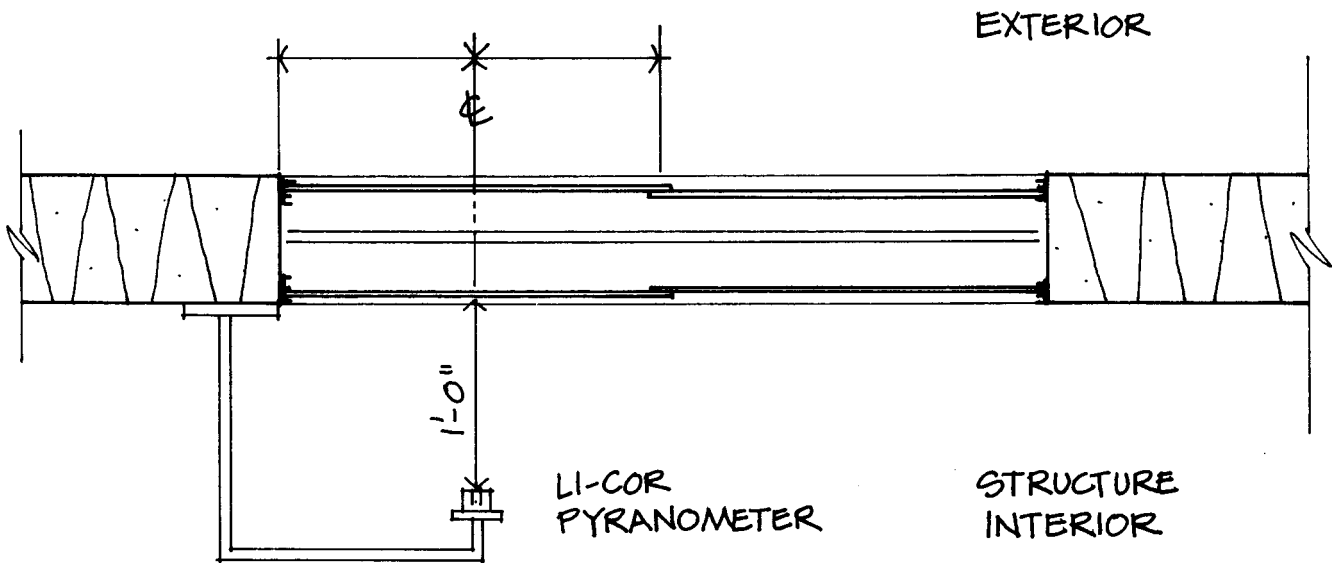
CEILING HEAT FLUX METER INSTALLATION



SURFACE TEMPERATURE THERMOCOUPLE INSTALLATION



EARTH TEMPERATURE SENSOR ARRAY (SIMILAR TO THOSE USED AT TRINITY UNIVERSITY)



PLAN VIEW

NOTE: LOCATE PYRANOMETER ONE FOOT FROM GLASS AND
AT THE MID-POINT OF A SINGLE PANE OF GLASS

LI-COR PYRANOMETER INSTALLATION

SENSOR LOCATIONS AND INSTALLATION

Structure Three

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KEY TO SYMBOLS

- + Earth Temperature Array Thermocouple
- Surface Temperature Thermocouple or Thermocouples in Rakes
- Heat Flux Meter
- || Naturally Aspirated Air Temperature Thermocouple
- Comfort Sensor Station
- △ Wall Temperature Rake
- ⊙ Pyranometer
- × Water Temperature
- ◊ □ Mechanically Aspirated Wet Bulb/Dry Bulb

SENSOR READ OUT ABBREVIATIONS

- AT Earth Temperature Array Thermocouple
- BT Rockbed Thermocouple
- CT Comfort Sensor Station Thermocouple
- DT Dry Bulb Thermocouple
- ET Rock Embedded Thermocouple
- LT Liquid Wall Thermocouple
- NT Naturally Aspirated Air Temperature Thermocouple
- RT Wall Temperature Rake Thermocouple
- ST Surface Temperature Thermocouple
- TT Test Terminal Thermocouple
- WT Wet Bulb Thermocouple
- AZ Wind Direction
- HF Heat Flux Meter
- PG Pyrgeometer
- PM Pyranometer
- TM Test Terminal Millivolt
- VA Continuous Air Velocity Meter
- WS Wind Speed

SENSOR NAMES AND LOCATIONS — STRUCTURE THREE

READ OUT NO.	LOCATION	FIGURE NO.
3BT001	AIR THERMOCOUPLES IN ROCKBED	5 & 6
3BT002		
3BT003		
3BT004		
3BT005		
3BT006		
3BT007		
3ET001	ATTACHED TO ROCK	6
3ET002	EMBEDDED IN ROCK	
3BT008	AIR THERMOCOUPLES IN ROCKBED	5
3BT009		
3BT010		
3BT011		
3BT012	THERMOCOUPLES ABOVE EARTH TEMP ARRAY	5 & 7
3BT013		
3ST065	SURFACE TEMP BELOW PLYWOOD	6
3ST066	SURFACE TEMP ABOVE PLYWOOD	
3BT014	THERMOCOUPLE ABOVE EARTH TEMP ARRAY	7
3BT015	AIR THERMOCOUPLE IN ROCKBED	6
3ST067	FLOOR SURFACE TEMP ABOVE EARTH TEMP ARRAY	1
3NT012	AIR TEMP AT FLOOR ABOVE EARTH TEMP ARRAY	
3CT060	COMFORT SENSING STATION-SOUTH ROOM	1 & 13
3CT061		
3CT062		
3CT063		
3CT064		
3CT065		
3CT066		
3CT067		
3ST068	SURFACE TEMP-CEILING AT SOUTH COMFORT STATION	2
3CT068		
3CT069	COMFORT SENSING STATION-NORTH ROOM	1 & 14
3CT070		
3CT071		
3CT072		
3CT073		
3CT074		
3CT075		
3ST069	SURFACE TEMP-CEILING AT NORTH COMFORT STATION	2
3AT107	EARTH TEMP ARRAY-BELOW ROCKBED	5 & 7
3AT108		
3AT109		
3AT110		
3AT111		
3AT112		
3RT006	WEST WALL-4.5 FT HEIGHT FRAME WALL CORE-TEMP RAKE	10 & 15
3RT007		
3RT008		
3RT009		
3RT010		
3RT011		

READ OUT NO.	LOCATION	FIGURE NO.
3RT012		
3RT013		
3RT014	WEST WALL-4.5 FT HEIGHT	10 & 15
3RT015	FRAME WALL WEB-TEMP RAKE	
3RT016		
3RT017		
3NT013	AIR TEMP-WEST WALL-4.5 FT HEIGHT	10
3ST070	SOUTH WALL SURFACE TEMP-EAST SIDE-4.5 FT	8
3ST071	PORCH WALL SURFACE TEMP-4.5 FT	
3ST072	SOUTH WALL SURFACE TEMP-WEST SIDE-4.5 FT	8
3ST073	CLEARVIEW WALL SURFACE TEMP-4.5 FT	
3NT014	CLEARVIEW AIR TEMP-8.5 FT	8
3ST074	EAST WALL SURFACE TEMP-INSIDE-4.5 FT	11
3ST075	EAST WALL SURFACE TEMP-OUTSIDE-4.5 FT	
3ST076	NORTH WALL SURFACE TEMP-INSIDE-4.5 FT	9
3ST077	NORTH WALL SURFACE TEMP-OUTSIDE-4.5 FT	
3LT001	WATER WALL WATER TEMP-EAST BOTTOM	
3LT002	WATER WALL WATER TEMP-EAST TOP	
3LT003	WATER WALL WATER TEMP-CENTER BOTTOM	12
3LT004	WATER WALL WATER TEMP-CENTER TOP	
3LT005	WATER WALL WATER TEMP-WEST BOTTOM	
3LT006	WATER WALL WATER TEMP-WEST TOP	
3NT015	AIR TEMP AT CENTER WATER WALL-4.5 FT	12
3DT009	SPARE	
3WT009	SPARE	
3DT010	SPARE	
3WT010	SPARE	
3DT011	DRY BULB-ROCKBED NORTH ENTRY/EXIT	9
3WT011	WET BULB-ROCKBED NORTH ENTRY/EXIT	
3DT012	DRY BULB-ROCKBED SOUTH ENTRY/EXIT	10
3WT012	WET BULB-ROCKBED SOUTH ENTRY/EXIT	
3ST086	ATTIC AIR TEMP INTAKE	3
3ST087	ATTIC AIR TEMP OUTPUT	
3ST088	METAL ROOF SURFACE TEMP-EAST	
3ST089	METAL ROOF SURFACE TEMP-CENTER	4
3ST090	METAL ROOF SURFACE TEMP-WEST	
3ST091	ATTIC FLOOR TEMP-EAST	
3ST092	ATTIC FLOOR TEMP-CENTER	3
3ST093	ATTIC FLOOR TEMP-WEST	
3ST094	ATTIC ABSORBER PANEL-EAST	
3ST095	ATTIC ABSORBER PANEL-CENTER	4
3ST096	ATTIC ABSORBER PANEL-WEST	
3ST097	SURFACE TEMP IN ATTIC ABOVE COMFORT STATION-SOUTH	3
3ST098	ATTIC SPARE-SOUTH	
3ST099	SURFACE TEMP IN ATTIC ABOVE COMFORT STATION-NORTH	3
3ST100	ATTIC SPARE-NORTH	
3LT007	WATER WALL WATER TEMP-SOUTH BOTTOM	
3LT008	WATER WALL WATER TEMP-SOUTH TOP	
3LT009	WATER WALL WATER TEMP-NORTHEAST BOTTOM	12
3LT010	WATER WALL WATER TEMP-NORTHEAST TOP	
3LT011	WATER WALL WATER TEMP-NORTHWEST BOTTOM	
3LT012	WATER WALL WATER TEMP-NORTHWEST TOP	

READ OUT NO.	LOCATION	FIGURE NO.
3NT016	AIR TEMP AT EAST WATER WALL-4 FT	12
3NT017	AIR TEMP AT WEST WATER WALL-4 FT	
3ST104	CLEARVIEW EXHAUST AIR TEMP	2
3ST101	CLEARVIEW ABSORBER SURFACE TEMP-EAST-4 FT	
3ST102	CLEARVIEW ABSORBER SURFACE TEMP-CENTER-4 FT	1
3ST103	CLEARVIEW ABSORBER SURFACE TEMP-WEST-4 FT	
3DT013	MAIN COOLER OUTPUT-WET BULB (THIS IS CORRECT)	8
3WT013	MAIN COOLER OUTPUT-DRY BULB (THIS IS CORRECT)	
3HF021	HEAT FLUX-FLOOR-ABOVE EARTH TEMP ARRAY	1 & 7
3HF022	HEAT FLUX-CEILING-ABOVE SOUTH COMFORT STATION	2
3HF023	HEAT FLUX-WEST WALL-CORE-4.5 FT	10
3HF024	HEAT FLUX-WEST WALL-WEB-4.5 FT	
3HF025	HEAT FLUX-SOUTH WALL-4.5 FT	8
3HF026	HEAT FLUX-WATER WALL-EAST	NOT
3HF027	HEAT FLUX-WATER WALL-CENTER	INSTALLED
3HF028	HEAT FLUX-WATER WALL-WEST	
3PM018	LI-COR PYRANOMETER-NORTH WINDOW	9
3PM019	LI-COR PYRANOMETER-SOUTH WINDOW	8
3PM020	LI-COR PYRANOMETER-CLEARVIEW INSIDE EXTERIOR GLASS	8
3PM021	LI-COR PYRANOMETER-CLEARVIEW EXTERIOR OR ROOF	
3TM005	TEST MILLIVOLT	
3TT005	TEST THERMOCOUPLE	

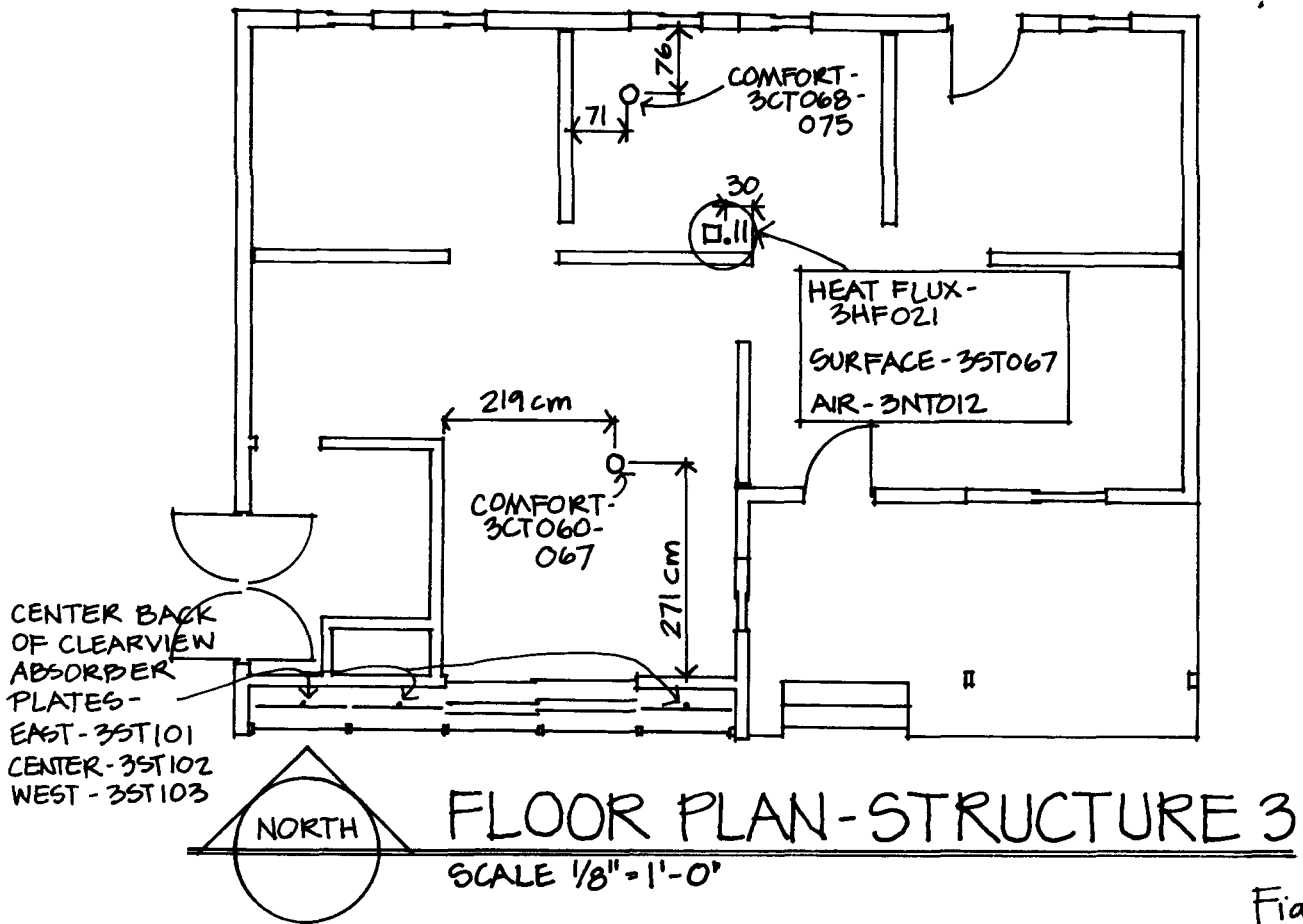


Fig. 1

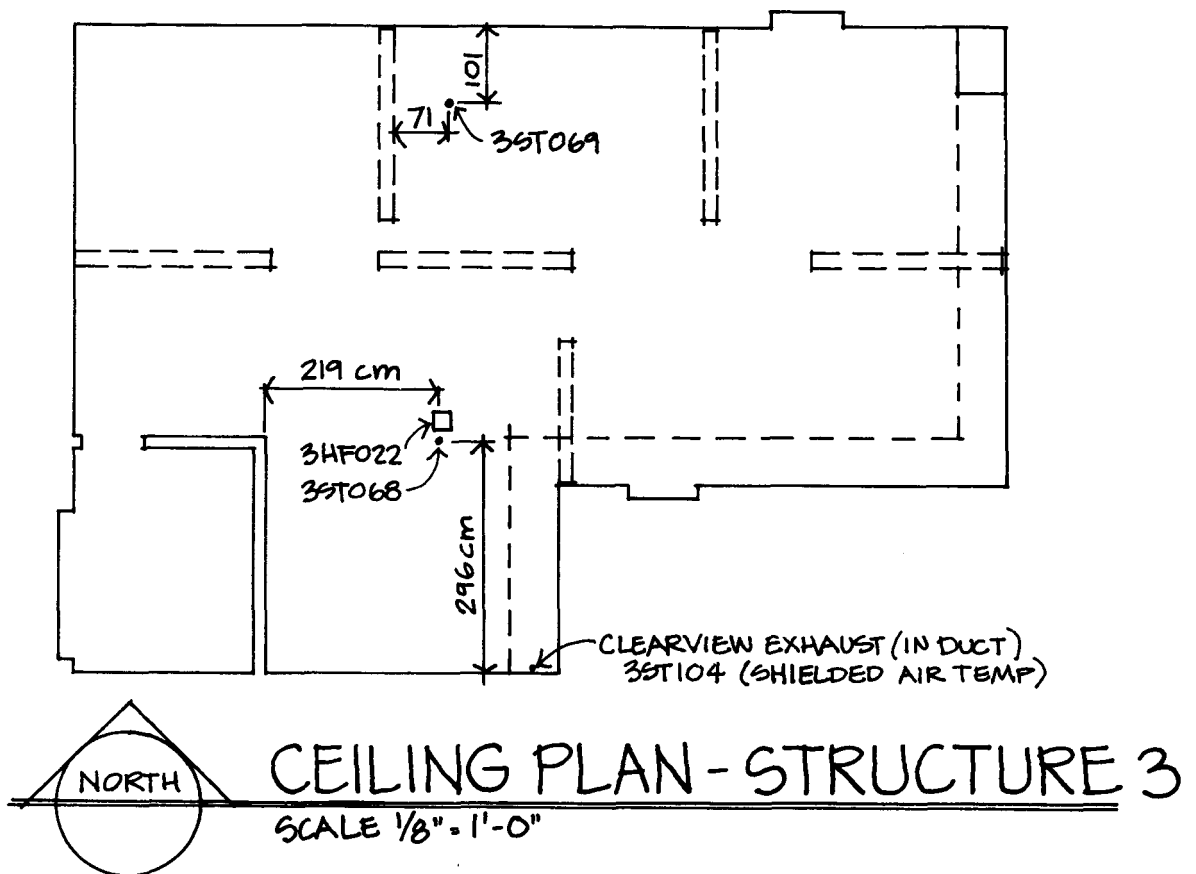
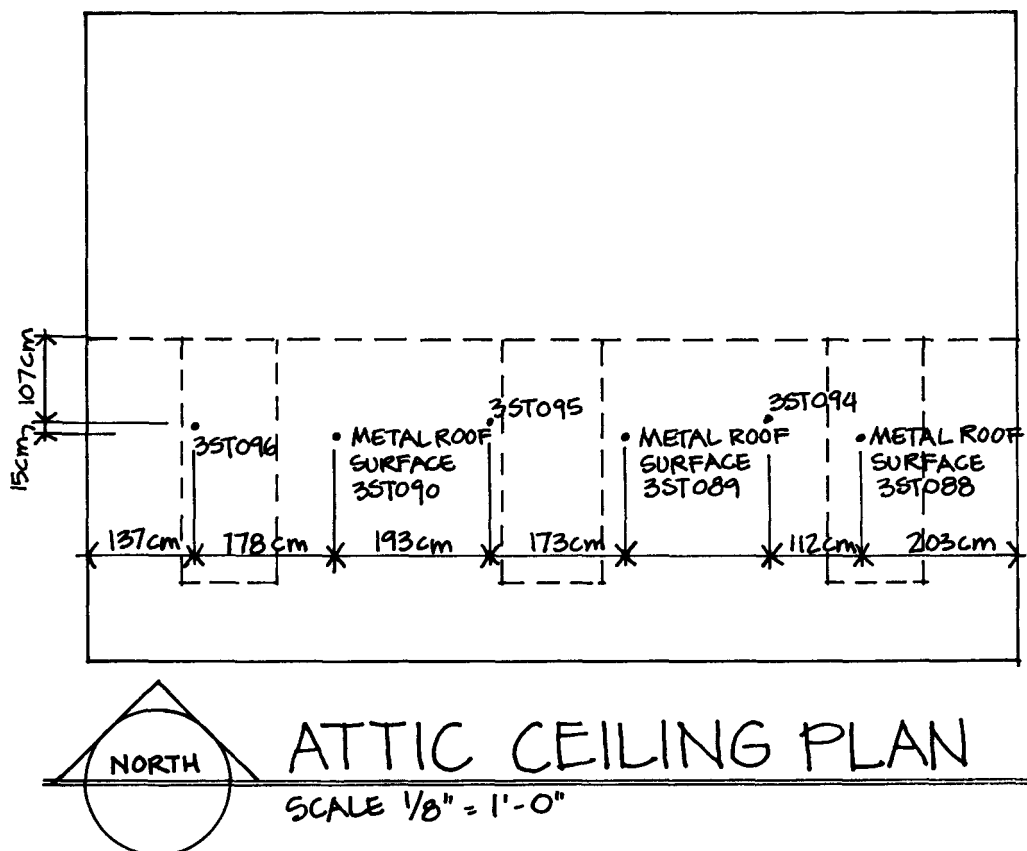
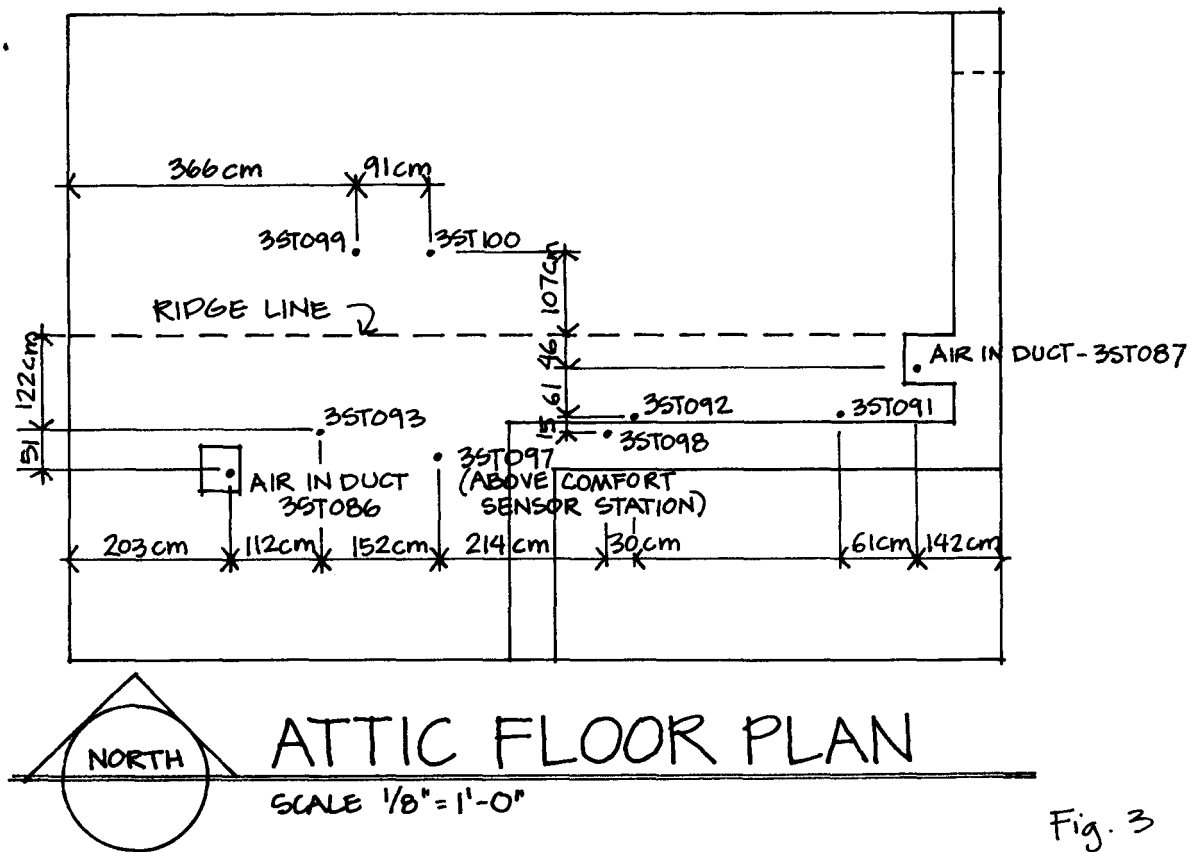
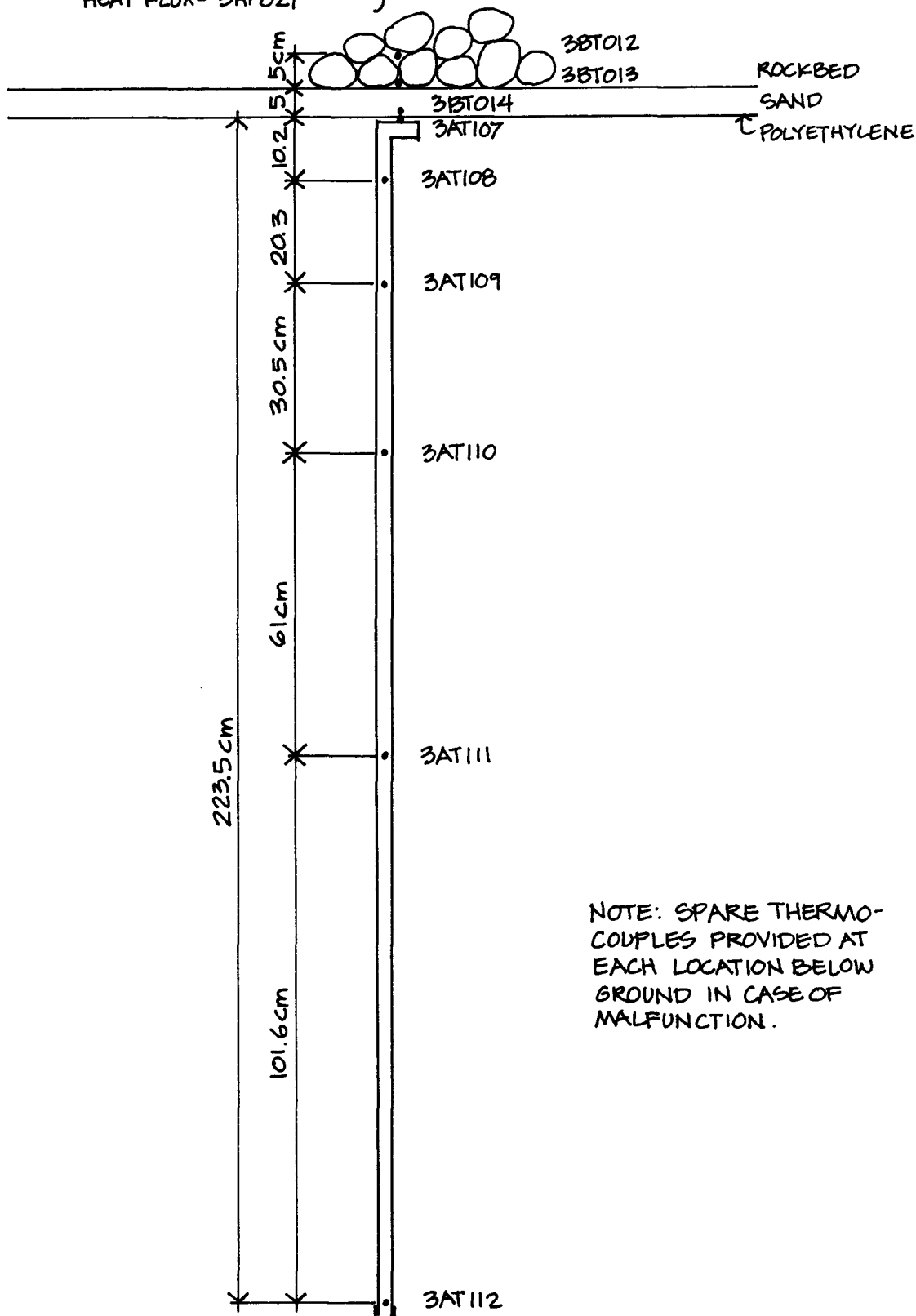


Fig. 2



AIR TEMP - 3NT012
 SURFACE TEMP - 3ST067
 HEAT FLUX - 3HF021

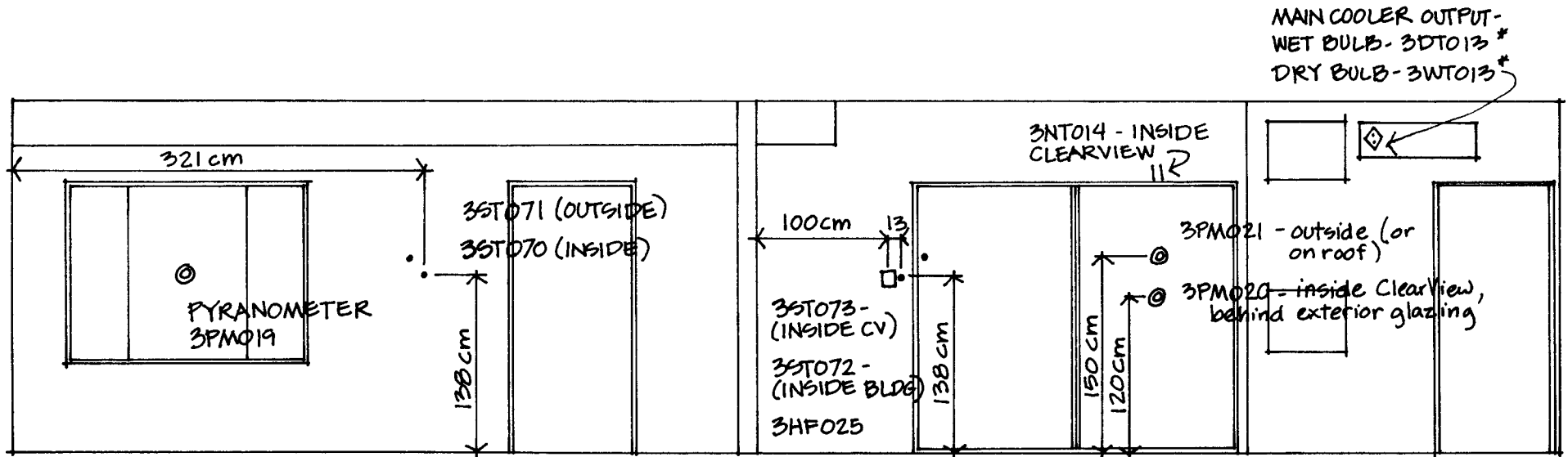
AT FLOOR LEVEL ABOVE EARTH ARRAY



EARTH TEMP ARRAY
 STRUCTURE THREE

Fig. 8

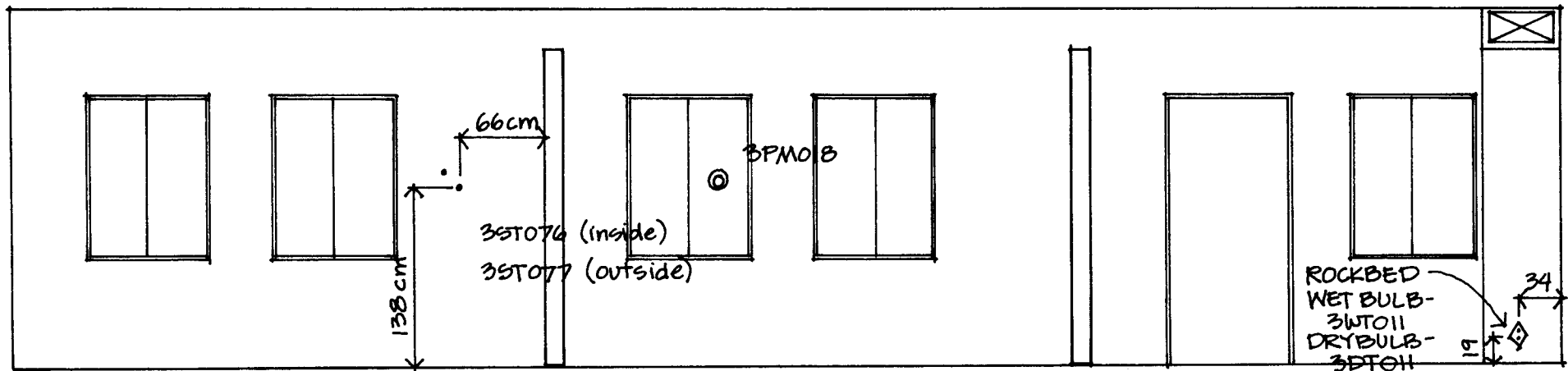
136



SOUTH WALL INTERIOR ELEVATION - STRUCTURE THREE

SCALE 1/4" = 1'-0"

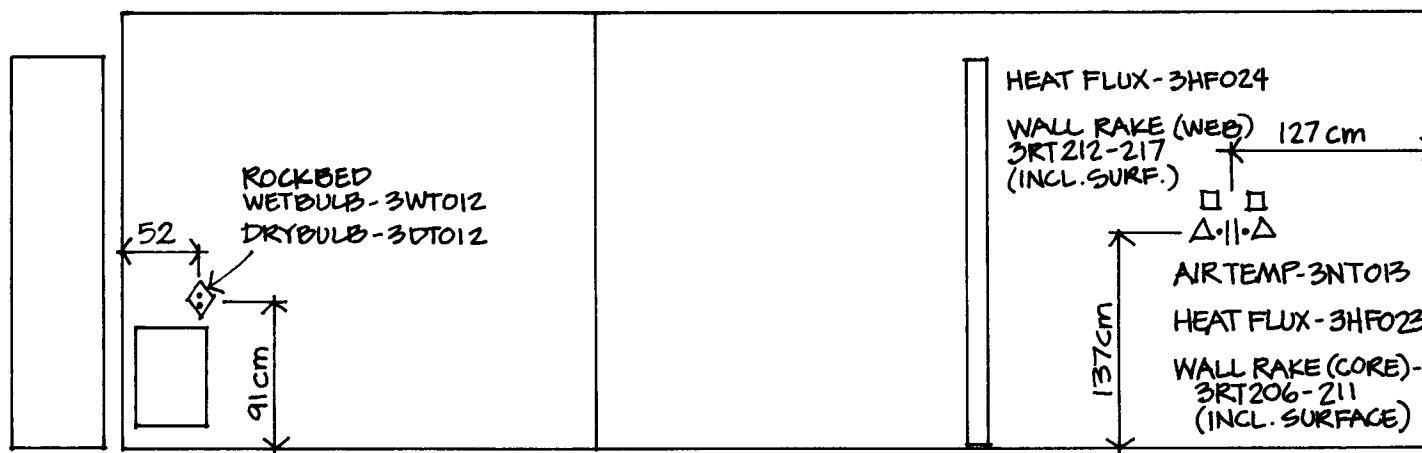
Fig. 9



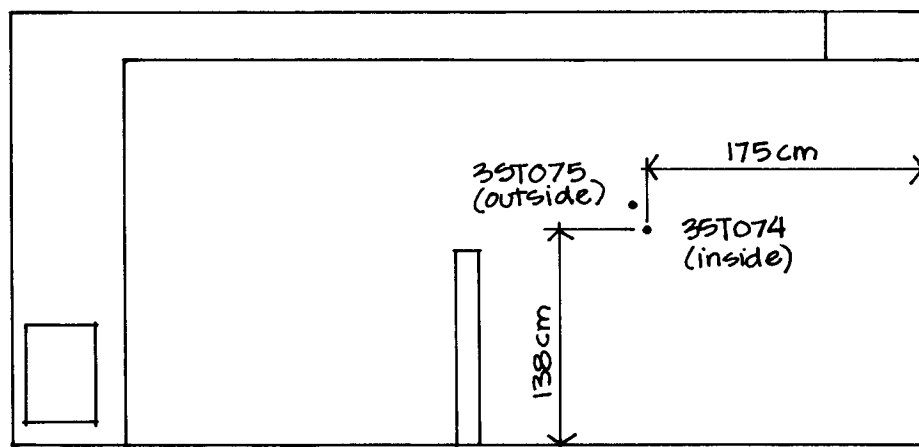
NORTH WALL INTERIOR ELEVATION - STRUCTURE THREE

SCALE 1/4" = 1'-0"

* LABELED BACKWARDS IN D.A.S.



WEST INTERIOR WALL ELEVATION - STRUCTURE 3
SCALE 1/4" = 1'-0"



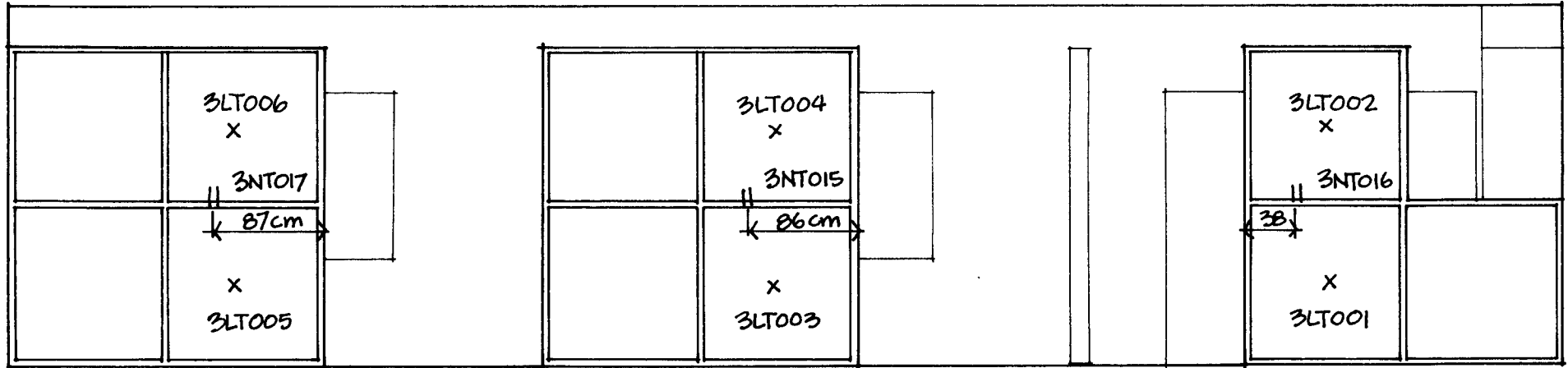
EAST INTERIOR WALL ELEVATION
SCALE 1/4" = 1'-0"

Fig. 10

137

Fig. 11

X-WATER WALL THERMOCOUPLES LOCATED IN WATER
AT APPROXIMATE CENTER OF TANK



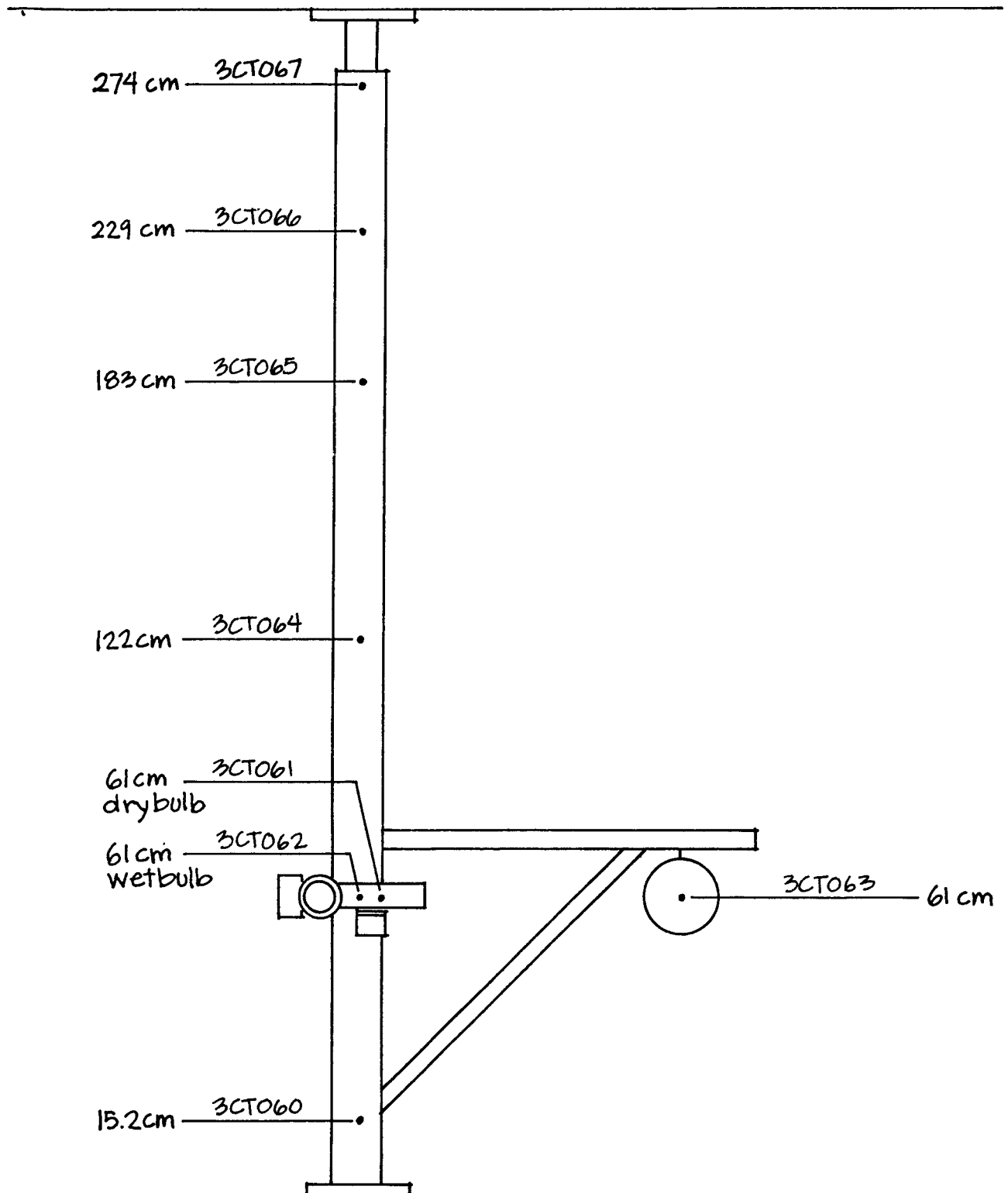
CENTER WATER WALL ELEVATION - STRUCTURE THREE

NOTE: WATERWALL THERMOCOUPLES LOCATED IN EACH BANK
OF TANKS:

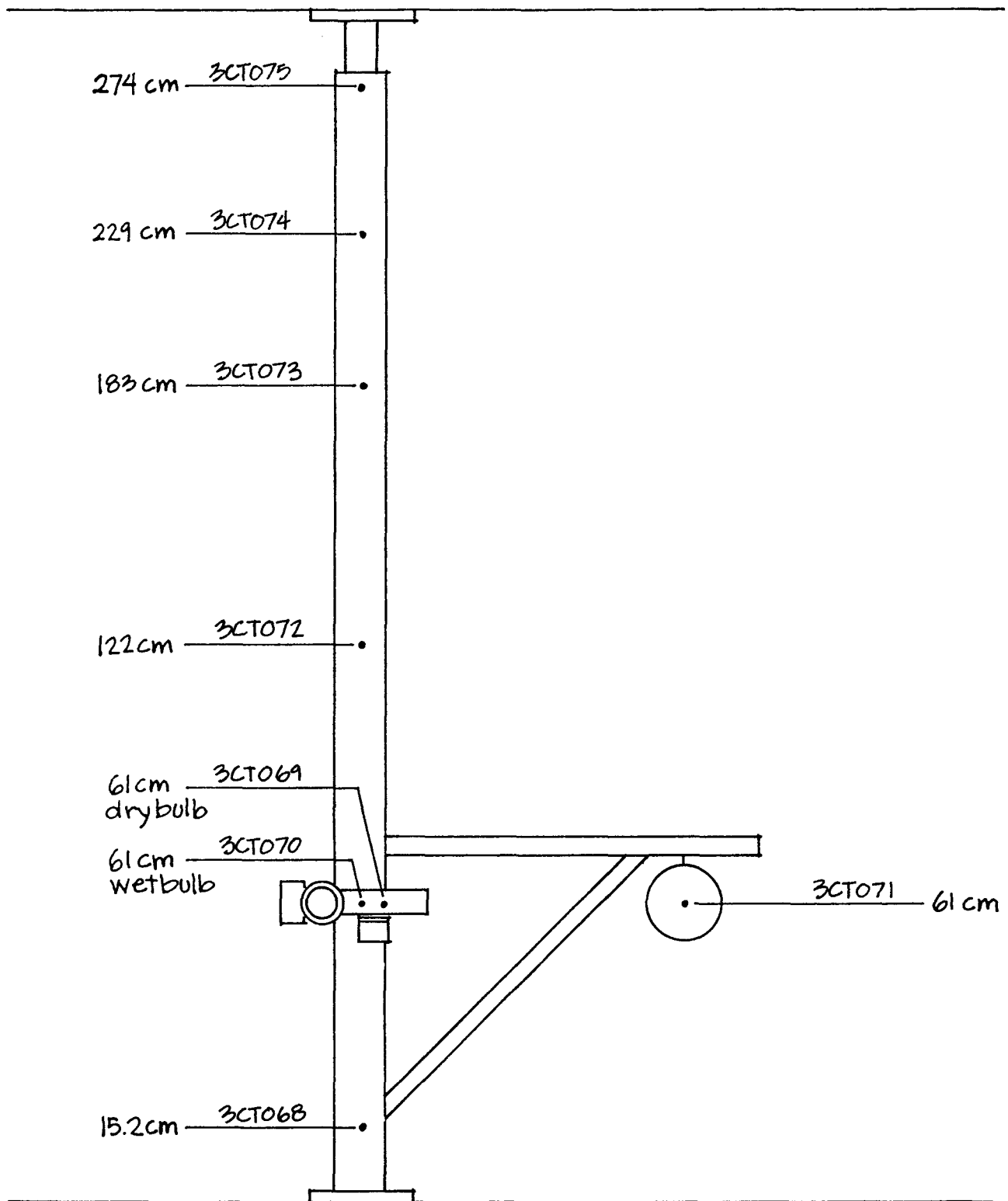
3LT007 - SOUTH BOTTOM
3LT008 - SOUTH TOP

3LT009 - NORTH EAST BOTTOM
3LT010 - NORTH EAST TOP

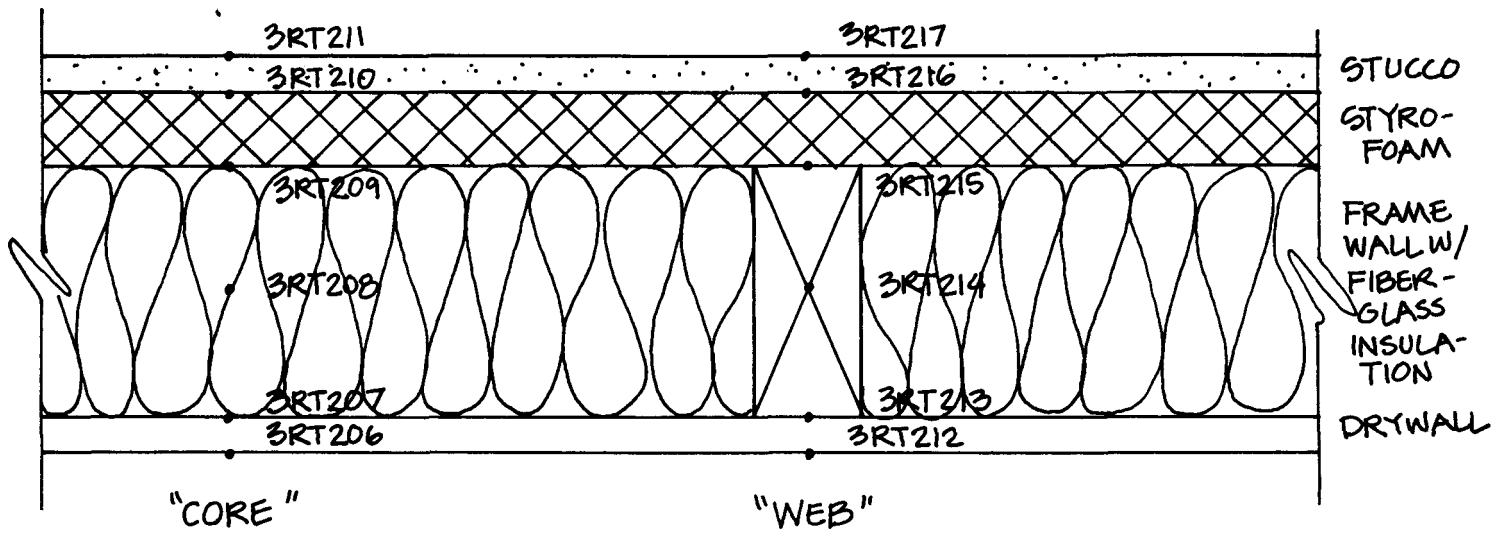
3LT011 - NORTH WEST BOTTOM
3LT012 - NORTH WEST TOP



COMFORT SENSOR STATION
STRUCTURE 3 - SOUTH ROOM

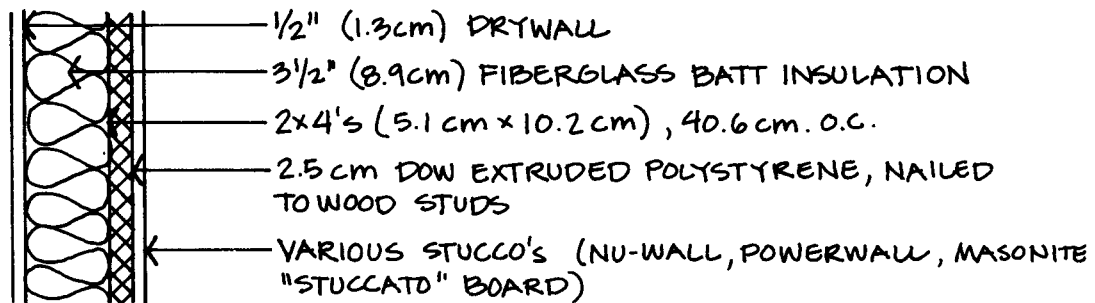


COMFORT SENSOR STATION
STRUCTURE 3 - NORTH ROOM

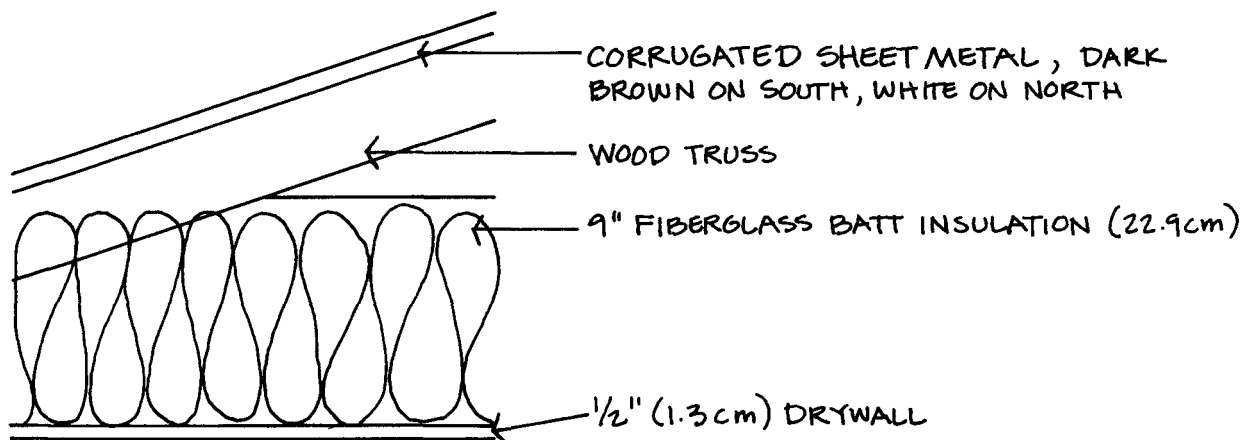


WOOD STUD WALL
STRUCTURE THREE-WEST WALL

BUILDING ENVELOPE DETAILS - STRUCTURE THREE



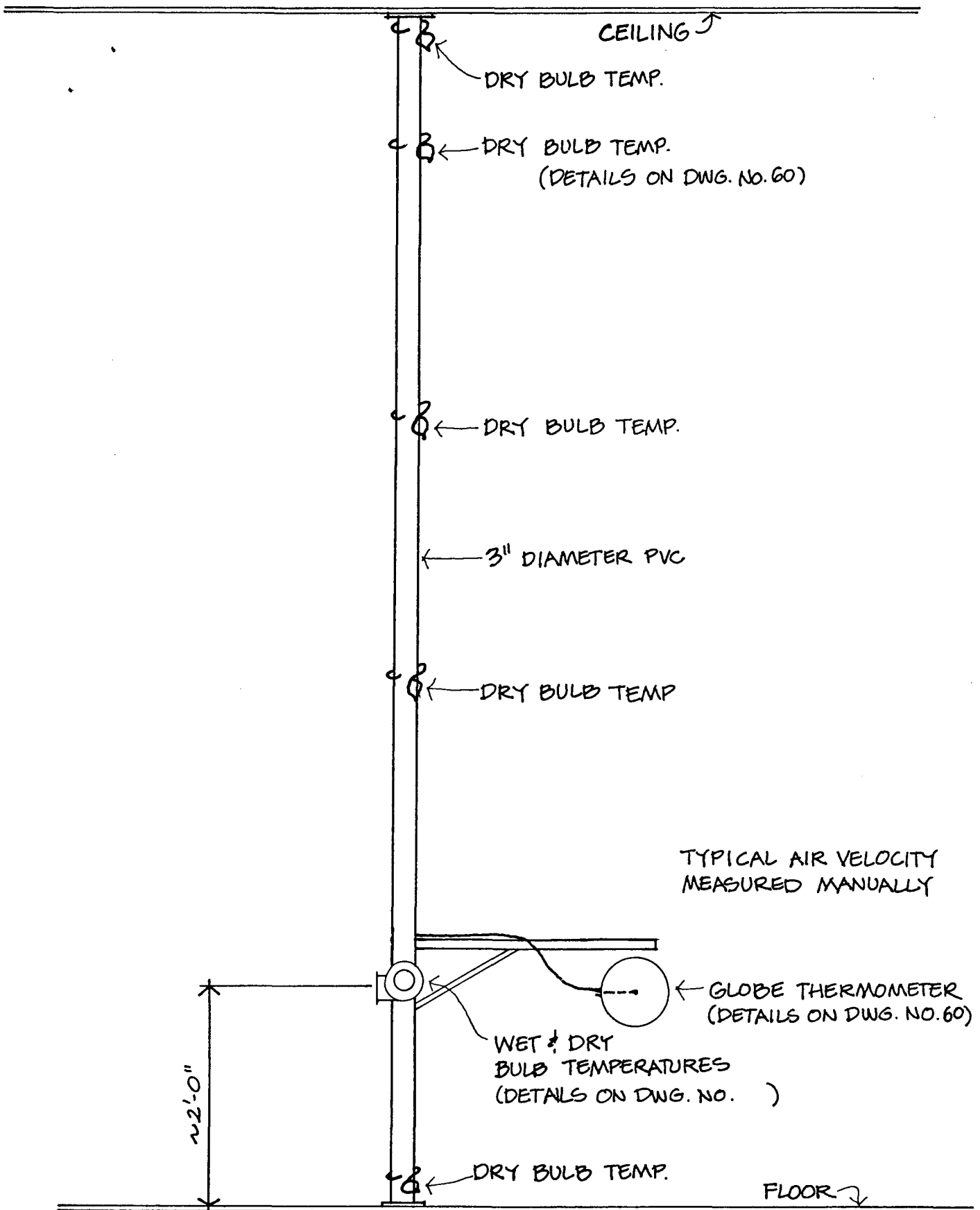
TYPICAL WOOD FRAME WALL



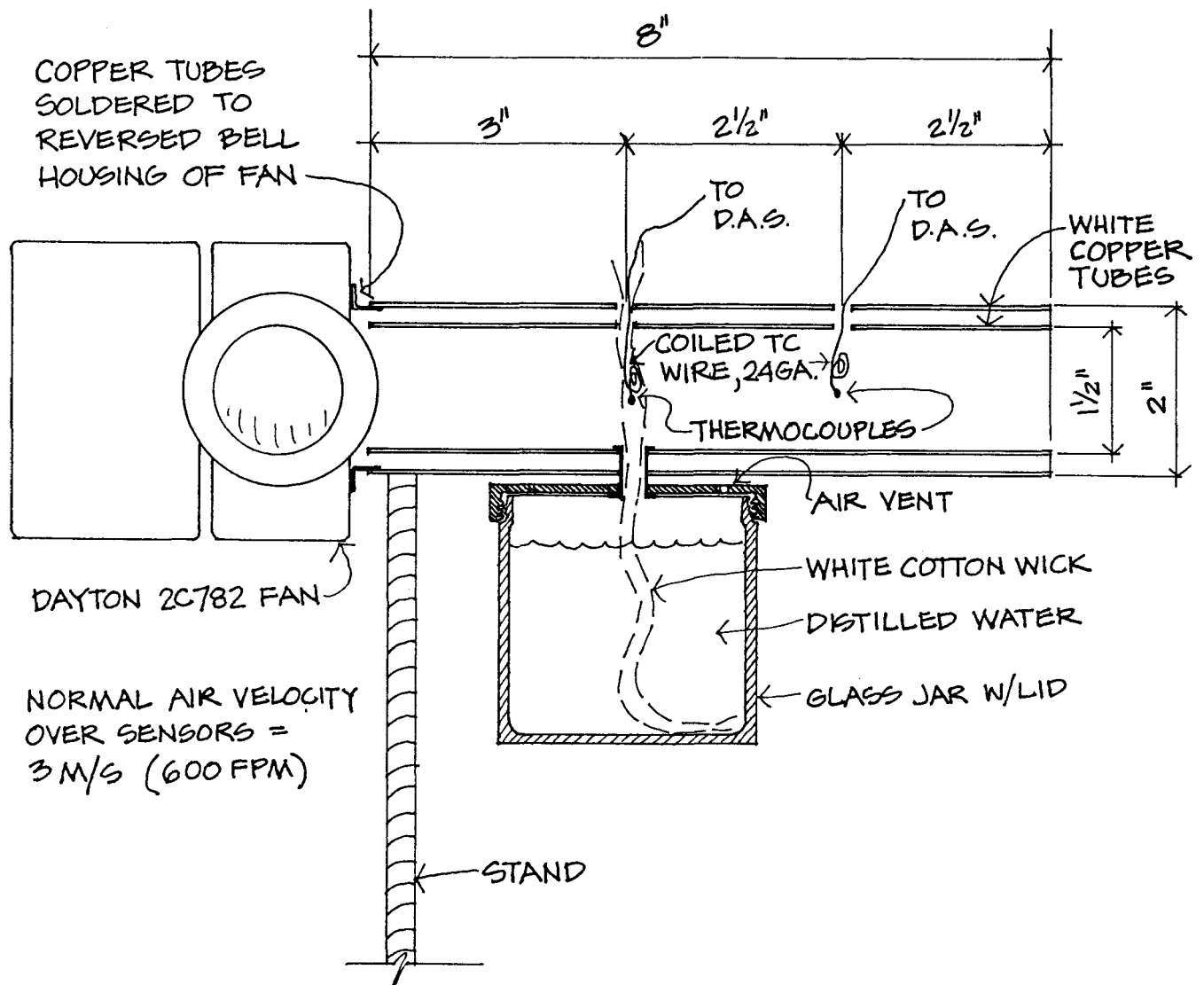
ROOF DETAIL

NOTE: EXTERIOR DOORS ARE SHEATHED IN METAL AND HAVE APPROXIMATELY 1 5/8" (4.1 cm) URETHANE INSULATION IN CORE.

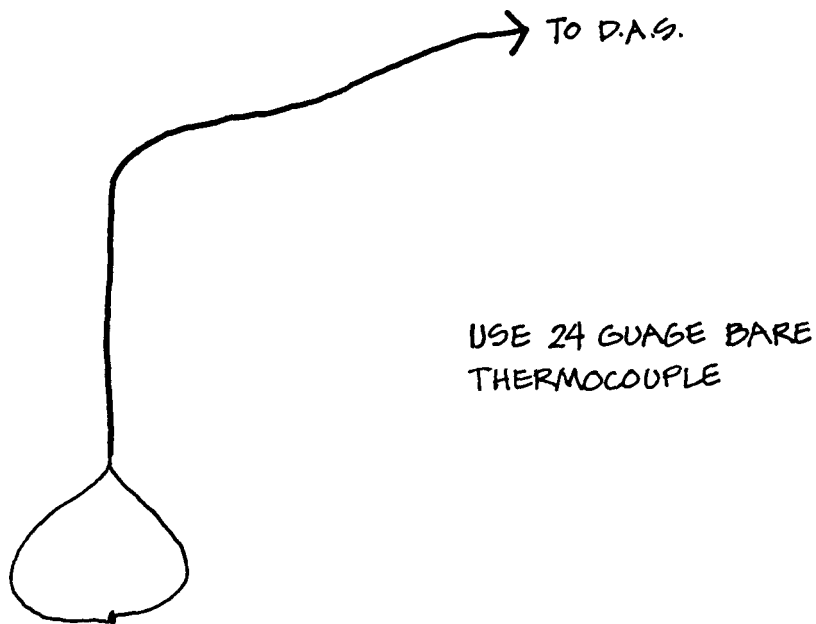
ALL WINDOWS ARE KLOS - 2 SINGLE-GLAZED WINDOWS LOCATED ~ 3" APART IN SEPARATE ALUMINUM FRAMES. DUO-TONE (DARK TOP, WHITE BOTTOM) VENETIAN BLINDS LOCATED BETWEEN WINDOWS.



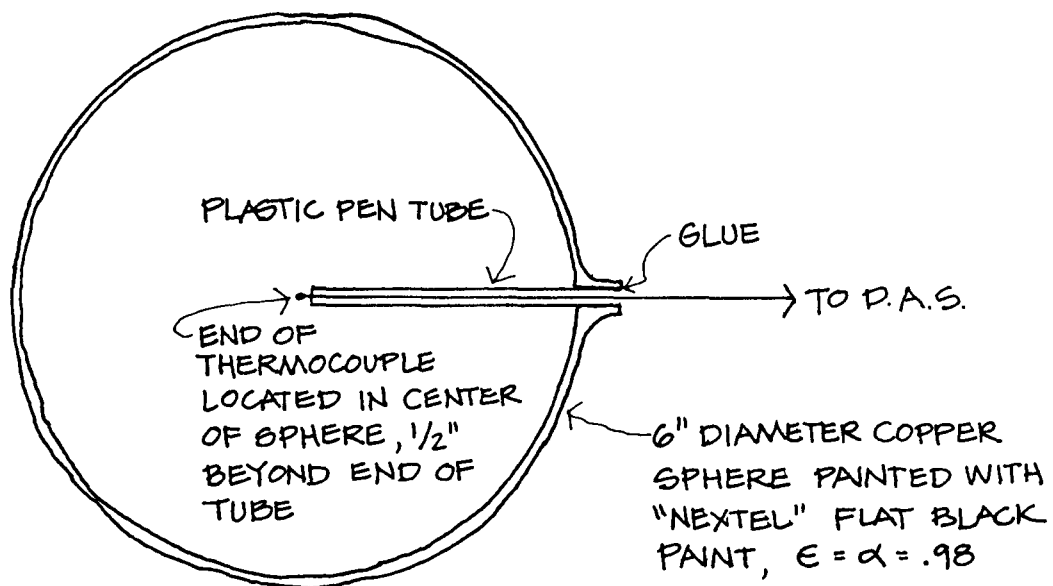
COMFORT SENSING STATIONS



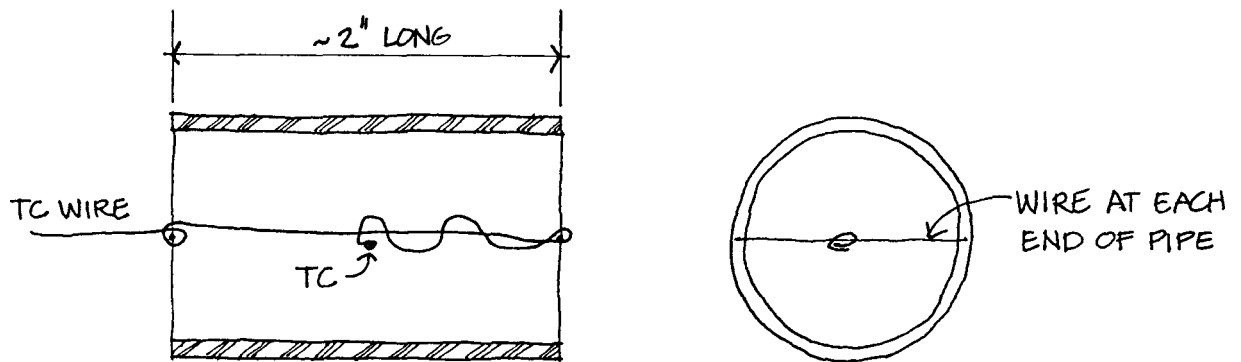
SINGLE POINT WET & DRY BULB TEMPERATURE STATION



DRY BULB TEMPERATURE STATION, NATURALLY ASPIRATED — USE ON FLOOR TO CEILING COMFORT STATIONS, AND ADJACENT TO ALL HEAT FLUX MTRS.

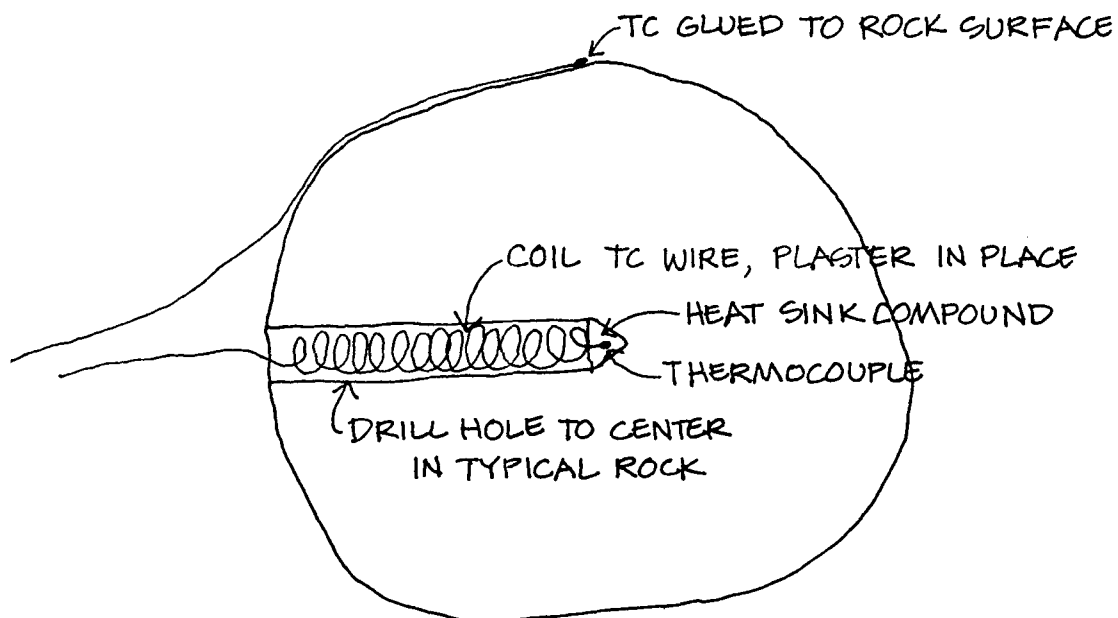


GLOBE THERMOMETER

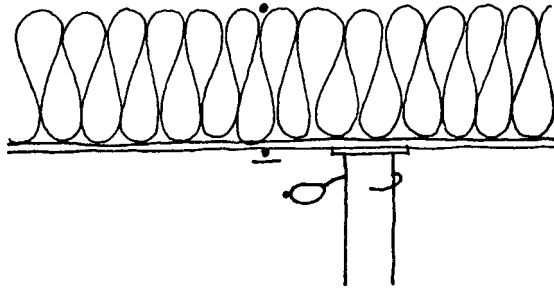


1 1/4" ϕ PVC PIPE FOR AIR THERMO-
COUPLES IN ROCKBED (12 REQ'D)

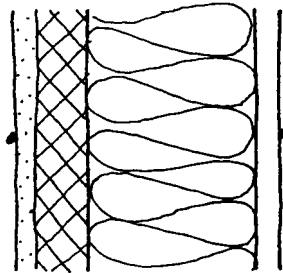
Drawing no.



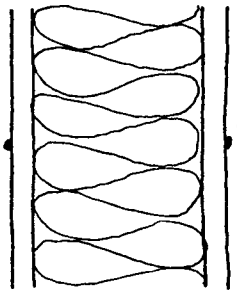
ROCK THERMOCOUPLES (1 REQ'D)



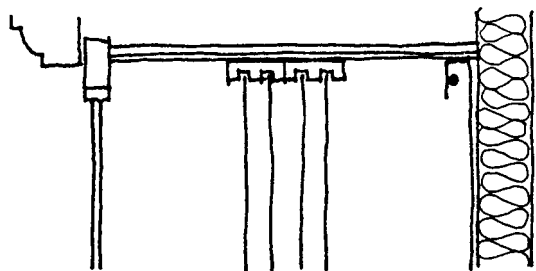
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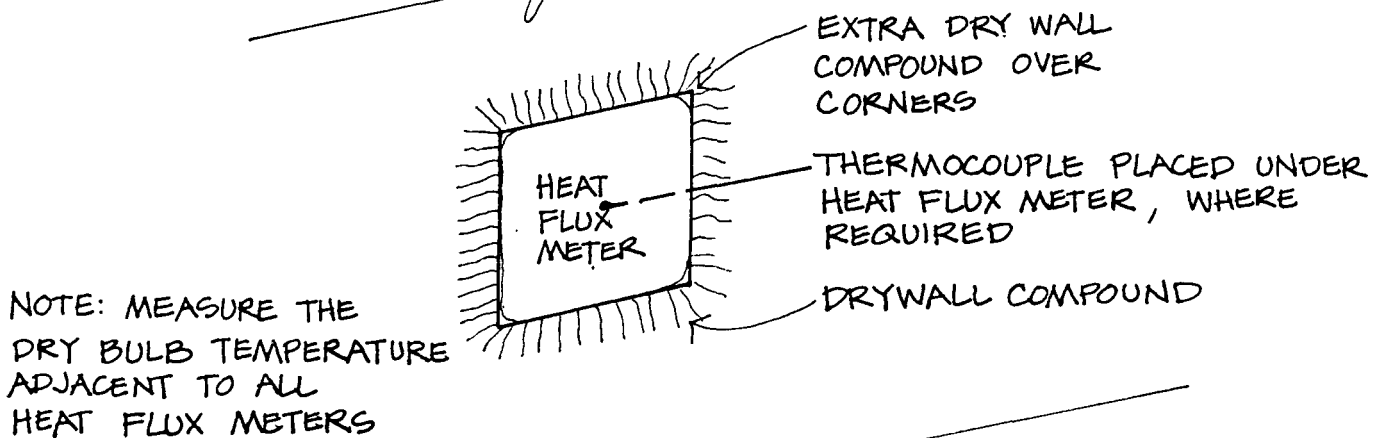
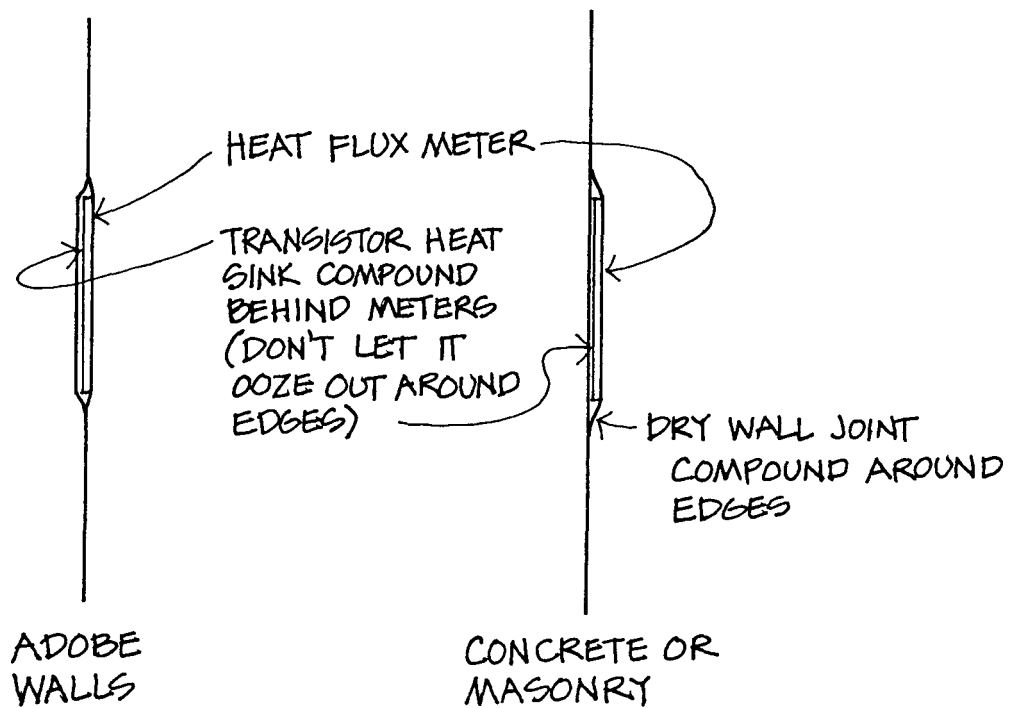
Drawing no.



Drawing no.

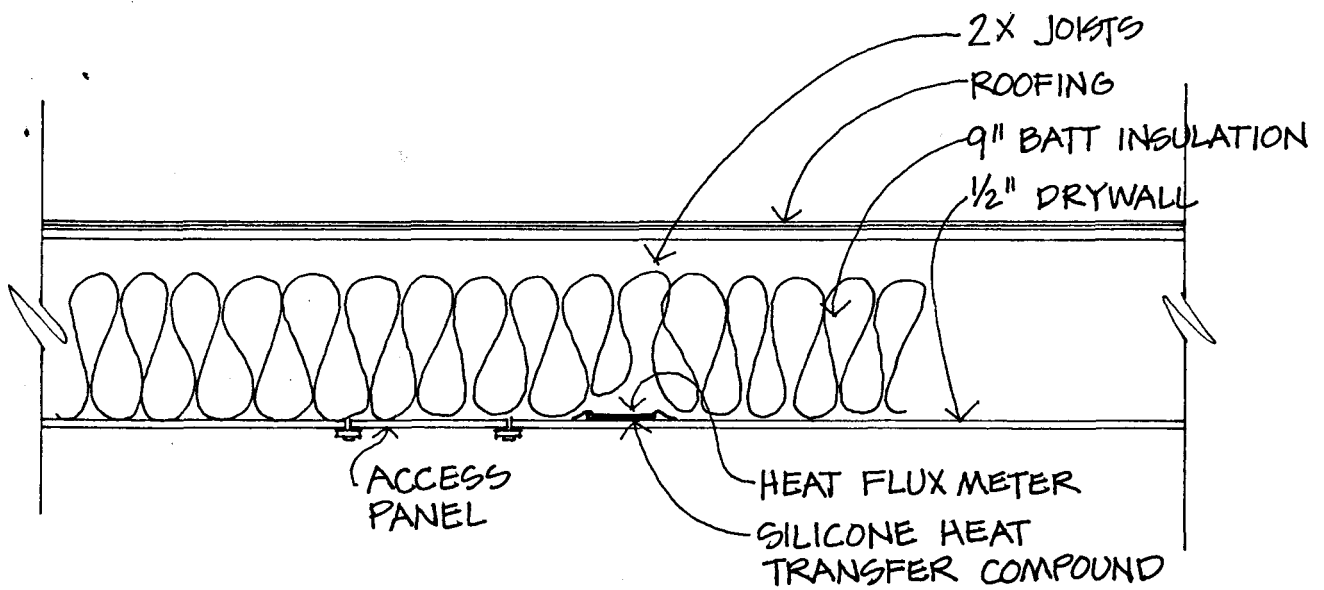


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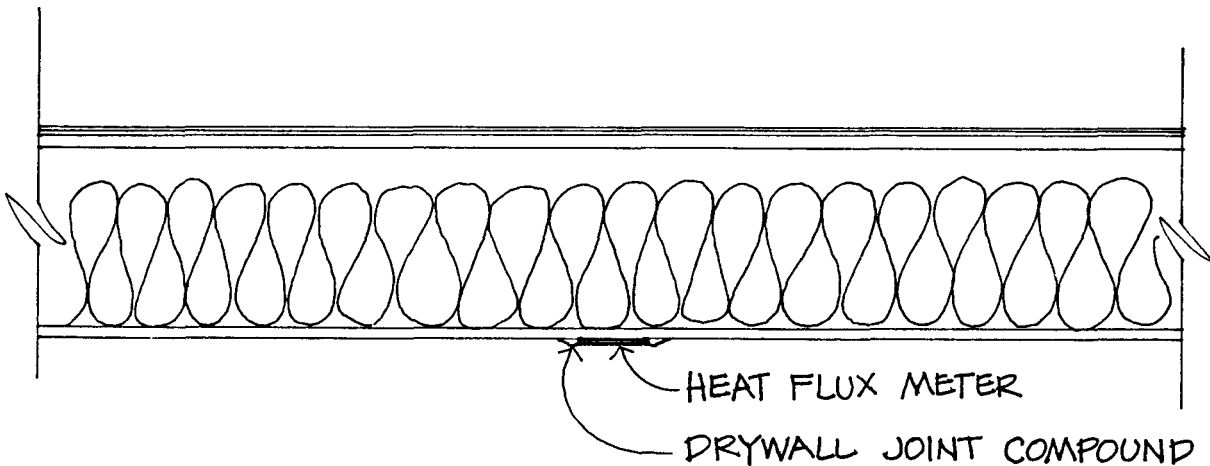


PAINT HEAT FLUX METER SAME COLOR AS WALL OR FLOOR

WALL & FLOOR HEAT FLUX METER INSTALLATION



ALTERNATE #1

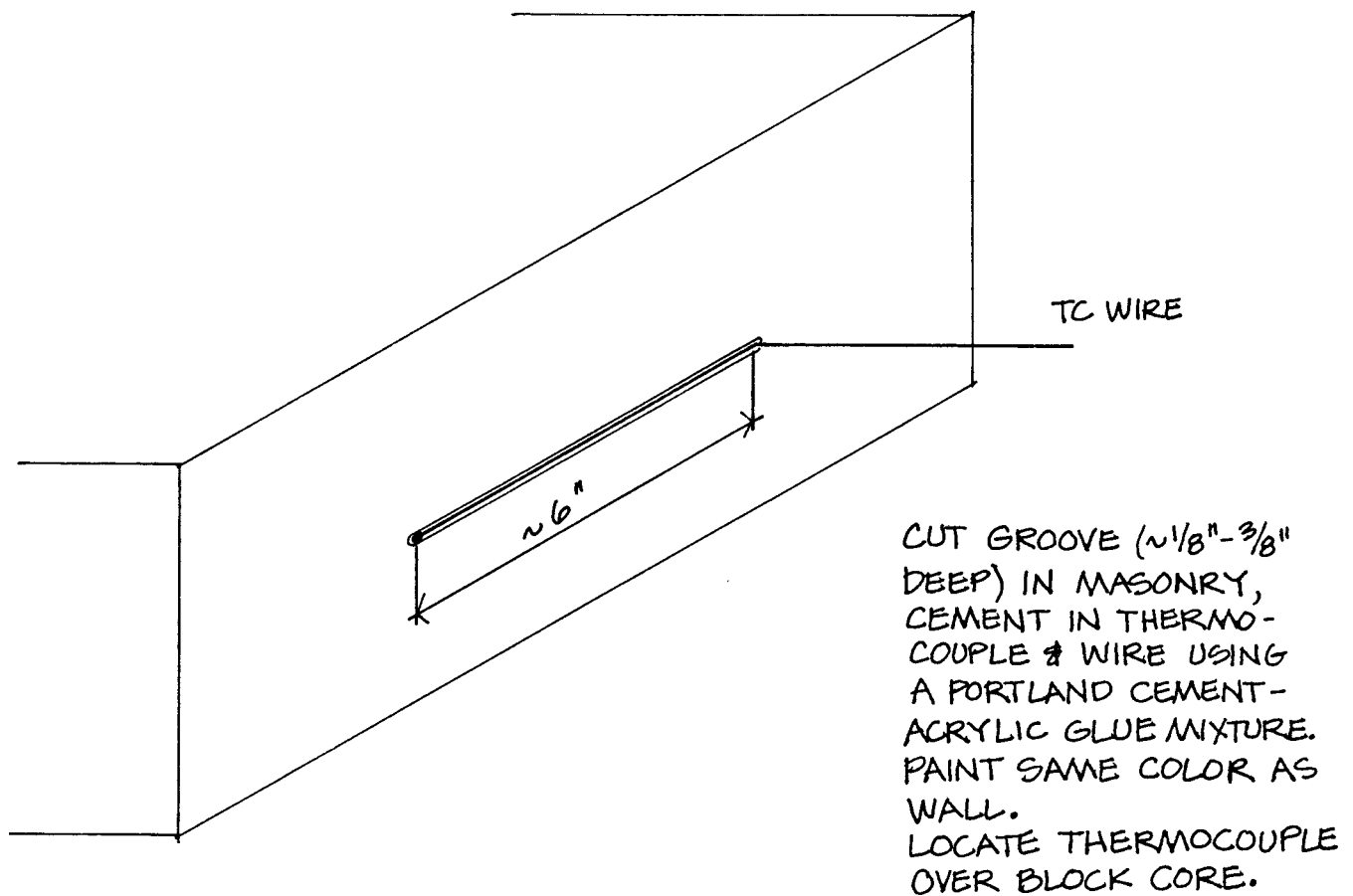


ALTERNATE #2

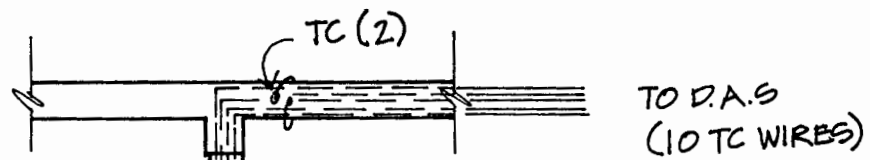
NOTES: APPLY SILICONE HEAT TRANSFER COMPOUND TO CEILING & TO METER. THEN PRESS TOGETHER AND SQUEEZE OUT EXCESS. SMOOTH JOINT BETWEEN METER & CEILING. APPLY DRYWALL COMPOUND AROUND EDGES OF METER.

TO REMOVE METER, GENTLY PRY OFF WITH DULL EDGED TOOL. IF DIFFICULT TO REMOVE, SAW OUT DRYWALL & PATCH HOLE.

CEILING HEAT FLUX METER INSTALLATION



SURFACE TEMPERATURE THERMOCOUPLE INSTALLATION



EPOXY CEMENT (W/ROSS
EPOXY GLUE NO. 179) ENTIRE
EXPOSED LENGTH OF
THERMOCOUPLE

TC (2)

ATTACH THERMOCOUPLE W/
PVC CEMENT (SOLVENT TYPE)
& HOLD IN PLACE UNTIL
SET

TC (2)

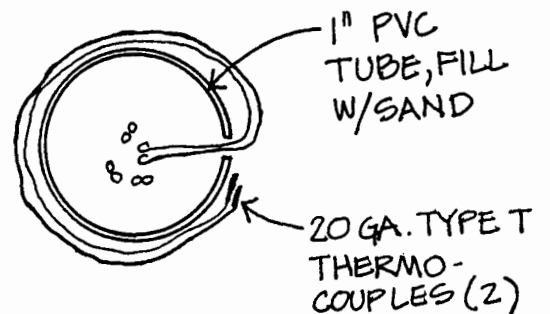
TC (2)

NOTE: EACH THERMOCOUPLE
LOCATION SHALL HAVE 2
THERMOCOUPLES (1 IS A
SPARE).

SPACE THERMOCOUPLES
ACCORDING TO LOCATIONS
INDICATED IN THE TEXT.

SAND FILL 1" DIAMETER
PVC PIPE

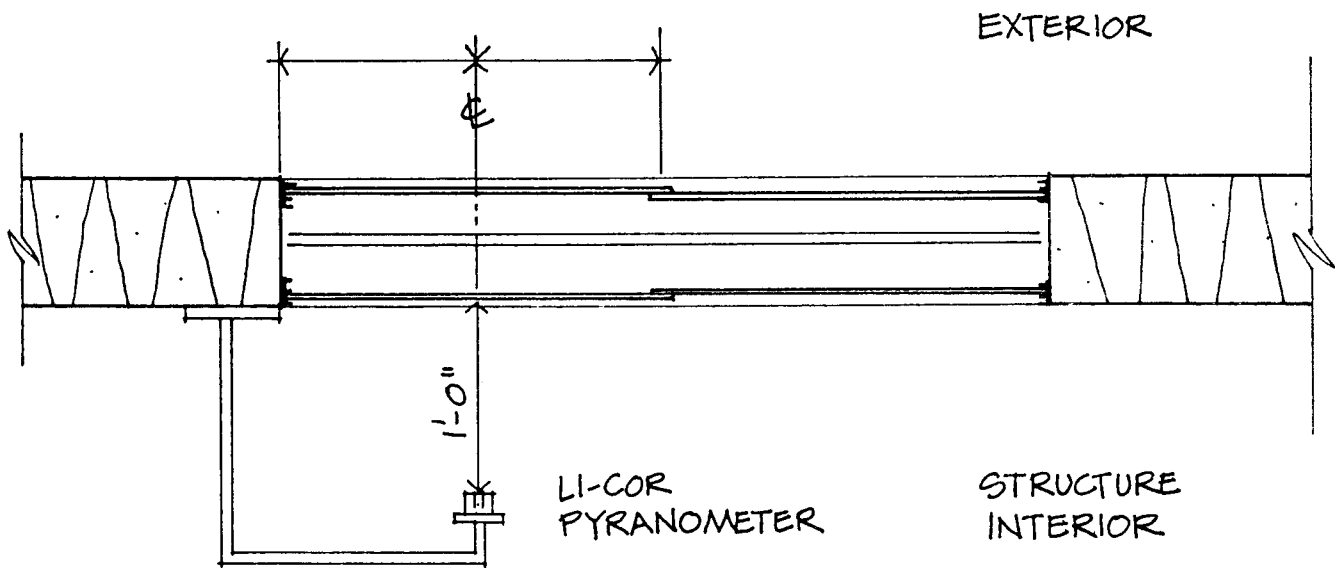
ELEVATION



PLAN

CAP TC (2)

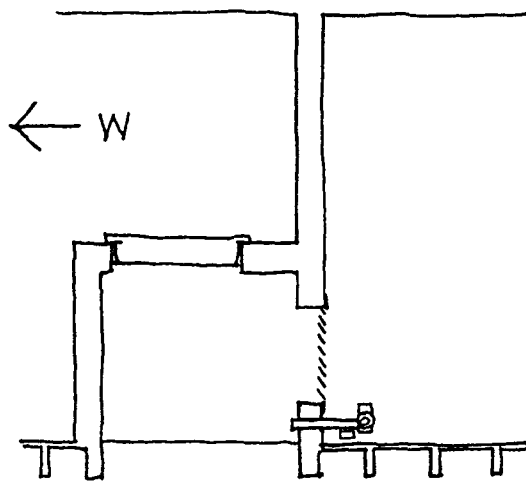
EARTH TEMPERATURE SENSOR ARRAY (SIMILAR TO THOSE USED AT TRINITY UNIVERSITY)



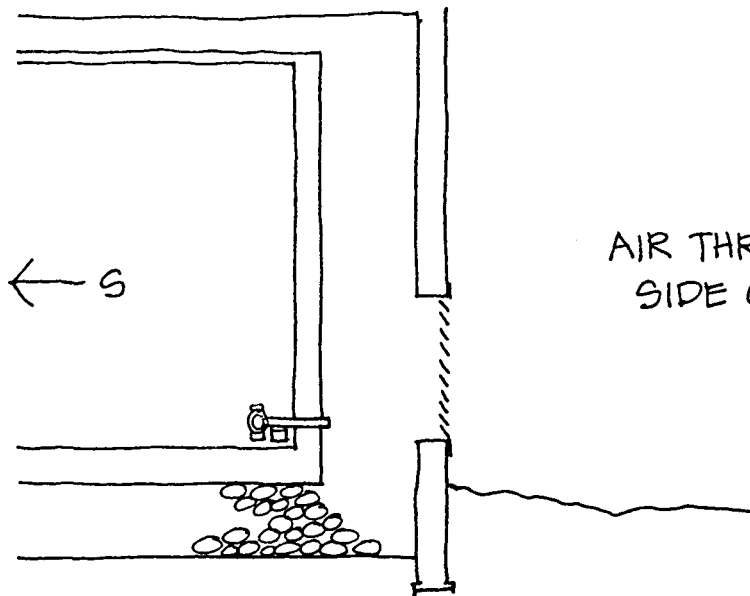
PLAN VIEW

NOTE: LOCATE PYRANOMETER ONE FOOT FROM GLASS AND
AT THE MID-POINT OF A SINGLE PANE OF GLASS

LI-COR PYRANOMETER INSTALLATION



AIR THROUGH COOLER
ROOM PLENUM (SOUTH)
SIDE OF ROCKBED)



AIR THROUGH NORTH
SIDE OF ROCKBED

WET BULB and DRY BULB TEMPERATURE SENSORS
FOR AIR ENTERING and LEAVING THE ROCKBED

Drawing no. 57