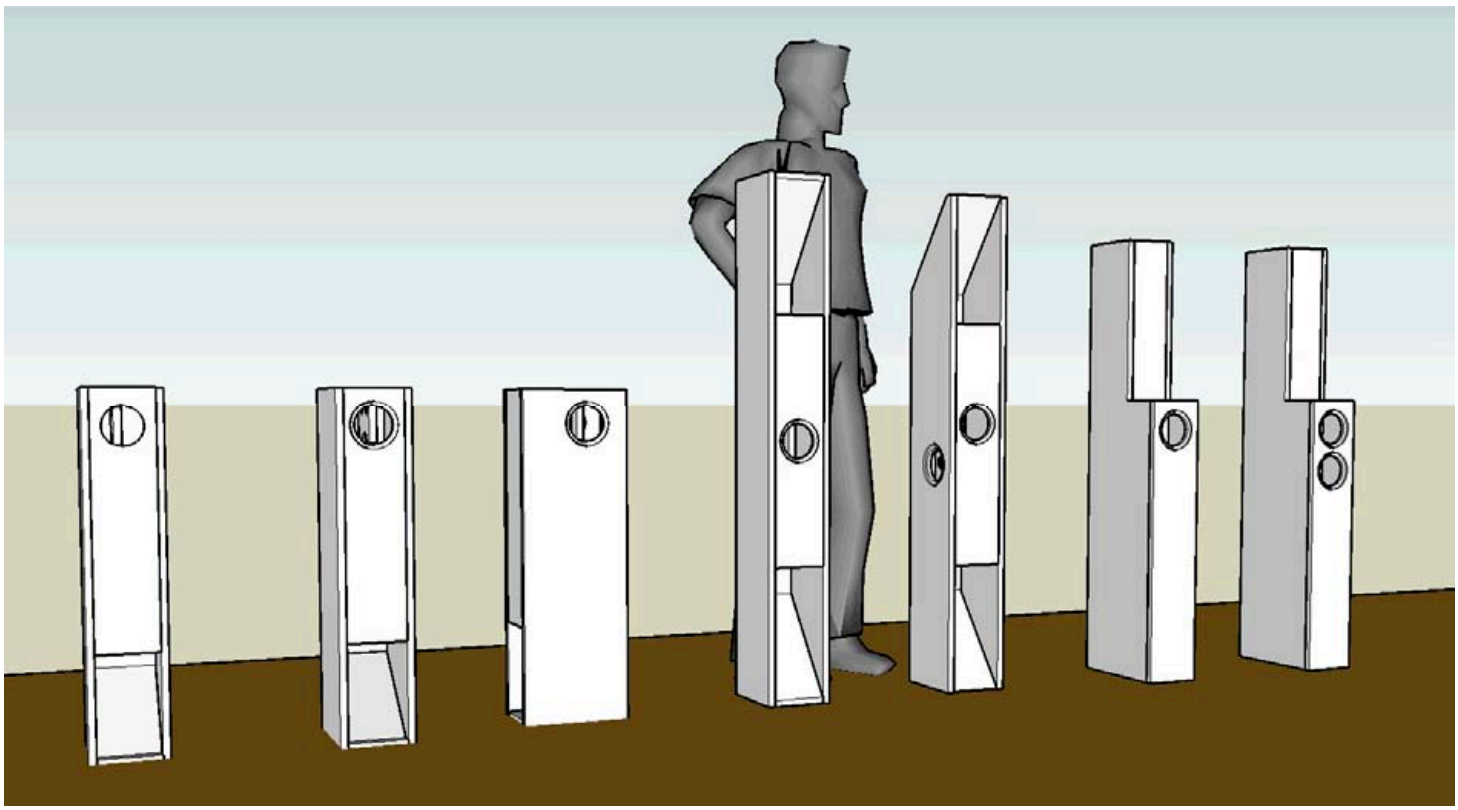
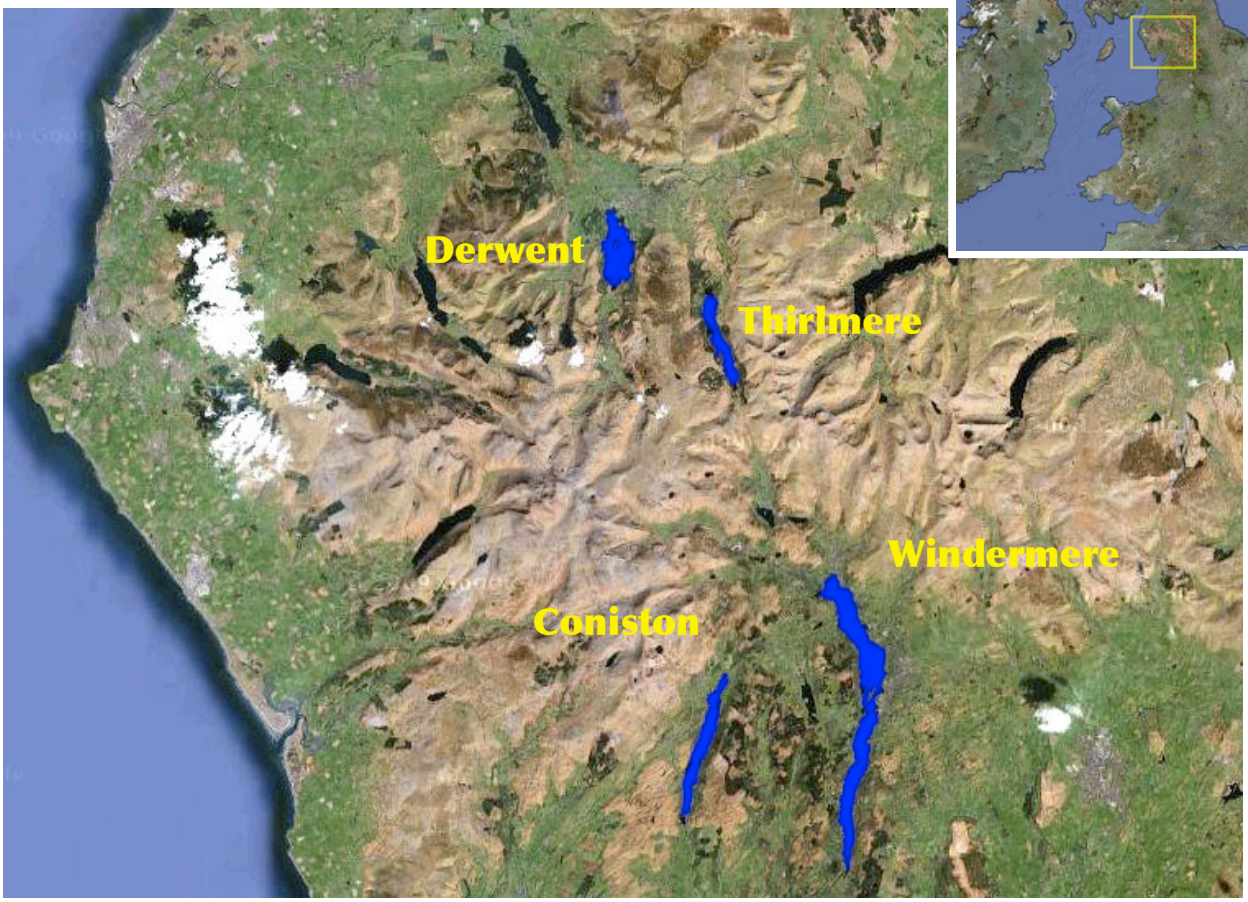
WODEN DESIGN

Lake District Design Series for
CSS EL70 & planet10-hifi EL70eN



Lake District Design Series
for CSS EL70 & planet10-hifi EL70eN

by Scott Lindgren (design) & David Dlugos (drawing & design detail)



Lake District Design Series
for CSS EL70 & planet10-hifi EL70eN

"The Lake series of cabinets for the new CSS EL70 driver, developed by Mark Audio, offers a range of high performance designs, from a compact BVR style horn, to a highly characterful resonance tube design that attempts to extract as much bass extension from the driver as possible. Minimalism is key to all of the Lake enclosures, which draw their names from haunting stretches of water in Britian's Lake District. As well being an essential design philosopy, this also ensures they are relatively easy for any DIYer to build, from the most experienced to someone planning their very first speaker project. The Lake range comprises of the following designs:

Derwent: A compact BVR horn for general listening use when space is at a premium, or for when a larger cabinet cannot be employed for aesthetic reasons. 50Hz - 20Khz.

Coniston: A tall but slender BVR double horn for use in modest spaces, or for when a larger soundstage with greater height and depth perspective is desired. 55Hz - 20KHz.

Coniston^2: A twin driver, semi-omni version of Coniston, offering greater power-handling and dynamic range for those with larger spaces, but who prefer to retain an elegantly sized cabinet. 55Hz - 20KHz.

Thirlmere: A modestly sized bipole BVR horn with a narrow front baffle. Twin drivers per channel offer greater power-handling and dynamic range. For use in slightly larger rooms, or for those who favour a more spacious soundstage. 50Hz - 20KHz.

Thirlmere-R: A modestly sized bipole BVR horn with a wide front baffle, and sideways firing horns. Twin drivers per channel offer greater power-handling and dynamic range. For use in slightly larger rooms, or for those who favour a more spacious soundstage. 50Hz - 20KHz.

Windermere: A characterful high gain twin pipe resonance tube / back horn for those who favour more unusual aesthetics, and are willing to sacrifice a little midrange finesse in order to extract the maximum bass extension from the EL70 driver. 35Hz - 20KHz.

Windermere^2: A twin driver version of Windermere with several different head-styles for those who require greater power handling and dynamic range, or have a larger space. 35Hz - 20KHz."

Lake District Design Series
Notes

10-august-09

Recommended materials | Baltic Birch or other near void-free plywood is highly recommended. The more plys the better – 18mm Baltic Birch has 13 plys. Plywood has been selected for the combination of its higher stiffness to weight ratio, well demonstrated advantages of speed of dissipation of resonances when compared to denser materials such as MDF or HDF, as well as its lower mass. The latter can be of significant benefit both during the construction and finishing of some of larger designs, such as Coniston double mouth BVR/Horn, and in their placement and movement in listening rooms.

Driver wiring | For the twin driver versions, series wiring is recommended; however parallel is possible providing the amp can cope with the very low impedance. Of course you can use 2 amplifiers as well. Locations and type of input terminals not shown, use your favorite.

Alternate material thicknesses | All these designs have been drawn with nominal 3/4" (19mm) material. As noted above, typical 13 ply Baltic Birch is 18mm. We have achieved excellent results on several of these and other designs utilizing 15mm (5/8") Baltic Birch plywood, with additional bracing. Also note that material thickness can vary from sheet to sheet within a lift of material, so it is important to check and to vary lengths of panels to avoid surprises. Maintain internal chamber sizes, vent depth & length, "horn" heights as a priority. If you have no alternative but to use MDF or particleboard, it is strongly suggested that the side panels have additional pieces laminated to achieve 1 1/8" - 1 1/4" to increase the stiffness to ~equal that of BB ply.

Holey Braces

1) Critical to the function of the driver holey brace is for it to transmit driver energy away from the baffle. It should fit tight against driver, but not so tight as to stress the frame.

2) Braces are placed just off-centre – ie on one side of the cabinet or driver centre line.

3) Dimensions & placement of holes in bracing panels are only suggestive. Goal is 30-40% holes, leaving a solid path between back of driver to back of cab (or other driver). More bracing than shown or interlocked braces is OK. Avoid braces that are parallel to the back of the driver in the vicinity of the driver.

Cut Plans

1) 1/8" (3mm) kerf allowed – none of the cut plans should be so tight as to not allow a larger kerf (such as in 5mm commercial production beam saws), or trim cuts to remove damaged factory edges.

2) Cut plans oriented for combination of yield efficiency and integrity of grain direction, but not optimized for contiguous grain wrap matching. If Post-veneering with highly figured grain patterns, higher waste factors can be anticipated.

Other drivers | Inevitably, people ask if they can use alternate drivers. These boxes were designed specifically for the T/S parameters and physical dimensions of the EL70. Drivers with very similar Theile/Small parameters may work, but you are on your own.

Driver Cutouts | Although all drawings show a bevel on the back of the driver cutout, our work with several initial prototypes using CHR & EL70 drivers suggest that due to the width and thickness of the mounting flange, beveling the back side of the driver cut out may not be appropriate with thinner baffle materials (ie 15mm), or if the driver is rebated for flush mounting

Damping Materials | Damping in the MBVRs: damp these as you would a bass reflex – line at least 3 sides with suitable damping to reduce standing waves and reflections. Use wool or cotton felt (1/4-1/2"), acoustic fiberglass (1") or polyester bats (1"). The centre side of the holey brace is a good place to attach some damping as at the middle between 2 walls is the most effective place to kill standing waves.

Optimal damping locations specified for Windermere.

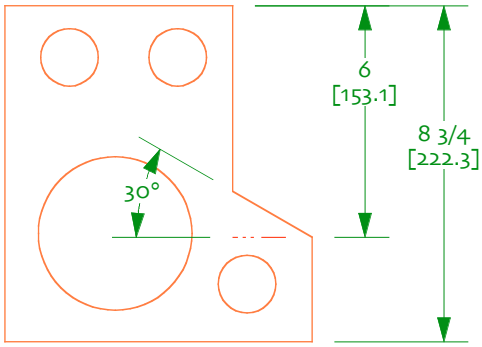
Amounts of material and location on other designs may be subject to experimentation to fine-tune individual system synergy – ie room, amplifier used, materials used, taste.

Tightening driver mounting screws | The polymer material used in the Mark Audio once piece moulded basket/flange requires the use of caution when tightening the mounting screws – preferably by hand not with cordless drill. Sonically just the right amount of torque on the screws has an effect. Screws should be just tight enough to hold a real or imaginary washer from being turned.

Rights to Designs

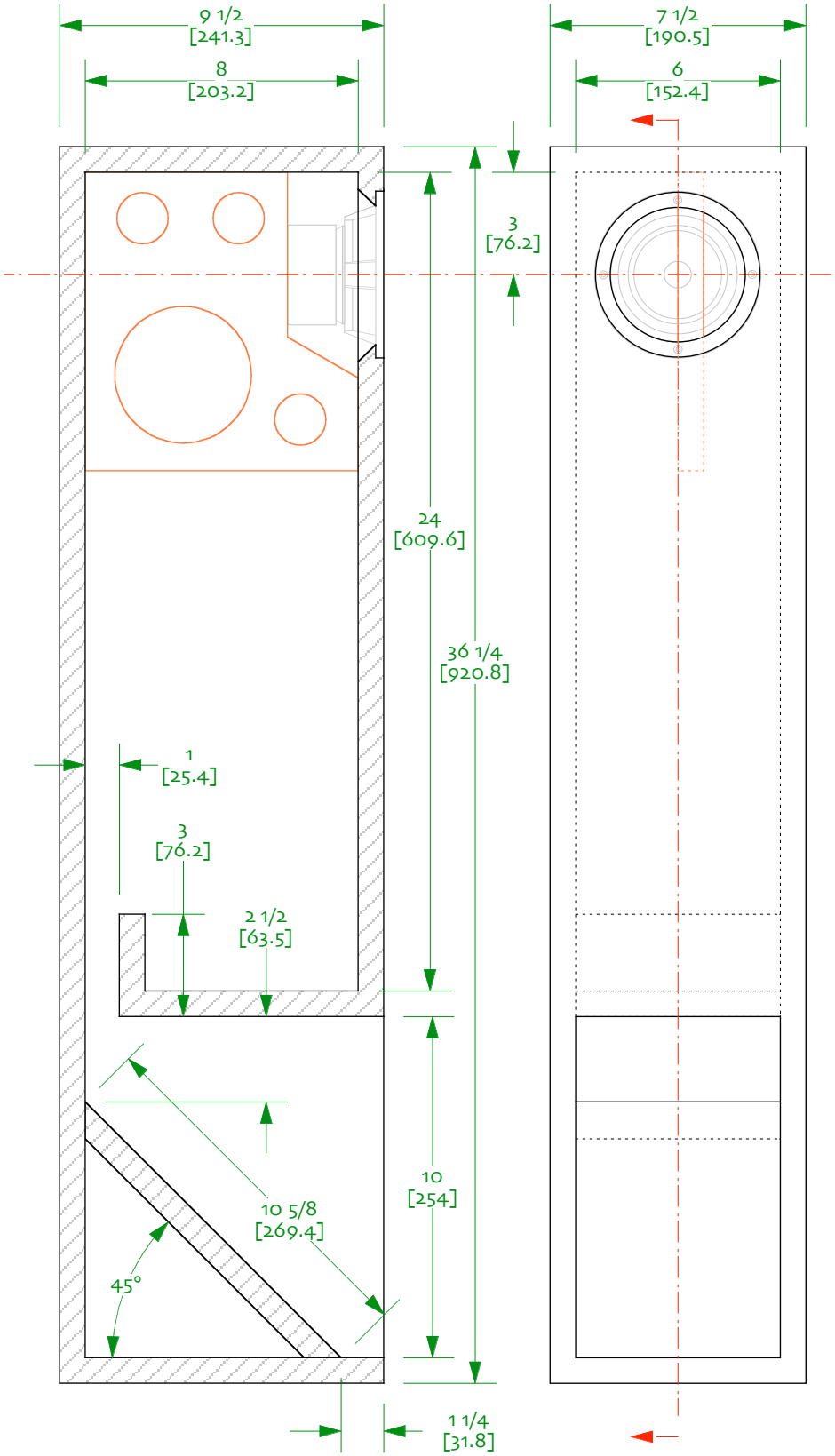
Designs all pass through Martin J. King MathCAD worksheets <www.quarter-wave.com> Any commercial licensees will be required to have a separate commercial license to this software.

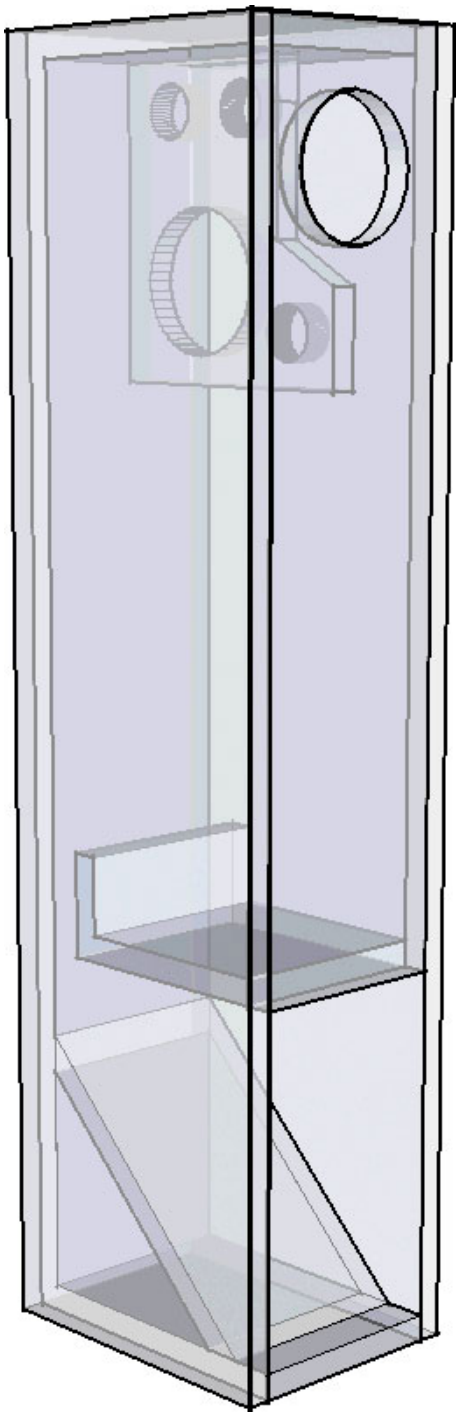
Of course feel free to exercise personal taste in both the finishing of cabinets and use of mounting spikes, bases, etc. Note that taller slim designs such as the Coniston and Windermere can be tippy, and definitely benefit from mass loaded base plates or ballast fill to lower void cavities.



Derwent MBVR
for CSS EL70 ov96
designed by Scott Lindgren
drawn by dld | 01-august-2009

Notes:
0/ drawn using 19mm (3/4") material
1/ minimal bracing shown
2/ damp as you would a bass reflex (ie top, back & 1 sidewall lined with 1/2in wool felt or similar as a start)





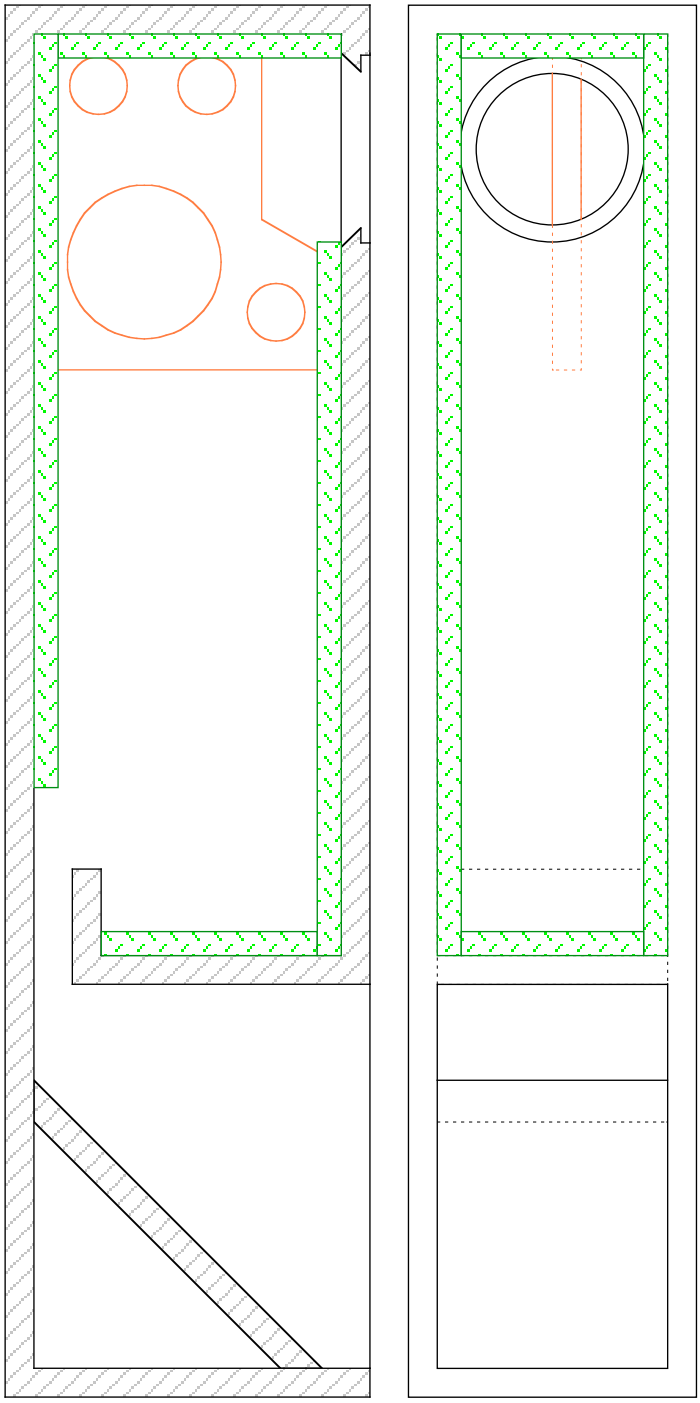
Derwent

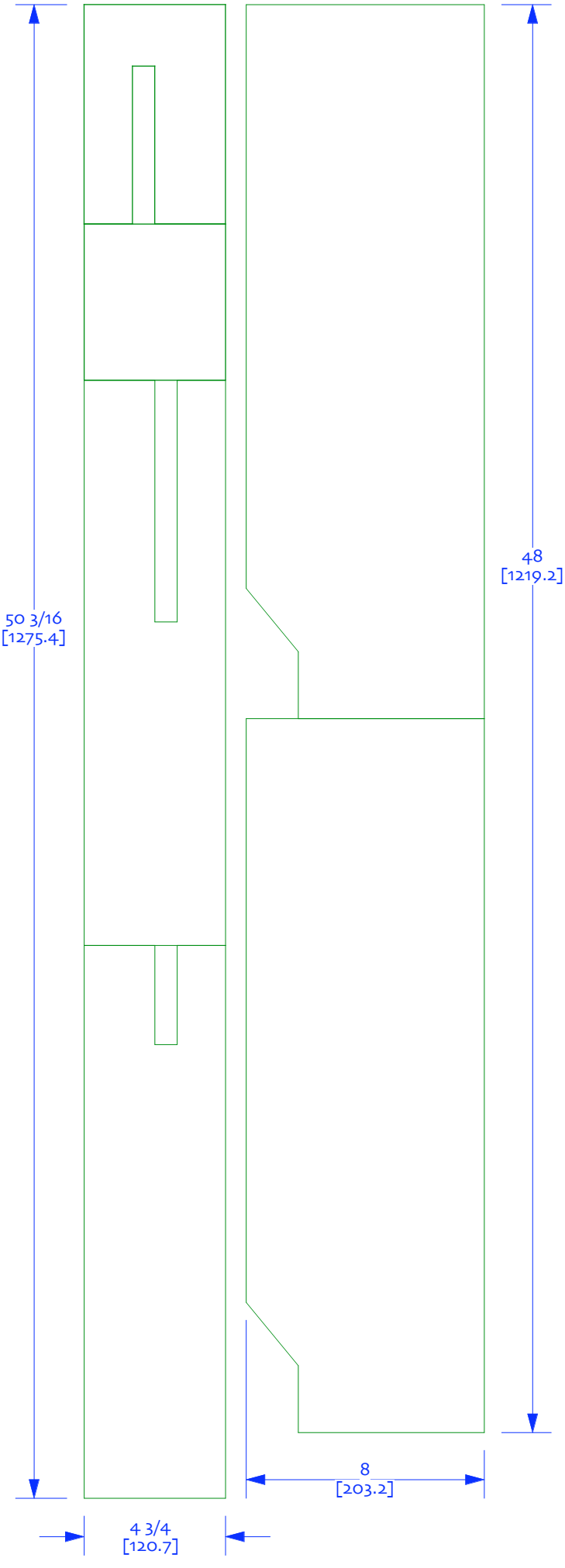
Damping Plan

designed by Scott Lindgren
drawn by dld | 07-september-2009

Notes:
Damping sheets shown for 5/8" (15mm) recycled cotton/denim felt damping material. Wool felt or 1" acoustic fiberglass may be substituted

Additional damping well tufted polyfuffo may be needed if the bass is found excessive in room. Start above the driver.

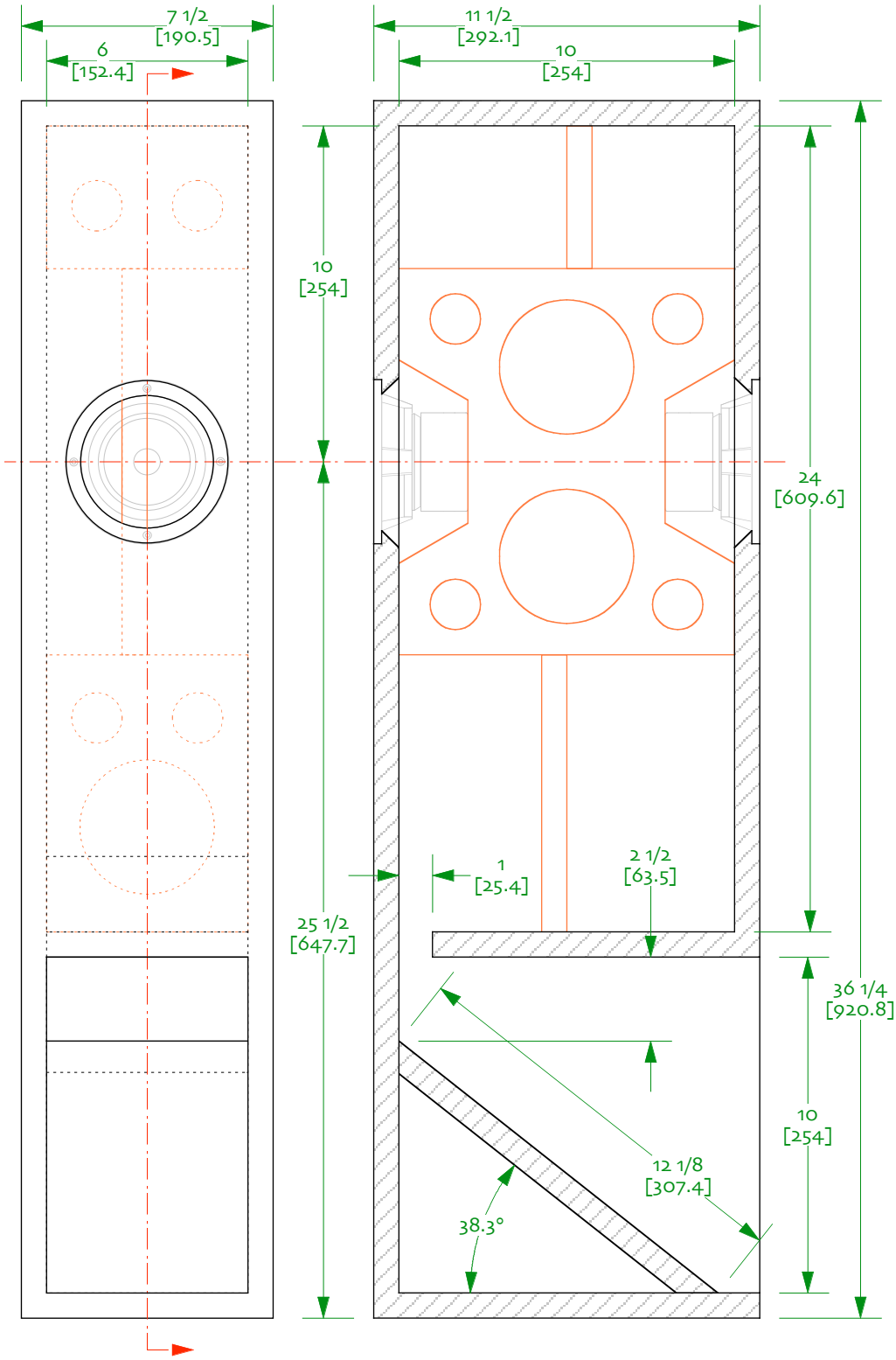


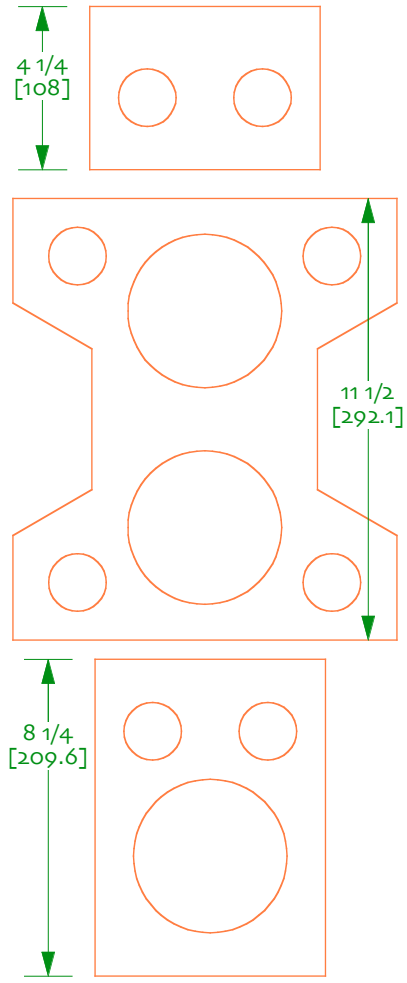


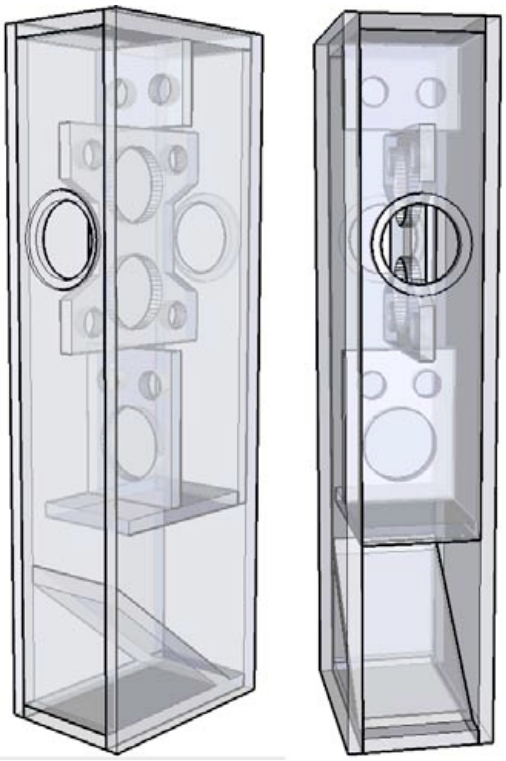
Thirlmere Bipole MBVR

for 2 x CSS EL70 1v01
designed by Scott Lindgren
drawn by dld | 05-sep-2009

Notes:
0/ drawn using 19mm (3/4") material
1/ damp as you would a bass reflex (ie top, back & 1 sidewall lined with 1/2in wool felt or similar as a start)
3/ holey braces could extend & interlock
4/ optimum driver position shown, 8" or 4.75" Zd are alternatives but will require some polyfluff damping thruout the reflex box. Bracing will need adjustment.

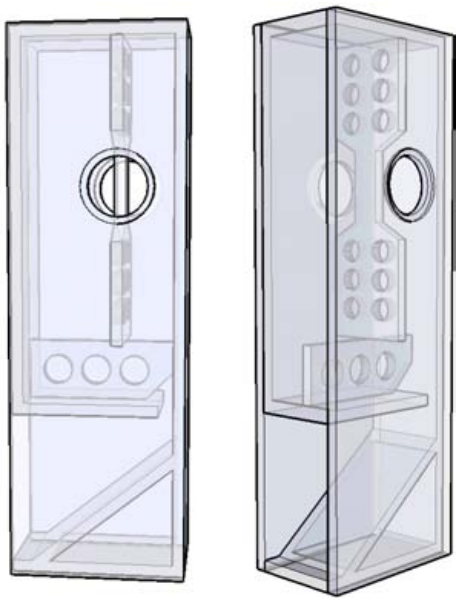


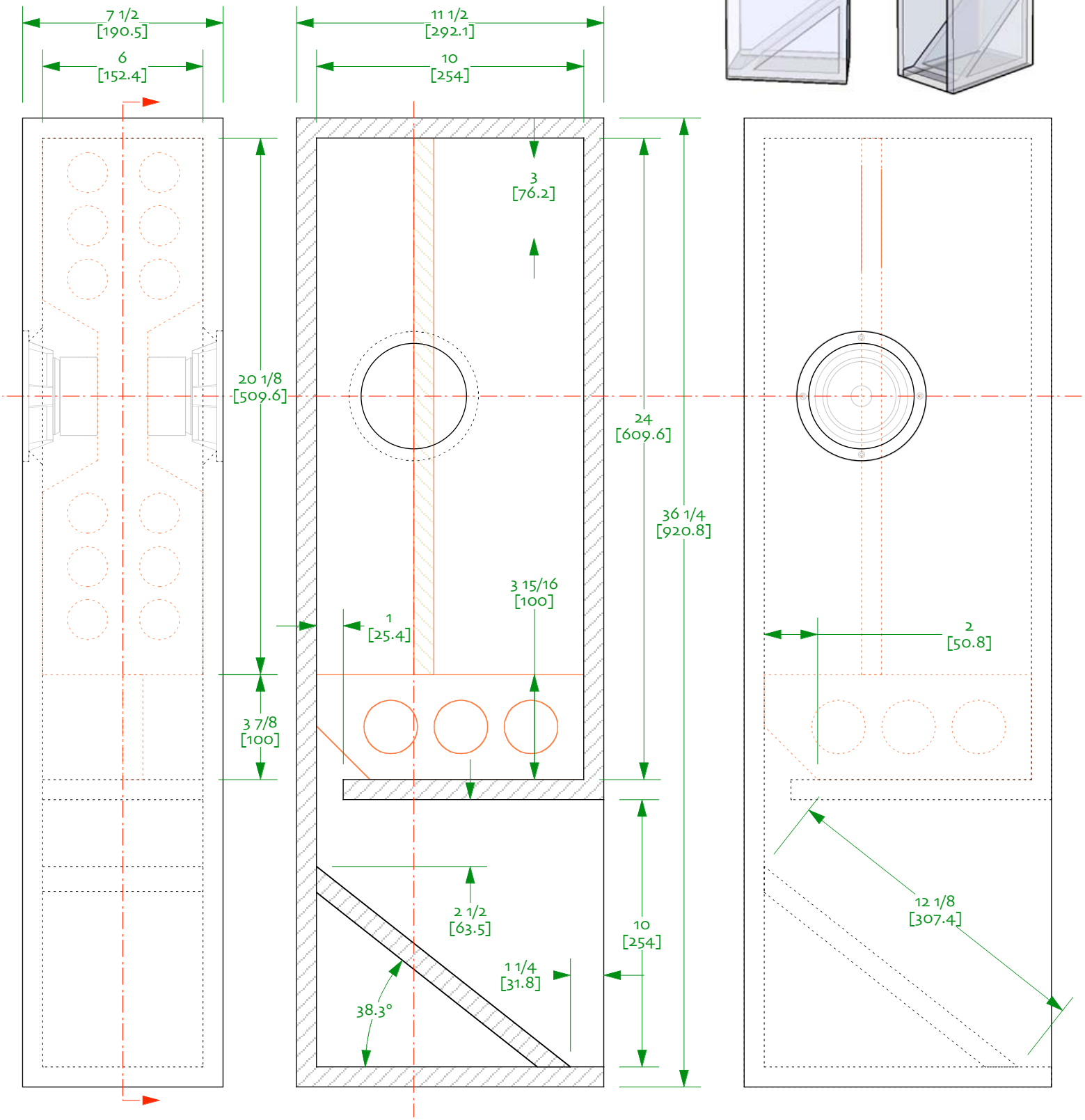




Thirlmere-R Bipole MBVR
for 2 x CSS EL70 ov99
designed by Scott Lindgren
drawn by dld | 05-september-2009

Notes:
o/ drawn using 19mm (3/4") material
1/ damp as you would a bass reflex (ie top, back & 1 sidewall lined with 1/2in wool felt or similar as a start)
3/ Driver shown at golden-ratio, could be centred
4/ mirror image the pair





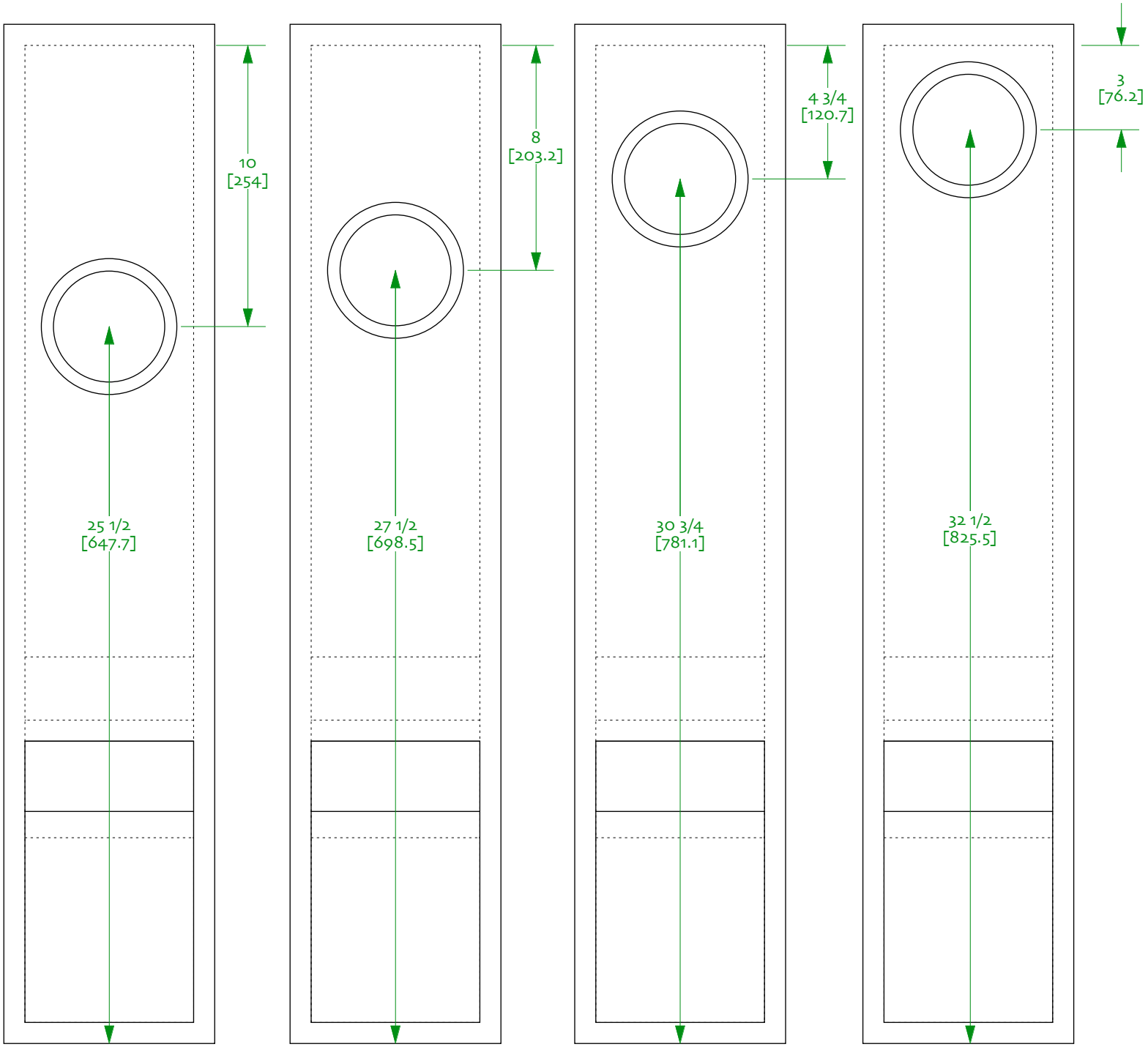
Thirlmere

alternate driver placement

designed by Scott Lindgren
drawn by dld | 06-sep-2009

Notes:
Some will find the optimal driver position (figure A) too low. To this end alternate positions are possible (note that the original design was figure D). These alternate driver positions require a different damping strategy, and may have a bit less bass quantity. Although shown for Thirlmere, they also apply to Thirlmere-R.

0/ damp B, C, D with 0.5 pounds/ft^3 of well teased polyfluff (or acoustistuff, wool, miraflex). Volume = 0.833 ft^3 -> 0.42 pounds = 190 g per box
2/ driver bracing will require adjustment (cut plans show the braces for D as an aside)
3/ as these could use a stabalizing base to make them less tippy, do account for the height it adds when choosing driver position



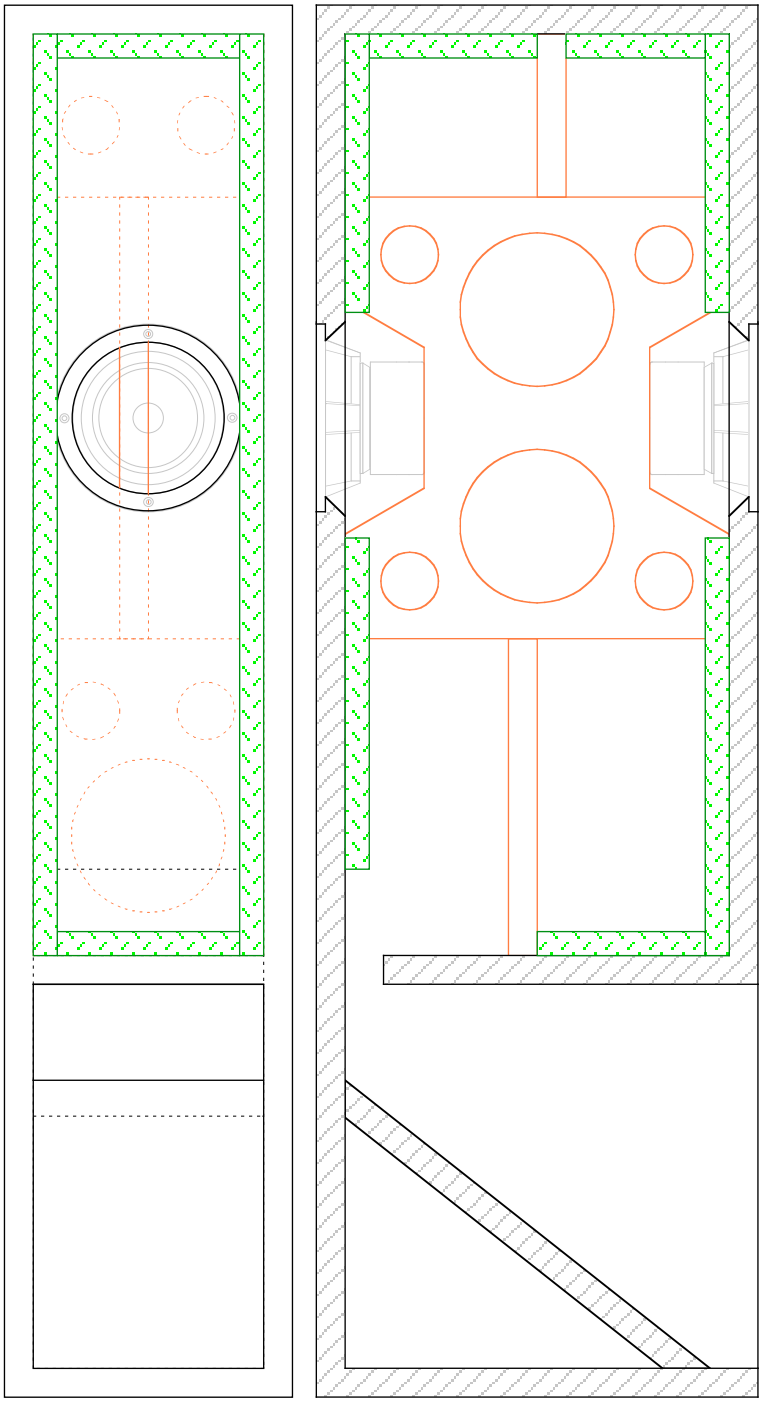
Thirlmere

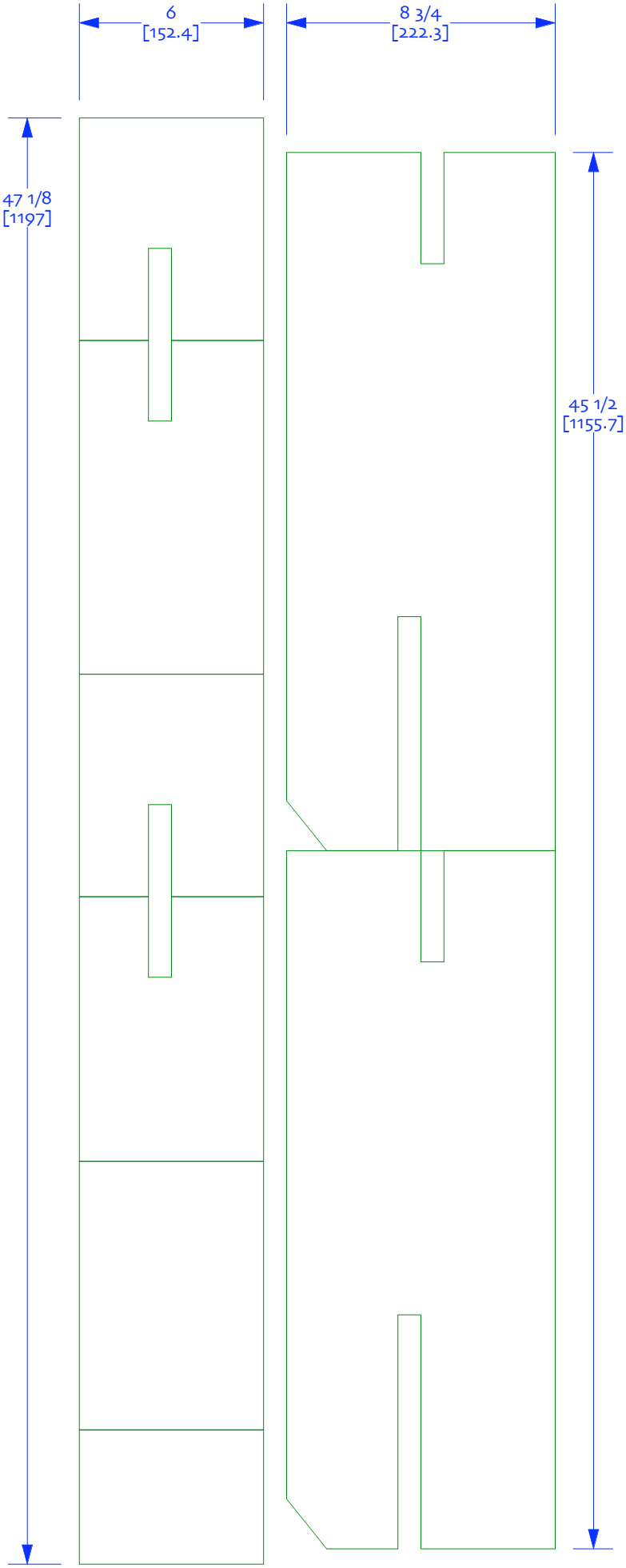
Damping Plan

designed by Scott Lindgren
drawn by dld | 05-sep-2009

Notes:
Damping sheets shown for 5/8" (15mm) recycled cotton/denim felt damping material. Wool felt or 1" acoustic fiberglass may be substituted

Additional damping well tufted polyfuffo may be needed if the bass is found excessive in room. Start above the driver.





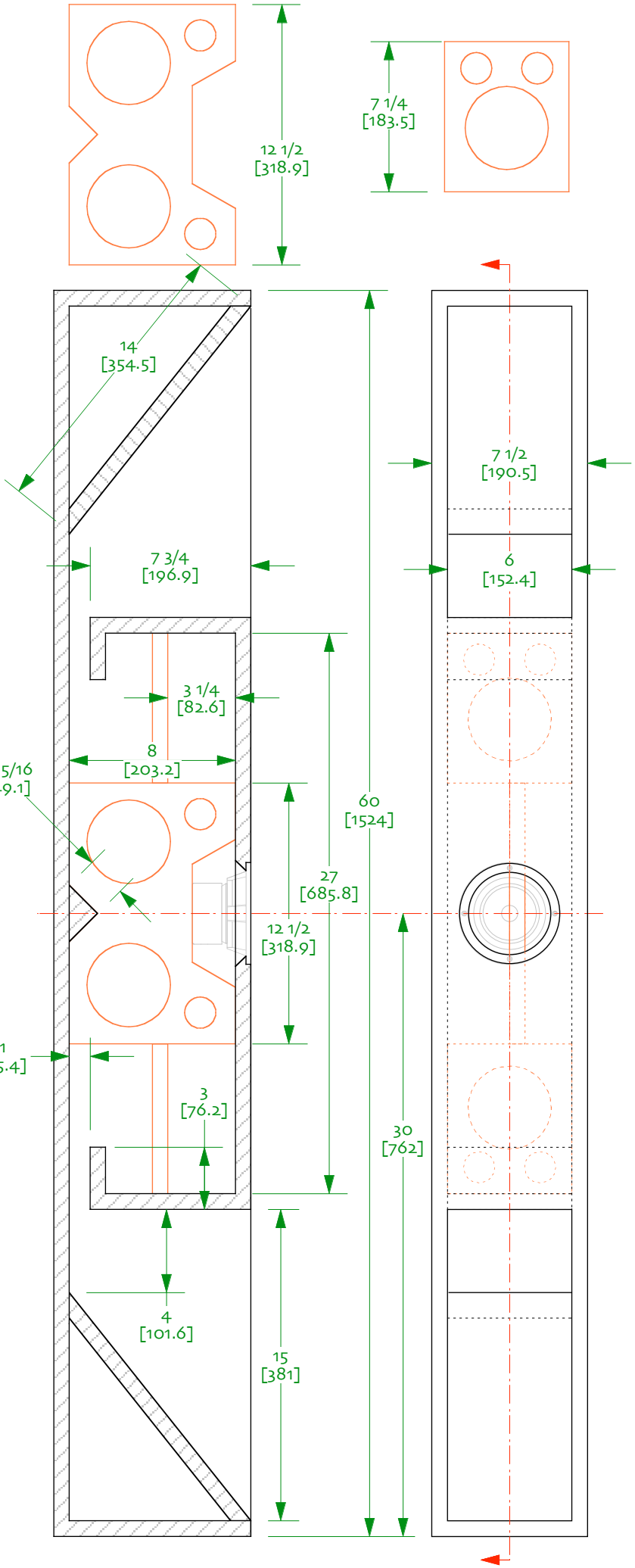
Coniston Twin Vent MBVR

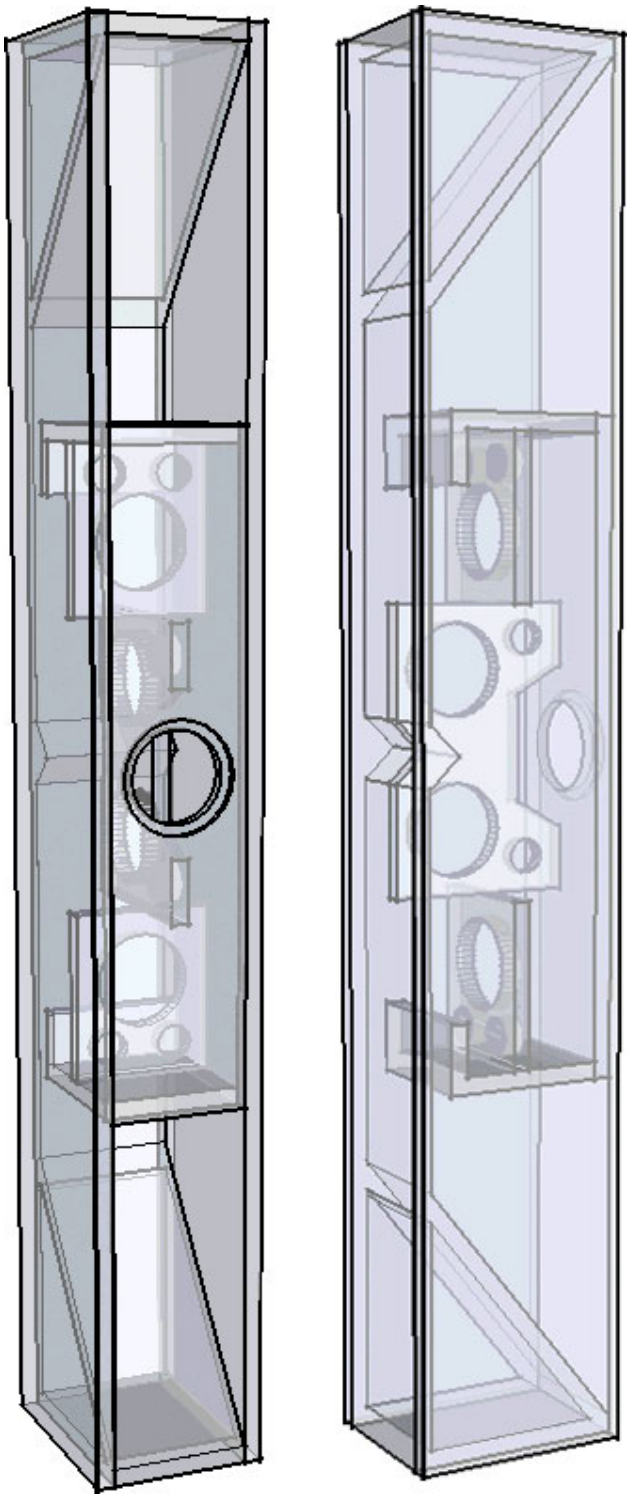
for CSS EL70 ov96

designed by Scott Lindgren

drawn by dld | 01-august-2009

Notes:
0/ drawn using 19mm (3/4") material
1/ damp as you would a bass reflex (ie top, back & 1 sidewall lined with 1/2in wool felt or similar as a start)



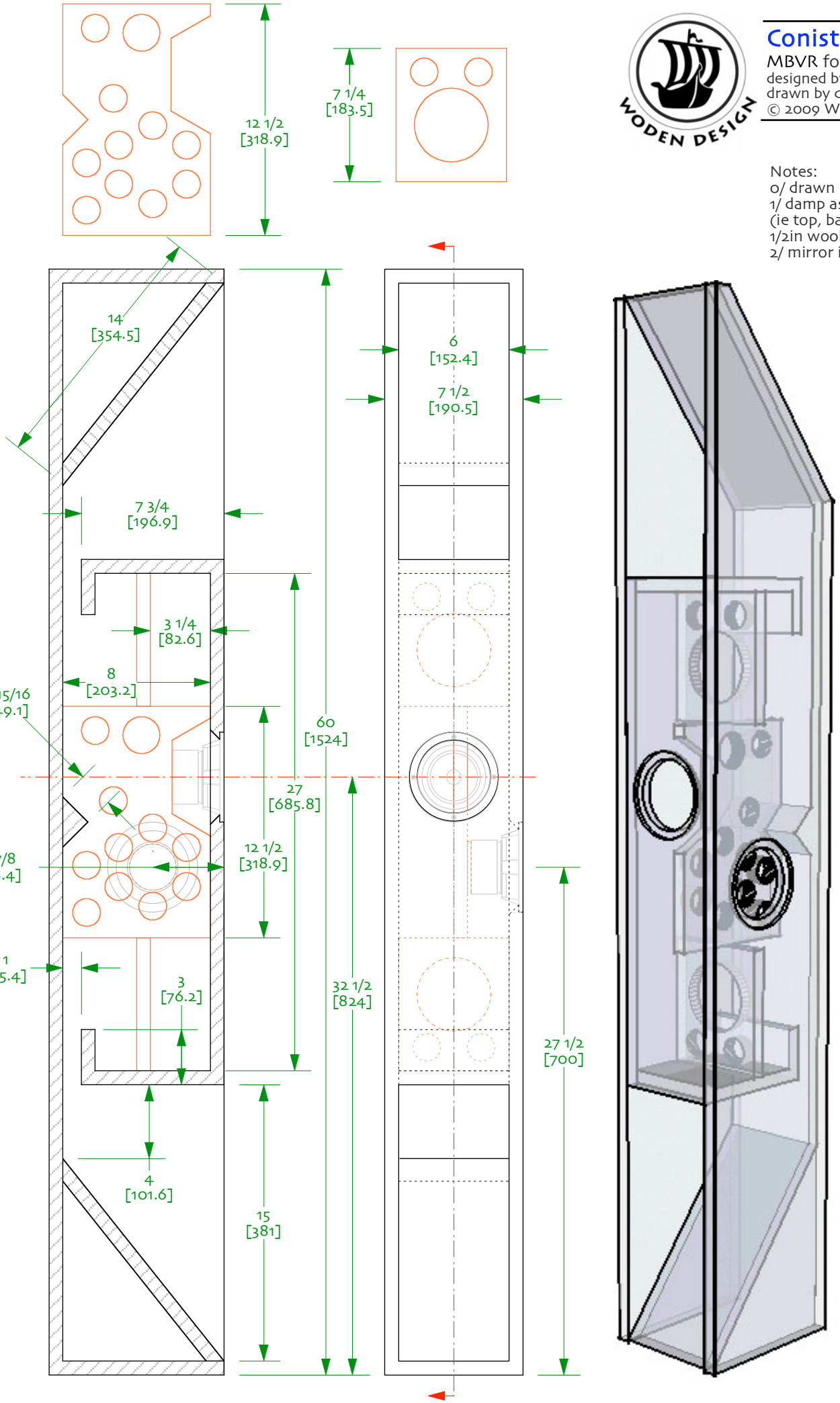


Coniston^2 Twin Vent

MBVR for CSS EL70 ov96

designed by Scott Lindgren
drawn by dld | 01-august-2009

Notes:
0/ drawn using 19mm (3/4") material
1/ damp as you would a bass reflex (ie top, back & 1 sidewall lined with 1/2in wool felt or similar as a start)
2/ mirror image pair



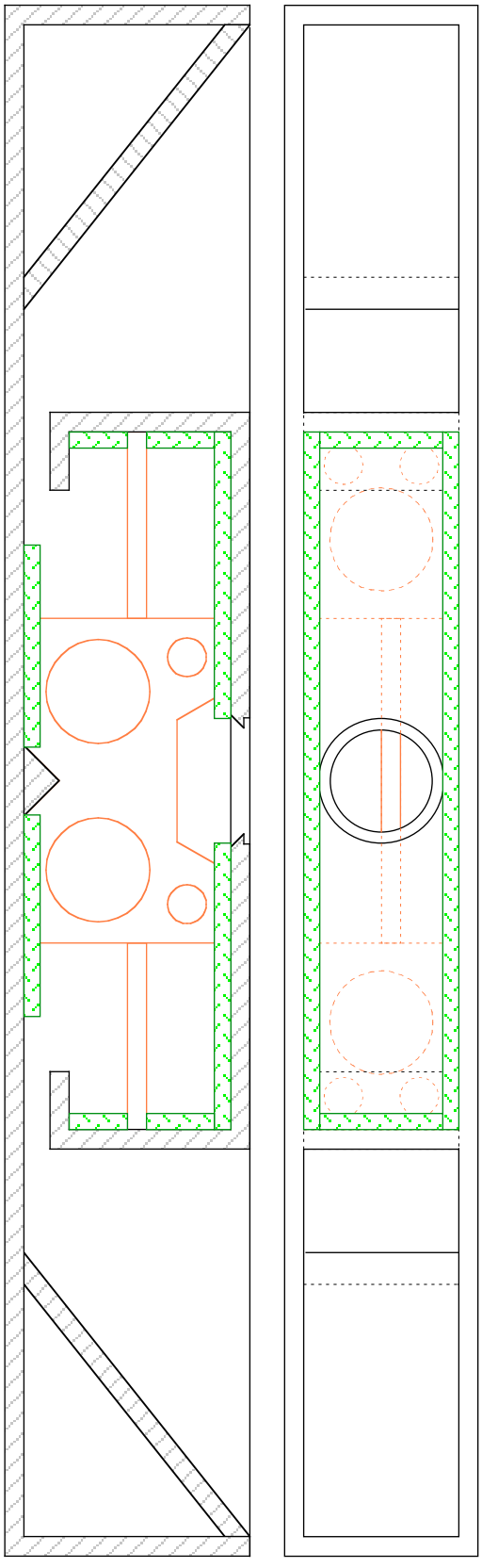
Coniston

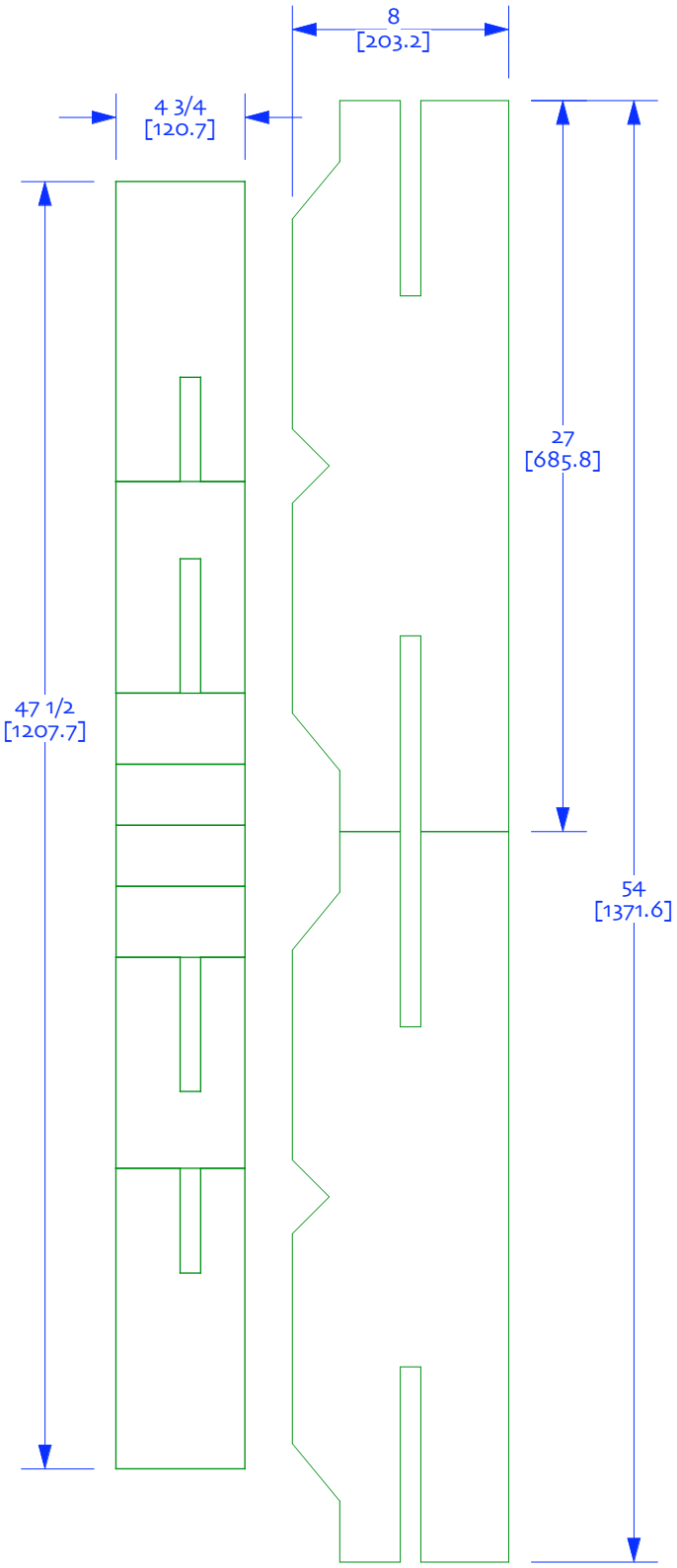
Damping Plan

designed by Scott Lindgren
drawn by dld | 07-september-2009

Notes:
Damping sheets shown for 5/8" (15mm) recycled cotton/denim felt damping material. Wool felt or 1" acoustic fiberglass may be substituted

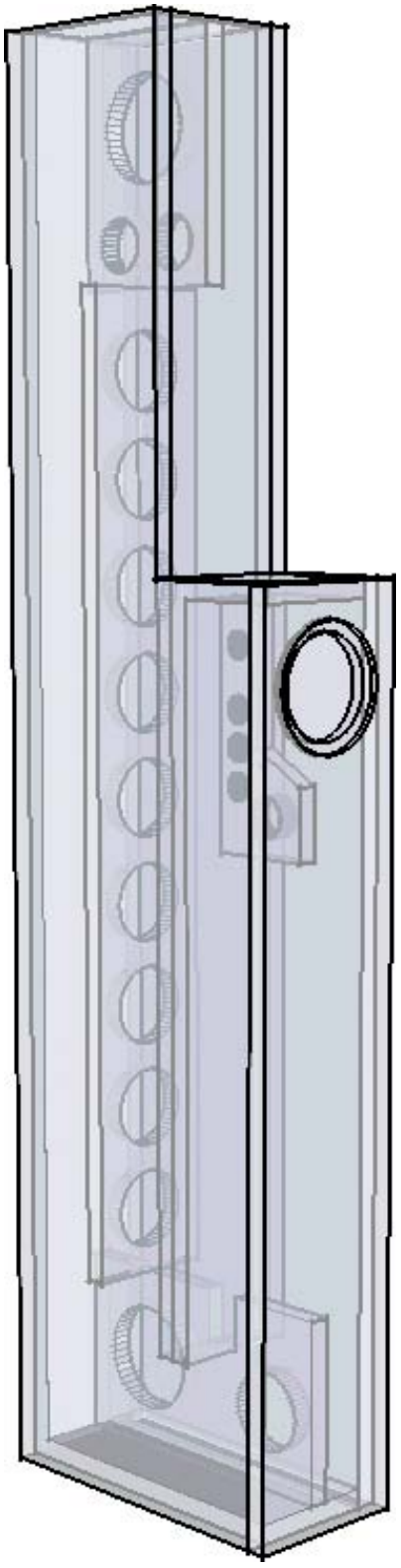
Additional damping well tufted polyfuffo may be needed if the bass is found excessive in room. Start above the driver.

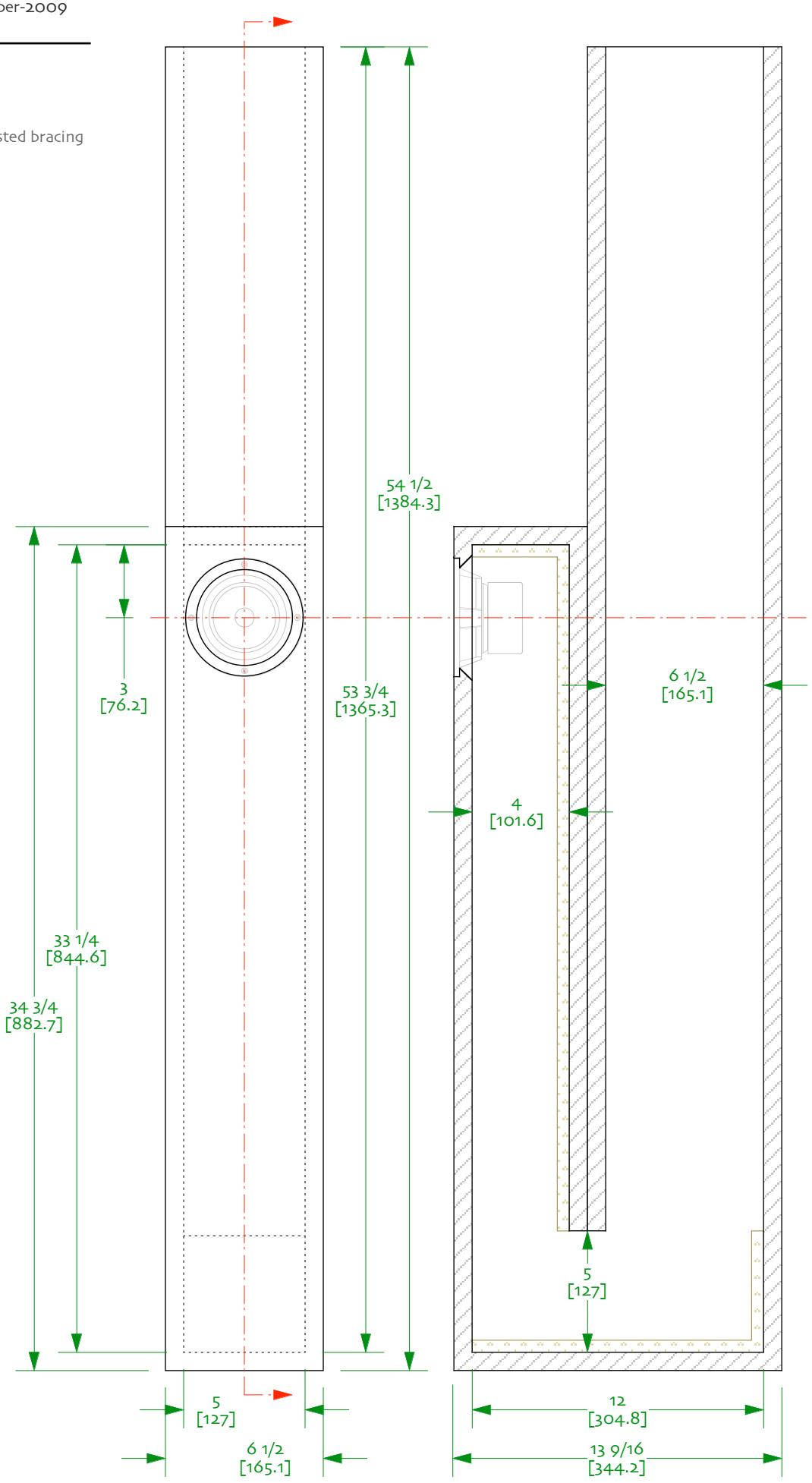




Windermere twin pipe resonant air coupler for CSS EL70 ov99
designed by Scott Lindgren
drawn by dld | 07-september-2009

Notes:
0/ drawn using 19mm (3/4") material
1/ Bracing not shown – see Bracing sheet for suggested bracing

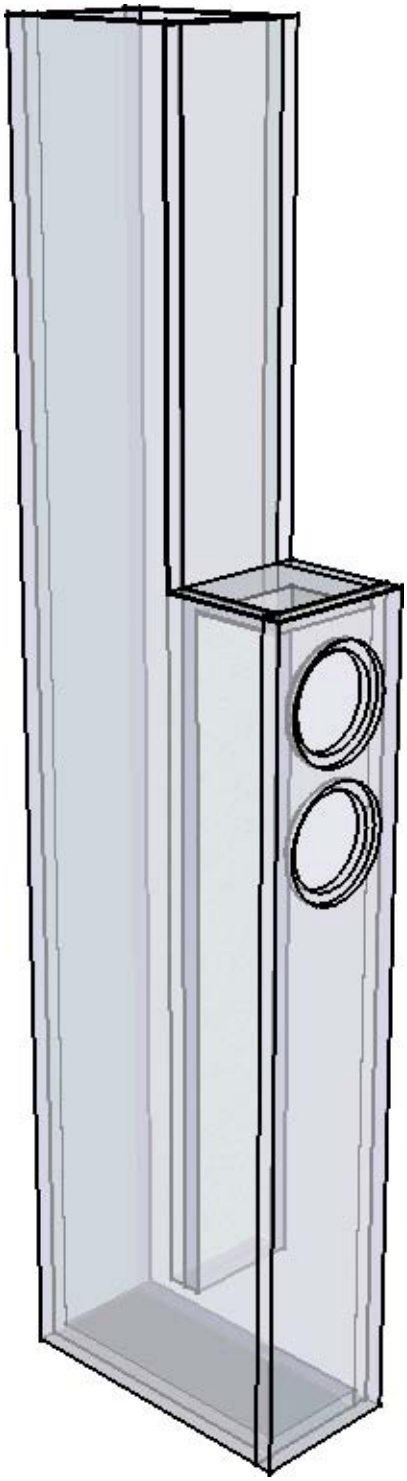


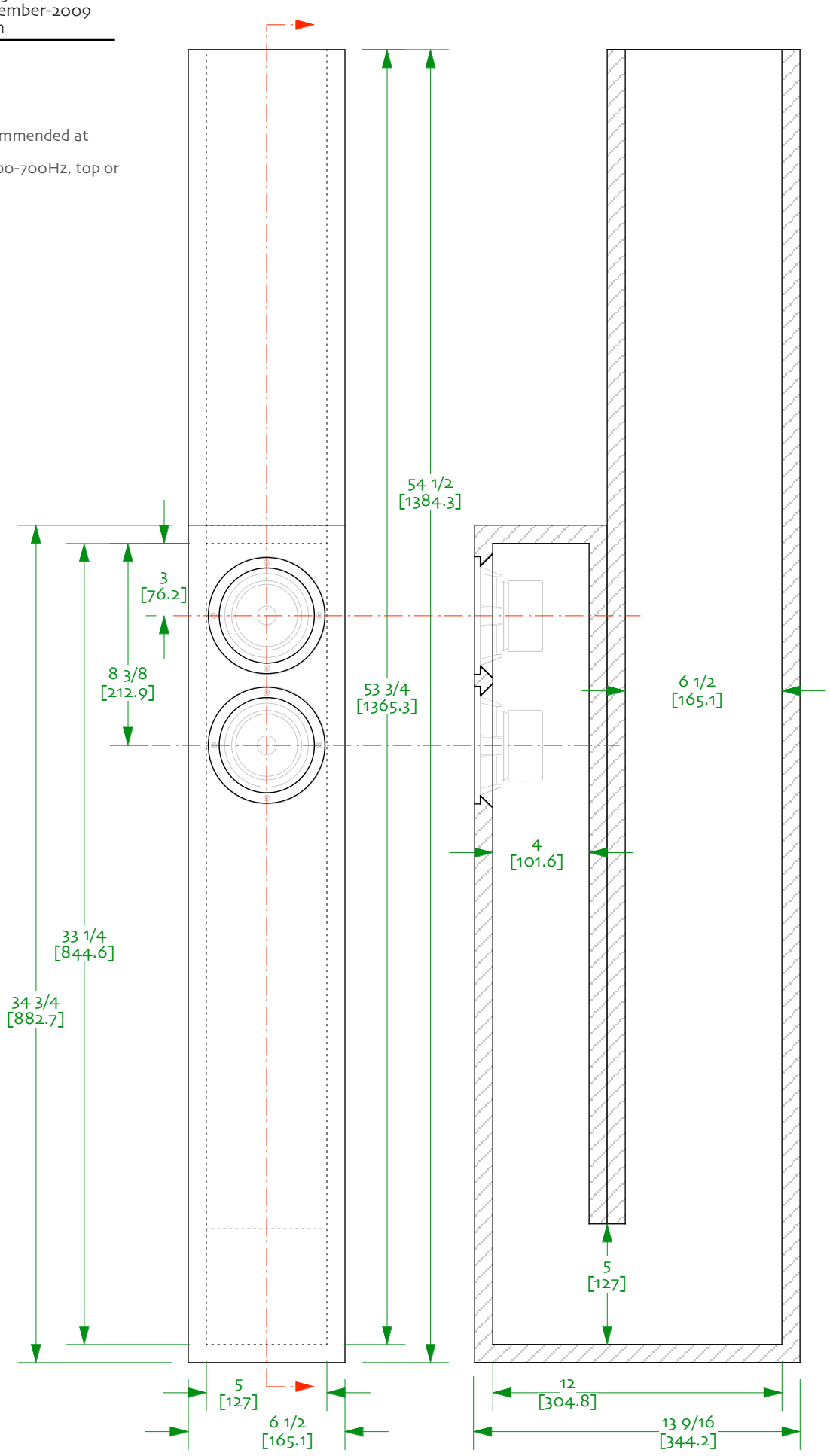


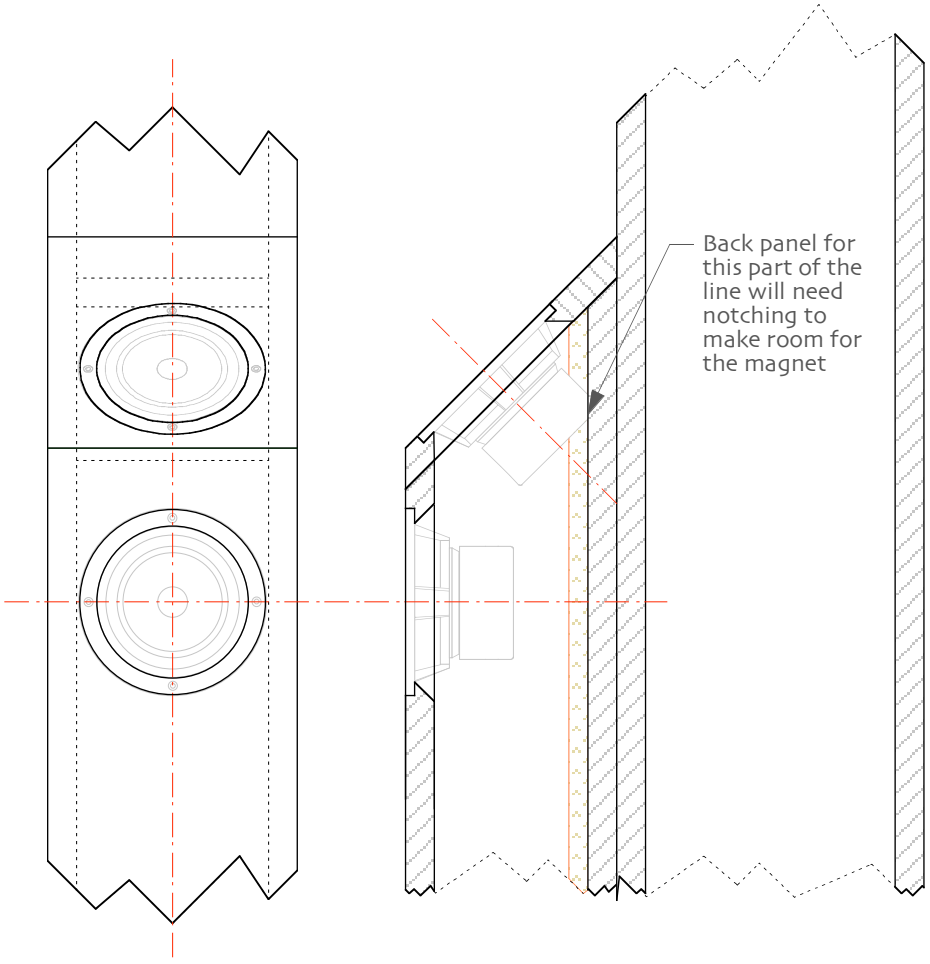
Windermere^2 twin pipe

resonant air coupler for 2x EL70 0v99
designed by Scott Lindgren
drawn by dld | 07-september-2009

Notes:
0/ drawn using 19mm (3/4") material
1/ no bracing shown, a holey driver brace recommended at minimum
2/ lower driver can be rolled off 1st order at 400-700Hz, top or side mounted (see alternate head drawings)

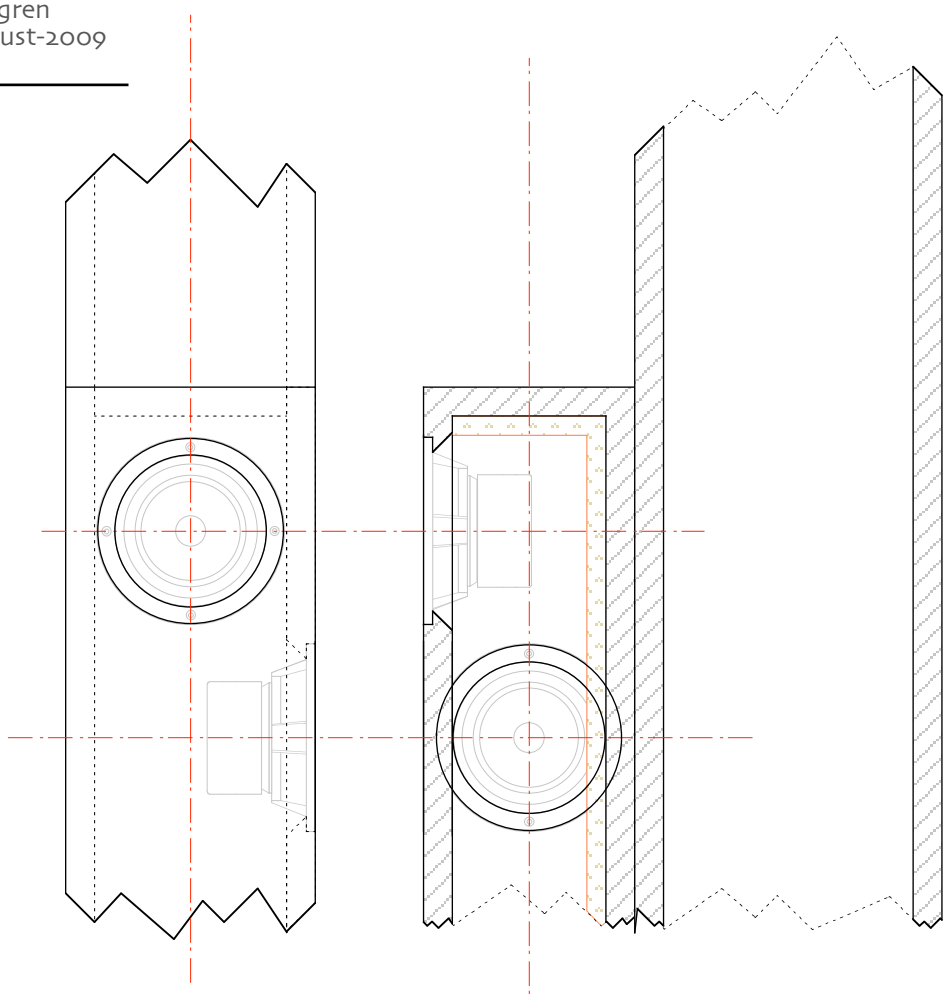






Windermere^2

for 2 x CSS EL70 ov95
Alternate Heads
designed by Scott Lindgren
drawn by dld / 01-august-2009



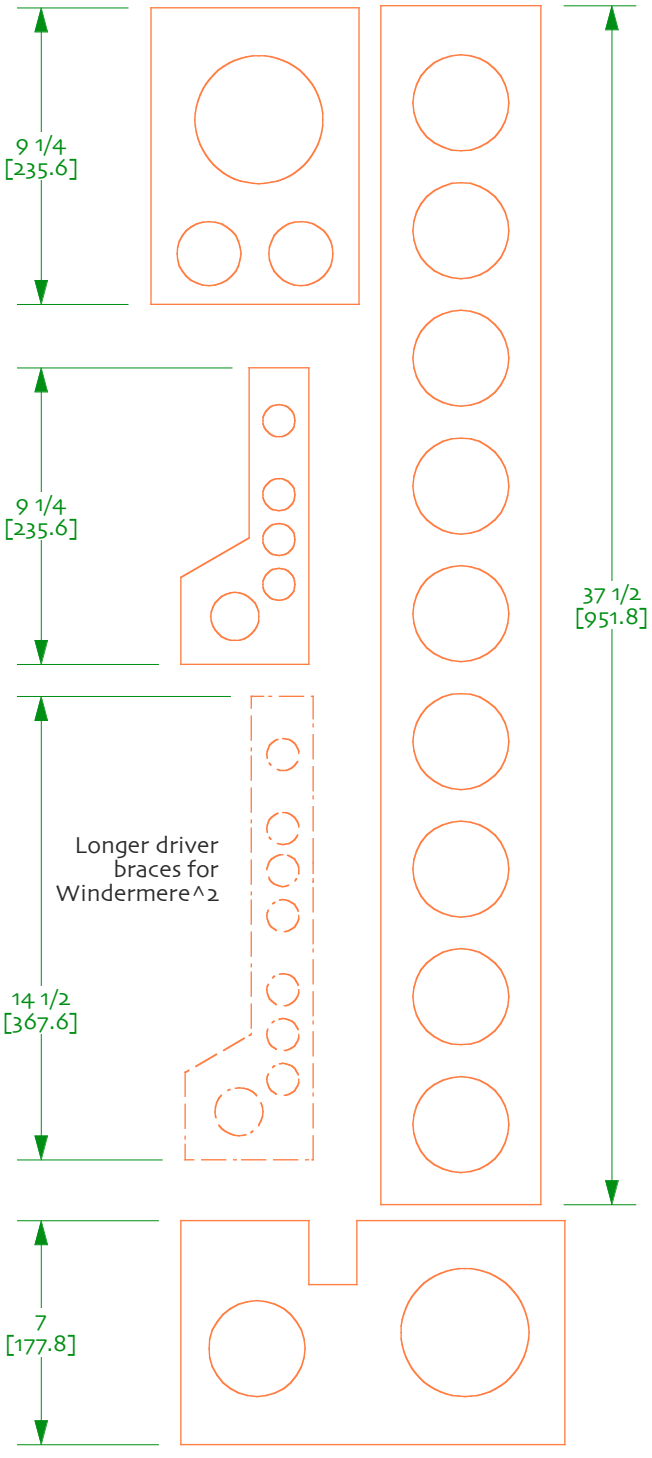
Notes:

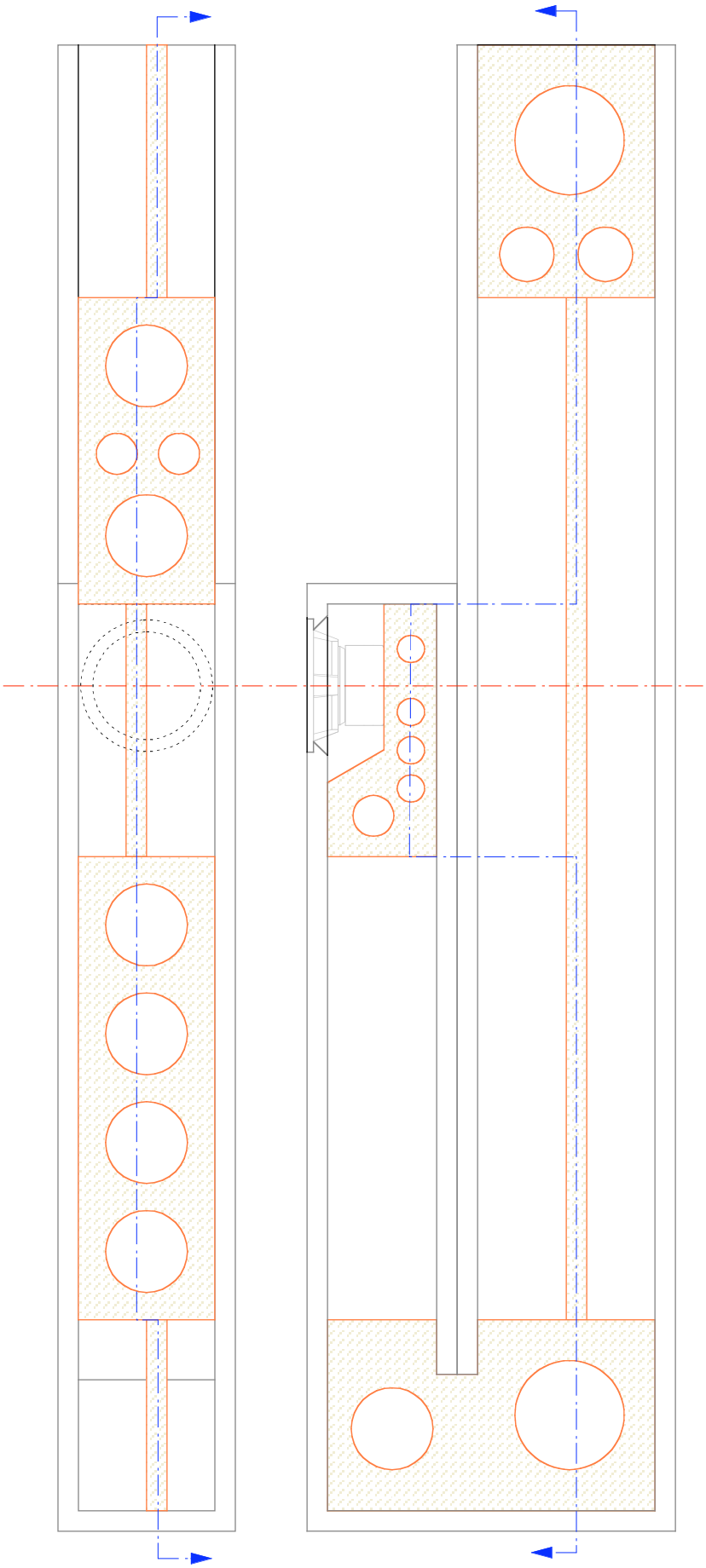
0/ drawn using 19mm (3/4") material
1/ damping shown in orange is 1/2" (12mm)
wool felt or 1" fiberglass
2/ no bracing shown

Windermere
for CSS EL70 ov92 Bracing

designed by Scott Lindgren
drawn by dld / 01-augusr-2009

Notes:
0/ drawn using 19mm (3/4") material
1/ an example bracing strategy – feel free to modify
2/ holey braces could extend & interlock
3/ braces oriented vertically to not restrict air flow, and to create subpanels that have greater aspect ratio. Braces offset from centre so that subpanels are dissimilat shape

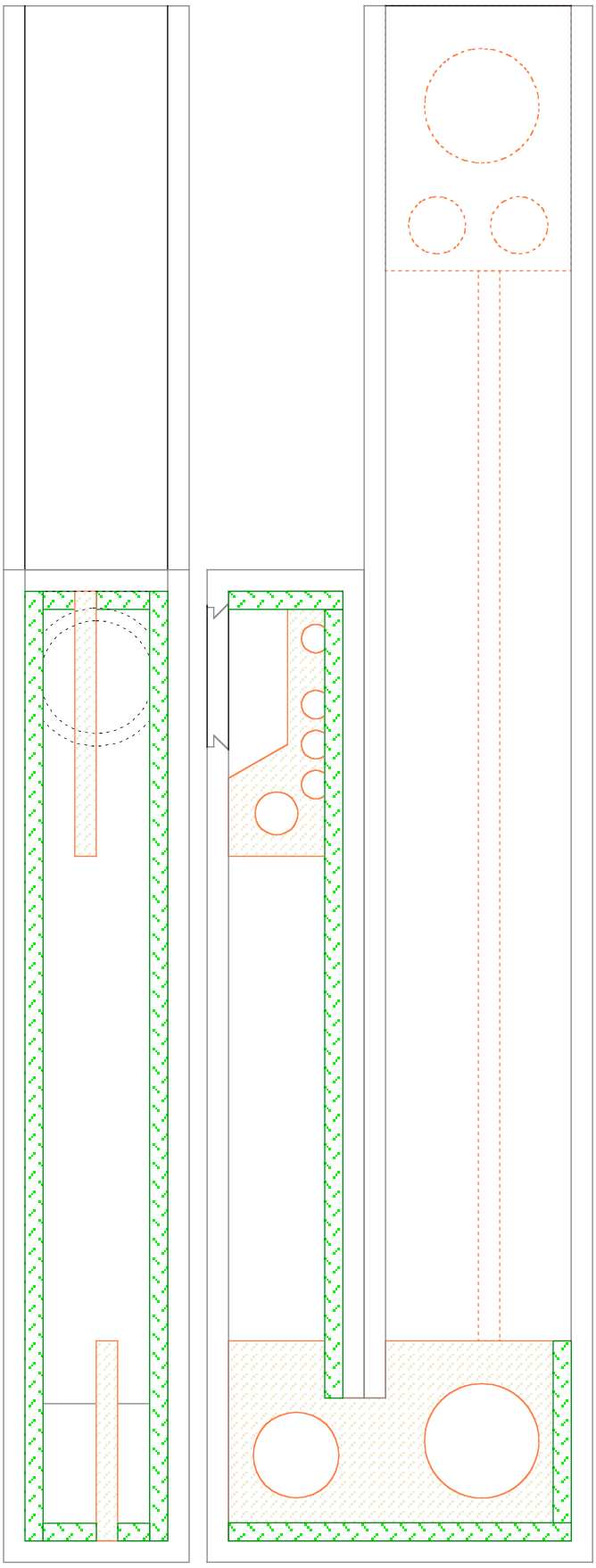


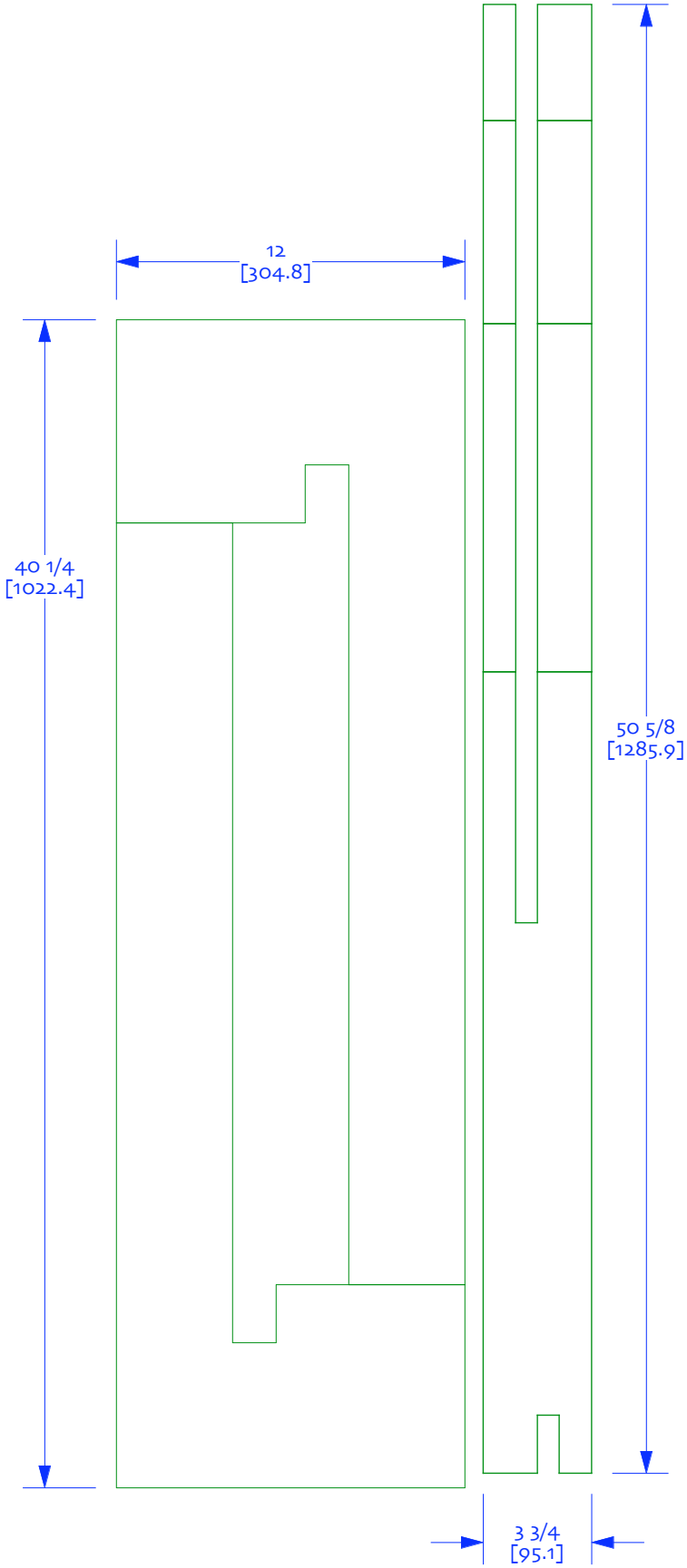


Windermere

Damping Plan
designed by Scott Lindgren
drawn by dld | 07-september-2009

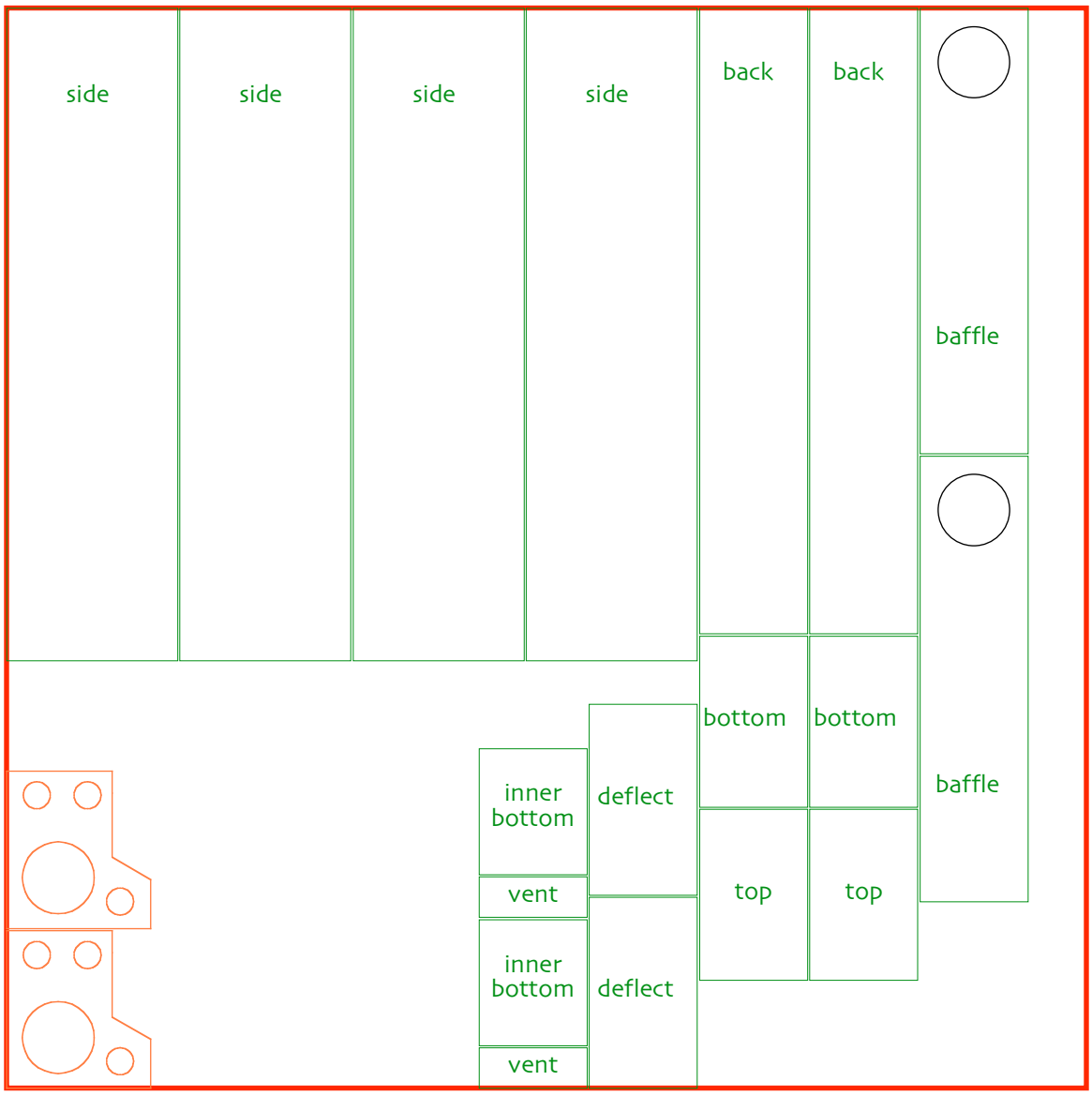
Notes:
Damping sheets shown for 5/8" (15mm) recycled cotton/denim felt damping material. Wool felt or 1" acoustic fiberglass may be substituted

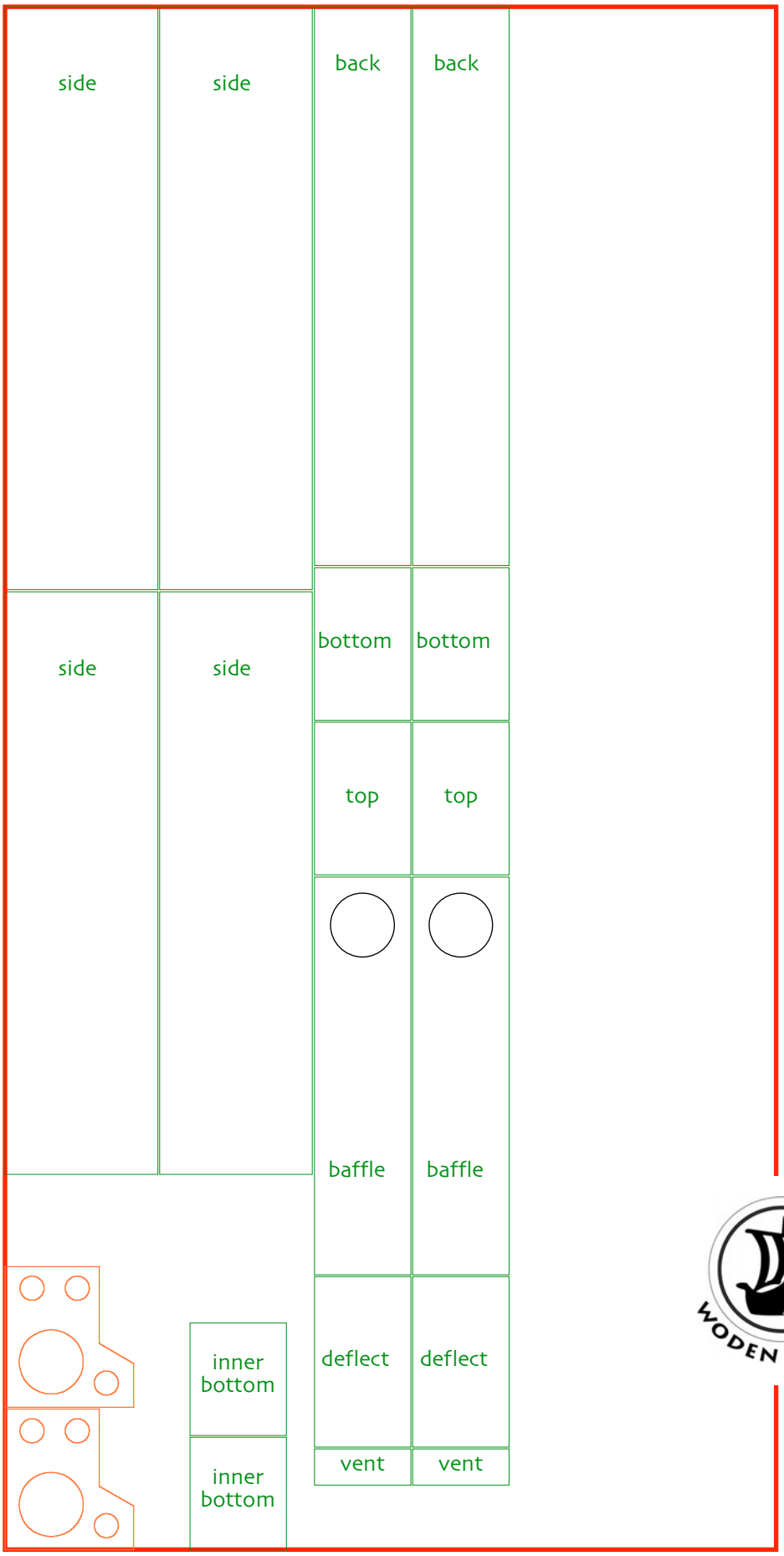




Derwent
5'x5' cut plan

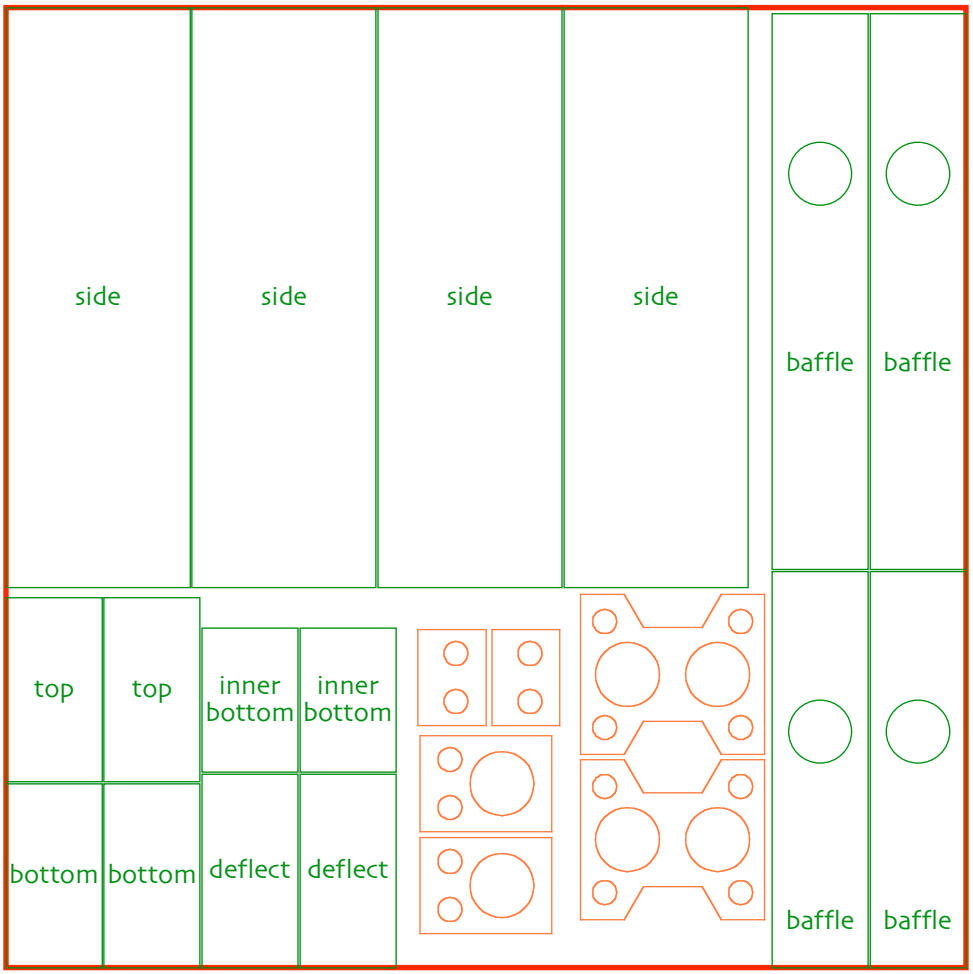
drawn by dld / 26-july-2009





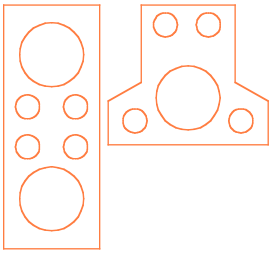
Derwent
4'x8' cut plan

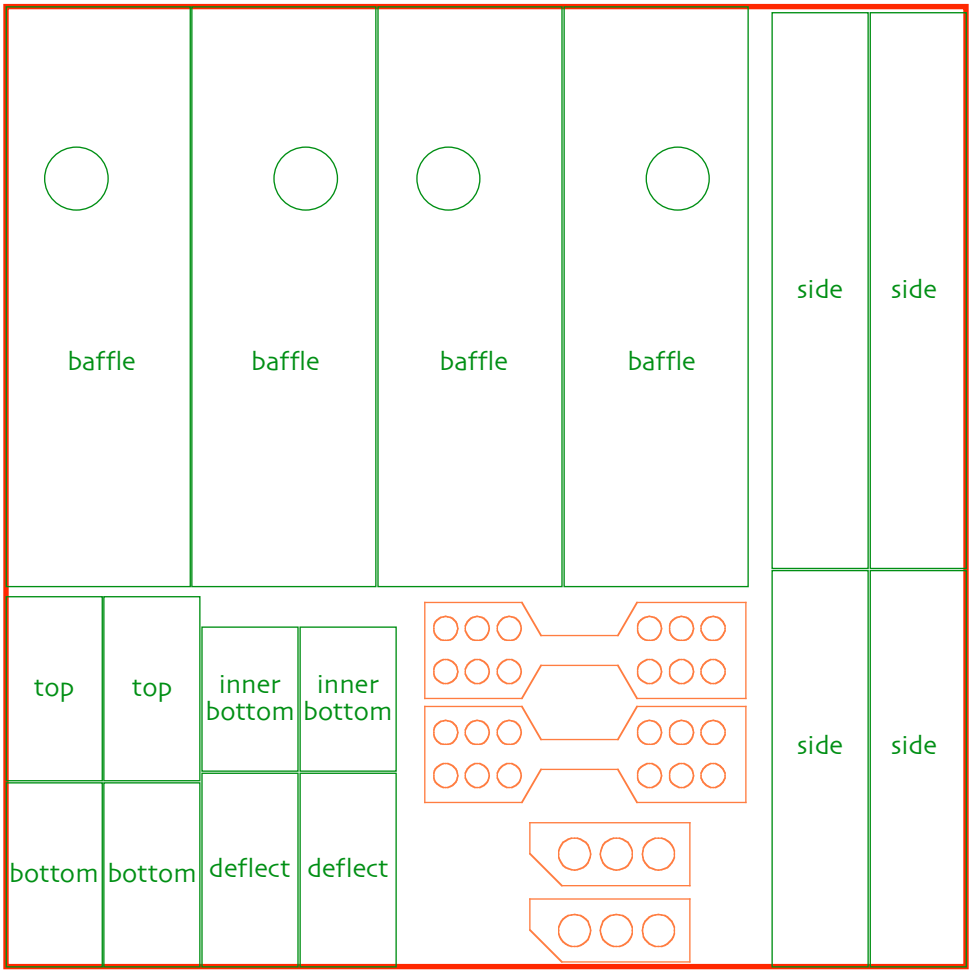
drawn by dld / 26-july-2009



Thirlmere
5'x5' cut plan

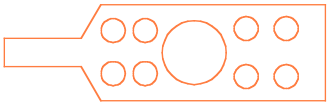
drawn by dld / 05-sep-2009

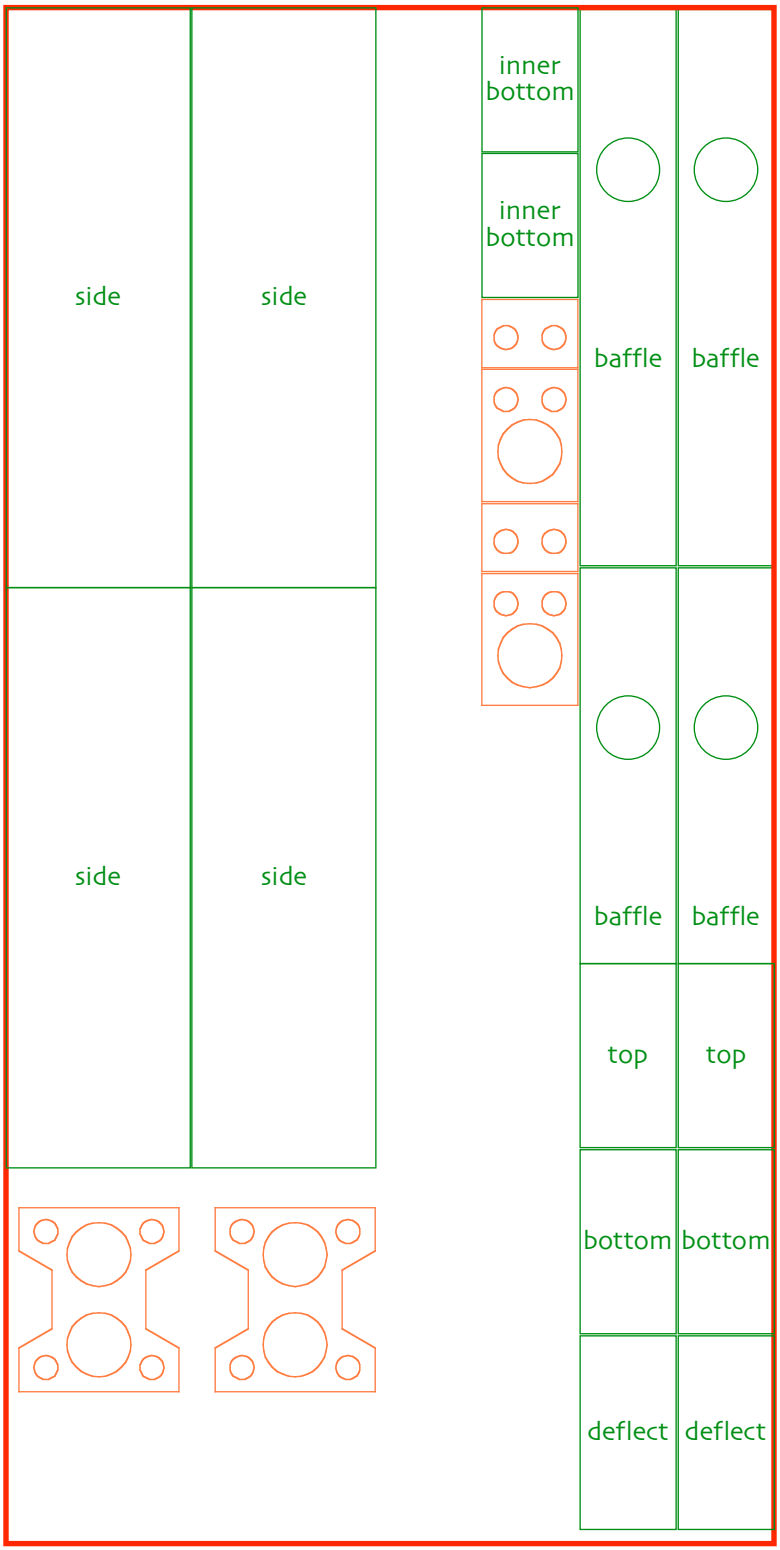


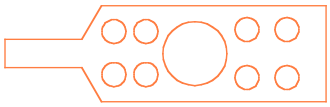


Thirlmere-R
5'x5' cut plan

drawn by dld / 05-sep-2009

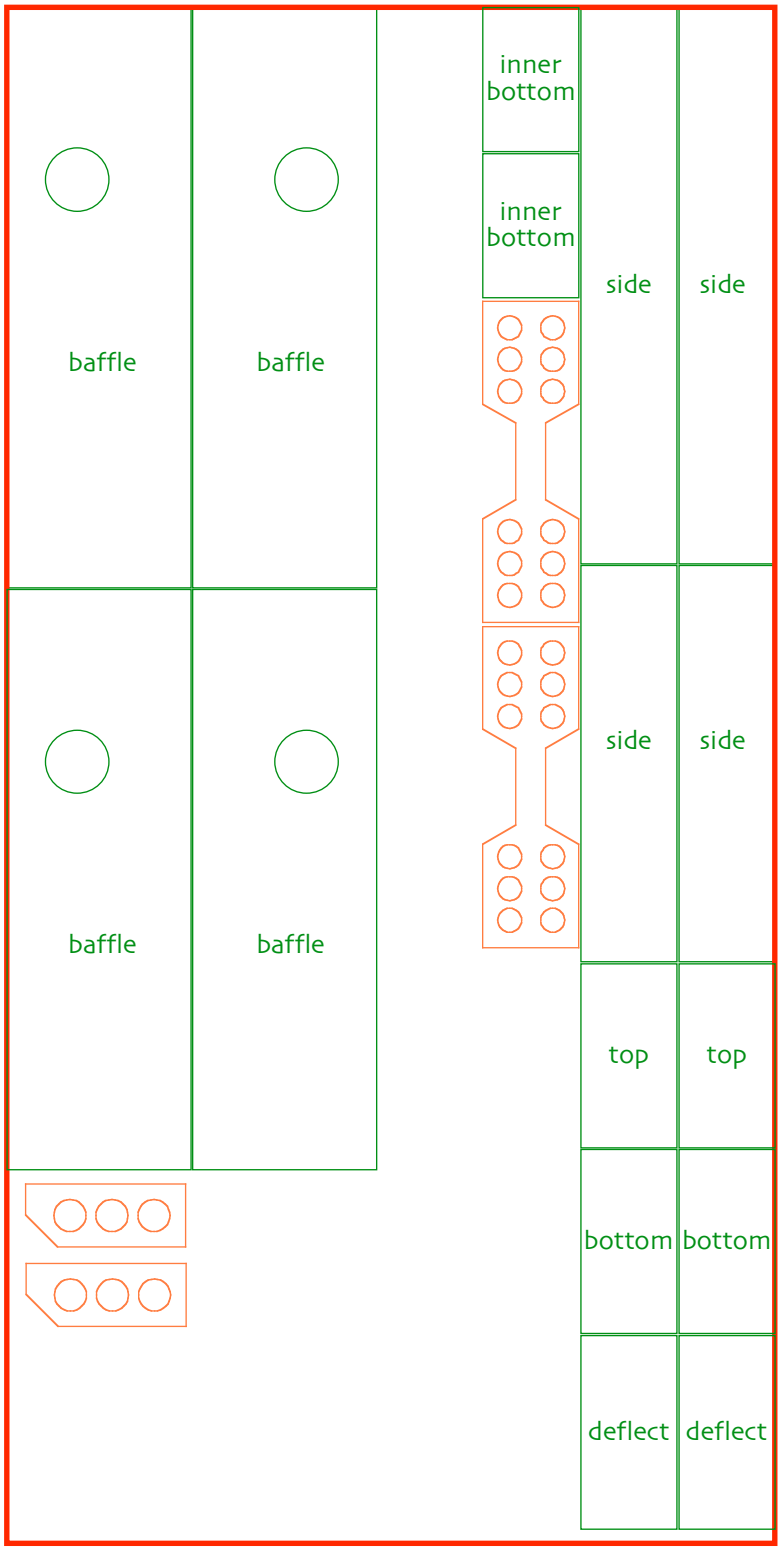






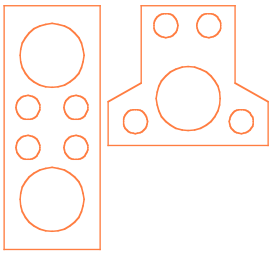
Thirlmere-R
4'x8' cut plan

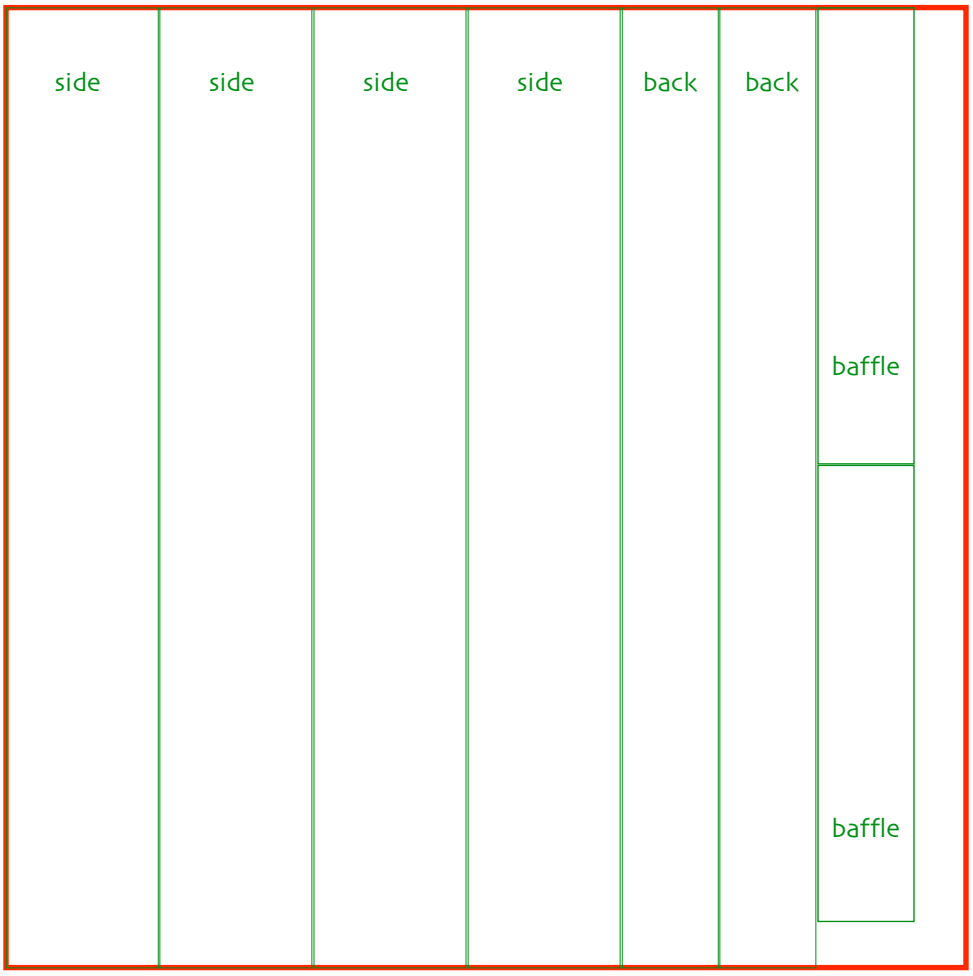
drawn by dld / 05-sep-2009



Thirlmere
4'x8' cut plan

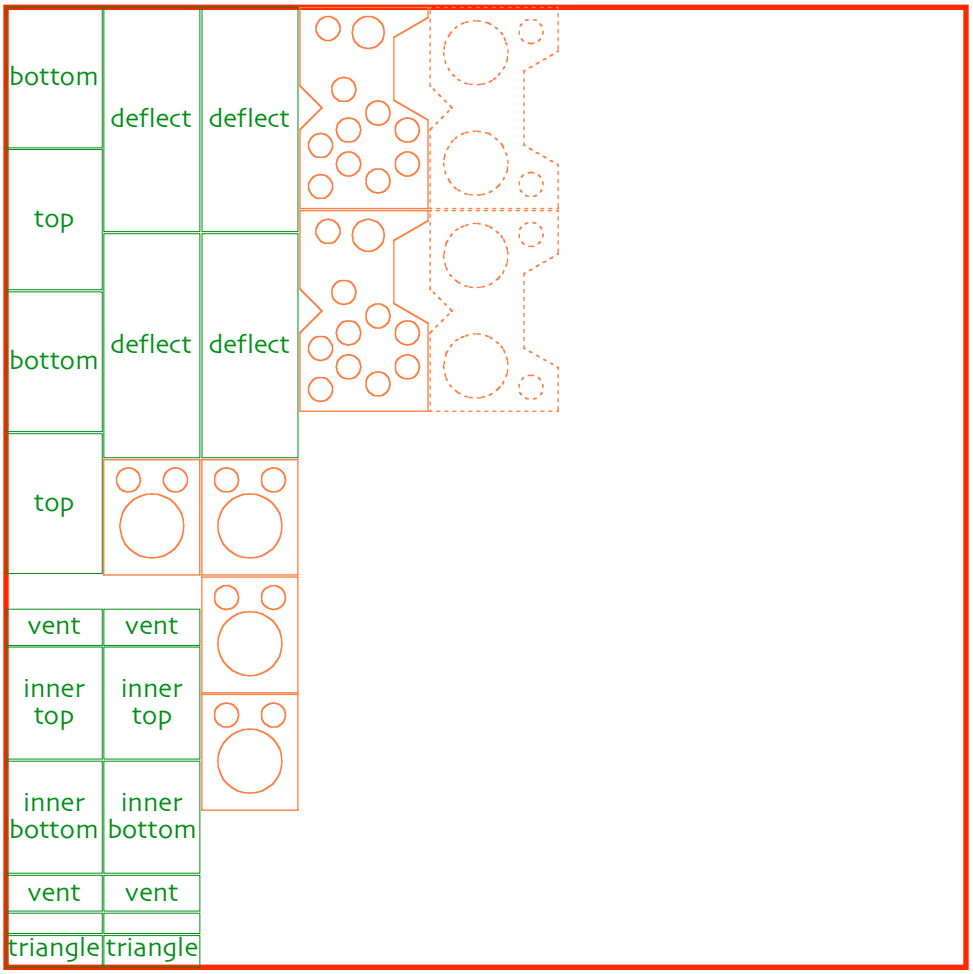
drawn by dld / 05-sep-2009

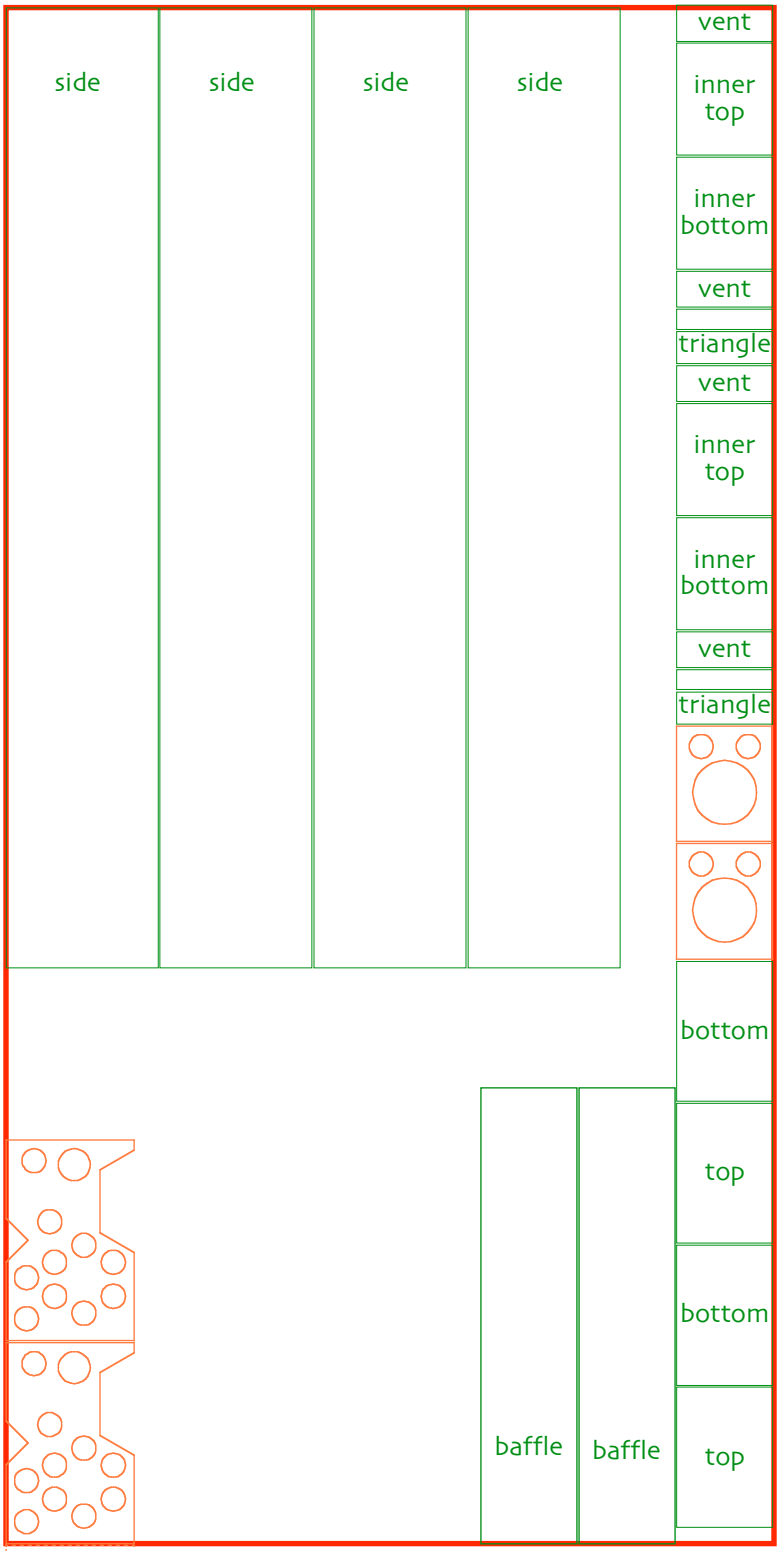


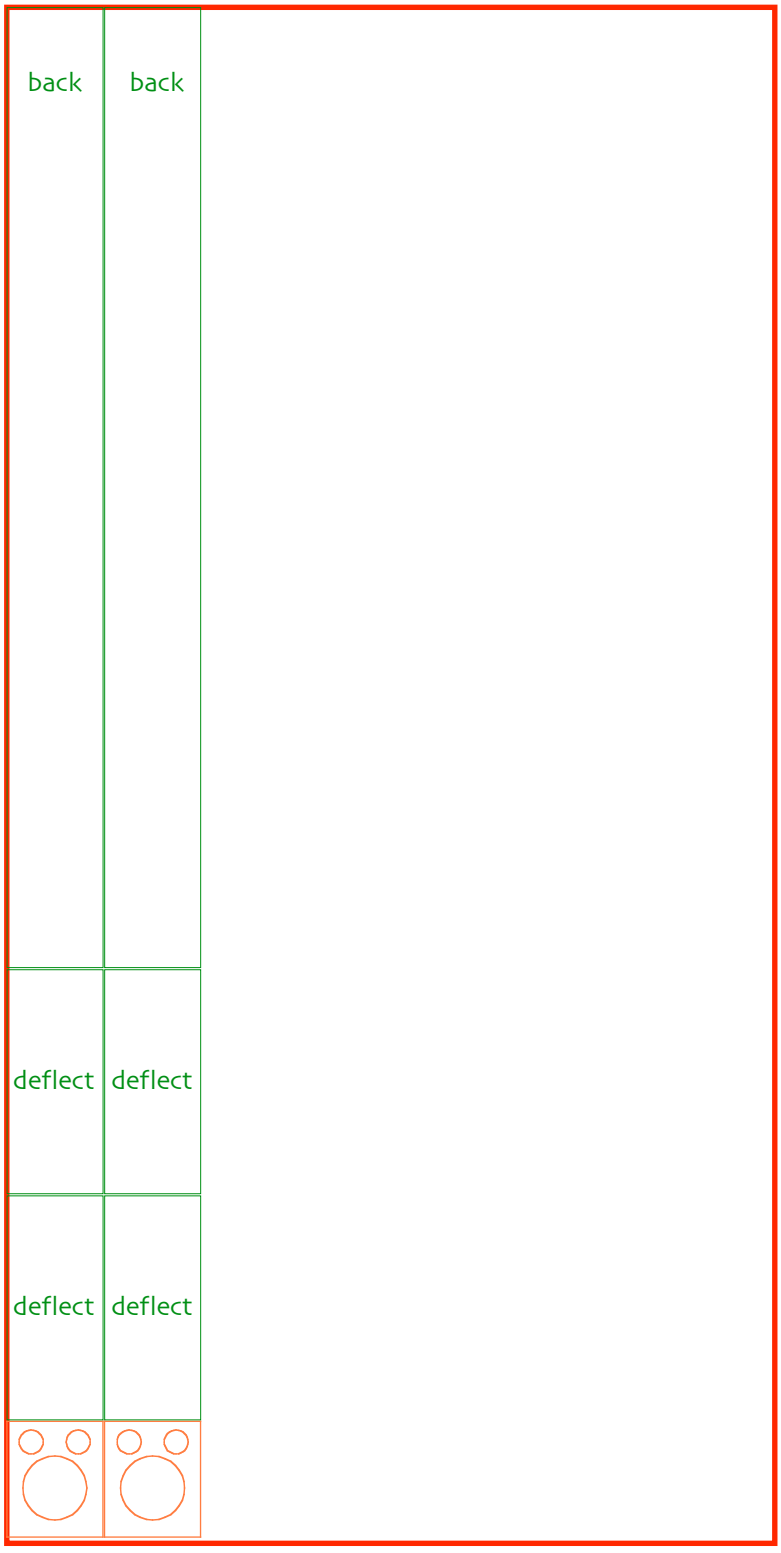


Coniston
5'x5' cut plan

drawn by dld / 25-july-2009







Coniston
4'x8' cut plan

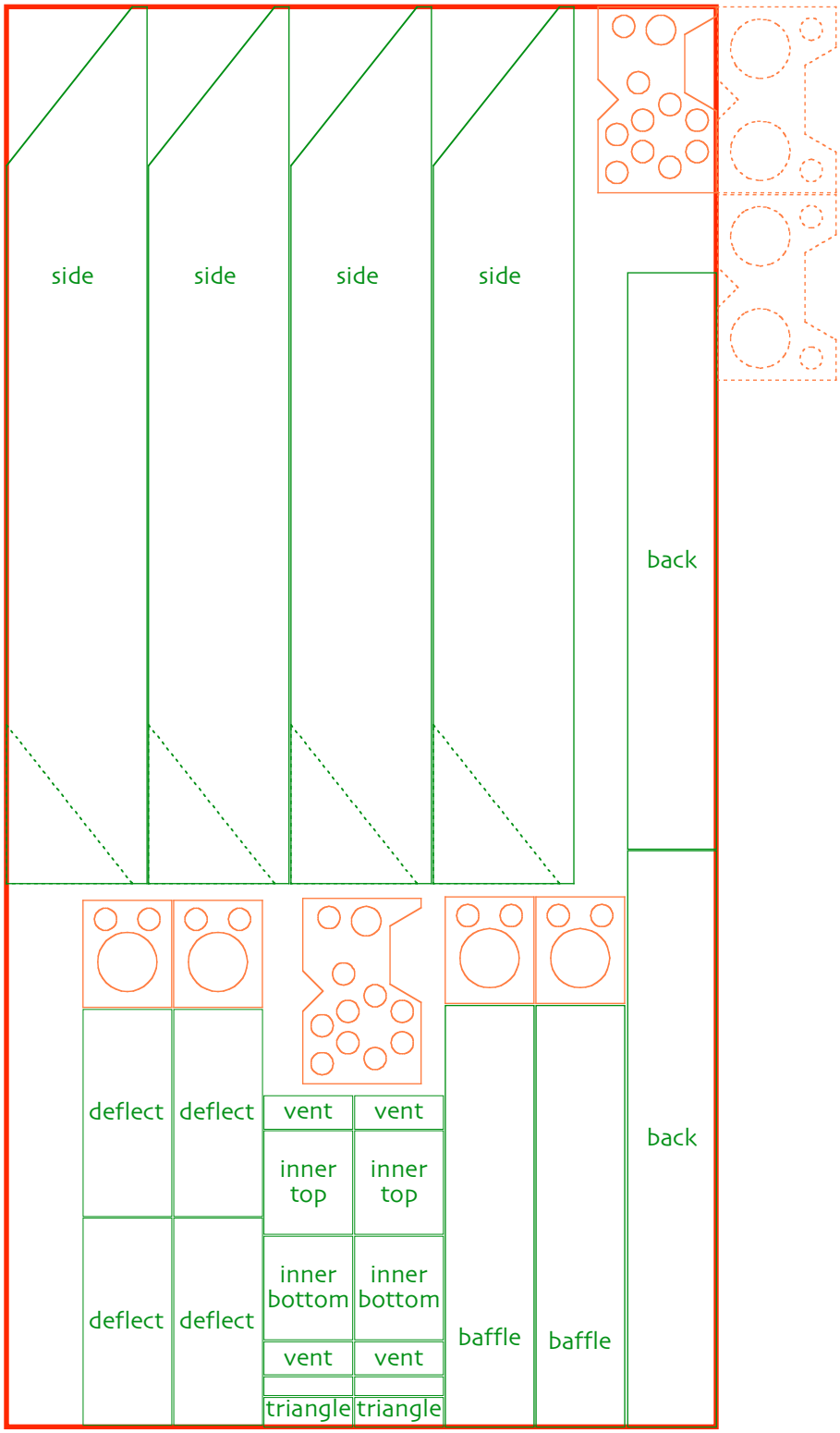
drawn by dld / 25-july-2009

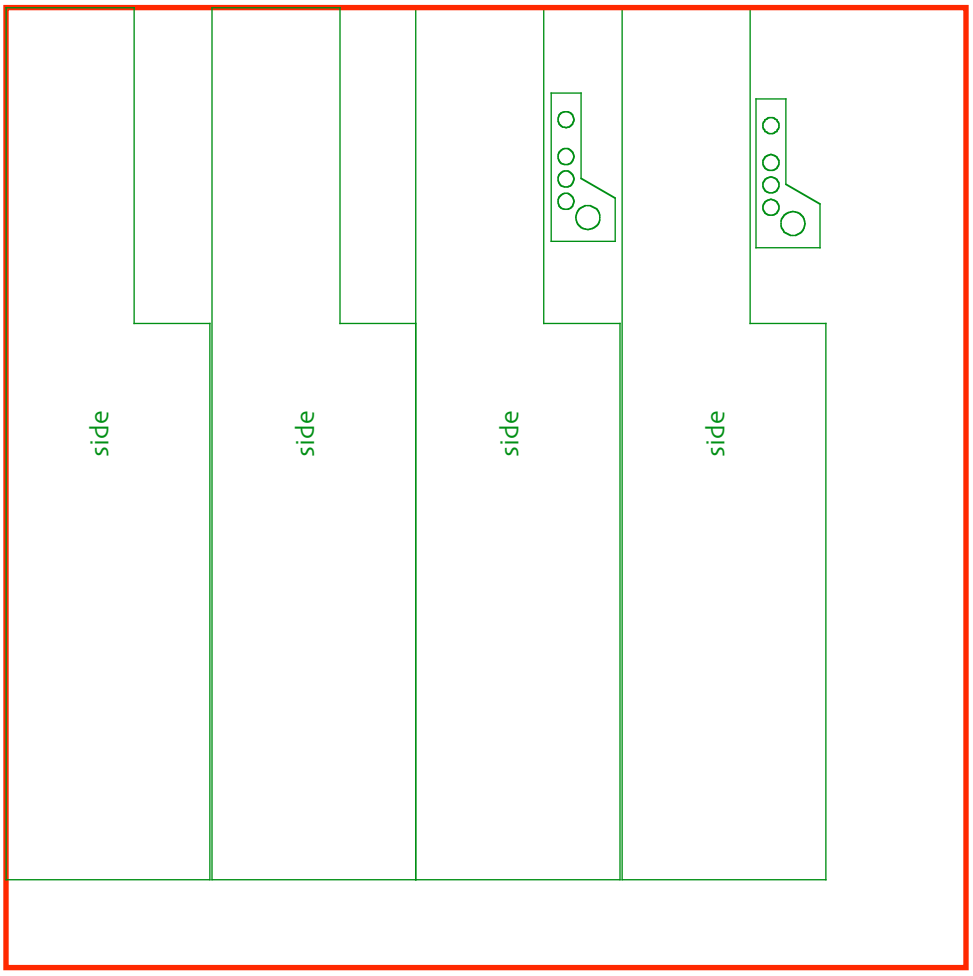
Coniston
4'x8' cut plan
Alternate

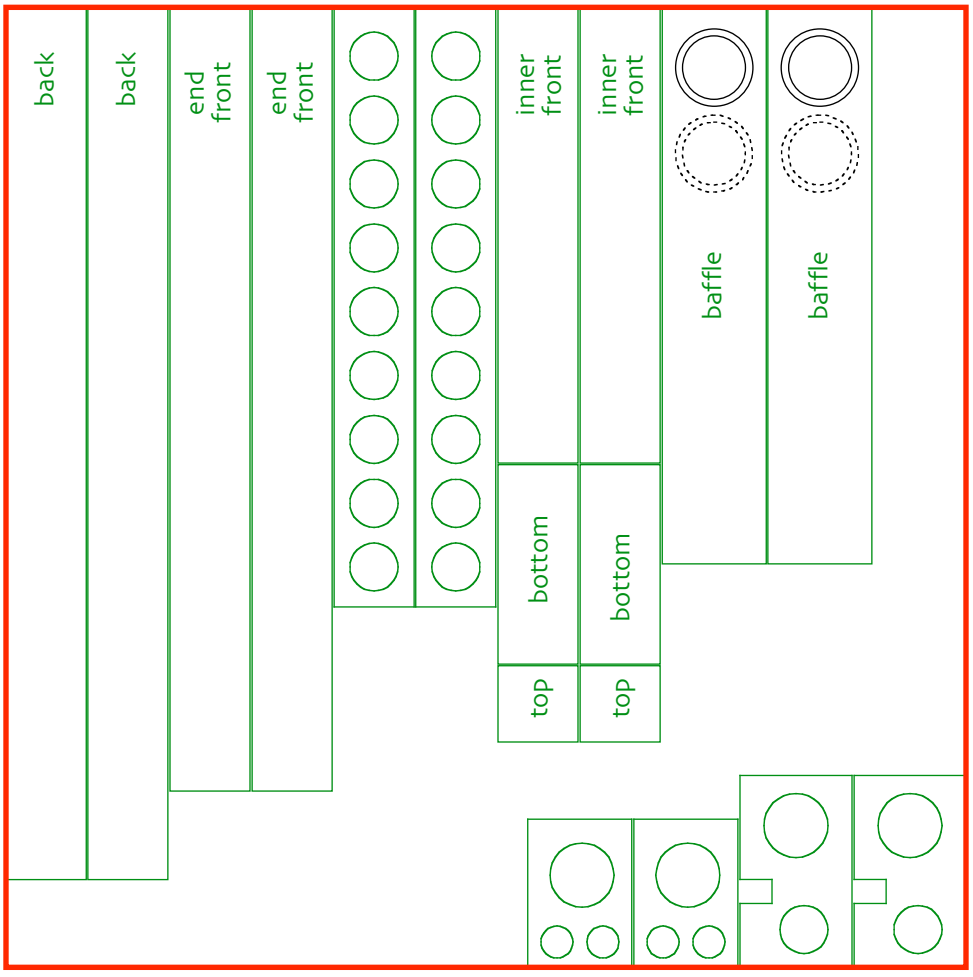
drawn by dld / 25-july-2009

Notes:

o/ with the minimal build it is possible to get a pair out of a single 4x8 sheet







WODEN DESIGN

Windermere
5'x5' cut plan

drawn by dld / 30-july-2009

Windermere
4'x8' cut plan

drawn by dld / 25-july-2009