NPS Form 10-900
(Rev. 8-86)

1589

OMB No. 1024-0018

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

AUG 31 1989

NATIONAL REGISTER

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name: The Solar Building
other names/site number: Bridgers & Paxton Office Building

2. Location

street & number: 213 Truman Street N. E. ☐ not for publication
city, town: Albuquerque ☐ vicinity
state: New Mexico code: 35 county: Bernalillo code: 001 zip code: 87108

3. Classification

Ownership of Property	Category of Property	Number of Resources within Property	
		Contributing	Noncontributing
☒ private	☒ building(s)	1	____ buildings
☐ public-local	☐ district	____	____ sites
☐ public-State	☐ site	____	____ structures
☐ public-Federal	☐ structure	____	____ objects
	☐ object	____	____ Total

Name of related multiple property listing: ____

Number of contributing resources previously listed in the National Register: -0-

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this ☒ nomination ☐ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ☒ meets ☐ does not meet the National Register criteria. ☐ See continuation sheet.

Thomas W. Hall State Historic Preservation Officer — 8-25-89
Signature of certifying official — Date

State or Federal agency and bureau

In my opinion, the property ☐ meets ☐ does not meet the National Register criteria. ☐ See continuation sheet.

Signature of commenting or other official — Date

State or Federal agency and bureau

5. National Park Service Certification

I, hereby, certify that this property is:

☒ entered in the National Register. ☐ See continuation sheet.
☐ determined eligible for the National Register. ☐ See continuation sheet.
☐ determined not eligible for the National Register.
☐ removed from the National Register.
☐ other, (explain:) ____

Carol D. Shull — 10-10-89
Signature of the Keeper — Date of Action

6. Function or Use

Historic Functions (enter categories from instructions)

Commerce/Trade - Professional
Engineering Office

Current Functions (enter categories from instructions)

Vacant - Not in Use

7. Description

Architectural Classification (enter categories from instructions)

International Style

Materials (enter categories from instructions)

foundation Reinforced Concrete
walls Stucco, brick veneer
roof Plywood, asphalt shingles
other Solar Collector Panels - glass, copper and aluminum with wood frames

Describe present and historic physical appearance.

The Solar Building, 213 Truman Street N. E., is located three and three-fourths miles east of downtown Albuquerque, just north of Central Avenue, formerly U. S. 66 and the city's old main thoroughfare. It is situated among commercial buildings and open parking lots in a "transition zone" between the strip commercial on Central Avenue and a residential subdivision to the north. The building's L-shaped design is dominated by a 750-square-foot glass-covered solar collector which covers the steep sloping south wall of the north wing. This wing forms a quadrilateral running east-west for 108 feet. The short leg of the "L" runs north-south on the east edge of the property. The east facade, which faces Truman Street and is the most highly visible, has a thirty foot brick-faced wall. It is this wall that is most often depicted when the building is photographed. The east wing is a rectangular flat-roofed one-story building which houses offices and is partially faced in matching brick.

☐ See continuation sheet

The original building had a gross floor area of 4300 square feet, all of which was solar heated. The one-story north wing is framed by seven structural steel bents placed eighteen feet on center with wood joists spanning between the bents under the 20-degree north roof slope. The south facing wall, which is sloped at a 30-degree angle from the vertical forms the support for the solar collectors. The 30-degree angle is the optimum slope for the solar collectors for 35-degrees north latitude, which is the latitudinal location of Albuquerque, New Mexico. The north facade is a long white wall with a continuous band of wood-framed windows at the roof line. The original southern section is a conventional International style structure; a small brick-faced rectangle sited parallel to the north wing. The main entry to the building is on the east where the two wings join. Most of the building is constructed on grade, except for an approximately 950 square foot basement.

The north wing contains drafting rooms and the equipment room for the solar heating system. The drafting rooms are located along the north side of the wing under the north sloping roof; indirect lighting enters this wing through several skylights in the roof and bounces off the long white wall of the drafting rooms. These skylights and the north windows eliminate the need for artificial light during the day.

Dropping vertically from the peak of the north sloping roof, the south wall of the drafting rooms separates these rooms from the mechanical equipment which lies beneath the solar collectors. The equipment located here transfers the heat collected by the flat plate collector to the building. The equipment includes a heat exchanger and a water-to-water heat pump. Heated water in the winter and cooled water in the summer is stored in an underground 6,000 gallon storage tank.

The collector panels are formed from two bonded aluminum sheets painted with non-reflective black paint; originally flow channels built into the panels transported water which was heated by the sun and then pumped to the storage tank. Shortly after the system was put into operation, the combination of soldering flux and water caused corrosion of the aluminum panels, which resulted in pin-hole water leaks. The system was retrofitted and the flow channels replaced by copper tubing attached to the back of the aluminum sheets. The panels are held in place by an insulated support frame and covered with a single layer of glass.

Heat absorbed by the collector plates is transferred to an ethylene-glycol water solution which circulates through the copper tubing. A heat exchanger then transfers the heat from the solution to the water in the 6,000 gallon storage tank buried next to the building. Heat energy stored in this tank water is circulated to the rooms by way of an air handling unit. At night and during overcast days enough heat energy is stored in the tank to heat the building. If the temperature of the water falls below a certain level a heat pump is used which can extract heat from the stored water even when the water temperature is as low as 50 degrees Fahrenheit. During the summer an evaporative water cooler is operated at night and with the original water chiller-heat pump provides enough cold water for storage to cool the building.

In 1962 the southern section was more than doubled in size with a southern addition; a horizontal row of wood windows was added just below the roof on the east side of the addition. Below these windows the wall is faced with small multicolor ceramic tiles. Although the 1962 addition was designed by the original architects, Stanley & Wright, the addition is well-defined and is easily distinguised from the original structure. Due to very low energy costs at this time, the owners decided to augment the solar-assisted system and install a conventional boiler which utilized the existing mechanical equipment. The new 4000 square foot addition to the southern wing was not solar heated, but utilized the conventional gas-fired boiler that augmented the solar system. In 1963 the northern wing of the original structure was extended to the west to provide an additional rear entry to the building. With the exception of two connecting passageways, a 1981 passageway which connected the 1962 southern addition to an adjacent existing building on Copper Avenue and a 1984 passageway connecting the 1962 southern addition to the immediately adjacent existing building on Truman, no other alterations have been made to either the system or the building since that time. When queried as to the ease with which one can identify the original structure, Frank Bridgers, who designed the unique solar system for the building, responded, "Our firm, Bridgers & Paxton, occupied the Solar Building for twenty-nine years, during which time our firm and our tenants had considerable growth. This required additions to the building to accomodate our expanding staffs. For all additions, both small and major, we gave careful consideration to preserving the integrity of the solar collectors and retaining the salient features of the original Solar Building."

In 1974, energy costs soared and the solar system was analyzed and restored with funding from a National Science Foundation Research Grant.

The original copper tubing attachment to the back of the aluminum plates did not have a continuous bond. The copper tubes were re-soldered using silver solder to re-establish a good heat transfer bond between the copper tubes and the aluminum plates. The water transport medium was replaced with the ethylene glycol mixture to prevent freezing problems that had occured in earlier years. The control system was revised for a completely automatic changeover for the various winter modes. In rooms where the heat could not be controlled by the thermostat in the drafting rooms, packaged water-to-air heat pumps were installed for individual control. The 1974 changes brought the solar system up to date and made it equivalent to a completely automatic conventional heating and air conditioning systems.

In preparation for this application, Professor Maurice W. Wildin, with the University of New Mexico's Department of Mechanical Engineering, was queried as to the extent of modifications associated with the 1974 NSF grant. Professor Wildin had been involved in the study, and the University of New Mexico Mechanical Engineering Department provided the instrumentation and monitoring for Pennsylvania State University. In response to the inquiry, Professor Wildin indicated "I recall clearly that one of the requirements of the NSF program which funded the project to renovate and operate the solar system was that it not be modified substantially from the original design." A copy of Professor Wildin's letter of April 4, 1989, is attached in an attempt to certify that the integrity of the solar system has long been recognized and maintained.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

☒ nationally ☐ statewide ☐ locally

Applicable National Register Criteria ☐ A ☐ B ☒ C ☐ D

Criteria Considerations (Exceptions) ☐ A ☐ B ☐ C ☐ D ☐ E ☐ F ☒ G

Areas of Significance (enter categories from instructions)	Period of Significance	Significant Dates
Engineering	1956	1956

Cultural Affiliation

Significant Person

Architect/Builder

Frank Bridgers & Donald Paxton, Engineers
George Wright & Francis Stanley, Architects

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

The Solar Building is an exceptionally significant structure. It has been recognized as the first solar-heated commercial building in the world. Since its completion in 1956, its contribution to the application of solar energy for heating and cooling has been well documented in architectural, engineering, scientific and general interest publications. In contrast to many early solar systems, the Solar Building's system is entirely intact, and has not been removed or substantially modified. It remains capable of functioning at its original level of efficiency. It has contributed significantly to the history of the development of applied solar energy.

☐ See continuation sheet

9. Major Bibliographical References

1. Architectural Records Magazine, "Solar-Heated Office Building Combines Good Architectural and Mechanical Design", December, 1956.

2. Architectural Forum, "Solar Energy Closer on the Horizon", January, 1957.

3. Progressive Architecture, "Solar-Heated Office Building", March, 1957.

4. Life Magazine, "Warm Winter Behind Glass", December 17, 1956.

☒ See continuation sheet

Previous documentation on file (NPS):

- ☐ preliminary determination of individual listing (36 CFR 67) has been requested
- ☐ previously listed in the National Register
- ☐ previously determined eligible by the National Register
- ☐ designated a National Historic Landmark
- ☐ recorded by Historic American Buildings Survey # _____
- ☐ recorded by Historic American Engineering Record # _____

Primary location of additional data:

- ☒ State historic preservation office
- ☐ Other State agency
- ☐ Federal agency
- ☐ Local government
- ☐ University
- ☐ Other

Specify repository: _____

10. Geographical Data

Acreage of property less than one acre

UTM References

	Zone	Easting	Northing
A	13	355320	3882960
B			
C			
D			

☐ See continuation sheet

Verbal Boundary Description

Lot 2 (formerly Lot B), Block 7 of the Buena Vista Business Addition, being a subdivision of portions of Track Number 4 of Heights Reservoir Addition, an addition of the City of Albuquerque, New Mexico.

☐ See continuation sheet

Boundary Justification

All of Lot 2 in Buena Vista Addition, 100' x 150', to include all areas traditionally associated with the building. The entire lot on which the Solar Building is located is nominated, since the working part of its solar system is at the rear and needs clear space around it to be seen.

☐ See continuation sheet

11. Form Prepared By

name/title Mary Davis, Preservation Planner and Lynn Bridgers, Technical Writing
organization Redevelopment Division, Planning Dept. date July 14, 1989
street & number Post Office Box 1293 telephone (505) 768-3277
city or town Albuquerque state New Mexico zip code 87103

In a 1979 Department of the Interior publication National Register Historians Marcella Sherfy and W. Ray Luce indicate that historical significance "may be represented by a building or structure whose developmental or design value is quickly recognized as historically significant by the architectural profession". (1) Following its completion in 1956, the Solar Building's significance was acknowledged in Architectual Record Magazine (December, 1956) (2), Architectural Forum (January, 1957) (3), Progressive Architecture (March, 1957) (4), Life Magazine (December, 1956) (5), and Fortune Magazine (November, 1957) (6). In later years its significance was recognized by the National Science Foundation (1974), New Mexico Professional Engineer (1975) (7), and Architectural Record Books' Energy Efficient Buildings (1980) (8). These organizations have recognized the unique contribution of the Solar Building to modern architectural and mechanical design, and to the continuing development of solar energy.

Sherfy and Luce, in the same Department of the Interior publication, indicate "a recent building may be of exceptional significance . . .because that building type is very scarce". (9) In May of 1975, William A. Shurcliff surveyed solar-heated buildings in the United States. (10) Shurcliff is an Honorary Research Associate in the Physics Department at Harvard University. Of the 138 buildings reported by Shurcliff, nearly 100 of them were initiated after 1970. As might be expected, the majority of the remainder are residential structures, further demonstrating the scarcity of commercial solar buildings constructed prior to 1970. In a later book, Solar Heated Buildings of North America: 120 Outstanding Examples, Shurcliff cites only four commercial office buildings. Of those four, only the Solar Building was constructed prior to 1976.

When the Solar Building was completed in 1956, active solar systems were considered experimental and an uncertain heating source. The technology and the use of active solar heating was less than 20 years old. The decision of Frank Bridgers and Donald Paxton to incorporate an active solar system into their building as their sole heating represented a considerable personal risk, but their confidence in the system was justified. The resultant system contributed significantly to the history and the development of the technology of applied solar energy.

As early as 1909, William J. Bailey had developed a solar water heater. Solar energy for water heating was in common use during the first four decades of the 20th century. However no full-scale application of an

active solar heating system for an entire building was made until 1939. After a year of research, engineers at the Massachussetts Institute of Technology (M.I.T.) installed solar flat plate collectors, a pumping system and a water storage tank in a specially constructed "solar house". The results were favorable. A considerable amount of data was collected regarding the optimum tilt angle for the collector, light transmission of the glass cover, heat loss, and the most effective type of absorber plate. With this basic data established, effective working systems could be developed.

The advent of the Second World War interrupted the M.I.T. experiments, but experimental work was continued by George Lof in Colorado on residential solar heating systems using air instead of water as the heat transport medium. After the war M.I.T. renewed its work with solar heated water systems. Concurrently Dr. Maria Telkes developed Glauber salt as a heat storage medium. By 1948 enough work had been done to encourage architect Arthur Brown to design a solar heating system for a public school in Tucson. This system worked well for ten years, but was removed when the school was expanded in 1958. Many structures with early solar systems have been destroyed, or have had the systems removed, again emphasizing the scarcity of early solar systems.

During these years of low energy costs, inventors and experimenters in solar energy kept working, many driven by their concern that non-renewable sources of energy were both finite and subject to the whims of the governments of the producing countries. These solar pioneers formed the Association for Applied Solar Energy Research in 1955 and that year held the first World Symposium on Applied Solar Energy in Phoenix, Arizona. Frank Bridgers, a young engineer from Albuquerque, attended the conference. Already familiar with solar energy research, he returned home newly inspired to attempt a practical application of the known principles of solar heating.

Bridgers was born in Birmingham, Alabama, received a mechanical engineering degree from Auburn University, and graduated with a master's degree from Purdue in 1948. His interest in solar energy began while he was a graduate student at Purdue. There, he studied with Professor F. W. Hutchinson in a special program on residential solar applications sponsored by the Libbey-Owens-Ford Company. After working with Charles S. Leopold, the Philadelphia engineer that designed some of the earliest commercial installations of radiant panel heating, Bridgers came to New Mexico as a consulting project engineer. He met Donald Paxton at the Los Alamos

Scientific Laboratory, now Los Alamos National Laboratories, and the two went into partnership in 1951.

Both were interested in the applications of solar energy. After their initial experiments on the roof of Bridgers' garage, they optimistically drew up plans for the Solar Building. After a lengthy search for financial backing, they obtained a loan from Albuquerque National Bank and began construction in 1956 of the first solar heated commercial building in the world.

Articles in a number of magazines hailed the innovative nature of the Solar Building. Life Magazine, in December, 1956, reported "an odd-looking new office building in Albuquerque, N.M. has one wall sheathed in glass and tilted to face the sun. . . . [The Solar Building]. . .is the first commercial structure in the country to be heated entirely by the sun." (11) Progressive Architecture, The Architectural Record, and the New Mexico Professional Engineer wrote enthusiastically about the Solar Building. The March, 1957, issue of Progressive Architecture noted:

> In recent years, numerous published papers have discussed various aspects of exploiting free and abundant energy for domestic heating and a few solar houses have actually been built, lived in and studied. For the most part, these examples have been in the realm of theory and applied research. Now, for the first time, a solar commercial building has been built at Albuquerque, New Mexico, to house the offices of Bridgers & Paxton, well known engineers who have executed mechanical designs for some of the most outstanding contemporary buildings in the Southwest. (12)

The first year of operation (1956-57) had the cloudiest January in Weather Bureau records, yet the building performed up to expectations despite some minor problems. These were soon corrected and the system maintained comfortable temperatures in the building for six years.

"Fuel costs were so low in the U. S. during the early Sixties that the additional construction cost for solar heating could not be justified on an economic basis." (13) When the building was expanded in 1962, the owners decided to augment the solar heating system with a conventional boiler.

Recognizing the building's historical significance, the owners retained the integrity of the original solar system. None of the system's equipment was removed. The new conventional heating system used the original mechanical equipment, leaving the solar system intact so that it could be re-activated at a later date.

Twelve years later their prudence was justified. Rapidly rising energy costs renewed interest in the Solar Building. In 1974 the original system with some minor modifications was put back into operation. Dr. Stanley F. Gilman of Pennsylvania State University received a National Science Foundation research grant (14) to restore the system and provide instrumentation for a demonstration and research program to establish a design procedure for solar assisted heat pump systems. The NSF hoped to provide a procedure that could be put into wide use throughout the country. Results of the study were reviewed in a workshop at Pennsylvania State University in 1975 and published in 1976. (15) As a result of the 1974 retrofit, the solar system with its solar-assisted heat pump continued to be used to heat the original part of the building.

The active solar system in the Solar Building has served as a model for over fifteen systems designed after 1956. One such is a solar assisted heating system for the Denver Community College, possibly the largest active solar system in the nation. Similar to the original system, this particular system heats 300,000 square feet of floor area. For his work in solar energy, Purdue University awarded Frank Bridgers the Distinguished Alumnus Award of 1978. The award stated in part; "Mr. Bridgers is one of the pioneers and innovators in utilizing solar energy to heat and cool large commercial buildings. He and his firm designed the first completely solar heated office building in the world."

In 1977 Bridgers was a key-note speaker at an international solar energy conference in London. The conference, "Profits, Projects, and Solar Energy", brought together solar specialists from sixteen different countries. Bridgers' speech "Large Scale and Commercial Applications of Solar Energy, Computer Models and Heat Pumps" was based largely on the success of the Solar Building's system and other systems modeled after it. In this way the Solar Building has contributed to the international development of solar energy applications.

The Solar Building's system remains a viable and effective solar method for heating and cooling. It has made, and continues to make, a significant contribution to the solar energy field. Knowledge gained from its use

. . has helped others understand the practical applications of solar energy and directed the course of further study and experimentation throughout the nation and the world. As early solar systems continue to be removed, modified beyond recognition, and destroyed, the Solar Building's unique historical significance increases. As the Solar Building has never been challenged as the first solar heated commercial building in the world, and given the true scarcity of this application prior to 1970, the registration of the Solar Building will insure the preservation of an integral part of our nation's early solar history.

FOOTNOTES

1. Marcella Sherfy and W. Ray Luce, "How to Evaluate and Nominate Potential National Register Properties That Have Achieved Significance Within the Last Fifty Years", U. S. Department of the Interior, Heritage Conservation and Recreation Service, Washington D. C., 1979, p. 2

2. Architectural Record Magazine, "Solar-Heated Office Building Combines Good Architectural and Mechanical Design", December, 1956.

3. Architectural Forum, "Solar Energy Closer on the Horizon", January, 1957.

4. Progressive Architecture, "Solar-heated Office Building", March, 1957.

5. Life Magazine, "Warm Winter Behind Glass", December 17, 1956.

6. Fortune Magazine, "Look to the Engineer", November, 1957.

7. New Mexico Professional Engineer, "Albuquerque's Solar Building, Nineteen Years Later", November, 1975.

8. J. Robinson and P. Markert, ed., Energy Efficient Buildings, Architectural Record Books, "Some Early Work of Solar Pioneer Frank Bridgers", McGraw-Hill, Inc., New York 1980.

9. Marcella Sherfy and W. Ray Luce, "How to Evaluate and

Nominate Potential National Register Properties That Have Achieved Significance Within the Last Fifty Years", U. S. Department of the Interior, Heritage Conservation and Recreation Service, Washington D. C., 1979, p. 2

10. Shurcliff, W. A., "Solar Heated Buildings: A Brief Survey", ninth edition, W. A. Shurcliff, Brick House Publishing Co., Harrisville, New Hampshire, 1975.

11. Life Magazine, "Warm Winter Behind Glass", December 17, 1956, p. 71.

12. Progressive Architecture, "Solar-heated Office Building", March, 1957, pp. 153-155.

13. New Mexico Professional Engineer, "Albuquerque's Solar Building, Nineteen Years Later", November 1975, pp. 6-7.

14. National Science Foundation Research Grant, Dr. Stanley F. Gilman, Pennsylvania State University, College of Engineering, 1974. (Data gathered was later assimilated by the Energy Resouce and Development Agency.)

15. Solar Energy Heat Pump Systems for Heating and Cooling Buildings, Stanley F. Gilman, ed., Pennsylvania State University, College of Engineering, University Park, Pennsylvania, 1976.

ADDITIONAL REFERENCES

1. Butti, Ken and Perlin, John. A Golden Thread: 2500 Years of Solar Architecture and Technology, Chesire Books and Van Nostrand Reinhold, New York, N. Y., 1980.

2. Personal Communications: Professor John I. Yellott, M. B. E., O. S. J., Professor Emeretis Engineering and Solar Technology Arizona State University: May 2, 1985.

3. Personal Communications: Frank H. Bridgers, M. M. E., C.E.O. Bridgers & Paxton Consulting Engineers, Inc., April 29, 1985, June 28, 1989, July 12, 1989.

5. Fortune Magazine, "Look to the Engineer", November, 1957.

6. New Mexico Professional Engineer, "Albuquerque's Solar Building, Nineteen Years Later", November, 1975.

7. J. Robinson and P. Markert, ed., Energy Efficient Buildings, Architectural Record Books, "Some Early Work of Solar Pioneer Frank Bridgers", McGraw-Hill, Inc., New York 1980.

8. Shurcliff, W. A., "Solar Heated Buildings: A Brief Survey", ninth edition, W. A. Shurcliff, Brick House Publishing Co., Harrisville, New Hampshire, 1975.

9. Solar Energy Heat Pump Systems for Heating and Cooling Buildings, Stanley F. Gilman, ed., Pennsylvania State University, College of Engineering, University Park, Pennsylvania, 1976.

10. Butti, Ken and Perlin, John. A Golden Thread: 2500 Years of Solar Architecture and Technology, Chesire Books and Van Nostrand Reinhold, New York, N. Y., 1980.

11. Personal Communications: Professor John I. Yellott, M. B. E., O. S. J., Professor Emeretis Engineering and Solar Technology Arizona State University: May 2, 1985.

12. Personal Communications: Frank H. Bridgers, M. M. E., C.E.O. Bridgers & Paxton Consulting Engineers, Inc., April 29, 1985, June 28, 1989, July 12, 1989.

B1. a. The Solar Building
Albuquerque, New Mexico

b. Jerry Rose

c. 1956

d. Jerry Rose Studios
Albuquerque, New Mexico

e. West-North-West

B2. a. The Solar Building
Albuquerque, New Mexico

b. Elizabeth Calhoun

c. 1985

d. City of Albuquerque, Planning Division

e. West-North-West

B3. a. The Solar Building
Albuquerque, New Mexico

b. Elizabeth Calhoun

c. 1985

d. City of Albuquerque, Planning Division

e. West

B4. a. The Solar Building
Albuquerque, New Mexico

b. Elizabeth Calhoun

c. 1985

d. City of Albuquerque, Planning Division

e. South

B5. a. The Solar Building
Albuquerque, New Mexico

b. Elizabeth Calhoun

c. 1985

d. City of Albuquerque, Planning Division

e. South

B6. a. The Solar Building
Albuquerque, New Mexico

b. Elizabeth Calhoun

c. 1985

d. City of Albuquerque, Planning Division

e. East

B7. a. The Solar Building
Albuquerque, New Mexico

b. Elizabeth Calhoun

c. 1985

d. City of Albuquerque, Planning Division

e. East-North-East

SOLAR BUILDING

EXHIBIT A

1. Letter from Professor Maurice W. Wildin regarding extent of modifications to solar system associated with 1974 National Science Foundation Grant to study efficiency of the solar building.

The University of New Mexico

Department of Mechanical Engineering
Albuquerque, NM 87131
Telephone 505: 277-2761

April 4, 1989

Mary P. Davis
Redevelopment Division
City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico 87103

Dear Mrs. Davis:

I am writing in response to your letter of March 30, specifically with respect to whether the heating and cooling system, including the solar system of the Solar Building in Albuquerque was modified substantially from the original version. It is my recollection that the system was not modified to the extent that the original design could not be conceived and understood by a visitor at this time. I recall clearly that one of the requirements of the NSF program which funded the project to renovate and operate the solar system was that it not be modified substantially from the original system. Hence, although I argued for replacing the collector panels with some that would have been representative of the technology at that time, the original collectors were refurbished and used. There were some storage tanks and a heat exchanger added, but I don't believe their presence would prevent someone from understanding the system as it originally existed.

I hope this is of some assistance.

Sincerely,

M. W. Wildin

Maurice W. Wildin
Professor

SOLAR BUILDING

EXHIBIT C

(Drawings Submitted with Registration)

1. Elevation - Sheet #5 - 1955 Original Solar Building

2. Section and Solar Panel Elevation - Sheet #6 - 1955 Original Solar Building

3. Floor Plan and Finish Schedule - Sheet #4 - 1955 Original Solar Building

4. Heating Floor Plan and Details - Sheet #12 - 1955 Original Solar Building

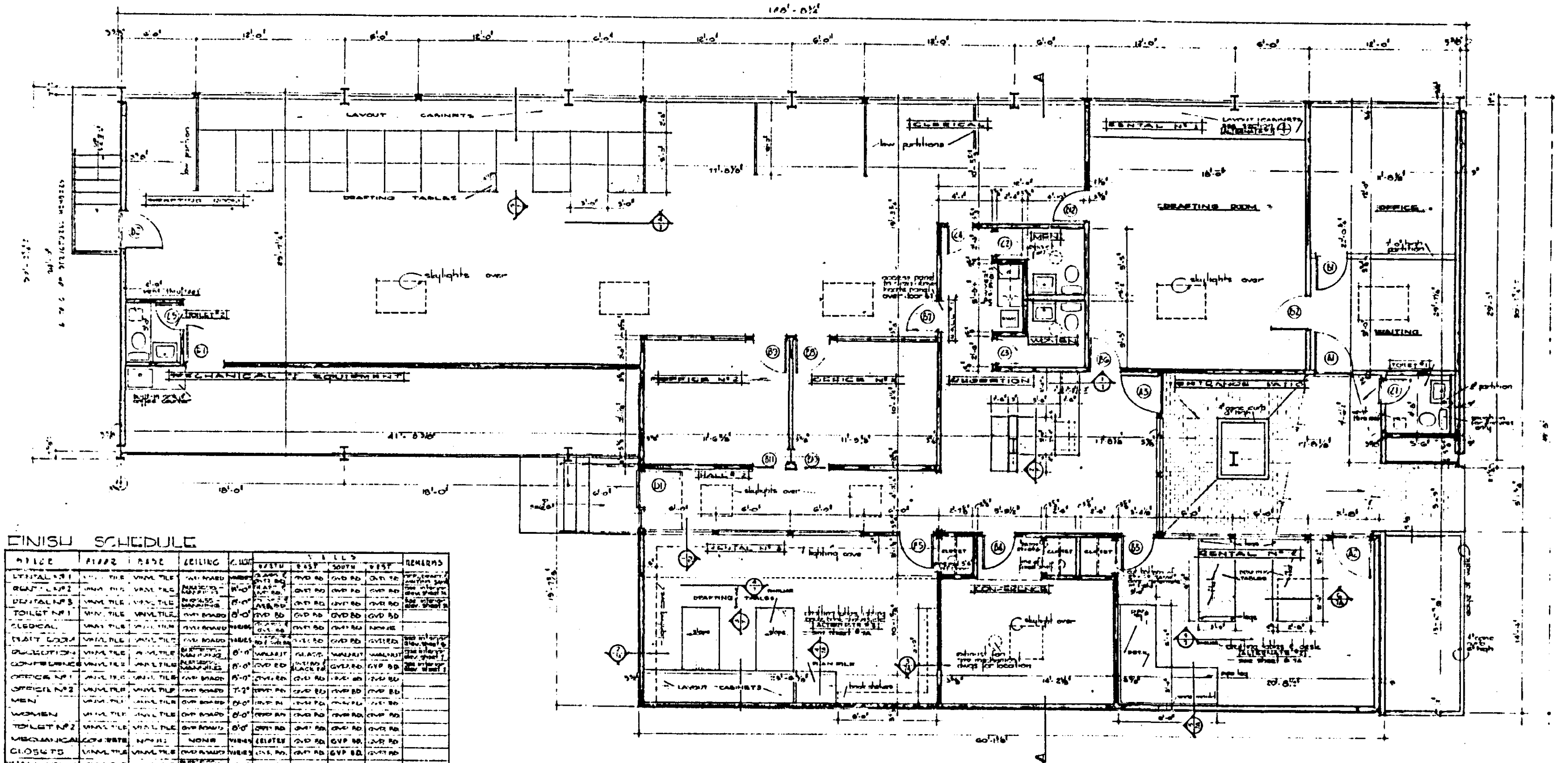
5. Heating Sections and Details - Sheet #13 - 1955 Original Solar Building

6. Heating Schedules and Diagrams - Sheet #14 - 1955 Original Solar Building

7. Addition to Solar Building - Exterior Elevation - 1961 - Sheet #3 - 1962 Addition (Southern Addition)

8. Addition to Solar Building - Sheet #2 - 1963 - Addition to North Wing to Provide Additional Rear Entry

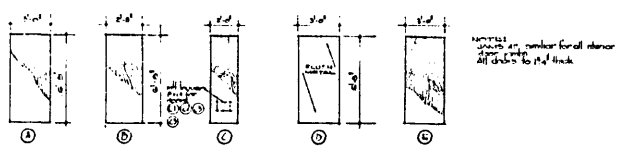
9. Floorplan of Solar Building - 1982 - No Sheet Number - Shows Current Floorplan of Building and Connecting Passageway Added in 1981



FINISH SCHEDULE

SPACE	FLOOR	BASE	CEILING	CLG. HT.	WALLS: NORTH	EAST	SOUTH	WEST	REMARKS
RENTAL Nº1	VINYL TILE	VINYL TILE	GYP BOARD	VARIES	GLASS & GYP BD	GYP BD	GYP BD	GYP BD	[illegible]
RENTAL Nº2	VINYL TILE	VINYL TILE	BURGESS-MANNING	8'-0"	GLASS & GYP BD	GYP BD	GYP BD	GYP BD	see interior elev. sheet [illegible]
RENTAL Nº3	VINYL TILE	VINYL TILE	BURGESS-MANNING	8'-0"	[illegible]	GYP BD	GYP BD	GYP BD	see interior elev. sheet [illegible]
TOILET Nº1	VINYL TILE	VINYL TILE	GYP BOARD	8'-0"	GYP BD	GYP BD	GYP BD	GYP BD	
CLERICAL	VINYL TILE	VINYL TILE	GYP BOARD	VARIES	GLASS & GYP BD	GYP BD	GYP BD	NONE	
DRAFT ROOM	VINYL TILE	VINYL TILE	GYP BOARD	VARIES	[illegible]	GYP BD	GYP BD	GYP BD	see interior elev. sheet 6
RECEPTION	VINYL TILE	VINYL TILE	BURGESS-MANNING	8'-0"	WALNUT	GLASS	WALNUT	WALNUT	see interior elev. sheet 7
CONFERENCE	VINYL TILE	VINYL TILE	BURGESS-MANNING	8'-0"	GYP BD	[illegible] BLACK [illegible]	GYP BD	GYP BD	see interior elev. sheet 1
OFFICE Nº1	VINYL TILE	VINYL TILE	GYP BOARD	8'-0"	GYP BD	GYP BD	GYP BD	GYP BD	
OFFICE Nº2	VINYL TILE	VINYL TILE	GYP BOARD	7'-2"	GYP BD	GYP BD	GYP BD	GYP BD	
MEN	VINYL TILE	VINYL TILE	GYP BOARD	8'-0"	GYP BD	GYP BD	GYP BD	GYP BD	
WOMEN	VINYL TILE	VINYL TILE	GYP BOARD	8'-0"	GYP BD	GYP BD	GYP BD	GYP BD	
TOILET Nº2	VINYL TILE	VINYL TILE	GYP BOARD	8'-0"	GYP BD	GYP BD	GYP BD	GYP BD	
MECHANICAL	CONCRETE	NONE	NONE	VARIES	CELOTEX	GYP BD	GYP BD	GYP BD	
CLOSETS	VINYL TILE	VINYL TILE	GYP BOARD	VARIES	GYP BD	GYP BD	GYP BD	GYP BD	
HALL Nº1	VINYL TILE	VINYL TILE	BURGESS-MANNING	8'-0"	GYP BD	GYP BD	NONE	GYP BD	
HALL Nº2	VINYL TILE	VINYL TILE	GYP BOARD	8'-0"	GYP BD	NONE	GYP BD & GLASS	GLASS	see interior elev. sheet 7

NOTES:
1. 'Fiberglas' insulation to be supplied by owner & installed by contractor



NOTES:
Jambs are similar for all interior door jambs.
All doors to 1¾" thick

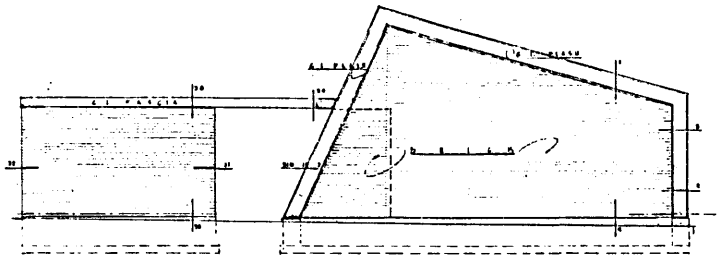
DOOR DIMENSIONS & TYPES

FLOOR PLAN & FINISH SCHEDULE

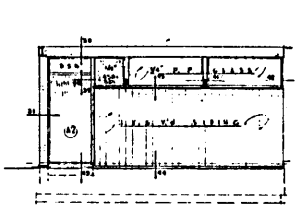
SOLAR BUILDING FOR
BRIDGERS & PAXTON
TRUMAN, NE — ALBUQUERQUE, N. MEXICO

STANLEY & WRIGHT ARCHITECTS
201 WELLESLEY, SE — ALBUQUERQUE, N. MEXICO
PHONE 5-7133

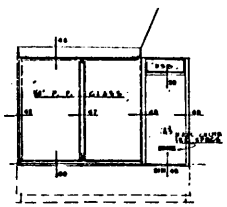
4 OF 14
DATE: 4-15-55
DRAWN BY: [illegible]
CHECKED BY: ___



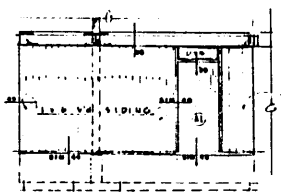
EAST ELEVATION



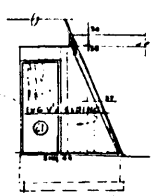
NORTH PATIO



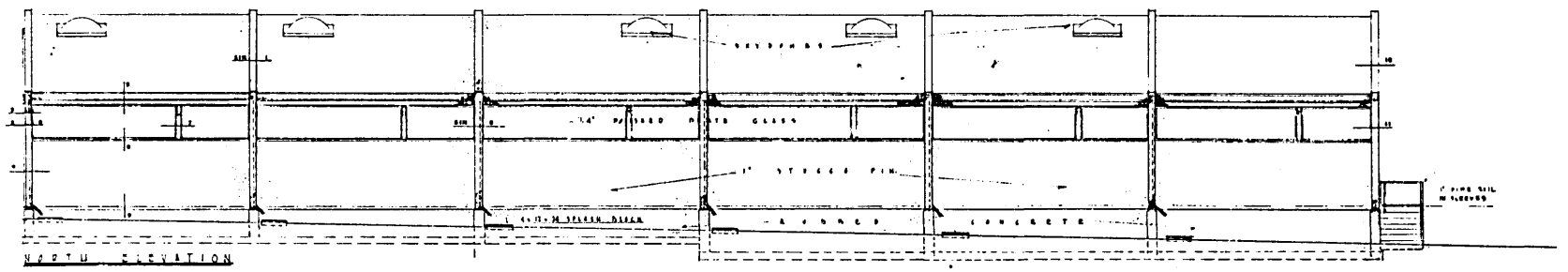
EAST PATIO



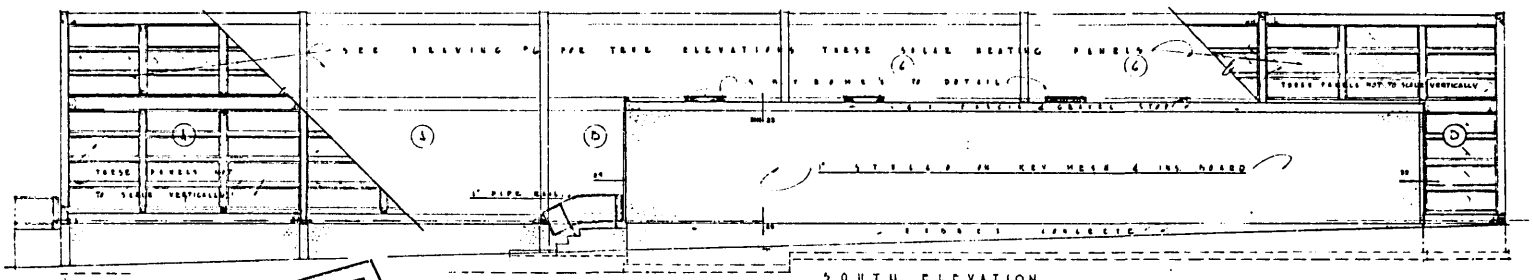
SOUTH PATIO



WEST PATIO



NORTH ELEVATION



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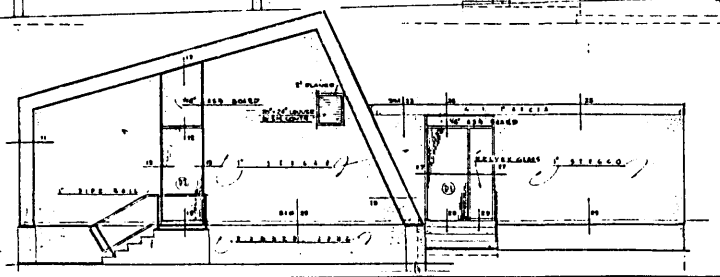


WEST ELEVATION

ELEVATIONS scale 1/4"=1'

SOLAR BUILDING

BRIDGER & PAXTON

TRUMAN, SE ALBUQUERQUE, N MEXICO

STANLEY & WRIGHT ARCHITECTS

FOR WELLESLEY, SE ALBUQUERQUE, N MEXICO

PHONE 6-7155

5

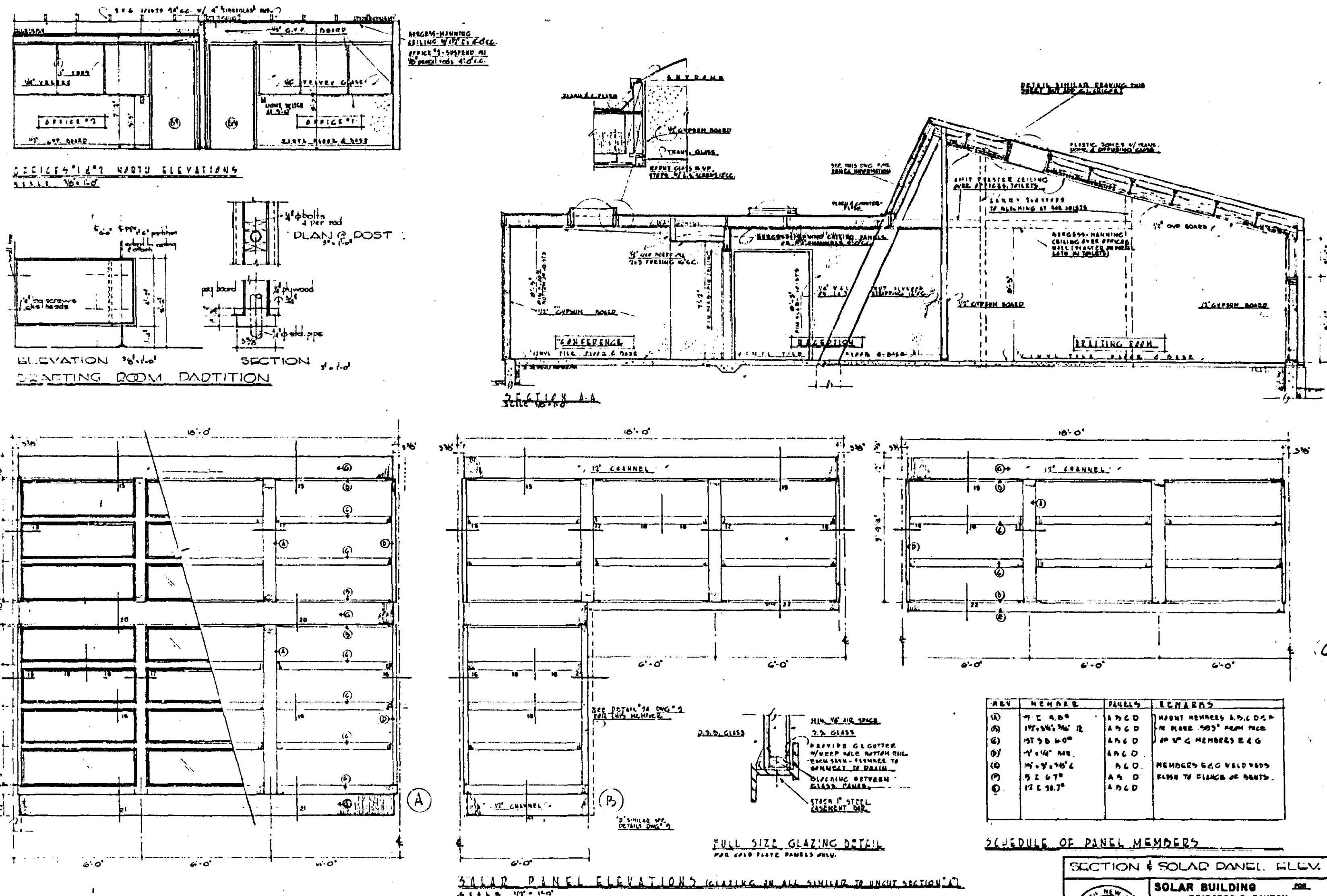
OF 16

DATE 6-15-55

DRAWN BY: GW

CHECKED BY:

JOB NO DATE



SCHEDULE OF PANEL MEMBERS

REV	MEMBER	PANELS	REMARKS
(A)	7 E 9.8#	A B C D	MOUNT MEMBERS A, B, C, D & F IN PLACE .385" FROM FACE OF 12" C MEMBERS E & G
(B)	1 1/2 x 3/4 x 3/16 R	A B C D	
(C)	ST 3 B 6.0#	A B C D	
(D)	2" x 1/4" BAR	A B C D	
(E)	4" x 3" x 5/16 L	B C D	MEMBERS E & G WELD ENDS FLUSH TO FLANGE OF BENTS.
(F)	5 E 6.7#	A B D	
(G)	12 E 20.7#	A B C D	

SECTION & SOLAR PANEL ELEV.

SOLAR BUILDING FOR **BRIDGERS & PAXTON**

TRUMAN, NE ALBUQUERQUE, N. MEXICO

STANLEY & WRIGHT ARCHITECTS

201 WELLESLEY, SE ALBUQUERQUE, N. MEXICO

PHONE: 5-7135

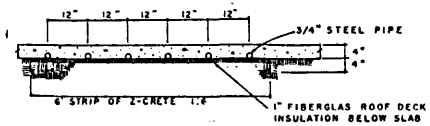
6 OF 14

DATE 4-12-55

DRAWN BY GEW

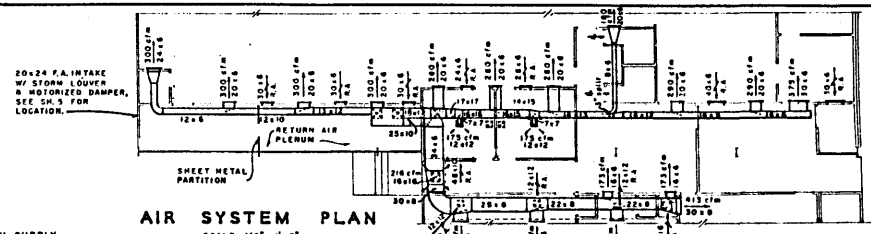
CHECKED BY —

JOB NO. 5412



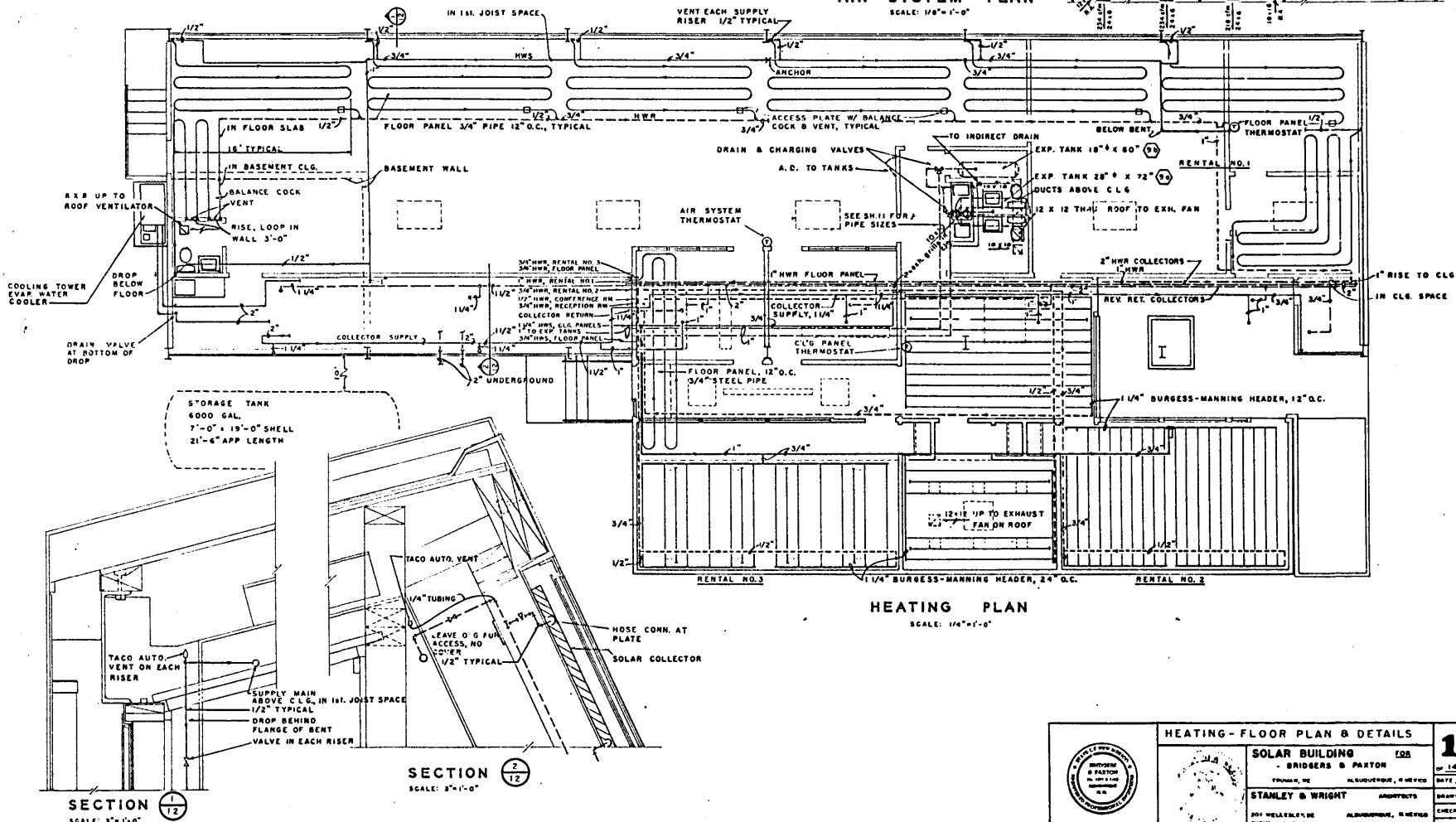
FLOOR HEATING PANEL DETAIL

SCALE 3/4" = 1'-0"



AIR SYSTEM PLAN

SCALE: 1/8" = 1'-0"



HEATING PLAN

SCALE: 1/4" = 1'-0"

SECTION (1/12)

SCALE: 3" = 1'-0"

SECTION (2/12)

SCALE: 3" = 1'-0"

HEATING - FLOOR PLAN & DETAILS

SOLAR BUILDING FOR - BRIDGERS & PAXTON

TRUMANN, NE ALBUQUERQUE, N MEXICO

STANLEY & WRIGHT ARCHITECTS

207 WELLESLEY SE ALBUQUERQUE, N MEXICO

PHONE 6-7159

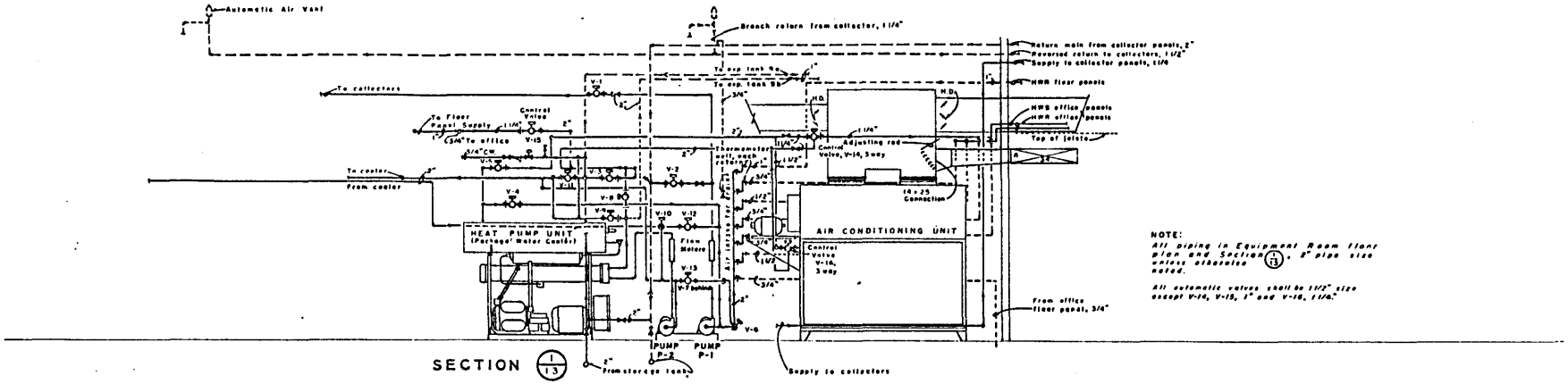
12 OF 14

DATE 4-15-55

DRAWN BY WH-JC

CHECKED BY DP

JOB NO 5415



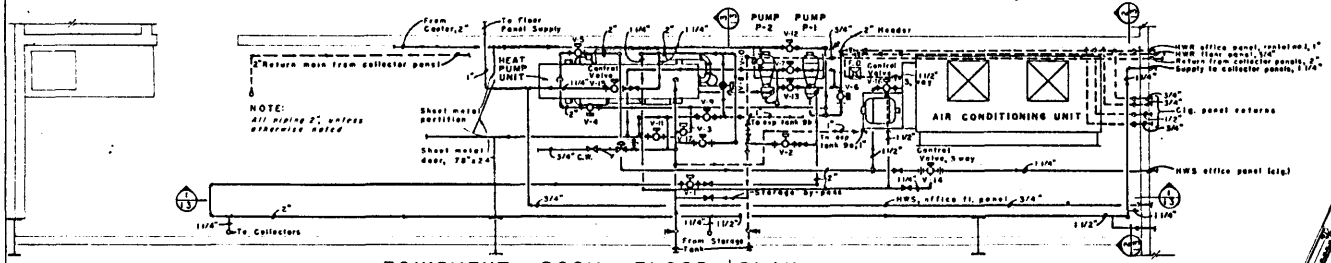
SECTION 1/13

EQUIPMENT ROOM ELEVATION

SCALE: 1/2" = 1'-0"

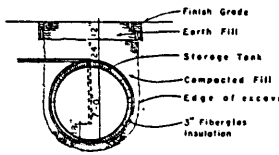
NOTE:
All piping in Equipment Room floor plan and Section 1/13, 2" pipe size unless otherwise noted.

All automatic valves shall be 1 1/2" size except V-14, V-15, 1" and V-16, 1 1/4".



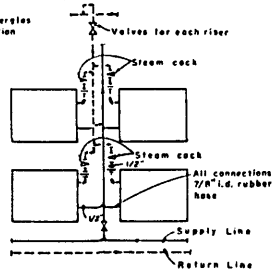
EQUIPMENT ROOM FLOOR PLAN

SCALE: 1/2" = 1'-0"



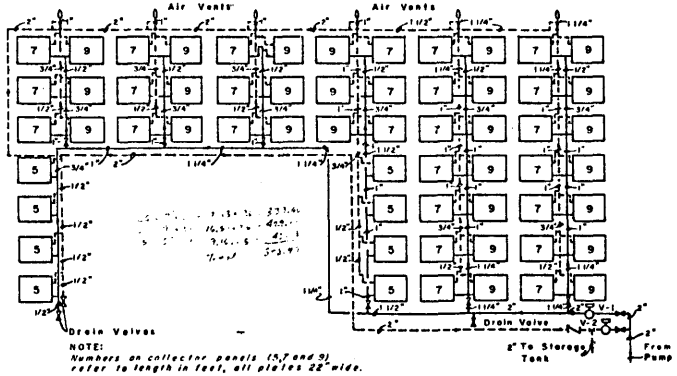
STORAGE TANK INSTALLATION DETAIL

NOT TO SCALE



PANEL SCHEMATIC

NOT TO SCALE

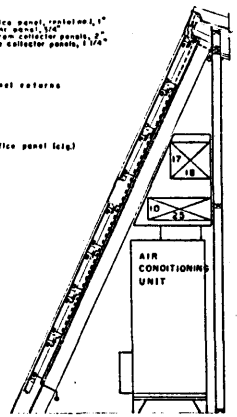


NOTE:
Numbers on collector panels (5,7 and 9) refer to length in feet, all plates 22" wide.

SCHEMATIC PIPING FOR COLLECTOR PANELS

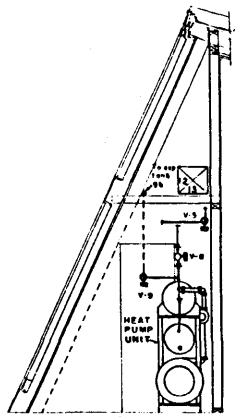
(INSIDE ELEVATION)

NOT TO SCALE



SECTION 2/13

SCALE: 1/2" = 1'-0"



SECTION 3/13

SCALE: 1/2" = 1'-0"

HEATING – SECTIONS & DETAILS

SOLAR BUILDING FOR BRIDGERS & PAXTON

TRUMBULL, MASS. ALBUQUERQUE, N. MEXICO

STANLEY & WRIGHT ARCHITECTS

207 WELLS BLDG., MINNEAPOLIS, MINN. PHONE 6-7126 ALBUQUERQUE, N. MEXICO

13 OF 14

DATE 4-15-55

DRAWN BY W.H.

CHECKED BY D.P.

JOB NO. 5415

piping legend

symbols	
—·—	cold water
—··—	hot water (domestic)
—HWS—	hot water supply (heating)
—HWR—	hot water return (heating)
——	sanitary sewer
—D—	drainage
———	vent line
—CWS—	chilled water supply
—CWR—	chilled water return
—RL—	refrigerant liquid line
—RS—	refrigerant suction line
—RD—	refrigerant discharge line
	gate valve
	globe valve
	check valve
	relief valve or safety valve
	automatic control valve
	pressure reducing valve
	thermostatic expansion valve
	angle valve
	gate valve in rise
	plug valve
	strainer
	pressure gauge
	thermometer
	floor drain
	union
	automatic air vent

abbreviations

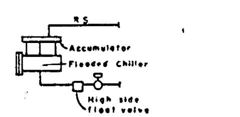
BTU	british thermal unit
GPM	gallons per minute
MBH	thousand BTU/hr.
EWC	electric water cooler
Lav.	lavatory
W.C.	water closet
C.I.	cast iron
C.O.	cleanout
H.B.	hosebib
V.T.R.	vent through roof
W.H.	wall hydrant
F.D.	floor drain
PRV	pressure reducing valve
O.A.E.	or approved equal

system legend

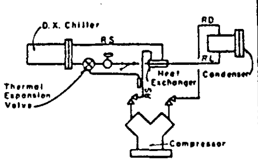
symbol	
	louver
	[illegible] and parallel [illegible] dampers
	supply duct
	return duct or exhaust
	duct dimensions [illegible] inches
	flexible connect[illegible]
	ceiling grille, return [illegible] exhaust
	supply grille, cfm and size
	ceiling diffuser
	duct turning [illegible]
T	room thermostat
T	duct thermostat
F	freestat
DM	damper motor
P	pressure stat
	remote bulb thermometer
	remote bulb thermostat

abbreviations

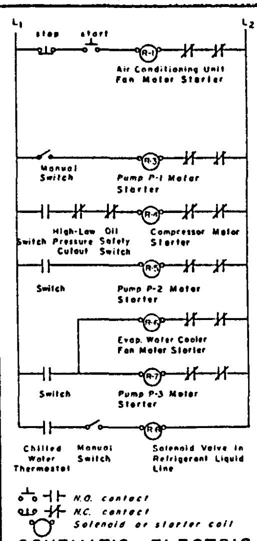
A.D.	access door
A.S.M.E.	amer. society of [illegible] engrs.
cfm	cubic feet per minute
[illegible]	[illegible] acting
[illegible]	[illegible] bulb [illegible]
F.A.	fresh air
[illegible]	[illegible] damper
MBH	thousand [illegible]
N.C.	normally closed
N.O.	normally open
R.A.	return air
R.A.	reverse acting
S.D.	splitter damper
S.P.	static pressure
W.B.	wet bulb temperature
[illegible]	[illegible]



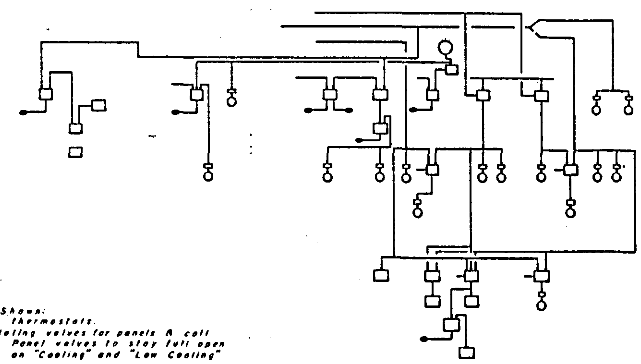
ALTERNATE PIPING FOR FLOODED CHILLER



SCHEMATIC REFRIGERATION PIPING

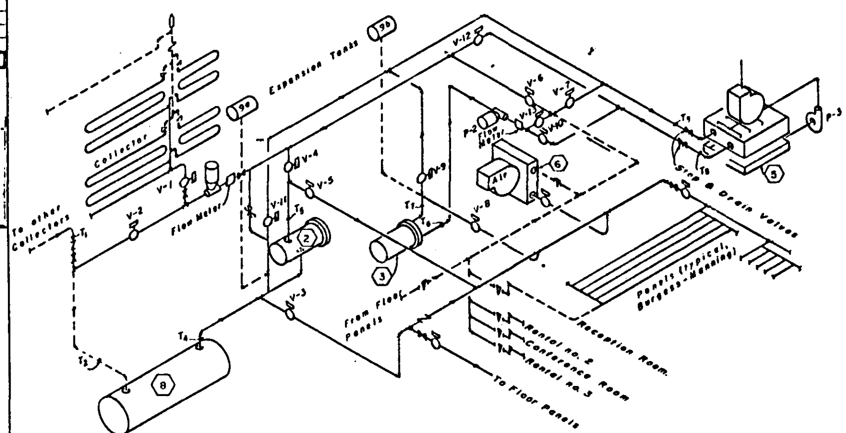


SCHEMATIC ELECTRIC CONTROL DIAGRAM



Not Shown:
Room thermostats.
Modulating valves for panels & coil
NOTE: Panel valves to stay full open on "Cooling" and "Low Cooling"

SCHEMATIC CONTROL DIAGRAM



SCHEMATIC PIPING DIAGRAM

CYCLES

1, 2	Heating - Collector or Storage direct to panels	
3a, 3b	Heating	Collector or storage to chiller Condenser to panels
4	Cooler to storage	
5a, 5b	Cooling	Chiller to panels Cooler to condenser
6	Cooler to panels	

CYCLES	CONTROLS
1, 2	On for "Heating" and reception rm. 'stat satisfied
3a, 3b	On for "Heating" and reception rm. 'stat not satisfied
4	On for "Cooling" and "Night"
5a, 5b	On for "Cooling" and "Day"
6	On for "Low Cooling"

PUMPS

P-1 On all cycles except 6
P-2 On 3, 5, 6 (also cooler fan)
P-3 (Cooler spray) on 3, 5, 6 and T8 > 50°
Compressor on 3, 5

VALVES

NOTE: All valves 30 gpm at 2 ft. drop

V-1	N.O.	Close if $T_3 > T_1$, close on "Cooling"
V-2	N.C.	Open if $T_3 \geq T_1$, open on "Cooling"
V-3	N.C.	Open 1, 2.
V-4	N.C.	Open on 3
V-5	N.C.	Open on 5
V-6	N.C.	Open 1, 2, 5
V-7	N.C.	Open 6
V-8	N.C.	Open 3, 6
V-9	N.C.	Open 5
V-10	N.C.	Open 5, 6
V-11	N.C.	Open 4
V-12	N.C.	Open 4
V-13	N.C.	Open 3

CONTROL DESCRIPTION AND SEQUENCE

EQUIPMENT SCHEDULE

(1) **REFRIGERATION COMPRESSOR**: Capacity 7.5 tons refrigeration effect at 110° condensing, 45° suction, 7½ hp motor, max. 6.0 BHP.

(2) **WATER CHILLER**: Capacity to cool 24 gpm from 48° to 40° with 35° suction, F-12 refrigerant Full flooded, with suction accumulator above chiller or direct expansion with 8° min. superheat. 9 ft. max. water pressure drop.

(3) **REFRIGERATION CONDENSER**: 110° condensing temp. with 24 gpm water entering at 95° leaving at 105°, .001 scale factor F-12 refrigerant. 9 ft. max. water pressure drop.

(4) **SUCTION GAS HEAT EXCHANGER**: Nominal 7.5 ton capacity

NOTE: Items 1, 2, 3, 4 may be combined in a factory assembled, package water chiller.

(5) **EVAPORATIVE WATER COOLER**: Capacity to cool 24 gpm water from 85° to 75° with 67° w.b. air temp. Complete with blower, motor, spray pumps, prime surface coil and starters with weatherproof housing for outdoor installation. Max. water pressure drop through coil = 5 ft.

(6) **AIR CONDITIONING UNIT**: 5200 cfm at ½" external s.p., 6 row water coil sized for 500 f.p.m. max. face velocity, 12 g.p.m. water, 5 ft max. water pressure drop. Throwaway type filters, 2 hp motor.

(7) **PUMPS**: Capacity - 30 g.p.m. at 30 ft head, ¾ hp 1750 rpm motor. Close coupled centrifugal.

(8) **STORAGE TANK**: 4000 gal capacity, 7 ft. diam. x 14 ft. long, 3/16" steel plate, one coat bitumastic paint inside.

(9) **EXPANSION TANK**: A.S.M.E. code construction for 50 p.s.i. working pressure, with water column

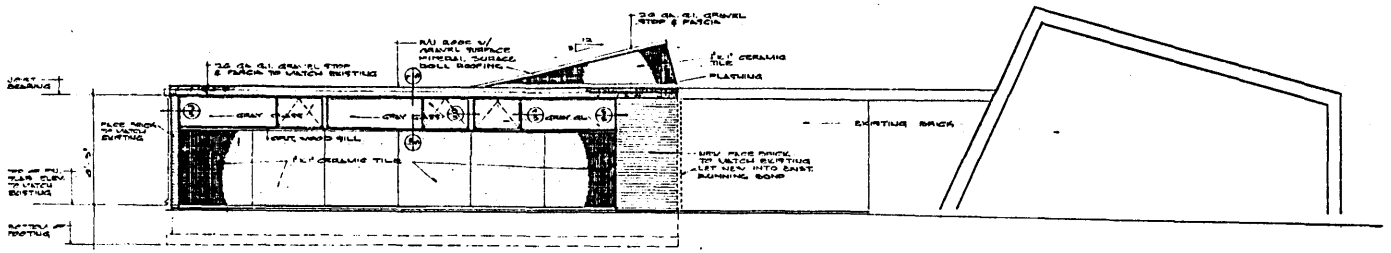
9a 200 gal. capacity
9b 60 gal. capacity

HEATING - SCHEDULES & DIAGRAMS

SOLAR BUILDING FOR
BRIDGERS & PAXTON
ALBUQUERQUE, N. MEXICO

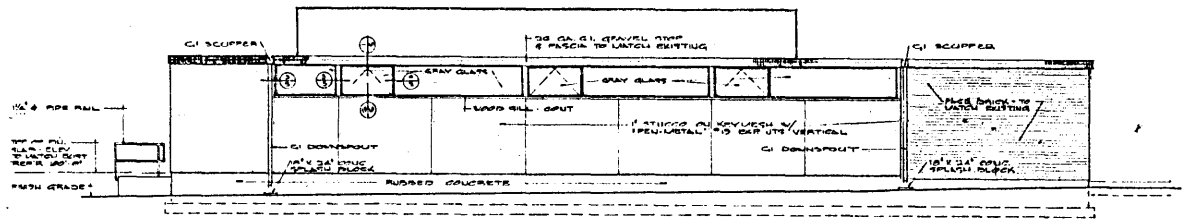
STANLEY & WRIGHT ARCHITECTS
ALBUQUERQUE, N. MEXICO

14
OF ____
DATE ____
DRAWN BY ____
CHECKED BY ____



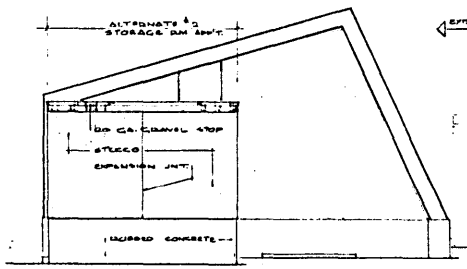
EAST ELEVATION

SCALE 1/4" = 1'-0"



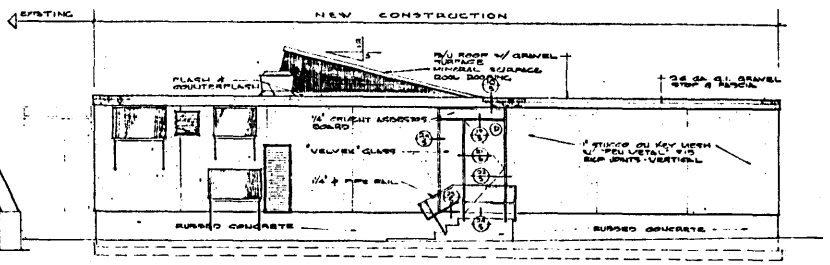
SOUTH ELEVATION

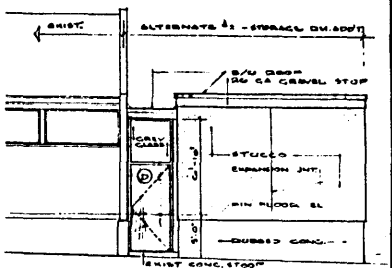
SCALE 1/4" = 1'-0"



WEST ELEVATION

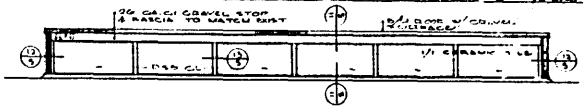
SCALE 1/4" = 1'-0"





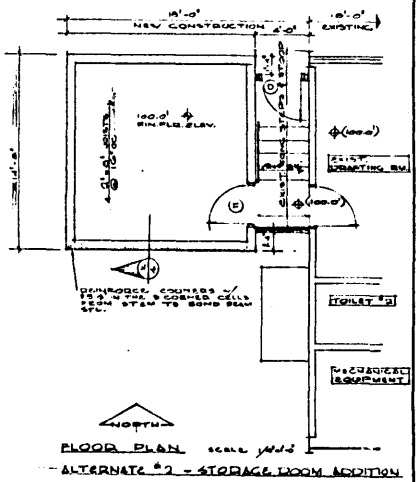
NORTH ELEVATION - ALTERNATE #2

SCALE 1/4" = 1'-0"



NORTH ELEVATION - CLERESTORY

SCALE 1/4" = 1'-0"



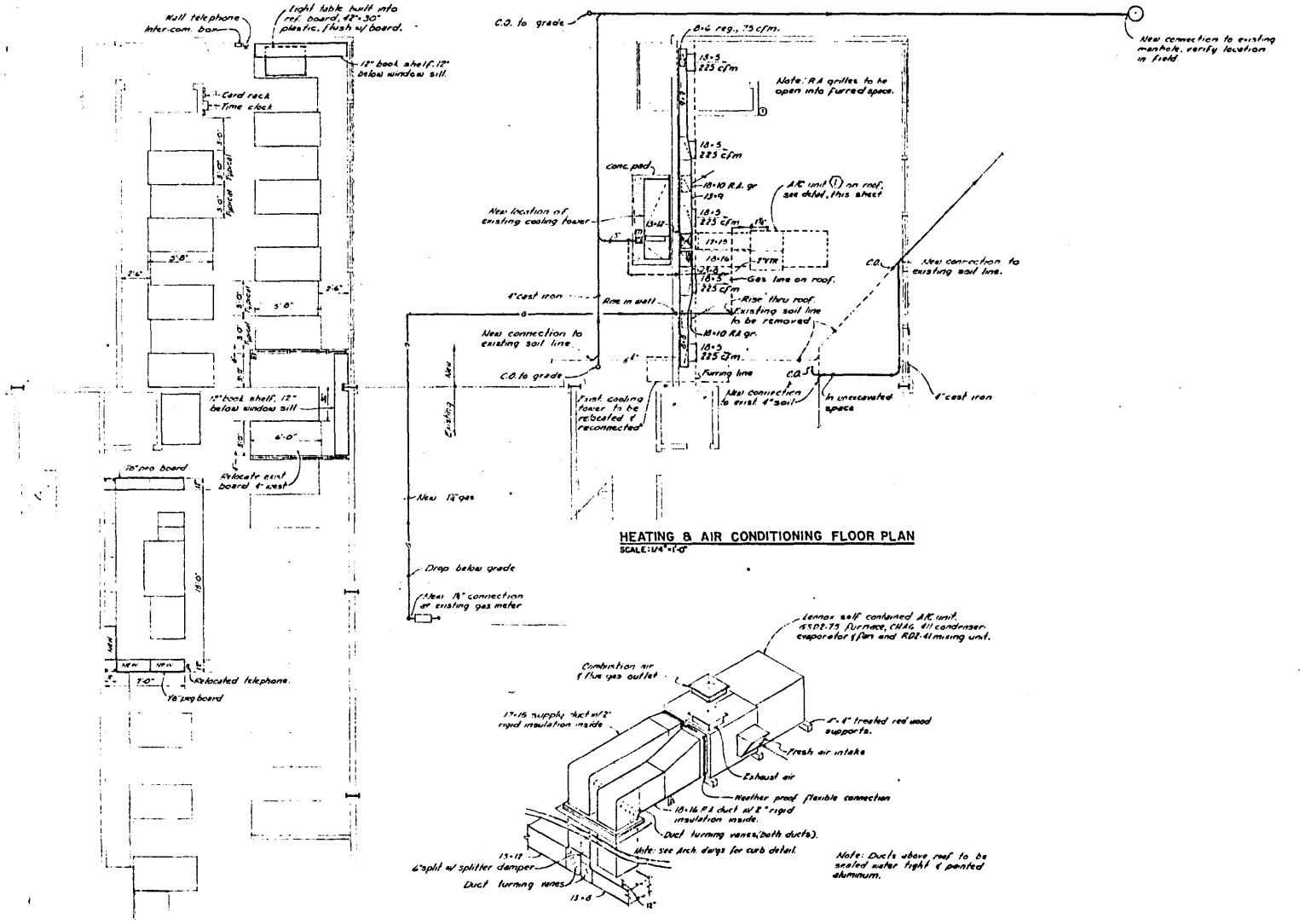
FLOOR PLAN

SCALE 1/8" = 1'-0"

ALTERNATE #2 - STORAGE ROOM ADDITION

STATE OF NEW MEXICO — STANLEY & WRIGHT — No. 119 — REGISTERED ARCHITECTS

STANLEY & WRIGHT AIA — ARCHITECT PLANNER — 1311 SAN PEDRO DR. N.E. ALBUQUERQUE, NEW MEXICO	PROJECT: ADDITION TO SOLAR BUILDING	DRAWN BY: V.A.A.	SHEET NO. 3
PHONE: 265-5300	SHEET TITLE: EXTERIOR ELEVATIONS	CHECKED BY:	JOB NUMBER: 8102



FURNITURE LOCATION FLOOR PLAN
SCALE: 1/4" = 1'-0"

HEATING & AIR CONDITIONING FLOOR PLAN
SCALE: 1/4" = 1'-0"

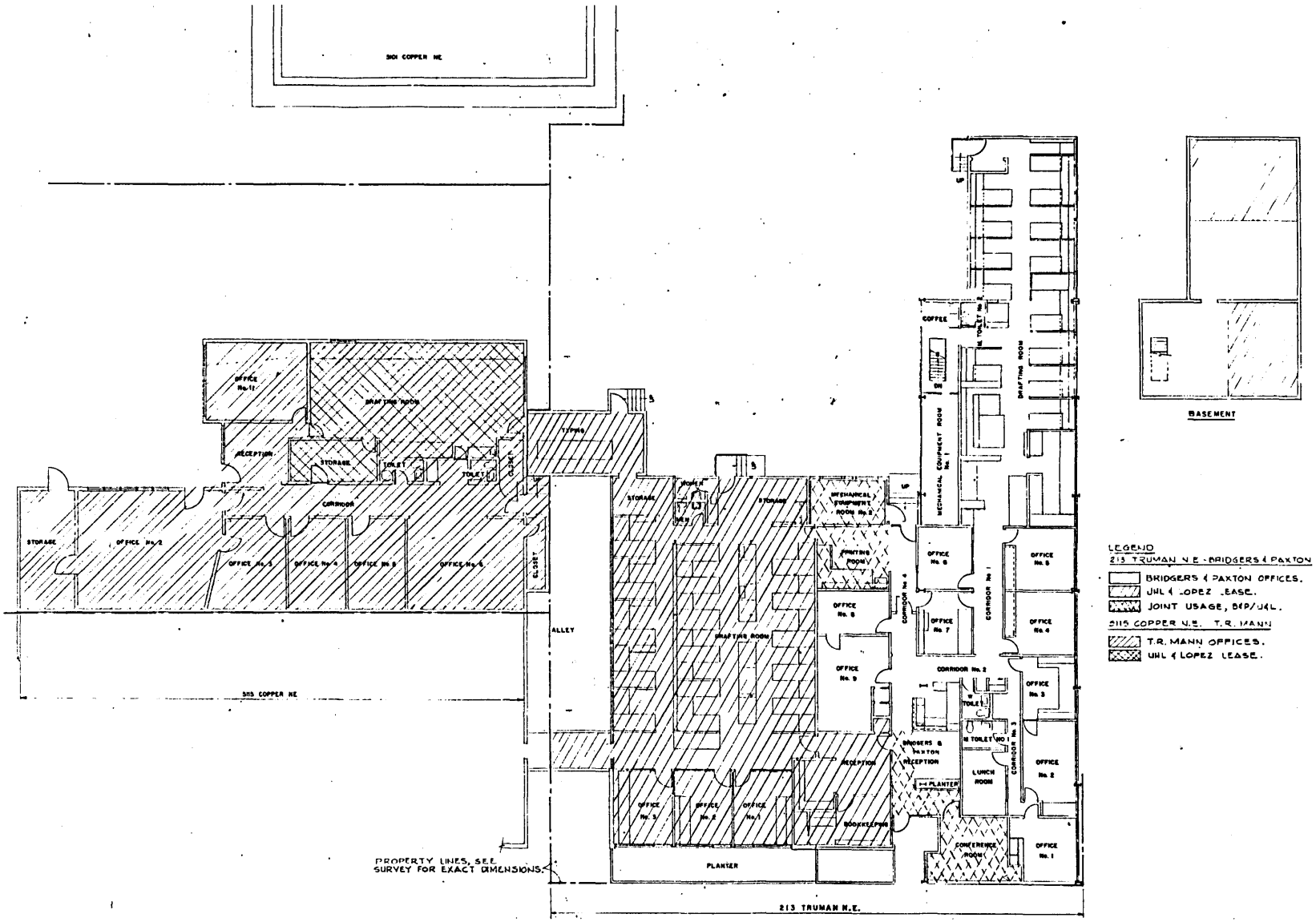
AIR CONDITIONING UNIT DETAIL
SCALE: NONE

GEORGE S. WRIGHT A.I.A.
THOMAS A. WEBB

ADDITION TO SOLAR BUILDING
FOR ROGERS & PAXTON
TRUMAN ST. NE ALBUQUERQUE N.M.

DATE: 11/20/79
PROJ. NO. 6305
DRAWN BY: J.C.

2



FLOOR PLAN: 213 TRUMAN NE

SCALE: 1/8"-1'0"