

This document was put together for re.source by Pump Studios
In 2013 as resource was exploring the logistics of improving the
Availability of CBS toilets. We are making this document available
as the toilet manufacturing was never pursued but the learnings
In this document may be useful for others thinking about CBS and toilets.

There are solid works drawings of this design available upon request.
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re.source sanitation

Dry Separation Toilet – Pro-Forma Costing

October 10th, 2013



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studios

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Design Overview



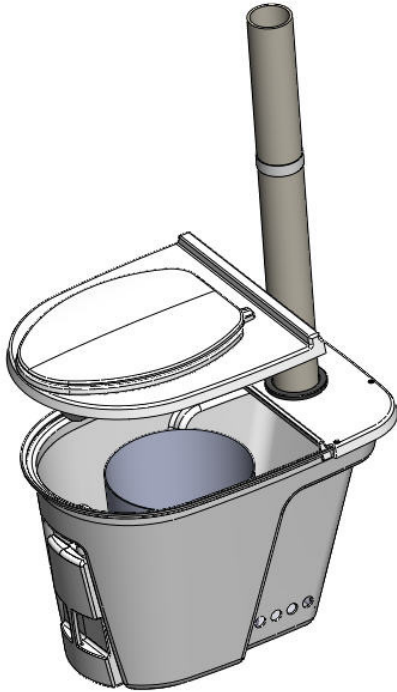
re.source Design Overview

- Lift off top to access feces bucket
- Rotomolded part cut in 3 pieces to form base, and lid parts
- Urine collection bottle in front

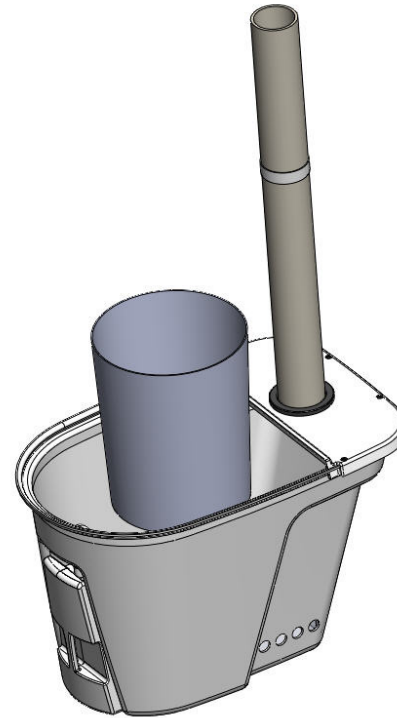


Lift Off Lid Design

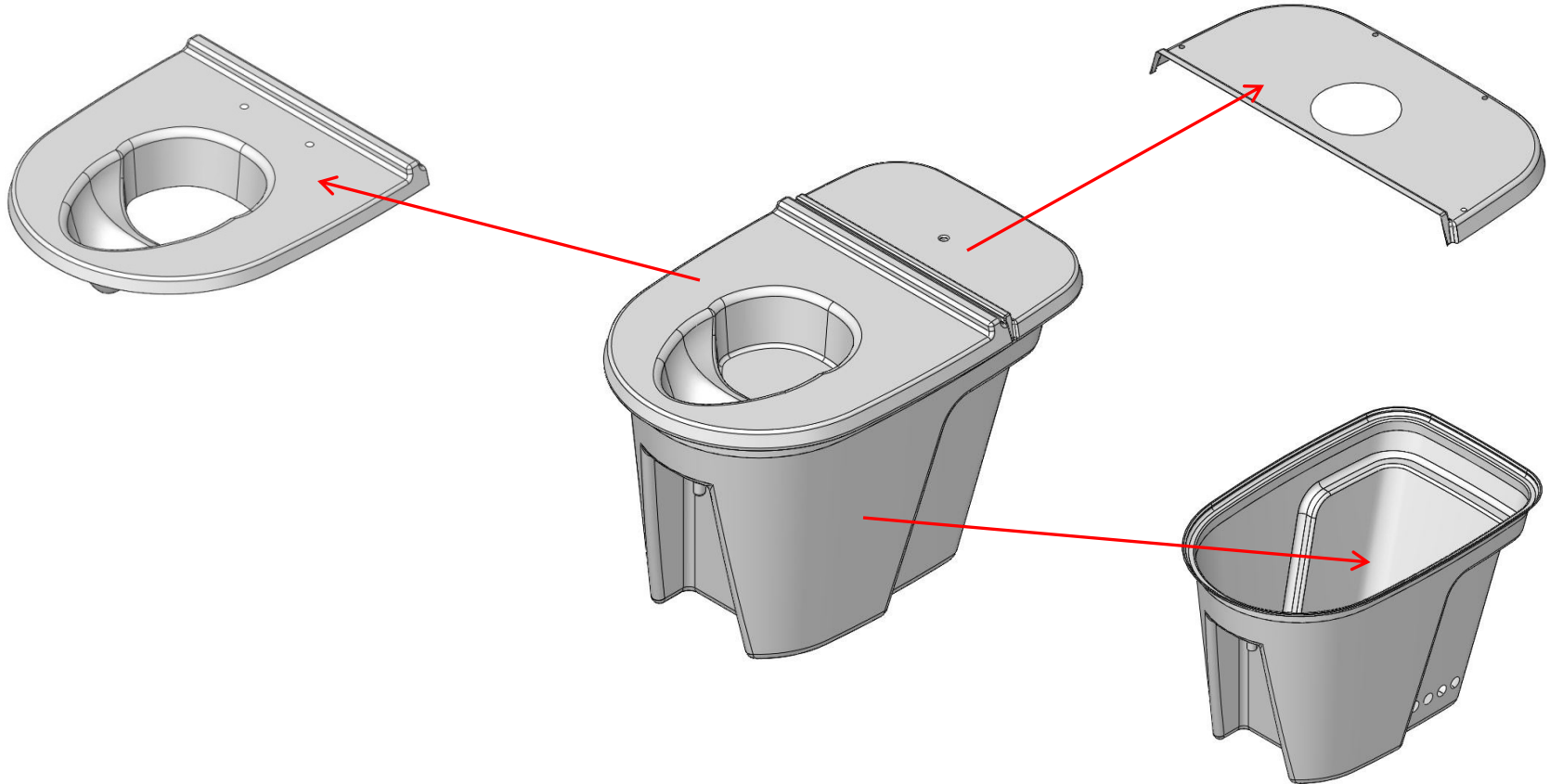
Lid lifts off to access feces bucket.



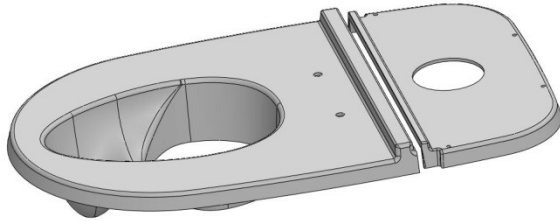
Container is lifted vertically out of toilet.



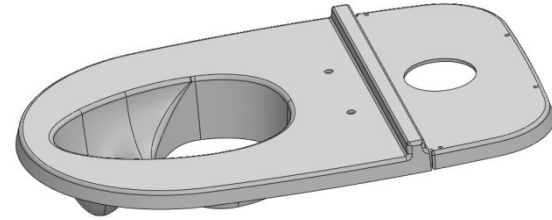
Rotomolded Part with Cutaways shown



Lid Overlap Details

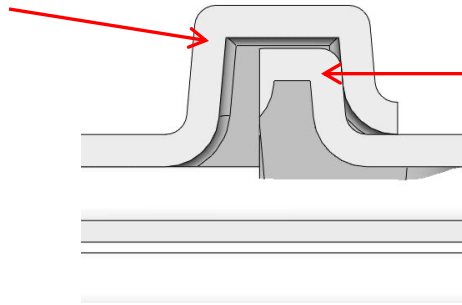


Lid is trimmed into two parts.



Rear part is slid forward. Front rib overlaps rear rib.

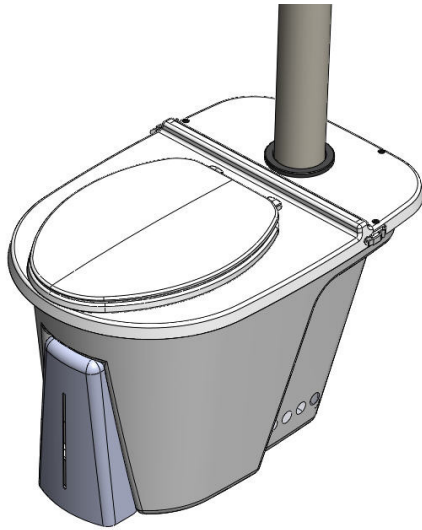
Front rib



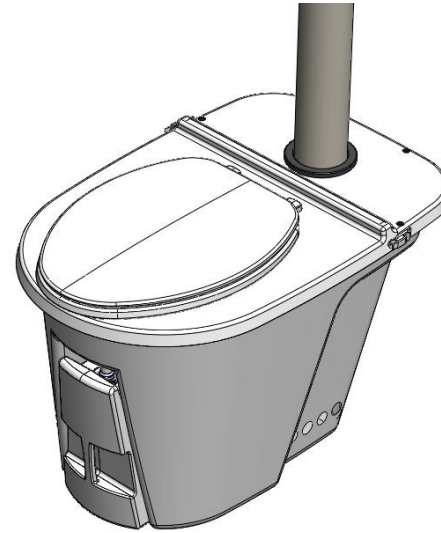
Rear rib

Overlap detail (gasket not shown).

Urine Bottle Options



Option 1:
Off-the-shelf bottle with formed cover plate.



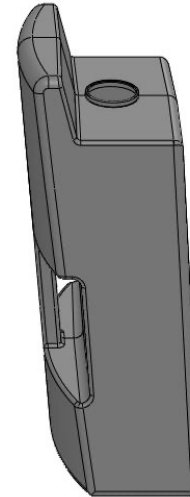
Option 2:
Custom blow molded bottle

Option 1: Custom Urine Bottle

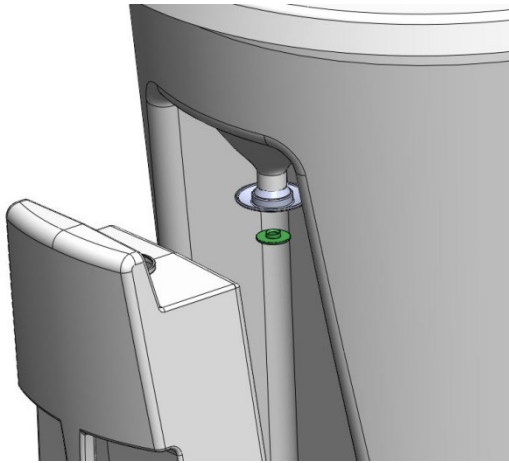


Bottle fits base cutout
and covers urine
funnel connection.

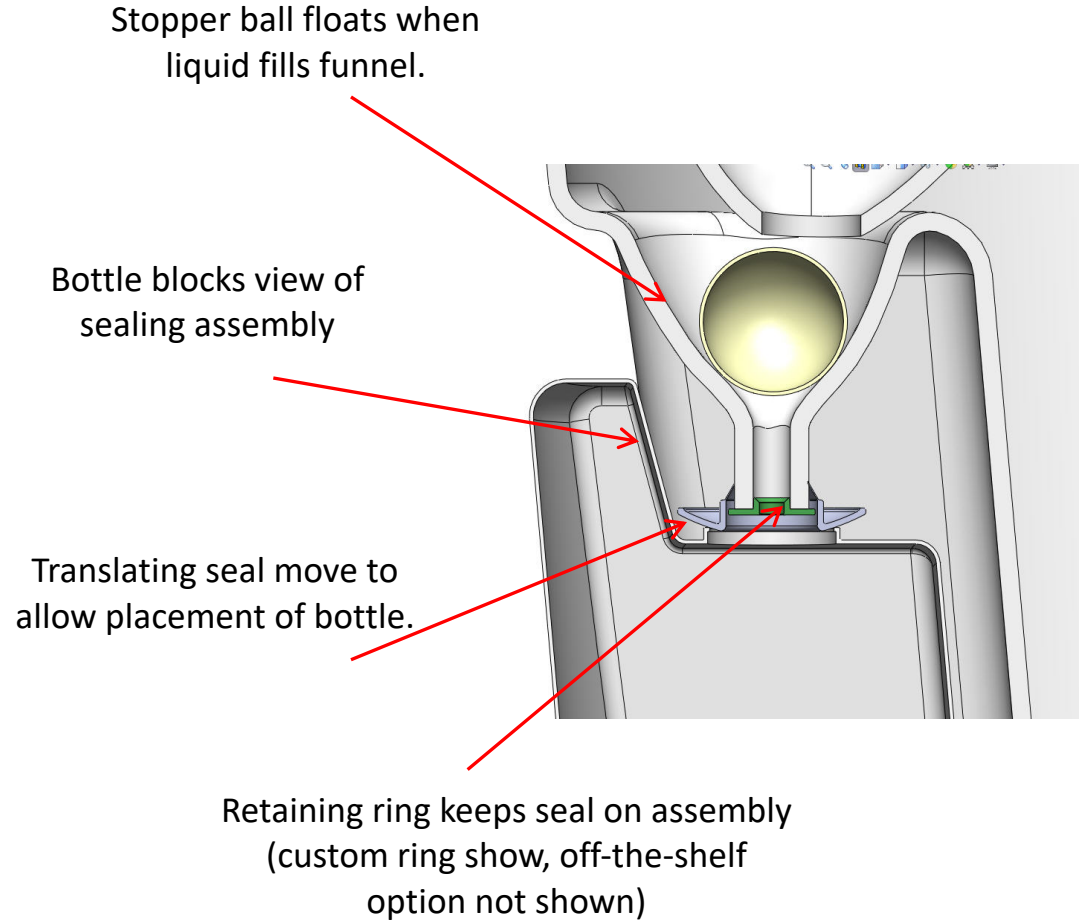
Custom bottle has
complex shape.



Option 1: Bottle Connection



Exploded view: bottle sealing assembly

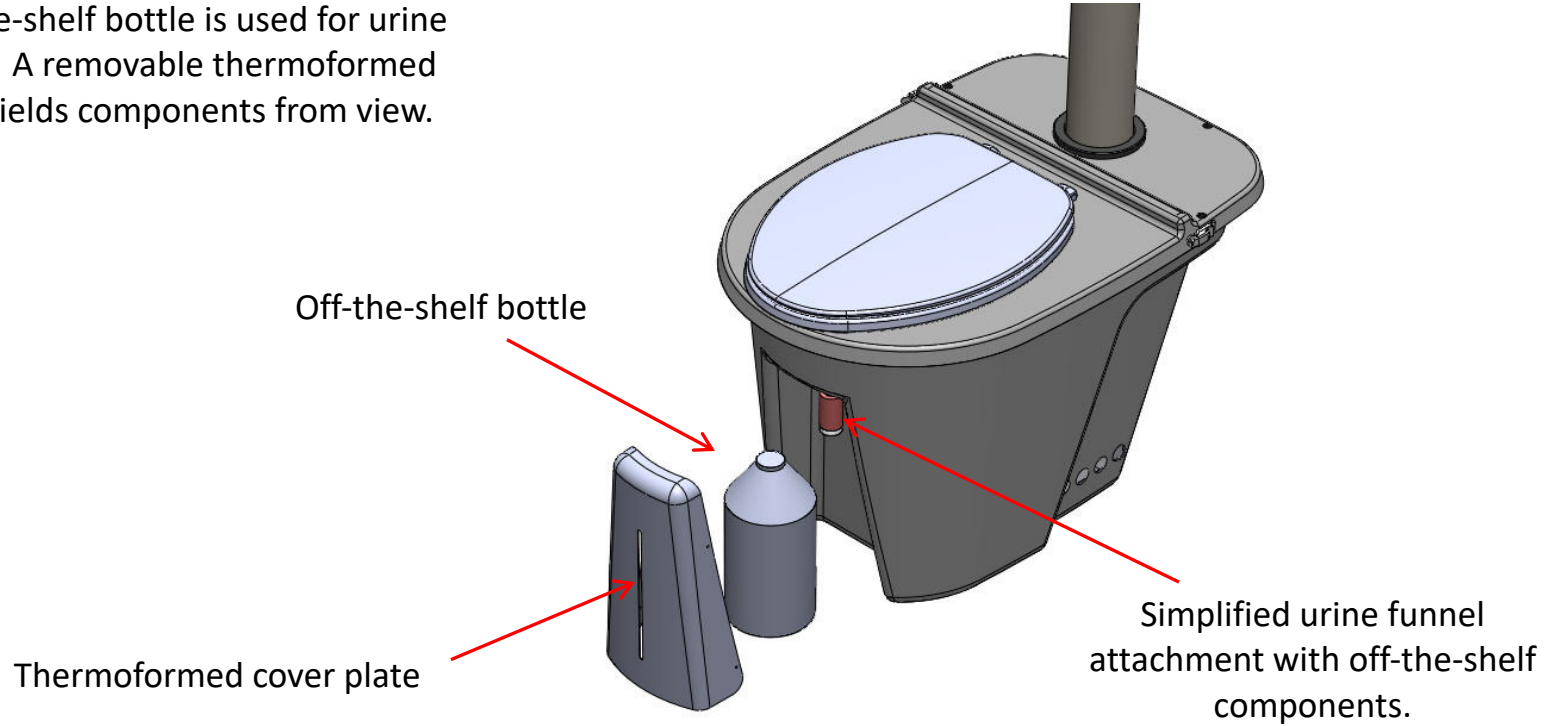


Option 1: Custom Urine Bottle

Pros	Cons
<ul style="list-style-type: none"> • Custom bottle hides funnel connection and provides smooth front • Efficient use of space: bottle capacity is maximized at 3.7 L (still under desired 5 L) 	<ul style="list-style-type: none"> • Bottle shape requires complex tooling, and may not be possible to blow mold. • Urine funnel connection is blind, requiring self aligning parts and features • Urine funnel, retaining ring, and seal are custom injection molded parts • It may not be possible to blow mold exact geometry needed to completely shield funnel assembly.

Option 2: Cover Plate

An off-the-shelf bottle is used for urine capture. A removable thermoformed cover shields components from view.

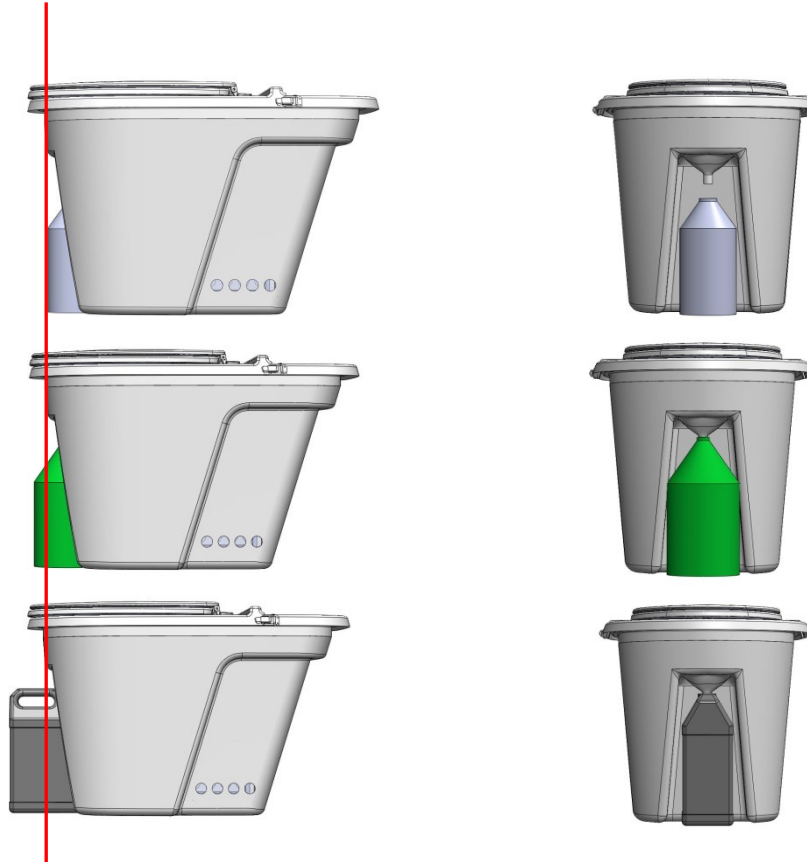


Bottle Sizing With Cover Plate Design

½ Gallon bottle fits well within current urine diverter opening, but does not have a large capacity.

1 Gallon round bottle extends past the front edge of the toilet, potentially causing interference with user's feet.

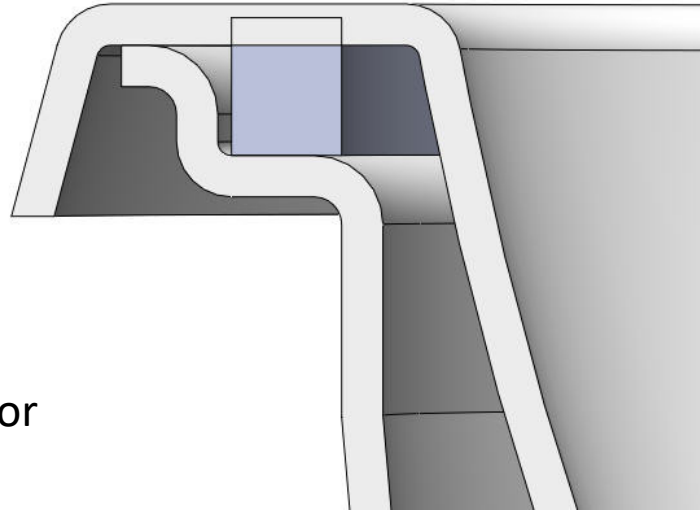
F-Style jug extends far beyond the profile of the toilet.



Option 2: Cover Plate

Pros	Cons
<ul style="list-style-type: none">• Cover plate tooling is simple• Uses mainly off the shelf parts• Provides clean, finished look	<ul style="list-style-type: none">• ½ gallon bottle fits best in current urine funnel geometry, but only has 1.9 L capacity• Cover requires a window (or other mechanism) to see urine bottle fill level.

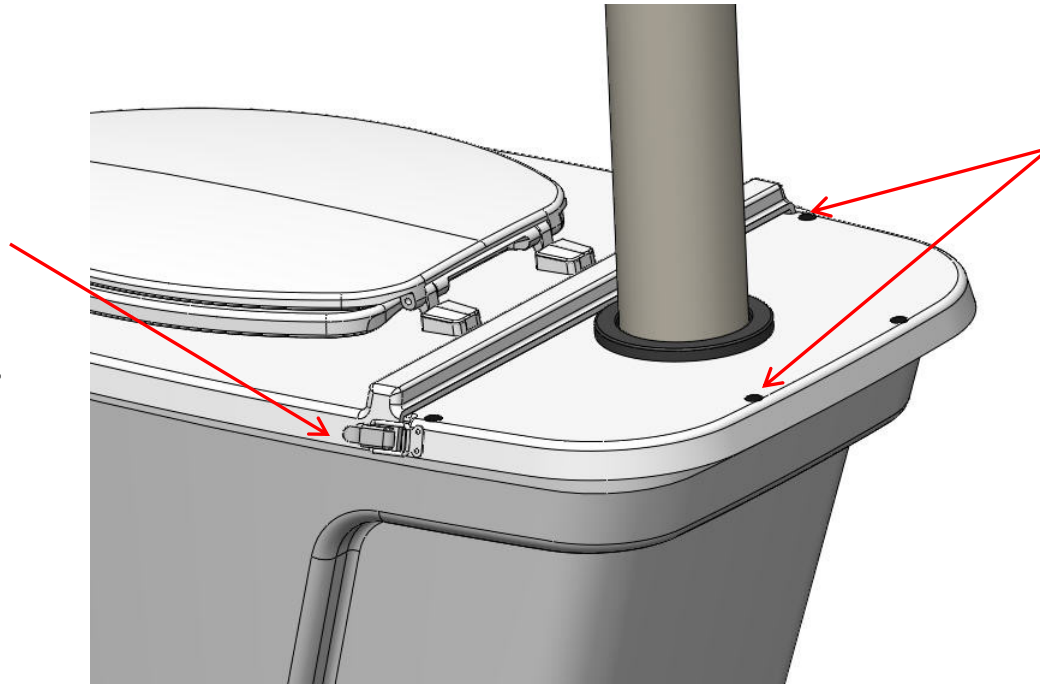
Gasket Seal



Molded geometry forms ledge for
sealing gasket.

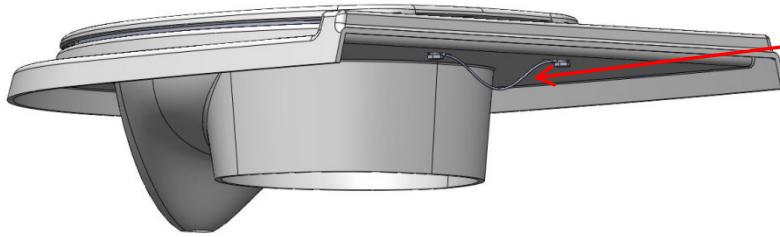
Lid Attachment

Front lid attached with off-the-shelf latches. Forward latches (not shown) require spacer block.



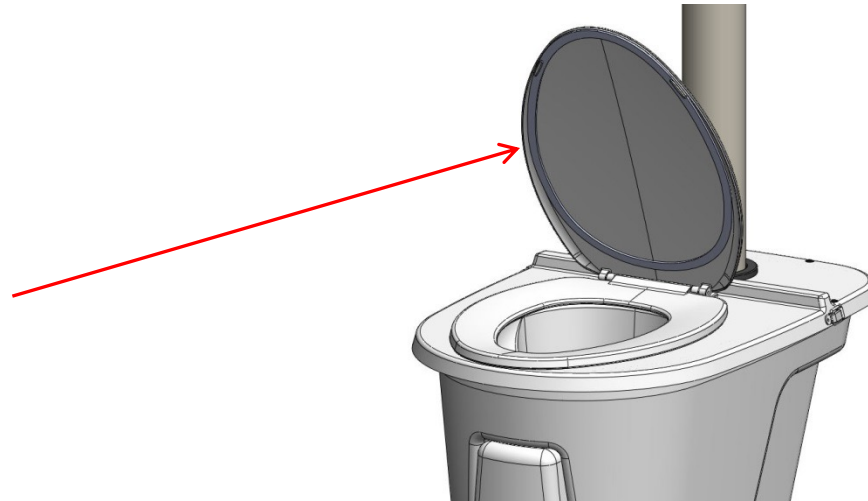
Rear lid attached with reusable plastic inserts.

Lid Assembly

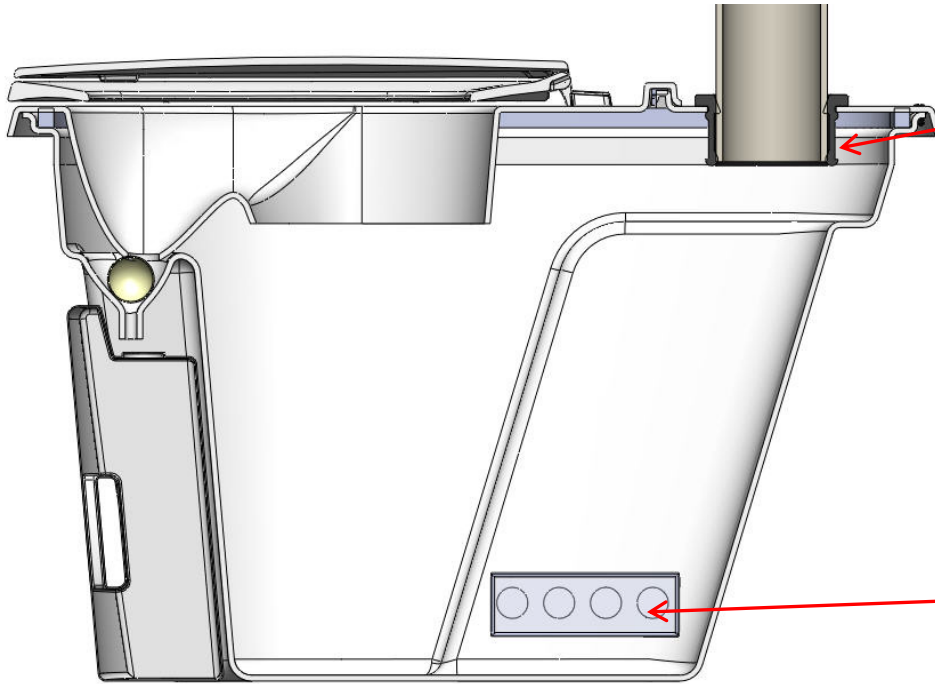


Wire cable attaches to hook on vent pipe in order to hang lid while toilet is serviced.

Gaskets run along inner edge of toilet seat and lid to seal toilet when not in use.



Venting

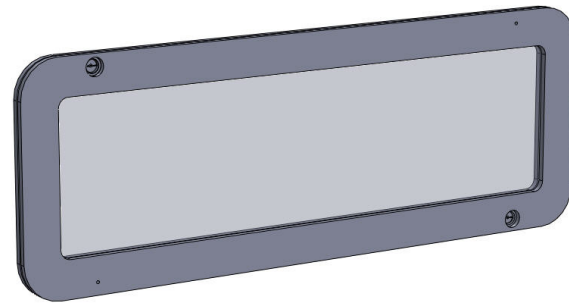
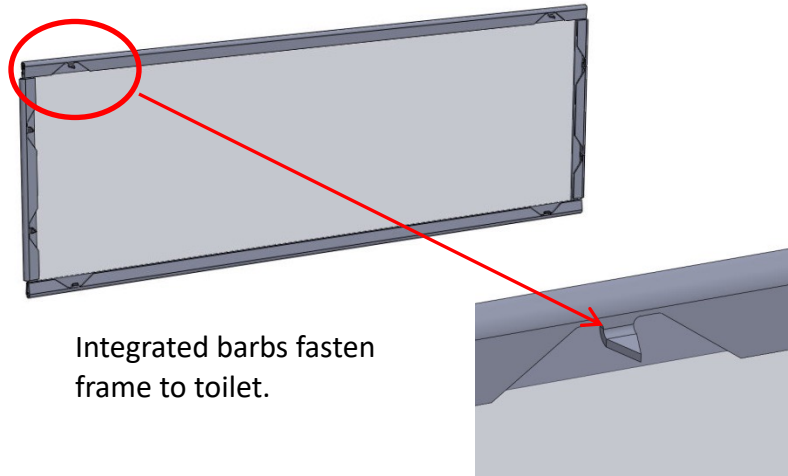


Vent pipe attaches to lid with off-the-shelf rubber gasket.

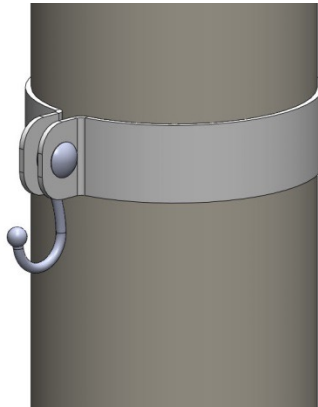
Inlet vent screen assembly keeps bugs and debris from entering toilet base.

Vent Screen Options

Formed Metal Frame	Injection Molding Plastic Frame
<ul style="list-style-type: none"> Minimal tooling costs Formed metal parts Stainless steel does not corrode Integrated fasteners 	<ul style="list-style-type: none"> Requires tooling Plastic frame parts



Hanger Concept



Hook holds toilet lid during servicing. Clamp can be custom part (looks nice, aspirational design), or off the shelf part (low price, easy to replace).

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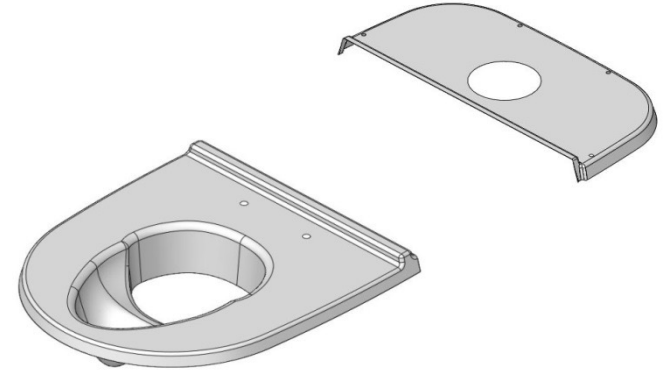
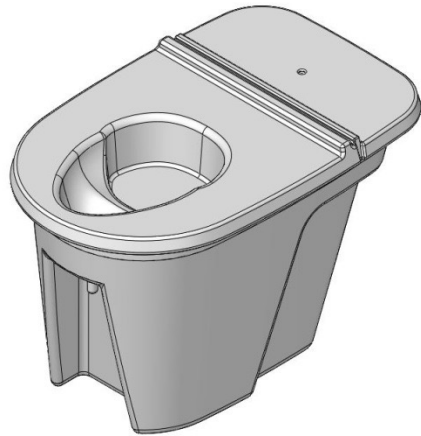


Cost Assumptions

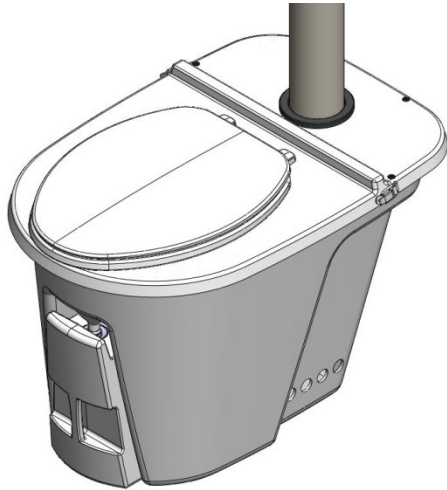
- Low end tooling and per part costs are for overseas manufacture.
- High end tooling and per part costs are for domestic manufacture.
- Volume price for parts with retail pricing were assumed to be 25% of quoted cost.
- Volume price for parts with wholesale pricing were assumed to be 50% of quoted cost.
- Prices were quoted for 1000 units per year.
- Where exact parts could not be quoted (material, screw length, etc.) similar representative parts were used for cost estimate.

Rotomolded Part

Part Count	Estimated Tooling Cost	Estimated Unit Cost
1 Part Cut into 3 parts	\$19,000	\$97.00



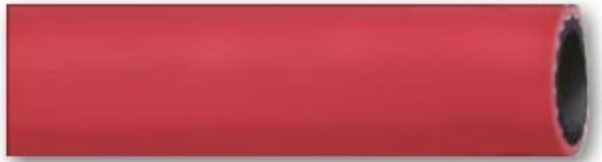
Custom Urine Bottle



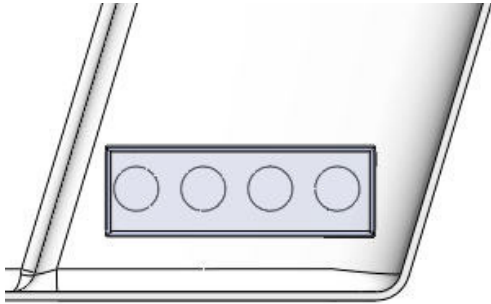
Part	Estimated Tooling Cost	Estimated Unit Cost
Urine Bottle	\$80,000	\$TBD
Urine Funnel	\$5,000-\$15,000	\$0.15 -\$0.50
Retaining Ring	-	\$0.14
Stopper Ball	-	\$0.11
Total	\$85,000 - \$100,000	\$TBD

Urine Diversion Option 1 - Cover Plate

Part	Estimated Tooling Cost	Estimated Unit Cost
Cover Plate	\$3,100	\$9.87
Urine Bottle	-	\$0.40
Urine Tube	-	\$0.68
Tube Fitting	-	\$0.75
Hose Clamp	-	\$0.95
Cover Mount Tabs	-	\$1.00
Mount Tab Hardware	-	\$0.10
Stopper Ball	-	\$.011
Total:	\$3,100	\$13.86

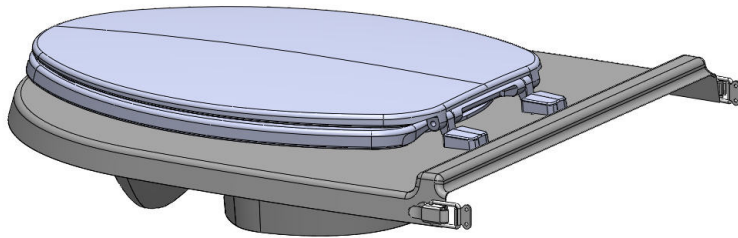


Base Assembly – Vent Screen



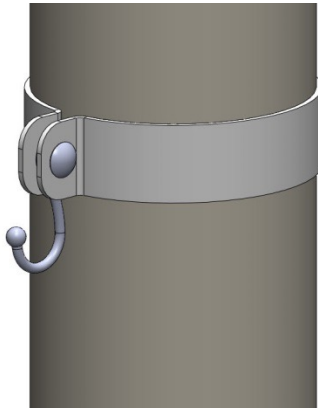
Part	Estimated Tooling Cost	Estimated Unit Cost
Screen	-	\$0.29
Metal Side Pieces (4x)	-	\$11.64
Metal Top/Bottom Pieces (4x)	-	\$9.24
Total	-	\$21.17
Screen	-	\$0.29
Plastic Frames (2x)	\$8,000 - \$15,000	\$3.00 - \$4.00
Mounting Hardware	-	\$0.06
Total	\$8,000 - \$15,000	\$3.53

Lid Assembly



Part	Estimated Unit Cost
Seat	\$7.00
Seat Gaskets	\$3.28
Latch Assemblies (4x)	\$9.92
Hanger Cable	\$0.98
Lid Gasket	\$0.34
Total	\$16.56

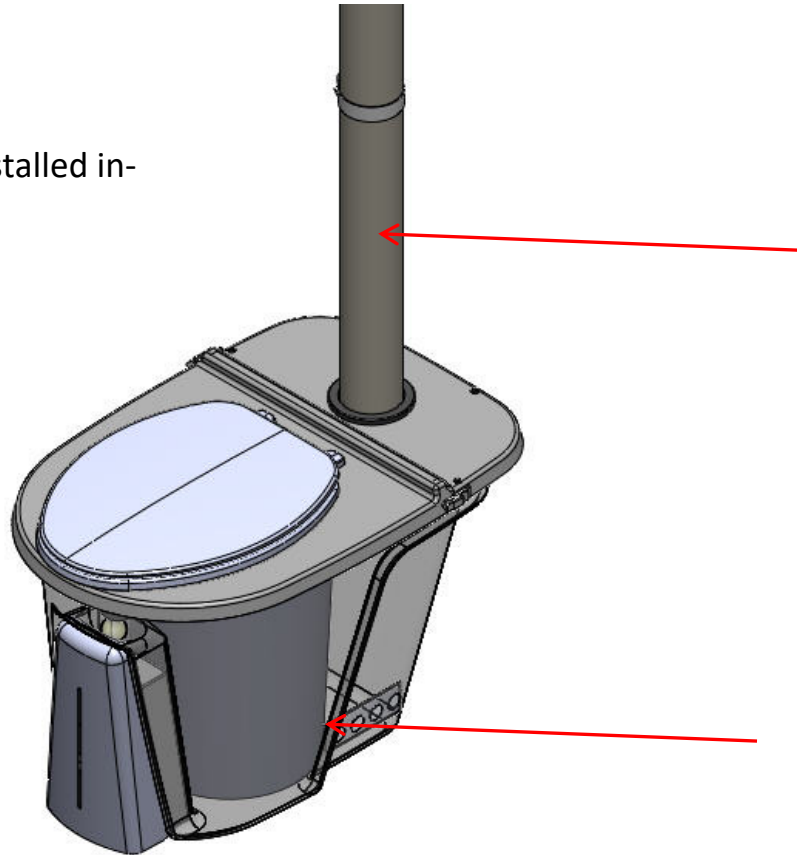
Hanger Concept



Part	Estimated Tooling Cost	Estimated Unit Cost
Vent Clamp	-	\$4.89
Hook	-	\$0.25
Bolt	-	\$0.06
Nut	-	\$0.01
Total	-	\$5.21

Additional Parts

PVC Pipe and 5 gallon container are installed in-country. Prices will vary by country.



Total Cost



Estimated Total Cost Range	Estimated Tooling	Estimated Unit Cost
	\$22,000 – \$108,000	\$160-\$180



fuel for thought...

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