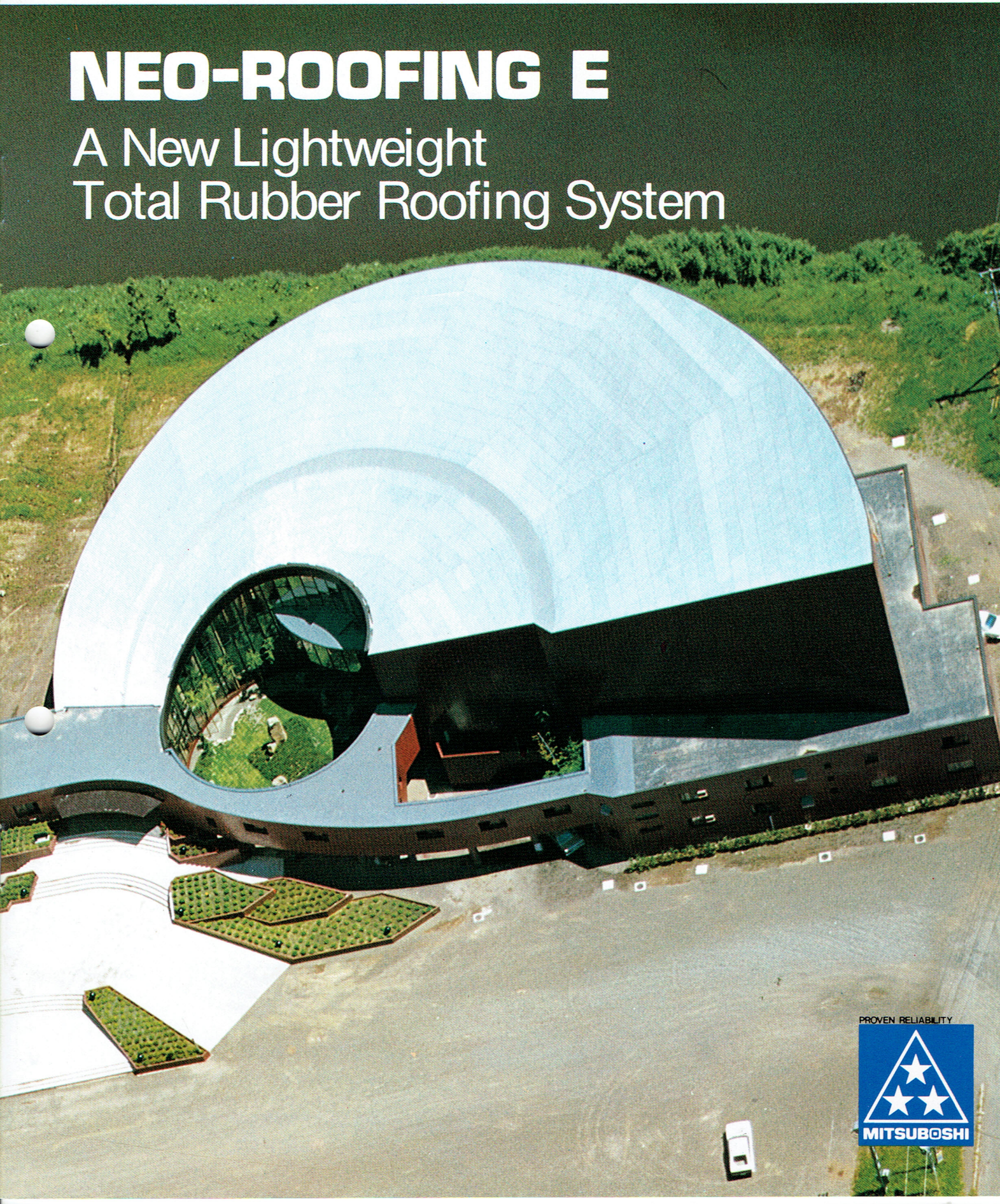
W510-C

MITSUBOSHI

NEO-ROOFING E

A New Lightweight Total Rubber Roofing System



PROVEN RELIABILITY

MITSUBOSHI

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Waterproof material supplied in sheets

The main polymer in this waterproof sheeting is Ethylene-propylene-diene monomer (EPDM); the material offers excellent resistance against weathering and aging.

Test-indicated durability:50years

Judging from the results of our accelerated aging tests using ozone (see page 4 for details). Neo-Roofing E should last for 50 years. The superior durability can be seen in the fact that there have been no incidents of failure during the approximately 20 years it has been on sale.

Stable physical properties at temperatures between −45°c and +100°c

No change in the material's qualities is observed over a temperature range of -45°C to +100°C so that it can be used in almost any type of climate (brittleness starts at-49°C).

NEO-ROOFING E Method of Construction

1. Freedom of design

You can plan a building exactly the way you want it without having to worry about roofing problems since it covers irregular surfaces uniformly; hence any shape is acceptable, e.g., a shell, dome or wave pattern. The completely waterproof layer obtained with the Neo-Roofing E system is certain to satisfy your needs.

2. One-ply total roofing system

A waterproofing system which includes all the components necessary to achieve a completely waterproof finish, from the waterproof material itself to the adhesive. Moreover, as it is only a single-ply waterproofing sheet, it is an important factor in the construction of light-weight buildings (approximately 2.0 kg/m^2).

3. No special tools or techniques requird

A roller brush, a hand brush, scissors, and a pressure roller are the only tools that are required. Moreover, no special techniques are necessary. All you have to do is to attach the waterproofing material to the surface with adhesive and then join the overlapping parts of the sheets together with the adhesive.

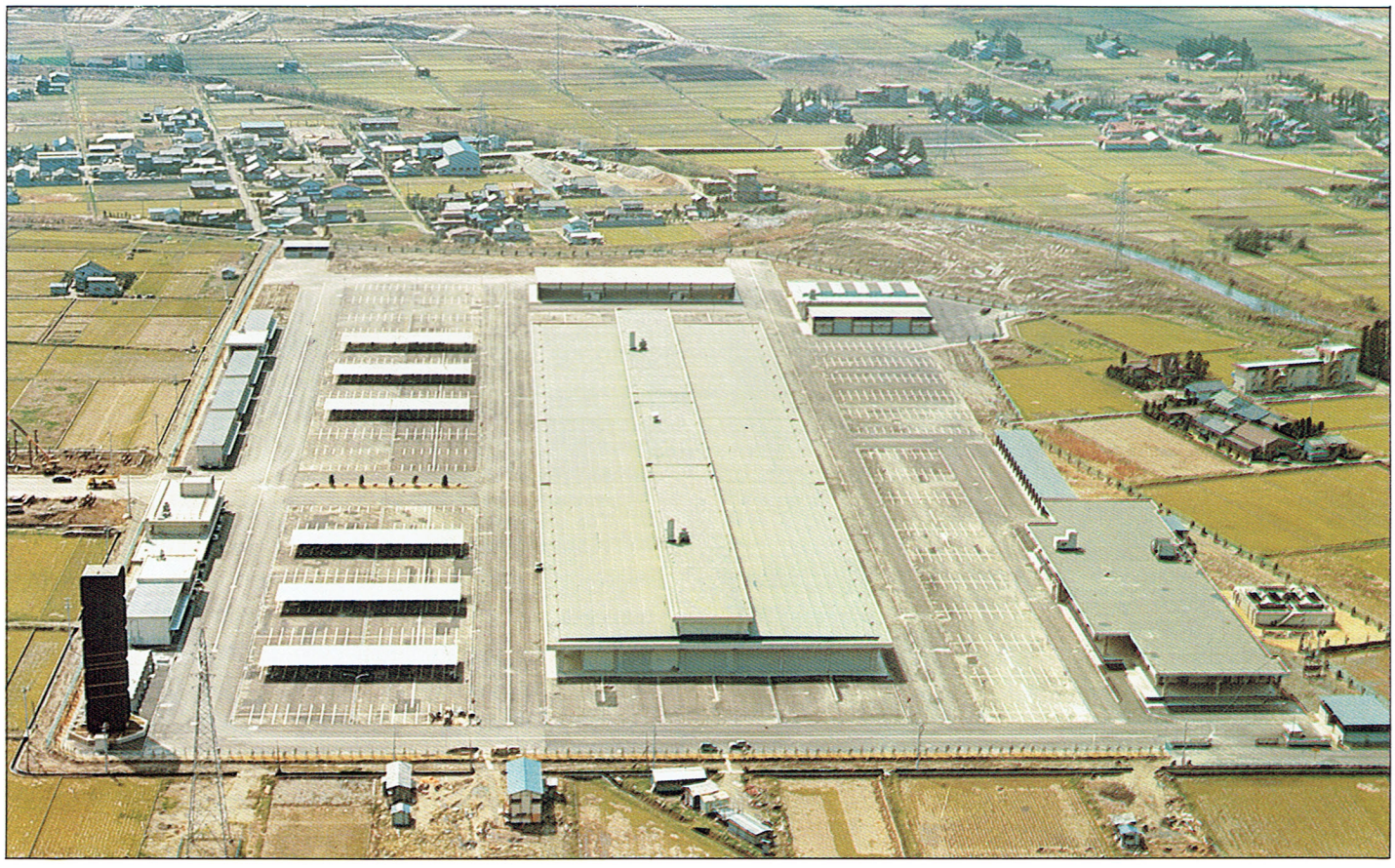
4. Application method at normal temperatures

As no heating is used, there is no fear either of burning or of pollution caused by smoke or offensive smells.

Comparison with Asphalt Waterproofing

The following are our product's advantages in comparison with traditional asphalt waterproofing.

	Neo-Roofing Method	Asphalt Method
Method	Normal temperature method. No heating required.	Heating method. Heating equipment like melting pots, etc. and a heat source are required. Smoke and offensive smells during tar heating cause pollution.
Weight	Only one waterproof layer, so it is possible to reduce the building's weight.(about 2 kg/m²)	A multi-layer method so many processes are necessary and the weight is considerable. (about 15 kg/m²)
Surface cracks	As the waterproofing material is a form of rubber, it has excellect waterproofness regardless of surface cracks in the roof deck.	Asphalt has low elasticity so it breaks up when the sub-layer begins to crack.
Physical properties	There is little change in the physical properties caused by high or low temperatures.	As asphalt has heat plasticity it becomes soft and deformed at high temperatures and extremely hard at low temperatures.
Application	It is easy to cover steeply sloping roofs, perpendicular sides and intricate areas.	As asphalt has poor elasticity, it can be used only on flat surfaces.
Cost	Although the cost of the material is high, the quantity necessary for application is low.	Although the material cost is low, a large quantity is necessary.



Properties of NEO-ROOFING E

1. Physical properties

Test Description	Test Method	Our Specification
Tensile strength, minimum kg/cm^2	ASTM D412	80
Modulus at 300 percent elongation, minimum kg/cm^2	ASTM D412	40
Ultimate elongation, percent minimum	ASTM D412	450
Tear resistance, minimum kg/cm	ASTM D624 (Die "C")	27
Heat aging – 7 days at 80°C	ASTM D573	
Tensile strength retained, percent of original		80 ~ 150
Modulus at 300percent elongation retained, percent of original		80 ~ 150
Elongation retained, minimum percent of original		70
Tear resistance retained, percent of original		50 ~ 150
Ozone resistance	1000±100 pphm at 40±2°C Extension: 100% 168 Hours	No cracks

2. Weathering resistance

It is very hard to judge to what extent the waterproofness of a material is affected by various deterioration–causing factors, such as ozone, heat or light. However the principal reason for deterioration in rubber sheets is zone, and so it may be reasonable to assume that it is of the utmost importance to use materials with high ozone resistance.
The following formula has been obtained from the results of the tests performed at our plant on the correlation between deterioration in the waterproofness of sheets due to concentrated ozone and deterioration due to natural exposure.

Ozone density: 1000 pphm
log Y = 1.423 logX + 0.226
Y: ozone cracking time (minutes)
X: natural exposure time (days)

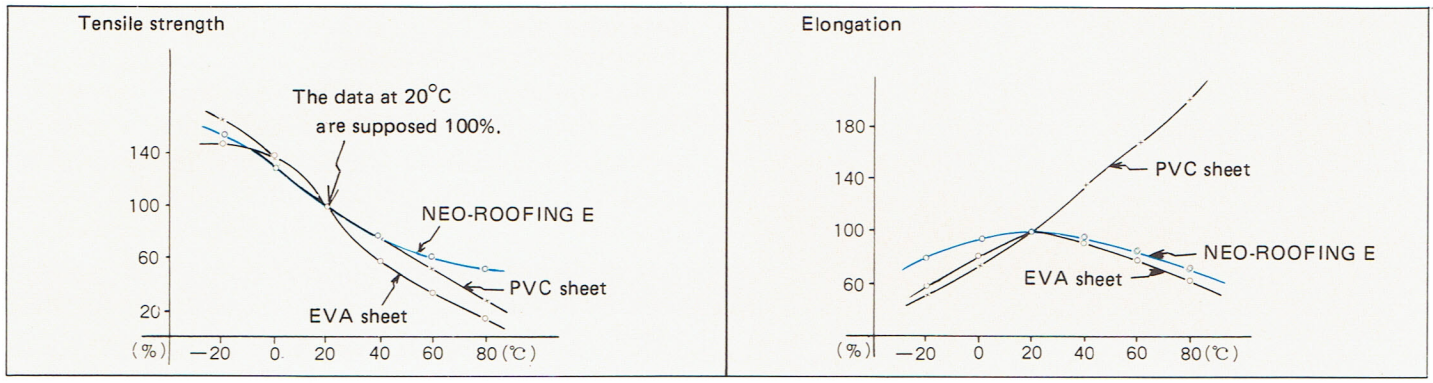
On the basis of this formula, the stated test time (36,000 hours) is equivalent to 19,610 days of outdoor exposure, which is about 53.7 years. Although these are estimated values, they can be assumed to be quite reasonable from the fact that in the almost 20 years this product has been on the market, no sheet has ever shown any defects nor have we received any customer complaints.

	Condition	Neo-Roofing E	Butyl sheet
Ozone test (1)	Ozone density: 1000 pphm Temperature: 40°C Extension: 100%	No cracks after 36,000 hours	Cracks occured after 17 hours
Outdoor exposure test	Extension: 100%	No cracks after 56,160 hours	Cracks occured after 240 hours
Weather-O-Meter test (2)	Extension: 100%	No cracks 2,000 hours	Cracks occured after 250 hours

(1) The results of 3,280 hours in ozone test is equivalent to ten years exposure, and 5,800 hours to fifteen years exposure.
(2) The result of 240 hours in Weather–O–Meter test is equivalent to one year exposure.

3. Effect of temperature

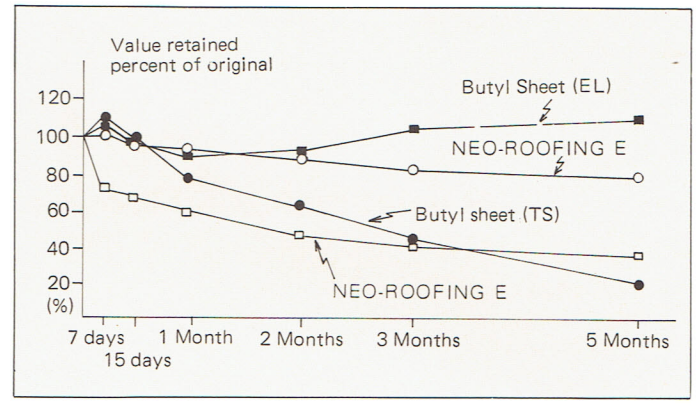
In resin (EVA, PCV, etc.) and asphalt sheets, the structure is deficient in bending between the molecules and so is quite unstable – the sheets soften at high temperatures and become extremely hard at low temperatures. Non-vulcanized rubber sheets show the same tendency, but vulcanized sheets like Neo-Roofing E with its strong molecular bond are physically stable both at low and at high temperatures. As it will be used under severe natural conditions, the material should be physically stable over a wide range of temperatures. In this sense Neo-Roofing E is perfectly suited as a waterproofing material.



4. Heat aging

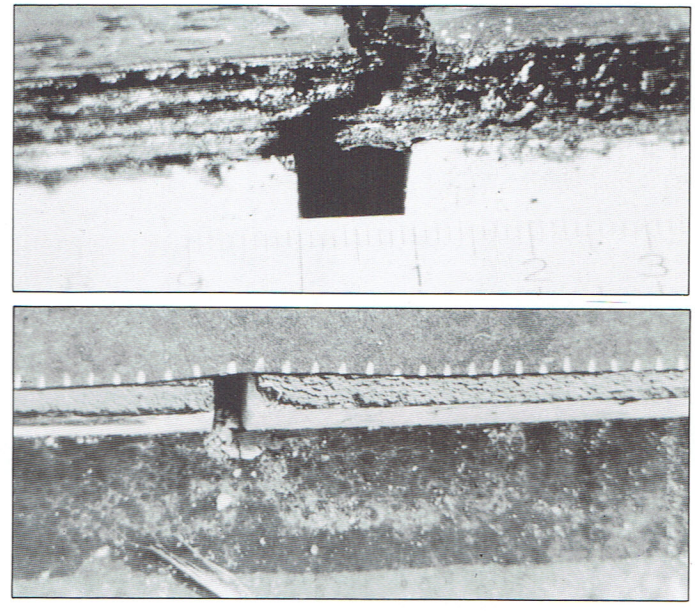
While naturally depending on the surroundings or the specifications, there are reports that the surface temperature of our sheets has risen as high as 70°C in mid-summer. The following chart shows the physical change in Neo-Roofing E and butyl sheet over a long period at 100°C.

The results of the test clearly show the outstanding characteristics of both Neo-Roofing E and butyl sheets, i.e., the fact that the maintenance rate of Neo-Roofing E's elongation and butyl sheet's tensile strength decreases. This is caused by the difference in position of the double bond which is necessary for vulcanization of rubber. In butyl rubber this is located in the main chain and molecules are cut and softened because of heat aging, while in Neo-Roofing E it is located in the lateral chain and the molecules are not cut; vulcanization by heat continues and the elongation percentage decreases. In the event that long term physical stability is required, hardening type Neo-Roofing E will naturally have a higher safety margin than the softening type butyl.



5. Resistance to surface cracking

Generally speaking, surface cracking is a common problem that all waterproofing materials must be able to contend with. The following photos were taken by bringing the sides of two flexible boards face to face with each other; then we laid waterproof layers of Neo-Roofing E and asphalt on them, and gradually separated the two boards till the gap reached 10mm, while observing the behavior of the two waterproof layers. The result was that asphalt waterproof layer started to crack when the distance between the two boards reached 2 ~ 3mm whereas our product showed no defect because of its high stretchability. This indicates the inherent problems found in using asphalt as a waterproofing material.



6. Chemical resistance

As shown in the following chart of test results, Neo-Roofing E has excellent resistance to chemicals, with the exception of strong acids, aliphatic solvents and petroleum, this enables it to be used as an inner coating on tanks for storing various chemicals or waste liquids, and as a protective layer for canals. For unknown chemicals or waste liquids, a soaking test should be carried out each time to confirm its suitability.

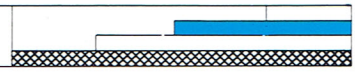
Chemicals	Density (%)	Evaluation
Hydrochloric acid	10	○
Hydrochloric acid	Conc	XX
Sulfuric acid	10	◎
Sulfuric acid	Conc	XX
Nitric acid	10	◎
Nitric acid	Conc	X
Phosphoric acid	Conc	◎
Sodium hydroxide	10	◎
Sodium hydroxide	Conc	◎
Potassium hydroxide	10	◎
Ammonium hydroxide	10	◎
Ammonium hydroxide	Conc	◎
Calcium hydroxide	10	◎
Sodium chloride	25	◎
Calcium chloride	25	◎
Ammonium nitrate	25	◎
Ammonium sulfate	25	◎
Acetic acid	5	○
Acetic acid	10	△
Slacial acetic acid		XX
Phosphoric acid	10	◎
Carbolic acid	100	○
Tartaric acid	10	◎
Methyl alcohol		◎
Ethyl alcohol		◎
Ethylene glycol		◎
Glycerin		○

Chemicals	Density (%)	Evaluation
Diethylene glycol		○
Ethyl acetate		△
Amyl acetate		X
Dioctyl phthalate		○
Dibutyl phthalic acid		○
Benzene		XX
Hexane		XX
Toluene		XX
Xylene		XX
Acetone		○
Methyl ethyl keton		△
Methyl isobutyl keton		X
Carbon tetrachloride		XX
Chloroform		XX
Ethylene chloride		XX
Aniline		○
Triethanolamine		○
Nitrobenzene		○
Cottonseed oil		△
Olive Oil		△
ASTM oil No. 1		X
ASTM oil No. 3		XX
Gasoline		XX

Evaluation:
Sufficient for actual use (◎)
To be used under certain condition (○, △)
Not usable (X, XX)
Method:
Test piece was totally submerged in solution at 20°C for one month.

Method of Application

Roof deck



As the deck surface conditions have a great effect on adhesiveness, they must be troweled to a completely smooth, continuous finish and be fully cured, clean and free of dust and contamination. Ⓐ

Completely dry the surfaces. It is desirable to allow more than ten days for drying mortar surfaces after construction and one month for concrete surfaces. If drying is insufficient, it causes swelling of the waterproof material after this is laid on the surface.

Give a good flat finish to the surfaces so that there are no differences in level or uneven patches. Be sure to chamfer sharp edges.

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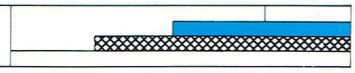
Primer Adhesives



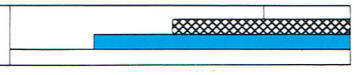
Apply primer uniformly with a roller brush (application ratio: 0.2kg/m²) in order to clean surfaces and to increase adhesiveness. Standard drying time is 15 minutes. Ⓑ

Remove the top of the adhesive can completely, stir well with stick, and apply adhesive.

Use roller brushes or rubber pallets for applying adhesives. You will soon get used to applying them uniformly (application ratio: 0.25kg/m² on roof deck and 0.15kg/m² on the membrane). Do not let the adhesive run over onto the adjacent sheet. Ⓒ

Drying time, which depends on weather and local conditions, is 20 minutes, on the average (the adhesive should be stickly to the touch, but not adhere to the fingers.)

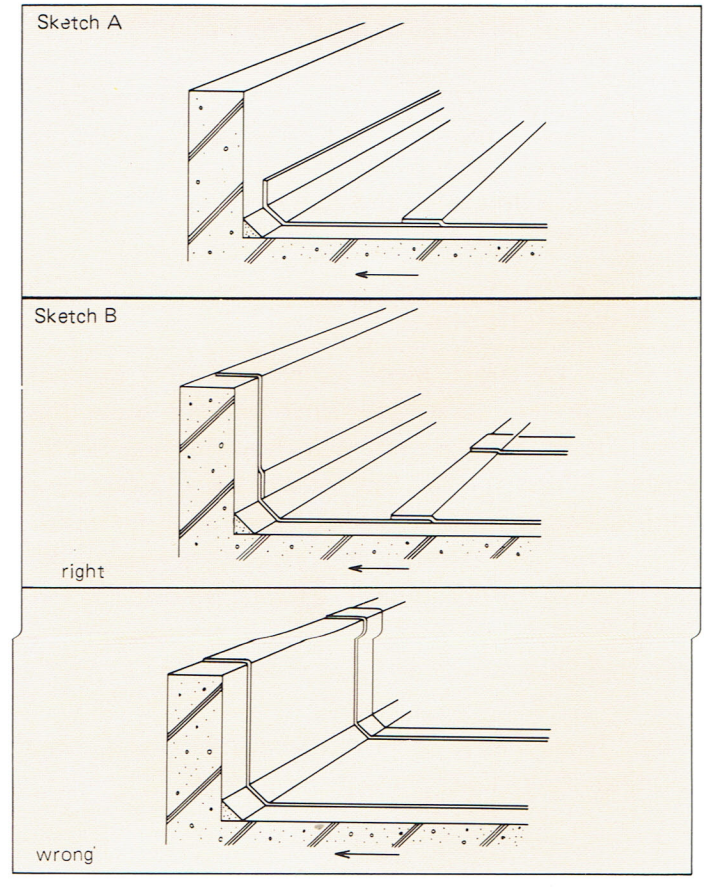
Membrane



When sheets are unrolled and laid, take care not to let air get trapped between the sheet and the roof deck which causes visible air pockets, and try to prevent *wrinkles and tension. Both ends of the sheets shall be* lapped a minimum of 10cm. Ⓓ

Smooth the laid surface of the applied sheet with a roller brush, brushing towards the outer edge to remove any pockets of trapped air.

Sheets must be installed from the bottom, at right



angles to the slope of deck.(See sketch A)
On perpendicular and gutter sections be sure to apply the material lengthwise, in strips, from the bottom. Overlapping should be avoided at corners as much as possible.(See sketch B)
Just after installing the sheets, roll the full length with a roller of more than 25kg. The rolling operation will ensure a perfect sheet-to-roof deck bond. Ⓔ


Ⓔ

Joint Adhesive

Stir well with a ratio of A : B = 1 : 1 by weight before use.(Overlap is 100mm wide.)
Follow the next three directions when adhering.

1 Volume to be applied Ⓕ

Paint 0.5 kg/m² of joint adhesive agent evenly on each side of the roof a hand brush or a roller brush.

2 Drying time before fixing joint

Average drying time is 20 minutes. The method of checking dryness is the same as that of the ground adhesive agent.

3 Rolling pressure

Just after plastering, apply sufficient pressure with an iron hand roller.

As long as all three of the above requirements are satisfied, you should get a satisfactory bond.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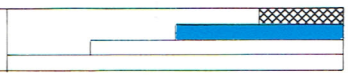
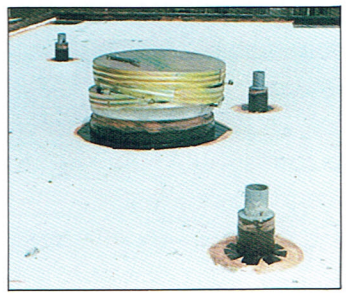
Coloring



Open the can completely, stir the coloring agent sufficiently with a stick and apply.
It is easy to apply with a roller brush. Ⓖ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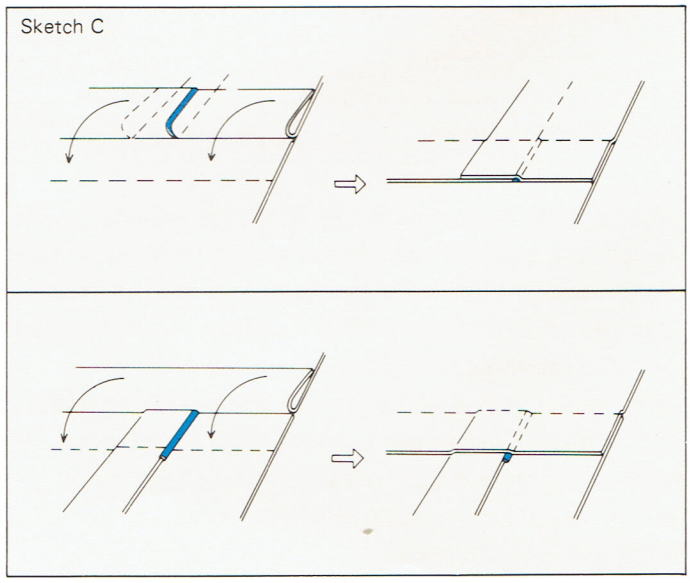
Miscellaneous

In order to avoid leaks in external and internal corners, gutters, pipes and other intricate areas, the areas should be plastered with Neo-Roofing RN in advance. Press it into the corners with fingertips a hard object or roller. However, when chamfer width of external and internal and internal corners is 40 mm, flashing may be applied. (Details are described in P. 14) Ⓗ
Put Neo-Seals on three layer sheets. (See sketch C)

Sketch C



Note: The adhesive agent must be employed without dilution. Keep it airtight when not using.

Specifications For NEO-ROOFING

The Neo-Roofing method can make most buildings waterproof. For waterproofing ordinary rooftops; roofs used for walking on; unusually-shaped roofs of gymnasiums and theaters; for heat insulating and waterproofing cold storage units, for subways, bridges, etc.; you may choose from the specifications below.

1 Exposed Waterproofing Method

Spec. No.	Application (Base, Structure)	Features
101	RC, PC board, mortar, Silbur kurl	Standard specification for ordinary outdoor roofing
102	ALC board and other rough foundation	Foundation treatment is provided to improve adhesion

2 Heat Insulation Method of Waterproofing

(arrangement of waterproofing and heat insulation)

401	RC, PC board, mortar	High standard achieved by using waterproof layers over the insulating material
407		Protective layer is placed just over the water-proof sheet to protect from damage.

3 Protective Layer Waterproofing Method

301	Ordinary roof for walking on	Excellent adhesion is taken by non-cured rubber laminated sheet.

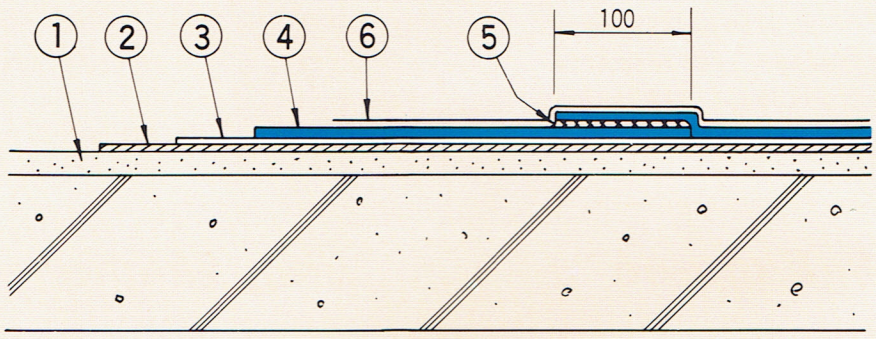
1. Exposed Waterproofing Method

101

Standard specification for ordinary outdoor roofing

Application

RC, PC board, mortar



	Process	Material	Quantity
1.	Base		
2.	Primer	Neo-Primer	0.2 kg/m^2
3.	Adhesive	Neo-Bond R	0.4 kg/m^2
4.	Membrane	Neo-Roofing E	
5.	Adhesive for lap	Neo-Bond #110JS	50 m/set
6.	Color	Neo-Color	

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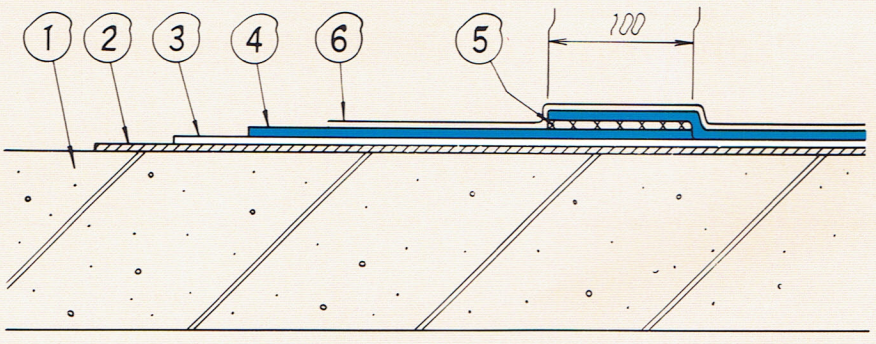
Foundation treatment is provided to improve adhesion

Application

ALC board and other rough foundation



	Process	Material	Quantity
1.	Base	ALC board	
2.	Primer	Neo-Primer ALC	0.5 kg/m^2
3.	Adhesive	Neo-Bond R	0.4 kg/m^2
4.	Membrane	Neo-Roofing E	
5.	Adhesive for lap	Neo-Bond #110JS	50 m/set
6.	Color	Neo-Color	