

Student
Design
Presentation

Water Filled-Weight

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Agenda

Concept

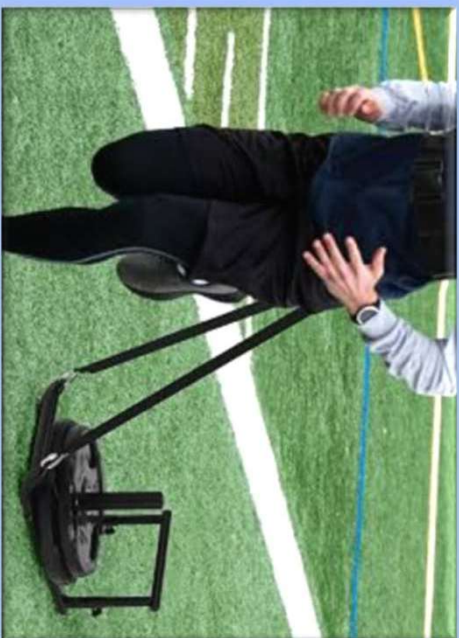
Design
Overview

Blow
Molding
Details

Challenges/
Reflections

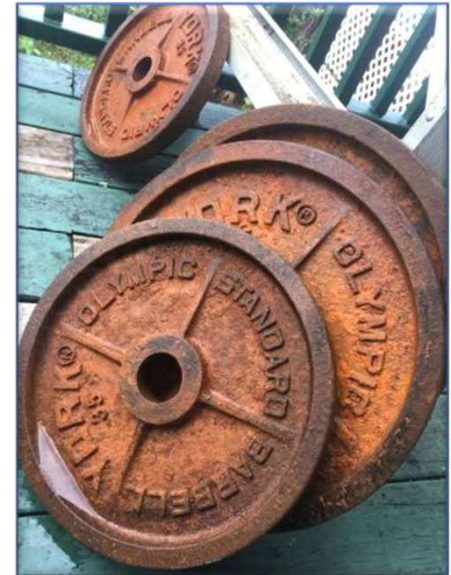
Questions

Inspiration



Problems with Traditional Plates

- Weight plates are heavy and can be difficult to transport outdoors
- Outdoor resistance training requires transporting multiple plates
- Outdoor use in wet conditions leads to equipment rusting





Big Question

**What if weight could be added
only when needed?**

Our Solution

Our plastic, water-filled plate:

- Can be transported empty and filled with water at the point of use
- Adds ability for adjustable resistance levels
- Has a standard 2-inch center opening for different activities
- Will not rust



End Use Requirements

25-lb Weight (Water + Part)

Lightweight & Portable

Threads/Cap

2-in. Olympic Bar Compatibility

Impact & Drop Resistance

Leak & Weather Resistance

End goal:

Empty = lightweight & portable

Filled = functional training weight

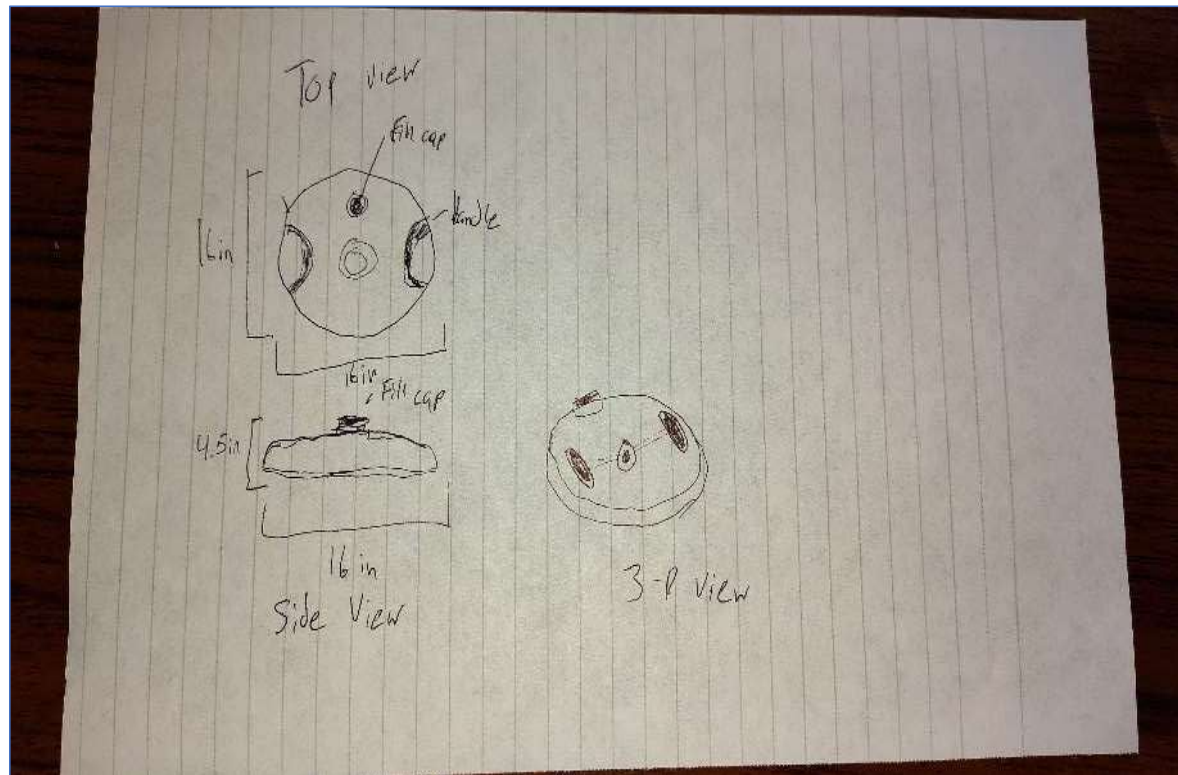


Why Choose Blow Molding?

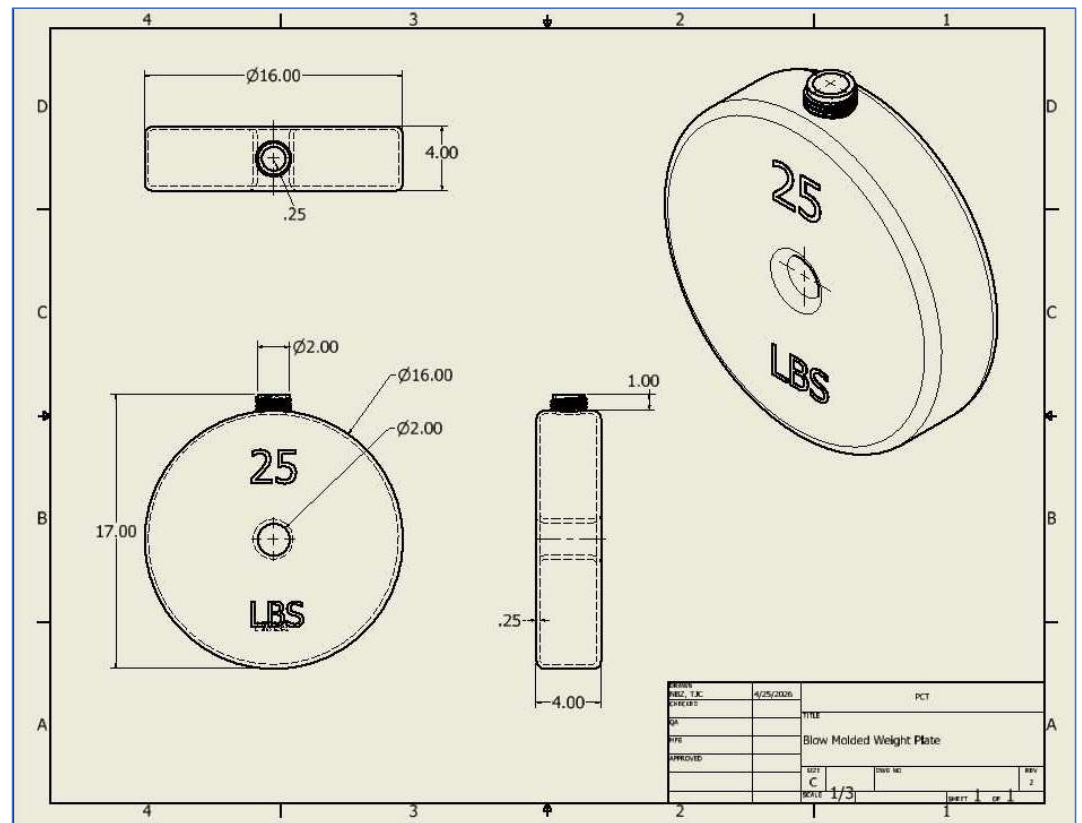
- **Ideal for Hollow Parts**
- **One-Piece, Seamless Construction**
- **Efficient High-Volume Production**
- **Well-Suited for HDPE**
- **Faster cycle times compared to roto-molding**



Rough Sketch



CAD Model and Drawing



Final Concept Renderings



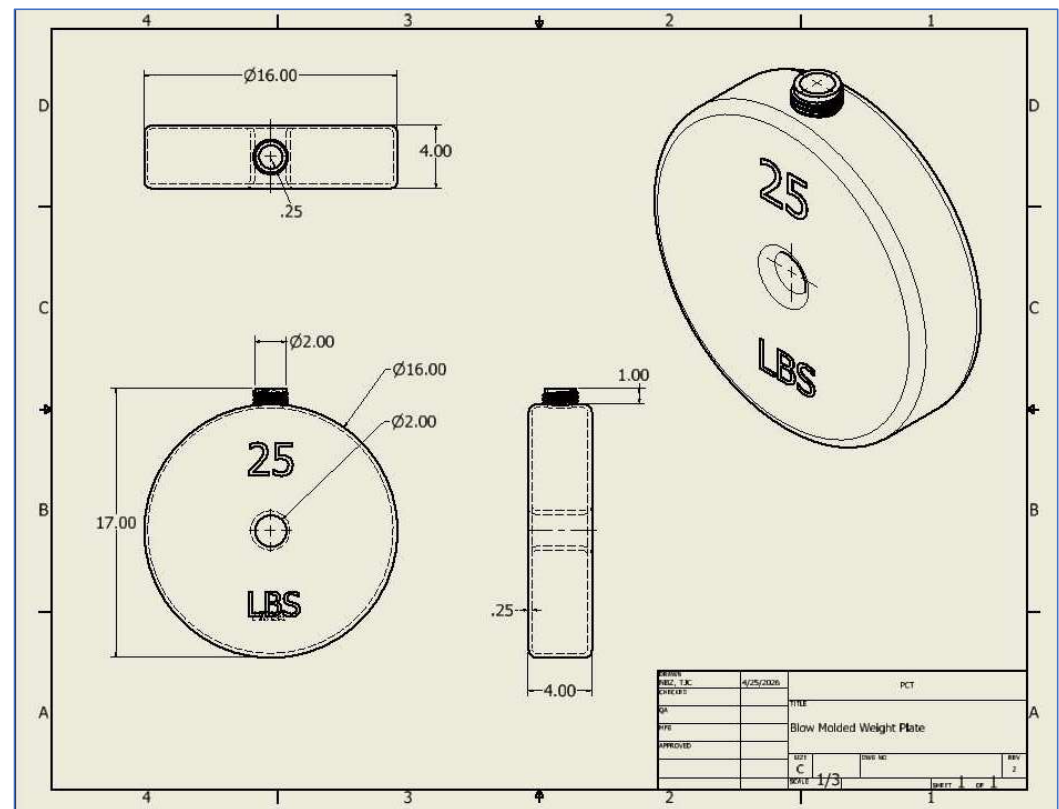
Key Design Features

Part Geometry

- 16-in. Overall Diameter
- 4-in. Overall Thickness
- 0.25-in. Nominal Wall Thickness
- 2-in. Center Opening
- 5-lb Part Weight

Functional Features

- Threaded Fill / Drain Port
- Rounded Edge Geometry
- Molded-In Weight Marking



Manufacturing Details

Process:

- Accumulator head EBM running
- Material: Blow-Molding Grade HDPE
- 5.5-6 lb shot (accounting for flash)
- Parison programming utilized for even wall distribution

Why Accumulator Head?

- Large HDPE Shot
- Rapid Parison Extrusion
- Reduces Parison Sag



Mold Details

Mold Materials:

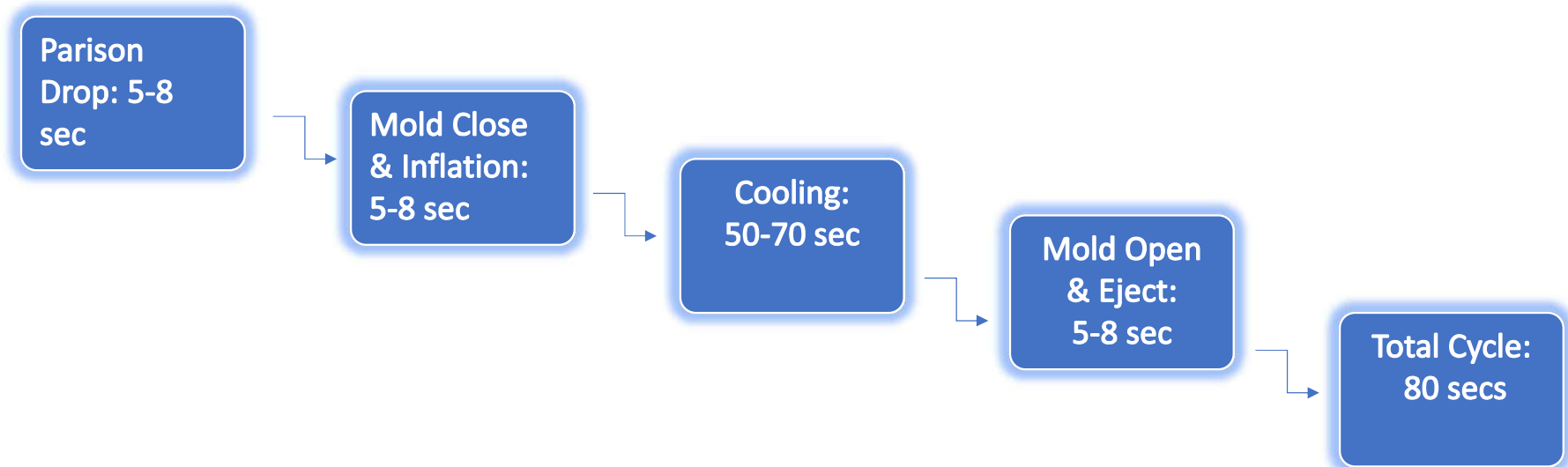
- Aluminum 6061
- BeCu for pinch off inserts (wear resistance)

Mold Design:

- Two-Piece Cavity
- Neck insert with threaded finish
- Compression Pinch-Off
- Vent Type: Parting Line
- Cooling System: Water Lines



Manufacturing Cycle



Engineering/EU Challenges Discovered

Biggest Issues:

- Full capacity will make plate heavier than specified
- Stress concentrations on center hole
- Drop resistance when fully filled

Other Engineering/EU Issues

- Fill-port sealing/leakage
- Water movement during use
- Environmental exposure/damage

$$Di = 16 - 2(0.25) = 15.5 \text{ in}$$

$$r = \frac{15.5}{2} = 7.75 \text{ in}$$

$$h = 4 - 2(0.25) = 3.5 \text{ in}$$

$$\text{Internal Vol} = \pi(7.75 \text{ in})^2(3.5) = 660.4 \text{ in}^3$$

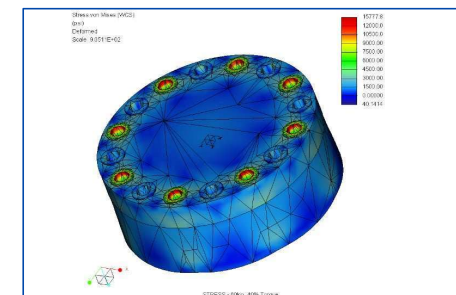
$$\frac{660.4}{231} = 2.86 \text{ Gals}$$

$$\text{Water Weight (lbs)} = 2.86(8.34) = 23.9 \text{ lbs}$$

$$\text{Total Weight: } 5 + 23.9 = 28.9 \text{ lbs}$$

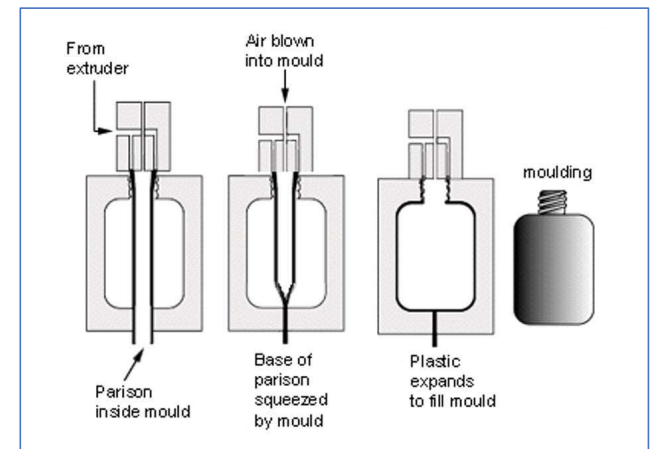
What we'd change

- Reduce size of plate to achieve the accurate volume
- Calculate accurate BUR to predict parison size
- Research the thread/cap combination thoroughly
- Add some sort of internal baffling to prevent slosh effect
- Utilize FEA



Things We Learned

- **Manufacturability is harder than it looks**
- **We take so many products for granted**
- **Mass production takes lots of specialization**
- **Our CAD skills need some work**



Not this simple!



Acknowledgements

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PCT

Questions?

THANK YOU!!!