

Polyamide (PA11 and PA12) Use in High Pressure Natural Gas Distribution Systems: Installations and Performance Review

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- > **Dennis Jarnecke**
Gas Technology Institute
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Why Polyamide (PA11 or PA12)?

- > In the past 40 years, the natural gas distribution industry has transformed from a near-exclusive metallic distribution piping network to a near-exclusive thermoplastic piping distribution network
- > The metal to plastic transformation has saved U.S. natural gas utilities in excess of \$10 Billion in installation and maintenance costs

Potential Installed Cost Savings

Average Cost per ft. to Install Gas Distribution Mains¹

Pipe Size	PE Cost/Ft (\$)	PE Avg Cost/Ft (\$)	Stl Cost/Ft (\$)	Stl Avg Cost/Ft (\$)	Cost Diff/Ft (\$)
2"	4.00 - 9.32	6.66	12 - 35	23.5	\$16.84
4"	8.00 - 15.56	11.78	16 - 32	24	\$12.22
6"	10.00 - 32.00	21	33 - 75	54	\$33.00

PA Pipe Savings:

1. Installed costs (including the opportunity for alternative installation methods)
2. Reduced maintenance (corrosion) costs

Overview

- > GTI conducted a comprehensive research program to validate the feasibility of PA11 and PA12 gas piping systems
 - Lab testing and field experiments
 - Up to 6" diameters and 250 psig
- > Sponsored by Operations Technology Development (OTD) and PA resin manufacturers
- > Developed a full-set of installation, operation and maintenance procedures for the use of PA piping systems
- > Generated a body of data supporting the use of PA11 and PA12 in high-pressure distribution systems

ASTM Standards

- > Developed the necessary standards and listings to allow the use of PA11 and PA12
 - F2785 “Standard Specification for Polyamide 12 Gas Pressure Pipe, Tubing, and Fittings”
 - F2945 “Standard Specification for Polyamide 11 Gas Pressure Pipe, Tubing, and Fittings”
 - F1973 “Standard Specification for Factory Assembled Anodeless Risers and Transition Fittings”
 - F2145 “Standard Specification for Polyamide 11 (PA 11) and Polyamide 12 (PA12) Mechanical Fittings”
 - Standard Specification for Butt Heat Fusion Polyamide (PA)
 - and more...

PA11 AND PA12

Field Evaluations

- > Over 10 years of actual in-service performance
 - Up to 250 psig (17 bars) operating pressure
 - Up to 6" pipe
- > Basis for permitting the use of PA11 and PA12 by revising 49CFR Part 192 (Federal Code)

PA11 AND PA12

Field Demonstrations

- > Several field demonstrations were performed to evaluate the handling, installation process, in-service stress conditions, etc.
- > Installations used various pipe sizes, climatic conditions, pressures, fittings, and installation practices



PA11 AND PA12

Field Demonstrations

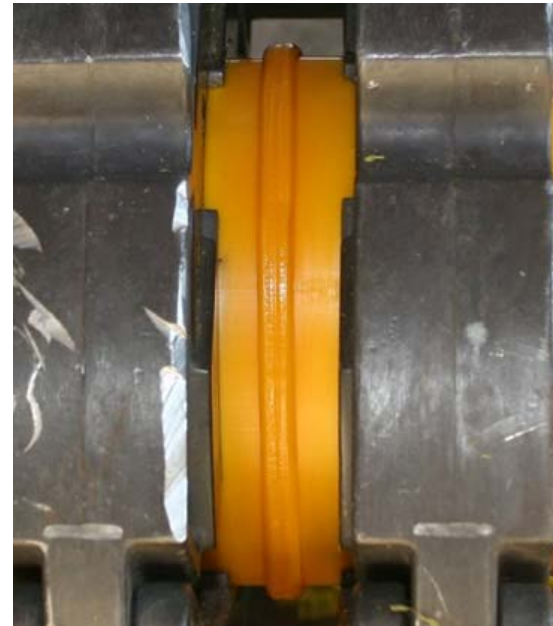
- > Coiled and stick PA pipe
- > Heat and electrofusion processes
- > And more...



PA11 AND PA12

Butt Fusions

- > Developed and evaluated butt fusion procedures
- > Trained and certified operators



PA INSTALLATION

6" Pipe for National Fuel

- > 6" SDR 11 pipe approximately 800' in length operating at 250 psig (17 bars)
- > Connected using qualified PA12 joining procedures and 6" PA12 EF Couplings
- > Pressure test to 375 psig (26 bars)
- > Installation completed in 2006

Wet and Cold Environments plus tight bend radius – 250 psig



PA INSTALLATION

4" Pipe for WE Energies

- > Wisconsin installation
- > Cold environment – 250 psig (17 bars)
- > All butt fused joining



PA INSTALLATION

4" Pipe for MichCon (DTE Energy)

- > Cold environment –
330 psig (22 bars)
- > Combination of
electrofusion and
butt fusion joining
- > Pressure test at 450
psig (30 bars)



PA INSTALLATION

Georg Fischer Central Plastics

BUTT FUSION FITTINGS



45° ELBOW



90° ELBOW



END CAP



REDUCER



TEE

COUPLINGS



EF COUPLING

TAPPING TEES



EF TAPPING TEE WITH BUTT OUTLET

RISERS



ANODELESS RISER

TRANSITION FITTINGS



PA-11 TO PE



TRANSITION FITTINGS WE



Hyperplast
Piping
System
(PA11 resin)



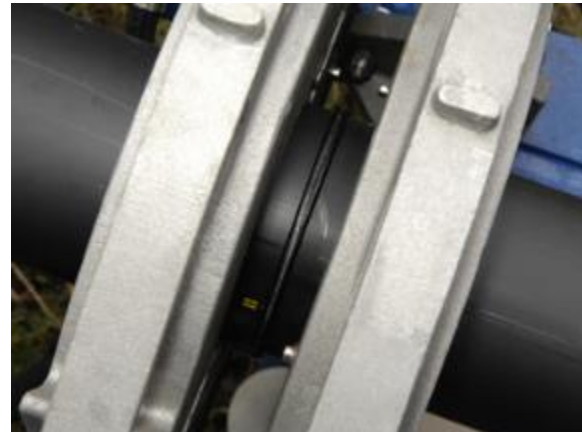
PA INSTALLATION

Atmos Energy Steel Replacement

ATMOS Installation History of PA11 Pipe				
	Location	Length (Feet of Pipe)	Size	Installation Year
Project 1	Frost, TX	6,000	4"	2010
Project 2	Coolidge, TX	55,440	4"	2010
Project 3	Grossbeck, TX	7280	4"	2010
Project 4	Hubbard, TX	16040	4"	2011
Project 5	Frost, TX addition	7600	4"	2011
Project 6	Waco, TX I-35 Bore	600	4"	2011
Project 7	Grossbeck, TX add-on	14,000	4"	2011
Project 8	Priscilla TX and Hubbard	24,000	4"	2012
Project 9	Ferris TX	23,360	4"	2012
Project 10	Various (service tubing, risers, transitions)	2,000	1"	various
Total Footage to Date		156,320		
Miles of Pipe		29.61		
Meters		47,652		

PA INSTALLATION

4" PA11 Pipe for Atmos Energy



PA INSTALLATION

4" Pipe for PA12 Energy West

- > 4" SDR 13.5 pipe approximately 3 miles in length operating at 160 psig (11 bars)
- > Connected using qualified PA12 joining procedures
- > Pressure test to 342 psig (24 bars)
- > Installation completed July/Aug 2009



PA INSTALLATION

4" Pipe for PA12 Energy West



PA INSTALLATION

4" Pipe for PA12 Energy West



PA INSTALLATION

1" PA12 Services for Energy West

- > Electrofusion fittings and PA tubing used to provide gas service to homes along the route
 - 1" PA tubing
 - Electrofusion fittings
 - > Service tees, EFVs, and anodeless risers



PA INSTALLATION

6" Pipe for PA12 Atmos Energy

- > Mississippi installation
- > 6" SDR 13.5 pipe approximately 1500' in length operating at 160 psig (11 bars)
- > Connected using qualified PA12 joining procedures
- > Pressure test to 300 psig (21 bars)
- > Installation completed August 2009



PA INSTALLATION

6" Pipe for PA12 Atmos Energy



PA INSTALLATION

2014 PA12 Project (In Progress)

- > Install 4" SDR 11 industrial line from cogeneration plant to chemical plant



Location	Date	Dimension	Pressure
DTE Walbridge, Marietta OH, USA	Aug 2014	4" SDR 11	200 psig (14 bars)

PA Piping System Advantages

> Operating Considerations

- Can operate up to 250 psig (17 bars)
- Coil and stick pipe available
- Diameters up to 6"
- Uses same equipment that you already use for PE

> Benefits

- Lower installation costs compared to steel piping systems
- Eliminates maintenance costs due to corrosion protection
- Similar benefits of using PE pipe but can now be extended for applications up to 250 psig



PA Piping System Advantages

Available Piping Systems:

- > Various fittings currently exist including:
 - Inline fittings
 - Couplings
 - Tees
 - Risers and transitions
 - Excess flow valves
 - And more...
- > Multiple resin, pipe, and fitting suppliers



Connect With Us

Contact:

Dennis Jarnecke

Gas Technology Institute

847-768-0943

dennis.jarnecke@gastechnology.org

Gas Technology Institute

1700 S Mount Prospect Rd,
Des Plaines, IL 60018, USA

www.gastechnology.org



@gastechnology