TR-2/2010
PPI PVC Range Composition Listing of Qualified Ingredients

PLASTICS·PIPE·INSTITUTE®

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Foreword

This technical report was developed and published with the technical help and financial support of the members of the PPI (Plastics Pipe Institute). The members have shown their interest in quality products by assisting independent standards-making and user organizations in the development of standards, and also by developing reports on an industry-wide basis to help engineers, code officials, specifying groups, and users.

PPI's PVC range composition and all applicable policies are included in this technical report. This technical report lists of each of the ingredients that have been accepted by the Hydrostatic Stress Board (HSB) by its commercial designation as qualified for use in PPI's PVC Range Composition. Requirements for acceptance are covered by applicable PPI policy or, in cases for which there is no applicable policy, the HSB may determine these requirements through a "Special Case" consideration. The listings included in this report also show allowable use levels for each ingredient and any other applicable limitation.

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PPI intends to revise this technical report annually, in response to comments and suggestions from users of the report. Please send suggestions of improvements to PPI. This report, as well as other publications, is available for download from PPI on the website www.plasticpipe.org.

The Plastics Pipe Institute

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I. Definitions Specific to TR-2

Vinyl Plastics – Compositions of polymers and ingredients that are based on polymers of vinyl chloride, or copolymers of vinyl chloride with other monomers, the vinyl chloride being in the greatest amount by mass. Within the context of TR-2 the term vinyl is limited to compositions of polyvinyl chloride (PVC).

Ingredient – Any chemical, mineral, polymer or other ingredient that has been added to a vinyl composition for the purpose of imparting certain desired processing or product performance properties.

Pre-qualified Ingredient – Any chemical, mineral, polymer, etc. having properties meeting the applicable requirements as set forth in Section III Part B.

Functionally Equivalent Ingredient – Any chemical, mineral, polymer, etc. not having properties meeting the applicable requirements as set forth in Section III Part B and shown to function in an equivalent manner through testing.

Combination Ingredient Package – A set ratio of a pre-blended combination of pre-qualified ingredients. As a service to formulators of PVC pipe compounders, some suppliers of ingredients make available "packages" of pre-blended combinations of Pre-qualified Ingredients provided: 1) each of its individual ingredients is qualified for such use; and 2) the net amount of each individual ingredient that is introduced into the composition, both through the "package" and by direct addition, is in compliance with the composition requirements for that ingredient. It is the responsibility of the formulator to make sure that the PPI PVC range composition is always prepared in accordance with the currently listed composition.

Functional Equivalent Ingredient Package – A set ratio of a pre-blended combination of ingredients containing an ingredient/ingredients that is not pre-qualified. This package will be accepted for listing upon completion of testing demonstrating that its use in PPI's PVC Range Composition continues to yield a PVC compound that complies with the minimum property requirements for cell class 12454, in accordance with ASTM D1784, and that qualifies for a 4,000 psi HDB, for water, for 73.4°F, in accordance with ASTM D2837. There is no standard protocol, or policy for effecting this demonstration. Minimum data requirements are established by the HSB for each case, depending on the nature of the ingredients, and the information already available. Those seeking to qualify these kinds of combinations of ingredients should make a "Special Case" request of the Chairman of the HSB.

PPI PVC Range Composition – A PVC composition, classified as PVC 1120, Class 12454 in accordance with applicable ASTM requirements, that carries a PPI recommended hydrostatic design basis (HDB) of 4,000 psi (27.58 MPa) for water for 73.4°F (23°C), with such basis having been established in accordance with requirements stated in PPI Technical Reports TR-2 and TR-3. This composition is maintained by the HSB of PPI and is made available for use by the general public.

Privately held PVC Composition – A privately held PVC composition that carries a PPI recommended hydrostatic design basis (HDB) that has been established based on the requirements of PPI Technical Reports TR-2 and TR-3. This private composition is maintained by a specific company or organization and is not made available by PPI to the general public.

Standard Grade (S) - A PPI HSB recommended rating that is valid for a five-year period, given to those materials that comply with the full data requirements of TR-2 and TR-3.

Experimental Grade (E) - A PPI HSB recommended rating that is valid for a limited duration, given to those materials covered by data that do not yet comply with the full requirements of the Standard Grade, but satisfy the applicable minimum preliminary data requirements that are detailed in TR-2 and TR-3. The owner of an experimental listing must understand there is a potential risk in commercial sale of an experimental ingredient in case it does not meet all theTR-2 requirements.

II. Introduction

It was recognized early in the evolution of the thermoplastics pipe industry that in consequence of its viscoelastic nature, the fracture strength of a thermoplastic polymer is significantly influenced – for any given set of conditions of temperature and environment – by duration of loading. The longer a load is sustained; the lower is the fracture strength. It was also recognized that the long-term strength of a thermoplastics composition is not only determined by the primary ingredient, the base polymer, but can also be profoundly influenced by the nature and quantity of ingredients – such as property modifiers, processing aids, stabilizers, and colorants – that are used to enhance performance and facilitate processing, and to give product identification. But in those early days there existed no standard method by which reliable design stresses could be established for thermoplastic compositions intended for pressure pipe. All too often, design stresses were based on results of relatively short-term loading with *safety factors* that – based on experience, educated guess, limited experience, or other rationale – were said to adequately compensate for the reduction in long-term strength that characteristically occurs with all plastics when subjected to prolonged loading. Unfortunately, this approach was not only inconsistent from material to material, but oftentimes it was unreliable. The long-term strength of some materials was overestimated, while that of others was underestimated.

To remedy this situation, the Thermoplastics Pipe Division (subsequently named the Plastics Pipe Institute) of the Society of the Plastics Industry established in November 1958 the Working Stress Subcommittee, the predecessor to the Hydrostatic Stress Board (HSB), consisting of technical persons well versed in the state-of-the-art of the evaluation and forecast of the long-term strength of plastics. Two and half years later, in April 1961, this group agreed on a uniform Tentative Method for Estimating Long-Term Hydrostatic Strength and Hydrostatic Design Stress of Thermoplastic Pipe; and in July 1963, it issued its first hydrostatic design stress recommendations for compositions for which data had been submitted in accordance with this method.

A frequent challenge to the HSB was the evolutionary nature of the industry, particularly in the case of PVC pipe compositions. At first, each PVC composition was a fixed and very specific composition, with the use level and identity of each ingredient spelled out. The ingredient identification would often consist of a manufacturer's trade designation. In search of more effective and less costly sources of ingredients, companies holding listings for PVC compositions would often qualify alternative sources of a certain ingredient. To demonstrate qualification a company had to submit to the HSB extensive long-term data that showed the proposed change would not compromise a listed composition's long-term strength. From the knowledge learned by this work, policies were developed whereby a newly proposed ingredient, for example, a calcium carbonate – can qualify for that purpose provided it is demonstrated that its physical and chemical properties comply to requirements that have been established for that class of ingredient based on results of industry wide testing. These policies provided for pre-qualification of ingredients that greatly facilitated the process of determining equivalence.

Later on, during the seventies, the concept of "PVC range compositions" was introduced. As new and improved extrusion technology began to be used, it was discovered that fine-tuning the quantity of certain ingredients – particularly, so called "internal" and "external" lubricants – would greatly benefit production rate and product quality. To avoid the impracticality of having to qualify each composition variation, industry expanded their fixed content recipes into range compositions, whereby the allowable content of certain ingredients was defined not by a

fixed amount but rather, by a minimum/maximum range. The acceptable ranges of ingredient content had also to be established by long-term data documentation.

To make it possible to use resins and other ingredients from different suppliers, extruders of PVC pipe had to qualify a number of "different" range PVC compositions – each provided by a different resin supplier – which in fact were often times quite the same except for source of resin, or some other key ingredient. For a manufacturer of a new ingredient, or of an alternative to an existing ingredient, having to qualify his product for inclusion in the many private PVC range compositions that then abounded was a costly and time consuming process. In recognition of this situation, the HSB proposed in 1983 to establish a single, generic and public PVC range composition which then included all PVC resins and ingredients which had been qualified in privately held compositions of the same kind. To accomplish this required the cooperation of all major holders of PVC compositions, including their willingness to share with the HSB their confidential recipes. This cooperation was obtained, the compositions of the many stress-rated compositions were compared, and a single, generic, state-of-the-art composition was established which allowed a wide choice in PVC resins and in ingredients.

The HSB next worked on defining the policies and procedures for qualifying new ingredients. In 1985 the PPI PVC range composition and related policies were agreed upon and are published in this report. Since that time many new alternate ingredients have been qualified for use in this composition.

The policies and procedures in this Technical Report are intended to cover ingredient listings for most PVC piping applications. PPI recognizes there may be unusual cases, issues or circumstances that are not covered in TR-2, and that may justify an exception to the standard policies. To allow manufacturers an opportunity to have their ingredient(s) listed by PPI when this occurs, the HSB has provided a "Special Case" system. The manufacturer may present its "Case" to the HSB at one of their two annual meetings, usually in February and August, using the approved "Special Case" form in TR-3. All information provided to HSB in these special cases will be made available for review only by HSB members and PPI staff, and will be held by them in strict confidence, in accordance with PPI's written confidentiality procedures (available from the HSB Chairman). There is a PPI fee for each special case. You must contact the HSB Chairman well in advance of each meeting to arrange for your special case. A completed HSB submission form **must** be received at least two (2) weeks prior to the HSB meeting to permit HSB consideration at that meeting.

III. PPI PVC Range Composition

The HSB has classified all ingredients in the PPI PVC range composition into four classes. Two classes cover **pre-qualified ingredients (Part A)** and the other two cover **functional equivalents (Part B)**, as follows:

- Ingredients that are **pre-qualified** for use in PPI's PVC Range Composition by the demonstration of the ingredient's compliance to chemical and physical property requirements of the applicable HSB policy;
- Packages (blends) of **pre-qualified** ingredients;
- Ingredients that although not meeting applicable pre-qualification requirements for that class of ingredient they exhibit an **equivalent function;**
- Packages (blends) of qualified ingredients, one or more of which is a **functional equivalent** to a pre-qualified ingredient.

In its continuing commitment to provide effective service to the industry, this TR-2 lists qualified ingredients in accordance with the above classification system.

Because the PPI PVC Range Composition has been established from a matrix of PPI listed range compositions – each of which has a 4,000 psi hydrostatic design basis at 73.4˚F that has been established through extensive stress-rupture testing – a company may obtain a *dependent* listing under this composition without having to submit any additional stress-rupture data. However, a company obtaining a dependent listing under PPI's PVC Range Composition must agree to formulate, and only use the materials as prescribed by Part A. Information on how a dependent listing may be obtained is given in Appendix A.

Part A. Pre-qualified Ingredients Exempted From Stress-Rupture Testing

An individual or combination ingredient that meets the allowable content range in Table 1 and the physical property requirements of Part A is a pre-qualified ingredient and is exempt from stress rupture testing for qualification. An ingredient manufacturer may still elect to publish this pre-qualified ingredient in the appropriate table in TR-2.

A PVC composition that complies with the minimum property requirements of cell class 12454 according to ASTM D 1784 and that satisfies the limitations of the PVC range formulation given in Table I, qualifies for a recommended hydrostatic design basis (HDB) of 4,000 psi at 73^{o}F (23^{o}C) without the need to submit the stress-rupture data. A manufacturer wishing to register this PVC range composition for use in his plant should apply to the Chairman of PPI's HSB and identify the manufacturer's commercial designation for this composition. These PVC compositions are dependent on the PPI PVC range composition and are published in PPI TR-4.

TABLE I

PPI PVC RANGE COMPOSITION FOR LISTING AT 73°F (23°C)

Ingredient	Qualification Requirements	Allowable Content Range (in parts per hundred parts of resin)
PVC Resin	**Compliance to B.1 and Listing by PPI**	**100**
Heat Stabilizer	**Compliance to B.2 and Listing by PPI**	**0.3 - 1.0**
Calcium Stearate	**Compliance to A.2**	**0.4 - 1.5**
Paraffin Wax	**Compliance to A.3**	**0.6 -1.5**
Polyethylene Wax	**Compliance to A.4**	**0.0 - 0.3**
Titanium Dioxide	**Compliance to A.5**	**0.5 - 3.0**
Calcium Carbonate	**Compliance to A.6**	**0.0 - 5.0**
Process Aid	**Compliance to B.2 and Listing by PPI**	**0.0 -2.0**
Colorant	**Compliance to B.2 and Listing by PPI, or compliance to TR-3 Part D.1**	**See Table 9**
Combination and Functional Equivalent	**Listing By PPI**	

NOTE: See TR-2, Section IV for listing of Prequalified and Functionally Equivalent Ingredients

The pipe manufacturer is encouraged to perform some stress-rupture testing on any combination of ingredients that is new to him to ensure that the anticipated strength is realized under the selected processing conditions. One of the best means to check for proper processing is by use of either the Accelerated Regression Test (ASTM D 2241) or other long-term stress-rupture data generated in accordance with ASTM D 1598 and analyzed by the method of least squares as described in ASTM D 2837.

Part A.1 PVC Resin

This policy only applies to suspension grades of PVC resins.

There are no pre-qualified PVC resins for the PPI PVC Generic Range Formulation. All PVC resins must be qualified according to Part B.

PVC Resin made in a new plant – For equivalent PVC resin that is currently listed in TR-2 that is made in a new plant, a provisional listing will be granted based on manufacturer's data supporting equality of the resin through chemical and physical property analysis. E-2 level hydrostatic data is required for a standard grade listing.

Part A.2 Calcium Stearate

The following guidelines are not to be considered as specifications or standards to indicate the requirements for calcium stearates, nor is it intended that they describe all the commercial calcium stearates that are suitable for use in polyvinyl chloride (PVC) plastic pipe compounds. The intent is only to give guidelines for alternative use of members of a group of commercial calcium stearates that are apparently chemically identical and that have been found by physio-chemical analysis, by engineering pipe testing, and by use of pipe in the field to be sufficiently similar in nature to produce pipe and fittings that are basically the same in properties and performance. Consideration has been given to physio-chemical analysis of the calcium stearates, long-term hydrostatic pressure testing of pipe, and requirements of the applicable pipe standards.

Commercial calcium stearates may be substituted one for another in polyvinyl chloride (PVC) plastic pipe and fitting compounds without additional long-term pipe testing provided (1) the substitution is for the same amount, (2) the substitution in the compound is 1.5 parts or less per hundred parts of resin and (3) the properties fall within the ranges given below:

Property (See Note 1)	**Requirements**
Melting Point, °F (°C)	293-329 (145-165)
Chlorides, as chloride ion, %, max	0.3
Free fatty acid, %, max	1.0
Acid number (See Note 2)	200 +/- 15
Iodine value, max (See Note 2)	5.0
Volatile content, at 221 °F (105 °C), %, max	3.5
Ash, as CaO, at 1832 °F (1000 °C)	9.00 – 12.0
Iron, ppm, max	100
Color	White to off-white
Particle Size	At least 95% through U.S. Standard 20 mesh

NOTE 1: The test methods shall be those commonly used in the calcium stearate industry.
NOTE 2: Acid number and iodine value apply to the stearic acid raw material.

Calcium stearates not meeting these guidelines may be evaluated as a functional equivalent in accordance with the policies and procedures in Part B of TR-2. When sufficient data, background, and successful usage, both in production and service, have been developed with other calcium stearates, they may be considered for inclusion in a new group under these guidelines.

Part A.3 Paraffinic Hydrocarbon Wax

The following guidelines are not to be considered as specifications or standards to indicate the requirements for hydrocarbon waxes, nor is it intended that they describe all the commercial hydrocarbon waxes that are suitable for use in polyvinyl chloride plastic (PVC) pipe compounds. The intent is only to give guidelines for the alternate use of members of a group of commercial paraffinic hydrocarbon waxes that have been found by physio-chemical analysis, by engineering pipe testing, and by use of pipe in the field to be sufficiently similar in properties and performance. Consideration has been given to physio-chemical analysis of the hydrocarbon waxes, long-term hydrostatic pressure testing of pipe, and requirements of the applicable standards (See Note 1).

Commercial paraffinic hydrocarbon waxes may be substituted one for another in polyvinyl chloride (PVC) plastic pipe and fitting compounds without additional long-term pipe testing provided (1) the substitution is for the same amount, (2) the substitution in the compound is 1.5 parts or less per hundred parts of resin, (3) the particle size is approximately the same and (4) the properties fall within the ranges given below:

PROPERTY	**TEST METHOD** (See Note 2)	**REQUIREMENT**
Chemical Type		*Hydrocarbon wax
Congealing Point,°F (°C)	ASTM D938	149 – 169 (65 – 76)
Viscosity at 210 °F	ASTM D445	5.5 – 7.5 cSt
Kinematic Carbon Number Distribution of Normal Hydrocarbons	ASTM D5442	Min 80% C26 – C50 <20% C26 and below <10% above C50 Zero above C85
Non-normal paraffin	ASTM D5442	10 – 50% Content
Needle Penetration (77°F)	ASTM D1321	10 – 18
Oil Content	ASTM D721	1% max
Flash point, °F (°C)	ASTM D92	446 (230)
Color (Saybolt)	ASTM D156	+10 min
Acid Number	ASTM D1386	0.5 max
Density, g/cm3	ASTM D792	0.915 – 0.940
Physical Appearance		Small uniform flake Prill or powder**

*Hydrocarbon waxes containing linear and branched chains with carbon numbers from C20 to C60.

** This requirement is not applicable when the wax is added as a liquid.

NOTE 1: Hydrocarbon waxes not meeting these guidelines may be evaluated as a functional equivalent in accordance with the policies and procedures in Part B of TR-2. When sufficient data, background, and successful usage, both in production and service, have been developed with other hydrocarbon waxes, they may be considered for inclusion in a new group under these guidelines.

NOTE 2: The test methods not prescribed shall be those currently used in the industry.

Part A.4 Polyethylene Wax

The following guidelines are not to be considered as specifications or standards to indicate the requirements for polyethylene waxes, nor is it intended that they describe all the commercial polyethylene waxes that are suitable for use in polyvinyl chloride (PVC) plastic pipe compounds. The intent is only to give guidelines for alternative use of members of a group of commercial polyethylene waxes that are apparently identical and that have been found by physio-chemical analysis, by engineering pipe testing, and by the use of pipe in the field to be sufficiently similar in nature to produce pipe and fittings that are basically the same in properties and performance. Consideration has been given to physio-chemical analysis of the polyethylene waxes, long-term hydrostatic pressure testing of pipe, and requirements of the applicable standards (See Note 1).

Commercial polyethylene waxes may be substituted one for another in polyvinyl chloride (PVC) plastic pipe and fitting compounds without additional long-term pipe testing provided (1) the substitution is for the same amount, (2) the substitution in the compound is 0.3 parts or less per hundred parts of resin and (3) the properties fall within the ranges given below:

PROPERTY	ASTM TEST METHOD	REQUIREMENT
Gardner Color (Molten Wax)	D-1544	4 max
Flash point, minimum ^{o}F (^{o}C)	D-92	500 (260) open cup 425 (218) closed cup
Ring and Ball Softening Point, ^{o}F (^{o}C) Or Mettler Drop Point Test, ^{o}F (^{o}C)	E-28 D3954	210 - 225 (99 - 107) 203 – 221 (95 – 105)
Thermosel Viscosity @ 283^{o}F (140^{o}C) cp	D-3236	70 - 400
Penetration Hardness	D-5	3 - 6
Acid Number, mg KOH/g	(1)	10 - 18

(1) The test method may be any that is commonly used by the industry such as Allied Chemical W-305-TW-1 or Eastman Chemical ECD 27-102.

NOTE 1: Polyethylene waxes not meeting these guidelines may be evaluated as a functional equivalent in accordance with the policies and procedures in Part B of TR-2. When sufficient data, background, and successful usage, both in production and service, have been developed with other polyethylene waxes, they may be considered for inclusion in a new group under these guidelines.

Part A.5 Titanium Dioxide

The following guidelines are not to be considered as specifications or standards to indicate the requirements for titanium dioxides, nor is it intended that they describe all the commercial titanium dioxides that are suitable for use in polyvinyl chloride (PVC) plastic pipe compounds. The intent is only to give guidelines for alternative use of members of a group of commercial titanium dioxides that are apparently chemically identical and that have been found by physiochemical analysis, by engineering pipe testing, and by use of pipe in the field, to be sufficiently similar in nature to produce pipe and fittings that are basically the same in properties and performance. Consideration has been given to physiochemical analysis of the titanium dioxides, long-term hydrostatic pressure testing of pipe, and requirements of the applicable pipe standards. (See Note 1)

Commercial titanium dioxides may be substituted one for another in polyvinyl chloride (PVC) plastic pipe and fitting compounds without additional long-term pipe testing provided (1) the substitution is for the same amount, (2) the substitution in the compound is three parts or less per hundred parts of resin, and (3) they meet the following requirements:

Property (See Note 2):	
Crystal structure	Rutile
Particle size	
Average, microns	0.10 - 0.35
Retained on 325 mesh screen, %, max	0.20
Titanium dioxide content, %, min	92.00
Chemical modification	alumina and/or silica
Carbon content, at 1652 °F (900 °C), %, max (burn and measure carbon dioxide)	0.30
Volatile content loss at 221 °F (105 °C), %, max	0.70
Specific gravity	4.0 - 4.3

NOTE 1. Titanium dioxides not meeting these guidelines may be evaluated as a functional equivalent in accordance with the policies and procedures in Part B of TR-2. When sufficient data, background and successful usage, both in production and service, have been developed with other titanium dioxides, they may be considered for inclusion in a new group under these guidelines.

NOTE 2. The test methods shall be those described in ASTM D 476, "Standard Specification for Titanium Dioxide Pigments."

Part A.6 Calcium Carbonate

The following guidelines are not to be considered as specifications or standards to indicate the requirements for calcium carbonate, nor is it intended that they describe all the commercial calcium carbonates that are suitable for use in polyvinyl chloride (PVC) plastic pipe and fitting compounds. The intent is only to give guidelines for the alternative use of members of two groups of commercial calcium carbonates that are apparently chemically identical (within each group) and that have been found by physio-chemical analysis, by engineering pipe testing, and by use of pipe in the field to be sufficiently similar (within each group) in nature to produce pipe and fittings that are basically the same in properties and performance. Consideration has been given to physio-chemical analysis of the calcium carbonates, long-term hydrostatic pressure testing of pipe, and requirements of the applicable pipe standards.

These guidelines cover two separate groups of calcium carbonates, Group A in which the particles are not coated with another material and Group B in which the particles are coated with commercial calcium stearate and/or stearic acid. Substitutions may be made within a group but not from one group to the other (See Note 1).

Group A (uncoated particles)
Uncoated commercial calcium carbonates may be substituted one for another in polyvinyl chloride (PVC) plastic pipe and fitting compounds without additional long-term testing provided (1) the substitution is for the same amount, (2) the amount used in the compound is five parts or less per hundred parts of resin, and (3) the properties fall within the ranges given below:

PROPERTY (PMD Test Methods – See Appendix B)		**REQUIREMENT**
General Description		**Calcium carbonate (Uncoated particles)**
Chemical analysis		
	Calcium carbonate analysis, min	94.00%
	Iron, as ferric oxide, max	0.25%
	Silica, SiO_2, max.	1.25%
	Weight loss at 221 °F (105 °C), max	0.50%
Particle properties		
	Type	Microcrystalline
	Size, micron, range	0.02 - 15.00
	Size, micron, mean	0.05 - 3.50
Other properties		
	Density, g/cm^3	2.65 - 2.71

Group B (Stearate coated)
Stearate coated commercial calcium carbonates may be substituted one for another in polyvinyl chloride (PVC) plastic pipe and fitting compounds without additional long-term pipe testing provided (1) the substitution is for the same amount, (2) the amount used in the compound is five parts or less per hundred of resin, and (3) the properties fall within the ranges given below:

PROPERTY (PMD Test Methods)		REQUIREMENT
General Description		Calcium carbonate coated with calcium stearate (a)
Chemical analysis		
	Calcium carbonate analysis, min	93.00%
	Iron, as ferric oxide, max	0.25%
	Silica, SiO_2, max.	1.25%
	Weight loss at 221°F (105°C), max	0.50%
	Fatty acids, as stearic acid	0.75 - 2.00
Particle properties		
	Type	Microcrystalline
	Size, micron, range	0.02 - 15.00
	Size, micron, mean	0.05 - 3.50
Other properties		
	Density, g/cm^3	2.65 - 2.71

(a) This group covers commercial calcium carbonates in which the particles are coated with commercial grades of calcium stearate and/or stearic acid. The fatty acid mixtures in these stearates are over 50 percent by weight stearic acid (C18) with other fatty acids, mainly palmitic (C16) and a small amount of myristic (C14).

NOTE 1: Calcium carbonates not meeting either of these two groups of guidelines may be evaluated as a functional equivalent in accordance the policies and procedures in Part B of TR-2. When sufficient data, background, and successful usage both in production and service have been developed with other calcium carbonates, they may be considered for inclusion in a new group under these guidelines.

Part B. PVC Resin, Functionally Equivalent and Other Ingredients Not Exempted From Stress-Rupture Testing - Data Requirements for Listing at 73ºF (23ºC)

An individual or combination ingredient that does not meet the allowable content range in Table 1 or the physical property requirements of Part A is a functionally equivalent ingredient and is not exempt from stress rupture testing. All functionally equivalent ingredients are published in the appropriate tables in TR-2.

The principal consideration in the establishment of policies and rulings regarding the determination of equivalence of a commercially offered ingredient for its use in PPI's PVC Range Composition is the potential adverse effect that the subject ingredient can have on the short-term and the long-term properties of the resultant composition. This composition must always be formulated so that it is in compliance with the ASTM requirements for PVC 1120 materials, Class 12454 as per ASTM D 1784. A particular concern of the HSB is that the long-term hydrostatic strength of this composition should always satisfy the ASTM requirements for a hydrostatic design basis (HDB) of 4,000 psi (27.58 MPa) for water at 73.4°F (23°C). It is not the HSB's role to consider the effect of the use of an alternate ingredient on the quality of the fluid that may be transported by the piping made from PPI's PVC Range Composition. This consideration is left to others. In the case of the transport of potable water the most commonly referenced standards that address this issue are NSF/ANSI Standard 14, "Plastics Piping Systems components and Related Materials", and NSF/ANSI Standard 61, "Drinking Water System Components – Health Effects". Agencies, such as NSF International, have established programs by which plastic piping compositions, including each of the composition's ingredients, are evaluated in accordance with these standards and listed when found acceptable. Because of their additional health effects criteria, some of the ingredients listed in this report may not be included in listing issued by these certifying agencies. Agencies certifying compliance to the above listed NSF/ANSI standards should be contacted for the specifics relating their listing programs.

This policy is intended only to apply to the PPI Range Composition, with alternative formulation components that have been determined to be satisfactory for the commercial production of PVC pressure pipe yielding a 4,000-psi HDB for water at 73ºF (23ºC). The requirements given herein are not to be considered as specifications or standards that describe the only PVC range formulation and components suitable for production of PVC 1120 or PVC 1220 pipe.

Part B.1 PVC Resin

This policy only applies to suspension grades of PVC resins.

1. The PVC resin must meet the property requirements given below:

PROPERTY	TEST METHOD	REQUIREMENT
Type of Material	**------**	**PVC Homopolymer**
Inherent Viscosity	**ASTM D1243**	**0.88 - 0.96**
Heat Loss (water); % by weight	**1 Hr @ 221ºF (105ºC)**	**0.5 max**
Apparent Bulk Density, gm/cc	**ASTM D1895**	**0.46 - 0.62**
Compacted Bulk Density, gm/cc	**------**	**0.54 - 0.72**
RVCM	**------**	**10 ppm max**

2. Stress-rupture data obtained on pipe extruded on commercial equipment from a PVC composition with components falling within the ranges given in Part A, except for liquid stabilizer and calcium carbonate which must be at the maximum levels, confirm that the use of the alternate PVC resin yields the anticipated HDB of 4,000 psi for water for 73°F (23°C). The data must be obtained in accordance with TR-3 and evaluated according to ASTM D 2837.

a. Experimental listing of a new PVC resin shall be available upon the presentation of acceptable E-2 or higher-grade data for one lot of pipe. The experimental listing expires one year following the effective date. **The owner of an experimental listing must understand there is a potential risk in commercial sale of an experimental ingredient in case it does not meet all theTR-2 requirements.**
b. Standard listing, with no expiration date, shall be available upon the presentation of acceptable E-10, or higher-grade data for one lot and E-2, or higher-grade data on two other lots.

Part B.2 Heat Stabilizer, Process Aid, Colorant and other Components Not Complying to Part A

Any heat stabilizer, process aid, or colorant and any calcium stearate, paraffin wax, polyethylene wax, titanium dioxide or other ingredient not meeting the guidelines given in Part A will be accepted for listing when the appropriate stress-rupture data confirm the anticipated HDB of 4,000 psi for water at 73°F (23°C) when evaluated according to ASTM D 2837. The data shall be obtained on pipe extruded on commercial equipment and from a composition that falls within the ranges listed in Part A except for the subject component that shall be at the maximum proposed use level. In cases where the minimum proposed use level is greater than zero, the composition shall be formulated in two lots with the subject component at the maximum proposed use level and with the subject component at the minimum proposed use level. The data must be obtained in accordance with TR-3 and evaluated according to ASTM D 2837.

a. Experimental listing of the component shall be available upon the presentation of acceptable E-2 or higher-level data for one lot of pipe that has been formulated with the subject component at the maximum proposed use level. The experimental listing expires one year following its effective date. **The owner of an experimental listing must understand there is a potential risk in commercial sale of an experimental ingredient in case it does not meet all the TR-2 requirements.**

b. Standard listing, with no expiration date, shall be available upon the presentation of acceptable E-10 or higher-grade data for one lot and E-2 or higher-grade level data for two other lots. One of these lots of pipe shall include the subject component at the minimum proposed use level as required per the above paragraph. Each of these three lots shall be formulated with different qualified PVC resin.

Part C. Standard Industry Practice of High Intensity Mixing of PVC Pipe Compounds

It is recognized that the method of mixing affects dispersion of ingredients in compounds and potentially the quality of pipe. Therefore, when qualifying new chemically equivalent ingredients to the current *PPI Range Formula* the method of mixing is to be described.

Part E.1 of TR-3 describes the standard industry practice of high intensity mixing of PVC pipe compounds.

IV. Listings of Pre-Qualified and Functionally Equivalent Ingredients

TABLE 1 – PVC RESIN

Ingredient Class	Qualification Requirement	Allowable Use Level (Phr)
PVC Resin	Listing by PPI or compliance to Section III Part A.1	100.0

Manufacturer	Product	Note
Braskem S.A.	NORVIC SP 767RA PROCESSA+	
CertainTeed Corporation	Certavin CT-1110	
Formosa Plastics Corp.	Formolon 622	
Formosa Plastics Corp.	Formolon 622F	
Formosa Plastics Corp.	Formolon S-65	
Georgia Gulf Chemicals	Georgia Gulf 1091	
Georgia Gulf Chemicals	Georgia Gulf 5385	
Georgia Gulf Chemicals	Georgia Gulf 566	
Georgia Gulf Chemicals	Georgia Gulf K5385	
Grupo Primex	PRIM-225-2	
Oxy Vinyls, LP	OxyVinyls 225	
Oxy Vinyls, LP	OxyVinyls 225 G	
Oxy Vinyls, LP	OxyVinyls 225 P	
PETCO	PVC-440	
Policyd, S.A. de C.V.	VINYCEL 103 EPF-76	
Reliance Industries Ltd.	Reon K67-01	
Shintech, Inc.	S6704	
Shintech, Inc.	SE1100	
Shintech, Inc.	SE-950	
Shintech, Inc.	SE-950EG	
Shintech, Inc.	SE-950W	
Shintech, Inc.	TK-1000	
Solvin S.A.	266 RC	
Solvin S.A.	267 RC	
Westlake PVC Corporation	Westlake 1230P_K	

* Denotes experimental or provisional listing

TABLE 2 – HEAT STABILIZER

Ingredient Class	Qualification Requirement	Allowable Use Level (phr)
Heat Stabilizer	Listing by PPI	0.3 – 1.0 (unless otherwise stated)

Manufacturer	Product	Limitations	Range, phr
Akcros Chemicals	Interstab T-5277		0.3 - 1.0
Arkema, Inc.	DM-9924		0.3 - 1.0
Arkema, Inc.	PA-1121		0.3 - 1.0
Arkema, Inc.	PA-2410B		0.3 - 1.0
Arkema, Inc.	PA-4062		0.3 - 1.0
Arkema, Inc.	Thermolite 121		0.3 - 1.0
Arkema, Inc.	Thermolite 130*	Expires 6/30/10	0.3 - 1.0
Arkema, Inc.	Thermolite 135*	Expires 6/30/10	0.3 - 1.0
Arkema, Inc.	Thermolite 140		0.3 - 1.0
Arkema, Inc.	Thermolite 150		0.3 - 0.4
Arkema, Inc.	Thermolite 161		0.3 - 1.0
Arkema, Inc.	Thermolite 170		0.3 - 0.5
Arkema, Inc.	Thermolite 176		0.3 - 1.0
Arkema, Inc.	Thermolite 176C		0.3 - 1.0
Arkema, Inc.	Thermolite 178		0.3 - 1.0
Arkema, Inc.	Thermolite 197		0.3 - 1.0
Chemtura	Mark 1925		0.3 - 1.0
Chemtura	Mark 1928		0.3 - 1.0
Chemtura	Mark 1930		0.3 - 1.0
Chemtura	Mark 1939		0.3 - 1.0
Chemtura	Mark 1939-RLD		0.3 - 1.0
Chemtura	Mark 1971		0.3 - 1.0
Chemtura	Mark 2903		0.3 - 1.0
Dow Chemical Co.	Advastab TM-283SP		0.3 - 1.0
Dow Chemical Co.	Advastab TM-3412		0.3 - 1.0
Dow Chemical Co.	Advastab TM-691		0.3 - 1.0
Dow Chemical Co.	Advastab TM-694		0.3 - 1.0
Dow Chemical Co.	Advastab TM-694-OM		0.3 - 1.0
Dow Chemical Co.	Advastab TM-696		0.3 - 1.0
Dow Chemical Co.	Advastab TM-697		0.2 - 1.0
Dow Chemical Co.	Advastab TM-697-OM		0.2 - 1.0
Dow Chemical Co.	Advastab TM-698		0.3 - 1.0
Dow Chemical Co.	Advastab TM-900F		0.3 - 1.0
PQ Corporation	ADVERA 401F	See Note 1	0.0 - 0.4
PQ Corporation	ADVERA 401PS	See Note 1	0.0 - 0.3

Reagens USA	RT-6610		0.3 - 1.0
Reagens USA	RT-6611		0.3 - 1.0
Reagens USA	RT-6611A		0.3 - 1.0
Reagens USA	RT-6611S		0.3 - 1.0
Reagens USA	RT-6612		0.3 - 1.0

NOTE 1: ADVERA 401 PS or ADVERA 401 F are co-stabilizers and **must** be used in conjunction with other approved tin stabilizers. The maximum amount of ADVERA 401 PS is 30% and 70% tin stabilizer. The maximum amount of ADVERA 401 F is 40% and 60% tin stabilizer. The total combined loading of the stabilizer and co-stabilizer must not exceed 1.0 phr, but must meet minimum stabilizer levels.

* Denotes experimental or provisional listing

TABLE 3A – CALCIUM STEARATE

Note – Tables of Prequalified Ingredients contain products commonly used by industry. Calcium stearates in compliance with Section III Part A.2 need not appear on this table to be used in the PPI Range Composition.

Ingredient Class	Qualification Requirement	Allowable Use Level (phr)
Calcium Stearate	Compliance to Section III Part A.2	0.4 – 1.5

Manufacturer	Product	Range, phr
Dover Chemical Corporation	Doverlube CA-20	0.4 - 1.5
Dover Chemical Corporation	Doverlube CA-21	0.4 - 1.5
Dover Chemical Corporation	Doverlube CA-22	0.4 - 1.5

TABLE 3B – CALCIUM STEARATE FUNCTIONAL EQUIVALENT

Note – Cannot be used with other functional equivalents.

Manufacturer	Product	Limitations	Range, phr

* Denotes experimental or provisional listing

TABLE 4A – PARAFFIN WAX

Note – Tables of Prequalified Ingredients contain products commonly used by industry. Paraffin waxes in compliance with Section III Part A.3 need not appear on this table to be used in the PPI Range Composition.

Ingredient Class	Qualification Requirement	Allowable Use Level (phr)
Paraffin Wax	Compliance to Section III Part A.3	0.6 – 1.5

Manufacturer	Product	Limitations	Range, phr
Dover Chemical Corporation	Doverlube PW-10		0.6 - 1.5
Ferro Polymer Additives	PETRAC 165		0.6 - 1.5
Honeywell Inc.	LOOBWAX 0597		0.6 - 1.5
Honeywell Inc.	RL 165		0.6 - 1.5
Honeywell Inc.	RL 250		0.6 - 1.5
Rheogistics LLC	Synertive Rx-165		0.6 - 1.5
Rheogistics LLC	Synertive Rx-170		0.6 - 1.5

TABLE 4B – PARAFFIN WAX FUNCTIONAL EQUIVALENT

Note – Cannot be used with other functional equivalents.

Manufacturer	Product	Limitations	Range, phr	Exp
Honeywell Inc.	HPL-6310*		0.6 - 1.5	12/31/10
Honeywell Inc.	HPL-6320*		0.6 - 1.5	12/31/10
Honeywell Inc.	HPL-6330*		0.6 - 1.5	12/31/10
International Group	INTERFLO 39		0.6 - 1.5	
Reagens USA	C WAX 100		0.6 - 1.5	
Reagens USA	C WAX 182		0.6 - 1.5	
Reagens USA	RW 1600		0.6 - 1.5	
Sasol Wax North America	Sasolwax B52		0.6 - 0.8	
Sonneborn, Inc.	HYDROBRITE PVC OIL		1.0 - 2.0	
Suncor Energy Inc.	Puretol PSO 550		1.0 - 2.0	

* Denotes experimental or provisional listing

TABLE 5A – POLYETHYLENE WAX

Note – Tables of Prequalified Ingredients contain products commonly used by industry. Polyethylene waxes in compliance with Section III Part A.4 need not appear on this table to be used in the PPI Range Composition.

Ingredient Class	Qualification Requirement	Allowable Use Level (phr)
Polyethylene Wax	Compliance to Section III Part A.4	0.0 – 0.3 (unless otherwise stated)

Manufacturer	Product	Limitations	Range, phr
Ferro Polymer Additives	PETRAC 215		0.0 - 0.3
Honeywell Inc.	A-C 629		0.0 - 0.5
Honeywell Inc.	A-C 629A		0.0 - 0.5
Honeywell Inc.	A-C 629P		0.0 - 0.5
Honeywell Inc.	A-C 629PA		0.0 - 0.5
Honeywell Inc.	A-C 630P		0.0 - 0.5
Honeywell Inc.	A-C 630PA		0.0 - 0.5
Rheogistics LLC	Synertive Rx-215		0.0 - 0.3

TABLE 5B – POLYETHYLENE WAX FUNCTIONAL EQUIVALENT

Note – Cannot be used with other functional equivalents.

Manufacturer	Product	Limitations	Range, phr
BASF Corporation	LUWAX OA5		0.0 - 0.3
Honeywell Inc.	A-C 307		0.0 - 0.5
Honeywell Inc.	A-C 307A		0.0 - 0.5
Honeywell Inc.	A-C 316		0.0 - 0.5
Honeywell Inc.	A-C 316 A		0.0 - 0.5
L&L Industrial Chemicals	LUBOL RAL XX		0.0 - 0.3
Sasol Wax North America	Sasolwax A28		0.0 - 0.3

* Denotes experimental or provisional listing

TABLE 6A – TITANIUM DIOXIDE

Note – Tables of Prequalified Ingredients contain products commonly used by industry. Titanium Dioxides in compliance with Section III Part A.5 need not appear on this table to be used in the PPI Range Composition.

Ingredient Class	Qualification Requirement	Allowable Use Level (phr)
Titanium Dioxide	Compliance to Section III Part A.5	0.5 – 3.0

Manufacturer	Product	Limitations	Range, phr
Camia Trade	Crimea Titan CR-02		0.5 - 3.0
Camia Trade	Sumtitan-R206		0.5 - 3.0

TABLE 6B – TITANIUM DIOXIDE FUNCTIONAL EQUIVALENT –Liquid Dispersed

Note – PPI Range Composition requires 0.5-phr minimum titanium dioxide content meeting the requirements of Section III Part A.5. Functional equivalents must demonstrate equivalent weathering performance when formulated at their minimum use level.

Manufacturer	Product	Limitations	Range, phr
ColorMatrix Corp.	90-004-NS, Blue	See Note 1	0.7 - 1.3
ColorMatrix Corp.	90-014-NS, Blue	See Note 1	0.7 -1.1
ColorMatrix Corp.	91-002-NS, White	See Note 1	0.7 - 1.0
ColorMatrix Corp.	91-003-NS, Bright White	See Note 1	0.7 - 1.0
ColorMatrix Corp.	91-006-NS, White	See Note 1	0.6 - 1.4
ColorMatrix Corp.	91-020-NS, White	See Note 1	0.6 - 1.4
ColorMatrix Corp.	91-030-NS, White	See Note 1	0.6 - 2.0
Ferro Corporation	Spectraflo 98-105040	Note 3	0.65 - 1.1
Ferro Corporation	Spectraflo 98-11088*	Note 3; exp 6/30/10	0.63 - 0.94
Ferro Corporation	Spectraflo 98-11090*	Note 3; exp 6/30/10	0.62 - 0.94
Ferro Corporation	Spectraflo 98-11091*	Note 3; exp 6/30/10	0.65 - 0.87
KibbeChem, Inc	KC-TI75 Blue	Note 2	0.67 - 1.35
KibbeChem, Inc	KC-TI75 Gray	Note 2	0.67 - 1.35
KibbeChem, Inc	KC-TI75 Green	Note 2	0.67 - 1.35
KibbeChem, Inc	KC-TI75 White	Note 2	0.67 - 1.35
KibbeChem, Inc	KC-TI80 White	Note 2	0.63 - 1.35
KibbeChem, Inc	KC-TI85 White	Note 2	0.59 - 1.35
RITE Systems	LQC-W1156-1		0.65 - 2.0

* Denotes experimental or provisional listing

NOTE 1: When using any of the ColorMatrix liquid titanium dioxide dispersions, additional titanium dioxide may be added but it must be in dry form, comply with Section III Part A.5, and cannot exceed the following amounts:

Dispersion	Maximum additional TiO_2 (phr)
90-004-NS Blue	2.0
90-014-NS Blue	1.75
91-002-NS White	2.1
91-003-NS Bright White	2.3
91-006-NS White	1.9
91-020-NS White	1.9
91-030-NS White	1.3

NOTE 2: When using any of the KibbeChem liquid titanium dioxide dispersions, additional titanium dioxide may be added, but it must be in dry form, comply with Section III Part A.5, and cannot exceed the following amounts:

Dispersion	Maximum additional TiO_2 (phr)
KC-TI75 Blue	2.0
KC-TI75 Gray	2.0
KC-TI75 Green	2.0
KC-TI75 White	2.0
KC-TI80 White	1.92
KC-TI85 White	1.85

NOTE 3: When using any of the Ferro Corporation liquid titanium dioxide dispersions, additional titanium dioxide may be added, but it must be in dry form, comply with Section III Part A.5, and cannot exceed the following amounts:

Dispersion	Maximum additional TiO_2 (phr)
Spectraflo 98-105040	2.0
Spectraflo 98-11088	2.0
Spectraflo 98-11090	1.88
Spectraflo 98-11091	2.15

TABLE 6C – TITANIUM DIOXIDE FUNCTIONAL EQUIVALENT – Dry Powders

Note – PPI Range Composition requires 0.5 phr minimum titanium dioxide content meeting the requirements of Section III Part A.5. Functional equivalents must demonstrate equivalent weathering performance when formulated at their minimum use level.

Manufacturer	Product	Limitations	Range, phr
Holland Colors, Inc.	Holcobatch C White 93104	See Note 1	0.7 - 1.2
TOR Minerals	Hitox TiO2		0.5 - 3.0

NOTE 1: When using Holcobatch C, additional titanium dioxide may be added, but it must be in dry form, comply with Section III Part A.5, and the amount cannot exceed 2.2 phr.

* Denotes experimental or provisional listing

TABLE 7A- CALCIUM CARBONATE

Note – Tables of Prequalified Ingredients contain products commonly used by industry. Calcium carbonates in compliance with Section III Part A.6 need not appear on this table to be used in the PPI Range Composition.

Ingredient Class	Qualification Requirement	Allowable Use Level (phr)
Calcium Carbonate	Compliance to Section III Part A.6	0.0 – 5.0

Manufacturer	Product	Limitations	Range, phr

TABLE 7B – CALCIUM CARBONATE – FUNCTIONAL EQUIVALENT

Manufacturer	Product	Limitations	Range, phr
Imasco Minerals	Dolomite 6HD		0.0 - 5.0
J.M. Huber Corp.	Hubercarb G2		0.0 - 5.0
J.M. Huber Corp.	Hubercarb G2T		0.0 - 5.0
J.M. Huber Corp.	Hubercarb G3		0.0 - 5.0
J.M. Huber Corp.	Hubercarb G35		0.0 - 5.0
J.M. Huber Corp.	Hubercarb G35T		0.0 - 5.0
J.M. Huber Corp.	Hubercarb G3T		0.0 - 5.0
J.M. Huber Corp.	Hubercarb M3		0.0 - 5.0
J.M. Huber Corp.	Hubercarb M3T		0.0 - 5.0
J.M. Huber Corp.	Huberflow		0.0 - 5.0
Omya, Inc	OMYACARB 2 - AZ		0.0 - 5.0
Omya, Inc	OMYACARB 3 - AZ		0.0 - 5.0
Omya, Inc	PULPROWHITE 3 - SA		0.0 - 5.0
Piqua Materials	Piqua Minerals Filler 30		0.0 - 5.0
Specialty Minerals	Super-Pflex 200		0.0 - 5.0
Specialty Minerals	Ultra-Pflex		0.0 - 5.0

* Denotes experimental or provisional listing

TABLE 8 – PROCESSING AID

Ingredient Class	Qualification Requirement	Allowable Use Level (phr)
Processing Aid	Listing by PPI	0.0 - 2.0 (unless otherwise stated)

Manufacturer	Product	Limitations	Range, phr
Arkema, Inc.	Plastistrength 501		0.0 - 3.0
Arkema, Inc.	Plastistrength 530		0.0 - 3.0
Arkema, Inc.	Plastistrength 550		0.0 - 3.0
Arkema, Inc.	Plastistrength 551		0.0 - 3.0
Arkema, Inc.	Plastistrength 700		0.0 - 3.0
Arkema, Inc.	Plastistrength 710		0.0 - 3.0
Arkema, Inc.	Plastistrength 770		0.0 - 2.0
Dow Chemical Co.	Paraloid K-120 N		0.0 - 2.0
Dow Chemical Co.	Paraloid K-120 ND		0.0 - 2.0
Dow Chemical Co.	Paraloid K-175		0.0 - 1.0
Dow Chemical Co.	Paraloid KM-334		0.0 - 3.0
Dow Chemical Co.	Paraloid KM-390		0.0 - 3.0
Dow Chemical Co.	Paraloid KM-940		0.0 - 3.0
Kaneka Texas Corp.	Kane Ace PA-10		0.0 - 2.0
Kaneka Texas Corp.	Kane Ace PA-20		0.0 - 2.0

Note 1 – also used as an impact modifier.

* Denotes experimental or provisional listing

TABLE 9A – COLORANT – DRY POWDER

Note: – In accordance with Part D.1 of PPI TR-3, the amount of dry colorant may be changed (decreased, or increased) from the amount specified by as much as 0.5 phr without the need to submit confirmatory stress-rupture data. Thus, it is permissible to mix different dry colorants to achieve a desired color, so long as the resultant mixture meets the requirements of TR-3 Part D.1.

Ingredient Class	**Qualification Requirement**	**Allowable Use Level (phr)**
Colorant	Listing by PPI	Product Specific

Manufacturer	Product	Limitations	Range, phr
BASF Corporation	Heliogen Blue K 7090		0.0 - 0.1
Brenntag Specialties, Inc.	Ultramarine Blue 5151		0.0 - 0.5
Brenntag Specialties, Inc.	Ultramarine Blue 6102 Premier GS		0.0 - 0.5
Brenntag Specialties, Inc.	Ultramarine Blue 6105 Premier RX		0.0 - 0.5
Brenntag Specialties, Inc.	Ultramarine Blue 6108 Premier RM		0.0 - 0.5
Brenntag Specialties, Inc.	Ultramarine Blue 6117 Premier RS		0.0 - 0.5
Brenntag Specialties, Inc.	Ultramarine Blue 6154 Premier AR		0.0 - 0.5
Brenntag Specialties, Inc.	Ultramarine Violet 6111 Premier VX		0.0 - 0.5
Brenntag Specialties, Inc.	Ultramarine Violet 6112 Premier VU		0.0 - 0.5
Cabot Corporation	BLACK PEARLS 880		0.0 - 0.14
Cabot Corporation	MONARCH 700		0.0 - 0.2
Cabot Corporation	REGAL 660		0.0 - 0.2
Cabot Corporation	REGAL 660R		0.0 - 0.2
Chemiplast Inc.	Chemiplast 515, Blue		0.0 - 0.1
Columbian Chemical Co.	Raven 410		0.0 - 0.2
Holland Colors, Inc.	Holcobatch C Black 93109		0.0 - 0.5
Holland Colors, Inc.	Holcobatch C Black 93109 F		0.0 - 0.5
Holland Colors, Inc.	Holcobatch C Black 938996		0.0 - 1.0
Holland Colors, Inc.	Holcobatch C Black 939049		0.0 - 0.75
Holland Colors, Inc.	Holcobatch C Blue 93108 F		0.0 - 0.5
Holland Colors, Inc.	Holcobatch C Blue 93198 F		0.0 - 0.5
Holland Colors, Inc.	Holcobatch C Blue 934884 F		0.0 - 1.0
Holland Colors, Inc.	Holcobatch C Blue 93718 F		0.0 - 0.5
Holland Colors, Inc.	Holcobatch C Green 93427 F		0.0 - 0.5
Holland Colors, Inc.	Holcobatch C Violet 934690		0.0 - 0.5
Holland Colors, Inc.	Holcobatch C Yellow 93055 F		0.0 - 0.5
KibbeChem, Inc	KC-MP Black		0.0 - 0.5
KibbeChem, Inc	KC-MP Blue		0.0 - 0.5
KibbeChem, Inc	KC-MP Green		0.0 - 0.5
KibbeChem, Inc	KC-MP Purple		0.0 - 0.5
KibbeChem, Inc	KC-MP Yellow		0.0 - 0.5

TABLE 9B – COLORANT – Liquid Dispersed

Note – Liquid dispersed colorant may not be combined with other liquid dispersed colorants.

Manufacturer	Product	Limitations	Range, phr
ColorMatrix Corp.	88-034-1, Violet		0.0 - 0.1
ColorMatrix Corp.	88-046-1, Violet		0.0 - 0.5
ColorMatrix Corp.	90-001-NS, Blue		0.0 - 0.4
ColorMatrix Corp.	90-003-NS, Blue		0.0 - 0.4
ColorMatrix Corp.	90-013-NS, Blue		0.0 - 1.2
ColorMatrix Corp.	90-016-NS Blue		0.0 - 1.0
ColorMatrix Corp.	90-017-NS, Blue		0.0 - 0.45
ColorMatrix Corp.	90-022-NS Blue		0.0 - 0.41
ColorMatrix Corp.	92-003-NS, Black		0.0 - 0.5
ColorMatrix Corp.	92-006-2 NS, Gray		0.0 - 0.9
ColorMatrix Corp.	92-012-NS, Dark Gray		0.0 - 0.85
ColorMatrix Corp.	92-013-NS, Black		0.0 - 0.34
ColorMatrix Corp.	92-100-NS Black		0.0 - 0.43
ColorMatrix Corp.	96-003-NS, Yellow		0.0 - 0.4
ColorMatrix Corp.	97-008-NS, Orange		0.0 - 0.15
ColorMatrix Corp.	98-003-NS Violet		0.0 - 0.57
ColorMatrix Corp.	98-004-NS, Purple		0.0 - 0.5
ColorMatrix Corp.	99-002-NS, Brown		0.0 - 0.4
ColorMatrix Corp.	99-004-NS, Brown		0.0 - 1.3
ColorMatrix Corp.	99-008-NS, Brown		0.0 - 0.3
ColorMatrix Corp.	99-010-NS, Brown		0.0 - 0.4
Ferro Corporation	Spectraflo 98-31053, Blue		0.74 - 0.81
Ferro Corporation	Spectraflo 98-31083, Blue*	Expires 6/30/10	0.1 - 0.45
Ferro Corporation	Spectraflo 98-36591, Blue		0.0 - 0.29
Ferro Corporation	Spectraflo 98-58071*	Expires 6/30/10	0.0 - 0.67
KibbeChem, Inc	KC-LD Black		0.0 - 0.5
KibbeChem, Inc	KC-LD Blue		0.0 - 0.5
KibbeChem, Inc	KC-LD Green		0.0 - 0.5
KibbeChem, Inc	KC-LD Purple		0.0 - 0.5
KibbeChem, Inc	KC-LD Yellow		0.0 - 0.5
National Plastics Color	LIQ-B52038 Green		0.0 - 1.1
National Plastics Color	LIQ-B63147 Blue		0.0 - 1.1
National Plastics Color	LIQ-B92345 Black*	Expires 6/30/10	0.0 - 0.2
RITE Systems	LQC-P1941-2 Purple		0.1 - 1.0
RITE Systems	NQC-B1124-1 Blue		0.1 - 0.75
RITE Systems	NQC-G2042-1 Green		0.1 - 1.0
RITE Systems	NQC-GY1060-1 Gray		0.1 - 1.0

Manufacturer	Product	Limitations	Range, phr
RITE Systems	NQC-W1054-1		0.5 - 2.0
RITE Systems	NQC-W1183-1		0.1 - 2.0
RITE Systems	WQC-P1039-5 Purple		0.3 - 0.6

* Denotes experimental or provisional listing

TABLE 10 – COMBINATION INGREDIENT PACKAGE

A set ratio of a pre-blended combination of pre-qualified ingredients under TR-2 policies. This table lists the percentage of the maximum allowable usage under the PPI generic range formulation (see Table I) that each ingredient contributes when used at its maximum use range. Additional amounts of other qualified ingredients can be added, but the total combined percentage can not exceed 100% of the allowable. See the example following this table.

Manufacturer	Product	Range, phr			Heat Stabilizer	Calcium Stearate	Paraffin Wax	Polyethylene Wax	Titanium Dioxide	Calcium carbonate	Processing Aid
		min	max								
Chemtura	Mark 2910	1.32	1.97		47%		100%	66%			
Dow Chemical Company	Advalube B-3021	1.50	1.88			12%	100%	45%		1%	1%
Dow Chemical Company	Advalube B-3025	1.50	2.30			68%	68%	46%			6%
Dow Chemical Company	Advapak LS-203NHS	1.80	2.05		18%	12%	100%	44%		1%	1%
Dow Chemical Company	Advapak S-1201	1.60	2.55		24%	40%	100%	30%		1%	3%
Dow Chemical Company	Advapak S-1203	1.60	2.45		23%	35%	100%	26%		1%	3%
Dow Chemical Company	Advapak S-1213	1.50	2.28		38%	14%	100%	53%			2%
Honeywell Inc.	Comboloob 0609	0.70	1.67				100%	56%			
Honeywell Inc.	Rheolub 315	0.70	1.50				89%	55%			
Honeywell Inc.	Rheolub 410	0.70	1.65				99%	55%			
Honeywell Inc.	Rheolub 415	0.70	1.75				99%	88%			
Honeywell Inc.	Rheolub 417	0.70	1.80				100%	100%			
Honeywell Inc.	Rheolub 420	0.70	1.50				80%	100%			
Honeywell Inc.	TLP-2003	1.85	2.30			33%	100%	100%			
KibbeChem, Inc.	KC-TI80 WC	0.63	3.75				50%		100%		

Manufacturer	Product	Range, phr			Heat Stabilizer	Calcium Stearate	Paraffin Wax	Polyethylene Wax	Titanium Dioxide	Calcium carbonate	Processing Aid
Reagens USA	RW 4060	0.00	1.66			66%	44%				
Reagens USA	RW 5050	0.00	2.00			67%	67%				
Reagens USA	RW 6040	0.00	2.50			67%	100%				
Reagens USA	RW 7030	0.00	2.14			43%	100%				
Reagens USA	S WAX 1T	0.00	2.14			43%	100%				
Reagens USA	S WAX 2T	0.00	2.50			67%	100%				
		min	max								
Reagens USA	S WAX 3T	0.00	2.00			67%	67%				
Reagens USA	S WAX 4T	0.00	1.66			66%	44%				
Reagens USA	SL 25	0.00	2.58		27%	41%	100%	65%			
Reagens USA	SL 25 T	0.00	2.58		27%	41%	100%	65%			
Rheogistics LLC	Synertive Rx-2675	1.50	2.25			40%	99%	56%			
Rheogistics LLC	Synertive Rx-3075	1.50	2.40			48%	100%	60%			
Rheogistics LLC	Synertive Rx-310	0.54	1.66				100%	55%			
Rheogistics LLC	Synertive Rx-3370	1.50	2.50			56%	100%	58%			
Rheogistics LLC	Synertive Rx-315-S	0.70	1.77				100%	88%			
Rheogistics LLC	Synertive Rx-320-S	0.75	1.50				80%	100%			
Sasol Wax North America	Sasolwax L8688A	0.70	1.67			56%	56%				
Sasol Wax North America	Sasolwax L8688B	1.20	3.00			100%	80%	100%			
Sasol Wax North America	Sasolwax L8688C	1.20	2.30			46%	100%	38%			

Using Table 10

Percentages shown in Table 10 are the percentages each Pre-qualified Ingredient present in the Combination Package contributes toward the maximum allowed in the PPI Range Formula when that package is used at the maximum phr of its range.

Example:

Manufacturer	Product	Range, phr		Heat Stabilizer	Calcium Stearate	Paraffin Wax	Polyethylene Wax	Titanium Dioxide	Calcium carbonate	Processing Aid
Rheogistics LLC	Synertive Rx-3370	1.50	2.50		56%	100%	12%			

When above package is used at 2.50 phr (PVC resin) it contributes the following phr of each ingredient to the blended compound:

Product	Ingredient	Contribution	PPI Maximum	Contribution to blend
Synertive Rx-3370	Heat Stabilizer	0%	1.0 phr	0.00 phr
	Calcium Sterate	56%	1.5 phr	0.84 phr
	Paraffin Wax	100%	1.5 phr	1.50 phr
	Polyethylene Wax	12%	0.3 phr	0.04 phr
	Titanium Dioxide	0%	3.0 phr	0.00 phr
	Calcium Carbonate	0%	5.0 phr	0.00 phr
	Processing Aid	0%	2.0 phr	0.00 phr

The addition of supplemental ingredients is allowed up to the PPI Maximum. In those instances where the use level of the package contributes less than the minimum use level specified in the PPI Range Formulation the addition of supplemental ingredients is required.

TABLE 11 – FUNCTIONALLY EQUIVALENT INGREDIENT PACKAGE

A set ratio of a pre-blended combination of ingredients containing one or more ingredients that is not pre-qualified under the policies of TR-2. This table lists the percentage of the maximum allowable usage under the PPI generic range formulation (see Table I) that each ingredient contributes when used at its maximum use range. Additional amounts of other qualified ingredients can be added, but the total combined percentage can not exceed 100% of the allowable. **The addition of other Functional Equivalent Ingredients is not allowed.** See the example following this table.

Manufacturer	Product	Range, phr		Heat Stabilizer	Calcium Stearate	Paraffin Wax	Polyethylene Wax	Titanium Dioxide	Calcium carbonate	Processing Aid
		min	max							
Ferro Polymer Additives	Petrac 480	0.00	2.38		48%	100%	56%			
Honeywell Inc.	HPL-6410	0.07	1.70			100%	69%			
Honeywell Inc.	HPL-6730	1.54	2.25		39%	100%	56%			
Honeywell Inc.	TLP-2010	1.60	2.34		43%	100%	62%			
Honeywell Inc.	TLP-2012	1.85	2.40		40%	100%	100%			
Honeywell Inc.	TLP-2020	1.60	2.38		47%	100%	60%			
Honeywell Inc.	TLP-2030	1.60	2.45		54%	97%	61%			
Honeywell Inc.	TLP-2040	1.50	2.20		54%	82%	55%			
Honeywell Inc.	TLP-2050	1.70	2.00		54%	70%	50%			
Honeywell Inc.	TLP-2610	1.75	2.44		43%	100%	99%			
Honeywell Inc.	TLP-2620	1.65	2.48		46%	99%	100%			
Honeywell Inc.	TLP-2630	1.50	2.48		52%	93%	100%			
Honeywell Inc.	TLP-2640	1.60	2.30		54%	81%	93%			
Honeywell Inc.	RL-517	0.70	1.75			98%	95%			
Honeywell Inc.	RL-615	0.70	1.77			100%	90%			
Honeywell Inc.	RL-1800	0.65	1.15		54%	23%				

Manufacturer	Product	Range, phr		Heat Stabilizer	Calcium Stearate	Paraffin Wax	Polyethylene Wax	Titanium Dioxide	Calcium carbonate	Processing Aid
Reagens USA	RW 9010	0.00	1.60			96%	53%			
Reagens USA	RW 4545	0.00	2.20		66%	66%	73%			
Reagens USA	RLS 5000	0.00	2.25		42%	98%	53%			
Sasol Wax North America	Sasolwax L355	0.60	1.50		90%	10%				
Solucor	Solulub 941	1.40	2.30		44%	95%	69%			

Using Table 11

Percentages shown in Table 11 are the percentages the package contributes in terms of functionality toward the maximums allowed in the PPI Range Formula when that package is used at the maximum phr of its range.

Example:

Manufacturer	Product	Range, phr		Heat Stabilizer	Calcium Stearate	Paraffin Wax	Polyethylene Wax	Titanium Dioxide	Calcium carbonate	Processing Aid
Reagens USA	RLS 5000	2.25			42%	98%	53%			

When above package is used at 2.25 phr (PVC resin) it functions like the following phr of each ingredient contributed to the blended compound:

Product	Ingredient	Contribution	PPI Maximum	Contribution to blend
RLS 5000	Heat Stabilizer	0%	1.0 phr	0.00 phr
	Calcium Sterate	42%	1.5 phr	0.63 phr
	Paraffin Wax	98%	1.5 phr	1.47 phr
	Polyethylene Wax	53%	0.3 phr	0.16 phr
	Titanium Dioxide	0%	3.0 phr	0.00 phr
	Calcium Carbonate	0%	5.0 phr	0.00 phr
	Processing Aid	0%	2.0 phr	0.00 phr

The addition of supplemental **pre-qualified ingredients** is allowed up to the PPI Maximum. **The addition of Functional Equivalent Ingredients is not allowed**. In those instances where the use level of the package contributes less than the minimum use level specified in the PPI Range Formulation the addition of supplemental pre-qualified ingredients is required.

Instructions and Submission Form

for

Combination Ingredient Packages and Functionally Equivalent Ingredient Packages

Step #1 – Determine type of your Additive Package

The following describes your package: A set ratio of a pre-blended combination of Pre-qualified Ingredients. A Pre-qualified Ingredient is defined as: "Any chemical, mineral, polymer, etc. having properties meeting the applicable requirements as set forth in PPI TR-2 - Section III - Part A.

An ingredient that meets the physical property requirements of Part A is a Pre-qualified ingredient and is exempt from stress rupture testing. When two or more of such ingredients are blended together to make a package the said package is called a Combination Ingredient Package.

A) Yes, the above describes my package -
   - Skip Step #2 - Go to Form A – *Combination Ingredient Package*

B) No, the above does not describe my package –
   - Go to Step #2

Step #2 – Determine type of your Additive Package cont'd

The following describes your package: A set ratio of pre-blended combination of ingredients containing an ingredient/ingredients that is not pre-qualified. The ingredient/ingredients present in the package which is/are not Pre-qualified is/are designed to serve the same function as a Pre-qualified ingredient. A Functionally Equivalent Ingredient is defined as: Any chemical, mineral, polymer, etc. not having properties meeting the applicable requirements as set forth in PPI TR-2 - Section III - Part A and shown to function in an equivalent manner through testing.

A) Yes, the above describes my package
   - Go to Form B – *Functionally Equivalent Ingredient Package*

B) No, the above does not describe my package
   - Return to Step #1

FORM A – COMBINATION INGREDIENT PACKAGES

Ingredient Class **Qualification Requirement** **Allowable Use Level (phr)**

Ingredient Packages Listing by PPI Product Specific

Manufacturer	**Product**	**Range, phr** **Min & Max**		**Heat Stabilizer**	**Calcium Stearate**	**Paraffin Wax**	**Polyethylene Wax**	**Titanium Dioxide**	**Calcium carbonate**	**Processing Aid**

#1 - Fill in the name of your company, product and the minimum and maximum use level you intend to get listed in the PPI Range Formulation.

#2 – Fill in the percentage of each Pre-qualified Ingredient that is blended into your package. The sum of the entries must equal 100%

Note: At the maximum use level specified for your package no single Pre-qualified ingredient component shall exceed the Maximum allowed in the PPI Range Formula. See PPI TR2 - Part A - Table 1 PVC Range Composition Exempted from Stress-Rupture Requirements for Listing at 73°F (23°C).

FORM B – FUNCTIONALLY EQUIVALENT INGREDIENT PACKAGE

Ingredient Class | **Qualification Requirement** | **Allowable Use Level (phr)**

Ingredient Packages | Listing by PPI | Product Specific

Manufacturer	**Product**	**Range, phr** **Min & Max**		**Heat Stabilizer**	**Calcium Stearate**	**Paraffin Wax**	**Polyethylene Wax**	**Titanium Dioxide**	**Calcium carbonate**	**Processing Aid**

#1 - Fill in the name of your company, product and the minimum and maximum use level of your package that you intend to get listed in the PPI Range Formulation.

#2 – Fill in the percentages the package contributes in terms of additive functionality. The sum of the entries must equal 100%

Note: At the maximum use level specified for your package no single additive functionality component shall exceed the Maximum allowed in the PPI Range Formula. See PPI TR2 - Part A - Table 1 PVC Range Composition Exempted from Stress-Rupture Requirements for Listing at 73°F (23°C).

Appendix A – Example Letter for Requesting Dependent Listing for PPI PVC Generic Range Formulation

Fill out with appropriate information specific to your request and send to:

Stephen Boros
Chair – Hydrostatic Stress Board
105 Decker Court, Suite 825
Irving, TX 75062

We wish to list with PPI, under our commercial designation _____, the pre-qualified PVC range compound as defined in PPI TR-2. We would also like to have this listing published in PPI TR-2, and NSF International notified of your acceptance of this listing. We understand and agree that this listing is given subject to the policies and procedures set forth in PPI TR-2 and/or TR-3.

We understand that this PVC compound is pre-qualified for a 4,000 psi hydrostatic design basis, and a maximum hydrostatic design stress of 2,000 psi, for water at 73°F (23°C), provided that only the specified materials are used, the blend of these materials is suitably homogenized prior to extrusion, and the extrusion into pipe is so conducted as to satisfy all the requirements of the applicable and current ASTM, AWWA, API, or other product standards

We also understand that we shall be periodically advised, by the issuance of the update to PPI TR-2, of any approved changes in composition and approved components of this compound to which we shall comply.

In addition, we reserve the right to modify this composition for public, or our own private use, in accordance with the stipulations given in TR-2.

*_____ agrees to hold the Plastics Pipe Institute (PPI) harmless and indemnify PPI for any and all liability, loss, damage, cost and expense which PPI may suffer, incur, or be put to by reason of any claim, suit or proceeding for personal injury, property damage or economic loss on account of the failure or alleged failure of the compound listed (or pipe produced from the compound) to conform to specifications on which the listing is based, and *_____ further agrees to defend PPI at *_____'s expense, against any and all such suits, claims or proceedings.

*Provide Company Name

APPENDIX B

PMD Test Procedures & References for the Evaluation of Calcium Carbonate

PMD-1: Calcium Carbonate Analysis**:** Acceptable data is generated when using EDTA titration procedures as per ASTM-C25 or equivalent, or as listed in the assay procedures of the current edition of Food Chemicals Codex for Limestone, Ground.

PMD-2: Iron, as Ferric Oxide: Acceptable data is generated when using wet chemical analysis as per ASTM-C25 or equivalent, or when using firmly established Atomic Absorption methods.

PMD-3: Silica, SiO2: Acceptable data is generated when using wet chemical analysis as per ASTM-C25 or equivalent, or using firmly established X-ray diffraction methodology.

PMD-4: Weight Loss at 221 deg. F.: Acceptable data is generated when using an oven method as described in ASTM-C25 or equivalent.

PMD-5: Fatty acids as stearic acid: Acceptable data is generated when using a heated weight loss procedure as described in Appendix A as published by the PMD or by using firmly established thermo gravimetric analysis (TGA) methods.

PMD-6: Particle type: Visual inspection via optical or SEM microscopy.

PMD-7: Particle Size, range & mean: Acceptable data is generated when using a Sedigraph* and following procedures as described in ASTM-D1199 or equivalent.

PMD-8: Density: Acceptable data is generated when following procedures as described in ASTM-D153 and C188 or their equivalents.
Sedigraph: Micromeritics, One Micromeritics Drive, Norcross, Ga. 30093-1877
Procedure for the determination of the organic treatment found on Stearate Treated Ground Limestone (Weight Difference Method).

Scope: This method of test is intended for the determination of stearate treated ground limestone products using a weight difference method.

Method: Weight loss is carefully determined when a ground limestone sample that has been stearate treated is heated to a temperature of 400 deg. C.

Apparatus:

a) Crucibles, porcelain, 30 ml. Capacity with cover.
b) Muffle Furnace, capable of maintaining 400 deg. C. + or - 10 deg. C.
c) Analytical balance accurate to 0.1 mg.
d) Dessicator

Procedure:

a) Dry approximately 5 grams of the stearate treated limestone product and approximately 5 grams of the limestone product prior to treatment with stearate, at 105 deg. C. for 2 hours. Cool in a dessicator.
b) Transfer the crucibles containing the limestone samples, treated and untreated, to a separate, previously ignited, weighed porcelain crucible and cover. The crucible and cover should have been cooled in a dessicator after ignition and weighed to 0.1 mg.
c) Weigh the crucibles containing the limestone samples, and the covers to 0.1 mg.
d) Remove the cover and place it and the crucibles containing the limestone samples in the muffle furnace. Heat the samples to 400 deg. C. for 1.5 hours.
e) Replace the covers, cool in dessicator and weigh to 0.1mg. To assure that constant weight has been achieved, heat the samples again for 30 minutes at 400 deg. C., cool and weigh.
f) Determine the percent weight loss in each crucible.

$L_W = [SC_B - SC_A \times 100] / [SC_B - C_T]$

Where:

L_W = % Loss of Weight

C_T = Tare Weight of Crucible and Cover

SC_B = Weight of Sample, Crucible and Cover before heating

SC_A = Weight of Sample, Crucible and Cover after heating

Reporting: The amount of stearate treatment in percent should be reported. The following calculation can be used to determine the amount of stearate treatment in percent.

$P_T = L_WT - L_WU$

Where:

P_T = Amount of Treatment in Percent

L_WT = % Loss of Weight of the Treated Sample

L_WU = % Loss of Weight off the Untreated Sample

Precision: Duplicate determinations should agree within plus or minus 0.1%.

APPENDIX C

CALCULATION EXAMPLE TO CONVERT PVC COMPOUND FORMULATIONS FROM PHR TO WEIGHT PERCENT

GIVEN: A typical PVC pressure pipe compound formulation is expressed in PHR, or parts of a specific ingredient per 100 parts resin used. This makes batching caluclations easier. PHR is not the same as weight percent, but the conversion from one basis to the other is fairly straight forward.

An example of such a formulation is given in the Table below.

Ingredient Type	**PHR**	**Weight Percent** (%)
Resin	100.00	92.57
Heat Stabilizer	0.70	0.65
Paraffin	1.20	1.11
PE Wax	0.15	0.14
Calcium Carbonate	5.00	4.63
Titanium Dioxide	0.50	0.46
Pigment	0.03	0.03
Calcium Stearate	0.45	0.42
TOTAL	**108.03**	**100.00**

DETERMINE: What is the weight percent for each individual ingredient?

1. Write down the PVC compound ingredients expressed as parts by weight for every ingedient in the formulation.(see column headed "PHR")
2. Add the PHR column of individual ingredients to obtain a total number of parts utilized (i.e. - pounds / one hundred lbs. of PVC resin) (e.g. 100+0.7+ 1.2+0.15+5.0+0.5+0.03+0.45 = 108.03
3. To calculate the corresponding weight percent for each ingredient, divide the PHR for each ingredient by the total number of parts utilized. Then multiply by 100 (e.g. (1.20 / 108.03) x 100 = 1.11%).
4. Record these results in the column labeled "weight percent".
5. Check - If the calculation was performed correctly, the total weight percent must equal 100 percent.

APPENDIX D

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APPENDIX E

1. 8 Reasons to Join the Plastics Pipe Institute. Learn from the Experts – Your Industry Peers!

PPI offers unmatched opportunities to learn more about the plastics pipe industry from the experts in your industry – your peers. Learn about best practices, market opportunities, standardization issues, ongoing research and many other areas critical to your company's success.

2. Input into Industry Positions

PPI is recognized as the industry voice before North American and international standards setting organizations, code writing bodies, municipalities and other regulatory agencies. And we regularly provide industry positions to these groups. Help us develop positions that will benefit your interests.

3. Networking

Membership allows you participation in all PPI forums and meetings. At these events, you will meet and learn from your peers in the industry. Our membership includes material and additive suppliers, pipe manufacturers, equipment manufacturers and distributors, giving you access to the complete supply chain. PPI's Spring and Fall meetings are recognized throughout the industry as "must-attends" and are open to members only.

4. Technical Credibility of PPI and the Use of the PPI Logo

PPI is recognized around the world as the technical expert on plastic piping issues. The use of our logos is available to members only, and provides unmatched credibility. Use the logo(s) on your literature, product packaging, website and business cards to show that you are part of the worldwide leader on plastic pipe issues.

5. Links to Your Company from PPI's Website

We provide links to all of our members through our website www.plasticpipe.org. PPI has thousands of visitors monthly, all looking for suppliers of piping products, or information about products. We provide a link for them to quickly get to you.

6. Services of PPI's Staff

Our technical, engineering and marketing staffs are ready to answer your questions and help you grow your business. This knowledge base is available to members everyday, and is a benefit we encourage you to use. Call us today!

7. Discounts on PPI Services & Products

PPI members get significant discounts on PPI's products and services, including literature, certification program fees and product listing fees. These products and services will help your business succeed – and at a discount!

8. 60 Years of Experience

PPI was founded in 1950, and through responsible and credible leadership, has established itself as the technical and marketing leader of the industry before a wide variety of stakeholders. Today, PPI is the voice of the plastics piping industry.

Working to make plastics the material of choice for all piping applications.