1. GENERAL
	1. RELATED DOCUMENTS
		1. Drawings and general provisions of contract, including general and supplementary conditions and division. Specification sections, insulation manufacturers shop/installation drawings Design & Installation manual apply to work of this section.
	2. DESCRIPTION OF WORK
		1. Extent of underground piping insulation required by this section is indicated on drawings and schedules and by requirement of this section.
		2. Types of underground piping insulation specified in this section include the following: Inorganic, engineered granular, underground pipe insulation.
	3. SECTION INCLUDES
		1. Controlled Density Thermal Insulation & Corrosion Protection Pipes & Tanks
		2. Miscellaneous incidental to complete installation of field applied exterior insulation to raw carrier pipe
	4. CODES AND STANDARDS *American Society for Testing and Materials* *(ASTM)*
		1. ASTM C-177-04 Steady-State Heat Flux Measurement and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
			1. Thermal Conductivity - material ASTM testing at installed/use density
		2. ASTM D-1895 Apparent Density, Bulk Factor and Pourability of Plastic Materials
			1. Method A: Apparent Density (Bulk Density)
			2. Method C: (Applied 400 lbs.) Compaction & Corresponding Density Under Static Load
			3. Method C: (Applied 400 lbs.) Percent of compaction of installed density under static load
			4. Method C: (Applied 12,000 lbs.) Material Bearing Under Applied Static Loading
	5. SUBMITTALS
		1. Submit product testing of product properties in accordance and compliance of ASTM Industry Codes and Standards for items in Section 1.4 “Codes and Standards” and Section 2.4 “Physical Properties”
		2. Long Term Water Retardency Test: Submit passage of 3rd party conducted laboratory testing for minimum of 30 days withstanding moisture penetration.
		3. Submit manufacturer entire warranty, per manufacturer’s current design/installation manual.
		4. Current Published Manufacturer's Design & Installation Manual and Instructions
		5. Manufacturer Statement: Indicating if the material is sold based on bulk density or installed/use density.
	6. QUALITY ASSURANCE
		1. Manufacturer’s Qualifications: Firm regularly engaged in the manufacture of granular insulation products of size and type required, whose product has been in satisfactory use in similar service for not less than 10 years.
		2. Installers Qualifications: Firm with at least 3 years of successful installation experience on projects with elevated temperature mechanical insulation systems.
		3. [If Required] On site supervision of direct buried insulation installation: Provide services of a manufacturer trained representative of the insulation manufacturer for a minimum of [Fill In] trip(s), to include pre-installation/start-up training and continued installation supervision. Provide a written report following each site trip. Advise manufacturer of minimum 7-10 days in advance for scheduling.
	7. SUBSTITUTIONS
		1. Request for alternative must be made within 10 days prior to bid. Proposed alternative must be a viable direct-buried product. Substitutions will be included in addendum prior to bid and all deviations from requirements of this specification noted.
	8. DELIVERY, STORAGE AND HANDLING
		1. Deliver insulation, associated adhesives, form work and supplementary steel to site in manufacturer’s containers with manufacturer’s stamp or label clearly shown.
		2. Protect insulation packaging and associated components against sun, dirt, water and chemical damage.
2. PRODUCTS
	1. MANUFACTURER & PROPRIETOR OF PATENT

##### Gilsulate International, Incorporated

##### 26000 Springbrook Ave 201

##### Santa Clarita, Ca 91350

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* 1. PATENTED PRODUCT
		1. Gilsulate®500XR (Patent 4,231,884)
			1. Exact Match Only –this necessary item is not available under any other product name.
			2. There is NO equal alternative to or replacement for Gilsulate®500XR.
	2. INSULATION & CORROSION PROTECTION
		1. Provide a system meeting Unified Facilities Guide Specifications UFGS-33.61.13 (2.4) including manufacturer requirements, ASTM Codes & Standards and installed guidelines.
		2. Product must consist of insulating minerals (sodium potassium aluminum silicate) and dielectric mineral filler (coated calcium carbonate). Material shall be dry, free-flowing, inert, inorganic, non-toxic, non-flammable, and completely free of asbestos and fibers. Material to be chemically treated to render it hydrophobic. Product is NOT to rely upon polyethylene barrier to prevent: foreign object/soil intrusion, material protection or direct contact of water. Unified Soil Classification System (USCS) recognizes well-graded and poorly graded materials. Underground fill product must consist of well-graded, multi-sized and shaped particles and raw material must be dimensionally stable. Insulation material must be able to be mechanically compacted.
	3. PHYSICAL PROPRTIES
		+ 1. ASTM C177-04 Thermal Conductivity (tested @ use density):
				1. K = 0.53 Btu/hr.ft2 °F/in.  @ 100 °F Mean Temp
				2. K = 0.60 Btu/hr.ft2 °F/in.  @ 175 °F Mean Temp
				3. K = 0.65 Btu/hr.ft2 °F/in.  @ 300 °F Mean Temp
			2. ASTM D1895A – Bulk Density
				1. 30-34 lbs./ft3
			3. ASTM D1895C (400 lbs.) – Consolidated Cubic Foot Installed/Use Density (CFUD)
				1. 40-42 lbs./ft3 CFUD
			4. ASTM D1895C (400 lbs.) – Percent of compaction of installed density under static load
				1. Shall not exceed more than 1% compaction
			5. ASTM D1895C (12,000 lbs.) – Material Bearing Under Applied Static Loading
				1. 12,000 PSF
			6. Particle Sizing Range: “Well-graded” diameter ranging from 1mm to sub-micron sizes
			7. Material Stability: Material for direct-buried application must support weight of a man prior to backfill placement.
			8. Temperature Range: 35°F to 800°F
			9. Electrical Resistivity: Greater than 10 to the 12th Ohm-cm
	4. ACCESSORIES
		1. Protective Coatings: provide a bitumastic self-priming, heavy duty, cold-applied, waterproof coating made from pitch derived from tar and solvents.  Approved product: Carboline® “Bitumastic 50” or equal.
		2. Structural Steel Components: provide steel anchors and guides as required by the contract documents and insulation manufacturer's drawings and Design and Installation Manual.
		3. Expansion Cushions: provide 3 to 5 pound density mineral fiber cushion to accommodate thermal expansion at expansion loops and elbows as required by the contract documents and insulation manufacturer's drawings and Design and Installation Manual.
1. EXECUTION
	1. EXAMINATION
		1. Examine area and conditions under which engineered controlled density insulating fill & corrosion protection system is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected. All standing water shall be removed from trench prior to installing insulation.
		2. Pile dirt from trenching on one side of trench and work from opposite side. Insure bottom of trench is free of debris and large stones.
		3. Bottom of trench shall be undisturbed soil.
	2. INSTALLATION
		1. Install and test carrier pipe: Install and test prior to installing insulation. Inspect welds and pressure test pipe as required by other sections of this specification. Clean pipe of all dirt, scale and foreign materials.
		2. Installation of anchors: Install structural steel and concrete of the size and quantity shown on the contract documents.  Pour 2000 psi concrete at 28 days around rebar and anchor post and against undisturbed soil.  Insure anchor post and support channel (if required) are at the proper elevation for installation of piping.  Insure the rebar and the bottom of the anchor post is within the concrete envelope. Just prior to pouring the insulation coat all exposed steel (anchor post, support channel and knee brace) with bitumastic. Bitumastic must be tacky during insulation.
		3. Installation of guides: Install structural steel and concrete of the size and quantity shown on the contract documents.  Pour 2000 psi concrete at 28 days around lower portion of guide brackets and against undisturbed soil. Weld the horizontal guide brackets at the proper pipe elevation. Just prior to pouring the insulation coat all exposed steel guide brackets and spacer angles with bitumastic. Bitumastic must be tacky during insulation installation.
		4. Installation of expansion loop support: Pour concrete support pad of the size indicated on the contract documents.  Insure pad elevation is correct for proper pipe elevation when the concrete pipe support is installed. Coat pipe support with bitumastic. Bitumastic must be tacky during insulation installation.
		5. Installation of temporary pipe supports: Provide temporary pipe support wires suspended from lumber bridging the trench. Temporary wood blocks located under the pipe may also be used. These supports must be removed as the insulation is poured and consolidated. No object should be allowed to bridge the gap between the soil and the pipe except the insulation.
		6. Installation of expansion cushions: Wrap mineral fiber cushions around pipe elbows on expansion elbows and expansion loops as indicated on the contract documents. Insure there is sufficient space or flexibility between cushions to allow insulation to pour and be consolidated under piping. Secure cushion to pipe with fiber reinforced tape. Specified Insulation thicknesses need to be maintained around fiber cushion areas.
		7. Installation of forms: Provide gypsum board forms with support posts as shown in Gilsulate International, Inc.'s Design and Installation Manual. Posts must be located on the outside of the forms and spaced to prevent bowing of the gypsum board. After forms are in place, partially backfill outside of form to height of pipe.
		8. Pouring of insulation: Pour insulation in short sections along the pipe axis. Apply bitumastic to structural steel surfaces and fill trench to centerline of pipe. Consolidate insulation using a rod-type concrete vibrator pulled along the sides and between the pipes. Pour and consolidate additional layers of insulation until the design coverage has been achieved.  Proper consolidation is achieved when the insulation can be walked on with foot prints less than 1" deep. No wood is to remain in contact with pipe(s) or left in insulation envelope. This could affect overall system efficiency (heat gain/loss) of non-metallic pipe(s) and/or cause corrosion to metallic pipe(s).
		9. Inspector must physically be capable of confirming specified installed/compacted insulation thicknesses prior to placement of any backfill.
		10. Backfill first 6" of soil (no stones) by hand. Complete backfilling and mechanically compact in uniform layers with suitable excavated soil to grade level.
		11. Refer to Gilsulate International Inc. “Design & Installation Manual for Installation Procedures.
2. END OF SECTION