Plastics Pipe Institute
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RECOMMENDATION B

Thermoplastic Piping for the Transport of Pressurized Gases

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INTRODUCTION

Various types of thermoplastic piping have been and are used for pressurized gas service. Common applications are buried infrastructure such as gathering, distribution and transmission of natural gas, compressed air for railroad equipment, or non-buried use in buildings for applications such as shop compressed air or pressurized gases for laboratory or health services. Thermoplastic tubing is also used for lower pressure pneumatic instrument controls.

Pressurized gas applications warrant special consideration for safety in material selection and installation design because an inadvertent loss of pipeline integrity releases both the internal pressure energy in the pipe wall and the energy used to pressurize the gas. Compared to an energy release from a pressurized liquid pipeline failure, the overall stored energy release from an equivalent pressure gas line failure is typically more energetic and detrimental due to the rapid decompression of the pressurized gases. Therefore, in addition to typical pipeline design, pressurized gas piping system design should consider:

- An evaluation of piping material properties with respect to the gas being transported and the pipeline's external environment
- An evaluation of the installation's risk of injurious physical damage to the pipeline - especially for above ground installations - and the potential for damage from the energetic discharge of the compressed gas. **Pipe that produces shards or fragments when allowed to burst should never be allowed in compressed gas applications without complete protective shielding or containment.**
- An evaluation of the piping material for potential of brittle or shatter type failure which could result in shards being energetically propelled to surrounding area.
- An evaluation of the piping material and operating conditions for potential of fast long running cracks in the pipeline, also known as rapid crack propagation - RCP.

An additional assessment and evaluation should involve the risk of exposure from inadvertent release of stored energy if a flammable or toxic hazardous gas is being transported. Federal, State or Provincial, and Municipal regulations can apply to hazardous gas pipelines. Regulations for hazardous gas pipelines are available from government publication sources and should be reviewed for applicability and to determine if permitting or restrictions for the installation or operation of the pipeline may be necessary.

EVALUATING PIPING MATERIAL PROPERTIES

An evaluation of a piping material for suitability in the transport of a pressurized gas should consider all pertinent design and safety considerations. Some considerations may be chemical and temperature effects, long-term material properties, impact and UV resistance for above ground installations, etc. **See PPI PE Pipe Handbook and other documents for design and installation guidance.**

EVALUATING THE INSTALLATION

For plastic piping systems **specifically** designed for use with compressed air or gasses the following requirements shall be met:

1. Manufacturers' instructions must be strictly followed for installation, visual inspection, testing and use of the systems, and
2. Compressed air or other gas testing is not prohibited by the authority having jurisdiction.

The manufacturer should be contacted if there is any doubt as to how a specific system should be tested.

The risk of pipeline exposure to injurious mechanical damage varies with the type of installation. Thermoplastic pipelines are susceptible to mechanical injury that can result when the pipeline is directly exposed to the mechanical effect.

- Thermoplastic pipes can be flexible and if unrestrained, injurious mechanical damage that severs or shatters the pipe can allow a pressurized gas pipeline to whip about or shards of shattered pipe to be energetically expelled, potentially endangering property or persons. With sufficient cover, embedment soil can provide some protection from damage and restraint against pipeline movement or the expulsion of shattered pipeline shards in the event of injurious mechanical damage.

- Pressurized gas pipelines that are installed in buildings or associated structures such as shops, garages, repair or maintenance facilities, etc., generally involve a supported installation where pipelines may be directly exposed. Where such exposure involves a higher risk of injurious mechanical damage from moving equipment, etc., pressurized gas pipeline installation should be above, below or beyond the typical reach or path of moving equipment that could damage the pipeline. Installing safety shut-off valves can be prudent, as well as routing the pipeline away from high-traffic areas. Pipelines should be frequently supported and secured to provide restraint against movement or whipping in the event that a flexible pipeline material is severed. In more vulnerable areas, brittle low-toughness materials should be avoided, or should be encased in shatter-resistant materials to provide a barrier against injurious mechanical damage.

CONCLUSION

The Plastics Pipe Institute recommends that thermoplastics piping that transports pressurized gas should be evaluated and selected for the intended service, and should be installed so that the risk of injurious mechanical damage is mitigated to the greatest practical extent. When appropriately selected and properly installed, thermoplastic pipes can be effective conduits for transporting pressurized gases. In contrast, the use of inappropriate materials or improper installation can be unsafe and hazardous to property or persons.

In addition to the information in this recommendation, the Plastics Pipe Institute recommends the review of standard specifications for the piping product such as those from ASTM International and ASME. Standard specifications typically identify the intended service, the material requirements, design considerations, fabrication, inspection/examination, installation and limitations for the piping product. Examples of such product standards are ASME B31 series (B31.1/B31.3/ B31.5/ B31.8/ B31.12), ASME NM.1 Thermoplastic Piping Systems and the Cal-OSHA Unfired Pressure Vessel Safety Order, Title 8, Section 462 and Appendix C.

Piping product manufacturers should also be consulted about the intended service and installation, for the product MSDS, for information about product capabilities and limitations, and for product installation instructions and recommendations. Information is also available in publications from the Plastics Pipe Institute and other industry sources. Government regulations (safety standards) for hazardous gas pipelines should be reviewed and questions directed to regulatory authorities.