Diamond Plastics has grown into a major national manufacturer of PVC pipe since purchasing two production facilities from Gifford-Hill in 1982. Diamond Plastics now operates 8 PVC pipe plants across the United States. For over 25 years Diamond Plastics has been providing reliable PVC pipe to the municipal water, sanitary, storm sewer, and agricultural irrigation markets. Diamond Plastics is now providing large diameter PVC closed profile pipe for the same markets. We call it “Pro-21™” (Profile Pipe for the 21st Century®).

**Product Description**

“PRO-21™” closed profile pipe is produced by extruding an “I-beam” type profile that is in turn wrapped onto a circular mandrel providing a continuous tube with a helical heat welded seam. The result is a pipe of solid wall appearance from the inside and outside which has the structural advantages of the “honey comb or I-beam” construction internal to the pipe wall itself. The pipe meets ASTM F1803.

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PVC

Pro-21™ is made of PVC. Therefore the entire product is immune to the corrosive acid conditions that result from hydrogen sulfide gas generated in sanitary sewer lines. It is not susceptible to electrolytic corrosion. Because it is PVC, it is resistant to a wide range of chemicals which cause corrosion in non-PVC products.

Interior Rib

By placing the structural rib between the inner and outer layer of Pro-21™ both the ID and OD are free of ribs or corrugations. The relatively smooth outside diameter allows easy fabrication of fittings, easy simple tapping, with a saddle or Inserta-Tee and easy connection to either boot or “A-Loc” manhole connectors.

Gasketed Joint

Pro-21™ has a deep insertion push-together gasketed joint which provides a water tight seal, meeting the requirements of ASTM D3212. This joint restricts infiltration to 25 gallons per inch of internal diameter per mile per day or less. This makes root intrusion virtually a thing of the past.

Gaskets

No statement, remark, agreement, representation, promise or understanding, oral or written, made by Diamond Plastics Corporation, or any agent, representative or employee thereof, which is not contained herein, will be recognized by, or be enforceable or binding upon Diamond Plastics Corporation. There are no understandings or undertakings of any kind with respect to the products or any part thereof which are not expressly set forth and contained herein, and all sales are made without any representation or warranty by Diamond Plastics Corporation that the goods are suitable for any particular purpose. In the event any provision of this LIMITED WARRANTY AND LIMITATION OF LIABILITY is held to be illegal or unenforceable by any court of competent jurisdiction, the remaining provisions shall remain in full force and effect.

Limited Warranty and Liability

Diamond Plastics Corporation, 1212 Johnstown Road, P.O. Box 1608, Grand Island, NE 68802, does hereby warrant, subject to the limitations hereinafter stated, its PVC Pipe to be free from defects in material and workmanship under normal use and service for a period of twelve (12) months from the date of invoice. This limited warranty extends only to the original purchaser for use, and will be void if the product is used under conditions other than those for which it was designed or if it is not used in compliance with all instructions contained in any operating manual or specification sheets provided for such product.

The sole obligation of Diamond Plastics Corporation, under this limited warranty, and the exclusive remedy of the purchaser under this limited warranty is the repair or replacement, without charge, F.O.B. shipping point, of such products or parts of products only, specifically excluding any labor or installation thereof, which Diamond Plastics Corporation, after inspection, determines to be defective. Purchaser must notify Diamond Plastics Corporation, in writing at its address shown above within ten (10) days from the date of discovery of any claimed defect specifically stating the details of such defect, and, if requested by Diamond Plastics Corporation, return the defective product, freight prepaid, to Diamond Plastics Corporation, F.O.B. shipping point as shown on Diamond Plastics Corporation’s order acknowledgement.

Diamond Plastics Corporation shall not be liable for any other damages, whether direct or consequential. Specifically, but without limitation, Diamond Plastics Corporation shall not be liable for any crop damage or any other incidental or consequential damages resulting from any breach of warranty, express or implied, or from any defects in its products.
Smooth Interior
Pro-21™ has a smooth interior which provides a Manning’s “n” equal to 0.009. This ensures superior hydraulics and less need for cleaning. Superior hydraulics allows downsizing or reduced slope compared to rougher surfaced products.

Lighter Weight
Pro-21™ provides an engineered structural wall which dramatically reduces weight while providing greater pipe stiffness. This reduces the costs of handling and requires less bedding for grade maintenance than heavier pipes.

Resilient Bevel
Pro-21™ is manufactured with a resilient rubber wedge on the spigot. This dramatic improvement reduces the likelihood of damage when the installer inserts the spigot into the bell during construction.

Long Term Deflection of PVC
The chart below was developed to show acceptable burial conditions for pipe. The areas shaded orange will result in long term deflections of less than 7.5%. A 7.5% deflection limit provides a safety factor of 4.0 on the well established conservative PVC deflection performance limit of 30%.

Excluding the effects of live load and longitudinal bending, the chart below gives the design engineer a ready reference without the need to calculate deflections. For example, an application that calls for depths of cover of 14 feet or less, with native Class IV materials can be designed by checking the chart. For 14 feet of cover we note that the square across from Class IV material compacted to 65% is gray and therefore not recommended. However, for Class IV material compacted to 75% or better, the square is orange under the 14 foot cover column. Therefore, the native soil may be used for backfilling as long as it is compacted to 75% or greater.

The chart does not take into account live loads. When live loads are not a factor, the chart can be used directly to determine whether long-term deflection of the Pro-21™ is below 7.5%. When live loads must be considered, first determine the combined total external load on the pipe. Next, determine the equivalent prism load (without live load) for the particular pipe size involved. Determine the height of the cover (ft.) for the equivalent prism load. Using this height of cover with the bedding class and proctor density, use the maximum long-term deflection chart to determine the burial conditions which are acceptable. In working with these charts, it becomes apparent that:

1. Soil density in the pipe zone plays a greater role than soil type in the control of deflection in buried flexible conduits.
2. The amount of deflection is independent of pipe size.

For minimum depths of cover as shallow as 1 foot, additional information should be obtained from your sales representative.
Preparation

PRO-21™ is a flexible conduit. The embedment should be designed to limit deflection to 7.5%. The long term deflection chart on the adjacent page may be used to easily determine acceptable burial conditions. Additional design information may be obtained from the Uni-Bell Handbook of PVC Pipe Design and Construction. PRO-21™ should be installed using the same good construction practices as those currently used for SDR35. Additional installation information may be obtained from Uni-PUB-6, Installation Guide for PVC Sewer Pipe, or ASTM D2321, Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

Foundation

Foundation preparation is only required when the trench bottom is unstable. Any foundation that will support a rigid pipe without causing loss of grade or flexural breaking of pipe, will be more than adequate for PRO-21™.

Bedding

The bedding directly underneath the pipe is required only to bring the trench bottom to grade and provide uniform longitudinal support for the pipe. It should not be so thick or soft that the pipe will settle and lose grade. A layer of material from 4” to 6” thick is typically placed to establish line, grade and support. Bell holes should be excavated to insure uniform bearing.

Haunching

The haunching area is the most important in terms of limiting the deflection of a flexible pipe. This is the area that should be compacted to the Proctor densities shown in the long term deflection chart on the adjacent page. Material which may be adequately placed and compacted to required levels for the specific application is suitable. It is important that no voids exist in this area. The installer has sole responsibility for proper placement and compaction of the haunching material, which is the key to controlling deflection.

Initial Backfill

The initial backfill protects the pipe from the final backfill placement and compaction. It begins at approximately the spring line of the pipe (the top of the haunching) and stops about 6” to 12” above the crown. The initial backfill provides no additional support for the pipe and therefore, the material requirements are relaxed. The material used should not be capable of filtering down into the lower pipe zones.

The Product

Introduction

PRO-21™ PVC Gravity Sewer and Storm Drain Pipe, manufactured by Diamond Plastics Corp., is a unique combination of PVC pipe technology and innovative engineering design. It brings to the marketplace a cost effective, high quality sewer and drain pipe system. It offers the user a pipe that has a seamless uniform cross-sectional wall, radial corrugations that are perpendicular to the axis of the pipe, and a smooth interior for excellent flow characteristics.

PRO-21™ design enables it to resist earth and impact loads normally associated with sewer and drain pipe installation. The outstanding chemical and corrosion resistance, along with an integral bell and rubber gasket joint, make it an excellent choice for sanitary sewer systems and other drainage applications.

PRO-21™ is available in sizes 30", 33", 36", 42", 48", 54", and 60". For diameters 4" through 27", see our Solid Wall or CORR-21™ brochures.

PRO-21™ is an optimized profile PVC pipe design, offering strength with economy and excellent flow rates.

Standards

PRO-21™ PVC sewer and storm drain pipe is manufactured to meet or exceed the requirements of the following:


AASHO M304M 91 Interim Specification for Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe & Fittings Based On Controlled Inside Diameter.

30"-60" PRO-21™ meets or exceeds section properties in AASHO Standard Specifications for Highway Bridges Section 18, Soil-Thermoplastic Pipe Interaction Systems.

Chemical and Abrasion Resistance

The chemical resistance of PVC pipe is legendary. Acids, alkalies, and normally-diluted hydrocarbons have no effect on the pipe and its gaskets. Aggressive soil conditions due to sulphates, carbonates or sea water are easily tolerated by PRO-21™, as are most industrial effluents and acid rain.

PVC pipe has been subjected to abrasion tests by several independent laboratories. These tests prove that PVC pipe will resist abrasion better than concrete and steel pipe. Where abrasive flows are encountered, PVC pipe offers exceptional resistance to wear.

PVC’s durability ensures that PRO-21™ will have a long life requiring little maintenance. Your sales representative will be glad to give specific recommendations concerning PRO-21™ chemical and abrasion resistance.
**Dimensions**

<table>
<thead>
<tr>
<th>Nominal Pipe Size</th>
<th>Barrel Average Outside Diameter</th>
<th>Bell Outside Diameter</th>
<th>Minimum Inside Diameter</th>
<th>Weight Per 100 Feet</th>
<th>Pieces Per Bundle</th>
<th>Pieces Per Truckload</th>
<th>Feet Per Truckload</th>
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PROFILE PIPE FOR THE 21st CENTURY®

Pro-21™ is supplied in 14 foot laying lengths.

![Pro-21™ Socket / Spigot Illustration](image)

### PRO-21™ PIPE DIMENSIONS

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### Quality Control

**Loading Data**

*Transportation regulations and the equipment utilized may increase or reduce the maximum footage per truckload.*

**Dimensions**

Dimensional checks are completed on every piece of Pro-21™.

**Flattening**

Pro-21™ must be capable of being flattened by 60% (circumferential deflection) between parallel plates, without splitting, cracking, breaking or any seam separation, to meet the requirements of ASTM F1803.

**Stiffness**

Pro-21™ is required by ASTM F1803 to have a minimum pipe stiffness of 46 psi. This is determined in accordance with procedures specified in ASTM D2412.

**Impact**

Pro-21™ must be capable of withstanding a direct impact of 220 ft-pounds, without cracking, splitting, shattering the waterway wall or any seam separation, when tested by falling weight in accordance with procedures in ASTM D2444.

**Extrusion Quality**

Pro-21™ is routinely immersed in an acetone bath and checked for attack in accordance with procedures found in ASTM D2152 to assure proper material fusion.

**Seam Quality**

Every piece of Pro-21™ undergoes a low pressure air test to check the soundness of the welded seam.

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**Foundation**

Foundation preparation is only required when the trench bottom is unstable. Any foundation that will support a rigid pipe without causing loss of grade or flexural breaking of pipe, will be more than adequate for PRO-21™.

**Bedding**

The bedding directly underneath the pipe is required only to bring the trench bottom up to grade and provide uniform longitudinal support for the pipe. It should not be so thick or soft that the pipe will settle and lose grade. A layer of material from 4” to 6” thick is typically placed to establish line, grade and support. Bell holes should be excavated to insure uniform bearing.

**Haunching**

The haunching area is the most important in terms of limiting the deflection of a flexible pipe. This is the area that should be compacted to the Proctor densities shown in the long term deflection chart on the adjacent page. Material which may be adequately placed and compacted to required levels for the specific application is suitable. It is important that no voids exist in this area. The installer has sole responsibility for proper placement and compaction of the haunching material, which is the key to controlling deflection.

**Initial Backfill**

The initial backfill protects the pipe from the final backfill placement and compaction. It begins at approximately the spring line of the pipe (the top of the haunching) and stops about 6” to 12” above the crown. The initial backfill provides no additional support for the pipe and therefore, the material requirements are relaxed. The material used should not be capable of filtering down into the lower pipe zones.

**Final Backfill**

The material used and densities required in this area should be based on the structure which lies above the pipe. This area provides no additional support to the pipe. Where the line runs through a backyard or open field, native material dumped or lightly compacted may be sufficient. Under a road surface, a material which can be highly compacted is required, and the initial backfill should be compacted as well. This material should be free of large rocks and boulders.

**Compactive Effort**

The compactive effort will be reduced if moisture content is controlled to optimum levels. Never contact the pipe with compactors. At all points in the pipe zone, adequate compaction of approved materials can be achieved using portable vibrators. For applications where minimum cover conditions exist (a minimum cover of one foot can be recommended for loads up to and including H20), Class I materials are needed to reduce compactive effort required over the pipe to achieve a high level of compaction (typically 95% Std. Proctor under a road surface). Heavy equipment, such as Hydro Hammers, should only be used when needed to achieve required densities, and not less than 3” above the pipe.

**Hydraulics**

The smooth interior wall of PRO-21™ provides excellent flow rates and resists the build-up of solids. The long length of PRO-21™ (14 feet), and the reduced number of required joints, yield a Manning flow coefficient of n = 0.09 under full flow conditions - the lowest resistance of any sanitary sewer or drain pipe.

**Chemical and Abrasion Resistance**

The chemical resistance of PVC pipe is legendary. Acids, alkalis, and normally-diluted hydrocarbons have no effect on the pipe and its gaskets. Aggressive soil conditions due to sulphates, carbonates or sea water are easily tolerated by PRO-21™, as are most industrial effluents and acid rain.

**Mechanical Properties**

PRO-21™ has a minimum uniform pipe stiffness (F/A) of 46 psi. Its tough, durable profile design is capable of withstanding a substantial impact loading when tested in accordance with ASTM D2444.
Smooth Interior
Pro-21™ has a smooth interior which provides a Manning’s “n” equal to 0.009. This ensures superior hydraulics and less need for cleaning. Superior hydraulics allows downsizing or reduced slope compared to rougher surfaced products.

Lighter Weight
Pro-21™ provides an engineered structural wall which dramatically reduces weight while providing greater pipe stiffness. This reduces the costs of handling and requires less bedding for grade maintenance than heavier pipes.

Resilient Bevel
Pro-21™ is manufactured with a resilient rubber wedge on the spigot. This dramatic improvement reduces the likelihood of damage when the installer inserts the spigot into the bell during construction.

Long Term Deflection of PVC
The chart below was developed to show acceptable burial conditions for pipe. The areas shaded orange will result in long term deflections of less than 7.5%. A 7.5% deflection limit provides a safety factor of 4.0 on the well established conservative PVC deflection performance limit of 30%.

Excluding the effects of live load and longitudinal bending, the chart below gives the design engineer a ready reference without the need to calculate deflections. For example, an application that calls for depths of cover of 14 feet or less, with native Class IV materials can be designed by checking the chart. For 14 feet of cover we note that the square across from Class IV material compacted to 65% is gray and therefore not recommended. However, for Class IV material compacted to 75% or better, the square is orange under the 14 foot cover column. Therefore, the native soil may be used for backfilling as long as it is compacted to 75% or greater.

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Short Form Specification for PVC Sewer Pipe

Pro-21™ PVC Gravity Sewer and Drain Pipe Sizes 30” – 60”

All sanitary sewer and storm drain pipe shall be Diamond Plastics Pro-21™ PVC profile wall sewer pipe made of compounds meeting the minimum cell classification of 12364 as defined in ASTM D1784 and manufactured in accordance with ASTM F 1803. It shall have a minimum pipe stiffness of 46psi. Pipe shall have a smooth interior and exterior. It shall have a gasket with four sealing fins and a resilient wedge bevel. The joint shall meet all the requirements of ASTM D 3212. The joint shall meet an allowable infiltration of 25 gallons per inch of internal diameter per mile per day or less. All PVC sewer pipe shall be installed in accordance with ASTM D2321, Uni-Bell’s Uni-Pub 6 and the manufacturer’s recommendations.