SECTION [23 07 19] – PREFABRICATED ENCAPSULATED PIPE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Prefabricated, factory-encapsulated rigid polyisocyanurate insulation systems for commercial and industrial piping applications.

B. Performance Intent: Provide a factory-encapsulated insulation system intended to reduce moisture ingress, maintain thermal efficiency, and support corrosion-under-insulation (CUI) mitigation practices where insulation system integrity is maintained.

C. Typical Applications: Exterior HVAC piping, chilled water piping, process water piping, potable water piping, wastewater piping, chemical manufacturing piping, industrial utility piping.

D. Limitations: Do not use on systems exceeding published temperature limits, continuous immersion service unless approved by manufacturer, or applications requiring fire ratings unless specified.

1.2 REFERENCES

A. ASTM C272: Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions.

B. ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

C. ASTM C585: Standard Practice for Inner and Outer Diameters of Thermal Insulation.

D. ASTM C591: Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

E. ASTM D1621: Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

F. ASTM D1622: Standard Test Method for Apparent Density of Rigid Cellular Plastics.

G. ASTM D2794: Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

H. ASTM D6226: Standard Test Method for Open Cell Content of Rigid Cellular Plastics.

I. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.

J. ASTM E96: Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, detailing insulation core properties, jacket thickness, and manufacturer’s installation instructions.

B. Shop Drawings: Include layout details of prefabricated straight sections, factory-fabricated fittings (elbows, tees, valves), and structural anchor interfaces.

C. Samples: Submit physical sample of insulation system showing integrated core and polyurea encapsulation matrix.

D. Warranty: Submit manufacturer’s standard 5-year limited warranty documentation.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installation may be performed by the Contractor's own forces or by an insulation subcontractor. Specialized insulation trade experience is not required. Installers shall be familiar with the manufacturer's published installation instructions before beginning work, and the manufacturer shall make its installation instructions and technical support available to the installing crew.

B. Regulatory Requirements: All materials and installation practices shall comply with applicable federal, state, and local codes, including OSHA standards.

C. Material Integrity: Insulation components that exhibit physical punctures, tears, or crushed cores prior to installation shall be rejected and removed from the job site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to the project site in original, unopened packaging clearly labeled with the manufacturer's name, product description, and part numbers.

B. Storage: Store materials in a clean, dry location protected from weather, direct physical damage, and chemical exposure. Maintain materials within the manufacturer's specified ambient service temperature limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Dragon Jacket Insulation (The Dragon Group, LLC), Post Falls, ID (208-772-8640 / www.dragonjacket.com).

B. Single Source Procurement: To ensure system integrity and vapor barrier continuity, all insulation cores, encapsulated jackets, molded fittings, high-density inserts, and joint sealants shall be provided by a single manufacturer.

2.2 ENCAPSULATED PIPE INSULATION SYSTEM

A. System Composition: Factory-fabricated composite consisting of a rigid, closed-cell polyisocyanurate foam core encapsulated in a factory-applied polyurea protective jacket.

B. Insulating Core Material: Rigid polyisocyanurate conforming to ASTM C591.

1. Core Density: 2.0 lb/ft³ nominal ±10% tested in accordance with ASTM D1622.
2. Compressive Strength: Minimum 22 psi perpendicular to rise direction per ASTM D1621.
3. Initial Thermal Conductivity (k): 0.160 BTU·in/hr·ft²·°F maximum at 75°F mean temperature per ASTM C518 (R-6.25/in).
4. Aged Thermal Conductivity (k): 0.183 BTU·in/hr·ft²·°F maximum at 75°F mean temperature per ASTM C518 (minimum R-5.4/in).
5. Closed Cell Content: Greater than 95% per ASTM D6226.
6. Core Water Absorption: Less than 0.6% by volume per ASTM C272.

C. Integrated Protective Jacket: Factory-applied polyurea elastomer matrix encapsulation.

1. Thickness: Nominal 60 mils.
2. Impact Resistance: Minimum 280 in-lbs per ASTM D2794.
3. Water Vapor Transmission: Maximum 0.64 grains/hr-ft² per ASTM E96.

4. System Continuity: System shall maintain continuous encapsulation across straight sections, factory-fabricated fittings, field closures, and terminations to preserve environmental protection and system integrity.
5. UV Resistance: Polyurea jacket shall be suitable for outdoor exposure as recommended by the manufacturer. Where color retention, gloss retention, or aesthetic appearance is required, provide UV-stable topcoat or aliphatic finish coat.
6. Core Operating Temperature Limits: Suitable for continuous service from -40°F up to 300°F.
7. Surface Burning Performance (ASTM E84):
    a. Standard Encapsulation System: Factory-applied polyurea protective jacket for general industrial and mechanical insulation applications.
    b. Fire-Rated Encapsulation System: Factory-applied fire-rated polyurea jacket complying with ASTM E84, maximum Flame Spread Index of 25 and maximum Smoke Developed Index of 250.

2.3 HIGH-DENSITY ENCAPSULATED INSULATION INSERTS

A. General: Provide factory-fabricated high-density insulation inserts where required to support piping loads and maintain insulation thickness at supports, hangers, rollers, guides, anchors, and other concentrated load locations. Select the density grade for each location as recommended by the manufacturer for the applied load.

B. System Composition: Factory-fabricated composite consisting of a rigid, closed-cell polyurethane foam core encapsulated in a factory-applied polyurea protective jacket.

C. Insulating Core Material: Rigid polyurethane with closed cell content greater than 95% per ASTM D6226, in the following density grades:
1. 4 lb/ft³ Grade:
    a. Core Density: 4.0 lb/ft³ nominal ±10% tested in accordance with ASTM D1622.
    b. Compressive Strength: Minimum 72 psi perpendicular to rise direction per ASTM D1621.
    c. Thermal Conductivity (k): 0.183 BTU·in/hr·ft²·°F maximum at 75°F mean temperature per ASTM C518.
2. 6 lb/ft³ Grade:
    a. Core Density: 6.0 lb/ft³ nominal ±10% tested in accordance with ASTM D1622.
    b. Compressive Strength: Minimum 132 psi perpendicular to rise direction per ASTM D1621.
    c. Thermal Conductivity (k): 0.190 BTU·in/hr·ft²·°F maximum at 75°F mean temperature per ASTM C518.
3. 8 lb/ft³ Grade:
    a. Core Density: 8.0 lb/ft³ nominal ±10% tested in accordance with ASTM D1622.
    b. Compressive Strength: Minimum 210 psi perpendicular to rise direction per ASTM D1621.
    c. Thermal Conductivity (k): 0.200 BTU·in/hr·ft²·°F maximum at 75°F mean temperature per ASTM C518.

D. Integrated Protective Jacket: Same as Article 2.2, Paragraph C.

2.4 ACCESSORIES

A. Fasteners & Banding:

1. Straight Piping & Mechanical Fittings: Heavy-duty plastic cable ties or Type 304L stainless steel bands as approved by the manufacturer.
2. Frequently Serviced Mechanical Fittings & Valves: Corrosion-resistant or zinc-coated steel threaded hardware for bolt-on bracket assemblies.

B. Joint Sealants and Mastics:

1. Primary Sealant: Chemlink M1 Structural Adhesive or approved equivalent.
2. Joint Closure Coating: Childers CP11-2 Black Mastic or approved manufacturer equivalent for treatment of field-cut foam edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Prior to installing insulation, the contractor shall verify that all piping systems have been hydrostatically pressure-tested, inspected, and officially released for insulation.

B. Surface Deficiencies: Do not apply insulation to piping exhibiting active fluid leaks, structural defects, or surface contamination. Notify the Construction Manager immediately of any adverse conditions.

3.2 PREPARATION

A. Surface Cleaning: Clean all pipe surfaces thoroughly immediately prior to insulation layout. Remove surface moisture, dust, dirt, grease, and oil.

B. Legacy Coatings: Existing structural primers or corrosion-preventative coatings shall be left intact and undisturbed.

C. Burrs and Edges: Mechanical contractors shall deburr all pipe welds and smooth down sharp structural elements to prevent interior abrasion of the insulation core.

3.3 SYSTEM INSTALLATION

A. General: Install all prefabricated insulation sections, fittings, and containment hardware in strict accordance with manufacturer's published installation manual.

B. Straight Piping Insulation:

1. Align prefabricated hinged or split insulation sections symmetrically around the pipe barrel.
2. Secure straight runs using approved bands or securements spaced at a maximum interval of one (1) band per linear foot of insulation.

C. Fitting and Valve Insulation:

1. Position prefabricated fitting covers (tees, elbows, flanges, valves) securely over structural targets.
2. Install a minimum of two (2) securement bands per fitting assembly.
3. For bolt-on components utilizing mechanical brackets, install one (1) complete corrosion-resistant fastener set (bolt, dual washers, nut) per individual mounting bracket slot.

D. Vapor Barrier and Joint Integrity:

1. Overlap all section interfaces utilizing the integrated factory-molded butt joint covers. Secure joint covers tightly with securement bands.
2. Where field cutting exposes the raw polyisocyanurate foam core, seal the raw edges immediately per manufacturer’s published installation manual.

3.4 ADJUSTING AND CLEANING

A. Field Modifications: Where field geometry forces deviation or trimming of prefabricated components, modifications shall be executed strictly following engineering pathways approved by the insulation manufacturer.

B. Post-Installation Cleaning: Remove installation debris, dirt, and dust from the finished encapsulated jacket surface using clear water or mild soapy solution.

C. Pressure Washing: Low-pressure washing of the finished polyurea jacket is permitted, provided the pressure settings do not cause surface abrasion or compromise joint seal integrity.

END OF SECTION [23 07 19]