



Design & Installation Manual

GILSULATE[®] 500XR

UNDERGROUND CONTROLLED DENSITY INSULATING FILL & CORROSION PROTECTION SYSTEM

Gilsulate International, Incorporated

UNDERGROUND CONTROLLED DENSITY INSULATING FILL & CORROSION PROTECTION SYSTEM

GILSULATE®500XR

by, Gilsulate International, Inc.



Development of patented Gilsulate® began in 1943. Gilsulate® was the first commercially successful granular pour in place underground pipe insulation.

The patented Gilsulate®500XR product was specifically invented for the primary purpose as an underground insulation and corrosion protection system. Development of the particle engineering was one of the many critical design phases. *The ability to mechanically compact the minerals to achieve a controlled density is one of the properties which makes Gilsulate®500XR so successful. This is one of the specific attributes as to why so many owners exclusively use Gilsulate®500XR.*

Gilsulate®500XR consists of safe, eco-friendly, non-toxic dielectric mineral and insulating minerals which enable it to be up to 40% more efficient!. It is the MOST thermally efficient, highest CO2 reducer and lowest operational cost PIP product available. It's delivery tote contains more than two times the CFUD volume of any other allowing for half the handling, faster delivery and fewer transport trucks.

Owners and Engineers specify Gilsulate®500XR because of its insulating properties, proven performance, recognized track record of long-term reliability and its simplistic design. With low installed costs and high insulating value, Gilsulate®500XR provides the incredible overall value owners are seeking in today's economy.

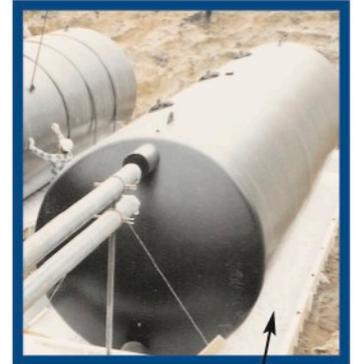
Gilsulate®500XR insulates and protects against corrosion for service temperatures between 35° -800 °F. It doesn't matter what type of pipes, sizes or configurations you have; we handle them all with our one patented product. It pours out of the bag with no mixing or curing. There is no maintenance on your Gilsulate®500XR system and no need for expensive cathodic protection or leak detection. Gilsulate®500XR is field flexible, so unforeseen underground obstructions during construction won't slow it down. Long lead times are not part of the vernacular with Gilsulate®500XR. We can help you with new distribution loops or help you with a quick repair of an existing system to get your back up and running.

WHY OWNERS ARE CHANGING FROM PRE-INSULATED PIPING SYSTEMS TO GILSULATE®500XR.

- Significant ROI over life of district cooling systems
- Quick and easy solution for time sensitive projects
- Long-Term protection to owner's critical infrastructure saving future maintenance repair dollars.
- Less Excavation =
Less Hardscape & Landscape replacement
- Cost effective, long-term and energy efficient solution for district heating system
- Maintenance free system saving operational dollars
- Gilsulate systems can be up to 30% more efficient
- Sustainable alternate to:
"the same way we have always done it"

WE WANT TO HELP YOU SAVE BTU'S TOO!
CONTACT US TODAY!

Gilsulate International, Inc. (800) 833-3881 • (661) 799-3881 • Fax: (661) 799-3882
26000 Springbrook Avenue 201 • Santa Clarita, Ca 91350 • www.gilsulate.com



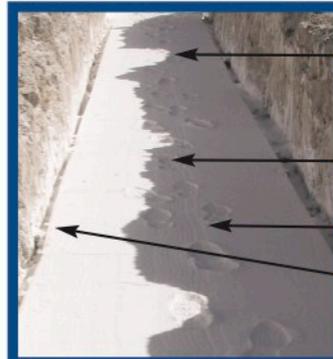
NARROW TRENCH REDUCES EXCAVATION. 24" CWSR. OUTSIDE CFUD THICKNESSES 6" PIPE SPACING 6".

STEEL TANKS SITTING ON BED OF COMPACTED GILSULATE®500XR. TANKS ARE COMPLETELY ENCAPSULATED IN GILSULATE®500XR AND WERE INSTALLED 1993. TANKS ARE STILL IN OPERATION TODAY - 2011.

CONTROLLED DENSITY FILL ALLOWS FOR SUCCESSFUL SYSTEMS IN CONCRETE TRENCHES AND UTILIDORS.

FILL MATERIAL SUPPORTS MANS WEIGHT DURING INSTALLATION PROCESS.

CONTROLLED DENSITY FILL IS QUICK AND EASILY COMPACTED USING WAND TYPE VIBRATOR. THIS ENABLES CONTRACTOR/INSPECTOR TO CONFIRM INSTALLED THICKNESSES.



LARGE DIAMETER PIPES ARE SUPPORTED INSIDE ENVELOPE SOLELY BY THE GILSULATE®500XR MATERIAL. TEMPORARY SUPPORTS ARE REMOVED DURING MECHANICAL COMPACTION.

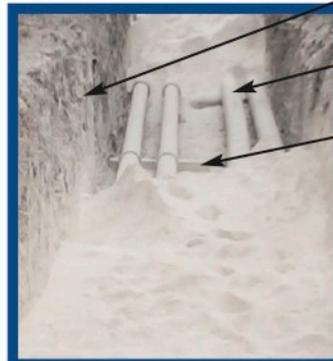
SYSTEM IS READY FOR BACKFILL. EMPTY BAGS CAN BE PLACED ON TOP OF ENVELOPE TO MINIMIZE CONSTRUCTION WASTE. ALSO WORKS AS AN ID MARKER IF LOCATION IS EXCAVATED AT A LATER DATE.

BARE COMPACTED FILL IS LOAD-BEARING WALK ON MATERIAL BEFORE BACKFILL.

ECONOMICAL GYPSUM TRENCH WALL FORMS USED TO ASSURE PROPER TRENCH WIDTH IS MAINTAINED THROUGHOUT SYSTEM.

ROUGH CUT TRENCH USED IN LIEU OF FORMING. QUICK AND EASY BUT TYPICALLY REQUIRES MORE MATERIAL DUE TO UNEVEN TRENCH WALLS.

CARRIER PIPE SELECTED BY ENGINEER. HDPE CWSR & HWSR DUCTILE IRON.

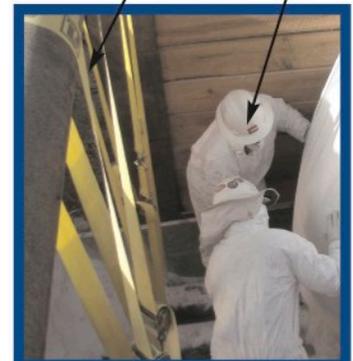


TEMPORARY WOOD SUPPORTS ARE EASILY REMOVED AS MATERIAL IS MECHANICALLY COMPACTED AROUND PIPING.

A NIOSH MASK RATED FOR NUISANCE DUST & GOGGLES ARE THE ONLY RECOMMENDED SAFETY ITEMS NEEDED WHILE INSTALLING THE ECO-FRIENDLY AND SAFE PRODUCT.

INSTALLATION: POURING MATERIAL FROM MEGASACK.

USING STRAPS AS TEMPORARY PIPE SUPPORT FOR QUICK AND EASY RELEASE AFTER INITIAL MECHANICAL COMPACTION LIFT COMPLETED.





**Gilsulate
International
Incorporated**

MISSION STATEMENT

- Introduction:** Gilsulate International is dedicated to growing and maintaining a leadership position in the manufacturing, marketing and distribution of the underground pipe insulation market. We are committed to providing our customers with products and services of the highest quality, on-time, and at competitive prices.
- Customers:** Customers are the focus of everything we do. Our future success and growth are dependent on a firm commitment to meeting our customers needs and providing better products and services than our competition.
- Quality:** We are focused on our customer's ultimate success. As such, our guiding principle is to provide our customers with the highest quality products and services.
- Suppliers:** Suppliers are our partners. We will maintain mutually beneficial relationships with each of our vendors. The support and partnership of our vendors will allow us to maintain and surpass the high standards we set for ourselves.
- Representatives:** Our representatives are an extension of our organization. Our customers success, and ours, is dependent on the ability and dedication of our representatives. We will maintain a mutually beneficial relationship with our representatives through communication and support.
- Employees:** Without the support and dedication of our employees we will achieve nothing. All our focus and efforts are achieved through teamwork. We will treat each other with trust and respect.
- Integrity:** Our integrity will never be compromised. Each of us will subscribe to the highest standards of conduct. We will act in a manner that is socially responsible and that commands respect for its positive contributions to society.

GILSULATE® 500_{XR}

GILSULATE® 500_{XR} is the result of extensive field experience, testing and laboratory research. GILSULATE® 500_{XR} is designed and manufactured to meet the special conditions required of underground insulation and protection systems.

GILSULATE® 500_{XR} is manufactured from naturally occurring inert, non-toxic, inorganic minerals. The particles of this dry granular material are specifically sized to be consolidated and provide the load bearing capabilities required by soil engineers. Particles are selected to provide an excellent K-factor. Particle coating and sizing create GILSULATE® 500_{XR}'s excellent resistance to hydrostatic heads. Galvanic action between piping and the soil is prevented by the materials high electrical resistivity.

Results of an extensive testing program are available through Gilsulate International, Inc. corporate offices.

Applications

GILSULATE® 500_{XR} insulating systems are designed for underground applications where product temperatures range from 35 °F to 800 °F. Examples are:

<i>Steam</i>	<i>Condensate</i>	<i>Domestic Water</i>
<i>Hot Water</i>	<i>Fuel Oil</i>	<i>Petrochemicals</i>
<i>Molten Sulphur</i>	<i>Chilled Water</i>	<i>Asphalt</i>
<i>Superheated Hot Water</i>		

Heat Transfer Design Criteria

Calculations found in this manual are based on the following design criteria:

Depth to Pipe Centerline	48"
K-Factor of Soil	0.80 BTU/ft ² /hr/°F/ft
Temp-Soil	50 °F
Thermal Efficiency	80%

Gilsulate International, Inc. will preform computerized heat transfer calculations for specific projects upon request of its customers. These calculations will provide the BTU loss of proposed or existing systems. Annual energy savings are easily calculated by cost per million BTU's saved. Short term paybacks are normal.

Design Assistance

Upon request Gilsulate International, Inc. will assist customer technical personnel during design. Gilsulate International, Inc. will review drawing and specifications submitted prior to bid or installation.

Limitations

The information and data presented in this manual and others is believed to be accurate and reliable and is presented as an accommodation. This manual supercedes prior publications and may change without notice.

Ultimate design and installation is the responsibility of the design engineer and/or the owner's representative.

Underground areas with flowing water or a positive underground water source should be avoided when designing or installing an underground piping system.

On March 1, 2004 Gilsulate International, Inc., acquired the assets, the patent and the copyright to the trade name Gilsulate and Gilsulate 500_{XR} from American Thermal Products, Inc. All references in this manual to American Thermal Products, Inc. or ATP should be considered as Gilsulate International, Inc. If you have any questions, call us at (800) 833-3881 or (800) 313-5091.

Index

Product Description and Design Criteria	2
Advantages and Packaging	3
1.0 Insulation Envelope Design	4
1.1 Pipe Coverage	4
1.2 Volume Calculations	4
2.0 Pipeline Design Considerations	5
2.1 Line Expansion	5
2.2 Expansion Table and Calculations	5
2.3 Expansion Loop - Anchor Guide	6
2.4 Anchors.....	7
2.5 Anchor Design - Block Size	8
2.6 Anchor Design - Pipe-to-Anchor Steel	9
2.7 Pipe Guide Design	10
2.8 Pipe Supports	
Unsupported Pipe Runs	11
2.9 Wall Entry and Riser Design	13
3.0 Installation Sequence	14-15
4.0 Special Site Conditions	16
4.1 Soil Permeability and Sub-Drainage System	16
4.2 Concrete Trenches	16
4.3 Utility Crossings	16
4.4 Unstable Soils	16
4.5 Street Crossings and Parking Lots	17
5.0 Retrofitting Existing Systems	18
6.0 Sample Specification - Division 15000	19-20
7.0 Installation Assistance	21
8.0 Material Specification	21
9.0 Warranty	21
Engineering Project Data Sheet	22

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U.S. Patent No. 4,231,884

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Advantages

Low Installed Cost: Low initial cost and easy installation add up to a lower installed cost than most insulation systems on the market today.

Easily Installed: Shipped in 40 lb. multi-ply paper bags (or 60 cubic foot semi-bulk bags). Easy to calculate requirements because one bag equals one cubic foot of insulation in the trench at the recommended density of 40 - 42 lb./cu. ft. **GILSULATE® 500XR** is simply poured around any pipe size or complicated manifolding, consolidated and backfilled.

Load Bearing, Yield, Coverage: **GILSULATE® 500XR** is designed to be consolidated prior to backfill. This feature provides excellent load bearing properties without loss of coverage due to “shrinkage” or settling during backfill operations. The “consolidated” envelope prevents foreign objects that fall into an open trench from penetrating the insulation envelope.

Retrofit, Repair or Extend Other Systems: Failures in conduit, concrete trench, direct burial, or other systems are easily repaired with **GILSULATE® 500XR**. Exentions are made with ease.

Insulates from 35°F to 800°F: Insulates either chilled or hot pipes. Not affected by “thermal shock” on startup or shutdown.

High Insulating Qualities: **GILSULATE® 500XR** meets all important physical characteristics of good insulation. It has a high resistance to water penetration, does not deteriorate in use and has good thermal properties.

Insulates Most Pipe Materials: Steel, iron, reinforced plastic, carrying any substances such as gas or liquid at temperatures from 35°F to 800°F.

Allows Thermal Pipe Expansion: Expansion movement is absorbed by a mineral fiber cushion surrounding the pipes at expansion loops and 90° bends. The cushion is enclosed and protected by the **GILSULATE® 500XR** envelope. No complicated vaults or internal cavities are required.

Chilled Water: Chilled water BTU’s are expensive. They can be conserved and water temperature stabilized by insulating chilled water pipes with **GILSULATE® 500XR**.

Operation Maintenance: Requires no maintenance or special startup/shutdown procedures.

Corrosion Protection: Excellent electrical resistivity properties prevent corrosion to buried steel pipes and tanks.

Use Density

GILSULATE® 500XR is packaged to take advantage of consolidation of “use density,” i.e., one (1) cubic foot per bag. It is not sold in loose bulk density. Additional material consideration for “yield losses” due to loose bulk density pricing isn’t required when purchasing **GILSULATE® 500XR**. Load bearing and consolidation test results are available upon request.

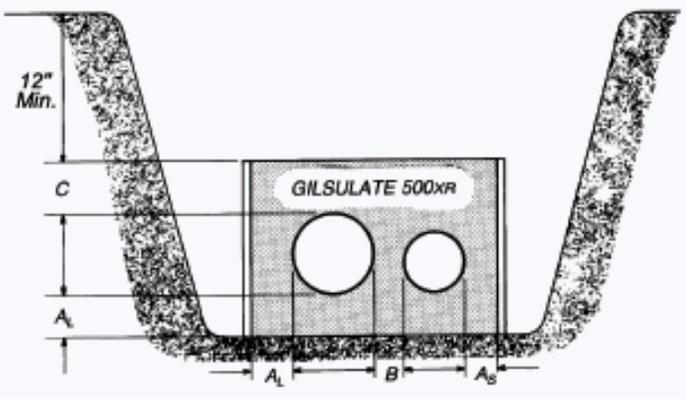
Packaging

Available in multi-ply paper bags, 40 lbs. (18.14 kg) net weight, containing approximately one cubic foot (0.028 cubic meter) of insulation at recommended use density, shipped on pallets with stretch wrap, 60 bags per pallet. Stacked bags should be placed on plywood or similar material elevated above the ground surface. When bags are stored outdoors, use of a canvas tarp or heavy gauge plastic protective covering is recommended. **GILSULATE® 500XR** may also be packaged in “semi-bulk” bags. Customers may order this packaging upon quotation by Gilsulate International, Incorporated

1.0 Design of the Insulation Envelope

1.1 Pipe Coverage Selection

Figure No. 1



- A_L - Coverage for Large Pipe Diameter
- A_S - Coverage for Small Pipe Diameter
- B - Selected for Small Pipe Diameter
- C - Coverage for Large Pipe Diameter

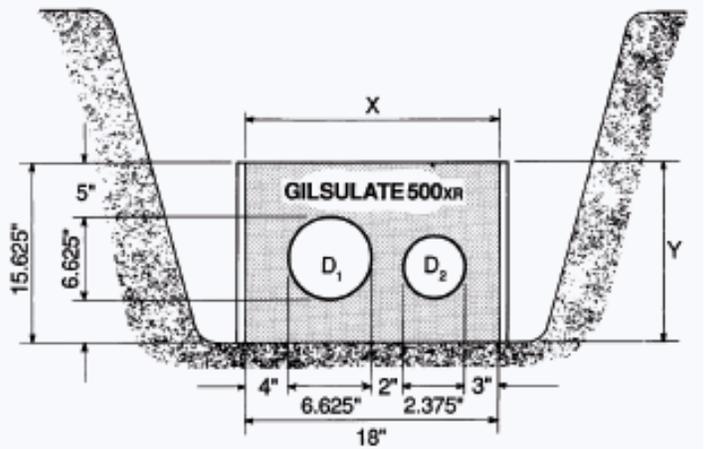
Contact Gilsulate International, Inc for design details when installing multiple types of piping systems in the same trench or insulation envelope.

GII will provide computerized heat transfer calculations upon request. Determining exact BTU savings is most valuable when evaluating insulation systems.

1.2 GILSULATE® 500XR Volume Calculations

The following example shows how to calculate the quantity of GILSULATE® 500XR (cubic feet). Dimensions for the insulation envelope are obtained from Table 1. Additional quantities (thicknesses) are required at expansion loops, and 90° bends as illustrated in Section 2.3.

Figure No. 2



SAMPLE PROBLEM NO. 1:

- 6" Steel Steam Pipe @ 300°F $C = 5$
- 2" Steel Condensate Pipe @ 115°F $A_L = 4$
- 100 L.F. of system (trench) $A_S = 3$
- $B = 2$

SOLUTION:

$$\text{Volume } (x \cdot y) - (\text{Area of Pipes}) = \text{Cu. Ft./L.F.}$$

$$144$$

$$\text{Volume} = \frac{(18.0 \times 15.625) - (34.47 + 4.43)}{144} = 1.68 \text{ Cu.Ft./L.F.}$$

$$\text{Trench Volume} = 1.68 \text{ Cu. Ft./L.F.} \times 100 \text{ L.F.}$$

$$= 168 \text{ Cubic Feet}$$

Table No. 1

OPERATING TEMPERATURE			GILSULATE® 500XR ENVELOPE DIMENSIONS																	
			35°F to 100°F			101°F to 220°F			221°F to 305°F			306°F to 405°F			406°F to 505°F			506°F to 600°F		
NOM. PIPE SIZE	OUTSIDE DIA.	PIPE AREA SQ. IN.	DIMENSIONS IN INCHES																	
			A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
1	1.315	1.4	3	2	4	3	2	4	3	2	4	3	2	4	4	2	5	4	3	6
2	2.375	4.4	3	2	4	3	2	4	3	2	4	4	2	5	4	2	5	4	3	6
3	3.500	9.6	3	2	5	3	2	5	4	2	5	4	2	5	4	2	5	5	3	6
4	4.500	15.9	4	2	5	4	2	5	4	2	5	5	2	6	5	2	6	6	3	7
5	5.563	24.3	4	3	5	4	3	5	4	3	5	5	3	6	5	3	6	6	4	7
6	6.625	34.5	4	3	5	4	3	5	4	3	5	5	3	6	5	3	6	7	4	8
8	8.625	58.4	4	3	5	5	3	6	5	3	6	6	3	7	6	3	8	7	4	8
10	10.750	90.8	4	3	6	5	3	6	6	3	7	6	3	7	6	3	8	8	4	10
12	12.750	127.7	4	3	6	6	3	7	6	3	8	6	3	8	7	3	9	9	5	11
14	14.000	153.9	5	4	6	6	4	7	6	4	8	6	4	8	7	4	9	9	5	11
16	16.000	201.1	5	4	6	6	4	7	7	4	8	7	4	9	8	4	10	10	5	11
18	18.000	254.5	5	4	6	6	4	8	7	4	8	7	4	9	8	4	10	10	5	11
20	20.000	314.2	5	4	7	6	4	8	8	4	9	8	4	9	9	4	10	10	5	11
24	24.000	452.4	5	4	7	6	4	8	8	4	9	8	4	10	10	4	11	11	5	12

2.0 Pipeline Design Considerations

2.1 Line Expansion

Thermal expansion must be provided for whenever the pipe operates significantly above ambient temperatures. Welded or other rigidly connected pipes operating at ambient temperatures need not have provision for thermal expansion.

Gilsulate International, Inc. will review piping plans and provide recommendations for accommodating thermal growth.

For most systems, thermal expansion of the piping is accommodated by loops, bends or expansion joints. Design of the expansion facility to provide for adequate expansion without overstressing the metal is the responsibility of the Design Engineer. The pipe expansion table below will be helpful in estimating pipe thermal expansion for design purposes.

Longitudinal expansion movement is limited only by the stress in the pipe wall caused by cumulative friction of the insulation against the outside surface of the pipe. In **GILSULATE® 500xr** this amounts to approximately 100 pounds per square foot (488 kg/m²) of pipe surface area. Many manufacturers make a shrouded bellows expansion joint which can be installed within the insulation. Bellows joints that are installed within the insulation must be shrouded. Bellows joints that are not shrouded must be installed in manholes or vaults.

SAMPLE PROBLEM NO. 2

Find the thermal expansion of a 6 inch carbon steel pipe 100 feet long, operating temperature 300°F installed at 60°F.

SOLUTION:

From Table 2, the thermal expansion (T) at 300°F is:

$$T = 1.84 \text{ in } 100 \text{ ft.}$$

Total Expansion (E_p) is then equal to:

$$E_p = \frac{T \times L}{100'} = \frac{1.84'' \times 100'}{100'}$$

$$E_p = 1.84 \text{ in.}$$

Where T = Thermal expansion in inches per 100 ft. of pipe.
 L = Length of pipe in feet.

2.2 Expansion Table and Calculations

Thermal Expansion in Inches
per 100 Feet - Above 60°F

Table No. 2

Saturated Steam Vacuum in HG below 212°F., Pressure psig above 212°F	Pipe		
	Temp. °F	Carbon Steel	Copper
	0	-0.51	-0.68
29.4	60	0	0
28.9	80	0.07	0.22
28.0	100	0.24	0.45
26.5	120	0.40	0.69
24.0	140	0.55	0.91
20.3	160	0.69	1.12
14.6	180	0.85	1.37
6.5	200	1.01	1.62
0	212	1.10	1.75

Steam Pressure	Temp °F	Pipe	
		Steel	Copper
2.5	220	1.17	1.84
10.3	240	1.33	2.08
20.7	260	1.51	2.31
34.5	280	1.67	2.54
52.3	300	1.84	2.78
74.9	320	2.02	3.02
103.3	340	2.19	3.26
138.3	360	2.37	3.50
180.9	380	2.55	3.74
232.4	400	2.72	3.99
293.7	420	2.91	4.23
366.1	440	3.08	4.47
451.3	460	3.27	4.73
550.3	480	3.44	4.97
664.3	500	3.64	5.23

Steam Pressure	Temp °F	Pipe	
		Steel	Copper
795.3	520	3.83	5.47
945.3	540	4.01	5.73
1115	560	4.22	5.97
1308	580	4.42	6.24
1525	600	4.62	6.50
1768	620	4.82	6.75
2041	640	5.02	7.01
2346	660	5.24	7.27
2705	680	5.44	7.52
3080	700	5.65	7.79
	720	5.85	8.03
	740	6.06	8.32
	760	6.28	8.58
	780	6.49	8.85
	800	6.72	9.11

2.0 Pipeline Design Considerations (cont'd)

2.3 Expansion Loop - Anchor - Guide Layout

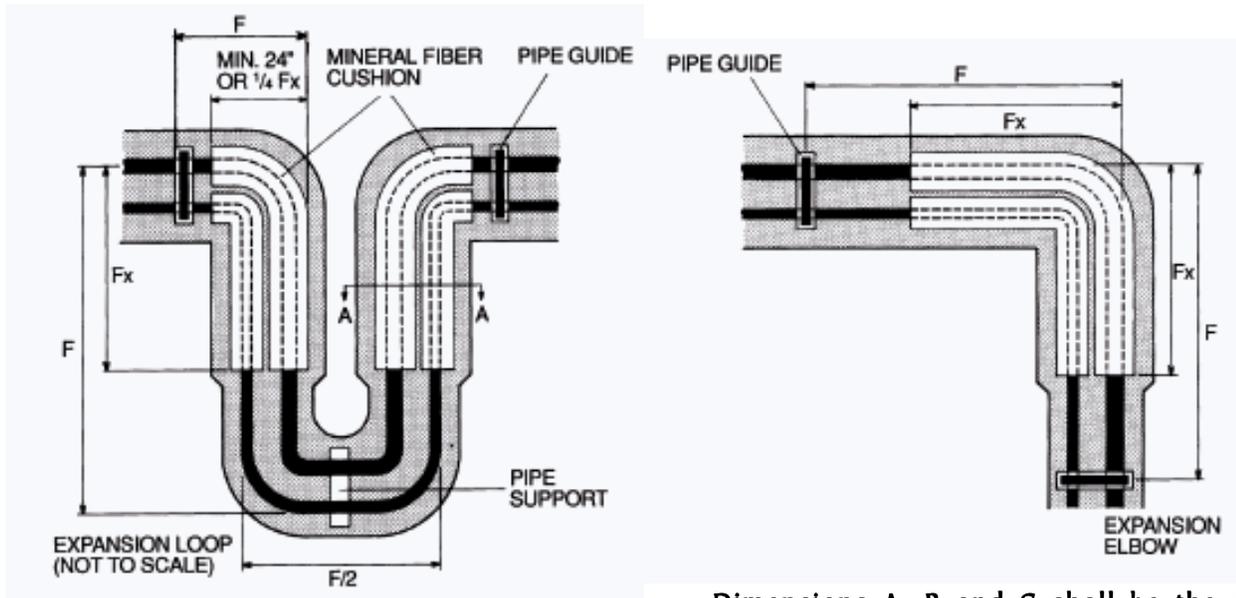
Expansion loops or bends and lateral connections can be installed directly within the **GILSULATE® 500XR** envelope. However, because of the excellent load bearing properties of **GILSULATE® 500XR**, pipe stress due to lateral pipe movement of more than 1/2" may be significant. In order to provide greater flexibility for expansion movement, and to reduce pipe stress to a minimum, an expansion absorbing cushion is required. The cushion shall be composed of mineral fiber of sufficient density and structural strength to maintain its dimensions within the **GILSULATE® 500XR** envelope. Mineral wool inorganic glass fiber and ceramic fiber

bonded with thermosetting resins, 3-5 Lb./Cu.Ft. density with continuous limit use temperature above the design temperature meet this pipe expansion cushion requirement. The expansion absorbing cushion thickness shall be 1.5 times the pipe expansion at the 90° bend. See sample problem below.

Provision for lateral pipe movement

Application and design requirements are illustrated in Figure 3. It is essential that the mineral fiber cushion be completely surrounded with a continuous **GILSULATE® 500XR** envelope.

Figure No. 3



Dimensions A, B and C shall be the dimensions A, B, and C (from Table No. 1) x1.5.

Table No. 3

PIPE SIZE (In)	F (Ft)	F x (Ft)
1-2	6	4.5
3-4	10	7.5
5-6	14	10.5
8	18	13.5
10	20	15
12	22	16.5
14	24	18
16	26	19.5
18	28	21
20	30	22.5

From Sample Problem No. 2:*

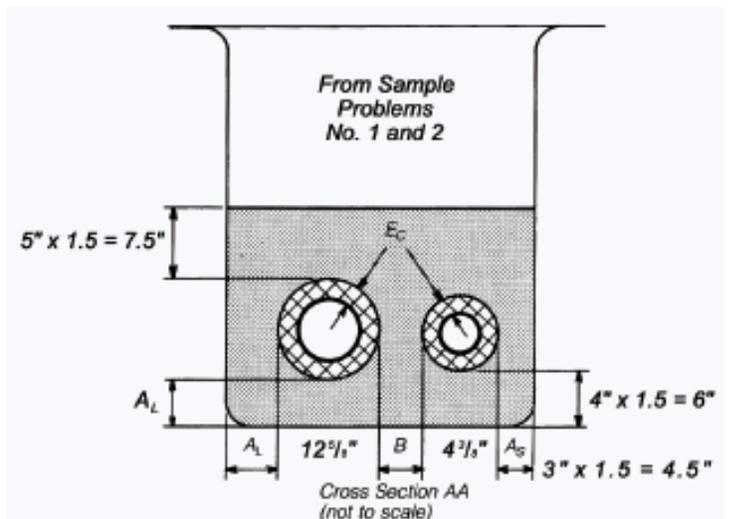
$$E_c = E_p \times 1.5$$

$$E_p = 1.84 \text{ inches}$$

$$E_c = 1.84 \times 1.5 = 2.8 \text{ inches, use 3" thick cushion}$$

Where:

E_p = Pipe Expansion Per Table 2
 E_c = Expansion Cushion



* Note: This example is for thermal growth into 90° expansion elbow. Mineral fiber cushions are generally packaged/sold in increments of 1/2" to 1". Use next size up from the calculated thickness.

2.0 Pipeline Design Considerations (cont'd)

2.4 Anchors

Anchors are required to insure that thermal expansion takes place at locations where it is provided for, and is within design limits. In addition, anchors are used to prevent expansion movement at locations where it is undesirable. Examples are at the base of the risers, at lateral branch connections, outside manholes, unless they contain expansion joints, and at equipment rooms to protect valves and equipment from forces resulting from pipe movement. In general, anchors should be located between expansion facilities and at all changes in direction except locations where the change in direction is intentionally used to accommodate pipe expansion. (Elbows, zee bends).

Anchors shall be designed to resist pipe forces caused by friction between the pipe and the insulation. In **GILSULATE® 500xr** this friction is about 100 pounds per square foot (488

kg/m²) of pipe surface area. An “end anchor” exists where pipe is in the insulation only on one side; for example, at the entrance to a building or at the base of a riser. In an end anchor, the entire friction force must be anchored.

“Intermediate anchors” exist when there is pipe within the insulation on both sides of the anchor. At an intermediate anchor, only the difference between the forces from each side need to be anchored. Anchor size shall be selected on the basis of unbalanced pipe surface area using the procedure below. This procedure allows for the use of smaller intermediate anchors when pipe surface areas on each side of the anchor are almost balanced. In this case, size the anchor for 1/3 of the larger area, or the unbalanced area, whichever is greater.

Figure No. 4

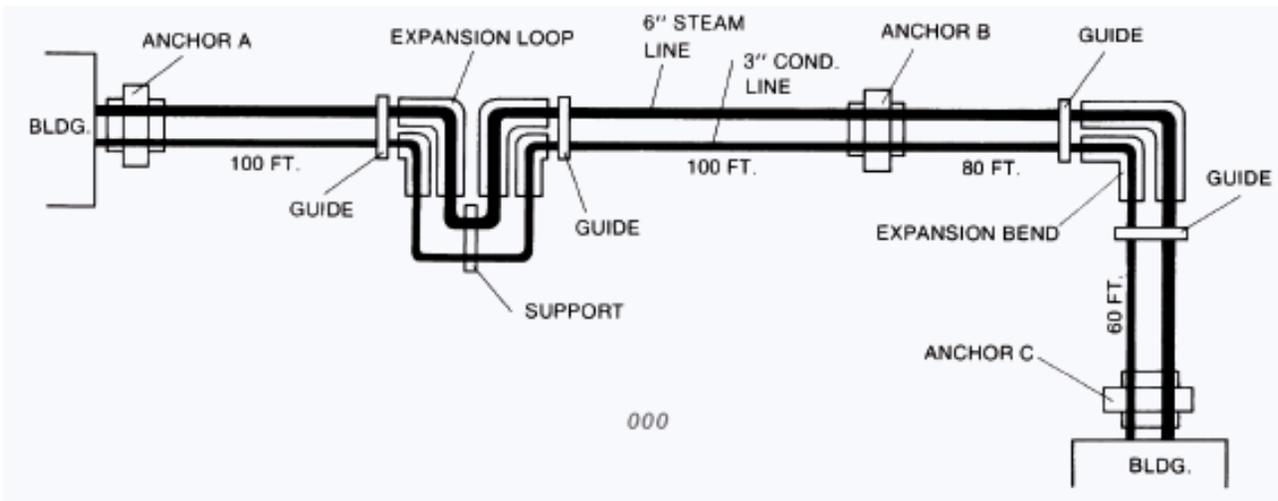


Table No. 4

PIPE SIZE (STEEL)	SQ. FT. OF SURFACE AREA PER LINEAR FT.
1	.03
2	0.6
3	0.9
4	1.2
5	1.5
6	1.7
8	2.3
10	2.8
12	3.3
14	3.7
16	4.2
18	4.8
20	5.2

EXAMPLES OF ANCHOR DESIGN

A End Anchor:

Unbalanced Area = $100 (1.7 + 0.9) = 260$ sq. ft.
 Use Anchor No. 5 for 300 sq. ft. on page 8
 Use End Anchor Attachments on page 9

B Intermediate Anchor:

Area at left = $100 (1.7 + 0.9) = 260$ sq. ft.
 Area at right = $80 (1.7 + 0.9) = 210$ sq. ft.
 Unbalanced area = 50 sq. ft.
 But, $1/3$ of 260 sq. ft. = 87 sq. ft. which is greater
 Therefore, use Anchor No. 2 for 100 sq. ft. from page 8
 Use Intermediate Anchor Attachments from page 9

C End Anchor

Unbalanced Area = $60 (1.7 + 0.9) = 156$ sq. ft.
 Use Anchor No. 3 for 160 sq. ft. from page 8
 Use End Anchor Attachments from page 9

2.0 Pipeline Design Considerations (cont'd)

2.5 Anchor Design, Block Size

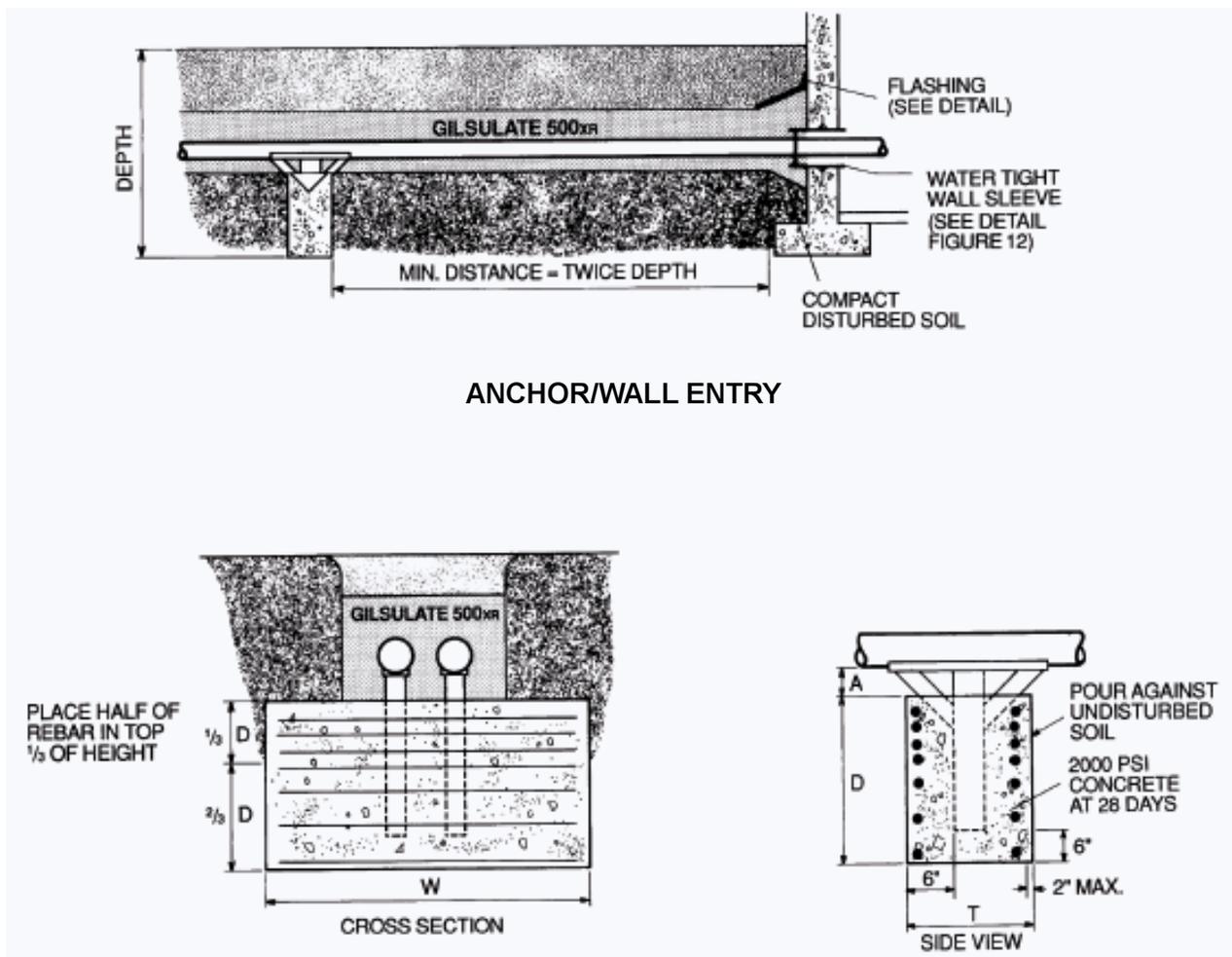
Anchor dimensions shown in Table No. 5 have been calculated for soils with an average bearing strength of 2,500 psf or over. If the soil has lower strength, the bearing area of the anchor face must be increased proportionately. **All metal parts must be completely enclosed by insulation or concrete. Concrete and metal structures such as supports, guides, anchors, wall entries, etc., shall be coated with a bitumastic coating just prior to installation of GILSULATE® 500XR.**

Bitumastic coating shall be at least equal to Lubrimatic Stalastic® Hi-temp Coating No. 61031, Carboline® Bitumastic® Super Service Black or General Electric Silicone Dielectric Compound G624 product specification data.

Table No. 5

ANCHOR NUMBER	MAXIMUM UNBALANCED PIPE SURFACE AREA-SQ. FT.	W (INCHES)	D (INCHES)	T (INCHES)	NUMBER OF REBARS EACH SIDE	SIZE OF REBARS NO.
1	60	28	16	10	4	3
2	100	36	20	12	5	3
3	160	44	24	14	7	3
4	220	52	28	16	9	3
5	300	60	32	18	7	4
6	400	68	36	20	9	4
7	500	76	40	22	12	4
8	600	84	44	24	15	4
9	750	92	48	26	11	5
10	900	100	52	28	13	5
11	1050	108	56	30	16	5
12	1250	116	60	32	19	5

Figure No. 5



2.0 Pipeline Design Considerations (cont'd)

2.6 Pipe-to-Anchor Steel

The GILSULATE 500_{xr} anchors provide the same steel connection between pipe and anchor, for a given pipe diameter, regardless of the pipe surface area being anchored and therefore regardless of the anchor block size. Steel for end anchors is heavier than steel for intermediate anchors.

Design and Tables found in this Section 2.0 do not apply to copper tubing/pipe or PVC piping.

Figure No. 6

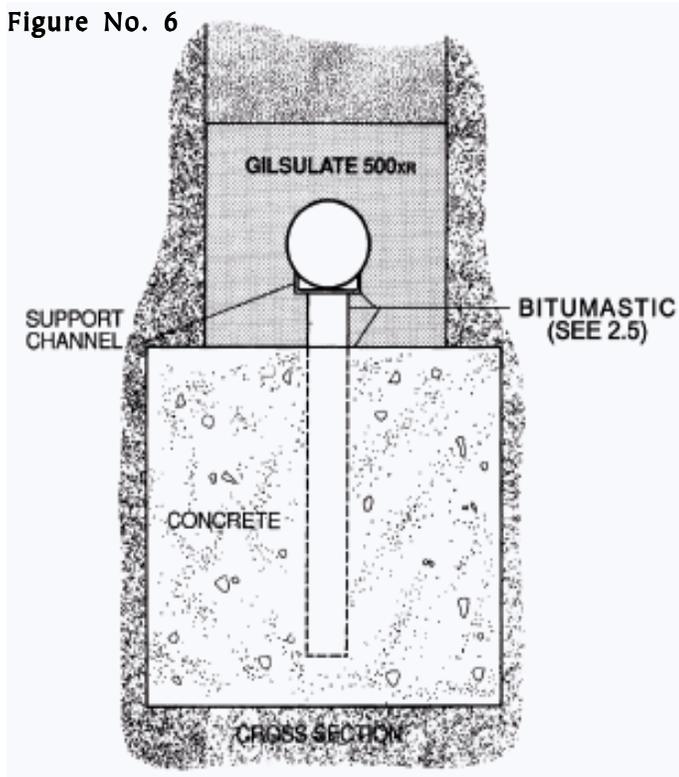
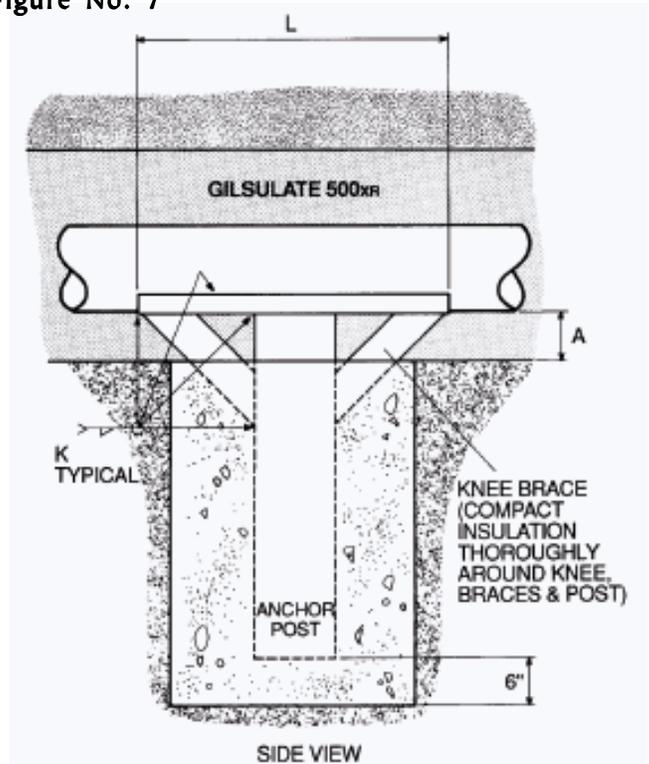


Figure No. 7



Note: Concrete and metal surfaces where in contact with GILSULATE 500_{xr} shall be coated with bitumastic. (See note on page 8)

Table No. 6

PIPE SIZE	END ANCHOR			
	SUPPORT CHANNEL	L IN	ANCHOR POST	FILLET K IN.
1	NR*		315.7	NR*
2	NR		5110.0	NR
3	NR		5114.75	NR
4	4[5.4	26	5114.75	21/2 /
5	5[6.7	28	6117.25	21/2 /
6	5[6.7	30	6117.25	3 /
8	7[9.8	34	8123.0	4 /
10	8[11.5	38	10135.0	5 /
12	10[15.3	40	10135.0	6 /
14	10[15.3	44	12131.8	5 WF 18.5
16	12[20.7	52	12140.8	6 WF 25
18	12[20.7	62	15142.9	6 WF 25
20	12[20.7	72	15142.9	6 WF 25

*NR = NOT REQUIRED / = DIA. PIPE ST'D WT.

Table No. 7

INTERMEDIATE ANCHOR				
SUPPORT CHANNEL	L IN	ANCHOR POST	KNEE BRACE	FILLET K IN.
NR*		315.7	NR*	1/4
NR		417.7	NR	1/4
NR		5110.0	NR	1/4
NR		6112.5	NR	1/4
NR		7115.3	NR	1/4
NR		8118.4	NR	1/4
7[9.8	26	5110.0	2 1/2 /	1/4
8[11.5	30	6112.5	3 /	5/16
10[15.3	34	7115.3	4 /	5/16
10[15.3	38	7115.3	4 /	5/16
12[20.7	42	8 WF 17	5 /	5/16
12[20.7	46	8 WF 20	5 /	5/16
12[20.7	50	8 WF 20	6 /	5/16

2.0 Pipeline Design Considerations (cont'd)

2.7 Pipe Guides

Guides are required only on both sides of the expansion loops, bends and expansion joints. Where expansion joints are used, see joint manufacturer's recommendations for location of guides.

The following illustrations show guides of acceptable design. Alternate designs may be acceptable, provided they have "point-contact" with the pipe, do not move with the pipe, are comparably strong and are completely enclosed in a minimum of 3 inches of GILSULATE® 500XR.

Table No. 8

NOM. PIPE SIZE IN.	DIM. H (IN.)	DIM. G (IN.)	BRACKET SIZE BAR OR ANGLE (IN.)
1 & 2	10	6	1/2 DIA.
3 & 4	10	8	5/8 DIA.
5 & 6	12	10	1 DIA.
8	12	10	1 3/4 X 1 3/4 X 1/4
10 & 12	16	12	2 1/2 X 2 1/2 X 1/4
14	16	12	3 X 3 X 5/16
16 & 18	18	14	3 1/2 X 3 1/2 X 5/16
20	18	14	3 1/2 X 3 1/2 X 5/16

Figure No. 8a

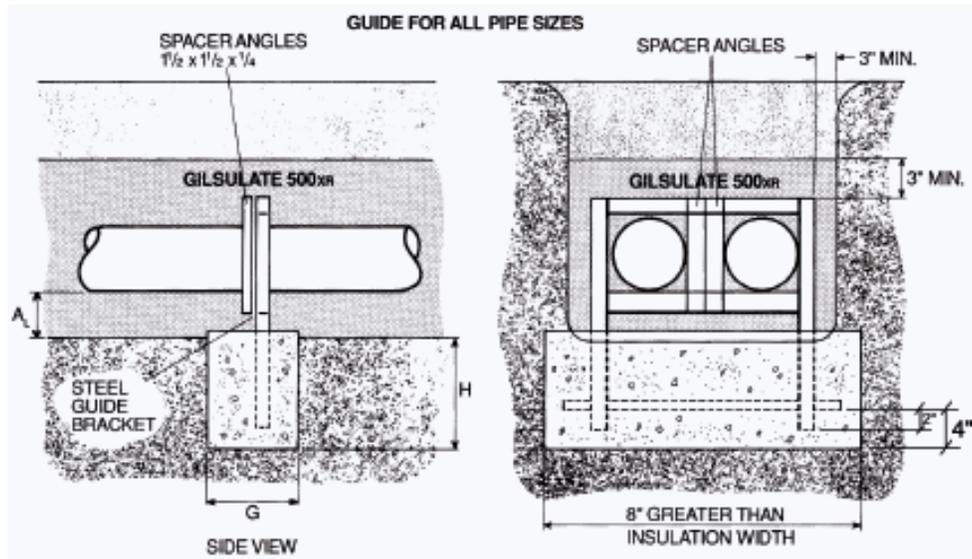
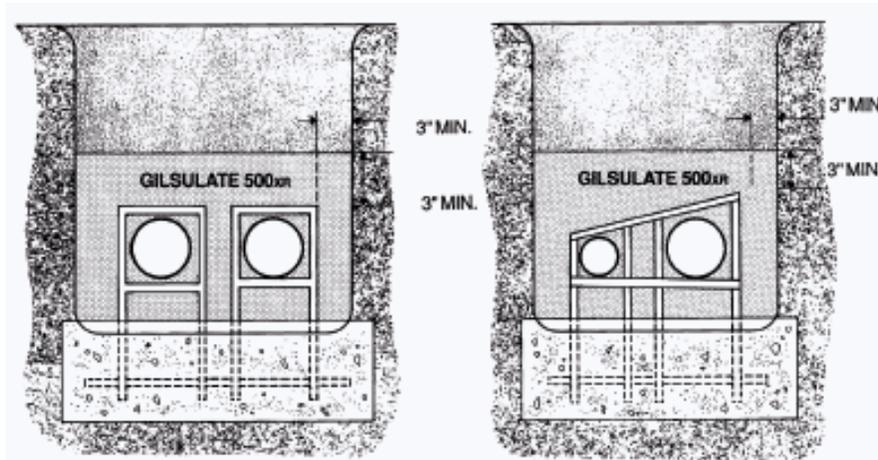


Figure No. 8b



Note: Concrete and metal surfaces where in contact with GILSULATE® 500XR shall be coated with bitumastic (see note on page 8).

2.0 Pipeline Design Considerations (cont'd)

2.8 Supports

Permanent type pipe supports are only required at expansion loops. They are not desired for straight runs of pipe. Permanent pipe supports meeting the following design requirements are acceptable.

- (a) Permanent pipe supports must be capable of carrying the entire weight of the waterfilled pipes without crushing or sinking.
- (b) The support must be made of smooth, inert material so that the **GILSULATE® 500XR** will form a watertight seal against the support. **Coat surface with bitumastic.**
- (c) Supports must not extend beyond the outer radius of the pipe and must be enclosed by a minimum of 3 inches of **GILSULATE® 500XR**.
- (d) The support must have minimum contact area with the pipe, so as to maximize the **GILSULATE® 500XR** contact with the pipe.

Concrete cores or precast concrete shapes supported on a small concrete pad are economical and reliable supports.

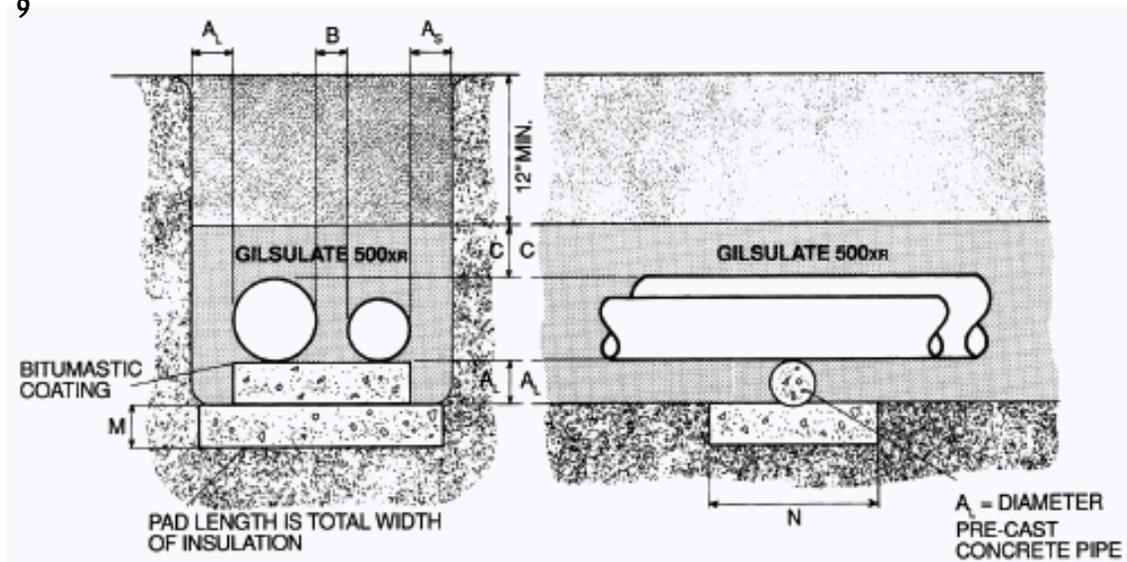
Permanent wood supports are never acceptable.

Figure 9 and Table 9 give design details of standard support which will not crush or sink into 2,500 psf (1.20 kg/cm²) soil.

Table No. 9

PIPE DIAM. (IN.)	BEARING PAD	
	M (IN.)	N (IN.)
1.2	None	None
3.4	4	10
5	4	10
6	4	10
8	4	12
10	4	12
12	5	12
14	5	12
16	8	15
18	8	15
20	8	15
24	10	18

Figure No. 9



Pipe Supports at Expansion Loops

2.0 Pipeline Design Considerations (cont'd)

2.8 Supports cont'd

Installation Without Supports

Permanent type pipe supports are not desired for straight runs of pipe. **GILSULATE® 500_{xr}** when consolidated to the specified density of 40 - 42 lb./cu. ft. will support straight runs of pipe of all sizes and temperatures without assistance of permanently installed pipe supports.

Permanent type pipe supports are required only at expansion loops. During construction, alignment, hydrostatic testing and placing of the **GILSULATE® 500_{xr}**, the pipe must be

temporarily supported to provide proper clearance for the specified thickness of insulation. The pipes can be temporarily supported as shown below. As placement and consolidation of the **GILSULATE® 500_{xr}** progress down the trench, temporary supports are removed **but in no case shall temporary supports be allowed to remain in the trench.**

Figure No. 10

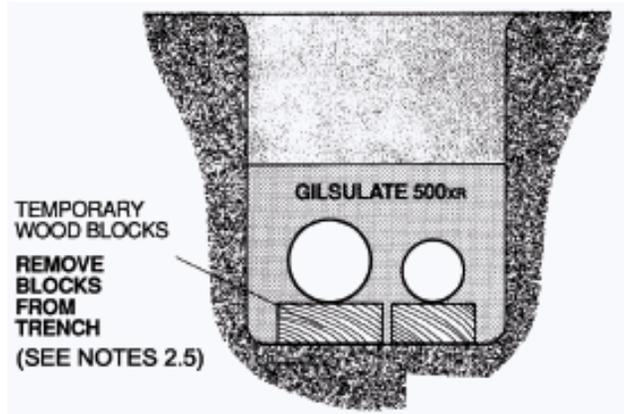
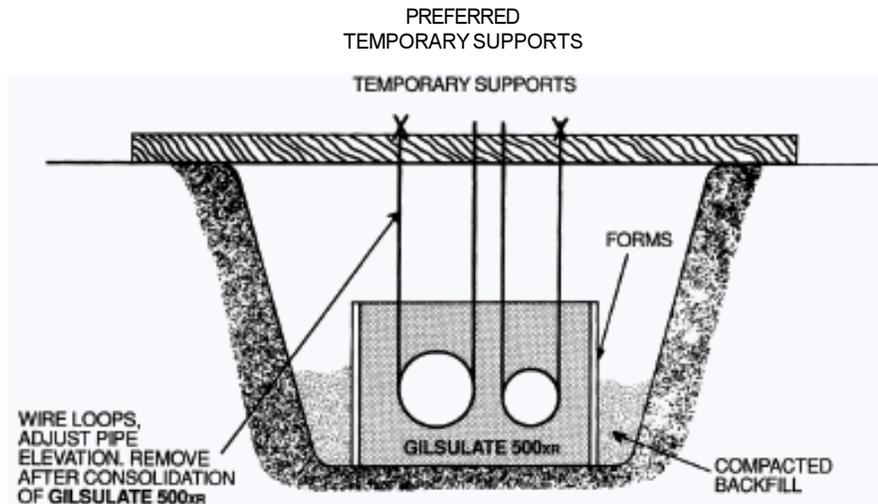


Figure No. 11



2.0 Pipeline Design Considerations (cont'd)

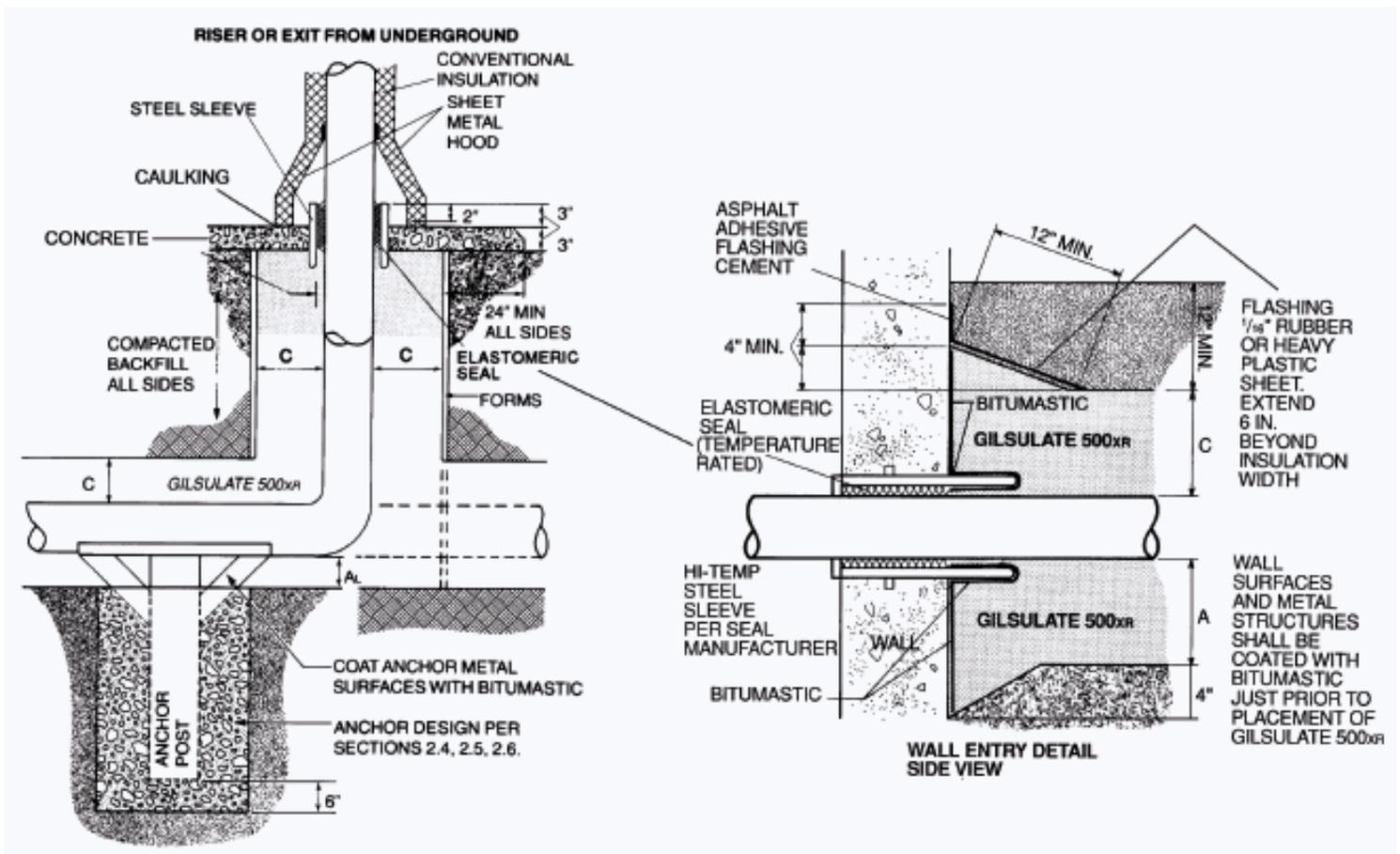
2.9 Wall Entries and Risers

Anchors shall be located at the base of risers to eliminate lateral movement at the surface, since there is no acceptable seal design to accommodate lateral movement.

Pipe entries through walls, and risers through floors or ground surface out-of-doors, shall be made through a metal sleeve

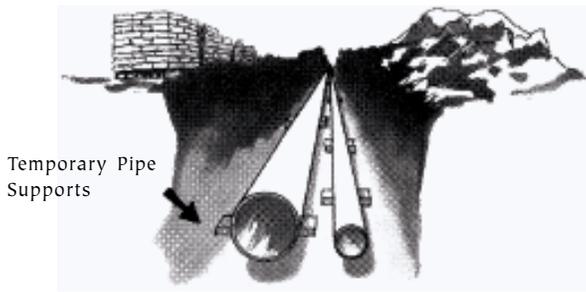
set in concrete with a temperature rated elastomeric seal (such as "Link Seal"), with the annulus packed with high temp rope, lead wool, or other packing material suitable for the pipe temperature, and capable of making a tight seal yet allowing longitudinal pipe movement.

Figure No. 12

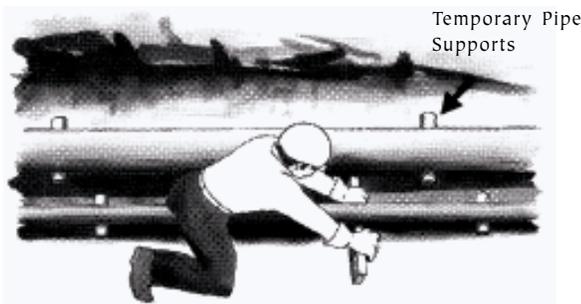


3.0 Installation Sequence

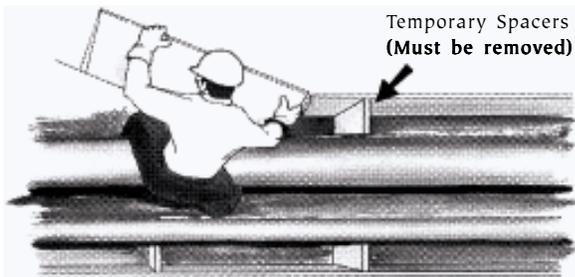
Also see Tech Data Sheet — “Forming”



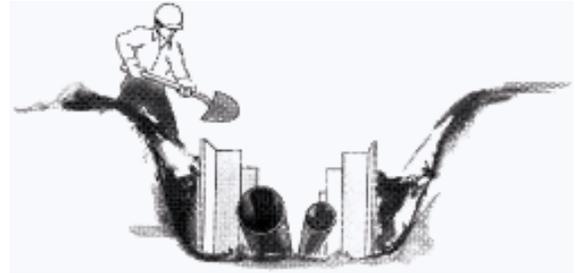
1. Excavate trench as required for piping and insulation and **preferably pile all backfill on one side**. Install pipes with required guides, supports and anchors. Perform pressure testing. Locate pallets of **GILSULATE® 500XR** on the side opposite the backfill.



2. Grade and compact trench under pipes leaving required space for specified thickness of **GILSULATE® 500XR**. Clean dirt off pipes.



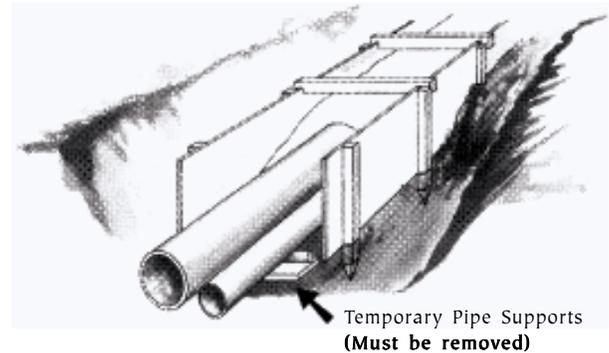
3. Side forms are recommended. Side forms cut from gypsum board and left in place are less expensive and easy to use. Forms are held away from pipes by **temporary spacers which must be removed**. Side forms left in place must not extend above the finished compacted level of the insulation envelope. Forming is always the preferred technique.



4. Check all measurements for correct insulation coverage. These are given in the plans and specifications or may be found in the GII “Design & Installation Manual.” Backfill behind forms to pipe height.

5. Preferred Forming Technique

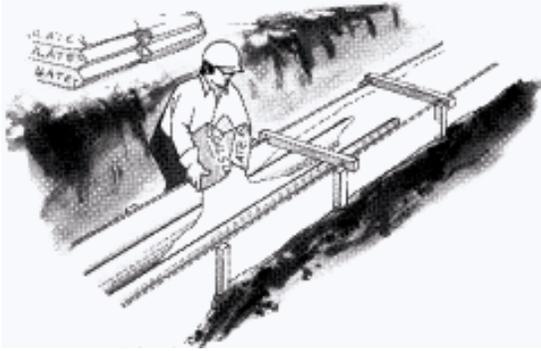
This forming technique does not require side block spacers inside the form walls which then must be removed.



Precut gypsum board with attached spacers on the exterior may be driven into place quickly. Horizontal spacer is used to determine envelope width. Backfill behind the forms to pipe height. Leave forming in place. **Calculate volume required per lineal foot of trench**. One bag equals 1 cu. ft. at use density (following consolidation).

Installer: See Tech Data Sheet “G2.00 Forming Techniques”

3.0 Installation Sequence (cont'd)



6. **GILSULATE® 500XR** is a light colored dry granular material. To minimize dust, empty bags on pipes with as little “free fall” as possible. Fill trench to mid pipe height and consolidate. **Remove spacers and temporary pipe supports as work progresses. Coat anchors, guides, supports, wall entries with bitumastic as specified just prior to placement of GILSULATE® 500XR.**



7. Add additional layers of **GILSULATE® 500XR** and consolidate to specified thickness and density. A rod-type concrete vibrator with a 1½" or smaller diameter head is the best and quickest means of consolidating **GILSULATE® 500XR**. Insert the head of the vibrator horizontally and pull along slowly. Larger pipes require consolidation in two or more lifts of material.



8. Walk on consolidated **GILSULATE® 500XR** envelope to ensure use density, footprints less than 1" deep are required.



9. Complete placement of backfill behind forms. Place layer of flattened empty bags on top of the **GILSULATE® 500XR** envelope. Hand place 4" to 6" of soil (no stones) on top of empty bags to protect from damage. Complete backfilling to grade level as soon as possible. Mechanical compaction of backfill is desired and follows good engineering and construction practice.

Notes:

1. Pack wall entries as specified. (See Design Manual).
2. Remove standing water prior to installation of insulation. Check soil permeability. Section 4.0.
3. Clear all “foreign” objects from insulation envelope to provide a “seamless” covering and eliminate “short circuits.”
4. Clean pipes of all dirt, scale and other foreign materials.
5. Just prior to placement of **GILSULATE® 500XR** coat anchors, guides, wall entries, etc. with bitumastic to provide a seal. Bitumastic is to be “tacky”.
6. Consolidate **GILSULATE® 500XR** with rod-type concrete vibrator to 40 - 42 L.B./C.F. density. Walk on top of envelope. Density has been achieved if footprints are less than 1" deep.
7. Bulkhead uncompleted end and backfill top with 4" to 6" of soil backfill at the end of each day to protect insulation envelope until work resumes.
8. If conditions cause excessive dusting, use NIOSH/MSHA approved face mask dust respirator. A material safety data sheet is available by calling 1-800-833-3881.

***GILSULATE® 500XR** is manufactured for used by experienced and knowledgeable contractors or maintenance personnel. For complete design and installation details please consult the GII manual or call Gilsulate International, Inc. at 1-800-833-3881.*

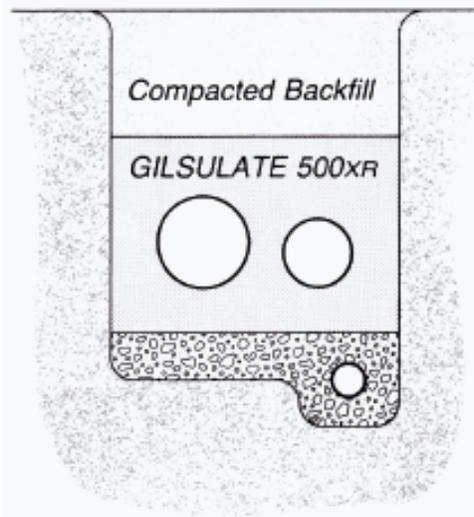
4.0 Special Conditions

4.1 Drainage and Permeability

Sub-drainage may be required in impermeable soil such as clay or mixtures containing clay. Soil permeability test details are available upon request. Attention to backfill compaction may assist to overcome impermeable soil conditions. Contact GII® for additional details.

1. Drain material of crushed rock gravel mixture with $\frac{3}{8}$ " maximum size. (pea gravel).
2. Use 3" or 4" perforated pipe located in the drain bed continuous for entire length. Longitudinal rows of perforations shall be installed with holes at bottom.
3. Connect sub-drainage system to a positive drain point away from the trench.
4. Sub-drainage system shall be continuous and shall not be capable of providing a reverse flow.

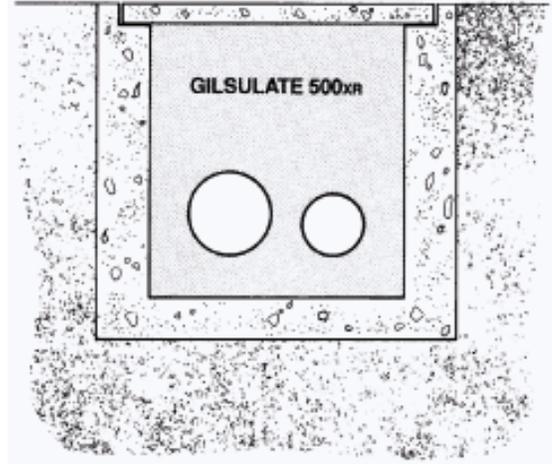
Figure No. 13



4.2 Concrete Trenches

GILSULATE® 500XR is used to fill concrete vaults and manholes to insulate pipes and prevent water entry.

Figure No. 14



1. Remove all foreign objects and materials from trench.
2. Coat pipe supports with bitumastic.
3. Fill and consolidate GILSULATE 500XR as in non-vault applications.
4. Slightly overfill and compact the top of the envelope with the weight of the lid.
5. Contact ATP for design review and application.

4.3 Utility Crossings

Other underground utility piping and electric conduit shall be located as far as possible from the hot insulated lines, and crossings shall be minimized. Cross piping and electric conduit shall not penetrate any part of the insulation. Where the crossing utility is temperature-sensitive (for example, electric conduit), it should preferably pass under the hot piping, with an increase in insulation thickness between.

4.4 Unstable Soils

Contact Gilsulate International, Inc. when pipeline is located in permafrost, expansive clay or other questionable sites.

4.0 Special Conditions *cont'd*

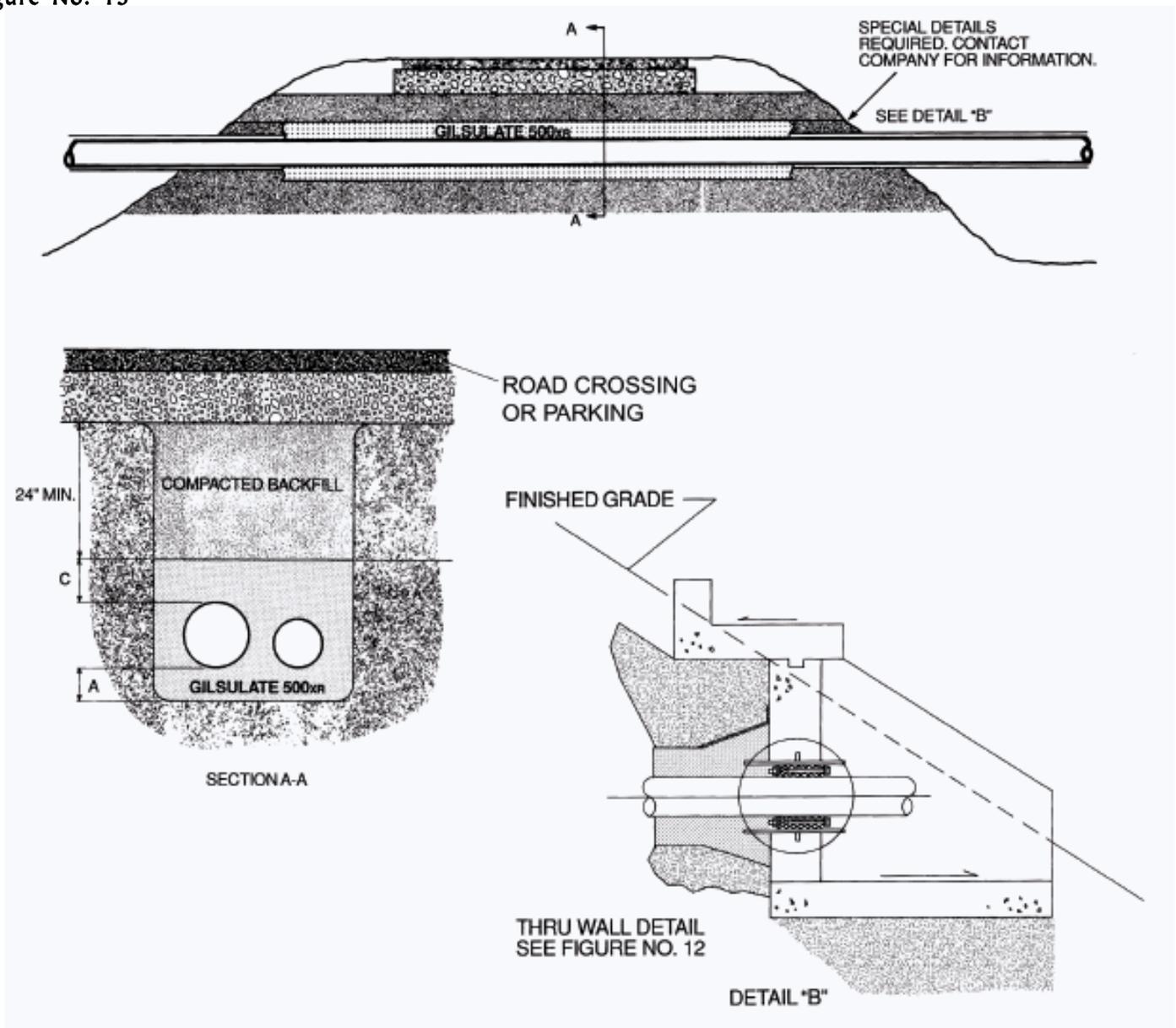
4.5 Railroad Crossings and Parking Lots

GILSULATE® 500_{XR} has excellent load bearing properties and can be consolidated similar to specially prepared road bed soils.

Road beds are mechanically compacted to AASHTO standards. The granular insulation below the compacted backfill must be capable of mechanical compaction to insure the pipe coverage design dimensions and load bearing properties.

Contact Gilsulate International, Inc. for additional information and details.

Figure No. 15



5.0 Retrofit

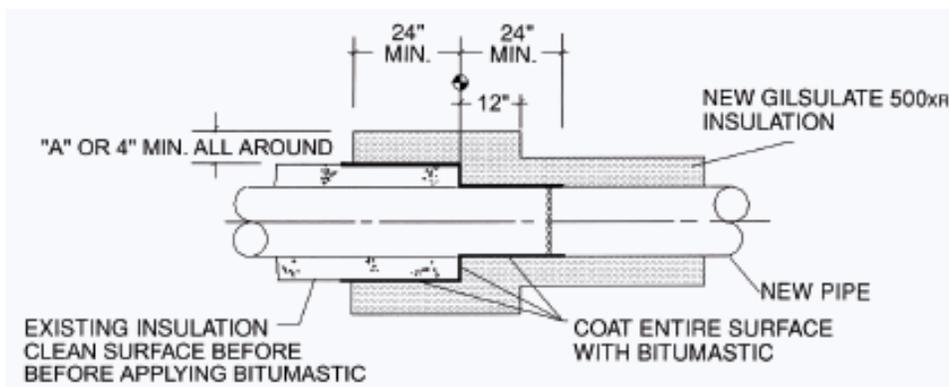
Short term paybacks are normal using **GILSULATE® 500XR**. Retrofit programs may be conducted as budget or funding allows. Selected segments of the system may be retrofitted as desired. Contact Gilsulate International, Inc for information regarding unusual conditions.

Gilsulate International will provide computerized heat transfer calculations for existing systems and retrofit designs. Energy savings may then be determined and payback time calculated.

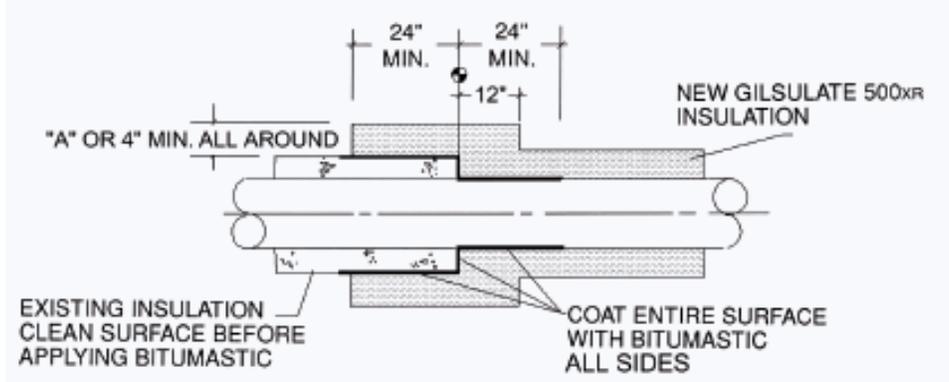
1. Clear area surrounding and below pipes to required dimensions for **GILSULATE® 500XR** coverage.
2. Forming may be required for wide trenches. See previous details.
3. Clean off pipes as much as possible of other insulations, rust, scale, etc.
4. A shovel cut to the shape of the pipe makes a good scraper.
5. Install **GILSULATE® 500XR** as in new construction procedures.
6. See Table No. 1 for **GILSULATE® 500XR** coverage.

Figure No. 16

INSULATION INTERFACE AT PIPE SPLICE



INSULATION INTERFACE WITH EXISTING INSULATION



Interface of existing insulation system retrofitted with **GILSULATE® 500XR**. Contact Gilsulate International, Inc. for details specific to the interface between the new **GILSULATE® 500XR** and the existing insulation system.

1. GENERAL

1.1. RELATED DOCUMENTS

- 1.1.1. 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.

1.2. DESCRIPTION OF WORK

- 1.2.1. Extent of underground piping insulation required by this section is indicated on drawings and schedules and by requirement of this section.
- 1.2.2. Types of underground piping insulation specified in this section include the following: Inorganic, engineered granular, underground pipe insulation.

1.3. SECTION INCLUDES

- 1.3.1. Controlled Density Thermal Insulation & Corrosion Protection Pipes & Tanks
- 1.3.2. Miscellaneous incidental to complete installation of field applied exterior insulation to raw carrier pipe

1.4. CODES AND STANDARDS *American Society for Testing and Materials (ASTM)*

- 1.4.1. ASTM C-177-04 Steady-State Heat Flux Measurement and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
 - A. Thermal Conductivity - material ASTM testing at installed/use density
- 1.4.2. ASTM D-1895 Apparent Density, Bulk Factor and Pourability of Plastic Materials
 - A. Method A: Apparent Density (Bulk Density)
 - B. Method C: (Applied 400 lbs.) Compaction & Corresponding Density Under Static Load
 - C. Method C: (Applied 400 lbs.) Percent of compaction of installed density under static load
 - D. Method C: (Applied 12,000 lbs.) Material Bearing Under Applied Static Loading

1.5. SUBMITTALS

- 1.5.1. 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"
- 1.5.2. Long Term Water Retardency Test: Submit passage of 3rd party conducted laboratory testing for minimum of 30 days withstanding moisture penetration.
- 1.5.3. Submit manufacturer entire warranty, per manufacturer's current design/installation manual.
- 1.5.4. Current Published Manufacturer's Design & Installation Manual and Instructions
- 1.5.5. Manufacturer Statement: Indicating if the material is sold based on bulk density or installed/use density.

1.6. QUALITY ASSURANCE

- 1.6.1. 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.
- 1.6.2. Installers Qualifications: Firm with at least 3 years of successful installation experience on projects with elevated temperature mechanical insulation systems.
- 1.6.3. [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.

1.7. SUBSTITUTIONS

DIRECT-BURIED CONTROLLED DENSITY THERMAL PIPE INSULATION CORROSION PROTECTION
GUIDE SPECIFICATION 56 5640
PLACE IN CIVIL AND HVAC MECHANICAL SECTIONS

- 1.7.1. 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.
- 1.8. DELIVERY, STORAGE AND HANDLING
 - 1.8.1. Deliver insulation, associated adhesives, form work and supplementary steel to site in manufacturer's containers with manufacturer's stamp or label clearly shown.
 - 1.8.2. Protect insulation packaging and associated components against sun, dirt, water and chemical damage.
2. PRODUCTS
 - 2.1. MANUFACTURER & PROPRIETOR OF PATENT
Gilsulate International, Incorporated
26000 Springbrook Ave 201
Santa Clarita, Ca 91350
800-833-3881 – www.gilsulate.com
 - 2.2. PATENTED PRODUCT
 - 2.2.1. Gilsulate®500XR (Patent 4,231,884)
 - A. Exact Match Only –this necessary item is not available under any other product name.
 - B. There is NO equal alternative to or replacement for Gilsulate®500XR.
 - 2.3. INSULATION & CORROSION PROTECTION
 - 2.3.1. Provide a system meeting Unified Facilities Guide Specifications UFGS-33.61.13 (2.4) including manufacturer requirements, ASTM Codes & Standards and installed guidelines.
 - 2.3.2. 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.
 - 2.4. PHYSICAL PROPERTIES
 1. ASTM C177-04 Thermal Conductivity (tested @ use density):
 - a. $K = 0.53 \text{ Btu/hr.ft}^2 \text{ }^\circ\text{F/in. @ } 100 \text{ }^\circ\text{F Mean Temp}$
 - b. $K = 0.60 \text{ Btu/hr.ft}^2 \text{ }^\circ\text{F/in. @ } 175 \text{ }^\circ\text{F Mean Temp}$
 - c. $K = 0.65 \text{ Btu/hr.ft}^2 \text{ }^\circ\text{F/in. @ } 300 \text{ }^\circ\text{F Mean Temp}$
 2. ASTM D1895A – Bulk Density
 - a. 30-34 lbs./ft³
 3. ASTM D1895C (400 lbs.) – Consolidated Cubic Foot Installed/Use Density (CFUD)
 - a. 40-42 lbs./ft³ CFUD
 4. ASTM D1895C (400 lbs.) – Percent of compaction of installed density under static load
 - a. Shall not exceed more than 1% compaction
 5. ASTM D1895C (12,000 lbs.) – Material Bearing Under Applied Static Loading
 - a. 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

2.5. ACCESSORIES

- 2.5.1. 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.
- 2.5.2. Structural Steel Components: provide steel anchors and guides as required by the contract documents and insulation manufacturer's drawings and Design and Installation Manual.
- 2.5.3. 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.

3. EXECUTION

3.1. EXAMINATION

- 3.1.1. 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.
- 3.1.2. 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.
- 3.1.3. Bottom of trench shall be undisturbed soil.

3.2. INSTALLATION

- 3.2.1. 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.
- 3.2.2. 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.
- 3.2.3. 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.
- 3.2.4. 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.
- 3.2.5. 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.
- 3.2.6. 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

DIRECT-BURIED CONTROLLED DENSITY THERMAL PIPE INSULATION CORROSION PROTECTION
GUIDE SPECIFICATION 56 5640
PLACE IN CIVIL AND HVAC MECHANICAL SECTIONS

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.

- 3.2.7. 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.
 - 3.2.8. 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).
 - 3.2.9. Inspector must physically be capable of confirming specified installed/compacted insulation thicknesses prior to placement of any backfill.
 - 3.2.10. Backfill first 6" of soil (no stones) by hand. Complete backfilling and mechanically compact in uniform layers with suitable excavated soil to grade level.
 - 3.2.11. Refer to Gilsulate International Inc. "Design & Installation Manual for Installation Procedures.
4. END OF SECTION

7.0 Installation Assistance

GILSULATE® 500_{XR} is manufactured for use by experienced and knowledgeable contractors or maintenance personnel. Correct placement procedures are to be followed to insure satisfactory performance.

Field assistance is available from a network of authorized engineering-oriented sales representatives. Pre-construction conferences are highly recommended for field supervisors. These conferences have been found to be most useful to the installer and the effective use of **GILSULATE® 500_{XR}**.

Factory assistance is available upon request for projects of reasonable size or complexity. Advance arrangements are required.

Extensive design and installation instructions and detailed drawings are available upon request. Use of this product in each situation must be specifically evaluated in terms of field conditions and product limits.

8.0 Material Specifications

Material Origin and Use

The insulation shall be a dry, free flowing granular product formulated from selected inert, inorganic materials. It shall be equal in all the following characteristics to Gilsulate International's product **GILSULATE® 500_{XR}**. It shall be non-toxic, non-flammable, and completely free of asbestos. It shall require no mixing prior to installation, and no curing. It shall be completely compatible with all materials typically used for underground piping and tanks in the service temperature range of 35°F to 800°F.

Load Bearing Stability/Resistance to Moisture Penetration

The insulation shall be composed of granular particles in a graded sizing ranging from a maximum diameter of 1mm down to sub-micron sizes in order to provide compactibility and load bearing capability. The consolidated insulation shall be capable of withstanding up to 12,000 psf (58,600 Kg/M³) at the recommended density of 40 - 42 lb./cu. ft. The granules shall be surface treated to render it hydrophobic. When consolidated to 40 - 42 lb./cu. ft. the insulation envelope shall be capable of withstanding moisture penetration equivalent to a 48" hydrostatic head for a period of 30 days as measured by a laboratory test comparable to Gilsulate International's procedure S-249.

Thermal Properties

The insulation shall have a thermal coefficient of heat conductivity (K factor) of no more than 0.60 BTU/hr/ft²/°F/in. at a density of 40 lb./cu. ft. at a mean temperature of 175° and 0.65 at a mean temperature of 300°F.

Electrical Resistivity

Electrical Resistivity of the insulation shall be greater than 10¹² Ohm-cm.

Installation

The insulation shall be installed according to the recommendations and details as published by Gilsulate International, Incorporated.

9.0 Warranty

Gilsulate International, Inc. warrants that this product will meet the specifications set forth under the heading "Material Specification" as found in the "Design & Installation Manual" published by the Company for a term of one year, provided that the use of and installation of the product conforms to the specifications and directions set forth in the "manual." The information is supplied as an accommodation and is subject to change without notice. Check with Gilsulate International, Inc. to insure that the information is current. Due to the fact that the Company does not have complete control over the widely varying conditions under which its product is used, installation workmanship, accessory materials or conditions of application, no warranties expressed or implied are made as to the length of service life, or otherwise are made as to performance or results of an installation containing this product. Use of the product constitutes the user's agreement to this limitation of warranty and the agreement that the Company shall not be liable for incidental or consequential damages and that any liability for such claims arising from negligence or otherwise are expressly and exclusively limited to the replacement of the material as determined to be defective. This warranty shall be void if notice of any claim has not been given to Gilsulate International within 7 days of discovery of a suspected defect.

Extensive design and installation instructions and details are available upon request. Use of this product in each situation must be specifically evaluated in terms of field conditions and product limits.