Testing To Increase Efficiencies in Extrusion

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Testing Scope

- RPII along with the NBRC, have been testing to develop an extrusion die with the ability to stiff extrude voids that maximize what is allowed in ASTM C652 using existing pre-die extrusion equipment.

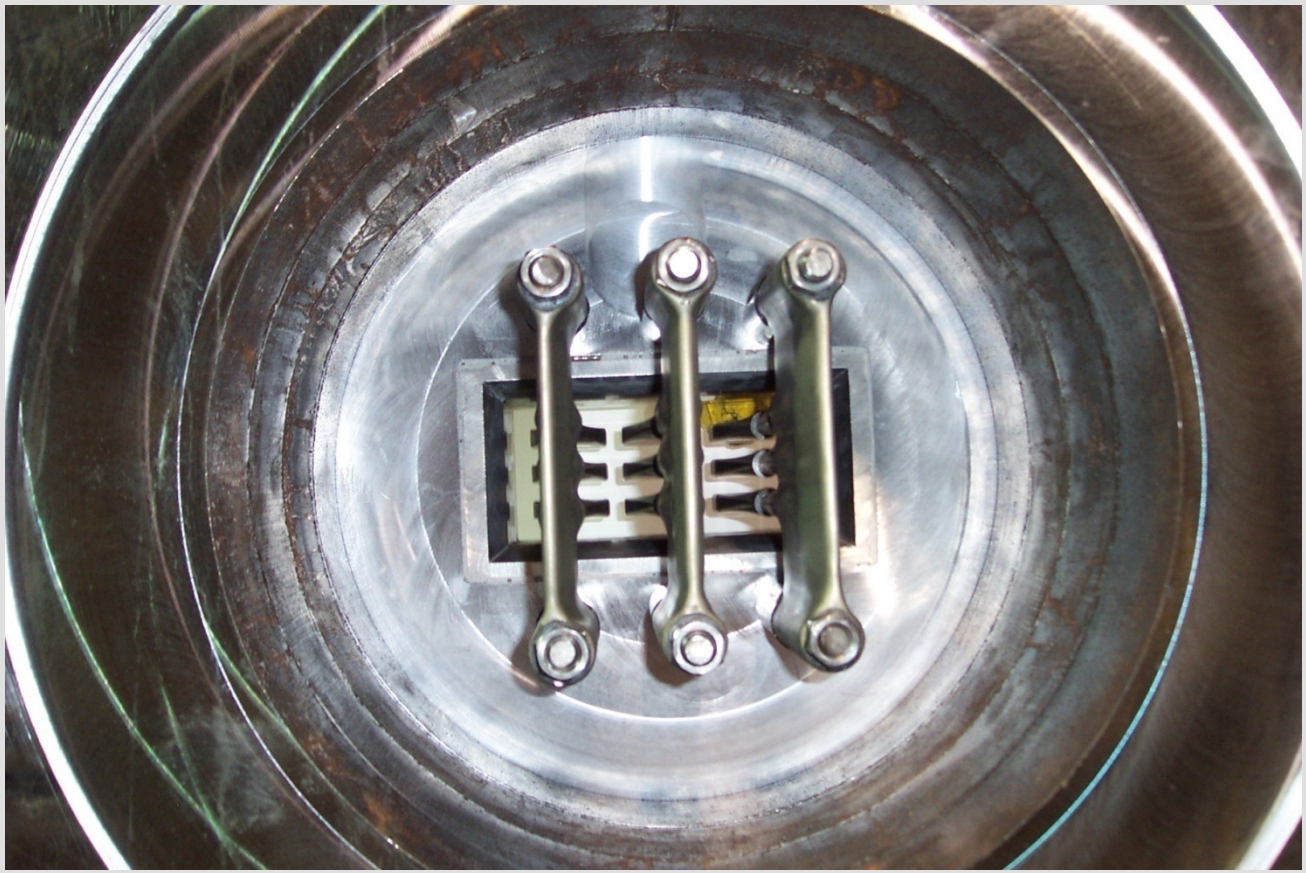
- Develop an extrusion die that will produce a product with enough strength to use existing down stream equipment.

- Increase void up to 40% in common size brick **without** using standard coring practices. I.e. 3-hole… To produce a brick that maximizes the cross sectional area in which to apply mortar during installation.

- When designing bridges for testing within the guide lines of ASTM C652 concerning shell and web requirements, we target patterns using cores not cells. "less than 1-½ in.²"

The flat back style die

Flat Back Rear View With Vertical Bridges



Nine Hole Core Pattern

Early Trials and Testing

- Testing of the tapered style die was borderline successful. Dependent upon the amount of control one has over the speed of the extruder, tonnage of material and amount of void. However, speed of extrusion and web pulling were not satisfactory.

- Resolve to the web pulling was to extrude 2.0 - 2.5 on the penetrometer. By doing so, product strength was jeopardized.

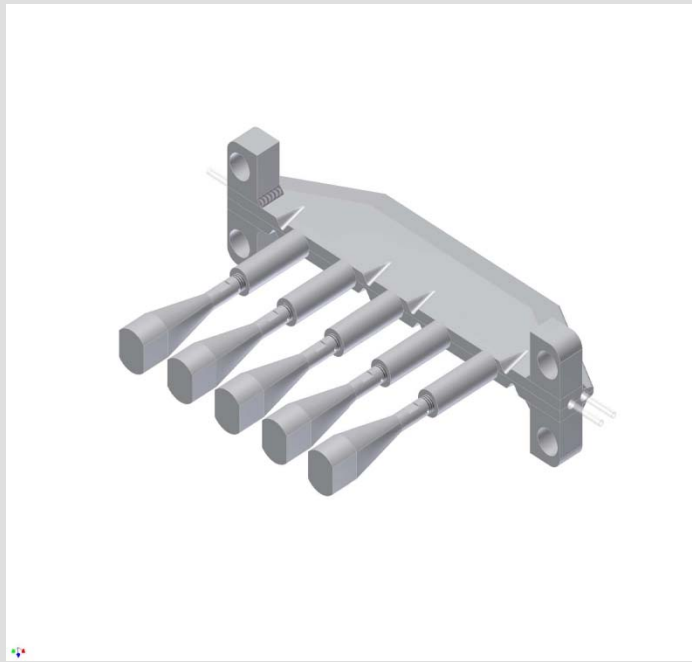
- In most cases above 2.8 on the penetrometer shear pin device fails

- Testing of the flat back style die was moderately unsuccessful, due to wedging material and forcing material to flow over itself, causing extreme internal pressure. Also, the lack of primary lubrication aided in the failure of the setup.

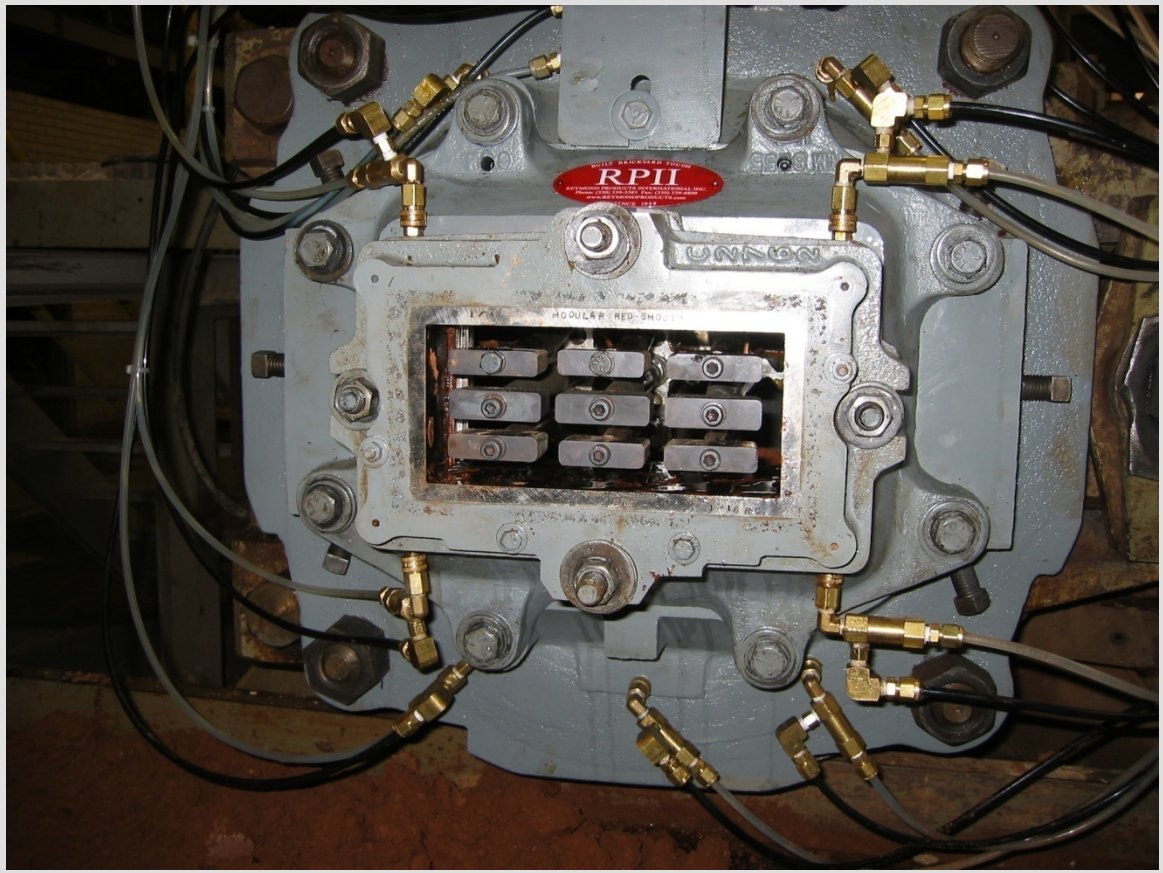
- It was soon realized that further development was needed to achieve further success in stiff extruded increased void with good gross cross section.

Patented Lubricated Bridge Development

- Lubrication is supplied to the bridge with the use of a separate lubrication pump.
- A special manifold supplies lubrication to each stem controlled separately by individual needle valves .
- Lubrication pressure of 60 – 80 psi is sufficient to supply lubrication.



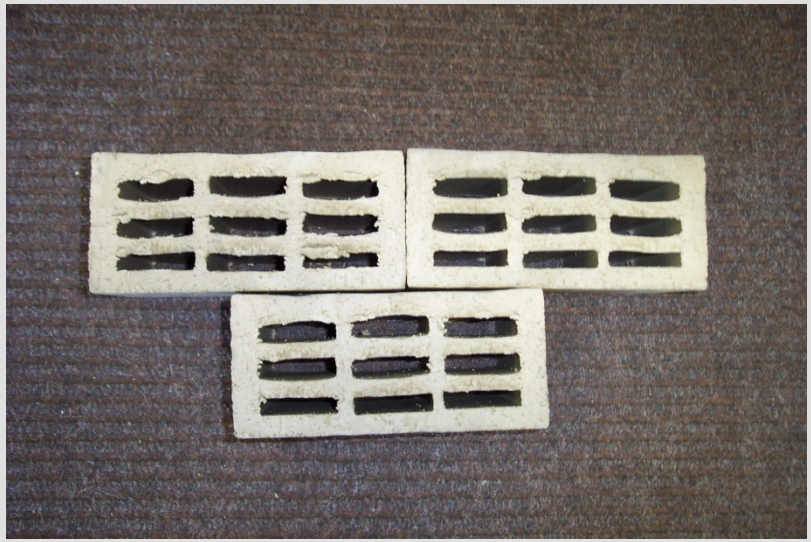
Nine Hole Core Pattern With Lubrication



Nine Hole Core Pattern Without Core Lubrication

Nine Hole Core Pattern With Core Lubrication

- No web pulling!
- Style of brick with good amount of gross cross sectional area in which to apply mortar.

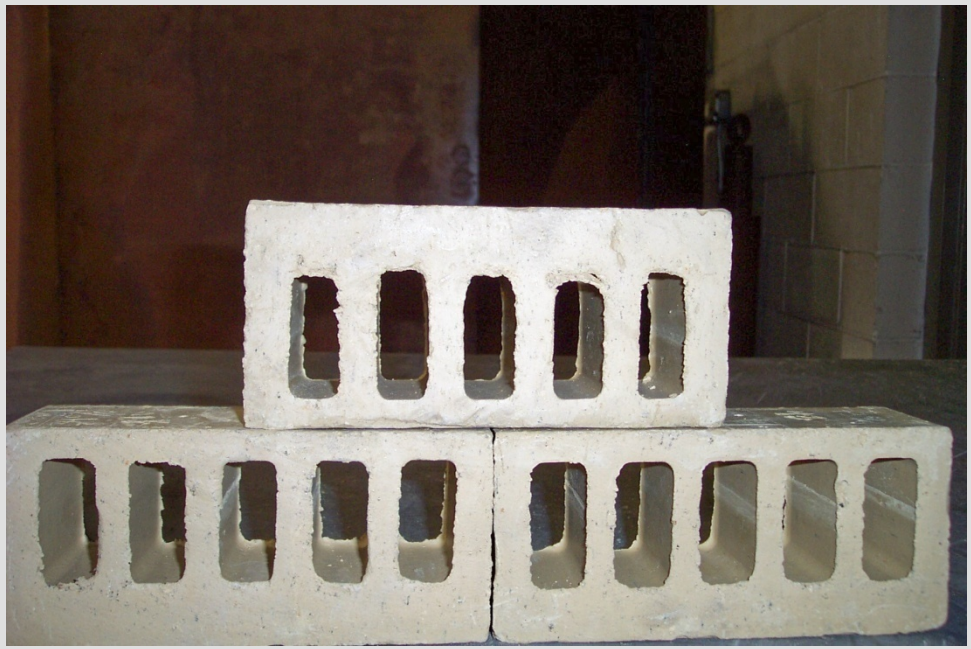


Latest Brick Produced With Lubricated Cores

- Projected Void
- 35.00%
- 39.00%
- 43.00%

- Actual Void
- 32.83%
- 36.12%
- 39.67%

- Actual Weight
- 2.99 lbs
- 2.80 lbs
- 2.63 lbs



Current testing shows promise

- Significant reduction in amperage used to produce green brick of increased void.
- Much to our surprise, our latest testing has proven an actual void of 39.67% extruding at 70-90 less amp's than 25% void brick. The 25% void extrusion was the same size, same penetrometer 3.75 – 4.0.
- Completely eliminating web pulling
- Offsetting the bridge in the clay flow normally would result in an unbalanced material flow leading to product defect. However, testing thus far using the lubricated bridge has proven balance to be consistent regardless of the location of the bridge bar.

Moving Forward With Core Lubrication

- Our next test will be conducted extruding king size. The test die is setup with a single bar seven core bridge at 39% void. Seven core configurations in most materials are difficult to extrude without web pulling.

- Continued testing will be performed on modular size and a broad range of materials.

- As we continue to test, we are discovering not only the ability to achieve higher voids with less restriction, we are also noticing potential benefits for use in ASTM 216 extrusion.

- In theory, the reduced power consumption that has been noticed during previous high void testing, should allow 25% void extrusion to be extruded with less power consumed and stiffer extrusions.