POLYBLADE IMPELLERS
by
Norstone, Inc.
Patent Nos:
5,888,440
8,028,944 B2
Norstone, Inc. started in 1982 by Sam Firestone as S.E. Firestone Associates. The company was a manufacturer’s representative for equipment and chemicals used in the coatings industry. Daniyel Firestone joined the company in 1992. By the year 2000, Daniyel Firestone was majority owner and had changed the company in significant ways:
1. The company name was changed to Norstone which at the time was the brand name for the POLYBLADE;
2. The company still represented milling and dispersing equipment but developed an expertise in both mixing/dispersing blades and grinding media;
3. The company now also manufactures and represents products for abrasion resistance, non-metal parts, beads for all uses such as shot peening, fillers, surface treatment, well fracturing, drilling fluids;
4. Norstone Inc. holds the patents on the POLYBLADE and continues to provide innovations and improvements for this dispersing impeller.
What is it?

The Polyblade is a high speed dispersing impeller that can also be used for high speed mixing without ever getting sharp. Its high pumping action is the key to the difference between this blade and metal blades as well as between this blade and other polymer dispersing blades.
Why the POLYBLADE was Developed

The POLYBLADE was developed for the abrasive industries, specifically TiO2, because polyurethane is far tougher than steel and outlasts steel up to 20x.

- TiO2
- Iron Oxide
- Minerals
- Ceramics

Disperser companies do not like this impeller because it lasts too long!
Traditional Looking Dispersing Blades also offered by Norstone:

- Stainless Steel
- 11 ga
- Outer teeth
- Number of teeth increase with blade size
- Teeth become razor sharp with use
- Single Direction
- 5000-5500 fpm tip speed
The Look

- No teeth
- Never gets sharp
- Bi-directional
- Many materials of construction
- 9 scoops regardless of size
- 4000-4500 fpm tip speed
- 3500 fpm for good mixing
Various Types, Materials & Sizes
Features & Benefits

**SAFETY**: the Number 1 benefit

The Polyblade NEVER gets sharp.

On small dispersers, the blade does not have to be covered or confined to a tank at all times;

On large dispersers, the danger of coming face to face with a razor sharp blade in confined space entry is eliminated.
MAINTENANCE

Outlasts a metal blade as much as 10-20 times longer.
No teeth to bend and deform
Blade is thick so it doesn’t bend
Will not chew up items that fall into the tank
Can’t be put on backwards
Can be turned over for extended life
Can be hand cleaned without fear
Can be made with stiffening plate on the inside for easier install.
BATCH CONTROL

Generates lower heat in most cases BUT can be designed to create more heat by changing the scoops;
Faster incorporation of powders;
Faster production due to pumping action;
Gentle on metal flake pigments;
Resistant to abrasion caused by aggregates;
Efficient at sucking in light weight powders;
Efficient at lifting heavily settling powders;
Excellent mixing at slow speeds;
The addition of Turbo Pegs creates a more aggressive action with less power;
Gentle dispersion can be created by changing the scoops.
Tank Set-Up for Metal Blades

- Blade should be ONE HALF blade diameter off tank bottom
- Blade diameter should be 33.3% diameter of tank
- Tip Speed of 5000-5500 fpm
- Liquid level should be a 1:1 ratio with tank diameter
- Horsepower should be 10 for every 100 gallons
- Blade should be centered but can be off centered for thin viscosities
- Dished bottom is best especially for 500+ batches
Tank Set-Up for POLYBLADEs

- Blade should be ONE FULL blade diameter off tank bottom
- Blade diameter should be 28% diameter of tank
- Tip Speed of 4000-4500 fpm
- Liquid level should be a 1:1 ratio with tank diameter
- Horsepower should be 10 for every 100 gallons
- Blade should be centered but can be off centered for thin viscosities
- Dished bottom is best especially for 500+ batches
How Does the Polyblade Work?

Material is accelerated by forming a vortex; The vortex meets the blade and continues to spin around the face of the blade thus shearing; There are no teeth to stop and slow down the speed of the material as it leaves the blade; The material hits the end to end radial scoop and is thrown up and to the side of the tank with increased velocity; This higher flow keeps the product better dispersed, cooler, and moves the material faster so that the material sees the shear zone of the blade more frequently; The blade should be a MINIMUM of a full diameter off the bottom of the tank so as not to choke the flow. Some customers set the blade 1.5 diameter off the bottom; The blade is bi-directional so what you see above the blade is also happening below the blade.
When to change the POLYBLADE

In order to maximize the life of the blade we suggest that the blade be turned over according to the chart below. The scoop of the blade wears on the following edge. When the wear pattern matches the chart, it is time to flip the blade over exposing the former leading edge which will look like the scoop of a new blade.

<table>
<thead>
<tr>
<th>SIZE</th>
<th>WIDTH OF SCOOP (new)</th>
<th>WIDTH OF SCOOP (used)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8”</td>
<td>1 ¼”</td>
<td>2”</td>
</tr>
<tr>
<td>12”</td>
<td>1 9/16”</td>
<td>2 ½”</td>
</tr>
<tr>
<td>14”</td>
<td>1 25/32”</td>
<td>2 7/8”</td>
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<tr>
<td>22”</td>
<td>3 3/16”</td>
<td>5 ¼”</td>
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<tr>
<td>24”</td>
<td>3 3/16”</td>
<td>5 ¾”</td>
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<tr>
<td>25”</td>
<td>3 5/8”</td>
<td>5 ¾”</td>
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<tr>
<td>26”</td>
<td>3 5/8”</td>
<td>5 ¼”</td>
</tr>
<tr>
<td>27”</td>
<td>3 5/8”</td>
<td>5 ¾”</td>
</tr>
<tr>
<td>28”</td>
<td>3 5/8”</td>
<td>5 ¾”</td>
</tr>
</tbody>
</table>

Measurements are made by holding a ruler on edge across the impeller and measuring from the left edge (leading edge) of the impeller to the place where the right edge (following edge) touches the ruler. See drawing below.
Specifications

MATERIALS OF CONSTRUCTION:

Polyurethane: wide variety of durometers and tear resistance

Polyethylene: natural and anti-static

Nylon

PTFE

Polypropylene

PEEK

Aluminum

Ceramic
TEMPERATURE LIMITATIONS:

Each MOC has a different continuous temperature limitation.
For example:

Polyurethane  max 85 C, 185 F
Polyethylene  max 100 C, 212 F
Nylon         max 220 C, 428 F
PTFE          max 260 C, 500 F
Polypropylene max 151 C, 305 F

We offer test coupons at no charge.
Each polymer has different chemical resistance. We have a chemical compatibility chart as well as test coupons.

For the coatings industry, the two main materials of interest are:

**POLYURETHANE**

Used for water based and mild solvent based (e.g., mineral spirits) coatings

**ANTI-STATIC POLYETHYLENE**

Used for solvent based coatings and when the same blade is used for water and solvent coatings.
POLYURETHANE OPTIONS:

**HARDNESS:**
- All Hard: single durometer
- Dual Hard: Hard inner core, Soft Edge
- Tear Resistant: embedded plate

**HUBS:**
- None
- Polymer
- Stainless Steel hub
- Carbon Steel Taper Lock
- Embedded Balanced Steel Plate
UHMW POLYETHYLENE OPTIONS:

**HARDNESS:**
UHMW comes in a single hardness – no options
Natural or Anti-Static

**HUBS:**
None
Polymer
Stainless Steel hub - detached
Innovations: TURBO PEGS

Designed to improve the dispersion when there are large agglomerates; Cube shaped pegs set on the diagonal to give a longer life and additional flat surfaces for shearing; Create a dual vortex with two additional high velocity sizes: by cutting the vortex into two; Some customers report lower amperage draws due to less load on the motor with two small vortices; Replaceable: Pegs can be remolded into the urethane blade and re-inserted into the other polymer blades. No metal parts.
Stiffening Plates

ALL dispersing impellers need stiffening plates:

Metal blades need stiffening plates to prevent vibration and bending because they are so thin;

Polyblades need stiffening plates to prevent the center bore, keyway and pin holes from stretching; they are thick and won’t bend;

Some Polyblades need to be counter-bored in order for the plates/blade sandwich to be able to fit on the shoulder of the shaft;

Bores that have a keyway also require pin holes so that the pins drive the blade and not the key or it will stretch;
A dynamically balanced stiffening plate can be molded inside the Polyblade with an area counter-bored so that the shaft or hub sits level and secure against the metal plate:

A balanced blade will extend the life of the bearings and disperser; Stiffening plates are not normally balanced (but can be);
The cost for the embedded plate is approximately the same as two plates that are balanced;
The blade with the embedded plate is a one piece install;
The plate edges never get sharp so another hazard is removed from the plant;
Some disperser designs will need to make a one time purchase of an extended end cap because the thickness of the embedded plate blade is now thinner than a standard steel blade with stiffening plates.
The Competition

- End-to-End radial scoop 9 scoops on each side, every size
- Abrasion Resistant Polyurethane for water based materials – 3x more abrasion resistant than polyethylene

POLYPELLER

- Straight side wall and flat bottom groove: product has a difficult time getting out of the groove which dampens flow and increases heat generation;
- Number of Grooves increase as blade gets larger aggravating the problem;
- Only available in polyethylene;
- Not recommended for solvents.
Customer Feedback

Testimonials on the POLYBLADE would be its own presentation mostly because everyone is surprised by the results. But here are a few comments:

- Production time was reduced by 3 hours on a 3000 gallon batch and 1.5 hours on a 1500 gallon batch due to the speed of powder incorporation;
- Our steel blade lasted 1 week, the polyethylene lasted 3 weeks. The polyurethane Polyblade was 2x more expensive than the polyethylene blade and it lasted 10 months;
- Our maintenance department is no longer getting cuts on their hands and arms now that we have the Polyblade;
- Confined space entry is much safer and happens far less often;
- It used to take days to make a batch because it would get too hot and we would have to stop for it to cool which we no longer have to do with the Polyblade;
We had problems getting a complete dispersion due to hard agglomerates until we used the Polyblade with Turbo Pegs;

Our motor would always kick out when the viscosity would build as we added solids; the Polyblade with Turbo Pegs solved the problem;

We used to change blade styles for different products and now we don’t have to do that with the Turbo Polyblade;

The once piece embedded plate made installation much easier, quicker and now no one gets cut by the sharp edge of the stiffening plate;

We use to have a lot of problems with heavy settling materials but now they get incorporated quickly with the Polyblade but it took time to figure out the correct height for the blade;

Keeping our product white and bright is important; eliminating a metal blade has made a big difference.
Typical Blade Set Up

Formula for tip speed is:
FPM = Blade diameter in feet x 3.14 x rpm;
Determining the Proper Size

Generally the Polyblade is sized down from a metal blade and approximately the same size as a competitive polymer blade.

We have an Impeller Specification Form that needs to be completed in order to size a blade:

- Shaft RPM
- Tank Diameter x Tank Height x Bottom Shape
- Hp or Kw of motor
- Viscosity & Density of Product
- Solvent or Water Based Products
- Current Blade Style: likes/dislikes
- Machine Bolt Pattern
- Diameter of shaft or hub on the shaft
HSD Blade Setup

Mixing Blade Assembly

- Shaft
- Shoulder
- Key (\(\frac{3}{8} \times \frac{3}{8} \times 1\)"")
- Bore
- Drive Pins
- Blade
- Reinforcing Disk
- Collar
- Locking Bolt (\(\frac{3}{8} \times 1\frac{1}{4}\)"")
For customers with multiple plants, we keep a record of each machine:

Coatings Company  
Attn: Customer  
123 ABC  
City, State, Country  
(905) 660-8926  
baine.johns@akzonobel.com

<table>
<thead>
<tr>
<th>Machine #</th>
<th>CO-12501</th>
<th>CO-20002</th>
<th>CO-15002</th>
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<td>84.75&quot;</td>
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<td>Agitator Make</td>
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<td>Ragogna</td>
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<td>Hp</td>
<td>125</td>
<td>200</td>
<td>150</td>
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<tr>
<td>High RPM</td>
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<td>756</td>
<td>832</td>
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<td>Low RPM</td>
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<td>416</td>
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<td>Blade style</td>
<td>Polypeller</td>
<td>Type 7 - DH</td>
<td>F Style</td>
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<td>Blade Diameter</td>
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<td>26&quot;</td>
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<tr>
<td>Center Bore</td>
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<td>2.5&quot;</td>
<td>2.5&quot;</td>
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<tr>
<td>Keyway</td>
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<td>1/2&quot; x 1/4&quot;</td>
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<tr>
<td>Pin holes dia.</td>
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<td>5/8&quot;</td>
<td>5/8&quot;</td>
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<tr>
<td># of Pin hole</td>
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<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Bolt circle</td>
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<td>4-1/16&quot;</td>
<td>4-1/16&quot;</td>
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<tr>
<td>Counterbore</td>
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<td>N/A</td>
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<tr>
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<td>19&quot; x 1/2&quot;</td>
<td></td>
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<tr>
<td>Application</td>
<td>Latex Paint</td>
<td>Latex Paint</td>
<td>Latex Paint</td>
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</table>
For more information contact:

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