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A Complete analysis of the problem involved

in the Heating and Ventilating of the

R.E.OLDS HALL OF ENGINEERING

at

the

MICHIGAN AGRICULTURAL COLLEGE

A Thesis submitted to

The Faculty of

MICHIGAN AGRICULTURAL COLLEGE

BY

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Bachelor of Science

June ,1916.

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The requirement for proper ventilation in public buildings of today has led to various methods of combined Heating and Ventilating installations.

The combined system used in the following pages is known as the Attic Steam Main - Plenum Warm Air , the Attic Steam Main delivering the heat for direct radiation while the Plenum Warm air is used entirely for Ventilation The two fundamental points in view are, first; to supply the entire radiation loss from the building with heat delivered by exhaust steam under five pounds pressure to each individual room by American Cast Iron Radiators, secondly; to supply the entire ventilation loss from the building by the use of force draft Plenum fans, the ventilating air to be heated from the outside temperature to the temperature required for delivery to the various rooms by means of Plenum Coils of such dimensions that the air shall enter the main air duct fromt the Fans at a constant velocity and a constant temperature.

The method used in determining the heat loss by radiation was to obtain from standard practice constants for the rate of transmission of the heat in B.T.U. per hour per square foot of exposed area per degree difference in temperature between the inside and the outside air. To obtain the heat loss by radiation from the rooms per hour the procedure was as follows:-

Determine the number of square feet of exposed glass area. The constant for single pane glass as taken from several authorities namely Hoffman, Haus and Wolff who agree very closely, is one B.T.U. per hour per degree difference in temperature between the inside and the outside air per square foot of exposed area. This constant times the total exposed glass area in square feet gives the number of B.T.U. radiated from the room through the glass per hour per degree difference in temperature.

The next step was to determine the total exposed wall area in square feet, deducting the glass area as found in the first step. The constants for different thicknesses of wall ,as recommended by the authorities before stated are; tabulated on a following page in the computations. The total wall area in square feet times the constant for the rate of transmission through that thickness of wall ,gives the total heat loss through the walls of the room in B.T.U. per hour per degree difference in temperature between the inside air and the outside air.

The next step in the determination of the heat loss ffom the rooms is to find the exposed ceiling area in square feet. This area times the constant for the rate of transmission through the ceiling, which is .10B.T.U. per hour per square foot of exposed area per degree difference in temperature between the inside and the outside air gives the heat loss for the room through the ceiling in B.T.U. per hour per degree difference in temperature.

The total volume of the room was next computed. This volume times the constant for the rate of leakage and transmission of heat from the room in B.T.U. per cubic foot per hour per degree difference in temperature gives the heat loss from the room in B.T.U. per hour per degree difference in temperature.

The total wall area as computed has to have added t to it a certain percent of the exposed area, which depends on the dirrection of exposure. The percentages allowed for exposure for the different rooms are given on a following page of constants for the building.

The final step in the computations for the total heat loss in B.T.U. per hour from the rooms is tomultiply the sum of the heat losses through the windows ,walls, ceiling and by convection from the rooms by the degree difference in temperature between the inside and the outside air,which for the case under consideration was 70°.

The forgoing principles follow very closely the formulae recommended by Professor Carpenter for obtaining the heat losses,from a room,due to radiation,

To determine the net radiation surface required to supply the radiation losses from the different rooms the formulae recommended by Professor Hoffman in his Heating and Ventilating Handbook from data used in standard practice is

$$Rs---- \quad H/1.7(ts-t)$$

Rs---- Total radiation surface,in square feet, required for the room.

1.7--- is the number of B.T.U. given off by one square foot of radiating surface per hour.

H---- Total Heat loss from the room.in B.T.U. per hour.

t----temperature of the room.

ts---temperature of the steam.

After determining the total net radiation surface required to supply the radiation loss from the rooms, it was necessary to determine the size of radiator to install in the rooms. The computed net area ~~of the~~ in square feet of the radiation surface ,divided by the radiation surface per stack as given by the American Radiator catalogue determines the number of stacks required for the room. These stacks were then built up into the proper size of radiators for the room under consideration.

In the determination of the size of radiator for the room, the height depended on the distance from the floor to the window cill and was first considered in finding the number of stacks for the room under con-- sideration . In order that the rediator would not be exce dingly long the width of the stacks and the number of columns per stack were so proportioned as to be best suited for the room in which they were to be placed.

For the ventilation of public buildings each individual requires a definite amount of Ventilating air per hour.Expressed in cubic feet per hour this value is a constant forthe case under consideration being about 1800 cubic feet , which is considered by authorities as sufficient fo r good ventilation where the occupants of the room are not doing physical exercize.After determining the amount of air necessary for the building the total heat loss by Ventilation is found by applying the formulae:-

H' equals**Q(t-t')/55

H' *****Heat loss by Ven tilation from the building

Q *****Total number of cubic feet of ventilating air required per hour for the building.

t ***** Temperature of the air entering the room from the register.

t' ***** Temperature of the air in the room.

55 ***** the number of degrees through which one cubic foot of air is heated by one B.T.U.

This formulae reduces to :-

H'------.3122 x Q

for t---87.2°

t'--70.0°

The Plenum Fans must deliver the total ventilating air required for the building. Knowing the number of cubic feet of air to be delivered to the rooms per hour the number of cubic feet delivered per minute is found. From the American Blower Companies Fan catalogue on Steel plate type of Fans the capacity of their different sizes is given in Cubic feet of air per minute. The back pressure or static pressure against which the fan delivers this air is one inch.and size Number 180 is necessary to completely ventilate the building properly.

The Plenum Coils through which the fan takes its Ventilating air to deliver it to the rooms has to be of such a depth with the air passing over the coils atea specified velocity as to raise the air from outside temperature to the temperature of delivery to the rooms. The limiting velocity of the air ,acting against a static pressure in theemain air duct,and passing over the coils such that upon leaving the fan it will have attained the proper amount of heat and be most edonomical in the number of stacks in the heater are given in the Buffalo Forge Companies Fan an Heater Catalogue. From this data the depth of heater is obtained which will raise the ventilating air from autside to delivery temperature each section of the heater being four pipes deep.

The total number of square feet of surface required forthe heater to raise the volume of air to be delivered by the fan to the building to that degree of temperature necessary to supply the ventilation loss.
The formulae used in the calculation of the heating surface is:-

$$Rs \text{ equals } H'/7.8(ts - \frac{t \text{ plus } t's}{2})$$

Rs***** Heat surface.

H'***** Heat Loss by ventilation from the building.

7.8 ***rate of transmission of heat to the air passing through the coils.

t****** temperature of air entering the room at the register.

ts **** temperature of the steam in the heater.

t's *** temperature of the room.

This total radiating surface required in the heater divided by the number of coils deep the heater must be to obtain the proper temperature of delivery, gives the number of square feet of surface per stack in the heater. The Buffalo Forge catalogue value for the depth of heater required to obtain the proper temperature for the ventilating air,87.2° in this case checks the value for the depth of heater as taken from the J.D.Hoffman Handbook on Heating and Ventilating and the requirement is a depth of twenty pipes or five sections of four pipes to a section The size of heater is then obtained by refering to the table on the sizes of Buffalo Standard Heaters.

For the quantity of air to be delivered by the fan per minute the free air space is determined by dividing the number of cubic feet supplied by the velocity of the air over the coils in feet per minute. This value should check the value found for the free air space in the heater determined upon and does within seventy one hundredths of a square foot.which is as close a value as can be obtained.

The size of air ducts required for the delivery of the ventilating air to the various rooms is found by :-

A------144Q/60V

A ***** Area of the duct.

Q ***** Quantity of air to be supplied by the duct, in cubic feet per hour.

V ***** Velocity of the air in the duct at the point at which the section is to be determined, Velocity in feet per minute .

144/60 a factor which reduces the area of the duct to square inches of cross-sectional area.

The above formulae applies to any portion of the ventilating air duct and gives a result in square inches from which the dimensions of the duct are determined.

All radiators are to be of Cast Iron and of the American Radiator Companies make.

Radiator connections and piping including the steam main and return equipment are to be of the Crane Companies make and to be of standard Cast Iron material threaded and reamed and ready for assembly .

Heater connections and piping to be of the Buffalo Forge make and of the kind specified in the Heater equipment necessary for the heater determined upon.

Window Scheduel and sizes for:-

Basement:-

West side:-(54-42) 2(26-34) *-------28.03 square feet.
East side:-(54-42) 2(26-34) -------28.03 square feet.
North side-(58-42) 2(28-34) ---------30.I3 Square feet.
South side-(48-42) 2(28-34) -------27.22 square feet.

First floor:-

West side:-(54-50) 2(26-42) -------33.90 square feet.
East side:-($4-50) 2(26-42) -------33.90 square feet.
North side-(58-50) 2(28-42) -------36.50 square feet.
South side-(58-50) 2(28-42) -------36.50 square feet.

Second floor:-

West side:-(54-48) 2(26-40) --------33.8 square feet.
East side:-(54-48) 2(26-40) --------33.80 square feet.
North side-(58-48) 2(28-40) --------34.90 square feet.
South side-(58-48) 2(28-40) ----------34.90 square feet.

Third floor:-

West side:-(54-46) 2(26-36) --------30.25 square feet.
East side:-(54-46) 2(26-36) --------30.25 square feet.
North side-(58-46) 2(28-36) --------32.53 square feet.
South side-(58-46) 2(28-36) --------32.53 square feet.

Fouath floor:-

West side:-(2(26-34) ---------I2.30 square feet.
East side:- 2(26-34) *--------I2.30 square feet.
North side-2(28-34) ---------I3.22 square feet.
South side-2(28-34) ---------I3.22 square feet.

South side center windows above Mechanical Laboratory.

Second floor:-(40-40) I(40-48) --------24.44 square feet.
Third floor :-(40-36) I(40-46) --------22.77 square feet.
Fourth floor:-(2(20-34) ------------- 9.44 square feet.

West windows in East wing above Mechanical Laboratory.

Second Floor:-(58-48) 2(28-40) -------34.90 square feet.
Third floor :(58-46) 2(28-36) -------32.53 square feet.
Fourth floor:-(2(28-34) --------------I3.22 square feet.

East windows West wing above Mechanicl Laboratory.

Second floor:-(none)
Third floor:-(58- 40) 2(28-36) -------32.53 square feet.
Fourth floor:-(2(28-34) ---------I3.22 square feet.

Heating and Ventilating Calculations for the Basement of the New R.E.Olds Mechanical Building.

Basement.

Window scheduel:-

West side	1(54x42)	2(26x34)	28.03	square feet
East side	1(54x42)	2(26x34)	28.03	square feet
North side	1(58x42)	2(28x34)	30.13	square feet
South side	1(48x42)	2(28x34)	27.22	square feet

Wall and window constants:-

Heat transmission	.222	for 20 " wall
Heat transmission	1.000	for glass
South exposure	5	percent
East exposure	15	percent
North exposure	25	percent
West exposure	25	percent

Height of ceiling	13 feet 6 inches
Height of window cill from floor	2feet 10 inches

Radiator heights except for corridors 32inch.
American Radiators used of Cast Iron ,two colmmn,eight inches wide three inches thick with a total radiating surfaceof 3.33 square feet per stack.

Formulae:-

Total Heat loss by radiation:- H:(Gplus ktimes W plus.02nC) tx
H ----Total Heat loss in B.T.U.per hour.
G ----Total Glass area in room.
k ----constant on heat transmission through the walls.
W ----Total wall area exposed minus the glass area.
n ----number of air changes per hour in the room for ventilation
C ----Cubic contents of the room.
tx ---difference in temperature between the inside air and the outside air.

Quantity of air required per hour for ventilation Q:1800 n
1800 cubic feet required per person per hour.
n --- the number of person requiring air.

Total heat loss by ventilation H': $Q\frac{(t-t')}{55}$

Q---ventilating air required.
t---temperature of the air at the register. 87.2°
t'--temperature of the air in the room. 70°
55 --a constant denoting that one cubic foot can be heated through 55 degrees by one B.T.U. (of air)
With t at 87.2 and t' at 70 this formulae develops into
H' equals 0.3122times Q the air required for ventilating purposes.

Basement .

Formulae continued:-

RsRadiator surface--Rs- $\frac{H}{1.7(220-70)}$ equals.004 H

I.7 --represents the rate at which the radiator surface gives off heat in B.T.U. per square foot per degree difference between the temperature of the air surrounding the radiator and the a average temperature of the heating medium which is taken at 220° for exhaust steam at five pounds gage at which this system receives it .The temperature of the surrounding air being room temperature 70 degrees.

In calculating the radiation surface the actual amount as found by the preceeding formulae is increased by twenty five percent to take care of ventilating losses.

This formulae reduces to .005 H.

With a given quantity of air passing through the main air duct, the calculations for which are shown under the Plenum and Ventilating side of the problem for the size of main duct required, and the branch ducts,the velocities of air entering the different rooms for ventilating purposes was taken depending on the use of the room and the number of occupants between the limits of One hundred and Five hundred feet per minute holding close to standard practice.

Assuming an air velocity for the register with a known amount of air to be furnished to the room per hour the formulae for the area of the gross register is :-

A equals Q' the ventilating air times 144/60V

The fraction 144/60 converts the Quantity of air per hour to the quantity per-minute for the use of V in feet per minute, while the term 144 makes the final answer in square inches of gross area of register.This formulae takes the form of

A equals 2.4 times Q'/V which is applicable for any part of the ventilating ducts in determining its sectional area.

From the gross area of the register the size of the opening is determined , the width of the opening being recorded first and the depth second in my tabulations.

The temperature of the steam under five pounds pressure as supplied to the heating system hasa temperature of 220°

The temperature of the ventilating air leaving the registersis 87.2.

The temperature of the rooms is to be kept at 70 degrees with an outside temperature of zero degrees thus allowing for the worst possible condition.

The preceeding formulae apply to each room individually in determining the several items enumerated. These apply through out the building and are used for each room separately in the calculations.

Radiation losses plus twenty five percent of the se losses are supplied by direct radiation , while the Plenum Fan furnishes all Ventilation loss in the building.

Constants for Heat Transmission through the Walls,Windows and Doors, in B.T.U. per square foot per hour per degree difference of Temperature.

Glass surface:- -----1.00
Ceilings ,Joist with single floor and roofing--------.I0
For :-

Basement with 20 inch wall ---------------------.222
First floor with20 and I6 inch walls -----------.222 and.272
Second floor with I4 inch walls -----------.272
Third floor with I6 and I4 inch walls ---------.26 and.27
Fourth floor with I2 inch walls ---------------.3I3
Fourth floor with ceiling as above stated ------.I0

Percentages allowed for exposures :-

South exposure -----------------------------.05
East exposure -----------------------------.I5
West exposure -----------------------------.25
North exposures -----------------------------.25

In the use of these constants the percentages of exposure were used in determiningthat amount of area of exposed surface sufficient to transmit from each room as calculated a greater number of B.T.U. than would adtually be radiated by the wall exposure which the room actually has.In this way sufficient heat isfound by the formulae for total radiation loss to overcome twenty five percent more radiation area,in the case of north or west exposure,than it would seem necessary but due to the high velocity of the wind over exposed surfaces ,it literally wipes off that excess twenty five percent of heat which these constants supply in the total heat loss.

By the constants of heat transmission the actual rate of passage of the heat from the room to the exposed surface in B.T.U. per square foot per hour per degree of difference of Temperature is allowed for in the total heat loss formulae.

The formulae used in determining the total heat loss from each room by radiation is:-in B.T.U. per hour.

Heat loss equals-{Glass area (plus) the constant of Heat transmission for that thichness of wall exposed,times the wall area exposedwith the percentageof expossure added (plus) .02 times the number of changes of air required in the room times the total volume of the room in cubic feet) all multiplied by thedifference in temperature between the inside and outside air which was taken as seventy degrees for this locallity.

All area in this formulae is in square feet and all volume in cubic feet. For fourth floor losses there has to be added to this formulae,before multiplying by the temperature ,the constant for Heat transmission through the ceiling times the number of square feet of exposed roof area,also I.2times the total square areaof exposed roofing has to be usedinstead of the actual roof area in order to take care of the exposure.losses

Calculations for the Heat Losses in B.T.U. per hour per degree difference in Temperature, Square inches of net register area for ventilating the rooms, Square feet of net radiator surface required to supply the radiation loss, The amount of Ventilating air required for each room in Cubic feet per hour.

BASEMENT.

Constants for the basement:-
Height of windows from the floor----- 2'10"
Height of Radiator used --------- 32"
Number of column to each radiator section---2

ROOM(I).

DIMENSIONS of ROOM -(22'6"x17'x13'6") -(6'6"x3'6"x13'6")
Dimensions of stack -(2 x4 x13'6") -(4x8'6"x13'6")
Windows --Two north @ 30;13 square feet---60.26 TOTAL
Walls (17x13.5) plus.25(17x13.5) minus 60.26--227.20 TOTAL
Volume (22.5x17x13.5) plus(6.5x3,5x13.5) -----4721.62 TOTAL
Heat Loss--(60.26 plus.222(227.2)plus.02x1x4722)70--
Radiation Loss--14,357 B.T.U. per hour.
Number of people to be accomodated------------ 5
Number of cubic feet per person 1800
Cubic feet of air required per hour 5x1800------9000
Heat Loss by ventilation 9000x.3122 -------- 2810 B.T.U.
Radiator surface required for the room
14357x.005-------- 73 1/3 square feet
Number of sections to a radiator -------11
Number of radiators ------------- 2

ROOM (2)

DIMENSIONS of ROOM--(11'6"x22'6"x13'6")
Dimensions of Stack-(2'x7'x13'6")
Windows-- One north @30.13 square feet 30.13 TOTAL
Walls --11.5x13.5)plus(.25(11.5x13.5)-30.13- 163.9 TOTAL
Volume--11.5x22.5x13.5)-(2x7x13.5) ------ 3304.00 TOTAL
Heat Loss--(30.13 plus.222(163.9)plus.02x1x3304)70------
Radiation Loss--9280 B.T.U. per hour.
Number of people to be accomodated ---------- 4
Number of Cubic feet per person ------- 1800
Number of Cubic feet of air per hour 4x1800------ 7200
Heat Loss by Ventilation 7200x.3122-- 2252 B.T.U.
Radiator surface required for the room
9280x.005---------46 2/3square feet
Number of radiators --------- 1
Number of sections to a radiator -- 14

The constant used in determining the Ventilation loss.3122 is the temperature of the air entering the room from the fan(87.2) minus the room temperature (70) divided by the number of degrees through which one cubic foot of air can be raised by one B.T.U. This constant times the number of cubic feet of air supplied to the room for ventilating purposes gives the number of B.T.U. lost by the ventilating air

ROOM(3)

DIMENSIONS of room(22'6"x29'x13'6")
Dimensions of stack(28'x2'x13'6")
Windows-- Two North @3013 ---------- 60.26 square feet
Walls(22.5x13.5) plus(22.5x13.5).25 -60.26--319.43 " "
Volume (22.5x29x13.5) ---------minus 7568 --8053 Cubic feet
Heat Loss ------(60.26plus.222(319.4)plus.02x1x8053)70
Radiation loss--20454 B.T.U. per hr
Number of people to be accomodated 15
Number of Cubic feet per person 1800
Cubic feet of air required per hour-----27000
Heat loss by Ventilation 27000x.3122--8450
Radiator surface required for the room--
20454x.005 ------- 103 1/3 square feet
Number of Sections to a Radiator--- 15 ---16
Number of radiators installed 2

ROOM (4)

DIMENSIONS of room(22'6"x40'x13'6")
Windows --Four East @28.03----------- 112.12
Two North @30.13----------- 60.26 Total-172.38
Walls ((22.5plus 40)13.5 plus.4(22.5plus40)-172.38-705.00
Volume22.5x40x13.5) -------- 12150
Heat Loss----(172.38 plus.222(705)plus.02x1x12150)70
Heat Loss by radiation--- 40033 B.T.U.
Number of people to be accomodated ----- 10
Number of cubic feet of air per person--- 1800
Number of Cubic feet to be supplied per hr- 18000
Heat Loss by Ventilation --- 18000x.3122-- 5630
Radiator Surface required for the room--
40033x.005-- 203 1/3
Number of Radiators installed 3
Number of stacks per radiator 2(20) 1(21)

ROOM(5)

DIMENSIONS of Room(29x26'6"x13'6")
Dimensions of stack(16x1'6"x13'6")
Windows----Three South@ 27.22-- 81.66 square feet
Three East @28.03--- 84.09 " "
Total 165.75 " "
Walls ((29plus 26.5)13.5 plus.(29plus26.5)13.5-165175--598.5
Volume(29x26.5x13.5)-(16x1.5x13.5)--- 10057.0
Heat Loss (165.75 plus.222(598.5) plus.02x1x10057) 70---
Heat Loss by radiation--35112 B.T.U. per hr.
Number of people to be accomodated--- 10
Number of Cubic feet to be supplied per person 1800
Number of Cubic feet of air per Hour----10x1800--18000
Heat Loss by Ventilation 18000x.3122-- 5630
Radiation surface required per room---
35112x.005---- 176 2/3
Number of Raddiators installed 2
Number of Sections per Radiator 1(26) 1(27)

Room(6)

DIMENSIONS of Room(10x29x13.5)
Windows --One South @27.22------- 27.22 square feet
Walls (10x13.5)plus.05(10x13.5)-27.22--114.53 " "
Volume ---(10x29x13.5) 3915 cubic feet
Heat Loss-(27.22plus.222(114.53)plus.02x1x3915)70
Heat Loss by Radiation 9170 B.T.U.
Number of peoplle to be accomodated 3
Number of cubic feet to be supplied per person 1800 per hour
Number of Cubic feet to nbe supplied per hour 5400
Heat Loss by Ventilation (5400x.3122)-- 1690
Radiator surface requkred for the room--
9170x.005-- 46 2/3
Number of radiators installed 1 -
Number of Stacks per Radiator 14

ROOM(7)

Dimensions of Room(26'6"x38'6"x13'6")
Dimensions of stack(15'x1'6"x13'6")
Windows-- Three South@27.22--- 81.66 square feet
Walls----(26.5 x13.5)plus.05(26.5x13.5)-81.66---294 " "
Volume of the Room(26.5x38.5x13.5)-15x1.5x13,5)--13472 Cu. Ft
Heat Loss --(81.66plus.222(294)plus.02x1x13472)70
Heat Loss by Radiation--29848
Number of people accomodated 10
Number of cubic feet of air per person 1800
Number of Cubic feet of air per hour (10x1800)--18000
Heat Loss by Ventilation--(18000x.3122)-- 5630
Radiator surface required for the room:-
29848x.005 --150
Number of Radiarors installed 2
Number of stacks per Radiator 1(23) 1(22)

ROOM(8)

DIMENSIONS of Room(This Room is the Mechanical Laboratory and has sufficient Heat developed in it to supply its heat loss so does not have to be considered in the calculations.

ROOM(9)

DIMENSIONS of Room(17'x10'6"x13'6")
Dimensions of the Stack(10'6"x1'6"x13'6")
Windows ----none
Walls exposed none
Volume(17x10.5x13.5)-(10.5x1.5x 13.5)
Heat Loss --(VOLUME)x.02x1x70------------ 3076 B.T.U.
Number of people accomodated 3
Number of cubic feet of air per person 1800
Number of Cubic feet of ait per hour 5400
Heat Loss by Ventilation (5400x.3122) 1690
Radiator surface required for the room
3076x.005 16 2/3
Number of Radiators installed 1 -
Number of stacks per Radiator 5

ROOM(10)

DIMENSIONS of Room(28x27x13'6")
Dimensions of stack None
Windows--Three South @27.22 --- 81.66 SQ. Ft
Walls (28x13.5) plus.05(28x13.5)-81.66-- 315.2 " "
Volume (28x27x13.5)--- 10206 Cu.Ft
Heat Loss by Radiation:-
(81.66 plus.222(315.2)plus.02x1x10206)70
Heat Loss-------24976 B.T.U. per Hour.
Number of people to be accomodated 20
Number of Cubic feet of air per person 1800
Number of Cubic feet of air per hour(20c1800)---36000
Heat Loss by Ventilation(36000x.3122)---- 11270
Radiator surface required for the room:-
24976x.005 -------126 2/3
Number of Radiators installed - 2
Number of Stacks per Radiator 2 (19)

ROOM(11)

DIMENSIONS of Room(36'6"x38'6"x13'6")
Dimensions of Stack(21'6"x1'6"x13'6")
Windows-- Four West @ 28.03 112.12
Four South @ 27.22 108.88 221 Total.
Walls(36.5plus38.5)13.5plus.25(75x13.5)-221---- 1044.6
Volume(36.5x38.5x13.5)-(21.5x1.5x13.5)--- 18535.4
Heat Loss by Radiation
(221 plus.222(1044.6) plus.02x1x18535.4)70
Heat Loss -------57653 B.T.U.per hour
Number of people to be accomodated 30
Number of Cubic feet of air per person 1800
Number of Cubic feet of air per hour 54000
Heat Loss by Ventilation (54000x.3122) 16900
Radiator surface required for the Room
57653x.005--- 276 2/3
Number of radiators to be installed 4
Number of stacks per Radiator 3(20) 1(23)

ROOM(12)

DIMENSIONS of Room(34x29x13'6")
Dimension of Stack(23'x1'6"x13'6")
Windows---Three North@ 30;13------ 90.39
Three West @ 28.03------ 84.09
174.48 Total
Walls--(34 plus 39)13.5 plus25%(63x13.5)-174.48--888.60
Volume--(34x29x13.5) -(23x1.5x13.5) 12793.50
Heat Loss by Radiation:-
(174.48plus.222 (888.6)plus .02x1x12793.5)70
Heat Loss -------- 43,960 B.T.U. per hour
Number of people to be accomodated 30
Number of cubic feet of air per person 1800
Number of cubic feet of air per hour 54000
Heat Loss by Ventilation 54000x.3122 16900
Radiator surface required for the room
43,960x.005------- 220
Number of Radiators installed 3
Number of stacks per radiator 3(22)

ROOM(13)

DIMENSIONS OF Room (12x29x13'6")plus5'6"x5'x13'6")
Dimensions of stack(6x8x13'6") Outer dimensions of a closet
Windows----One North @30.13-- 30.13 sq.Ft
Walls(12x13.5)plus.25(12x13.5) minus30.13--172.3 " "
Volume --(12x29x13.5)plus6x8x13.5)-5.5x5x13.5--4422 cu.Ft.
Heat Loss by Radiation:-
(30.13 plus.222(172.3)plus.02x1x4422)70
Heat Loss---10976 B.T.U. per hour

Number of people to be accomodated	5
Number of Cubic feet of air per person	1800
Number of Cubie feet of air per hour	9000
Heat Loss by Ventilation (9000x.3122)--	2815
Radiator Surface required for the room 10976x.005 --	56 2/3
Number of Radiators installed	1 -
Number of Stacks per radiator	17

ROOM(14)

DIMENSIONS OFRoom(22'6"x20'x13'6")
Dimensions of stack(11x2x13'6")
Windows-----(Two North @30.13 60.26 square feet
Walls --(20x13.5)plus.25(20x13.5)- 60.26--277.20 " "
Volume --22.5x20x13.5)-11x2.13.5)------ 5778.00 " "
Heat Loss by Radiation:-
(60,26plus .222(277.2)plus .02x1x5778)70
Heat Loss-----16618 B.T.U. per hour

Number of people accomodated	10
Number of Cubid feet of air per person	1800
Number of cubic feet of air per hour	18000
Heat Loss by Ventilation (18000x.3122)	5630
Radiator surface required for the room 16618x.005) ----	83 1/3
Number of Radiators installed	2 -
Number of Stacks per radiator	1(13) 1(12)

ROOM(15)

DIMENSIONS OF Room(8'6"x22'6"x13'6")
Dimensions of stack(4x2x13'6")
Windows --One North @30.13 30.13 Sq.Ft
Walls --(8.5x13.5) plus .25(8.5x13.5)-30.13--113.3 Sq.Ft.
Volume --(8.5x22.5x13.5) -(4x2x13.5) -------2473.9 Cu/Ft.
Heat Loss by Radiation:-
(30.13 plus.222(113.3) plus .02x1x2473.9) 70
Heat Loss-----7334 B.T.U.per hour

Number of people to be accomodated	6
Number of Cubic feet of air per person	1800
Number of Cubic feet of air per hour	10800
Heat Loss by Ventilation (10800x.3122)--	3380
Radiation Surface required for the room 7334x.005----	36 2/3
Number of Radiators installed	1 -
Number of stacks per Radiator	11

FIRST FLOOR.

Room air to be heated to 70° by direct radiation ,the Ventilating air to be supplied to the rooms as a separate unite at a temperature of 87.2°.

The Constahts for the first floor are :-

For Heat Transmission through 20" wall:- .222

For Heat Transmissionnthrough single Glass--1.00

Window Scheduel :-

West Side----	33.9 square feet
East Side----	33.9 square feet
North Side ----	36.5 square feet
Sóu th Side-----	36.5 square feet

Room heat Losses figured individually as numbered on the Floor design.

Height of windows from the floor--- 2'6"

Height of Radiators installed 26"

Number of column per stack 3

Square feet of heating surface per stack--- 3.75 sq.ft

Cast Iron Radiators (PEERLESS) installed.

ROOM (101)

DIMENSIONS of Room(9x20'6"x13'6")minus(2x4.5x13'6")

Dimension of stack(2x4x13'6")

Windows --One North @36.5 36.5 sq.ft.

Walls (9x13.5)plus 25%(9x13.5)-36.5------ 115.3 " "

Volume (9x20.5x13.5)-(2x4x13.5) 2613 Cu.Ft

Heat Loss br radiation:-

(36.5plus.222(115.3)plus.02(1x2613))70--

Heat Loss------8008 B.T.U. per hour.

Number of people accomodated	2
Number of Cubic feet of air per person	1800
Number of Cubic feet of air per hour	3600
Heat Loss by Ventilation 3600x.3122	1125
Radiator surface required for the room:- 8008x.005 --	41 1/4
Number of Radiators installed	1
Number of Stacks per Radiator	11

ROOM (102)

Dimensions of Room(20x20'6"xx13'6")plus(4x7'6"x13'6")

Dimensions of Stacks(2x14'6"x13'6")

Windows-- Two North @ 36.5" square feet ----73.0sq ft.

Walls -(20x13.5) plus.25(20x13.5)- 73.0--- 210.5" "

Volume(20c20.5x13.5)plus(4x7'6"x13.5)-(2x14.5x13.5)--6051.5 cuft

Heat Loss by Radiation:-

(73plus.222(210.5)plus .02(1x6051.5))70

Heat Loss --------16282 B.T.U. per Hour.

Number of people to be accomodated 3

Number of cubic feet of air to be supplied per person 1800

Number of Cubic feet of air to be supplied per hour 5400

For Toilet

Number of persons ~~to be~~ accomodated with air 3

Number of cubic feet per hour 5400

Radiation Surface required for the Two rooms16849x.005--86 1/4

Number of Radiators installed 2

Number of stacks per radiator 1(11) 1(12)

Heat Loss by Ventilation------(5400x.3122)--- 1690 B.T.U.

ROOM (103)

DIMENSIONS OF Room(12x15'3"x13'6")plus(5'9"x3'6"x13'6")
Dimensions of the Stacks None.
Windows one North @ 36.5 ----------- 36.5 sq;ft.
Walls (12x13.5)plus .25(12x13.5)- 36.5---- 166.0 " "
Volume (12x15.25x13.5)plus5.75x3.5x13.5)plus Toilet(4.5x6.5x13.5)
3136 Cubic feet.
Heat Loss By Radiation:-
(36.5 plus.222(166) plus.02x1x3136)70
Heat Loss-----9536 B.T.U. per hour
Number of people to be accomodated 2
Number of cubic feet of air per person 1800
Number of cubic feet per hour 3600
Heat Loss by Ventilation (3600x.3122) 1125
Radiator surface required for the rooms
9536x.oo5 -------- 48 3/4
Number of Radiators installed 1 -
Number of stacks per radiator 13

ROOM(104)

DIMENSIONS OF Room:-(10x21x13'6")
Dimensions of stack (9x2.5x13.5)
Windows:- ------One North @36.5 -- 36.5 square ft
Walls (10x13.5)plus (10x13.5).25-36.5--- 105.3 " "
Volume--(21x10x13.5) -(9x2.5x13.5) ---- 2519.0 Cu.Ft.
Heat Loss by Radiation:-
(36.5plus.222(105.3) plus.02x1x2519)70
Heat Loss---------7714 B.T.U.per hour.
Number of people to be accomodated 3
Number of cubic Feet of air per person 1800
Number of cubic feet of air per hour 5400
Heat loss by Ventilation (5400x.3122) 1690
Radiator surface required for the room
7714x.005--- 37 1/2
Number of radiators installed 1 -
Number of stacks per radiator 10

ROOM(105)

DIMENSIONS OF Room(40x22'6"x13'6")
Windows --Four East @ 33.9---- 135.6
Two North @ 36.5---- 73.0
Total--208.6
Walls40plus 22.5)13.5plus .4(859.4)-208.6---- 1034.6 squareft.
Volume (22.5x40x13.5)----- 12377 cubic"
Heat Loss by radiation---
(208.6 plus .222(1034.6) plus.02x1x12377)70
Heat Loss ---------48013B.T.U.per hour.
Number of people accomodated----- 15
Number of cubic feet of air per person 1800
Number of cubic feet of air per hour 27000
Radiator surface required for the room
48013x.005 240 square feet
Heat loss by Ventilation (27000c.3122)---- 8450
Number of radiators installed 4
Number of stacks per radiator 4(16)

ROOM(106)

DIMENSIONof Room(22'6"x9'6"x13'6")
Windows 1East @ 33.9-------------- 33.9Sq ft
Walls (9.5x13.5) plus(9.5x13.5)x15%-33.9--------113.6 sq ft
Volume -(22.5x9.5x13.5)------ 2942.0 Cu ft
Heat Loss by radiation
(33.9plus.222(113.6)plus.02x1x2942).70
Heat Loss ----------8267 B.T.U per hour

Number of people to be accomodated 3
Number of cubic feet of air per person 1800
Number of Cubic feet of air per hour 5400
Heat Loss by Ventilation (5400x.3122)----- 1690
Radiator surface required for the room
(8267x.005)-------- 41 1/4
Number of radiators installed 1
Number of stacks per radiator 11

ROOM(107)

DIMENSIONS of the Room(29'x27'3"x13'6")
Windows--Three South @36.5-- ------ 109.5 sq.ft
Three East @33.9 --------- 101.7 sq.ft.
Total-211.2 Sqft
Walls (29plus 27.25)13.5 plus .20(759)-211.2---690.4 Sq. Ft
Volume -(29x27.25x13.5)--------- 10665 Cubic Ft
Heat Loss by radiation---
(211.2plus.222(690.4) plus.02x1x10665)70
Heat Loss -----40446 B.T.U.per hour

Number of people to be accomodated-- 15
Number of cubic feet of air per person 1800
Number of cubic feet of air per hour 27000
Heat Loss by Ventilation (27000x.3122)----- 8450 B.T.U.
Radiator surface required for the room
(40446x.005)-------- 202 1/2
Number of Radiators installed 3
Number of stacks per radiator 3(18)

ROOM(108)

DIMENSIONS of Room (11x22'6"x13'6")
Windows One South @ 36.5 --------- 36.5 square feet
Walls (11x13.5)plus .05(11x13.5)-36.5 119.4 " "
Volume (11x22'6"x 13.5) -------- 2005 cubic "
Heat Loss by Radiation
(36.5plus.222(119.4) plus .02x1x2005)70
Heat Loss -----7217 B.T.U. per hour.

Number of people to be accomodated 2
Number of Cubic feet of air per person 1800
Number of cubic feet of air per hour 3600
Heat Loss by Ventilation ------(3600x.3122)--1125
Radiator surface required for the room
(7217x.005)----p 37 1/2
Number of radiators installed 1
Number of stacks per radiator 10

ROOM(109)

DIMENSIONS of Room (38'6"x26'6"x13'6")
Dimensions of Stack (15'x1.5'x13'6")
Windows-- Three South @ 36.5 ********** 109.5 sq.ft
Walls --(26.5x13.5)plus .05(26.5x13.5)-109.5*266.0 " "
Volume --(38.5x26.5x13.5)-(15c1.5x13.5) ******13390 " "
Heat Loss by radiation
(109.5 plus .222(266) plus .02x1x13390) 70
Heat Loss ******* 30562 B.T.U. loss per hour
Number of people to be accomodated 25
Number of cubic feet of air per hour 45000
Number of cubic feet per person 1800
Heat Loss by ventilation (45000x .3122) 14050
Radiation surface required for the room
(30562x.005) 153 3/4 square feet
Number of radiators installed - 3
Number of stacks per radiator 2(13) 1(15)

ROOM (110)
DIMENSIONS of Room(44x27x13'6")
Ceiling exposure (44x 27 x13.5) ********** 1425 Sq.ft.
Volume of Room (44 x27 x13.5) **********16050 Cubic Ft.
Heat Loss by Radiation (1425 X1 plus16050x2x.02)65 --50992
Number of people to be accomodated ---------- 20
Number of Cubic feet of air per person 1800
Number of cubic feet of air per hour 36000
Heat Loss by Ventilation (36000x.3122) ----- 11250
Radiation Surface required for the room
(50992x .005) ----- 258 3/4
Number of Radiators to be installed 4 -
Number of stacks per radiator 3(15) 1(24)

ROOM (111)
DIMENSIONS of Room (48 x38'6" x13.5)
Dimensions of Stack(20x1.5x13.5)
Windows Two South @ 36.5 ****** 73 sq.ft.
Walls (48x13.5)plus .05(13.5x48) -73 **** 607.4 sq. ft
Volume (48x 38.5 x13.5)-(20x1.5x13.5) ****24249 cu ft
Heat Loss by Radiation---
(73plus.222(607.4)plus .02x1x 24249)70
Heat Loss --48496 B.T.U.per hour
Number of people accomodated 150
Number of Cubic feet of air per person 1800
Number of cubic feet of air per hour 270,000
Heat Loss by Ventilation (270,000x.3122) 84500
Radiation surface required for the Room
(48496x.005)--243 3/4 square feet
Number of Radiators installed - 3
Number of stacks per Radiator 2(22)1(21)

ROOM (112)

DIMENSIONS of Room (36'6"x17'x13'6")
Dimensions of Stack(7'6"x1'6"x13'6") One south @36.5 **36.5
Windows **Four west @ 33.9 square feet ****** 135.6
Walls (38 plus 17)x13.5 plus .25(842.5)-172.1*** 881.0
Volume(36.5x17x13.5)-(7.5x1.5x13.5)----------- 8528.7 cubicft
Heat Loss by radiation
(172.1plus .222(881) plus .02x1x8528.7) 70
Heat Loss ****** 37680 B.T.U. per hour
Number of people to be accomodated 5
Number of cubic feet per person 1800
Number of cubic feet per hour 9000
Heat Loss by Ventilation (9000x.3122) 2810
Radiation surface required for the room
(37680x.005) ****** 187.5 square feet
Number of radiators installed 2
Number of stacks per radiator 2(25)

ROOM(113)

DIMENSIONS of Room (34x27'6"x13'6")
Dimensions of Stack(5'6"x2'x13'6")2
Windows** Three North @ 36.5 109.5 square ft
Three West @ 33.9 101.7 " "
Walls(34 plus 29.5)13.5 plus.4(857.2)-211.2** 989.0 " "
Volume(34x 27.5x13.5) -2(5.5x2x13.5) 12652 Cubic ft.
Heat Loss by radiation
(211.2plus .222(989) plus .02x1x12652)70
Heat Loss ***** Per hour 47866 B.T.U.
Number of people to be accomodated 30
Number of Cubic feet of air per person 1800
Number of cubic feet of air per hour 54000
Heat Loss by Ventilation (54000x.3122) 16900
Radiation surface required for the room
(47866x.005) 240
Number of Radiators installed 3
Number of stacks per Radiator 2(21)1(22)

ROOM(114)

DIMENSIONS OF ROOM(12x21'4"x13'6")
Dimensions of closets(8x6x13'6") plus(5'6"x5'x13'6")
Windows *****One North @ 36.5 36.5square ft
walls (12x13.5)plus.25(162)-36.5 166.0 " "
Volume (12x13.5x21.3)plus(8x6x13.5)plus(5.5x5x13.5)
VOLUME-****** 4590 cubic ft.
Heat Loss by Radiation
(36.5plus .222(166) plus.02x1x4590)70
Heat loss***** per hour 11557 B.T.U.
Number of people to be accomodated 3
Number of cubic feet per person 1800
Number of cubic feet of air per hour 5400
Heat Loss by Ventilation (5400x.3122) 1690
Radiation surface required forrthe room
11557x.005**(60) 60
Number of Radiators installed 1
Number of stacks per Radiator 16

ROOM(115)

DIMENSIONS of Room(30'3"x20'6"x13'6")
Dimensions of Stacks(2x5x13.5)2---(2x4.5x13.5)

Windows-----Three North @36.5----	109.5 Sq.Ft
Walls (30.25x13.5) plus.25(378.4) -109.5	364.0 " "
Volume (30.25x20.5x13.5)-2(2x5x13.5) -(2x4.5x13.5)	
VOLUME*******	8149 Cu.Ft.
Heat Loss by Radiation	
(109.5plus.222(364) plus.02x1x8149)70	
Heat Loss per hour	24731 B.T.U.
Number of people to be accomodated	25
Number of cubic feet of air per person	1800
Number of cubic feet of air per hour	45000
Heat Loss by Ventilation (45000x.3122)	14050
Radiation surface required for the Room	
(24731x.005)	123 3/4
Number of Radiators installed	3
Number of Radiators, sections to a radiator	3(11)

SECOND FLOOR.

Room air to beheated to 70° by direct radiation, the Ventilating air to be supplied to the rooms as a separate unite at a Temperature of 87.2°.

The Constants for the second floor are:-

For Heat Transmission through 14" wall---	.272
For Heat Transmission through single glass	1.000

Window Scheduel:-

West Side----	33.8 square feet	
East Side----	33.8 square feet	
North Side----	34.9 square feet	
South Side----	34.9 square feet	
Centre of main floor South--		24.44 Sq.Ft
East Side of west wing		none
West Side of East Wing		34.9 Sq.Ft

Allowances for exposure:-

South	5%
North	35%
West	25%
East	15%

Constants for the Rooms on the Second Floor

Height of Windows from the floor--	2'5"
Height of Radiator used	26"
Number of Columns per stack--	3

Square feet of Heating surface per stack--3.75

Cast Iron PEERLESS installed.

Number of Cubic feet of Ventilating air per person per hour ******* 1800

Calculations for the separate rooms taken as follows according to Floor Plans.

Seconds Floor

ROOM(201)

DIMENSIONS of Room:-10x23x13'6")
Dimensions of stack(5x2x13'6")

Windows One North @34.9 sq.ft.	34.9 Sq. Ft.
Walls (10x13.5) plus .25(135)-34.9---	134.1 " "
Volume (10x23x13.4)-5x2x13.5) -----	2970.0 Cu. Ft
Heat Loss by Radiation	
(34.9plus.272(134.1) plus .02x1.5x2970)70	
Heat Loss ---- per hour	10297 B.T.U.
Number of people to be accomodated	4
Number of cubic feet of air per hour	7200
Heat Loss by Ventilation (7200x.3122)	2250
Radiation Surface required for the room	
10297x.005------ square feet	52 1/2
Number of Radiators installed	1
Number of stacks per radiator	14

ROOM(202)

DIMENSIONS of Room:-19'6"x23'x13'6")
Dimensions of stack(10' 6"x2'x13'6")

Windows -----Two North @34.9 square feet	69.8 SQ.FT.
Walls (19.5x13.5) plus.25(19.5x13.5)-69.8	259.3 " "
Volume (19.3x23x13.5)-10.5x2x13.5)	5772.4 Cu.Ft
Heat Loss by Radiation	
(69.8plus .272(259.3)plus.02x1.5x5772.4)70	
Heat Loss per hour	21945 B.T.U.
Number of people to be accomodated	20
Number of Cubic feet of air per hous	36000
Radiation surface required for the Romm	
21945x.005------ square feet	108 3/4
Heat Loss by Ventilation(36000x.3122)	11250-
Number of Radiators installed	2
Number of Stacks per radiator	(14) (15)

ROOM(203)

DIMENSIONS of Room(23x29x13'6")
Dimensions of stack(31'6"x2x13'6")

Windows ----Two North @ 34.9	69.8 Sq.Ft
Walls(23x13.5Lplus .25(23x13.5)-69.8	318.9 " "
Volume 23x29x13.5)-31.5x2x13,5)	8168.5 Cu. Ft
Heat Loss by Radiation	
(69.8plus .272(318.9)plus .02x1.5x8168.5) 70	
Heat Loss------ per hour	28112B.T.U.
Number of people to be accomodated	25
Number of cubic feet of air per hour	45000
Heat Loss by Ventilation (45000x.3122)	14050
Number of square feet of radiation required for the Room	
(28112x.005)	146 1/4
Number of Radiators installed	2
Number of Stacks per radiator	(19) (20)

ROOM (204)

DIMENSIONS of Room(40'x22'6"x13'6")
Windows   Four East   @33.8   135.2square feet
          Two North   @34.9   49.8 " "
                Total Glass--205 " "
Walls(22.5xplus 40) 13.5plus .40(62.5x13.5)-205   976.3
Volume (40x22.5x13.5)   12150
Heat Loss by Radiation
    (205plus .272(976.3) plus .02x 2x 12150)70
        Heat Loss per hour   66962B.T.U.
Number of people to be accomodated   25
Number of cubic feet of air per hour   45000
Heat Loss by Ventilation(45000x .3122)   14050
Number of square feet of radiation surface for the Room
        (66962x.005)   333 3/4
Number of radiators installed   4 -
Number of stacks per radiator   3(22)1(23)

ROOM(205)

DIMENSIONS of Room(26'6"x40'6"x13'6")
Dimensions of stacks(16x1.5x.3'6")(9'5"x3'6"x .3'6")
Windows   Three South   @34.9   104.7 Sq. Ft.
Walls   Four East   @33.8   135.2 " "
                Total Glass   239.9 " "
Volume (26.5x 40.5x13.5)-16x1.5x13.5)-(9.5x3.5x13.5)
        VOLUME------   13685.4 Cu. Ft
Walls (26.5plus 40.5) ~~pl~~13.5plus .2(67x13.5-239.9)
        Walls-----   846.1 Sq.Ft
Heat Loss by Radiation
    (239.9plus .272(846.1)plus .02x2x13685.4)70
        Heat Loss per hour   65028B.T.U.
Number of people to be accomodated   25
Number of cubic feet of air per hour   45000
Heat Loss by Ventilation(45000x.3122)   14050
Radiation surface required for the Room
        (65028x.005)---   sqyare feet   326 1/4
Number of Radiators installed   4 -
Number of stacks per radiator   3(21) 1(24)

ROOM(206)

DIMENSIONS of Room(11x22'6"x13'6")
Windows one south   @34.9   34.9square feet
Walls(11x13..5)plus .05x11x13.5)-34.9   121 " "
Volume(11x22.5x13.5)   3341.25 cu.Ft.
Heat Loss by Radiation
    (34.9 plus.272(121)plus .02x2x 3341. 25)70
        Heat Loss----per hour   14102B.T.U.
Number of people to be accomodated   3
Number of cubic feet of air per hour   5400
Heat Loss by Ventilation   1690
Radiation surface required for the room
        (14102x.005)   71 1/4
Number of Radiators installed   1 -
Number of stacks per radiator   19

ROOM(207)

DIMENSIONS of Room(26'6"x 38'6"x 13'6")
Dimensions of stack(15x1.5x13,5)
Windows Four West in East Wing @34.9-- 139.6 Sq. Ft.
Three South @34.9--- 104.7 " "
Walls (26.4plus 38.5)13.5Plus.25(64.9)-244.3--852.8 " "
Volume (26.5x 38.5x13.5)-(15x1.5x13.5)-- 13459.5 Cu. Ft
Heat Loss by radiation
(244.3plus.272(852.8)plus.02x2x13459.5) 70
Heat Loss----per hour 71309 B.T.U.
Number of paople to be accomodated 30
Number of Cubic feet per hour of air 54000
Heat Loss by Ventilation(54000x.3122) 16800
Radiation surface required for the room
(71309x.005) 356 1/4
Number of radiators installed 4 -
Number of stacks per radiator 3(23) 1(26)

ROOM(208)

DIMENSIONSof Room(34x29x13'6")
Dimensions of stack(22'6"x1'6"x13'6")
Windows--Three North @34.9--- 104.7
Three West @33.8--- 101.4
Total Glass 206.1square feet
Walls(34plus 29)13.5plus.5(63) 13.5-206.1 1069,7 " "
Volume (34x29x13.5)-22.5x1.5x13.5)--- 12856 Cubic feet
Heat Loss by radiation
(206.1plus.272x1069.7plus.02x2x 12856)70
Heat Loss per hour 70791B.T.U.
Number of people to be accomodated 35
Number of cubic feet of air per hour 63000
Heat Loss by Ventilation(63000x.3122) 19700
Radiation Surface required for the room
(70791x.005) 356 1/4
Number of radiators installed 4 -
Number of stacks per radiator 3(23) 1(26)

ROOM(209)

DIMENSIONS of Room(12x29x13'6")
Outer dimensions of closet(6x8x13'6")
Inner dimensions of closet(5x5x13'6")
Windows One North @34.9 34.9square feet
walls (12x13.5)plus .25(12x13.5)-34.9 167.6 " "
Volume (12x29x13.5)-(6x8x13.5)plus(5x5x13.5) 5562.5 Cubic feet
Heat Loss by radiation
(34.9plus .272(167.5) plus .02x2x5562.5)70
Heat Loss per hour 21210 B.T.U.
Number of people to be accomodated 4
Number of cubic feet of air per hour 7200
Heat Loss by Ventilation(7200x.3122) 2250
Radiator surface required for the room
(21210x.005) 105
Number of radiators installed 1
Number of stacks per radiator 28

ROOM(210)

DIMENSIONS of Room(30x23x13.5)
Dimensions of stack(15'6"x1'6"x13'6")

Windows ----Three North @ 34.9	104.7 square feet
Walls30x13.5plus .25(405) --104.7	401.5 " "
Volume(30x23x13.5) -(15.5x1.5x13.5)	9002.0 cubic feet

Heat loss by radiation
(104.7plus .272(401.5 plus.02x2x9002)70

Heat Loss per hour	40180 B.T.U.
Number of people to be accomodated	30
Number of cubic feet of air per hour	54000
Heat Loss by Ventilation(54000x.3122)	16900
Radiator surface required for the room (40180x.005)	202 1/2
Number of radiators installed	3
Number of stacks per radiator	3(18)

ROOM(211)

DIMENSIONS of Room(66'x38'6"x13'6")
Dimensions od stack(30'6"x1'6"x13'6")

Windows Four West @33.8	135.2
seven South @34.9	244.3
Total Glass	379.5 Square feet

Walls(66plus2(38.5))13.5plus .25(66plus2(38.5)13.5)-379.5

Total Wall exposed	2043.6 SQ.FT.
Volume(66x38.5x13.5)-(30,5x1.5x13.5)	33685.2 Cubic feet

Heat Loss by radiation
(379.5plus .272(2043.6) plus.02x2x33685.2)60

Heat Loss per hour	136956 B.T.U.
Number of people to be accomodated	250
Number of cubic feet of air per hour	450,000

Radiation Surface required for the room allowing 50000B.T.U per hour from the occupants of the room

(136956-50000) .005	412 1/2
Heat Loss by Ventilation(450000x.3122)	140500 B.T.U.
Number of radiators installed	5
Number of stacks per radiator	5(22)

THIRD FLOOR .

Rooms to be heated to 70° by direct radiation , the ventilation losses to be supplied to the rooms as a separate unite at a temperature of 87.2°.

The constants for the Third floor are :-
For Heat Transmission through 16" wall-.26
For Heat Transmission through 14" wall .27
For Heat Transmission through single Glass 1.00

Window schaduel:-

West side	30.25 square feet
East Side	30.25 square feet
North Side	32.53 square feet
South side	32.53 square feet
West windows East Wing	32.53 square feet
East windows West Wing	32.53 square feet
South windows center	22.77 square feet

THIRD FLOOR CONTINUED:-

Allowances for exposures:-

North	25%
South	.05%
East	15%
West	25%

Height of Windows from the floor	2'5"
Height of radiators installed	26"
Number of columns per stack	3
Square feet of radiation surface per stack	3.75
Number of cubic feet of air per person per hour	1800

Cast Iron Radiators PEERLESS installed.

ROOM(301)

DIMENSIONS of Room(30x23x13'6")
Dimensions of stack(20x2x13'6")
Dimensions of closet(5x6x13.5)
Windows Three North @32.53 97.59 square feet
Walls (30x13.5) plus .25(30x13.5)-97.59 408.7 " "
Volume (30x23x13.5)-(20x2x13.5)plus(5x6x13.5)--8370 Cubic feet
Heat Loss by Radiation
(97.59plus.26(408.7) plus .02x1.5x8370) 70
Heat Loss per hour 31847 B.T.U.
Number of people to be accomodated 25
Number of cubic feet of air per hour 45000
Heat Loss by ventilation (45000x.3122) 14050
Number of radiators installed 3
Radiation surface required for the room
(31847x.005) 161 1/4
Number of stacks per radiator 2(14) 1(15)

ROOM(302)

DIMENSIONS OF Room(23x29x13.5)
Dimensions of stack(31'6"x2'x13.5)
Windows Two North @ 32.53 65.06 Sq Ft.
walls (23x13.5) plus .25(23x13.5) -65.06 323.00 " "
Volume (23x29x13,5)plus (31.5x2x13,5) 8154 Cubic feet
Heat Loss by radiation
(65.06plus .26(323)plus .02x1.5x8154)70
Heat Loss per hour 27556 B.T.U.
Number of people to be accomodated 25
Number of cubic feet of air per hour 45000
Heat Loss by Ventilation(45000x.3122) 14050
Radiation surface required for the room
(27556x.005) 138 3/4
Number of radiators installed 2 -
Number of stacks per radiator 18 19

ROOM(303)

DIMENSIONS OF Room(40x22'6"x13'6")
Windows Four East @30.25 121.00
Two North @32.53 65.06
Total Glass 186.06 Square feet
Walls (40 plus 22.5) 13.5 plus .40(62.5x13.5)-186.06
Walls 995.20 Square feet
Volume (40x22.5x13.5) 12150 Cubic feet
Heat Loss by radiation
(186.1plus.27(995.2)plus .02x1.5x12150)70---57351B.T.U.

ROOM(303) continued

Number of people to be accomodated	30
Number of Cubic feet of air per hour	54000
Heat Loss by Ventilation (54000x.3122)--16900	
Radiation surface required for the room (57351x.005)	285
Number of radiators installed	4
Number of stacks per radiator	4(19)

ROOM (304)

DIMENSIONS of Room(26'6"x40'6"x13'6")
Dimensions of stack(2x16x13'6")

Windows	Three South @ 32.53	97.59	
	Four East @ 30.25	121.00	
	Total Glass	218.59	Square feet

Walls (26.5plus 40.5) 13.5plus .20(67)13.5-218.59

Walls	866.8	" "
Volume(26.5x 40.5x13.5) -(2x16x13.5)	14056	Cubic feet

Heat Loss by radiation
(218.59plus .27(866.8) plus.02x2x14056.)70

Heat Loss per hour	71044B.T.U.
Number of people to be accomodated	30
Number of cubic feet of air per hour	54000
Heat loss by Ventilation (54000x.3122)	16900
Radiation surface required for the room (71044x.005)	356 1/4
Number of radiators installed	4 -
Number of stacks per radiator	3(23) 1(26)

ROOM(305)

DIMENSIONS OF ROOM(11x23x13.5)

Windows One South @ 32.53	32.53	Square feet
Walls(11x13.5)plus .05(11x13.5)-32.53	123.39	" "
Volume (11x23x13.5)	3415.5	Cubic feet

Heat Loss by radiation
(32.53plus .27(1234) plus .02x1.5x3415.5)70

Heat Loss----- per hour	11782B.T.U.
Number of people to be accomodated	4
Number of cubic feet of air per hour	7200
Heat Loss by Ventilation(7200x.3122)	2250
Number of radiators installed	1
Number of stacks per radiator	16
Radiation surface required for the room (11782x.005)	60

ROOM(306)

DIMENSIONS OF Room(26'6"x38'6"x13'6")
Dimensions of stack(15'x1.5x13'6")

Windows	Three South @32.53	97.59	
	Four West @32.53	130.12	
	Total Glass	227.71	Square feet

Walls(26.5 plus 38.5)13.5plus .25(65)13.5-227.71

Walls	869.8 square feet
Volume(26.5x38.5x13.5)-(15x1.5x13.5)	13470 cubic feet

Heat Loss by radiation
(227.7plus.27(869.8) plus.02x1.5x13470)70

Heat Loss------ per hour	60662 B.T.U.
Number of people to be accomodated	30
Number of cubic feet of air per hour	54000

ROOM(306) continued:-

Heat Loss by Ventilation (54000x.3122)	16900 B.T.U.
Number of radiators installed	4
Radiation surface required for the room (60663x.005)	303 3/4
Number of stacks per radiator	3(20) - 1(21)

ROOM(307)

DIMENSIONS OF Room(19x9'6"c13.5)	
Windows One East of west wing @ 32.53	32.53 Square feet
Walls 9.5x13.5) plus .15(9.5x13.5) -32/53	102.3 " "
Volume (19x9.5x13.5) -	2437 cubic FT.
Heat Loss by radiation (32.53plus .27(102.13) plus .02x1.5x2437)70	
Heat Loss per hour	9327
Number of people to be accomodated	4
Number of cubic feet of air per hour	7200
Heat Loss by Ventilation (7200x.3122)	2250
Number of Radiators installed	1
Number of stacks per radiator	13
Radiation surface required for the room (9327x.005)	48 3/4

ROOM(308)

DIMENSIONS of Room (28x28x13.5)	
Windows Three south @ 32.53	97.59
West wing Three East @32.53	97.59
Tolal Glass	195.18 Square fet
Wall (28plus 28) 13.5 plus.2(56)13.5-195.18--712.00	" "
Volume(28x28x13.5)	10584 cubic feet
Heat Loss by radiation (195.18plus .27(712) plus .02x1.5x10584)70	
Heat Loss per hour	49346B.T.U.
Number of people to be accomodated	15
Number of cubic feet of air per hour	27000
Heat Loss by Ventilation(27000x.3122)	8450
Number of radiat ors installed	3
Radiation surface required for the room 49346x.005	247 1/2
Number of stacks per radiator	3(22)-

ROOM(309)

DIMENSIONS of Room(36'6"x38'6" x13'6")	
Dimensions of stack(21'6" x1'6"x13'6")	
Windows Four West @ 30.25	121.00
Four South @ 32.53	130.12
Total Glass	251.12 Square Ft.
Walls (36.5 plus 38.5) 13.5plus .3(75) 13.5-251.12	
Walls	1065 " "
Volume(36.5x 38.5x13.5) -(21.5x1.5x13.5)	18536 cu.ft.
Heat Loss by radiation (251.12plus .26(712) plus .02x1.5x10584)70	
Heat Loss per hour	75922 B.T.U.
Number of people to be accomodated	20
Number of cubic feet per hour	36000
Heat Loss by Vemtilation (36000x.3122)	11250
Number of radiators installed	4
Radiation surface required 75922x.005	412 1/2
Number of stacks per radiator	3(27)-1(29)

ROOM(310)

DIMENSIONS of Room(22'6"x10'x13'6")

Windows One West @30.25	30.25 square feet
Walls(10x13.5) plus .25(135) -30.25	138.5 " "
Volume (22.5x10x13.5)	3038.00 cubic feet
Heat Loss by radiation	
(30.25plus .27(138.5) plus .02x1.5x3038)70	
Heat Loss per hour	11116 B.T.U.
Number of peopls to be accomodated	4
Number of cubic feet of air per hour	7200
Heat Loss by Ventilation(7200x.3122)	2250
Radiation surface required for the room	
(11116x.005)56******	56 1/4
Number of radiators installedl	1 -
Number of stacks per radiator	15

ROOM(311)

DIMENSIONS of room(47x29x13'6")

Dimensions of stack(29'6" x1'6" x13'6")

Windows Four North @ 32.53	130.12
Three West @ 30.25	90.75
Total Glass	220.87 Square Ft.
Walls(47plus 29)x13.5plus.40x76(13.5)-220.87**	1215.6 " "
Volume (47x29x13.5)-(29,5x1.5x13.5)	17803.0 Cubic Ft.
Heat Loss by radiation	
(220.9 plus .27(1215.6) plus.02x2x17803)70**	
Heat Loss per hour	98214 B.T.U.
Number of people to be accomodated	30
Number of cubic feet of air per hour	54000
Heat Loss by Ventilation (54000x.3122)	16900
Radiation surface required for the room	
(98214x.005) *****	477 1/2
Number of radiators installed	5 -
Number of stacks per radiator	5(26)

ROOM #312)

DIMENSIONS of Room(12x23x13'6")

Dimensions of stack(7x1.5x13'6")

Windows One North @ 32.53	32.53 square Ft.
Walls(12x13.5)plus .25(12x13.5) -32.53--	170 " "
Volume (12x23x13.5)-(7x1.5x13.5)----	3588 cubic feet
Heat Loss by radiation	
(32.53 plus.26(170)plus .02x1.5x3588) 70	
Heat Loss per hour	13649 B.T.U.
Number of people to be accomodated	5
Number of cubic feet of air per hour	9000
Heat Loss by Ventilation (9000x.3122)	2810
Radiation surface required for the room	
(13649x.005)	67 1/2
Number of radiators installed	1 -
Number of stacks per radiator	15

ROOM (313)

DIMENSIONS of the Room(17'6"x23x13'6")
DIMENSIONS of stack (4'6" x8'6" x13'6")

Windows Two North @32.53	65.06 square Ft.
Walls(17.5x13.5)plus 17.5x13.5)x.25- 65.06**	230.25 " "
Volume(17.5x23x13.5)plus(4.5x8.5x13.5)	4917.4 cubic Ft.
Heat Loss by radiation (65.06plus.26(230.25)plus .02x1.5x4917.4)70	
Heat Loss per hour	19071B.T.U.
Number of people to be accomodated	8
Number of cubic feet of air per hour	14400
Heat Loss by Ventilation (14400x13122)	4500
Radiation surface required for the room (19071 x.005)*****	93 3/4
Number of radiators installed	2 -
Number of stacks perradiator ******	13 ---12

FOURTH FLOOR.

Room air to be heated to 70 degrees by direct radiation,the Ventilationair to be supplied as a separate unite to the rooms at a temperature of 87.2 degrees.

The constants for the fourth floor are:-

Heat transmission through 12" wall	.313	Heat transmission
Heat transmission through single glass	1.00	through joist with
Number of columns per stack	2	single floor-.10

Window scheduel:-

West side	12.3 square feet
East Side	12.3 square feet
North side	13.22 square feet
South side	13.22 square feet
East side west wing	13.22 square feet
West side East Wing	13.22 square feet
South side center	9.44 square feet

Allowances for exposure:-

South	5%
North	25%
East	15%
West	25%

Height of windows from the floor---	3'10"
Height of radiators installed	32"
Number of columns per stack	2
Width of radiator	8"
Thickness of stack	2 1/2 "
Number of cubic feet of air per person per hour---1800	
Square feet of heating surface per stack	3 1/3
Cast Iron Radiators PEERLESS installed.	-

ROOM(401)

DIMENSIONS OF Room(30x23x11)
Dimensions of stack(20x2x11)

Windows Three North @ 13.22	13.22 square feet
Skylights Nine North@ 3	27.00 " "
Nine south @ 3	27.00 " "
Total Glass	93.66 " "
Walls(3oxll)1.35 -93.66	351.84 " "
Ceiling (30x23)1.2	828.00 " "
Volume(30x23x11) -(20x2x11)	7150.00 Cubic feet
Heat Loss by radiation (93.66plus .313(351.8)plus.10(828) plus .02x2x7150) 70	
Heat Loss per hour	40080 B.T.U.

ROOM(404)

Room (404) was calculated with the heat loss of the Fourth Floor Corridor so is not considered in the calculations.

ROOM (405)

DIMENSIONS OF Room(26'6"x40'6"x11')
Dimensions of stack(16x1'6"x11)

Windows	Three South	@ 13.22	39.66 Sq. Ft.
	Four East	@ 12.3	49.20 " "
Skylights	18 South	@ 3	54.00 " "
	18 North	@ 3	54.00 " "
	Total Glass		196.86 " "

Walls(26.5plus40.5)11plus(26.5plus40.5)11x.2-196.86--
Walls -- 687.6 " "
Ceiling(26.5x40.5)1.2----- 128799 " "
Volume(26.5x40.5x11)-(16x1.5x11) 11541.75 Cubic feet
Heat Loss by radiation
(196.86plus.313(687.6) plus128799x.10 plus .02x2x11541.75)70
Heat Loss per hour 70179 B.T.U.
Number of people to be accomodated 30
Number of cubic feet of air per hour 54000
Heat Loss by Ventilation (54000x.3122) 16900
Radiation surface required for the room
(70179x.005) 366 2/3
Number of radiators installed 4 -
Number of stacks per radiator 3(27) 1(29)

ROOM(406)

DIMENSIONS OF Room(11x22x10)
Windows One South @13.22 13.22 Sq Ft.
Walls (11x10)1.05 -13,22 102.28" "
Ceiling(22x11)1.2---------- 290.4 " "
Volume (11x22x10) 2420.0Cu.Ft.
Heat Loss by radiation
(13.22plus .313(102.28)plus .10(290.4) plus .02x1.5x2420)70
Heat Loss per hour 102816 B.T.U.
Number of people to be accomodated 4
Number Of cubic feet of air per hour 7200
Heat Loss by Ventilation(7200x.3122) 2250
Radiation surface required for room
(10282x.005) 53 1/3
Number of Radiators installed 1 -
Number of stacks per radiator 16

ROOM(407)

DIMENSIONS of Room(27x39x11) Stack(15x1.5x11)

Windows	Three South	@13.22	39.66 square feet
East wing	Four West	@13.22	52.88 " "
Skylights	15North	@ 3	45.00 " "
	15South	@ 3	45.00 " "
	Total Glass		181.54 " "

Walls(27plus39)11 times1.3 -181.54 762.2 " "
Ceiling(27x39)1.2 ------ 1263.6 " "
Volume(27x39x11)-15x1.5x11)------ 1133515 Cubic "
Heat Loss by Radiation
(181.54plus .313(762.2)plus .10(1263.6)plus .02x2x11336)70
Heat Loss--per hour 69923 B.T.U.
Number of people to be accomodated 30
Number of cubic feet of air per hour 54000
Heat Loss by Ventilation(54000x.3122) 16900

ROOM(407) continued:-

Radiation surface required for the room
(69923x.005) 366 2/3
Number of radiators installed 4 -
Number of stacks per radiator 3(27) 1(29)

ROOM(408)

DIMENSIONS of Room(12' 6"x9'6"x10)
Windows One East side West wing @13.22 13.22 Square feet
Wall(9.5x10)1.2 -13.22--- 100.80 " "
Ceiling (12.5x9.5)x1.2 --- 142.50 " "
Volume(12.5x9.5x10) --- 1187.50 " "
Heat Loss by radiation
(13.22plus .313(100.8) plus .10(142.5) plus .02x2x1187.5) 70
Heat Loss per hour 7456
Number of people to be accomodated 4
Number of cubic feet of air per hour 7200
Heat loss by Ventilation(7200x.3122) 2250
Number of Radiators installed in the room 1
Radiation surface required for the room
(7456x.005) 36 2/3 Square ft
Number of stacks per radiator 11 -

ROOM(409)

DIMENSIONS of Room (19x28x10)
Windows Two South @ 13.22 26.44
East of West Wing Three@ 13.22 39.66
Total Glass 66.10 square ft.
Walls (19plus28) 10 x1.25 -66.1 ----- 521.40 " "
Ceiling(19x28)1.2 ******* 638.40 " "
Volume(19x28x10) ------ 5320.00 Cubic Ft
Heat Loss by radiation
(66.1plus .313(521.4) plus .10(638.4) plus .02c2x5320) 70
Heat Loss per hour 35413 B.T.U.
Number of people to be accomodated 15
Number of cubic feet of air required per hour 27000
Heat Loss by Ventilation (27000x.3122) 8450
Radiation surface required for thr room
(35413 x.005) 180 Sq.Ft.
Number of radiators installed 2
Number of stacks per Radiator 2(27)

ROOM(410)

DIMENSIONS of Room-(46x38'6"x11)
Dimensioms of stack(21'6"x1'6" x11)
Windows--Four West @ 12.3 49.2 square ft.
Five South @ 13.22 66.1 " "
Skylights 30 North @ 3.00 90.0 " "
30 South @ 3.00 90.0 " "
Total Glass 295.3 " "
Walls(46 plus 38'6")11x1.3-295.3 ----- 913.3 " "
Ceiling(46x38.5x1.2 ----- 2125.2 " "
Volume(46x38.5x11)-(21.5x1.5x11) 19126.2 Cubic Ft.
Heat Loss by Radiation
(295.3plus .313(913.1) plus .10(2125.2) plus .02x2x19126.2) 70
Heat Loss per hour 109102.7B.T.U.
Number of people to be accomodated 60
Number of cubic feet of air per hour 108000
Heat Loss by Ventilation(108000x.3122) 33800

ROOM(410) continued:-

Square feet of radiation surface required (109103x.005)	533 1/3
Number of Radiators installed	6 -
Number of stacks per radiator	5(26) 1(30)

ROOM(411)

DIMENSIONS of Room(23x10x10)

Windows One west @12.3	12.3 Square Ft.
Walls (10x10)1.25 -12.3--------	102.7 " "
Ceiling (23x10)1.2 ------------	276.0 " "
Volume (23x10x10)	2300.0 Cubic Ft.

Heat Loss by radiation

(12.3plus.313(102.9)plus276x.10plus .02x1.5x2300) 70

Heat Loss per hour	9877 B.T.U.
Number of people to be accomodated	4
Number of cubic feet of air per hour	7200
Heat Loss by Ventilation (7200x.3122)	2250
Radiation surface required for the room (9877x.005)	50
Number of Radiators installed	1
Number of stacks per radiator	15

ROOM(412)

DIMENSIONS OFRoom(47x29x11)

Dimensions of Stacks(29'6" x1'6" x11)

Windows Four @13.22	42.88 square Ft.
Three West@ 12.3	36.9 " "
Skylights 23 North @ 3	69.0 " "
23 South @ 3	69.0 " "
Total Glass	217.78 " "
Walls(11(47plus 29)1.4 -79.78	1090.6 " "
Ceiling (47x29)1.2 -138	1497.6 " "
Volume(47x29x11) -(29.5x1.5x11)	14506.2 Cubic ft.

Heat Loss by Radiation

(217.78plus .313(1090.6) plus .10(1497.6) plus.02x2x14506.2)70

Heat Lossper hour	90240 B.T.U.
Number of people to be accomodated	40
Number of cubic feet of air per hour	72000
Heat Loss by ventilation (72000x.3122)	22500
Radiation surface required for the room (90240 x.005)	466 2/3
Number of radiators installed	5 -
Number of stacks per radiator7	5(28)

ROOM(413)

DIMENSIONS of Room(23x12x10) Stack (7x1.5x10)

WindowsOne North @ 13.22	13.22 Square Ft.
Walls(12x10)1.3 -13.22	142.8 " "
Ceiling(23x12)1.2	331.2 " "
Volume (23x12x10)-7x1.5x10)	2655.0 Cubic feet

Heat Loss by Radiation

(13.22plus .313(142.8)plus.10(331.2) plus .02x1.5 x2655)70

Heat loss per hour	11948 B.T.U.
Number of people to be accomodated	3
Number of cubic feet of air per hour	5400
Heat Loss by Ventilation (5400x.3122)	1690
Radiation Surface required for the room(11948x.005)-63 1/3	
Number of radiators installed	1 -
Number of stacks per radiator	19

ROOM(414)

Dimensions of Room(17'6"x23'x10'6") Stack(12'x2'x10'6")

Windows Two North @ 13.22	26.44 Square Ft.
Walls (17.5x10.5)1.35-26.44	157.31 " "
Ceiling (17.5x23)1.2	483.00 " "
Volume(17.5x23x10.5)-(12x2x10.5)	3974.25 " "
Heat Loss by radiation	
(26.44plus.313(157.31)plus.10(483) plus .02x2x3974.3)70	
Heat Loss per hour	19779 B.T.U.
Number of people to be accomodated?	15
Number of cubic feet of air per hour	27000
Heat Loss by ventilation (27000x.3122)	8459
Radiation Surface required for the room (19779x.005)	100 square feet
Number of radiators installed	2
Number of stacks per Radiator	15

CORRIDORS .

BASEMENT:-

Dimensions to obtain the exposed areas and the Total volume of the Corridor.

(9'x37'x13'6") plus(3x5x13.5)plus(140x10x13.5)plus(10x10'6 x13'6")plus1'x7'6"x13'6") plus(11'x14'x13'6")

Staircase:-(22x21x13'6")-(22x5'3"x5')-(9x10x9'6")

Total Volume of Corridor:- ----- 33361.8 Cu.Ft.

Glass :-

Main entrance 2(24"x78")--	26 sq.ft.
East Entrance2(16"x62")---	13.78 sq. ft.
West Entrance2(16"x62")---	13.78 sq.ft.
Transoms East and West(38"x24")	6.34 sq.ft.
Total Glass:- ----------	66.24 " "
Walls(9x13.5)2 plus(22x8)-66.24------	271.20 " "

Heat Loss by radiation:-

(66.24plus.222(271.2)plus .02x1x33361.8)70---

Heat Loss per hour-- 55558 B.T.U.

First Floor:-

Dimensions to obtain the exposed areas and the Total Volume of the Corridor.

(11x6x13.5)plus(28x14x13.5)plus(140x10x13.5)

Stack (10'6"x2'x13'6")

Total Volume--------	24800 Cu. Ft.
Windows One West @33.9 TotalGlass---	33.9 Sq.Ft.
Walls((10x13.5)plus2(10x13.5)-33.9--------	128.2 " "

Heat Loss by Radiation:-

(33.9plus.222(128.2)plus.02x1x24800)70-- 40088 B.T.U.

Staircase:-(21x7x6'9") plus(15X21x6'9")

Windows One North @36.5 Square Feet	36.5 Square feet
Walls (21x13.5)plus.25(21x13.5)-36.5 ------	317.9 " "
Volume (21x7x6'3")plus(15x21x6.75)---	3118.5 Cubic Feet

Heat Loss by radiation:-

(36.5plus .222(318)plus .02x1x3118.5)70-- 11865 B.T.U.

Total Heat Loss in B.T.U. per hour for the floor

51953 B.T.U.

CORRIDORS:-
SECOND FLOOR:-
Dimensions to obtain the exposed areas and the volume of the Corridor:-
(11x15x13.5)plus(8'6"x2x13.5) plus(152'6"x10x13.5)
Di,mensions of staircase:-
(21x4x13.5)plus 21x7'6"x6'3") plus(21x12x6'3")

Windows Six South @ 34.9	209.4	
One West @ 33.8	33.8	
Two North @ 34.9	69.8	
Total Glass	313.0	Square feet

Walls:-(10x13.5)plus(135).25 plus34x13.5) plus(10x13.5) plus 10x13.5).25plus (34x13.5).05 plus (34x13.5)plus (21x13.5)1.25-313------------ ------------------ 791.9
Volume:-(11x15x13.5)plus(8.5x2x13.5)plus152.5x10x13.5) plus (21x4x13.5)plus(21x7.5x6.25)plus(21x12x6.25)
Total Volume--------------- -------26248 Cu.Ft
Heat Loss by radiation---
(313plus791.9x.272plus.02x1.5x26248)70--------
Heat Loss per hour 92124B.T.U.

THIRD FLOOR:-
Dimensions to obtain the exposed area and the volume of the corridor:-
(8x12x13.5)plus(11x12x13.5)plus(2.5x7.5x13.5)plus(1.8,5 x10x13.5) South exposure:-(34x13.5)
Dimensions of theStaircase:-
(21x4x13.5)plus(21x7.5x6'3")plus(21x12x6'3")

Windows:-Six south @22.77	136.63	
Two North @32.53	65.06	
Total Glass	201.69	square Ft

Walls(34x13.5)plus(34x13.5).05plus(21x13.5)plus(21x13.5).25 minus 201.69 634.7 square ft
Volume(21273.1plus3693.4) 24966.5 Cu.Ft.
Heat Loss by radiation:-
(201.69plus.263(6 4.7)plus.02x1.5x24966.5)70
Heat Loss per hour 78341 B.T.U.

FOURTH FLOOR:-
Dimensions to obtain the exposed area and the volume of the Corridor:-
((17x11x10)plus 2.5x7.5x10)plus(128.5x10x10)plus(6x12x10)
Plus(Exposure south ---(34x1 0)
Dimensions of the Staircase:-
(21x24x10)

Windows:- Six south @9.44	56.64	
Two North @13.22	26.44	
Total Glass	83.08	Square ft.

Walls:-34x10)1.05plus21x10)x1.3-83.08 546.9 " "
Volume:-(17x11x10)plus2.5x7.5x10)plus(128.5x10x10)plus (6x12x10)plus(21x24x10) 18508 Cubic Ft.
Ceiling((17x11)plus2.5x7.5)plus 128.5x10)plus6x12))timesl.2 plus (21x24x1.2)---------------------- 2479.8 Square Ft
Heat Loss by Radiation:-
(83.08plus.313(546.9)plus.10(2479.8)plus.02x2x18508)70
Heat Loss per hour 86979B.T.U.

Complete tabulation for the square feet of Radiation required for the individual rooms for the R.E.Olds Engineering Hall with the size of Radiators installed .
Tabulations made by Floors.

Basement.

Height of windows from the floor----- 2'10"
Height of radiators used ----- 32"
Number of columes per stack ----- 2
Width of Radiators ----- 8½"
Thickness of sections -----2½"
Square feet per section ----- 3 1/3

ROOM NO.	RADIATION LOSS	SQUARE FEET RAD. SURFACE	NUMBER OF RADIATORS	SIZE OF RADIATORS: NUMBER OF STACKS		SIZE OF RADIATORS: LENGTH OF RADIATORS	
1	14357	73 1/3	2	(11)	(11)	(27½)	(27½)
2	9280	46 2/3	1	(14)		(35)	
3	20544	103 1/3	2	(15)	(16)	(37½)	(40)
4	40033	203 1/3	3	2(20)	(21)	2(50)	(52½)
5	35112	176 2/3	2	(26)	1(27)	(65)	(67½)
6	9170	46 2/3	1	(14)		(35)	
7	29848	150 -	2	(23)	(22)	(57½)	(55)
8	******	****	**	*********		********	
9	3076	16 2/3	1	(5)		(12½)	
10	24976	126 2/3	2	(19)	(19)	(47½)	(47½)
11	57653	276 2/3	4	3(20)	1(23)	3(50)	1(57½)
12	43960	220 -	3	3(22)		3(55)	
13	10976	56 2/3	1	(17)		(42½)	
14	16618	83 1/3	2	(13)	(12)	(32½)	(30)
15	7334	36 2/3	1	(11)		(27½)	

TOTAL RADIATION SURFACE******* 1616 2/3 square feet
NUMBER OF RADIATORS ******* 27

FIRST FLOOR.

Height of windows from the floor----- 2'6"
Height of radiators used -----26"
Number of columes per stack ----- 3
Width of Radiators ----- 9½"
Thickness of section ----- 2½"
Square feet per stack ----- 3.75

ROOM NO.	RADIATION LOSS	SQUARE FEET RAD. SURFACE	NUMBER OF RADIATORS	SIZE OF RADIATORS: NUMBER OF STACKS		SIZE OF RADIATORS: LENGTH OF RADIATORS.	
101	8008	41 1/4	1	(11)		(27½)	
102	16849	86 1/4	2	(11)	(12)	(27½)	(30)
103	9536	48 3/4	1	(13)		(32½)	
104	7714	37½ -	1	(10)		(25)	
105	48013	240	4	4(16)		4(40)	
106	8267	41 1/4	1	(11)		(27½)	
107	40446	202 1/2	3	3(18)		(45)	
108	7217	37 1/2	1	(10)		(25)	
109	30562	153 3/4	3	2(13)	1(15)	3(32 1/2)	1(37½)
110	50992	258 3/4	4	3(15)	1(24)	3(37½)	-1(60)
111	48496	243 3/4	3	2(22)	1(21)	2(55)	1(52½)
112	37680	187 1/2	2	2(25)		2(67½)	
113	47866	240 -	3	2(21)	1(22)	2(52½)	1(55)
114	11557	60	1	(16)		(40)	
115	24731	123 3/4	3	3(11)		3(27½)	

Tabulation of square feet of radiation required for the rooms with the sizes of radiators and heat losses.

SECOND FLOOR

Height of windows from the floor----- 2'5"
Height of radiators used ----- 26"
Number of columes per stack ----- 3
Width of Radiators ----- 9½"
Thickness of sections -----2½"
Square feet per stack ----- 3.75

ROOM NO.	RADIATION LOSS	SQUARE FEET RAD. SURFACE	NUMBER OF RADIATORS	SIZE OF RADIATORS NUMBER OF STACKS	LENGTH OF RADIATORS
201	10297	52 1/2	1	(14)	(35)
202	21945	108 3/4	2	(14) (15)	(35) (37½)
203	28112	146 1/4	2	(19) (20)	(47½) (50)
204	66963	333 3/4	4	3(22) 1(23)	3(55) 1(57½)
205	65028	326 1/4	4	3(21) 1(23)	3(52½) 1(57½)
206	14102	71 1/4	1	(19)	(47½)
207	71309	356 1/4	4	3(23) 1(26)	3(57½) 1(65)
208	70791	356 1/4	4	3(23) 1(26)	3(57½) 1(65)
209	21210	105 -	1	(28)	(70)
210	40180	202 1/2	3	3(18)	3(45)
211	86956	412 1/2	5	5(22)	5(55)

Third FLOOR

Height of windows from the floor-----2'5"
Height of radiators used ----- 26"
Number of columes per stack -----3
Width of Radiators -----9½"
Thickness of radiators sections------ 2½"
Square feet per stack ----- 3.75

ROOM NO.	RADIATION LOSS	SQUARE FEET RAD. SURFACE	NUMBER OF RADIATORS	SIZE OF RADIATORS. NUMBER OF STACKS	LENGTH OF RADIATORS
301	31847	161 1/4	3	2(14) 1(15)	2(35) 1(37½)
302	27556	138 3/4	2	(18) (19)	(45) (47½)
303	57351	285 -	4	4(19)	4(47½)
304	71044	356 1/4	4	3(23) 1(26)	3(57½) 1(65)
305	11782	60 -	1	(16)	(40)
3066	60662	303 3/4	4	3(20) 1(21)	3(50) 1(52½)
307	9337	48 3/4	1	(13)	(32½)
308	49346	247 1/2	3	3(22)	3(55)
309	75922	412 1/2	4	3(27) 1(29)	3(67½) 1(72½)
310	11116	56 1/4	1	(15)	(37½)
311	98214	477 1/2	5	5(26)	5(65)
312	13649	67 1/2	1	(15)	(37½)
313	19071	93 3/4	2	(13) (12)	(32½) (30)

Total radiation surface for FIRST FLOOR***** 2002 square feet
Total number of radiators installed ***** 33

Total radiation surface for SECOND FLOOR**** 2471.25 sq.feet
Total number of radiators installed ***** 31

Total radiation surface for THIRD FLOOR*****2708.75 sq.feet
Total number of radiators installed ***** 35

Complete tabulation for the square feet of radiation required for the individual rooms for the R.E.Olds Engineering Hall with the size of radiators installed.

FOURTH FLOOR

Height of windows from the floor------3'10"
Height of radiators used ------32"
Number of columes per stack ----- 2
Width of Radiators ------$8\frac{1}{2}$"
Thickness of one stack -------$2\frac{1}{2}$"
Square feet per stack -------3 1/3

ROOM NO.	RADIATION LOSS	SQUARE FEET RAD.SURFACE	NUMBER OF RADIATORS	SIZE OF RADIATORS NUMBER OF STACKS	LENGTHOF RADIATORS
401	40080	203 1/3	3	2(20)1(21)	2(50)1($52\frac{1}{2}$)
402	34725	176 2/3	2	(26) (27)	(65) ($67\frac{1}{2}$)
403	47287	240 -	3	3(24)	3(60)
404	*****	***	*	****	****
405	70179	366 2/3	4	3(27)1(29)	3($67\frac{1}{2}$)1($72\frac{1}{2}$)
406	10282	53 1/3	1	(16)	(40)
407	69923	366 2/3	4	3(27)1(29)	3($67\frac{1}{2}$)1($72\frac{1}{2}$)
408	7456	36 2/3	1	(11)	($27\frac{1}{2}$)
409	35413	180 -	2	2(27)	2($67\frac{1}{2}$)
410	109103	533 1/3	6	5(26)1(30)	5(65)1(75)
411	9877	50 -	1	(15)	($37\frac{1}{2}$)
412	90240	466 2/3	5	5(28)	5(70)
413	11948	63 1/3	1	(19)	($47\frac{1}{2}$)
414	19779	100 -	2	2(15)	2($37\frac{1}{2}$)

Total radiation surface for FOURTH FLOOR ***** 2836.666 sq.feet
Total number of radiators installed ***** 35

TOTAL RADIATING SURFACE IN THE BUILDIND *****by floors

BASEMENT:-	1616.66	Square feet
FIRST FLOOR:*	2002.00	Square feet
SECOND FLOOR:-	2471.25	Square feet
THIRD FLOOR:-	2708 .75	Square feet
FOURTH FLOOR:-	2836.66	Square feet
FOR BUILDING **********************	11635.32	Square feet

TOTAL NUMBER OF RADIATORS INSTALLED ****** BY floors

BASEMENT:-	27
FIRST FLOOR:-	33
SECOND FLOOR:-	31
THIRD FLOOR:-	35
FOURTH FLOOR:-	35
FOR BUILDING**************************	161

CORRIDOR RADIATION LOSSES WITH SIZE OF RADIATORS INSTALLED
BASEMENT***********55558B.T.U.
1st floor 51953 "
2nd floor 92124 " Total-----199635 B.t.U.
3rd floor taken care of by plenum ---78347
4th floor taken care of by plenum----87244 Total--165591 B.T.U.
Radiation surface required--- 199635x.005--998.18 square feet
Two radiators in main entrance and one in each side entrance of (25 stacks each)of C.I. 45"--4Colume 10 square feet per stack with 3" width of section and $10\frac{1}{2}$" width of radiator.Length of Radiators (75")

STEAM PIPING AND CONNECTIONS for the insʇalation of Radiators.

BASEMENT.

No. of Pieces.	Size of Pieces.	Kind of equipment.	length per piece.	Total length.
3	(2x2)	Elbows		
31	(2x2x2)	Tees		
27	(2)	Risers	13½ feet	364.5 feet
2	(2)		16 feet	32.0 feet
1	(2)		15 feet	15.0 feet
27	(2)	Riser Arms	1 foot	27.0 feet
		Total 2" piping		438.5 feet

First Floor.

No. of Pieces.	Size of Pieces.	Kind of equipment.	length per piece.	Total length.
1	(2x2)	Elbows.	13½	
35	(2x2x2)	Tees		
31	(2)	Risers	13½ feet	445.5 feet
1	(2)		18 feet	18.0 feet
33	(2)	Riser Arms	1 foot	33.0 feet
		Total 2" piping		496.5 feet.

Second Floor.

No. of Pieces.	Size of Pieces.	Kind of equipment.	length per piece.	Total length.
1	(2x2)	Elbows.		
31	(2x2x2)	Tees		
31	(2)	Risers,	13½ feet	418.5 feet.
1	(2)		17 feet	17.0 feet.
31	(2)	Riser Arms.	1 foot	31.0 feet.
		Total 2" piping		466.5 feet.

Third Floor.

No. of Pieces.	Size of Pieces.	Kind of equipment.	length per piece.	Total length.
		Elbows.		
38	(2x2x2)	Tees		
36	(2)	Risers	13½ feet	406.0 feet
36		Riser Arms	1 foot	36.0 feet
		Total 2" piping		442.0 feet

Fourth Floor.

No. of Pieces.	Size of Pieces.	Kind of equipment.	length per piece.	Total length.
40	(2x2)	Elbows		
34	(2x2x2)	Tees		
36	(2)	Risers	9 feet	324 feet
35	(2)	Riser Arms	1 foot	35 feet
		Total 2" piping		359.0 feet

Attic Steam Main Piping.

Number of pieces required.	Size of piping.	Kind of equipment.	Length of one piece	Total length of piping.
		Steam Main.		
1	$2\frac{1}{2}$"		24 feet	24 feet
2	$2\frac{1}{2}$"		20 feet	40 feet
3	$2\frac{1}{2}$"		8 feet	24 feet
2	$2\frac{1}{2}$"		14 feet	28 feet
1	$2\frac{1}{2}$"		16 feet	16 feet
1	$2\frac{1}{2}$"		13 feet	13 feet
1	$2\frac{1}{2}$"		18 feet	18 feet
2	$2\frac{1}{2}$"		4 feet	8 feet
36	$2\frac{1}{2}$"		4 feet	144 feet
1	3"		25 feet	25 feet
1	3"		2 feet	2 feet
2	3"		19 feet	38 feet
4	3"		4 feet	16 feet
1	3"		20 feet	20 feet
1	3"		12 feet	12 feet
1	3"		10 feet	10 feet
1	3"		21 feet	21 feet
4	4"		3 feet	12 feet
4	4"		15 feet	60 feet
3	4"		10 feet	30 feet
2	4"		4 feet	8 feet
1	4"		16 feet	16 feet
1	4"		8 feet	8 feet
1	4"		9 feet	9 feet
1	4"		17 feet	17 feet
2	4"		26 feet	52 feet
1	4"		6 feet	6 feet

The length of piping leading to Attic Steam Main:-

2	6"		20 feet	40 feet
2	6"		21 feet	42 feet
1	6"		5 feet	5 feet
1	6"		18 feet	18 feet
1	6"		20 feet	20 feet

Total $2\frac{1}{2}$ inch piping required--------	315 feet
Total 3 inch piping required--------	144 feet
Total 4 inch piping required --------	218 feet
Total 6 inch piping required --------	125 feet.
Total 2 inch piping required --------	2202.5 feet.
Total (2x2) 90° Elbows required ------	4
Total (2x2x2) Tees required ------	169
Total (4x$2\frac{1}{2}$x4) Tees required ------	4
Total (4x4x$2\frac{1}{2}$) Tees required ------	8

Attic acd Radiator Risers and Connections:-

Total(4x4) Elbows required ------------- 6
Total(4x3x2½) Tees required------------- 2
Total(3x2½x3) Tees required------------- 8
Total(3x2½x2½) Tees required ------------ 2
Total (2½x2½x2½) Tees required ---------- 9
Total(2½x2) Elbows required ------------- 39
Total (2½x3x2½)Tees required ------------ 1
Total (3x2½)Elbows required ------------- 1
Total (2½x2½) Elbows required ----------- 3
Total number of Radiator Valves --------- 165 Victor Auto type

All Radiator valves to be of the Victor Automatic type No 7.
All Riser pipes to be of wrought iron threaded and reamed for assembly.
All Riser Arms to be threaded and reamed for assembly.
All Radiators to be tapped at two thirds(2/3) the distance from the bottom for air valvess and threaded to one quarter (1/4) inch for valve connections.
All-fittings to be threaded for Radiators and Steam line with sufficient pitch to insure tight joints.
All radiator s to be equipped with female connection witha enough pitch to insure good drainage.
All Tees and Elbows to be of cast iron and threaded for connection.

Steam Headers and branches to top of Risers on the fourth floor and leading to fourth floor mains to be covered with Asbestos Cement Felting recommended by the Crane Co. Number eight grade to be used on all steam headers.

Steam headers to be provided with Expansion Pipe Hangers or Ring Hooks as recommended by the Crane Company . Hangers to be placed at TEN foot intervals along the Header with sufficient distance between the hanger and the end of the pipe when making a turn to allow for the free expansion of the pipe --- three feet at least between the end of the pipe and the hanger.

The number of Hangers required of the different sizes of pipe are:-

For 4 inch pipe 26
For 3 inch pipe 10
For 2½ inch pipe 10

Each Hanger to be provided with :-
One Plate, One button, and one ring.
One hundred(100) feet of one half,(1/2) inch pipein ten foot length, for use in hangers.
Twenty4feet (24) of one half(1/2) inch pipe in twelve foot lengths, for use in hangers.

Risers are to be provided with Crane's Patent Ceiling Plates for wrought iron pipe. One Hundred and sixty five(165) Ceiling plates required.Also 1 floor plate is required for each riser Making (165) required for the building.

Determination of the size of Plenum fan required for the Ventilation of the New R.E.Olds Mechanical Building and the size of Heater to deliver the ventilating air at the required Temperature of 87.2°.

With a velocity of air over the coils at 1000 feet per minute the number of sections of four pipes deep required to deliver air with the outside temperature of the air at zero degrees and the temperature of the air leaving the coils at 87.2 degrees ,is four sections making a total depth of the heater sixteen pipes deep.

The total air to be delivered for ventilating purposes in cubic feet per hour is 2,717,600.

The heat necessary in B.T.U. per hour to raise this air from zero ° to 87.2 ° is:-

H equals Q times the difference between the air from the coils and the room temperature to be kept constant divided by 55(the number of degrees through which theone cubic foot of air can be raised by one B.T.U.)

H equals 2,717,600 x 87.2-70/55 ---------850,000 B.T.U.

Total heat loss by ventilation is 850,000 plus 25%(850,000) the excess air required for leakage losses equals 1,062,500 B.T.U.

Atfour pipes witha four section heater of the Buffalo Heater return bend type of heaterwith a velocity of 1000 feet per minute over the coilseach lineal foot of pipe will deliver 661 B.T.U. at 87.2° F. The total lineal feettof pipe required to deliver 1,062,500 B.T.U. per hour are:-

1,026,500/ 661 equals----------------1610 feet

The free air space in a 1655 lineal foot ,four sections four pipes deep is 46 square feet.

The free air space required for the delivery of 2,717,600 cubic feet of air per hour which is needed for ventilating purposes at a velocity of 1000 feet per minute over the coils at 87.2°F is:-

2,717,600/ 60x1000 equals 45.29 square feet.

Heater@ -

R.B. manufactured by the Buffalo Fan Company with 170 pipes,

Length of section --------------	9feet 6 inches
width of base --------------	10 inches
Extreme height --------------	10feet 4 inches.
Total weight ------------------	3770 pounds.

Plenum Fan.

With the fan delivering againsta static pressure of One inch and required to deliver 2,717,600 cubic feet per hour or 45,290 cubic feet per minute:-

Fan number required to deliver this necessary air is :-

Number --- 150 delivers 48,900 cubic feet per minute.
Number --- 180 delivers 60,300 cubic feet per minute
both running at full rated capacity.

For case of necessity Fan number 180 is the best instalation with a full rated capacity of 60, 300 cubic feet per minute running at 185 R.P.M. with 27.55 B.H.P. required for operation. The Fan speed can be cut down when delivering the required air but in case of necessity can be operated at full rated capacity and deliver air at the necessary velocity and temperature with live steam supplied to the heater at a higher pressure and temperature.

Fan number 180 is manufactured by the American Blower Company And listed in their Steel Plate Fan Catalogue .

The diameter of the wheel is:---------108 inches
Cubic Feet per minute -------------60,300
R.P.M. -------------------------- 185
B.H.P .-------------------------- 27.55

Fan must be placed at least 36 inches from the inner surface of the Heaterto insure good draft and no increase in friction due to short bend onthe air entering the main air duct .

The Heater shall be equipped with the necessary connections for the steam drip and the steam mains or headers with steam at five pounds gage and of sufficient strength to withstand a pressure of 30 pounds of live steam when it is required to. These connections will be as stipulated by the Buffalo Fan Company for the size heater which I have determined, of the Buffalo Return Bend Type .

DETERMINATION OF THE SIZE OF AIR DUCTS AND THE Registers for the individual rooms, with a complete tabulation of the cubic feet of air required for the ventilation of the room ,the velocity of the air leaving the register ,thenet area of the register in square inches,the dimensions of the registers and the size of uptake for each room.

The velocity of the air in the main air duct after leaving the Fan.--1600 feet per minute.

FORMULAE USED IN THE COMPUTATION OF THE SIZE OF NET Register.This formulae applies to the air ducts or register openings as well as any part of the main air duct.

AREA IN SQ.IN.EQUALS**144xQ'/60xV

Q'-- the ventilating air supplied per hour.

V -- the velocity of the air leaving the register.

144/60 puts the area in square inches ,NET.

ROOM	CU.FT. AIR PER HOUR	VEL.OF AIR FT/MIN.	NET AREA OF REGISTER	SIZE OF REGISTER IN INCHES		SIZE OF UPTAKE IN INCHES.	
1	9000	200	108	(10x10)		(10x10)	
2	7200	150	115	(10x10)		(10x10)	
3	27000	350	186	(10x18)		(10x18)	
4	18000	200	216	(16x14)		(16x14)	
5	18000	200	216	(16x14)		(16x14)	
6	5400	150	86.5	(8x12)		(8x12)	
7	18000	200	216	(16x14)		(16x14)	
8	****	***	***	*******		*******	
9	5400	150	86.5	(8x12)		(8x12)	
10	36000	250	345	(18x20)		(18x20)	
11	54000	350	361	(18x20)		(18x20)	
12	54000	300	432	(18x24)		(18x24)	
13	9000	200	108	(10x10)		(10x10)	
14	18000	150	288	(12x12)	(12x12)	(12x12)	(12x12)
15	108000	250	104	(none)		(10x10)	
101	3600	90	96	(10x10)		(10x10)	
102	5400	150	86.5	(8x12)		(8x12)	
103	3600	90	96	(10x10)		(10x10)	
104	5400	150	86.5	(8x12)		(8x12)	
105	27000	150	432	(10x12)	(16x20)	(16x14)	(16x20)
106	5400	150	86.5	(8x12)		(8x12)	
107	27000	150	432	(18x24)		(16x26)	
108	3600	90	96	(10x10)		(8x12)	
109	45000	200	538	(16x34)		(16x34)	
110	27000	150	432	(12x18)	(12x18)	(12x18)	(12x18)
111	270000	450	1440	(24x30)	(24x30)	(10x10)	(18x74)
112	9000	200	108	(10x10)		(10x10)	
113	54000	250	518	(20x26)		(18x24)	
114	5400	150	86.5	(8x12)		(8x12)	
115	45000	200	538	(30x18)		(18x30)	

Calculations and tabulation of the size of registers on the Second, Third and Fourth Floors.

ROOM	CU.FT AIR PER HOUR	VEL. OF AIR FT/MIN	NET AREA OF REGISTER	SIZE OF REGISTER IN INCHES		SIZE OF UPTAKE IN INCHES	
201	7200	150	115	(10x10)		(10x10)	
202	36000	450	192	(10x10)	(10x10)	(10x10)	(10x10)
203	45000	250	432	(18x24)		(18x24)	
204	45000	150	720	(18x20)	(18x20)	(16x20)	(18x16)
205	45000	300	360	(18x20)		(18x24)	
206	5400	150	86.57	(8x12)		(10x10)	
207	54000	250	518	(20x26)		(16x34)	
208	63000	250	608	(30x20)		(20x26)	
209	7200	150	115	(10x10)		(10x10)	
210	54000	300	432	(18x24)		(18x24)	
211	450000	500	2160	(24x45)	(24x45)		
301	45000	250	432	(18x24)		(18x24)	
302	45000	250	432	(18x24)		(18x24)	
303	54000	250	518	(20x26)		(16x32)	
304	54000	250	518	(20x26)		(20x26)	
305	7200	150	115	((10x10)		(10x10)	
306	54000	250	518	(20x26)		(20x26)	
307	7200	150	115	(10x10)		(8x12)	
308	27000	150	432	(18x24)		(18x24)	
309	36000	150	578	(24x24)		(24x30)	
310	7200	150	115	(10x10)		10x10)	
311	54000	150	865	(18x24)	(18x24)	(20x20)	(18x24)
312	9000	200	108	(10x10)		(10x10)	
313	14400	350	99	(10x10)		(12x12)	
401	36000	300	288	(12x24)		(18x24)	
402	36000	300	288	(20x25)		(12x25)	
403	45000	375	288	(12x24)		(20x26)	
404	****	***	***	*******		******	
405	54000	300	432	(18x24)		(20x26)	
406	7200	150	115	(10x10)		(10x10)	
407	54000	300	432	(18x24)		(20x26)	
408	7200	150	115	*******		(10x10)	
409	27000	250	259	(13x20)		(12x22)	
410	108000	450	576	(24x24)		(24x24)	
411	7200	150	115	(10x10)		(10x10)	
412	72000	250	692	(18x18)	(18x18)	(18x24)	(18x24)
413	5400	150	86.5	(8x12)		(10x12)	
414	27000	450	144	(8x18)		none opens to hall	

CORRIDORS:-
BASEMENT----
27000
First floor
36000
Second floor
36000
Third floor
36000
Fourth floor
36000

Total Air required for the Corridors
171000 cubic feet per hour
Allow 71000 " " " "
Air to be supplied by register on the second floor at west end of corridor
Velocity of air leaving register--300 ft/min
Area of Register NET----- 965 sq.inches
Dimensions on register(24x40) This air supplies the Ventilating heat loss for the Second ,Third and Fourth Floor Corridors.

DETERMINATION of the size of ducts leaving the fan and the auxiliary ducts leading the air to the room stacks.

With a Velocity of 1800 feet per minute of the air leaving the Fan with the fan delivering 2,717,600 cubic feet per hour the sectional area of the duct at the fan is: sq.

Area ---144x2,717600/60x1800------------- 3622inches

The dimensions of the duct at this point are:- 60x60"

The cross section of the duct under the basement corridor with the air at a velocity of 1400 feet per minute is:-

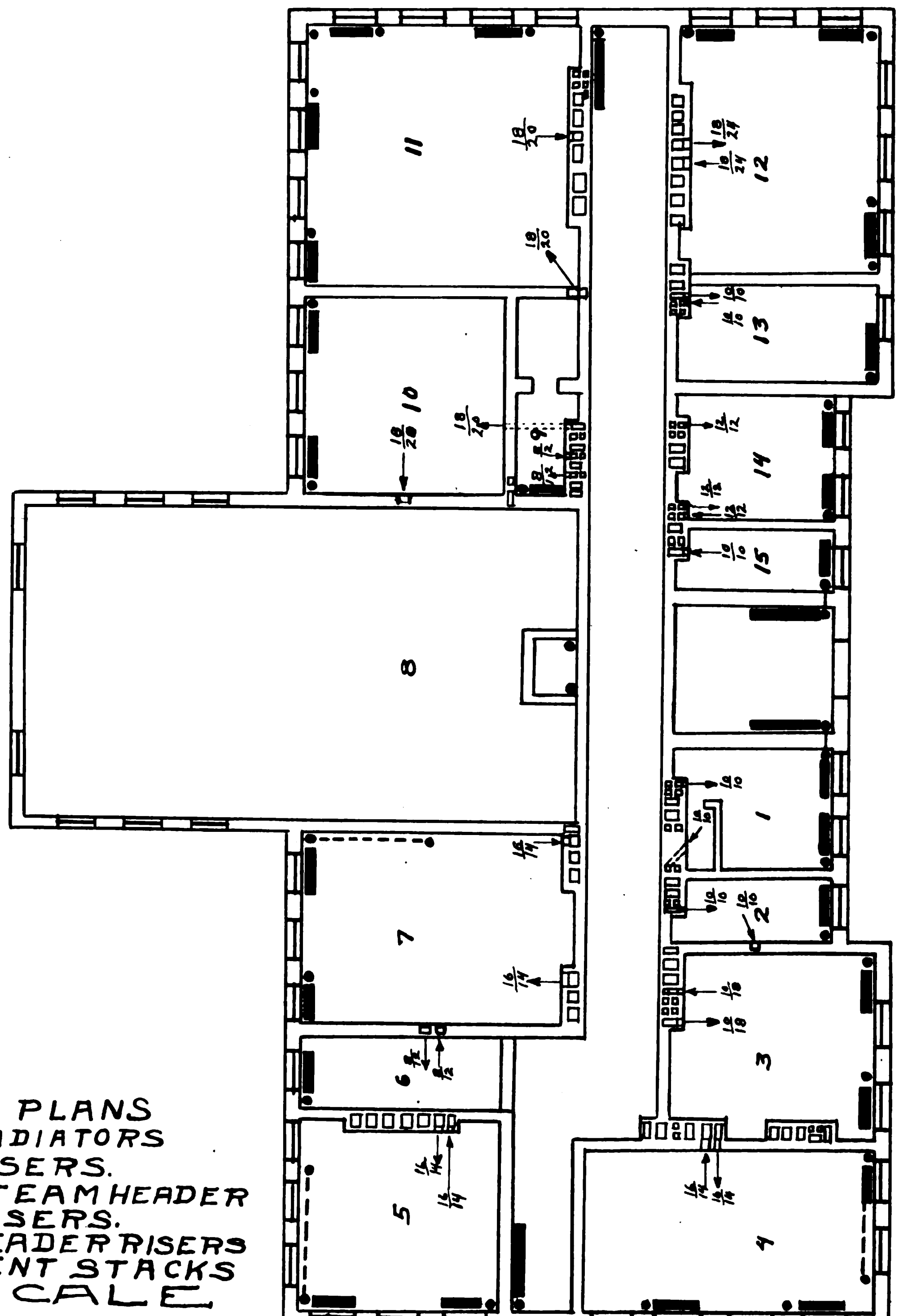
Area ---144x2,717600/60x1400------------- 4650 sq. inches.

The dimensions of the duct at this point are:- 96x48"

TOTALS FOR THE BUILDING BY FLOORS.

RADIATION LOSS	AIR SUPPLIED FOR VENTILATION.	NET AREA OF RADIATORS.	FLOORS.
318947	316800	1616.58	BASEMENT
397935	571400	2008.60	FIRST FLOOR
546893	847800	2471.25	SECOND FLOOR
535771	444800	2708.75	THIRD FLOOR
546415	576800	2836.66	FOURTH FLOOR

Total radiation loss per hour from the Building-2,335,961 B.TU.
Total air supplied for Ventilation per hour -2,717,600 cu.ft
Total Net radiator surface required for building- 11635.32 sqft



ON ALL PLANS

- ▬ RADIATORS
- ---- RISERS.
- —— STEAM HEADER RISERS.
- • HEADER RISERS
- ▫ VENT STACKS

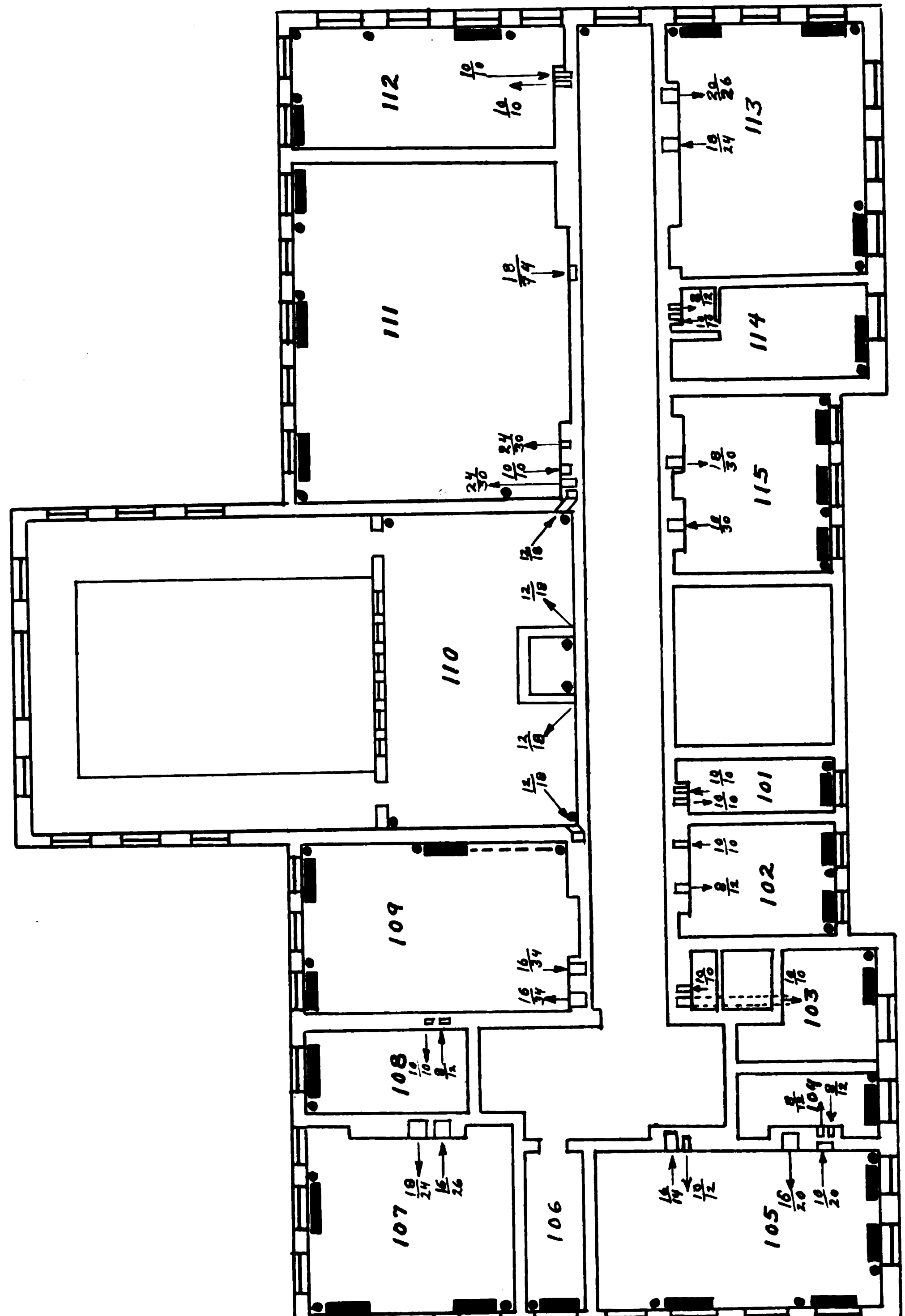
1/24" to 1' SCALE

N

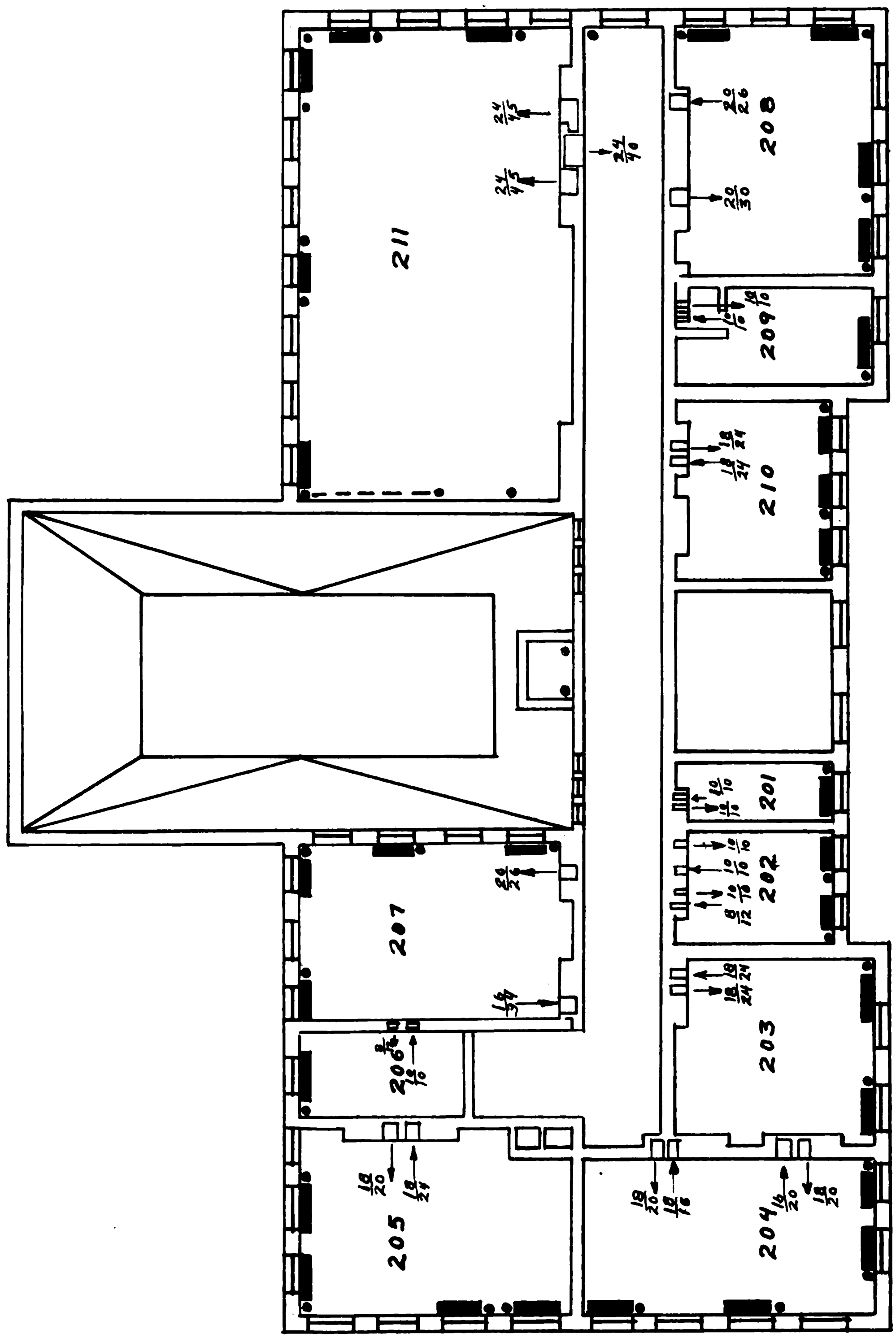
R.E. OLDS MECHANICAL BUILDING

BASEMENT PLAN

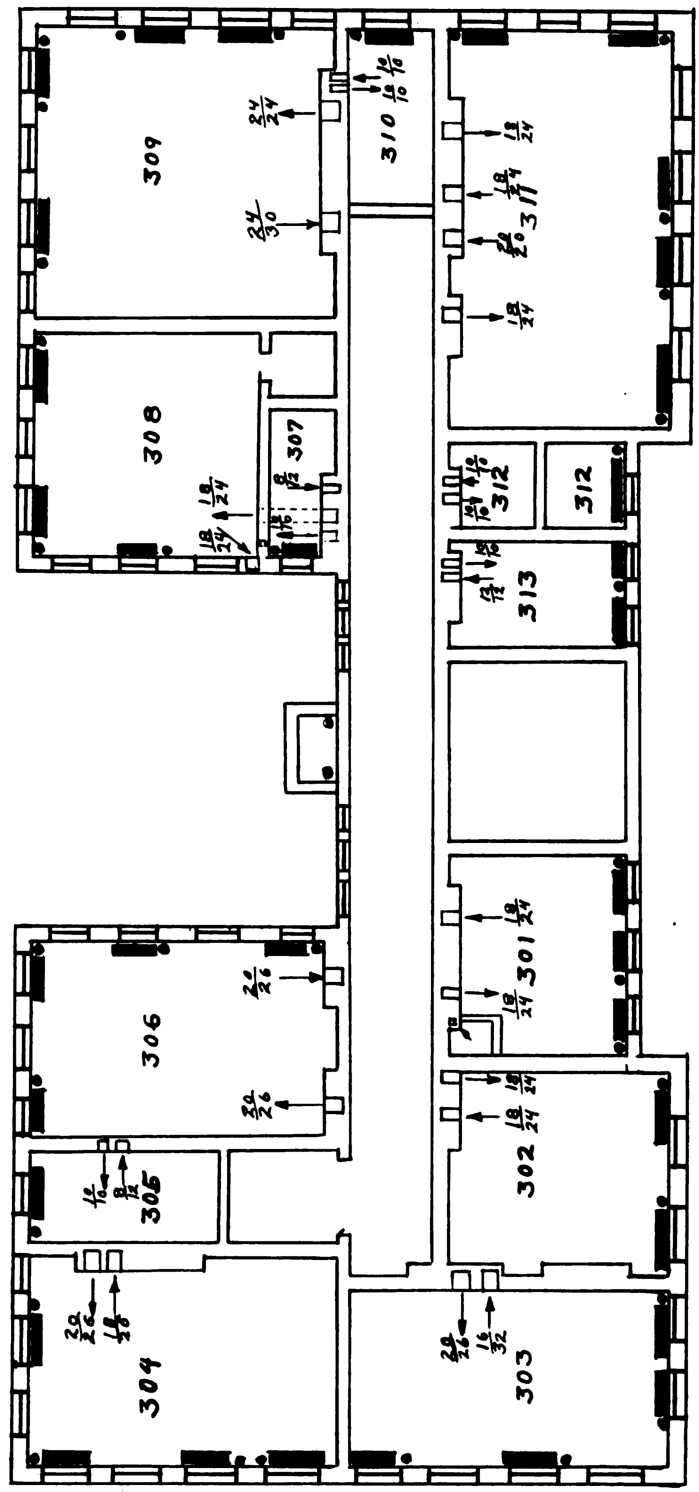
FOR HEATING AND VENTILATING EQUIPMENT



R. E. OLDS MECHANICAL BUILDING
FIRST FLOOR PLAN
FOR HEATING AND VENTILATING
EQUIPMENT

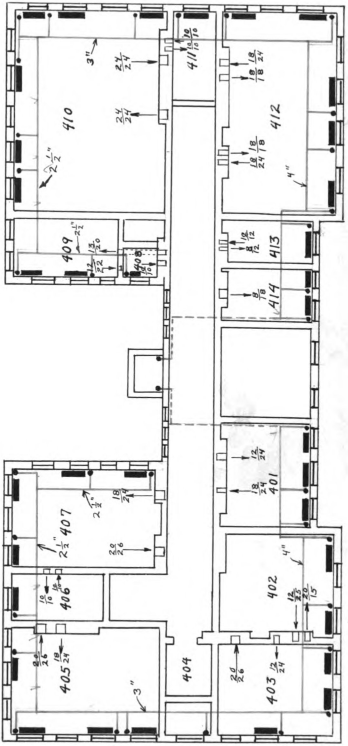


R.E.OLDS MECHANICAL BUILDING
SECOND FLOOR PLAN
FOR HEATING AND VENTILATING
EQUIPMENT



R. E. OLDS MECHANICAL BUILDING
THIRD FLOOR PLAN
FOR HEATING AND VENTILATING
EQUIPMENT

570 09\04 5



R E OLDS MECHANICAL BUILDING

FOURTH FLOOR PLAN

FOR HEATING AND VENTILATING EQUIPMENT

ROOM USE ONLY

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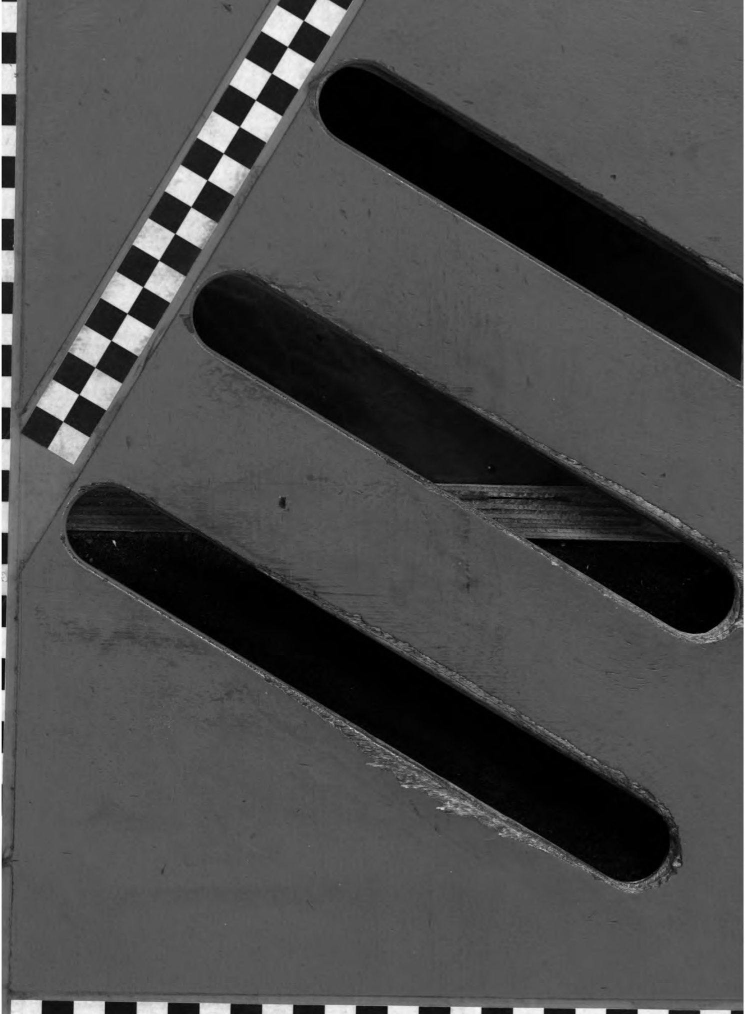

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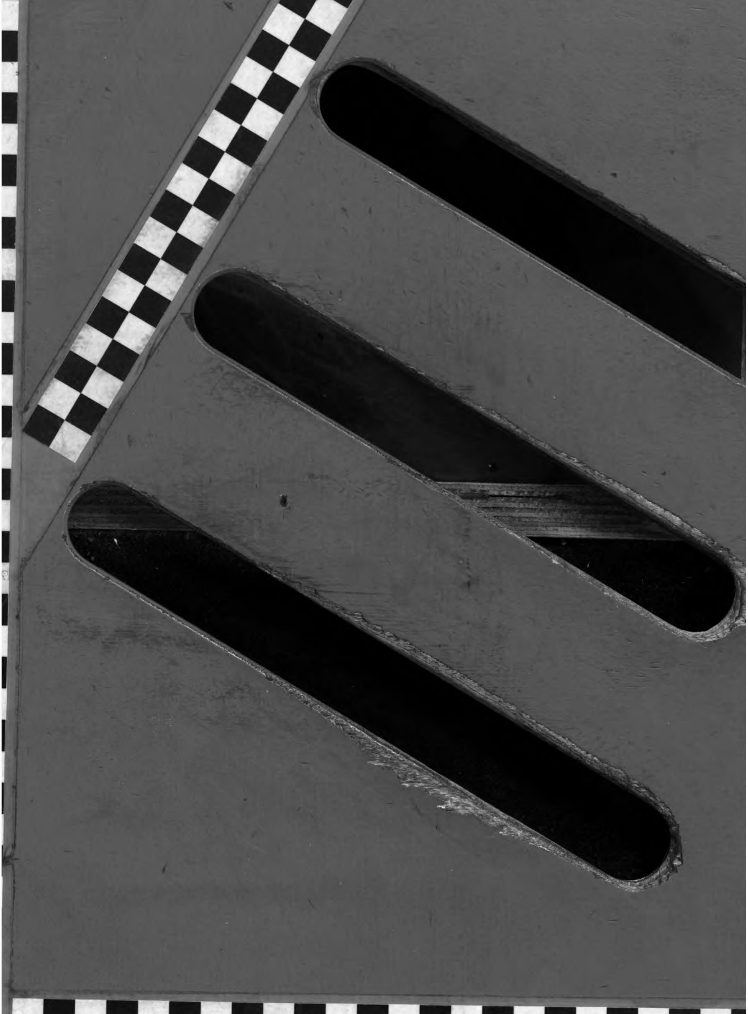

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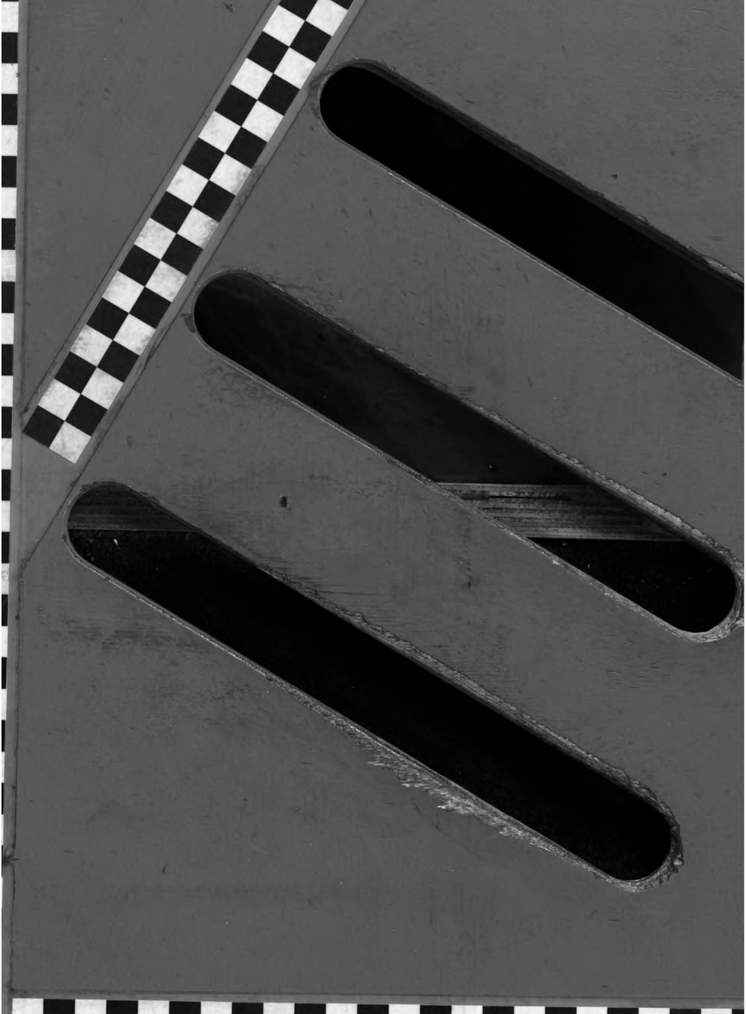

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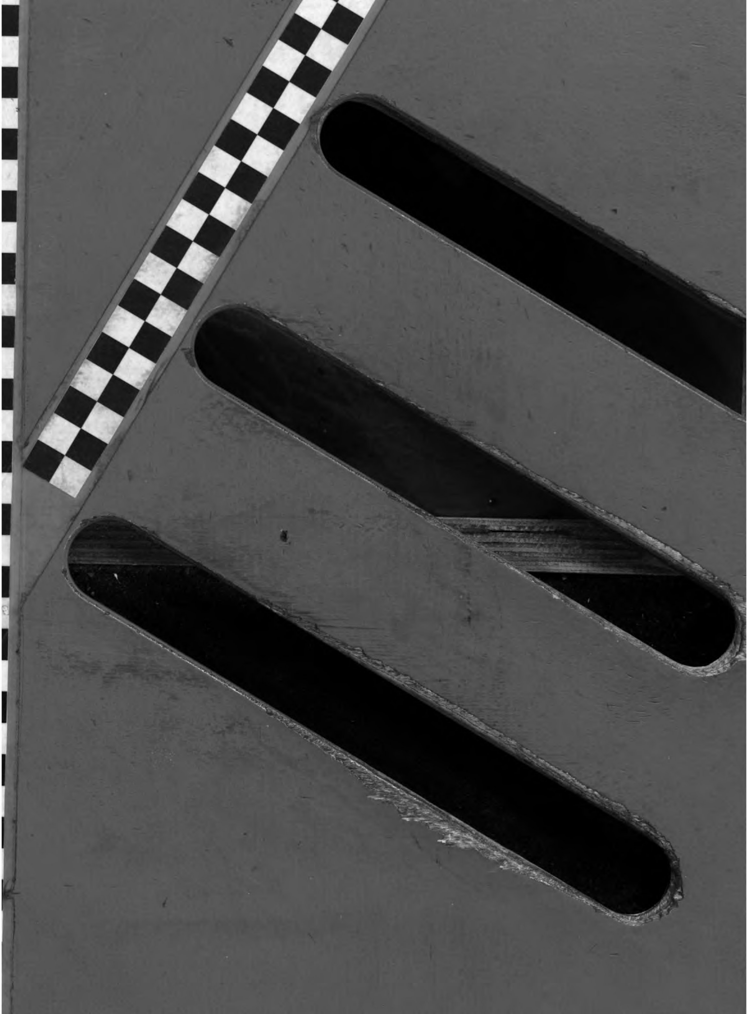

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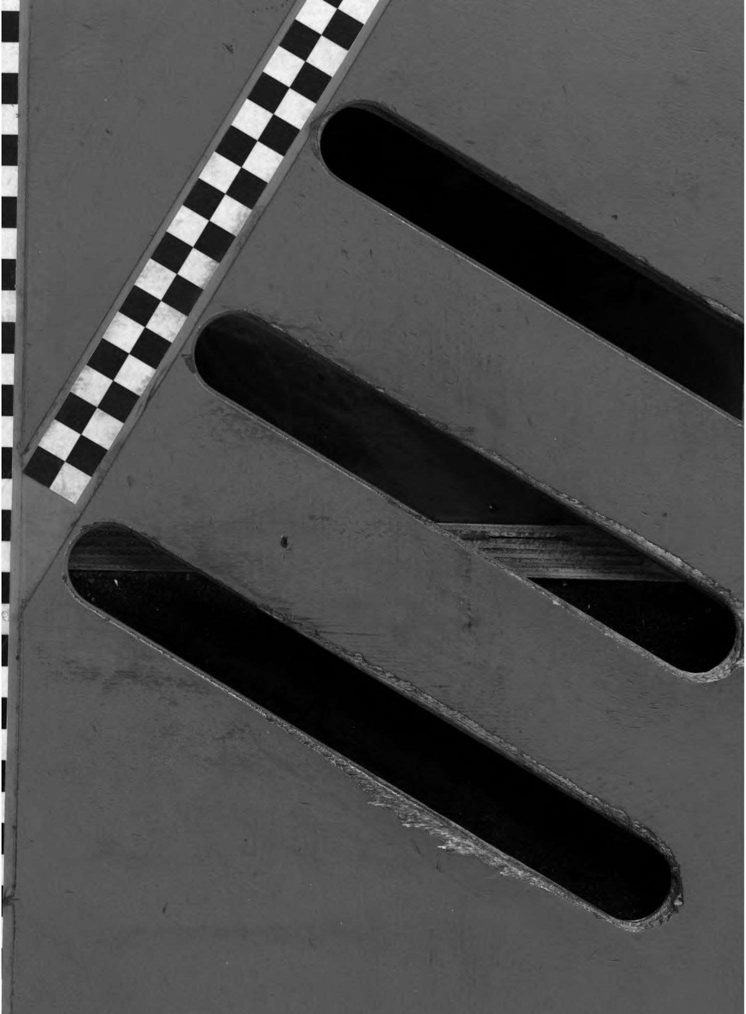

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