POTATO AERATION SYSTEMS

THE MOST ADVANCED NAME IN WATER MANAGEMENT SOLUTIONS®
Advanced Drainage Systems, Inc. (ADS) manufactures N-12\textsuperscript{®} pipe (Figure 1) from high-density polyethylene (HDPE) and SaniTite\textsuperscript{®} HP pipe (Figure 2) from polypropylene (PP) resin. Both materials are widely utilized for their long service life, especially for durability and overall chemical resistance. While ADS pipes were developed for the storm and sanitary sewer markets, the unique benefits and features of the product has found success in the potato aeration market.

SANITIZATION
Products traditionally used for potato aeration today, most notably corrugated metal pipe, commonly rust and deteriorate over time, raising concern of crop contamination. ADS pipe products do not have the same issues. With superior durability, the plastic pipe will not degrade or leach over time. With a comparable service life to currently used products, ADS pipe products provide improved sanitization over today’s products. Overall maintenance and sanitization of pipe aeration systems is critical to success and no change to the standard cleaning products and processes is required when using ADS pipe products.

AIR FLOW
Most corrugated pipe products being used today have a corrugated exterior and interior (Figure 3). However, ADS pipe products are available with a corrugated exterior and smooth interior (Figure 4). By utilizing the structural performance of a corrugated wall structure, but providing a smooth inner surface, air flow through the pipe is improved, minimizing loss and improving overall system efficiency and distribution through the pipe run.

DURABILITY
ADS N-12 and SaniTite HP pipes provide a balance of stiffness and flexibility to withstand the rigors of handling and installation. SaniTite HP (polypropylene) is a slightly stiffer material and improves performance when using 24” or larger pipe. Stiffness is important for handling, especially with placement and removal using heavy equipment. However, the improved flexibility of plastic compared to metal is beneficial to longevity of the product allowing for slight movement without deformation. Whereas metal pipe will permanently deform under a load and will continue to deform over time,
plastic will deflect (change to a slightly elliptical shape) under a load, but can “rebound” when the load is removed.

Damage to the pipe can and will occur, but with ADS pipe products, whole pieces of pipe don’t need to be thrown away when damage is only to a small portion. With standard power cutting tools, like a reciprocating saw or circular saw, damaged sections of pipe can be easily cut away and the remaining portion of the pipe can still be used. There is also no worry about sharp edges and fragments that can hurt personnel or equipment. With ADS products, adjustments are made easily, quickly and safely to keep the installation on time.

**PRODUCT OFFERINGS**

**DIAMETERS AND LENGTHS**
ADS offers many diameters, but most predominately used in the market is 18” (450 mm) and 24” (600 mm) pipe. Both 20 feet (6 m) and 13 feet (4 m) pipe lengths are available and shorter lengths are available upon request. ADS recommends either N-12 (HDPE) or SaniTite HP (PP) for 18” (450 mm) pipe and SaniTite HP (PP) pipe for 24” (600 mm) pipe.

**PERFORATION SIZE AND PATTERN**
Specified perforation diameter and the number of perforations around the pipe circumference vary based on the air flow requirements for the aeration system (Figure 5). ADS can accommodate many pattern requests, however some standard guidelines are provided for reference and design in Table 1. Most pipe is ordered with 6 or 8 holes per valley, evenly spaced around the pipe’s circumference.

**COUPLING METHODS**
ADS offers pipe in standard 20 feet (6 m) and 13 feet (4 m) lengths and multiple connection methods are available to create longer runs as needed. Whether the coupler needs to be easy to install and remove or minimizes pull-apart during placement of potatoes, ADS offers multiple connection options to select the method that best serves the primary purpose.

**Butt Joint**
Sometimes a coupling is simply not desired. ADS pipe can be provided with plain ends (Figure 6) that allow the installer to place pipes end-to-end with no other connection.
methods, resulting in quick pipe installation and removal. There is the potential for the pipes to move over time, especially during initial potato placement, so consideration should be given to whether gaps at the joints is acceptable, especially related to air flow along the length of the run.

**Taped Joint**
A taped join offers added restraint to a simple butt joint and allows the installer to keep minimal amount of material on hand. The annular corrugations of ADS pipe allow for quick and even taping around the joint (Figure 7). Tape can also provide minimal restraint of the pipe to the floor of the storage facility to minimize movement of pipe during potato placement.

**Integral Bell and Spigot Joint**
ADS pipes can be manufactured with a bell and spigot joint (Figure 8) that is integral and monolithic with the pipe. This joint includes corrugations that have a shorter height and are sized to fit inside the bell end of another stick of pipe. This joint is more commonly requested without a gasket, but a gasket can be provided if a tighter joint is desired. The integral bell and spigot joint is only available on 20-feet (6 m) or 13-feet (3.9 m) pipe lengths.

**Split Band Coupler**
The ADS split band coupler is manufactured using high-density polyethylene plastic. This coupler can be used as either a full part that wraps and locks around the entire circumference of the pipe (Figure 9) or the full coupler can be cut into sections to create a “cradle” for the invert of the pipe (Figure 10) to keep the two sections together. Table 2 provides the product code for ordering the split band coupler.

**Fabricated Spigot**
Using plain end pipe, the fabricated spigot option utilizes a thin-walled tube welded to the interior of the pipe on one end. The cylinder is welded to the pipe such that approximately 6” (150 mm) extends beyond the pipe end and is inserted into the preceding piece of pipe (Figure 11). This connection is slightly tighter than using an integral bell and spigot joint without a gasket, but is a fabricated part and requires a slightly longer lead time.

**CUSTOM FITTINGS**
ADS has the capability to fabricate and weld custom parts as needed (Figure 12). Whether it is transitioning to a connection, accommodating existing storage building layouts or configuring a unique layout, ADS has the

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**Table 2: Split Band Coupler Product Codes**

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>ADS Product Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>18” (450 mm)</td>
<td>1865AA</td>
</tr>
<tr>
<td>24” (600 mm)</td>
<td>2411AA</td>
</tr>
</tbody>
</table>
expertise and materials to meet many requests.

END CAPS
End caps may be required to end a pipe run at a location other than the air plenum wall. ADS offers a split end cap, which wraps and tightens around the exterior corrugations of the pipe (Figure 13). This part can be provided with a solid end, allowing the installer to drill the desired perforation size and pattern, or ADS can perforate before shipment to a pattern provided by the customer. A second option is a fabricated (welded) end cap that uses a bell to slide over a plain end section of pipe (Figure 14). This cap does not lock or engage the corrugations and is easier to remove than the split end cap. Table 3 provides the product codes for ordering the split band coupler.

INSTALLATION & STORAGE CONSIDERATIONS

POTATO PILE HEIGHT & PIPE DEFLECTION
Potato crop and storage practices vary from owner to owner and region to region so establishing definitive installation limits and product performance predictions can be difficult. However, previous installations of ADS pipe products helps to provide owners with reasonable expectations for use in their particular installation.

The performance and success of flexible pipe is based upon the pipe deflecting to “shed” some of the load being applied from the potato pile. Deflection is a behavior unique to flexible pipe products (metal and plastic) and occurs when a circular pipe changes to an elliptical shape when a load is applied. Pipe deflection itself does not constitute failure of the pipe, but should be managed to remain below 15% through observations during its use and be accounted for appropriately in air flow calculations. Deflections in excess of 15% can be an indicator of future issues to performance and should be evaluated for pipe integrity. The size and species of the potato will impact how much the pipe will deflect under the pile; the larger the potato, the more potential there is for pipe deflection. Other environmental conditions such as humidity and temperature will also impact pipe performance.

The information presented in Table 4 is based upon

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Split End Cap</th>
<th>Fabricated End Cap</th>
</tr>
</thead>
<tbody>
<tr>
<td>18&quot; (450 mm)</td>
<td>1867AA</td>
<td>1801AN65B</td>
</tr>
<tr>
<td>24&quot; (600 mm)</td>
<td>2467AA</td>
<td>2401AN65B</td>
</tr>
</tbody>
</table>

Table 3: End Cap Product Codes

Table 4: Estimated Pipe Deflection Based on Potato Pile Height

<table>
<thead>
<tr>
<th>Potato Pile Height - feet (m)</th>
<th>Pipe Deflection (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10' (3 m)</td>
<td>6%</td>
</tr>
<tr>
<td>15' (4.6 m)</td>
<td>10%</td>
</tr>
<tr>
<td>20' (6 m)</td>
<td>12%</td>
</tr>
</tbody>
</table>

Note: Deflection based upon initial pipe deflection at 0%. Deflections noted in Table 4 are cumulative if an already deflected pipe is installed at the beginning of the season and must be accounted for appropriately.
actual installations and inspection of the pipe during one season of storage (approximately 5 months). One of these installations is depicted in Figure 15.

It is important to note ADS pipe products will deflect when installed and is expected for any installation. Unlike traditional metal products though, plastic pipe will not remain in the same deflected state when uninstalled. When properly stored for the next season, a deflected pipe is expected to “rebound” back to a near circular shape. Storage recommendations and best practices for re-installing pipe for subsequent seasons are discussed in later sections.

END WALL CONNECTIONS
A common aeration system layout will orient the pipe runs to connect the two side walls of the facility, typically 50-80 feet (15-24.4 m) in width. The sides of the storage facility are the air plenums where the air temperature and humidity is controlled and distributed to the pipe laterals. The air
plenum walls are most commonly poured concrete and holes are provided where each pipe run will connect in order to aerate the potato pile. The outside diameter of ADS pipe is comparable to other corrugated pipe products and a reasonably snug fit is provided by simply butting/inserting the pipe into the existing hole (Figure 16). Alternatively, an adapter (thin-walled, tube-welded to ADS pipe) can be provided for installations where a smaller diameter is desired or if the pipe needs to protrude further through the wall (Figure 17).

**PIPE STORAGE**

While the pipe is in use it is expected, and necessary for proper performance, for the pipe to deflect over time. As the potato pile is picked for processing and the pipe laterals are exposed, the pipe will need to be removed from the floor to access the remainder of the pile. One of the many benefits of ADS pipe is the ability for the pipe to “rebound” after deflecting and return to a near-circular shape with no more effort than proper storage, which is placing the pipe vertically, on-end when it is not in use. When stored in this manner, the pipe is expected to reduce deflection by 90% or more (e.g. a 10% deflected pipe will reduce to approximately 1% deflection after storage). While horizontal storage and stacking of the pipe can be done, vertical orientation provides the greatest potential for the pipe to rebound close to its original shape and will help extend its viable use over multiple storage seasons.

**PIPE RE-USE FOR MULTIPLE SEASONS**

Vertical pipe storage, as noted in the previous section, provides the best opportunity for the pipe to move back to a near-circular shape. Planned orientation of the pipe when re-installed for another season can greatly benefit and extend the working life of the pipe. Since any flexible pipe will deflect, rotating the pipe 90°, such that the horizontal deflection would become vertical deflection, will help “re-round” the pipe with no more effort than simply installing the pipe as would be done anyway.

ADS pipe comes with a green stripe down the length of the pipe that will not disappear or wear away with time and this feature can be used to quickly orient the pipe season-to-season. As a rule of thumb, ADS encourages installers to orient the pipe with the green stripe **UP on ODD years** and to orient the green stripe to the **SIDE on EVEN years** (i.e. install green stripe up in 2015 and rotate the stripe to the side for re-installation in 2016). Alternatively, an orientation schedule is available for posting within the storage facility for quick reference to any installer season-to-season.

*ADS warrants the product to be free from defects in materials and workmanship. The installation practices and recommendations provided herein are for general guidance only.*