142
11-14-75

Dc-1741

ANCR-1256
UC-13

IDAHO NATIONAL ENGINEERING LABORATORY

FEASIBILITY REVIEW FOR GEOTHERMAL CONVERSION OF EXISTING H&V SYSTEMS ON THE BOISE GEOTHERMAL SPACE HEATING PROJECT

L.D. Torgerson
A.S. Richardson

PREPARED FOR THE
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
IDAHO OPERATIONS OFFICE UNDER CONTRACT E (10-1)-1375

DATE PUBLISHED—SEPTEMBER 1975

MASTER

Aerojet Nuclear Company
IDAHO FALLS, IDAHO - 83401

DISCLAIMER

Printed in the United States of America
Available from
National Technical Information Service
U. S. Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22161
Price: Printed Copy $5.45; Microfiche $2.25

ANCR-1256

ANCR-1256

FEASIBILITY REVIEW

FOR GEOTHERMAL CONVERSION OF EXISTING H&V SYSTEMS

ON THE BOISE GEOTHERMAL SPACE HEATING PROJECT

L. D. Torgerson

A. S. Richardson

AEROJET NUCLEAR COMPANY

Date Published - September 1975

Prepared for The

Energy Research and Development Administration
Idaho Operations Office
Under Contract No. E -(10-1)-1375

ABSTRACT

A pilot demonstration project to be located in the city of Boise, Idaho has been initiated to heat by geothermal water a number of public buildings. This report presents the findings of a study which was made to review the feasibility of converting the various public building heating systems to allow the use of geothermal water at a temperature of at least $170^{o}F$ as a heat source.

TABLE OF CONTENTS

FIGURES

FIGURES (Cont'd)

1.0 SUMMARY

This report presents and summarizes the findings of a study to evaluate the feasbility of converting various building heating systems in Boise, Idaho so as to allow the use of geothermal water at 170° F as a heat source. Of the many buildings investigated, this report addresses itself to those buildings which appear to have the greatest potential for conversion to hot water heat. Those buildings having such potential are currently heated using hot water pumped to convectors or with heated air circulated to room diffusers through ductwork and include:

Circulated Hot Water

Idaho State Capitol Building (80% Hot Water)
Idaho Veterans Retirement Home (100% Hot Water)
Boise City Library (75% Hot Water)

Forced Air

Len B. Jordan Building
Idaho Supreme Court Building
Idaho State Library and Archives Building
School of Business Building BSU
Library Building BSU
Liberal Arts Building BSU
Student Union Building BSU
Federal Office Building
Federal Post Office 8th and Bannock

Modifications to these buildings such that geothermal hot water could be used in the heating systems include:

1. Installation of a heat exchanger in existing piping such that geothermal hot water could be used to supply heat to the heating system water in the circulated hot water systems.

2. Installation of a hot water coil in the existing ductwork such that geothermal hot water could be used to supply heat to the air in the forced air heating systems.

Buildings in the proposal or initial construction stages which were discussed with persons involved with the design and approval of such design include: The State Office Building, City/County Office Complex and four new schools. Those individuals were made aware of the Geothermal Project and that they should make every effort to see that provisions were made so that geothermal hot water could be made a part of the heating system with a minimum of modifications.

2.0 INTRODUCTION

A study was undertaken to investigate the heating systems in various buildings in Boise, Idaho and determine the feasibility of converting or making modifications such that geothermal water at 170° F could be used as an energy source. For the purpose of this report an assumption was made that sufficient geothermal water at 170° F was available for use and also available was a means for the disposal of thermally spent geothermal waste water. This report, therefore, addresses itself only to building heating systems and their potential for conversion such that a hot water heat source could be utilized.

The following buildings were investigated:

1. Idaho State Capitol Building
2. Boise City Library
3. Idaho Veterans Retirement Home
4. Len B. Jordan State Office Building
5. Idaho Supreme Court Building
6. Idaho State Library and Archives Building
7. Federal Office Building
8. Federal Post Office Building
9. School of Business Building BSU
10. Library Building BSU
11. Liberal Arts Building BSU
12. Student Union Building BSU
13. Marion Hall on the Capitol Mall Grounds
14. Ada County Court House
15. Veterans Hospital Complex
16. Boise City Schools, 41 Each
17. Boise State University Central Boiler Plant
18. Idaho Capitol Mall Central Boiler Plant

Note: Refer to the Boise Partial City Map, Capitol Mall Plan and Boise State University Plan for the location of the above buildings with the exception of the 41 public schools (#16). The schools are dispersed throughout the City.

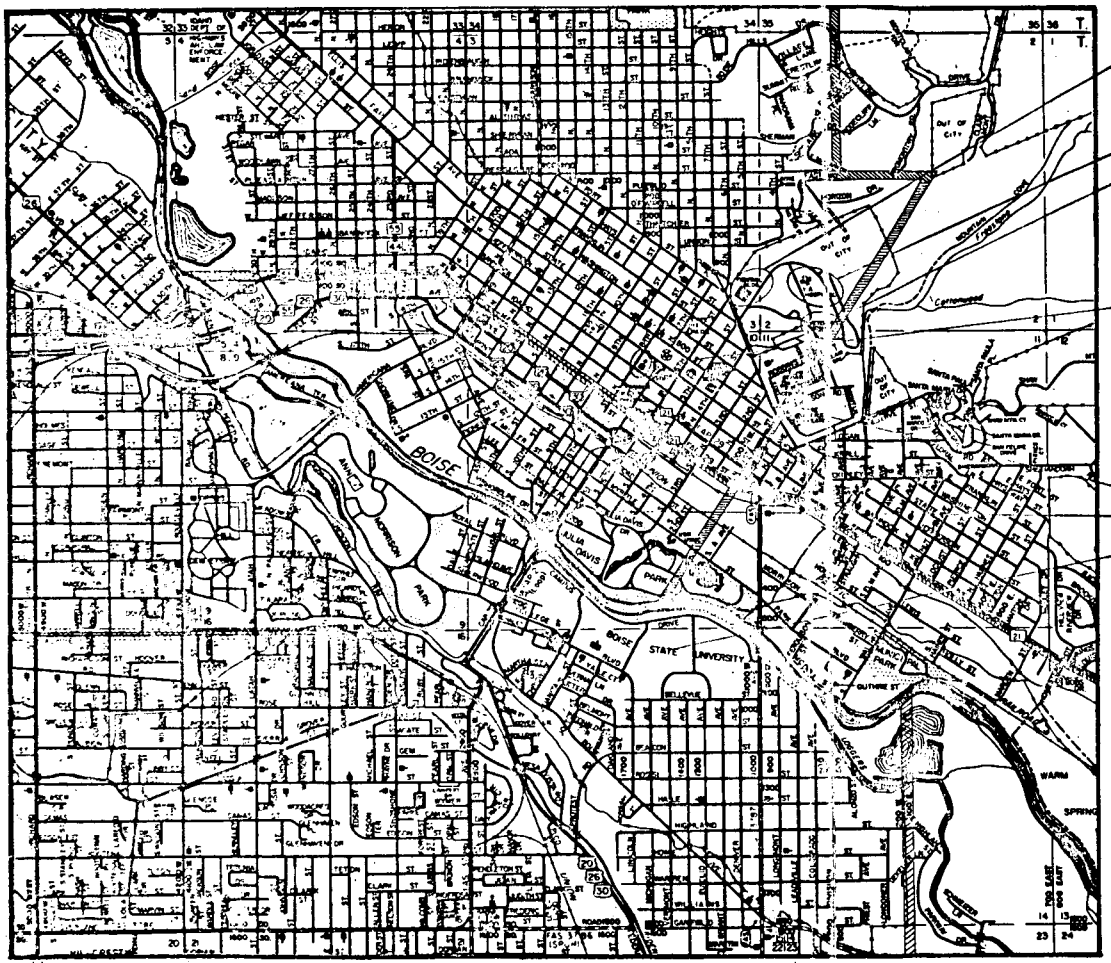
Of the referenced buildings, the first 12 were found to have, in varying degrees, the greatest potentials for conversion to geothermal hot water heat.

The remainder of the buildings, items 13 through 18, were found to be poor candidates for geothermal conversion. Marion Hall, the Ada County Court House and the Veterans Hospital Complex are steam heated using for the most part steam convectors. The conversion of these systems would require new heating convectors and associated pipe and fittings throughout each building.

The Boise City School buildings are for the most part steam heated wall convectors passing a good percentage of outside air through a heating coil and distributing it within the room. This type of convector requires steam so as to keep the unit from freezing. There are also direct fired natural gas heating units in four schools, and one smaller school with a forced air system. Some of the steam plants for the various schools are said to return condensate at 120° F for 130° F. Geothermal hot water might at some time be considered to preheat boiler feed water to 160° F and eliminate a small portion of the boiler load but such conversions are not felt to be within the scope of the project.

The two steam plants, one at the Capitol Mall the other at Boise State University were inspected to determine if geothermal hot water could be used for preheating condensate. Both of these facilities return condensate at 155° F to 160° F and as such only a negligible gain (5%) could be realized from geothermal hot water at 170°.

This report addresses itself to the various modifications required at each building such that geothermal hot water heating could be incorporated into existing systems. The recommendations are based on preliminary investigations and serve only to depict one possible method of performing conversions. It will be noted that the existing heating systems, steam coils, heat exchangers, etc., are not shown to be removed when the geothermal modifications are made. There is a two fold reason for this: First, this being somewhat a pilot project for this area it is felt until the geothermal source has been proven, a back-up system is required. Secondly, the proposed geothermal heating systems which could be fit into existing equipment may not carry the total heating load and as such would require an additional heat source. In the future, if proven geothermal sources are used, there is no reason a building's heating system could not be designed totally around geothermal hot water.



- FEDERAL OFFICE BUILDING FIGURE 6-1
- VETERANS HOSPITAL
- VETERANS RETIREMENT HOME - FIGURE 8-1
- CAPITOL MALL SEE ENLARGED PLAN, FIGURE 1
- FEDERAL POST OFFICE FIGURE 7-1
- BOISE CITY LIBRARY - FIGURE 13-1
- BOISE STATE UNIVERSITY SEE ENLARGED PLAN, FIGURE 2

N

PARTIAL CITY MAP

BOISE

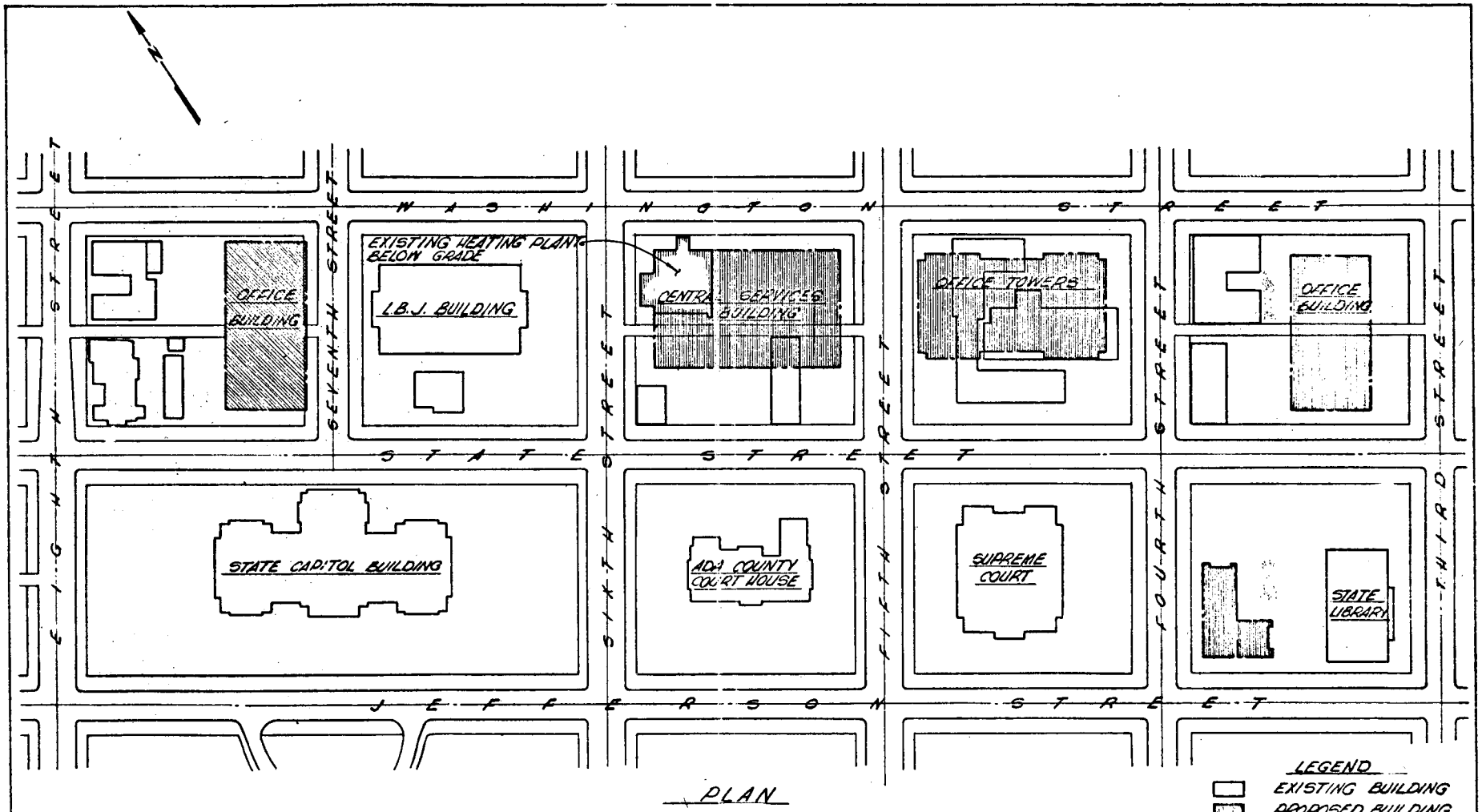


FIGURE 1
CAPITOL MALL PLOT PLAN

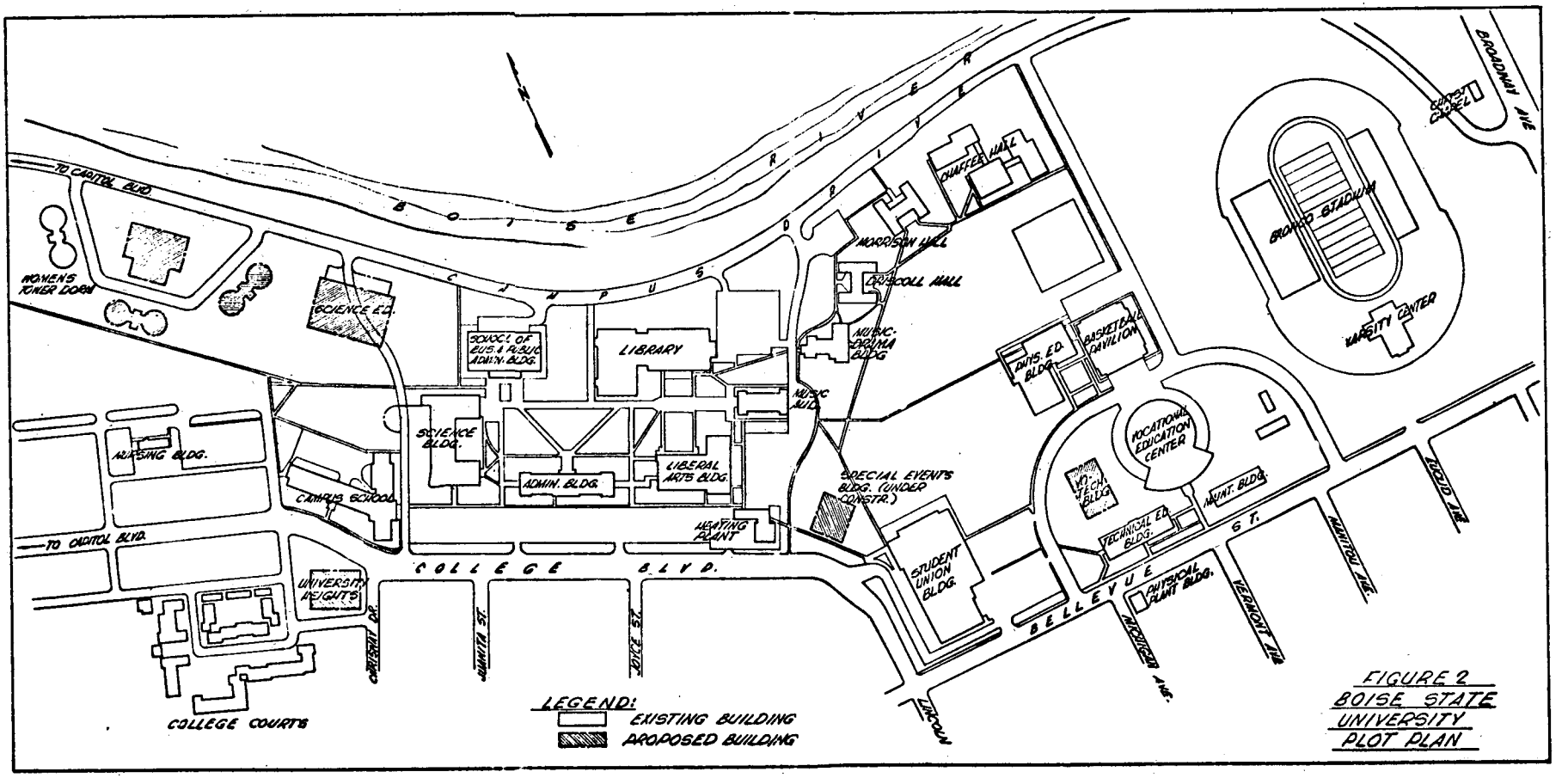


FIGURE 2
BOISE STATE UNIVERSITY
PLOT PLAN

3.0 PROJECT DESCRIPTION

Of those aforementioned buildings having potential for geothermal heating conversion two distinct building heating concepts are apparent, hot water circulated to convectors located in heated spaces and heated forced air blown to diffusers located in heated spaces. To modify existing hot water systems a geothermal hot water heated heat exchanger would be installed in series with the existing steam heated heat exchanger. Water to be used for heating would then be pumped through the new heat exchanger and back into the existing hot water piping. Refer to Figure #3. To modify the heated forced air systems a new hot water coil would be installed in the existing ductwork. Air to be used for space heating would then be drawn or blown thru the geothermal hot water heating coil and continue on through existing ductwork. Refer to Figure #4. The modifications required to existing forced air systems such that a new hot water coil can be installed vary in complexity and could include:

1. Modifications to existing supply or return air ductwork.

2. Installation of larger blower motor to overcome additional hot water coil static pressure.

3. Installation of a "dummy coil" in the cold deck such that the proper static pressure is maintained relative to the hot deck.

4. Sheet metal modifications to existing air handler enclosures.

5. Miscellaneous piping and control modifications.

The following subsections depict in some detail the heating and cooling system for each of the twelve buildings found to have geothermal hot water heating potential. Also, shown is one possible method of performing necessary modifications such that new heat exchangers and hot water heating coils could be installed in the existing systems.

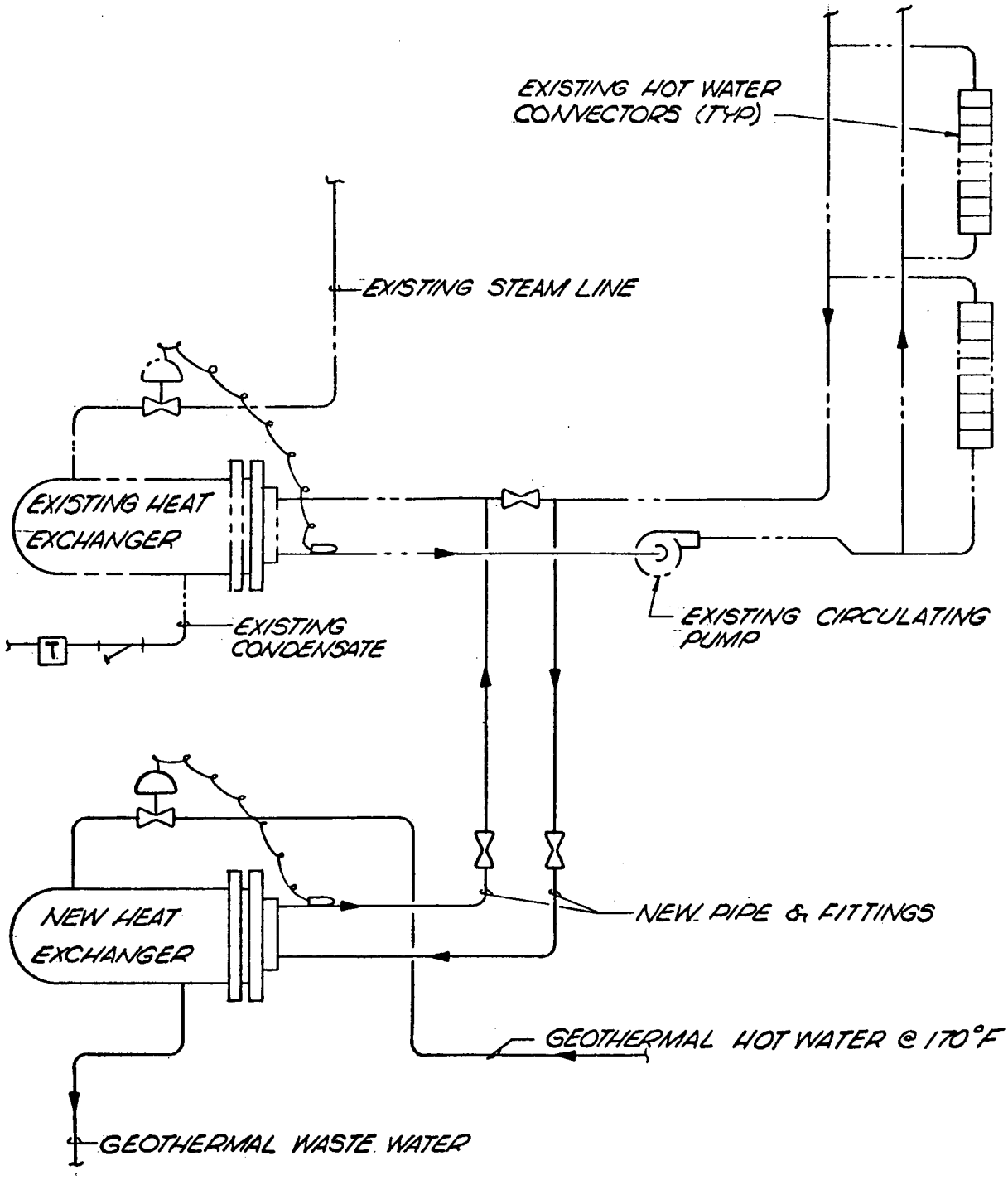
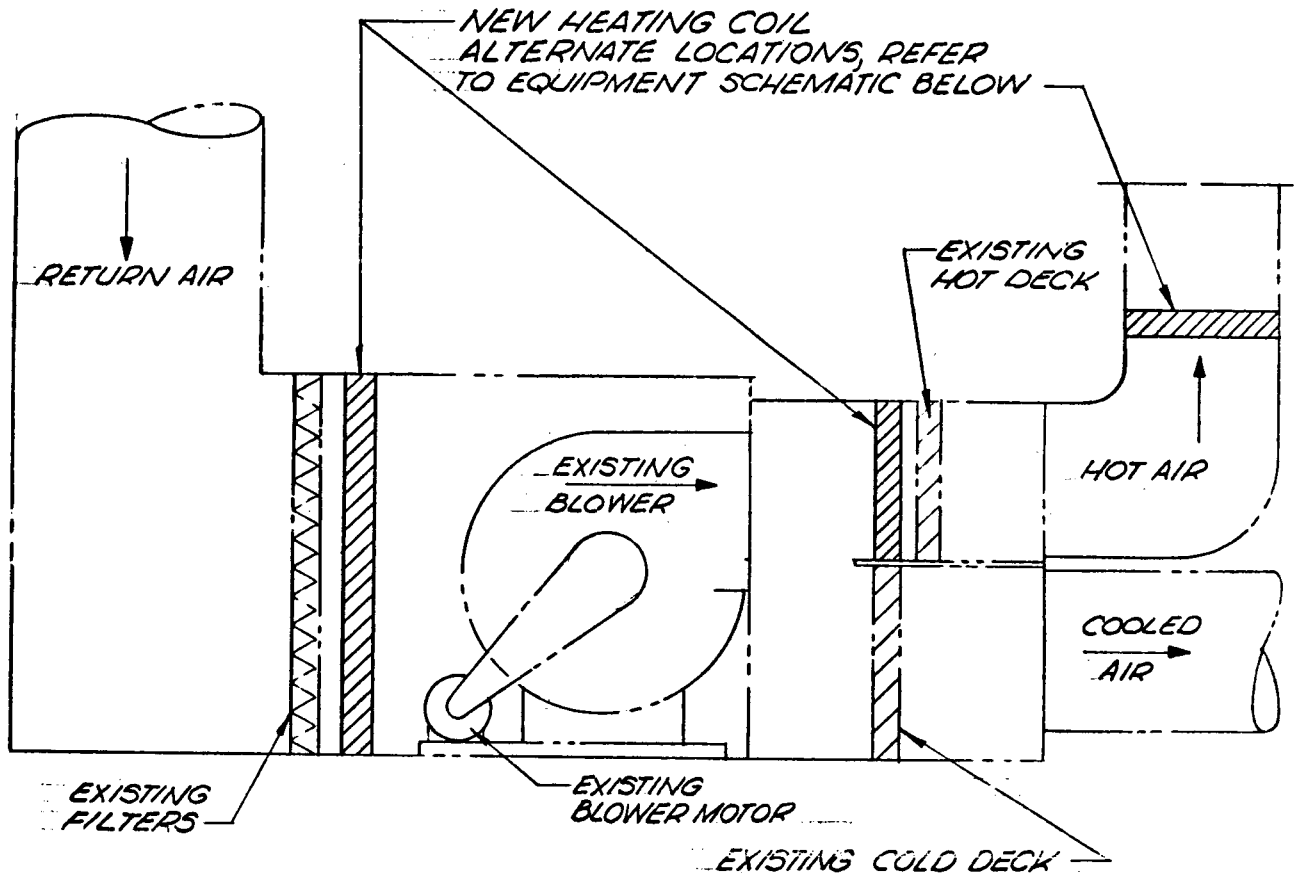


FIGURE 3
TYPICAL MODIFICATIONS TO EXISTING HOT WATER HEATING SYSTEMS



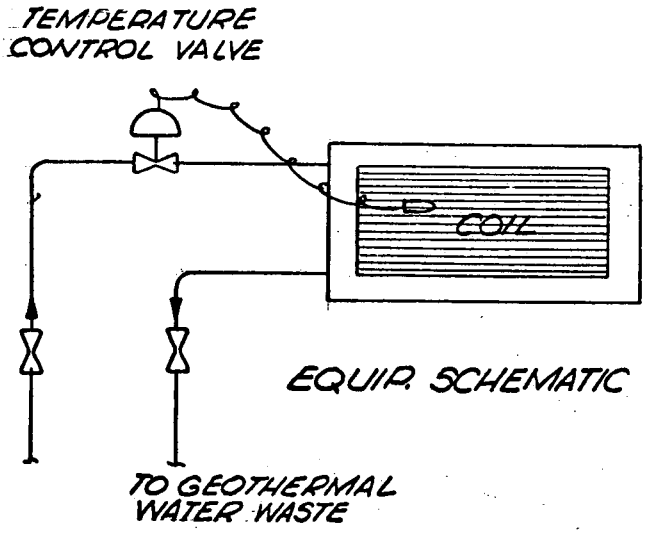


FIGURE 4
TYPICAL MODIFICATIONS TO EXISTING
FORCED AIR HEATING SYSTEMS

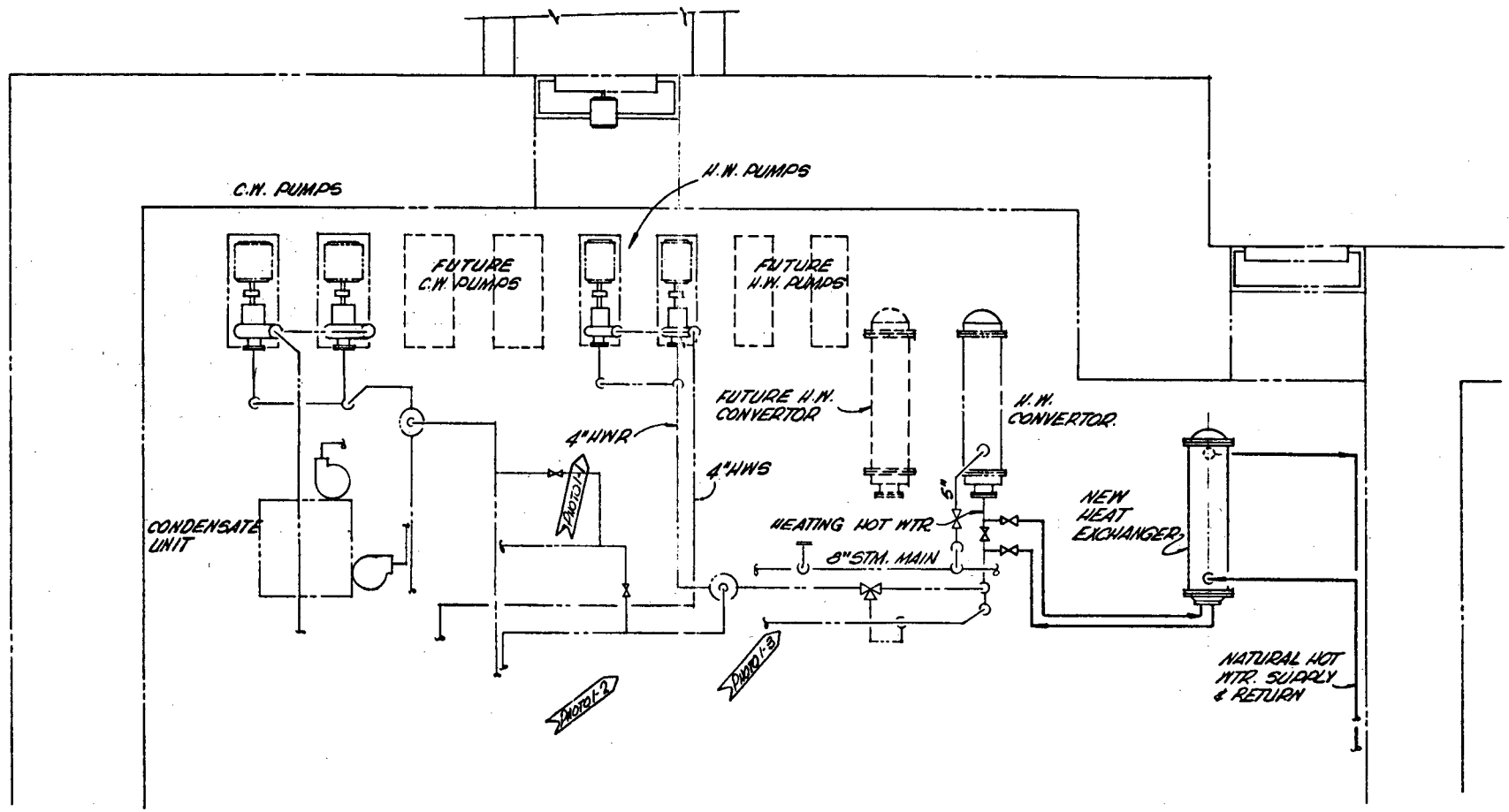
3.1 Idaho State Capitol Building

At the present time approximately 80% of the Capitol Building is heated with hot water with plans to convert the remaining 20% to hot water within the near future.

The existing system uses a steam/water heat exhanger to heat water which is then circulated to convectors located throughout the Capitol Building. In the near future an additional circulating pump and heat exchanger will be installed to carry the load as more and more of the Capitol Building is converted to hot water heat.

Modifications to the system to allow the use of geothermal hot water would be very minor and require only a geothermal water/water heat exchanger, miscellaneous piping and valves. The existing circulating pumps would then draw or pump water through the existing steam/water heat exchanger and also through the new geothermal water/water heat exchanger.

Refer to Figure 1-1 and photographs 1-1, 1-2 and 1-3 at the end of this subsection. Locations from which the photographs were taken are indicated on Figure 1-1.



PARTIAL PLAN 3/8" = 1'-0"

LEGEND:
EXIST.
NEW

NOTE: ALL EXIST. PIPING & EQUIP. IS NOT SHOWN.

FIGURE 1-1
IDAHO STATE CAPITOL BUILDING
MECHANICAL ROOM

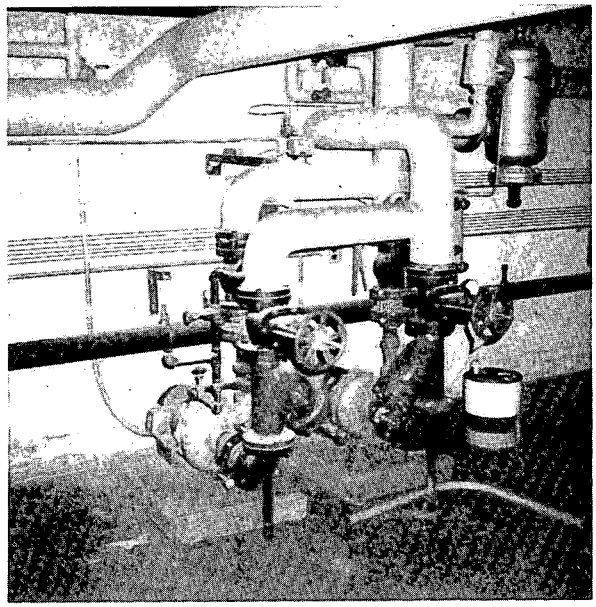


Photo 1-1

Two hot water circulation pumps

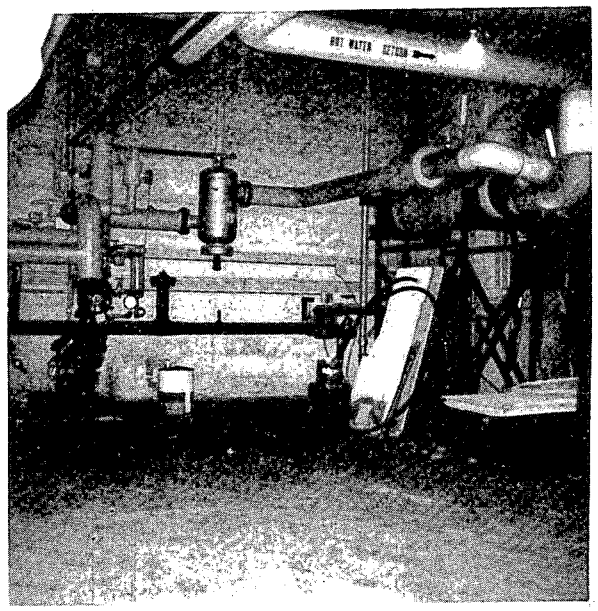


Photo 1-2

Hot water circulation lines with floor space reserved for future hot water convector. One hot water convector is shown in the background and to the right.

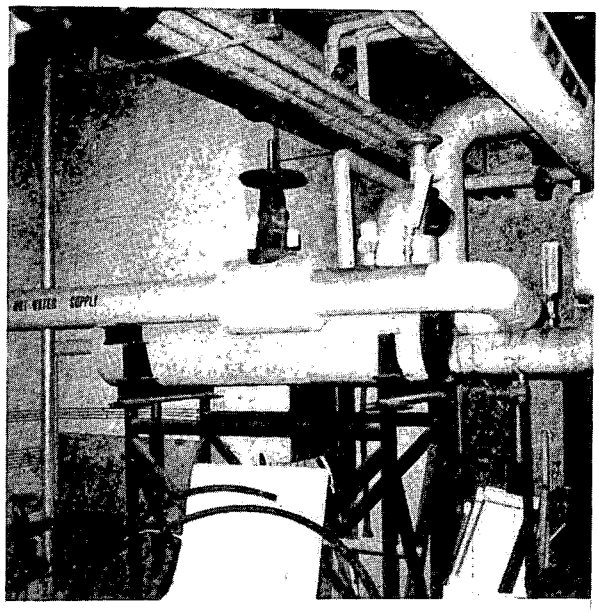


Photo 1-3

Close up of the hot water convector with associated piping and valving

3.2 Len B. Jordan State Office Building

The Len B. Jordan State Office Building is presently heated and cooled through a two pipe HVAC forced air system covering all but the E.O.C.*area. The E.O.C. area in the basement is heated and cooled through a package HVAC forced air unit. Steam is supplied to both systems from the Capitol Mall Central Boiler Plant. Heat is supplied to the forced air through steam coils located down stream from the fans.

Modifications to the systems would include the installation of a geothermal hot water fin tube coil located between the existing steam coils and the fans. The new coils will add some additional pressure drop in the system and as such the fans will be sped up. No investigation was made at this time to determine if sufficient fan motor capacity exists or if new fan motors will be required.

Refer to Figures 2-1 and 2-2 and photographs 2-1 through 2-7 at the end of this subsection. Locations from which the photographs were taken are indicated on Figure 2-1.

* Emergency Operational Control

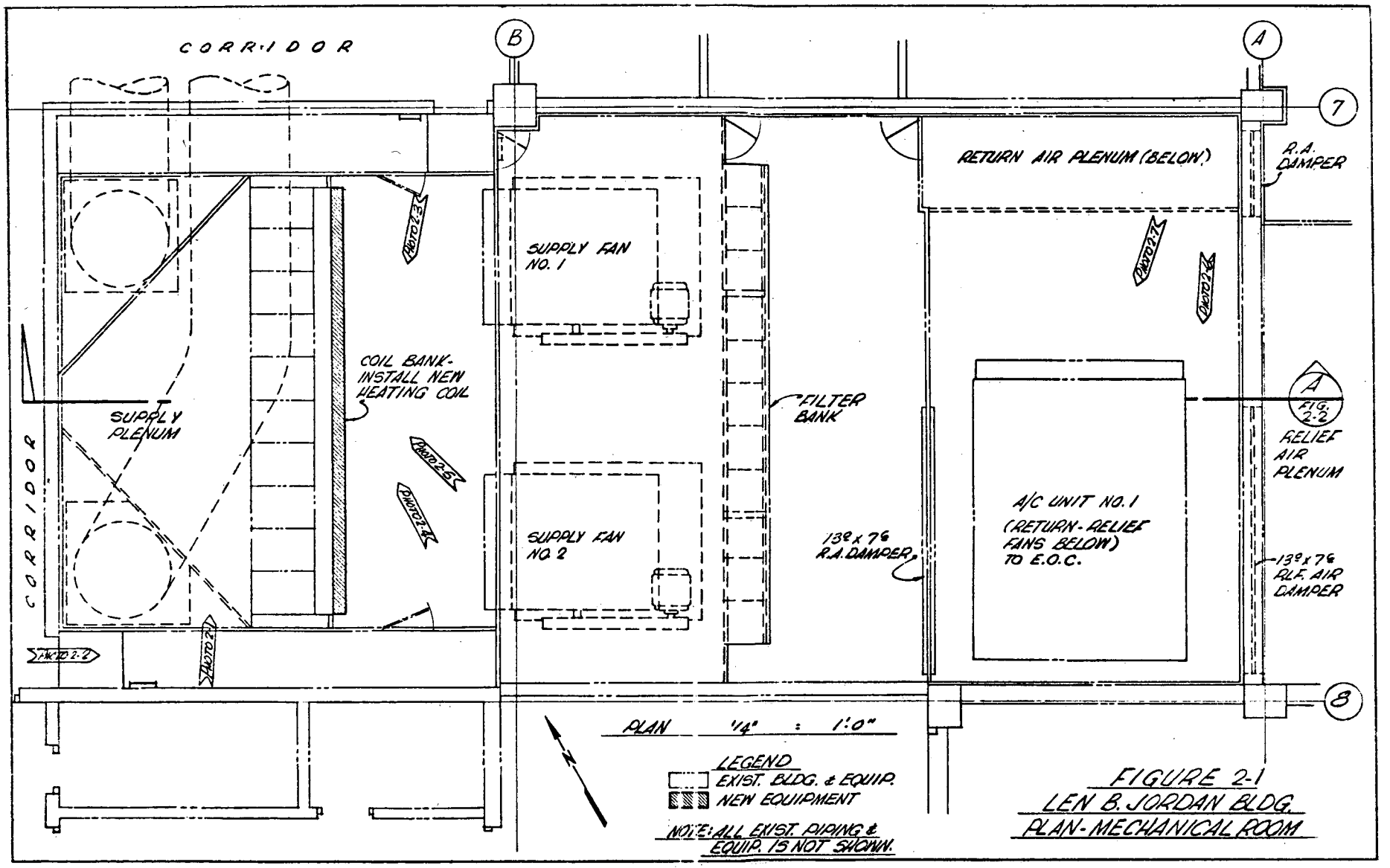


FIGURE 2-1
LEN B. JORDAN BLDG.
PLAN-MECHANICAL ROOM

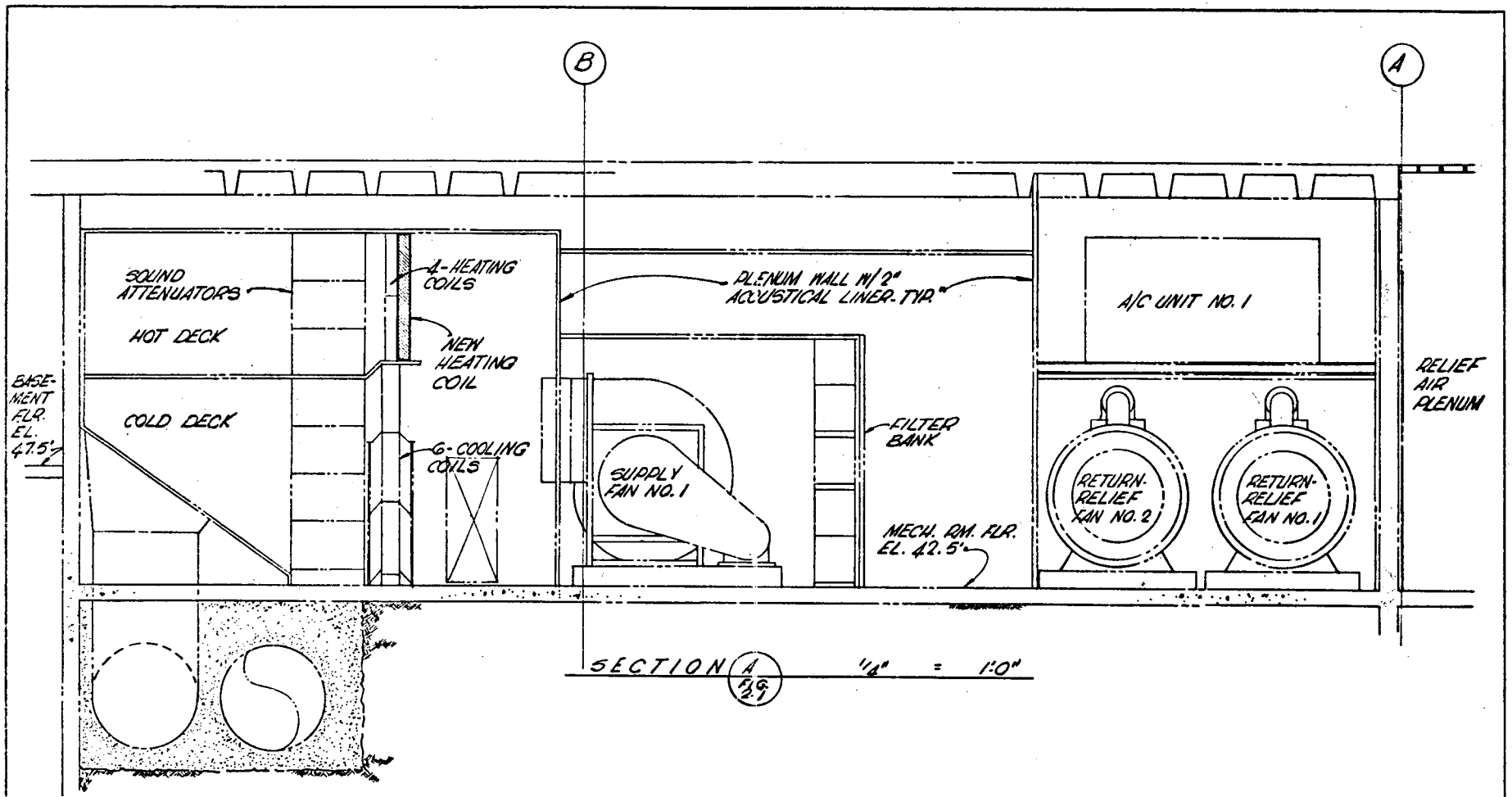


FIGURE 2-2
LEN B JORDAN BLDG.
MECHANICAL ROOM

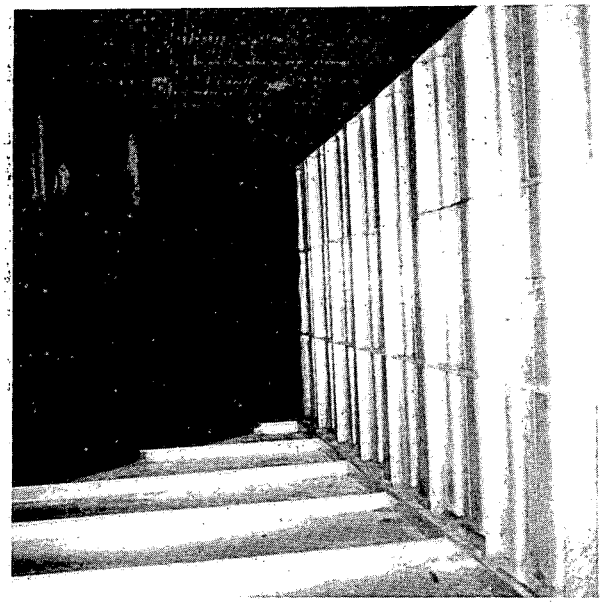


Photo 2-1

Sound attenuation material installed on discharge side of coils

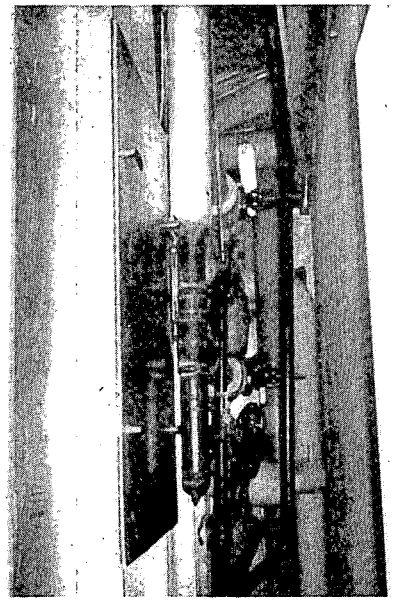


Photo 2-2

Access door shown on left to supply air plenum and heating/cooling coils. In the background, refrigeration and steam piping are shown.

Photo 2-3

Steam heating coils are shown at the top right and cooling coils directly below.

Photo 2-4

Upper portion of cooling coils.

Photo 2-5

Steam heating coils shown at the top left and cooling coild directly below.

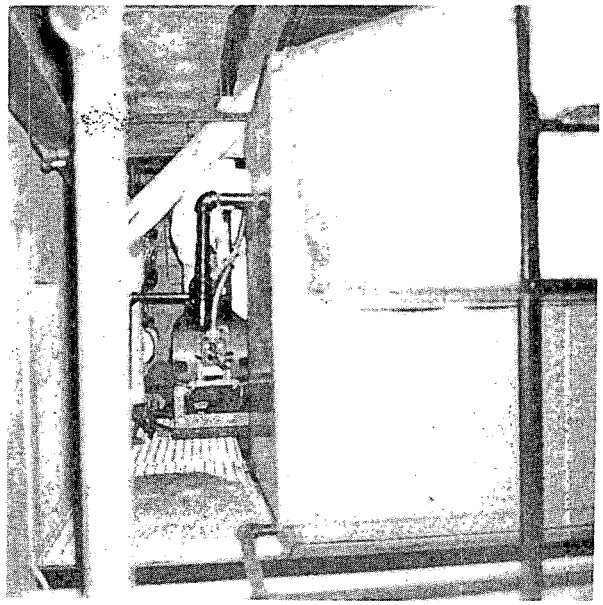


Photo 2-6

Intake end of package air conditioner for the E.O.C. area shown with the fan motor in the background.

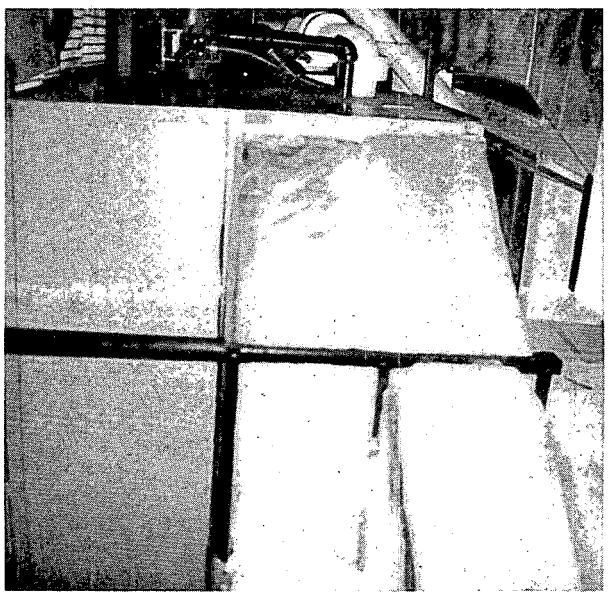


Photo 2-7

Intake end of package air conditioner for the E.O.C. area.

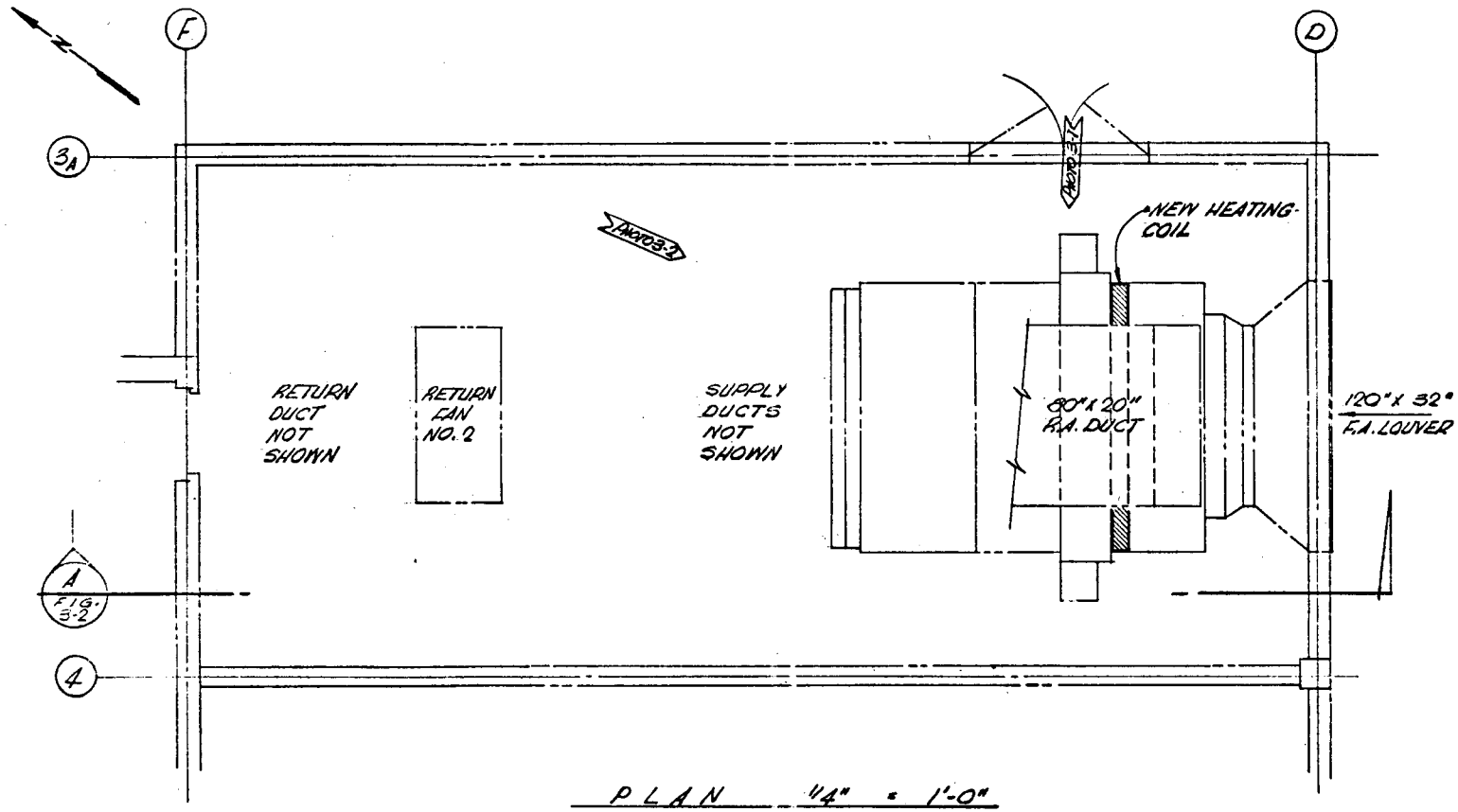
3.3 Idaho Supreme Court Building

The Idaho Supreme Court Building is presently heated and cooled through one two pipe HVAC forced air system covering all but the court rooms and Judges Chambers. The Court rooms and Judges Chambers are heated and cooled through a package HVAC multizone forced air unit. Steam is supplied to both systems from the Capitol Mall Central Boiler Plant. Heat is supplied to the forced air through steam coils located down stream from the fans.

Modifications to the two pipe HVAC forced air system located in the basement would include the installation of a geothermal hot water fin tube coil located between the existing steam coils and the fan.

Modifications to the package HVAC multizone forced air unit located in the penthouse while feasible could be extensive. The multi-zone outlet duckwork may require rework such that one large geothermal hot water coil or several small coils, one in each zone outlet, could be installed. This rework would be expensive and a cost benefit analysis should be made during the initial design stages of the project to determine if in fact this unit should be modified.

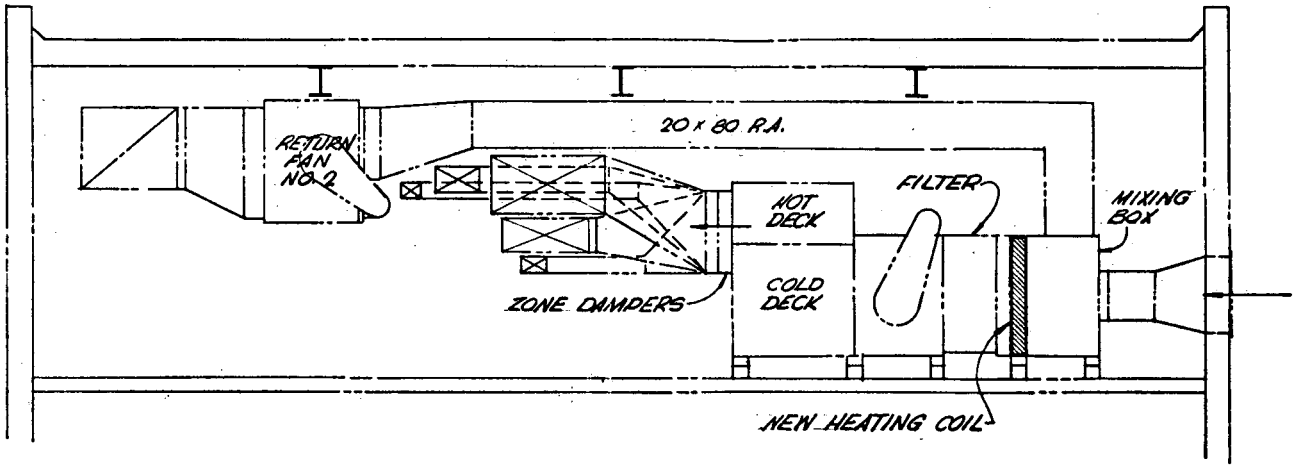
Refer to Figures 3-1 through 3-4 and photographs 3-1 through 3-4 at the end of this subsection. Locations from which the photographs were taken are indicated on Figures 3-1 and 3-3.



PLAN 1/4" = 1'-0"

ALL PIPING & EQUIP. IS NOT SHOWN

FIGURE 3-1
IDAHO SUPREME COURT BLDG.
PENTHOUSE



SECTION A FIG. 3-1 1/4" = 1'-0"

FIGURE 3-2
IDAHO SUPREME
COURT BLDG.
PENTHOUSE

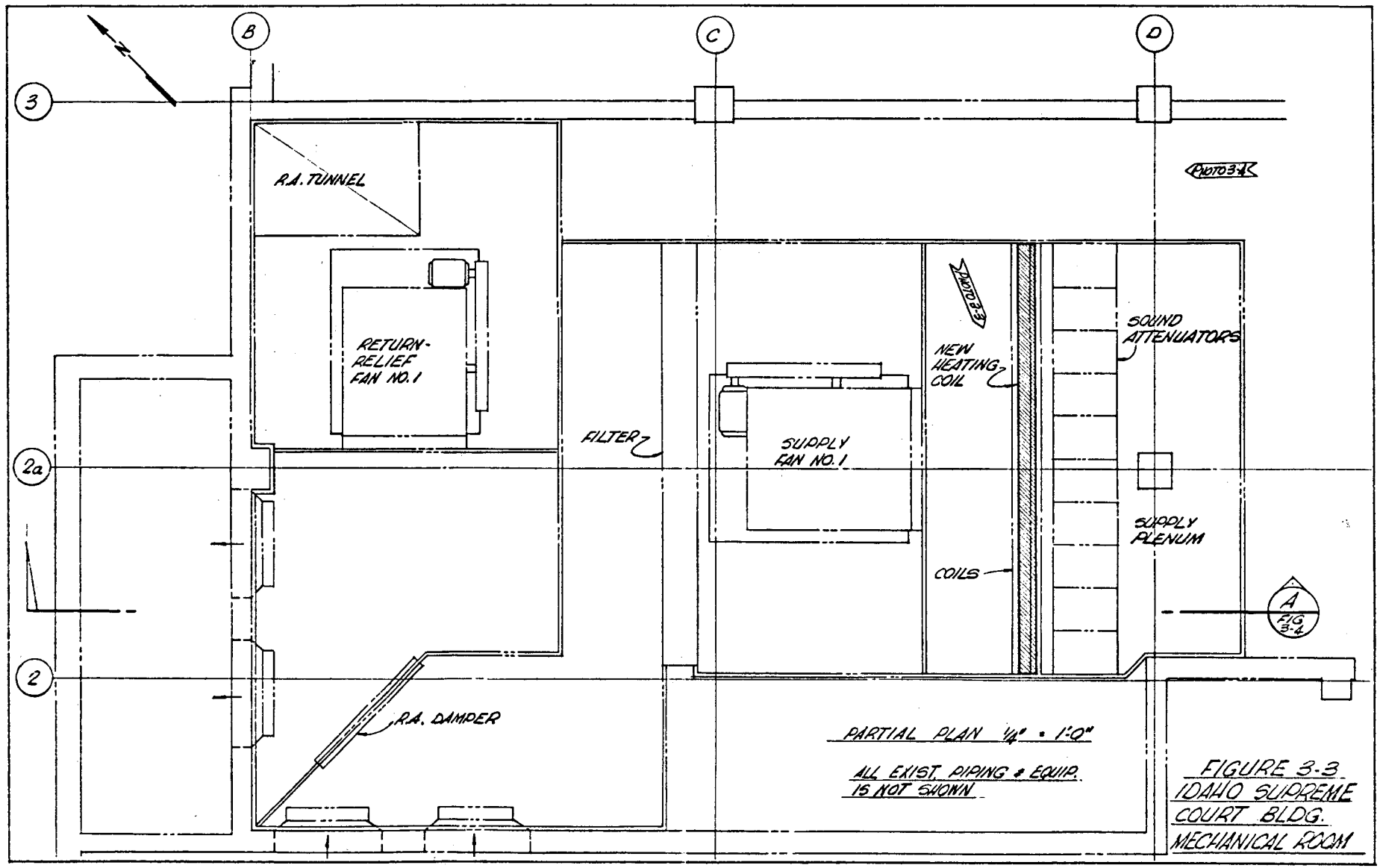


FIGURE 3-3
IDAHO SUPREME COURT BLDG.
MECHANICAL ROOM

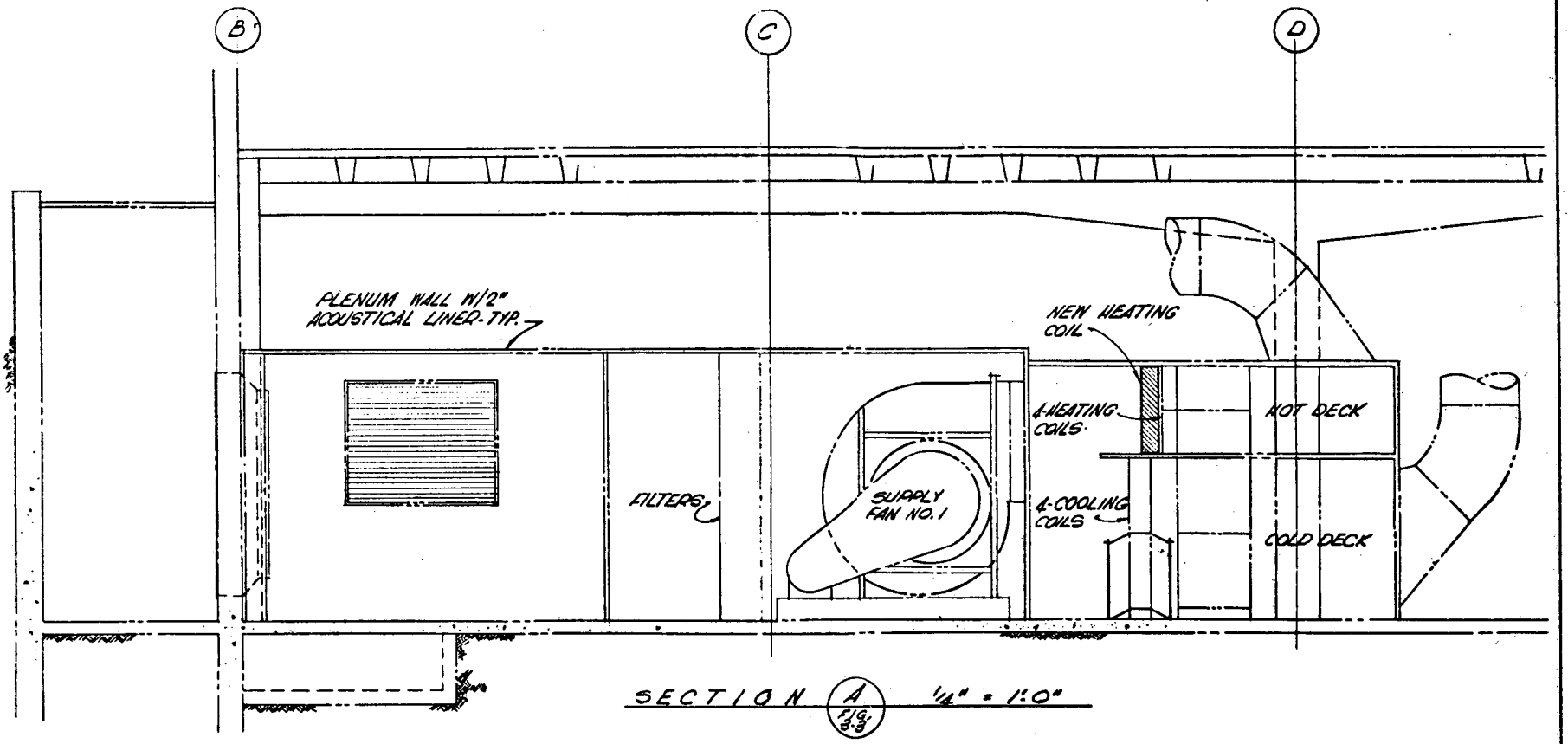


FIGURE 3-4
IDAHO SUPREME COURT BLDG.
MECHANICAL ROOM

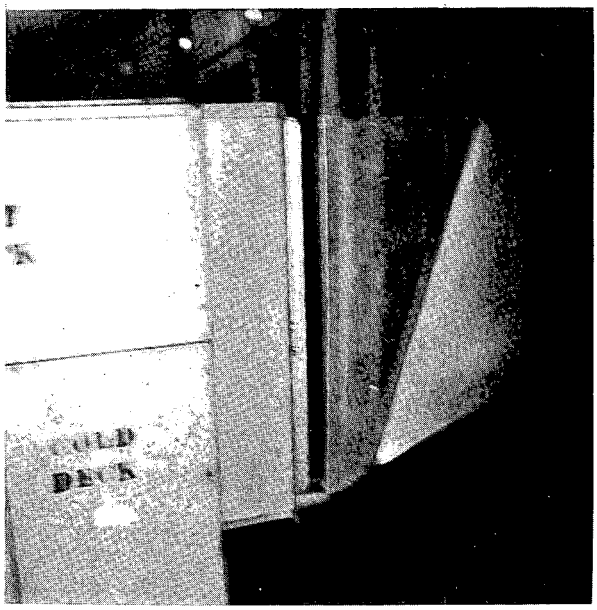


Photo 3-1

Side view of the hot/cold deck and discharge duct work for the multizone package unit in the penthouse.

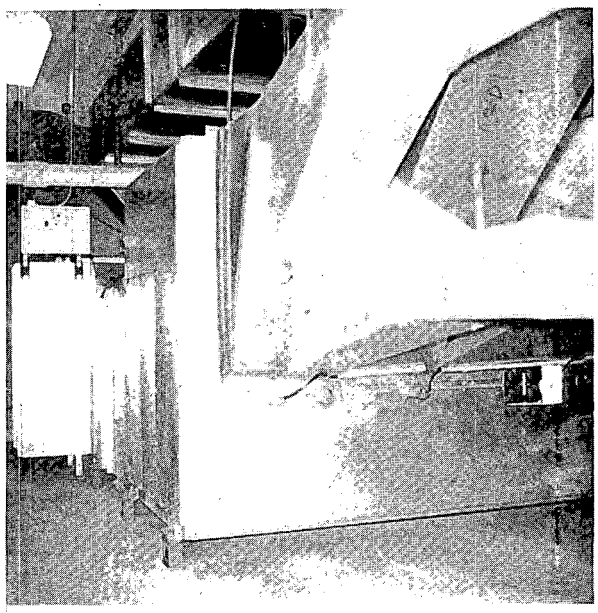


Photo 3-2

Front or discharge end view of the multizone package unit in the penthouse.

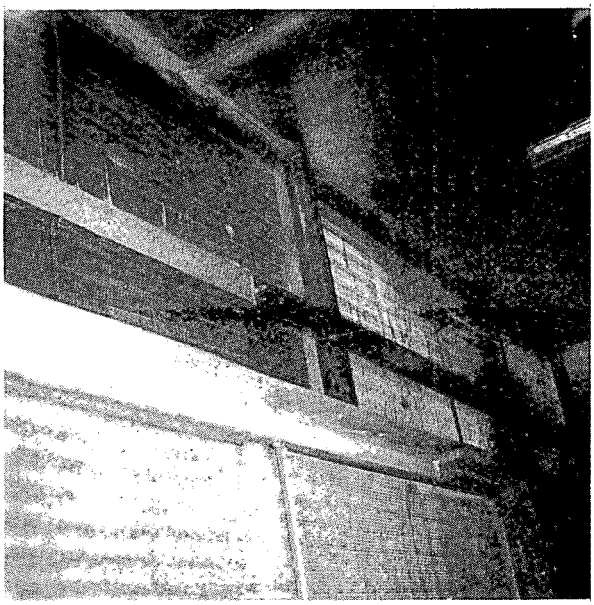


Photo 3-3

Heating coils above and cooling coils below for the mechanical room installed HVAC unit.

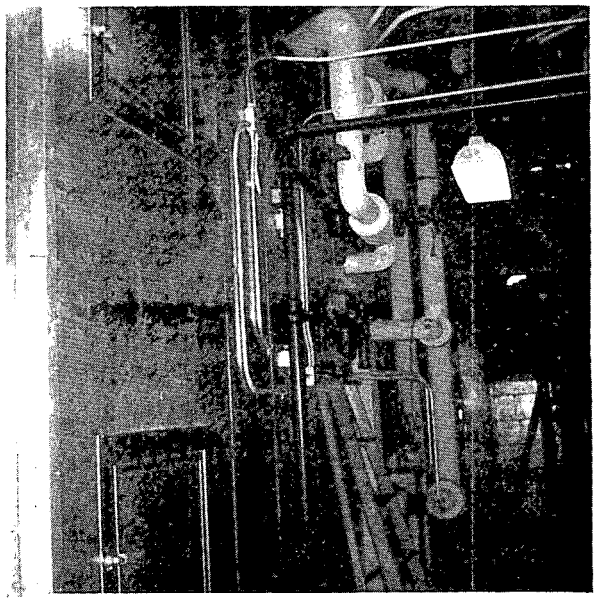


Photo 3-4

Exterior view of heating/cooling coil section of the mechanical room HVAC unit showing access doors, steam and refrigeration piping to coils.

3.4 Idaho State Library and Archives

The Idaho State Library and Archives is presently heated and cooled using a two pipe HVAC forced air system. Steam is supplied to the forced air fin tube heating coils from the Capitol Mall Central Boiler Plant.

Modifications to the system would include the installation of a geothermal hot water fin tube coil located between the existing steam coils and the fan. The new coils will add some additional static pressure drop in the system and as such the fan will be sped up. No investigation was made at this time to determine if sufficient fan motor capacity exists or if a new fan motor will be required.

Refer to Figures 4-1 and 4-2 and photographs 4-1 and 4-2 at the end of this subsection. Locations from which the photographs were taken are indicated on Figure 4-1.

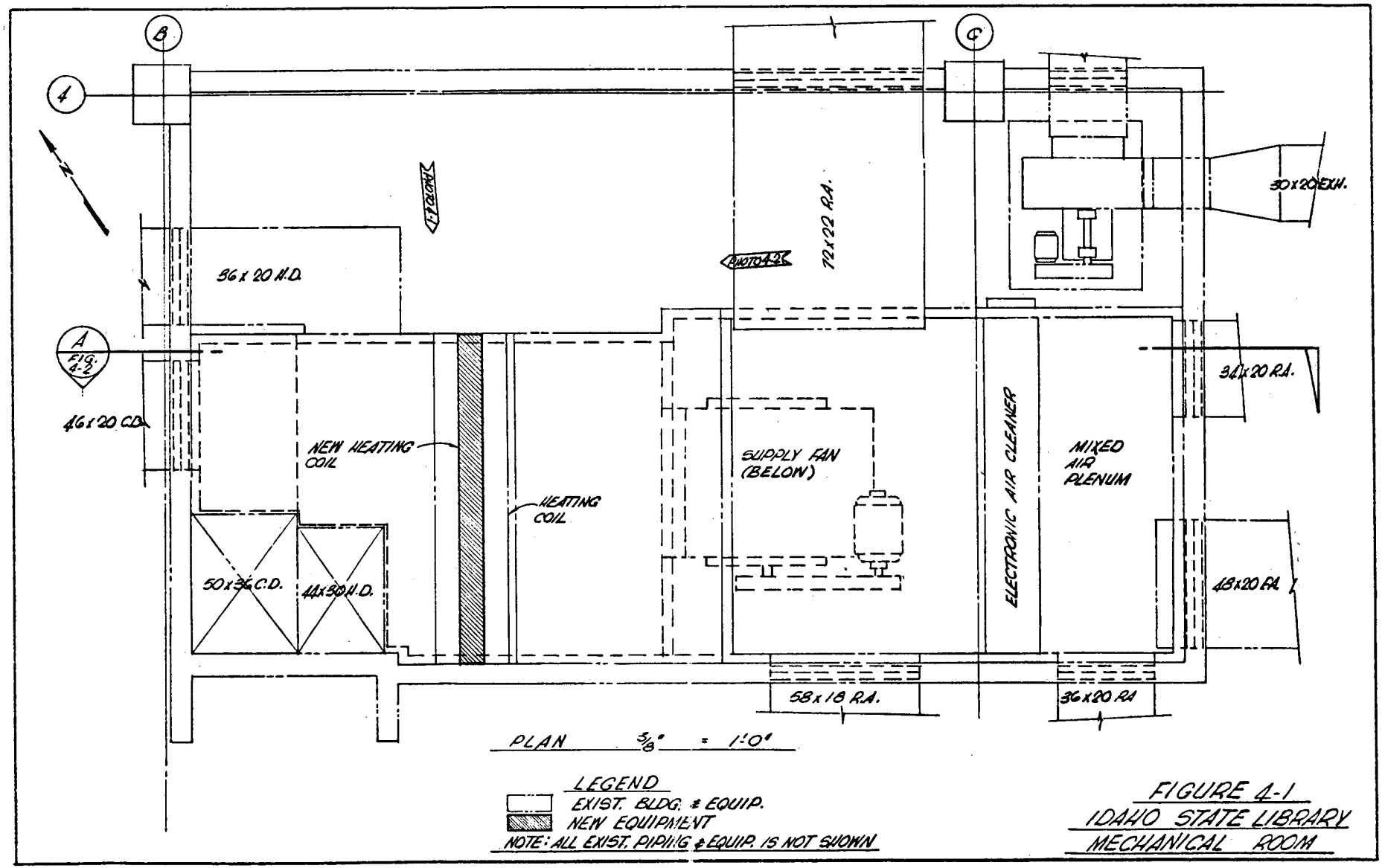


FIGURE 4-1
IDAHO STATE LIBRARY
MECHANICAL ROOM

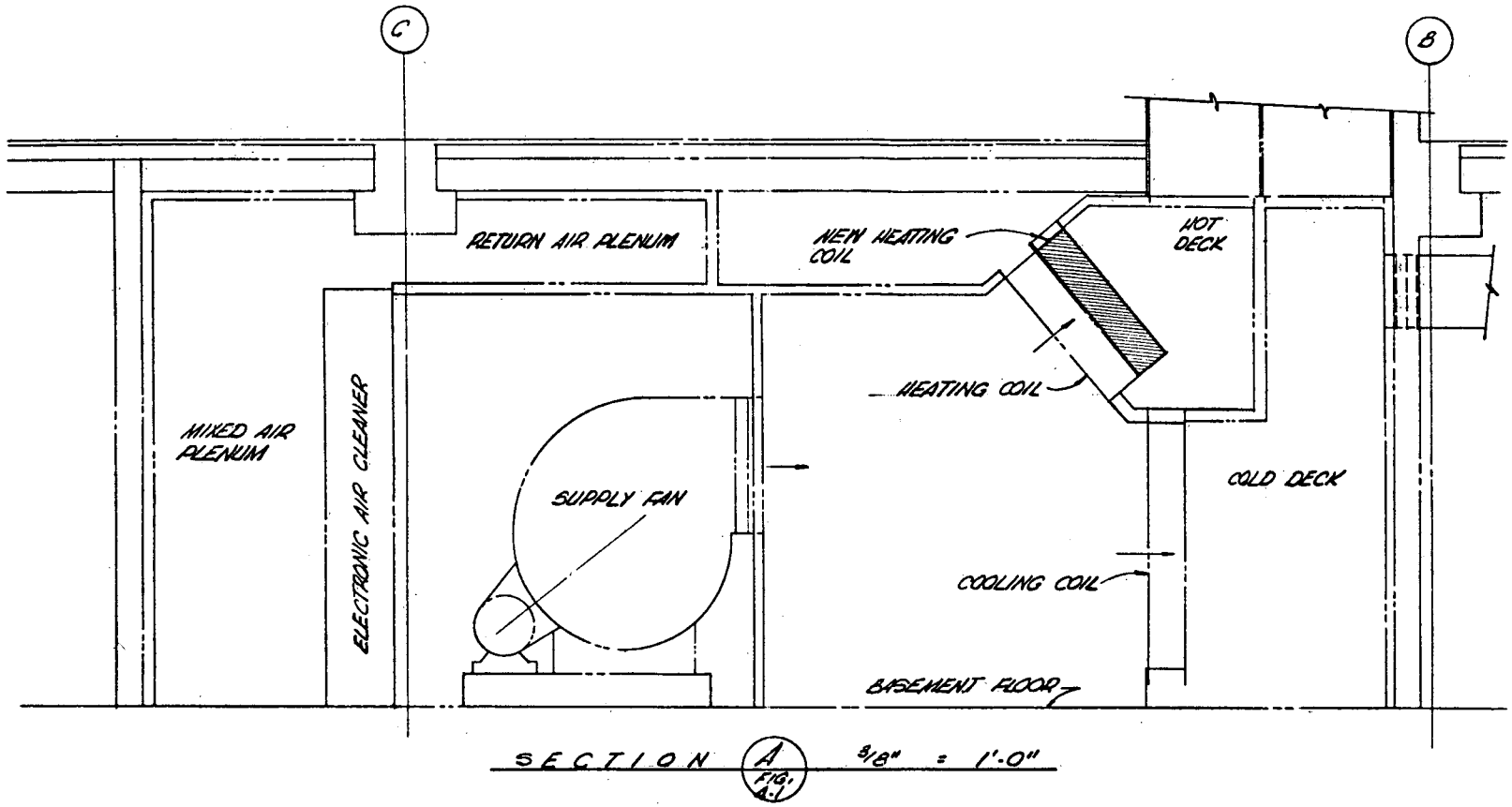


FIGURE 4-2
IDAHO STATE LIBRARY
MECHANICAL ROOM

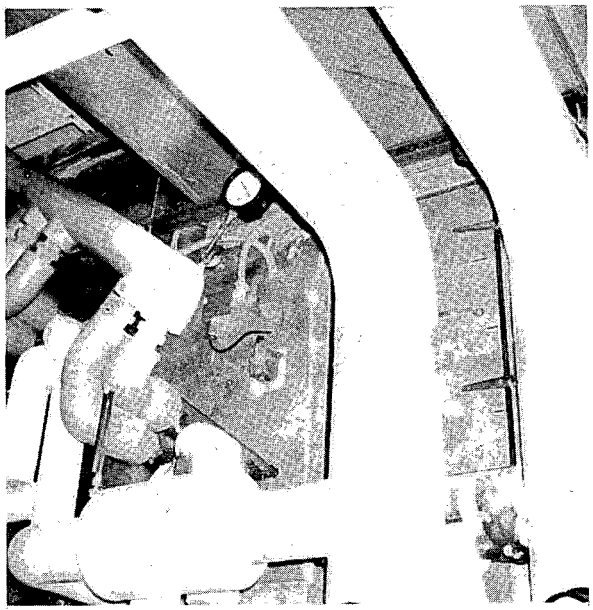


Photo 4-1

Exterior view of hot/cold deck showing access doors and steam piping.

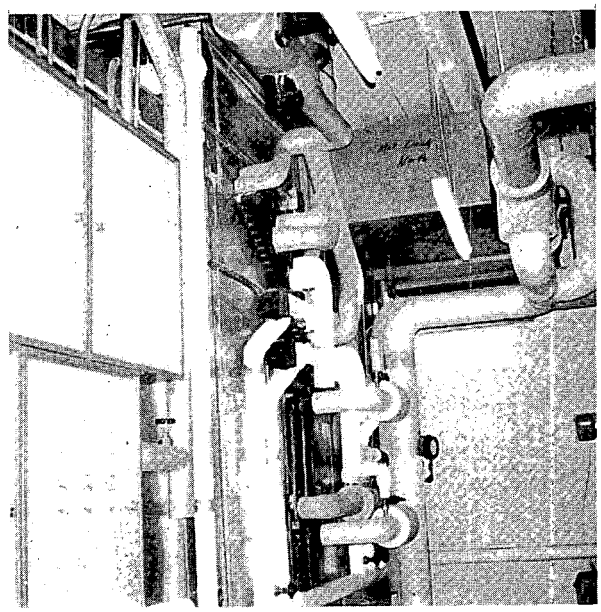


Photo 4-2

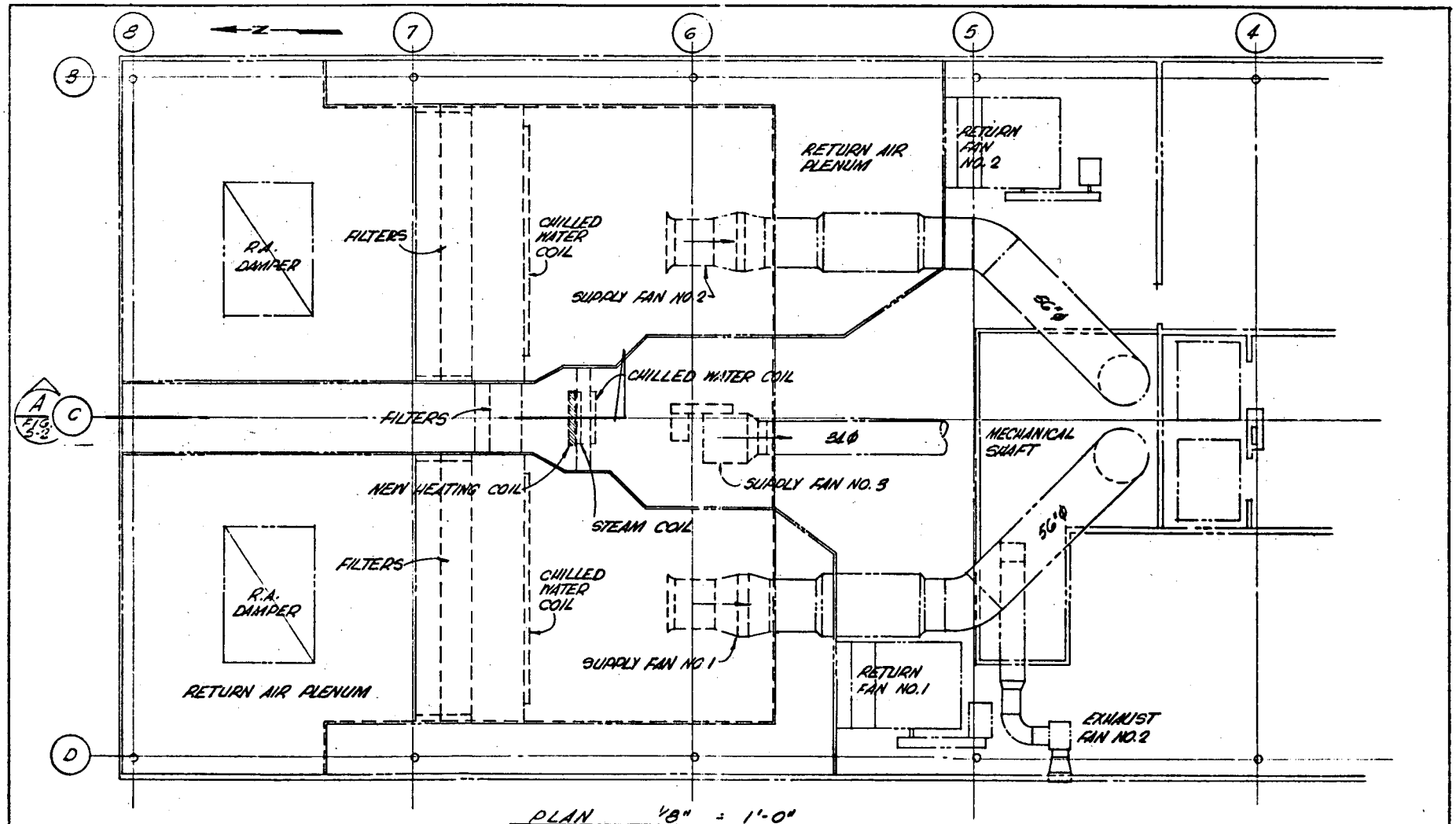
Exterior view of hot/cold deck showing steam and refrigeration piping.

3.5 State Office Building

The State Office Building is in the initial construction phase at this time. Construction drawings were reviewed and the heating and ventilating system found to be a two pipe forced air HVAC type. Steam for the heating coils will be supplied from the Capitol Mall Central Boiler Plant.

Modifications to this sytem would include the installation of a geothermal hot water fin tube coil located adjacent to the steam coils. Since this building is in the initial construction stages the design could be changed as required to optimize the installation of a hot water coil in series with the steam coil.

Refer to Figures 5-1 and 5-2 at the end of this subsection.

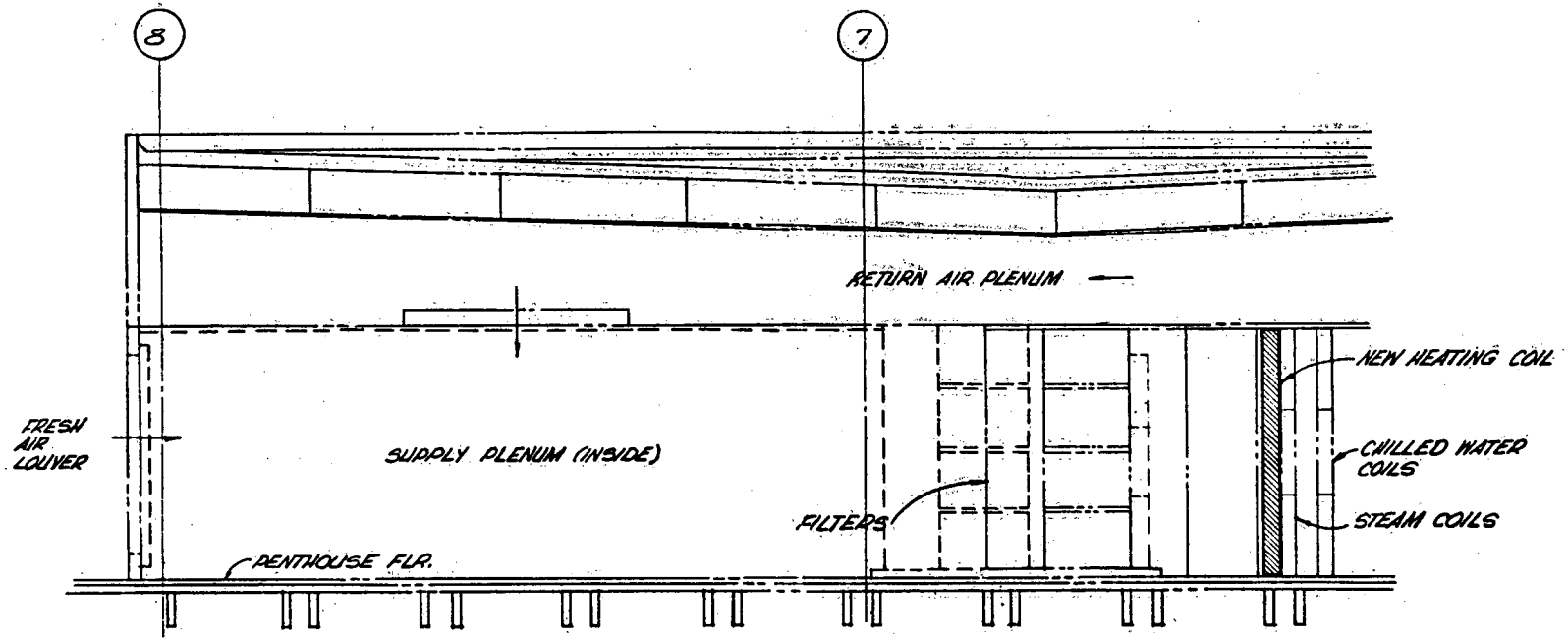


PLAN 1/8" = 1'-0"

LEGEND:
EXIST. BLDG. & EQUIP.
NEW EQUIPMENT

NOTE: ALL EXIST. PIPING & EQUIP. IS NOT SHOWN

FIGURE 5-1
STATE OFFICE BLDG.
MECHANICAL ROOM



SECTION A (FIG. 5-1) 1/4" = 1'-0"

FIGURE 5-2
STATE OFFICE BLDG.
MECHANICAL ROOM

3.6 Federal Office Building

The Federal Office Building is presently heated and cooled using 2, two pipe HVAC forced air systems. The two mechanical rooms containing the supply fans, steam and chiller coils, return/fresh air/exhaust by pass dampers, associated equipment enclosures, etc., are both located in the penthouse. The supply ductwork distributes tempered air throughout the building and the air is then returned to the penthouse through two return air shafts. Steam for the heating coils is supplied from two boilers located in the basement mechanical room.

Modifications to each system would include the installation of geothermal hot water fin tube coils in the return air sections between the return air shaft outlet and the return air/make up air mixing chamber. The new coils will add some additional static pressure drop in the system and as such the fans will be sped up. No investigation was made at this time to determine if sufficient fan motor capacities exist or if new fan motors will be required.

Refer to Figures 6-1 and 6-2 and photographs 6-1 through 6-4 at the end of this subsection. Locations from which the photographs were taken are indicated on Figure 6-1.

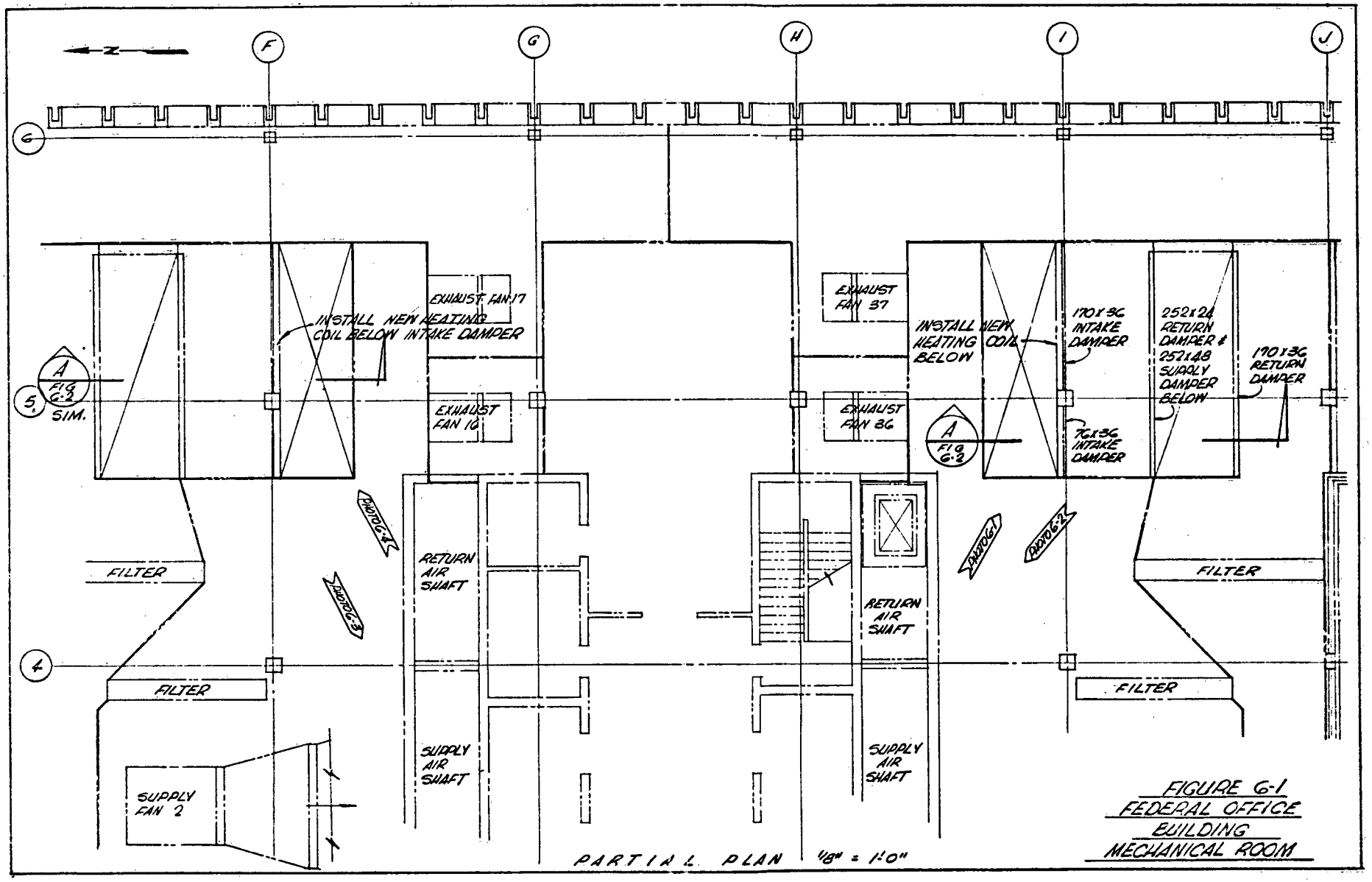


FIGURE 6-1
FEDERAL OFFICE BUILDING
MECHANICAL ROOM

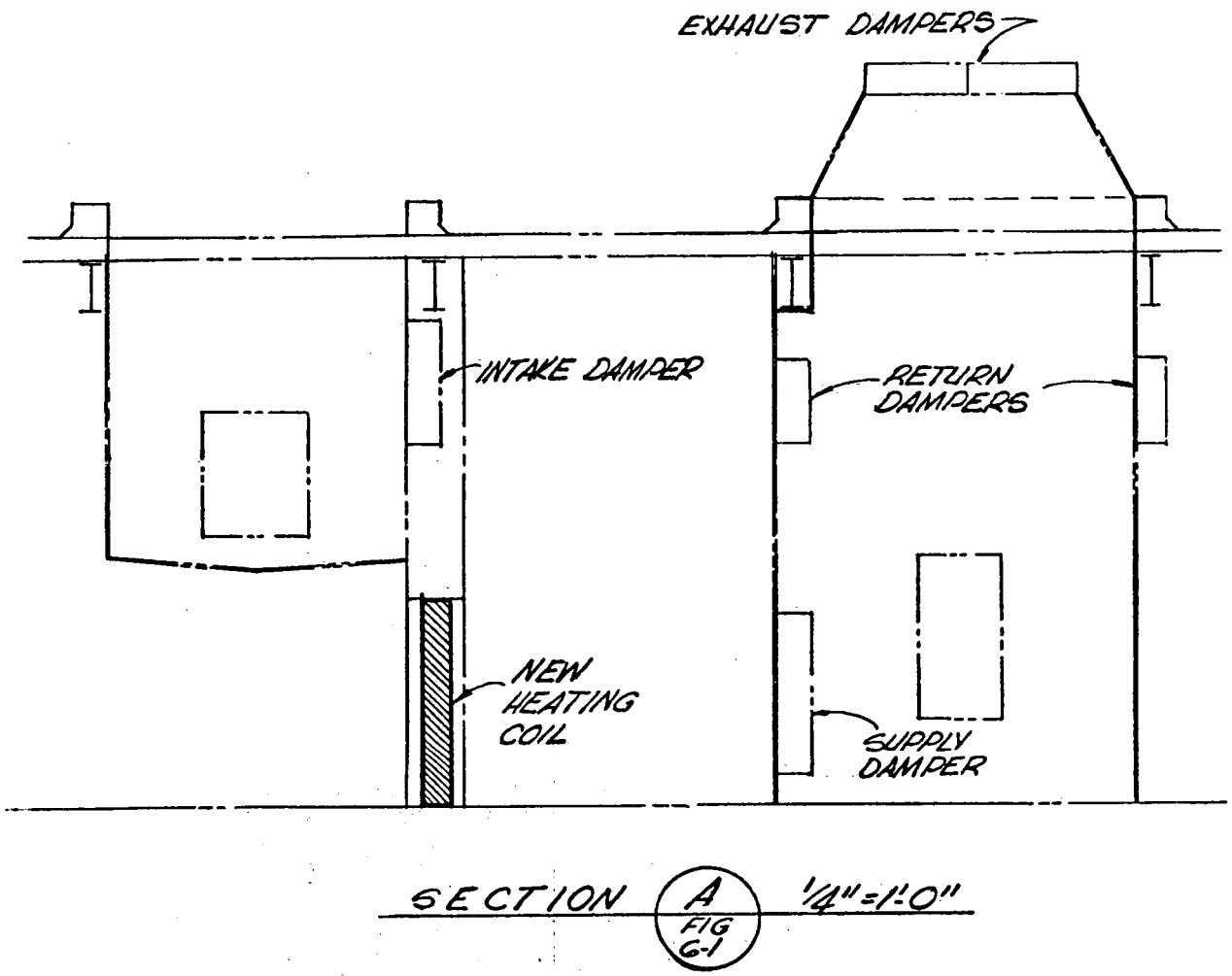


FIGURE 6-2
FEDERAL OFFICE BLDG.
MECHANICAL ROOM

Photo 6-1

Intake duct work and plenum for south unit. Heating/cooling coils on the right side.

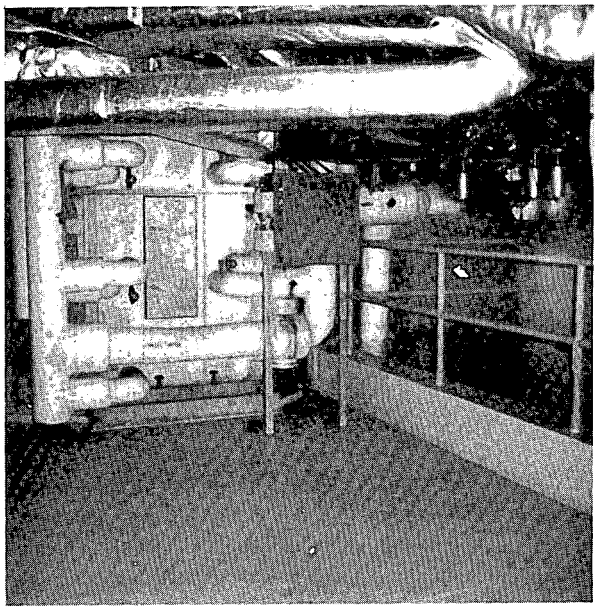


Photo 6-2

Distribution piping for south unit.

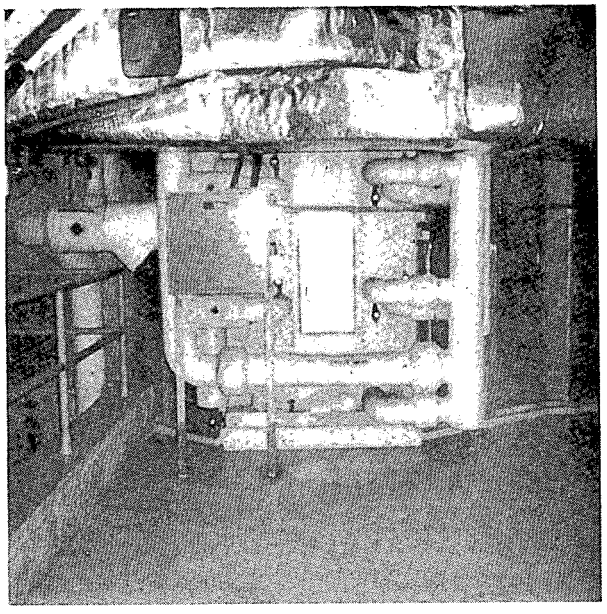


Photo 6-3

Distribution piping for north unit.

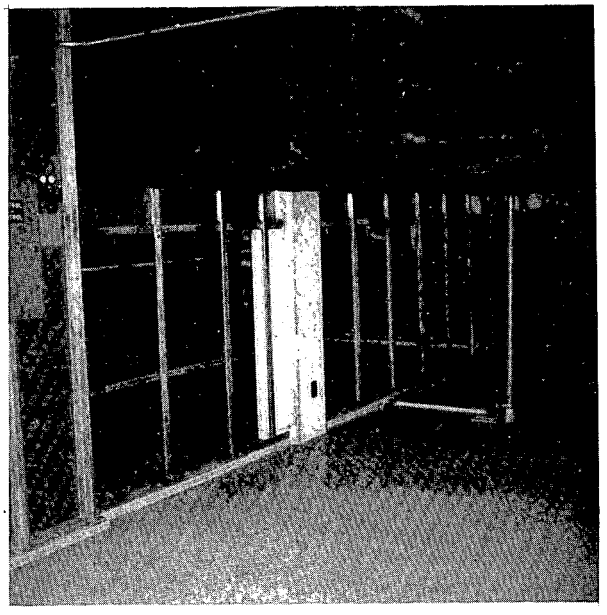


Photo 6-4

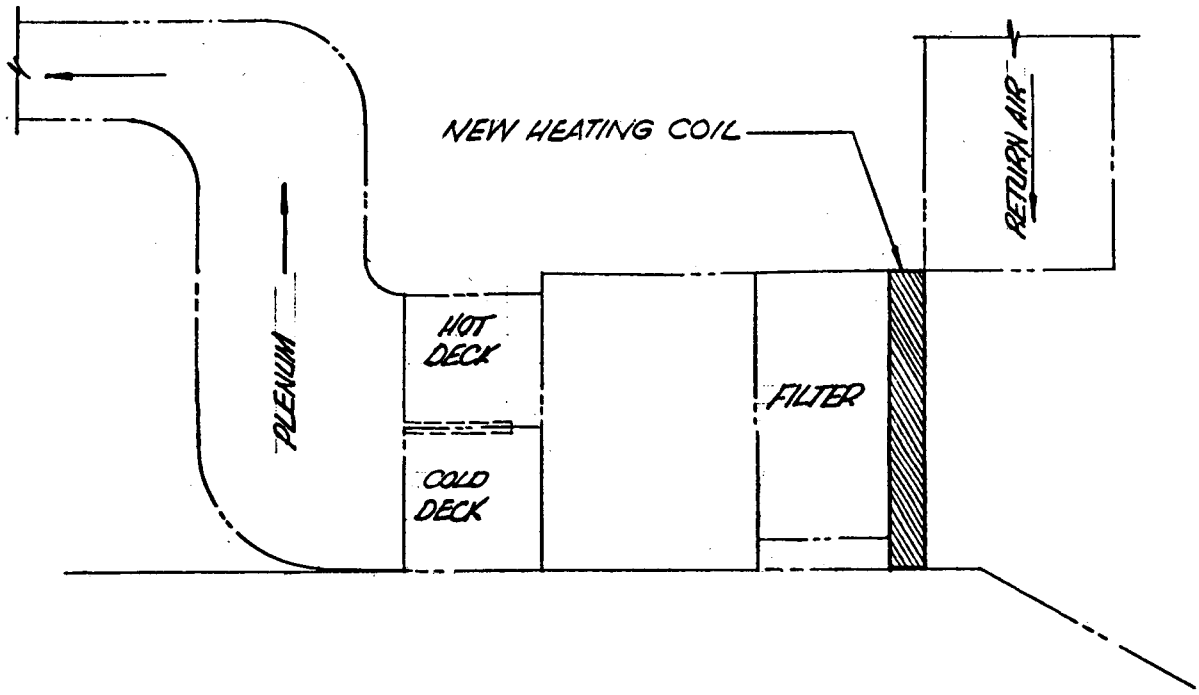
Intake duct work and heating/cooling coils on north unit.

3.7 Federal Post Office, 8th/Bannock

The Federal Post Office @8th and Bannock is presently heated using steam heated forced air units located on each floor of the building. Steam is supplied to each unit from one natural gas steam boiler and a coal fired back-up boiler.

Modifications to each forced air unit would include the installation of a geothermal hot water fin tube coil. A possible location for the new coil which would require a minimum of modifications to existing equipment is in the return air intake at each unit. This location would be on the suction side of the fan and as such a coil should be sized to minimize the static pressure drop. The fan will also be sped up so as to maintain the proper air flow. No determination was made at this time to determine if sufficient fan motor capacity exists or if new fan motors may be required.

Refer to Figure 7-1 and photograph 7-1 at the end of this subsection.



SECTION (TYPICAL FOUR PLACES)

SEE PHOTO 7-1

FIGURE 7-1
FEDERAL POST OFFICE
MECHANICAL ROOM

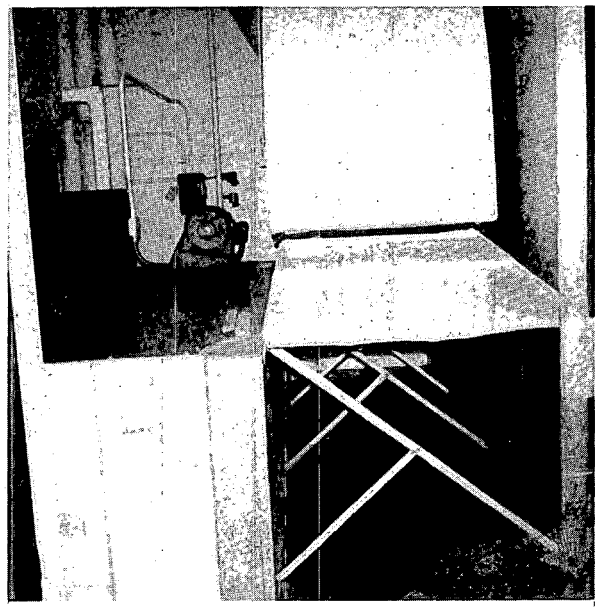


Photo 7-1

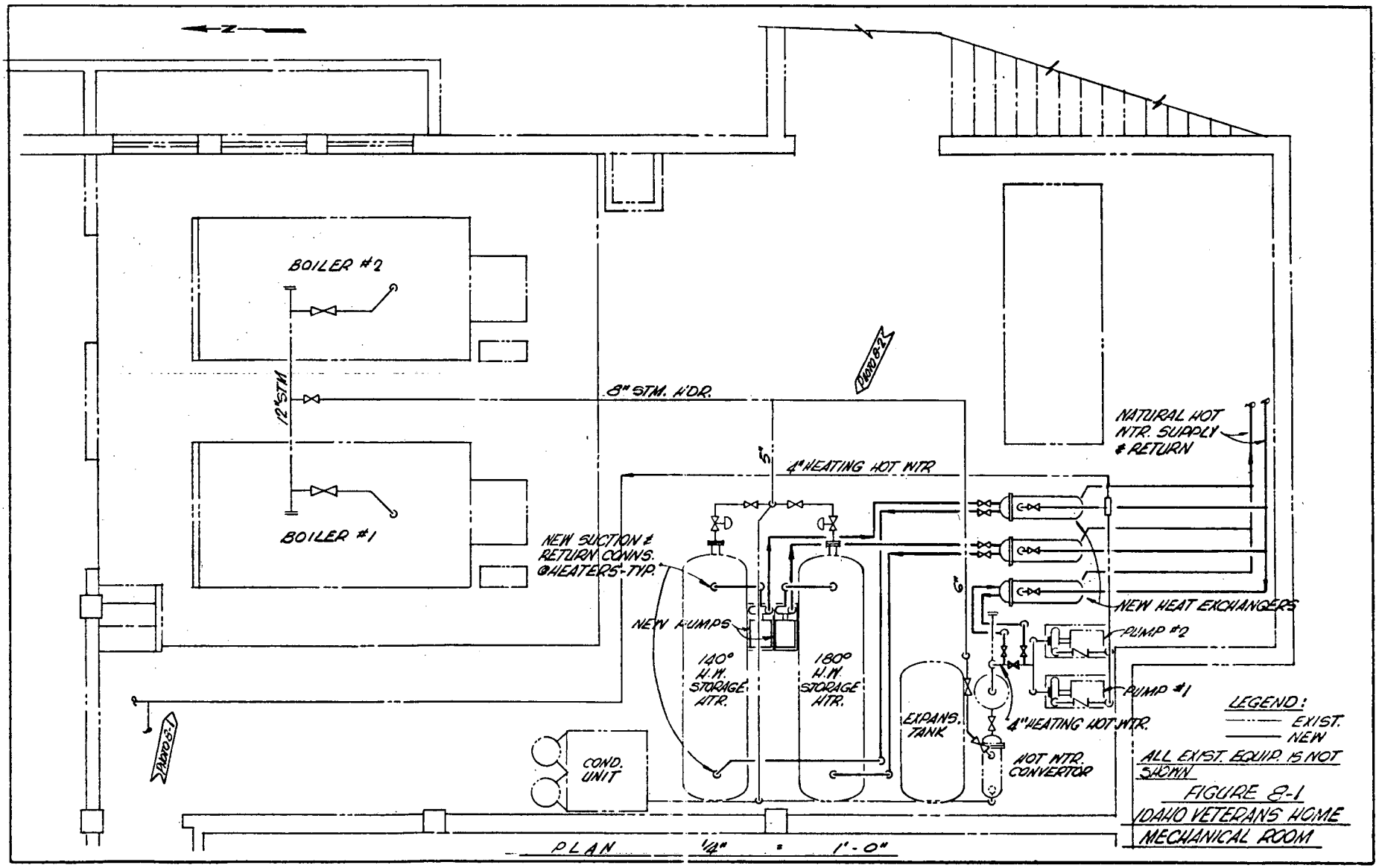
Intake end of air handler with filters and return duct.

3.8 Idaho Veteran's Retirement Home

The Idaho Veterans Retirement Home is presently heated with hot water using two steam boilers, a steam/water heat exchanger, circulating pumps and convectors located throughout the building.

Modifications to the comfort heating system to allow the use of geothermal hot water would be very minor and require only a geothermal water/water heat exchanger, miscellaneous piping and valves. The existing circulating pumps would then draw or pump water through the existing steam/water heat exchanger and also through the new geothermal water/water heat exchanger.

Modifications to allow the 140° F and the 180° F water storage tanks to be heated geothermally would be similar to the above and require new geothermal water/water heat exchangers and associated pipe and valves.


BOILER #2
BOILER #1
12" STM.
8" STM. HDR.
4" HEATING HOT WTR.
NATURAL HOT WTR. SUPPLY & RETURN
NEW SUCTION & RETURN CONNS. @ HEATERS - TYP.
NEW PUMPS
140° H.W. STORAGE HTR.
180° H.W. STORAGE HTR.
EXPANS. TANK
4" HEATING HOT WTR.
HOT WTR. CONVERTOR
NEW HEAT EXCHANGERS
PUMP #2
PUMP #1
COND. UNIT
PLAN 1/4" = 1'-0"
LEGEND:
EXIST.
NEW
ALL EXIST. EQUIP. IS NOT SHOWN
FIGURE 8-1
IDAHO VETERANS HOME
MECHANICAL ROOM

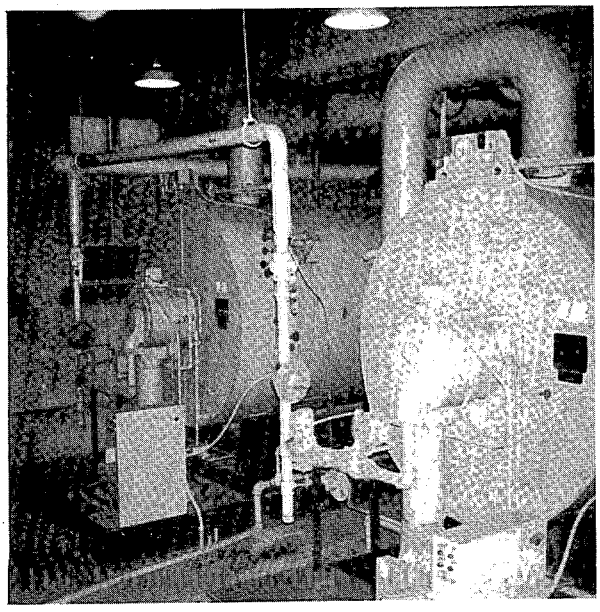


Photo 8-1

View of two steam boilers for heating system.

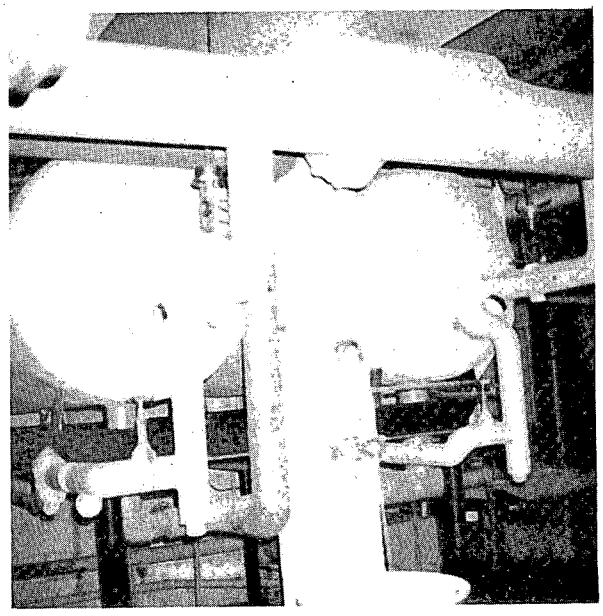


Photo 8-2

Two hot water storage tanks. One operates at 180°F the other at 140°F.

3.9 SCHOOL OF BUSINESS AND PUBLIC ADMINISTRATION BUILDING, BSU

The School of Business and Public Administration Building (Classroom - Office Building) is presently heated and cooled using a two pipe HVAC forced air system. Steam is supplied to the forced air fin tube heating coils from the University Control Boiler Plant.

Modifications to the system would include the installation of geothermal hot water fin tube coils located between the existing steam coils and the fans. The new coils will add some additional static pressure drop in the system and as such the fans will be sped up. No investigation was made at this time to determine if sufficient fan motor capacity exists or if a new fan motor will be required.

Refer to Figures 9-1 and 9-2 and photographs 9-1 and 9-2 at the end of this subsection. Locations from which the photographs were taken are indicated on Figure 9-1.

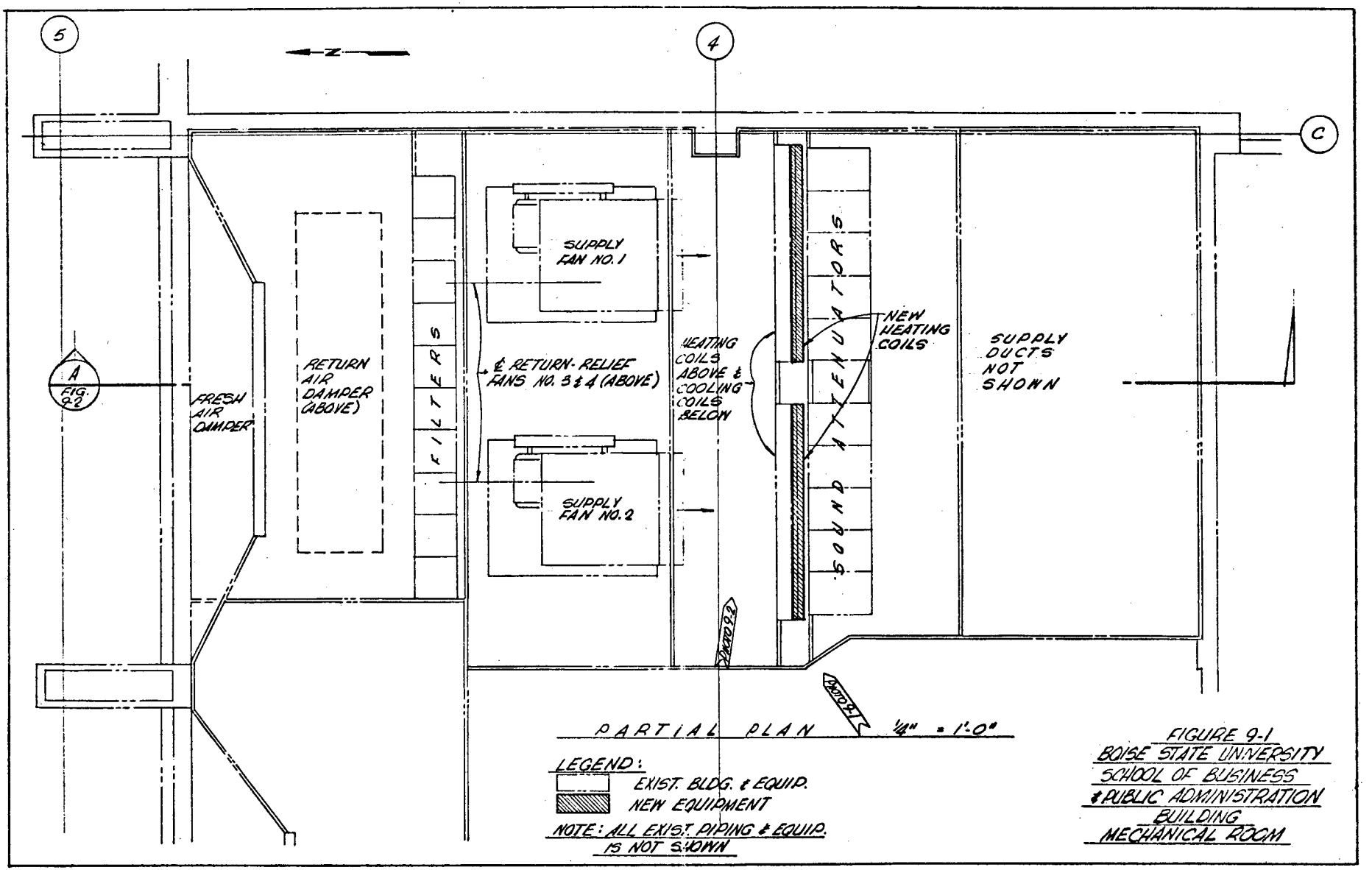
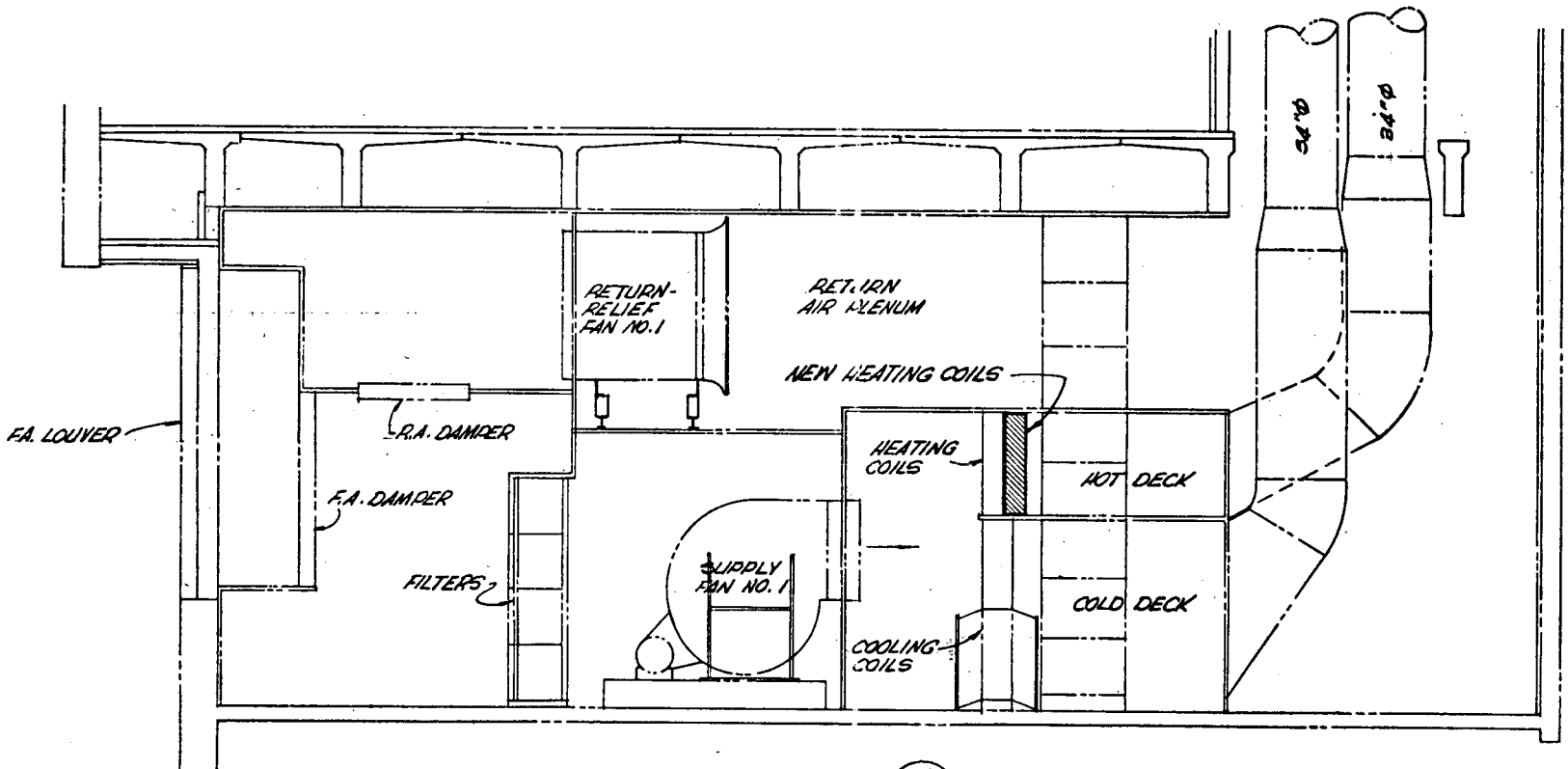


FIGURE 9-1
BOISE STATE UNIVERSITY
SCHOOL OF BUSINESS
& PUBLIC ADMINISTRATION
BUILDING
MECHANICAL ROOM



SECTION A Fig. 9-1 1/4" = 1'-0"

FIGURE 9-2
BOISE STATE UNIVERSITY
SCHOOL OF BUSINESS &
PUBLIC ADMINISTRATION
BUILDING
MECHANICAL ROOM

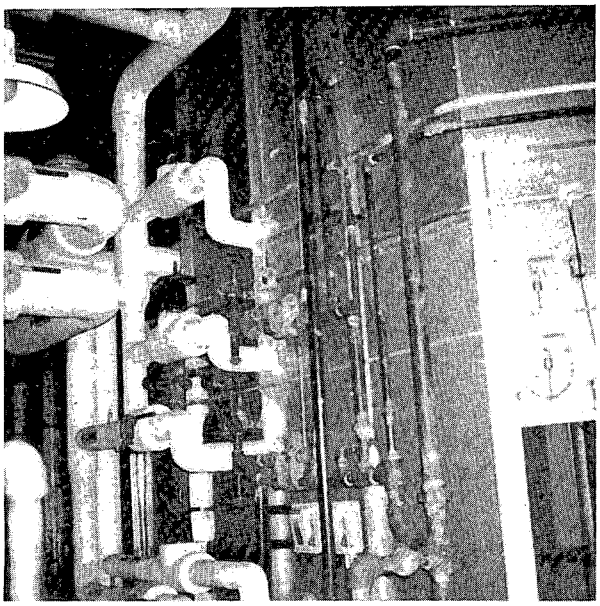


Photo 9-1

Piping for hot/cold deck.

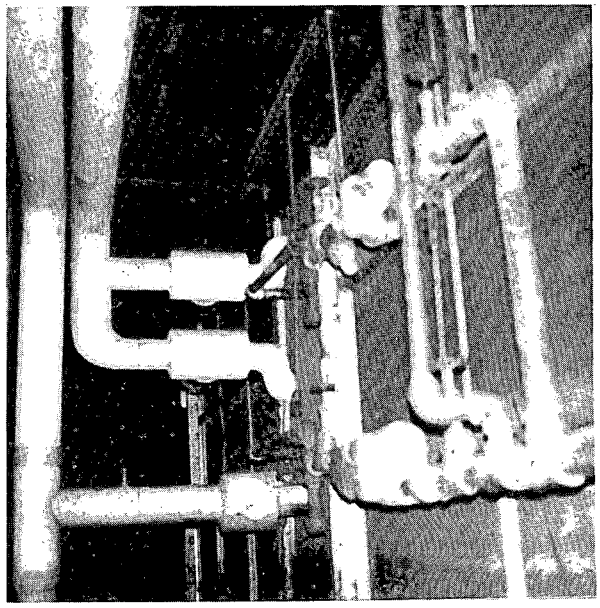


Photo 9-2

Rear face view of hot/cold deck.

3.10 Library Building, BSU

The Library Building was constructed in two phases; the initial phase included two forced air multizone units and a hot water perimeter heat system, the second phase included a penthouse and a two pipe HVAC forced air system. Steam is fed to each multizone, the hot water heat exchanger and the two pipe system from the University Central Boiler Plant.

Modifications to each unit will be made and include the installation of geothermal hot water fin tube coils in each multizone unit and the two pipe HVAC forced air system and the installation of a geothermal hot water/water heat exchanger in series with the existing hot water system.

The new coils will add some additional static pressure drop in the multizone systems and the two pipe system and as such the fans will be sped up. No investigation was made at this time to determine if sufficient fan motor exists or if a new fan motor will be required.

Refer to Figures 10-1 through 10-4 and photographs 10-1 through 10-6 at the end of this subsection. Locations from which the photographs were taken are indicated on Figures 10-1 and 10-3.

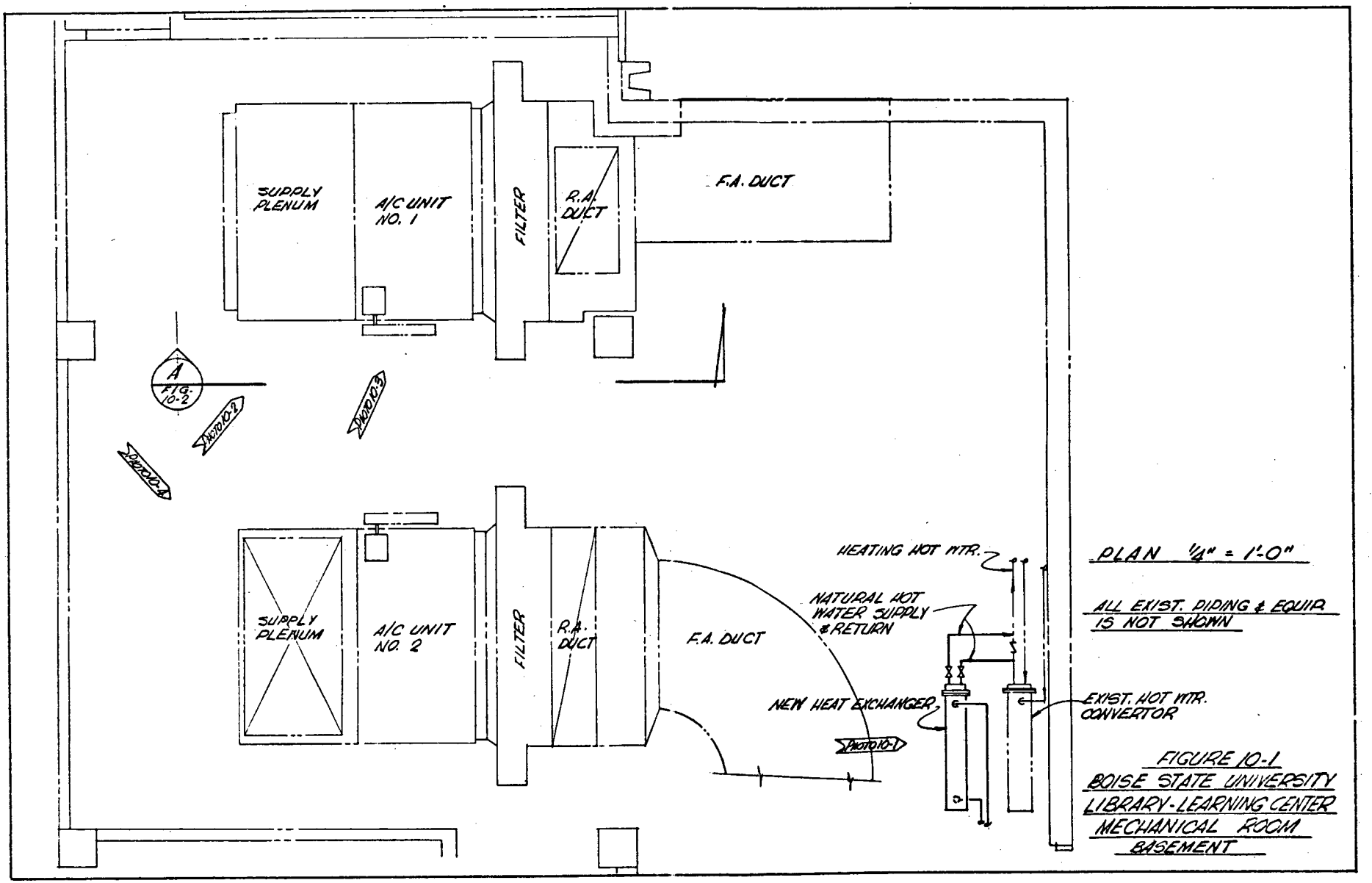
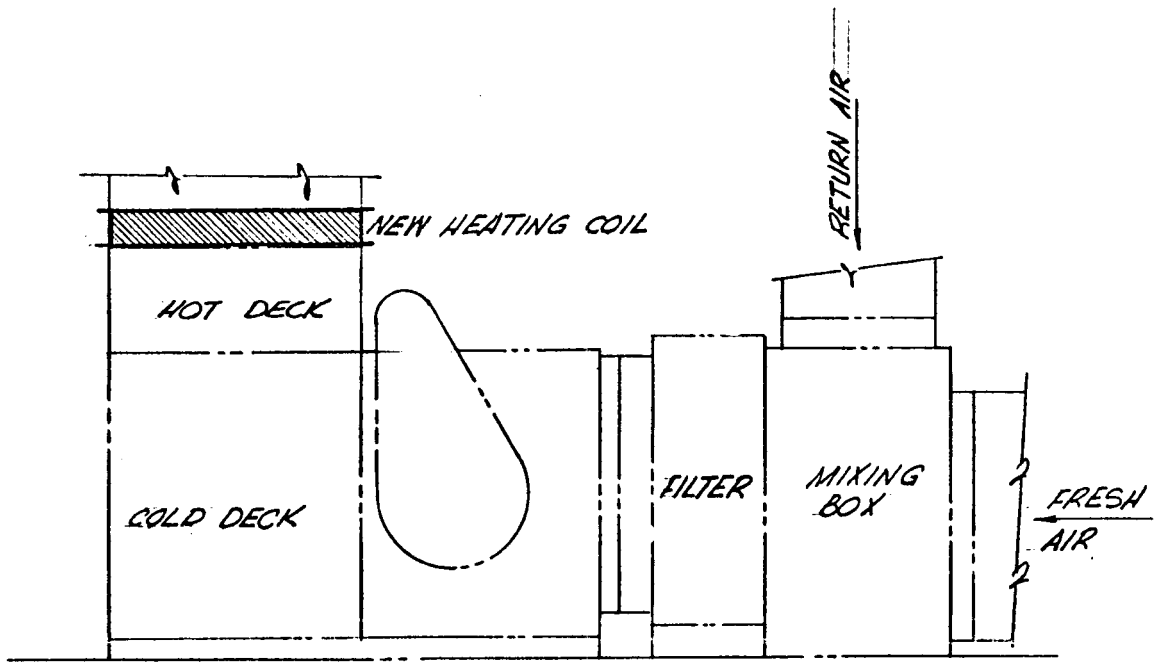


FIGURE 10-1
BOISE STATE UNIVERSITY
LIBRARY-LEARNING CENTER
MECHANICAL ROOM
BASEMENT



SECTION A FIG 10-1 1/4" = 1'-0"

FIGURE 10-2
BOISE STATE UNIVERSITY
LIBRARY - LEARNING CENTER
MECHANICAL ROOM

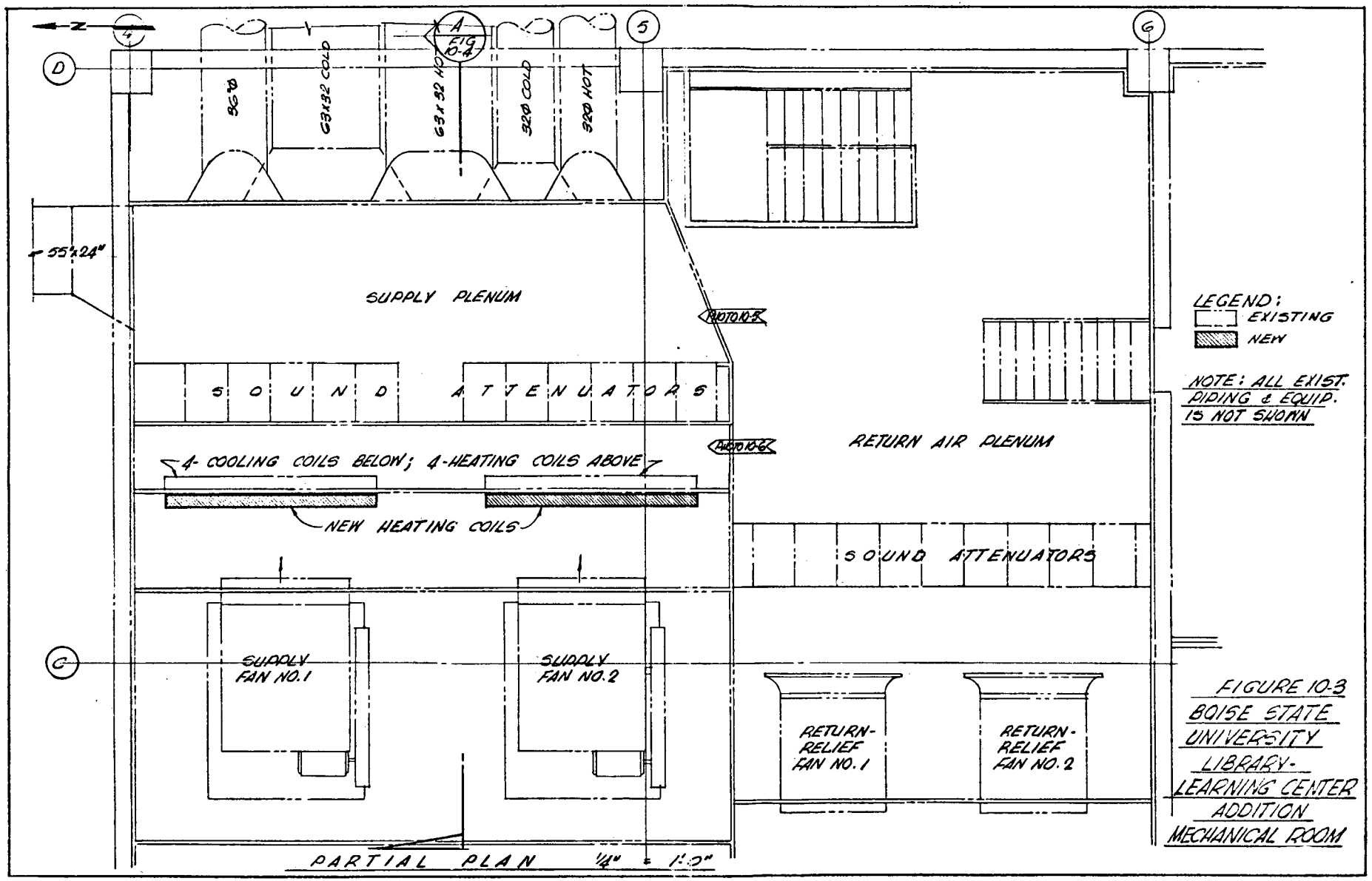
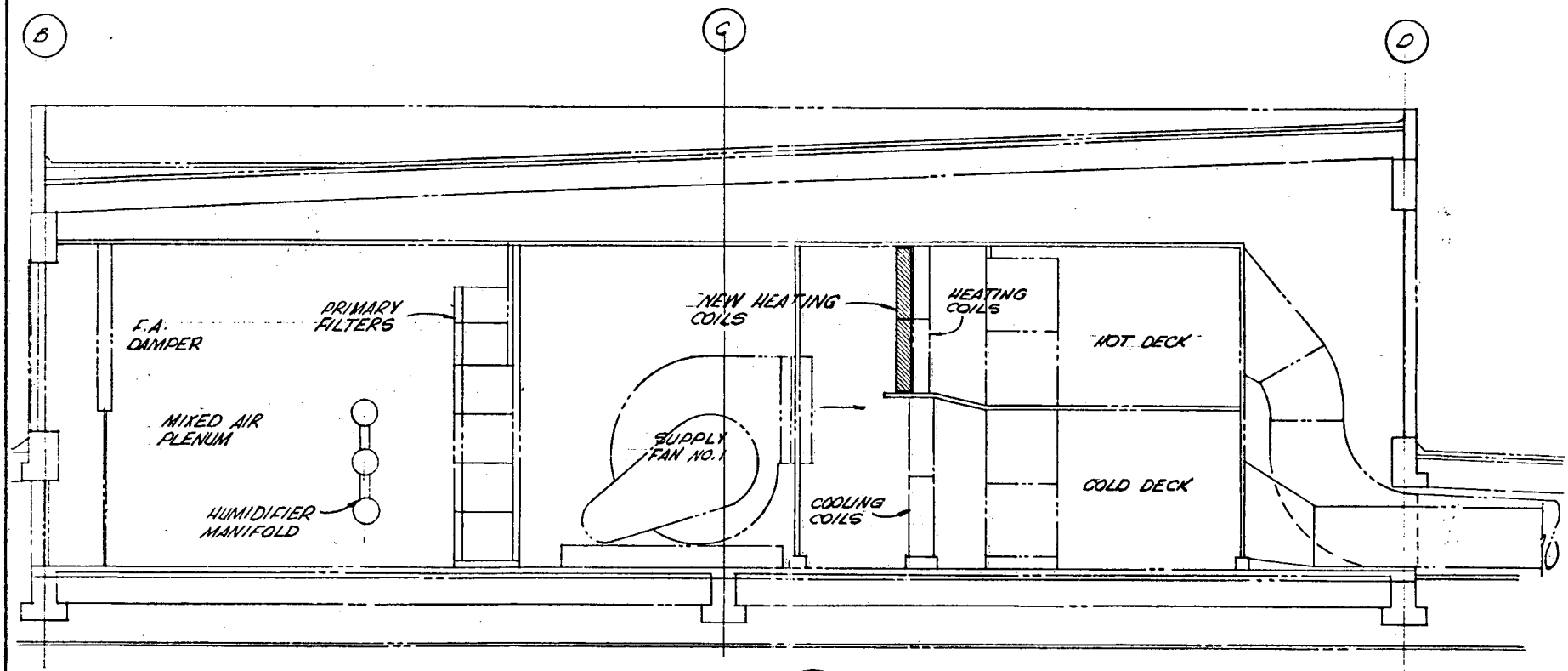


FIGURE 10-3
BOISE STATE UNIVERSITY
LIBRARY-LEARNING CENTER ADDITION
MECHANICAL ROOM



SECTION A 1/4" = 1'-0"

FIG. 10-4

FIGURE 10-4
BOISE STATE UNIVERSITY
LIBRARY-LEARNING CENTER
ADDITION
MECHANICAL ROOM

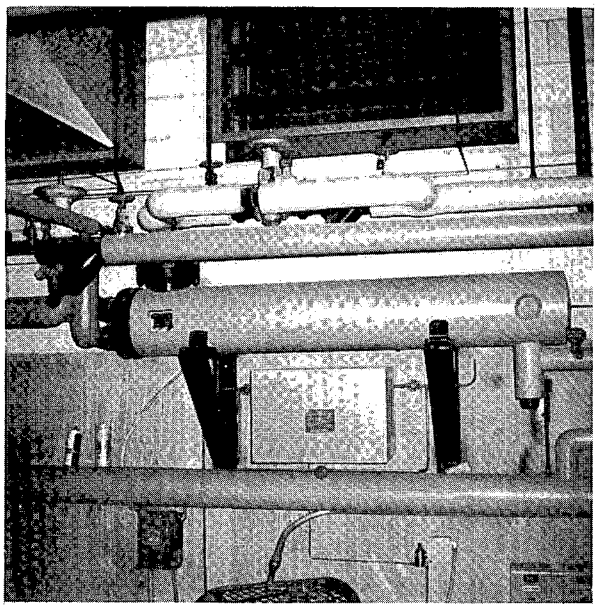


Photo 10-1

Wall mounted heat exchanger in Mechanical Room.

Photo 10-2

Piping to and discharge duct work from A/C unit #1 in Mechanical Room.

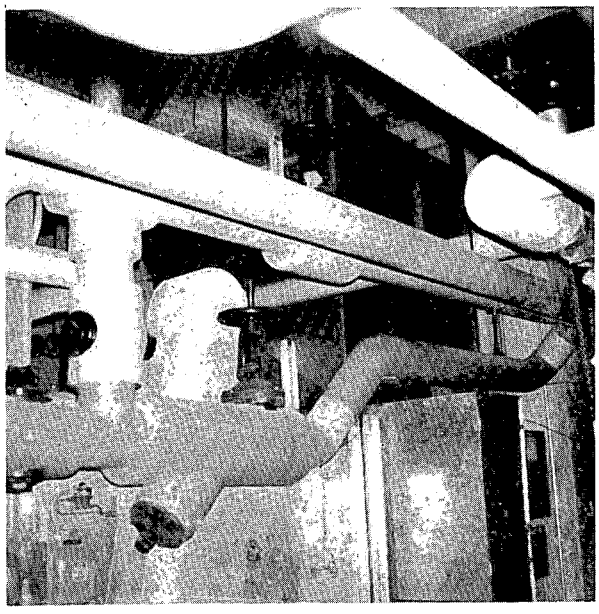


Photo 10-3

Side view of A/C unit #1 in Mechanical Room.

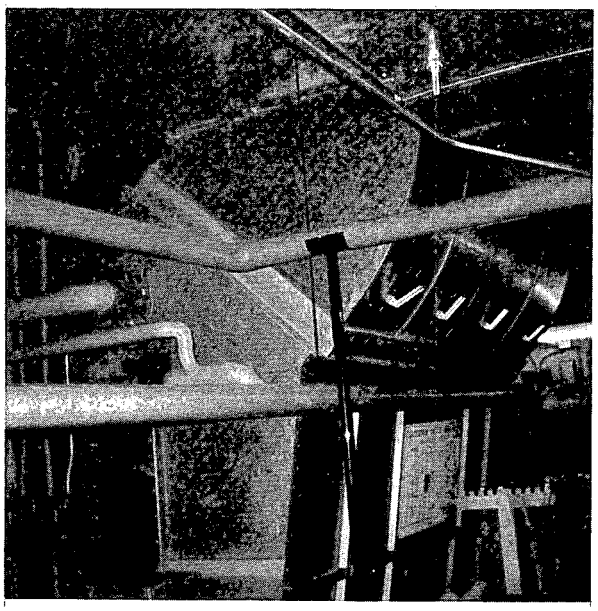


Photo 10-4

Discharge duct work from A/C unit #2 in Mechanical Room.

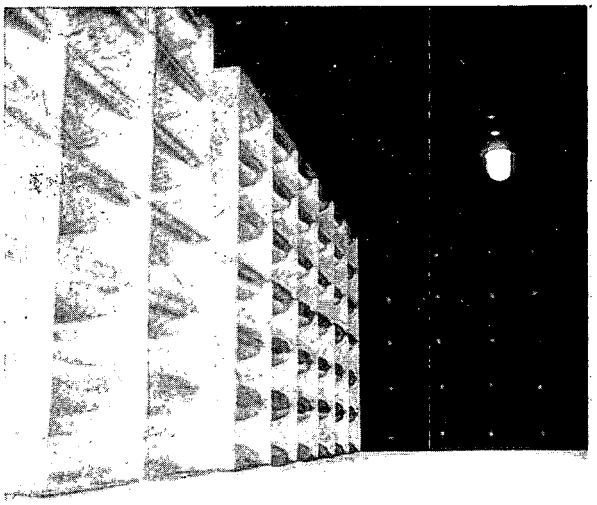


Photo 10-5

Sound attenuators on discharge side of hot/cold deck in learning center addition Mechanical Room.

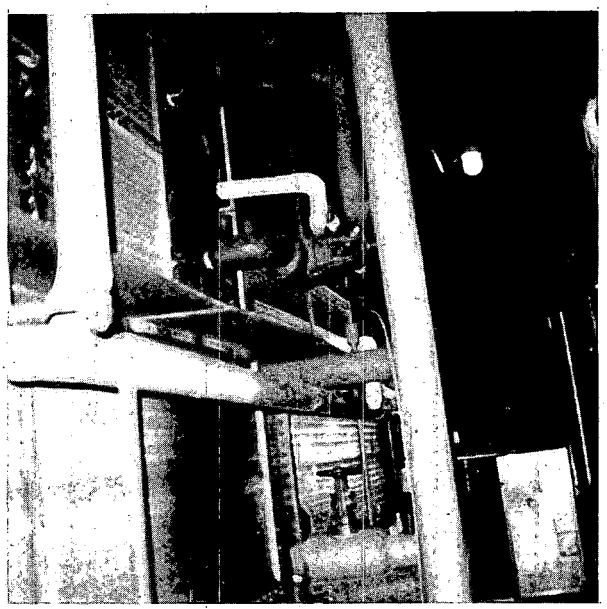


Photo 10-6

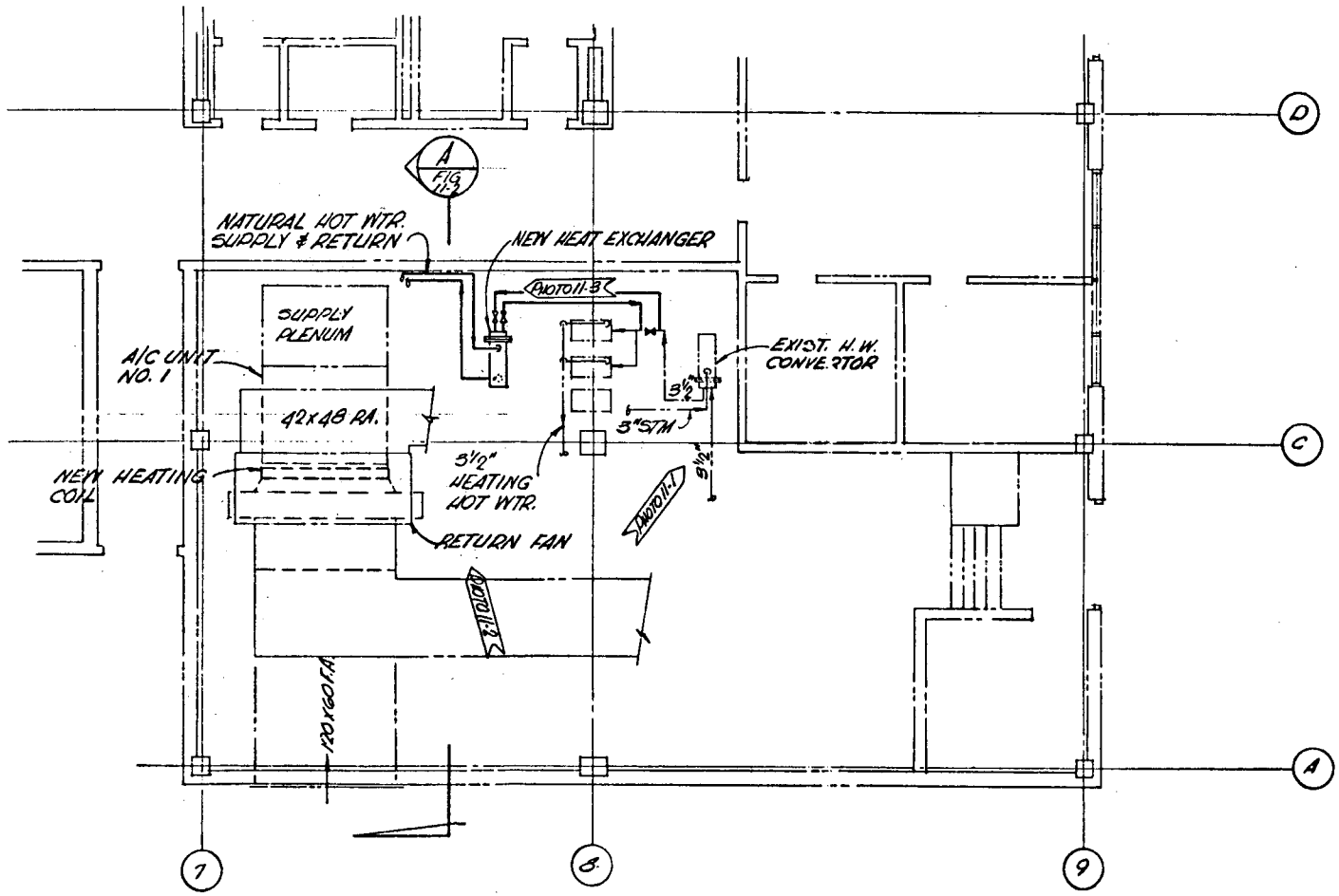
Hot/cold deck in learning center addition Mechanical Room.

3.11 Liberal Arts Building, BSU

The Liberal Arts Building is presently heated and cooled thru one multizone HVAC unit and one hot water heat exchanger both of which are located in the basement. Steam is supplied to each unit from the University Central Boiler Plant.

Modifications to each unit would include the installation of one geothermal hot water fin tube coil in the existing HVAC unit and the installation of one geothermal hot water/water heat exchanger series in series with the existing hot water piping. The new fin tube hot water coil will add some additional pressure drop through the forced air system and as such, the fan will be sped up. No investigation was made at this time to determine if sufficient fan motor capacity exists or if a new fan motor will be required.

Refer to Figures 11-1 and 11-2 and photographs 11-1 through 11-3 at the end of this subsection. Locations from which the photographs were taken are indicated on Figure 11-1.

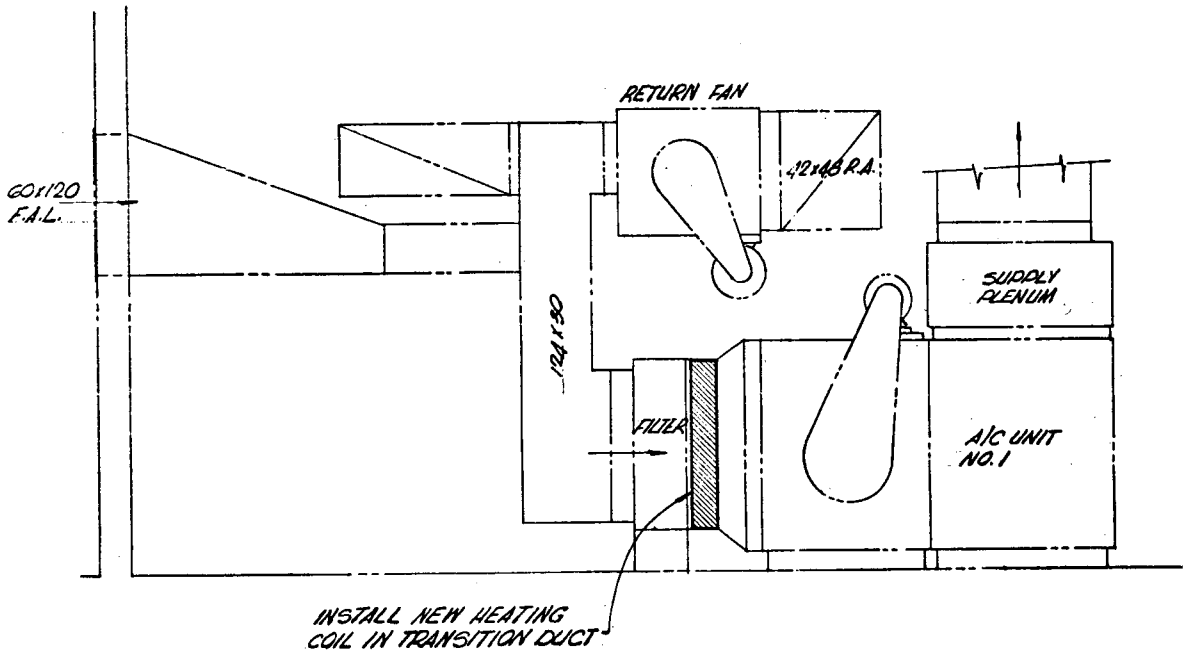


PLAN 1/8" = 1'-0"

LEGEND:
EXIST.
NEW

NOTE: ALL EXIST. PIPING & EQUIP. IS NOT SHOWN

FIGURE 11-1
BOISE STATE UNIVERSITY
LIBERAL ARTS BLDG.
MECHANICAL ROOM



SECTION A FIG 11-1 1/4" = 1'-0"

FIGURE 11-2
BOISE STATE UNIVERSITY
LIBERAL ARTS BLDG.
MECHANICAL ROOM

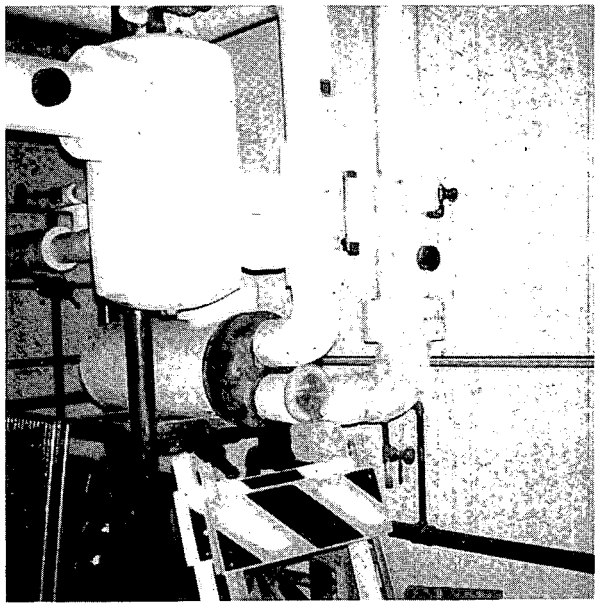


Photo 11-1

Hot water convertor.

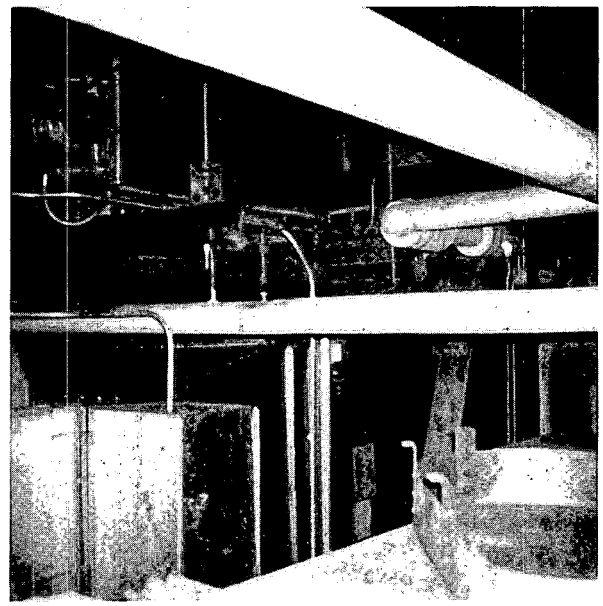


Photo 11-2

Side view of return fan above and A/C unit #1 below.

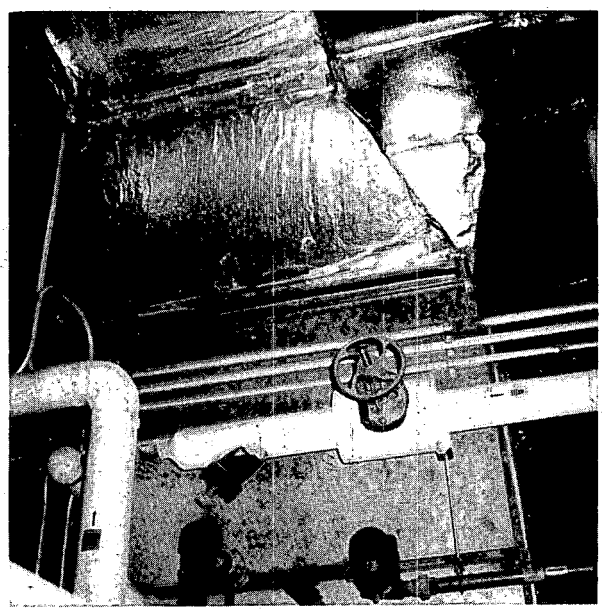


Photo 11-3

View of supply air plenum from A/C unit #1.

3.12 Student Union Building, BSU

The Student Union Building was constructed in two phases; the Student Union Building was built first and the Student Union Building Expansion followed at some later date. The total building is heated and cooled using eight multi-zone HVAC units, three Carrier HVAC units installed during the first phase and five Trane units installed during the expansion. Two of the Carrier units and four of the Trane units are installed in penthouses while one Carrier unit and one Trane unit are installed in the basement. Steam is fed to each unit from the University Central Boiler Plant.

Modifications to each of the eight units would include the installation of geothermal hot water fin tube coils located in the existing ductwork. In general, it is felt the least extensive modification would be to install the new coils in the return air ductwork between the electrostatic filters and the fan enclosure. The new coils will add some additional static pressure drop and as such the fans will be sped up. No investigation was made at this time to determine if sufficient fan motor capacity exists or if a new fan motor will be required.

Refer to Figures 12-1 through 12-4 and photographs 12-1 through 12-3 at the end of this subsection. Locations from which the photographs were taken are indicated on Figure 12-3.

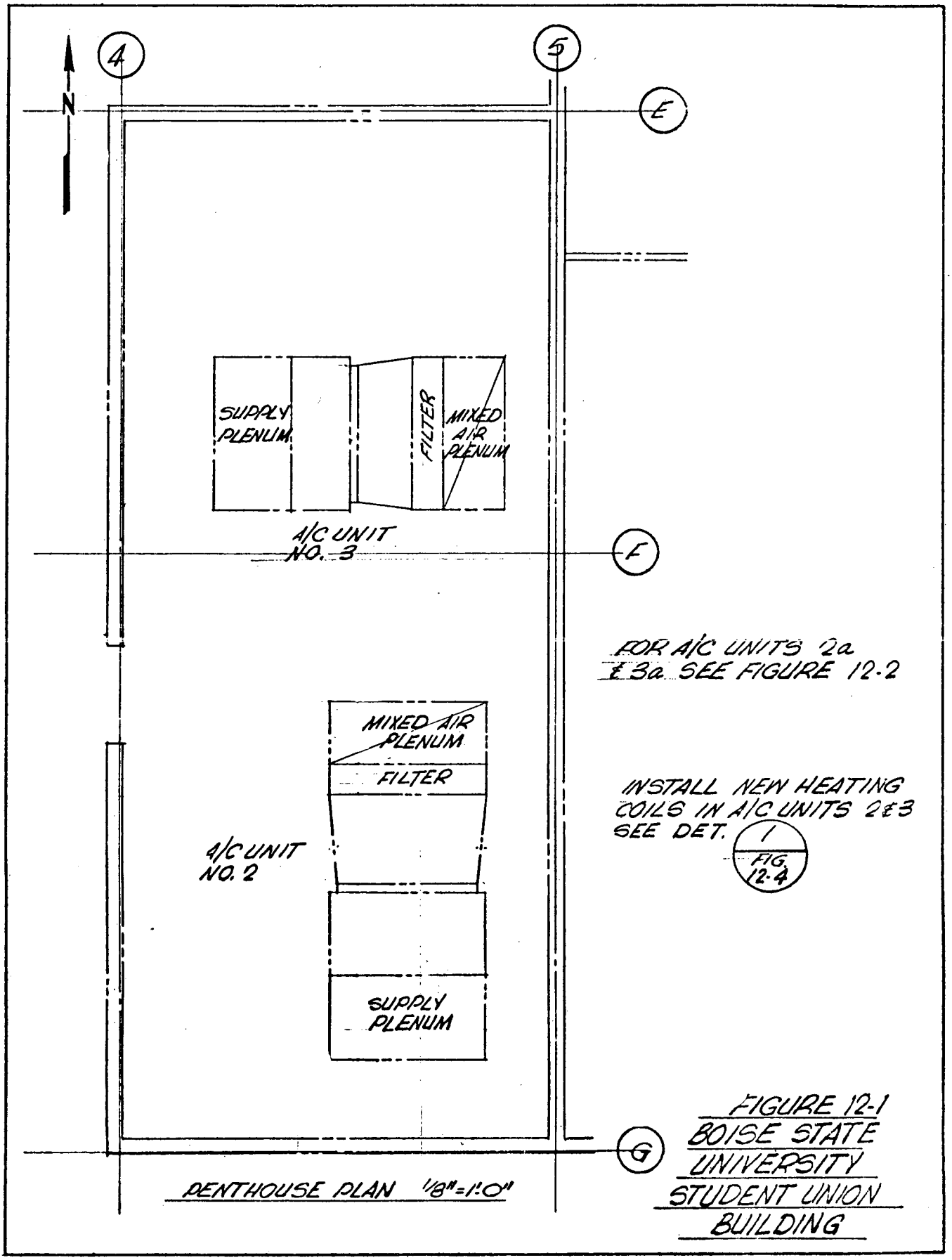


FIGURE 12-1
BOISE STATE UNIVERSITY
STUDENT UNION BUILDING

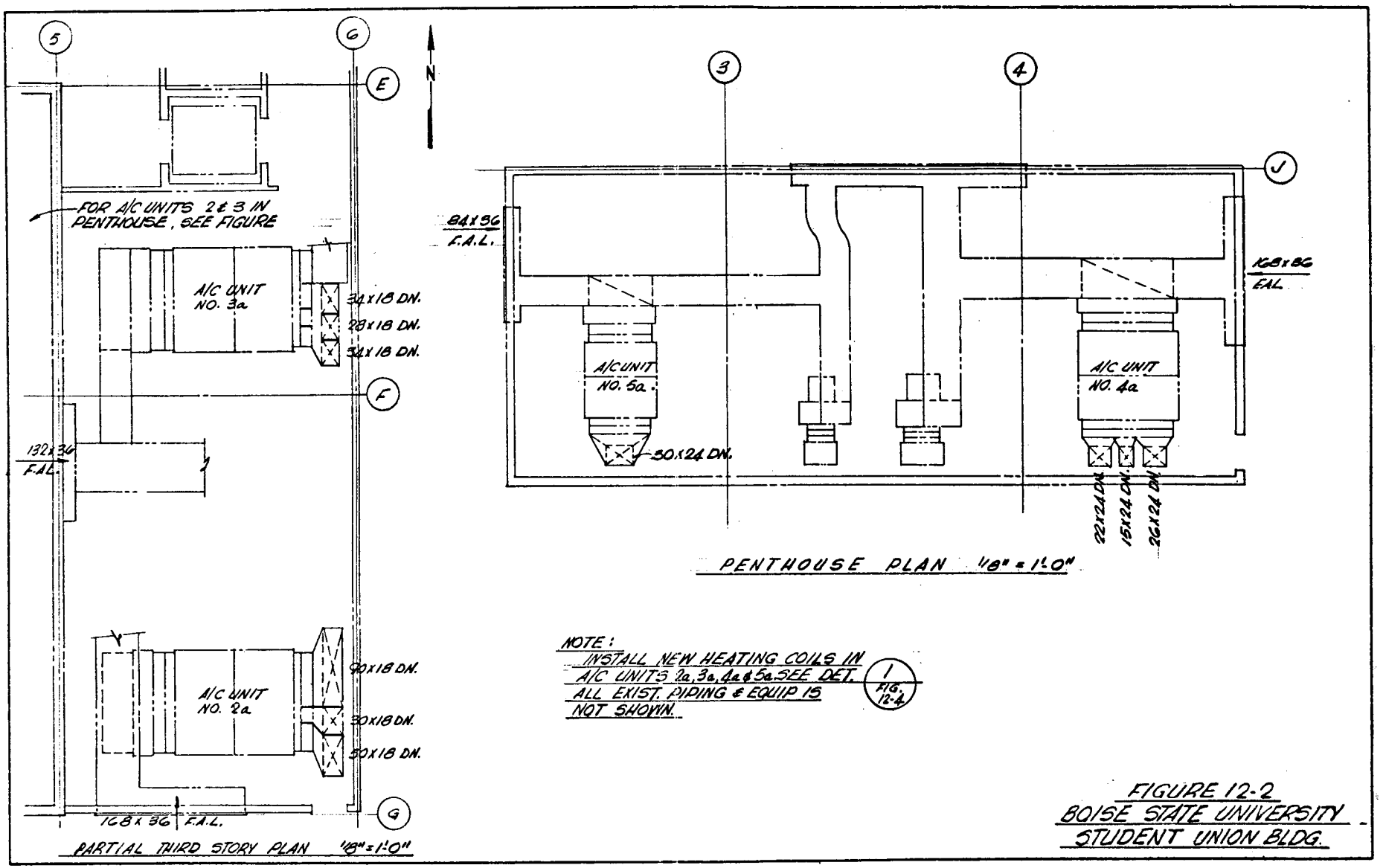
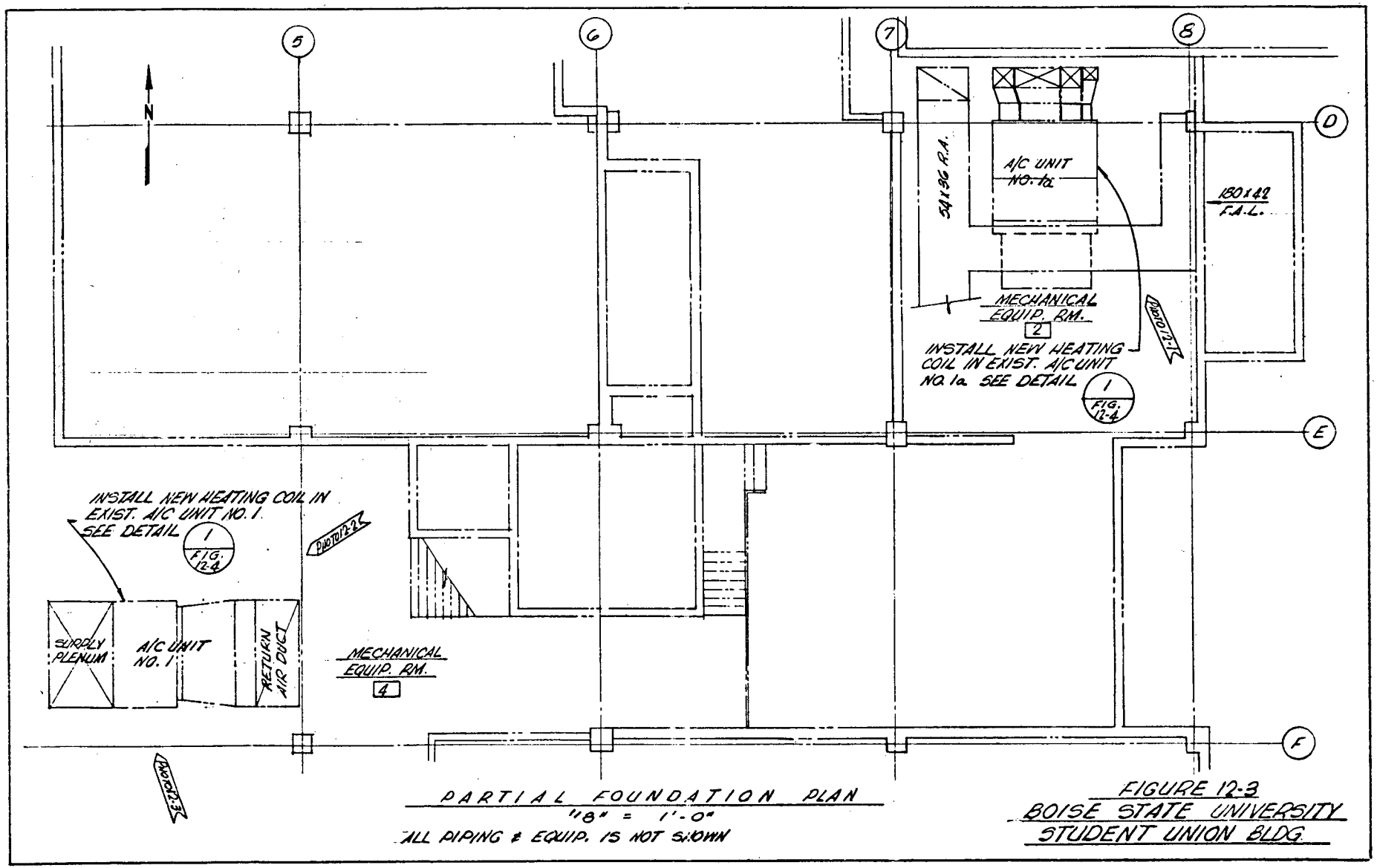


FIGURE 12-2
BOISE STATE UNIVERSITY
STUDENT UNION BLDG.



PARTIAL FOUNDATION PLAN
"8" = 1'-0"
ALL PIPING & EQUIP. IS NOT SHOWN

FIGURE 12-3
BOISE STATE UNIVERSITY
STUDENT UNION BLDG.

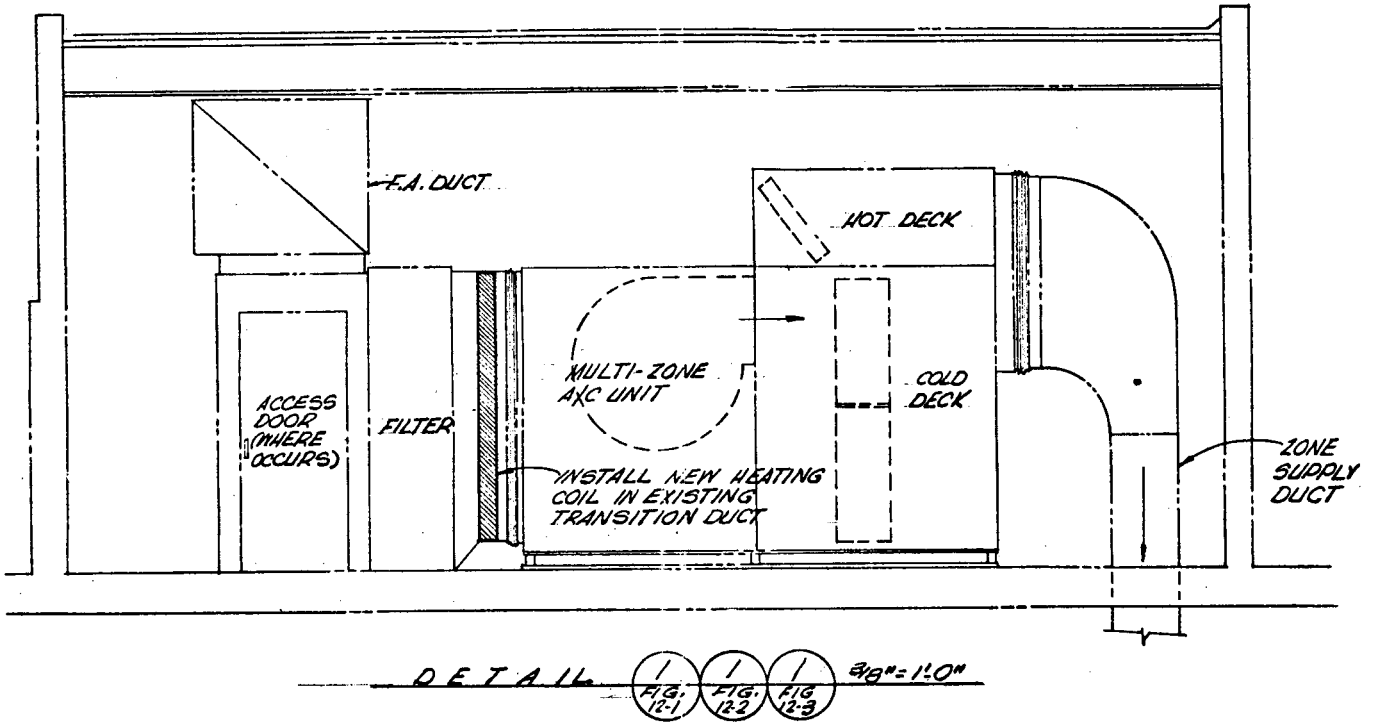


FIGURE 12-4
BOISE STATE UNIVERSITY
STUDENT UNION BLDG.

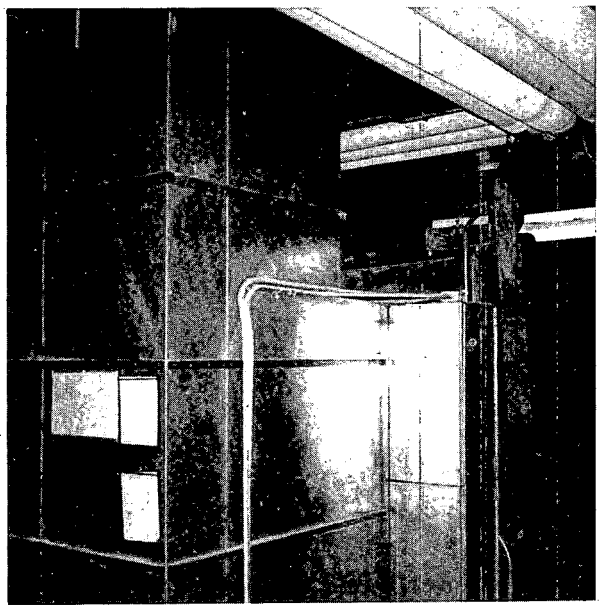


Photo 12-1

Side view A/C unit #1A.

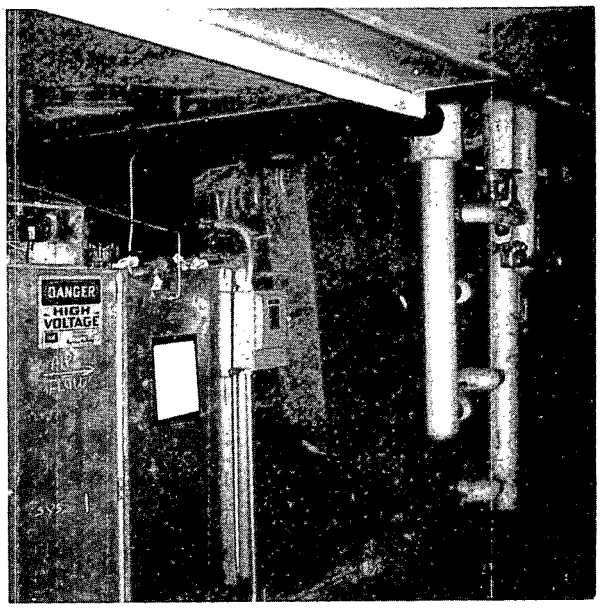


Photo 12-2

Side view A/C unit #1.

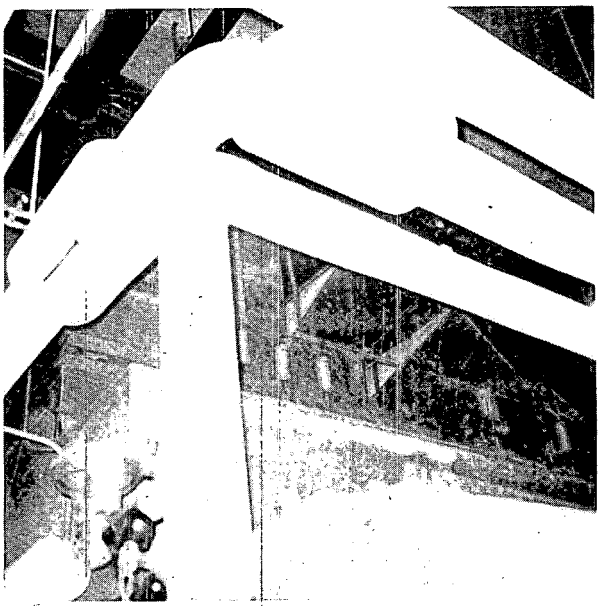


Photo 12-3

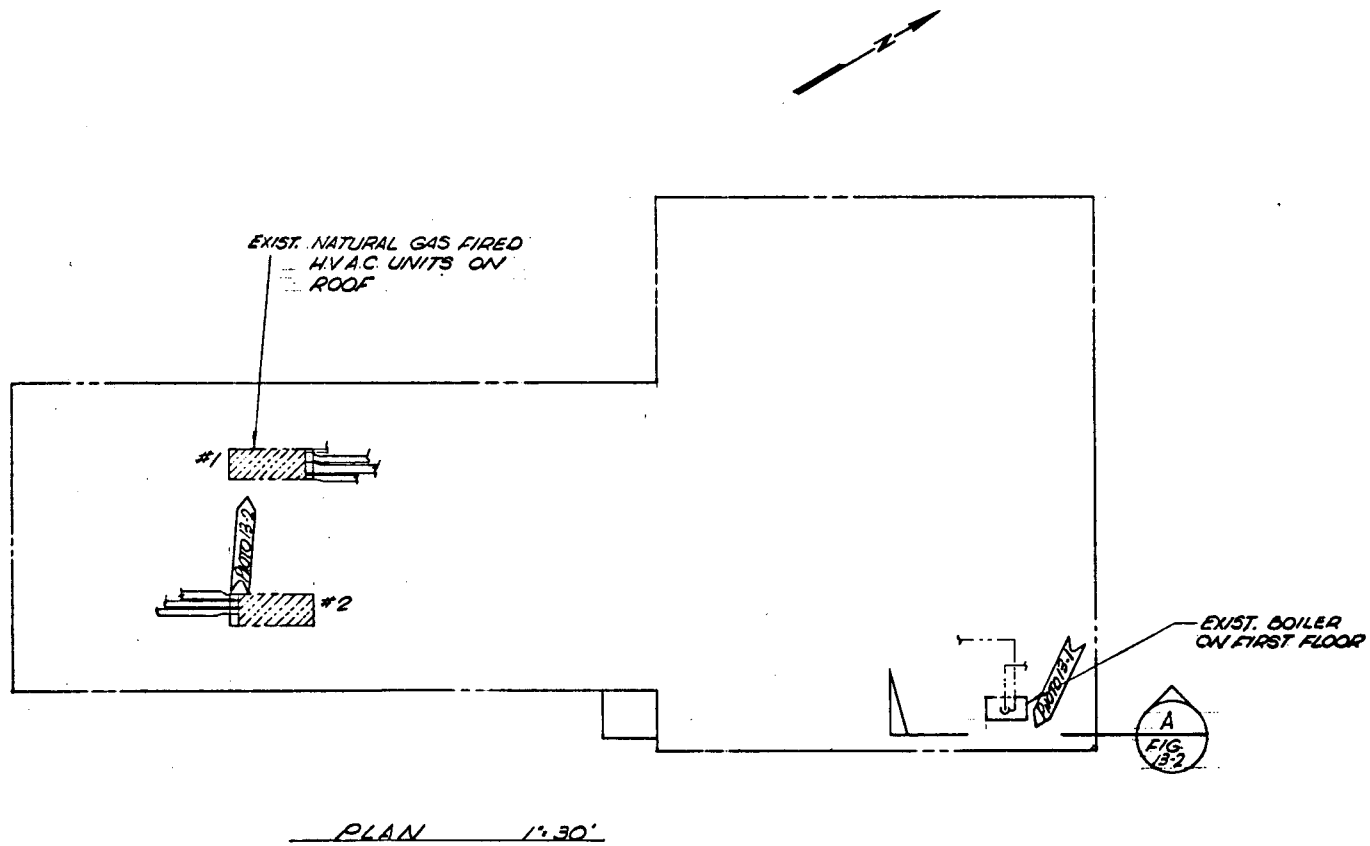
Side view of A/C unit #1 with supply piping.

3.13 Boise City Library

The Boise City Library building is presently heated using one hot water boiler located on the ground floor of the old addition and two natural gas fired forced air multi-zone heating and air conditioning units located on the roof of the new addition. Modifications to the system would include the installation of a geothermal water/water heat exchanger in the existing hot water piping. The existing circulating pumps would then draw or pump water through the existing boiler and also the new geothermal water/water heat exchanger.

The two natural gas fired forced air multi-zone units located on the roof of the new addition could be modified by installing geothermally heated hot water coils in each unit's outlet ductwork. At this time this modification appears to be quite difficult and although mentioned here it is recommended that further study be made during the initial design stages of this project.

Refer to Figures 13-1 and 13-2 and photographs 13-1 and 13-2 at the end of this subsection. Locations from which the photographs were taken are indicated on Figure 13-1.



PLAN 1"=30'

LEGEND:
EXIST BLDG & EQUIP

FIGURE 13-1
BOISE CITY LIBRARY
PLAN

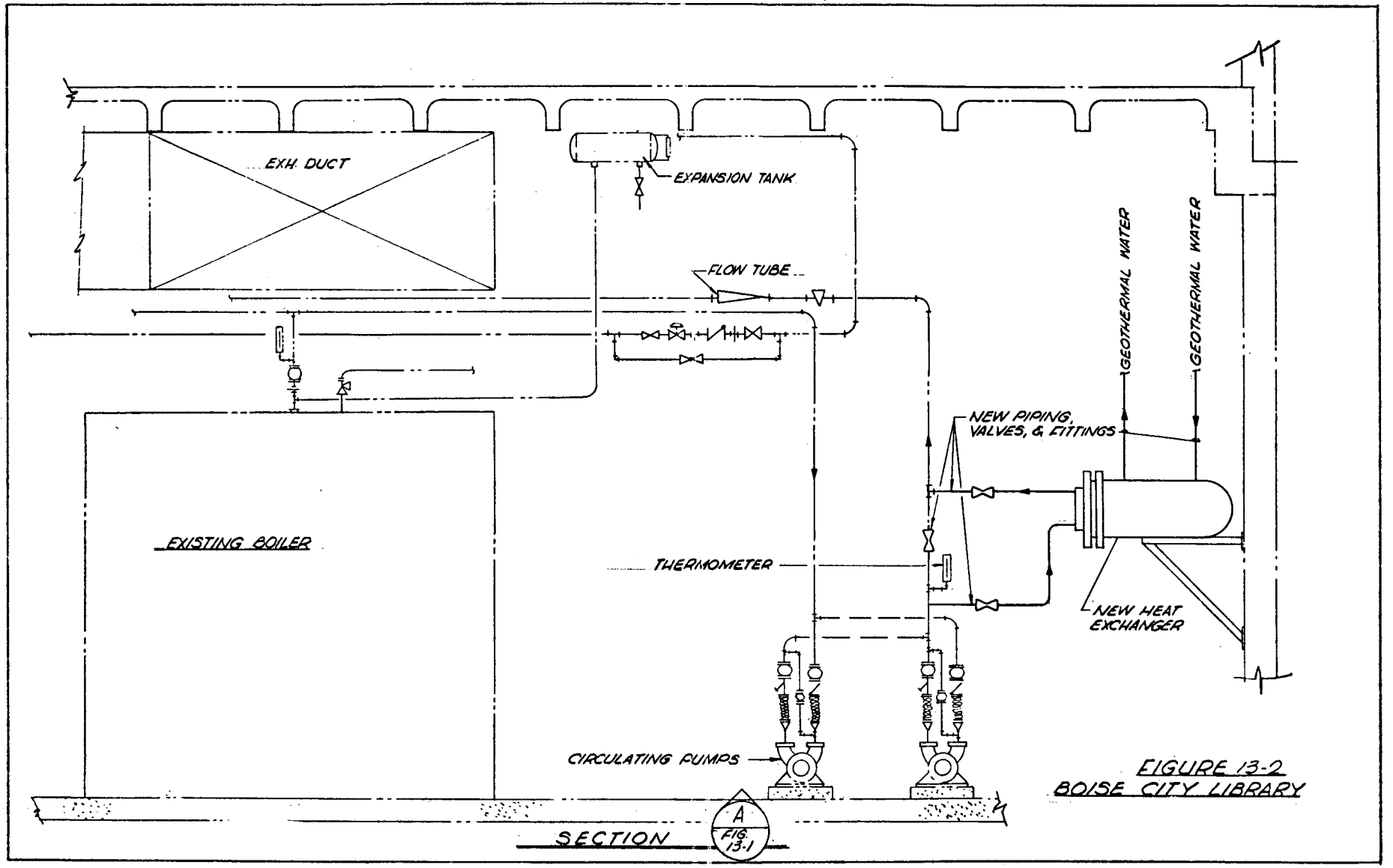


FIGURE 13-2
BOISE CITY LIBRARY

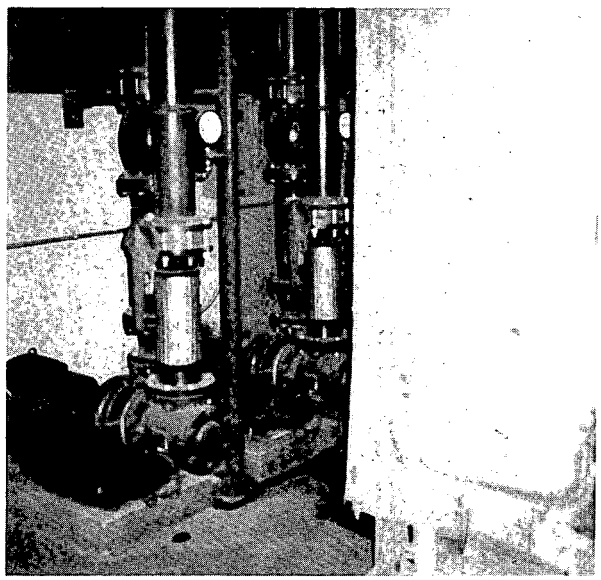


Photo 13-1
Hot water circulation pumps.

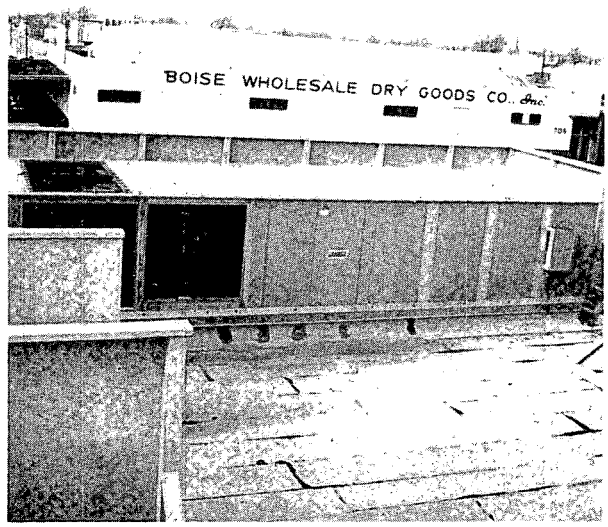


Photo 13-2
Roof mounted gas fired HVAC units.

13.14 Miscellaneous Photographs

Photographs 14-1 through 14-6 show typical installed fossil fueled boiler systems of the several buildings and building complexes studied in this feasibility study.

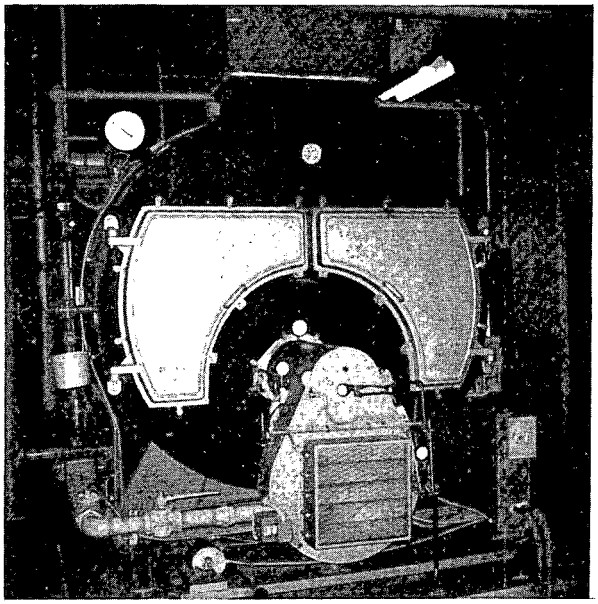


Photo 14-1

FEDERAL OFFICE BUILDING

Shown is one of the two 242 HP boilers installed.

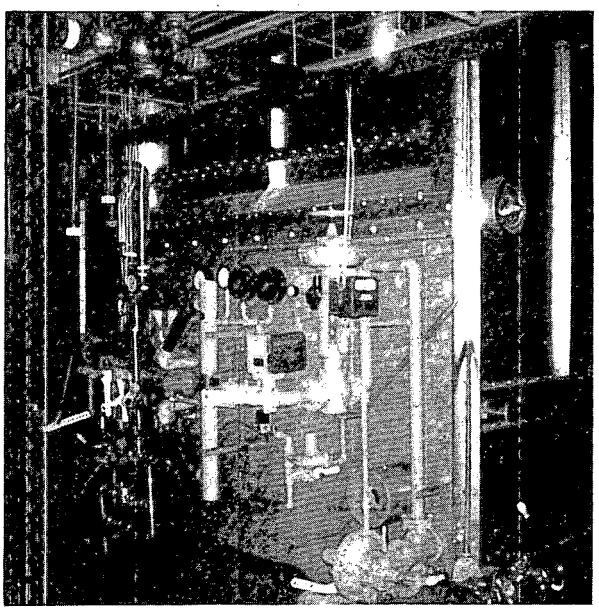


Photo 14-2

VETERANS ADMINISTRATION HOSPITAL

Shown is typical of the three boilers installed in the Central Heating Plant. The units include 2 boilers at 13,500 #/hr and 1 boiler at 10,000 #/hr capacity.

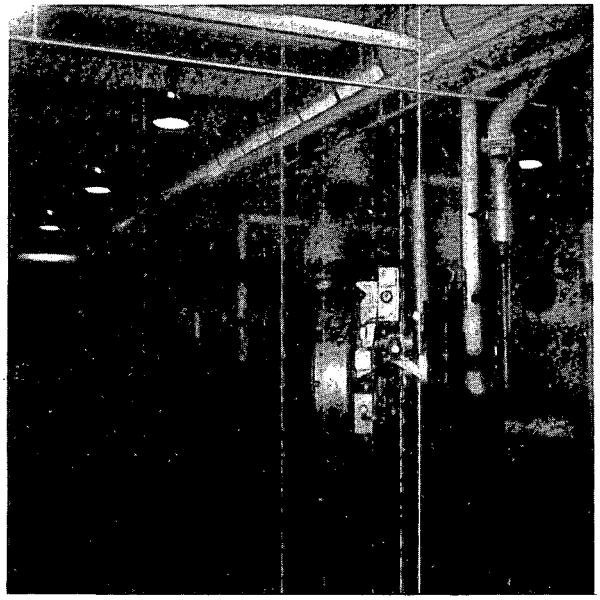


Photo 14-3

IDAHO STATE CAPITOL MALL

Shown in the foreground is one 200 HP boiler. In addition two 400 HP boilers are presently installed with one 600 HP unit under design.

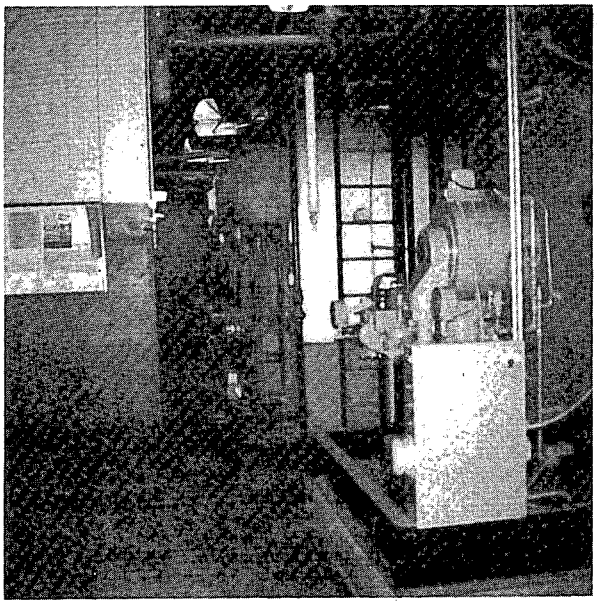


Photo 14-4
BOISE STATE UNIVERSITY CENTRAL BOILER PLANT

In the foreground is one 200 HP Powermaster boiler which is scheduled to remain. In the background are (5) 85 HP Kewaunee Fire Box boilers which are scheduled for removal.

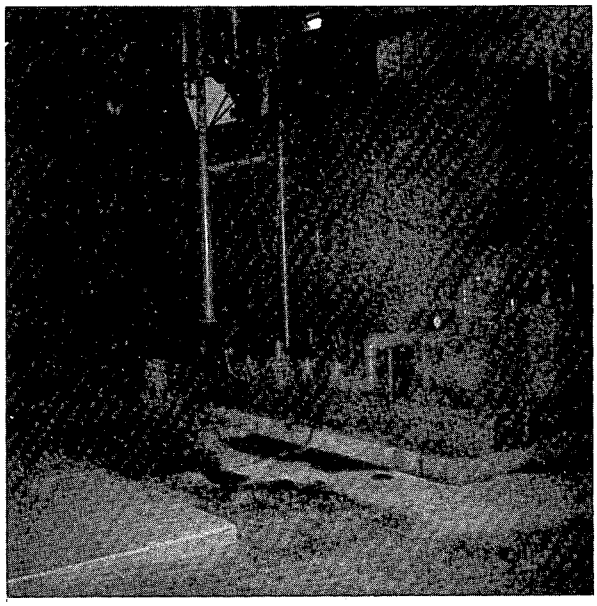


Photo 14-5
BOISE STATE UNIVERSITY CENTRAL BOILER PLANT

Shown on the right is one 600 HP boiler. An additional 600 HP unit is scheduled for installation on the pad to the left.

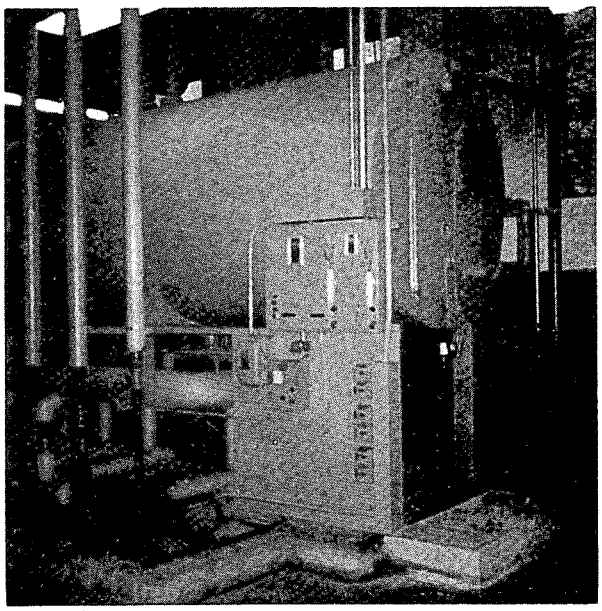


Photo 14-6
BOISE STATE UNIVERSITY CENTRAL BOILER PLANT

Shown is the deaerator tank. Returned condensate is collected here and heated to 200°F before the boiler feedwater pumps in the foreground pump the water to each boiler.

SECTION D

ACKNOWLEDGEMENTS AND REFERENCES

John Bell, Maintenance Foreman, Ada County Courthouse

Larry Garrett, Idaho Veterans Retirement Home

Mike Goodrich, Heating Inspector, Boise

Larry Loughridge, Idaho Veterans Retirement Home

W. Mike McClintoch, Building Manager, GSA

Herb Mingle, Director of Physical Plant, Boise State University

Claire Neves, Chief Engineer, Veterans Hospital

Tom Payne, Facility Superintendent, State Capitol and State Office Buildings

Nolan Prescott, Maintenance Foreman, Federal Post Office Building

Don Radkte, H&V Maintenance and Controls Technician, State Capitol and State Office Buildings

Joe Schultz, Assistant Director of Buildings and Grounds, Boise School District

Harry Stone, Assistant to Commissioner, Department of Public Works, State of Idaho.

Tom Towey, H&V Maintenance and Controls Engineer, Boise State University

Al Vaughn, Assistant Building Manager, GSA

Don Wisdom, Engineering, Inc.

Hummel, Hummel, Jones & Shawver

Watson & Leatham Architects

Dropping and Kelley Architects

Wayland Cline and Smull Architects

Cline, Smull, Hamill, Shaw & Associates

Engineering, Inc.

Cornell, Howland, Hayes and Merryfield

DISTRIBUTION RECORD FOR ANCR-1256

External

143 - UC-13 (TID-4500, R-62) Nonnuclear Energy Sources and Energy Conversion Devices.

Internal

1 - Chicago Patent Group - ERDA
9800 South Cass Avenue
Argonne, Illinois 60439

3 - A. T. Morphew, Classification and Technical Information Officer
ERDA-ID
Idaho Falls, Idaho 83401

31 - INEL Technical Library

20 - Author

Total Copies Printed - 198