THE ADVANCED GEOCELL FOR ROOFTOP SPORTS FIELD CONSTRUCTION
RAPID DRAINAGE, COLLECTION, RETENTION AND REUSE FOR NATURAL AND ARTIFICIAL TURF
With limited space on campus, both high schools and colleges are turning to rooftop sports surfaces to create multi-use green areas. Building a rooftop sports field or just a patio with an AirField System provides drainage under 100% of the playing surface, prevents ponding, and moves water efficiently for reuse elsewhere on campus.

Over 2,000,000 square feet and counting of AirDrain rooftop drainage system has been installed.

LACC “LA Community College” 95,000 sqft., MSOE “Milwaukee School of Engineering” 100,000 sqft., UCSD “University of California in San Diego” 80,000 sqft., WPI “Worcester Polytechnics Institute” 174,000 sqft. and Binghamton High School 47,000 sqft.

Benefits of AirDrain in a green roofing system include:

- AirDrain creates and helps maintain a more consistent Gmax for Synthetic Turf
- ASTM testing proves AirDrain’s shock absorption properties reduces Gmax
- AirDrain can be reused when the Synthetic Turf must be replaced
- Can help qualify for LEED™ and other green building credits
- A smaller carbon and development footprint with reduced site disturbance
- Water harvesting reclamation and reuse is easy
- AirDrain creates a 1” air barrier on the rooftop which increases the insulating properties.
- AirDrain is a 100% recycled copolymer which has the impact modifier “metallocene” added to it for qualification as a “No Break” plastic, making it able to withstand extreme heat and cold and still maintain performance
- Resins can be made to the following specification “Flammability UL 94, Flame Retardant, High Impact Polypropylene Copolymer Resins”

*This drawing, specifications and the information contained herein is for general presentation purposes only. All final drawings and layouts should be determined by a licensed engineer(s). HIC & Gmax testing are measured in a lab setting and are not site specific.*
**Unit Panel Specifications:**

- **Size:** 32" x 32" x 1"
- **Weight:** 3.1 lb
- **Volume:** 8% material, 92% air void
- **Strength:** 233 psi (unfilled)
- **Resin:** 100% Recycled (PIR) Copolymer with Impact Modifier "No Break" Polymer Material
- **Color:** Black (3% carbon black added for UV Protection)

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**AirDrain Cross Section**

Scale 0.12:1

Typical

For AirDrain Grass Systems
ASTM Testing Proves the AirDrain Synthetic Turf Drainage Doubles as a Drainage Layer and Shock Pad

Whether installed on an aggregate base, concrete or asphalt the AirDrain drainage grid helps provide you with a consistent GMAX (as seen below) across the entire field. Some factors that might influence a change in GMAX would be an inconsistency of the infill or wear of the synthetic turf fibers. Unlike traditional shock pads / e-layer the AirDrain is 1" high, has a 92% air void. This unmatched vertical and lateral drainage all but eliminates standing water.

Some of the Benefits of an AirField Synthetic Turf Drainage System include:

• AirDrain creates and helps maintain a constant Gmax for artificial turf (See below)
• Shock absorption reduces the strain on joints and ligaments
• AirDrain is only limited by the drainage capacity of the profile above it and the exit drain
• AirDrain can be reused when the synthetic turf must be replaced
• Can help qualify for LEED and other green building credits
• A smaller carbon and development footprint with reduced site disturbance
• Water harvesting reclamation and reuse is possible
• AirDrain is a 100% recycled copolymer with the impact modifier metallocene qualifying it as a "No Break" plastic

*** AirDrain can be made to the following specification “Flammability UL 94, 30% Fiberglass Reinforced, High Impact, Flame Retardant Polypropylene Copolymer Resins” for Rooftop applications. FLAMMABILITY @ 0.100 in V-0/5VA* UL94*

GMAX Results for: Turf - 2 1/2" Slit Film, in filled with 50% Green Rubber Infill and 50% Silica Sand.

The drainage/shock pad and turf underlying substrate consists of a concrete deck/rooftop, coated with a waterproof membrane and 2 separate layers of 5 ounce 100% recycled polyester geo-textile filter fabric.

<table>
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<tr>
<th>Test #</th>
<th>Drop No.</th>
<th>Drainmatt Tested</th>
<th>Ft / Sec.</th>
<th>H.I.C</th>
<th>Peak/Gmax</th>
<th>Avg./Loc. Drainmatt Average</th>
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<tr>
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<td>16</td>
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<td>8</td>
<td>22</td>
<td>AIRFIELD Drop 3</td>
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<td>97</td>
<td>113 Average of all Three 107.166</td>
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<tr>
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<td>308</td>
<td>109</td>
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<tr>
<td>24</td>
<td>24</td>
<td>AIRFIELD Drop 3</td>
<td>11.7</td>
<td>333</td>
<td>117</td>
<td></td>
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The Standard Test Method for Shock-Absorbing Properties of Playing Surface Systems and Materials (ASTM F1936-98 American Football Field) testing locations and procedure were performed. The tests were performed using a Triax 2000 A-1 Missile, tripod mounted Gmax registration unit (www.triax2000.com). This report presents background information on the test procedures, existing conditions, test results and observations.
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**Green Roofing - Natural Turf**

With limited space in urban areas; businesses, school and government buildings are turning to rooftop surfaces to create multi-use green areas. When building a rooftop an AirField System provides drainage under 100% of the surface. An AirField Drainage System will prevent ponding and quickly remove excess water even during a torrential rain.

*Over 2,000,000 square feet of AirDrain rooftop drainage system installed and counting.*

**Natural Turf-** [Chesapeake Energy](#) 74,000 sqft., [Chesapeake Building 14 Rooftop Garden](#) 4,000 sqft., [Chesapeake Building 14 Courtyard](#) 9,400 sqft.

**Benefits of AirField in a green roofing system include:**

- 1 to 3 more days of plant available water stored in the root zone (depending on climate)
- Significantly reduces daily irrigation needs (as told to us by our customers)
- Healthier turf / Stronger root system (as told to us by our customers)
- Can help qualify for LEED™ and other green building credits
- A smaller carbon and development footprint with reduced site disturbance
- Reduces Heat Island Effect and makes water harvesting, reclamation and reuse is easy
- AirDrain creates a one inch air barrier on the rooftop increasing the insulating properties. (R-Value)
- AirDrain is a 100% recycled copolymer with the impact modifier “metallocene” added qualifying it as a “No Break” plastic. Making it able to withstand extreme heat and cold and still maintain performance.
- Resins can be made to the following specification “Flammability UL 94, Flame Retardant, High Impact Polypropylene Copolymer Resins”
- Pallets are 32”x32” and can easily fit into an elevator

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AirField Systems, LLC
8025 N May Ave, Suite 201
Oklahoma City, OK 73120
www.airfieldsystems.com
(405) 359-3375

*Impermiable Liner and or other waterproofing must be specified by a qualified engineer.
1. The roofing membrane underlying the proposed green roof area is to be verified as in compliance with all project specifications before work commencement on the AirField Sub-Surface Drainage System. Any discrepancies noted upon preliminary roofing inspection are to be satisfactorily repaired according to related specification sections and repairs verified before proceeding with work.

2. Once the roofing membrane system has been inspected and accepted, begin installation of the architect or engineer specified geo-textile filter fabric material over the approved roofing membrane system to act as a cushioning layer and must protect the waterproofing and membrane from the GeoCell for the life of the roof. Then the AirDrain™ GeoCell panels are to be installed with the larger diameter clover openings facing upwards. Place the first GeoCell panel to the roof area’s upper left hand corner. It is of primary importance to orient the GeoCell materials with the integral indicator tab to the panels bottom left hand corner (refer to Figures 17). Proper sequencing and orientation of panels will result in a rapid installation.

The GeoCell panels are to be installed across the roofing membrane system in a rowed pattern. Staggering of rows will allow for multiple row completion by a multi-manned crew. Secure the first panel (1-1) and commence with panels 1-2, 1-3 and so on with one directional pull to secure (see Figures 16, 18 and 19). Once the first row has progressed across the field, start with the second row. By maintaining proper GeoCell panel orientation, the top edge panel connectors will drop into the previously installed panel receptors after the one directional pull secures the panel (see Figures 18). The GeoCell panels can be shaped to individual field areas as needed with an appropriate cutting device.

3. Install the architect or engineer specified geo-textile filter fabric layer over the AirDrain™ GeoCell material. Firmly attach one end of the geo-textile filter fabric roll to the GeoCell panel edge with approved adhesive. Roll the geo-textile filter fabric across the entire width of the roof area until it reaches the GeoCell panel on the opposite side of the roof. Firmly attach the filter fabric to the GeoCell panel outside edge. Apply 2 to 4 inches of approved adhesive with a paint roller on top surface of fabric.

Firmly attach the next geo-textile filter fabric roll to the GeoCell panel edge. Overlap the first piece of filter fabric by approximately 6 inches to cover the 2 to 4 inches of approved adhesive and roll out the next filter fabric section across the roof. When the opposite side of the roof is reached, firmly attach the filter fabric to the GeoCell panel outside edge. Repeat this process until all the AirDrain™
GeoCell is completely covered with geo-textile filter fabric. Once the geo-textile filter fabric installation is complete there should be no visible gaps, puckering, folds, wrinkles or excessive loose material overhangs. Installed geo-textile filter fabric is to be smoothly laid across all the AirDrain™ GeoCell material.

4. Once the geo-textile fabric has been installed atop the AirDrain™ GeoCell material, the Sub-Surface Drainage System is complete and ready for inspection and acceptance by the Green Roof System Contractor. Satisfactorily repair all deficiencies noted and obtain approval and acceptance before proceeding with green roof system installation. Minimize any required vehicular traffic on completed sub-surface drainage system. Where vehicular traffic is required, limit equipment to flotation tire type and minimize vehicle speed and turning on drainage system to the greatest extent possible. Any sub-surface drainage system damaged by green roof system installation is to be satisfactorily repaired and accepted before the green roof system is installed. Refer to AirDrain™ Rooftop Drainage for Synthetic Turf or Natural Turf drawings for typical completed green roof system cross section.

DISCLAIMER: The following drawings and/or general installation instructions are provided only to show a concept design for installation and are not instructions for any particular installation. These drawings and general instructions are not complete and are provided only to assist a licensed Geo-Technical Engineer, a Landscape Architect and/or Civil Engineer in preparing actual construction and installation plans. These drawings and instructions must be reviewed by a licensed Geo-Technical Engineer, a Landscape Architect and/or Civil Engineer and adapted to the condition of a particular installation site and to comply with all state and local requirements for each installation site. THESE DRAWINGS AND/OR GENERAL INSTRUCTIONS DO NOT MODIFY OR SUPPLEMENT ANY EXPRESS OR IMPLIED WARRANTIES INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, IF APPLICABLE RELATING TO THE PRODUCT.
Figure 16
Figure 17
Figure 18

Figure 18A
Figure 19
Proper Sequencing and Orientation of AirDrain GeoCell Panels for Rapid Installation

Pallet Staging: AirDrain pallets cover approximately 798sqft. per pallet and should be staged accordingly within the installation area so that you minimize the amount of time to stage the AirDrain grid along the install lines across the project. Typically placing the AirDrain every 65 feet across and 15-20 feet back from each other. (Call AirField with questions that you might have about proper staging and installation.)

All Installations must start in the Top Left Corner of the Field and work Left to Right to be installed properly.

1. Orientate the AirDrain GeoCell materials with the integral indicator tab to the panel's bottom left corner (painted yellow). Install the AirDrain units by placing units with the connectors and platforms up creating a flat surface for the profile above. If the male connectors do not fall or drop into the female connectors then the orientation is incorrect, please call AirField Systems Immediately at 405-359-3775.
2. Install the AirDrain panels across the field in a rowed pattern. Staggering of rows will allow for multiple row completion by a multi-manned crew.

3. Once the first row has progressed across the project, start with a second row. Have a person staging the panels in groups of three snapped together along the row. The crew can then install the left side of the panel while elevating slightly the top portion (so the male and female connectors don't touch each other). Once the left side has been snapped with a pull along the row direction, the top portion should fall into place and with a bottom vertical pull holding the inside of parts 1 & 3 snap all three parts in place.

4. AirDrain panels can be shaped to individual field areas as needed with appropriate cutting device. If a typical field is installed correctly there should only be two sides that would need to be trimmed.

   A. If only a few parts need to be trimmed, use tin snips.

   B. If many parts require trimming, set up a table and use a circular saw with a no melt, plastic cutting saw blade.

Visit AirField Systems Flickr page to watch a video of a 74,000 sq ft project for Chesapeake Energy illustrating a 3 man crew installation.

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## General Information

<table>
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<th>General</th>
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<tbody>
<tr>
<td>Construction: Injection Molded Copolymer</td>
</tr>
<tr>
<td>Composition: Copolymer Polypropylene Using Impact Modifier</td>
</tr>
<tr>
<td>Dimensions: 31.784&quot; x 31.880&quot; x 1.000&quot; (7.03 sq ft.)</td>
</tr>
<tr>
<td>Unit Weight: 3.100 lbs.</td>
</tr>
<tr>
<td>Forms: Pellets</td>
</tr>
</tbody>
</table>

## Shipping

| Parts Per Pallet: 114                        |
| Pallet Dimensions: 33" x 33" x 48"           |
| Pallet Weight: 390 lbs.                      |
| Area Per Pallet: 798 sq. ft.                 |
| Pallets Per Trailer: 114 (3 wide x 2 tall x 19 deep) |
| Area Per Trailer: 90,972 sq. ft.             |

## ASTM and ISO Properties

### Physical

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<thead>
<tr>
<th>Physical Property</th>
<th>Nominal Value</th>
<th>Test Method</th>
</tr>
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<tbody>
<tr>
<td>Specific Gravity</td>
<td>0.940</td>
<td>ASTM D792</td>
</tr>
<tr>
<td>Melt Mass-Flow Rate (230°C/2.16 kg)</td>
<td>20 g/10 min</td>
<td>ASTM D1238</td>
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### Mechanical

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<tr>
<th>Mechanical Property</th>
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<tr>
<td>Density</td>
<td>57.490 lb/ft³</td>
<td>ASTM D1505</td>
</tr>
<tr>
<td>Tensile Strength (Yield, 73°F)</td>
<td>2,145 psi</td>
<td>ASTM D638</td>
</tr>
<tr>
<td>Tensile Elongation (Yield, 73°F)</td>
<td>16%</td>
<td>ASTM D638</td>
</tr>
<tr>
<td>Flexural Modulus (73°F)</td>
<td>100,175 psi</td>
<td>ASTM D790</td>
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</table>

### Compression Strength (73°F)

| Compression Strength (73°F)                    | 233 psi        | ASTM D6254        |

### Impact

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<th>Impact Property</th>
<th>Nominal Value</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notched Izod Impact (73°F, 0.125 in)</td>
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<td>ASTM D256</td>
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### Thermal

<table>
<thead>
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<th>Thermal Property</th>
<th>Nominal Value</th>
<th>Test Method</th>
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</thead>
<tbody>
<tr>
<td>Deflection Temperature Under Load 264 psi, Unannealed</td>
<td>160°F</td>
<td>ASTM D648</td>
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## Expansion/Contraction Index

<table>
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<tr>
<th>Temperature</th>
<th>Humidity</th>
<th>Length</th>
<th>Width</th>
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</thead>
<tbody>
<tr>
<td>100°F</td>
<td>98%</td>
<td>31.881&quot;</td>
<td>31.817&quot;</td>
</tr>
<tr>
<td>-5°F</td>
<td>0%</td>
<td>31.765&quot;</td>
<td>31.713&quot;</td>
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</table>

### Change

- .116"
- .104"

### Joint Expansion/Contraction Capacity

- .420"
- .572"

### Safety Factor

- 362%
- 550%

## Examples of Usage

<table>
<thead>
<tr>
<th>Application</th>
<th>Required Strength</th>
<th>Safety Factor</th>
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<tbody>
<tr>
<td>Auto</td>
<td>40 psi</td>
<td>x 168</td>
</tr>
<tr>
<td>Truck</td>
<td>110 psi</td>
<td>x 61</td>
</tr>
<tr>
<td>DC10</td>
<td>250 psi</td>
<td>x 27</td>
</tr>
<tr>
<td>Space Shuttle</td>
<td>340 psi</td>
<td>x 19</td>
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1 Independent laboratory testing conducted by TRI/Environmental, Inc., TSI/Testing Services, Inc. and Wassenaar.
100% Post Manufactured Content

Recycled

The AirDrain GeoGrid is made of 100% post-manufactured material, you can feel good about helping the planet while adding valuable LEED Points to your project! We also add an impact modifier for incredible strength and superior performance in extreme heat and cold - on top of the already durable AirDrain design.

AirDrain Co-Polymer with an Impact Modifier Performance and Temperature Durability

Attached you will find the specification of the resin used to produce both the 32 x 32 and the 32 x 18 Geo cells. This material is a co-polymer polypropylene that is 100% recycled resin. In order to be able to produce a consistent recycled resin a PIR (post industrial resin) is used for the base resin. This is the only way to produce a consistent material as opposed to a PCR (post consumer resin) which is dependent on the consumer to supply a consistent material. Using the PIR as a base resin 3% carbon black is added to insure good UV stabilization and metallocene (an ethylene base material) is used as an impact modifier.

Impact Modifier

The impact modifier is added in an amount to achieve a 10.0 Notched Izod Impact which comfortably qualifies this material as a NO BREAK material (4.0 and greater are normally considered no break material). The AirDrain resin offers an advantage over many ethylene and HDPE products since the AirDrain resin is often superior when it comes to pliability, warping and internal stress related issues. Referring to the attached specification sheet you will notice that all testing is done to specific ASTM Standards.

Resin Blends

AirDrain’s blend of resins gives it the ability to perform in extreme temperatures. AirDrain does not need a temperature above 50 degrees Fahrenheit to be installed or warmed in the sun to be pliable on site for install. In addition, AirDrain's unique resin blend also helps prevent breakage and cracking in extreme temperatures, thus giving it the ability to withstand repeated freeze thaw cycles.

Airfield posts its resin content and performance values with ASTM test methods and guide lines to measure the properties of our grid.
CLIENT: Airfield Systems  
8028 N. May Ave, Ste 201  
Oklahoma City, OK 73120

Attn: Michael Bean

Test Report No: TJ0963 Date: November 21, 2012

REFERENCE: QAI Laboratories Proposal Number FB110812-1


SAMPLE ID: One sample identified by client as: Airdrain™ Synthetic Turf Rooftop Drainage, was received from client on 11/14/12 in good condition.

TEST REQUESTED: The material was tested and evaluated for Thermal Conductivity in accordance with the procedures outlined in ASTM C 518-10.

TEST DATE: 11/20/12

RESULTS: See test data on the following pages.

CERTIFICATION: The tests reported here were conducted under the continuous direct supervision of QAI Laboratories Inc., Tulsa, OK.

SIGNED FOR AND ON BEHALF OF QAI LABORATORIES, INC.

Linda Lewis  
Materials Department Technician

Randall P. Baker, PE  
Tulsa Plumbing and Materials Manager

WWW.QAI.ORG  
info@qai.org
Test Procedure and Results

Sample ID: Airdrain™ Synthetic Turf Rooftop Drainage

**Thermal Conductivity/Thermal Resistance**
ASTM C 518-10

<table>
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<th>Value</th>
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<tr>
<td>$T_H$ = Hot Plate Temp ($^\circ$F)</td>
<td>102.26</td>
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<tr>
<td>$T_C$ = Cold Plate Temp ($^\circ$F)</td>
<td>51.33</td>
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<tr>
<td>$Q$ = Heat Flow (mV)</td>
<td>4.903</td>
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<tr>
<td>$\Delta \chi$ = Sample Thickness (in.)</td>
<td>1.743</td>
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<tr>
<td>$\Delta T$ = Hot Plate - Cold Plate ($^\circ$F)</td>
<td>50.93</td>
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</table>

$k$ = Thermal Conductivity, (BTU in) / (hr·ft²·°F) | 0.6326 |
| $R$ = Thermal Resistance, (hr·ft²·°F) / BTU | 2.7553 |

End of Report