





## 1.5 SUBMITTALS

- A. Submit under provisions of Section 01300
- B. Manufacturer's technical data, details, and specifications giving information on material composition and physical properties of the insulation, vapor retarders, and jacketing, if used. Also include:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Manufacturer/supplier installation instructions or methods.

**\*\* NOTE TO SPECIFIER \*\*** The polyisocyanurate insulation industry has been forced to alter its product and manufacturing processes to eliminate the original CFC and HCFC blowing agents, and certain physical properties may vary as new blowing agents are used. Specifiers and contractors should be pro-active in protecting themselves from installing polyiso insulations that may not meet the advertised fire/smoke properties.

- C. Manufacturer's Certificate: Certify stated R-values (aged) and flame spread/smoke development ratings are in accordance with laboratory testing from certified laboratories.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original, unopened, undamaged containers with shipping labels intact. The manufacturer's plastic wrapping is provided for protection during shipment only. Replace insulation that is damaged by physical abuse or water.
- B. Store products off the ground, in dry conditions, under cover and in manufacturer's unopened packaging until ready for installation.
- C. Consider flexural strength and friability characteristics of alternative polyiso manufacturers to minimize breakage during handling and to minimize dust while cutting and abrasion to hands when handling.

## 1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions within the limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Maintain ambient conditions required by manufacturers of adhesives, vapor retarders, sealants, etc.

# PART 2 PRODUCTS

## 2.1 MATERIALS

**\*\* NOTE TO SPECIFIER \*\*** Specifics of the insulation installation process and the practices of the insulation contractor will determine the accessory equipment required. For a complete listing of possible accessories and recommended manufacturers and suppliers, see ISO-25 Specification and Installation procedure at [www.dyplastproducts.com](http://www.dyplastproducts.com).

- A. Insulation: Rigid closed-cell polyisocyanurate thermal insulation bunstock, fabricated into shapes required to insulate pipe, valves, fittings, vessels, and/or special shapes. Density and physical properties are as specified in the Equipment Sections below. Polyiso material shall not be produced with, or contain, any of the United States EPA regulated CFC compounds listed in the Montreal Protocol of the United Nations Environmental Program.
- B. Vapor Retarder: Even though polyisocyanurate has excellent water vapor permeance, an additional vapor retarder is recommended and can improve thermal efficiency, water penetration characteristics, and fire spread and smoke development attributes. Vapor retarders may consist of sheet-type film, such as cross-laminated high density polyethylene sheeting, polyvinylidene chloride polymer film, or similar materials. (Vapor retarder sheets may require matching tape if not self-adhering.)
- C. Tape: Polyiso insulation is secured to the pipe with filament-reinforced tape, such as the synthetic filament-reinforced polyester film backing tape with non-thermosetting rubber adhesive, wrapped on a 3 inch paper core manufactured by 3M.

**\*\* NOTE TO SPECIFIER \*\*** Construction and operational circumstances must be considered when specifying all service jackets (ASJ) since they are easily damaged. All service jackets (ASJ) must be handled carefully in order to avoid compromising integrity of the insulation system.

- D. Outer surface finish: A finish with a high emissivity such as painted metal, PVC or All Service Jacket (ASJ) is recommended.
- E. Non-setting joint sealer.

**\*\* NOTE TO SPECIFIER \*\*** Dow Chemical Saran Wrap and Tape data sheets indicate their process eliminates the need for mastic-fab-mastic.

- F. Vapor retarder mastic: (use with an open weave glass fiber reinforcing cloth between the coats)
- G. Smooth aluminum rolled jacketing, To ASTM B2089, 0.016 inch thick. Specify 2.5- mil poly/surlyn backing with plain, white acrylic or tedlar coated. Order 36 inch or 48 inch rolls.
  - 1. Childers 16-mil aluminum roll jacketing
  - 2. RPR 16-mil aluminum roll jacketing
  - 3. Pabco 16-mil aluminum roll jacketing
- H. Deep Corrugated (1 ¼ inch) Aluminum Sheeting, To ASTM B209, 0.024 inch thick. Specify 2.5-mil poly/surlyn with plain or white acrylic coated. ([Top](#))
  - 1. Childers, 24-mil Deep Corrugated Aluminum Sheets
  - 2. RPR, 24-mil Deep Corrugated Aluminum Sheets
  - 3. Pabco, 24-mil Deep Corrugated Aluminum Sheets
- I. Smooth stainless steel rolled jacketing, To ASTM A-240, 0.010 inch thick with standard moisture barrier backing.
  - 1. Childers, 10-mil stainless steel rolled jacketing
  - 2. RPR, 10-mil stainless steel rolled jacketing

- 3. Pabco, 10-mil stainless steel rolled jacketing
- J. Smooth Stainless Steel Rolled Jacketing, To ASTM A-240, 0.016 inch thick with standard moisture barrier.
  - 1. Childers, 16-mil stainless steel rolled jacketing
  - 2. RPR, 16-mil stainless steel rolled jacketing
  - 3. Pabco, 16-mil stainless steel rolled jacketing
- K. Deep Corrugated (1 ¼ inch) Stainless Steel Sheeting, To ASTM A-240, 0.010 inch thick with standard moisture barrier.
  - 1. Childers, 10-mil Corrugated Stainless Steel Sheeting
  - 2. RPR, 10-mil Deep Corrugated Stainless Steel Sheeting
  - 3. Pabco, 10-mil Deep Corrugated Stainless Steel Sheeting
- L. PVC (polyvinylchloride) rolled jacketing, 0.020 inch thick. Order pre-curved. Specify color. The following PVC meets 25/50 rating to ASTM E-84
  - 1. Proto, LoSmoke 20-mil Proto-Jac
  - 2. Manville, Zeston 2000 20-mil
  - 3. CEEL-Co, CEEL-Tite 320
- M. PVC (polyvinylchloride) rolled jacketing, 0.030 inch thick. Order pre-curved.
  - 1. Specify color.
  - 2. Proto, LoSmoke 30-mil Proto-Jac (Meets 25/50 rating)
  - 3. Manville, Zeston 2000 30-mil
  - 4. CEEL-Co, CEEL-Tite330
- O. Heavy Gage PVC (polyvinylchloride) Ribbed Panels, 0.060 inch thick. Specify color.
  - 5. Proto, Proto Corrugated Panels-60mil
- P. Heavy Gage PVC (polyvinylchloride) Gore Vessel Heads, 0.060 inch thick. Specify color
  - 1. Proto, LoSmoke PVC Prototop Tank Tops
- Q. Aluminum Covers For Vessel Heads, Fabricated Gores, 0.020 inch thick, Specify Plain or Acrylic Coated. Order 2.5-mil Poly/Surlyn Backing.
  - 1. Childers, Aluminum Gore Head-Jacs
  - 2. RPR, Aluminum Gore Head Jacket
- R. Aluminum Two-piece Die-Formed 45 and 90 Ell Covers. Specify plain, acrylic or tedlar coated.
  - 1. Childers, Ell-Jac
  - 2. RPR, 2-Piece Aluminum Elbow Covers
  - 3. Pabco, Sure-Fit Elbow Covers
- S. Stainless Steel Two-Piece Die-Formed 45 and 90 Ell Covers.
  - 1. Childers, Stainless Steel Unifers Ell-Jacs
  - 2. RPR, 2-Piece Stainless Steel Elbow Covers ([Top](#))
- T. Light Gage PVC One-Piece Ell Covers. 0.020 inch nom. thickness. Specify color
  - 1. Proto, LoSmoke Light Gage
  - 2. Manville, Zeston 2000
  - 3. CEEL-Co, 300 Series, Light-Gage
- U. Heavy Gage PVC One-Piece Ell Covers. 0.030 inch nom. thickness. Specify color.
  - 1. Proto, Industrial Weight PVC (Meets 25/50 per ASTM E84)
  - 2. Manville, Zeston 2000 Heavy Gage
  - 3. CEEL-Co, Ceel-Tite 300 Series Heavy Duty
- V. Vapor Retarder Mastics and Coatings - Indoor
  - 1. Childers Chil-Perm CP-30, CP-32 (non-flammable)
  - 2. Marathon Lo Perm 590, 591
  - 3. Fosters Vapor-Fas 30-15
- W. Vapor Retarder Mastics and Coatings – Indoor/Outdoor
  - 1. Childers Encacel V, X, Chil-Perm WB CP-35
  - 2. Fosters Monolar 60-39, 60-59
  - 3. Fosters Vapor-Safe Mastic 30-90
- X. Vapor Retarder Membrane
  - 1. Polyguard Products, inc. Insulrap 30, Insulrap 50
  - 2. Alpha Associates Inc. Alpha-Alaflex Style 13 MAM
  - 3. TGH-1000 VB
- Y. Insulation Joint Non-Setting Sealer
  - 1. Fosters Foamseal 30-45
  - 2. Childers CP-70
  - 3. Epolux Cadaseal 745
- Z. Insulation Adhesive For Adhesion To Itself and To The Substrate.
  - 1. Fosters Fire Resistant Adhesive 81-33 or Kold-Fas 82-08
  - 2. Childers Chil-Rene CP-96
- AA. Open-Weave Glass Cloth, 10x10/in.sq. min.
  - 1. J.P. Stevens, Glass Cloth, Style 1659/Geon
  - 2. Burlington , Resin Treated Style 1659
  - 3. Childers, No. 10 Chil-Glas
- BB. ASJ Kraft Aluminum Laminate-White
  - 1. Alpha, Alpha-Temp 10651 ASJ
  - 2. Compac, FB200 ASJ
- CC. Breather Acrylic Type Mastic

1. L&L Coatings, L&L 300 Mastic-White
  2. Childers, Vi-Cryl CP-11
  3. Fosters, Weatherite Mastic 36-10, 46-10
- DD. Caulking Sealant, Silicone Rubber Compound
1. Dow Corning, Silastic 732 RTV, 999 RTV
  2. Rhone-Poulenc, Rhodorsil 3B-2542 (Aluminum)
  3. Pecora, 863 Silicone Sealant 345 (White) ([Top](#))
- EE. Stainless Steel Bands and Seals. Type 430, 304 acceptable. ½ or ¾ inch widths x 0.020 inch thickness. Available from insulation distributors
- FF. Stainless Steel Bands and Seals, 1 ¼ inch wide
1. Childers, 1 ¼ inch Stainless Steel Bands and seals
  2. A.J.Gerrard, 1 ¼ inch Stainless Steel Bands and Seals
- GG. Stainless Steel 4 inch Expansion Springs
1. A.J. Gerrard, 4 in. Breather Spring
  2. Childers, Chil-Spring 4 in.
- HH. Heavy Duty Stainless Steel Compression Springs
1. Childers, Super-Mity-Springs
- II. Polyester Film Tape, Pressure-Sensitive Glass Reinforced, ½ inch wide
1. 3M Co., Scotchbrand No.898 Polyester Tape
- JJ. ASJ Pressure Sensitive Tape, 3 inches wide
1. Compac, Perm Tape ASJ Std 105-7
  2. Venture, 1540 CW ASJ
- KK. Foil (2-mil) Pressure Sensitive Tape, 3 inches wide
1. Compac, Perm Tape Foil Std 120-6
  2. Venture, 1520 CW Foil
- LL. PVC Cement. Specify clear or white
1. Available from the PVC Distributors
- MM. Tedlar Pressure Sensitive Tape, 2 inch wide
1. Alpha, Avalock Style 209TG (Gray), Style 209 TW (White)

NN. Table of accessory materials:

Application	Finish	Remarks
Pipe	0.016 inch thick plain, smooth, rolled Aluminum jacket	Indoor/Outdoor, non-corrosive; Moderate mechanical abuse
Pipe	0.016 inch thick white acrylic coated, smooth, rolled aluminum jacket	Indoor/Outdoor, mild corrosion; Moderate mechanical abuse
Pipe	0.020 inch thick white, smooth, rolled PVC Jacket	Indoor, mild corrosion; Low mechanical abuse
Pipe	0.030 inch thick white, smooth, rolled PVC Jacket	Indoor/Outdoor, mild corrosion; Moderate mechanical abuse
Pipe	0.010 inch thick smooth, rolled stainless steel Jacket	Indoor/Outdoor, severe corrosion; High mechanical abuse
Pipe	0.010 inch thick tedlar, glass, hypalon rolled Laminate jacketing	Indoor/Outdoor, severe corrosion; High mechanical abuse
Pipe	0.016 inch thick white tedlar coated, smooth, Rolled aluminum jacket	Indoor/Outdoor, severe corrosion; Moderate mechanical abuse
Equipment	0.016 inch thick plain, smooth, rolled Aluminum jacket	Indoor, non-corrosive; Moderate mechanical abuse
Equipment	0.016 inch thick white acrylic coated, smooth, Rolled aluminum jacket	Indoor, mild corrosion; Moderate mechanical abuse
Equipment	0.030 inch thick white, smooth, rolled PVC Jacket	Indoor, mild corrosion; Moderate mechanical abuse
Equipment	0.024 inch thick deep corrugated, plain Aluminum sheets	Outdoor, non-corrosive; Moderate mechanical abuse
Equipment	0.024 inch thick white acrylic coated, deep Corrugated aluminum sheets	Outdoor, mild corrosion; Moderate mechanical abuse
Equipment	0.060 inch thick ribbed PVC panels	Outdoor, severe corrosion; High mechanical

		abuse
Equipment	0.016 inch thick smooth, rolled stainless steel Jacket	Indoor/Outdoor, severe corrosion; High mechanical abuse
Equipment	0.010 inch thick deep corrugated, stainless Steel jacket	Outdoor, severe corrosion; High mechanical abuse
Ducts	Scrim reinforced, acrylic mastic system	Indoor, non-corrosive; Low mechanical abuse
Ducts	0.016 inch thick plain, smooth, rolled Aluminum jacket	Indoor/Outdoor, non-corrosive; Moderate mechanical abuse
Ducts	0.016 inch thick white acrylic coated, smooth, Rolled aluminum jacket	Indoor/Outdoor, mild corrosion; Moderate mechanical abuse
Ducts	0.020 inch thick white, smooth, rolled PVC Jacket	Indoor, mild corrosion; Low mechanical abuse
Ducts	0.030 inch thick white, smooth, rolled PVC Jacket	Indoor/Outdoor, mild corrosion; Moderate mechanical abuse
Irregular shapes	Scrim reinforced, acrylic mastic system	Indoor, non-corrosive; Low mechanical abuse
Irregular shapes	Scrim reinforced, hypalon-type mastic vapor Retarder system	Indoor/Outdoor, mild corrosion; Low mechanical abuse

## 2.2 MANUFACTURERS

- \*\* NOTE TO SPECIFIER \*\*** For information on dP-ISO products, including ISO-25, their physical, chemical, and dimensional attributes refer to [www.dyplastproducts.com](http://www.dyplastproducts.com), or contact Dyplast Products directly.
- A. Acceptable Manufacturer of Insulation: Polyisocyanurate pipe and equipment insulation shall be dP-ISO produced by Dyplast Products, LLC., 12501 NW 38th Avenue, Miami, Florida 33054. Phone: (800) 433-5551 or (305) 921-0100. Fax: (305) 687-8013. E-mail: [info@dyplastproducts.com](mailto:info@dyplastproducts.com)
- \*\* NOTE TO SPECIFIER \*\*** Only Dyplast Products, Dow Chemical Company, Elliott Company, and Duna USA, Inc. manufacture polyiso foam bunstock. Each product has varying Physical Properties and laboratory testing accreditations. Engineers and specifiers should carefully evaluate Physical Properties to ensure compliance with specifications, with particular attention to R-value, Strength, Water Vapor Permeance, and Flame Spread and Smoke Development Ratings.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.
- C. Acceptable Manufacturers of Vapor Retarders: Cross-laminated high density polyethylene sheeting such as Polyguard Insulrap, or polyvinylidene chloride polymer film such as Dow Saran, or equivalent. All-service jackets (ASJ) provide a lower quality of vapor barrier and should be specified only in less demanding environments.
- \*\* NOTE TO SPECIFIER \*\*** PVC jackets improve the long term resistance to moisture penetration, thereby extending the longevity of the insulation system. PVC jackets also improve resistance to abuse and aid fire spread and/or smoke development attributes.
- D. Acceptable Manufacturers of PVC Jackets: Proto Corporation, Johns Manville (Ceel-Co and Zeston), Childers Products Company Ltd., Sure-Fit System, Speedline, and Thermo-Cover Inc.
- E. Requests for substitutions of PVC jacket manufacturers will be considered in accordance with provisions of Section 01600.
- F. Acceptable Manufacturers of All Service Jackets (ASJ), Metal Jacketing and Fitting Covers: Any reputable manufacturer qualified by the engineer or specifier.
- G. Acceptable Manufacturers of Vapor Retarder Mastics include Foster Products' VAPOR-SAFE® Mastic, or equivalent.

## 2.3 PIPE INSULATION

- \*\* NOTE TO SPECIFIER \*\*** Piping and vessel systems that require polyisocyanurate insulation may include industrial or commercial cold water, chilled water, refrigerant, refrigeration, liquid natural gas, liquid oxygen, liquid hydrogen, and other cryogenic fluids or low-temperature applications. Two-pound density polyiso is preferable over higher densities due to lower cost, but higher densities may be appropriate for locations where insulation may be subject to substantial abuse. Vapor retarders should be utilized in the vast majority of installations. PVC or metal jacketing should be specified at the discretion of the designer/engineer for protection of the vapor retarder, particularly in high-abuse areas, or the decision can be left to the discretion of the construction contractor.
- \*\* NOTE TO SPECIFIER \*\*** Paragraphs A – D below list the nominal densities normally suitable in pipe insulation applications. The following paragraphs delineate the physical properties of Dyplast Products' ISO line of products. For comparison with other polyiso bunstock alternatives see the Comparison Chart at [www.dyplastproducts.com](http://www.dyplastproducts.com). Delete the following paragraphs that refer to polyiso product densities that are not specified for this project.
- A. 2 lb/ft<sup>3</sup> Density Polyiso (dP ISO-25® Series 200): Physical properties:
1. Compressive Strength: minimum 25 psi (172 kPa) Parallel to Rise (thickness)

2. Shear Strength: minimum 28 psi (193 kPa) Parallel and Perpendicular
  3. Tensile Strength: minimum 30 psi (206 kPa) Parallel and Perpendicular
  4. Flexural Strength: minimum 45 psi (310 kPa) Parallel and Perpendicular
  5. Dimensional Stability: <1 percent linear change (7 days) at -40 degrees F and +158 degrees F (-40 degrees C and +70 degrees C, respectively)
  6. Water Vapor Permeance: less than or equal to 3 perm-inch (4.4 ng/(Pa\*s\*m)).
  7. Water Absorption: < 1 percent by volume; D 2842 (96-hour immersion) < 2 percent by volume
  8. Flame Spread: 0-25 for thicknesses up to 4 inches
  9. Smoke Development: 0-50 for thicknesses up to 2 inches (50 mm); 0-65 for thicknesses up to 4 inches (102 mm)
  10. Service Temperature: -297 degrees to 300 degrees F (-183 degrees C to +149 degrees C).
  11. R-value: minimum 5.6 hr\*ft<sup>2</sup>\*F/BTU after 6 months aging
  12. K-value: maximum 0.178 BTU\*in/hr\*ft<sup>2</sup>\*F after 6 months aging
- B. 3 lb/ft<sup>3</sup> Density Polyiso (dP ISO-HD™ Series 300): Physical properties:
1. Compressive Strength: minimum 43 psi (296 kPa) Parallel to Rise (thickness)
  2. Shear Strength: minimum 40 psi (275 kPa) Parallel and Perpendicular
  3. Tensile Strength: minimum 52 psi (358 kPa) Parallel and Perpendicular
  4. Flexural Strength: minimum 90 psi (620 kPa) Parallel and Perpendicular
  5. Dimensional Stability: <0.5 percent linear change (7 days) at -40 degrees F (-40 degrees C )
  6. Water Vapor Permeance: less than or equal to 3 perm-inch (4.4 ng/(Pa\*s\*m)).
  7. Flame Spread: 0-25 for thicknesses up to 4 inches
  8. Smoke Development: 0-225 for thicknesses up to 1 inch (25 mm); 0-300 for thicknesses up to 4 inches (102 mm)
  9. Service Temperature: -297 degrees to 300 degrees F (-183 degrees C to +149 degrees C).
  10. R-value: minimum 5.6 hr\*ft<sup>2</sup>\*F/BTU after 6 months aging
  11. K-value: maximum 0.178 BTU\*in/hr\*ft<sup>2</sup>\*F after 6 months aging
- C. 4 lb/ft<sup>3</sup> Density Polyiso (dP ISO-HD™ Series 400): Physical properties:
1. Compressive Strength: minimum 77 psi (530 kPa) Parallel to Rise (thickness)
  2. Shear Strength: minimum 50 psi (344 kPa) Parallel and Perpendicular
  3. Dimensional Stability: less than or equal to 1.5 percent linear change (7 days) at -40 degrees F (-40 degrees C)
  4. Water Vapor Permeance: less than or equal to 3 perm-inch (4.4 ng/(Pa\*s\*m)).
  5. Flame Spread: 0-25 for thicknesses up to 4 inches
  6. Smoke Development: 0-225 for thicknesses up to 1 inch (25 mm); 0-300 for thicknesses up to 4 inches (102 mm)
  7. Service Temperature: -297 degrees to 300 degrees F (-183 degrees C to +149 degrees C).
  8. R-value: minimum 5.6 hr\*ft<sup>2</sup>\*F/BTU after 6 months aging
  9. K-value: maximum 0.178 BTU\*in/hr\*ft<sup>2</sup>\*F after 6 months aging
- D. 6 lb/ft<sup>3</sup> Density Polyiso (dP ISO-HD™ Series 600): Physical properties:
1. Compressive Strength: minimum 124 psi (853 kPa) Parallel to Rise (thickness)
  2. Shear Strength: minimum 80 psi (550 kPa) Parallel and Perpendicular
  3. Tensile Strength: minimum 100 psi (688 kPa) Parallel and Perpendicular
  4. Flexural Strength: minimum 200 psi (1376 kPa) Parallel and Perpendicular
  5. Dimensional Stability: <0.5 percent linear change (7 days) at -40 degrees F (-40 degrees C)
  6. Flame Spread: 0-25 for thicknesses up to 4 inches
  7. Smoke Development: 0-300 for thicknesses up to 1 inch (25 mm); 0-450 for thicknesses up to 4 inches (102 mm)
  8. Service Temperature: -297 degrees to 300 degrees F (-183 degrees C to +149 degrees C).
  9. R-value: minimum 5.6 hr\*ft<sup>2</sup>\*F/BTU after 6 months aging
  10. K-value: maximum 0.178 BTU\*in/hr\*ft<sup>2</sup>\*F after 6 months aging

\*\* NOTE TO SPECIFIER \*\* Polyiso insulation thickness in low temperature pipe applications must be adequate to reduce condensation to acceptable levels and achieve process design efficiencies, and must consider Ambient Temperature, Ambient Relative Humidity, Dewpoint, Outer Surface metal, Wind Velocity, Geometry, and R-value of selected insulation. In certain situations the insulation thickness required to achieve the requisite R-value may not have the inherent fire or smoke rating that is required. In such cases, the entire system fire and/or smoke rating must be determined, considering vapor retarder, jacketing, sprinkler systems, and so forth. Alternative approaches include rerouting of piping to reduced fire/smoke requirements, or the use of supplemental insulation with the required fire/smoke rating to supplement the R-value. Use of cellular glass should be minimized due to short and long-term cost implications and handling. Dyplast Product's ISO line of products generally provide the highest fire and smoke ratings for given thicknesses of polyiso insulation.

E Insulation thickness:

\*\* NOTE TO SPECIFIER \*\* Select one of the following three paragraphs, delete other paragraphs.

1. As indicated on the drawings.
2. Construction contractor calculate insulation thickness based on required R-values.
3. Insulation thickness: \_\_\_\_\_

#### 2.4 ACCESSORIES FOR PIPE INSULATION

\*\* NOTE TO SPECIFIER \*\* For more detailed information on accessories required for installation, visit the ISO installation section of [www.dyplastproducts.com](http://www.dyplastproducts.com).

- A. Install a vapor retarder as specified in Materials Section over pipe insulation, rather than applying a mastic system. The sheet material usually has a better perm rating, improves continuity and is easier to apply. Install vapor retarders in accordance with instructions provided below and by manufacturer.
- B. Finish insulation as required on drawings, and in exposed outdoor areas, in mechanical rooms and in high traffic areas with the following jacketing, unless otherwise indicated on drawings. Install jacketing in accordance with instructions provided below and by manufacturer.
  - 1. Jacket: PVC jacketing and fitting covers
  - 2. Where PVC jacketing can not be used, use specified metal jacketing and fitting covers.
- C. Do not use PVC jacketing where exposed to direct sunlight and insulation is more than 20 inches (510 cm) in outside diameter, or where insulation thickness is not adequate to ensure that the surface temperature of PVC does not exceed 125 degrees F (51 degrees C).

## 2.5 EQUIPMENT INSULATION

**\*\* NOTE TO SPECIFIER \*\*** Equipment that might be insulated using polyisocyanurate insulation includes tanks, vessels, piping components, or other components in systems that operate between -297 degrees F and +300 degrees F. Such systems include industrial or commercial cold water, chilled water, refrigerant, refrigeration, liquid natural gas, liquid oxygen, liquid hydrogen, and other cryogenic fluids or low-temperature applications. Two-pound density polyiso is preferable over higher densities due to lower cost, but higher densities may be appropriate for locations where insulation may be subject to substantial abuse. Vapor retarders should be utilized in the vast majority of installations. PVC or metal jacketing should be specified at the discretion of the designer/engineer for protection of the vapor retarder, particularly in high-abuse areas, or the decision can be left to the discretion of the construction contractor.

**\*\* NOTE TO SPECIFIER \*\*** Paragraphs A – D below list the nominal densities normally suitable in equipment insulation applications. The following paragraphs delineate the physical properties of Dyplast Products' ISO line of products. For comparison with other polyiso bunstock alternatives see the Comparison Chart at [www.dyplastproducts.com](http://www.dyplastproducts.com). Delete the following paragraphs that refer to polyiso product densities that are not specified for this project.

- A. 2 lb/ft<sup>3</sup> Density Polyiso (dP ISO-25<sup>®</sup> Series 200): Physical properties:
  - 1. Compressive Strength: minimum 25 psi (172 kPa) Parallel to Rise (thickness)
  - 2. Shear Strength: minimum 28 psi (193 kPa) Parallel and Perpendicular
  - 3. Tensile Strength: minimum 30 psi (206 kPa) Parallel and Perpendicular
  - 4. Flexural Strength: minimum 45 psi (310 kPa) Parallel and Perpendicular
  - 5. Dimensional Stability: <1 percent linear change (7 days) at -40 degrees F and +158 degrees F (-40 degrees C and +70 degrees C, respectively)
  - 6. Water Vapor Permeance: less than or equal to 3 perm-inch (4.4 ng/(Pa\*s\*m)).
  - 7. Water Absorption: < 1 percent by volume; D 2842 (96-hour immersion) < 2 percent by volume
  - 8. Flame Spread: 0-25 for thicknesses up to 4 inches
  - 9. Smoke Development: 0-50 for thicknesses up to 2 inches (50 mm); 0-65 for thicknesses up to 4 inches (102 mm)
  - 10. Service Temperature: -297 degrees to 300 degrees F (-183 degrees C to +149 degrees C).
  - 11. R-value: minimum 5.6 hr\*ft<sup>2</sup>\*F/BTU after 6 months aging
  - 12. K-value: maximum 0.178 BTU\*in/hr\*ft<sup>2</sup>\*F after 6 months aging
- B. 3 lb/ft<sup>3</sup> Density Polyiso (dP ISO-HD<sup>™</sup> Series 300): Physical properties:
  - 1. Compressive Strength: minimum 43 psi (296 kPa) Parallel to Rise (thickness)
  - 2. Shear Strength: minimum 40 psi (275 kPa) Parallel and Perpendicular
  - 3. Tensile Strength: minimum 52 psi (358 kPa) Parallel and Perpendicular
  - 4. Flexural Strength: minimum 90 psi (620 kPa) Parallel and Perpendicular
  - 5. Dimensional Stability: <0.5 percent linear change (7 days) at -40 degrees F (-40 degrees C)
  - 6. Water Vapor Permeance: less than or equal to 3 perm-inch (4.4 ng/(Pa\*s\*m)).
  - 7. Flame Spread: 0-25 for thicknesses up to 4 inches
  - 8. Smoke Development: 0-225 for thicknesses up to 1 inch (25 mm); 0-300 for thicknesses up to 4 inches (102 mm)
  - 9. Service Temperature: -297 degrees to 300 degrees F (-183 degrees C to +149 degrees C).
  - 10. R-value: minimum 5.6 hr\*ft<sup>2</sup>\*F/BTU after 6 months aging
  - 11. K-value: maximum 0.178 BTU\*in/hr\*ft<sup>2</sup>\*F after 6 months aging
- C. 4 lb/ft<sup>3</sup> Density Polyiso (dP ISO-HD<sup>™</sup> Series 400): Physical properties:
  - 1. Compressive Strength: minimum 77 psi (530 kPa) Parallel to Rise (thickness)
  - 2. Shear Strength: minimum 50 psi (344 kPa) Parallel and Perpendicular
  - 3. Dimensional Stability: less than or equal to 1.5 percent linear change (7 days) at -40 degrees F (-40 degrees C)
  - 4. Water Vapor Permeance: less than or equal to 3 perm-inch (4.4 ng/(Pa\*s\*m)).
  - 5. Flame Spread: 0-25 for thicknesses up to 4 inches
  - 6. Smoke Development: 0-225 for thicknesses up to 1 inch (25 mm); 0-300 for thicknesses up to 4 inches (102 mm)
  - 7. Service Temperature: -297 degrees to 300 degrees F (-183 degrees C to +149 degrees C).
  - 8. R-value: minimum 5.6 hr\*ft<sup>2</sup>\*F/BTU after 6 months aging
  - 9. K-value: maximum 0.178 BTU\*in/hr\*ft<sup>2</sup>\*F after 6 months aging
- D. 6 lb/ft<sup>3</sup> Density Polyiso (dP ISO-HD<sup>™</sup> Series 600): Physical properties:
  - 1. Compressive Strength: minimum 124 psi (853 kPa) Parallel to Rise (thickness)
  - 2. Shear Strength: minimum 80 psi (550 kPa) Parallel and Perpendicular
  - 3. Tensile Strength: minimum 100 psi (688 kPa) Parallel and Perpendicular

4. Flexural Strength: minimum 200 psi (1376 kPa) Parallel and Perpendicular
5. Dimensional Stability: <0.5 percent linear change (7 days) at -40 degrees F (-40 degrees C)
6. Flame Spread: 0-25 for thicknesses up to 4 inches
7. Smoke Development: 0-300 for thicknesses up to 1 inch (25 mm); 0-450 for thicknesses up to 4 inches (102 mm)
8. Service Temperature: -297 degrees to 300 degrees F (-183 degrees C to +149 degrees C).
9. R-value: minimum 5.6 hr\*ft<sup>2</sup>\*F/BTU after 6 months aging
10. K-value: maximum 0.178 BTU\*in/hr\*ft<sup>2</sup>\*F after 6 months aging

**\*\* NOTE TO SPECIFIER \*\*** Polyiso insulation thickness in low temperature pipe applications must be adequate to reduce condensation to acceptable levels and achieve process design efficiencies, and must consider Ambient Temperature, Ambient Relative Humidity, Dewpoint, Outer Surface metal, Wind Velocity, Geometry, and R-value of selected insulation. In certain situations the insulation thickness required to achieve the requisite R-value may not have the inherent fire or smoke rating that is required. In such cases, the entire system fire and/or smoke rating must be determined, considering vapor retarder, jacketing, sprinkler systems, and so forth. Alternative approaches include rerouting of piping to reduced fire/smoke requirements, or the use of supplemental insulation with the required fire/smoke rating to supplement the R-value. Use of cellular glass should be minimized due to short and long-term cost implications and handling. Dyplast Product's ISO line of products generally provide the highest fire and smoke ratings for given thicknesses of polyiso insulation.

E Insulation thickness:

**\*\* NOTE TO SPECIFIER \*\*** Select one of the following three paragraphs, delete other paragraphs.

1. As indicated on the drawings.
2. Construction contractor calculate insulation thickness based on required R-values.
3. Insulation thickness: \_\_\_\_\_

**\*\* NOTE TO SPECIFIER \*\*** It is recommended that all equipment and vessels 24 inches in diameter and less, operating at 0F (-18C) and below, have a double layer insulation system.

- F. For equipment and vessels greater than 24 inches in diameter, operating below 30F (-2C), should have a double layer insulation system.
- G. ISO-25 foam insulation is available in 4 feet by 8 feet sheets. With insulation thickness up to 1 ½ inch thick, the sheet is flexible enough to be wrapped around a vessel 12 feet in diameter or greater. This application will reduce the number of joints to be sealed and coverage is faster, thus savings in labor.
- H. For vessels 24 inches in diameter and less pipe insulation sections should be used.
- I. For vessels less than 12 feet in diameter, the longitudinal joints of the ISO-25 blocks shall be beveled to the radius of the vessel to ensure tight fitting joints.

## 2.6 ACCESSORIES FOR EQUIPMENT INSULATION

**\*\* NOTE TO SPECIFIER \*\*** For more detailed information on accessories required for installation, visit the ISO installation section of [www.dyplastproducts.com](http://www.dyplastproducts.com).

- A. Non-setting sealers are used to butter all insulation joints.
- B. Insulation adhesive is used on flat equipment surfaces to secure the insulation to the substrate.
- C. Stainless steel bands and seals a minimum ½ inch wide stainless are used to secure the blocks of insulation on equipment (vessels) 12 feet in diameter and less. For equipment greater than 12 feet use ¾ inch wide stainless steel bands.
- D. Reinforced vapor retarder mastic is applied to vessel heads and irregular shapes.
- E. ASJ finish vapor retarder is an acceptable vapor retarder for equipment operating at 0F and above. All seams are sealed with appropriate tape.
- F. A protective finish is recommended.

## 2.7 DUCT INSULATION

- A. For square and rectangular ducts, the insulation shall be polyiso boards.
- B. For cylindrical ducts up to 24 inches in diameter, use 2-piece pipe sectional polyiso insulation.

## 2.8 ACCESSORIES FOR DUCT INSULATION

**\*\* NOTE TO SPECIFIER \*\*** For more detailed information on accessories required for installation, visit the ISO installation section of [www.dyplastproducts.com](http://www.dyplastproducts.com).

- A. Non-setting sealers are used to butter all insulation joints.
- B. Insulation adhesive is used on flat equipment surfaces to secure the insulation to the substrate.
- C. ASJ finish is recommended.
- D. All seams are sealed with appropriate tape.

## 2.9 FABRICATION

- A. Polyisocyanurate insulation for pipe and equipment applications is manufactured as bunstock. Dyplast Products utilizes the latest technologies and equipment to produce bunstock not only with different densities but also different dimensions, from 36' to 48' widths, heights to 36" and virtually any length (commonly 24'). The ability to vary bun sizes allows sizing the bun to closely fit final dimensions of pipe and equipment insulation components, reducing waste during fabrication. Buns are fabricated using only highly qualified fabrication facilities, ensuring close tolerances to reduce rework in the field as well as to ensure tight fit and improved thermal efficiencies. Dyplast Products' ISO line of polyiso has excellent workability characteristics, allowing for cutting to 1/16 inch tolerance or better.

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Verify that all piping, equipment, and ductwork are tested and approved prior to insulation installation.

- B. Verify that all surfaces are clean, dry, and free of foreign material before applying insulation materials.
- \*\* NOTE TO SPECIFIER \*\*** For more detailed information on installation, visit the ISO installation section of [www.dyplastproducts.com](http://www.dyplastproducts.com).
- 3.2 INSTALLATION - GENERAL**
- A. Install in accordance with manufacturer's instructions and applicable building codes.
  - B. Where R-values are indicated, install in thickness required to achieve R-values; otherwise install to thicknesses required.
  - C. Install continuously on surfaces to be insulated without gaps to minimize losses in thermal efficiency, as follows:
- \*\* NOTE TO SPECIFIER \*\*** Select the appropriate paragraph below and delete the other paragraphs:
- 1. Overlap layers of insulation so seams are not contiguous.
  - 2. Use shiplap joints.
  - 3. Butt sections firmly.
- D. Locate seams in least visible location. Extend surface finishes to protect raw edges, ends and surfaces of insulation.
  - E. Where vapor retarder facing or jacketing is specified, maintain continuous, unbroken moisture and vapor seal; insulate and vapor seal all hangers, supports, anchors, and other projections secured to cold surfaces to prevent condensation; repair penetrations and damage to vapor retarder using joint tape prior to system startup.
- 3.3 PIPE INSULATION**
- A. Install pipe insulation continuously through walls, ceiling and floor openings, and sleeves except where firestopping materials are required.
  - B. Vapor barriers: install vapor barriers as indicated on drawings and in accordance with manufacturer's instructions. Seal all joints, seams and fittings.
  - C. Insulate fittings and valves with insulation equivalent to that required for adjacent piping; finish with same materials unless otherwise specified.
  - D. Molded Pipe Insulation:
    - 1. Install metal shields between hangers or supports and piping insulation and install rigid insulation inserts between pipe and the insulation shields.
  - E. Jacketing: Install jacketing as indicated on drawings and in accordance with manufacturer's instructions. Seal all joints, seams and fittings.
  - F. Contraction and expansion joints:
    - 1. For cold piping and vessels, contraction joints are not normally required with ISO-25 for operating temperatures above -50F (-45C). For operating temperatures at - 50F (-45C) and below and over 48 lineal feet of pipe or vessels over 48 feet long, a contraction joint is recommended every 12 feet.
    - 2. The contraction joints shall be in the inner layer of insulation only. The contraction joint space shall be 1 inch wide and packed with glass fiber insulation. The glass fibers shall be oriented perpendicular to the pipe or vessel length. Cover the contraction joint with a vapor retarder membrane sheet, overlapping the joint by 2 inches on both sides. Secure the membrane with reinforced tape on the pipe an stainless steel bands.
    - 3. For hot piping and vessels, expansion joints are not normally required with ISO-25. For the exception see ISO Specification and Installation Instructions at [www.dyplastproducts.com](http://www.dyplastproducts.com).
- 3.4 EQUIPMENT INSULATION**
- A. Apply insulation with joints firmly butted as close as possible to the equipment surface. Secure insulation as specified in manufacturer's instructions with adhesive or banding material.
  - B. Overlap vapor retarders and tape as specified in manufacturer's instructions.
  - C. Equipment Insulation Exposed on Exterior: Position joints so as to shed water.
- 3.5 DUCT LINER**
- A. Cover internal duct areas with duct liner.
  - B. Apply duct lining in strict accordance with the latest edition of SMACNA HVAC Duct Construction Standards and manufacturer's instructions.
    - 1. Butt transverse joints firmly with no gaps and coat with adhesive.
    - 2. Overlap longitudinal corner joints.
    - 3. When air velocity will be 4000 to 6000 feet per minute (1219 to 1829 meters per minute), apply metal nosing to upstream transverse edges to secure the insulation.
  - D. Adhesive:
    - 1. Apply adhesive to the sheet metal with a 90 percent minimum coverage.
    - 2. Coat exposed edges of the duct liner with the same adhesive.
    - 3. Repair rips and tears using the same adhesive.
- 3.6 EXTERNAL DUCT INSULATION**
- A. Install duct insulation continuously through walls, ceiling and floor openings, and sleeves except where firestopping materials or fire or smoke dampers are required.
  - C. Board Insulation: Secure in place using adhesive and/or mechanical fasteners as indicated in manufacturer's instructions.
- 3.7 PROTECTION**
- A. Protect installed products until completion of project.
  - B. Touch-up, repair or replace damaged products before Substantial Completion.