

Silicone Foam Insulation

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LINE HEATER

Heat Retention TEST

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Overview

Maintaining the temperature of the gas at 40 degrees Celsius or higher enabling smooth supply and stable operation.

To propose new material insulation for excellent workability and efficient power consumption, installed on selected equipment within Hynix M16 and conducted two tests

TEST1: After finishing with Teflon tape, TEST

- Confirmed cumulative power consumption using the Teflon tape currently in use

TEST2: Test after finishing with new insulation material (silicone foam insulation)

- Finished with the newly proposed silicone insulation material and verified the cumulative power meter reading

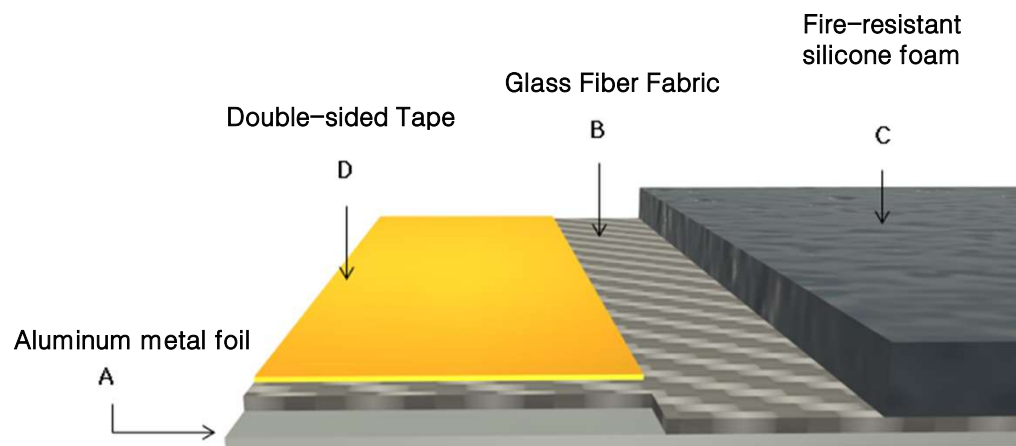
Foamed Insulation Specification

1. What is Silicone Foam Insulation?

- a thermal insulation cover manufactured by applying a special silicone foam to flame-retardant aluminum-coated fiberglass
It is an insulation cover.
- Designed for pipe heating cable insulation covers, it is manufactured in a rolled circular form through a special processing method for easy insulation and installation.

2. Structure and Characteristics

- Power consumption and temperature data verification



Aluminum metal foil

- Material: Aluminum foil with thermal conductivity and heat reflection properties
- Heat resistance: 150°C

Glass Fiber Fabric

- Material: Glass fiber, an asbestos substitute
- Heat resistance: 150°C

Fire-resistant Silicone Foam

- Material: Silicone foam (fire-resistant silicone or flame-retardant silicone)
- Heat Resistance: 150°C

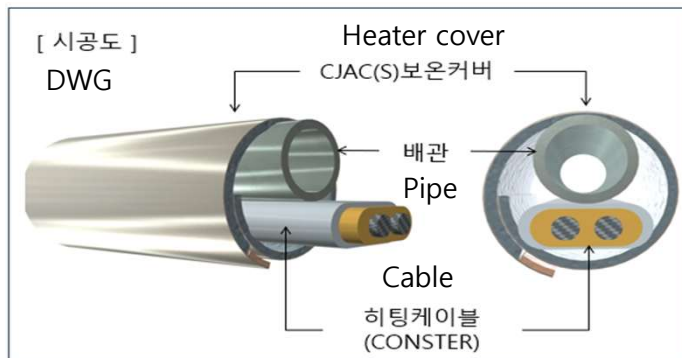
※ Unlike conventional thermoplastic materials that melt under normal flames, flame-retardant silicone rubber is a thermosetting material.

it is a thermosetting material that vitrifies, delaying flame propagation. Particularly for fire-resistant silicone,

When exposed to flames, it ceramicizes to maintain its shape as much as possible and block flame propagation.

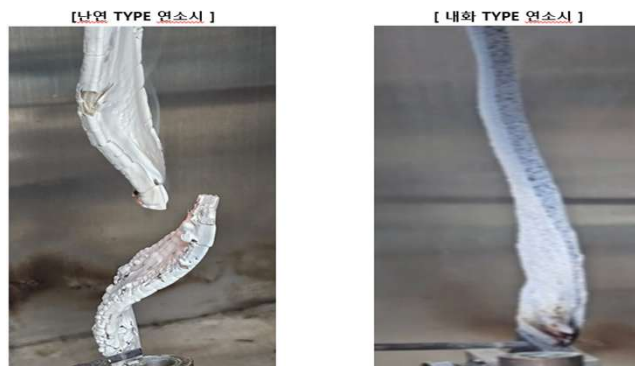
Foamed Insulation Specification

3. Key Features



- High thermal insulation performance is achieved by incorporating silicone containing internal air layers.
- The self-curved shape makes installation and mounting extremely convenient.
- The curled shape allows for easy versatile use within the appropriate inner diameter range.
- Double-sided tape is attached to the ends, allowing for fixation without separate finishing materials.
- There is no particle generation when cutting for use.
- It can be cut and used according to any length, so no loss occurs at all.
- Even elbow sections, which are difficult to install, can be constructed in the same way as straight pipes through pre-shape processing.

4. Flame-Retardant Silicone VS Fire-Resistant Silicone Comparison Test



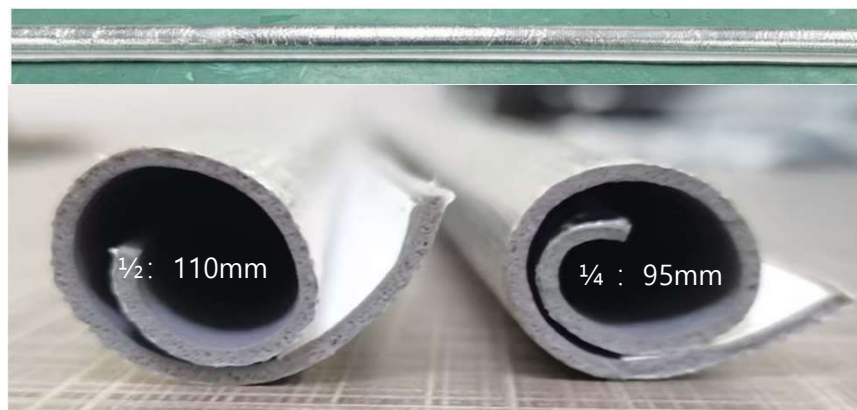
- Both flame-retardant and fire-resistant silicones are materials rated V1 or higher for flame retardancy. In particular, fire-resistant silicone rubber is a specially developed material engineered to enhance its ability to maintain its original shape. This is achieved through a ceramicisation process on the silicone surface when exposed to flames, forming a ceramic epidermal layer.
- By this principle, it can block flame propagation and is applied to firefighting-related cables such as sprinkler cables, as well as to cables for electric vehicles and thermal diffusion barrier pads.

Foamed Insulation Specification

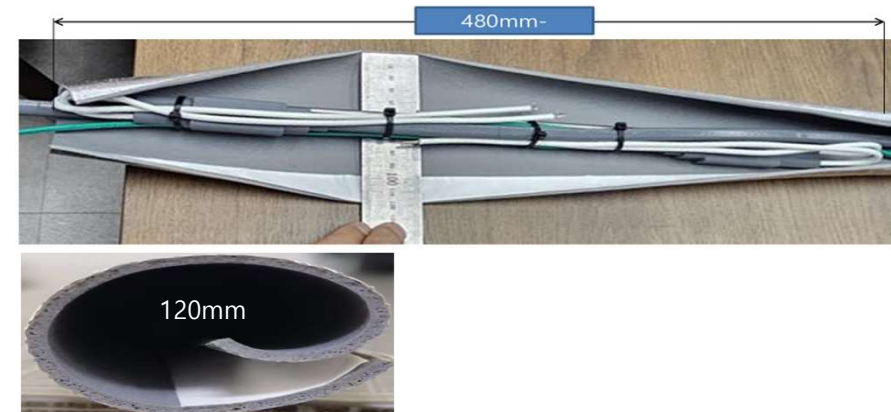
5. Product Specifications (1.5T)

Name	Specifications(MM)		Lenfgh(M)	Application
	Width	Thickness		
IN-95-1.5-1	95	1.5	1	¼ Pipe
IN-110-1.5-1	110	1.5	1	½ Pipe
IN-120-1.5-1	120	1.5	1	Power supply

Linear type



Power connection

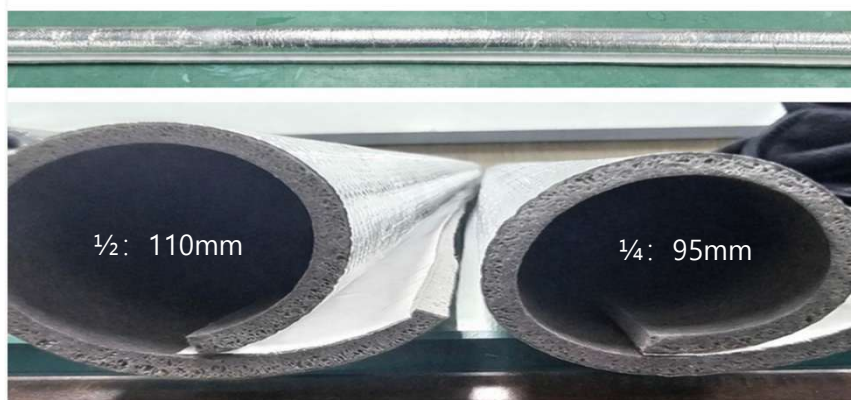


Foamed Insulation Specification

5. Product Specifications (2.5T)

Name	Specifications(MM)		Lenfgh(M)	Application
	Width	Thickness		
IN-95-2.5-1	95	2.5	1	¼ Pipe
IN-110-2.5-1	110	2.5	1	½ Pipe
IN-120-2.5-1	120	2.5	1	Power supply

Linear type



Power connection



Production of Foamed Silicone Insulation Material

1. Foamed Silicone Technology

- High-Conductivity Rubber (HCR) Utilization

Silicone rubber compound is a rubber compound primarily composed of silicone raw rubber, which possesses both inorganic and organic properties, and silica.

compound.

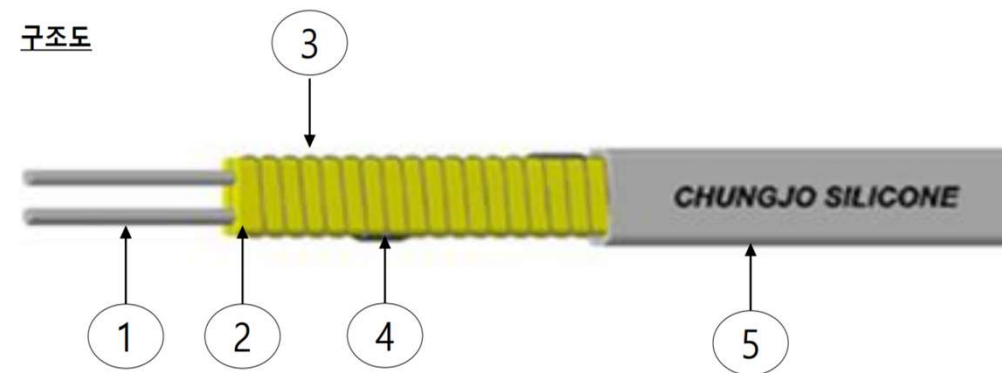
- By combining a pyrolytic foaming agent with the silicone rubber compound, foam is formed simultaneously with heating and curing. processing methods to produce foamed silicone molded products.

2. Advantages & Characteristics of Foamed Silicone

- Lightweight, soft, and flexible with excellent bendability
- Heat resistance/cold resistance_ The most outstanding characteristic of silicone rubber. Compared to general organic rubber, it exhibits no change in properties at high temperatures (150°C) and allows for permanent use. It also maintains high flexibility at low temperatures (-65°C).
- Weather resistance: Excellent ozone resistance. While conventional organic rubber rapidly softens, silicone rubber remains unaffected. Properties remain unchanged even after prolonged exposure to UV light, rain, or wind.
- Electrical Properties_ Possesses outstanding insulation properties and exhibits excellent resistance to corona discharge and arcing.
- Excellent flexibility and elasticity make it widely used as a heat-resistant and insulating material
- Excellent dustproofing, soundproofing, non-toxicity, oil resistance, electromagnetic wave absorption, water resistance, lightweight, sealing properties, and semi-permanent durability

Heater Cable SPECIFICATION

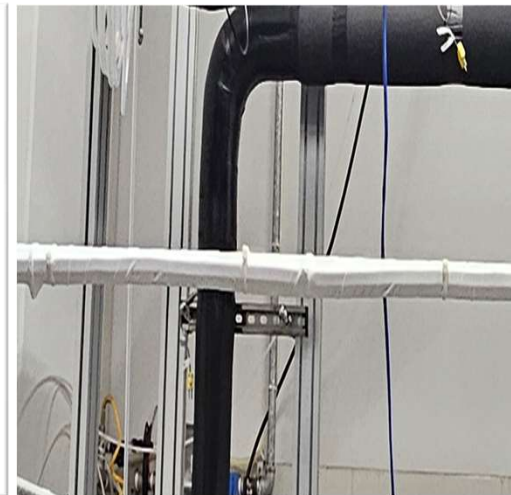
CABLE SPECIFICATION	
Rated Voltage	220Vac
Heating Density	30Watt/m
Withstand Voltage	AC 1,000V /1min
Standard Resistance	1613Ω/m
Usable Length Limit	1~100m
Weight	66g/m



1 - Busbar: Tin-plated wire 1.25 mm ² *2C
2 - Primary Insulation: Silicone Rubber
3 - Heating Element: Metal Heating Wire
4 - Internal connection point
5 - Secondary insulation: Silicone rubber

TEST Installation (1st TEST LINE)

Teflon Tape Installation



[PTFE TAPE]

TEST1: TEST after PTFE tape application

- Insulation using Teflon tape currently in use at Hynix, secured with cable ties
- Verify power consumption

TEST Installation (Secondary TEST LINE)

Silicone Insulation Material Installation

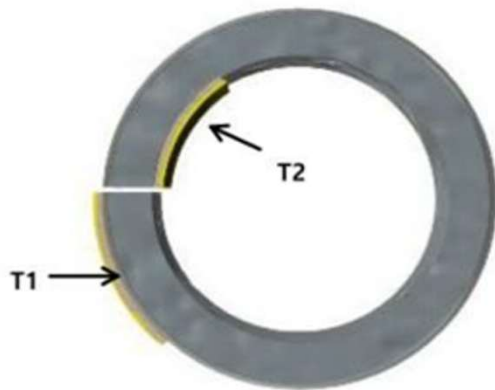


TEST2: Test After Finishing with New Insulation Material (Silicone Insulation)

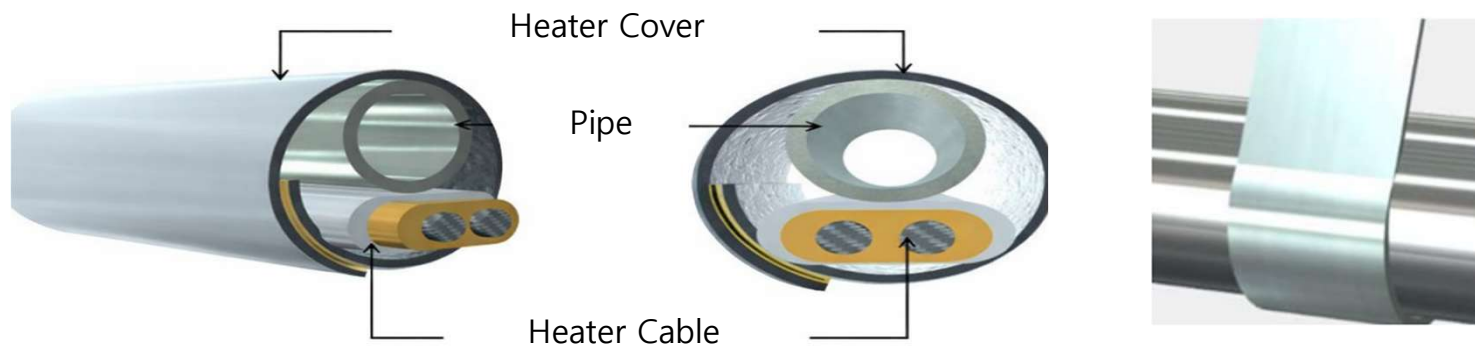
- Insulation installation using the newly proposed silicone insulation material (with double-sided tape attached)
- Verify power consumption

TEST Installation (Secondary TEST LINE)

1. Straight Section COVER Standard Installation Method

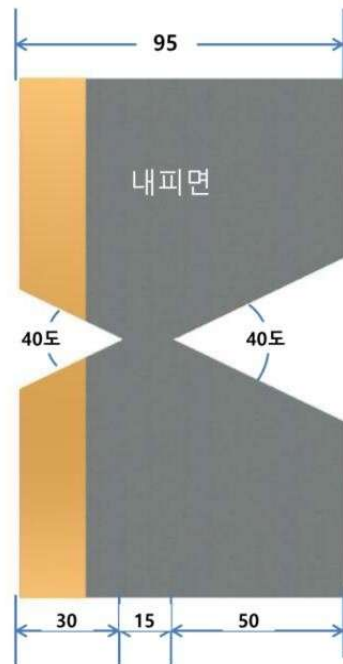


1. Heater Cable onto pipework
2. Remove the release liner from TAPE T1 on the outer surface of the COVER
3. Gradually peel back TAPE T2 on the Inner surface of the COVER while pressing it firmly, then attach section T2 to section T1 to bond and complete installation
4. Finish the COVER joint for straight sections
- Finish the COVER joint using separate AL TAPE

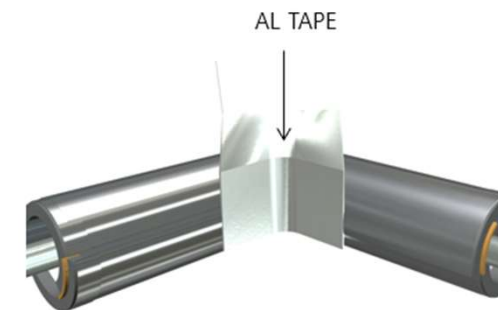


TEST Installation (Secondary TEST LINE)

2. Elbow Section COVER Standard Installation Method



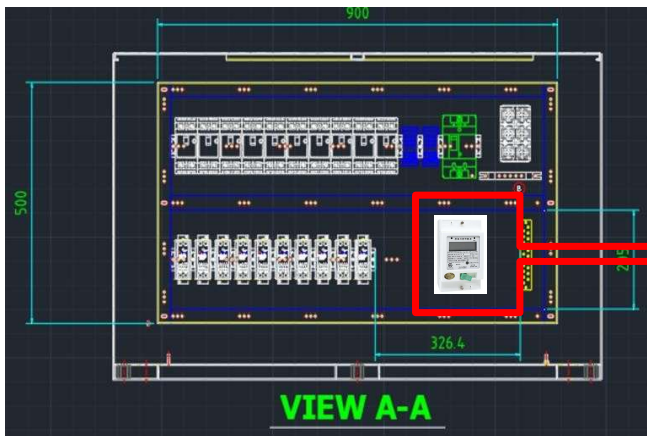
1. Flatten the COVER to match the elbow section and cut it to size
2. Apply COVER to closely conform to the shape and attach TAPE
3. Finish the overlapping cut edges with AL TAPE



The above cut dimensions are reference measurements for 1/4-inch 90-degree pipe + heater installation

Electricity Meter Installation

Electricity Meter Installation Location



Operating Voltage: 1P 2W 220V

Current: 40A

Heater Capacity: 30W x 50M = 1500W (Allowance Factor: 8.5A)

Frequency: 60Hz

Dimensions: W75 x H130 x D60

Electricity Meter Installation

Electricity Meter Cable Connection Method

1. INPUT POWER



1. INPUT POWER Cable

- From the lower terminal of the ELCB corresponding to the TEST LINE inside the VMB equipment to the upper terminal of the power meter

2. OUTPUT POWER Cable

- Connect the lower terminal of the power meter to the corresponding LINE to the upper terminal of the SSR

3. Due to limited installation space for the power meter and cable installation conditions, select the vertical type.

- Vertical Type: W75 x H130 x D60

TEST Conditions

TEST conducted after selecting internal VMB equipment for Hynix M16

Line	Br社	Gas	Type	Location	code	STICK	Device	Resistance(Ω)	Distance(M)	Note
M16B	KC	C4F6	VMB	X25/Y10	6BEVC4F6_20	5		95.1	17	
M16B	WONIK	SiCl4	VMB	X25/Y10	6BEVSiCl4_08	6	6EASD316	51.3	31	Insulation material

 : Teflon (6BEVC4F6_20)  heater 17M

 : Silicon Insulation Material (6BEVSiCl4_08)  heater 31M

TEST Conditions

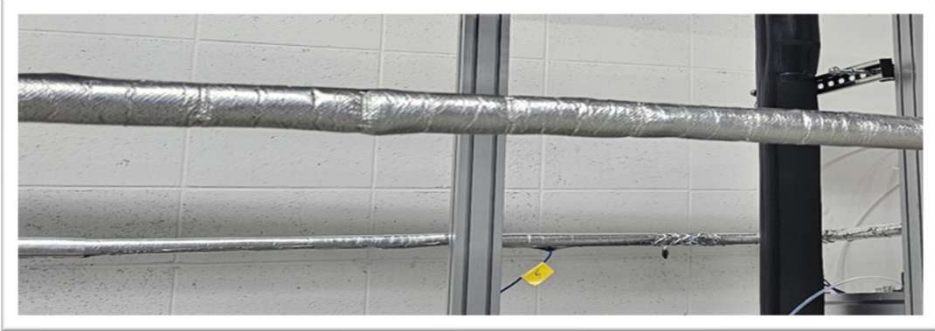
TEST 1 (Teflon tape)

Pipe (17M) with heater installed
After finishing with Teflon tape, operational test
(cable ties used for securing)
Temperature control: 40°C
Measurement Period: 7 weeks (49 days)





TEST 2 (Silicone Insulation)

After wrapping the pipe (31M) with silicone insulation and installing the heater
TEST
(Secured with double-sided tape)
Temperature control: 40°C
Measurement Period: 7 weeks (49 days)



TEST Power Consumption Comparison

Power Consumption Comparison by Insulation Material (kWH)

Division	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7		Note
Teflon tape 6BEVC4F6_20	36	72.2	109.3	150.4	179	214.6	250		Check
Silicone Insulation 6BEVSICL4_08	39.9	80.1	120.9	167.6	202.2	242.3	282.6		

Power Consumption Comparison by TEST

Based on TEST 1 (Teflon tape) results

Daily Power Consumption per 1m of Cable: 0.30012kWh

Hynix M14 (approx. 50,000M standard) LINE HEATER

Annual Power Consumption and Cost

- Annual Power Consumption Based on 50,000m: **5,477,190kWh**
- Annual Cost (Based on a simple calculation of 100 won per 1Kw)
: **547,719,000 won**



Based on TEST 2 (Silicone Insulation) Results

Daily power consumption per 1m of cable : 0.18604 kWh

Hynix M14 (approx. 50,000M standard) LINE HEATER

Annual Power Consumption and Cost

- Annual power consumption based on 50,000m: **3,395,230kWh**
- Annual Cost (Based on a simple calculation of 100 won per 1Kw)
: **339,523,000 won > Approximately 39% savings compared to Teflon tape**



Delivery Status

No	Construction Period	Project Name	Order Quantity	Ordering Party/Construction Site
1	December 2024 ~ Ongoing	SK Hynix Cheongju M15X 1st & 2nd Phase Piping Line Heater Installation	10,000M_(1/4" piping)	Wonik_(SK hynix/Cheongju)

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