Innocreative System

# Silicone Foam Insulation

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**LINE HEATER**
Heat Retention TEST

# 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

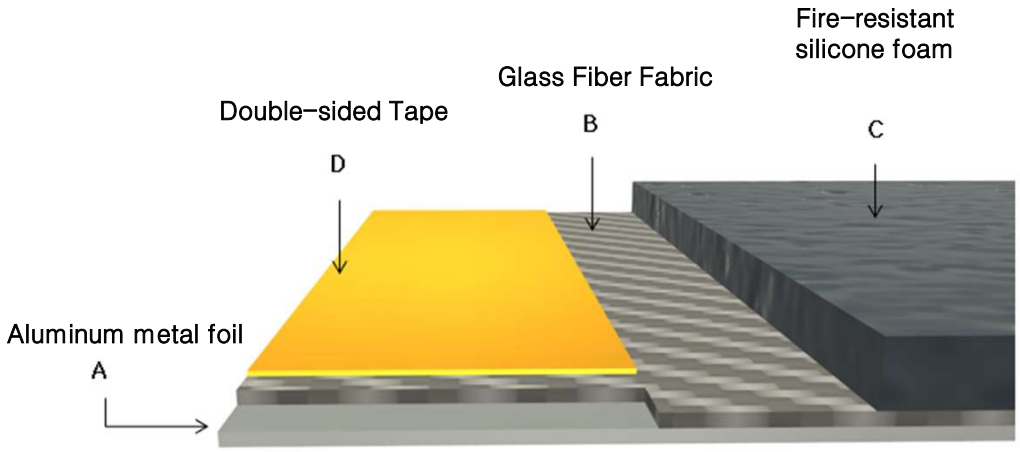
# Foamed Insulation Specification

## 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

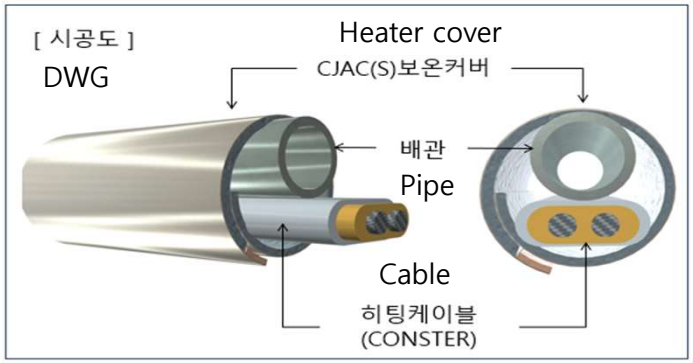
**※ Unlike conventional thermoplastic materials that melt under normal flames, flame-retardant silicone rubber is a thermosetting material.**

**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-curled 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

[난연 TYPE 연소시 ]

[ 내화 TYPE 연소시 ]

- 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.

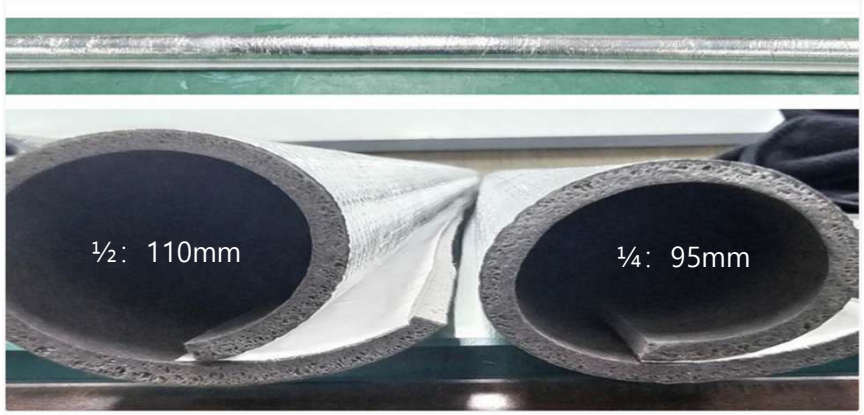
- By this principle, it can block flame propagation and is applied to firefighting-related cables such as sprinkler cables, as well as to cables for electric vehicles and thermal diffusion barrier pads.

# Foamed Insulation Specification

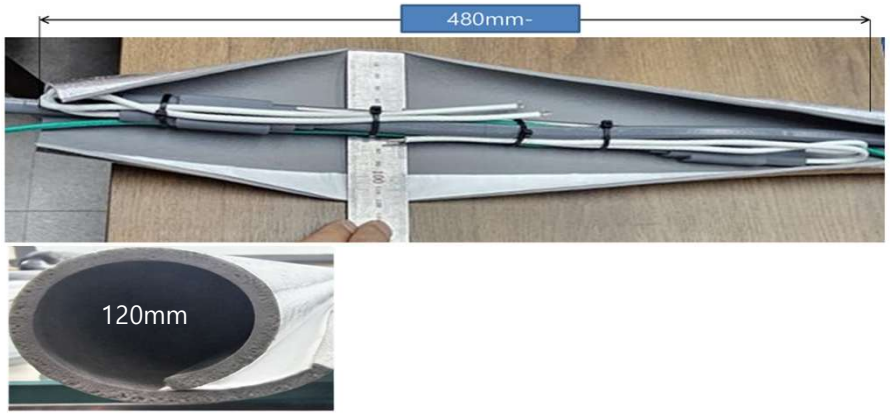
## 5. Product Specifications

| 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 toproduce foamed silicone molded products.

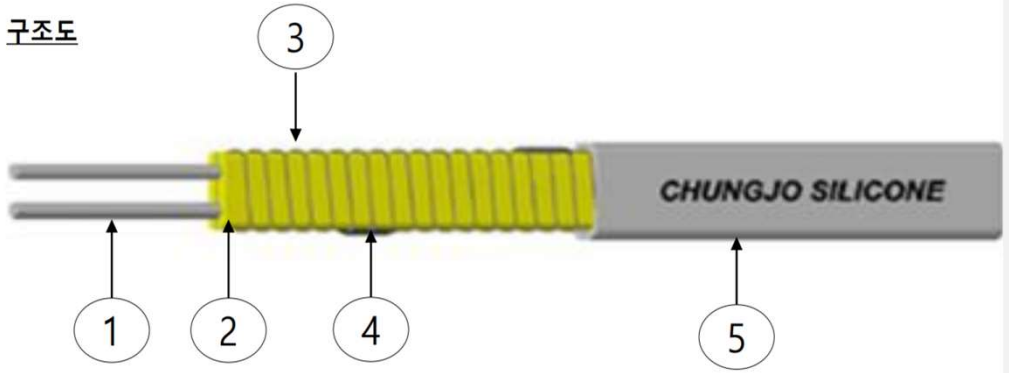
**2. Advantages & Characteristics of Foamed Silicone**

- 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 |

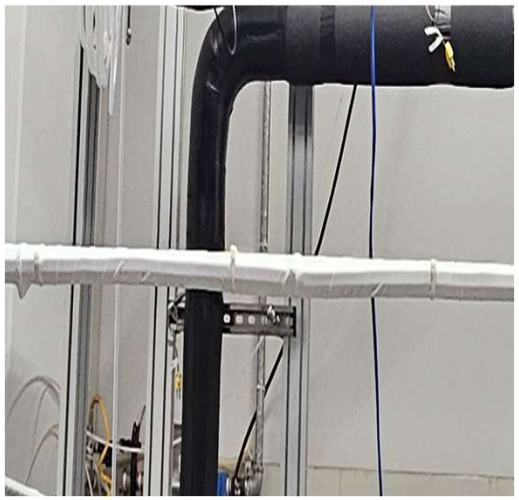
구조도




| |
|---|
| **1** - Busbar: Tin-plated wire 1.25 mm²*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

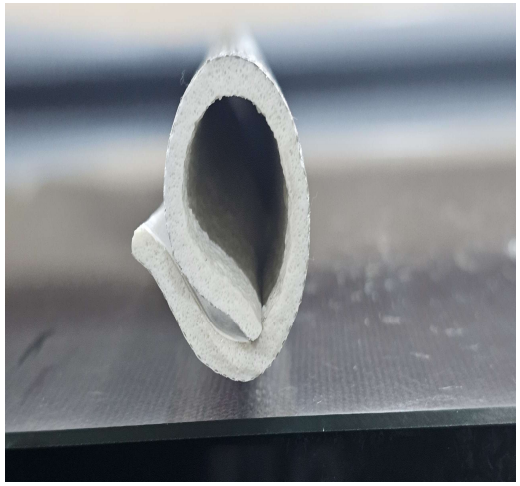
**[ PTFE TAPE ]**

**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

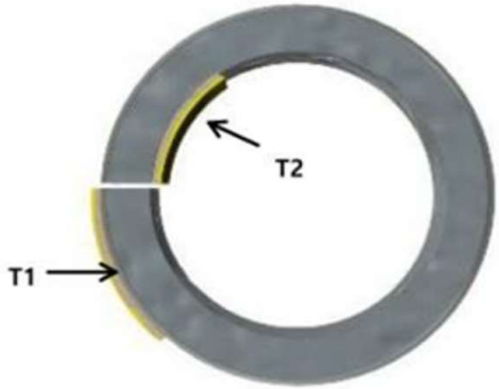



**TEST2: Test After Finishing with New Insulation Material (Silicone Insulation)**

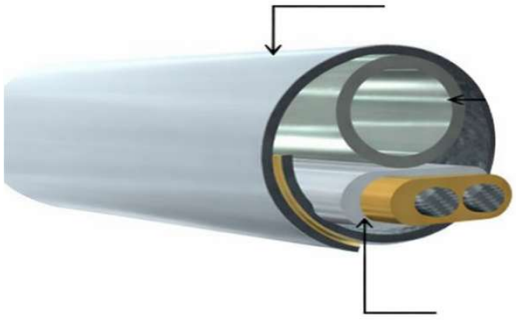
- Insulation installation using the newly proposed silicone insulation material (with double-sided tape attached)
- Verify power consumption

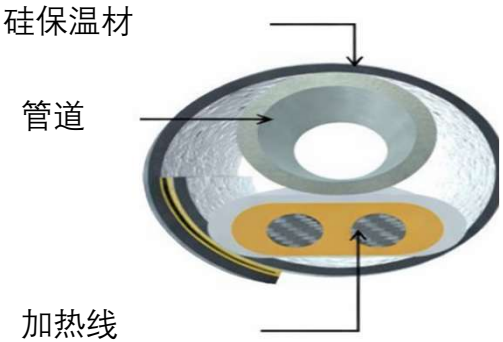
# TEST Installation (Secondary TEST LINE)

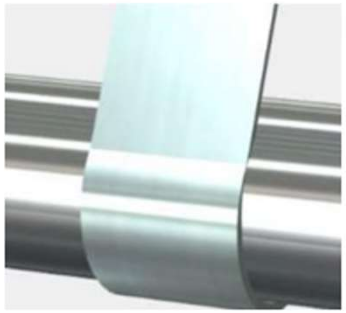
## 1. Straight Section COVER Standard Installation Method




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

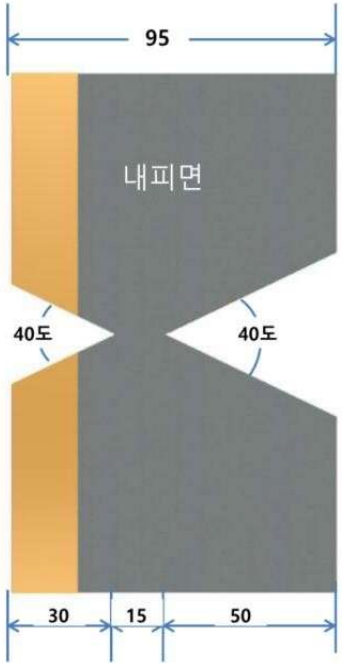




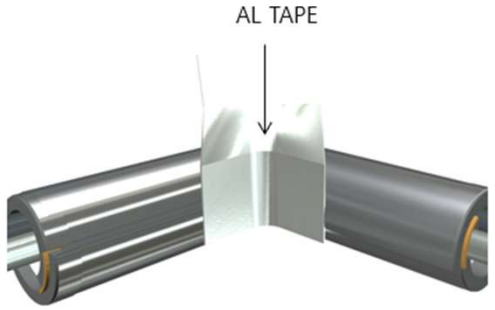



# TEST Installation (Secondary TEST LINE)

## 2. Elbow Section COVER Standard Installation Method



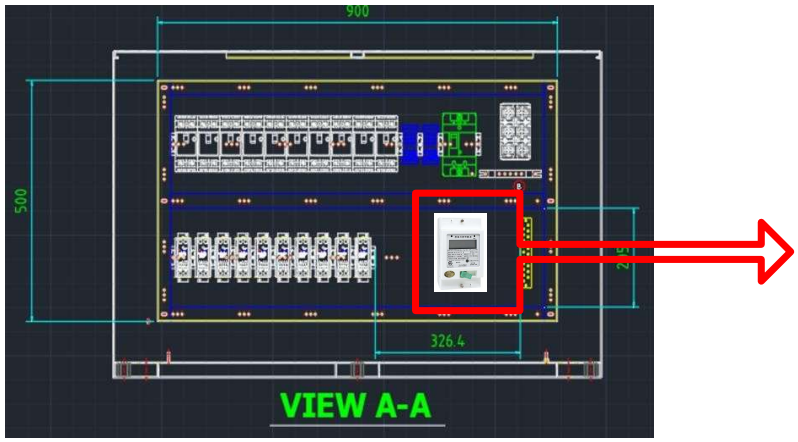

1. Flatten the COVER to match the elbow section and cut it to size
2. Apply COVER to closely conform to the shape and attach TAPE
3. Finish the overlapping cut edges with AL TAPE




**The above cut dimensions are reference measurements for ¼-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 | Bp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)

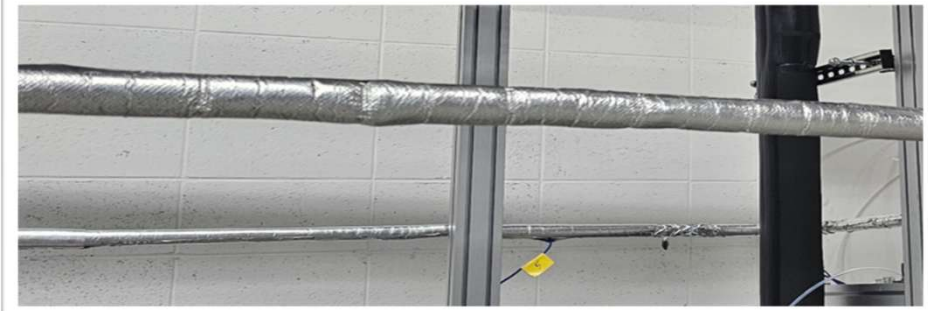
After wrapping the pipe (31M) with silicone insulation and installing the heater

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**<br>6BEVC4F6_20 | 36 | 72.2 | 109.3 | 150.4 | 179 | 214.6 | 250 |  | Check |
| **Silicone Insulation**<br>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) |

# Precautions for Handling This Material

**This material contains confidential information.**


Thank you for your attention