


Understanding the Residential Energy Code Requirements for Mechanical Systems

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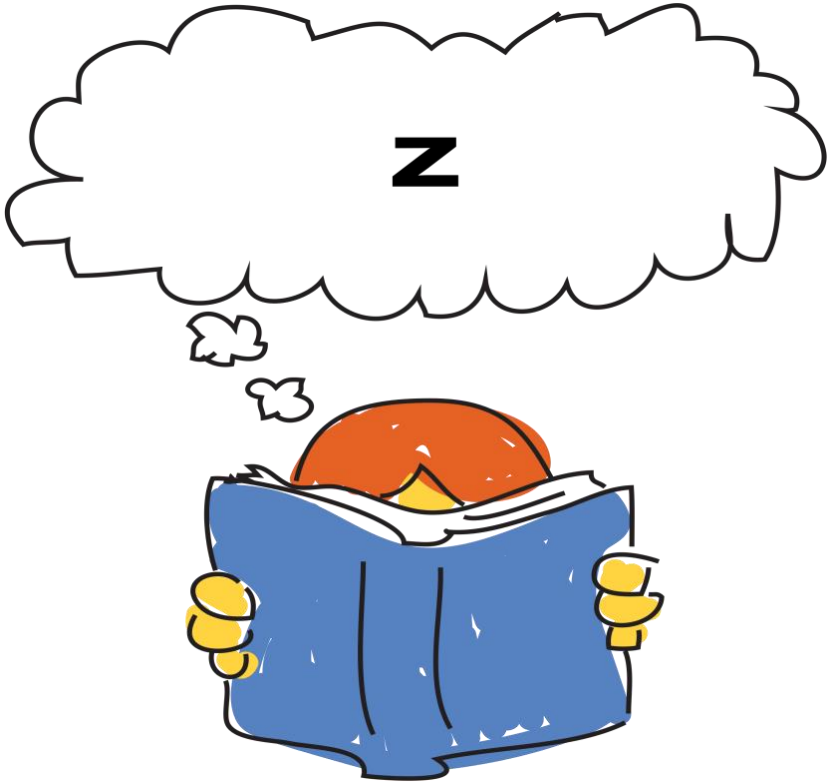
DEPARTMENT OF LABOR AND INDUSTRY
CONSTRUCTION CODES AND LICENSING

❖ Coffee Breaks



Continuing Educational Credits Available

- In accordance with the Department of Labor and Industry's statute 326.0981, Subd. 11,

  "This educational offering is recognized by the Minnesota Department of Labor and Industry as satisfying **4 hours** of credit toward **Building Officials and Residential Contractors** continuing education requirements", **including the 1 Hour Energy Credit**

- For additional continuing education approvals, please see your credit tracking card.

Course Objectives

- **Calculate Heat loss for Building**

Course Objectives

- Calculate Heat loss for Building
- **Size the Furnace for the Building**
  - **Including Oversizing**

Course Objectives

- Calculate Heat loss for Building
- Size the Furnace for the Building
- **Calculate the Make up air requirements**
  - **Table 501.4.1**

Table 501.4.1
Procedure to Determine Makeup Air Quantity for Exhaust Equipment in Dwellings

Use the Appropriate Column to Estimate House Infiltration

	One or Multiple power vent or direct vent appliances or no combustion appliances[A]	One or multiple fan-assisted appliances and power vent or direct appliances[B]	One atmospherically vented gas or oil appliance or one solid vent fuel appliance[C]	Mulltiple atmospherically vented gas or oil appliance or solid vent fuel appliance[D]
1 a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf) (including unfinished basements)				
Estimated House Infiltration (cfm): [1a x 1b]				
2 Exhaust Capacity a) continuous exhaust only ventilation system (not applicable to balanced ventilation systems such as HRV)				
b) clothes dryer	135	135	135	135
c) 80% of largest exhaust rating (cfm): (not applicable if recirculating system or if powered makeup air is electrically interlocked and matched to exhaust)				
d) 80% of next largest exhaust rating (cfm): (not applicable if recirculating system or if powered makeup air is electrically interlocked and matched to exhaust)	not applicable			
Total Exhaust Capacity (cfm): [2a+2b+2c+2d]				
3 Makeup Air Requirement a) Total Exhaust Capacity (from Above)				
b) Estimated House Infiltration (from Above)				
Makeup Air quanity (cfm): [3a - 3b] (if value is negative, no makeup air is needed)				
4 For Makeup Air Opening Sizing, refer to Table 501.3.2				

Course Objectives

- Calculate Heat loss for Building
- Size the Furnace for the Building
- Calculate the Make up air requirements
  - **Sizing table 501.4.2 for passive or powered MUA**

Table 501.4.2

Makeup Air Opening Sizing Table for New and Existing Dwellings

Type of opening or system	One or Multiple power vent or direct vent appliances or (cfm)	One or multiple fan-assisted appliances and power vent or (cfm)	One atmospherically vented gas or oil appliance or one (cfm)	Mulltiple atmospherically vented gas or oil (cfm)	Passive makeup air opening duct diameter E,F & G (inches)
Passive Opening	1 - 36	1 - 22	1 - 15	1 - 9	3
Passive Opening	37 - 66	23 - 41	16 - 28	10 - 17	4
Passive Opening	67 - 109	42 - 66	29 - 46	18 - 28	5
Passive Opening	110 - 163	67 - 100	47 - 69	29 - 42	6
Passive Opening	164 - 232	101 - 143	70 - 99	43 - 61	7
Passive Opening	233 - 317	144 - 195	100 - 135	62 - 83	8
Passive Opening	318 - 419	196 - 258	136 - 179	84 - 110	9
Passive Opening	420 - 539	259 - 332	180 - 230	111 - 142	10
Passive Opening with Motorized Damper	540 - 679	333 - 419	231 - 290	143 - 179	11
Powered Makeup Air[H]	> 679	> 419	> 290	> 179	Not applicable

A Use this column if there are other than fan-assisted or atmospherically vented gas or oil appliances or if there are no combustion appliances.

B Use this column if there is one fan-assisted appliance per venting system. Other than atmospherically vented appliances may also be included.

C Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil appliance per venting system or one solid fuel appliance.

D Use this column if there are multiple atmospherically vented gas or oil appliances using a common vent or if there are atmospherically vented gas or oil appliances and solid fuel appliance(s).

E An equivalent length of 100 feet of round smooth metal duct is assumed. Subtract 40 feet for the exterior hood and ten feet for each 90-degree elbow to determine the remaining length of straight duct allowable.

F If flexible duct is used, increase the duct diameter by one inch. Flexible duct shall be stretched with minimal sags.

G Barometric dampers are prohibited in passive makeup air openings when any atmospherically vented appliance is installed.

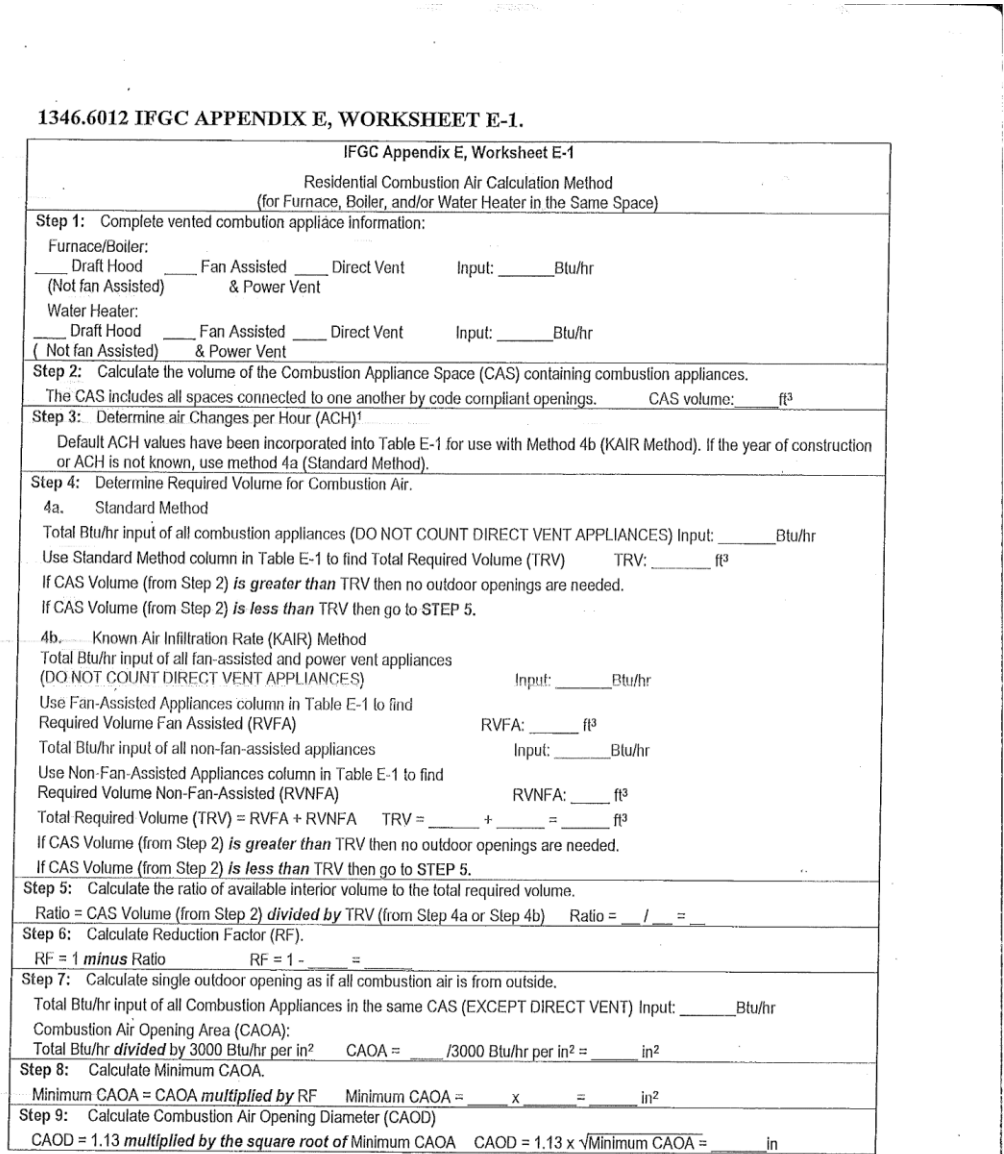
H Powered makeup air shall be electrically interlocked with the largest exhaust system.

Course Objectives

- Calculate Heat loss for Building
- Size the Furnace for the Building
- Calculate the Make up air requirements
- **Calculate the Combustion air requirements**

Course Objectives

- Calculate Heat loss for Building
- Size the Furnace for the Building
- Calculate the Make up air requirements
- Calculate the Combustion air requirements
  - **IFGC Appendix E**



1346.6012 IFGC APPENDIX E, WORKSHEET E-1.

IFGC Appendix E, Worksheet E-1

Residential Combustion Air Calculation Method
(for Furnace, Boiler, and/or Water Heater in the Same Space)

Step 1: Complete vented combution appliace information:

Furnace/Boiler:
____ Draft Hood (Not fan Assisted) ____ Fan Assisted & Power Vent ____ Direct Vent Input: _____Btu/hr

Water Heater:
____ Draft Hood (Not fan Assisted) ____ Fan Assisted & Power Vent ____ Direct Vent Input: _____Btu/hr

Step 2: Calculate the volume of the Combustion Appliance Space (CAS) containing combustion appliances.

The CAS includes all spaces connected to one another by code compliant openings. CAS volume: _____ ft³

Step 3: Determine air Changes per Hour (ACH)[1]

Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR Method). If the year of construction or ACH is not known, use method 4a (Standard Method).

Step 4: Determine Required Volume for Combustion Air.

4a. Standard Method

Total Btu/hr input of all combustion appliances (DO NOT COUNT DIRECT VENT APPLIANCES) Input: _____Btu/hr

Use Standard Method column in Table E-1 to find Total Required Volume (TRV) TRV: _____ ft³

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

4b. Known Air Infiltration Rate (KAIR) Method

Total Btu/hr input of all fan-assisted and power vent appliances (DO NOT COUNT DIRECT VENT APPLIANCES) Input: _____Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find Required Volume Fan Assisted (RVFA) RVFA: _____ ft³

Total Btu/hr input of all non-fan-assisted appliances Input: _____Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find Required Volume Non-Fan-Assisted (RVNFA) RVNFA: _____ ft³

Total Required Volume (TRV) = RVFA + RVNFA TRV = _____ + _____ = _____ ft³

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

Step 5: Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2) ***divided by*** TRV (from Step 4a or Step 4b) Ratio = __ / __ = __

Step 6: Calculate Reduction Factor (RF).

RF = 1 ***minus*** Ratio RF = 1 - _____ = _____

Step 7: Calculate single outdoor opening as if all combustion air is from outside.

Total Btu/hr input of all Combustion Appliances in the same CAS (EXCEPT DIRECT VENT) Input: _____Btu/hr

Combustion Air Opening Area (CAOA):
Total Btu/hr ***divided*** by 3000 Btu/hr per in² CAOA = _____ /3000 Btu/hr per in² = _____ in²

Step 8: Calculate Minimum CAOA.

Minimum CAOA = CAOA ***multiplied by*** RF Minimum CAOA = _____ x _____ = _____ in²

Step 9: Calculate Combustion Air Opening Diameter (CAOD)

CAOD = 1.13 ***multiplied by the square root of*** Minimum CAOA CAOD = 1.13 x √Minimum CAOA = _____ in

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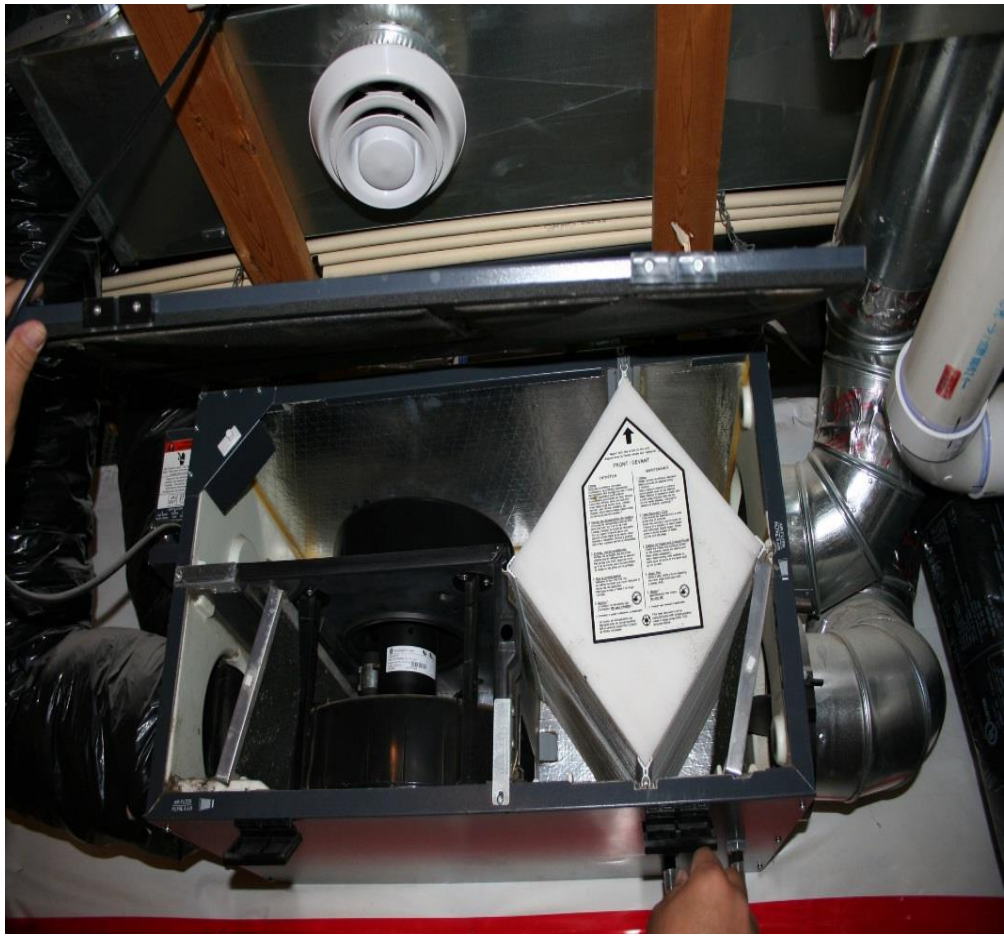
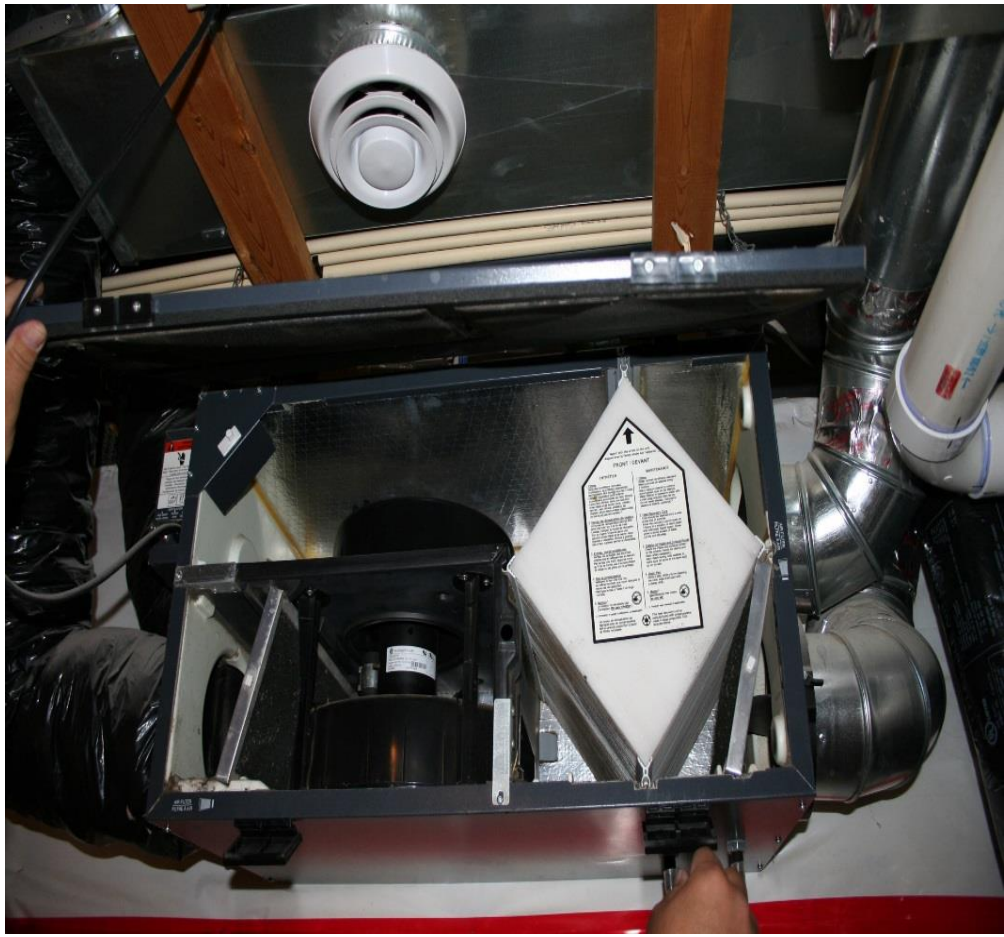
- Calculate the Make up air requirements
- Calculate the Combustion air requirements
- **Calculate and design the ventilation system**
  - **R 403.5.3 Continuous ventilation**



Course Objectives

- Calculate Heat loss for Building
- Size the Furnace for the Building
- Calculate the Make up air requirements
- Calculate the Combustion air requirements
- **Calculate and design the ventilation system**
  - R 403.5.3 Continuous ventilation
  - **R 403.5.2 Total Ventilation (continuous + intermittent)**



Course Objectives

- Calculate Heat loss for Building
- Size the Furnace for the Building
- Calculate the Make up air requirements
- Calculate the Combustion air requirements
- Calculate and design the ventilation system
  - Continuous ventilation
  - Total Ventilation (continuous + intermittent)

- **Discussion on the Service water heating System and the Energy code Requirements R 403.4.2**

Course Objectives

- Calculate Heat loss for Building
- Size the Furnace for the Building
- Calculate the Make up air requirements
- Calculate the Combustion air requirements
- Calculate and design the ventilation system
  - Continuous ventilation
  - Total Ventilation (continuous + intermittent)

- Discussion on the Service water heating System and the Energy code Requirements
- **Discussion on Electrical requirements and the Energy Code Requirements R R404**

Disclaimer

- Information in this seminar may contain code language which has been **paraphrased or summarized in order to provide more clarity for instruction purposes.** When inquiries arise in the field, reference must be made to the actual code language contained in the appropriate Rule Chapter of the Minnesota State Building Code.

- Heating and Cooling Systems and calculated heat loss requirements

Lets calculate a simple Heat loss of a wall

Lets calculate a simple Heat loss of a wall

- **Here is a simple example of a wall and then the same wall with a window**

Lets calculate a simple Heat loss of a wall

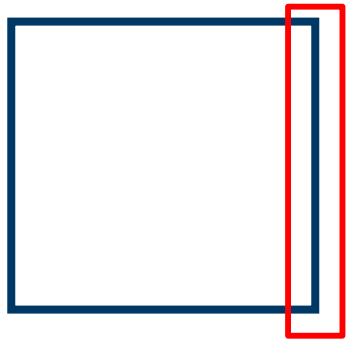
- Here is a simple example of a wall and then the same wall with a window
- **Note the changes in heat loss with the window**

Do the Math

Q = UA(dT) = heat load assessment = defines equipment sizing.

Ex.

Using



(Conversion)

Room is 10 x 10 x 10

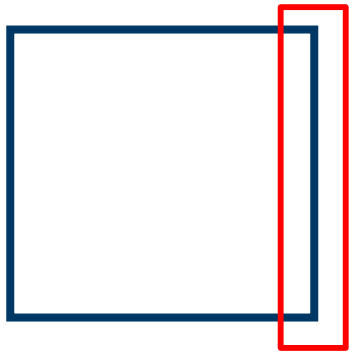
Assuming a wall U=0.0476

R-21 = (1 divided by 21) = U

Q = UA(dT) =

Ex.

Using



1 Wall is 10 x 10 or 100 Sq. Ft. of Area

Assuming a wall U=0.0476

(Conversion) R-21 = (1 divided by 21) = U

Q= 0.0476 (U) x 100 (A) x 90 (dT) = 428.4 (or 429) Btu per hour of heat loss on each wall (assuming no windows)

What is the total for the building in Heat Loss (Btu's)

- **Adding in all 4 walls at the exact same Btu's for each wall (4 x 429) would require a heating appliance capable of supplying a minimum of 1,716 Btu's**

What is the total for the building in Heat Loss (Btu's) when we add a 4 x 4 window meeting code to one wall?

- **Wall #4 was 100 Sq. Ft. at .0476 U- Factor. Now it is only 84 Sq. Ft. at the .0476 U-Factor + 16 Square foot at a 0.30 U-Factor to accommodate the window.**

- Wall 1 = .0476 x 100 x 90 = 429 Btu's
- Wall 2 = .0476 x 100 x 90 = 429 Btu's
- Wall 3 = .0476 x 100 x 90 = 429 Btu's
- Wall 4 = .0476 x 84 x 90 = 360 Btu's
- Window 1 In wall 4=

.30 x 16 x 90 = 432 Btu's

Total Btu's now are 2079 total Btu's

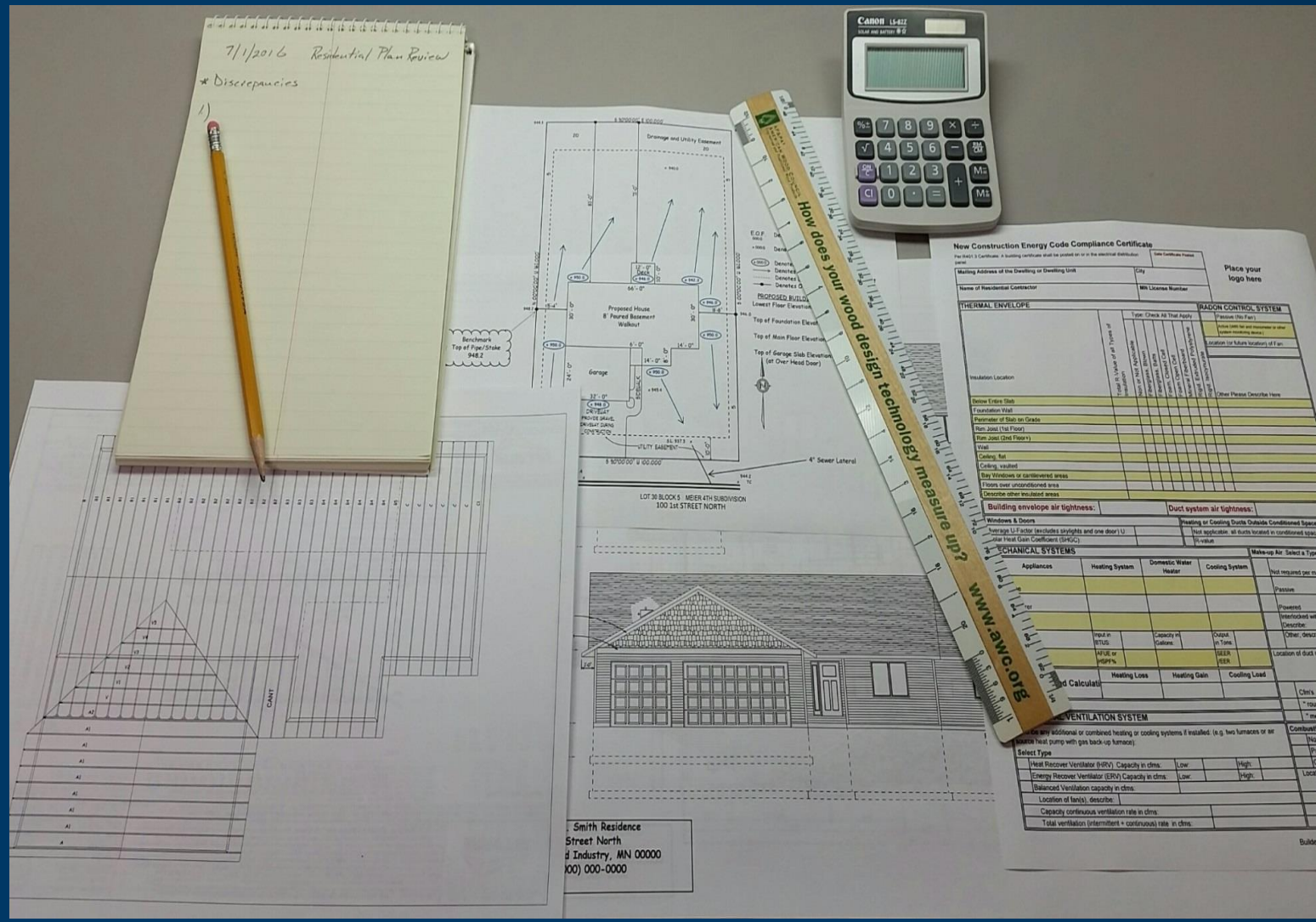
-1716 Wall w/out Window

Difference of + 363 Btu's (adding the window)

This can make a big difference in heating and cooling appliances depending on Number of windows and their U-factors

Classroom Exercise

- Grab the Plans and Lets calculate this home together



First of all do you have everything on the plans?

4 Pages of the Plans

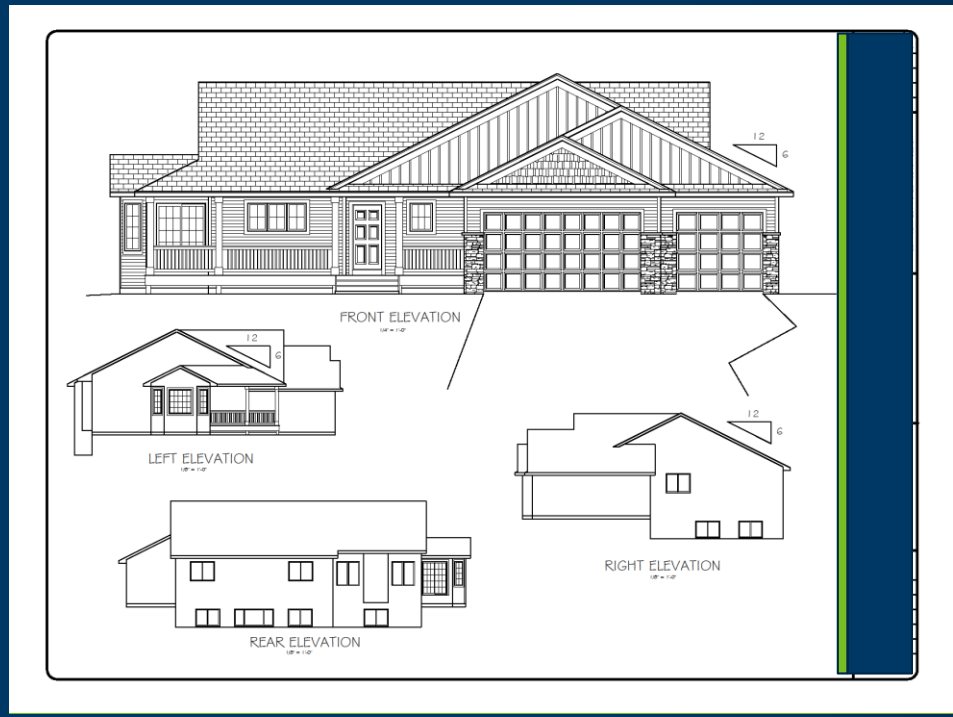
Elevations Page

Type of foundation

Walk out (8’ Grade Differential)

Look out (4’ Grade Differential)

Full Basement (No Grade Differential)



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Elevations Page

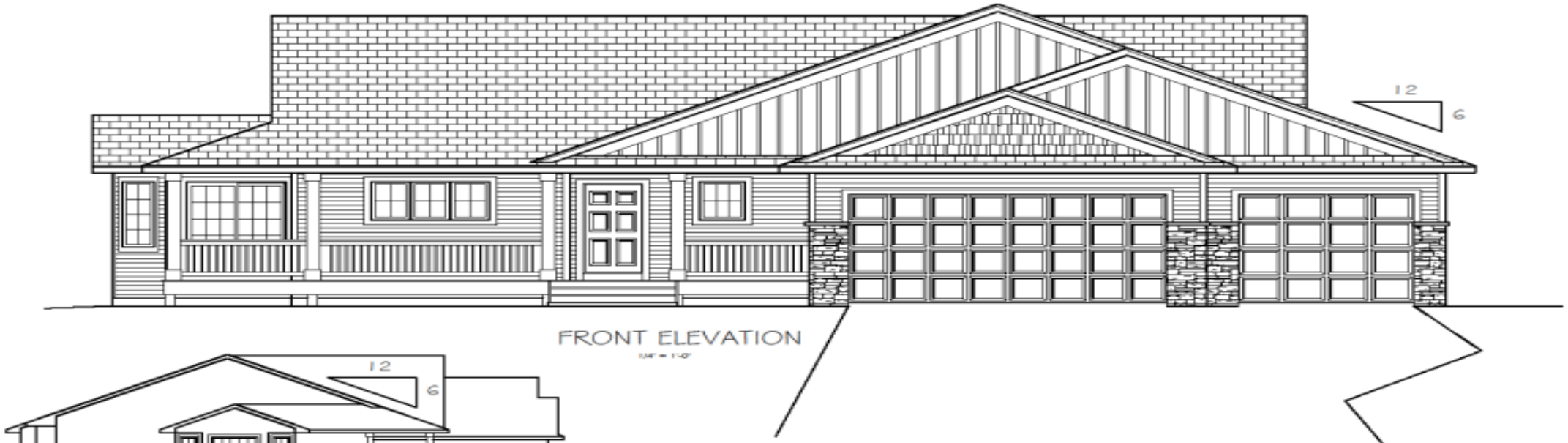
type of foundation

Walk out (8’ Grade Differential)

Look out (4’ Grade Differential)

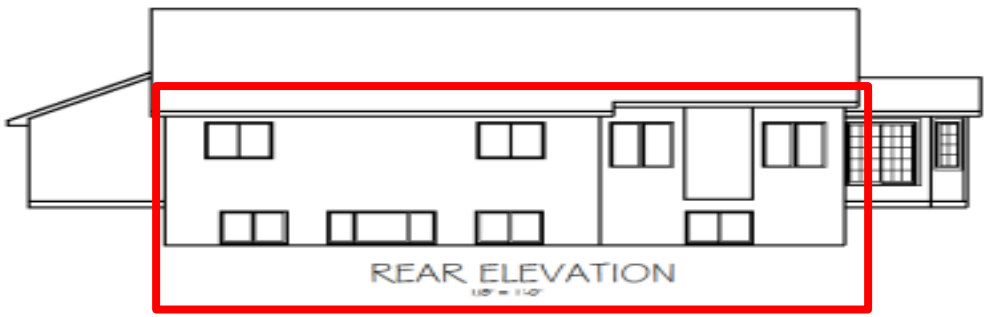
Full Basement (No Grade Differential)

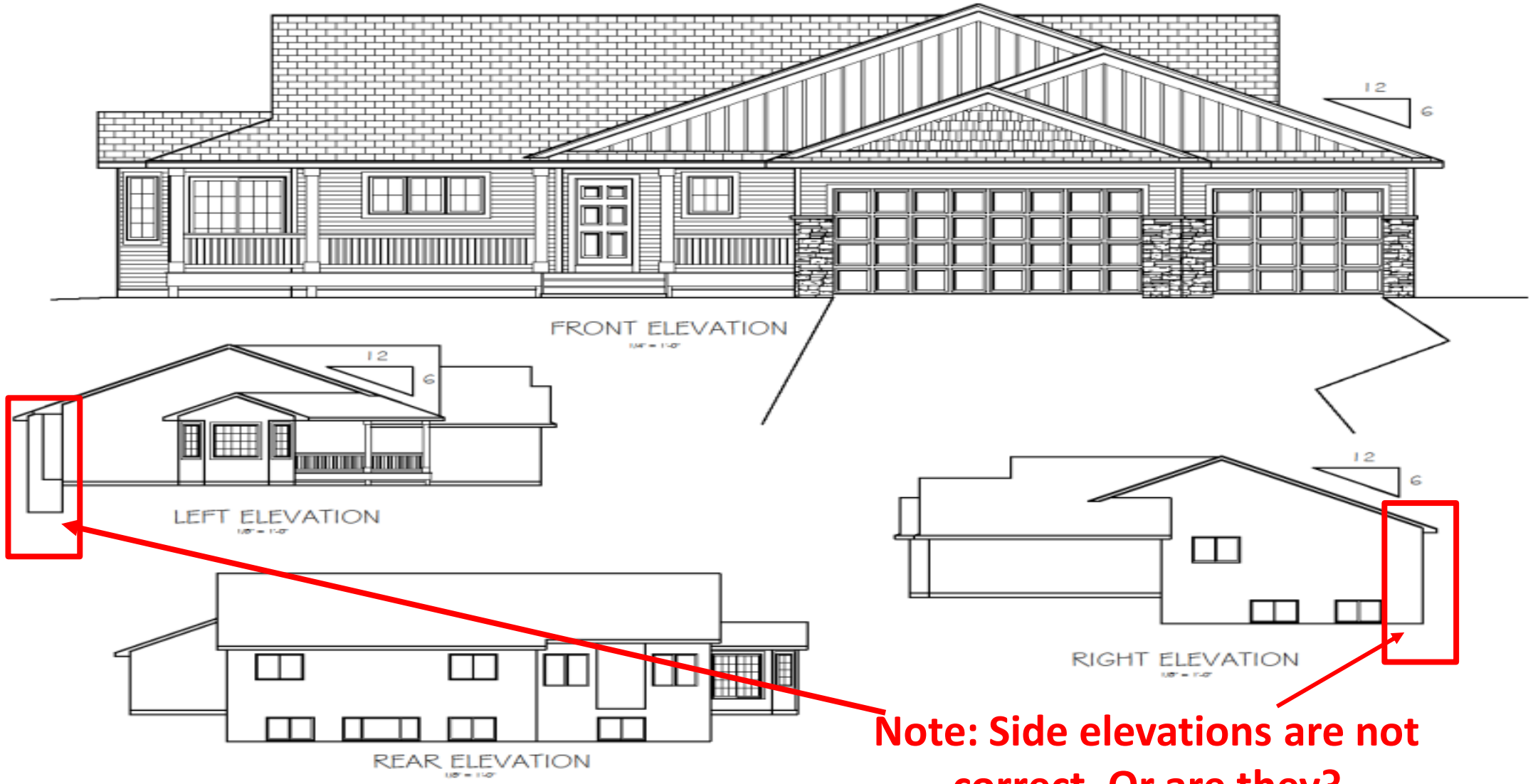
What does this tell us about the Back wall(s) of the home?

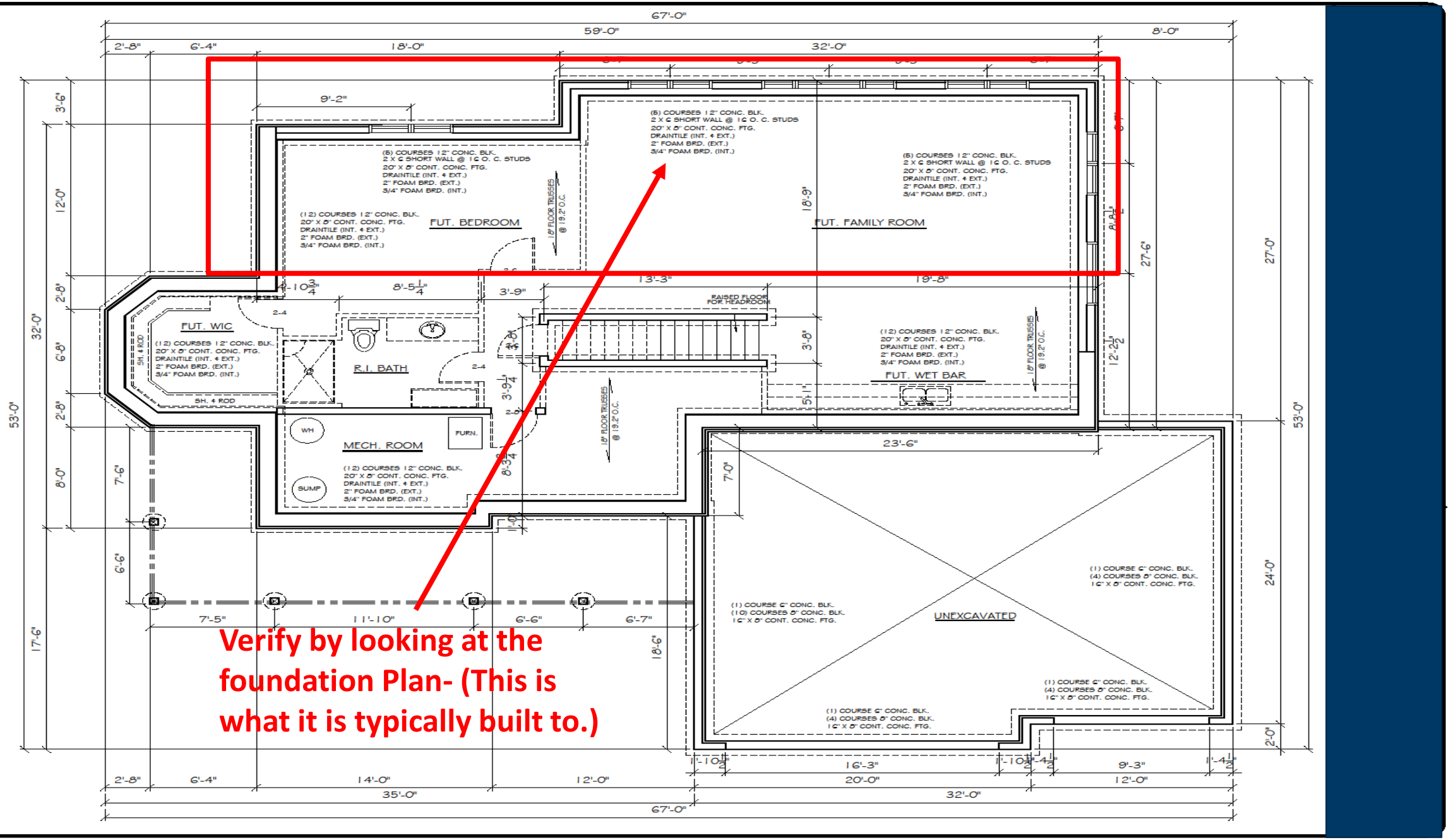

12
6
FRONT ELEVATION


12
6
LEFT ELEVATION


12
6
RIGHT ELEVATION


REAR ELEVATION


12
6
FRONT ELEVATION
12
6
LEFT ELEVATION
12
6
RIGHT ELEVATION
REAR ELEVATION
Note: Side elevations are not correct. Or are they?


67'-0"
59'-0"
8'-0"
2'-8"
6'-4"
18'-0"
32'-0"
9'-2"
(5) COURSES 12" CONC. BLK.
2 X 6 SHORT WALL @ 16 O. C. STUDS
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
(12) COURSES 12" CONC. BLK.
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
FUT. BEDROOM
FUT. FAMILY ROOM
18" FLOOR TRUSSES @ 19.2" O.C.
FUT. WIC
SH. & ROD
R.I. BATH
MECH. ROOM
WH
FURN.
SUMP
RAISED FLOOR FOR HEADROOM
FUT. WET BAR
23'-6"
7'-0"
UNEXCAVATED
(1) COURSE 6" CONC. BLK.
(10) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
(4) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
7'-5"
11'-10"
6'-6"
6'-7"
14'-0"
12'-0"
35'-0"
16'-3"
20'-0"
9'-3"
12'-0"
53'-0"
32'-0"
27'-0"
24'-0"
17'-6"
18'-6"
12'-0"
6'-8"
8'-0"
7'-6"
6'-6"
3'-6"
2'-0"
Verify by looking at the foundation Plan- (This is what it is typically built to.)

First of all do you have everything on the plans?

4 Pages of the Plans

Main Floor Page

Where is the Building Envelope?

What does it consist of Wood Framed- Masonry Etc..?

First of all do you have everything on the plans?

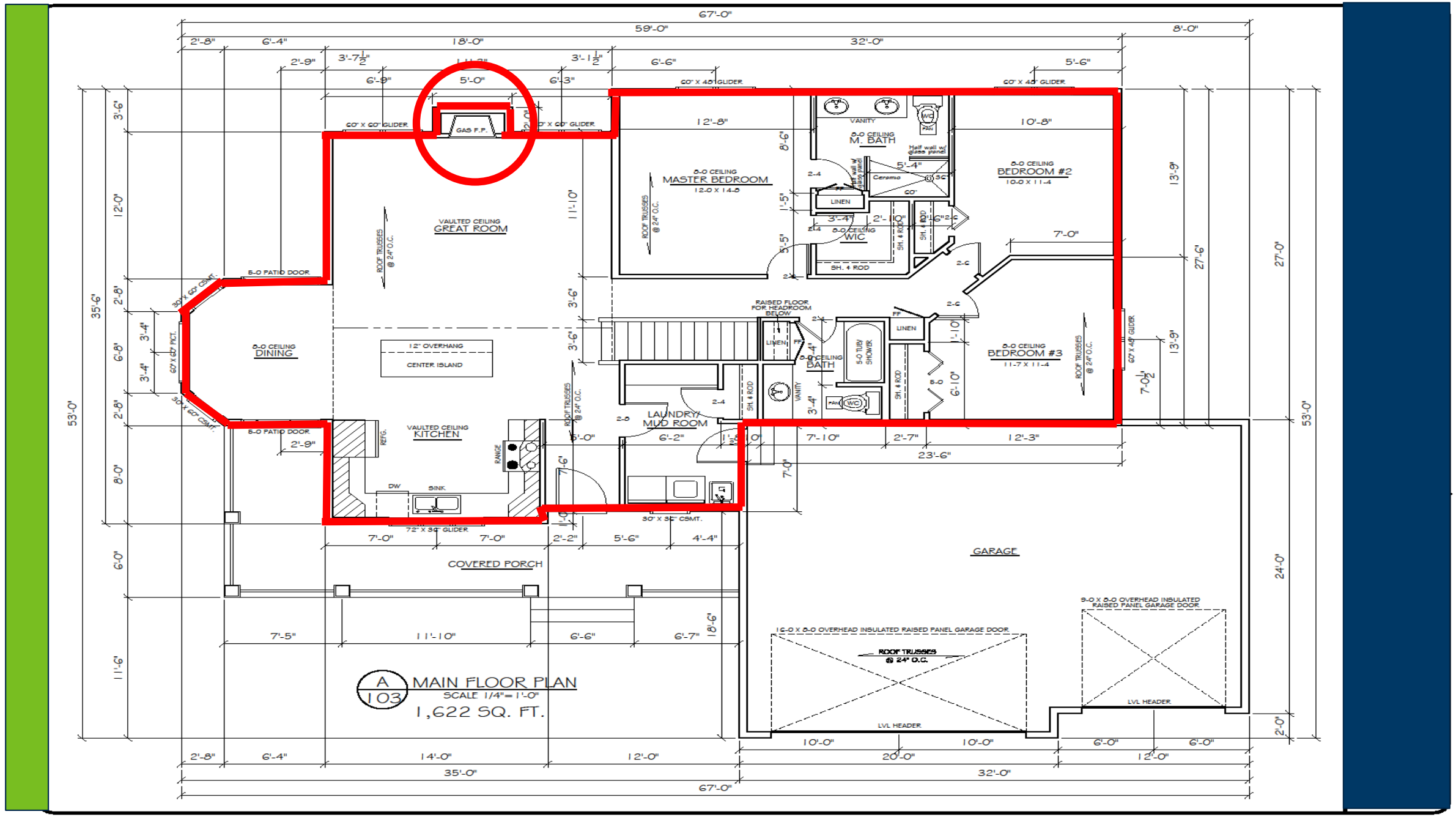
4 Pages of the Plans

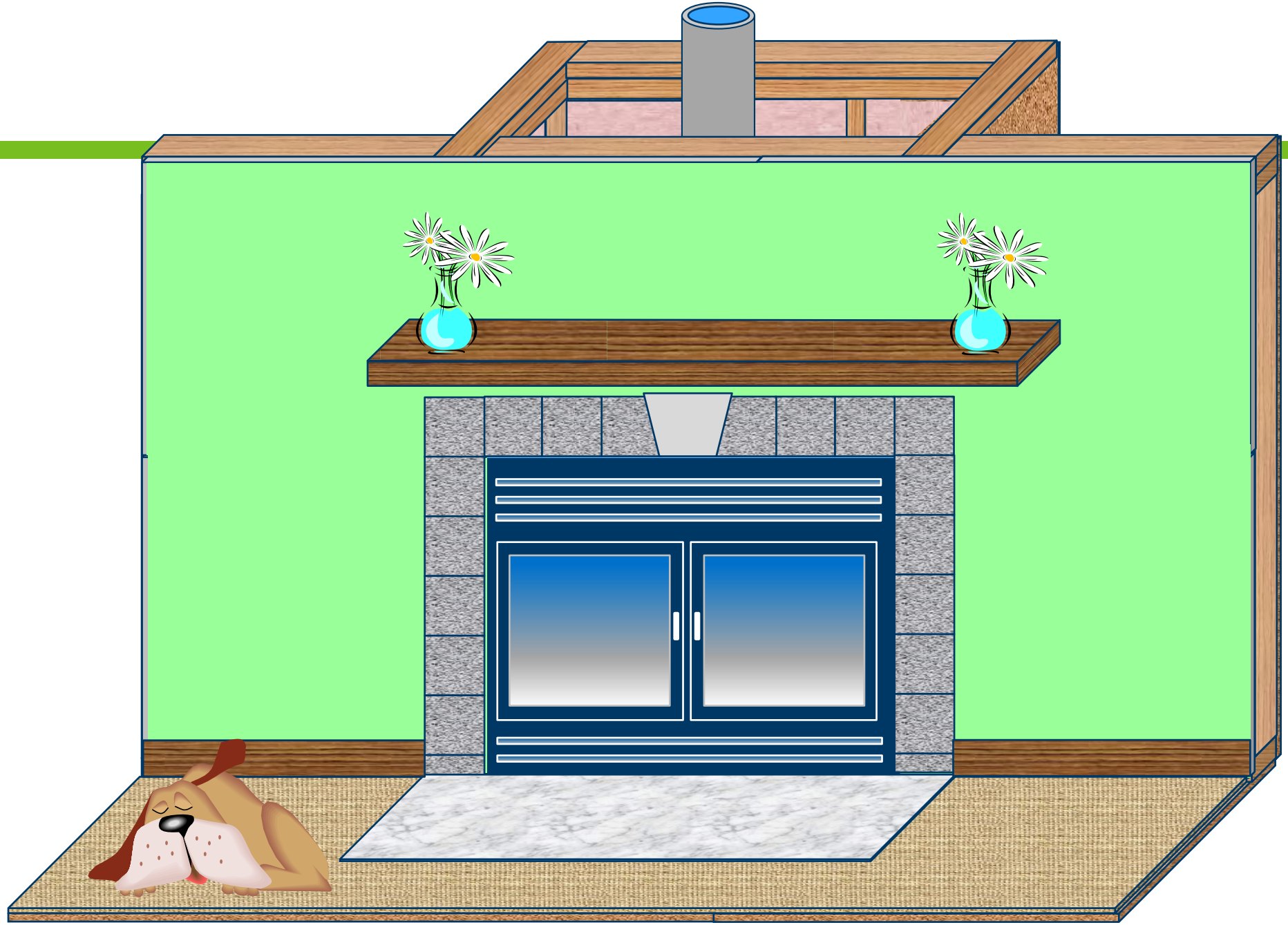
Main Floor Page

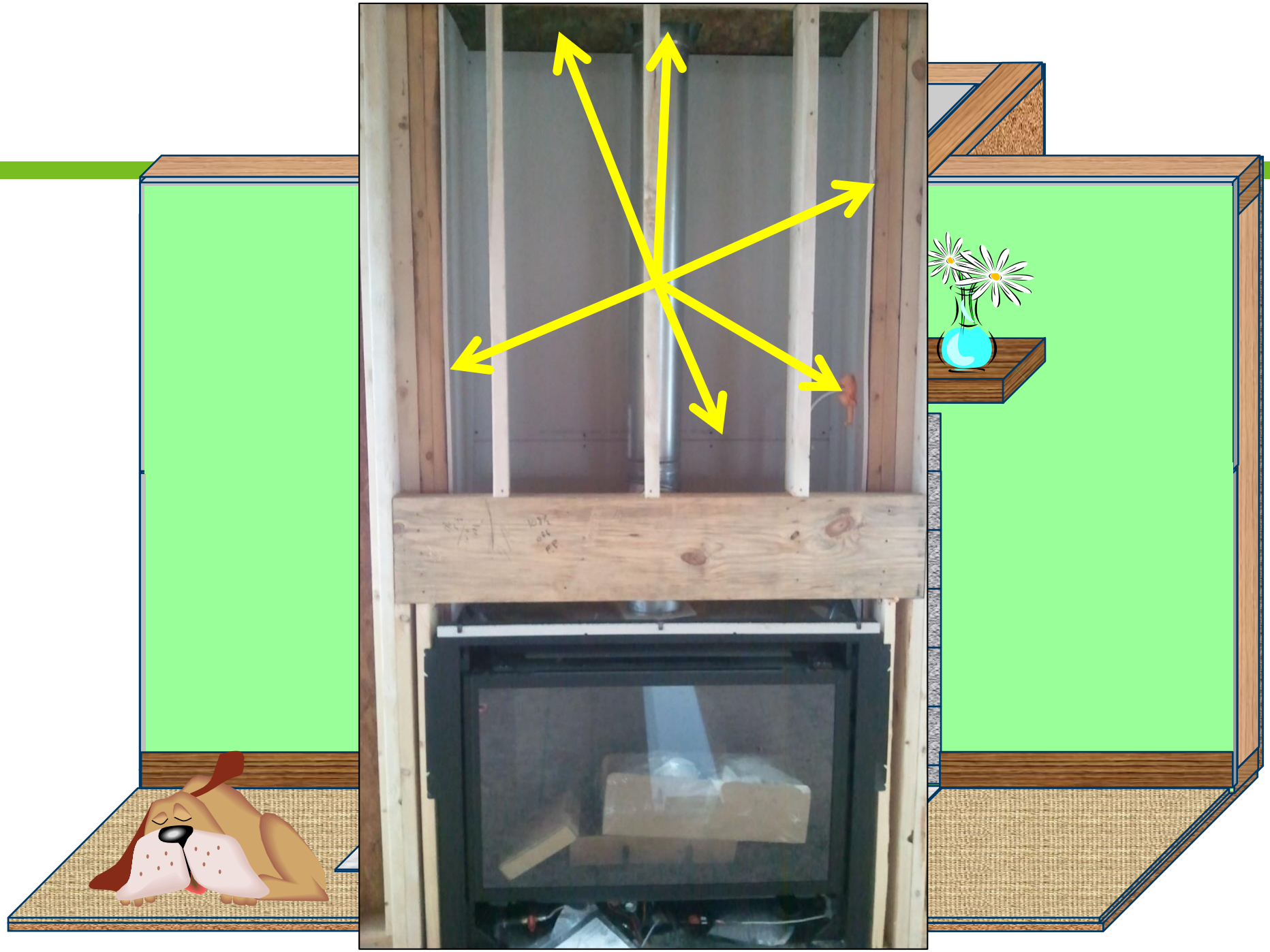
Where is the Building Envelope?

What does it consist of Wood Framed- Masonry Etc..?

Are there any cantilevers or Bump-Outs?


67'-0"
59'-0"
8'-0"
2'-8"
6'-4"
18'-0"
32'-0"
2'-9"
3'-7½"
3'-1½"
6'-6"
5'-6"
6'-9"
5'-0"
6'-3"
GAS F.P.
6'-0" X 6'-0" GLIDER
6'-0" X 4'-0" GLIDER
12'-8"
10'-8"
8'-6"
5'-0" CEILING
M. BATH
VANITY
WC
PAN
Half wall w/ glass panel
5'-4"
Ceramic
SC
LINEN
5'-0" CEILING
MASTER BEDROOM
12'-0" X 14'-5"
5'-0" CEILING
BEDROOM #2
10'-0" X 11'-4"
ROOF TRUSSES @ 24" O.C.
VAULTED CEILING
GREAT ROOM
11'-10"
5'-5"
3'-4"
2'-10½"
5'-0" CEILING
WIC
SH. & ROD
7'-0"
13'-9"
27'-6"
27'-0"
35'-6"
12'-0"
2'-8"
6'-8"
3'-4"
3'-6"
6'-0" PATIO DOOR
30" X 60" CSMT.
60" X 60" PICT.
RAISED FLOOR FOR HEADROOM BELOW
FF
LINEN
5'-0" CEILING
DINING
12" OVERHANG
CENTER ISLAND
5'-0" CEILING
BATH
5'-0 TUB SHOWER
5'-0" CEILING
BEDROOM #3
11'-7 X 11'-4
6'-10"
1'-10"
60" X 48" GLIDER
7'-0½"
53'-0"
6'-0" PATIO DOOR
2'-9"
REFG.
VAULTED CEILING
KITCHEN
RANGE
DW
SINK
LAUNDRY/ MUD ROOM
6'-2"
7'-10"
2'-7"
12'-3"
23'-6"
7'-6"
7'-0"
72" X 36" GLIDER
30" X 36" CSMT.
7'-0"
7'-0"
2'-2"
5'-6"
4'-4"
COVERED PORCH
GARAGE
9'-0" X 8'-0" OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
16'-0" X 8'-0" OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
ROOF TRUSSES @ 24" O.C.
LVL HEADER
LVL HEADER
24'-0"
2'-0"
11'-6"
6'-0"
7'-5"
11'-10"
6'-6"
6'-7"
18'-6"
10'-0"
10'-0"
6'-0"
6'-0"
20'-0"
12'-0"
2'-8"
6'-4"
14'-0"
12'-0"
35'-0"
32'-0"
67'-0"
A
103
MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.





First of all do you have everything on the plans?

4 Pages of the Plans

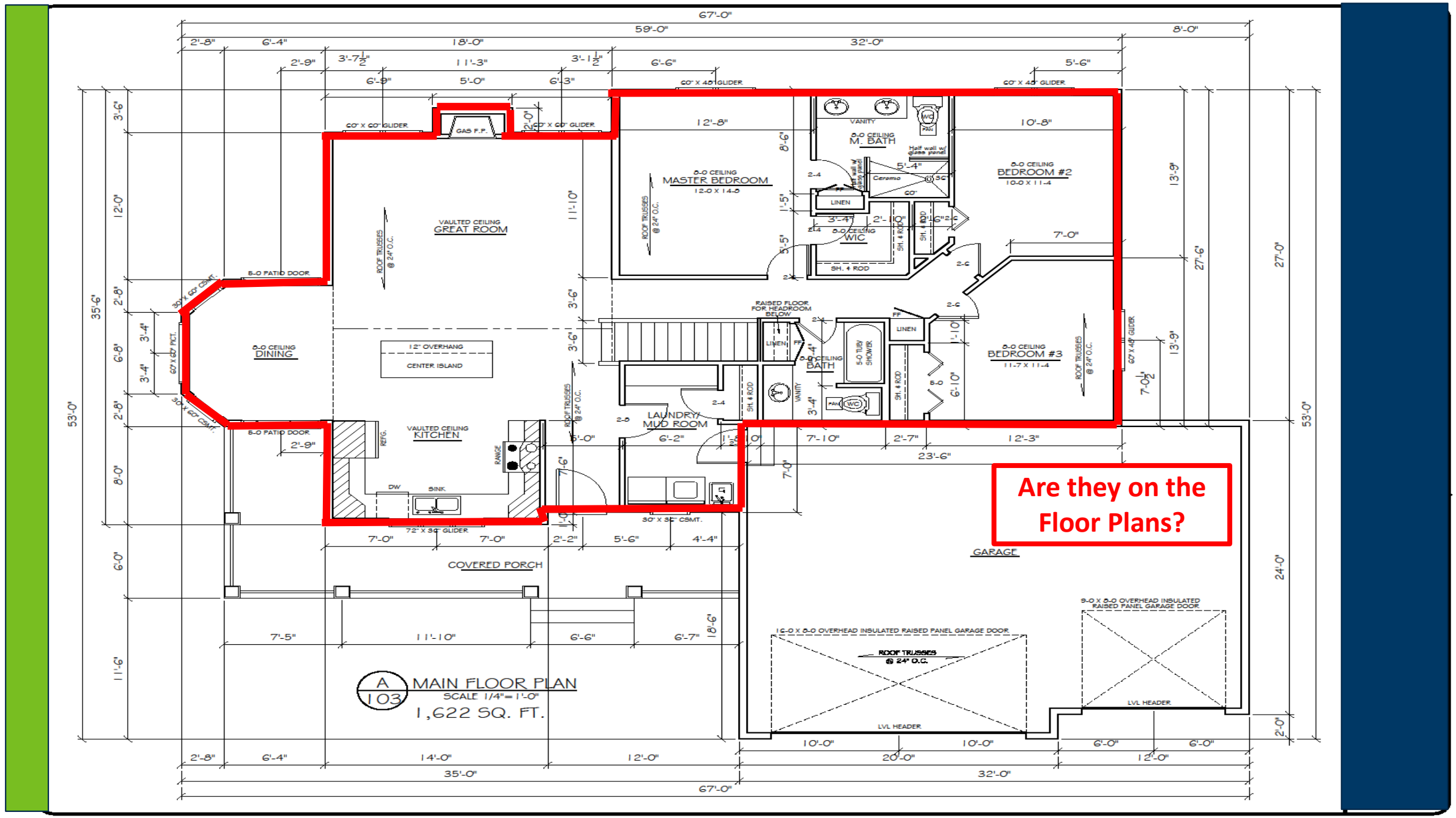
Main Floor Page

Where is the Building Envelope?

What does it consist of Wood Framed- Masonry Etc..?

Are there any cantilevers or Bump-Outs?

What Are the R values and where do I find them?


Are they on the Floor Plans?
A 103
MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.
VAULTED CEILING GREAT ROOM
8'-0 PATIO DOOR
5'-0 CEILING DINING
12" OVERHANG
CENTER ISLAND
VAULTED CEILING KITCHEN
REFG.
RANGE
DW
SINK
72" X 80" GLIDER
COVERED PORCH
GAS F.P.
5'-0 CEILING MASTER BEDROOM
12'-0 X 14'-5
5'-0 CEILING M. BATH
VANITY
LINEN
SH. & ROD
WIC
RAISED FLOOR FOR HEADROOM BELOW
LAUNDRY/ MUD ROOM
6'-2"
5'-0 CEILING BATH
5'-0 TUB SHOWER
5'-0 CEILING BEDROOM #2
10'-0 X 11'-4
5'-0 CEILING BEDROOM #3
11'-7 X 11'-4
GARAGE
16'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
9'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
ROOF TRUSSES @ 24" O.C.
LVL HEADER
67'-0"
59'-0"
32'-0"
8'-0"
35'-0"
53'-0"
27'-0"
24'-0"

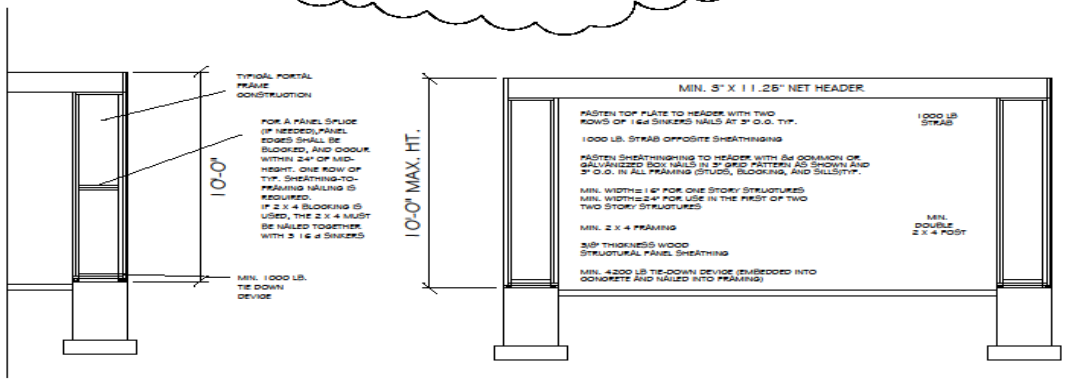
ENERGY CODE NOTE:

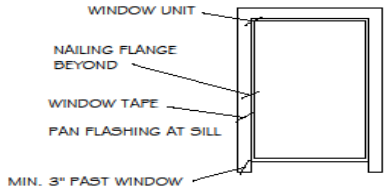
CONTRACTOR AND SUB-CONTRACTOR ARE RESPOSIBLE FOR COMPLIANCE OF THE CURRENT CODE AS REQUIRED.

1. INTERIOR VAPOR RETARDER ON INSULATED CEILINGS, WALLS AND FLOORS.
2. CONTINIOUS AIR BARRIER AT ALL PLUMBING AND HEATING PENETRATIONS.
3. FIRE STOPS MUST BE INSTALLED TO BLOCK AIR MOVEMENT INTO ATTIC.
4. PENETRATIONS IN THE BUILDING ENEVELOPE FOR ELECTRICAL AND TELECOMMICATIONS (EXCEPT FOR ELECTRICAL BOXES AND FAN HOUSINGS) MUST BE SEALED TO PREVENT AIR LEAKAGE.
5. WIND WASH BARRIER REQUIRED AT THE EXTERIOR EDGE OF ATTIC INSULATION.
6. WIND WASH BARRIER REQUIRED AT OVERHANG SUCH AS CANTILEVERED FLOORS AND BAY WINDOWS.
7. WINDOW AND DOOR FRAMES MUST BE SEALED.
8. ALL EXTERIOR JOINTS THAT MAY BE A SOURCE OF AIR INTRUSION MUST BE SEALED.
9. RIM JOISTS MUST BE SEALED TO PREVENT AIR LEAKAGE.
10. TOPS OF INTERIOR PARTITION WALLS MUST BE SEALED TO PREVENT AIR LEAKAGE.
11. ELECTRICAL BOXES AND FANS MUST BE SEALED TO PREVENT AIR LEAKAGE.
12. BETWEEN WALL ASSEMBLIES,RIM JOISTS, AND FOUNDATIONS MUST BE SEALED TO PREVENT AIR LEAKAGE.
13. A MECHANICAL VENTILATION SYSTEM WHICH REPLACES, BY DIRECT OR INDIRECT MEANS, AIR FROM HABITABLE ROOMS WITH OUTDOOR AIR (THIS WOULD ALLOW EXHAUST ONLY. AIR EXCHANGER OR HEAT RECOVERY VENTILATOR-HRV)
14. DIRECT VENT,POWER VENT, OR SEALED COMBUSTION FURNACE,WATER HEATER, OR GAS FIREPLACE.
15. IF ANY SINGLE EXHAUST DEVICE (E.G. KITCHEN FAN OR DRYER) OVER 300 CFM IS INSTALLED. A SEALED COMBUSTION FURNACE MUST BE USED OR AN ALTERNATIVE MAKE UP AIR SOURCE MUST BE USED.

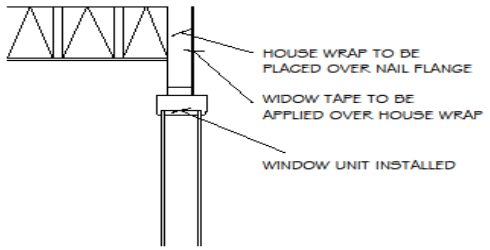
Are they On this Cross Section Page?

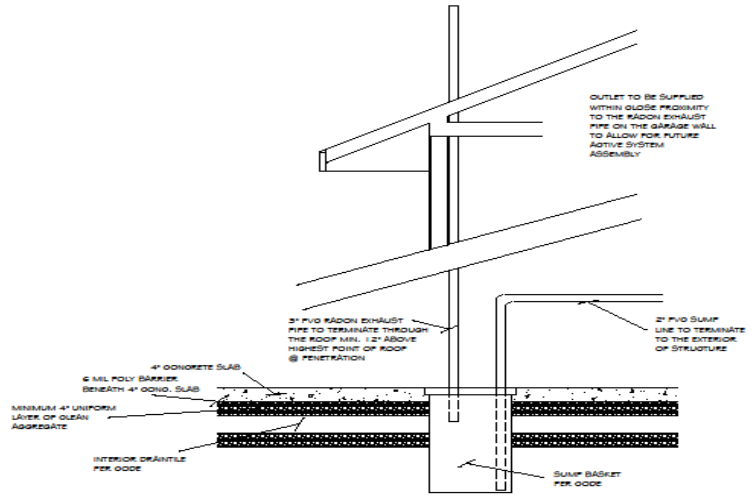
NOTE;
ALL OVERHEAD DOORS TO HAVE A 90 MPH WIND RATING PER CODE.





WINDOW TAPE DETAIL





RADON DETAIL

NOTE;
THESE PLANS ARE PREPARED AS A DRAFTING SERVICE ONLY. GENERAL CONTRACTOR ASSUMES FULL RESPONSIBILITY FOR ALL DIMENSIONS, GRADES, ELEVATIONS, NOTES, AND CONFORMITY TO LOCAL BUILDING CODES. VERIFY THESE PLANS FOR ANY POSSIBLE CHANGES OR CORRECTIONS PRIOR TO CONSTRUCTION.

NOTE;
ALL BEAMS AND STRUCTURAL MEMBER SIZES TO BE DETERMINED AND VERIFIED BY SUPPLIERS AND CONTRACTOR. ROOM DIMENSIONS TO BE APPROXIMATE AND TO BE DETERMINED ON JOB SITE.

ENERGY CODE NOTE:

CONTRACTOR AND SUB-CONTRACTOR ARE RESPOSIBLE FOR COMPLIANCE OF THE CURRENT CODE AS REQUIRED.

1. INTERIOR VAPOR RETARDER ON INSULATED CEILINGS, WALLS AND FLOORS.
2. CONTINIOUS AIR BARRIER AT ALL PLUMBING AND HEATING PENETRATIONS.
3. FIRE STOPS MUST BE INSTALLED TO BLOCK AIR MOVEMENT INTO ATTIC.
4. PENETRATIONS IN THE BUILDING ENEVELOPE FOR ELECTRICAL AND TELECOMMICATIONS (EXCEPT FOR ELECTRICAL BOXES AND FAN HOUSINGS) MUST BE SEALED TO PREVENT AIR LEAKAGE.
5. WIND WASH BARRIER REQUIRED AT THE EXTERIOR EDGE OF ATTIC INSULATION.
6. WIND WASH BARRIER REQUIRED AT OVERHANGS SUCH AS CANTILEVERED FLOORS AND BAY WINDOWS.
7. WINDOW AND DOOR FRAMES MUST BE SEALED.
8. ALL EXTERIOR JOINTS THAT MAY BE A SOURCE OF AIR INTRUSION MUST BE SEALED.
9. RIM JOISTS MUST BE SEALED TO PREVENT AIR LEAKAGE.
10. TOPS OF INTERIOR PARTITION WALLS MUST BE SEALED TO PREVENT AIR LEAKAGE.
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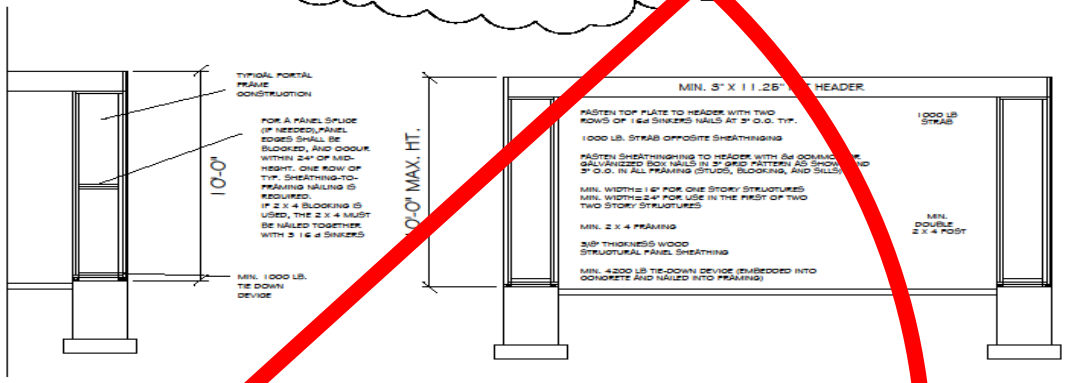
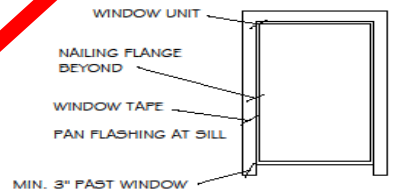
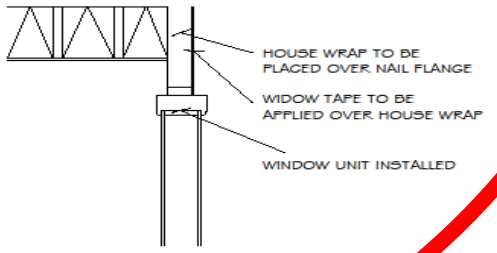
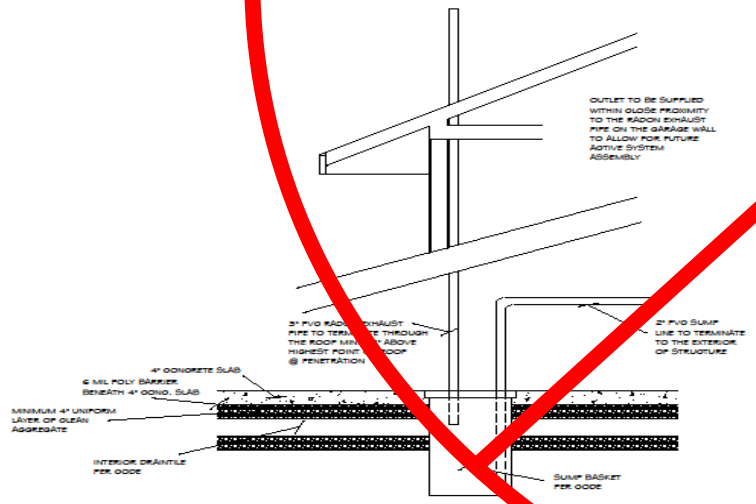




WINDOW TAPE DETAIL





RADON DETAIL

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ROOM DIMENSIONS TO BE APPROXIMATE AND TO BE DETERMINED ON JOB SITE.

New Construction Energy Code Compliance Checklist/Certificate

Per R401.3 Certificate. A building certificate shall be posted on or in the electrical distribution panel.

Date Certificate Posted

DEPARTMENT OF LABOR AND INDUSTRY

Mailing Address of the Dwelling or Dwelling Unit	City
1234 Any Street	Any town Mn
Name of Residential Contractor	**MN License Number**
John Doe Construction Inc.	0000123456

THERMAL ENVELOPE

Insulation Location	Total R-Value of all Types of Insulation	Type: Check All That Apply								Other Please Describe Here
		Non or Not Applicable	Fiberglass, Blown	Fiberglass, Batts	Foam, Closed Cell	Foam Open Cell	Mineral Fiberboard	Rigid, Extruded Polystyrene	Rigid, Isocynurate	
Below Entire Slab		N/A								
Foundation Wall					X				R-10	**Using Exterior Closed cell Foam**
Perimeter of Slab on Grade		N/A								
Rim Joist (1st Floor)		R-21			X					**Using R-21 Foam Insulation. Closed cell**
Rim Joist (2nd Floor+)		N/A								
Wall		R-21		X						**Using Friction Fit Fiberglass Batt Insulation**
Ceiling, flat		R-49	X							
Ceiling, vaulted		R-49	X							
Bay Windows or cantilevered areas		R-49		X						
Floors over unconditioned area		R-30		X						
Describe other insulated areas	N/A									

RADON CONTROL SYSTEM

X	Passive (*No Fan*)
	Active (*With fan and monometer or other system monitoring device*)

Location (or future location) of Fan:

Attic

Building Envelope Air Tightness:	Will Be Testing to a Maximum of 2.6 Final Test = ?	**Duct System Air Tightness:**	**N/A-Ducts will be inside envelope**

Windows & Doors		**Heating or Cooling Ducts Outside Conditioned Spaces**
Average U-Factor (*excludes skylights and one door*) U:	.30	**Not applicable, all ducts located in conditioned space**
Solar Heat Gain Coefficient (SHGC):	.35	R-value **(need This if ducts are in exterior walls) N/A**

MECHANICAL SYSTEMS

Appliances	Heating System		Domestic Water Heater		Cooling System	
Fuel Type	Gas Forced Air furnace Sealed Combustion		Gas- Fan Assisted		Elec	
Manufacturer	Lennox.		State		RUUD	
Model	G26Q3-75-5		CV 30 NSRT6 33,000 Btu's Input		UAND-042JAZ	
Rating or Size	Input in BTUS:	70,000	Capacity in Gallons:	30	Output in Tons:	3.5
Efficiency		92%	80%		SEER /EER	12
Residential Load Calculations	**Heating Loss**				**Cooling Load**	
	62,515				TBD	

Make-up Air *Select a Type*

	Not required per mech. code
X	Passive
N/A	Powered
N/A	Interlocked with exhaust device. Describe:
X	Other, describe: **Flex Duct**

Location of duct or system:

In Mechanical Room

16-28	CFMs
5	" round" duct OR
	" metal " duct

MEHCANICAL VENTILATION SYSTEM Broan

Describe any additional or combined heating or cooling systems if installed: (e.g. two furnaces or air source heat pump with gas back-up furnace):

Select Type

X	Heat Recovery Ventilator (HRV) Capacity in CFMs:	Low:	75	High:	150	
	Energy Recovery Ventilator (ERV) Capacity in CFMs:	Low:		High:		
X	Balanced Ventilation Capacity in CFMs:					
	Location of fans(s), describe:	HRV System				
	Capacity of continuous ventilation rate in CFMs:	63				
	Total ventilation (intermittent + continuous) rate in CFMs:	125				

Combustion Air *Select a Type*

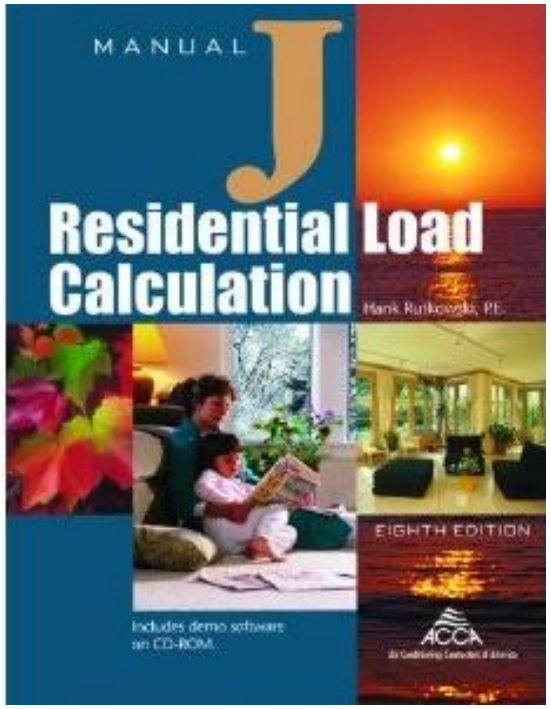
X	Not required per mech. code
	Passive
	Other, describe:
	Location of duct or system:
	CFMs
	"round" duct OR
	"metal" duct

Calculating Heat Loss

- **Now that we have found the information on the plans. How do we calculate heat loss?**

Calculating Heat Loss

- Now that we have found the information on the plans. How do we calculate heat loss?
- **What are all the parts of the structure we need to look at?**



DEPARTMENT OF LABOR AND INDUSTRY
CONSTRUCTION CODES AND LICENSING

OR

Q=UA(deltaT)

Calculating Heat Loss can be done Either way

Q = UA(dT)

- What exactly is this equation?.... and why do we need to understand it?

Q = UA(dT)

- Q = what we are trying to define (Btu's lost Per hour)

Q = UA(dT)

- Q = what we are trying to define
- **U = the U-value of the wall**

Q = UA(dT)

- Q = what we are trying to define
- U = the U-value of the wall
- **A = Area of the wall**

Q = UA(dT)

- Q = what we are trying to define
- U = the U-value of the wall
- A = Area of the wall
- **(dt) = Delta T or temperature difference…**

Q = UA(dT)

- Q = what we are trying to define
- U = the U-value of the wall
- A = Area of the wall
- (dT) = Delta T or temperature difference…

Or as it looks in a mathematical equation **Q = UA(dT)**

Did we miss anything on the plans?

4 Pages of the Plans

Main Floor Page

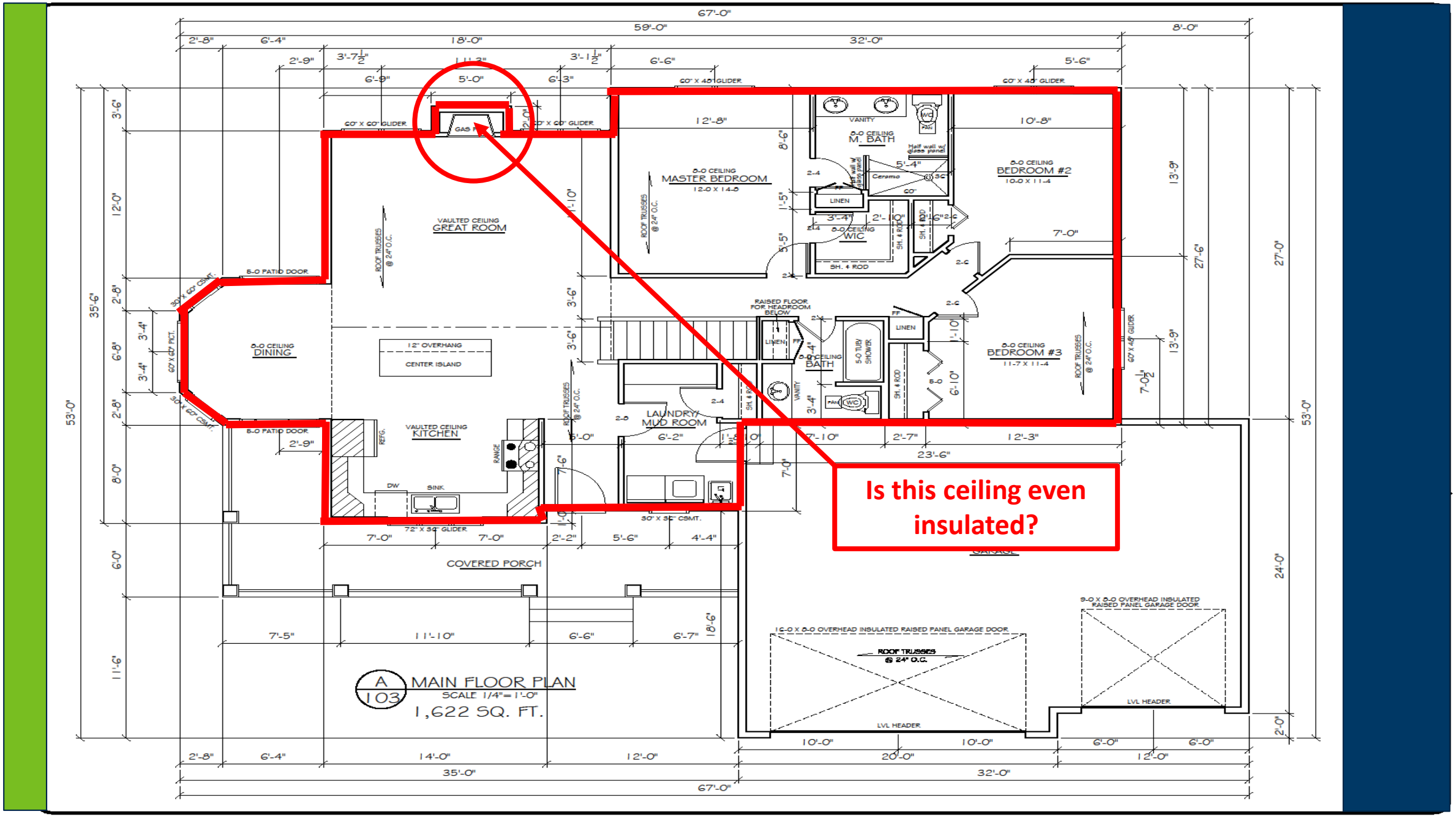
Where is the Building Envelope?

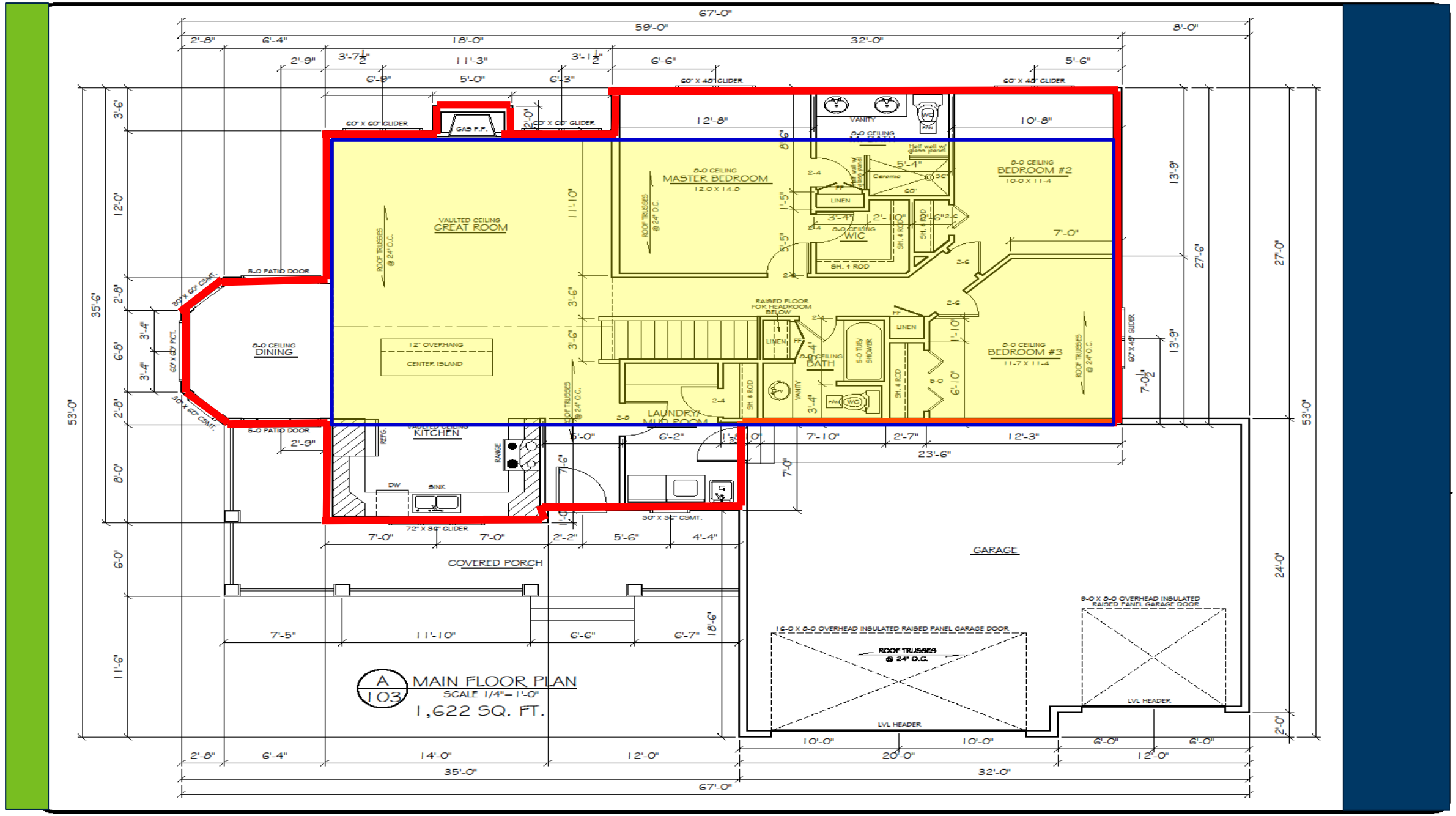
What does it consist of Wood Framed- Masonry Etc..?

Are there any cantilevers or Bump-Outs?

What is the Ceiling Area (Square Footage)?

What is the Ceiling R Value


Is this ceiling even insulated?
A 103 MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.
VAULTED CEILING GREAT ROOM
5-0 CEILING MASTER BEDROOM 12-0 X 14-5
5-0 CEILING M. BATH
5-0 CEILING BEDROOM #2 10-0 X 11-4
5-0 CEILING WIC
5-0 CEILING DINING
12" OVERHANG
CENTER ISLAND
VAULTED CEILING KITCHEN
LAUNDRY/ MUD ROOM
5-0 CEILING BATH
5-0 CEILING BEDROOM #3 11-7 X 11-4
COVERED PORCH
GARAGE
8-0 PATIO DOOR
ROOF TRUSSES @ 24" O.C.
RAISED FLOOR FOR HEADROOM BELOW
16'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
9'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
LVL HEADER
67'-0"
59'-0"
32'-0"
53'-0"
35'-0"
27'-0"
24'-0"



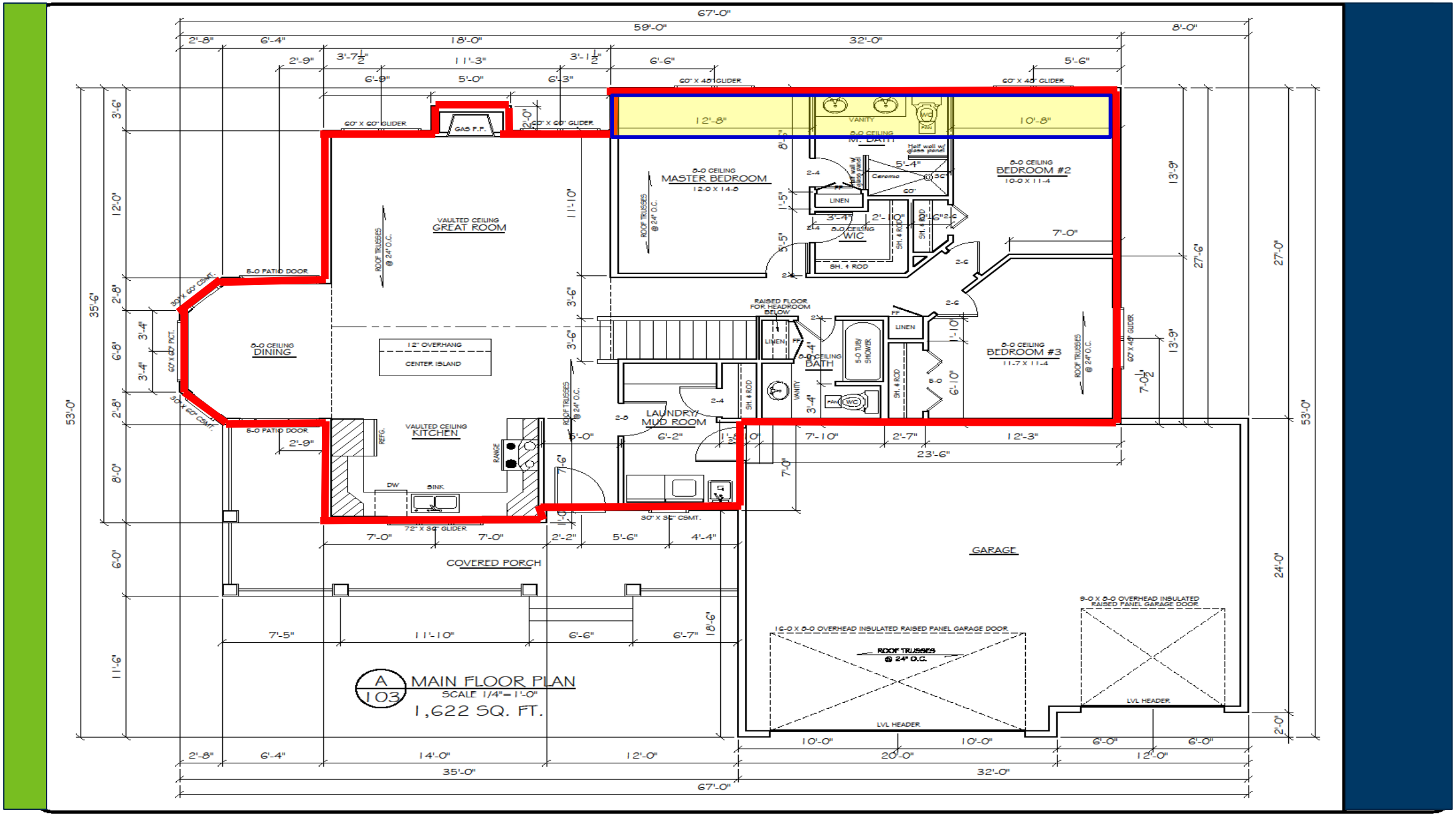
A/103 MAIN FLOOR PLAN

SCALE 1/4"=1'-0"

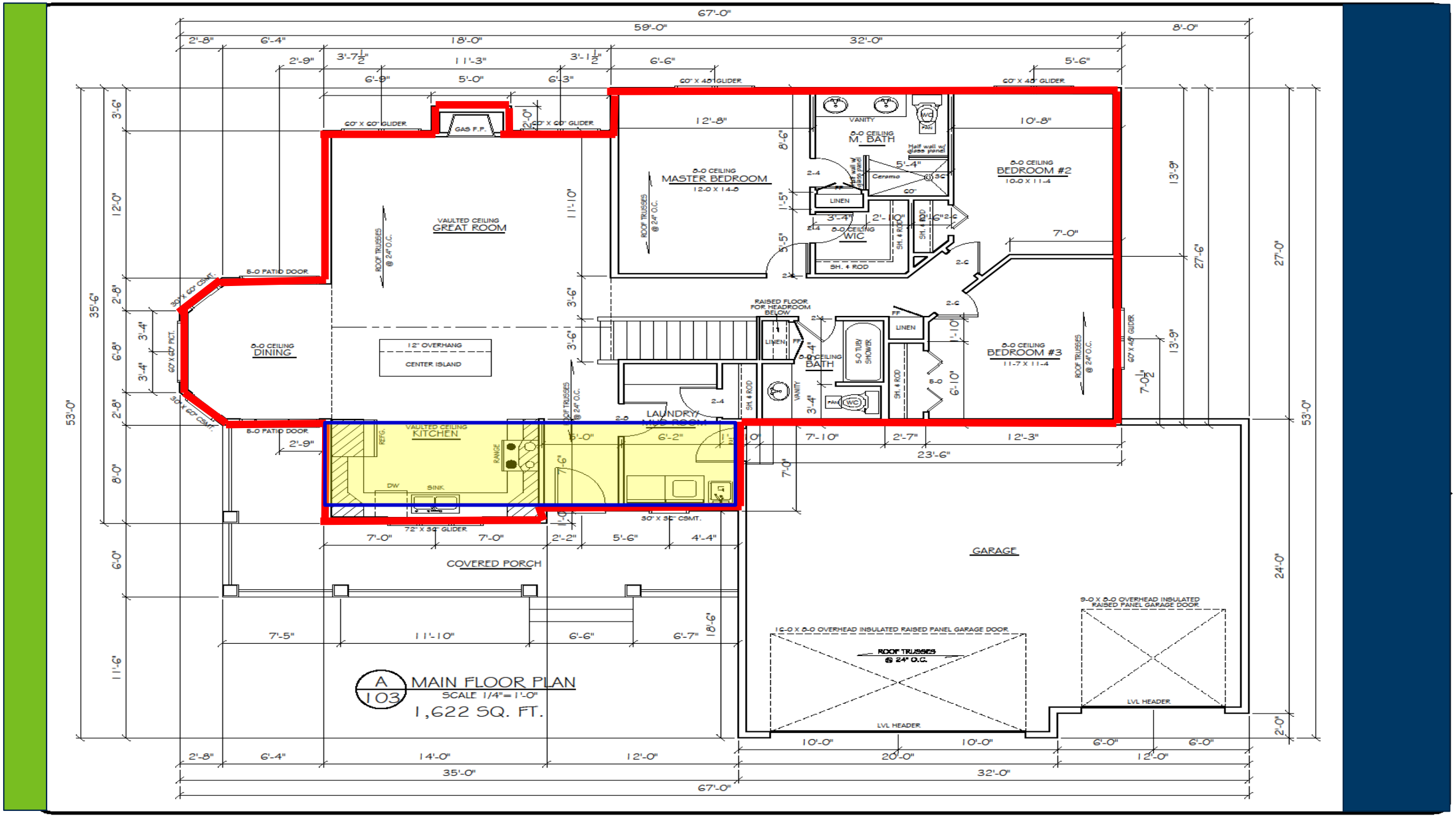
1,622 SQ. FT.

Using the Q = UA (delta T) Method

- **Ceiling Heat Loss**
  - **24 x 50 = 1200**


67'-0"
59'-0"
8'-0"
2'-8"
6'-4"
18'-0"
32'-0"
2'-9"
3'-7½"
11'-3"
3'-1½"
6'-6"
5'-6"
6'-9"
5'-0"
6'-3"
6'-0" X 4'-6" GLIDER
6'-0" X 4'-6" GLIDER
6'-0" X 6'-0" GLIDER
GAS F.P.
2'-0"
6'-0" X 6'-0" GLIDER
12'-8"
10'-8"
VANITY
WC
FAN
5'-0" CEILING
M. BATH
Half wall w/ glass panel
5'-4"
Ceramic
SC
CO"
LINEN
5'-0" CEILING
MASTER BEDROOM
12'-0" X 14'-5"
ROOF TRUSSES @ 24" O.C.
3'-4"
2'-10½"
5'-0" CEILING
WIC
SH. & ROD
5'-0" CEILING
BEDROOM #2
10'-0" X 11'-4"
7'-0"
VAULTED CEILING
GREAT ROOM
11'-10"
5'-5"
8'-0" PATIO DOOR
30" X 60" CSMT.
60" X 60" PICT.
3'-6"
RAISED FLOOR FOR HEADROOM BELOW
FF
LINEN
1'-10"
5'-0" CEILING
DINING
12" OVERHANG
CENTER ISLAND
5'-0" CEILING
BATH
5'-0 TUB SHOWER
5'-0" CEILING
BEDROOM #3
11'-7 X 11'-4
6'-10"
7'-0½"
13'-9"
27'-6"
27'-0"
35'-6"
53'-0"
12'-0"
2'-8"
6'-8"
3'-4"
2'-8"
8'-0"
6'-0"
11'-6"
LAUNDRY/ MUD ROOM
6'-2"
VAULTED CEILING
KITCHEN
REFG.
RANGE
DW
SINK
72" X 36" GLIDER
30" X 36" CSMT.
7'-10"
2'-7"
12'-3"
23'-6"
7'-0"
5'-0"
7'-6"
1'-0"
7'-0"
7'-0"
2'-2"
5'-6"
4'-4"
COVERED PORCH
GARAGE
7'-5"
11'-10"
6'-6"
6'-7"
18'-6"
9'-0" X 8'-0" OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
16'-0" X 8'-0" OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
ROOF TRUSSES @ 24" O.C.
LVL HEADER
LVL HEADER
10'-0"
10'-0"
6'-0"
6'-0"
20'-0"
12'-0"
2'-0"
2'-8"
6'-4"
14'-0"
12'-0"
35'-0"
32'-0"
67'-0"
A 103
MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.

- **Ceiling Heat Loss**
  - **24 x 50 = 1200**
  - **3.5 x 32 = 112**


VAULTED CEILING
GREAT ROOM
8'-0 PATIO DOOR
30" X 60" CSMT.
8'-0 CEILING
DINING
60" X 60" PICT.
12" OVERHANG
CENTER ISLAND
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ROOF TRUSSES @ 24" O.C.
8'-0 CEILING
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12-0 X 14-5
8'-0 CEILING
M. BATH
VANITY
Half wall w/ glass panel
Ceramic
LINEN
SH. & ROD
8'-0 CEILING
WIC
8'-0 CEILING
BEDROOM #2
10-0 X 11-4
RAISED FLOOR FOR HEADROOM BELOW
8'-0 CEILING
BATH
5'-0 TUB SHOWER
8'-0 CEILING
BEDROOM #3
11-7 X 11-4
60" X 48" GLIDER
LAUNDRY/ MUD ROOM
50" X 36" CSMT.
COVERED PORCH
GARAGE
16'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
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A 103 MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
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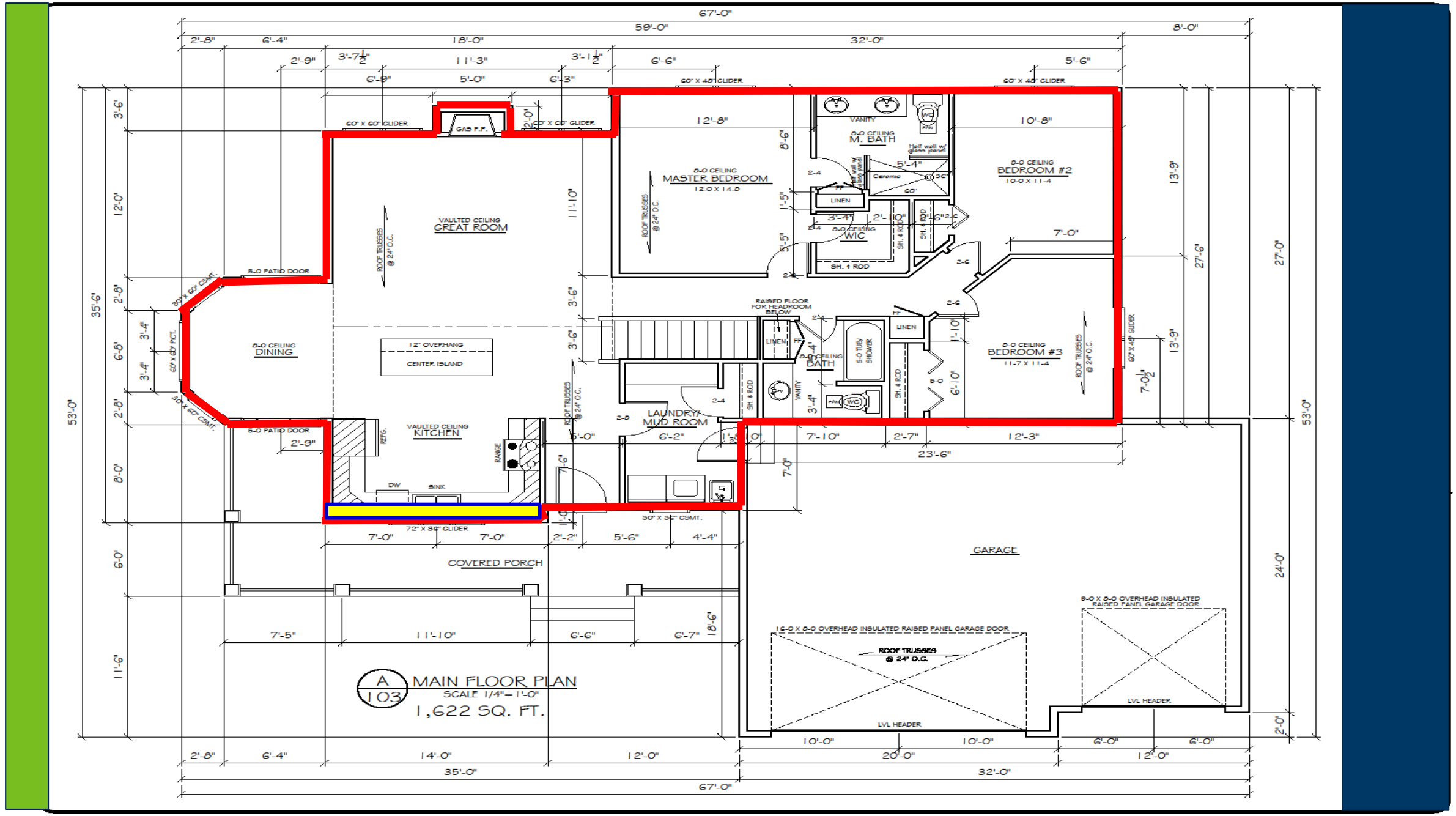
- **Ceiling Heat Loss**
  - **24 x 50 = 1200 Sq. Ft.**
  - **3.5 x 32 = 112 Sq. Ft.**
  - **7 x 26 = 182 Sq. Ft.**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FF
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BATH
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BEDROOM #3
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7'-0½"
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12" OVERHANG
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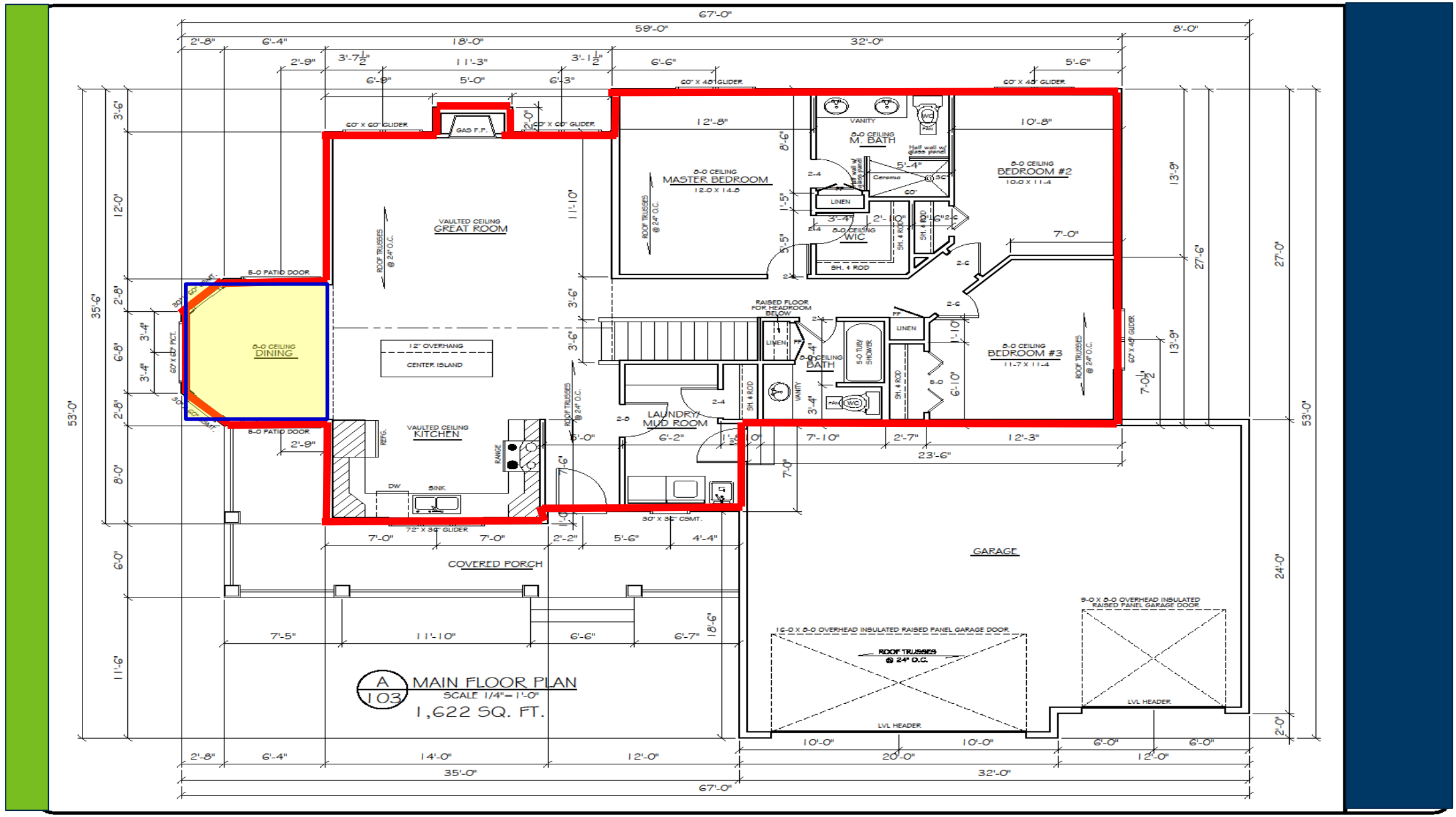
10'-0"
20'-0"
6'-0"
12'-0"
2'-8"
14'-0"
35'-0"
A
103
MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.

- **Ceiling Heat Loss**
  - **24 x 50 = 1200 Sq. Ft.**
  - **3.5 x 32 = 112 Sq. Ft.**
  - **7 x 26 = 182 Sq. Ft.**
  - **1 x 12 = 12 Sq. Ft.**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GREAT ROOM
5-0 CEILING
DINING
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BATH
5-0 TUB SHOWER
5-0 CEILING
BEDROOM #3
11-7 X 11-4
50" X 36" CSMT.
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16-0 X 8-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
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A 103 MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.

- **Ceiling Heat Loss**
  - **24 x 50 = 1200 Sq. Ft.**
  - **3.5 x 32 = 112 Sq. Ft.**
  - **7 x 26 = 182 Sq. Ft.**
  - **1 x 12 = 12 Sq. Ft.**
  - **9 x 12 = 108 Sq. Ft.**

- **Ceiling Heat Loss (using a R-49 Ceiling insulation)**
  - **24 x 50 = 1200 Sq. Ft.**
  - **3.5 x 32 = 112 Sq. Ft.**
  - **7 x 26 = 182 Sq. Ft.**
  - **1 x 12 = 12 Sq. Ft.**
  - **9 x 12 = 108 Sq. Ft.**
  - **Total Sq. Ft. = 1614 Sq. Ft of Area (A) at R-49**

- **Ceiling Heat Loss (using a R-49 Ceiling insulation)**
  - 24 x 50 = 1200 Sq. Ft.
  - 3.5 x 32 = 112 Sq. Ft.
  - 7 x 26 = 182 Sq. Ft.
  - 1 x 12 = 12 Sq. Ft.
  - 9 x 12 = 108 Sq. Ft.
  - Total Sq. Ft. = 1614 Sq. Ft of Area (A) at R-49

Q = U x A x 90 (delta T) or Heat Loss (Q) = .0204 (R-49) x 1614 (Area) x 90 (delta T) = Ceiling Heat Loss of 2,963.3 or 2964 Btu's of Heat Loss

- **Ceiling Heat Loss (using a R-49 Ceiling insulation)**
  - 24 x 50 = 1200 Sq. Ft.
  - 3.5 x 32 = 112 Sq. Ft.
  - 7 x 26 = 182 Sq. Ft.
  - 1 x 12 = 12 Sq. Ft.
  - 9 x 12 = 108 Sq. Ft.
  - Total Sq. Ft. = 1614 Sq. Ft of Area (A) at R-49

Q = U x A x 90 (delta T) or Heat Loss (Q) = .0204 (R-49) x 1614 (Area) x 90 (delta T) = Ceiling Heat Loss of 2,963.3 or 2964 Btu's of Heat Loss

- **+ Fireplace bump out Ceiling at R-30 and an Area Of 10 Sq. Ft. =**

- **Ceiling Heat Loss (using a R-49 Ceiling insulation)**
  - 24 x 50 = 1200 Sq. Ft.
  - 3.5 x 32 = 112 Sq. Ft.
  - 7 x 26 = 182 Sq. Ft.
  - 1 x 12 = 12 Sq. Ft.
  - 9 x 12 = 108 Sq. Ft.
  - Total Sq. Ft. = 1614 Sq. Ft of Area (A) at R-49

Q = U x A x 90 (delta T) or Heat Loss (Q) = .0204 (R-49) x 1614 (Area) x 90 (delta T) = Ceiling Heat Loss of 2,963.3 or 2964 Btu's of Heat Loss

- **+ Fireplace bump out Ceiling at R-30 and a Area Of 10 Sq. Ft. = Calculate this and tell Me what you get for Heat Loss**
- **-Remember Q = UA(deltaT)**

- **Ceiling Heat Loss (using a R-49 Ceiling insulation)**
  - 24 x 50 = 1200 Sq. Ft.
  - 3.5 x 32 = 112 Sq. Ft.
  - 7 x 26 = 182 Sq. Ft.
  - 1 x 12 = 12 Sq. Ft.
  - 9 x 12 = 108 Sq. Ft.
  - Total Sq. Ft. = 1614 Sq. Ft of Area (A) at R-49

Q = U x A x 90 (delta T) or Heat Loss (Q) = .0204 (R-49) x 1614 (Area) x 90 (delta T) = Ceiling Heat Loss of 2,963.3 or 2964 Btu's of Heat Loss

- **+ Fireplace bump out Ceiling at R-30 and a Area Of 10 Sq. Ft. = Btu's = .0333 x 10 x 90 = 29.97 or 30 Btu's of Heat loss**

- **Ceiling Heat Loss (using a R-49 Ceiling insulation)**
  - 24 x 50 = 1200 Sq. Ft.
  - 3.5 x 32 = 112 Sq. Ft.
  - 7 x 26 = 182 Sq. Ft.
  - 1 x 12 = 12 Sq. Ft.
  - 9 x 12 = 108 Sq. Ft.
  - Total Sq. Ft. = 1614 Sq. Ft of Area (A) at R-49

Q = U x A x 90 (delta T) or Heat Loss (Q) = .0204 (R-49) x 1614 (Area) x 90 (delta T) = Ceiling Heat Loss of 2,963.3 or 2964 Btu's of Heat Loss

- **+ Fireplace bump out Ceiling at R-30 and a Area Of 10 Sq. Ft. = Btu's = .0333 x 10 x 90 = 29.97 or 30 Btu's of Heat loss**

Adding them all up we get 2964 + 30 = 2994 total Btu's of Heat Loss for Ceilings- Write this down and save it for later- we will need it

First of all do you have everything on the plans?

4 Pages of the Plans

Main Floor Page

Where is the Building Envelope?

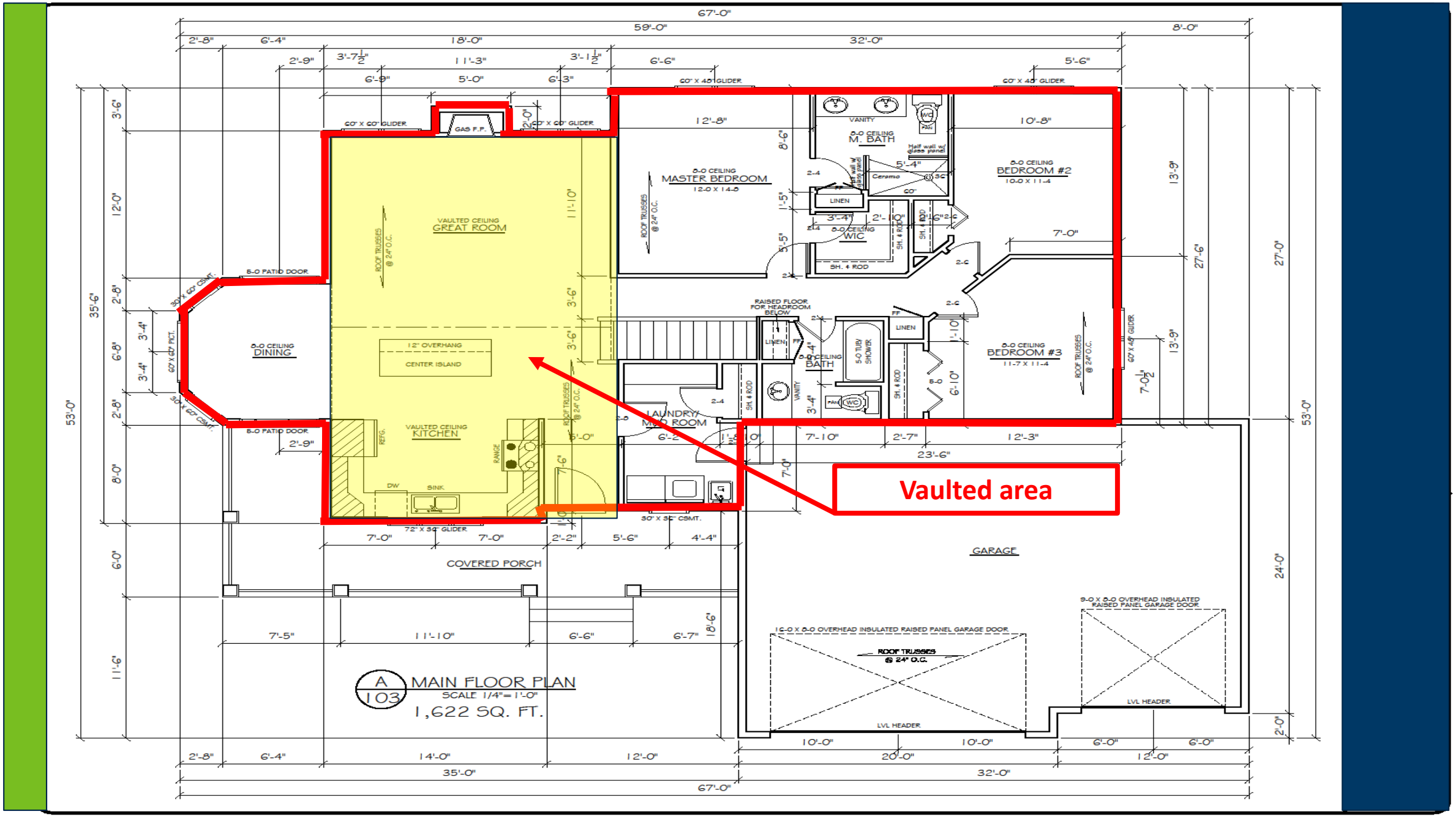
What does it consist of Wood Framed- Masonry Etc..?

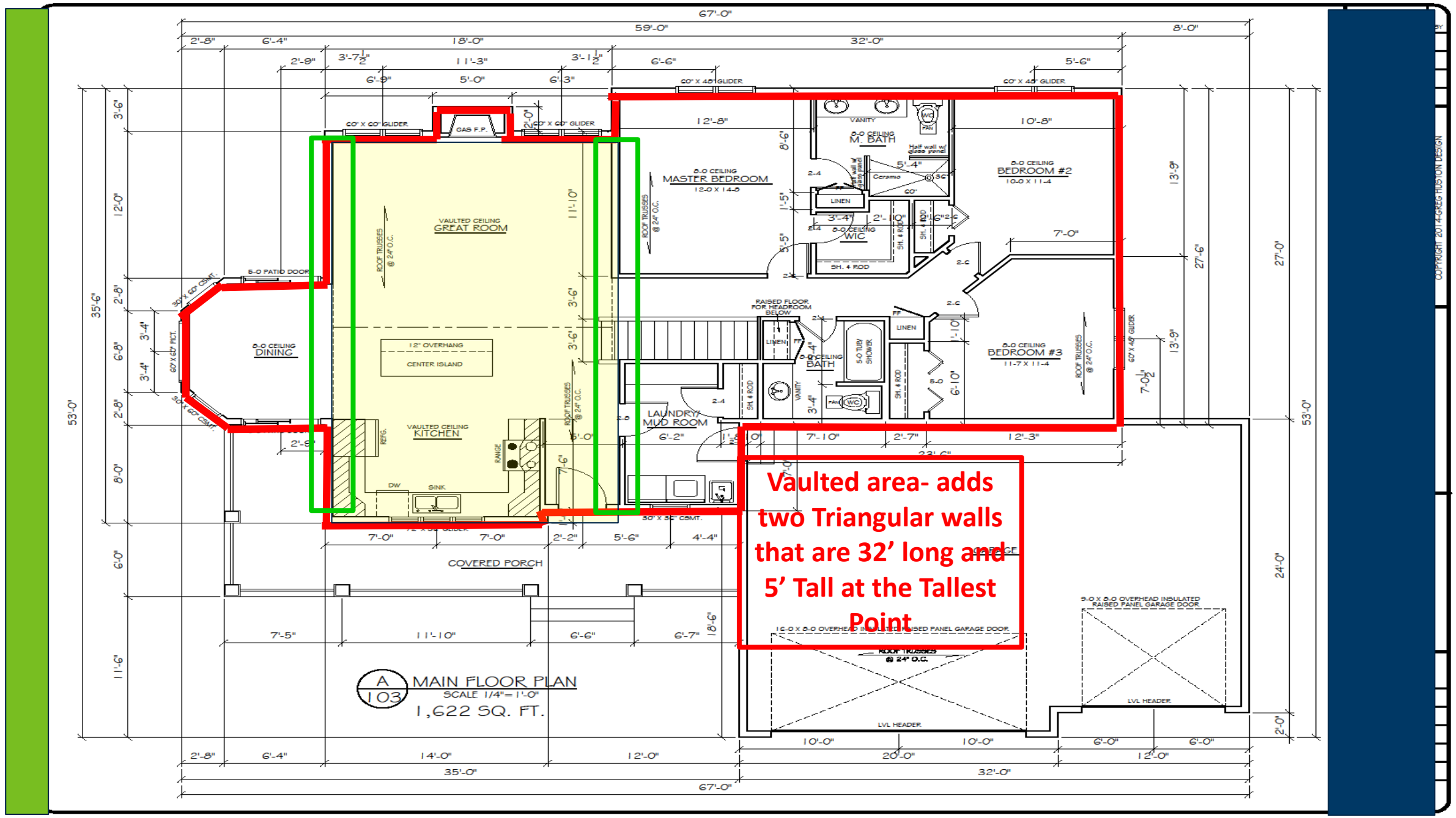
Are there any cantilevers or Bump-Outs?

What is the Ceiling Area (Square Footage)?

What is the Ceiling R Value

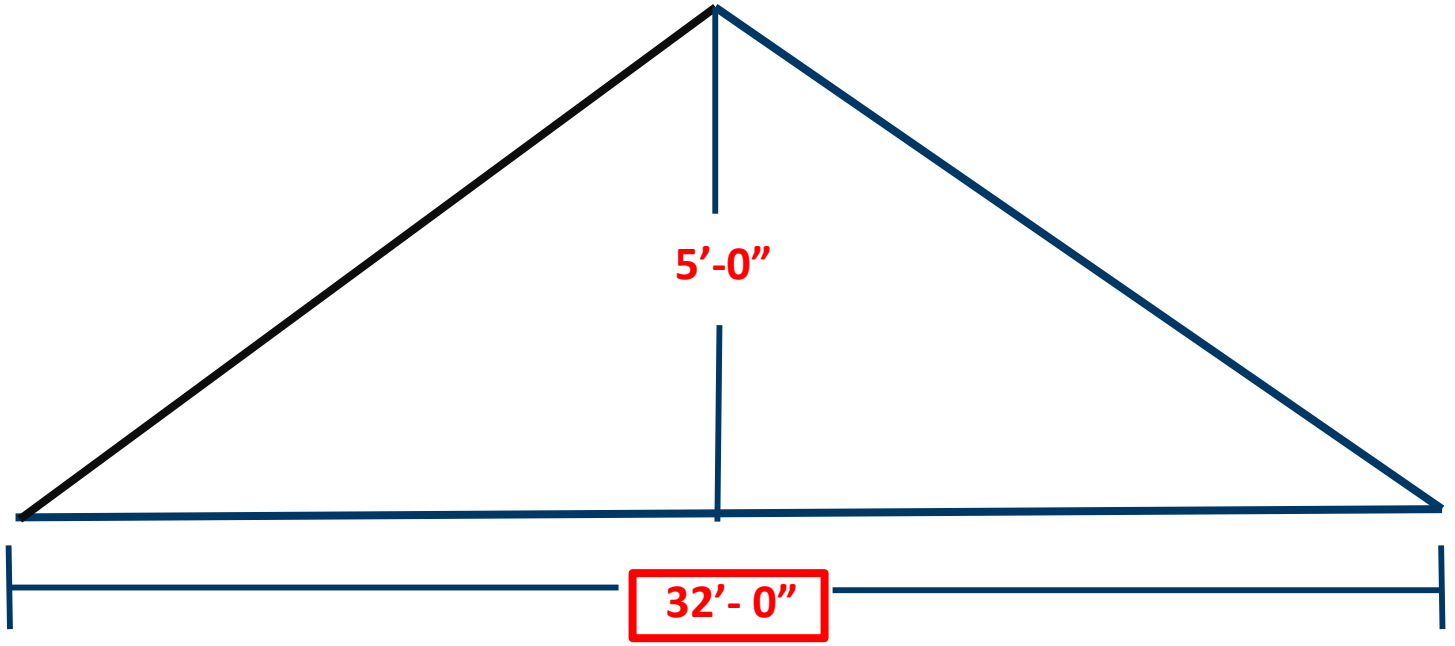
Is there a Vaulted area that adds wall area to our envelope?


Vaulted area
VAULTED CEILING
GREAT ROOM
12" OVERHANG
CENTER ISLAND
VAULTED CEILING
KITCHEN
8'-0 CEILING
DINING
8'-0 CEILING
MASTER BEDROOM
12'-0 X 14'-5
8'-0 CEILING
M. BATH
8'-0 CEILING
WIC
8'-0 CEILING
BEDROOM #2
10'-0 X 11'-4
8'-0 CEILING
BEDROOM #3
11'-7 X 11'-4
8'-0 CEILING
BATH
LAUNDRY/
MUD ROOM
RAISED FLOOR
FOR HEADROOM
BELOW
GARAGE
COVERED PORCH
8'-0 PATIO DOOR
GAS F.P.
ROOF TRUSSES
@ 24" O.C.
16'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
9'-0 X 8'-0 OVERHEAD INSULATED
RAISED PANEL GARAGE DOOR
LVL HEADER
A
103
MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.


Vaulted area- adds two Triangular walls that are 32’ long and 5’ Tall at the Tallest Point
A 103 MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.
VAULTED CEILING GREAT ROOM
8'-0 CEILING DINING
VAULTED CEILING KITCHEN
LAUNDRY/ MUD ROOM
8'-0 CEILING M. BATH
8'-0 CEILING MASTER BEDROOM 12-0 X 14-6
8'-0 CEILING WIC
8'-0 CEILING BATH
8'-0 CEILING BEDROOM #2 10-0 X 11-4
8'-0 CEILING BEDROOM #3 11-7 X 11-4
COVERED PORCH
GARAGE
LVL HEADER
ROOF TRUSSES @ 24" O.C.
COPYRIGHT 2014 GREG HUSTON DESIGN

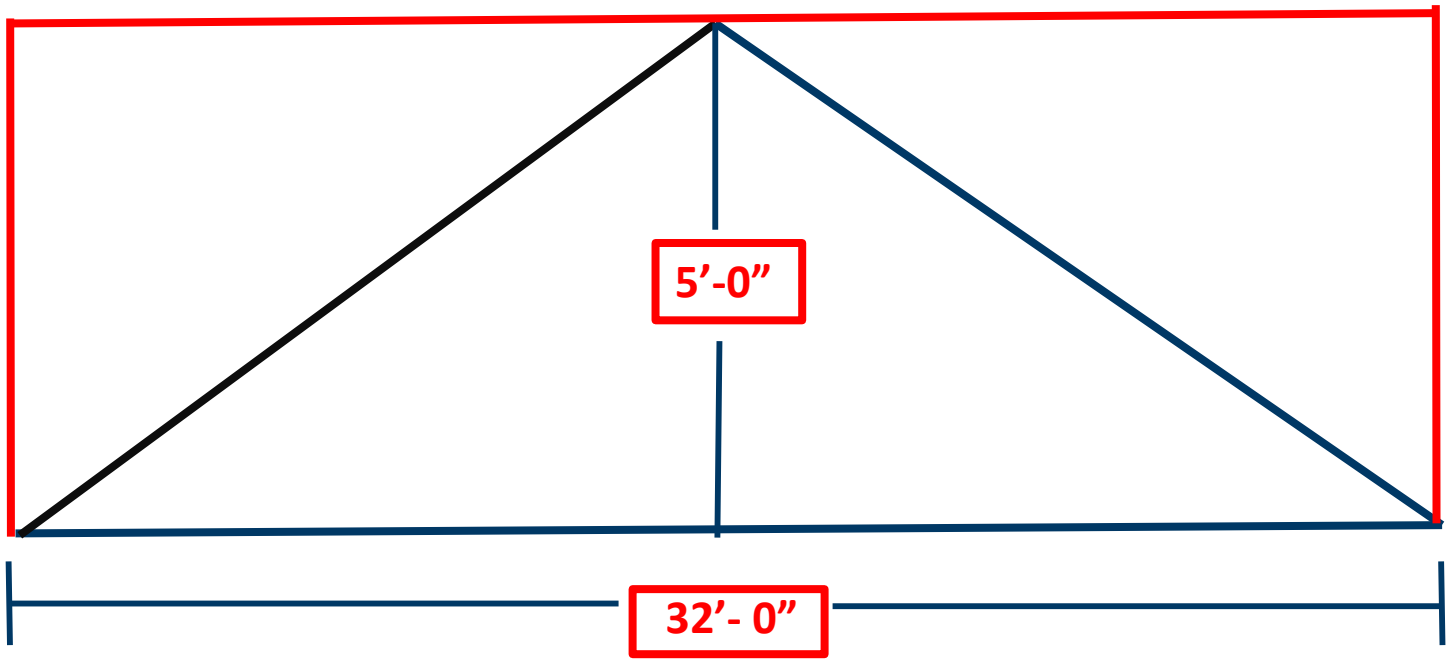
Calculate the Area of A triangle "Geometry"

Area = ½ (base x height) or ½ x (5 x 32) = 80



Calculate the Area of A Rectangle and divide by 2 "Geometry"

Here is a simpler way (in my opinion). L x W / 2 (or 32 X 5 = 160 / 2 = 80)



- **Ceiling Vaulted Area Side Walls**
  - **Side #1 = 80 Sq. Ft.**
  - **Side #2 = 80 Sq. Ft.**
  - **Total Sq. Ft. = 160 Sq. Ft of Area (A) at R-21**

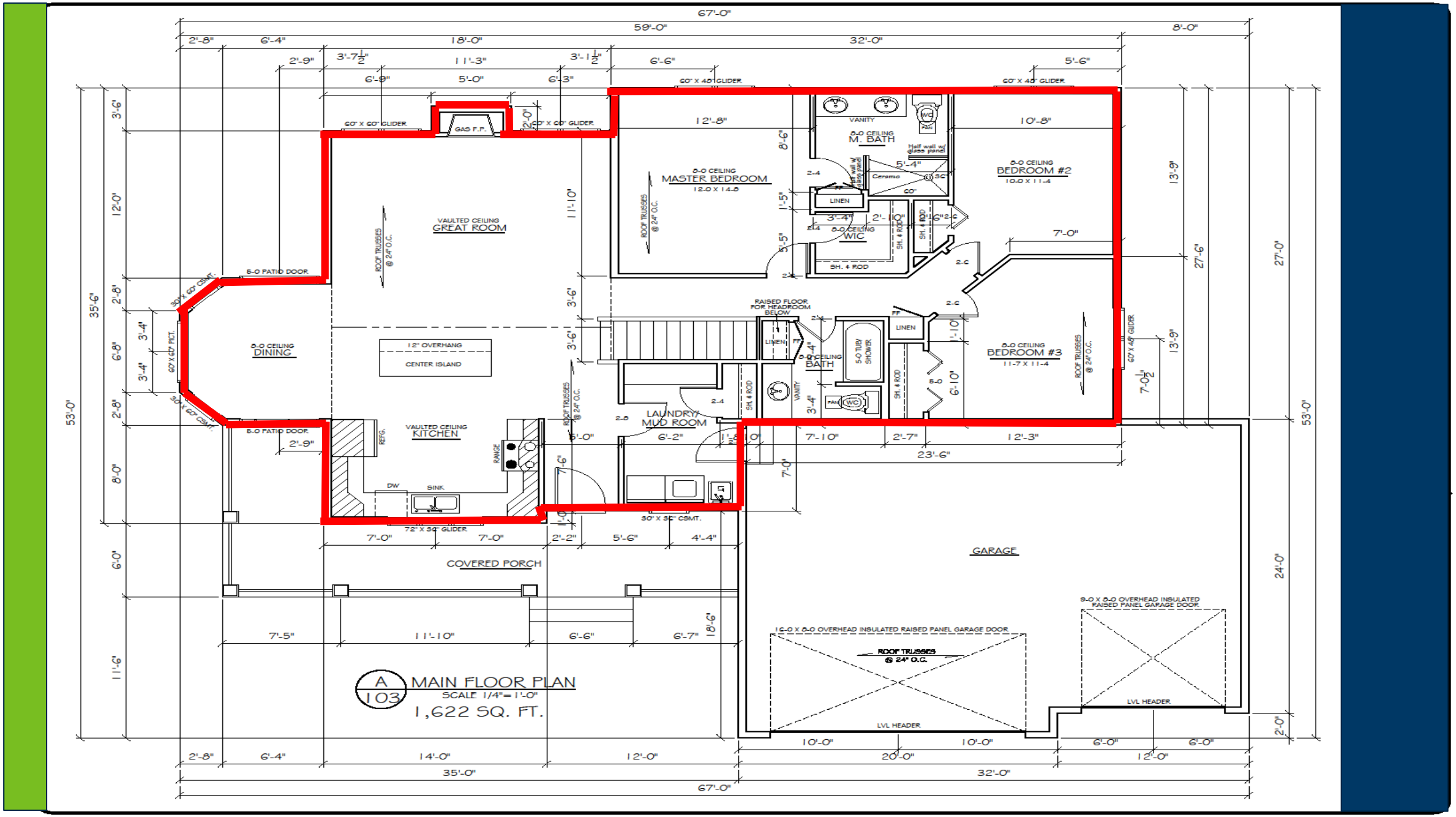
Q = U x A x 90 (delta T) or Heat Loss (Q) = .0476 (R-21) x 160 (Area) x 90 (delta T) = Ceiling Heat Loss of 685.44 or 686 Btu's of Heat Loss

There are no windows in these walls so our heat loss ends there but make a note of it.

Running total of Btu's of Heat Loss for Our Home

• Ceiling Area	=	2994 Btu's of Heat loss
• Ceiling Vaulted Area Side Walls	=	686 Btu's of Heat Loss

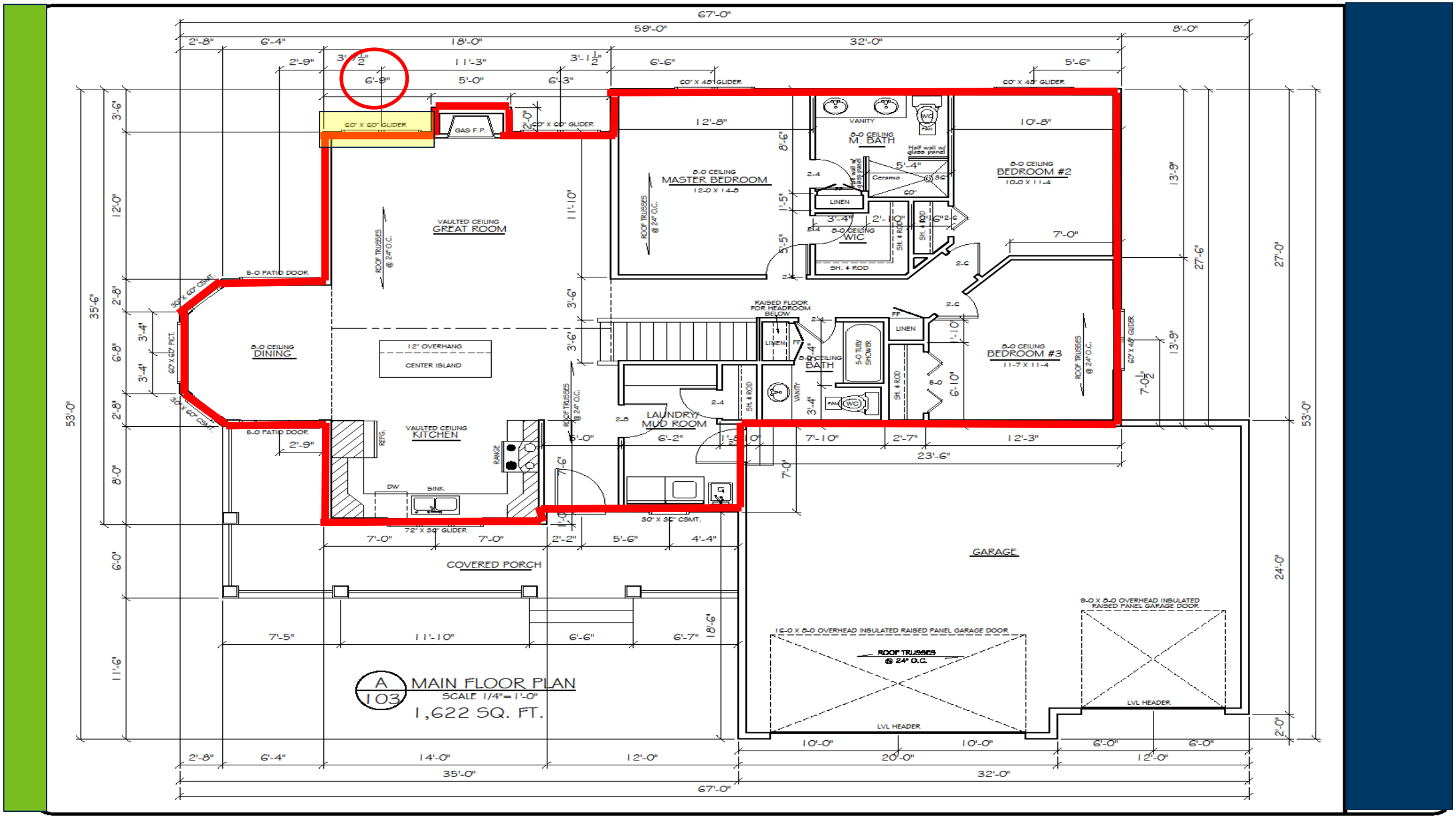
Main Floor Exterior Walls



A/103 MAIN FLOOR PLAN

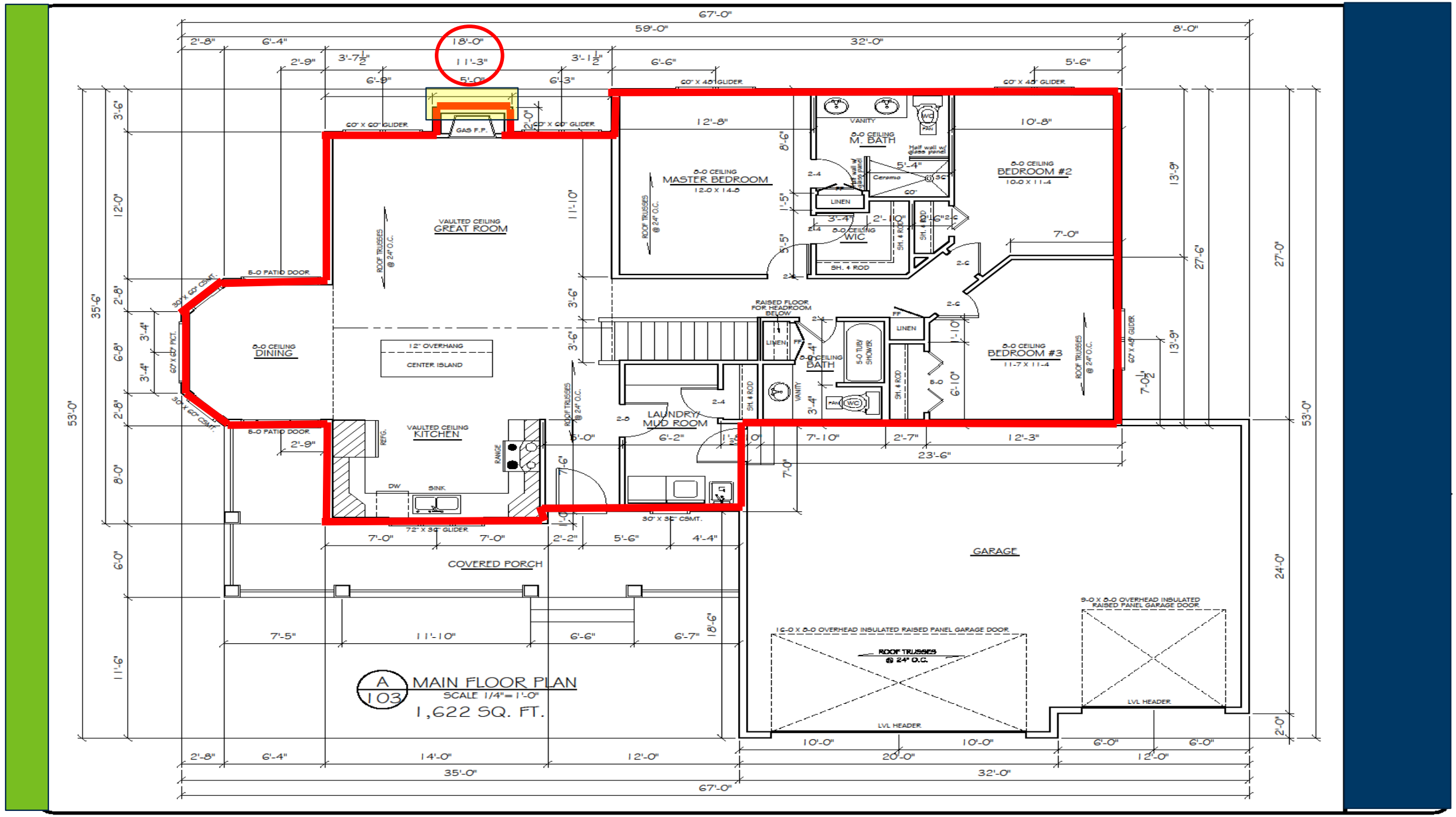
SCALE 1/4"=1'-0"

1,622 SQ. FT.


67'-0"
59'-0"
8'-0"
2'-8"
6'-4"
18'-0"
32'-0"
2'-9"
3'-1½"
11'-3"
6'-6"
5'-6"
6'-9"
5'-0"
6'-3"
60" X 48" GLIDER
60" X 60" GLIDER
GAS F.P.
12'-8"
10'-8"
8'-0" CEILING
M. BATH
VANITY
WC
Half wall w/ glass panel
5'-4"
Ceramic
SC
LINEN
8'-6"
11'-10"
11'-5"
3'-4"
2'-10"
SH. & ROD
8'-0" CEILING
MASTER BEDROOM
12-0 X 14-5
ROOF TRUSSES @ 24" O.C.
8'-0" CEILING
BEDROOM #2
10-0 X 11-4
13'-9"
27'-6"
7'-0"
VAULTED CEILING
GREAT ROOM
8-0 PATIO DOOR
30" X 60" CSMT.
60" X 60" PICT.
3'-6"
2'-8"
3'-4"
6'-8"
35'-6"
53'-0"
RAISED FLOOR FOR HEADROOM BELOW
FF
8'-0" CEILING
DINING
12" OVERHANG
CENTER ISLAND
8'-0" CEILING
BATH
5-0 TUB SHOWER
8'-0" CEILING
BEDROOM #3
11-7 X 11-4
6'-10"
7-0½"
60" X 48" GLIDER
VAULTED CEILING
KITCHEN
REFG.
RANGE
DW
SINK
72" X 36" GLIDER
LAUNDRY/ MUD ROOM
6'-2"
7'-10"
2'-7"
12'-3"
23'-6"
36" X 36" CSMT.
7'-0"
2'-2"
5'-6"
4'-4"
GARAGE
COVERED PORCH
8'-0"
6'-0"
11'-6"
7'-5"
11'-10"
6'-6"
6'-7"
18'-6"
9-0 X 8-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
16-0 X 8-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
ROOF TRUSSES @ 24" O.C.
LVL HEADER
24'-0"
2'-0"
10'-0"
20'-0"
6'-0"
12'-0"
14'-0"
35'-0"
A
103
MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.

- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 +



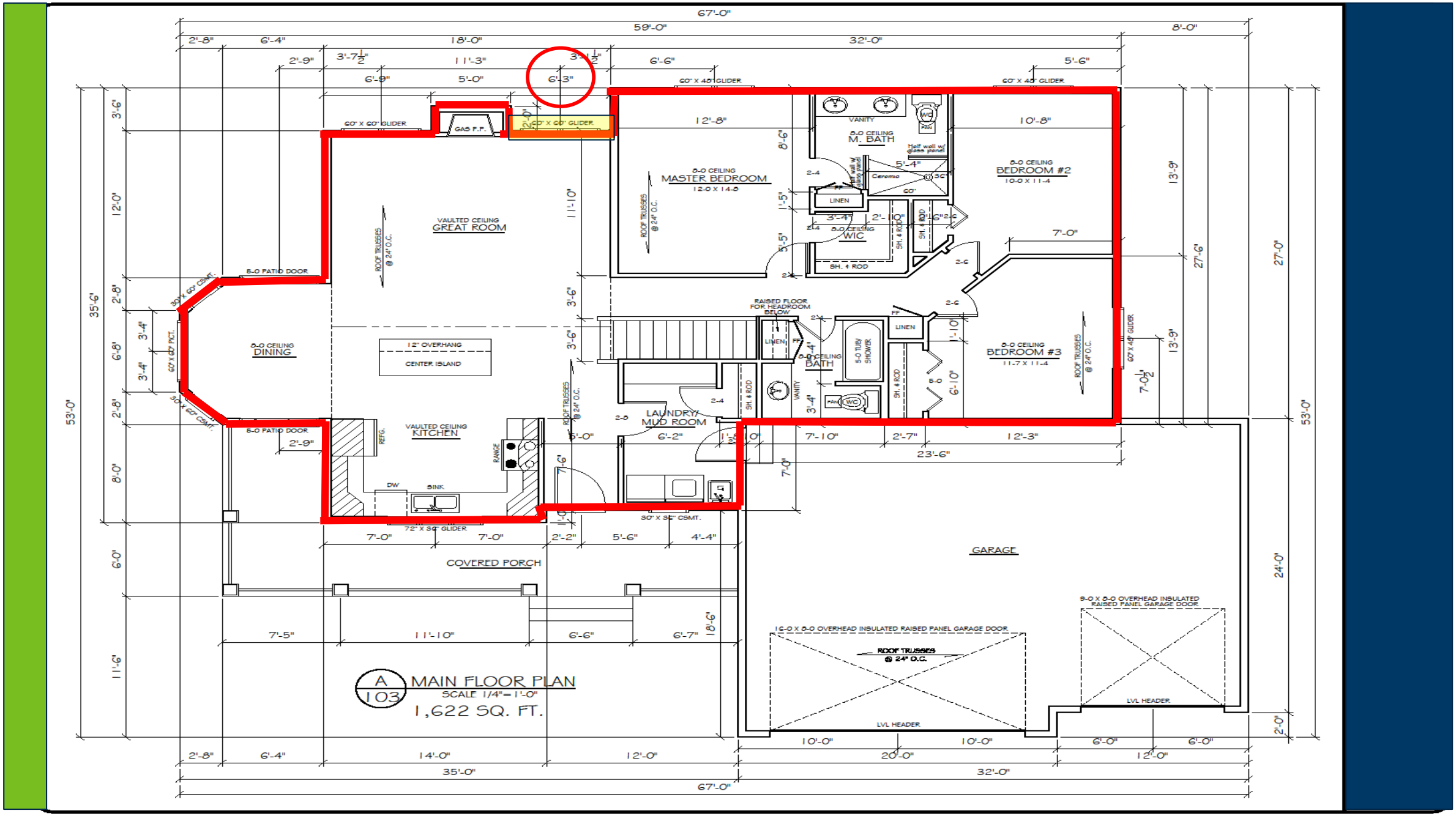
A/103 MAIN FLOOR PLAN

SCALE 1/4"=1'-0"

1,622 SQ. FT.

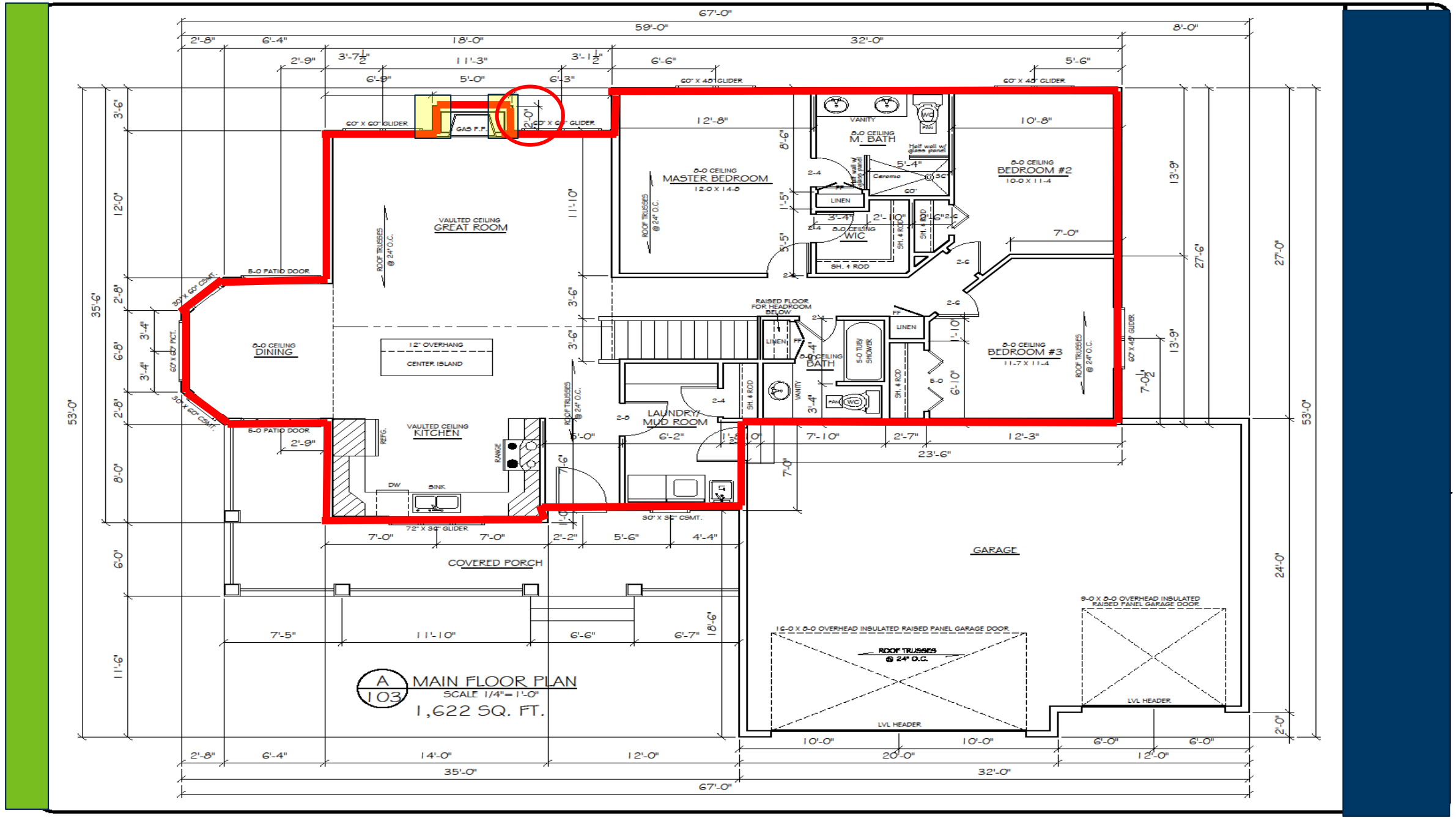
- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 +


MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.
A 103
VAULTED CEILING GREAT ROOM
8'-0 PATIO DOOR
ROOF TRUSSES @ 24" O.C.
8'-0 CEILING DINING
12" OVERHANG
CENTER ISLAND
VAULTED CEILING KITCHEN
REFG.
RANGE
DW
SINK
72" X 36" GLIDER
COVERED PORCH
GAS F.P.
60" X 60" GLIDER
8'-0 CEILING MASTER BEDROOM
12'-0 X 14'-5
VANITY
8'-0 CEILING M. BATH
Half wall w/ glass panel
Ceramic
LINEN
SH. & ROD
8'-0 CEILING WIC
60" X 48" GLIDER
8'-0 CEILING BEDROOM #2
10'-0 X 11'-4
RAISED FLOOR FOR HEADROOM BELOW
8'-0 CEILING BATH
5'-0 TUB SHOWER
LAUNDRY/ MUD ROOM
8'-0 CEILING BEDROOM #3
11'-7 X 11'-4
30" X 60" CSMT.
60" X 60" PICT.
30" X 36" CSMT.
GARAGE
16'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
9'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
LVL HEADER
67'-0"
59'-0"
32'-0"
8'-0"
53'-0"
35'-0"
27'-0"
24'-0"

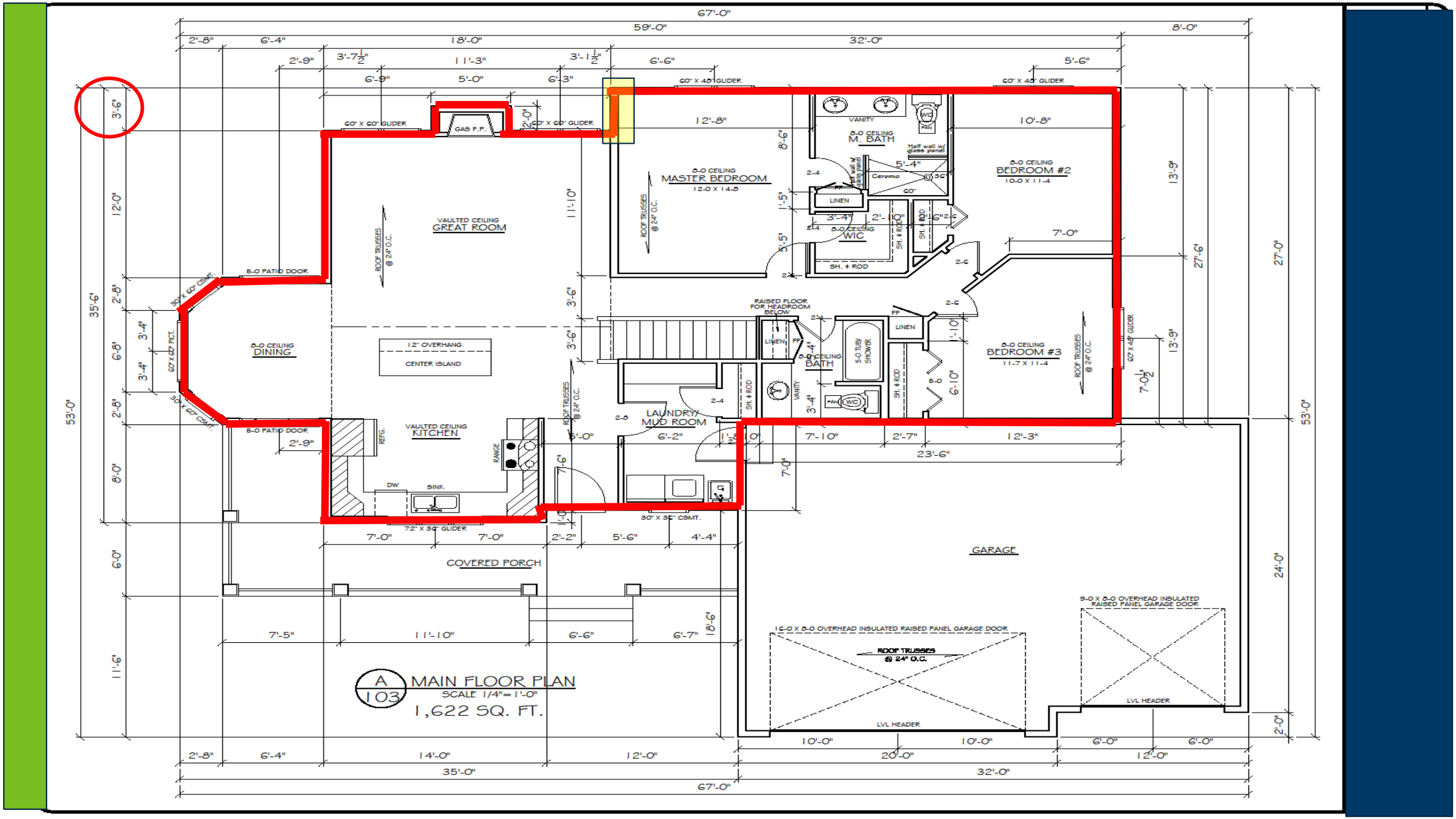
- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 +


MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.
A 103
VAULTED CEILING GREAT ROOM
8'-0 CEILING DINING
12" OVERHANG
CENTER ISLAND
VAULTED CEILING KITCHEN
REFG.
RANGE
DW
SINK
8'-0 PATIO DOOR
2'-9"
30" X 60" CSMT.
60" X 60" PICT.
72" X 36" GLIDER
COVERED PORCH
8'-0 CEILING MASTER BEDROOM
12'-0 X 14'-5
60" X 48" GLIDER
GAS F.P.
60" X 60" GLIDER
ROOF TRUSSES @ 24" O.C.
RAISED FLOOR FOR HEADROOM BELOW
LAUNDRY/ MUD ROOM
6'-2"
30" X 36" CSMT.
8'-0 CEILING M. BATH
VANITY
Half wall w/ glass panel
Ceramic
LINEN
SH. & ROD
8'-0 CEILING WIC
SH. & ROD
8'-0 CEILING BATH
5'-0 TUB SHOWER
8'-0 CEILING BEDROOM #2
10'-0 X 11'-4
8'-0 CEILING BEDROOM #3
11'-7 X 11'-4
GARAGE
16'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
9'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
ROOF TRUSSES @ 24" O.C.
LVL HEADER
67'-0"
59'-0"
32'-0"
8'-0"
53'-0"
35'-0"
27'-0"
24'-0"

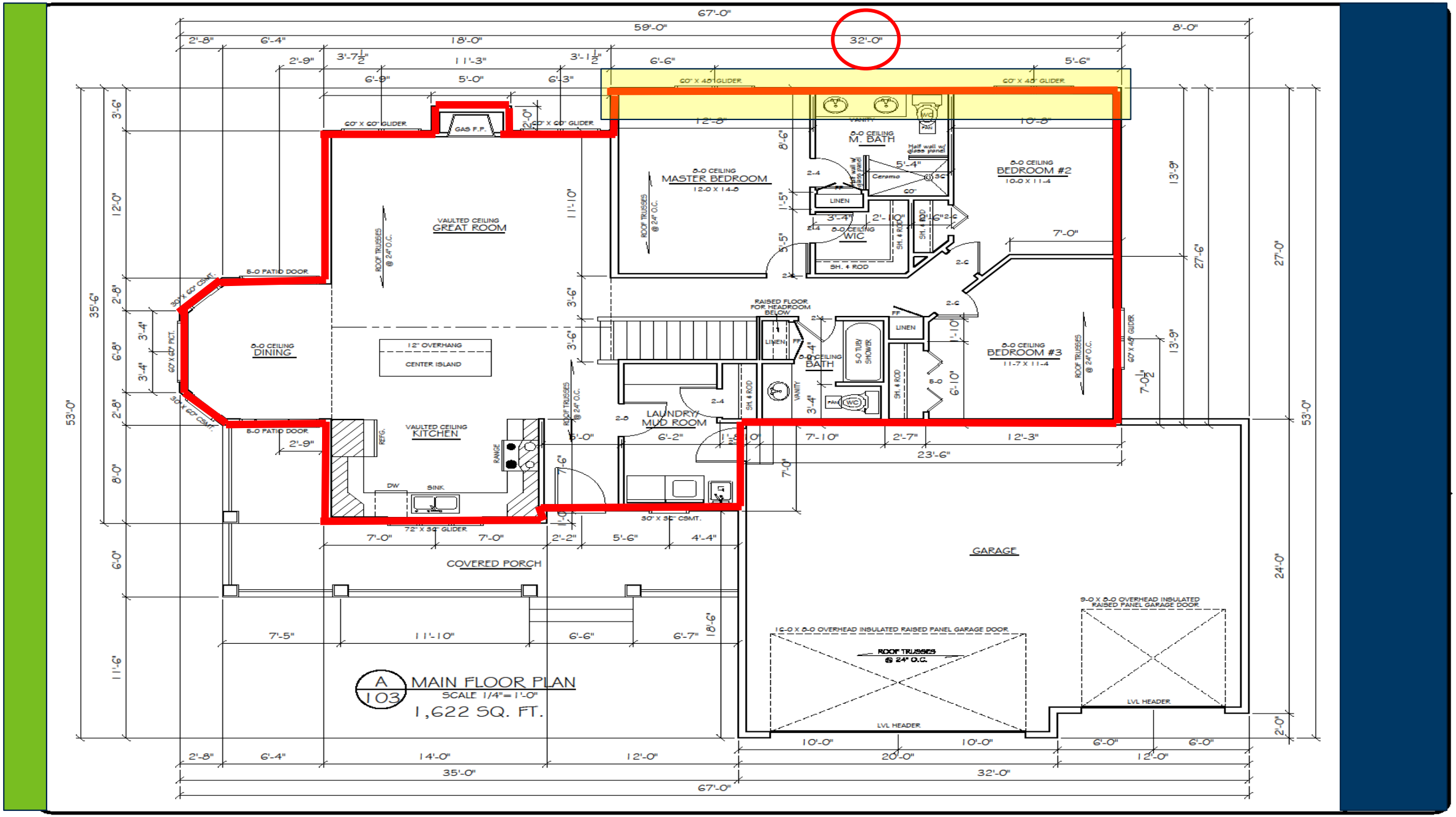
- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) +


67'-0"
59'-0"
8'-0"
2'-8"
6'-4"
18'-0"
32'-0"
2'-9"
3'-7½"
11'-3"
3'-1½"
6'-6"
5'-6"
6'-9"
5'-0"
6'-3"
60" X 48" GLIDER
60" X 60" GLIDER
GAS F.P.
2'-0"
12'-8"
10'-8"
5-0 CEILING
M. BATH
VANITY
WC
PAN
Half wall w/ glass panel
5'-4"
Ceramic
SC
60"
LINEN
3'-4"
2'-10½"
5-0 CEILING
WIC
SH. 4 ROD
5-0 CEILING
MASTER BEDROOM
12-0 X 14-5
5-0 CEILING
BEDROOM #2
10-0 X 11-4
VAULTED CEILING
GREAT ROOM
ROOF TRUSSES @ 24" O.C.
11'-10"
8'-6"
5'-5"
7'-0"
13'-9"
27'-6"
27'-0"
35'-6"
12'-0"
2'-8"
3'-4"
6'-8"
3'-4"
8'-0"
2'-8"
6'-0"
11'-6"
53'-0"
8-0 PATIO DOOR
30" X 60" CSMT.
60" X 60" PICT.
3'-6"
RAISED FLOOR FOR HEADROOM BELOW
FF
5-0 TUB SHOWER
5-0 CEILING
BATH
5-0 CEILING
BEDROOM #3
11-7 X 11-4
6'-10"
1'-10"
7-0½"
60" X 48" GLIDER
5-0 CEILING
DINING
12" OVERHANG
CENTER ISLAND
LAUNDRY/ MUD ROOM
6'-2"
7'-10"
2'-7"
12'-3"
23'-6"
VAULTED CEILING
KITCHEN
REFG.
RANGE
DW
SINK
2'-9"
5'-0"
7'-6"
7'-0"
30" X 36" CSMT.
72" X 36" GLIDER
7'-0"
7'-0"
2'-2"
5'-6"
4'-4"
COVERED PORCH
GARAGE
9-0 X 8-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
16-0 X 8-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
ROOF TRUSSES @ 24" O.C.
LVL HEADER
LVL HEADER
7'-5"
11'-10"
6'-6"
6'-7"
18'-6"
10'-0"
10'-0"
6'-0"
6'-0"
20'-0"
12'-0"
2'-0"
2'-8"
6'-4"
14'-0"
12'-0"
35'-0"
32'-0"
67'-0"
A
103
MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.

- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 +


67'-0"
59'-0"
32'-0"
8'-0"
2'-8"
6'-4"
18'-0"
2'-9"
3'-7½"
11'-3"
3'-1½"
6'-6"
5'-6"
6'-9"
5'-0"
6'-3"
GAS F.P.
VAULTED CEILING
GREAT ROOM
ROOF TRUSSES @ 24" O.C.
8'-0 PATIO DOOR
30" X 60" CSMT.
8'-0 CEILING
DINING
60" X 60" PICT.
12" OVERHANG
CENTER ISLAND
VAULTED CEILING
KITCHEN
REFG.
RANGE
DW
SINK
72" X 36" GLIDER
2'-9"
7'-0"
7'-0"
2'-2"
5'-6"
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COVERED PORCH
7'-5"
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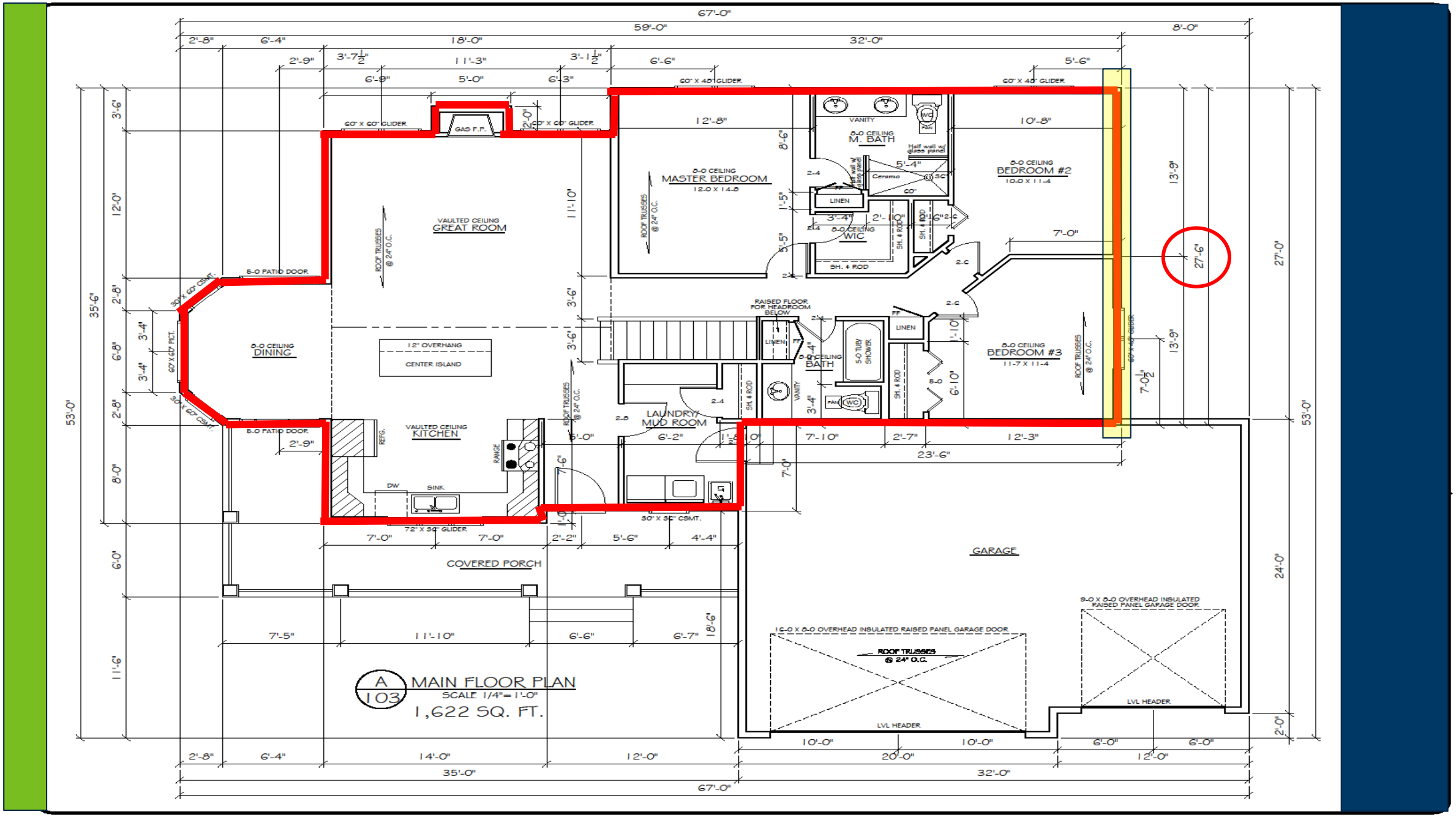
6'-7"
18'-6"
11'-6"
35'-6"
53'-0"
3'-6"
12'-0"
2'-8"
6'-8"
3'-4"
8'-0"
6'-0"
60" X 48" GLIDER
8'-0 CEILING
MASTER BEDROOM
12-0 X 14-5
11'-10"
8'-6"
11'-5"
5'-5"
3'-6"
8'-0 CEILING
M. BATH
VANITY
Half wall w/ glass panel
5'-4"
Ceramic
SC
LINEN
3'-4"
2'-10½"
8'-0 CEILING
WIC
SH. & ROD
CO"
12'-8"
10'-8"
8'-0 CEILING
BEDROOM #2
10-0 X 11-4
13'-9"
27'-6"
7'-0"
RAISED FLOOR FOR HEADROOM BELOW
FF
LINEN
8'-0 CEILING
BATH
5'-0 TUB SHOWER
WC
6'-10"
8'-0 CEILING
BEDROOM #3
11-7 X 11-4
ROOF TRUSSES @ 24" O.C.
7'-0½"
LAUNDRY/ MUD ROOM
6'-2"
7'-10"
2'-7"
12'-3"
23'-6"
7'-0"
36" X 36" CSMT.
GARAGE
9'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
16'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
ROOF TRUSSES @ 24" O.C.
LVL HEADER
LVL HEADER
10'-0"
10'-0"
6'-0"
6'-0"
20'-0"
12'-0"
32'-0"
27'-0"
24'-0"
2'-0"
2'-8"
6'-4"
14'-0"
12'-0"
35'-0"
67'-0"
A
103
MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.

- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 +


67'-0"
59'-0"
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18'-0"
32'-0"
2'-9"
3'-7½"
11'-3"
3'-1½"
6'-6"
5'-6"
6'-9"
5'-0"
6'-3"
GAS F.P.
12'-8"
10'-8"
VANITY
5'-0 CEILING
M. BATH
Half wall w/ glass panel
5'-4"
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MASTER BEDROOM
12'-0 X 14'-5
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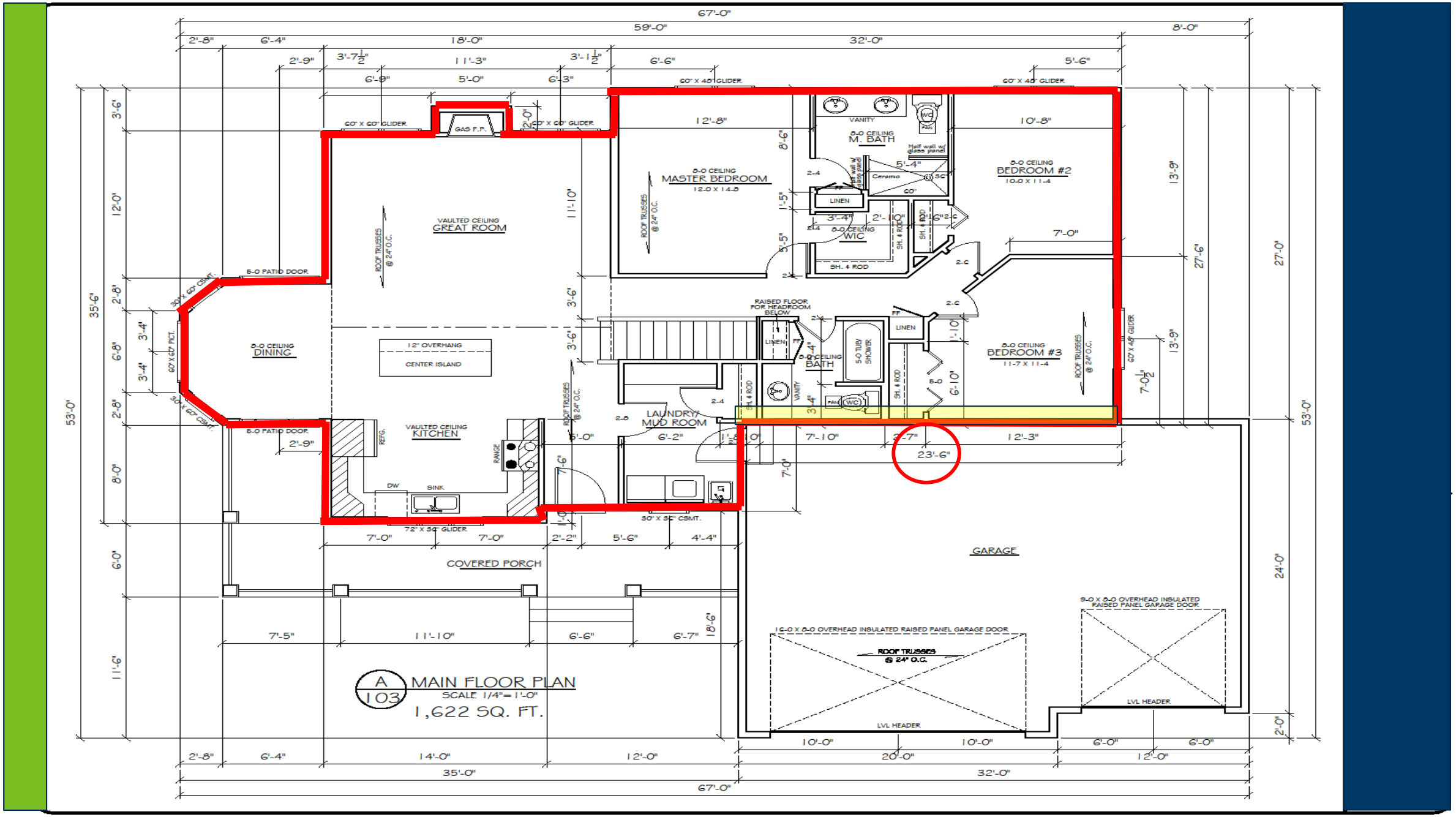
BEDROOM #2
10'-0 X 11'-4
ROOF TRUSSES @ 24" O.C.
VAULTED CEILING
GREAT ROOM
11'-10"
5'-5"
3'-4"
2'-10½"
5'-0 CEILING
WIC
SH. & ROD
7'-0"
8'-0 PATIO DOOR
30" X 60" CSMT.
60" X 60" PICT.
RAISED FLOOR FOR HEADROOM BELOW
FF
5'-0 CEILING
DINING
12" OVERHANG
CENTER ISLAND
5'-0 CEILING
BATH
5'-0 TUB SHOWER
5'-0 CEILING
BEDROOM #3
11'-7 X 11'-4
6'-10"
7'-0½"
VAULTED CEILING
KITCHEN
REFG.
RANGE
DW
SINK
LAUNDRY/ MUD ROOM
6'-2"
7'-10"
2'-7"
12'-3"
23'-6"
72" X 36" GLIDER
30" X 36" CSMT.
7'-0"
5'-6"
4'-4"
COVERED PORCH
GARAGE
7'-5"
11'-10"
6'-6"
6'-7"
18'-6"
16'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
9'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
ROOF TRUSSES @ 24" O.C.
LVL HEADER
10'-0"
20'-0"
6'-0"
12'-0"
35'-0"
32'-0"
67'-0"
27'-6"
27'-0"
53'-0"
35'-6"
24'-0"
A 103
MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.

- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 + 27.5 +



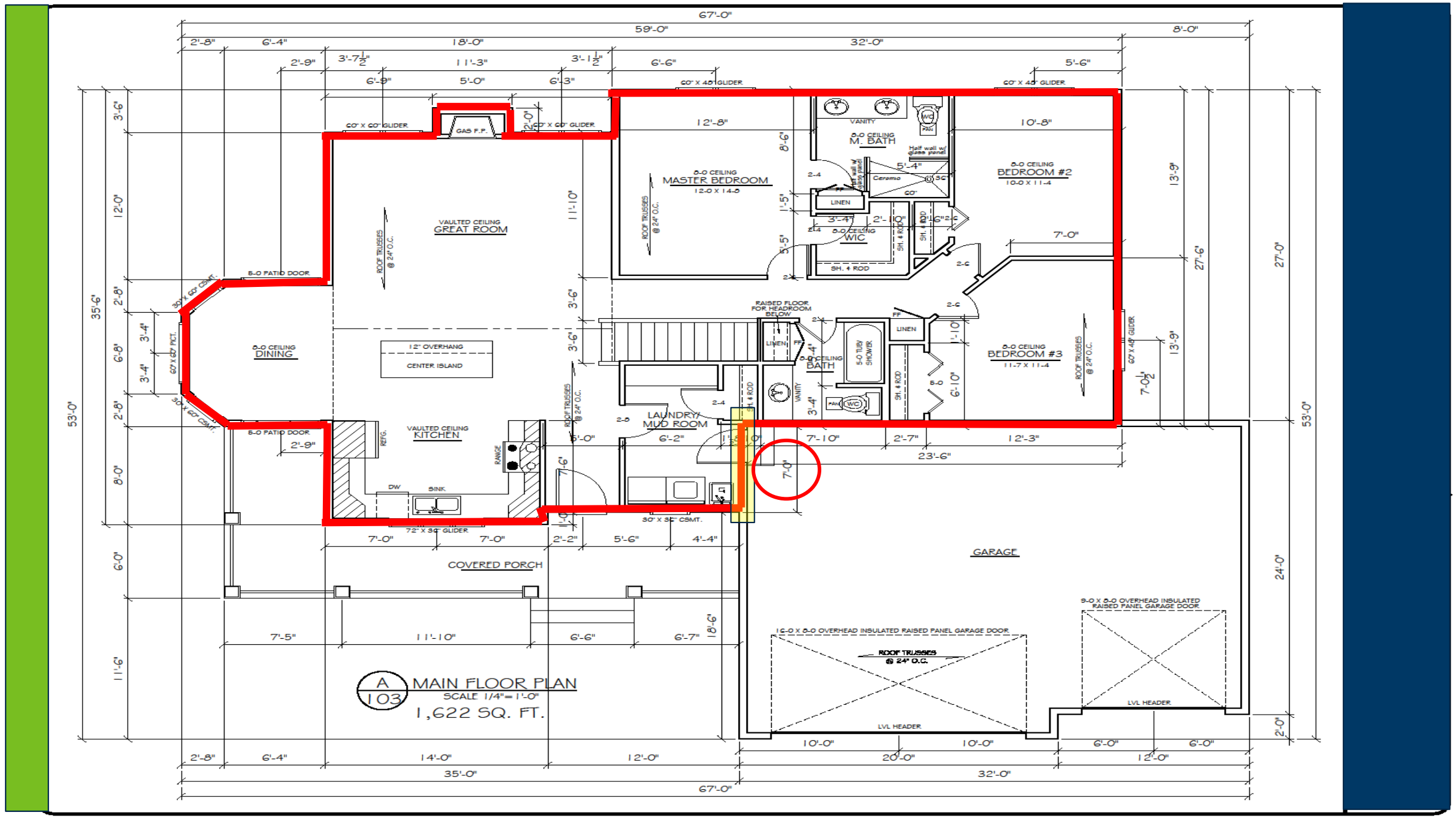
A/103 MAIN FLOOR PLAN

SCALE 1/4"=1'-0"

1,622 SQ. FT.

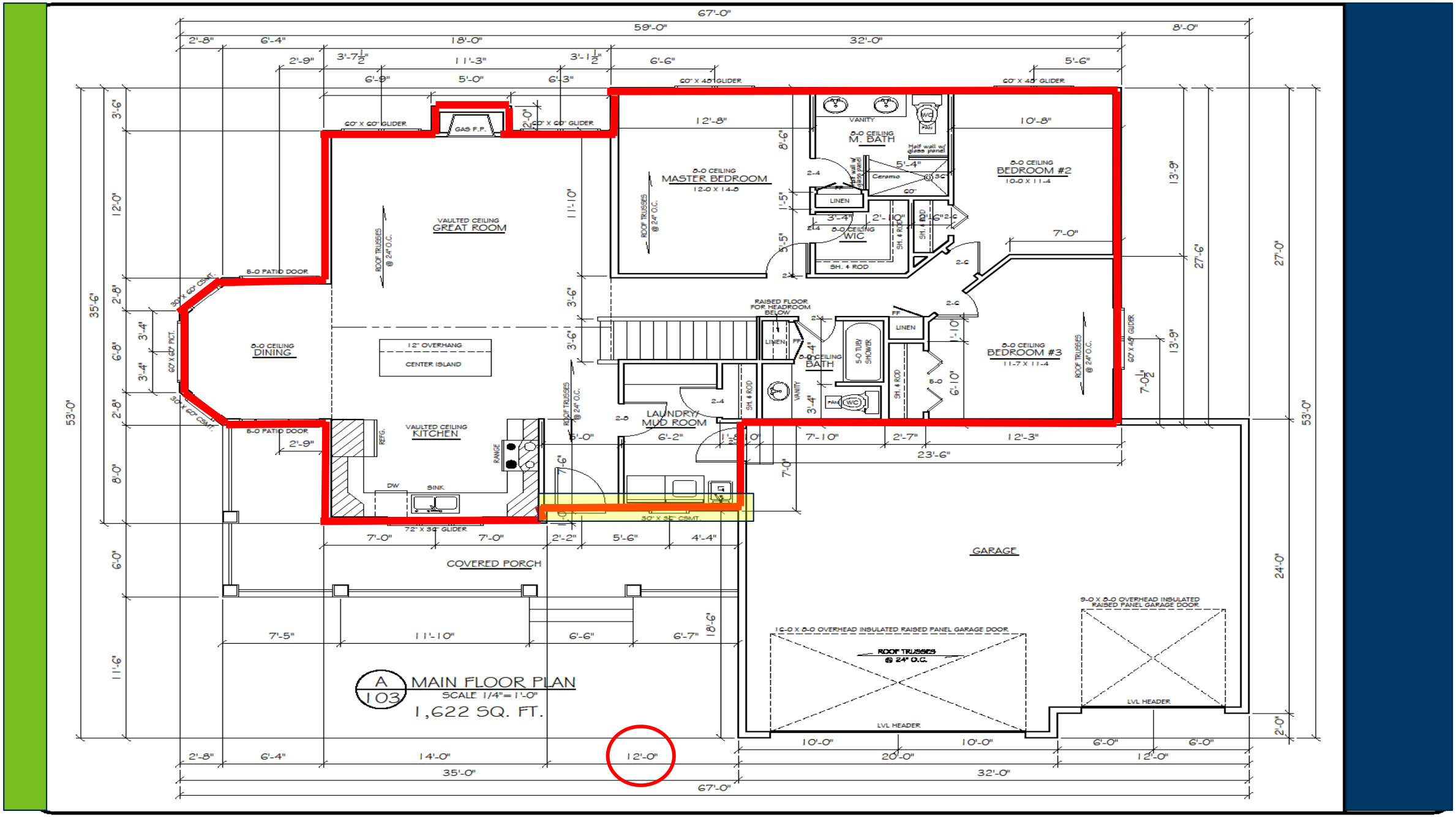
- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 + 27.5 + 23.5 +


67'-0"
59'-0"
8'-0"
2'-8"
6'-4"
18'-0"
32'-0"
2'-9"
3'-7½"
11'-3"
3'-1½"
6'-6"
5'-6"
6'-9"
5'-0"
6'-3"
6'-0" X 4'-0" GLIDER
6'-0" X 4'-0" GLIDER
6'-0" X 6'-0" GLIDER
6'-0" X 6'-0" GLIDER
GAS F.P.
2'-0"
12'-8"
10'-8"
8'-6"
5'-0" CEILING
M. BATH
VANITY
WC
PAN
Half wall w/ glass panel
5'-4"
Ceramic
SC
CO"
LINEN
3'-4"
2'-10½"
5'-0" CEILING
WIC
SH. 4 ROD
2'-6"
5'-0" CEILING
MASTER BEDROOM
12'-0 X 14'-5
ROOF TRUSSES @ 24" O.C.
5'-5"
5'-1"
5'-0" CEILING
BEDROOM #2
10'-0 X 11'-4
13'-9"
27'-6"
7'-0"
VAULTED CEILING
GREAT ROOM
11'-10"
3'-6"
8'-0" PATIO DOOR
30" X 60" CSMT.
60" X 60" PICT.
3'-4"
6'-8"
35'-6"
2'-8"
RAISED FLOOR FOR HEADROOM BELOW
FF
LINEN
5'-0" CEILING
DINING
12" OVERHANG
CENTER ISLAND
5'-0" CEILING
BATH
5'-0 TUB SHOWER
1'-10"
6'-10"
5'-0" CEILING
BEDROOM #3
11'-7 X 11'-4
60" X 48" GLIDER
7'-0½"
13'-9"
ROOF TRUSSES @ 24" O.C.
8'-0"
2'-8"
53'-0"
8'-0" PATIO DOOR
2'-9"
REFG.
VAULTED CEILING
KITCHEN
RANGE
DW
SINK
72" X 36" GLIDER
LAUNDRY/ MUD ROOM
6'-2"
5'-0"
7'-6"
7'-10"
2'-7"
12'-3"
23'-6"
7'-0"
30" X 36" CSMT.
7'-0"
7'-0"
2'-2"
5'-6"
4'-4"
GARAGE
COVERED PORCH
6'-0"
9'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
16'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
ROOF TRUSSES @ 24" O.C.
LVL HEADER
LVL HEADER
7'-5"
11'-10"
6'-6"
6'-7"
18'-6"
11'-6"
24'-0"
2'-0"
10'-0"
10'-0"
6'-0"
6'-0"
20'-0"
12'-0"
2'-8"
6'-4"
14'-0"
12'-0"
35'-0"
32'-0"
67'-0"
A 103
MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.

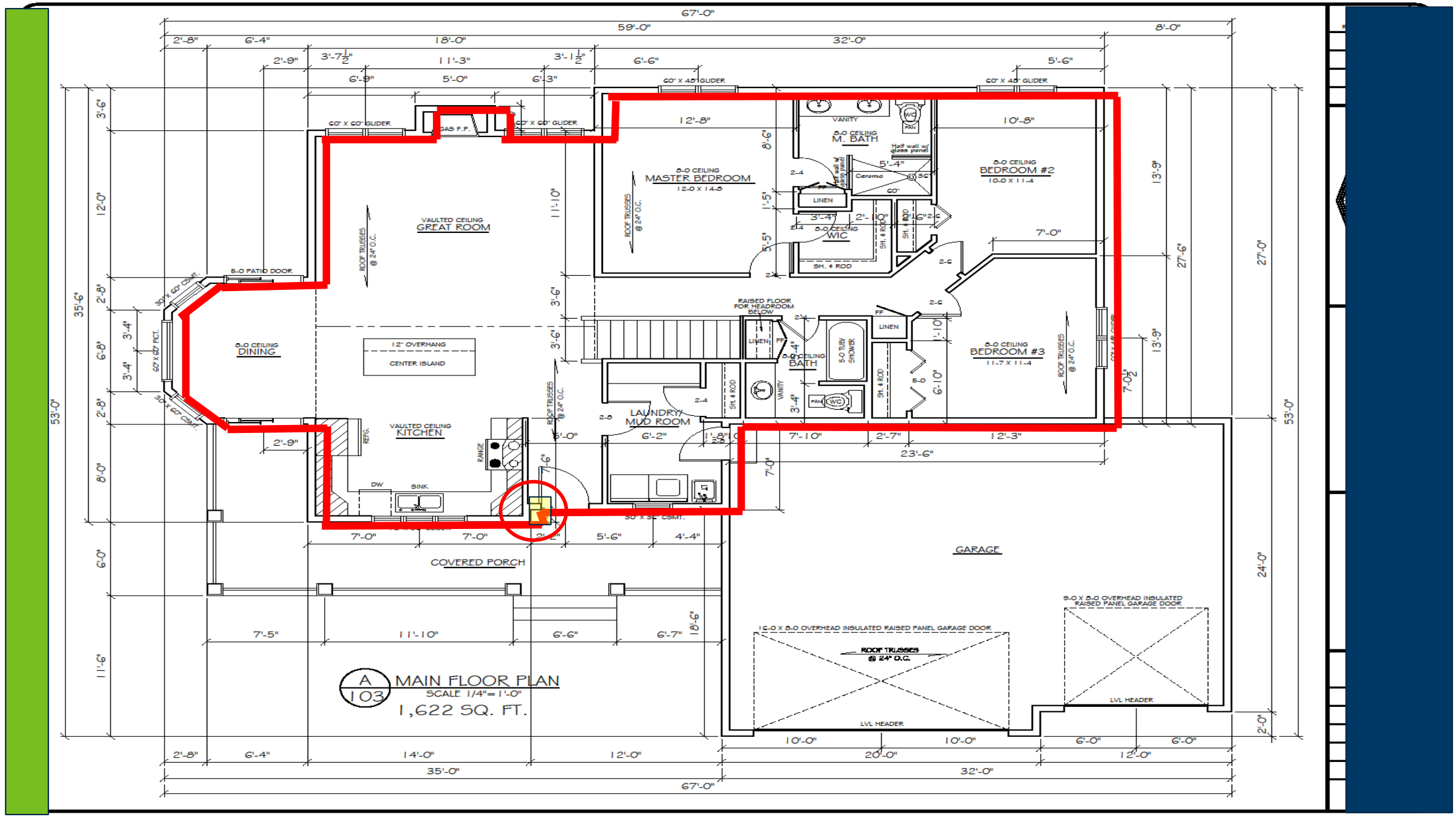
- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 + 27.5 + 23.5 + 7 +


VAULTED CEILING
GREAT ROOM
8'-0" PATIO DOOR
30" X 60" CSMT.
60" X 60" PICT.
8'-0" CEILING
DINING
12" OVERHANG
CENTER ISLAND
VAULTED CEILING
KITCHEN
REFG.
RANGE
DW
SINK
72" X 36" GLIDER
COVERED PORCH
GAS F.P.
60" X 60" GLIDER
8'-0" CEILING
MASTER BEDROOM
12'-0" X 14'-5"
ROOF TRUSSES @ 24" O.C.
RAISED FLOOR FOR HEADROOM BELOW
LAUNDRY/ MUD ROOM
8'-0" CEILING
M. BATH
VANITY
Half wall w/ glass panel
Ceramic
LINEN
SH. & ROD
8'-0" CEILING
WIC
60" X 48" GLIDER
8'-0" CEILING
BEDROOM #2
10'-0" X 11'-4"
8'-0" CEILING
BATH
5'-0 TUB SHOWER
8'-0" CEILING
BEDROOM #3
11'-7 X 11'-4"
30" X 36" CSMT.
GARAGE
16'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
9'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
ROOF TRUSSES @ 24" O.C.
LVL HEADER
A 103 MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.
67'-0"
59'-0"
32'-0"
8'-0"
53'-0"
35'-6"
27'-0"
24'-0"

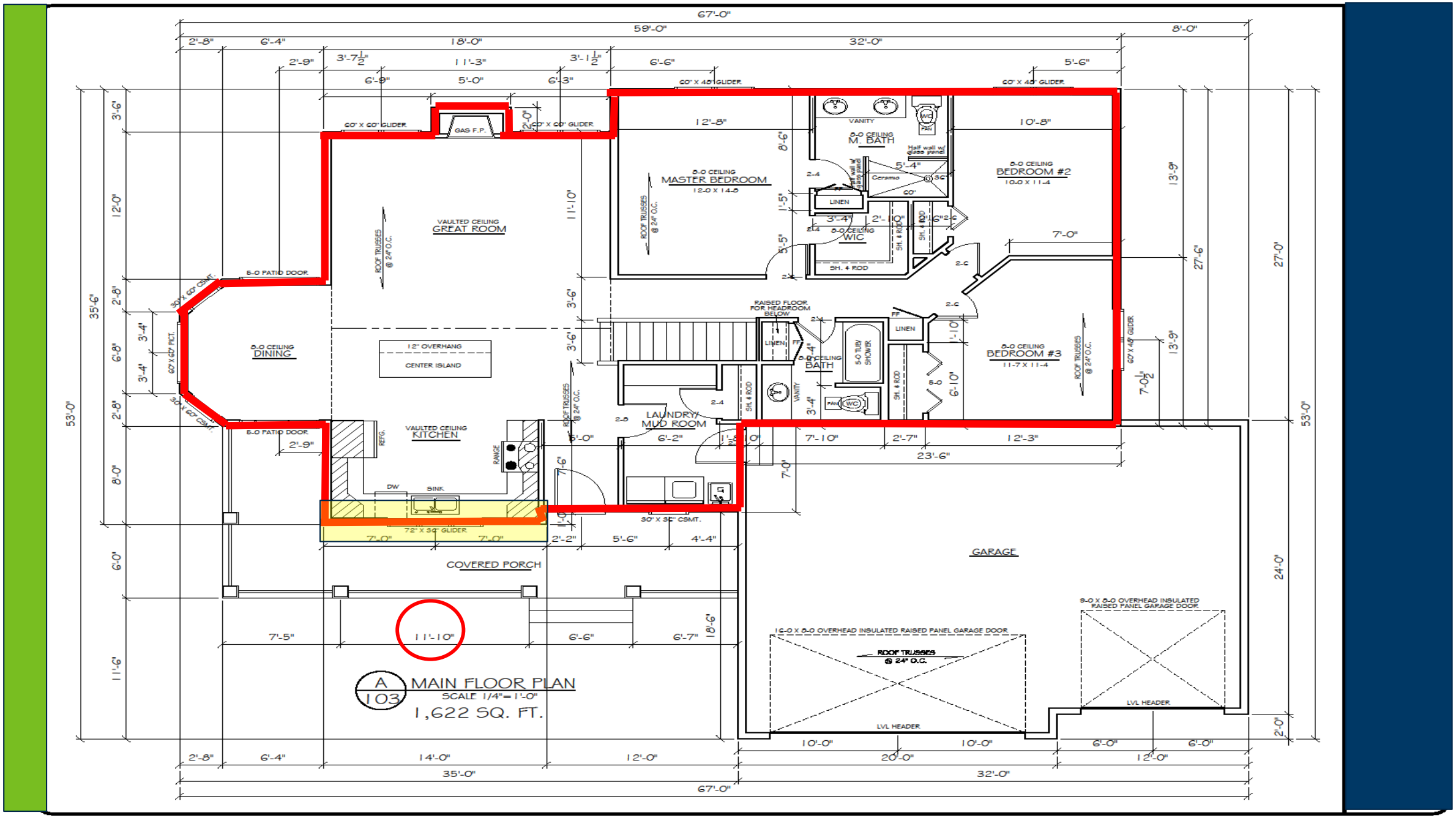
- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 + 27.5 + 23.5 + 7 + 12+


VAULTED CEILING
GREAT ROOM
8'-0 PATIO DOOR
30" X 60" CSMT.
60" X 60" PICT.
8'-0" X 60" CSMT.
8'-0 CEILING
DINING
12" OVERHANG
CENTER ISLAND
VAULTED CEILING
KITCHEN
REFG.
RANGE
DW
SINK
ROOF TRUSSES @ 24" O.C.
GAS F.P.
60" X 60" GLIDER
8'-0 CEILING
MASTER BEDROOM
12-0 X 14-8
8'-0 CEILING
M. BATH
VANITY
Half wall w/ glass panel
Ceramic
LINEN
8'-0 CEILING
WIC
SH. & ROD
RAISED FLOOR FOR HEADROOM BELOW
LAUNDRY/ MUD ROOM
5'-0 TUBE SHOWER
8'-0 CEILING
BATH
8'-0 CEILING
BEDROOM #2
10-0 X 11-4
8'-0 CEILING
BEDROOM #3
11-7 X 11-4
60" X 48" GLIDER
30" X 36" CSMT.
COVERED PORCH
GARAGE
10'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
9'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
ROOF TRUSSES @ 24" O.C.
LVL HEADER
A 103 MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.

- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 + 27.5 + 23.5 + 7 + 12 + 1 +



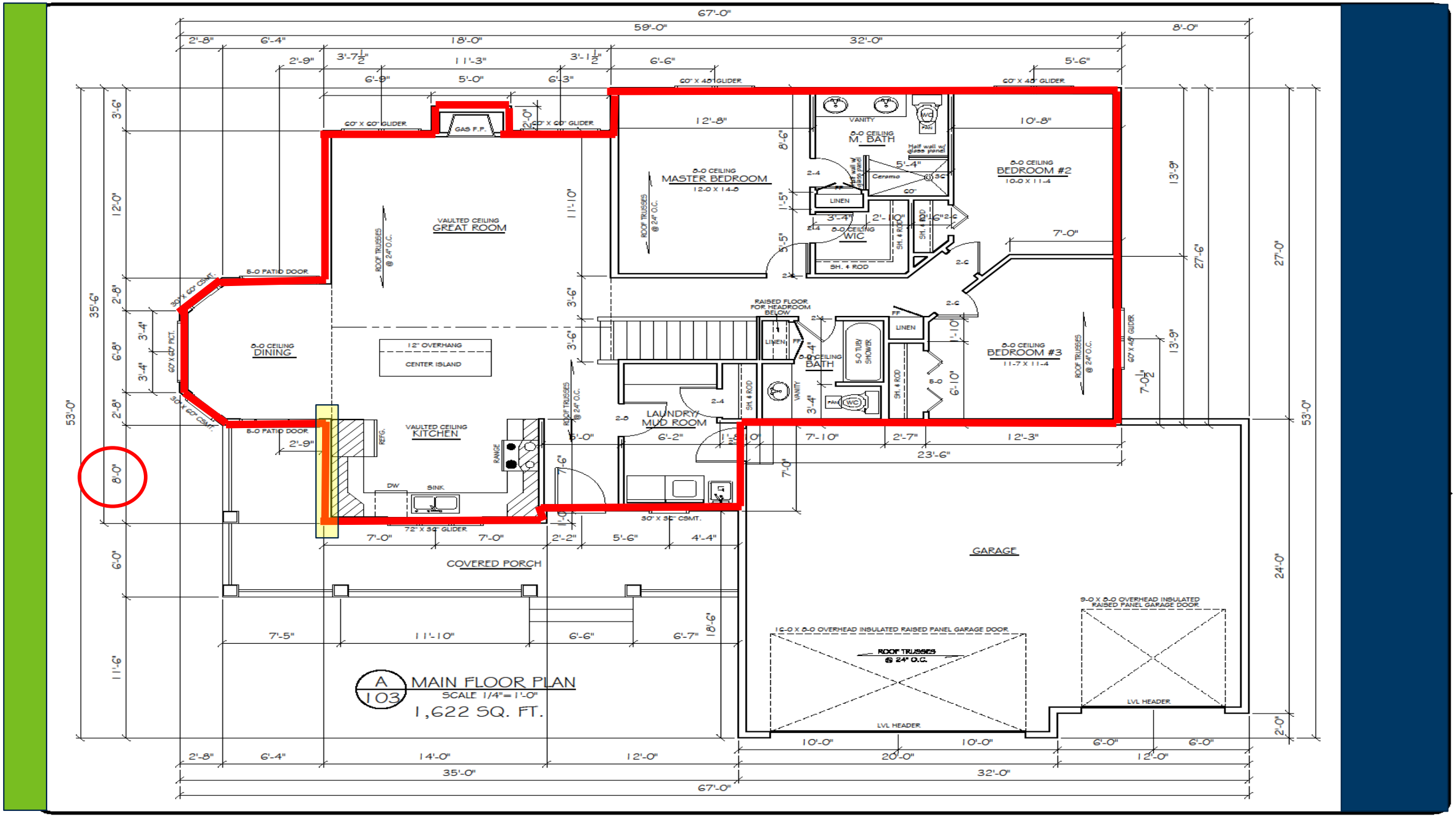
A/103 MAIN FLOOR PLAN

SCALE 1/4"=1'-0"

1,622 SQ. FT.

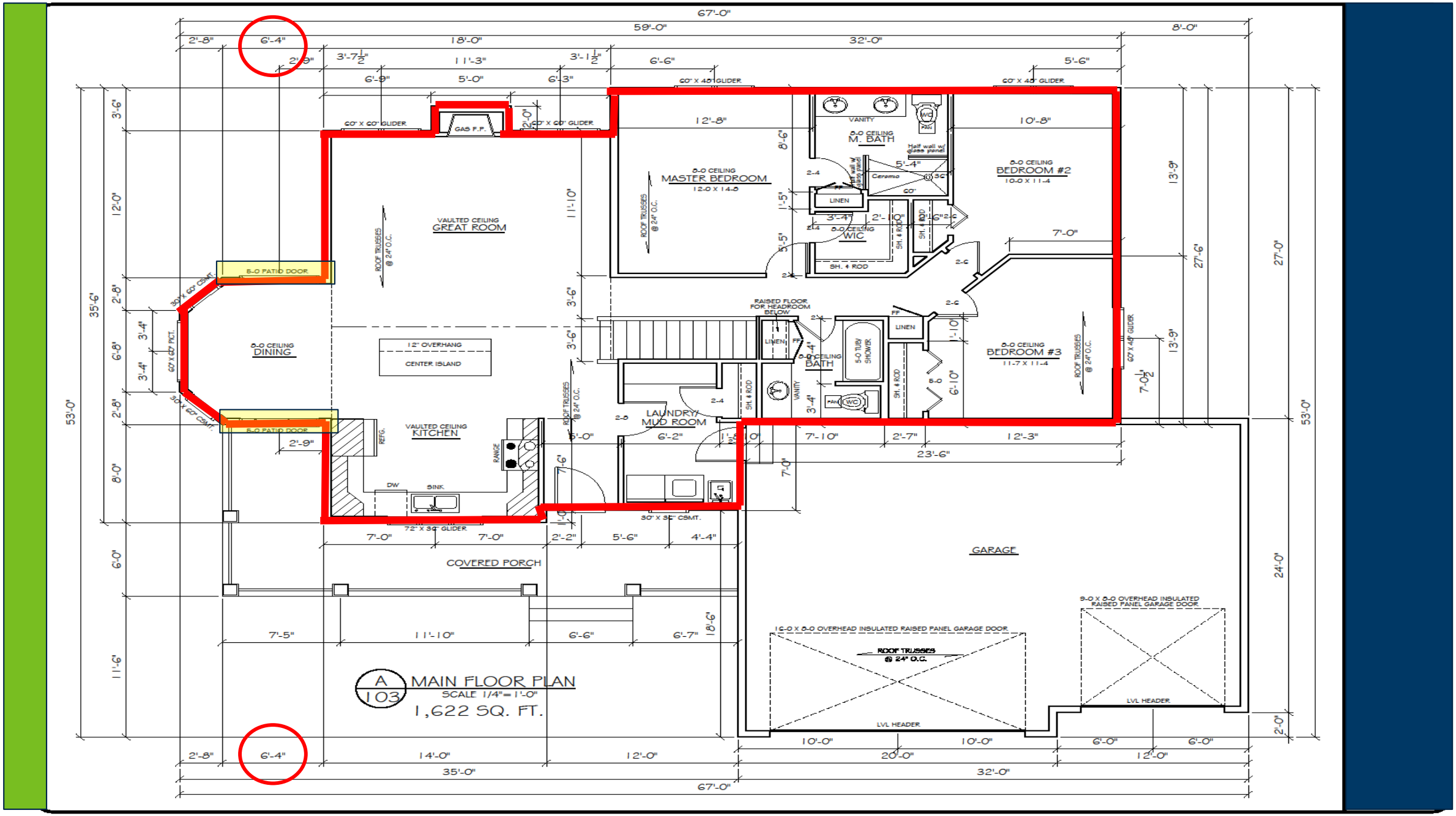
- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 + 27.5 + 23.5 + 7 + 12 + 1 + 11.75


GREAT ROOM
VAULTED CEILING
MASTER BEDROOM
12'-0 X 14-5
M. BATH
WIC
BEDROOM #2
10-0 X 11-4
BEDROOM #3
11-7 X 11-4
BATH
LAUNDRY/ MUD ROOM
DINING
CENTER ISLAND
KITCHEN
COVERED PORCH
GARAGE
8-0 PATIO DOOR
72" X 80" GLIDER
60" X 48" GLIDER
60" X 40" GLIDER
GAS F.P.
RAISED FLOOR FOR HEADROOM BELOW
ROOF TRUSSES @ 24" O.C.
16'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
9'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
LVL HEADER
A 103
MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.

- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

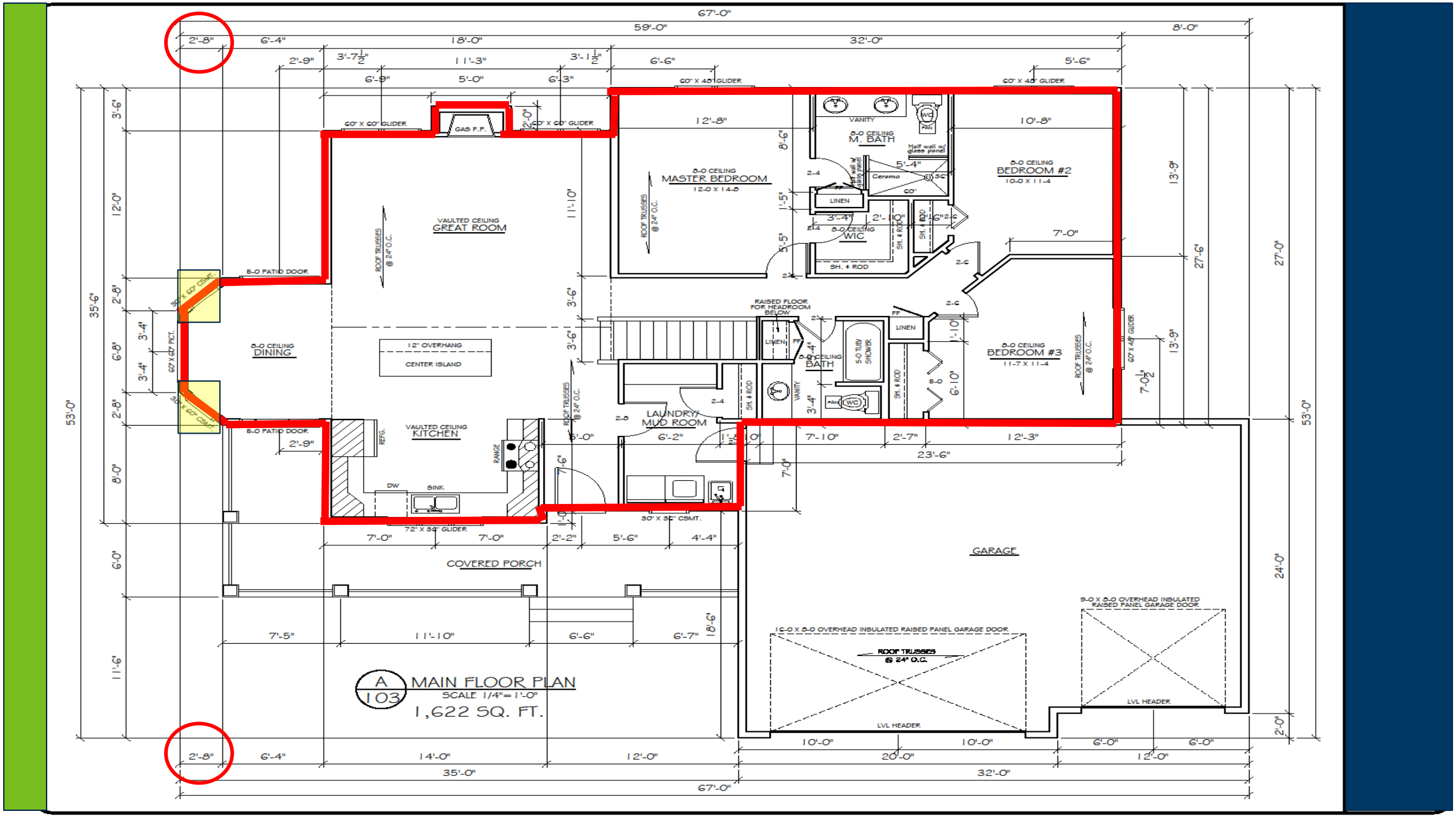
  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 + 27.5 + 23.5 + 7 + 12 + 1 + 11.75 + 8 +



A/103 MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.

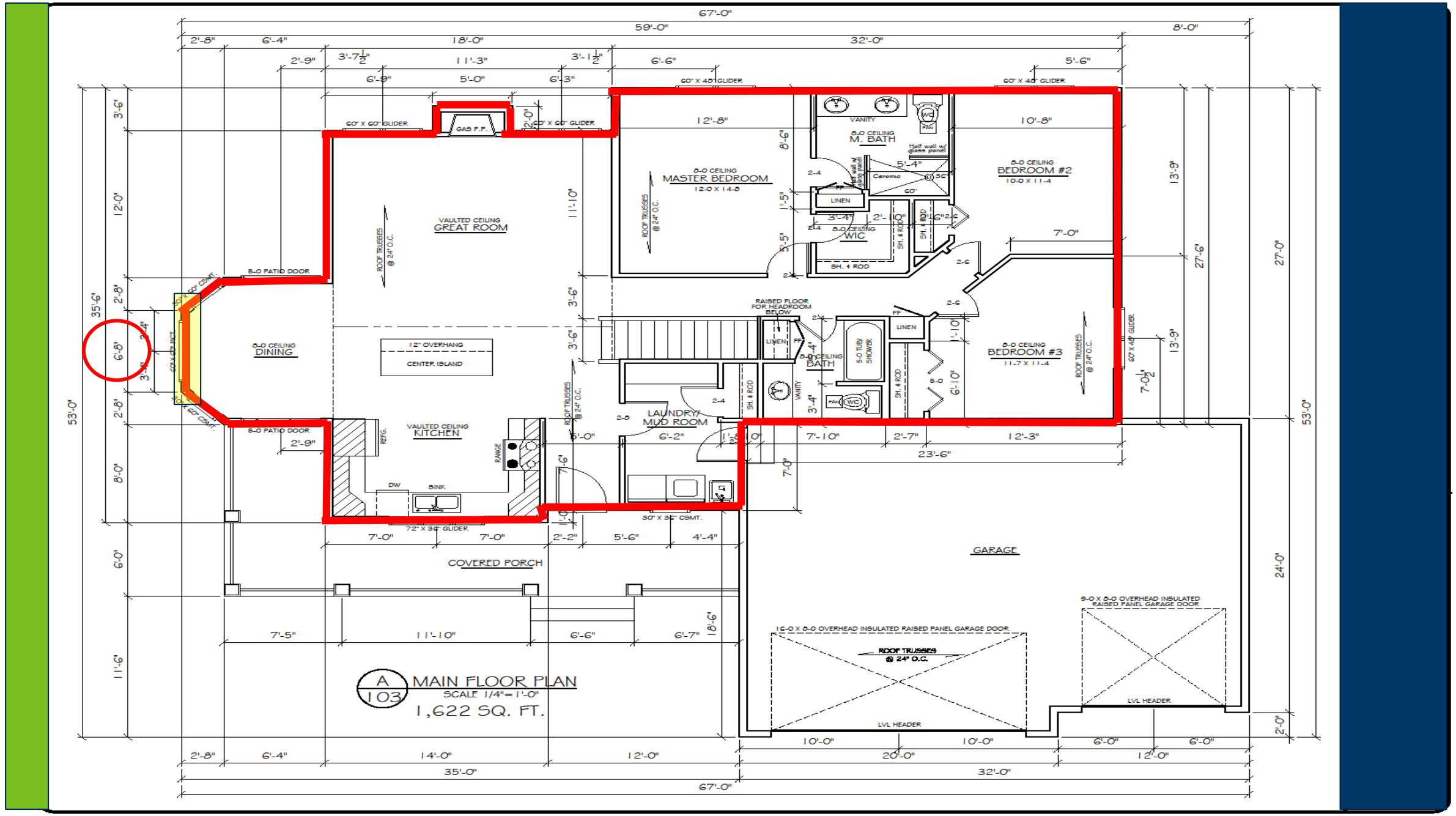
- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 + 27.5 + 23.5 + 7 + 12 + 1 + 11.75 + 8 + 12.5 (6.25 x 2) +


MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.
A 103
VAULTED CEILING GREAT ROOM
8'-0 CEILING DINING
12" OVERHANG
CENTER ISLAND
VAULTED CEILING KITCHEN
REFG.
RANGE
DW
SINK
8'-0 PATIO DOOR
2'-9"
72" X 80" GLIDER
30" X 60" CSMT.
60" X 60" PICT.
COVERED PORCH
GAS F.P.
60" X 60" GLIDER
8'-0 CEILING MASTER BEDROOM
12'-0 X 14'-5
ROOF TRUSSES @ 24" O.C.
8'-0 CEILING M. BATH
VANITY
LINEN
SH. & ROD
WIC
RAISED FLOOR FOR HEADROOM BELOW
LAUNDRY/ MUD ROOM
8'-0 CEILING BATH
5'-0 TUB SHOWER
60" X 48" GLIDER
8'-0 CEILING BEDROOM #2
10'-0 X 11'-4
8'-0 CEILING BEDROOM #3
11'-7 X 11'-4
GARAGE
16'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
9'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
LVL HEADER
67'-0"
59'-0"
32'-0"
8'-0"
53'-0"
35'-6"
27'-0"
24'-0"
23'-6"
20'-0"
35'-0"

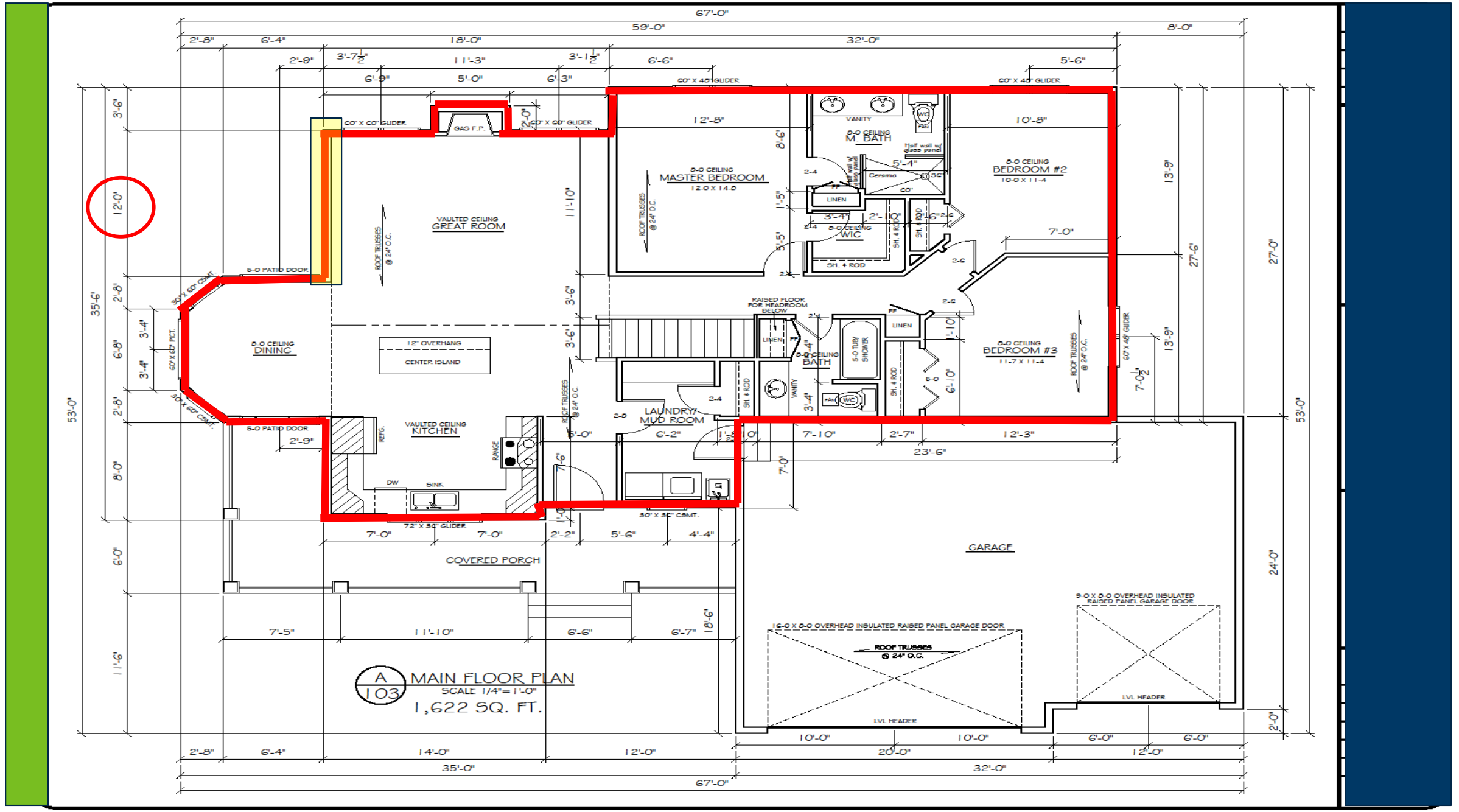
- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 + 27.5 + 23.5 + 7 + 12 + 1 + 11.75 + 8 + 12.5 (6.25 x 2) + 5.5 (2.75 x 2) +


VAULTED CEILING
GREAT ROOM
8'-0 PATIO DOOR
8'-0 CEILING
DINING
12" OVERHANG
CENTER ISLAND
VAULTED CEILING
KITCHEN
REFG.
RANGE
DW
SINK
72" X 96" GLIDER
COVERED PORCH
GAS F.P.
60" X 60" GLIDER
8'-0 CEILING
MASTER BEDROOM
12-0 X 14-5
ROOF TRUSSES @ 24" O.C.
VANITY
8'-0 CEILING
M. BATH
Half wall w/ glass panel
Ceramic
LINEN
SH. & ROD
8'-0 CEILING
WIC
8'-0 CEILING
BEDROOM #2
10-0 X 11-4
RAISED FLOOR FOR HEADROOM BELOW
LAUNDRY/ MUD ROOM
8'-0 CEILING
BATH
5'-0 TUB SHOWER
8'-0 CEILING
BEDROOM #3
11-7 X 11-4
60" X 48" GLIDER
50" X 36" CSMT.
GARAGE
16'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
9'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
LVL HEADER
A 103 MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.

- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 + 27.5 + 23.5 + 7 + 12 + 1 + 11.75 + 8 + 12.5 (6.25 x 2) + 5.5 (2.75 x 2) + 6.75 +


VAULTED CEILING
GREAT ROOM
5-0 CEILING
MASTER BEDROOM
12-0 X 14-5
5-0 CEILING
M. BATH
5-0 CEILING
BEDROOM #2
10-0 X 11-4
5-0 CEILING
WIC
5-0 CEILING
DINING
12" OVERHANG
CENTER ISLAND
VAULTED CEILING
KITCHEN
LAUNDRY/
MUD ROOM
5-0 CEILING
BATH
5-0 CEILING
BEDROOM #3
11-7 X 11-4
COVERED PORCH
GARAGE
8-0 PATIO DOOR
GAS F.P.
ROOF TRUSSES
@ 24" O.C.
RAISED FLOOR
FOR HEADROOM
BELOW
LVL HEADER
16'-0 X 8'-0 OVERHEAD INSULATED RAISED PANEL GARAGE DOOR
9'-0 X 8'-0 OVERHEAD INSULATED
RAISED PANEL GARAGE DOOR
A
103
MAIN FLOOR PLAN
SCALE 1/4"=1'-0"
1,622 SQ. FT.

- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 + 27.5 + 23.5 + 7 + 12 + 1 + 11.75 + 8 + 12.5 (6.25 x 2) + 5.5 (2.75 x 2) + 6.75 + 12 = <u>191.25 Lin Ft</u>

- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 + 27.5 + 23.5 + 7 + 12 + 1 + 11.75 + 8 + 12.5 (6.25 x 2) + 5.5 (2.75 x 2) + 6.75 + 12 = 191.25 Lin Ft

  191.25 x 8 = 1530 Sq. Ft of Area

- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor) and a delta T of 90**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 + 27.5 + 23.5 + 7 + 12 + 1 + 11.75 + 8 + 12.5 (6.25 x 2) + 5.5 (2.75 x 2) + 6.75 + 12 = 191.25 Lin Ft

  191.25 x 8 = 1530 Sq. Ft of Area

  Q = UA (delta T) Do the Math on this one

- **Main Floor Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  6.75 + 11.25 + 6.25 + 4 (2 x 2) + 3.5 + 32 + 27.5 + 23.5 + 7 + 12 + 1 + 11.75 + 8 + 12.5 (6.25 x 2) + 5.5 (2.75 x 2) + 6.75 + 12 = 191.25 Lin Ft

  191.25 x 8 = 1530 Sq. Ft of Area

  Q = UA (delta T)

  Q = .0476 x 1530 x 90 = (6554.52 Btu's Per hour) Rounded up to 6555 Btu's of Heat Loss per hour

  Make a note of it.

Running total of Btu's of Heat Loss for Our Home

• Ceiling Area	=	2994 Btu's of Heat loss
• Ceiling Vaulted Area Side Walls	=	686 Btu's of Heat Loss
• Main Floor Exterior Walls	=	6555 Btu's of Heat Loss

Basement wall -Knee Walls

Basement wall -Knee Walls

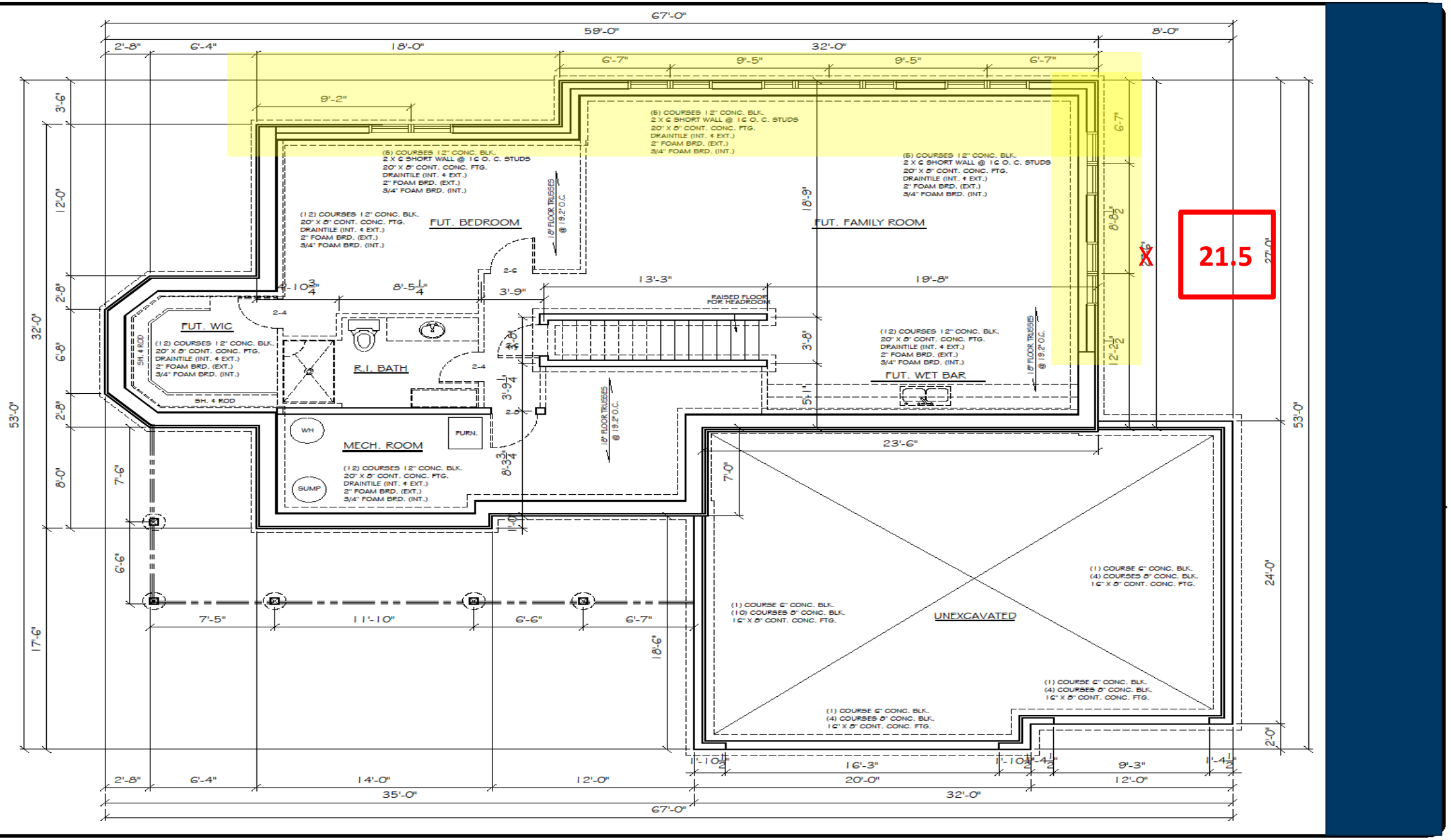
Your Turn - Calculate the Framing wall for the Homes Knee walls.

Assume The Following

-Total Wall Height of 4.5 Feet

-R Value of 21

-Knee wall behind Garage = 21.5 Ft. Long


67'-0"
59'-0"
8'-0"
2'-8"
6'-4"
18'-0"
32'-0"
6'-7"
9'-5"
9'-5"
6'-7"
9'-2"
(6) COURSES 12" CONC. BLK.
2 X 6 SHORT WALL @ 16 O. C. STUDS
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
(12) COURSES 12" CONC. BLK.
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
FUT. BEDROOM
FUT. FAMILY ROOM
18" FLOOR TRUSSES @ 19.2" O.C.
FUT. WIC
SH. & ROD
R.I. BATH
MECH. ROOM
WH
FURN.
SUMP
RAISED FLOOR FOR HEADROOM
FUT. WET BAR
13'-3"
19'-8"
4'-10 3/4"
8'-5 1/4"
3'-9"
5'-11"
23'-6"
7'-0"
UNEXCAVATED
(1) COURSE 6" CONC. BLK.
(10) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
(1) COURSE 6" CONC. BLK.
(4) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
7'-5"
11'-10"
6'-6"
6'-7"
16'-3"
20'-0"
9'-3"
12'-0"
14'-0"
35'-0"
32'-0"
53'-0"
32'-0"
17'-6"
12'-0"
3'-6"
2'-8"
6'-8"
2'-8"
8'-0"
7'-6"
6'-6"
18'-6"
24'-0"
2'-0"
X
21.5

- **Basement wall -Knee Walls with a R Value of R 21 (Or 1/21 = .0476 U-factor)**

  18 + 3.5+ 32 + 21.5 = 75 Lin Ft

  75 x 4.5 = 337.5 Sq. Ft of Area

  Q = UA (delta T)

  Q = .0476 x 337.5 x 90 = (1445.85) Rounded Up to 1446 Btu's of heat loss per hour

  Make a Note of it- We will need it later

Running total of Btu's of Heat Loss for Our Home

• Ceiling Area	=	2994 Btu's of Heat loss
• Ceiling Vaulted Area Side Walls	=	686 Btu's of Heat Loss
• Main Floor Exterior Walls	=	6555 Btu's of Heat Loss
• Basement Knee walls	=	1446 Btu's of Heat Loss

Foundation Walls

First of all do you have everything on the plans?

4 Pages of the Plans

Foundation Page

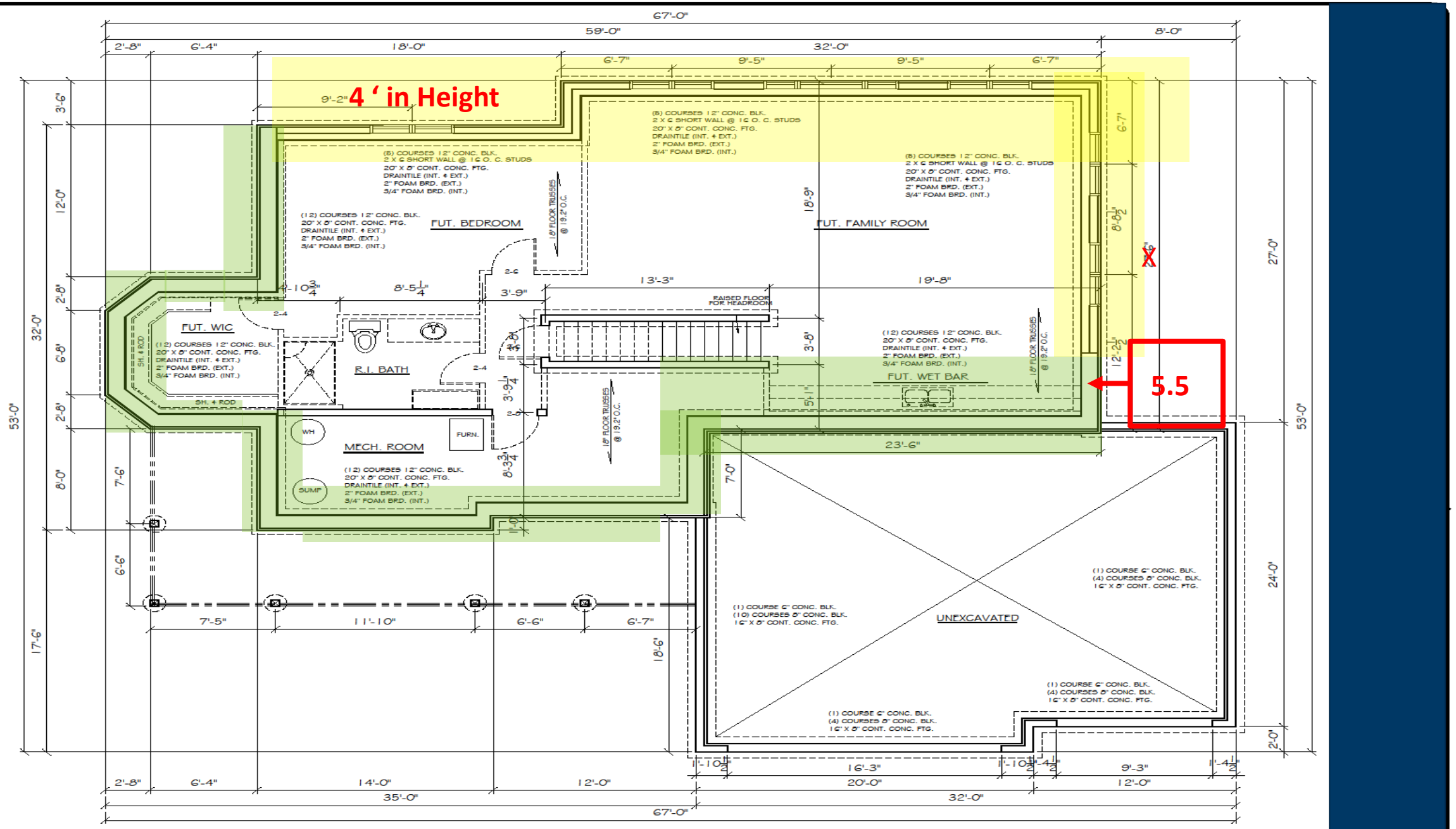
Where is the Building Envelope

What does it consist of Wood Framed- Masonry Etc..

Foundation Walls

- **Assume the Following:**
  - Foundation wall is insulated on the Exterior with a R Value Of 15
  - There is no Interior insulation installed
  - T1 (outside temperature) = -20 Degrees F at top of foundation wall and 50 Degrees F at bottom of Foundation wall (or an Average of 35 Degrees F) for a (delta T of 55)
  - “Tip #1 ” Don’t forget the 5.5 Lin. Ft of wall behind the Garage
  - “Tip #2 “ Some walls are 8 ft in height and others are 4 ft. in height

Calculate all the foundation walls Remember Q = UA (deltaT)


4 ' in Height
5.5
X
FUT. BEDROOM
FUT. FAMILY ROOM
FUT. WIC
R.I. BATH
MECH. ROOM
FUT. WET BAR
UNEXCAVATED
RAISED FLOOR FOR HEADROOM
18" FLOOR TRUSSES @ 19.2" O.C.
SH. 4 ROD
WH
FURN.
SUMP
67'-0"
59'-0"
8'-0"
32'-0"
27'-0"
53'-0"
24'-0"
17'-6"
23'-6"
19'-8"
13'-3"
8'-5 1/4"
3'-9"
11'-10"
7'-5"
6'-6"
6'-7"
14'-0"
12'-0"
35'-0"
20'-0"
16'-3"
9'-3"

- **4’ Tall Basement wall - Walls with a R Value of R 15 (Or 1/15 = .0666 U-factor)**

  18 + 3.5+ 32 + 21.5 = 75 Lin Ft

  75 x 4.0 = 300 Sq. Ft of Area

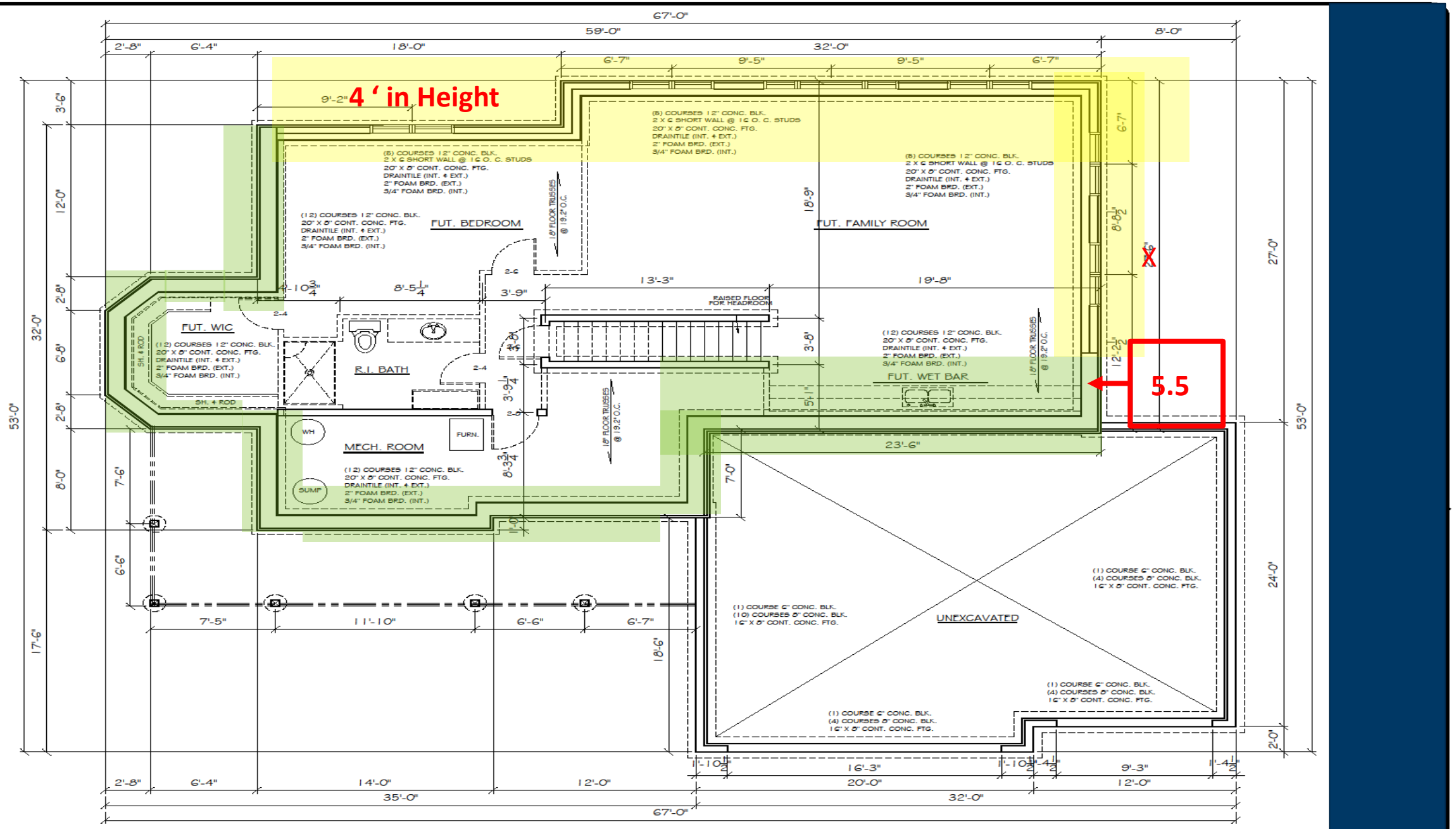
  Q = UA (delta T)

  Q = .0666 x 300 x 55 = (1098.90) Rounded Up to 1099 Btu’s of heat loss per hour

  Make a Note of it

Running total of Btu's of Heat Loss for Our Home

• Ceiling Area	=	2994 Btu's of Heat loss
• Ceiling Vaulted Area Side Walls	=	686 Btu's of Heat Loss
• Main Floor Exterior Walls	=	6555 Btu's of Heat Loss
• Basement Knee walls	=	1446 Btu's of Heat Loss
• 4' Foundation Walls	=	1099 Btu's of Heat Loss


4 ' in Height
5.5
X
FUT. BEDROOM
FUT. FAMILY ROOM
FUT. WIC
R.I. BATH
MECH. ROOM
FUT. WET BAR
UNEXCAVATED
RAISED FLOOR FOR HEADROOM
18" FLOOR TRUSSES @ 19.2" O.C.
SH. 4 ROD
WH
FURN.
SUMP
67'-0"
59'-0"
8'-0"
32'-0"
27'-0"
53'-0"
24'-0"
17'-6"
23'-6"
19'-8"
13'-3"
8'-5 1/4"
3'-9"
11'-10"
7'-5"
6'-6"
6'-7"
14'-0"
12'-0"
35'-0"
20'-0"
16'-3"
9'-3"

- **8’ Tall Basement wall - Walls with a R Value of R 15 (Or 1/15 = .0666 U-factor)**

  5.5 + 23.5 + 7 + 12 + 1 + 12 + 7.5 + 2.75 + 6.75 + 2.75 + 6.25 + 12 = 99 Lin Ft

  99 x 8.0 = 792 Sq. Ft of Area

  Q = UA (delta T)

  Q = .0666 x 792 x 55 = (2901.09) Rounded Up to 2902 Btu’s of heat loss per hour

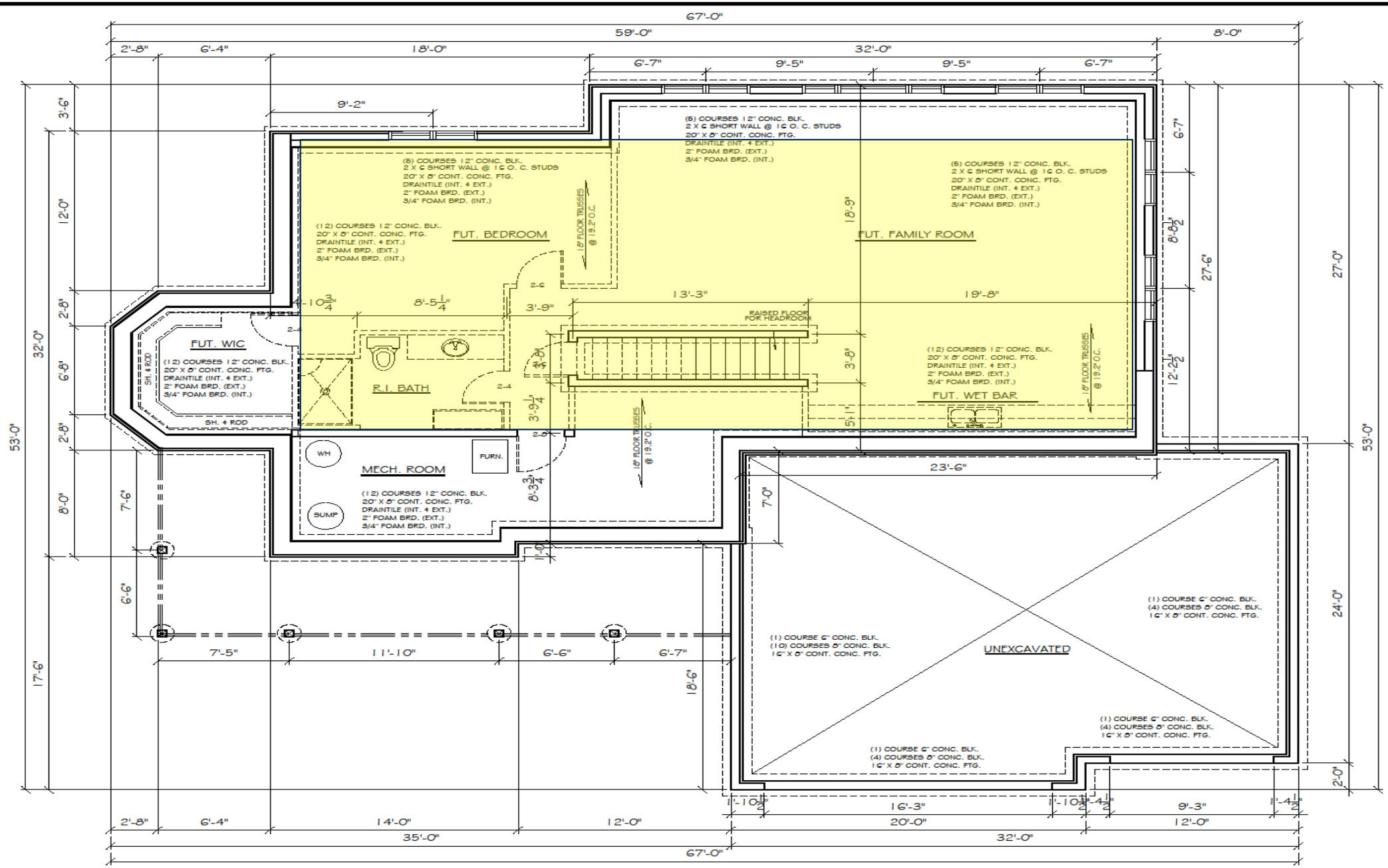
  Make a Note of it

Running total of Btu's of Heat Loss for Our Home

• Ceiling Area	=	2994 Btu's of Heat loss
• Ceiling Vaulted Area Side Walls	=	686 Btu's of Heat Loss
• Main Floor Exterior Walls	=	6555 Btu's of Heat Loss
• Basement Knee walls	=	1446 Btu's of Heat Loss
• 4' Foundation Walls	=	1099 Btu's of Heat Loss
• 8' Foundation Walls	=	2,902 Btu's of Heat Loss

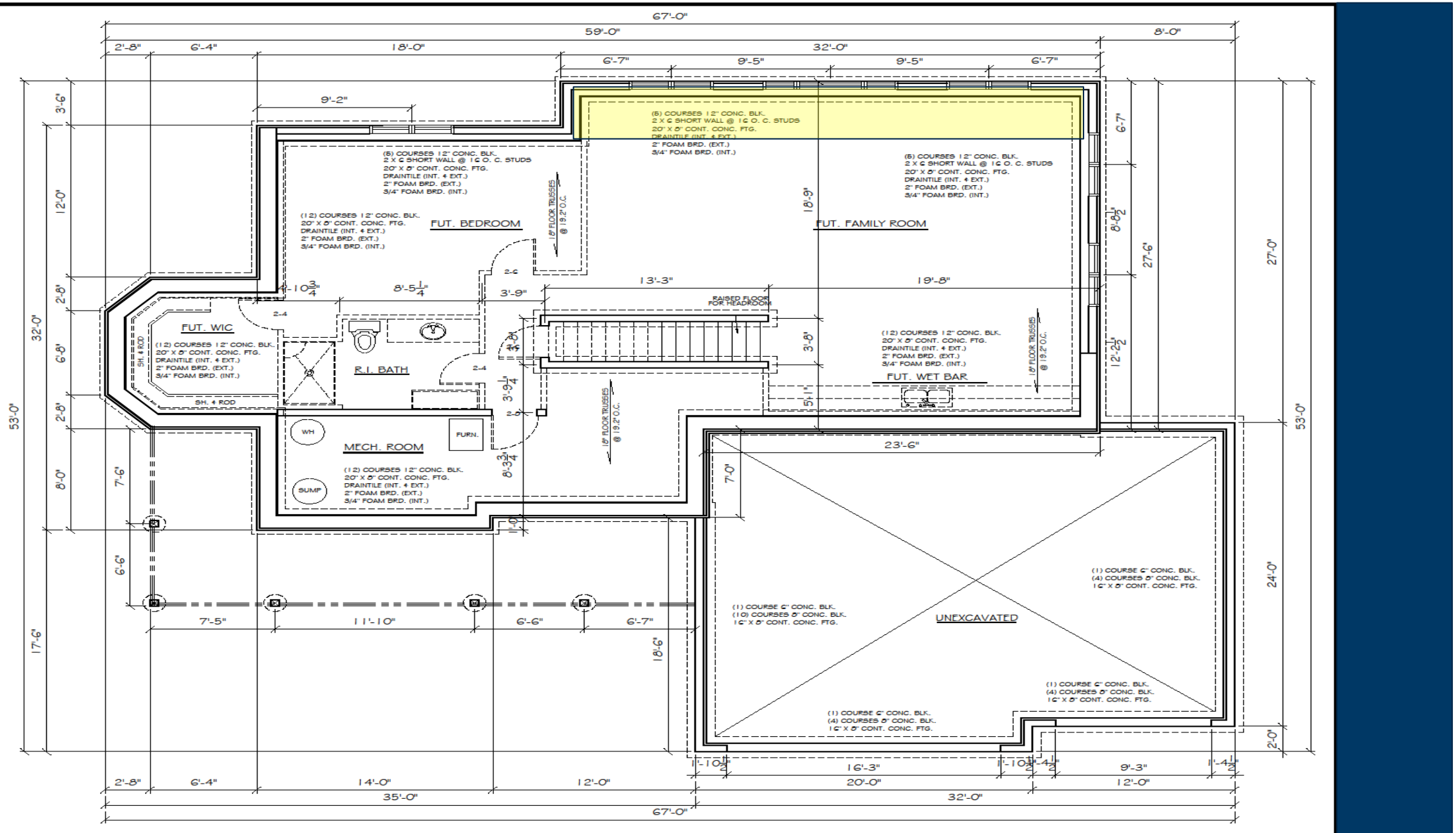
Using the Q = UA (delta T) Method

- **Basement Floor Heat Loss**


FUT. BEDROOM
FUT. FAMILY ROOM
FUT. WIC
R.I. BATH
FUT. WET BAR
MECH. ROOM
WH
FURN.
SUMP
UNEXCAVATED
SH. & ROD
RAISED FLOOR FOR HEADROOM
18" FLOOR TRUSSES @ 19.2" O.C.
(5) COURSES 12" CONC. BLK.
2 X 6 SHORT WALL @ 16 O. C. STUDS
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
(12) COURSES 12" CONC. BLK.
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
(1) COURSE 6" CONC. BLK.
(10) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
(1) COURSE 6" CONC. BLK.
(4) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
67'-0"
59'-0"
8'-0"
2'-8"
6'-4"
18'-0"
32'-0"
6'-7"
9'-5"
9'-5"
6'-7"
9'-2"
3'-6"
12'-0"
2'-8"
6'-8"
2'-8"
8'-0"
32'-0"
53'-0"
7'-6"
6'-6"
17'-6"
18'-9"
6'-7"
8'-6 1/2"
27'-6"
27'-0"
53'-0"
13'-3"
19'-8"
3'-9"
3'-8"
5'-1"
12'-2 1/2"
10 3/4"
8'-5 1/4"
4'-8"
3'-9 1/4"
8'-3 3/4"
23'-6"
7'-0"
24'-0"
2'-0"
7'-5"
11'-10"
6'-6"
6'-7"
18'-6"
1'-10 1/2"
16'-3"
1'-10 1/2"
1'-4 1/2"
9'-3"
1'-4 1/2"
20'-0"
12'-0"
2'-8"
6'-4"
14'-0"
12'-0"
35'-0"
32'-0"
67'-0"

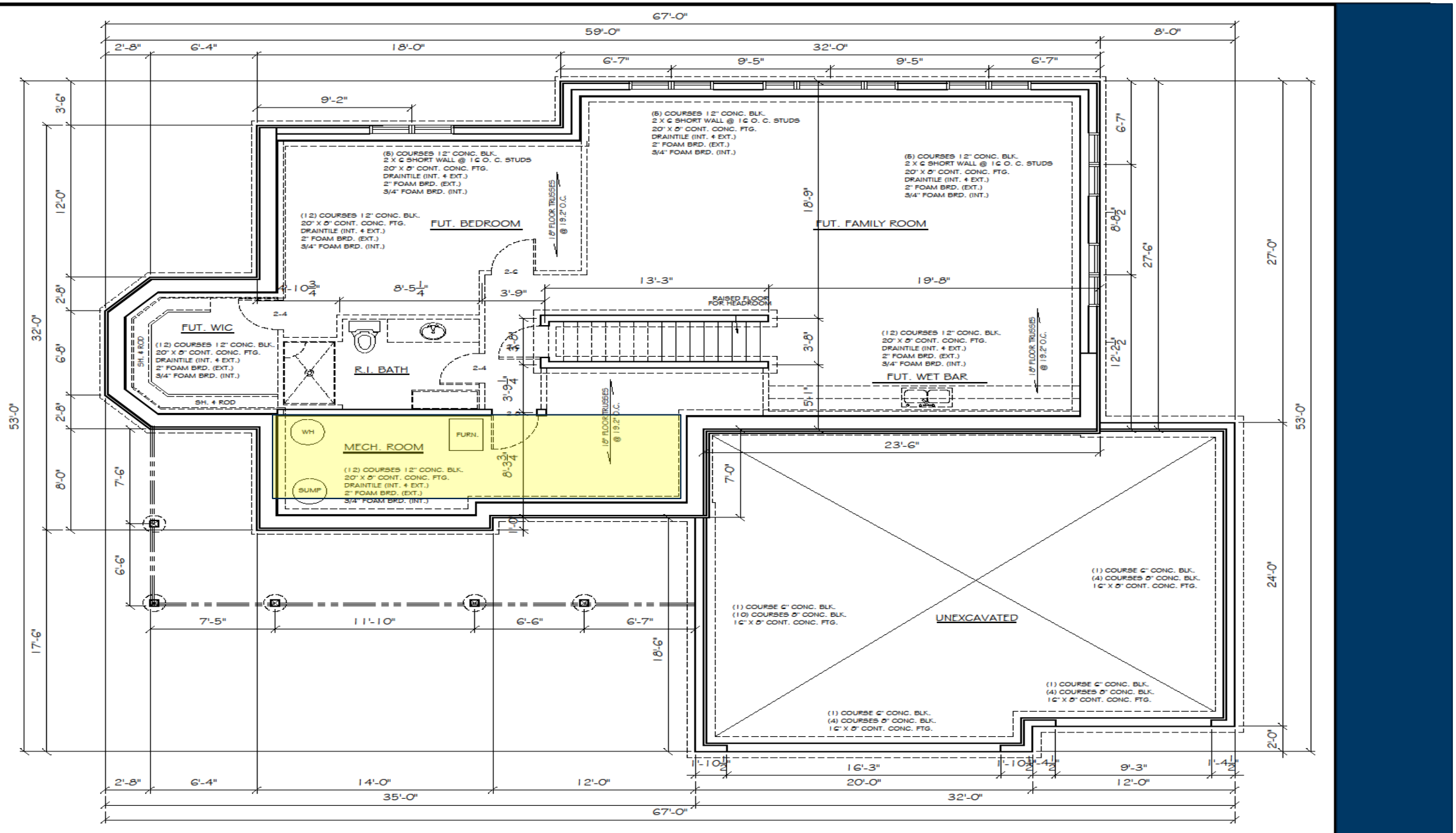
Using the Q = UA (delta T) Method

- **Basement Floor Heat Loss**
  - **24 x 50 = 1200**


67'-0"
59'-0"
8'-0"
2'-8"
6'-4"
18'-0"
32'-0"
6'-7"
9'-5"
9'-5"
6'-7"
9'-2"
3'-6"
12'-0"
2'-8"
6'-8"
2'-8"
8'-0"
32'-0"
53'-0"
17'-6"
7'-6"
6'-6"
(5) COURSES 12" CONC. BLK.
2 X 6 SHORT WALL @ 16 O. C. STUDS
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
(12) COURSES 12" CONC. BLK.
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
FUT. BEDROOM
18" FLOOR TRUSSES @ 19.2" O.C.
FUT. FAMILY ROOM
18'-9"
8'-8½"
27'-6"
27'-0"
53'-0"
FUT. WIC
SH. 4 ROD
R.I. BATH
4'-10¾"
8'-5¼"
3'-9"
13'-3"
19'-8"
RAISED FLOOR FOR HEADROOM
3'-8"
5'-1"
FUT. WET BAR
12'-2½"
WH
FURN.
MECH. ROOM
SUMP
3'-9¼"
8'-3¾"
23'-6"
7'-0"
UNEXCAVATED
(1) COURSE 6" CONC. BLK.
(10) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
(1) COURSE 6" CONC. BLK.
(4) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
18'-6"
24'-0"
2'-0"
7'-5"
11'-10"
6'-6"
6'-7"
1'-10½"
16'-3"
1'-10½"
1'-4½"
9'-3"
1'-4½"
20'-0"
12'-0"
2'-8"
6'-4"
14'-0"
12'-0"
35'-0"
32'-0"
67'-0"

Using the Q = UA (delta T) Method

- **Basement Floor Heat Loss**
  - **24 x 50 = 1200 Sq. Ft**
  - **32 x 3.5 = 112 Sq. Ft**


67'-0"
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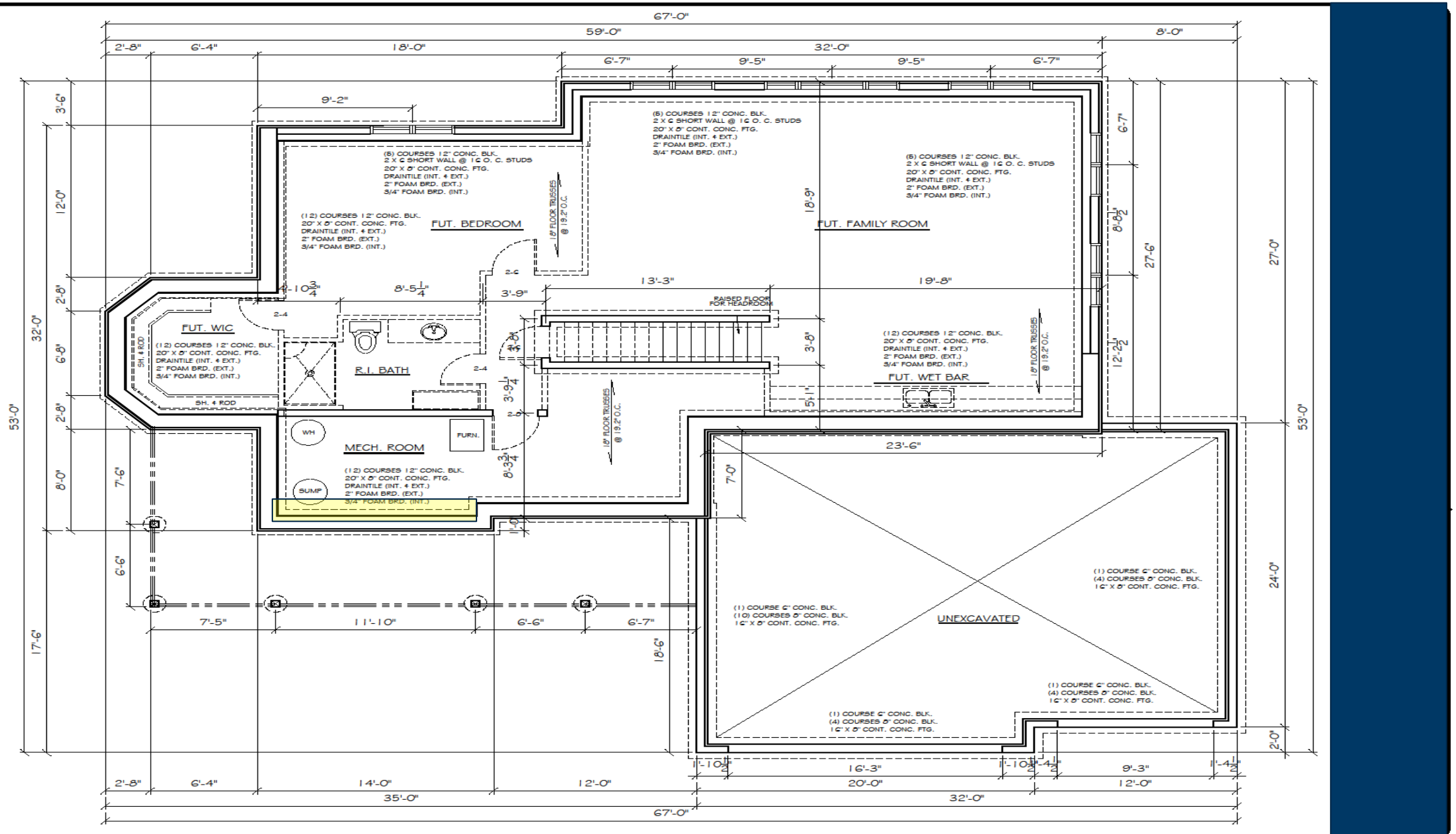
8'-0"
2'-8"
6'-4"
18'-0"
32'-0"
6'-7"
9'-5"
9'-5"
6'-7"
9'-2"
3'-6"
12'-0"
2'-8"
6'-8"
2'-8"
8'-0"
32'-0"
53'-0"
17'-6"
7'-6"
6'-6"
(6) COURSES 12" CONC. BLK.
2 X 6 SHORT WALL @ 16 O. C. STUDS
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
(12) COURSES 12" CONC. BLK.
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
FUT. BEDROOM
18" FLOOR TRUSSES @ 19.2" O.C.
FUT. FAMILY ROOM
18'-9"
8'-8½"
27'-6"
27'-0"
53'-0"
4'-10¾"
8'-5¼"
3'-9"
13'-3"
19'-8"
RAISED FLOOR FOR HEADROOM
FUT. WIC
SH. 4 ROD
R.I. BATH
3'-8"
5'-1"
FUT. WET BAR
12'-2½"
3'-9¼"
WH
FURN.
MECH. ROOM
SUMP
8'-3¾"
1'-0"
23'-6"
7'-0"
24'-0"
UNEXCAVATED
(1) COURSE 6" CONC. BLK.
(10) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
(1) COURSE 6" CONC. BLK.
(4) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
18'-6"
7'-5"
11'-10"
6'-6"
6'-7"
2'-0"
1'-10½"
16'-3"
1'-10½"
1'-4½"
9'-3"
1'-4½"
20'-0"
12'-0"
2'-8"
6'-4"
14'-0"
12'-0"
35'-0"
32'-0"
67'-0"

Using the Q = UA (delta T) Method

- **Basement Floor Heat Loss**
  - **24 x 50 = 1200 Sq. Ft**
  - **32 x 3.5 = 112 Sq. Ft**
  - **7 x 26 = 182 Sq. Ft**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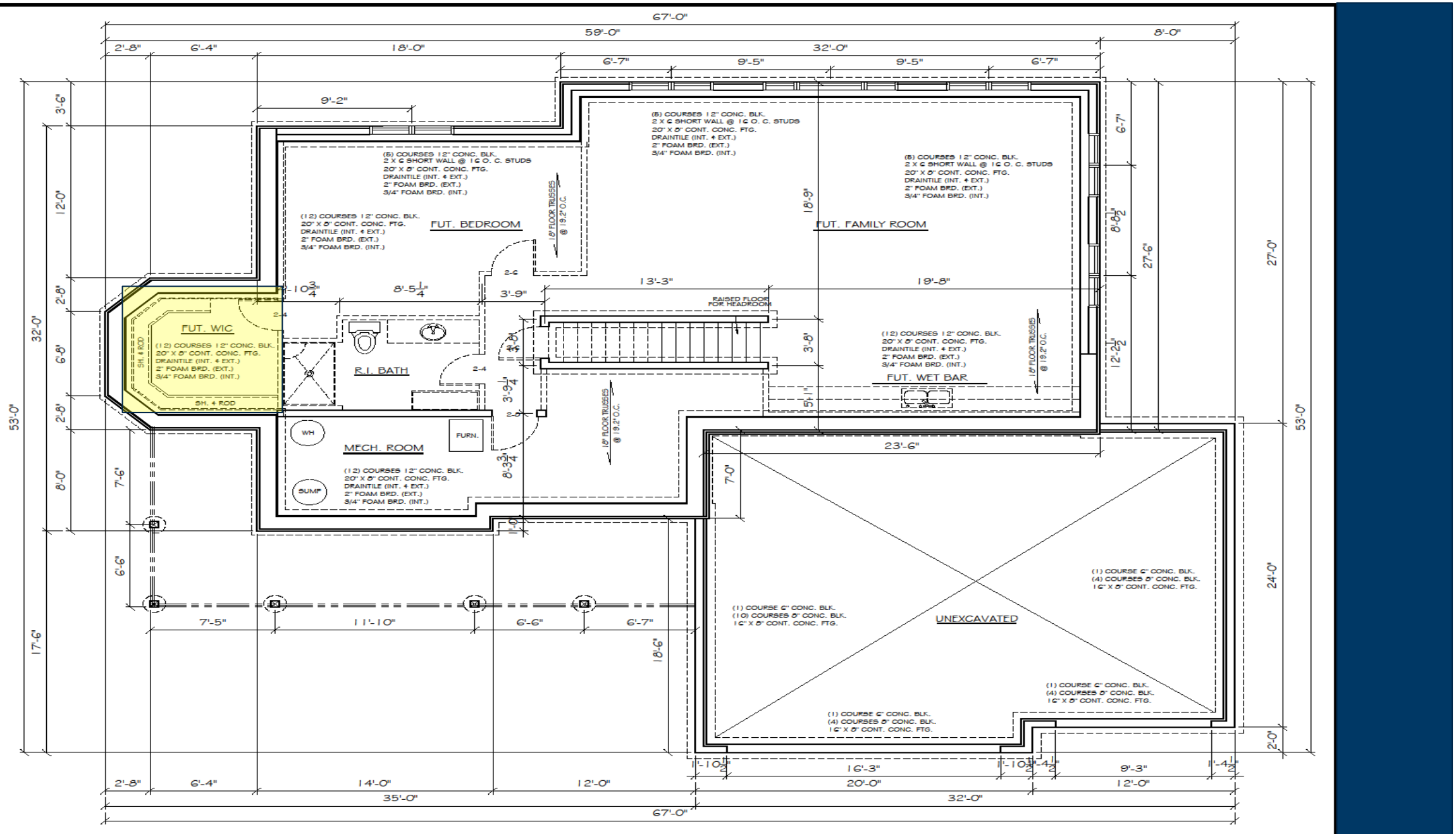
59'-0"
8'-0"
2'-8"
6'-4"
18'-0"
32'-0"
6'-7"
9'-5"
9'-5"
6'-7"
9'-2"
3'-6"
12'-0"
2'-8"
6'-8"
2'-8"
8'-0"
32'-0"
53'-0"
17'-6"
7'-6"
6'-6"
(6) COURSES 12" CONC. BLK.
2 X 6 SHORT WALL @ 16 O. C. STUDS
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
(6) COURSES 12" CONC. BLK.
2 X 6 SHORT WALL @ 16 O. C. STUDS
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
(12) COURSES 12" CONC. BLK.
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
FUT. BEDROOM
18" FLOOR TRUSSES @ 19.2" O.C.
18'-9"
FUT. FAMILY ROOM
6'-7"
8'-8 1/2"
27'-6"
27'-0"
53'-0"
4'-10 3/4"
8'-5 1/4"
3'-9"
13'-3"
19'-8"
RAISED FLOOR FOR HEADROOM
FUT. WIC
SH. 4 ROD
(12) COURSES 12" CONC. BLK.
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
R.I. BATH
3'-9 1/4"
3'-8"
5'-1"
(12) COURSES 12" CONC. BLK.
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
FUT. WET BAR
18" FLOOR TRUSSES @ 19.2" O.C.
12'-2 1/2"
WH
FURN.
MECH. ROOM
SUMP
(12) COURSES 12" CONC. BLK.
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
8'-3 3/4"
1'-0"
23'-6"
7'-0"
(1) COURSE 6" CONC. BLK.
(10) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
UNEXCAVATED
(1) COURSE 6" CONC. BLK.
(4) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
(1) COURSE 6" CONC. BLK.
(4) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
(1) COURSE 6" CONC. BLK.
(4) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
24'-0"
2'-0"
7'-5"
11'-10"
6'-6"
6'-7"
18'-6"
1'-10 1/2"
16'-3"
1'-10 1/2"
1'-4 1/2"
9'-3"
1'-4 1/2"
2'-8"
6'-4"
14'-0"
12'-0"
20'-0"
12'-0"
35'-0"
32'-0"
67'-0"

Using the Q = UA (delta T) Method

- **Basement Floor Heat Loss**
  - **24 x 50 = 1200 Sq. Ft**
  - **32 x 3.5 = 112 Sq. Ft**
  - **7 x 26 = 182 Sq. Ft**
  - **12 x 1 = 12 Sq. Ft**


67'-0"
59'-0"
8'-0"
2'-8"
6'-4"
18'-0"
32'-0"
6'-7"
9'-5"
9'-5"
6'-7"
9'-2"
3'-6"
12'-0"
2'-8"
6'-8"
2'-8"
8'-0"
32'-0"
53'-0"
7'-6"
6'-6"
17'-6"
(6) COURSES 12" CONC. BLK.
2 X 6 SHORT WALL @ 16 O. C. STUDS
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
(12) COURSES 12" CONC. BLK.
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
FUT. BEDROOM
18" FLOOR TRUSSES @ 19.2" O.C.
FUT. FAMILY ROOM
18'-9"
8'-8½"
27'-6"
27'-0"
53'-0"
FUT. WIC
SH. 4 ROD
R.I. BATH
1'-10¾"
8'-5¼"
3'-9"
13'-3"
19'-8"
RAISED FLOOR FOR HEADROOM
3'-8"
5'-1"
FUT. WET BAR
12'-2½"
WH
FURN.
MECH. ROOM
SUMP
3'-9¼"
8'-3¾"
23'-6"
7'-0"
UNEXCAVATED
(1) COURSE 6" CONC. BLK.
(10) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
(1) COURSE 6" CONC. BLK.
(4) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
24'-0"
2'-0"
7'-5"
11'-10"
6'-6"
6'-7"
18'-6"
1'-10½"
16'-3"
1'-10½"
1'-4½"
9'-3"
1'-4½"
2'-8"
6'-4"
14'-0"
12'-0"
20'-0"
12'-0"
35'-0"
32'-0"
67'-0"

Using the Q = UA (delta T) Method

- **Basement Floor Heat Loss**
  - **24 x 50 = 1200 Sq. Ft**
  - **32 x 3.5 = 112 Sq. Ft**
  - **7 x 26 = 182 Sq. Ft**
  - **12 x 1 = 12 Sq. Ft**
  - **9 x 12 = 108 Sq Ft**
    - **1614 Total Sq. Ft of basement Floor Area at a R value of 2 (Concrete is .5 per inch, so 4" x .5 =2)**
    - **Ground Temperature 8 Feet down is approx. 55 degrees**
    - **Interior temperature is 70 degrees What is the heat loss of the Basement Floor? Calculate it out**

Using the Q = UA (delta T) Method

- 1614 Total Sq. Ft of basement Floor Area at a R value of 2 (Concrete is .5 per inch, so 4” x .5 =2)
- So the U factor of the Floor is .50
- Ground Temperature 8 Feet down is approx. 55 degrees
- Interior temperature is 70 degrees What is the heat loss of the Basement Floor?
- The delta T is (70-55) = 15 degrees
- So Q = UA(deltaT)
- Q = .50 x 1614 x 15 or 12,105 Btu’s of Heat Loss

- **Make a note of it**

Running total of Btu's of Heat Loss for Our Home

• Ceiling Area	=	2994 Btu's of Heat loss
• Ceiling Vaulted Area Side Walls	=	686 Btu's of Heat Loss
• Main Floor Exterior Walls	=	6555 Btu's of Heat Loss
• Basement Knee walls	=	1446 Btu's of Heat Loss
• 4' Foundation Walls	=	1099 Btu's of Heat Loss
• 8' Foundation Walls	=	2902 Btu's of Heat Loss
• Basement Floor	=	12,105 Btu's of Heat Loss
• Total Heat loss of building Envelope (not including Windows)	=	27,787 Btu's of Heat loss

Using the Q = UA (delta T) Method

- **Did we forget anything?**

Using the Q = UA (delta T) Method

- **Did we forget anything?**
  - **What about the Floor over a Unconditioned space at the fireplace bump out?**
    And…
  - **What about the Rim Joist area – Which is a 12” tall wall at a R-value of 21 around the entire perimeter?**

  - **You Do the math and Figure these out.**

Using the Q = UA (delta T) Method

- **Floor at Fireplace 2 x 5 = 10 Square foot of area at a R value of R -30 Min per code**
  - **Q = .0476 (1/30) x 10 x 90 = 29.97 Btu's of Heat Loss or Rounding up = 30 Btu's**

- **Rim area of 191.25 Lin. Ft. at a R value of 21 121.25 x 1 = 121.75 Sq. Ft.**
  - **Q = .0476 (1/21) 121.75 x 90 = 521.57 Btu's of Heat loss or rounding up = 522 Btu's**

Running total of Btu's of Heat Loss for Our Home

• Ceiling Area	=	2994 Btu's of Heat loss
• Ceiling Vaulted Area Side Walls	=	686 Btu's of Heat Loss
• Main Floor Exterior Walls	=	6555 Btu's of Heat Loss
• Basement Knee walls	=	1446 Btu's of Heat Loss
• 4' Foundation Walls	=	1099 Btu's of Heat Loss
• 8' Foundation Walls	=	2902 Btu's of Heat Loss
• Basement Floor	=	12,105 Btu's of Heat Loss
• Total Heat loss of building Envelope (not including Windows)	=	27,787 Btu's of Heat loss
• Add 30 for Floor over Unconditioned Space and 522 for rim are of home 27787 + 552 =		28,339 Btu's of Heat loss (So far…)

Windows

Windows

Window or door unit	Sq. Inches	Divided by 144= Sq Ft	U Factor	(dT)	Btu's Heat Loss

Create a very Simple Spread Sheet or take a look at the window Schedule if one is provided

Energy Efficiency of Windows are based on U-factors

NFRC PRODUCT CERTIFICATION PROGRAM

NFRC Label Certificate for Site-Built Products

World's Best Window Co.
Millennium 2000+
Vinyl-Clad Wood Frame
Double Glazing • Argon Fill • Low E
Product Type: Vertical Slider

ENERGY PERFORMANCE RATINGS

U-Factor (U.S./I-P)	Solar Heat Gain Coefficient
0.35	0.32

ADDITIONAL PERFORMANCE RATINGS

Visible Transmittance	Air Leakage (U.S./I-P)
0.51	0.2

Project Location

Street Address:
City: State: Zip Code:
Project Name (Optional): Designer (Optional):

Product Line Information

Operator Type (per Table 4-3 of NFRC 100)
Product Line ID No. Individual Product ID No.
How many of this individual product Location in building
Elevation drawing page Fenestration (window & door) schedule page

Frame Material Supplier Company name:
City: State: Zip Code:
Street Address:
Contact: Phone: Fax:

Glazing Material Supplier Company name:
City: State: Zip Code:
Street Address:
Contact: Phone: Fax:

Glazing Contractor/Installer Comp. name:
City: State: Zip Code:
Street Address:
Contact: Phone: Fax:

Certification Authorization

Independent Certification & Inspection Agency (IA):
Date Certification Authorization Issued:

World's Best Window Co.
Millennium 2000+
Vinyl-Clad Wood Frame
Double Glazing • Argon Fill • Low E
Product Type: Vertical Slider

National Fenestration Rating Council
CERTIFIED

ENERGY PERFORMANCE RATINGS

U-Factor (U.S./I-P)	Solar Heat Gain Coefficient
0.34	0.25

ADDITIONAL PERFORMANCE RATINGS

Visible Transmittance	Air Leakage (U.S./I-P)
0.41	0.2

Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. Consult manufacturer's literature for other product performance information.
www.nfrc.org

Using the Q = UA (delta T) Method

- Calculated Square foot of all windows as per plan.
- All windows and doors having a U factor of .30 per Certificate

New Construction Energy Code Compliance Checklist/Certificate

Per R401.3 Certificate. A building certificate shall be posted on or in the electrical distribution panel.

Date Certificate Posted

Place your logo here

Mailing Address of the Dwelling or Dwelling Unit	City
1234 Any Street	Any town Mn
Name of Residential Contractor	**MN License Number**
John Doe Construction Inc.	0000123456

THERMAL ENVELOPE

Insulation Location	Total R-Value of all Types of Insulation	Type: Check All That Apply								Other Please Describe Here
		Non or Not Applicable	Fiberglass, Blown	Fiberglass, Batts	Foam, Closed Cell	Foam Open Cell	Mineral Fiberboard	Rigid, Extruded Polystyrene	Rigid, Isocynurate	
Below Entire Slab		N/A								
Foundation Wall					X				R-10	Using Exterior Closed cell Foam
Perimeter of Slab on Grade		N/A								
Rim Joist (1st Floor)		R-21			X					Using R-21 Foam Insulation. Closed cell
Rim Joist (2nd Floor+)		N/A								
Wall		R-21		X						Using Friction Fit Fiberglass Batt Insulation
Ceiling, flat		R-49	X							
Ceiling, vaulted		R-49	X							
Bay Windows or cantilevered areas		R-49		X						
Floors over unconditioned area		R-30		X						
Describe other insulated areas	N/A									

RADON CONTROL SYSTEM

X	Passive (*No Fan*)
	Active (*With fan and monometer or other system monitoring device*)

Location (or future location) of Fan: **Attic**

Building Envelope Air Tightness: Will Be Testing to a Maximum of 2.6 Final Test = ?

Duct System Air Tightness: N/A-Ducts will be inside envelope

Windows & Doors

Average U-Factor (*excludes skylights and one door*) U:	.30
Solar Heat Gain Coefficient (SHGC):	.35

Heating or Cooling Ducts Outside Conditioned Spaces

Not applicable, all ducts located in conditioned space

R-value **(need This if ducts are in exterior walls) N/A**

MECHANICAL SYSTEMS

Appliances	Heating System		Domestic Water Heater		Cooling System	
Fuel Type	Gas Forced Air furnace Sealed Combustion		Gas- Fan Assisted		Elec	
Manufacturer	Lennox.		State		RUUD	
Model	G26Q3-75-5		CV 30 NSRT6 33,000 Btu's Input		UAND-042JAZ	
Rating or Size	Input in BTUS:	70,000	Capacity in Gallons:	30	Output in Tons:	3.5
Efficiency		92%	80%		SEER /EER	12
Residential Load Calculations	Heating Loss				Cooling Load	
	62,515				TBD	

Make-up Air *Select a Type*

	Not required per mech. code
X	Passive
N/A	Powered
N/A	Interlocked with exhaust device. Describe:
X	Other, describe: **Flex Duct**

Location of duct or system: **In Mechanical Room**

16-28	CFMs
5	" round" duct OR
	" metal " duct

MEHCANICAL VENTILATION SYSTEM Broan

Describe any additional or combined heating or cooling systems if installed: (e.g. two furnaces or air source heat pump with gas back-up furnace):

Select Type

X	Heat Recovery Ventilator (HRV) Capacity in CFMs:	Low:	75	High:	150
	Energy Recovery Ventilator (ERV) Capacity in CFMs:	Low:		High:	
X	Balanced Ventilation Capacity in CFMs:				
	Location of fans(s), describe:	HRV System			
	Capacity of continuous ventilation rate in CFMs:	63			
	Total ventilation (intermittent + continuous) rate in CFMs:	125			

Combustion Air *Select a Type*

X	Not required per mech. code
	Passive
	Other, describe:
	Location of duct or system:
	CFMs
	"round" duct OR
	"metal" duct

Using the Q = UA (delta T) Method

- Calculated Square foot of all windows as per plan.
- All windows and doors having a U factor of .30 per Certificate
- **Interior temperature is 70 degrees**
- **The delta T is = 90 degrees**
- **So Q = UA(deltaT)**

- **Let's Give it a Shot and see what we Come Up with.**
  - **Here is the first window as a example.**

Windows and Doors (Main Floor)

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Great Rm Window #1	60 x 60 = 5760	Divide by 144 = 25 Sq. Ft	x	.30	x 90 =	675 Btu's

Windows and Doors (Main Floor)

Window or door unit	Sq. Inches	Divided by 144= Sq Ft	U Factor	(dT)	Btu's Heat Loss
Great Rm Window #1	60 x 60 = 5760	Divide by 144 = 25 Sq. Ft x	.30	x 90 =	675 Btu's
Great Rm Window #2	60 x 60 = 5760	Divide by 144 = 25 Sq. Ft x	.30	x 90 =	675 Btu's
Master B. R.	60 x 48 = 2880	Divide by 144 = 20 Sq. Ft x	.30	x 90 =	540 Btu's
Bedroom #2	60 x 48 = 2880	Divide by 144 = 20 Sq. Ft x	.30	x 90 =	540 Btu's
Bedroom #3	60 x 48 = 2880	Divide by 144 = 20 Sq. Ft x	.30	x 90 =	540 Btu's
Dr. to Gar.	32 x 80 = 2560	Divide by 144 = 17.8 Sq. Ft x	.30	x 90 =	481 Btu's
Front Dr.	48 x 80 = 3840	Divide by 144 = 26.7 Sq. Ft x	.30	x 90 =	721 Btu's
Laundry Rm.	30 x 36 = 1080	Divide by 144 = 7.5 Sq. Ft x	.30	x 90 =	203 Btu's
Kitchen	72 x 36 = 2592	Divide by 144 = 18 Sq. Ft x	.30	x 90 =	486 Btu's
Patio Doors (#1)	60 x 80 = 4800	Divide by 144 = 33.4 Sq. Ft x	.30	x 90 =	902 Btu's
Patio Doors (#2)	60 x 80 = 4800	Divide by 144 = 33.4 Sq. Ft x	.30	x 90 =	902 Btu's
Dining room (#1)	30 x 60 = 180	Divide by 144 = 12.5 Sq. Ft x	.30	x 90 =	338 Btu's
Dining room (#2)	30 x 60 = 180	Divide by 144 = 12.5 Sq. Ft x	.30	x 90 =	338 Btu's
Dining room	60 x 60 = 3600	Divide by 144 = 25.0 Sq. Ft x	.30	x 90 =	675 Btu's

Window or door unit	Sq. Inches	Divided by 144= Sq Ft	U Factor	(dT)	Btu's Heat Loss	
Great Rm Window #1	60 x 60 = 5760	Divide by 144 = 25 Sq. Ft	x	.30	x 90 =	675 Btu's
Great Rm Window #2	60 x 60 = 5760	Divide by 144 = 25 Sq. Ft	x	.30	x 90 =	675 Btu's
Master B. R.	60 x 48 = 2880	Divide by 144 = 20 Sq. Ft	x	.30	x 90 =	540 Btu's
Bedroom #2	60 x 48 = 2880	Divide by 144 = 20 Sq. Ft	x	.30	x 90 =	540 Btu's
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Kitchen	72 x 36 = 2592	Divide by 144 = 18 Sq. Ft	x	.30	x 90 =	486 Btu's
Patio Doors (#1)	60 x 80 = 4800	Divide by 144 = 33.4 Sq. Ft	x	.30	x 90 =	902 Btu's
Patio Doors (#2)	60 x 80 = 4800	Divide by 144 = 33.4 Sq. Ft	x	.30	x 90 =	902 Btu's
Dining room (#1)	30 x 60 = 180	Divide by 144 = 12.5 Sq. Ft	x	.30	x 90 =	338 Btu's
Dining room (#2)	30 x 60 = 180	Divide by 144 = 12.5 Sq. Ft	x	.30	x 90 =	338 Btu's
Dining room	60 x 60 = 3600	Divide by 144 = 25.0 Sq. Ft	x	.30	x 90 =	675 Btu's
Main Floor Totals		**296.8 Sq. Ft (Main Floor)**				**8,016 Btu's**

Windows and Doors (Basement Level)

Window or door unit	Sq. Inches	Divided by 144= Sq Ft		U Factor	(dT)	Btu's Heat Loss
Future BR	48 x 42= 2016	Divide by 144 = 14 Sq. Ft	x	.30	x 90 =	378 Btu's
Future Family Rm	48 x 42= 2016	Divide by 144 = 14 Sq. Ft	x	.30	x 90 =	378 Btu's
Future Family Rm	60 x 42 = 2520	Divide by 144 = 17.5 Sq. Ft	x	.30	x 90 =	473 Btu's
Future Family Rm	48 x 42= 2016	Divide by 144 = 14 Sq. Ft	x	.30	x 90 =	378 Btu's
Future Family Rm	48 x 42= 2016	Divide by 144 = 14 Sq. Ft	x	.30	x 90 =	378 Btu's
Future Wet Bar Area	48 x 42 = 2016	Divide by 144 = 14 Sq. Ft	x	.30	x 90 =	378 Btu's

Basement Level Totals	**87.58 Sq. Ft (Main Floor)**	**2,363 Btu's**
+		
Main Floor Totals	**296.8 Sq. Ft (Main Floor)**	**8,016 Btu's**
Overall Window totals	**384.38**	**10,379 Btu's**

Note: Total Sq. Ft of window area 151.6 @ a U factor of .0526 needs to be subtracted from wall area Btu's So…

Running total of Btu's of Heat Loss for Our Home

• Ceiling Area	=	2994 Btu's of Heat loss
• Ceiling Vaulted Area Side Walls	=	686 Btu's of Heat Loss
• Main Floor Exterior Walls	=	6,555 Btu's of Heat Loss
• Basement Knee walls	=	1,446 Btu's of Heat Loss
• 4' Foundation Walls	=	1,099 Btu's of Heat Loss
• 8' Foundation Walls	=	2902 Btu's of Heat Loss
• Basement Floor	=	12,105 Btu's of Heat Loss
• F-place bump out and Rim Area	=	552 Btus of Heat Loss
• Windows and Doors	=	10,379 Btu's of Heat Loss
• Total Heat loss of building Envelope (including Windows)	=	38,718 Btu's of Heat loss

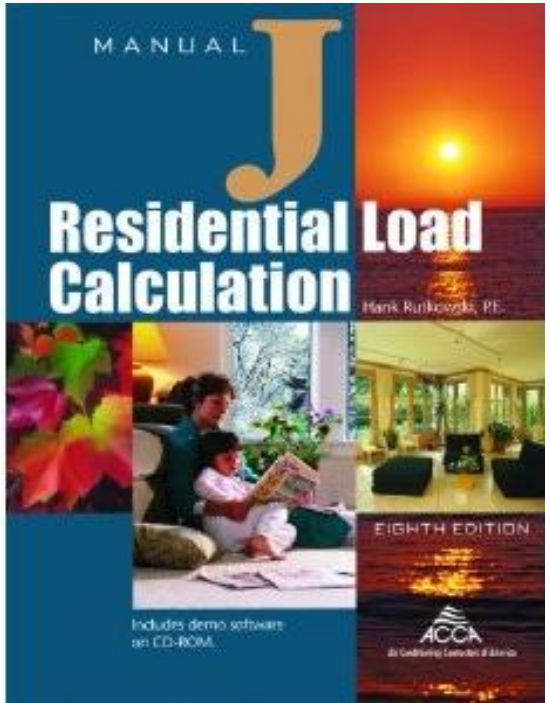
Running total of Btu's of Heat Loss for Our Home

• Ceiling Area	=	2994 Btu's of Heat loss
• Ceiling Vaulted Area Side Walls	=	686 Btu's of Heat Loss
• Main Floor Exterior Walls	=	6,555 Btu's of Heat Loss
• Basement Knee walls	=	1,446 Btu's of Heat Loss
• 4' Foundation Walls	=	1,099 Btu's of Heat Loss
• 8' Foundation Walls	=	29,598 Btu's of Heat Loss
• Basement Floor	=	12,105 Btu's of Heat Loss
• Fire Place bump out and rim Area	=	552 Btu's of Heat Loss
• Windows and Doors	=	10,379 Btu's of Heat Loss
• Sub-Total Heat loss of building Envelope	=	38,78 Btu's of Heat loss
• (-) Area of windows figured as R21 walls Or 384.38 x .0476 x 90	=	(1,647 Btu's of Heat Loss)
• *Grand Total of Building Heat Loss*	=	*36,071 Btu's of Heat loss for the Building*

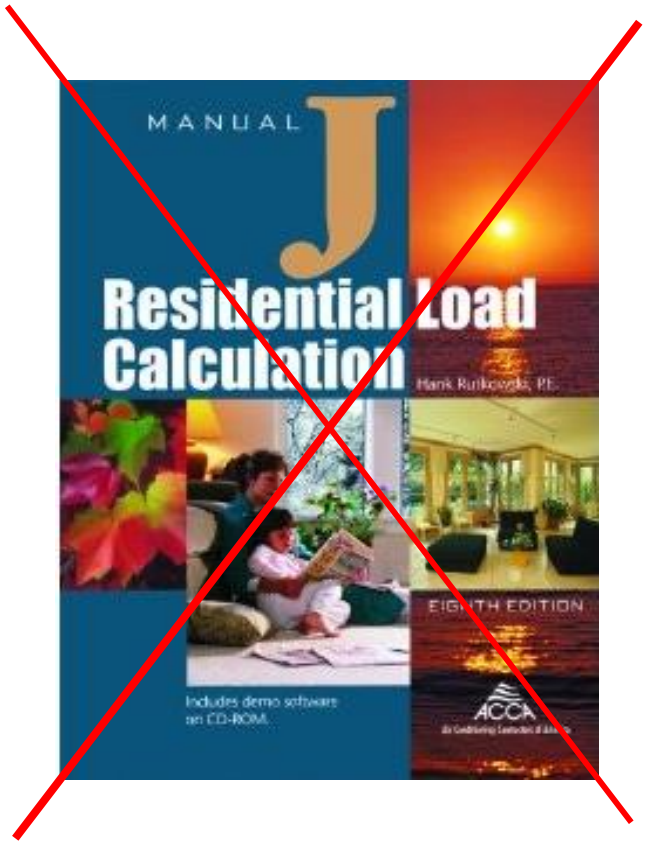
- Sizing the Mechanical Equipment

Equipment Sizing
ACCA Manual 'J', Manual 'S'

- **Heating and cooling equipment will be sized in accordance with ACCA *Manual S* based on building loads calculated in accordance with ACCA *Manual J*…**

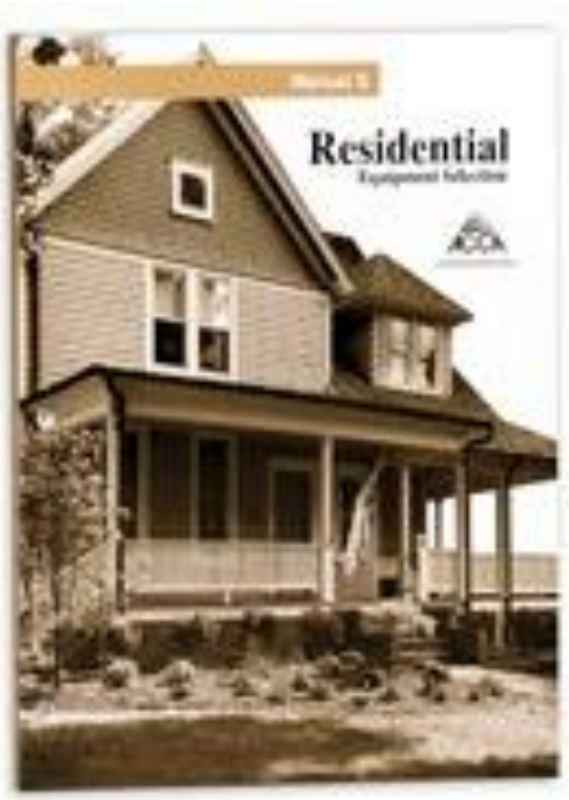


Or Other accepted and established method for sizing
Ex. Q=UA (dT) and Manual S (or Manufactures Tables



Equipment Sizing
ACCA Manual 'J', Manual 'S'

- ***Manual J 8th*** **is only used to calculate the residential heating and cooling loads.**



Equipment Sizing
ACCA Manual 'J', Manual 'S'

- *Manual J8th* is only used to calculate the residential heating and cooling loads.
- ***Manual J 8th* guides HVAC designers to use ACCA *Manual S* to select equipment that is the right size.**

Equipment Sizing
ACCA Manual 'J', Manual 'S'

- *Manual J 8th* is only used to calculate the residential heating and cooling loads.
- *Manual J 8th* guides HVAC designers to use ACCA *Manual S* to select equipment that is the right size (see§10-4 of *Manual S*).
- ***Manual S* sets equipment sizing limits, as summarized in Table 1.**

ACCA Manual S= Sizing of Equipment

Manual S Equipment Selection Sizing Limitations		
Equipment	Sizing Limits	Reference
Furnaces	100% - 140% of total heating load	Section 2-2
Boilers	100% - 140% of total heating load	Section 2-2
Air conditioners	115% of total cooling load*	Section 3-4
Heat pumps	115%[1] or 125%[2] of total cooling load*	Section 4-4
Supplemental heat (heat pumps)		
• Electric	Based on equipment balance point	Section 4-8
• Dual fuel	100% - 140% of total heating load	Section 6-8
Emergency Heat (heat pumps)	Based on local codes	Section 4-9

Manual S Input for Design Air Flow (*Manual D*)		
Mode of Operation	Requirement	Reference
• Heating	Temperature rise requirement	Section 2-6
• Cooling	Air flow associated with the selected equipment's capacity	Section 3-11

[1] Heat pumps in a *cooling* dominant climate are allowed to be 115% of the cooling load.
[2] Heat pumps in a *heating* dominant climate are allowed to be 125% of the cooling load.
* The size of the cooling equipment must be based on the same temperature and humidity conditions that were used to calculate the *Manual J* loads.

Equipment Sizing
Applying Manual S to a Heating
Example Home #2

Equipment Sizing
Applying Manual S to a Heating
Example #2 Home

- Select a furnace for a home with a **63,215 Btu/h output** heating requirement based on **Q=UA delta T or ACCA Manual J.**

Equipment Sizing
Applying Manual S to a Heating
Example #2 Home

- Select a furnace for a home with a **63215 Btu/h** output heating requirement based on **Q=UA delta T or ACCA Manual J.**
- Furnace **must** deliver as least **63,215 Btu/h** to maintain the interior design temperature (T-1) in the home (70)when the outdoor temperature (T-2) dips to design temperature. (-20)

Equipment Sizing
Applying Manual S to a Heating
Example #2 Home

- Select a furnace for a home with a **63,215 Btu/h** output heating requirement based on **Q=UA delta T or ACCA Manual J.**
- Furnace must deliver as least **63,215 Btu/h** to maintain the interior design temperature (T-1) in the home (70) when the outdoor temperature (T-2) dips to design temp.
- ***Manual S* sets a sizing limit for furnaces using Table.**

ACCA Manual S= Sizing of Equipment

Manual S Equipment Selection Sizing Limitations		
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[1] Heat pumps in a *cooling* dominant climate are allowed to be 115% of the cooling load.
[2] Heat pumps in a *heating* dominant climate are allowed to be 125% of the cooling load.
* The size of the cooling equipment must be based on the same temperature and humidity conditions that were used to calculate the *Manual J* loads.

Equipment Sizing
Applying Manual S to a Heating
Example #2 Home

- Select a furnace for a home with a minimum **63,215 Btu/h** output heating requirement based on **Q=UA delta T or ACCA Manual J.**
- Furnace must deliver as least **63,215 Btu/h** to maintain the interior design temperature (T-1) in the home when the outdoor temperature (T-2) dips to design temp.
- *Manual S* sets a sizing limit for furnaces using Table.
- Furnace shall have a capacity no larger than 140% of heating load.
  - (140% x 63,215 = 88,501 Btu/h)
-

Equipment Sizing
Applying Manual S to a Heating
Example #2 Home

- Select a furnace for a home with a **63,215 Btu/h** output heating requirement based on **Q=UA delta T or ACCA Manual J.**
- Furnace must deliver as least **63,215 Btu/h** to maintain the interior design temperature (T-1) in the home when the outdoor temperature (T-2) dips to design temp.
- *Manual S* sets a sizing limit for furnaces using Table.
- Furnace shall have a capacity no larger than 140% of heating load.
  - (140% x 62,515 = 88,501 Btu/h)
- Based on home's load and sizing limitations, the furnace must produce a **minimum of 62,515 Btu/h ≤ heating requirement for the home but can not produce more than ≤ 88,501 Btu/h**.

Make –Up Air

What is a make up air system

- Replenishes the air removed from the home by exhaust air systems

How much make up air is required in (new dwellings)

- MN 1346.501.4.1 Makeup air in new dwelling units.
  - Determined by using IMC Table 501.4.1
  - Needs to be supplied in accordance with IMC section 501.4.2

What Column Are we going to be in?

	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf)	—	—	—	—
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a × 1b]	—	—	—	—
2. Exhaust Capacity				
a) clothes dryer	135	135	135	135
b) 80% of largest exhaust rating (cfm):	—	—	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
c) 80% of next largest exhaust rating (cfm):	not applicable	—	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
Total Exhaust Capacity (cfm): [2a+2b+2c]	—	—	—	—
3. *Makeup Air* Requirement				
a) Total Exhaust Capacity (from above)	—	—	—	—
b) Estimated House Infiltration (from above)	—	—	—	—
Makeup Air Quality (cfm): [3a - 3b]	—	—	—	—
(if value is negative, no makeup air is needed				
4. For *Makeup Air* Opening Sizing, refer to Table 501.4.2.				

A. Use this column if there are other than fan-assisted or atmospherically vented gas or oil *appliances* or if there are no *combustion appliances*.

B. Use this column if there is one fan-assisted *appliance* per venting system. Other than atmospherically vented *appliances* may also be included.

C. Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil *appliance* per venting system or one solid fuel *appliance*.

D. Use this column if there are multiple atmospherically vented gas or oil *appliances* using a common vent or if there are atmospherically vented gas or oil *appliances* and solid fuel *appliances*.

What Column Are we going to be in?

1. **Sealed Combustion Furnace**
2. **A Fan Assisted Water Heater**
3. **Direct vent Fireplace**
4. **HRV System –Balanced**
5. **2- 50 CFM Bath Fans**

	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf)	—	—	—	—
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a × 1b]	—	—	—	—
2. Exhaust Capacity				
a) clothes dryer	135	135	135	135
b) 80% of largest exhaust rating (cfm):	—	—	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
c) 80% of next largest exhaust rating (cfm):	not applicable	—	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
Total Exhaust Capacity (cfm): [2a+2b+2c]	—	—	—	—
3. *Makeup Air* Requirement				
a) Total Exhaust Capacity (from above)	—	—	—	—
b) Estimated House Infiltration (from above)	—	—	—	—
Makeup Air Quality (cfm): [3a - 3b]	—	—	—	—
(if value is negative, no makeup air is needed				
4. For *Makeup Air* Opening Sizing, refer to Table 501.4.2.				

A. Use this column if there are other than fan-assisted or atmospherically vented gas or oil *appliances* or if there are no *combustion appliances*.

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1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf)	—	—	—	—
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a × 1b]	—	—	—	—
2. Exhaust Capacity				
a) clothes dryer	135	135	135	135
b) 80% of largest exhaust rating (cfm):	—	—	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
c) 80% of next largest exhaust rating (cfm):	not applicable	—	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
Total Exhaust Capacity (cfm): [2a+2b+2c]	—	—	—	—
3. *Makeup Air* Requirement				
a) Total Exhaust Capacity (from above)	—	—	—	—
b) Estimated House Infiltration (from above)	—	—	—	—
Makeup Air Quality (cfm): [3a - 3b]	—	—	—	—
(if value is negative, no makeup air is needed				
4. For *Makeup Air* Opening Sizing, refer to Table 501.4.2.				

A. Use this column if there are other than fan-assisted or atmospherically vented gas or oil *appliances* or if there are no *combustion appliances*.

B. Use this column if there is one fan-assisted *appliance* per venting system. Other than atmospherically vented *appliances* may also be included.

C. Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil *appliance* per venting system or one solid fuel *appliance*.

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What Column Are we going to be in?

1. Sealed Combustion Furnace
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	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf)	—	3224	—	—
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a × 1b]	—	—	—	—
2. Exhaust Capacity				
a) clothes dryer	135	135	135	135
b) 80% of largest exhaust rating (cfm):	—	—	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
c) 80% of next largest exhaust rating (cfm):	not applicable	—	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
Total Exhaust Capacity (cfm): [2a+2b+2c]	—	—	—	—
3. *Makeup Air* Requirement				
a) Total Exhaust Capacity (from above)	—	—	—	—
b) Estimated House Infiltration (from above)	—	—	—	—
Makeup Air Quality (cfm): [3a - 3b]	—	—	—	—
(if value is negative, no makeup air is needed				
4. For *Makeup Air* Opening Sizing, refer to Table 501.4.2.				

A. Use this column if there are other than fan-assisted or atmospherically vented gas or oil *appliances* or if there are no *combustion appliances*.

B. Use this column if there is one fan-assisted *appliance* per venting system. Other than atmospherically vented *appliances* may also be included.

C. Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil *appliance* per venting system or one solid fuel *appliance*.

D. Use this column if there are multiple atmospherically vented gas or oil *appliances* using a common vent or if there are atmospherically vented gas or oil *appliances* and solid fuel *appliances*.

What Column Are we going to be in?

1. Sealed Combustion Furnace
2. A Fan Assisted Water Heater
3. Direct vent Fireplace
4. HRV System –Balanced
5. 2- 50 CFM Bath Fans

	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf)	—	3224	—	—
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a × 1b]	—	193	—	—
2. Exhaust Capacity				
a) clothes dryer	135	135	135	135
b) 80% of largest exhaust rating (cfm):	—	—	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
c) 80% of next largest exhaust rating (cfm):	not applicable	—	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
Total Exhaust Capacity (cfm): [2a+2b+2c]	—	—	—	—
3. *Makeup Air* Requirement				
a) Total Exhaust Capacity (from above)	—	—	—	—
b) Estimated House Infiltration (from above)	—	—	—	—
Makeup Air Quality (cfm): [3a - 3b]	—	—	—	—
(if value is negative, no makeup air is needed				
4. For *Makeup Air* Opening Sizing, refer to Table 501.4.2.				

A. Use this column if there are other than fan-assisted or atmospherically vented gas or oil *appliances* or if there are no *combustion appliances*.

B. Use this column if there is one fan-assisted *appliance* per venting system. Other than atmospherically vented *appliances* may also be included.

C. Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil *appliance* per venting system or one solid fuel *appliance*.

D. Use this column if there are multiple atmospherically vented gas or oil *appliances* using a common vent or if there are atmospherically vented gas or oil *appliances* and solid fuel *appliances*.

What Column Are we going to be in?

1. Sealed Combustion Furnace
2. A Fan Assisted Water Heater
3. Direct vent Fireplace
4. HRV System –Balanced
5. 2- 50 CFM Bath Fans

	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf)	—	3224	—	—
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a × 1b]	—	193	—	—
2. Exhaust Capacity				
a) clothes dryer	135	135	135	135
b) 80% of largest exhaust rating (cfm):	—	40	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
c) 80% of next largest exhaust rating (cfm):	not applicable	—	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
Total Exhaust Capacity (cfm): [2a+2b+2c]	—	—	—	—
3. *Makeup Air* Requirement				
a) Total Exhaust Capacity (from above)	—	—	—	—
b) Estimated House Infiltration (from above)	—	—	—	—
Makeup Air Quality (cfm): [3a - 3b]	—	—	—	—
(if value is negative, no makeup air is needed				
4. For *Makeup Air* Opening Sizing, refer to Table 501.4.2.				

What Column Are we going to be in?

1. Sealed Combustion Furnace
2. A Fan Assisted Water Heater
3. Direct vent Fireplace
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	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf)	—	3224	—	—
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a × 1b]	—	193	—	—
2. Exhaust Capacity				
a) clothes dryer	135	135	135	135
b) 80% of largest exhaust rating (cfm):	—	40	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
c) 80% of next largest exhaust rating (cfm):	not applicable	40	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
Total Exhaust Capacity (cfm): [2a+2b+2c]	—	—	—	—
3. *Makeup Air* Requirement				
a) Total Exhaust Capacity (from above)	—	—	—	—
b) Estimated House Infiltration (from above)	—	—	—	—
Makeup Air Quality (cfm): [3a - 3b]	—	—	—	—
(if value is negative, no makeup air is needed				
4. For *Makeup Air* Opening Sizing, refer to Table 501.4.2.				

What Column Are we going to be in?

1. Sealed Combustion Furnace
2. A Fan Assisted Water Heater
3. Direct vent Fireplace
4. HRV System –Balanced
5. 2- 50 CFM Bath Fans

	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf)	—	3224	—	—
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a × 1b]	—	193	—	—
2. Exhaust Capacity				
a) clothes dryer	135	135	135	135
b) 80% of largest exhaust rating (cfm):	—	40	---	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
c) 80% of next largest exhaust rating (cfm):	not applicable	40	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
Total Exhaust Capacity (cfm): [2a+2b+2c]	—	215	--	—
3. *Makeup Air* Requirement				
a) Total Exhaust Capacity (from above)	—	—	—	—
b) Estimated House Infiltration (from above)	—	—	—	—
Makeup Air Quality (cfm): [3a - 3b]	—	—	—	—
(if value is negative, no makeup air is needed				
4. For *Makeup Air* Opening Sizing, refer to Table 501.4.2.				

What Column Are we going to be in?

1. Sealed Combustion Furnace
2. A Fan Assisted Water Heater
3. Direct vent Fireplace
4. HRV System –Balanced
5. 2- 50 CFM Bath Fans

	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09 **3224**	0.06	0.03
b) conditioned floor area (sf)	—	— **193**	—	—
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a × 1b]	—	— **40**	—	—
2. Exhaust Capacity				
a) clothes dryer	135	135	135	135
b) 80% of largest exhaust rating (cfm):	—	—	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
c) 80% of next largest exhaust rating (cfm):	not applicable	— **40**	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
Total Exhaust Capacity (cfm): [2a+2b+2c]	—	— **215**	—	—
3. *Makeup Air* Requirement				
a) Total Exhaust Capacity (from above)	—	— **215**	—	—
b) Estimated House Infiltration (from above)	—	—	—	—
Makeup Air Quality (cfm): [3a - 3b]	—	—	—	—
(if value is negative, no makeup air is needed				
4. For *Makeup Air* Opening Sizing, refer to Table 501.4.2.				

What Column Are we going to be in?

1. Sealed Combustion Furnace
2. A Fan Assisted Water Heater
3. Direct vent Fireplace
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5. 2- 50 CFM Bath Fans

	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf)	—	3224	—	—
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a × 1b]	—	193	—	—
2. Exhaust Capacity				
a) clothes dryer	135	135	135	135
b) 80% of largest exhaust rating (cfm):	—	40	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
c) 80% of next largest exhaust rating (cfm):	not applicable	40	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
Total Exhaust Capacity (cfm): [2a+2b+2c]	—	215	—	—
3. *Makeup Air* Requirement				
a) Total Exhaust Capacity (from above)	—	215	—	—
b) Estimated House Infiltration (from above)	—	193	—	—
Makeup Air Quality (cfm): [3a - 3b]	—	—	—	—
(if value is negative, no makeup air is needed				
4. For *Makeup Air* Opening Sizing, refer to Table 501.4.2.				

What Column Are we going to be in?

1. Sealed Combustion Furnace
2. A Fan Assisted Water Heater
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	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf)	—	3224	—	—
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a × 1b]	—	193	—	—
2. Exhaust Capacity				
a) clothes dryer	135	135	135	135
b) 80% of largest exhaust rating (cfm):	—	40	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
c) 80% of next largest exhaust rating (cfm):	not applicable	40	—	—
(not applicable if recirculating system or if powered *makeup air* is electrically interlocked and matched to exhaust)				
Total Exhaust Capacity (cfm): [2a+2b+2c]	—	215	—	—
3. *Makeup Air* Requirement				
a) Total Exhaust Capacity (from above)	—	215	—	—
b) Estimated House Infiltration (from above)	—	193	—	—
Makeup Air Quality (cfm): [3a - 3b]	—	22	—	—
(if value is negative, no makeup air is needed				
4. For *Makeup Air* Opening Sizing, refer to Table 501.4.2.				

A. Use this column if there are other than fan-assisted or atmospherically vented gas or oil *appliances* or if there are no *combustion appliances*.

B. Use this column if there is one fan-assisted *appliance* per venting system. Other than atmospherically vented *appliances* may also be included.

C. Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil *appliance* per venting system or one solid fuel *appliance*.

D. Use this column if there are multiple atmospherically vented gas or oil *appliances* using a common vent or if there are atmospherically vented gas or oil *appliances* and solid fuel *appliances*.

TABLE 501.4.2 MAKEUP AIR OPENING SIZING TABLE FOR NEW AND EXISTING DWELLING UNITS

TYPE OF OPENING OR SYSTEM	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]	PASSIVE MAKEUP AIR OPENING DUCT DIAMETER[E, F, G]
	(cfm)	(cfm)	(cfm)	(cfm)	(inches)
Passive opening	1-36	1-22	1-15	1-9	3
Passive opening	37-66	23-41	16-28	10-17	4
Passive opening	67-109	42-66	29-46	18-28	5
Passive opening	110-163	67-100	47-69	29-42	6
Passive opening	164-232	101-143	70-99	43-61	7
Passive opening	233-317	144-195	100-135	62-83	8
Passive opening with motorized damper	318-419	196-258	136-179	84-110	9
Passive opening with motorized damper	420-539	259-332	180-230	111-142	10
Passive opening with motorized damper	540-679	333-419	231-290	143-179	11
Powered makeup air[H]	> 679	> 419	> 290	> 179	Not applicable

A. Use this column if there are other than fan-assisted or atmospherically vented gas or oil *appliances* or if there are no *combustion appliances*.

B. Use this column if there is one fan-assisted *appliance* per venting system. Other than atmospherically vented *appliances* may also be included.

C. Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil *appliance* per venting system or one solid fuel *appliance*.

D. Use this column if there are multiple atmospherically vented gas or oil *appliances* using a common vent or if there are atmospherically vented gas or oil *appliances* and solid fuel *appliances*.

E. An equivalent length of 100 feet of round smooth metal duct is assumed. Subtract 40 feet for the exterior hood and ten feet for each 90-degree elbow to determine the remaining length of straight duct allowable.

F. If flexible duct is used, increase the duct diameter by one inch. Flexible duct shall be stretched with minimal sags.

G. Barometric dampers are prohibited in passive *makeup air* openings when any atmospherically vented *appliance* is installed.

H. Powered *makeup air* shall be electrically interlocked with the largest exhaust system.

TABLE 501.4.2 MAKEUP AIR OPENING SIZING TABLE FOR NEW AND EXISTING DWELLING UNITS

TYPE OF OPENING OR SYSTEM	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]	PASSIVE MAKEUP AIR OPENING DUCT DIAMETER[E, F, G]
	(cfm)	(cfm)	(cfm)	(cfm)	(inches)
Passive opening	1-36	1-22	1-15	1-9	3
Passive opening	37-66	23-41	16-28	10-17	4
Passive opening	67-109	42-66	29-46	18-28	5
Passive opening	110-163	67-100	47-69	29-42	6
Passive opening	164-232	101-143	70-99	43-61	7
Passive opening	233-317	144-195	100-135	62-83	8
Passive opening with motorized damper	318-419	196-258	136-179	84-110	9
Passive opening with motorized damper	420-539	259-332	180-230	111-142	10
Passive opening with motorized damper	540-679	333-419	231-290	143-179	11
Powered makeup air[H]	> 679	> 419	> 290	> 179	Not applicable

A. Use this column if there are other than fan-assisted or atmospherically vented gas or oil *appliances* or if there are no *combustion appliances*.

B. Use this column if there is one fan-assisted *appliance* per venting system. Other than atmospherically vented *appliances* may also be included.

C. Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil *appliance* per venting system or one solid fuel *appliance*.

D. Use this column if there are multiple atmospherically vented gas or oil *appliances* using a common vent or if there are atmospherically vented gas or oil *appliances* and solid fuel *appliances*.

E. An equivalent length of 100 feet of round smooth metal duct is assumed. Subtract 40 feet for the exterior hood and ten feet for each 90-degree elbow to determine the remaining length of straight duct allowable.

F. If flexible duct is used, increase the duct diameter by one inch. Flexible duct shall be stretched with minimal sags.

G. Barometric dampers are prohibited in passive *makeup air* openings when any atmospherically vented *appliance* is installed.

H. Powered *makeup air* shall be electrically interlocked with the largest exhaust system.

TABLE 501.4.2 MAKEUP AIR OPENING SIZING TABLE FOR NEW AND EXISTING DWELLING UNITS

TYPE OF OPENING OR SYSTEM	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]	PASSIVE MAKEUP AIR OPENING DUCT DIAMETER[E, F, G]
	(cfm)	(cfm)	(cfm)	(cfm)	(inches)
Passive opening	1-36	1-22	1-15	1-9	3
Passive opening	37-66	23-41	16-28	10-17	4
Passive opening	67-109	42-66	29-46	18-28	5
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Passive opening with motorized damper	540-679	333-419	231-290	143-179	11
Powered makeup air[H]	> 679	> 419	> 290	> 179	Not applicable

A. Use this column if there are other than fan-assisted or atmospherically vented gas or oil *appliances* or if there are no *combustion appliances*.

B. Use this column if there is one fan-assisted *appliance* per venting system. Other than atmospherically vented *appliances* may also be included.

C. Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil *appliance* per venting system or one solid fuel *appliance*.

D. Use this column if there are multiple atmospherically vented gas or oil *appliances* using a common vent or if there are atmospherically vented gas or oil *appliances* and solid fuel *appliances*.

E. An equivalent length of 100 feet of round smooth metal duct is assumed. Subtract 40 feet for the exterior hood and ten feet for each 90-degree elbow to determine the remaining length of straight duct allowable.

F. If flexible duct is used, increase the duct diameter by one inch. Flexible duct shall be stretched with minimal sags.

G. Barometric dampers are prohibited in passive *makeup air* openings when any atmospherically vented *appliance* is installed.

H. Powered *makeup air* shall be electrically interlocked with the largest exhaust system.

TABLE 501.4.2 MAKEUP AIR OPENING SIZING TABLE FOR NEW AND EXISTING DWELLING UNITS

TYPE OF OPENING OR SYSTEM	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]	PASSIVE MAKEUP AIR OPENING DUCT DIAMETER[E, F, G]
	(cfm)	(cfm)	(cfm)	(cfm)	(inches)
Passive opening	1-36	1-22	1-15	1-9	3
Passive opening	37-66	23-41	16-28	10-17	4
Passive opening	67-109	42-66	29-46	18-28	5
Passive opening	110-163	67-100	47-69	29-42	6
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Passive opening	233-317	144-195	100-135	62-83	8
Passive opening with motorized damper	318-419	196-258	136-179	84-110	9
Passive opening with motorized damper	420-539	259-332	180-230	111-142	10
Passive opening with motorized damper	540-679	333-419	231-290	143-179	11
Powered makeup air[H]	> 679	> 419	> 290	> 179	Not applicable

A. Use this column if there are other than fan-assisted or atmospherically vented gas or oil *appliances* or if there are no *combustion appliances*.

B. Use this column if there is one fan-assisted *appliance* per venting system. Other than atmospherically vented *appliances* may also be included.

C. Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil *appliance* per venting system or one solid fuel *appliance*.

D. Use this column if there are multiple atmospherically vented gas or oil *appliances* using a common vent or if there are atmospherically vented gas or oil *appliances* and solid fuel *appliances*.

E. An equivalent length of 100 feet of round smooth metal duct is assumed. Subtract 40 feet for the exterior hood and ten feet for each 90-degree elbow to determine the remaining length of straight duct allowable.

F. If flexible duct is used, increase the duct diameter by one inch. Flexible duct shall be stretched with minimal sags.

G. Barometric dampers are prohibited in passive *makeup air* openings when any atmospherically vented *appliance* is installed.

H. Powered *makeup air* shall be electrically interlocked with the largest exhaust system.

TABLE 501.4.2 MAKEUP AIR OPENING SIZING TABLE FOR NEW AND EXISTING DWELLING UNITS

TYPE OF OPENING OR SYSTEM	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES[A]	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES[B]	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE[C]	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES[D]	PASSIVE MAKEUP AIR OPENING DUCT DIAMETER[E, F, G]
	(cfm)	(cfm)	(cfm)	(cfm)	(inches)
Passive opening	1-36	1-22	1-15	1-9	3
Passive opening	37-66	23-41	16-28	10-17	4
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Passive opening	233-317	144-195	100-135	62-83	8
Passive opening with motorized damper	318-419	196-258	136-179	84-110	9
Passive opening with motorized damper	420-539	259-332	180-230	111-142	10
Passive opening with motorized damper	540-679	333-419	231-290	143-179	11
Powered makeup air[H]	> 679	> 419	> 290	> 179	Not applicable

A. Use this column if there are other than fan-assisted or atmospherically vented gas or oil *appliances* or if there are no *combustion appliances*.

B. Use this column if there is one fan-assisted *appliance* per venting system. Other than atmospherically vented *appliances* may also be included.

C. Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil *appliance* per venting system or one solid fuel *appliance*.

D. Use this column if there are multiple atmospherically vented gas or oil *appliances* using a common vent or if there are atmospherically vented gas or oil *appliances* and solid fuel *appliances*.

E. An equivalent length of 100 feet of round smooth metal duct is assumed. Subtract 40 feet for the exterior hood and ten feet for each 90-degree elbow to determine the remaining length of straight duct allowable.

F. If flexible duct is used, increase the duct diameter by one inch. Flexible duct shall be stretched with minimal sags.

G. Barometric dampers are prohibited in passive *makeup air* openings when any atmospherically vented *appliance* is installed.

H. Powered *makeup air* shall be electrically interlocked with the largest exhaust system.

Combustion Air Requirements

1346.6012 IFGC APPENDIX E, WORKSHEET E-1.

IFGC Appendix E, Worksheet E-1

Residential Combustion Air Calculation Method

(for Furnace, Boiler, and/or Water Heater in the Same Space)

Step 1: Complete vented combustion appliance information.

Furnace/Boiler:

_____ Draft Hood (Not fan assisted)	_____ Fan Assisted & Power Vent	_____ Direct Vent	Input: _____ Btu/hr

Water Heater:

_____ Draft Hood (Not fan assisted)	_____ Fan Assisted & Power Vent	_____ Direct Vent	Input: _____ Btu/hr

Step 2: Calculate the volume of the Combustion Appliance Space (CAS) containing combustion appliances.

The CAS includes all spaces connected to one another by code compliant openings. CAS volume:_____ft^3

Step 3: Determine Air Changes per Hour (ACH)[1]

Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR Method). If the year of construction or ACH is not known, use method 4a (Standard Method).

Step 4: Determine Required Volume for Combustion Air.

4a. Standard Method

Total Btu/hr input of all combustion appliances (DO NOT COUNT DIRECT VENT APPLIANCES)	Input: _____ Btu/hr
Use Standard Method column in Table E-1 to find Total Required Volume (TRV)	TRV: _____ ft 3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

f CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

b. Known Air Infiltration Rate (KAIR) Method

1346.6012 IFGC APPENDIX E, WORKSHEET E-1.

IFGC Appendix E, Worksheet E-1

Residential Combustion Air Calculation Method

(for Furnace, Boiler, and/or Water Heater in the Same Space)

Step 1: Complete vented combustion appliance information.

Furnace/Boiler:

_____ Draft Hood (Not fan assisted)	_____ Fan Assisted & Power Vent	X _____ Direct Vent	Input: 70,000 _____ Btu/hr

Water Heater:

_____ Draft Hood (Not fan assisted)	_____ Fan Assisted & Power Vent	_____ Direct Vent	Input: _____ Btu/hr

Step 2: Calculate the volume of the Combustion Appliance Space (CAS) containing combustion appliances.

The CAS includes all spaces connected to one another by code compliant openings. CAS volume:_____ft^3

Step 3: Determine Air Changes per Hour (ACH)[1]

Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR Method). If the year of construction or ACH is not known, use method 4a (Standard Method).

Step 4: Determine Required Volume for Combustion Air.

4a. Standard Method

Total Btu/hr input of all combustion appliances (DO NOT COUNT DIRECT VENT APPLIANCES) Input: _____ Btu/hr

Use Standard Method column in Table E-1 to find Total Required Volume (TRV) TRV: _____ ft 3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

f CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

b. Known Air Infiltration Rate (KAIR) Method

1346.6012 IFGC APPENDIX E, WORKSHEET E-1.

IFGC Appendix E, Worksheet E-1

Residential Combustion Air Calculation Method

(for Furnace, Boiler, and/or Water Heater in the Same Space)

Step 1: Complete vented combustion appliance information.

Furnace/Boiler:

_____ Draft Hood (Not fan assisted)	_____ Fan Assisted & Power Vent	X Direct Vent	Input: 70,000 Btu/hr

Water Heater:

_____ Draft Hood (Not fan assisted)	X Fan Assisted & Power Vent	_____ Direct Vent	Input: 33,000 Btu/hr

Step 2: Calculate the volume of the Combustion Appliance Space (CAS) containing combustion appliances.

The CAS includes all spaces connected to one another by code compliant openings.

CAS volume:_____ft^3

Step 3: Determine Air Changes per Hour (ACH)[1]

Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR Method). If the year of construction or ACH is not known, use method 4a (Standard Method).

Step 4: Determine Required Volume for Combustion Air.

4a. Standard Method

Total Btu/hr input of all combustion appliances (DO NOT COUNT DIRECT VENT APPLIANCES) — Input: _____ Btu/hr

Use Standard Method column in Table E-1 to find Total Required Volume (TRV) — TRV: _____ ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

4b. Known Air Infiltration Rate (KAIR) Method

1346.6012 IFGC APPENDIX E, WORKSHEET E-1.

IFGC Appendix E, Worksheet E-1

Residential Combustion Air Calculation Method

(for Furnace, Boiler, and/or Water Heater in the Same Space)

Step 1: Complete vented combustion appliance information.

Furnace/Boiler:

_____ Draft Hood (Not fan assisted)	_____ Fan Assisted & Power Vent	X Direct Vent	Input: 70,000 Btu/hr

Water Heater:

_____ Draft Hood (Not fan assisted)	X Fan Assisted & Power Vent	_____ Direct Vent	Input: 33,000 Btu/hr

Step 2: Calculate the volume of the Combustion Appliance Space (CAS) containing combustion appliances.

The CAS includes all spaces connected to one another by code compliant openings.

CAS volume: 12,896 ft^3 (1612 Sq. Ft x 8 = 12896 ft3)

Step 3: Determine Air Changes per Hour (ACH)[1]

Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR Method). If the year of construction or ACH is not known, use method 4a (Standard Method).

Step 4: Determine Required Volume for Combustion Air.

4a. Standard Method

Total Btu/hr input of all combustion appliances (DO NOT COUNT DIRECT VENT APPLIANCES)	Input: _____ Btu/hr
Use Standard Method column in Table E-1 to find Total Required Volume (TRV)	TRV: _____ ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

4b. Known Air Infiltration Rate (KAIR) Method

1346.6012 IFGC APPENDIX E, WORKSHEET E-1.

IFGC Appendix E, Worksheet E-1

Residential Combustion Air Calculation Method

(for Furnace, Boiler, and/or Water Heater in the Same Space)

Step 1: Complete vented combustion appliance information.

Furnace/Boiler:

_____ Draft Hood (Not fan assisted)	_____ Fan Assisted & Power Vent	X Direct Vent	Input: 70,000 Btu/hr

Water Heater:

_____ Draft Hood (Not fan assisted)	X Fan Assisted & Power Vent	_____ Direct Vent	Input: 33,000 Btu/hr

Step 2: Calculate the volume of the Combustion Appliance Space (CAS) containing combustion appliances.

The CAS includes all spaces connected to one another by code compliant openings.

CAS volume: 12,896 ft^3 (1612 Sq. Ft x 8 = 12896 ft3)

Step 3: Determine Air Changes per Hour (ACH)[1]

Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR Method). If the year of construction or ACH is not known, use method 4a (Standard Method).

Step 4: Determine Required Volume for Combustion Air.

4a. Standard Method

Total Btu/hr input of all combustion appliances (DO NOT COUNT DIRECT VENT APPLIANCES)	Input: _____ Btu/hr
Use Standard Method column in Table E-1 to find Total Required Volume (TRV)	TRV: _____ ft 3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

4b. Known Air Infiltration Rate (KAIR) Method

1346.6012 IFGC APPENDIX E, WORKSHEET E-1.

IFGC Appendix E, Worksheet E-1

Residential Combustion Air Calculation Method

(for Furnace, Boiler, and/or Water Heater in the Same Space)

Step 1: Complete vented combustion appliance information.

Furnace/Boiler:

_____ Draft Hood (Not fan assisted)	_____ Fan Assisted & Power Vent	X Direct Vent	Input: 70,000 Btu/hr

Water Heater:

_____ Draft Hood (Not fan assisted)	X Fan Assisted & Power Vent	_____ Direct Vent	Input: 33,000 Btu/hr

Step 2: Calculate the volume of the Combustion Appliance Space (CAS) containing combustion appliances.

The CAS includes all spaces connected to one another by code compliant openings.

CAS volume: 12,896 ft^3 (1612 Sq. Ft x 8 = 12896 ft3)

Step 3: Determine Air Changes per Hour (ACH)[1]

Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR Method). If the year of construction or ACH is not known, use method 4a (Standard Method).

Step 4: Determine Required Volume for Combustion Air.

4a. Standard Method

Total Btu/hr input of all combustion appliances (DO NOT COUNT DIRECT VENT APPLIANCES)

Input: 33,000 Btu/hr

Use Standard Method column in Table E-1 to find Total Required Volume (TRV)

TRV: _____ ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

4b. Known Air Infiltration Rate (KAIR) Method

1346.6012 IFGC APPENDIX E, WORKSHEET E-1.

IFGC Appendix E, Worksheet E-1

Residential Combustion Air Calculation Method

(for Furnace, Boiler, and/or Water Heater in the Same Space)

Step 1: Complete vented combustion appliance information.

Furnace/Boiler:

_____ Draft Hood (Not fan assisted)	_____ Fan Assisted & Power Vent	X Direct Vent	Input: 70,000 Btu/hr

Water Heater:

_____ Draft Hood (Not fan assisted)	X Fan Assisted & Power Vent	_____ Direct Vent	Input: 33,000 Btu/hr

Step 2: Calculate the volume of the Combustion Appliance Space (CAS) containing combustion appliances.

The CAS includes all spaces connected to one another by code compliant openings.

CAS volume: 12,896 ft^3 (1612 Sq. Ft x 8 = 12896 ft3)

Step 3: Determine Air Changes per Hour (ACH)[1]

Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR Method). If the year of construction or ACH is not known, use method 4a (Standard Method).

Step 4: Determine Required Volume for Combustion Air.

4a. Standard Method

Total Btu/hr input of all combustion appliances (DO NOT COUNT DIRECT VENT APPLIANCES)

Input: 33,000 Btu/hr

Use Standard Method column in Table E-1 to find Total Required Volume (TRV)

TRV: 1750 ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

4b. Known Air Infiltration Rate (KAIR) Method

1346.6012 IFGC APPENDIX E, WORKSHEET E-1.

IFGC Appendix E, Worksheet E-1

Residential Combustion Air Calculation Method

(for Furnace, Boiler, and/or Water Heater in the Same Space)

Step 1: Complete vented combustion appliance information.

Furnace/Boiler:

_____ Draft Hood (Not fan assisted)	_____ Fan Assisted & Power Vent	X Direct Vent	Input: 70,000 Btu/hr

Water Heater:

_____ Draft Hood (Not fan assisted)	X Fan Assisted & Power Vent	_____ Direct Vent	Input: 33,000 Btu/hr

Step 2: Calculate the volume of the Combustion Appliance Space (CAS) containing combustion appliances.

The CAS includes all spaces connected to one another by code compliant openings.

CAS volume: 12,896 ft^3 (1612 Sq. Ft x 8 = 12896 ft3)

Step 3: Determine Air Changes per Hour (ACH)[1]

Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR Method). If the year of construction or ACH is not known, use method 4a (Standard Method).

Step 4: Determine Required Volume for Combustion Air.

4a. Standard Method

Total Btu/hr input of all combustion appliances (DO NOT COUNT DIRECT VENT APPLIANCES)

Input: 33,000 Btu/hr

Use Standard Method column in Table E-1 to find Total Required Volume (TRV)

TRV: 1750 ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

4b. Known Air Infiltration Rate (KAIR) Method

1346.6012 IFGC APPENDIX E, WORKSHEET E-1.

IFGC Appendix E, Worksheet E-1

Residential Combustion Air Calculation Method

(for Furnace, Boiler, and/or Water Heater in the Same Space)

Step 1: Complete vented combustion appliance information.

Furnace/Boiler:

_____ Draft Hood (Not fan assisted)	_____ Fan Assisted & Power Vent	X Direct Vent	Input: 70,000 Btu/hr

Water Heater:

_____ Draft Hood (Not fan assisted)	X Fan Assisted & Power Vent	_____ Direct Vent	Input: 33,000 Btu/hr

Step 2: Calculate the volume of the Combustion Appliance Space (CAS) containing combustion appliances.

The CAS includes all spaces connected to one another by code compliant openings.

CAS volume: 12,896 ft^3 (1612 Sq. Ft x 8 = 12896 ft3)

Step 3: Determine Air Changes per Hour (ACH)[1]

Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR Method). If the year of construction or ACH is not known, use method 4a (Standard Method).

Step 4: Determine Required Volume for Combustion Air.

4a. Standard Method

Total Btu/hr input of all combustion appliances (DO NOT COUNT DIRECT VENT APPLIANCES)

Input: 33,000 Btu/hr

Use Standard Method column in Table E-1 to find Total Required Volume (TRV)

TRV: 1750 ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

4b. Known Air Infiltration Rate (KAIR) Method

1346.6012 IFGC APPENDIX E, WORKSHEET E-1.

IFGC Appendix E, Worksheet E-1

Residential Combustion Air Calculation Method

(for Furnace, Boiler, and/or Water Heater in the Same Space)

Step 1: Complete vented combustion appliance information.

Furnace/Boiler:

_____ Draft Hood (Not fan assisted)	_____ Fan Assisted & Power Vent	X Direct Vent	Input: 70,000 Btu/hr

Water Heater:

_____ Draft Hood (Not fan assisted)	X Fan Assisted & Power Vent	_____ Direct Vent	Input: 33,000 Btu/hr

Step 2: Calculate the volume of the Combustion Appliance Space (CAS) containing combustion appliances.

The CAS includes all spaces connected to one another by code compliant openings.

CAS volume: 12,896 ft^3 (1612 Sq. Ft x 8 = 12896 ft3)

Step 3: Determine Air Changes per Hour (ACH)[1]

Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR Method). If the year of construction or ACH is not known, use method 4a (Standard Method).

Step 4: Determine Required Volume for Combustion Air.

4a. Standard Method

Total Btu/hr input of all combustion appliances (DO NOT COUNT DIRECT VENT APPLIANCES)

Input: 33,000 Btu/hr

Use Standard Method column in Table E-1 to find Total Required Volume (TRV)

TRV: 1750 ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

4b. Known Air Infiltration Rate (KAIR) Method

Total Btu/hr input of all fan-assisted and power vent appliances (DO NOT COUNT DIRECT VENT APPLIANCES) — Input: 33,000 Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find Required Volume Fan Assisted (RVFA) — RVFA: _____ ft^3

Total Btu/hr input of all non-fan-assisted appliances — Input: _____ Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find Required Volume Non-Fan-Assisted (RVNFA) — RVNFA: _____ ft^3

Total Required Volume (TRV) = RVFA + RVNFA

RV^3 = _____ + _____ = _____ ft

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

Step 5: Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2) ***divided by*** TRV (from Step 4a or Step 4b) — Ratio = _____ / _____ = _____

Step 6: Calculate Reduction Factor (RF).

RF = 1 ***minus*** Ratio — RF = 1 - _____ = _____

Step 7: Calculate single outdoor opening as if all combustion air is from outside.

Total Btu/hr input of all Combustion Appliances in the same CAS (EXCEPT DIRECT VENT) — Input: _____ Btu/hr

Combustion Air Opening Area (CAOA):
Total Btu/hr ***divided by*** 3000 Btu/hr per in^2

CAOA^2 = _____ /3000 Btu/hr per in^2 = _____ in

Step 8: Calculate Minimum CAOA.

Minimum CAOA = CAOA ***multiplied by*** RF

Minimum CAOA^2 = _____ x _____ = _____ in

Total Btu/hr input of all fan-assisted and power vent appliances (DO NOT COUNT DIRECT VENT APPLIANCES) — Input: 33,000 Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find Required Volume Fan Assisted (RVFA) — RVFA: 2625 ft^3

Total Btu/hr input of all non-fan-assisted appliances — Input: _____ Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find Required Volume Non-Fan-Assisted (RVNFA) — RVNFA: _____ ft^3

Total Required Volume (TRV) = RVFA + RVNFA

RV = _____ + _____ = _____ ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

Step 5: Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2) ***divided by*** TRV (from Step 4a or Step 4b) — Ratio = _____ / _____ = _____

Step 6: Calculate Reduction Factor (RF).

RF = 1 ***minus*** Ratio — RF = 1 - _____ = _____

Step 7: Calculate single outdoor opening as if all combustion air is from outside.

Total Btu/hr input of all Combustion Appliances in the same CAS (EXCEPT DIRECT VENT) — Input: _____ Btu/hr

Combustion Air Opening Area (CAOA):
Total Btu/hr ***divided by*** 3000 Btu/hr per in^2

CAOA = _____ /3000 Btu/hr per in^2 = _____ in^2

Step 8: Calculate Minimum CAOA.

Minimum CAOA = CAOA ***multiplied by*** RF

Minimum CAOA = _____ x _____ = _____ in^2

Total Btu/hr input of all fan-assisted and power vent appliances (DO NOT COUNT DIRECT VENT APPLIANCES) — Input: 33,000 Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find Required Volume Fan Assisted (RVFA) — RVFA: 2625 ft^3

Total Btu/hr input of all non-fan-assisted appliances — Input: N/A Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find Required Volume Non-Fan-Assisted (RVNFA) — RVNFA: _____ ft^3

Total Required Volume (TRV) = RVFA + RVNFA

RV = _____ + _____ = _____ ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

Step 5: Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2) ***divided by*** TRV (from Step 4a or Step 4b) — Ratio = _____ / _____ = _____

Step 6: Calculate Reduction Factor (RF).

RF = 1 ***minus*** Ratio — RF = 1 - _____ = _____

Step 7: Calculate single outdoor opening as if all combustion air is from outside.

Total Btu/hr input of all Combustion Appliances in the same CAS (EXCEPT DIRECT VENT) — Input: _____ Btu/hr

Combustion Air Opening Area (CAOA):
Total Btu/hr ***divided by*** 3000 Btu/hr per in^2

CAOA = _____ /3000 Btu/hr per in^2 = _____ in^2

Step 8: Calculate Minimum CAOA.

Minimum CAOA = CAOA ***multiplied by*** RF

Minimum CAOA = _____ x _____ = _____ in^2

Total Btu/hr input of all fan-assisted and power vent appliances (DO NOT COUNT DIRECT VENT APPLIANCES) — Input: 33,000 Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find Required Volume Fan Assisted (RVFA) — RVFA: 2625 ft^3

Total Btu/hr input of all non-fan-assisted appliances — Input: N/A Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find Required Volume Non-Fan-Assisted (RVNFA) — RVNFA: N/A ft^3

Total Required Volume (TRV) = RVFA + RVNFA

RV_3 = _____ + _____ = _____ ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

Step 5: Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2) ***divided by*** TRV (from Step 4a or Step 4b) — Ratio = _____ / _____ = _____

Step 6: Calculate Reduction Factor (RF).

RF = 1 ***minus*** Ratio — RF = 1 - _____ = _____

Step 7: Calculate single outdoor opening as if all combustion air is from outside.

Total Btu/hr input of all Combustion Appliances in the same CAS (EXCEPT DIRECT VENT) — Input: _____ Btu/hr

Combustion Air Opening Area (CAOA):
Total Btu/hr ***divided by*** 3000 Btu/hr per in^2

$CAOA_2$ = _____ /3000 Btu/hr per in^2 = _____ in^2

Step 8: Calculate Minimum CAOA.

Minimum CAOA = CAOA ***multiplied by*** RF

Minimum $CAOA_2$ = _____ x _____ = _____ in^2

Total Btu/hr input of all fan-assisted and power vent appliances (DO NOT COUNT DIRECT VENT APPLIANCES) — Input: 33,000 Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find Required Volume Fan Assisted (RVFA) — RVFA: 2625 ft^3

Total Btu/hr input of all non-fan-assisted appliances — Input: N/A Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find Required Volume Non-Fan-Assisted (RVNFA) — RVNFA: N/A ft^3

Total Required Volume (TRV) = RVFA + RVNFA

RV_3 = 2625 + N/A = 2625 ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

Step 5: Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2) ***divided by*** TRV (from Step 4a or Step 4b) — Ratio = _____ / _____ = _____

Step 6: Calculate Reduction Factor (RF).

RF = 1 ***minus*** Ratio — RF = 1 - _____ = _____

Step 7: Calculate single outdoor opening as if all combustion air is from outside.

Total Btu/hr input of all Combustion Appliances in the same CAS (EXCEPT DIRECT VENT) — Input: _____ Btu/hr

Combustion Air Opening Area (CAOA):
Total Btu/hr ***divided by*** 3000 Btu/hr per in^2

$CAOA_2$ = _____ /3000 Btu/hr per in^2 = _____ in

Step 8: Calculate Minimum CAOA.

Minimum CAOA = CAOA ***multiplied by*** RF

Minimum $CAOA_2$ = _____ x _____ = _____ in

Total Btu/hr input of all fan-assisted and power vent appliances (DO NOT COUNT DIRECT VENT APPLIANCES) — Input: ___ 33,000 Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find Required Volume Fan Assisted (RVFA) — RVFA: __ 2625 __ ft^3

Total Btu/hr input of all non-fan-assisted appliances — Input: __ N/A _ Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find Required Volume Non-Fan-Assisted (RVNFA) — RVNFA: __ N/A _ ft^3

Total Required Volume (TRV) = RVFA + RVNFA

RV = __ 2625 __ N/A = __ 2625 ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

Step 5: Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2) ***divided by*** TRV (from Step 4a or Step 4b) — Ratio = _____ / _____ = _____

Step 6: Calculate Reduction Factor (RF).

RF = 1 ***minus*** Ratio — RF = 1 - _____ = _____

Step 7: Calculate single outdoor opening as if all combustion air is from outside.

Total Btu/hr input of all Combustion Appliances in the same CAS (EXCEPT DIRECT VENT) — Input: _____ Btu/hr

Combustion Air Opening Area (CAOA):
Total Btu/hr ***divided by*** 3000 Btu/hr per in^2

CAOA = _____ /3000 Btu/hr per in^2 = _____ in^2

Step 8: Calculate Minimum CAOA.

Minimum CAOA = CAOA ***multiplied by*** RF

Minimum CAOA = _____ x _____ = _____ in^2

Total Btu/hr input of all fan-assisted and power vent appliances (DO NOT COUNT DIRECT VENT APPLIANCES) — Input: ___ 33,000 Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find Required Volume Fan Assisted (RVFA) — RVFA: __ 2625 __ ft^3

Total Btu/hr input of all non-fan-assisted appliances — Input: __ N/A _ Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find Required Volume Non-Fan-Assisted (RVNFA) — RVNFA: __ N/A _ ft^3

Total Required Volume (TRV) = RVFA + RVNFA

RV = __ 2625 __ N/A = __ 2625 ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

Step 5: Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2) ***divided by*** TRV (from Step 4a or Step 4b) — Ratio = 12,896 / 1750 = 7.37

Step 6: Calculate Reduction Factor (RF).

RF = 1 ***minus*** Ratio — RF = 1 - _____ = _____

Step 7: Calculate single outdoor opening as if all combustion air is from outside.

Total Btu/hr input of all Combustion Appliances in the same CAS (EXCEPT DIRECT VENT) — Input: _____ Btu/hr

Combustion Air Opening Area (CAOA):
Total Btu/hr ***divided by*** 3000 Btu/hr per in^2

CAOA = _____ /3000 Btu/hr per in^2 = _____ in^2

Step 8: Calculate Minimum CAOA.

Minimum CAOA = CAOA ***multiplied by*** RF

Minimum CAOA = _____ x _____ = _____ in^2

Total Btu/hr input of all fan-assisted and power vent appliances (DO NOT COUNT DIRECT VENT APPLIANCES) — Input: ___ 33,000 Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find Required Volume Fan Assisted (RVFA) — RVFA: __ 2625 __ ft^3

Total Btu/hr input of all non-fan-assisted appliances — Input: __ N/A _ Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find Required Volume Non-Fan-Assisted (RVNFA) — RVNFA: __ N/A _ ft^3

Total Required Volume (TRV) = RVFA + RVNFA

RV = __ 2625 __ N/A = __ 2625 ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

Step 5: Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2) ***divided by*** TRV (from Step 4a or Step 4b) — Ratio = 12,896 / 1750 = 7.37

Step 6: Calculate Reduction Factor (RF).

RF = 1 ***minus*** Ratio — RF = 1 - 7.37 = -6.37

Step 7: Calculate single outdoor opening as if all combustion air is from outside.

Total Btu/hr input of all Combustion Appliances in the same CAS (EXCEPT DIRECT VENT) — Input: _____ Btu/hr

Combustion Air Opening Area (CAOA):
Total Btu/hr ***divided by*** 3000 Btu/hr per in^2

CAOA = _____ /3000 Btu/hr per in^2 = _____ in^2

Step 8: Calculate Minimum CAOA.

Minimum CAOA = CAOA ***multiplied by*** RF

Minimum CAOA = _____ x _____ = _____ in^2

Total Btu/hr input of all fan-assisted and power vent appliances (DO NOT COUNT DIRECT VENT APPLIANCES) — Input: ___ 33,000 Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find Required Volume Fan Assisted (RVFA) — RVFA: __ 2625 __ ft^3

Total Btu/hr input of all non-fan-assisted appliances — Input: __ N/A _ Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find Required Volume Non-Fan-Assisted (RVNFA) — RVNFA: __ N/A _ ft^3

Total Required Volume (TRV) = RVFA + RVNFA

RV = __ 2625 __ N/A = __ 2625 ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

Step 5: Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2) ***divided by*** TRV (from Step 4a or Step 4b) — Ratio = 12,896 / 1750 = 7.37

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Combustion Air Opening Area (CAOA):
Total Btu/hr ***divided by*** 3000 Btu/hr per in^2

CAOA = _____ /3000 Btu/hr per in^2 = _____ in^2

Step 8: Calculate Minimum CAOA.

Minimum CAOA = CAOA ***multiplied by*** RF

Minimum CAOA = _____ x _____ = _____ in^2

Total Btu/hr input of all fan-assisted and power vent appliances (DO NOT COUNT DIRECT VENT APPLIANCES) — Input: ___ 33,000 Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find Required Volume Fan Assisted (RVFA) — RVFA: __ 2625 __ ft^3

Total Btu/hr input of all non-fan-assisted appliances — Input: __ N/A _ Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find Required Volume Non-Fan-Assisted (RVNFA) — RVNFA: __ N/A _ ft^3

Total Required Volume (TRV) = RVFA + RVNFA

RV = __ 2625 __ N/A = __ 2625 ft^3

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

Step 5: Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2) ***divided by*** TRV (from Step 4a or Step 4b) — Ratio = 12,896 / 1750 = 7.37

Step 6: Calculate Reduction Factor (RF).

RF = 1 ***minus*** Ratio — RF = 1 - 7.37 = -6.37

Step 7: Calculate single outdoor opening as if all combustion air is from outside.

Total Btu/hr input of all Combustion Appliances in the same CAS (EXCEPT DIRECT VENT) — Input: 33,000 Btu/hr

Combustion Air Opening Area (CAOA):
Total Btu/hr ***divided by*** 3000 Btu/hr per in^2

CAOA = 33,000 /3000 Btu/hr per in^2 = 11 in^2

Step 8: Calculate Minimum CAOA.

Minimum CAOA = CAOA ***multiplied by*** RF

Minimum CAOA = _____ x _____ = _____ in^2

Total Btu/hr input of all fan-assisted and power vent appliances (DO NOT COUNT DIRECT VENT APPLIANCES) — Input: 33,000 Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find Required Volume Fan Assisted (RVFA) — RVFA: 2625 ft³

Total Btu/hr input of all non-fan-assisted appliances — Input: N/A Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find Required Volume Non-Fan-Assisted (RVNFA) — RVNFA: N/A ft³

Total Required Volume (TRV) = RVFA + RVNFA

RV = 2625 + N/A = 2625 ft³

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

Step 5: Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2) ***divided by*** TRV (from Step 4a or Step 4b) — Ratio = 12,896 / 1750 = 7.37

Step 6: Calculate Reduction Factor (RF).

RF = 1 ***minus*** Ratio — RF = 1 - 7.37 = -6.37

Step 7: Calculate single outdoor opening as if all combustion air is from outside.

Total Btu/hr input of all Combustion Appliances in the same CAS (EXCEPT DIRECT VENT) — Input: 33,000 Btu/hr

Combustion Air Opening Area (CAOA):
Total Btu/hr ***divided by*** 3000 Btu/hr per in²

CAOA = 33,000 /3000 Btu/hr per in² = 11 in²

Step 8: Calculate Minimum CAOA.

Minimum CAOA = CAOA ***multiplied by*** RF

Minimum CAOA = 11 x 6.37 = -59.07 in²

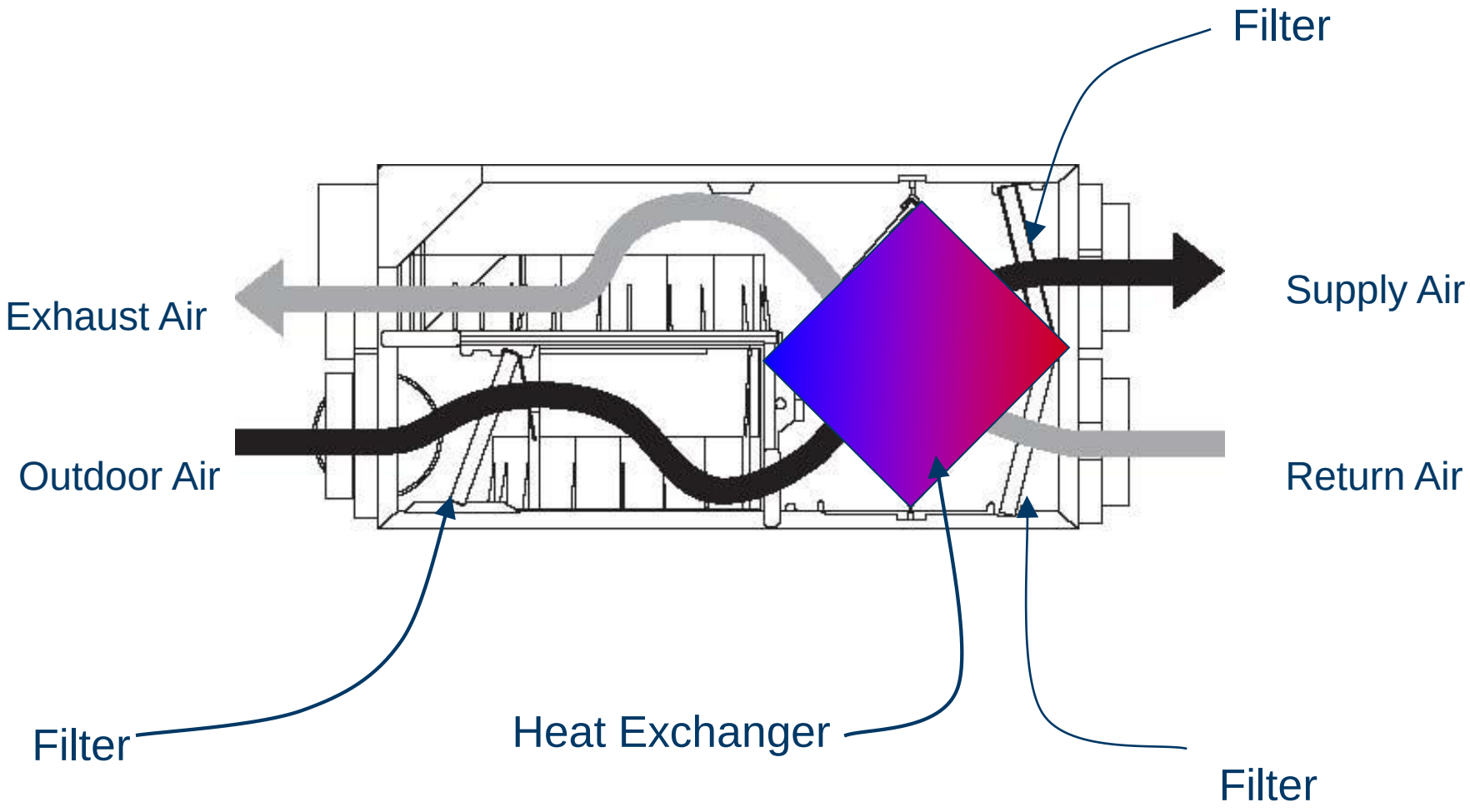
- Balanced Ventilation
  - IECC Section R 403.5 (as Amended)

Ventilation System Requirements

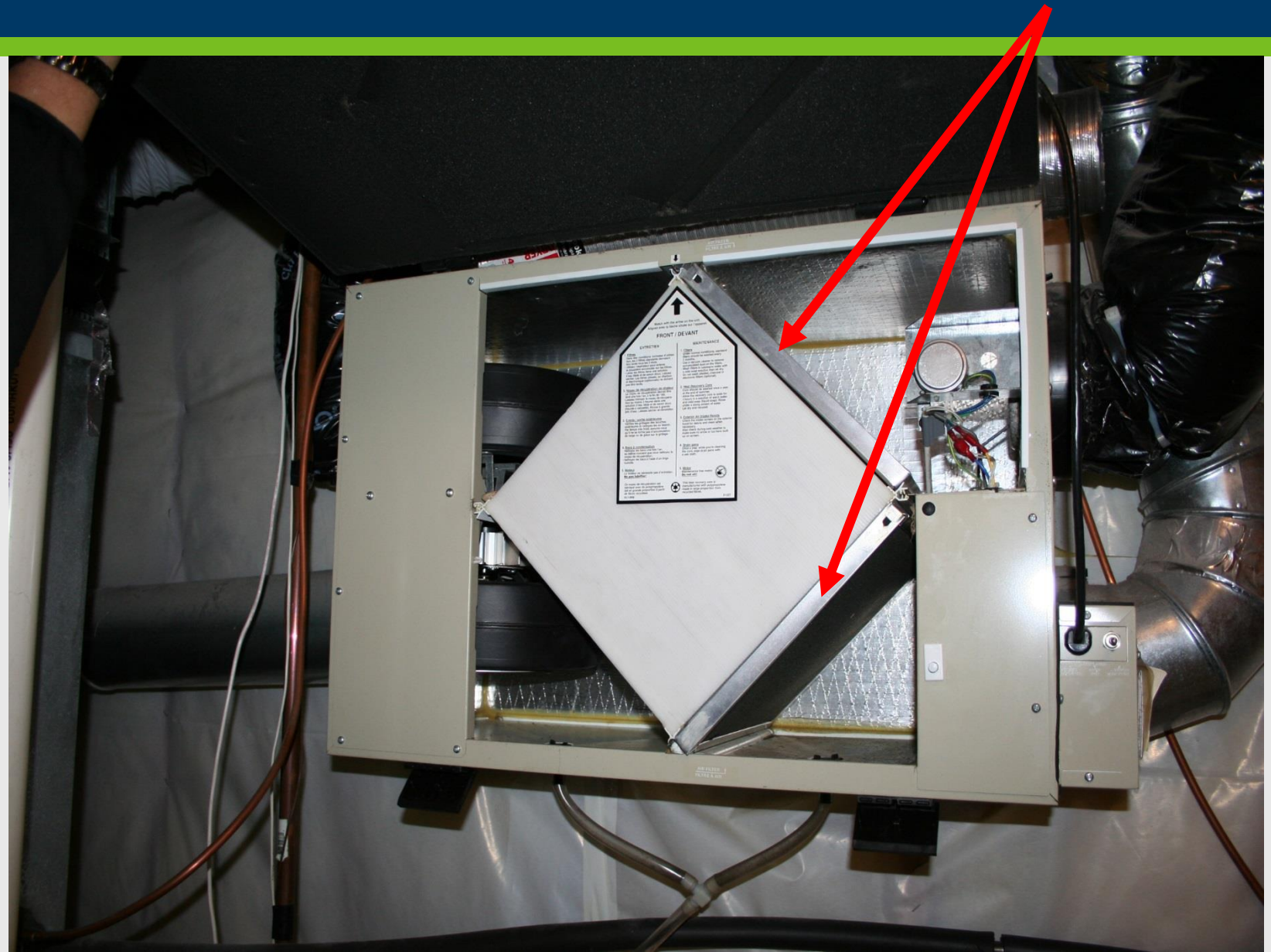
- **Exhaust Only Systems (no longer Allowed)**

- **“Balanced Systems”**
  - HRV/ERV
  - An intake and exhaust fan linked together to operate equally

Heat Recovery Ventilator

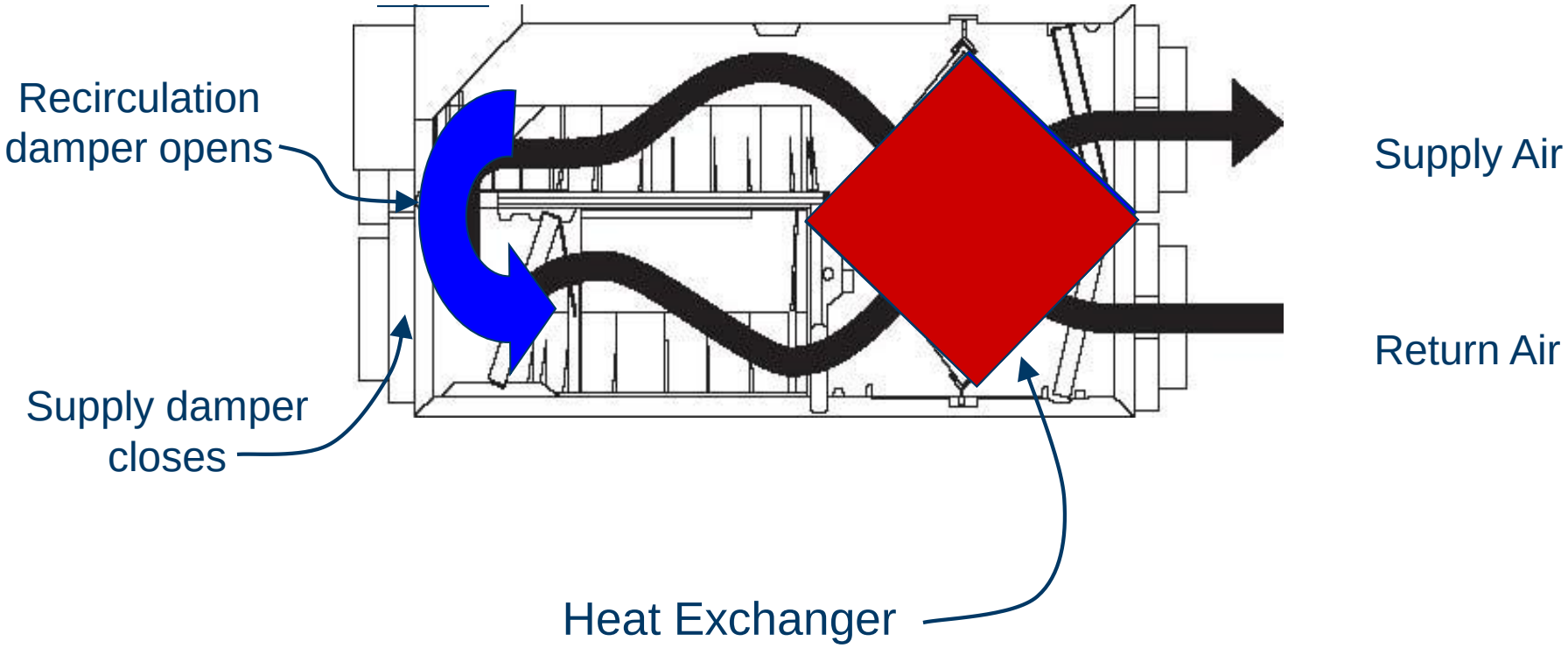


Filters Require maintenance

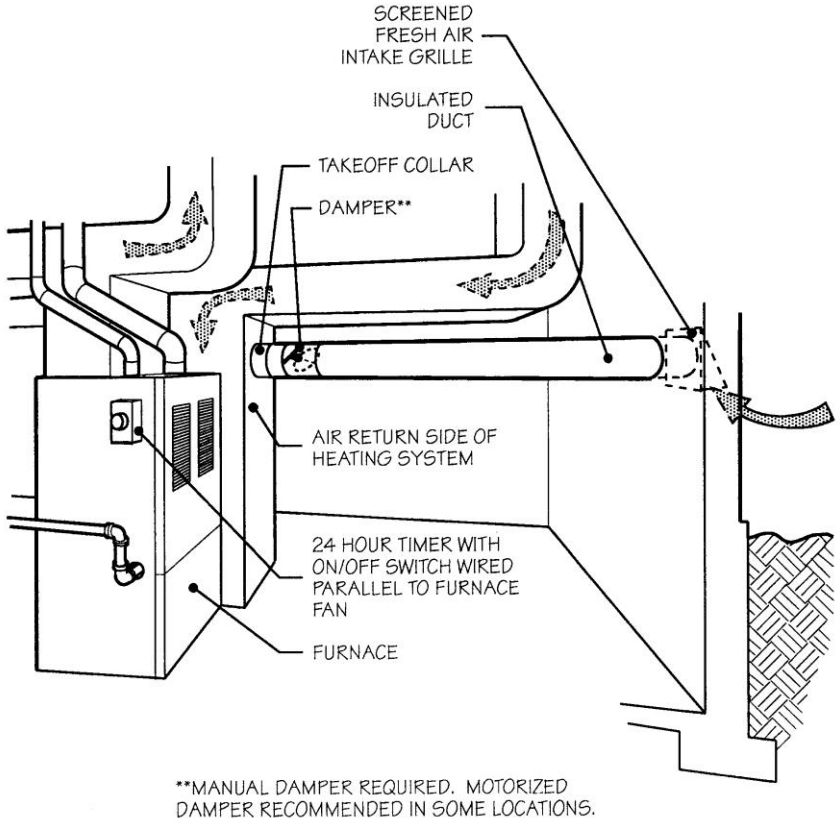


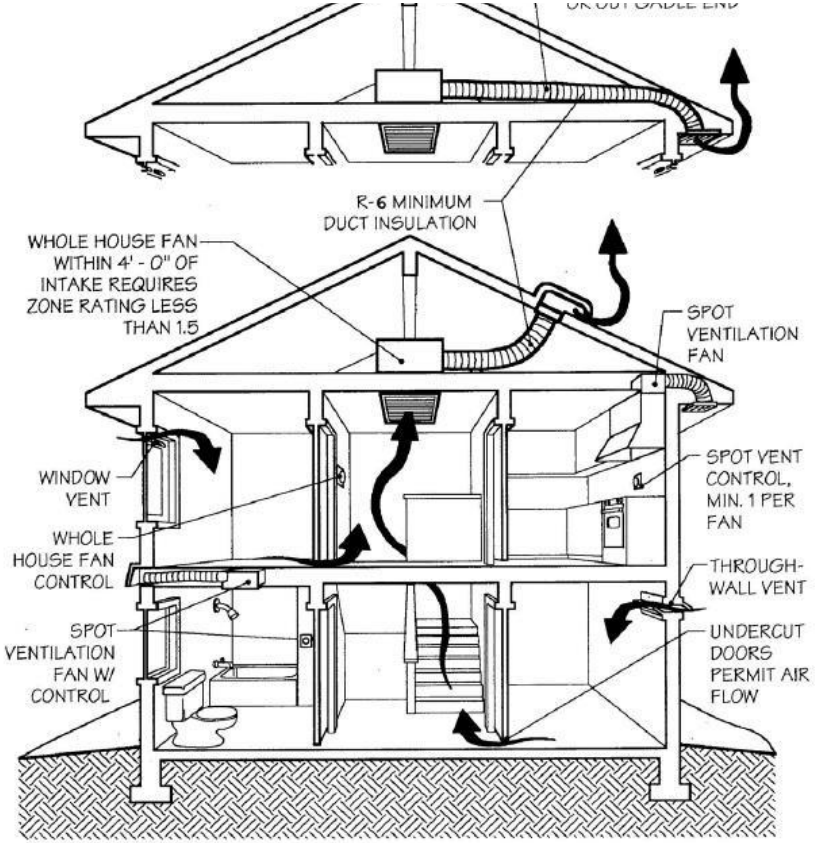
Filters Require maintenance

HRV Defrost Operation (10%)



Balanced Ventilation System





Total Ventilation Air (Method 1)

- **Equation R403.5.2**
- **Total ventilation rate (CFM) = (0.02 x square feet of conditioned space) + (15 x (number of bedrooms +1)).**

Table R 403.5.2 (Method 2)

Total and continuous ventilation rates (in CFM)

Conditioned space[1] (in sq. ft.)	Number of Bedrooms					
	1	2	3	4	5	6[2]
	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous
1000 – 1500	60/40	75/40	90/45	105/53	120/60	135/68
1501 – 2000	70/40	85/43	100/50	115/58	130/65	145/73
2001 – 2500	80/40	95/48	110/55	125/63	140/70	155/78
2501 – 3000	90/45	105/53	120/60	135/68	150/75	165/83
3001 – 3500	100/50	115/58	130/65	145/73	160/80	175/88
3501 – 4000	110/55	125/63	140/70	155/78	170/85	185/93
4001 – 4500	120/60	135/68	150/75	165/83	180/90	195/98
4501 – 5000	130/65	145/73	160/80	175/88	190/95	205/103
5001 – 5500	140/70	155/78	170/85	185/93	200/100	215/108
5501 – 6000[2]	150/75	165/83	180/90	195/98	210/105	225/113

Total Ventilation Air

- **Equation R403.5.2**
- **Total ventilation rate (CFM) = (0.02 x square feet of conditioned space) + (15 x (number of bedrooms +1)).**

Total Ventilation Air

- **Equation R403.5.2**
- **Total ventilation rate (CFM) = (0.02 x square feet of conditioned space) + (15 x (number of bedrooms +1)).**
  - **Includes the basement but excludes conditioned crawl spaces.**

Total Ventilation Air

- **Equation R403.5.2**
- **Total ventilation rate (CFM) = (0.02 x square feet of conditioned space) + (15 x (number of bedrooms +1)).**
  - **Includes the basement but excludes conditioned crawl spaces.**
  - **Subsript 2 in the table states "If conditioned space exceeds 6000 Sq. Ft or there are more than 6 bedrooms, use the equations"**

Total Ventilation Air

- **Our Home:**
  - **3224 square feet** of conditioned space house
    - Conditioned space = “An area, room or space being heated or cooled by any equipment or appliance.”
  - **3 bedrooms**

Total Ventilation Air

- **Our Home**
  - **3224square feet** of conditioned space house
    - Conditioned space = “An area, room or space being heated or cooled by any equipment or appliance.”
  - **3 bedrooms**

- .02 x square feet of conditioned space = .02 x 3224 = 65 CFM
- Number of bedrooms (3) + 1 = 4
- 15 x 4 = 60 CFM
- Total ventilation rate (CFM) = 65 CFM + 60 CFM = **125 CFM**

Table R 403.5.2

Total and continuous ventilation rates (in CFM)

Conditioned space[1] (in sq. ft.)	Number of Bedrooms					
	1	2	3	4	5	6[2]
	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous
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Total and continuous ventilation rates (in CFM)

	Number of Bedrooms					
	1	2	3	4	5	6[2]
Conditioned space[1] (in sq. ft.)	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous
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Total and continuous ventilation rates (in CFM)

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Continuous Ventilation Air

- **Continuous Ventilation:**

Continuous Ventilation Air

- **Continuous Ventilation:**
  - **R403.5.3: "… a minimum of 50% of the total** ventilation rate, **but not less than 40 CFM,** on a continuous rate average for each one hour period in accordance with Table R403.5.2 or Equation 403.5.2

Continuous Ventilation Air

- **Continuous Ventilation:**
  - **R403.5.3: "… a minimum of 50% of the total** ventilation rate, **but not less than 40 CFM,** on a continuous rate average for each one hour period in accordance with Table R403.5.2 or Equation 403.5.2
  - **Equation R403.5.3**: Continuous ventilation (CFM)= total ventilation rate /2.

Our Home = 125 CFM (Total ventilation Rate) divided by 2 =

125 / 2 = 62.5 or 63 CFM of Continuous Ventilation

Table R 403.5.2

Total and continuous ventilation rates (in CFM)

Conditioned space[1] (in sq. ft.)	Number of Bedrooms					
	1	2	3	4	5	6[2]
	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous
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Total and continuous ventilation rates (in CFM)

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5501 – 6000[2]	150/75	165/83	180/90	195/98	210/105	225/113

Service Hot Water Systems

New SHW pipe insulation and run-length requirements (R-3)

R 403.4.4 Hot Water Pipe Insulation

- **Hot water piping will be insulated to at least R-3 as follows:**
  - Piping is larger than 3/4” in nominal diameter,
  - Piping serves more than one dwelling unit,
  - Piping runs from water heater to kitchen outlets,
  - Piping is located outside of conditioned space,
  - Piping runs from water heater to a distribution manifold,
  - Piping is located under a floor slab,
  - Piping is buried,
  - Supply and return piping is in recirculation systems other than demand recirculation systems,
  - **Piping run exceeds the following maximum run lengths:**

Nominal diameter of largest pipe diameter in run	3/8”	1/2"	3/4”	> 3/4"
Max run length	30 ft	20 ft	10 ft	5 ft

R403.4.2 – Hot water pipe insulation

- **All hot water pipe, minimum R-3. Thermal resistance for all piping**

TABLE R403.4.2
MAXIMUM RUN LENGTH (feet)[a]

Nominal Pipe Diameter of Largest Diameter Pipe in the Run (inch)	3/8	1/2	3/4	> 3/4
Maximum Run Length	30	20	10	5

For SI: 1 inch = 25.4 mm, 1 foot 304.8 mm.

a. Total length of all piping from the distribution manifold or the recirculation loop to a point of use.

Prescriptive Lighting Equipment

A minimum of 75 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps or 75% of permanently installed lighting fixtures to contain only high efficacy lamps

Exception:

- ✓ Low-voltage lighting

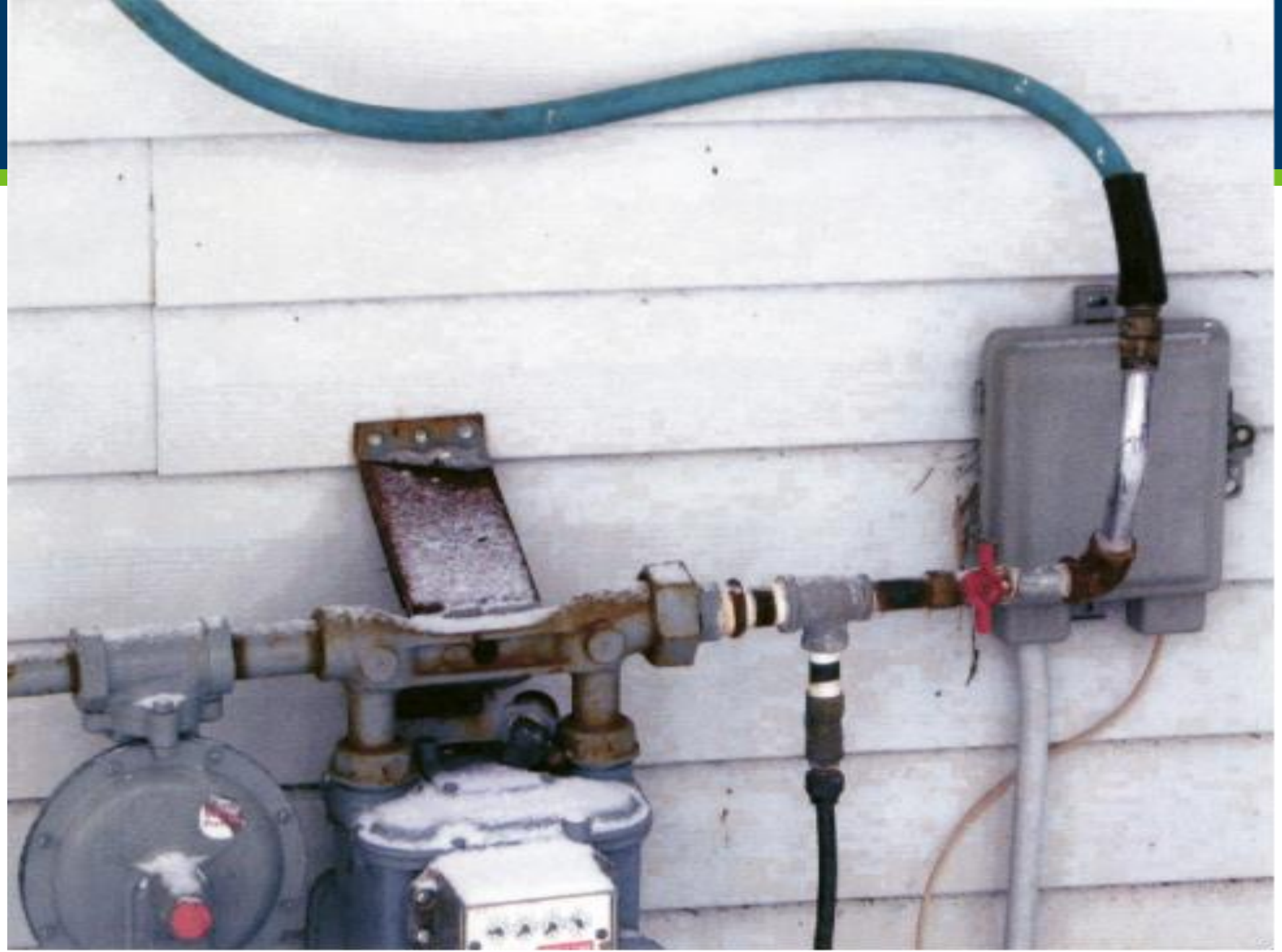
Recessed Lighting Fixtures
Section R402.4.5

- ✓Type IC rated and labeled as meeting ASTM E 283 when tested at 1.57 psf (75 Pa) pressure differential with no more than 2.0 cfm of air movement
- ✓Sealed with a gasket or caulk between the housing and interior wall or ceiling covering

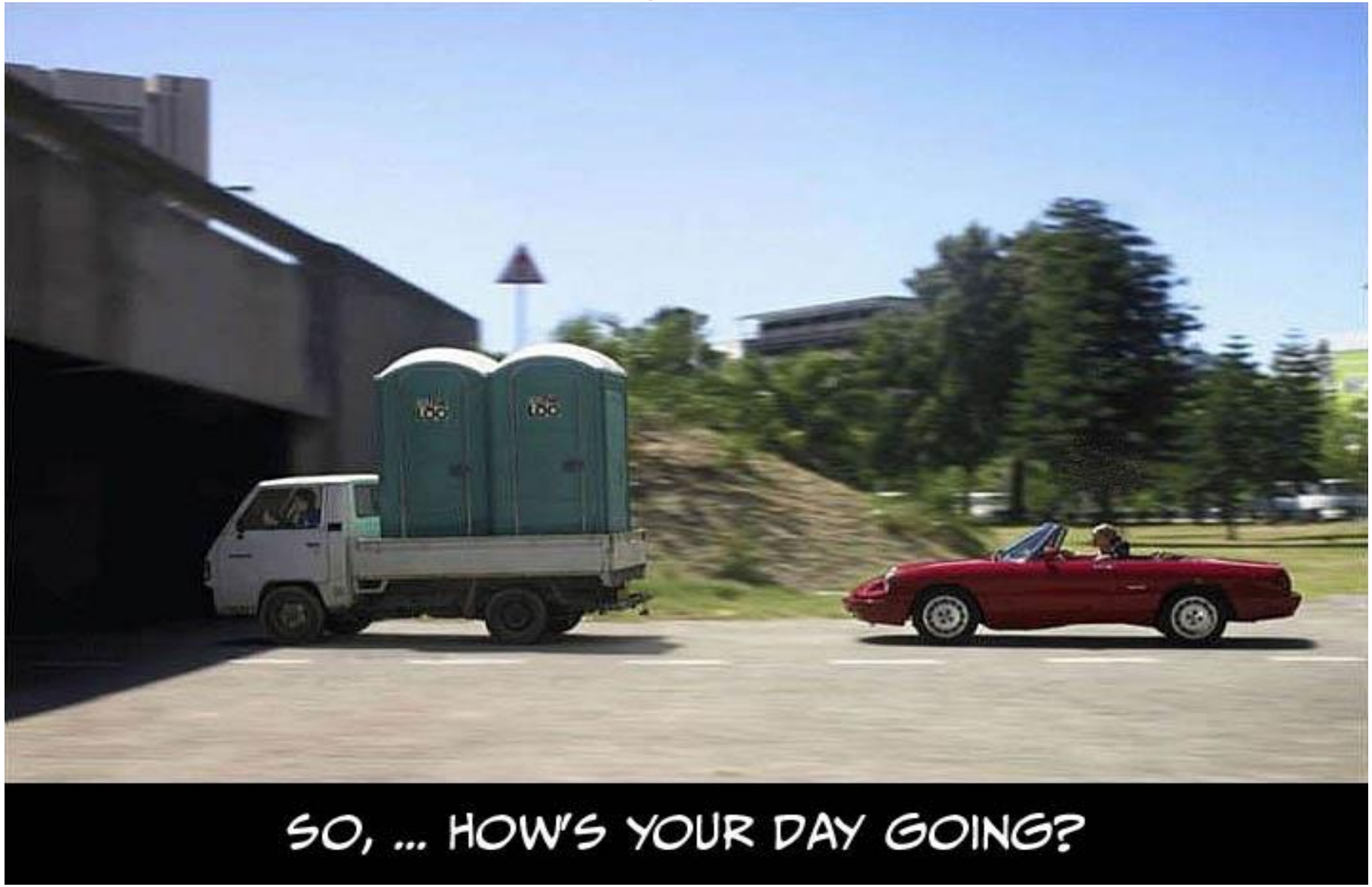
Review of our Course Objectives

- Calculate Heat loss for Building
- Size the Furnace for the Building
- Calculate the Make up air requirements
- Calculate the Combustion air requirements
- Calculate and design the ventilation system
  - Continuous ventilation
  - Total Ventilation (continuous + intermittent)
- Discussion on the Service water heating System and the Energy code Requirements
- Discussion on Electrical requirements and the Energy Code Requirements R R404

Gas Meter locations



Please Drive Carefully on your way home!



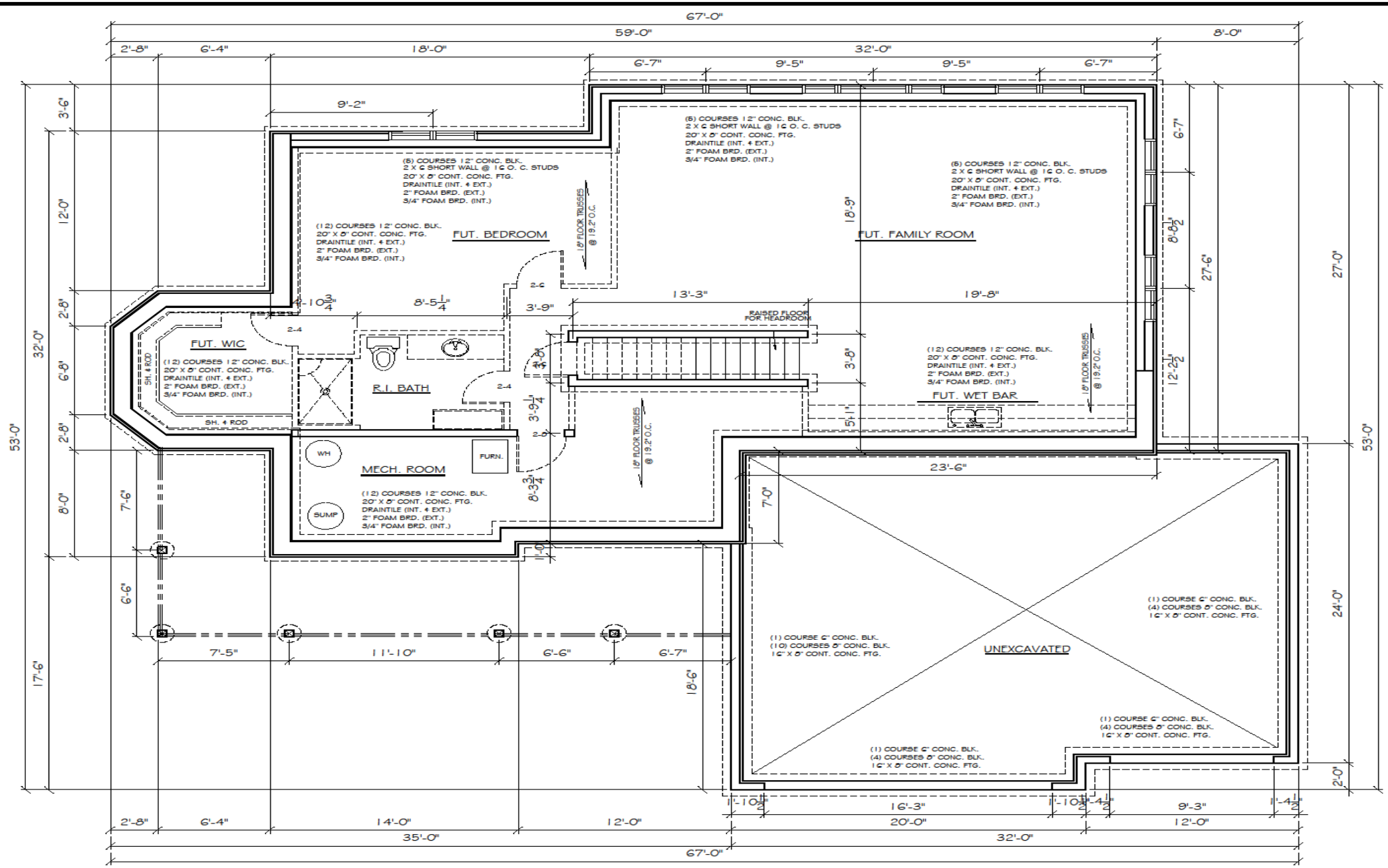
DEPARTMENT OF LABOR AND INDUSTRY
CONSTRUCTION CODES AND LICENSING

Thank You!

Don Sivigny

don.sivigny@state.mn.us

651-284-5874


67'-0"
59'-0"
8'-0"
2'-8"
6'-4"
18'-0"
32'-0"
6'-7"
9'-5"
9'-5"
6'-7"
9'-2"
3'-6"
12'-0"
2'-8"
6'-8"
2'-8"
8'-0"
32'-0"
53'-0"
7'-6"
6'-6"
17'-6"
(5) COURSES 12" CONC. BLK.
2 X 6 SHORT WALL @ 16 O. C. STUDS
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
(12) COURSES 12" CONC. BLK.
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
FUT. BEDROOM
18" FLOOR TRUSSES @ 19.2" O.C.
FUT. FAMILY ROOM
18'-9"
8'-6 1/2"
27'-6"
6'-7"
27'-0"
53'-0"
24'-0"
2'-0"
4'-10 3/4"
8'-5 1/4"
3'-9"
13'-3"
19'-8"
RAISED FLOOR FOR HEADROOM
FUT. WIC
SH. & ROD
R.I. BATH
FUT. WET BAR
3'-8"
5'-1"
12'-2 1/2"
MECH. ROOM
WH
FURN.
SUMP
8'-3 3/4"
3'-9 1/4"
23'-6"
7'-0"
UNEXCAVATED
(1) COURSE 6" CONC. BLK.
(10) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
(1) COURSE 6" CONC. BLK.
(4) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
7'-5"
11'-10"
6'-6"
6'-7"
18'-6"
1'-10 1/2"
16'-3"
1'-10 1/2"
1'-4 1/2"
9'-3"
1'-4 1/2"
20'-0"
12'-0"
2'-8"
6'-4"
14'-0"
12'-0"
35'-0"
32'-0"
67'-0"

ENERGY CODE NOTE:

CONTRACTOR AND SUB-CONTRACTOR ARE
RESPOSIBLE FOR COMPLIANCE OF THE CURRENT
CODE AS REQUIRED.
1. INTERIOR VAPOR RETARDER ON INSULATED CEILINGS, WALLS
AND FLOORS.
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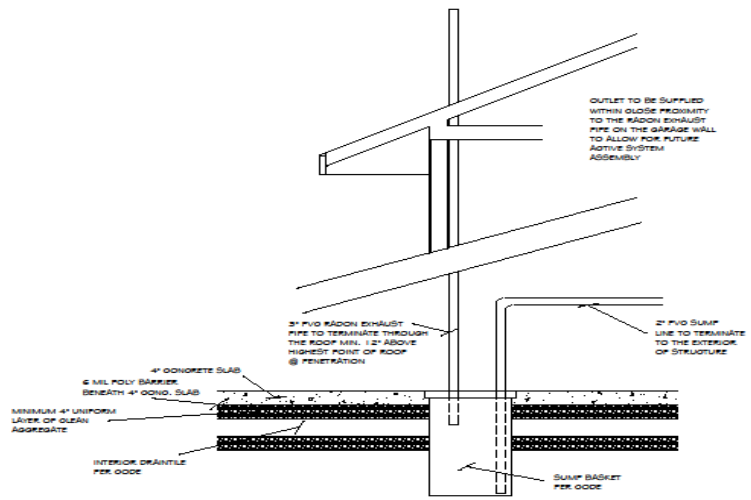

RADON DETAIL

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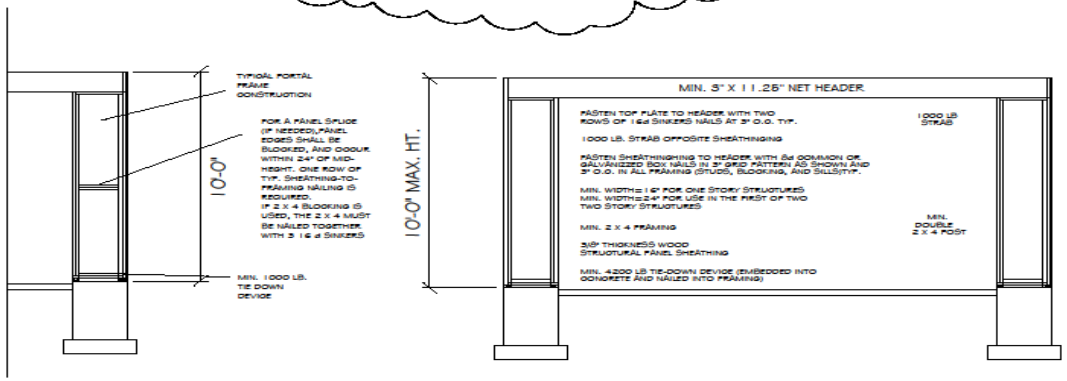
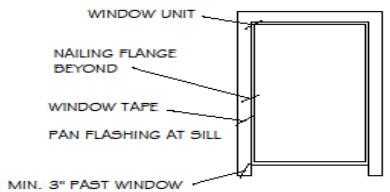
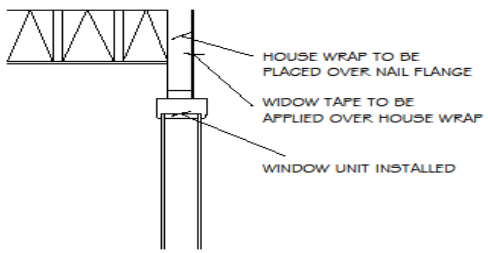




WINDOW TAPE DETAIL



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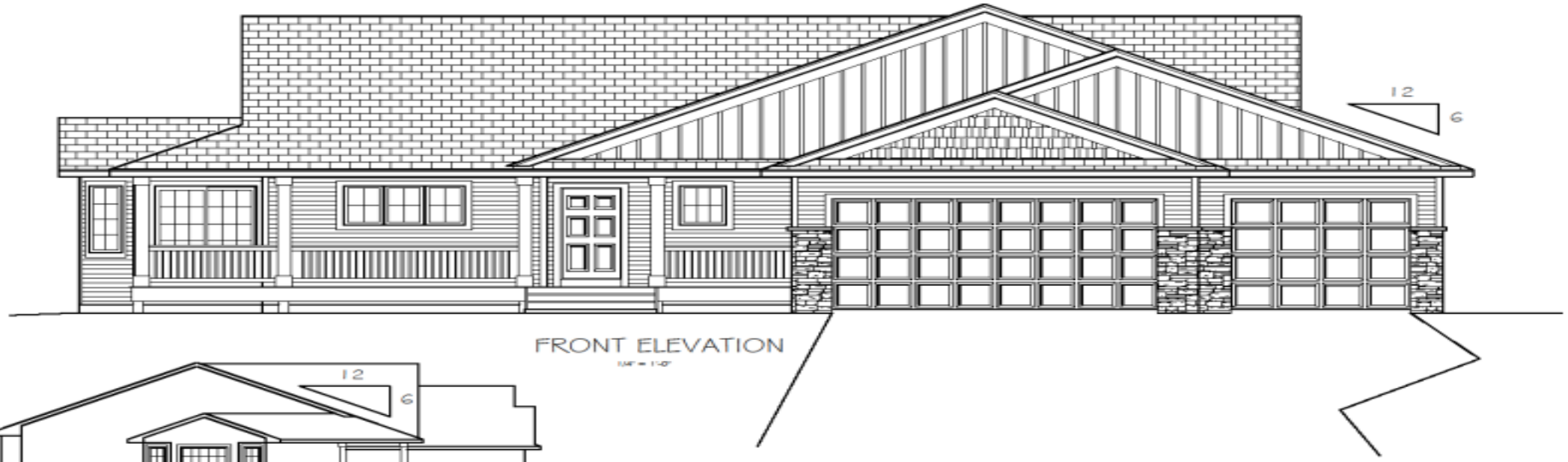
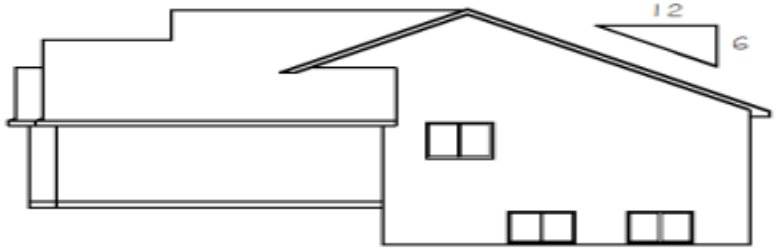
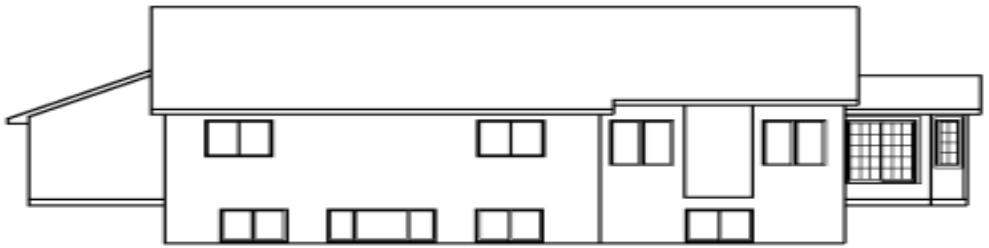


FRONT ELEVATION

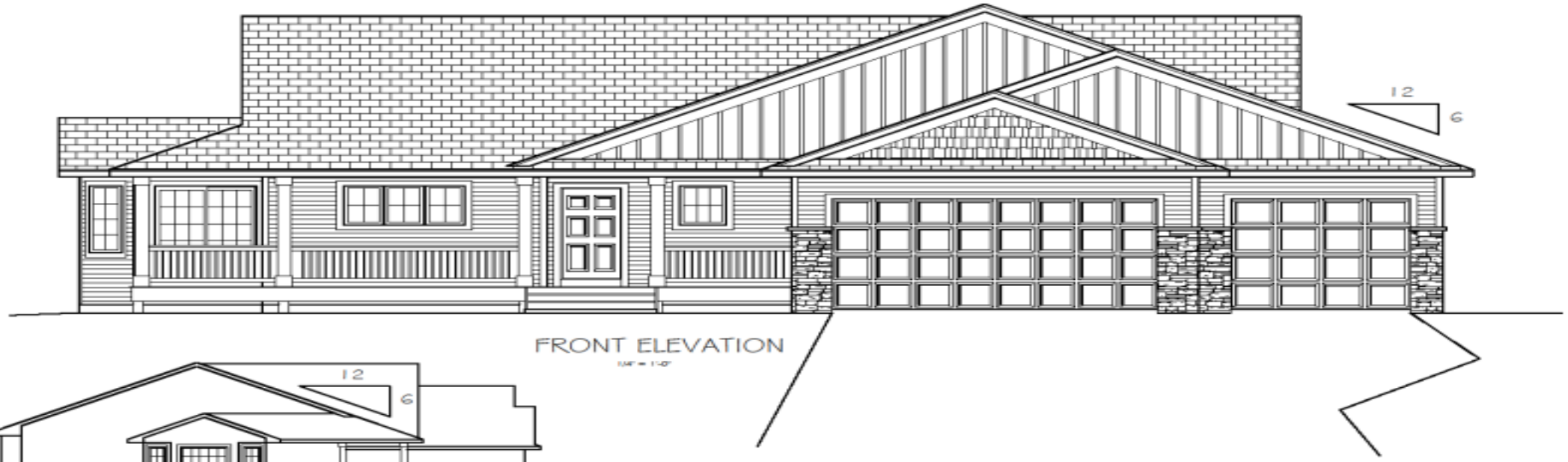
LEFT ELEVATION



RIGHT ELEVATION

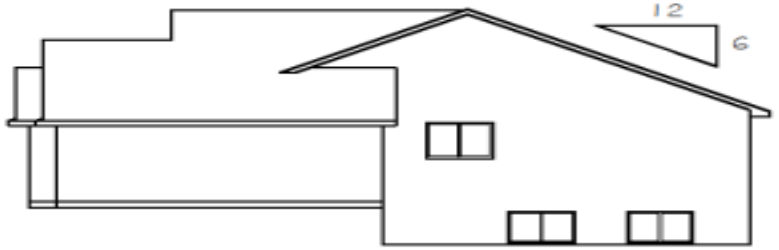


REAR ELEVATION



FRONT ELEVATION

LEFT ELEVATION



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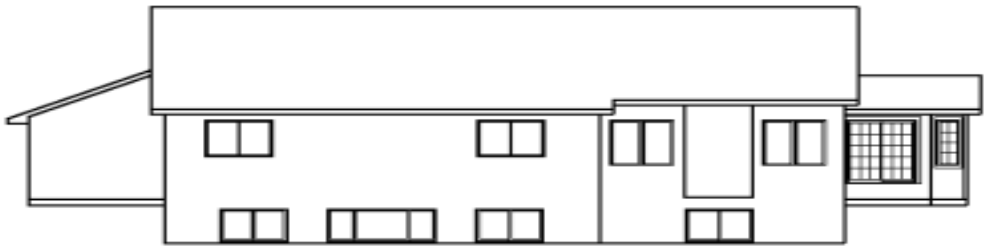

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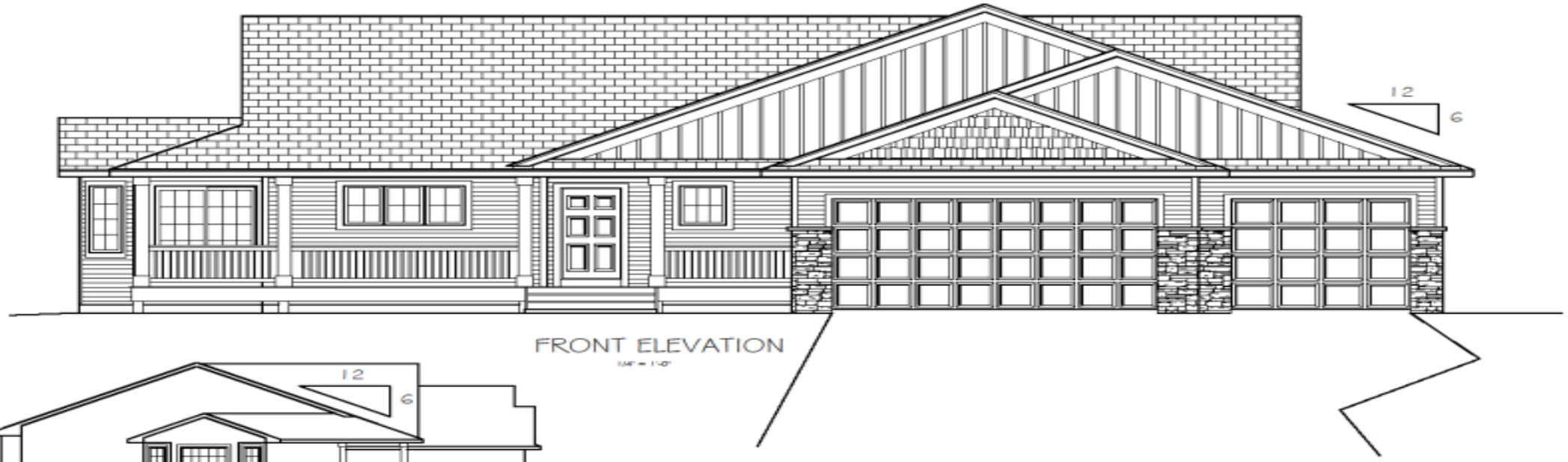

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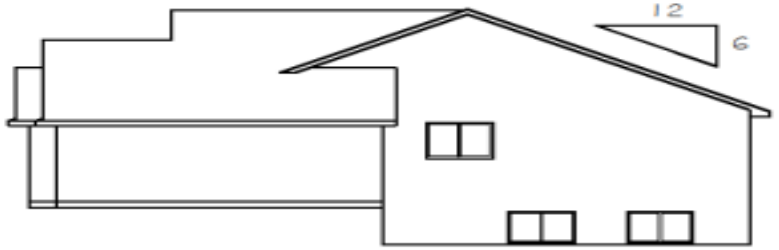

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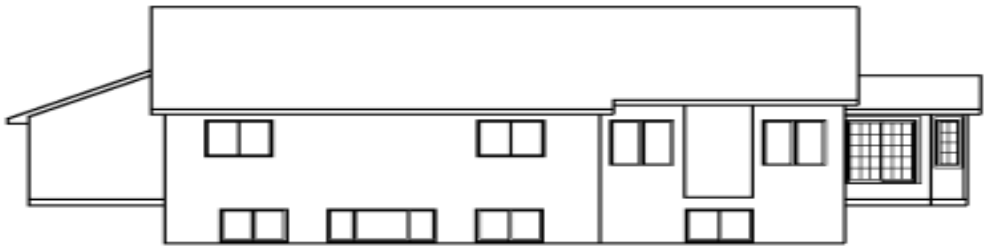

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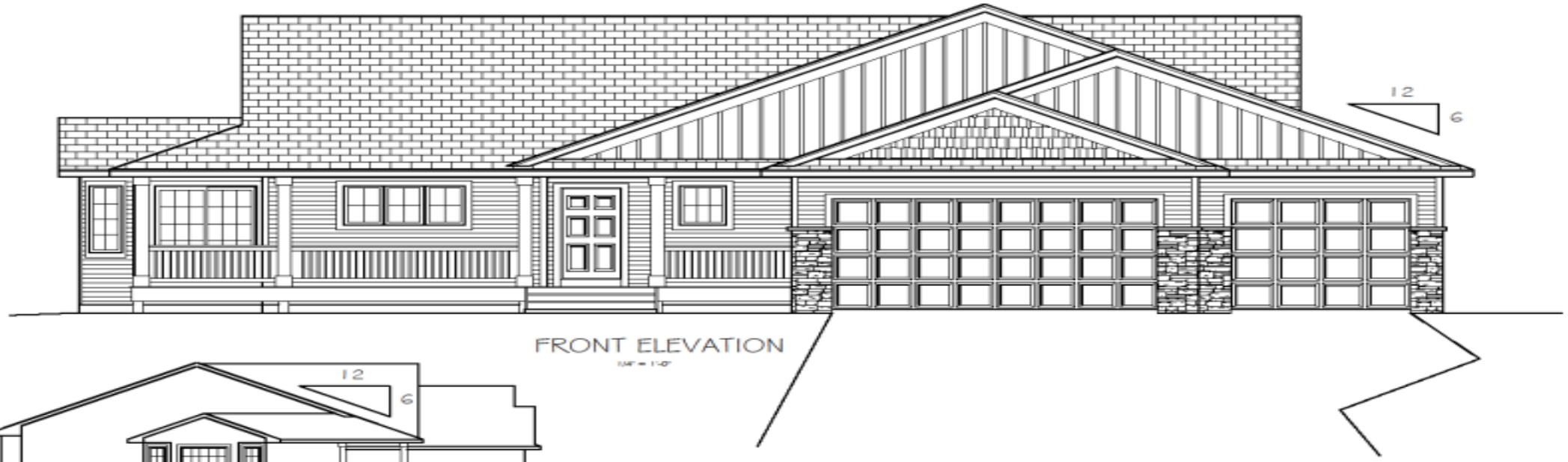

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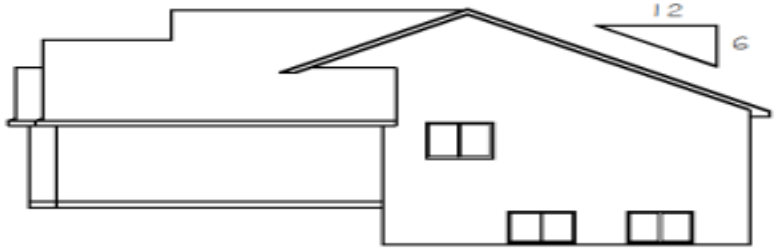

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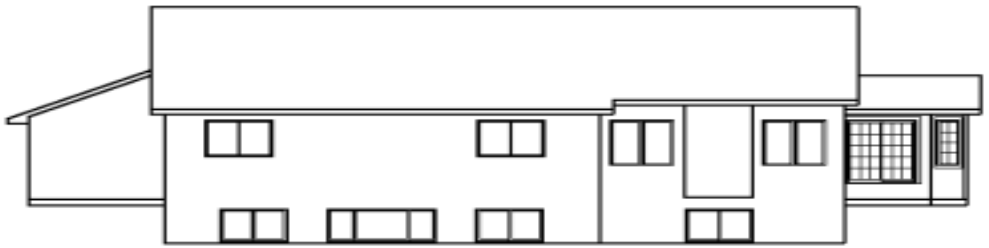

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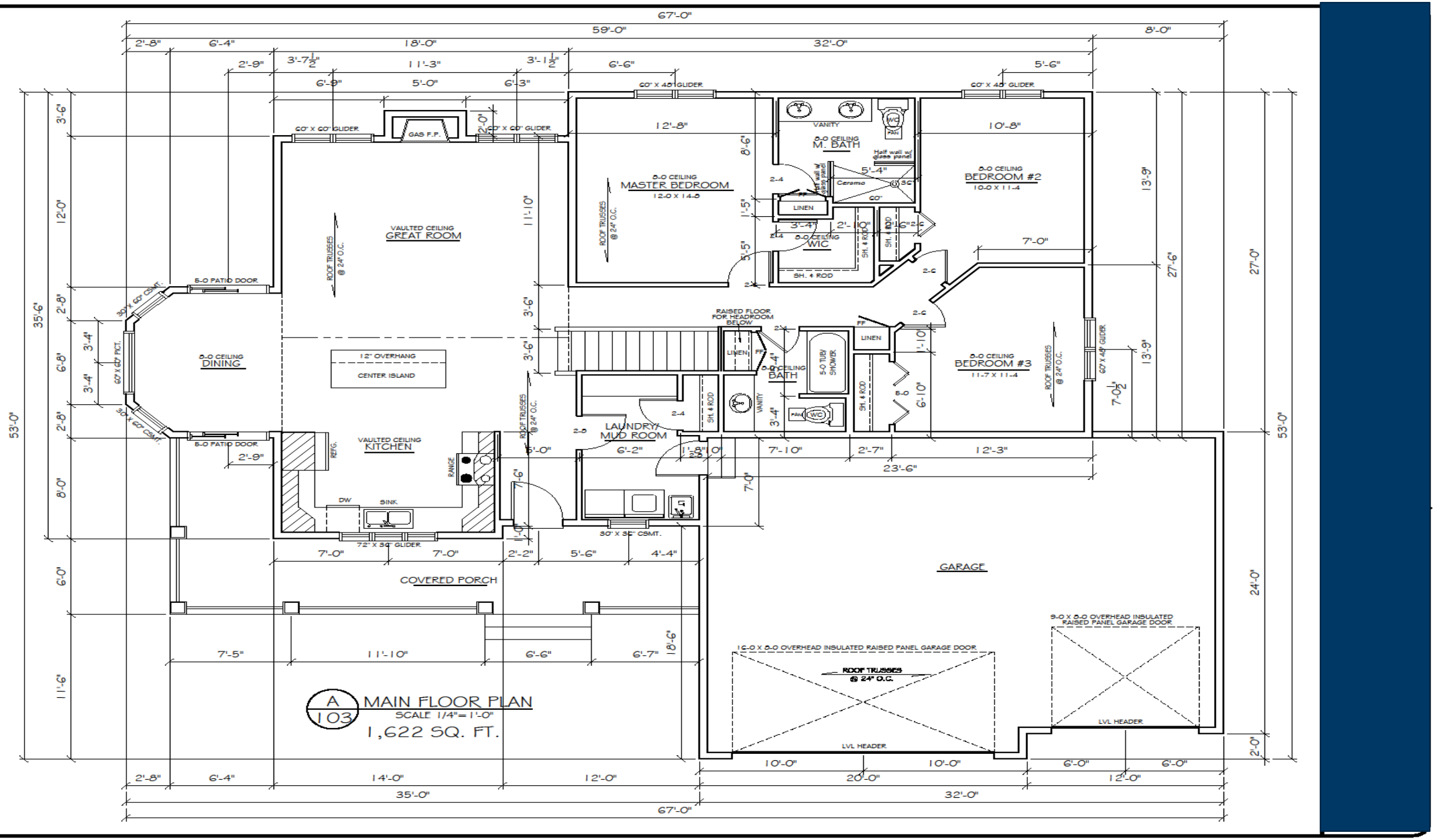
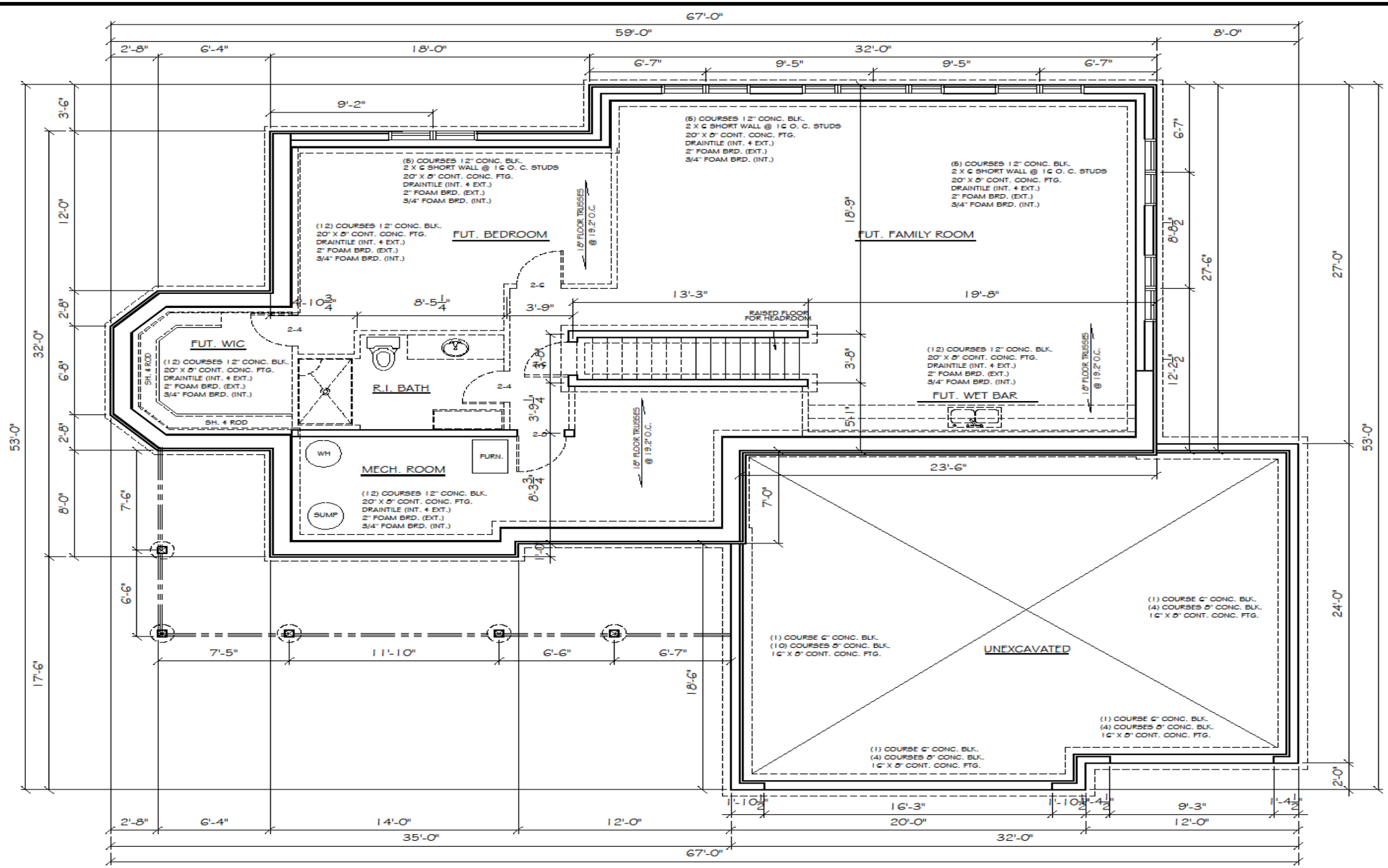


A 103 MAIN FLOOR PLAN

SCALE 1/4"=1'-0"

1,622 SQ. FT.


67'-0"
59'-0"
8'-0"
2'-8"
6'-4"
18'-0"
32'-0"
6'-7"
9'-5"
9'-5"
6'-7"
9'-2"
3'-6"
12'-0"
2'-8"
6'-8"
2'-8"
8'-0"
32'-0"
53'-0"
7'-6"
6'-6"
17'-6"
(5) COURSES 12" CONC. BLK.
2 X 6 SHORT WALL @ 16 O. C. STUDS
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
(12) COURSES 12" CONC. BLK.
20" X 8" CONT. CONC. FTG.
DRAINTILE (INT. & EXT.)
2" FOAM BRD. (EXT.)
3/4" FOAM BRD. (INT.)
FUT. BEDROOM
18" FLOOR TRUSSES @ 19.2" O.C.
FUT. FAMILY ROOM
18'-9"
8'-6 1/2"
27'-6"
6'-7"
27'-0"
53'-0"
24'-0"
2'-0"
4'-10 3/4"
8'-5 1/4"
3'-9"
13'-3"
19'-8"
RAISED FLOOR FOR HEADROOM
FUT. WIC
SH. & ROD
R.I. BATH
FUT. WET BAR
3'-8"
5'-1"
12'-2 1/2"
MECH. ROOM
WH
FURN.
SUMP
8'-3 3/4"
3'-9 1/4"
23'-6"
7'-0"
UNEXCAVATED
(1) COURSE 6" CONC. BLK.
(10) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
(1) COURSE 6" CONC. BLK.
(4) COURSES 8" CONC. BLK.
16" X 8" CONT. CONC. FTG.
7'-5"
11'-10"
6'-6"
6'-7"
18'-6"
1'-10 1/2"
16'-3"
1'-10 1/2"
1'-4 1/2"
9'-3"
1'-4 1/2"
20'-0"
12'-0"
2'-8"
6'-4"
14'-0"
12'-0"
35'-0"
32'-0"
67'-0"

ENERGY CODE NOTE:

CONTRACTOR AND SUB-CONTRACTOR ARE RESPOSIBLE FOR COMPLIANCE OF THE CURRENT CODE AS REQUIRED.

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3. FIRE STOPS MUST BE INSTALLED TO BLOCK AIR MOVEMENT INTO ATTIC.
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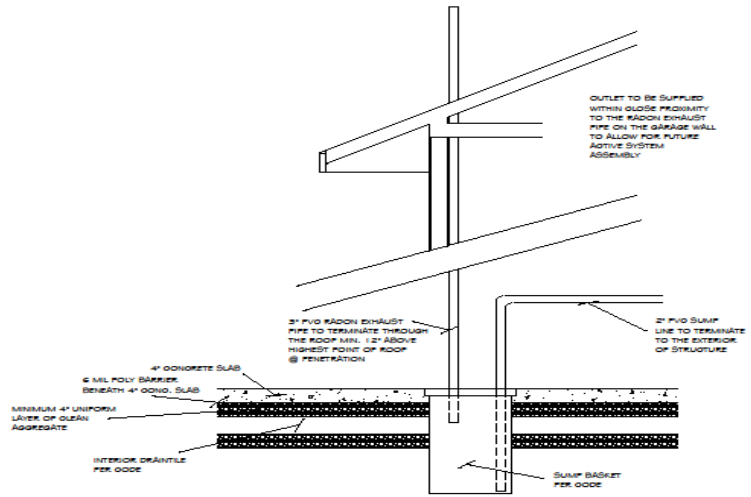

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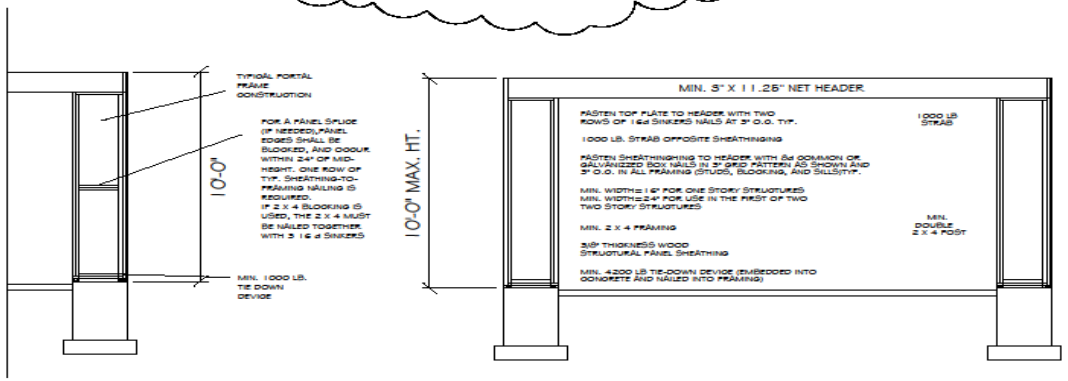

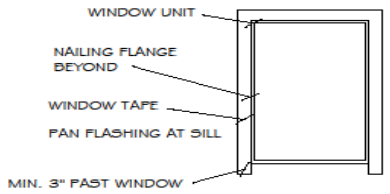

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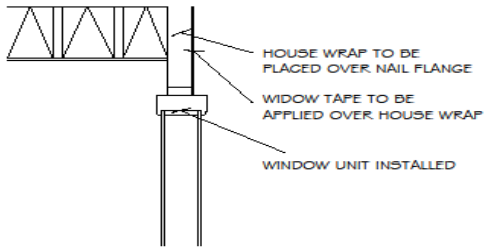

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New Construction Energy Code Compliance Checklist/Certificate

Per R401.3 Certificate. A building certificate shall be posted on or in the electrical distribution panel.

Date Certificate Posted

Place your logo here

Mailing Address of the Dwelling or Dwelling Unit
1234 Any Street

City
Any town Mn

Name of Residential Contractor
John Doe Construction Inc.

MN License Number
0000123456

THERMAL ENVELOPE

Insulation Location	Total R-Value of all Types of Insulation	Type: Check All That Apply								Other Please Describe Here
		Non or Not Applicable	Fiberglass, Blown	Fiberglass, Batts	Foam, Closed Cell	Foam Open Cell	Mineral Fiberboard	Rigid, Extruded Polystyrene	Rigid, Isocynurate	
Below Entire Slab		N/A								
Foundation Wall					X				R-10	**Using Exterior Closed cell Foam**
Perimeter of Slab on Grade		N/A								
Rim Joist (1st Floor)		R-21			X					**Using R-21 Foam Insulation. Closed cell**
Rim Joist (2nd Floor+)		N/A								
Wall		R-21		X						**Using Friction Fit Fiberglass Batt Insulation**
Ceiling, flat		R-49	X							
Ceiling, vaulted		R-49	X							
Bay Windows or cantilevered areas		R-49		X						
Floors over unconditioned area		R-30		X						
Describe other insulated areas	N/A									

RADON CONTROL SYSTEM

X	Passive (*No Fan*)
	Active (*With fan and monometer or other system monitoring device*)

Location (or future location) of Fan:
Attic

Building Envelope Air Tightness: Will Be Testing to a Maximum of 2.6
Final Test = ?

Duct System Air Tightness: N/A-Ducts will be inside envelope

Windows & Doors	
Average U-Factor (*excludes skylights and one door*) U:	.30
Solar Heat Gain Coefficient (SHGC):	.35

Heating or Cooling Ducts Outside Conditioned Spaces

- **Not applicable, all ducts located in conditioned space**
- R-value **(need This if ducts are in exterior walls) N/A**

MECHANICAL SYSTEMS

Appliances	Heating System		Domestic Water Heater		Cooling System	
Fuel Type	**Gas Forced Air furnace Sealed Combustion**		**Gas- Fan Assisted**		**Elec**	
Manufacturer	**Lennox.**		**State**		**RUUD**	
Model	**G26Q3-75-5**		**CV 30 NSRT6**		**UAND-042JAZ**	
Rating or Size	Input in BTUS:	**70,000**	Capacity in Gallons:	**30**	Output in Tons:	**3.5**
Efficiency		92%	**80%**		SEER /EER	**12**
Residential Load Calculations	**Heating Loss**				**Cooling Load**	
	62,515				**TBD**	

Make-up Air *Select a Type*

	Not required per mech. code
X	Passive
N/A	Powered
N/A	Interlocked with exhaust device. Describe:
X	Other, describe: **Flex Duct**

Location of duct or system:
In Mechanical Room

16-28	CFMs
5	" round" duct OR
	" metal " duct

MEHCANICAL VENTILATION SYSTEM Broan

Describe any additional or combined heating or cooling systems if installed: (e.g. two furnaces or air source heat pump with gas back-up furnace):

Select Type

X	Heat Recovery Ventilator (HRV) Capacity in CFMs:	Low:	**75**	High:	**150**
	Energy Recovery Ventilator (ERV) Capacity in CFMs:	Low:		High:	
X	Balanced Ventilation Capacity in CFMs:				
	Location of fans(s), describe:	**HRV System**			
	Capacity of continuous ventilation rate in CFMs:	**63**			
	Total ventilation (intermittent + continuous) rate in CFMs:	**125**			

Combustion Air *Select a Type*

X	Not required per mech. code
	Passive
	Other, describe:
	Location of duct or system:
	CFMs
	"round" duct OR
	"metal" duct