



PRODUCT INFORMATION

PRO/ANGLE BUNKER SAND PLANT: THOMPSON, OH

R.W. Sidley operates a state of the art processing plant that produces the highest quality bunker sands of the highest purity free from deleterious materials. Pro/Angle is from our Thompson, Ohio mine, part of the Sharon conglomerate formation. Pro/Angle is manufactured by crushing pure silica creating a 100% angular bunker sand. Pro/Angle is regarded as one of the highest quality, best performing bunker sands in North America. Our 100% angular sand provides unmatched playability, longevity, design, and maintenance advantages.

Available packaging: Bulk quantities

Sample Description	Particle Size Analysis										
	Soil Textural Components [Reported values are % of the whole]				Sand Distribution by Size Size reported as mesh # & mm (Value reported is % retained)						
	Sand .05-2.0 mm	Silt .002-.05 mm	Clay <.002	10 Gravel 2.0 mm	18 Coarse 1.0 mm	35 Coarse .50 mm	60 Medium .25 mm	80 Fine .18 mm	100 Fine .15 mm	140 Fine .10 mm	270 Fine .05mm
USGA Recommended Specifications for Root Zone Mixes	≥ 89% of total	≤ 5% ≤ 10% with #140 + #270	≤ 3% ≤ 10% with #10 + #18	≤ 3% ≤ 10% with #10 + #18	≤ 10% #35 + #60	≥ 60% #80 + #100	≤ 20% #80 + #100	≤ 5% #140 + #270 & ≤ 10% with silt + clay			
Pro/Angle Bunker Sand	98.14	0.99	0.27	0.60	14.10	31.37	30.43	9.78	4.88	5.00	2.58

ATM F1632 & C136 Reported values are averages of two tests.

The USGA's particle size recommendations for golf green construction do not apply to bunker sands. The recommendations are relevant, however, in evaluating the layering impact a migrating bunker sand may have on a golf green.

The tested Pro-Angle sand exceeded the USGA's 10% maximum for the very coarse sand retained on the 18 sieve. It also exceeded the 5% maximum for the very fine sand retained on the 140 & 270 sieves. The mowers will pick up the very coarse sand particles and the very fine sand is capable of creating a surface layer that impedes air & water permeability. It is our recommendation that the coarse particles be removed prior to

Moisture Content	Penetrometer Values [kg/cm ²]			
-predicted % in field-	"Fluffed" Dry	"Settled" Dry	"Fluffed" Moist	"Settled" Moist
2.52	2.0 to 3.0	4.0 to >4.75	3.0 to 3.75	4.75 to >4.75

NML SOP, Moisture content prediction based on-50 cm tension table.

The Pro-Angle sand sample was tested for its resistance to fried egg lies in both an oven dried and a moist condition. The moist condition had water holding of approximately 2.5%. The water holding predicts the moisture content of the sand in the field when affected by irrigation overspray, rain events, or syringing. Historically, penetrometer tests have been based on bunker sands solely in their dried condition. Our field research has found that a significant percentage of bunkers are played in a moist rather than a dry condition. Irrigation overspray and rain events are the primary source of water in bunker sands, but syringing is becoming a common practice. Moisture firms up a sand thereby increasing its resistance to golf ball burying. As the top inch dries out, its properties emulate the penetrometer values in the dry condition while the moist sand below the surface will emulate the penetrometer values in the moist condition.

The Bunker Sand Analysis reports penetrometer ranges in "Fluffed" and "Settled" conditions, and in both dry and the predicted moist conditions. The dry fluffed condition simulates both: (a) the conditions of a well-worked (fluffed) base when allowed to dry out, and (b) the conditions on a bunker's face with a gentle pitch. The moist fluffed condition simulates the conditions of a moist sand on a steep bunker face. Shallower faces will emulate the moist settled property. The dry settled condition simulates the conditions in a bunker's flat areas when allowed to dry out. The moist settled condition simulates the moist base and typical bunker faces. The first value in each range is the amount of pressure required to bury a golf ball to its midpoint. The second value in each range is the amount of pressure required to bury a golf ball past its midpoint. Each range's midpoint should be used to evaluate the resistance of a sand in each predicted condition.

In its moist fluffed and settled conditions, the submitted sand exceeded the penetrometer's maximum range of 4.75 kg/cm² of force to bury the ball past its midpoint. In both conditions, the sand is highly resistant to burying. In the fluffed dry condition, the range was reduced to 2.0 to 3.0 kg/cm². In the settled dry condition, the range was 3.0 to 3.75 kg/cm². The sand exhibited very good resistance to burying in both dried conditions. Obviously, it was firmer in when settled.

Revised: 11..09.17



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Acid Reaction	Crusting	Color			
		Munsell Color Name	Hue	Value	Chroma
Non - Non Carbonate	None	Very Pale Brown	10YR	8	3

NML SOP, Munsell Soil Color Chart

Sphericity & Angularity	Angle of Repose	Infiltration Rate [in/hr Ksat]	D 85 [mm]
Low to medium sphericity, angular to sub-angular	40°	73.85	1.46

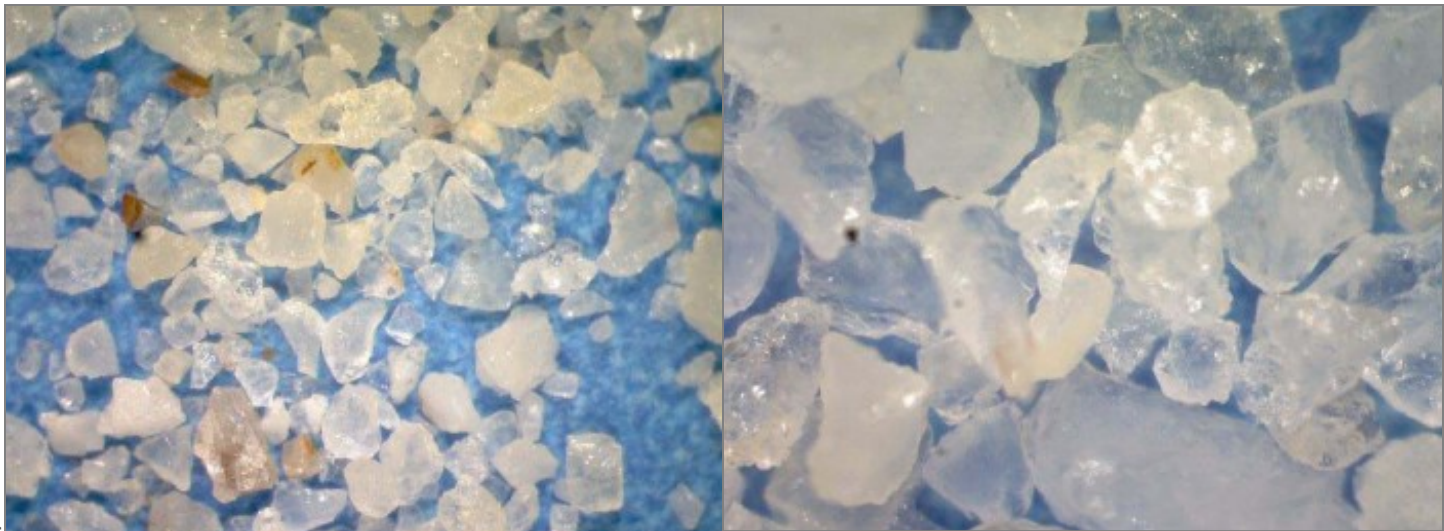
Sphericity & Angularity, D85 ASTM F1632

The testing included the angle of repose for the sand sample. The angle of repose defines the maximum pitch of the sand in a stable condition. If the sand is spread on a bunker face at a higher pitch angle, the sand will tend to slide off the face. The Pro-Angle's 400 angle of repose is very good and exceeds the angle of repose of most sands we have tested.

Infiltration Rate ASTM F815

A 1 kg gram sub-sample was split from the submitted material, its moisture content was increased to approximately 8.0%, and lab cores were prepared for the infiltration rate testing. The infiltration rate samples were collected after compacted lab cores were subjected to a constant head of water for a period of 4 hours. The 73.85 inches of water per hour is very high even for a straight sand. The sand will drain exceptionally well in a bunker. It also has excellent evaporation potential. We predict that the bunkers exposed to wind and sunlight will dry out

Magnified Images of Pro/Angle



Testing: Results are typical for the product.

Testing was conducted by New Mix Labs, LLC., Lenexa, KS.

Acid Reaction Testing:

Samples will be provided for independent testing, upon request.

Revised: 11.09.17