PROPERTIES AND APPLICATION OF THERMAL MASS

CONCRETE SLAB ON GROUND – LOWER HEATING REQUIREMENT
LIGHT WEIGHT

WALL INSULATION – LOWER ANNUAL HEATING / COOLING REQUIREMENT

FLOOR INSULATION – LOWER ANNUAL HEATING REQUIREMENT
EXCEPT FOR MILDEST WINTER

CONCRETE SLAB – INCREASE COOLING REQUIREMENT.

INSTALLATION OF THERMAL MASS

INSIDE THE INSULATED FABRIC OF BUILDING

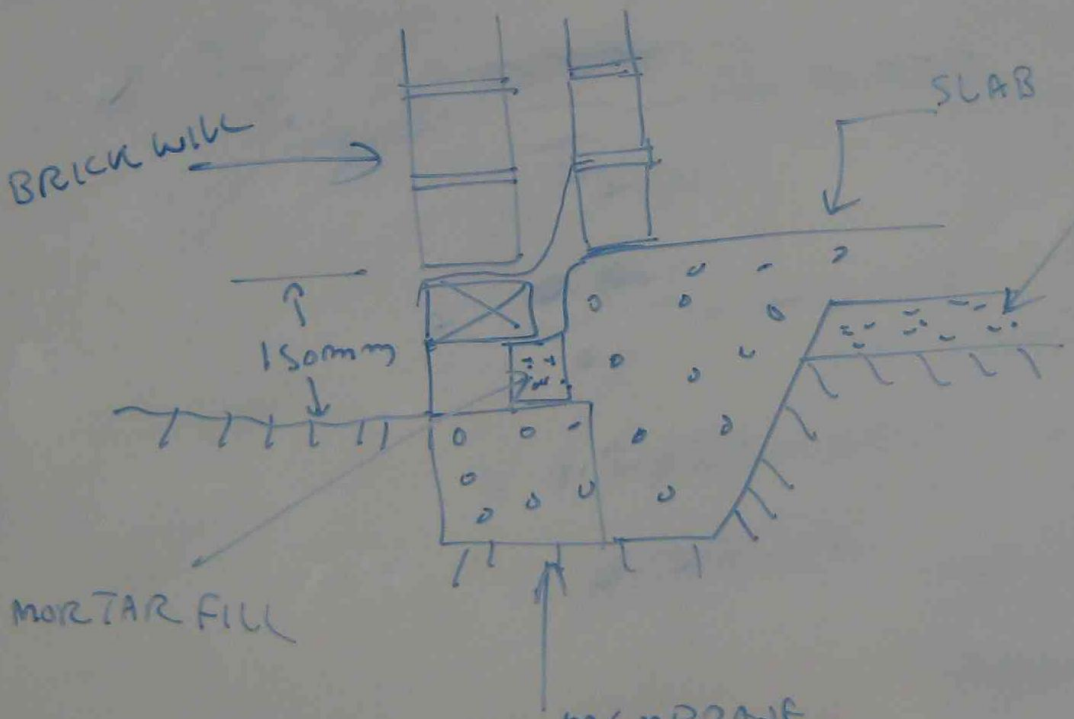
DARK COLOUR FOR SUN RAY

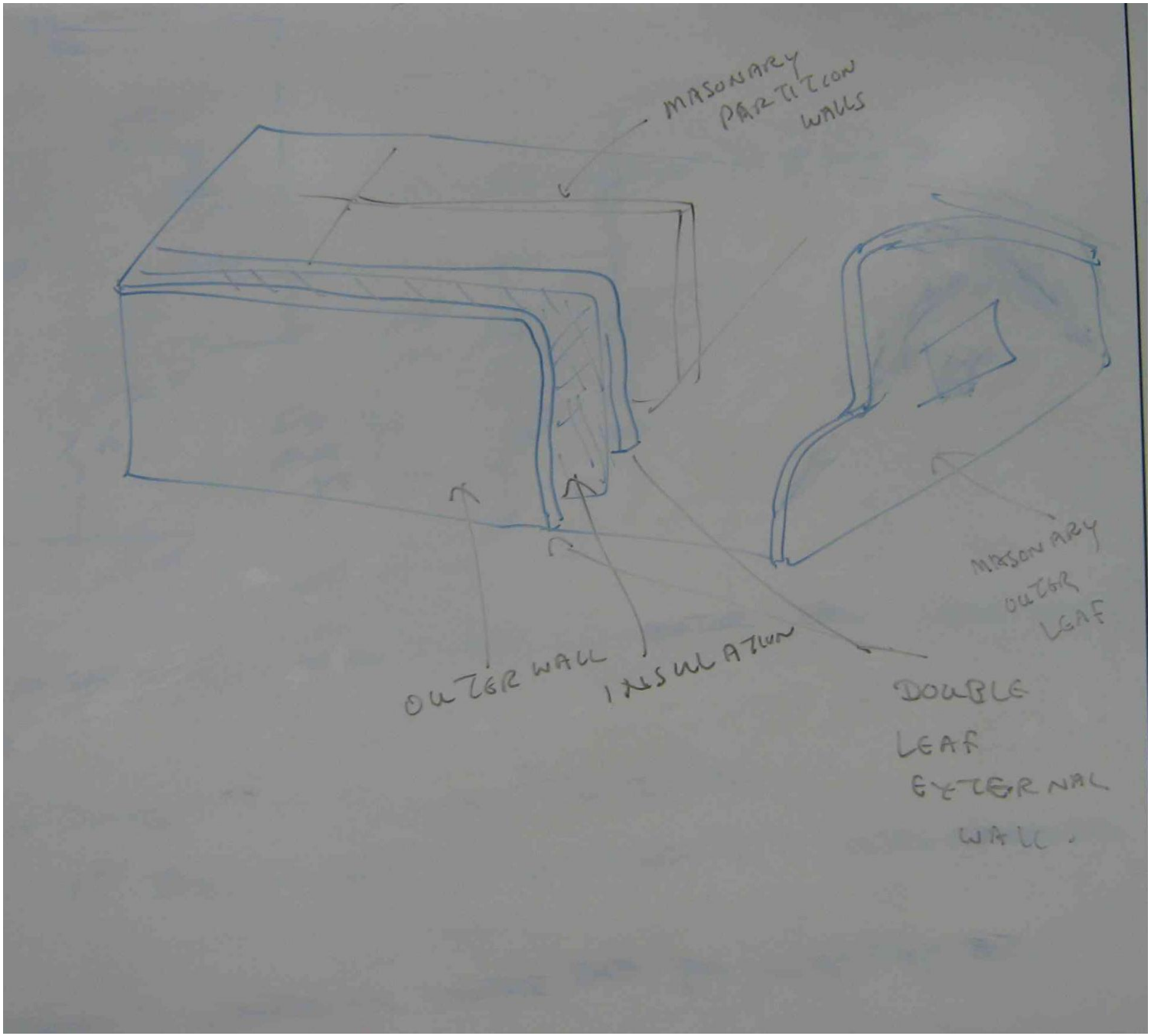
IN NORTH FACING LIVING ZONE

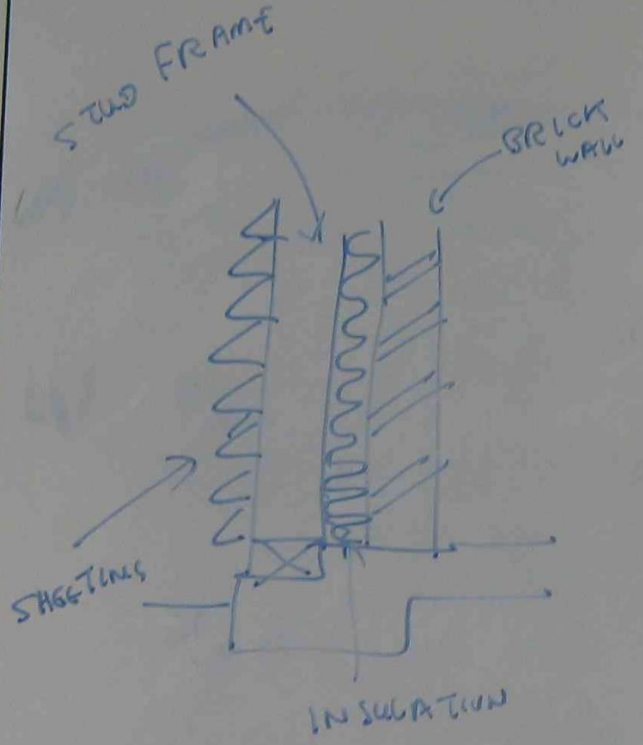
CONCRETE SLABS – LAY DIRECTLY ON THE GROUND RATHER THAN BEING SUSPENDED

FIRE PLACE – BEST LOCATED AWAY FROM EXTERNAL WALL.

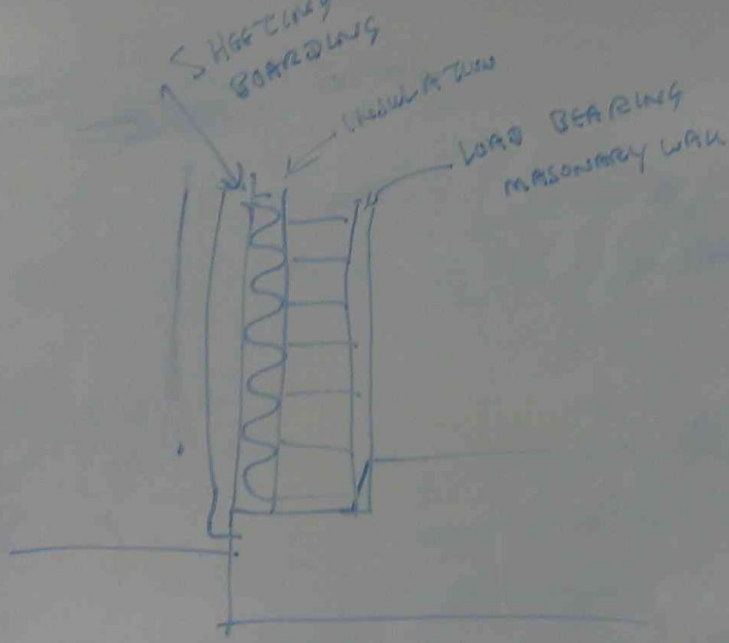
CONCRETE SLAB ON GROUND FOR STABLE SOIL

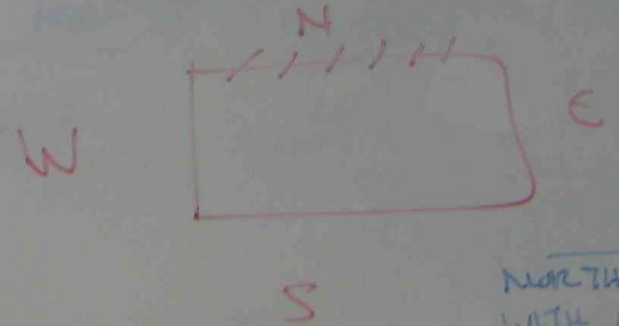



MASONARY
PARTICON
WALLS
MASONARY
OUTER
LEAF
OUTER WALL
INSULATION
DOUBLE
LEAF
EXTERNAL
WALL.



REVERSE BRICK VENEER WALL





NORTHERN CO
WITH HARD SU
% OF TOTAL

— LOAD BEARING MASONARY WALL

ACTIVITY (7) FOR TEST (2)

- MEASURE TOTAL WALL AREA of YOUR HOME / UNIT FLAT (OUTER WALL), AND ALSO TAKE TOTAL AREA of ALL WINDOW GLASSES. & FLOOR AREA
- FIND TOTAL GLASS AREA of NORTH FACING WALL

(IF THERE IS NO GLASS, JUST WRITE THE COMMENT)

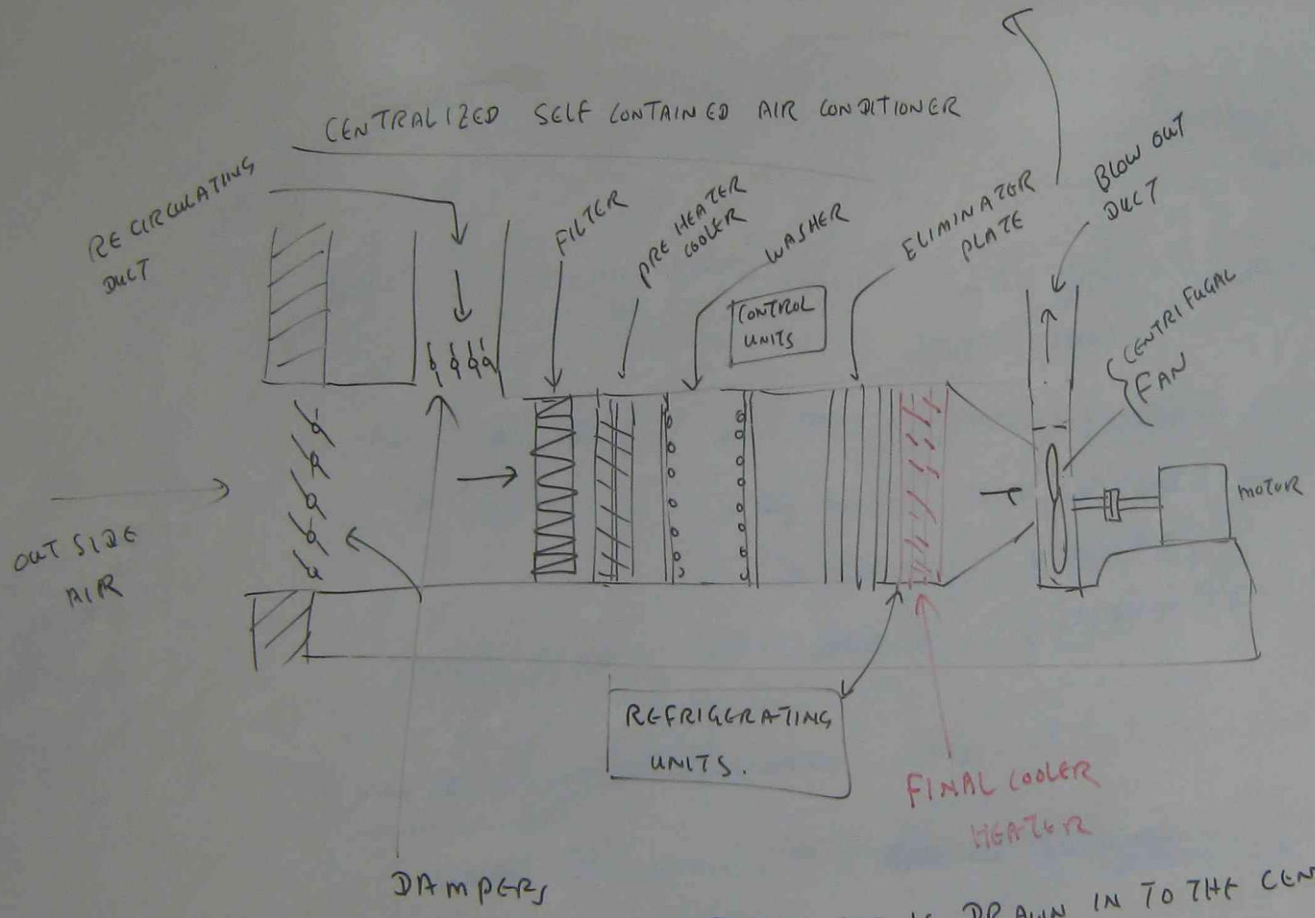
JUDGE WHETHER IT AGREES WITH RECOMMENDED % NORTH FACING GLASS AREA GIVEN IN FOLLOWING TABLE

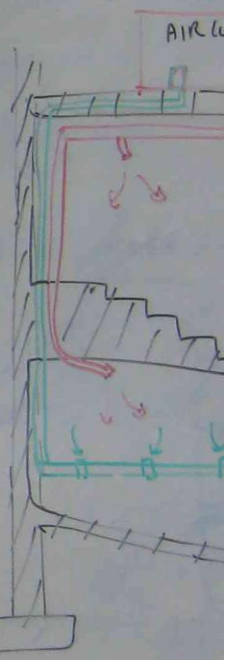
SYDNEY — NORTH FACING GLASS

INTERNAL MASONARY % OF FLOOR AREA	60	70	80	90	100	110	120
NORTHERN CONCRETE SLAB WITH HARD SURFACE % OF TOTAL							
0					10 — 15		20 — 25
20				15 — 20			30
40			10 — 15		25 — 30		35
60		10 — 20		25 — 30		35 — 45	
80	10 — 20		25 — 30		35 — 40		45
100	15 — 20		30 — 35		40 — 45		

IF NORTH FACING IS HIGHER %, THE HOME WILL BE OVER HEATED

IF NORTH FACING GLASS IS LESS % (OR) NO GLASS, HOME WILL NOT GET NATURAL LIGHT.



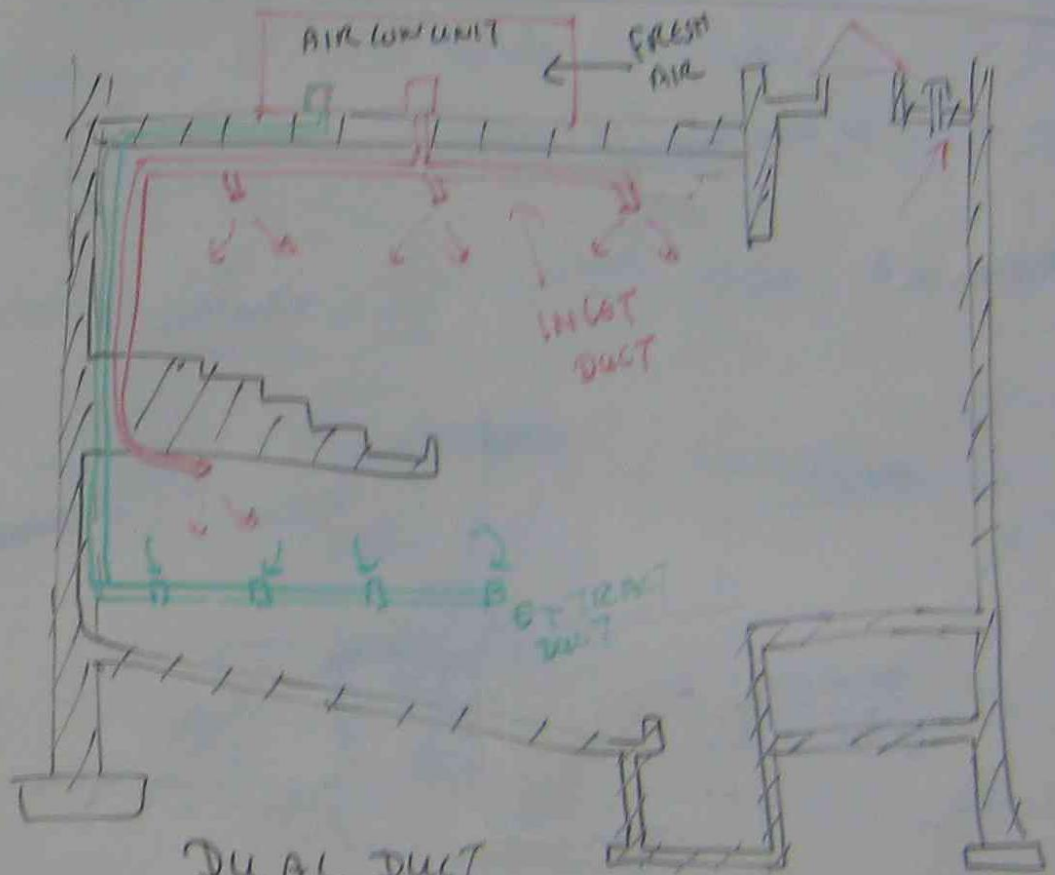


DUAL

FRESH AIR IS DRAWN IN TO THE CENTRALIZED UNIT. IMPURITIES ARE ELIMINATED BY FILTER, ELIMINATOR PLATE. THE AIR PASSES THROUGH COOLERS AND IS BLOWN OUT BY FAN IN TO INLET DUCT.

THE CIRCULATED AIR IS EXTRACTED INTO EXHAUST DUCT AND EXHAUST FAN BLOWS IT OUTSIDE.

SCHEMATIC DIAGRAM OF AN AIR CONDITIONING PLANT FOR



DUAL DUCT SYSTEM

unit.

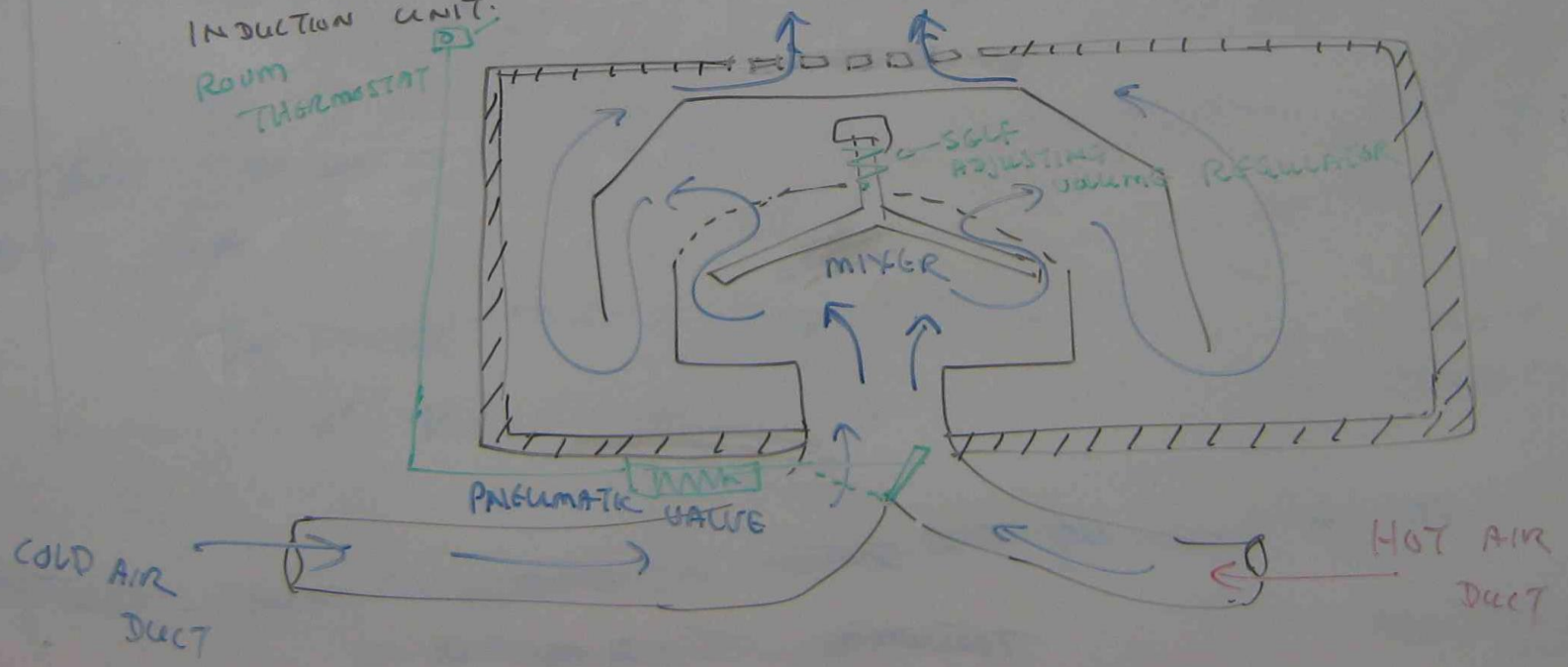
HOT

IS BLOWN OUT BY

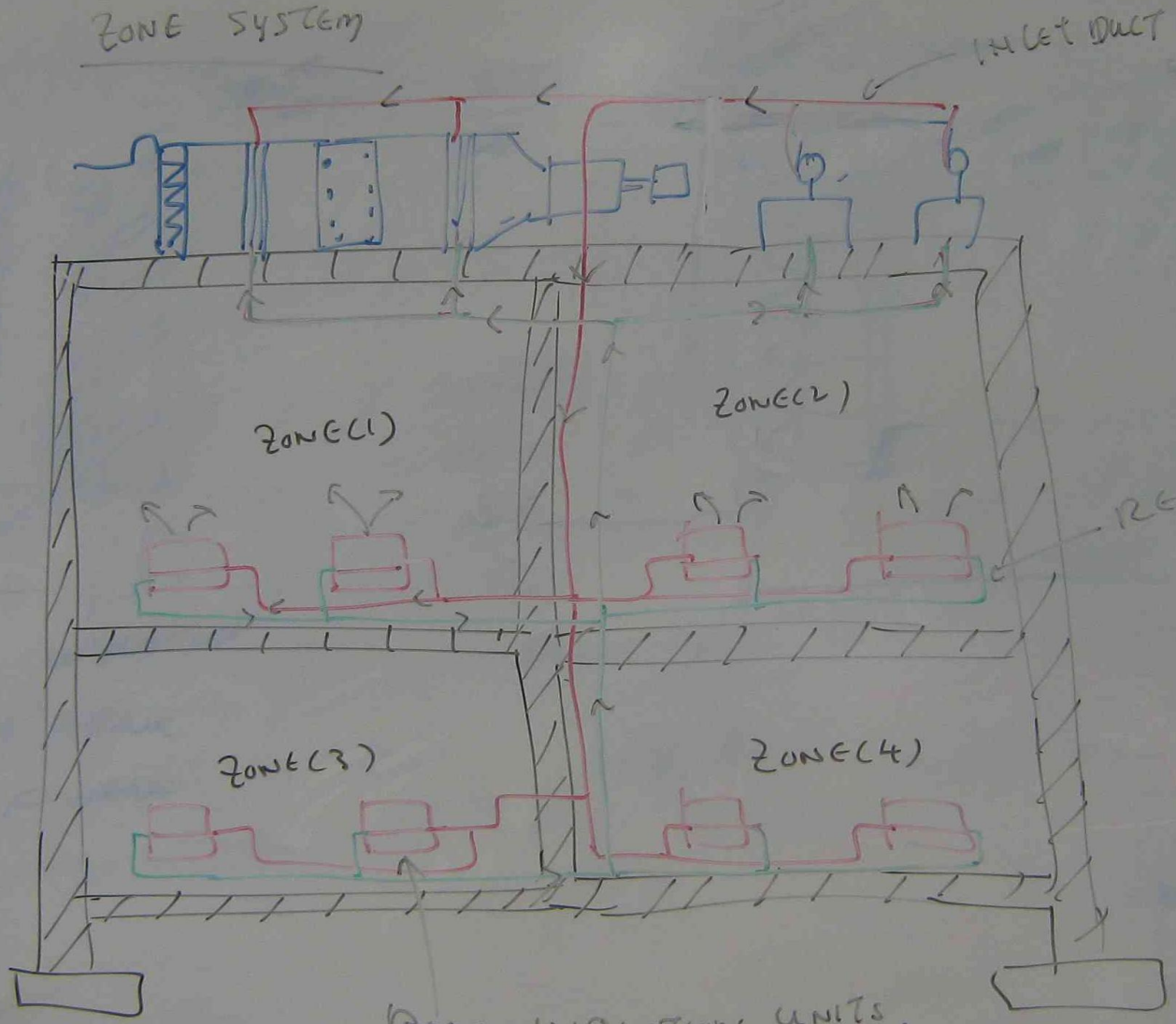
THEATRE

THE INDUCTION CONVECTOR AIR CONDITIONING SYSTEM

AN INDUCTION SYSTEM CAUSES THE SECONDARY AIR IN THE ROOM TO BE RECIRCULATED BY THE PRIMARY AIR PASSING THROUGH NOZZLES IN THE INDUCTION UNIT. THIS CAUSES GOOD AIR MOVEMENT IN THE ROOM. THIS INDUCED AIR FLOWS OVER A COOLING OR HEATING COIL AND COOLED OR HEATED SECONDARY ROOM AIR TO BE MIXED WITH THE PRIMARY CONDITIONED AIR BEFORE BEING DISCHARGED THROUGH A GRILL AT THE TOP OF INDUCTION UNIT.



ZONE SYSTEM



pb

COEFFICIENT OF PERFORMANCE (COP)

$$COP = \frac{t_c}{t_c - t_e}$$

t_e = EVAPORATOR TEMPERATURE (K)

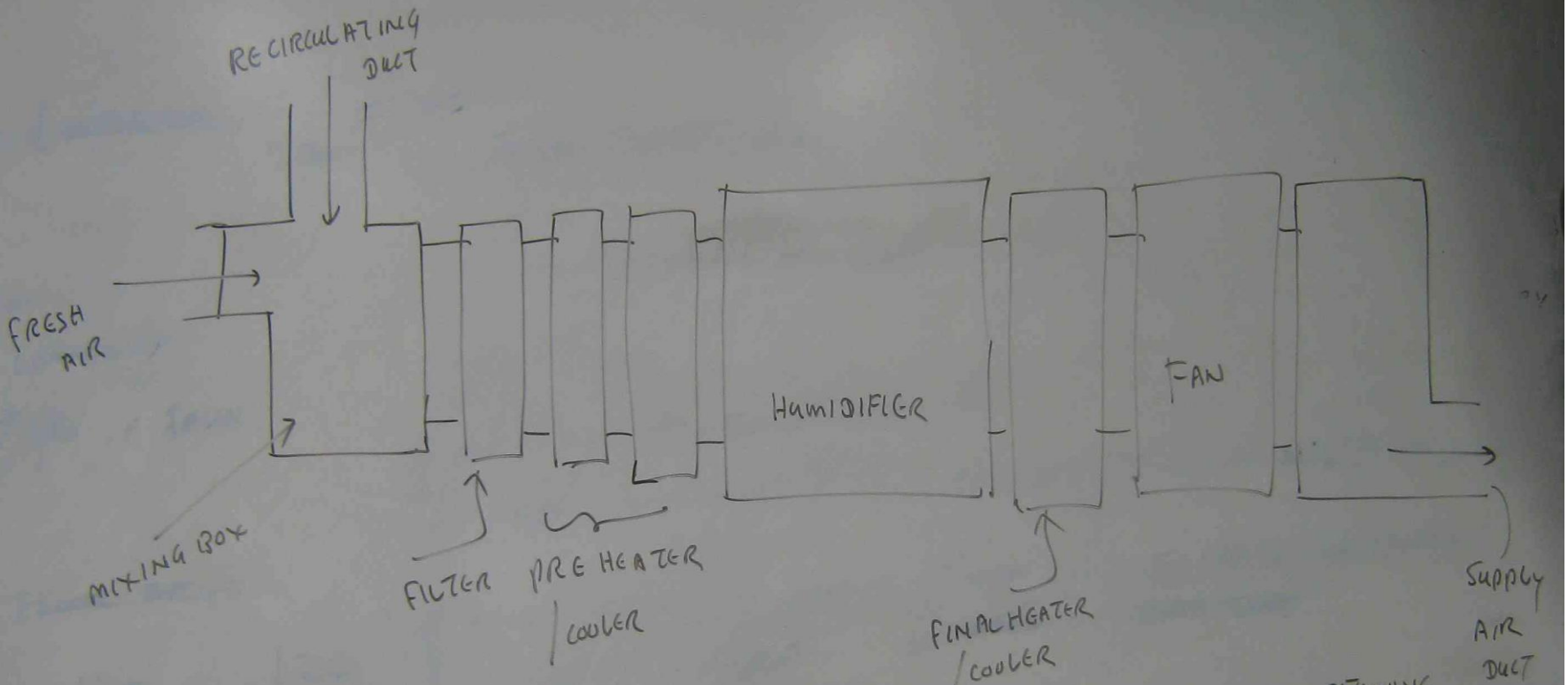
t_c = CONDENSER TEMPERATURE (K)

Pb CALCULATE COP OF A HEAT PUMP WHEN CONDENSER AND EVAPORATOR TEMPERATURE ARE 45c AND 4c RESPECTIVELY, ASSUMING 100% EFFICIENCY.

$t_c = 45 + 273 = 318$ K

$t_e = 4 + 273 = 277$ K

$$COP = \frac{t_c}{t_c - t_e} = \frac{318}{318 - 277} = 7.75$$



THE FUNCTION OF HUMIDIFIER IN ABOVE LARGE COMMERCIAL AIR CONDITIONING UNIT IS TO REHEAT THE AIR TO REMOVE THE MOISTURE CONTENT WHEN THE HUMIDITY IS TOO HIGH CAUSING UNCOMFORT.

$\Delta t = 95 - 68 = 27^{\circ}F$

TABLE (3) COOLING (DOOR & WINDOWS)

DIRECTION	SINGLE GLASS			DOUBLE GLASS			TRIPLE GLASS		
	TEMP DIFF			TEMP DIFF			TEMP DIFF		
	15°	20°	25°	15°	20°	25°	15°	20°	25°
N	15	20	20	15	20	25	11	12	13
NE & NW	31	41	45	31	33	35	25	27	38
E & W	52	56	60	44	46	48	38	39	40
S	28	32	36	23	29	27	19	20	21

TABLE (D) INFILTRATION MULTIPLIER (WINTER)

FLOOR AREA	900 OR LESS	900 – 1500	1500 – 2100	OVER 2100
BEST	0.4	0.4	0.3	0.3
AVERAGE	1.2	1	0.9	0.7
POOR	2.2	1	1.2	1

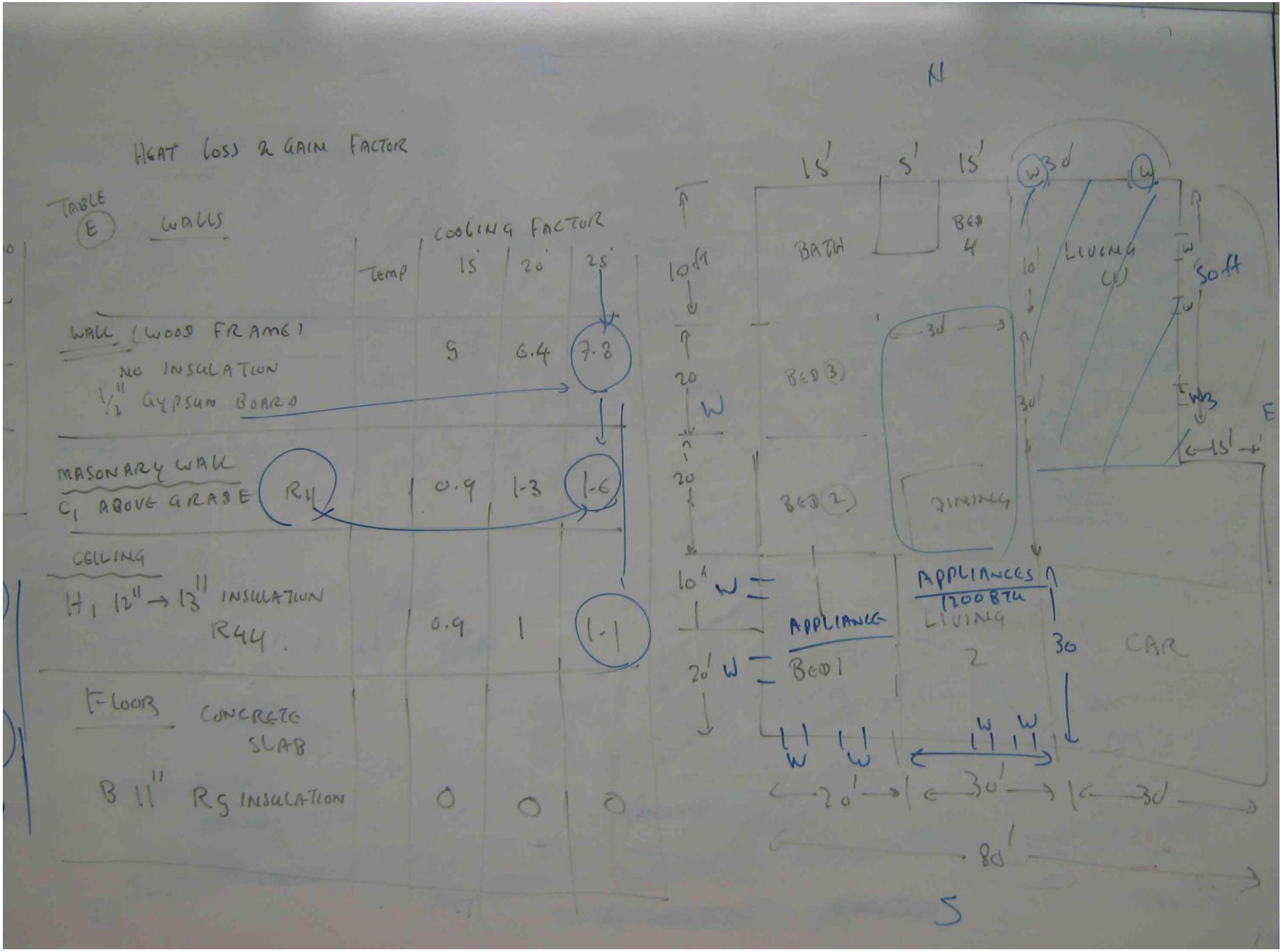
SUMMER

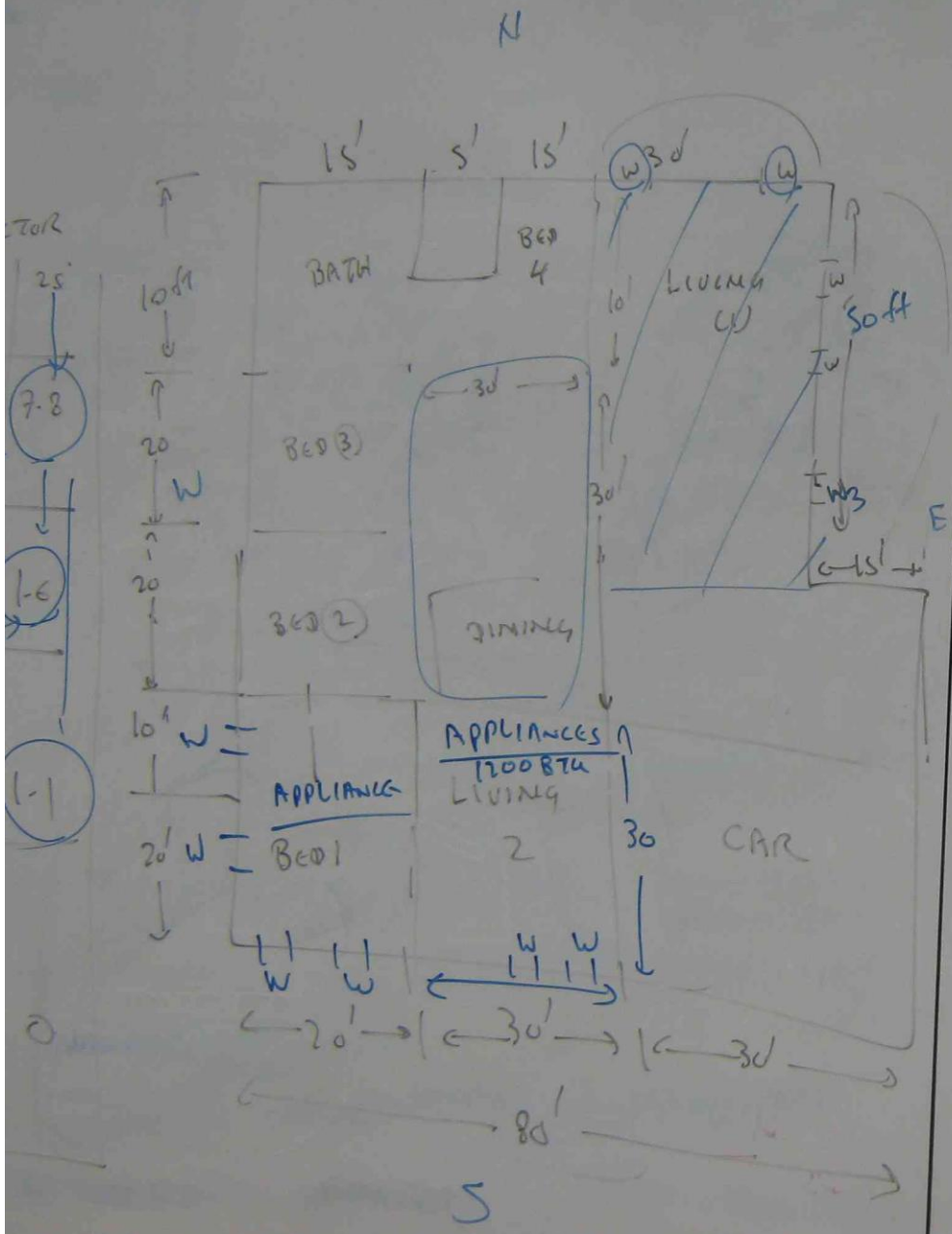
FLOOR AREA	900 OR LESS	900 – 1500	1500 – 2100	OVER 2100
BEST	0.2	0.2	0.2	0.2
AVG	0.5	0.5	0.4	0.4
POOR	0.8	0.7	0.8	0.8

HEAT LOSS & GAIN FACTOR

TABLE (E) WALLS

		COOLING FACTOR		
	Temp	15°	20°	25°
WALL (WOOD FRAME) NO INSULATION ½" GYPSUM BOARD		5	6.4	7.8
MASONARY WALL C_1 ABOVE GRADE	R11	0.9	1.3	1.6
CEILING H_1 12" → 13" INSULATION R44		0.9	1	1.1
FLOOR CONCRETE SLAB B 11" R5 INSULATION		0	0	0


HEAT LOSS & GAIN FACTOR
TABLE E
WALLS
COOLING FACTOR
TEMP
15'
20'
25'
WALL (WOOD FRAME)
NO INSULATION
1/2" GYPSUM BOARD
5
6.4
7.8
MASONARY WALL
C1 ABOVE GRADE
R11
0.9
1.3
1.6
CEILING
H1 12" → 13" INSULATION
R44.
0.9
1
1.1
FLOOR
CONCRETE SLAB
B 11" R5 INSULATION
0
0
0
N
S
E
15'
5'
15'
30'
BATH
BED 4
LIVING
10'
50ft
30'
BED 3
20
W
BED 2
DINING
APPLIANCES
1200 BTU
LIVING 2
APPLIANCE
BED 1
CAR
30
20'
30'
80'



1 LIVING (1) & DINNING

GROSS WALL = 50X10 + 30X10 = 800 Sqft

DOOR + WINDOW = 5 x 6 x 7 = 210 Sq ft

NETWALL = 590 Sqft.

CEILING 30x50 + 30x30 = 2400 Sqft

Floors 30x50 + 30x30 = 2400 Sqft

300 BTU / People

NORTH WINDOW

$2 \times 13 \times 6 \times 7\ ft^2 = 1092$ ✓ BTU

EAST WINDOWS

$2 \times 40 \times 6 \times 7 = 3360$ ✓ BTU

WALL

EAST WALL $7.8\left(50 \times 10 - 3 \times (6 \times 7)\right) = 374$ ✓ BTU

NORTH $1.6 \times (30 \times 10 - 2 \times 6 \times 7) = 345.6$ BTU

CEILING

$2400 \times 1.1 = 2640$ ✓ BTU

FLOOR $2400 \times 0 = 0$

HEAT TRANSFER IN THROUGH WALL CEILING/WINDOWS

INFILTRATION $\left(\frac{\text{CEILING}}{\text{FLOOR AREA}} \times \text{HEIGHT}\right) \times 0.01833 \times \Delta T \times 0.4$ FACTOR

$2400 \times 10 \times 0.01833 \times 27 \times 0.4 = 475$ ✓ BTU

$4 \times 300 = 1200$ BTU

$= 14962$ BTU

DUCT GAIN FACTOR = 1.3 × SUB TOTAL BTU

= 1.3 × 14962

= 19451 BTU

DUCT GAIN = 7726 × 1.3 = 10044 BTU

LIVING ROOM (2)

GROSS WALL = 30×10 = 300 sq ft

DOOR + WINDOW = 2×6×7 = 84

NET WALL = 216 sq ft

CEILING: 30×30 = 900 sq ft

FLOOR = = 900 sq ft

SOUTH WINDOW + DOOR

2×6×7×21 = 1764 BTU.

WALL 216×1.6 = 345.6 BTU

CEILING 900×1.1 = 990

FLOOR 900×0 = 0

INFILTRATION 900×10×27×0.5 ×0.01833 = 2227

PEOPLE 4×300 = 1200

APPLIANCE = 1200

TOTAL 7726

BED ROOM (1)

SOUTH WALL = 20×10 = 200

WINDOW 2×6×7 = 84

NET WALL 116

WEST WALL = 30×10 = 300

WINDOW = 2×6×7 = 84

NET WALL = 216 MASONARY

CEILING = 30×20 = 600

FLOOR 600

SOUTH WINDOW 84×21 = 1764

SOUTH WALL 116×1.6 = 185.6

WEST WINDOW = 84×40 = 3360

WEST WALL = 216×1.6 = 345.6

CEILING = 600×1.1 = 660

FLOOR 0

INFILTRATION

600×10×0.01833×27×0.5 = 1484

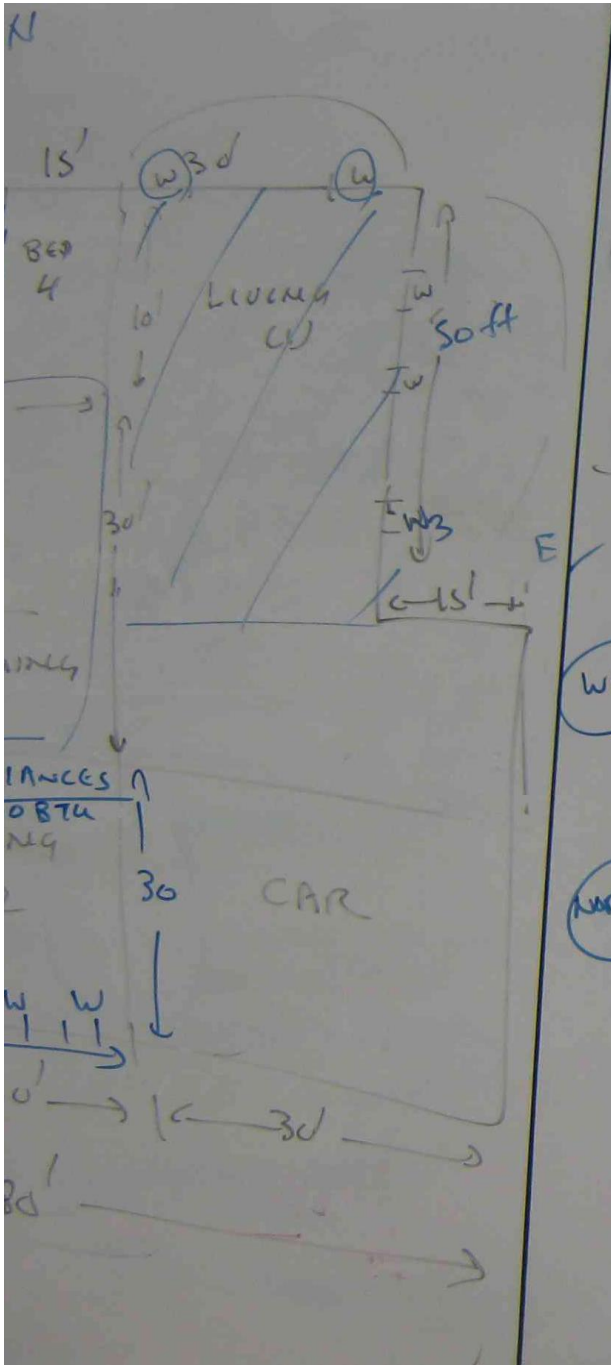
1 PEOPLE = 1×300 = 300

APPLIANCE = 1200

8699

INFILTRATION

8699×1.3 = 113



BED ROOM 2 + 3 + BATH + W/R

WEST

GROSS WALL = 6 DX 10 = 600

WINDOWS = 2x6x7 + 2x3x3 = 96

NET = 504

NORTH

GROSS = (15+5) x 10 = 200

WINDOW 1 x 6 x 7 = 42

158

CEILING = 60x15 + 10x5 = 950

FLOOR = 950

WEST MASONARY = 504 × 1.6 = 806.4

NORTH (——) = 158 × 1.6 = 252.8

NORTH WINDOW = 1 × 6 × 7 × 13 = 546

WEST WINDOW = 96 × 13 = 1248

CEILING = 950 × 1.1 = 1045

FLOOR = 0

INFILTRATION

$$\frac{950 \times 10 \times 0.01833 \times 27}{0.5} = 2350$$

13505

PEOPLE = 2 × 300 = 600

APPLIANCE = 2 × 1200 = 2400

16505 BTU

DUCT GAIN = 16505 × 1.3 = 21457 BTU

= 14962 BTU

BED ROOM

NORTH GROSS

WINDOW

CEILING

FLOOR

HEAT GAIN

NORTH

WALL

CE

INF

BED ROOM (4)

NORTH GROSS WALL = 15x10 = 150

WINDOW = 6x7 = 42

NET WALL = 108

CEILING = 15x10 = 150

FLOOR = 150

HEAT GAIN

NORTH WINDOW = 42x13 = 546

WALL 108x1.6 = 172.6

CEILING 150x1.1 = 165

FLOOR 0

INFILTRATION 150x10x0.01833x27x0.5 = 371

people 1x300 = 300

APPLANCE = 1700

2754

DUCT GAIN = 2754x1.3

= 3581.24

TOTAL

62 BTU

TOTAL

LIVING 1 = 19451

2 = 10044

BED 1 = 10952

BED 2 = 21457
+3 BATH WC

BED 4 = 3581

TOTAL = 64585 BTU

TOTAL FLOOR AREA

LIVING 1 + LIVING 2 + $B_1 + B_2$ 3 WC + B4

2400 + 400 + 400 + 950 + 150

= 4800 sq ft

BTU/sq ft-sec = $\frac{64585}{4800}$ = 13.45

KW = BTU/sq ft-sec × 1.05

= 14.1 KW