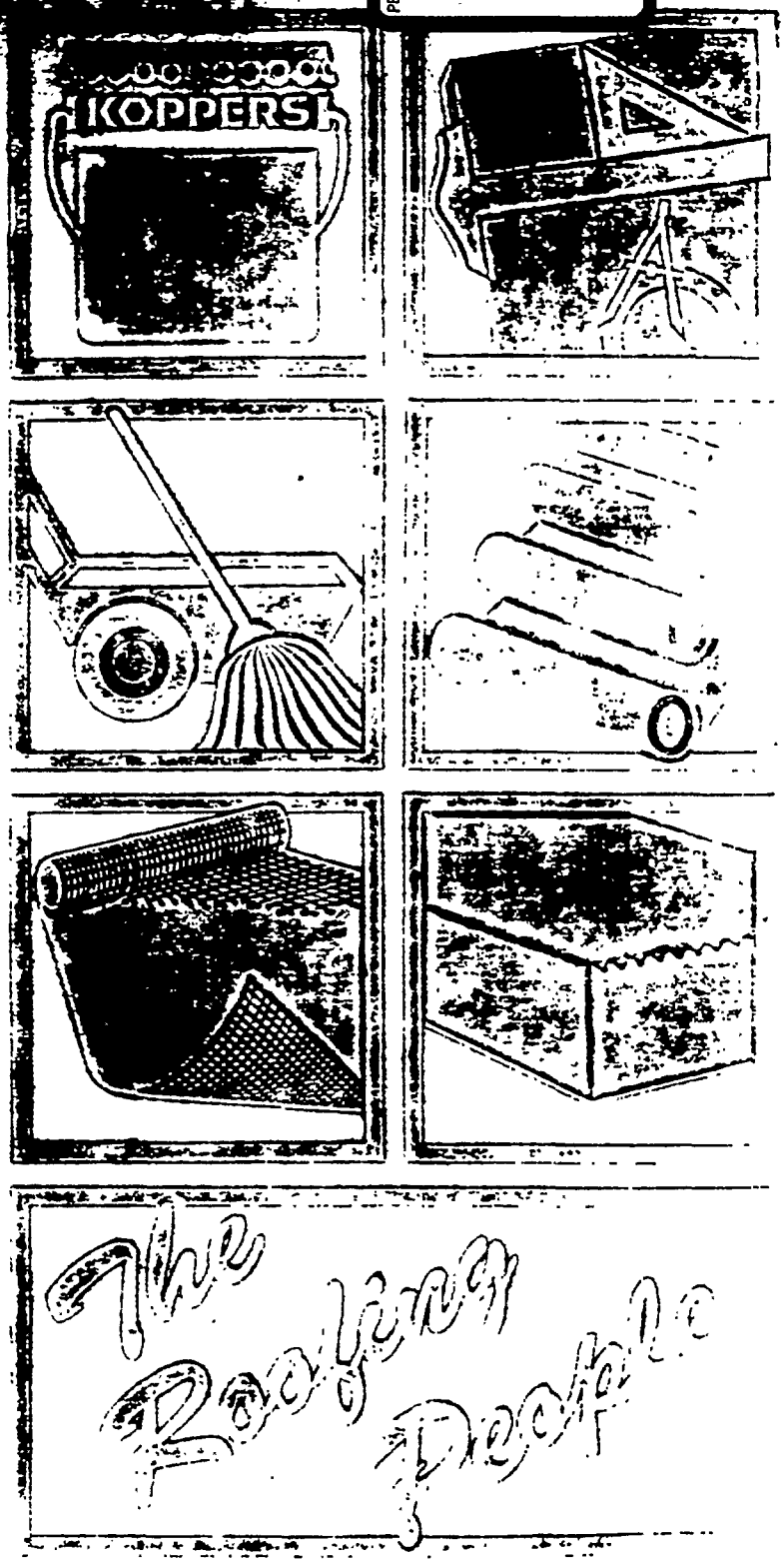
PENGAD-Bayonne, N.J.

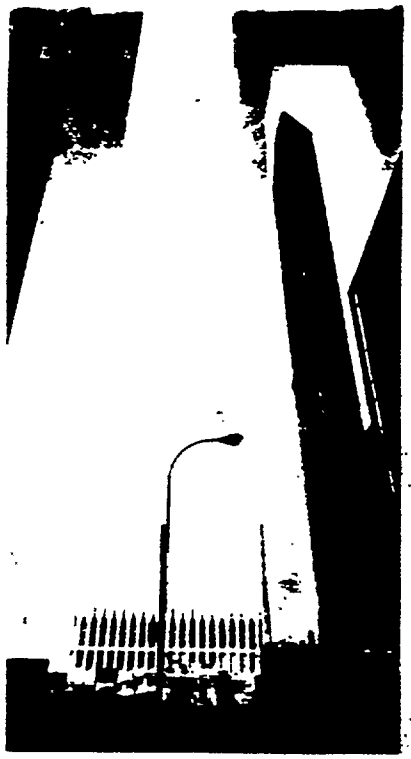
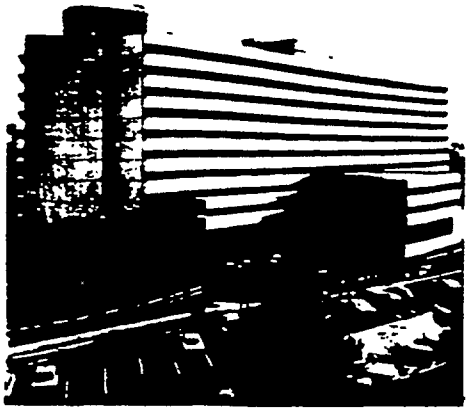
7-1/85DP

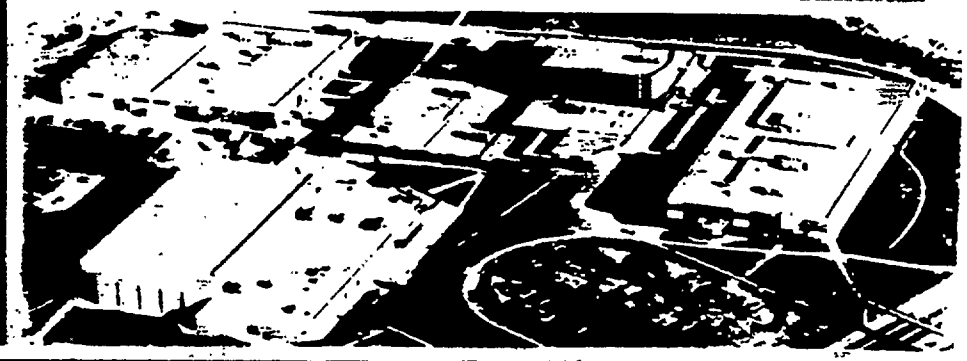
ROOFING, WATERPROOFING and INSULATION SYSTEMS

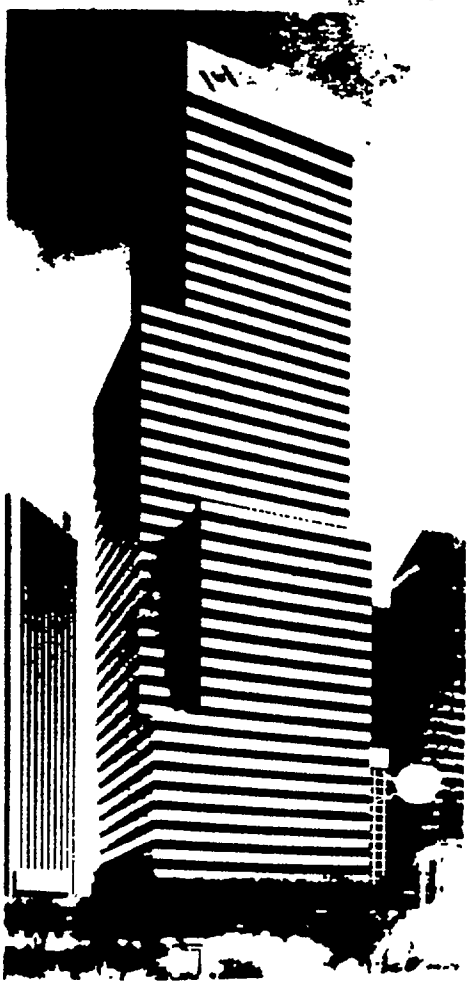
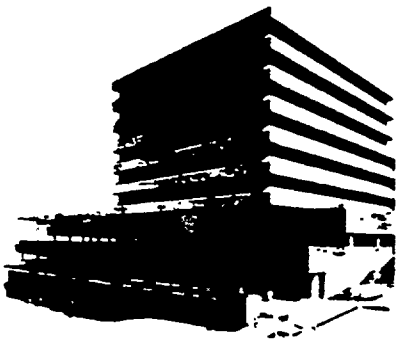
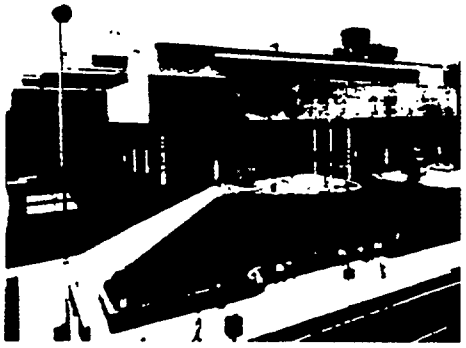


KOPPERS

1985




Preface

This manual contains recommended roofing specifications and procedures for use and application of Koppers roofing products. The specifications and details contained in this manual are intended as a guide for the appropriate use of Koppers products and to the necessary procedures to obtain a Koppers guarantee [illegible]

Remember a Koppers guarantee can only be obtained through a Koppers representative and must be applied for prior to the beginning of application of the roofing system. The availability of a Koppers guarantee for roofing and flashing constructed according to the information contained in this manual under Koppers guarantee procedure and the publishing of these specifications and information shall not be construed as creating any warranty, expressed or implied with regard to any roofing or flashing for which a guarantee has not been issued.

The design criteria and details contained herein have been compiled and are offered as a guide for consideration to assist the architect, owner and roofer in an attempt to provide the best roof possible. Responsibility, however, for design of any roofing system remains with the architect or engineer and building owner.

This roofing manual supersedes all previous roofing manuals published by Koppers in Sweets Catalogs.

INFORMATION CONTAINED IN THIS BULLETIN IS PRESENTED IN GOOD FAITH, BUT IT IS NOT TO BE INFERRED THAT BY PUBLICATION HEREOF BY KOPPERS COMPANY, INC., NOR BY THE USE OR EMPLOYMENT BY THE READER OF ANY SUGGESTIONS OF METHOD CONTAINED HEREIN, THAT KOPPERS COMPANY, INC., HAS ASSUMED ANY LIABILITY FOR INFRINGEMENT OF ANY PATENT, FOREIGN OR DOMESTIC, NOR GIVEN ANY WARRANTY, EXPRESSED OR IMPLIED INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTIBILITY OR FITNESS FOR PARTICULAR PURPOSE.

Table of Contents 1985

Notice:

Any claim shall be deemed waived unless submitted in writing and received by Koppers within thirty (30) days of the date that the defect to which each claim relates is or should have been discovered. Koppers liability shall be limited to at Koppers sole option resupply of a like quantity of non-defective product or repair. Koppers shall not be liable in any event for any incidental, consequential or special damages. Further such damages shall not be recoverable even if the remedy supplied fails [illegible] or for any other reason. Koppers distributors or salesmen or any representative of [illegible] no authority to extend the [illegible] stated as above or [illegible] limitations or [illegible]

Product Guide

[illegible]

The products listed below are manufactured to meet applicable Federal and ASTM specifications. If a certification is required on any of these products it must be requested at the time of order placement.

[illegible]

Insulations

[illegible]

Fabrics

[illegible]

Products	Description	Federal Spec.	ASTM Spec.	Page No
Roof cements				
Flashing 444*	Flashing cement formulated for weathering and flow resistance	SS-C-153C Type I	D-2822-75 Type I	
Flashing Cement	Not as heavy consistency as Flashing 444*	SS-C-153C Type I	D-2822-75 Type I	
Hydroshield	Asphalt cutback. Formulated for application in most weather conditions. Trowel or brush grades			
Tar Roof Cement	Tar based plastic cement	SS-C-153C Type II	ASTM D-4022-81	
Roof coatings				
Emulsions				
Liquid Asphalt 480	Asphalt emulsion. Resists alligatoring if properly applied. Heavy bodied, exceptionally high quality, non-fibrated clay emulsion		D-1227-82 Type III D-1187-82 Type A	
Liquid Asphalt 472	Asphalt emulsion. High quality, fibrated medium body clay emulsion	SS-R-1181 Type I	D-1227-82 Type I	
Liquid Asphalt 484	Fiber glass reinforced asphalt emulsion			
Cutbacks				
Asphalt Roof Coating 454	Medium body, fibrated cutback coating	SS-A-694D	D-2823-75 Type I	
Fiber Coating 415	Tar cutback. Penetrates and resaturates tar and gravel roofs	SS-C-540B	N.A.	
Resaturants				
Roof Resaturant 425	Asphalt Cutback. Combines maximum penetration and coating properties			34
Roof Resaturant L.O. 410	High quality low odor resaturant			34
Roof Resaturant 410	Highest quality tar resaturant available. Excellent penetration and softening qualities			34
Primers				
High-Pen Primer 452	Thin asphalt cutback primer with maximum penetrating capabilities	SS-A-701B	D-41-78	
Coal Tar Concrete Priming Oil	Coal tar based primer for roofing and waterproofing applications		D-43-73	
Adhesives				
CF Adhesive	Superior asphalt cutback adhesive for asphalt felt applications			
Reflective roof coatings				
Alum. Roof Coating 434	Premium grade reflective coating. Non-fibrated		D-2824-82 Type I	
Alum. Roof Coating 435	Premium grade reflective coating reinforced with fibers	TT-C-498C	D-2824-82 Type II	
Alum. Roof Coating 444	Commercial grade reflective coating. Non-fibrated		D-2824-82 Type I	
Alum. Roof Coating 445	Commercial grade reflected coating. Reinforced with fibers		D-2824-82 Type II	
Colored Roof Coating (White)	White acrylic emulsion decorative coating. To be used over new Liquid Asphalt 480			
Caulkings				
Acrylic 400	One part gunnable acrylic caulking			

***Applicable Federal and/or ASTM Guide Specifications are not available for this product.**

Koppers Roof Guarantee Program

Koppers Guarantees are available for those roofing specifications listed in this manual. To qualify for a Koppers Roofing Guarantee roofing and flashing must be constructed in accordance with Koppers Specifications with Koppers materials, and by a roofing contractor authorized by Koppers.

Prior to the beginning of any guaranteed roof application the contractor must apply for the required document in accordance with Koppers standard procedures.

An inspection of the roofing and the approval by Koppers of the application is required for the issuance of a Guarantee. Koppers reserves the right to refuse to issue a Guarantee or to renew such Guarantee at its sole discretion.

General requirements for guaranteed roof applications:

1. All roofing to be guaranteed must be constructed in conformance with Koppers specifications.

2. Koppers guarantees are not available for residential roofing.

3. Koppers guarantees are available within the Continental United States in all areas except those areas where Koppers does not presently provide inspection service.

4. Approved flashings may be guaranteed for terms up to but not exceeding the term for which the roof is guaranteed.

5. Charges for roofing guarantees are made on a per square (100 sq. ft.) basis of the roofing membrane.

Coverage:

Koppers roof guarantees provide for repairs of leaks to the roofing not caused by defects in the building, abuse or extreme weather conditions during the term of the guarantee up to the monetary limit specified in the guarantee. ***Coal Tar Bitumen System Guarantees do not make exception to roof areas with standing water.***

Roof guarantees DO NOT cover the repair, installation or replacement costs of the following:

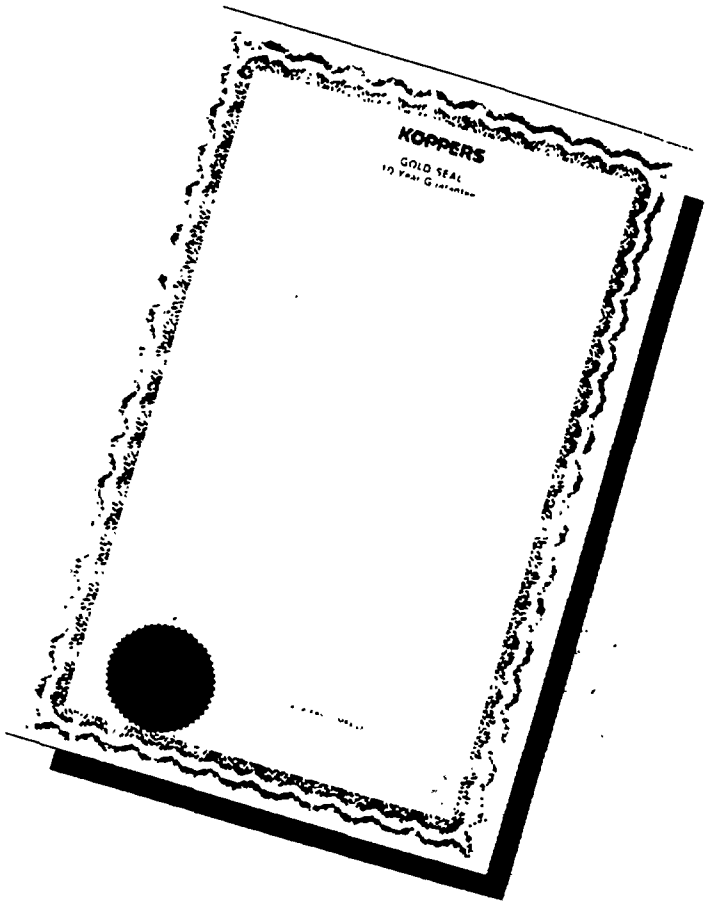
1. Decking Materials
2. Vapor retarders
3. Insulation products (except Gold Seal Guarantee Systems).
4. Metal work
5. Products in the roof assembly (curb, sleeper, others)
6. Damage to the guaranteed roofing or flashing caused by the use of the products listed in 1 through 5 above (their insulation attachment)
7. Vandalism or owner abuse.

Koppers reserves the right to void the guarantee if the roof is damaged due to items not covered by the guarantee. It is determined that the roof's satisfactory performance during the remaining term of the guarantee is impaired. Cancellation due to damage of this type does not provide for any refund of the original cost.

GOLD SEAL GUARANTEE

Koppers offers its Gold Seal guarantee on certain roofing systems that include the use of Exeltherm Xtra (Koppers phenolic insulation board.) The Gold Seal Guarantee is a limited liability guarantee offered for a period of ten years. It provides the building owner coverage against leaks directly caused by the roof membrane, composition flashing, or Exeltherm Xtra roof insulation.

The Gold Seal guarantee program is applicable for Coal Tar systems only. Coverage includes both materials and workmanship.



OTHER GUARANTEES

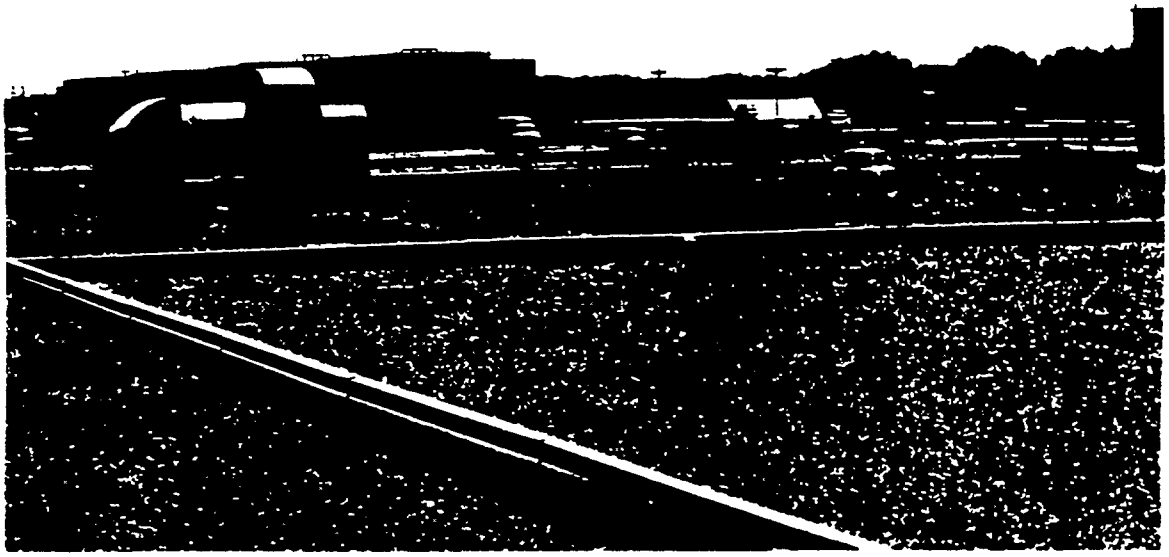
Built-Up Roof Guarantees

Koppers guarantees are available for 5, 10, 15 or 20 year terms, and only cover coal tar built-up roofing and flashings where approved. The 5 and 10 year guarantees carry a renewable option provided Koppers standard procedures are followed.

BUILT-UP ROOFING SYSTEMS

Coal Tar Bitumen Built-Up Roofing
Materials and System Discussion

KOPPERS
Architectural and Construction Materials



Description

Koppers Coal Tar Bitumen built-up roofing systems consist of alternate layers of Koppers Coal Tar Bitumen and Koppers Tarred Felt surfaced with a heavy top pouring of Koppers Coal Tar Bitumen into which is embedded an aggregate

Koppers Coal Tar Bitumen built-up roofing systems are used whenever a roof is exposed to water and on all even or low sloped roofs with a maximum slope of inch per foot

Features

Coal Tar Bitumen built-up roofing provides one of the most durable roofing systems known due to its inherent waterproofing and weathering characteristics. Coal tar roofing systems are the time proven roofing systems for level and low sloped roofs.

Coal Tar Bitumen provides numerous advantages to an owner The superior performance of coal tar roofing systems in the areas listed below make coal tar roofing systems unique in the roofing industry

1. Coal Tar Bitumen has natural resistance to water, air and water vapor penetration.

A tight molecular structure enables Coal Tar Bitumen to resist water penetration and oxidation of the roof surface

2. Another feature of coal tar roofing is its self-healing ability.

Alligatoring and hairline cracks common to most materials eventually cause damage to the roofing membrane Coal Tar Bitumen has a property known as "cold flow" which automatically corrects these conditions before serious damage takes place This "cold flow" feature heals small mechanical fractures at normal temperatures

3. Application improvements.

Because Koppers has expertise in the chemistry of aromatic coal tars Coal Tar Bitumen was developed with the beneficial features of low fume evolution at application temperatures thus reducing potential irritation during application

These features represent significant improvements which are in consort with the aims of government labor and industry in the areas of reduced air pollution and improved worker conditions

Uses

1. All dead level roofs
2. All water cooled roofs
3. Low sloped roofs with occasional ponding
4. Low sloped roofs with retarded drainage
5. All buildings with level or low sloped roofs that are built for long service

Slopes

Koppers recommends that the maximum roof slope be one-half inch per foot for all built-up Coal Tar Bitumen roof systems For recommendations on roofing procedures for slopes over 1/2 inch per foot consult your Koppers representative Koppers does however permit slopes up to two 2 inches per foot at flashings that incorporate tapered curbs and for short run crickets or saddles for drainage provided there are provisions for adequate back nailing and these crickets or saddles do not cover more than 15% of the roof area All felts must be back nailed on slopes over one-half inch per foot

Underwriters Laboratories

The current Underwriters Laboratories Building Materials Directory under the heading Built-Up Roof Covering Materials lists Koppers Coal Tar Bitumen and Tarred Felt for use in construction of Class A and B built-up roof coverings

Roof Deck Constructions and Roof Construction Materials such as Foamed Plastic insulation board are listed under their appropriate headings or under Koppers in the index of Companies

Guarantees

Koppers Guarantees are available for 5 10 15 and 20 year terms Roof guarantees cover ONLY the built-up roofing and flashing membrane (Except Gold Seal Guarantee which includes Exeltherm Xtra roof insulation)

For further details please refer to Page 6 of this manual

Note: Due to varying architectural designs Koppers built-up roofing products should not be used on single family residential construction

General Requirements and Special Conditions

Roof Structure System

In any building the performance of the Built-Up Roofing will be affected to some degree by all of the parts of the roof structure system as well as the inside and outside atmospheric environment. Each component should be investigated for its compatibility with each of the others. The roof structure system may include any or all of the following:

- Outside Atmospheric Conditions
- Roofing System
- Peripheral Details (Flashings)
- Insulation (if present)
- Vapor Retarder (if present)
- Structural Deck including sub purlins (supports)
- Structural Framing
- Air Space (if present)
- Ceiling (if present)
- Interior Air Conditions

You will find information in this manual pertaining to materials and application methods other than for built-up roofing. They are offered to assist the designer in establishing their normal position in the roof structure system. They should not be construed as part of the built-up roofing system as endorsement, nor as part of the designated specifications other than to establish a suitable roofing base in the roof structure system.

The proper design, specification and positioning of the various components of the roof structure system are the responsibility of the building owner or his designer. Any subsequent failures due to either the installation or lack of installation will not be Koppers responsibility.

Decks

The deck is the base over which the built-up roofing (or insulation and built-up roofing) is applied. Where the term deck is used in this manual without reference to insulation, it shall designate the surface over which roofing is to be applied. All decks shall be clean, smooth, dry, rigid and free of debris. Any deck defect shall be corrected before application of roofing. All decks shall be installed in accordance with the deck manufacturer's specifications and shall be in compliance with Koppers General Requirements.

If Koppers approves a deck as satisfactory to receive a Koppers roof, Koppers only reviews and approves the deck surface. It is the responsibility of the building designer and the deck manufacturer to provide for expansion and contraction in a manner that will provide a stable base for the roofing, for support of maximum anticipated loads, secure attachments vertically and laterally, and the selection of the deck material and construction details including their ability to contain bitumens.

Roof decks shall be designed so that they will not have a deflection exceeding 1/240 of clear span under all types of loads (live & dead). Designer should take into account wind loads (both positive and negative pressures) and roof traffic conditions including mechanical equipment used for roof application.

KOPPERS WILL NOT ASSUME RESPONSIBILITY FOR DECK DEFECTS OR BITUMEN SEEPAGE.

The placing of conduits, bolt heads, etc. above the roof deck and below the roofing membrane is not recommended.

All projections or openings in the deck should be completed prior to the application of the roofing.

Optimum adhesion to the deck is necessary for good roof performance. Where Koppers Bitumen or steep asphalt is used as an adhesive, questionable decks may be tested for dryness and adhesion by pouring one pint of the bitumen, heated to application temperature, over a representative area or areas of the deck. The deck is not satisfactory if the bitumen foams or bubbles, or upon cooling to ambient temperature may be stripped clean of the deck.

This test should be conducted in an area which simulates the most adverse roof conditions.

When decks can not be sufficiently cleaned to permit adequate adhesion a primer is required.

Metal Decks

Metal Decks: Decks of this type must be clean, smooth and properly anchored to the steel purlins and all joints correctly lapped and fastened.

It is absolutely necessary to install board type insulation on a metal deck before the Koppers roofing is applied.

Type of metal deck, flute opening and various other factors determine the type and thickness of insulation required. Consult the insulation manufacturers literature.

Note: When applying insulation and roofing over a perforated or acoustical type metal deck, it is required that a vapor retarder be installed prior to the application of the insulation or that a base sheet set in steep asphalt be utilized as the first ply of Built-Up Roofing. This is to reduce the possibility of Bitumen drippage.

Note: On short run crickets, saddles or cants where the slope exceeds 1/2" per foot maximum slope requirements, all plies of tarred felt must be back nailed. Wood nailing strips must be provided when the substrate is not considered capable of retaining nails.

Application of Vapor Retarder and Board-Type Insulation (Felt Type Vapor Retarder)

1. Coat the ribs of the metal deck with Steep Asphalt and then install two (2) full thicknesses of Koppers No. 15 Asphalt Felt, lapping each sheet nineteen (19) inches over the preceding sheet, mopping with Steep Asphalt the full width of the nineteen (19) inch lap. Extend and adhere all felt up vertical surfaces to a height 6" above the plane of the insulation surface.
2. Mop the entire surface with a uniform coating of Steep Asphalt, into which we will firmly embed the insulation.
3. Complete the system in accordance with Specification No. 220.

Application of Board-Type Insulation (Without Vapor Retarder)

1. Install insulation with FM approved mechanical fasteners or Steep Asphalt (Type III). When attachment is made with Steep Asphalt, it shall be applied to the deck at the rate of 15 lbs. min. per 100 sq. ft. of deck, while steep asphalt is still molten to ensure good adhesion. (See Attachment Figure 1.)
2. Complete the system in accordance with Specification No. 220.

Poured Portland Cement Concrete

The deck surface must be smooth, dry and free of dirt, dust and debris. Projections should be removed, low points filled with cement grout or other suitable material and all cracks pointed up. Roof deck shall be properly graded to outlets.

Note: In areas that exceed the 1/2" per foot maximum slope requirement (short run crickets, saddles or cants) all plies of tarred felt must be back nailed. Wood nailing strips must be provided when the substrate is not considered capable of retaining nails.

Application of Vapor Retarder and Board-Type Insulation

1. Apply a uniform coating of Coal Tar Bitumen to the deck.
2. Lay over the entire surface two (2) full thicknesses of Koppers Tarred Felt, lapping each sheet nineteen (19) inches over the preceding sheet — mopping with Coal Tar Bitumen the full nineteen (19) inches so that in no place shall felt touch felt.
3. Extend and adhere all plies of felt to vertical surfaces to a height 6" above the plane of the insulation surface.
4. Apply a uniform coating of Coal Tar Bitumen over the entire surface into which while hot, embed the insulation. If there are two (2) layers of insulaton mop the entire surface of the first layer with Coal Tar Bitumen into which while hot embed the second layer of insulation.
5. Complete the system in accordance with Specification No. 220.

Application of Board-Type Insulation (Without Vapor Retarder)

1. Apply a uniform coating of Coal Tar Bitumen over the entire surface into which while hot, embed the insulation.
2. Complete the system in accordance with Specification No. 220.

Application of Roof Membrane to Deck (Without Insulation)

Install the roof in accordance with Specification No. 220, mopping directly to the deck.

Precast Structural Concrete Sections

Precast structural concrete sections demand the same recommendations as poured concrete decks although the presence of moisture due to insufficient drying time is not as likely. If the contractor finds one or more slabs resting unevenly with edges projecting above the surface this should be corrected by resetting or leveling off. Leveling off should be gradual and smooth to permit insulation full contact with the substrate. All insulation joints must be even and smooth. Open-cell aggregate concrete is not acceptable for filling or leveling low areas. **All joints must be grouted, and as well, must be caulked with trowel-graded asphaltic plastic cement. As additional protection from bitumen drippage, an 8 inch wide (min.) felt stripping must be totally embedded in a the troweling of plastic cement and centered on the joint.** Sides and ends of deck sections should be square, rest firmly and evenly on supporting members and be installed to prevent lateral and vertical movement.

Note: On short run crickets, saddles or cants where the slope exceeds 1/2" per foot maximum slope requirements, all plies of tarred felt must be back nailed. Wood nailing strips must be provided when the substrate is not considered capable of retaining nails.

Application of Vapor Retarder and Board-Type Insulation

1. On precast concrete decks, solid mop the entire deck surface with Coal Tar Bitumen.

2. Lay over the entire surface two (2) full thicknesses of Koppers Tarred Felt, lapping each sheet nineteen (19) inches over the preceding sheet — mopping with Coal Tar Bitumen the full nineteen (19) inches so that in no place shall felt touch felt.

3. Extend and adhere all plies of felt up vertical surfaces to a height 6" above the plane of the insulation surface.

4. Apply a uniform coating of Coal Tar Bitumen over the entire surface. While hot, embed the insulation. If there are two (2) layers of insulation mop the entire surface of the first layer with Coal Tar Bitumen. While hot, embed the second layer of insulation.

5. Complete the system in accordance with Specification No. 220.

Application of Board-Type Insulation (Without Vapor Retarder)

1. Over precast concrete, solid mop with Coal Tar Bitumen. While the bitumen is still hot, embed the insulation. Insulation joints shall not coincide with joints of the precast units.

2. Complete the system in accordance with Specification No. 220.

Application of Roof Membrane to Deck (Without Insulation)

1. On precast concrete, solid mop with Coal Tar Bitumen.

2. Complete the system in accordance with Specification No. 220.

Lightweight Decks

Poured Insulation
Gypsum — Poured/Plank

Lightweight insulating decks include lightweight aggregate concrete (20 to 40 lbs. per cu. ft. oven dry density), foamed concrete, gypsum and thermosetting asphaltic decks.

Poured Decks:
Poured lightweight insulating deck systems must be capable of venting excess water vapor to the underside. Koppers will not accept these poured lightweight insulating decks to be placed over vapor retarders, poured concrete substrates, unvented metals, or any type of base which will not permit these materials to vent from the underside. This is necessary to prevent a water vapor pressure buildup under the built-up roofing. Occasional or spot vents through the roofing, as the only venting method, is not sufficient.

Provisions should be made wherever possible to provide additional venting such as notched wood perimeter nailers, etc., in conjunction with the venting from the underside of the deck. If board type insulation is to be applied over a lightweight insulating deck, provisions must be made between the fill and the board insulation to prevent fill moisture from affecting the insulation and roofing.

Precast Panels:
On precast gypsum panels, all joints must be grouted, and as well, must be caulked with trowel-grade asphaltic plastic cement. As additional protection from bitumen drippage, an 8 inch wide (min.) felt stripping must be totally embedded in the troweling of plastic cement and centered on the joint.

Note: On short run crickets, saddles or cants where the slope exceeds 1/2" per foot maximum slope requirements, all plies of tarred felt must be back nailed. Wood nailing strips must be provided when the substrate is not considered capable of retaining nails.

Application of Vapor Retarder and Board-Type Insulation

1. Apply over entire surface one (1) ply of Koppers Coated Base Sheet, lapping each sheet four (4) inches over preceding sheet and nailing at lap no less than nine (9) inches and stagger nailed down center of each sheet on nine (9) inch centers. (This is approximately 100 nails per 100 sq. ft.)

2. Lay over the entire surface two (2) full thicknesses of Koppers Tarred Felt, lapping each sheet nineteen (19) inches over the preceding sheet — mopping with Coal Tar Bitumen the full nineteen (19) inches so that in no place shall felt touch felt.

3. Extend and adhere all plies to vertical surfaces to a height 6" above the plane of the insulation surface.

4. Mop the entire surface with a uniform coating of Coal Tar Bitumen into which while hot, firmly embed the insulation.

5. Complete the system in accordance with Specification No. 220.

Application of Board-Type Insulation (Without Vapor Retarder)

1. Apply over entire surface one [illegible] Koppers coated base sheet, lapping each sheet four (4) inches over preceding sheet and nailing at lap no less than nine (9) inches and staggered nailed down the center of each sheet on nine (9) inch centers. This is approximately [illegible] nails per 100 sq. ft.

2. Mop the entire surface with a uniform coating of Coal Tar Bitumen into which while hot, firmly embed the insulation.

3. Complete the system in accordance with Specification No. 220.

Application of Roof Membrane to Deck (Without Insulation)

1. Apply over entire surface one [illegible] Koppers coated base sheet, lapping each sheet four (4) inches over preceding sheet and nailing at lap no less than nine (9) inches and stagger nailed down center of each sheet on nine (9) inch centers. This is approximately 100 nails per 100 sq. ft.

2. Complete the system in accordance with Specification No. 210.

Thermosetting Asphaltic Fill
When applying the roofing membrane directly over a thermosetting asphaltic fill, follow Specification 210 except the first ply of the roofing membrane must be a base sheet set in a solid mopping of steep asphalt.

Wood Plank/Plywood

Wood shall be well seasoned, dry and preferably treated. End joints shall have adequate bearing. Loose or void knot holes, large cracks, etc., shall be covered with sheet metal.

Lumber shall be a minimum of 1" nominal thickness.

Plywood (exterior grade) shall be a minimum of 1/2" thickness. Hot Coal Tar Bitumen should never be applied directly to a wood deck. Sandwiched between the heat from above and the heat from below, such material finds its way through the boards into the building. Good roofing practice demands the cushioning and blotting effect of a layer of sheathing paper followed by one ply of base sheet nailed to the deck. **Shiplap and square edge boards should be avoided and tongue-and-grooved lumber used where possible.**

Preparation to Deck Surface — (Mandatory on all Wood Decks)

The wood roof deck shall be covered with one (1) layer of approved rosin-sized sheathing paper weighing approximately five (5) pounds per one hundred (100) square feet. The sheathing paper shall be lapped two (2) inches and secured to the deck by occasional nailing.

Note: On short run crickets, saddles or cants where the slope exceeds 1/2" per foot maximum slope requirements, all plies of tarred felt must be back nailed. Wood nailing strips must be provided when the substrate is not considered capable of retaining nails.

Application of Vapor Retarder and Board-Type Insulation

1. Apply over entire surface one (1) ply of Koppers Coated Base Sheet lapping each sheet four (4) inches over preceding sheet and nailing at lap no less than nine (9) inches and stagger nailed down center of each sheet on nine (9) inch centers (This is approximately 100 nails per 100 sq ft)

2. Lay over the entire surface two (2) full thicknesses of Koppers Tarred Felt lapping each sheet nineteen (19) inches over the preceding sheet — mopping with Coal Tar Bitumen the full nineteen (19) inches so that in no place shall felt touch felt

3. Mop the entire surface with a uniform coating of Coal Tar Bitumen into which while hot firmly embed the insulation

4. Complete the system in accordance with Specification No 220

Application of Board-Type Insulation (Without Vapor Retarder)

1. Apply over entire surface one (1) ply of Koppers coated base sheet, lapping each sheet four (4) inches over preceding sheet and nailing at lap no less than nine (9) inches and stagger nailed down center of each sheet on nine (9) inch centers (This is approximately 100 nails per 100 sq ft)

2. Apply a uniform coating of Coal Tar Bitumen over the entire surface into which, while hot embed the insulation.

3. Complete the system in accordance with Specification No 220

Note When the roof insulation is to be nailed and a vapor retarder is not required, the one ply of base sheet may be omitted, however the sheathing paper is required

Application of Roof Membrane to Deck (Without Insulation)

1. Apply over entire surface one (1) ply of Koppers coated base sheet, lapping each sheet four (4) inches over preceding sheet and nailing at lap no less than nine (9) inches and stagger nailed down center of each sheet on nine (9) inch centers. (This is approximately 100 nails per 100 sq ft)

2. Complete the system in accordance with Specification No 210

Structural Wood Fiber

All decking must be installed in strict accordance with the particular deck manufacturer's recommendations Deck material must be protected during shipment, job site storage and prior to roofing application No planks which have become structurally weakened due to moisture, fractures or mutilated edges may be used All joints must be level and preferably grouted full and level with plank surfaces as recommended by the deck manufacturer All planks must be well anchored to supporting members to resist movement in a fashion recommended by the deck manufacturer Any planks which bow or deflect or do not seat securely must be replaced Responsibility for the selection of a particular type of wood fiber deck, its installation provision for expansion and contraction, its suitability to job requirements, and its ability to support anticipated loads in its environment rests with the designer and deck manufacturer

All deck joints of these types must be grouted and as well must be caulked with Koppers Flashing Cement which shall be applied so that the top surface is level and smooth Felt stripping four (4) to six (6) inches wide set in a troweling of the cement is required to assist in leveling uneven joints and bridge the joint openings thus providing a better surface for the roofing materials

Caution: care must be taken to avoid bitumen drippage.

Note: On short-run crickets saddles or cants where the slope exceeds 1" per foot maximum slope requirements all plies of tarred felt must be back nailed. Wood nailing strips must be provided when the substrate is not considered capable of retaining nails

Applications of Vapor Retarder and Board-Type Insulation

1. Install two (2) plies of No 15 asphalt felt lapped nineteen (19) inches in Type III steep asphalt Plies shall be mopped solidly so that in no place shall felt touch felt

2. Mop the entire surface with a uniform coating of Type III steep asphalt into which while hot, embed the insulation

3. Complete the system in accordance with Specification No 220

Application of Board-Type Insulation (Without Vapor Retarder)

1. Mop the entire surface with a uniform coating of Type III steep asphalt into which while hot, embed the insulation.

2. Install roofing in accordance with Specification No 220 except that a base sheet, set in steep asphalt, must be substituted as the first ply See "Base Sheet Alternate" Page 12

Application of Roof Membrane to Deck (Without Insulation)

1. Install roof membrane directly to deck in accordance with Specification No 220 except that a base sheet, set in Type III steep asphalt must be substituted as the first ply See Base Sheet Alternate Page 12

Material Protection

It is the responsibility of the roofing contractor to protect all roll roofing materials and roof insulation from ground or construction moisture and weather before and during construction of the roof membrane

Roof insulation boards are often shipped from the manufacturing plant with plastic sheets wrapped around the boards securing them on the pallets These are generally not acceptable for job site protection as they do not breathe and therefore can trap moisture Removing these plastic shipping protection sheets and replacing them with breathable type tarpaulins such as canvas is recommended

Attachment

Maximum adhesion or secure attachment of all components in the roofing assembly is necessary for satisfactory long term performance of the roofing membrane Bitumen adhesive and or fastener quantities specified by the manufacturer must be capable of passing a minimum uplift resistance of 40 pounds per square foot (psf)

When Building Code requirements dictate a higher uplift resistance than our minimum requirement additional fasteners or adhesive will be required over and above the quantities described in the ensuing specifications

When asphalts are to be used to adhere insulations to concrete decks the deck shall first be primed with an asphalt primer at a rate of one gallon per 100 square feet

When nails or fasteners are used they must be nailed through disks or have sufficiently large heads to prevent fracture or puncture through the roofing felts

Mechanical fastening of insulation is the preferred method of attachment. Beginning in 1984 Factory Mutual announced that mechanical fastening of the first layer of board type insulation to a metal deck will be their only acceptable method of attachment

The FM Approval Guide should be consulted for specific details on fasteners and required application procedures

Contact the insulation manufacturers literature for requirements

Cold applied adhesives are not acceptable for attaching insulation or vapor retarders.

Koppers will not be responsible for any damage caused by or the result of unsatisfactory attachment.

For further information contact your Koppers representative

Expansion Joints (Building)

Since all materials expand and contract due to temperature and or moisture, the use location, and design of building expansion joints, especially in the roof structure system, should be taken into consideration at the time of original building design

Koppers will not be responsible for any damage caused by such phenomenon

Although provisions for adequate expansion joints are the responsibility of the building designer Koppers offers the following suggestions for the protection of the roofing system against splits caused by expansion and contraction of the building Building expansion joints should be installed

1. On roof areas larger than 200 feet in any direction

2. At all places where the structural supports and roof assembly change direction

3. Where type of adjoining deck materials change

Where control or expansion-contraction joints are provided in the structural steel deck material, or deck system provisions must be made for continuation of this relief through the built-up roofing system Koppers realizes that in a climate controlled building there may be little or no expansion AFTER the building is in use, however building expansion joints are still recommended based upon the following points

1. During construction the building will not be under a steady state temperature humidity condition so that thermal and moisture movement can be sufficient to fracture the roofing

2. If no building expansion joint is provided the owner must keep the building at steady state temperature and humidity conditions at all times

Water Stops (Temporary Protection)

Water stops consisting of two (2) plies of tarred felt and moppings of Coal Tar Bitumen extending onto the deck and insulation at least 6" and 4" shall be applied at the end of each day's work over exposed edges of insulation **These temporary protective measures must be removed cleanly from the insulation (top surface and vertical joint) and from the deck to ensure tight insulation joints and level insulation surfaces. Improperly removed water stops have been determined as a cause of roof splits and have prevented moisture vapor movement to vented edge details.**

Cut Offs (Permanent Installation)

Venting of roof insulation at walls curbs eaves etc is recommended for most roof structures Therefore cut-offs should not be installed at edges of insulation adjoining these areas for venting purposes

Cut-offs may be installed however provided they are constructed to run in one direction continuously to vented edges and provided no section of the roofing is isolated or blocked from venting

Vapor Retarders

Vapor retarders are normally used where the heat flow direction and or humidity within the building during any climate or occupancy cycle might cause the dew point or condensation to occur under the built-up roofing within the insulation chamber It is important that the vapor retarder when installed provide a continuous seal, (including ventilators, skylights peripheral walls and other terminations) from the source of the water vapor

Insulation

Insulations come in varying thicknesses and sizes Should the manner of attachment as suggested conflict with that specified by the individual insulation manufacturer the insulation manufacturers specifications shall be followed and in addition shall be in compliance with Koppers General Requirements

Good roofing practice dictates that the following points be considered when specifying board type roof insulation

1. The roofing insulation must be kept dry at all times It must be of a type approved by Koppers for use with a Koppers built-up roof It should only be applied over a deck complying with all of Koppers General Requirements.

2. If the roof deck slope is one-half ( ) inch per foot or more, the insulation must be able to retain nails or wood nailers must be installed perpendicular to the slope at each course of insulation

Spacing of nailers must be such that the insulation fits snugly with the nailers but must not be force fitted

3. No more insulation shall be laid at any one time than can be protected by bitumen and felt in case of sudden weather changes

4. Edges of insulation shall be brought closely together and shall not be forced into place

Where insulation joins vertical surfaces the insulation shall be cut in a neat manner allowing approximately one-quarter [illegible] clearance

5. When more than one [illegible] layer of insulation is used joints in each layer shall not coincide All layers shall be parallel to preceding layers

Note: When urethane, urethane composite or isocyanurate roof insulation is specified, it must be installed directly to the roof deck and a second layer of fiberboard, perlite board or glass fiber roof insulation installed over top. The joints of the second layer must not correspond with that of the first. In lieu of the second layer of insulation, a Koppers Vented Base Sheet may be used as the first ply of the membrane system. Consult the manufacturers' literature for specific information.

Wood Nailing Strips

All non-nailable decks require wood nailing strips at eaves edges walls roof-openings etc for proper securement of metal flanges Nailers must be securely and firmly attached to the deck or through to its supporting members Nailers shall extend not less than 1" beyond the apron or flange

Roofing felts for all deck areas having a slope of more than 1 2" per foot must be back nailed and therefore non-nailable decks must be furnished with treated wood nailing strips treated with a material compatible with bituminous roofing

Cold Storage and Freezer Buildings

Koppers will **not** bond its built-up roofing over these structures if insulation or insulation and vapor retarder is installed over the deck unless there is an adequately ventilated air space between the deck and insulated refrigerated area For procedures on non-guaranteed built-up roofing applications, consult a Koppers representative

Water Retaining and Retarded Drainage

When the roofing system is subjected to common standing water or retarded drainage refer to the Special Applications Section, Pg 15

Temporary Roofing

Temporary roofing specifications are available for all Koppers Coal Tar Bitumen Built-Up Roofing Systems Consult your Koppers representative for recommended specifications over various type decks for temporary roof construction

Reroofing Design Considerations:

During the reroof design and specification phase and prior to commencement of reroofing work, it is the building owner's responsibility to have his architectural or consulting representative ascertain if the existing roof structure, with the new roof system installed will meet all local building structural codes

If additional insulation is to be a part of the new roof system an evaluation of the dew point and its effect on the roofing system should be determined

Reroofing application can be complicated since many factors must be considered For more specific information pertaining to special situations contact your Koppers representative

Note Koppers will not be responsible for any damage caused by excess loads on structural systems or damage due to rate of change in location of new dew point

General Application Procedure

Felt Shall Not Touch Felt

In no place shall felt touch felt It is generally agreed that maximum strength between layers of felt is achieved by the thinnest practical glue line of bitumen Too thin a layer starves the ply whereas an excessive layer can permit interply movement on sloped roofs

Care should be taken by all parties to provide thin but continuous moppings of interply bitumen Too heavy of interply quantities can result in felt slippage on sloped roofs

In Place Weights per 100 sq. ft.

In order that the felt shall not touch felt standard is met experience shows that **an average, in place interply mopping of not less than 20 lbs. per square is adequate for membrane construction. An average, in place top coat of not less than 70 lbs. per square is also adequate.**

Actual Amounts Used

The specifier and applicator are responsible for estimating amounts on a job-wide basis. The total amount used will vary due to application technique rate of application applicator's experience temperature weather, surface conditions, glaze coatings water cut-offs and many other factors **The specifier's and applicator's experience must be their guide in making estimates.**

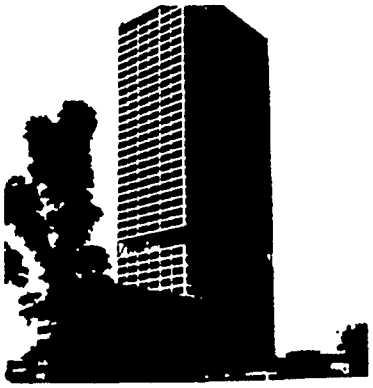
Flood Coat

The top pouring is most important, it must be thorough and uniformly covered with specification aggregate embedded into the bitumen **while the bitumen is still hot**

Recommended Temperature Limitations:

	Maximum Kettle Temp	Point of Application Temp
Koppers Coal Tar Bitumen	425° F	350-400° F
Steep Asphalt	475° F	400-450° F
	Use manufacturers recommended EVT Temperature when listed	

Where reference is made in this manual to application of bitumen while hot, such reference is to the point of application temperature range as listed above



Note: Bitumen temperatures below those recommended at the point of application can result in heavy interply quantities which in turn can potentially contribute to the cause of membrane slippage

When roofing bitumens are excessively overheated and/or held at elevated temperatures for long periods of time, their waterproofing qualities are greatly reduced, and at the same time the volume of fuming is increased. In order to achieve the maximum benefits of low fuming and unequaled waterproofing performance, it is imperative that Koppers Coal Tar Bitumen be heated within the temperature limitations listed above. Close supervision of heating is good roofing practice for all bitumens

If heat is desired during a holding period at the jobsite while material is not being drawn off and replenished as under normal usage kettle temperature should be reduced and not permitted to exceed 350°F for Koppers Coal Tar Bitumen or 425°F for steep asphalt The kettle should be full lid closed These temperatures are applicable to job conditions and do not apply to holding or storage in kettles in excess of 4 hours If bitumen is not to be used for periods over 4 hours the kettle should be shut off

Koppers Coal Tar Bitumen may be contained in 1000 gal or greater capacity heated and automatically controlled closed vessel tankers at 375°F for periods not exceeding 96 hours

Application of Felt

Plies of felt must be laid shingle fashion.

Where a water flow direction exists, felts should be applied so that the direction of flow is not against the laps Broom or press all plies of felt into the hot bitumen and lay without wrinkles buckles or kinks so that the finished roof is free of pockets or blisters Each felt ply shall be completely covered with a complete mopping of bitumen

The number of plies are controlled by varying widths of the edge laps Four-ply (4) roofing, for example is achieved by lapping each ply approximately twenty-seven and one-half (27½) inches

Koppers felts are marked at the factory with lap lines for this purpose Except as specifically provided for in Koppers specifications application of felt lapping methods other than shingle fashion will not be permitted

When beginning a membrane roofing installation appropriate width starting strips of felt shall be used at the starting point to achieve the specification ply build-up at that point so that successive felt applications will produce the ply requirements Overlap ends of all connecting plies of felt (end laps) not less than 10 inches End stripping or taping of these laps is not permitted

Application of Koppers Bitumen and Aggregate Surface

The final application of Koppers Roofing is a uniform flood coat of Koppers Coal Tar Bitumen not less than 70 lbs sq into which is distributed an approved aggregate while the Bitumen is still hot

Benefits of aggregate surfacing

1. Protection from foot traffic of other trades during construction and afterwards for routine roof maintenance
2. Weight as additional protection for wind uplift
3. Reduced surface temperature
4. Even flow of water to the drains
5. *Fire protection from burning brands*
6. Protect bitumen from the actinic rays of the sun
7. **Most important** — by using an aggregate surface an additional minimum of 70 lbs sq of Coal Tar Bitumen the waterproofing agent is included in the installation

The application of Koppers Coal Tar Bitumen and aggregate must be done at the time the felts are applied

The aggregate surfacing must be applied into the top pouring while the bitumen is still hot so that a uniform layer will be embedded and adhered The completed roof assembly will *have a uniform aggregate surface* Depending on slag weights in certain parts of the country 400 lbs of slag per square may be required Occasionally on well applied roofs small black globes known as raspberries or blackberries will form in the roof surface These are not detrimental to the roof

Aggregate Surfacing

The aggregate to be used should meet the ASTM Specification D1863-80 The basic requirements for this aggregate are as follows

Gradation Requirements

Sieve	Amounts Finer than Sieve Specified mass %	
	Size No 67 19 0 to 4 75-mm (¾-in to No 4)	Size No 7 12 5 to 4 75-mm (½-in to No 4)
25 mm (1 in)	100	...
19 mm (¾ in)	90 to 100	100
12 5 mm (½ in)	...	90 to 100
9 5 mm (⅜ in)	20 to 55	40 to 70
4 75 mm (No 4)	0 to 10	0 to 15
2 36 mm (No 8)	0 to 5	0 to 5

[a] Size number and requirements data are from Specification C 33 and D 448

Physical Properties

Moisture max %	
Crushed stone and gravel	2 0
Crushed roofing slag	5 0
Unit mass (loose) min kg m (lb ft)	960 (60)
Dust max %	2 0
Hardness max percentage passing a 3 35-mm (No 6) sieve	20

[a] A higher moisture content is permitted for slag because of moisture entrapment in the internal pores of the pieces of slag

Cold Weather Application

When roofing is applied in cold weather special precautions must be taken to insure the satisfactory performance of the finished *roof Before applying roofing, moisture, ice,* snow surface water, etc must be removed from the deck

Hot applied bitumens tend to congeal rapidly in cold weather Extra care must be taken to set insulation or roofing as quickly as possible while the bitumen is still hot

When temperature is below 45°F felt must be embedded in bitumen while it is still hot and **broomed-in immediately** with sufficient pressure to ensure necessary embedment into bitumen

Do not heat bitumens above the maximum temperature limit listed above to compensate for rapid chilling. Insulated containers along with carefully timed material delivery methods must be employed

Note: Bitumen temperatures below those recommended at the point of application can result in heavy interply quantities which in turn can potentially contribute to the cause of membrane slippage

Base Sheet Alternate

When substituted for the first ply in a solid mop application specification the Base Sheet shall be embedded in a solid mopping of Koppers Steep Asphalt followed by thorough brooming to eliminate air pockets wrinkles fishmouths buckles etc The remaining three (3) plies of tarred felt shall be solidly mopped with Coal Tar Bitumen in accordance with the specification

When rosin sized or sheathing paper is a part of the original specification it shall remain and be applied beneath the Base Sheet Edge laps shall be 4 and end laps shall be 6 The nailing pattern for the Base Sheet shall be 9 on center through the lap and 2 from the edge lap and stagger-nailed down the center of each sheet on 9" centers (Note This is approximately 100 nails per square)

After applying a base sheet as the first ply on the four (4) ply roofing membrane three (3) additional plies must be installed immediately

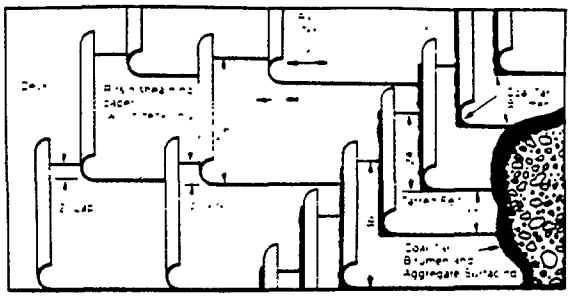
When applying the additional three (3) plies of tarred felt lap each ply shingle fashion 24±2 3 inches *Each ply must be solidly mopped with* Coal Tar Bitumen

When specifying the Base Sheet alternate use the designation **BS** as a subscript to the specification number

Note: If Koppers Asphalt Coated Base Sheet (ASTM D-2626) is substituted for the first ply of the Coal Tar Bitumen roofing specifications, it must not be left exposed or used as a work *surface or temporary roof* prior to roof completion. Good roofing practice dictates that the total roofing membrane be completed the same day.

Koppers Tarred Felt Systems

Specification No. 210



Materials Required per 100 sq. ft. of roof area

Rosin Sheathing Paper (1 ply)	5 lbs	5 lbs
Coated Base Sheet** (1 ply)	43 lbs	43 lbs
Tarred Felt (Mopped in Bitumen) (3 plies)	45 lbs	45 lbs
Roofing Bitumen (3 moppings @ not less than 20 lbs. each)	60 lbs	60 lbs
Top Pour Coat (not less than 70 lbs.)	70 lbs	70 lbs
Surfacing: Slag	300 lbs	—
Gravel	—	400 lbs
Approximate Total Weight	523 lbs	623 lbs

*Wood Decks only
**Unless otherwise indicated

Nailable decks without insulation:
Plywood, wood plank, lightweight insulating concrete, poured and precast gypsum

Slope requirements:
1/2" per foot maximum

Procedure

1. General Requirements on Pages 8 through 12 and Flashing Details, Specifications on Pages 16 through 20 are a part of this specification and must be adhered to where applicable.

2. When a vapor retarder and or roof insulation are required, install in accordance with the manufacturer's instructions and comply with Koppers General Requirements and Special Conditions. Follow Specification No. 220 for roofing materials [illegible]

Application of roofing direct to roof deck:

1. (Wood decks only) Over the surface of the roof deck, install one (1) ply Rosin Sheathing Paper weighing approximately 5 lbs. per 100 sq. ft. Lap each sheet at least [illegible] inches and nail sufficiently to hold in place.

2. Apply over entire surface one (1) ply of Koppers coated base sheet. Add [illegible] sheet four (4) inches over preceding sheet and nailing at [illegible] not less than nine (9) inches and stagger nailed down center of each sheet on nine (9) [illegible] centers.

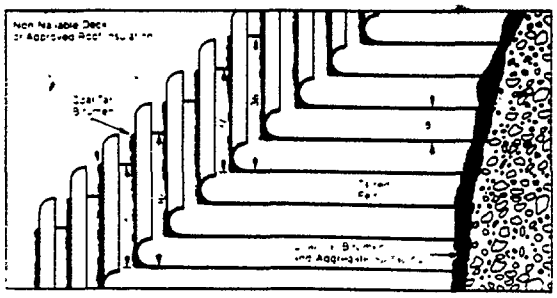
Note: This is approximately 100 nails per 100 sq. ft. Nails [illegible] are to be of required length for maximum holding power.

3. Over the entire roof area, apply three (3) plies of Koppers Tarred Felt lapping plies twenty-four and two-thirds (24-2/3) inches. All laps shall be mopped with Coal Tar Bitumen the full twenty-four and two-thirds (24-2/3) inches, so that in no place shall felt touch felt.

4. On short run slopes, such as on crickets and saddles, one-half inch per foot or more, nail each sheet of felt six (6) inches from the back edge on twenty-four (24) inch centers.

5. Pour over the entire surface of the roofing membrane a uniform coating of Coal Tar Bitumen, and while hot, embed not less than four hundred (400) pounds of gravel or three hundred (300) pounds of slag for each one hundred (100) square feet.

Specification No. 220



Materials Required per 100 sq. ft. of roof area

Tarred Felt (Mopped in Bitumen) (4 plies)	60 lbs	60 lbs
Roofing Bitumen (4 moppings @ not less than 20 lbs. each)	80 lbs	80 lbs
Top Pour Coat (not less than 70 lbs.)	70 lbs	70 lbs
Surfacing: Slag	300 lbs	—
Gravel	—	400 lbs
Approximate Total Weight	510 lbs	610 lbs

Non-nailable decks or approved roof insulation:
Precast Concrete, Poured Concrete, Structural Wood Fiber*

Roof insulations:
Various Decks.

Slope requirements:
1/2" per foot maximum.

Procedure

General Requirements on Pages 8 through 12 and Detail Specifications on Pages 16 through 20 are a part of this specification and must be adhered to where applicable.

When a vapor retarder and or roof insulation are required, install in accordance with the manufacturer's instructions and comply with Koppers General Requirements and Special Conditions.

1. Mop deck (or insulation — if is applicable) completely with Coal Tar Bitumen.

2. Apply over the entire surface four (4) plies of Koppers Tarred Felt lapping plies twenty-seven and one-half (27½) inches. Mop solidly between each 27 inch lap with Coal Tar Bitumen so that in no place shall felt touch felt.

3. On short run slopes of one-half (½) inch per foot or more, such as on crickets and saddles, and when the deck permits nailing, nail along back of upper edge of each sheet on twenty-four (24) inch centers. Where deck does not permit nailing, nailing strips are required and each sheet must be nailed along back or upper edge at spacings to assure penetration of nailers.

4. Pour over the entire surface of the roofing membrane a uniform coating of Coal Tar Bitumen, and while hot, embed not less than four hundred (400) pounds of gravel or three hundred (300) pounds of slag for each one hundred (100) square feet.

***NOTE: On structural wood fiber decks, the first ply must be a Koppers coated base sheet set in a solid mopping of steep asphalt (see structural wood fiber, page 10).**

Koppers Glass Fiber Felt Systems

General Information

Along with its coal tar and tarred felt roof systems, Koppers offers built-up roof membranes utilizing Coal Tar Bitumen and Glass Fiber Felt. These systems offer the superior waterproofing characteristics of Coal Tar and the unique features of Glass Fiber Felts.

The General Requirements published on Pages 8 through 12 and Detail Specifications on Pages 16 through 20 of this manual are a part of this specification and must be adhered to where applicable.

Application of Vapor Retarder and Insulation
When a vapor retarder and or roof insulation are required, install in accordance with the manufacturer's instructions and comply with Koppers General Requirements and Special Conditions.

Product Guide

Coal Tar Bitumen
Coal Tar based roofing and waterproofing bitumen.

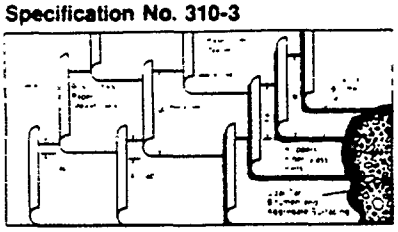
ASTM Spec. D-450-78 Type III

Glass Felt
Koppers glass fiber roofing felt is a quality inorganic ply sheet coated with a bituminous resin coating compatible with coal tar bitumen.

Specification: ASTM D-2178 Type IV

Note: Drawings shown not to scale.

Specification No. 310-3



Nailable decks without insulation:

Plywood, wood plank, lightweight insulating concrete, poured and precast gypsum

Slope requirements:

per foot maximum

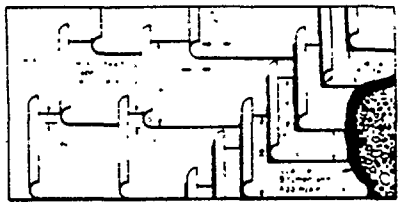
Materials Required per 100 sq. ft. of roof area

Rosin Sheathing Paper (Wood Decks Only)		1 ply
Coated Base Sheet (Nailed)		1 ply
Glass Felts		2 plies
Roofing Bitumen (2 Moppings @ not less than 20 lbs. each)		40 lbs
Top Pour Coat (not less than 70 lbs.)		70 lbs
Surfacing	Slag	300 lbs
	Gravel	400 lbs

Application of Roofing Materials to Deck

1. Over the surface of the roof deck, install one layer Rosin Sheathing Paper weighing approximately 5 lbs. per 100 sq. ft. Lap each sheet at least two (2) inches and nail sufficiently to hold in place. (Wood decks only.)
2. Apply over entire surface one (1) ply of Koppers coated base sheet, lapping each sheet four (4) inches over the preceding sheet, nailing at the lap on nine (9) inch centers and stagger nail down the center of each sheet on nine (9) inch centers.
3. Apply over the entire suface two (2) plies of Koppers Glass Felt, lapping plies nineteen (19) inches. Mop solidly between each nineteen inch lap with Coal Tar Bitumen so that in no place shall felt touch felt.
4. At all areas requiring membrane edge enveloping, a standard organic tarred felt must be used as the enveloping membrane.
5. Pour over the entire surface of the roofing membrane, a uniform coating of Coal Tar Bitumen, and while hot, embed not less than four hundred (400) pounds of gravel or three hundred (300) pounds of slag for each one hundred (100) square feet.

Specification No. 310-4



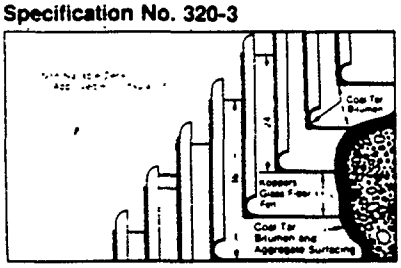
Materials Required per 100 sq. ft. of roof area

Rosin Sheathing Paper (Wood Decks Only)		1 ply
Coated Base Sheet (Nailed)		1 ply
Glass Felts		3 plies
Roofing Bitumen (3 Moppings @ not less than 20 lbs. each)		60 lbs
Top Pour Coat (not less than 70 lbs.)		70 lbs
Surfacing	Slag	300 lbs
	Gravel	400 lbs

Application of Roofing Materials to Deck

1. Over the surface of the roof deck, install one layer Rosin Sheathing Paper weighing approximately 5 lbs. per 100 sq. ft. Lap each sheet at least two (2) inches and nail sufficiently to hold in place. (Wood decks only.)
2. Apply over entire surface one (1) ply of Koppers coated base sheet, lapping each sheet four (4) inches over the preceding sheet, nailing at the lap on nine (9) inch centers and stagger nail down the center of each sheet on nine (9) inch centers.
3. Apply over the entire suface three (3) plies of Koppers Glass Felt, lapping plies twenty-four and two-thirds (24-2/3) inches. Mop solidly between each 24-2/3 inch lap with Coal Tar Bitumen so that in no place shall felt touch felt.
4. At all areas requiring membrane edge enveloping, a standard organic tarred felt must be used as the enveloping membrane.
5. Pour over the entire surface of the roofing membrane, a uniform coating of Coal Tar Bitumen, and while hot, embed not less than four hundred (400) pounds of gravel or three hundred (300) pounds of slag for each one hundred (100) square feet.

Specification No. 320-3



Non-nailable decks or approved roof insulation:

Precast Concrete, Poured Concrete, Structural Wood Fiber*

Roof Insulations:

Various Decks.

Slope Requirements:

(1") per foot maximum

Materials Required per 100 sq. ft. of roof area

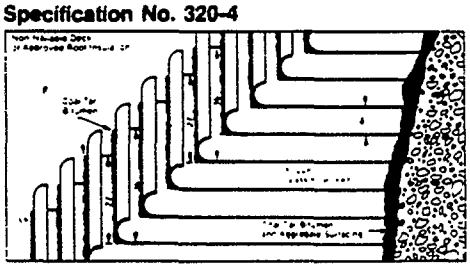
Glass Felts (Mopped in Bitumen)		3 plies
Roofing Bitumen (3 Moppings @ not less than 20 lbs. each)		60 lbs
Top Pour Coat (not less than 70 lbs.)		70 lbs
Surfacing	Slag	300 lbs
	Gravel	400 lbs

Application of Membrane

1. Mop deck (for insulation — as applicable) completely with Coal Tar Bitumen.
2. Over the entire roof area, apply three (3) plies of Koppers Glass Felt lapping plies twenty-four and two-thirds (24-2/3) inches. All laps shall be mopped with Coal Tar Bitumen the full twenty-four and two-thirds (24-2/3) inches, so that in no place shall felt touch felt.
3. At all areas requiring membrane edge enveloping, a standard organic tarred felt must be used as the enveloping membrane.
4. Pour over the entire surface of the roofing membrane, a uniform coating of Coal Tar Bitumen, and while hot, embed not less than four hundred (400) pounds of gravel or three hundred (300) pounds of slag for each one hundred (100) square feet.

***NOTE. On structural wood fiber decks, the first ply must be a Koppers coated base sheet set in a solid mopping of steep asphalt (see structural wood fiber, page 10).**

Specification No. 320-4



Materials Required per 100 sq. ft. of roof area

Glass Felt (Mopped in Bitumen)		4 plies
Roofing Bitumen (4 Moppings @ not less than 20 lbs. each)		80 lbs
Top Pour Coat (not less than 70 lbs.)		70 lbs
Surfacing	Slag	300 lbs
	Gravel	400 lbs

Application of Membrane

1. Mop deck (for insulation — as applicable) completely with Coal Tar Bitumen.
2. Over the entire roof area, apply four (4) plies of Koppers Glass Felt lapping plies twenty-seven and one-half (27-1/2) inches. All laps shall be mopped with Coal Tar Bitumen the full twenty-seven and one-half (27-1/2) inches, so that in no place shall felt touch felt.
3. At all areas requiring membrane edge enveloping, a standard organic tarred felt must be used as the enveloping membrane.
4. Pour over the entire surface of the roofing membrane, a uniform coating of Coal Tar Bitumen, and while hot, embed not less than four hundred (400) pounds of gravel or three hundred (300) pounds of slag for each one hundred (100) square feet.

Water Retaining Roofs

Water Cooled Roofs

- Spray Systems
- Ponded Systems

Water Retaining Roofs

- Process Water

Retarded Drainage Systems

- Controlled Flow

Discussion

Due to Coal Tar Bitumen's natural resistance to water it may be utilized in the construction of built-up roofing membranes that will be expected to hold water over long periods of time When applying a membrane that is required to hold water follow Specification 220 for applications over non-nailable decks (four plies of No 15 Tarred Felt set in solid moppings of Coal Tar Bitumen)

Note: The base sheet alternate shall not be used.

When the roof is water cooled or has been designed to be continuously wet the top surfacing of bitumen and gravel must be applied as follows

1. Pour over the entire surface of the roofing membrane a uniform coating of Coal Tar Bitumen (not less than 70 lbs) While hot, embed not less than four hundred (400) pounds of gravel or three hundred (300) pounds of slag for each one hundred (100) square feet

2. All loose gravel or slag shall be swept from surface and a second uniform pouring of not less than eighty-five (85) pounds of Coal Tar Bitumen shall be applied over the gravel or slag, into which while hot, shall be applied a second layer of three hundred (300) pounds of gravel or two hundred (200) pounds of slag for each 100 square feet The entire surface shall then be thoroughly broomed free from all loose gravel or slag It is advisable to roll the finished surface with a light roller so that aggregate is thoroughly embedded.

3. Follow flashing detail 110A (page 16)

NOTE: Roofs equipped with controlled flow drainage systems do not require the extra top pour and gravel application.

Design consideration

When designing a water cooled, water retaining or retarded drainage roof assembly certain design criterion must be considered

Note:

1. Due to the extremely heavy weight loads normally associated with retained water, poured and precast concrete or other heavy load bearing decks must be specified Wood or metal decks should only be considered where ponded or standing water is at a minimum

2. Roof structure design for live loads shall be a minimum of 50 psf and deflection shall not exceed 1 360 of the span both in addition to the anticipated weight of the water Insulation joints must be taped in single layer applications Vapor retarders must be two plies and solidly mopped Use steep asphalt over metal decks Wood must be treated to prevent warping (see wood nailing strips

3. At points where water pressure from a spray system may be excessive the roof surface should be protected with treated board platforms or other suitable construction to break the force of the water These platforms should be laid on top of the roof surface and not fastened to the deck

4. Insulation under a Water Cooled [illegible] should be a type which is rigid dimensionally stable with high compressive strength

5. IT IS MANDATORY THAT THE WATER COOLING SYSTEM BE CLOSED DOWN AND THE ROOF DRAINED PRIOR TO FREEZING WEATHER Neither roofing nor the structure will withstand the [illegible] caused by ice formation

Flashing Specifications

General

Flashings are the terminal closures of a roofing system which perform a waterproofing and in some systems a decorative function. Flashings must be installed at all intersections formed by vertical surfaces. Their importance cannot be stressed too strongly. Water entering the roofing system through flashings can result in water vapor forces which will destroy the effectiveness of the roofing.

Koppers flashings are an integral part of a Koppers roof. Designed for flexibility so that slight movements do not dislodge them and fastened securely to the wall they give many years of service.

It is particularly important that the top edge of the flashing be protected by counter flashing which will insure a diversion of the water away from any opening which might develop between flashing and wall.

Metal work is only useful for decorative, water shedding or protection against mechanical damage and is not a waterproofing part of the flashing system. Because of the high coefficient of expansion of sheet metals and the large temperature changes experienced on a roof sheet metal or exposed metal components must be isolated from the waterproofing components of the roofing and flashing system as efficiently as possible to prevent the metal from splitting the membrane.

[illegible] roofing [illegible] to prevent water damage to [illegible] deck under the roofing. If this is [illegible] water cut-offs must be installed [illegible] when flashing is installed. [illegible] must be installed as flashing progresses.

The basic Koppers flashings require a cap flashing to be inserted [illegible] immediately upon completion of the flashing. The cap flashing should have not more than a four (4) inch exposed apron extending down over the base flashing.

NOTE:

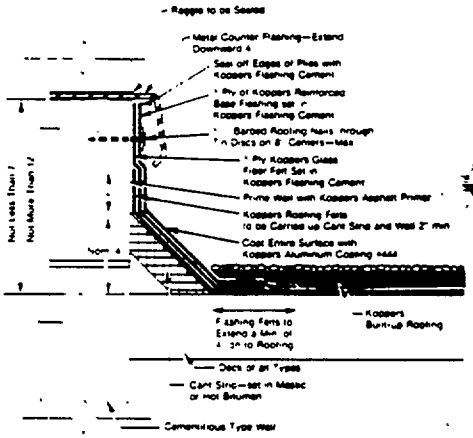
1. If guaranteed flashing is required, [illegible] installed in conjunction with a Koppers guaranteed roof and can be guaranteed for standard periods up to but not greater than the period for which the roofing is guaranteed. **To be guaranteed, composition flashings must be set at least 7½" above the roofing base.**

2. **Metal Cap flashings** are not [illegible] any flashing guarantee.

3. Metal work of any description [illegible] flashing or a part of a flashing system [illegible] included under any flashing guarantee.

Specification No. 108

Application Detail



Application

Extend plies of roofing felts and bitumen moppings up all walls, parapets and curbs for a distance of two (2) inches above cant strip.

A raggle not less than seven and one-half (7½) inches or more than twelve (12) inches above the roof deck is to be provided.

1. Prime all masonry walls from top of roofing felts to raggle with Koppers Asphalt Primer. Allow to dry thoroughly.

2. In a uniform coating of Koppers Flashing Cement* install one (1) ply of Koppers Glass Fiber Felt extending from the raggle to not less than four (4) inches from the base of the cant onto the roof.

3. On top of this apply a second uniform coat of Koppers Flashing Cement into which embed one (1) ply of Koppers Reinforced Base Flashing (reinforced fabric side down).

Care shall be taken to assure that all flashing membrane end laps are fully embedded in flashing cement. Firmly trowel all end laps in place to assure good adhesion.

4. Nail with one and one-half (1½) inch masonry roofing nails through flat tin discs along upper edge eight (8) inches o.c. maximum into mortar joints. For concrete construction nail to treated wood nailing strips set in flush with the surface with appropriate nail through flat tin discs.

End laps for each ply shall be not less than three (3) inches. End laps between plies shall be staggered not less than twenty-four (24) inches.

5. The top edge of the flashing felts are to be sealed with flashing cement. (Stripping of this top edge with Koppers Glasfab Fabric set in the cement is preferred but remains optional.)

6. Coat entire surface of flashing with Koppers Aluminum Coating #444 applied at a rate of 1 gal./100 sq. ft. (including nail caps along top edge of flashing as well as top edges of felts).

7. Interply cement shall be troweled uniformly full height and continuously approximately one-eighth (⅛) inch thick. Plies must be laid in smoothly with no pockets, wrinkles or buckles.

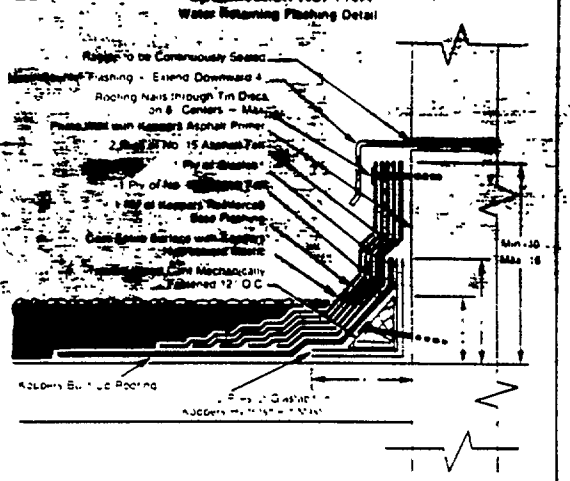
8. Install metal cap flashing.

***NOTE: Koppers steep asphalt may be used as an alternature to the two (2) interply trowelings of asphaltic plastic cement.**

All other requirements of this specification must be adhered to.

Specification No. 110A

Water Retaining Flashing Detail



Application

A raggle not less than ten (10) inches or more than sixteen (16) inches above the roof deck is to be provided.

1. Prime all masonry walls with Koppers Asphalt Primer. Allow to dry thoroughly.

2. In uniform coatings of Koppers Hydroshield mastic install two (2) plies of asphalt coated Glasfab* extending from the corner of the wall and substrate six (6) inches in both directions.

3. Mechanically fasten a treated wood cant twelve (12) inches O.C.

4. Extend plies of roofing felts and bitumen moppings up all walls, parapets and curbs for a distance of two (2) inches above the cant strip.

5. In uniform coatings of Koppers Hydroshield mastic install two (2) plies of No. 15 Asphalt Felt, followed by one (1) ply of asphalt coated Glasfab*. Then one additional ply of No. 15 Asphalt Felt.

6. A final ply of Koppers Reinforced Base Flashing is to be applied in Hydroshield mastic and coated heavily with Hydroshield as the finishing surface.

7. Mechanically fasten the flashing membrane to the wall eight (8) inches O.C. maximum and on a line two (2) inches below the top of the membrane.

8. Install metal cap flashing.

NOTE: When Flashing Specification No. 110A is specified in a non-waterproofed roofing system, Koppers Aluminum Coating 444 should be substituted as the final surface coating. Koppers Aluminum Coating 444 should be applied to the entire surface of flashing at a rate of two (2) gallons per one-hundred (100) square feet. No other alternates are permitted in this specification.

General information

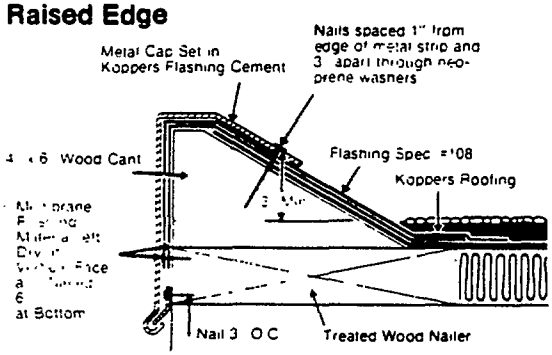
There are numerous flashing details that have been proven by experience over the years. There are normally a number of acceptable construction details for accomplishing one purpose The architect should select a detail that best serves the purpose under the various and different conditions concerned with the specific job at hand In certain cases, slight modifications are necessary to adjust a proven detail to job conditions or one method may serve better than another

The details shown in this manual are some suggestions based on experience Space limitations prohibit listing many others

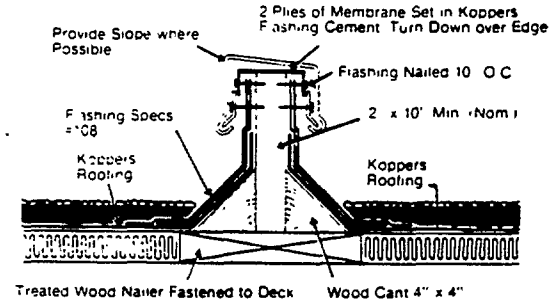
Design or selection is a responsibility of the architect

Koppers representatives are available to review flashing details to assist the architect in providing the best details for specific jobs

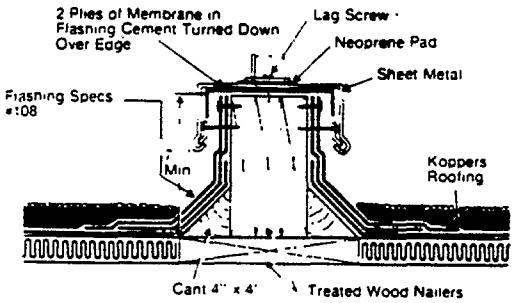
Raised Edge



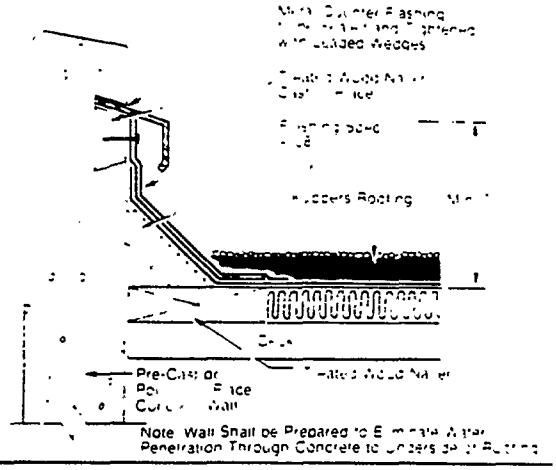
Relief Joint



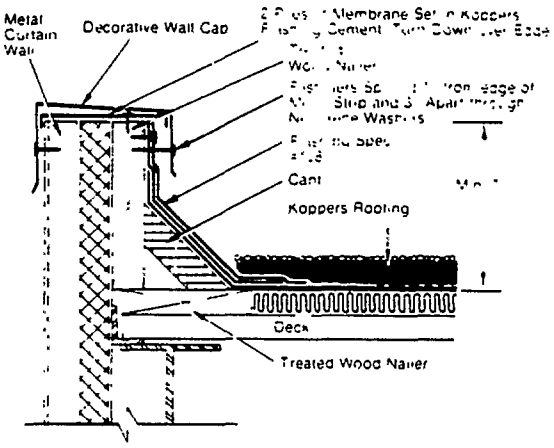
Equipment Support



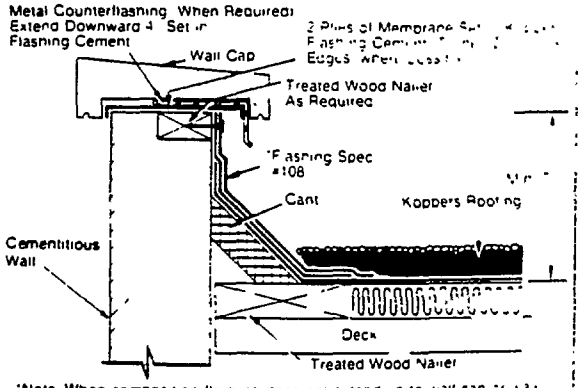
Parapet/Precast or Poured Concrete



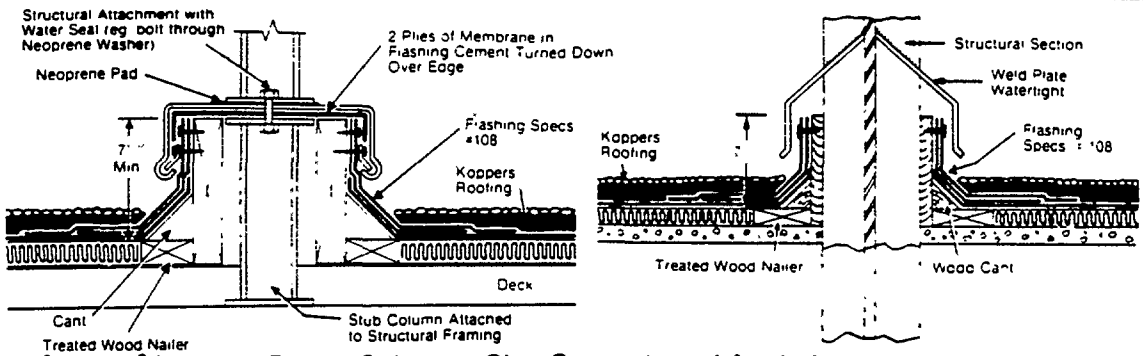
Parapet/Metal Curtain Wall



Parapet/Wall Cap

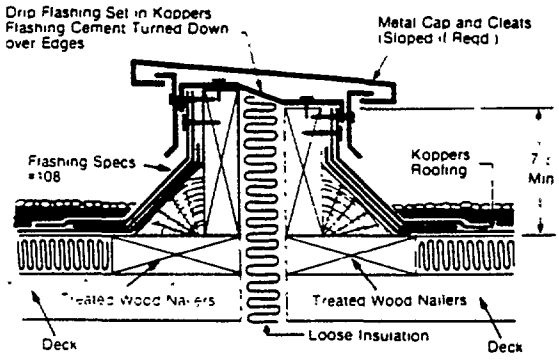


*Note When composition flashing does not extend up to wall cap or wall cap does not provide water egress protection a metal counterflashing must be installed according to procedures found in flashing specifications



Future Columns, Sign Supports and Angle Irons

At all locations where stub or future columns, sign supports and angle irons are to penetrate built-up roofing, Koppers recommends wooden curbed base units with cant strips to be installed to accept KMM flashing systems Where structural steel section extends beyond stub height, metal cap flashing with tight fit to the structural section must be fabricated and continuously welded to the projection to assure a watertight metal cap



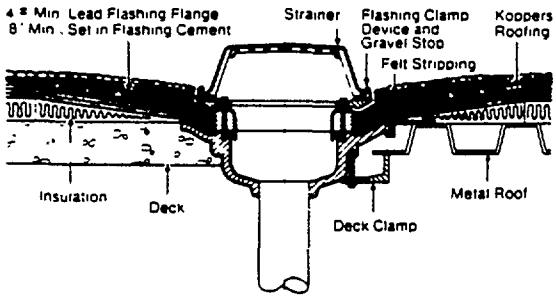
Curbed Expansion Joint

Curb expansion joints are to be flashed in accordance with Koppers specifications for parapet walls. Metal cap must be designed to expand so as not to disturb flashing

It is the responsibility of the designer of the building to provide, for adequate expansion joints

For the protection of the roofing system against splits caused by expansion and contraction, Koppers recommends that an expansion joint be installed: (1) on roof areas larger than 200 feet in each direction, (2) at all places where the structural supports and roof assembly change direction, (3) where type of adjoining deck materials change

Where control expansion, or contraction joints are provided in structural steel deck material or deck system, provisions must be made for continuation through the roofing system See (Expansion Joints) Page 11



Roof Drain

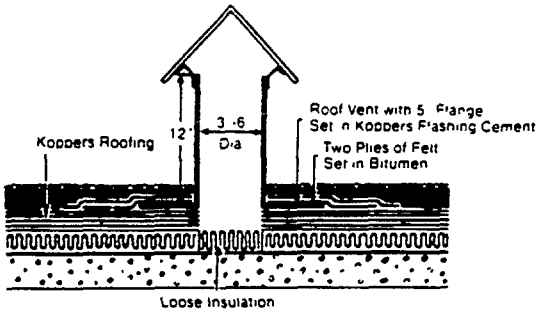
All roof drains shall be provided with metal roof drain flashing flanges which extend at least 12" beyond drain opening and shall be stripped with felt in accordance with drain detail All drains should be provided with expansion joint sleeves.

The sheet metal flange furnished with the drain must be cemented to the surface of the felt with hot Coal Tar Bitumen or flashing cement. Over the flange apply, with alternate moppings or trowelings, two (2) reinforcing plies of felt so that the first extends not less than three (3) inches beyond the outer edge of the flange, and the second not less than six (6) inches

Roof drains must be of a type provided with a wide lead or copper flange Strainer construction should provide adjustment for meeting variations in roof level or slope

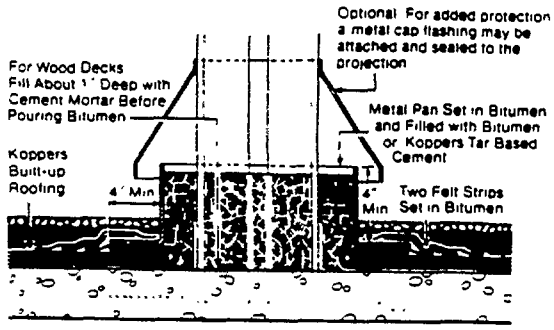
To obtain proper drainage, roof drains should be located at points of lowest expected deflection in roof deck

Note: Special care must be taken to prevent bitumen migration into drain openings



Roof Vent

Koppers does not recommend occasional or spot vents through the roof as the only venting method or a substitute for underside or continuous vented systems. There may be certain instances where spot or mushroom type vents might be deemed advisable by the designer for a new building (eg. at expansion joints for vent relief on long run underside continuous venting systems, etc.)



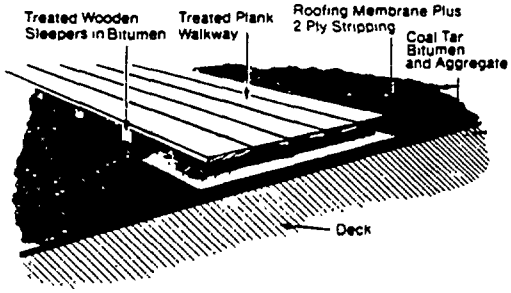
Pitch Pocket

Although controversial, the Pitch Pocket is one of the most frequently used design details.

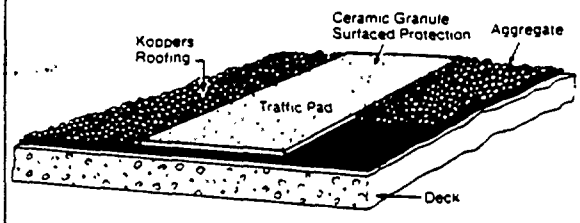
The sheet metal flange must be cemented to the surface of the felt with hot coal-tar-bitumen or flashing cement. Over the flange apply, with alternate moppings, two (2) reinforcing plies of tarred felt so that the first extends not less than three (3) inches beyond the outer edge of the flange and the second no less than six (6) inches.

Fill metal pan with hot coal-tar-bitumen or flashing cement. Paint exposed sections of all reinforcing rods with dampproofing paint.

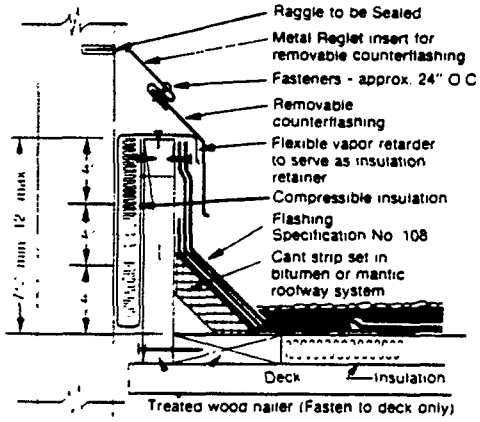
Walkways (Treated Wood Walkway)



Traffic Pad



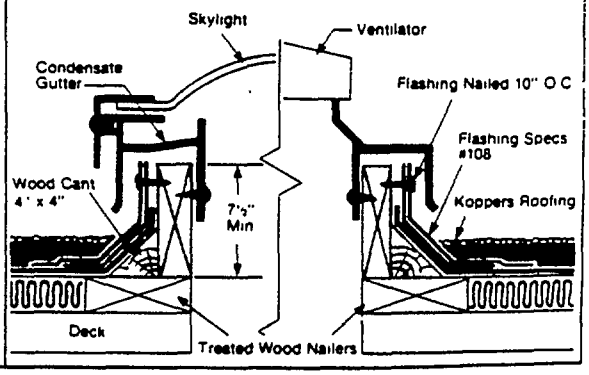
Non Wall Support Flashing



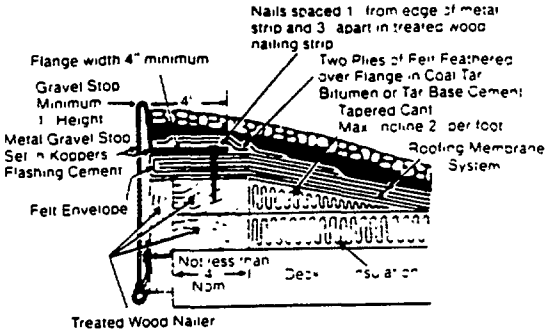
Note: Suggested detail where possibility exists that differential movement will occur between deck and vertical surface. This detail is intended as a guide only.

Roof Opening

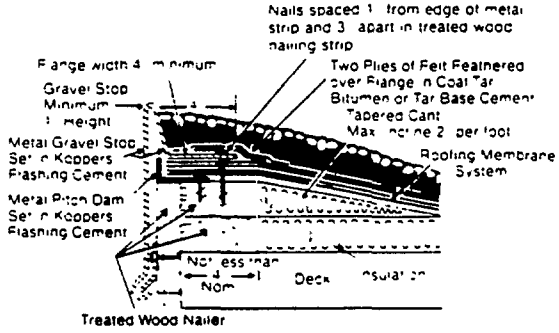
Curbs extending a nominal 10 inches to 14 inches above roof surface shall be provided at all openings for skylights, ventilators, expansion joints, etc., to provide for installation of KMM flashing.



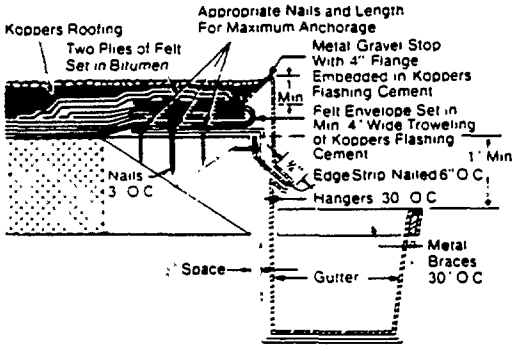
Tapered Cant



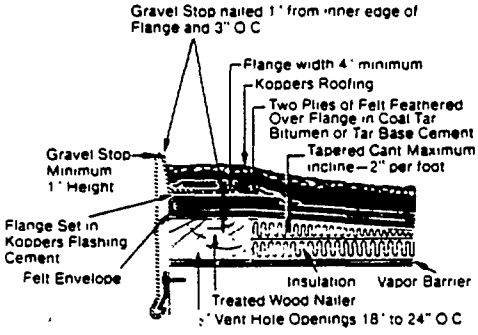
Tapered Cant



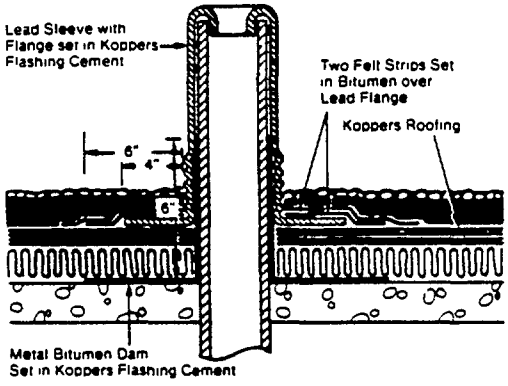
Hanging Gutter

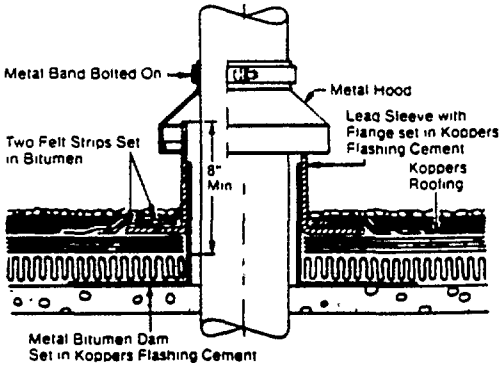


Vented Edge



Vent Pipes, Stacks, Flagpoles, and Other Projections





All vent pipes, stacks, flagpoles, or other projections penetrating the built-up roofing, whether indicated on drawings or not, must have a proper metal sleeve flashing with flange, pan flashing with flange or other flanged flashing installed.

Behind metal sleeves and beneath the roofing membrane next to deck install a metal bitumen dam as shown in detail. The sheet metal flange must be cemented to the surface of the felt with a mopping of hot Coal Tar Bitumen. Over flange apply with alternate moppings, two (2) reinforcing plies of felt so that the first extends not less than three (3) inches beyond the outer edge of the flange and the second not less than six (6) inches.

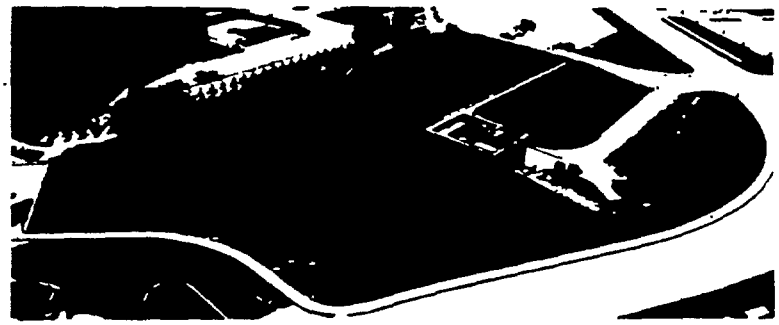
Koppers Waterproofing and Dampproofing Systems

FOR DESIGN ASSISTANCE

Since the majority of projects pres- such a wide variety of conditions the specifier must take precautions in the preparation of waterproofing specifications and related details to maximize the possibilities of a permanently watertight application

Coal tar membrane waterproofing systems

The function of waterproofing and dampproofing is to prevent the entry or passage of water through masonry or concrete structures The most important property that must be possessed by any waterproofing or dampproofing material is its ability to resist prolonged contact with water



Cold-applied mastic and liquid waterproofing and dampproofing systems

Many projects require the advantages of cold applied liquid or mastic moistureproofing materials Koppers manufactures a wide variety of quality dampproofing compounds Applied by themselves or in combination with reinforcing fabrics Koppers dampproofing products will assure you of dependable moisture protection

Liquid and Mastic Applied Waterproofing Dampproofing Systems

Hydroshield Mastic 451 All-weather cold process mastic membrane system

Hydroshield Mastic 451 is a solvent based asphalt mastic which is unaffected by immersion in water either before or after curing It will adhere tightly to damp or even wet surfaces Hydroshield is not damaged by soil alkalinity acidity or minerals This unique mastic may be applied under an extreme range of weather and temperature conditions.

Hydroshield Mastic for Dampproofing. When applied to masonry or concrete construction Hydroshield Mastic serves as an effective dampproofing barrier to prevent the entrance of moisture by capillarity Usually only one coat is necessary for dampproofing. Hydroshield Mastic goes on cold and may be applied to a wet or dry surface

Hydroshield Mastic for Waterproofing. When a permanent vapor barrier to prevent the entrance of water under a head of pressure is required, Hydroshield Mastic combined with Koppers Heavy Duty Glass Fiber Mesh produces a tough durable waterproofing membrane that cannot rot or deteriorate at sub-grade levels For details of waterproofing applications consult your Koppers representative

Application Guide

	452 Primer Per 100 ft.² (When Needed)	Hydroshield First Coat Per 100 ft.²	Koppers Heavy Duty Glass	Hydroshield Top Coat Per 100 ft.²
Dampproofing	. to . gal	2 gal	None	None
Waterproofing	. to . gal.	5 gal	1 or more plies	3 gal

Liquid Asphalt 480 A cold applied asphalt emulsion dampproofing. (Vertical Walls)

Liquid Asphalt 480 is a filled, cold-applied, high-quality asphalt emulsion containing Bentonite clay

When applied to masonry or concrete construction Liquid Asphalt 480 serves as an effective dampproofing barrier to help prevent the entrance of moisture by capillarity Usually two coats are necessary for dampproofing

Liquid Asphalt 480 goes on cold and may be applied to a wet or dry surface For detailed specifications consult your Koppers representative

Application Guide

	452 Primer Per 100 ft.²	Liquid Asphalt 480 Per 100 ft.² (2 coats)
Dampproofing	. to gal	3 gal

Coal tar plaza deck and wall waterproofing systems

Membrane Waterproofing

Materials

a. Coal Tar Waterproofing Bitumen A S T M D-450 Type III

b. Membrane (Select one or combination) GLASFAB — A S T M D-1668

Tar Saturated Cotton Fabric — A S T M D-173
Tarred felt — A S T M D-227

c. Concrete Priming Oil — A S T M D-43-73

General Requirements

a. Preparation of surfaces Surfaces to be waterproofed shall be reasonably smooth and free from holes or projections which might cause puncture of the membrane The surface shall be dry and thoroughly cleaned to remove dust and loose materials immediately before application of the waterproofing Do not apply waterproofing where effects of freezing or moisture will adversely affect the waterproofing application

b. Applicator: All membrane waterproofing shall be applied by an experienced roofing and waterproofing contractor

Application Precautions

a. Waterproofing bitumen shall not be heated above 425° F

b. Roll or press firmly all plies of membrane into the hot bitumen and apply without wrinkles, buckles or kinks.

c. On vertical walls apply hot bitumen with cotton roller mops or by other suitable application techniques.

d. Apply membranes on vertical surfaces in courses not exceeding ten feet in length where immediate and careful backfilling is not possible After each course of the waterproofing system is completed and before the top mopping is applied, nail each course at the upper edge before the next course is applied Nail each succeeding course end-lapping not less than 10 inches.

e. Reinforce w[illegible]ngles, corners or any place the waterproofing membrane course may be subject to unusual stresses with not less than 2 additional plies of fabric or GLASFAB reinforcement and moppings of bitumen

f. Insulate and protect all hot water and steam pipes which project through or are near the surfaces to be waterproofed. Take the necessary precautions to prevent water from getting between the waterproofing and the waterproofed surface at all points where the membrane is penetrated by drains, pipes, etc. Apply extra plies of reinforcing membrane and bitumen moppings in these areas.

g. Carefully examine laps which have been exposed for any length of time, such as at the junction of a vertical wall and a slab, for defects and insufficient lap areas and repair as necessary before proceeding with further application

h. Apply all membrane waterproofing systems in a workmanlike manner and use wood nailers treated with a water-borne preservative for all vertical wall waterproofing

i. Protect the membrane from damage by other trades after installation to maintain the integrity of the waterproofing throughout the structure

j. Ventilation should be provided in enclosed spaces during application

Horizontal waterproofing applications:

1. Beginning at the low point of the slab mop the surface with hot Koppers Waterproofing Bitumen and immediately apply the reinforcing membrane over the entire area

2. Be sure that each ply is solidly mopped and adhered

3. For the various waterproofing systems lap the reinforcing plies as follows (a) Two Ply System — lap 19 inches (b) Three Ply System — lap 24-2 3 inches (c) Four Ply System — lap 27 . inches

4. Mop the entire top surface with Koppers Waterproofing Bitumen. The completed waterproofing forms a firmly bonded system and the reinforcement shall not be exposed at any place.

5. As soon as any portion of the waterproofing has been completed, cover it with the protection course specified, such as brick, tile, concrete, rigid insulation or other specified material.

Plaza deck waterproofing applications:

When membrane waterproofing is used in plaza construction with interior drains and the finish slab does not rest immediately on the waterproofing, but on concrete pedestals, the following additional precautions shall be taken:

1. If deck is sloped to interior drains, specify Waterproofing Bitumen conforming to ASTM Specification D-450 Type III.

2. Before the pouring or placing of pedestals supporting precast finish slabs additional reinforcement shall be installed under each pedestal over existing membrane

3. Extreme care should be taken to protect the finished waterproofing from damage by other trades during construction of towers etc Place a protective course over the finished membrane until the wearing surface is placed

4. On precast concrete systems all joints should be grouted with flashing cement and stripped with a reinforcement fabric

Below grade wall waterproofing application:

1. Apply a uniform brush coat of Koppers Concrete Priming Oil over the entire surface to be waterproofed (approximately 1 gallon for each 100 square feet). Primer to be slightly tacky to dry to touch before applying bitumen

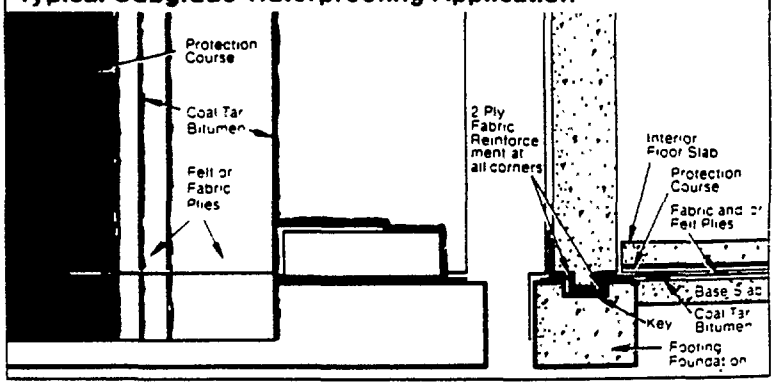
2. Mop wall completely with Koppers Waterproofing Bitumen

3. Starting at the most practical place, install the desired number of plies lapping them as follows (a) Four Ply — lap 27 ." (b) Three Ply — lap 24-2 3 inches. (c) Two Ply — lap 19 inches (d) When more than 4 plies are used in a membrane, it is recommended that they be installed in at least two operations, i e., 2 plies over three, 3 plies over three, etc. maintaining the shingle fashion method in each operation

4. Nail membrane with concrete nails 8 inches on centers through flat tin discs at the end lap horizontally across the membrane If wood nailers are installed, nail membrane to nailer with 1 : inch roofing nails through flat tin discs 8 inches on centers.

5. Mop the entire surface with Koppers Waterproofing Bitumen. The completed waterproofing forms a firmly bonded system and the reinforcement shall not be exposed at any place

Typical Subgrade Waterproofing Application



ROOF INSULATION EXELTHERM Xtra® Roof Insulation

The thermally efficient roof insulation with superior fire performance characteristics.

General Description

Exeltherm Xtra Roof Insulation is a closed cell thermoset phenolic base plastic foam. Compared to other type foams used in the construction of roofing systems Exeltherm Xtra demonstrates superior physical characteristics low flame spread rating and low smoke development.

The following information is provided to specifiers and purchasers in order to assist them in utilizing this product in a proven and recommended manner. If additional information is required or special assistance is necessary contact the Koppers regional office closest to you. Their locations are listed on the back page of this manual.

Typical Physical Properties*		Test Method
Compressive strength 10% consolidation psi	25	ASTM D 1621
Dimensional stability 7 days 158° F 95% R H	<1.0 (length)	ASTM D 2126-75
	<1.0 (width)	
	<1.0 (thickness)	
Thermal conductivity ("k" value)	0.12	ASTM C 518
Water absorption increase by volume (two-hour immersion), %	1.8	ASTM C 272
Water Vapor Transmission, Perms		
Desiccant Method	1.4	ASTM E 96-80
Water Method	7.0	(Procedure A & B)
Density lb/ft.³ (nominal)	2.5	ASTM D 1622
Coefficient of linear thermal expansion, per °F	13×10^{-6}	ASTM D 696
Surface burning characteristics (1" to 3" thickness bare foam)		ASTM E 84**
Flame spread	20-25	
Smoke development	5-15	

*The physical properties listed above are presented as typical average values as determined by accepted test methods and are subject to normal manufacturing variations. This data is offered as a service to our customers and are subject to change without notice. All information can be confirmed by contacting the Koppers regional sales office near you.

**The numerical flame spread rating as determined by ASTM Test Method E-84 is not intended to reflect hazards presented by this or any other material under actual fire conditions.

Thermal Performance

One of the most important features of any insulation product is its ability to retain its thermal characteristics for an extended period of time. Several factors such as moisture and heat soaking can affect the performance of a product during its life. The roof insulation industry through the efforts of the Thermal Insulation Manufacturers Association, Roof Insulation Committee (RIC/TIMA), have evaluated methods and procedures for determining long-term insulation value. Koppers supports and follows the ASTM C 518 test method of determining thermal values: after samples have been conditioned in accordance with the RIC/TIMA method as described in their Bulletin 281-1.

The data presented for Exeltherm Xtra in the following chart has been determined by the procedure described above. For comparison purposes this chart offers data on various types of foamed roof insulation. The data presented on these products is based on ASHRAE's recommendation that aged urethane can be calculated using a "k" value of 0.16. Koppers along with the rest of the insulation industry is striving to remain current with state of the art procedure, at the same time continuing to investigate new procedures in order to provide our customers with the most accurate product data.

"Aged" Thermal Value Comparison (Inches)

"C" Value	"R" Value	*Exeltherm Xtra	**Urethane Perlite Composite	**Urethane	***Isocyanurate	****Polystyrene (EPS)
0.1000	10.00	1.8	2.0	1.8	1.8	2.8
0.0857	11.67	1.4	2.2	1.8	1.8	3.1
0.0800	12.50	1.5	2.4	2.0	2.0	3.3
0.0686	14.58	1.75	2.7	2.3	2.3	3.8
0.0600	16.67	2.0	3.1	2.7	2.7	4.3
0.0500	20.00	2.4	3.8	3.2	3.2	5.2
0.0400	25.00	3.0	4.6	4.0	4.0	6.5

*The thermal value was determined by ASTM C 518. All test specimens were conditioned in accordance with RIC/TIMA Bulletin 281-1.
Exeltherm Xtra thermal calculations are based on a "k" value of 0.12.
**In the ASHRAE Handbook of Fundamentals 1981, a "k" value of 0.16 has been established for rigid urethane foams.
***Many manufacturers publish a "k" value of 0.16 or higher. Consult current literature for "aged" product R values.
****Values based on thermal conductivity ("k") of 0.26 at 75° F mean test temperature for nominal 1.0 pcf density EPS.

Underwriters Laboratories, Inc.

Listed Approved

RIC TIMA

Product Compliance

EXELTHERM XTRA Roof Insulation meets the following requirements

F.M. Approvals: Class I Insulated Steel Roof Deck Construction with both I-60 and I-90 Windstorm Classifications. Refer to the FM approval guide for details.

U.L. Classifications:
(1) Insulated Metal Deck Construction Assemblies Construction Numbers 1, 2, 120 and 123
(2) UL Class A Roofing Covering with Coal Tar Built-Up Roof
(3) UL Class A with Asphalt Built-Up Roof

Federal Specification: Exeltherm Xtra is a phenolic foam insulation board with physical properties which meet or exceed performance criteria in Federal Specification HH-I-1972, a specification covering polyurethane or isocyanurate roof insulation.

BOCA Building Code: Research Report #82-95. Exeltherm Xtra must be installed in accordance with Koppers Company instructions and must be installed in accordance with Section 1317 of BOCA Basic National Building Code — 1984 Edition.

Uniform Building Code: ICBO — Research Report #4086. Exeltherm Xtra installed over wood or metal decks on or covered with fire retardant roof covering.

Standard Building Code: SBCC Compliance Report #8370. Exeltherm Xtra may be used for roof insulation when installed in accordance with Koppers instructions.

Exeltherm Xtra must be installed in compliance with Section 706 (Roof Coverings) and Section 717 (Foam Plastics) of the Standard Building Code.

Accepted for use city of New York dept. of bldgs MEA #35-78-M thru 40-78-M Volume and 126 & 127-81-M Volume II.

Typical Exeltherm Xtra Application Requirements

This chart is offered as a reference guide to alternate methods of proper application for Exeltherm Xtra roof insulation

For specific detailed installation procedures consult the Insulation Application section of this manual (See note below)

These requirements are based on experience and are subject to change. To confirm the application requirements for your project, contact the Koppers Regional Office nearest you.

	Koppers Coal Tar Membrane Systems	Asphalt Built-Up Roofing Systems		Single-Ply Membrane Systems		
Deck Type	Coal Tar Bitumen	Reflective Aggregate	Smooth Surface Non-Reflective	Loose Laid Ballasted	Fully Adhered	Semi-Attached
Metal	1 3	1 3	1b	1 3 4	1c	1c
Concrete	1 2 3	1 3	1b 3b	1 3 4	1c	1c
Gypsum	3b	3a	3ab	1 3a 4	ab	
Wood Plank Plywood	1 3a	1 3a	1b	1 3a 4	1c	1c
Structural Wood Fiber	1 3c	1 3a	1b 3ab	1 3a 4	1c 3ab	1c 3ab

Methods of Insulation Attachment:
1 Mechanical Fasteners
2 Coal Tar Bitumen
3 Asphalt (ASTM D312 Type III)
4 Loose Laid

Special Insulation Application Requirements:
a A base ply must be first nailed to the deck using the approved number and type fasteners prior to installing the insulation board
b [illegible] board of wood fiber [illegible] minimum thickness must be installed over Exeltherm Xtra [illegible] insulation. If perlite board is used the minimum thickness shall be [illegible] Stagger board joints
c A base ply must first be mopped to the deck using Type III asphalt prior to installing the insulation board

*NOTE These requirements apply to the [illegible] Exeltherm Xtra as described above. It is also recommended that the specifier consult the membrane manufacturer's literature and specifications in order to determine if additional requirements or restrictions apply

Important Application Considerations

Introduction

Roof insulation plays a major role in the conservation of our nation's energy resources. As well it has become an important part of a building owner's energy saving package

Of equal importance to an insulation's thermal performance is the product's ability to become a compatible part of the roofing assembly.

Exeltherm Xtra has been laboratory tested and field evaluated to determine its [illegible] performance within various roofing [illegible] As with any product, Exeltherm Xtra must be installed properly in order to perform as it has previously demonstrated

The following information is offered as a guide to the proper specification and basic application of Exeltherm Xtra Roof Insulation.

If you have an unusual situation or desire further clarification of these recommendations, contact your Koppers representative through one of the offices listed on the back page of this booklet

Roof Deck Requirements

The roof deck is the foundation for the insulation and membrane roof assembly The performance of any assembly will in part depend on the integrity of that foundation

Although special application requirements may be required for some decks Exeltherm Xtra can be installed over most types of roof decks in the conventional manner.

Metal roof decks shall be [illegible] so that they will not have a deflection exceeding 1/240 of clear span under all types of loads (live & dead) when subjected to 300 lbs concentrated on a 1 sq ft area at midspan. Designer should take into account roof traffic conditions all roof mounted mechanical equipment as well as equipment used in the application of the roof.

Koppers acceptance of any deck as satisfactory to receive Exeltherm Xtra roof insulation involves the deck surface only. It is the responsibility of the building designer and the deck manufacturer to establish the requirements for

a. Expansion and contraction in a manner that will create a stable base for the roof insulation
b. Support of maximum anticipated loads
c. Acceptable deck deflection
d. Etc.

Koppers will not assume responsibility for deck defects, bitumen drippage, or the placement of conduits, bolt heads, etc., above the roof deck.

Surface Preparation

Decks must be rigid, well attached dry smooth, clean free of defects and be installed in accordance with the manufacturer's recommendations

All projections or openings in the deck should be completed before the application of the insulation and roofing.

Insulation Stops

At all roof edges and roof openings, treated wood nailers should be installed The treatment of the wood should be a waterborne type such as in the Wolmanized® process and kiln dried after treatment The thickness of the nailer must correspond to the thickness of the insulation and be approximately 6" wide

On decks with slopes greater than two inches per foot, wood insulation stops should be used. They should be treated with a waterbased preservative and should be the same thickness as the insulation. They must be securely fastened to the deck perpendicular to the slope line of roof The maximum spacing of the stops should be 48-1 8 inches from face to face

Vapor Retarders

Vapor retarders are used to control the flow of water vapor from the interior of the building into the roofing assembly Vapor retarders are located between the deck and the roof insulation [illegible] assemblies

The use of a vapor retarder within the roof assembly usually depends upon the occupancy conditions when the outside mean January temperature is below 40° and the interior air conditions are expected to be above [illegible] relative humidity are normally considered [illegible] conditions for the need of vapor retarders

Since the architects and building designers are aware of the actual conditions of the specific installation, they have the responsibility for determining if a vapor retarder should be used.

The application of the vapor retarder should be in accordance with the recommendations of the manufacturer of the vapor retarder specified and be compatible with Koppers insulation and attachment requirements

Insulation Application

Built-up roofing and attached single-ply systems require maximum adhesion of the roof insulation to assure optimum membrane performance Roof insulation as well can be exposed to unusual stress or even damaged when poorly or partially attached

> **Good attachment is a *must* for success. Koppers will not be responsible for any damage caused by or the result of unsatisfactory attachment.**

Improperly attached insulation boards can move or take on an irregular shape due to several factors including excessive heat and or moisture

To avoid this potential problem be sure that each board is securely attached to its substrate Mechanical fastening is the surest way to avoid lack of attachment Hot bitumen attachment can be accomplished with careful application controls and techniques Koppers requires that insulation attachment can withstand 60 lbs per sq foot (min) wind uplift force Koppers recommends checking with local codes for other requirements

For the reasons listed above Exeltherm Xtra may when conditions are right slightly bow in a loose laid ballasted application This condition will correct itself once the light colored heat reflective ballast surface is in place Such an occurrence should not be considered at all detrimental to the performance of a loose laid single-ply system

• MECHANICAL ATTACHMENT

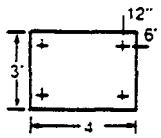
Insulation by mechanical fastening is the recommended method of attachment whenever possible Factory Mutual now requires total mechanical fastening for steel deck construction

Exeltherm Xtra currently requires a minimum of 4 fasteners per 3 x 4 board (3 sq ft fastener) for an FM I-60 approval and a minimum of 5 fasteners per 3' x 4' board (2 4 sq ft fastener) for an I-90 approval

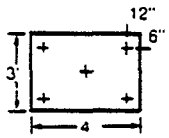
All fasteners must be FM approved and installed as prescribed by FM The placement of the fasteners must be as illustrated below

Special Note:
It has long been recognized that the broader membrane temperature changes experienced with smooth and or non-reflective surfaces can sometimes create stress with in the roofing assembly which can cause premature roof problems particularly if any one or more components of the system is poorly installed To avoid potential problems when a smooth surface and or non-reflective roof is specified Exeltherm Xtra must be mechanically fastened in the required manner to the deck and overlaid with a minimum of 1 2 fiber or 3 4 perlite board See page 24 for specific requirements

Factory Mutual I-60



Factory Mutual I-90



(ALSO SEE THE MEMBRANE APPLICATION SECTION OF THIS MANUAL)

• BITUMEN ATTACHMENT

When mechanical fastening is not preferred or may not be practical such as on concrete decks hot applied coal tar or asphalt bitumens may be used When using asphalt on concrete decks priming is necessary When using hot applied bitumen for attachment care must be taken to apply the material in sufficient quantity to totally cover the available deck surface Use just enough material to assure adhesion

The temperature of the bitumen is important It must be hot enough at the moment the board is installed to allow embedment of the board To assure embedment the board must also be stepped on at several points while the bitumen is still hot enough to allow for full adhesion

It is recommended that attachment be checked from time to time by removing and inspecting a recently installed board

> **Cold adhesives are not acceptable for the installation of Exeltherm Xtra.**

• LOOSE LAID APPLICATIONS

Manufacturers of certain loose laid and ballasted single-ply membrane systems allow the insulation to be installed without attachment

Under such conditions Exeltherm Xtra may be installed without attachment however all other recommendations specified in this manual must be followed

Note: Exeltherm Xtra may when conditions are right, slightly bow in a loose laid ballasted application This condition will correct itself once the light colored heat reflective ballast surface is in place Such an occurrence should not be considered at all detrimental to the performance of a loose laid single-ply system

Whether attached by mechanical fastening, hot bitumen or loose laid the insulation board shall be installed in parallel courses butted firmly with the cross joints broken

On metal decks the long dimension of the board shall run parallel to the ribs with the long edges of the board resting firmly on the top of the ribs

When possible the insulation boards should be laid perpendicular to the direction of the roof membrane

As the insulation is being installed and checked for proper attachment the roofing membrane application must closely follow

Roof Membrane Application

No more insulation is to be installed than can be covered by the **COMPLETED** roofing system in the same day Exeltherm [illegible] and most manufacturers require [illegible] gravel surfacing is specified [illegible] applied at the same time the membrane is installed

Koppers does not recommend the practice of phase construction.

At the completion [illegible] exposed edges [illegible] roof membrane system [illegible] means [illegible] allowed to enter the [illegible] insulation chamber [illegible] offs must be [illegible] application [illegible]

Install the roofing system [illegible] with the manufacturer's specific [illegible] recommendations

Special Application Requirements

BUILT-UP ROOFING SYSTEMS

• Gravel Surfaced Membranes:
The application of Exeltherm Xtra [illegible] no additional special installation [illegible] Install the membrane in strict accordance with the manufacturer's [illegible] specifications

• Smooth and/or Non-Reflective Membranes:
With the exception of applications noted in the Typical Application Requirements Chart Exeltherm Xtra must be mechanically fastened to the deck and overlaid with a minimum of 1 2" fiber or 3 4" perlite board See page 24 for specific requirements The overlay must be attached either by mechanical fastening or hot bitumen Install the membrane in strict accordance with the manufacturer's published specifications

SINGLE PLY ROOFING SYSTEMS

• Loose Laid Ballasted Membrane Systems
Exeltherm Xtra can be attached without mechanical fastening or hot bitumen [illegible] be required It may also be loose laid [illegible] Install the membrane in strict accordance with the membrane manufacturer's [illegible] specifications

• Semi-Attached Membrane Systems:
With the exception of applications noted in the Typical Application Requirements Chart presented in this manual Exeltherm Xtra must be mechanically fastened in the required manner to the deck and overlaid with a minimum of 1 2 fiber or 3 4 perlite board See page 24 for special requirements The overlay may be mechanical fastened or hot bitumen or loose laid if permitted by the roofing membrane manufacturer

Install the membrane in strict accordance with the manufacturer's published specifications

• Fully Adhered Membrane Systems:
With the exception of applications noted in the Typical Application Requirements presented in this manual Exeltherm Xtra [illegible] Insulation must be mechanically fastened to the deck and overlaid with a minimum [illegible]

fiber or 3/4" perlite board. See page 24 for specific requirements. Due to the unique characteristics of these type systems special application procedures are often required. When specifying Exeltherm Xtra along with a fully adhered single-ply system, consult your Koppers representative for special application requirements.

Temporary Roofs

The application of an insulated roof membrane system prior to the building structure being ready to accept the system has been recognized as a major cause of premature roof failure. All work such as vent pipes, nailers, curbs, perimeter walls, drains, etc. must be in place prior to the installation of the insulated roofing system.

If such work cannot be completed prior to the need for weather protection, Koppers recommends a temporary roofing system which can be removed and replaced by the permanent system when the structure is ready. **No roof insulation should be applied until the permanent roofing system is installed.**

Reroofing

When reroofing, complete removal of the old roof membrane and insulation is the preferred procedure. This allows the deck to be checked for structural integrity and a new insulated roof assembly to be installed in accordance with state of the art standards.

When it is not possible to remove the old roofing system, certain factors must be considered:

- All existing insulation must be dry, well attached and structurally sound.
- The existing roof must also be dry, smooth and well attached.

Any wet and/or damaged areas must be removed and replaced with material of equal thickness, leaving a level substrate to receive the new insulation.

Where possible it is suggested that a new layer of insulation be installed over the old roof. Mechanical fastening is the preferred method of attachment. When attaching the new insulation to the existing roof or insulation with hot bitumen, extreme care must be taken that a sufficient quantity of bitumen is used in order to obtain total adhesion of the new board.

Precautions

Protection of Material

Keeping insulation dry and undamaged is essential to assure maximum thermal and structural performance with the roofing insulation membrane assembly.

Exeltherm Xtra is shipped covered with plastic shrouds which are intended to temporarily protect the material while in transit. Due to the potential of moisture condensing on the inside of the plastic surface on cool humid mornings **it is recommended that the shrouds be removed during storage at the job site and the material be be covered with a breathable type weatherproof covering such as tarpaulins.**

Exeltherm Xtra roof insulation must be protected from the weather at all times. Wet insulation shall not be used. No more insulation should be laid than can be completely covered with roofing membrane system the same day. At the end of each day's work, or in the event work is stopped abruptly, temporary watertight cut-offs must be installed at all exposed insulation edges. Cut-offs must be removed when work is started again.

Roof insulation which has become wet and/or damaged must be removed and replaced by solid dry insulation.

Exeltherm Xtra has been designed to withstand normal construction traffic. However protection from mechanical damage by excessive traffic and/or abuse is extremely important.

Areas where excessive traffic is anticipated must be adequately protected with a surface protection such as plywood. It is recommended that test cuts be taken in protected and unprotected traffic areas to determine if damage is occuring. Areas which have become damaged must be removed and replaced. Protection is especially important when single ply systems are being installed. Special application equipment may also be required.

If damage is occurring, steps must be taken to reduce the amount of weight or more properly distribute the weight.

Cold Weather Application

Roofing system installation at temperatures below 45°F requires special precautions to insure satisfactory performance of the finished roof.

The deck surface must be dry and free from all traces of ice, snow and moisture before applying roof insulation. Any moisture present on the deck at the time the roof insulation is applied may result in poor adhesion of materials to the deck and blistering of the membrane.

Although mechanical fastening is the preferred method of attachment, if hot bitumens are used it is recommended that their point of application temperatures be not less than 375°F coal tar bitumens and 425°F steep asphalt. Special insulated equipment is often required during cold weather conditions in order to assure these point of application temperatures without exceeding the bitumen manufacturer's maximum heat limitations.

Special Applications

Koppers recommends contacting a representative before specifying the use of Exeltherm Xtra Roof Insulation for storage, plaza deck or horizontal waterproofing applications.

Koppers recommends Exeltherm Xtra Roof Insulation only for roofing applications installed by a qualified roofing contractor.

Factory Mutual has approved the use of Exeltherm Xtra Roof Insulation as a component in Class I insulated metal roof deck construction. Koppers has also maintained an Underwriters Laboratories when Exeltherm Xtra Roof Insulation was tested as a component of an insulated roof deck construction under UL's test procedure. Koppers does not recommend the use of Exeltherm Xtra Roof Insulation for any other applications. Anyone using Exeltherm Xtra Roof Insulation for any other applications is doing so at their own risk.

Koppers recommends that anyone using Exeltherm Xtra insulation for any other uses consult the local authority on the regulation of building materials, usually the building code official and the insurance carrier prior to such use.

Health & Safety Issues

Exeltherm Xtra has not only exhibited superior thermal values, fire performance characteristics and high dimensional stability, but it has also been tested for toxicity, mutagenicity and combustion product toxicity. It has been shown to have a very limited potential for adverse health effects. Exeltherm Xtra has demonstrated no short term health effects except for the dust generated during cutting of the board which may cause eye irritation. Based on acute toxicity tests done according to protocols developed by the Consumer Product Safety Commission in the Federal Hazardous Substances Act (FHSA), a powder made from the board resin is less than toxic (FHSA definition) by ingestion or skin penetration and does not cause skin irritation. The powder from the board resin also gave negative results in the bacterial mutagenicity assay, the Ames test, i.e. no genetic effects were observed in this test. Under flaming and non-flaming conditions this insulation is no more toxic than wood (Douglas fir-standard) based on the results of a combustion toxicity test developed by the National Bureau of Standards.

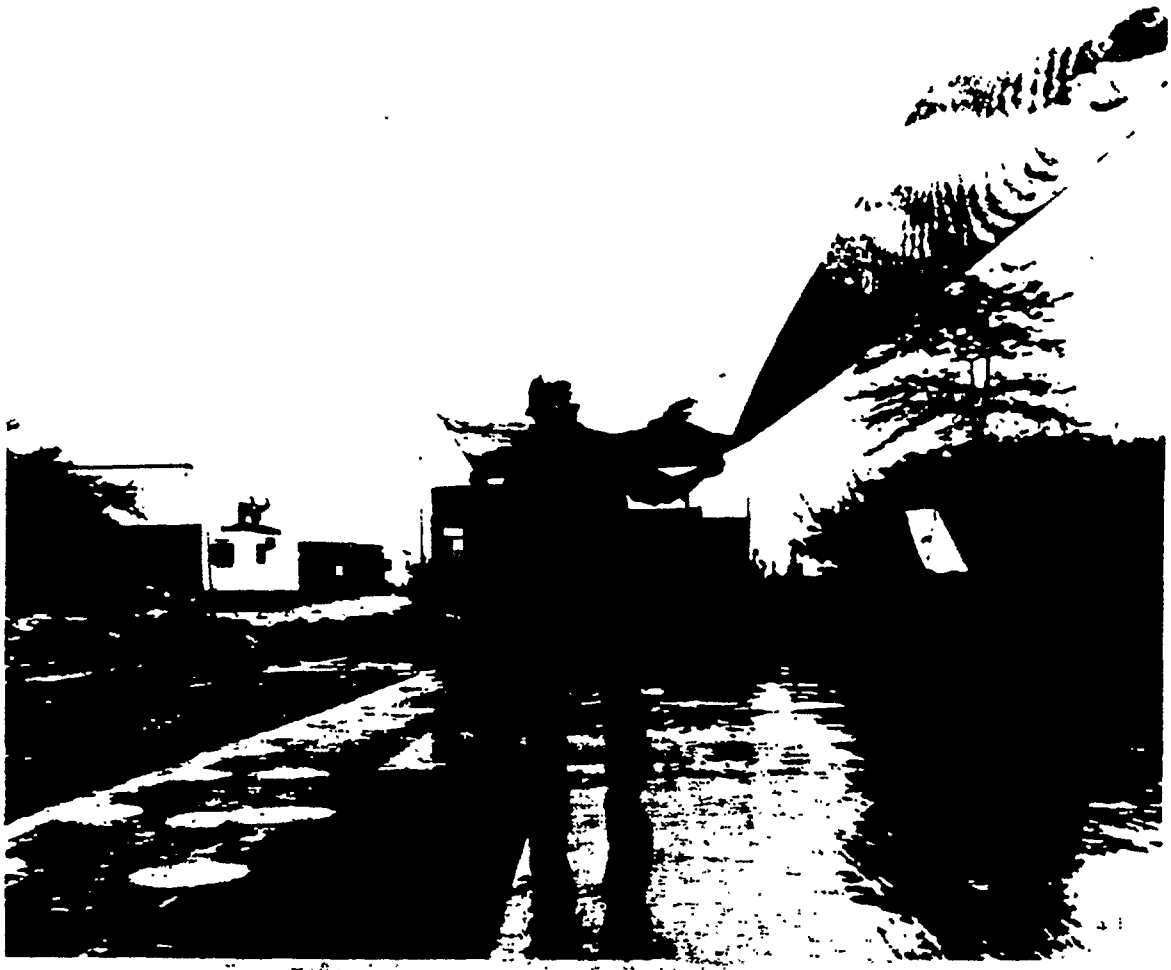
Additional Product Information

3' x 4' insulation boards				
Nominal thickness (inches)	Pieces per pallet	Sq. ft. per pallet	Approx. Weight/Lbs. Per Sq. Ft.	*Flute spanability (inches)
1.2	72	864	0.42	1.75
1.4	64	768	0.48	1.75
1.5	60	720	0.50	1.75
1.75	48	576	0.56	2.75
2.0	42	504	0.62	2.75
2.4	36	432	0.72	2.75
3.0	28	336	0.88	2.75

*For flute spans greater than 2.75 inches special provisions may be necessary. For specific information consult your Koppers representative.

REINFORCEMENT FABRICS

The extra strength needed for all roofing and waterproofing systems.



Reinforcement Fabrics are necessary for waterproofing and roofing systems because the waterproofing agents (bitumens) have practically no strength by themselves. Koppers Reinforcement Fabrics provide this extra strength in a manner similar to that of reinforcing rods in concrete. Sometimes called membranes, these fabrics serve as mechanical reinforcement for hot or cold applied bituminous coatings in roofing and waterproofing systems They also provide the framework to build up coating thicknesses, achieving longer lasting waterproofing systems Once applied, they form stress-resistant pliable sheets that withstand strains caused by wind vibration, and expansion or contraction due to temperature changes

A complete range of reinforcement fabrics is available from Koppers:

Koppers Asphalt Or Coal Tar Saturated Cotton Fabrics are available in both standard and specification grade The primary difference between the two grades is weight Cotton Fabric has the longest successful application record. Specification grade cotton complies with specifications from the federal government, the American Society for Testing Materials (ASTM), the American Railroad and Engineering Association (AREA) and the American Association of State Highway Officials (AASHO)

Glasfab® and Glascoat® Woven Glass Fabrics are both well-known and widely accepted in the construction industry Glasfab, an asphalt or tar coated fabric, and Glascoat, a white resin-coated fabric are inorganic woven glass membranes which will not rot, are lightweight and will conform to irregular surfaces The tensile strength of glass fabric is greater than cotton fabric or jute

Koppers Jute (Burlap) Fabric is asphalt saturated Commonly known as treated burlap, it is a coarse fabric which tends to hold more bituminous roof coating material, resulting in a heavier build-up of coating in fewer applications It is quite often specified for roofing and waterproofing Jute is also used for protection of newly seeded areas embankment erosion control and ditch liners for holding planted materials in place until growth starts

Koppers Glass Mats are widely used with cold-applied roofing products They are non-shrinking, possess excellent embedment qualities and conform to irregular surfaces

The U F Glass Mat is white, lightweight comprised of fine glass filaments in a random swirl arrangement, reinforced with glass strands at the edges and bonded with polymeric resin An asphalt coated U F Mat is also available.

Standard Glass Fiber Mesh consists of chopped monofilaments formed into a random pattern and bonded with a resinous binder

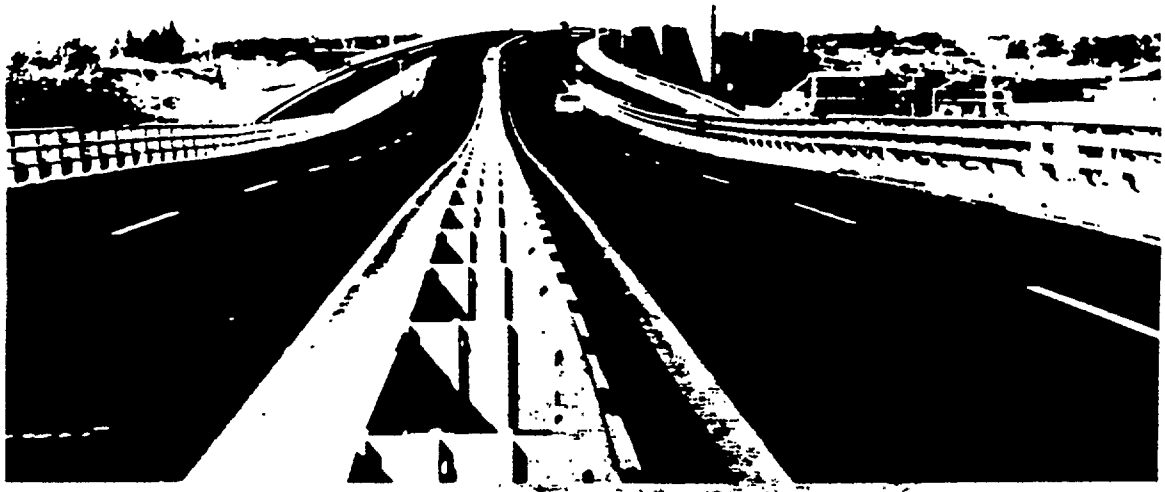
Heavy Duty Glass Fiber Mesh is constructed of heavy glass yarn chopped in two inch lengths and formed into a jackstraw pattern and is bonded and coated with a pliable asphalt The open pattern permits excellent bleed-through of the asphalt into which it is embedded

The perfect material for every application.

Applications of Koppers Reinforcement Fabrics are extensive most used in conjunction with hot or cold applied bituminous coatings in roofing and waterproofing

Other applications include bridge deck waterproofing and flashings foundations slabs tunnels subways pipeline wrapping pipeline joint wrap parapet wall treatment asphalt paving repair and protection driveways parking areas and tennis courts

Many of the reinforcement fabric systems installed over 25 years ago are still in use today in large construction projects such as highway bridges their applications have ensured complete protection against the moisture penetration that ultimately leads to corrosion and weakening of the structure



Bridge Deck Waterproofing effectively protects bridge surfaces and substrates from premature deterioration Koppers Reinforcement Fabric used in conjunction with coal-tar coatings repels the adverse effects of weather salt gasoline and oil spillage In addition, the waterproofing prevents spalling of concrete and the corrosion of bridge reinforcing rods (caused by penetration of moisture and deicing chemicals) The woven glass reinforcement fabric serves a function similar to that of steel mesh in concrete. Forming a stress-resistant pliable sheet, the supporting membrane adds strength and serviceability to the inherent water resistance of the coal-tar emulsion

Foundation Waterproofing And Damp-proofing at the time of construction can eliminate the problems of damaging leaks Architects and engineers have long realized the advantages of waterproofing compounds in preventing or retarding the passage of water Reinforcement fabric enables waterproofing compounds to remain stationary while being built-up to the specific quantities desired thus allowing the depth of material necessary to resist existing hydrostatic pressure

Plaza Deck Waterproofing provides subterranean structures with needed protection against moisture. Whether used as office space, classrooms, storage or a parking garage, all below-ground facilities must be watertight, including walls and top surfaces. Landscaped plazas are often constructed on these top surfaces. It is here that Glasfab is used as the reinforcing membrane in the waterproofing systems placed under the plaza surface.

Glasfab is available with a coating of asphalt or tar to be compatible with the specified bitumen. Possessing the highest tensile strength of any reinforcing membrane currently in use, Glasfab provides a strong waterproofing system. It strengthens and secures the waterproofing agent between slabs and on walls under the plaza deck, sealing and protecting them from water and chemical penetration. When a reinforcing membrane is required that is not coated with asphalt or tar, Koppers fills the need with Glascoat. Like Glasfab, Glascoat is a woven glass fabric but is coated with white resin. Glass mats and cotton fabrics may be needed in specific cases. Koppers makes these products also available as waterproofing membranes.

Roof Repairs are long lasting when Koppers Reinforcement Fabric is used. Quick repairs to roofing and flashing membranes are possible. If a ply of fabric is embedded in the first application of roof coating. A second application then completely seals the area where blisters and cracks once appeared.

Roof Resurfacing with reinforcement fabric adds strength to existing built-up roofs. Since it is important to select the membrane that performs best with a particular coating, Koppers manufactures fabrics that can be utilized with cold-applied products or hot bitumen. Coated glass fabrics are available as well as glass mats and saturated cotton fabrics. Glass membrane's non-rotting feature, its ability to conform to irregular surfaces and its high tensile strength make it a highly desirable reinforcement. Cotton fabric is often used for stripping-in and covering corrugated metal roofs.

When selecting the proper roof resurfacing reinforcement, it is important to also use the proper amount of coating to assure a long service life.

Other uses for Koppers Reinforcement Fabrics exist wherever waterproofing systems are required.

Tennis courts can better maintain their original smooth playing surfaces with applications of Glasfab membranes coated with bituminous or synthetic sealers. This waterproofing combination eliminates the recurrence of cracks, thereby preventing water from seeping under the asphalt and gradually breaking up the base.

Tunnels are effectively protected against water seepage into and through the concrete shell with Koppers Reinforcement Fabric embedded in a bituminous compound. A properly installed tunnel waterproofing system prevents rapid deterioration of reinforcing rods, heaving of concrete and the formation of icicles on the underside.

Pipeline protection has been achieved through an application consisting of a bituminous coating, Koppers Coal Tar Enamel and a reinforcement fabric (Glasfab membranes) to successfully prevent corrosion and soil stress.

Specifications and Technical Data

Product	Applicable Specifications	Nominal Sq. Yd Dry Weight	Sq. Yd. Saturated Wt	Breaking Strength of Saturated Fabric	Nominal Thread Count	Coating	Color	Roll Width (150' Long) Nominal	Rolls per Carton	Carton Weights
Specification Cotton Fabric	Fed Spec SS-C-450A ASTM D-173-80 AREA and AASHO for various states	3.5 oz	10 oz minimum	50 Warp 50 Fill Minimum	26 to 32 Warp 24 to 32 Fill	Asphalt or Tar	Black	36 24 18 12 9 6 4 3	1 1 2 3 4 6 9 12	40= 36= 40= 40= 40= 40= 40= 40=
Standard Cotton Fabric	None	2.0 oz	6.5 oz Typical Analysis	40 Warp 20 Fill Typical Analysis	27 Warp 15 Fill Typical Analysis	Asphalt or	Black	36 24 18 12 9 6 4 3	1 1 2 4 4 8 12 16	[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
Glasfab*	Fed Spec HH-C-466b ASTM D-1668-80 Type I & II	1.2 oz to 2.0 oz 1.4 oz min	1.5 oz to 2.6 oz 2 oz to 3 oz	75 Warp 75 Fill Minimum	20 x 10 or 20 x 20	Asphalt or Tar	Black	48 36 24 18 12 9 6 4 3	4 6 8 12 18 24 36 54 72	48= 56= 48= 56= 56= 56= 56= 56= 56=
Glascoat*	White ASTM D-1668-80 Type III	1.2 oz to 2.0 oz	1.6 oz to 2.6 oz	75 Warp 75 Fill Minimum	20 x 10 or 20 x 20	Resin	White	36" 24" 18" 12" 9" 6" 4" 3"	6 8 12 18 24 36 54 72	42= [illegible] 42= 42= 42= 42= 42= 42=
Jute	Fed Spec HH-B-00800 ASTM D-1327-78	7.5 oz	9.8 minumum Typical Analysis	50 Warp 50 Fill Typical Analysis	9 Warp 9 Fill Typical Analysis	Asphalt	Black	36" 24" 18" 12" 9" 6" 4" 3"	1 1 2 3 4 6 9 12	44= 28= 44= 44= 44= 44= 44= 44=

Product	Binder	Glass Weight 100 sq. ft.	Total Weight 100 sq. ft	Tensile Strength Width	Tensile Strength Length	Roll Width (150' Long) Nominal	Rolls per Carton	Carton Weights
U F Mat—White	Polymeric	9 lbs	1.0 lbs	4 lbs	13 lbs.	36" x 180	1	[illegible]
U F Mat—Asphalt	Polymeric	9 lbs	2.5 lbs.	31 lbs	47 lbs	36" x 180	1	46=
Standard Mesh	Resin	1.39 lbs	1.44 lbs	10 lbs	18 lbs	36 x 180	1	[illegible]
Heavy Duty Mesh	Asphalt	2.22 lbs	4.5 lbs	25 lbs	34 lbs	27 x 96'	4	[illegible]

ROOF MAINTENANCE PRODUCTS AND SYSTEMS

All roofs require preventive maintenance.

As soon as the roofing system is first applied the degradation process begins. If the roof is allowed to age unattended, you may be faced with the high cost of replacing the entire roof.

The materials needed to repair or maintain the common built-up roof depends upon the construction and condition of the roof and the nature of the problem. Maintenance or repair isn't merely a matter of adding more bitumen. Each roof responds to the ravages of time and weather in different ways. Each needs specific materials to combat deterioration.

Also there are flashings, counterflashings, parapet walls, pitch pans and possible wet insulation to be considered. Each of these areas is susceptible to deterioration and damage. Each requires particular materials for maintenance and repair.

Koppers has all the materials necessary to keep your roof in top condition. Our Roof Shield System, for instance, can add years of extra life to smooth surface asphalt roofs and our resaturant applications have extended the life of many built-up gravel roofs.

Koppers Early Warning System is a program which will provide you with a complete and thorough roof-top survey determining the actual conditions throughout the roof system. Koppers will be pleased to put a preventive roof maintenance program together for you.

Roof conditions

Dry Felts & Bare Spots: are caused by the oxidation of surface bitumen on gravel roofs. Roof Felts become exposed to attack by the sun's ultra violet rays and rapid deterioration follows. Koppers roof resaturants help avoid this situation.

Blisters: usually are formed by the presence of moisture resulting in vapor pressure that has been trapped between plies of felt on either gravel or smooth surface roofs. Koppers roof cements and membranes can solve this problem.

Alligatoring: is a condition almost universal to smooth surface hot asphalt roofs. Attack from the sun starts immediately and progresses to the formation of deep roof alligators as time goes by. The appropriate Koppers asphalt emulsions will provide a smooth top surface that will not alligator in the future.

Splits: are the result of excessive movement in the roof system. Freeze-thaw cycles and expansion and contraction may cause roof splits if proper expansion joints have not been provided. Koppers Stripshield and other systems can help control this condition.

Wet Insulation: will greatly effect the performance of any built-up roof. Hydrostatic pressure trapped within the roofing system must be released.

Worn Flashings: can lead to a total roof failure. Koppers cements and membranes offer a system to restore worn flashings to a "like new" condition.

Koppers Aluminum Roof Coatings

KOPPERS
Architectural and Construction Materials

Asphalt base reflective coatings

Koppers asphalt base aluminum coatings contain pure aluminum paste consisting of millions of tiny pigment flakes. When the coating is applied these flakes rise to the surface and arrange themselves into many shingle-like layers of aluminum. The result is a reflective metal surface that protects the substrate from the elements. With Koppers aluminum coatings there is no peeling or separating because the asphalt base securely bonds the aluminum to the protected surface.

There is an aluminum coating to suit your needs:

Aluminum Coating 434 is a premium grade reflective coating containing an extra quantity of fine quality aluminum pigments in a non-fibrated asphalt base. It provides a tough long lasting surface.

Aluminum Coating 435 contains the same high quality ingredients as aluminum coating 434 but with fibers added to the base. This provides a thicker tougher surface and longer life.

Aluminum Coating 444 is a commercial grade reflective coating containing high quality aluminum pigments in a non-fibrated asphalt base.

Aluminum Coating 445 contains the same high quality ingredients as aluminum coating 444 in a fibrated asphalt base to provide a tough long lasting surface.

Application:

1. **Preparation** — The surface to be coated should be cleaned of all loose material such as gravel, dirt, dust, rust or scale. All breaks, cracks, holes and other structural deficiencies should be repaired prior to applying the Aluminum Coating.

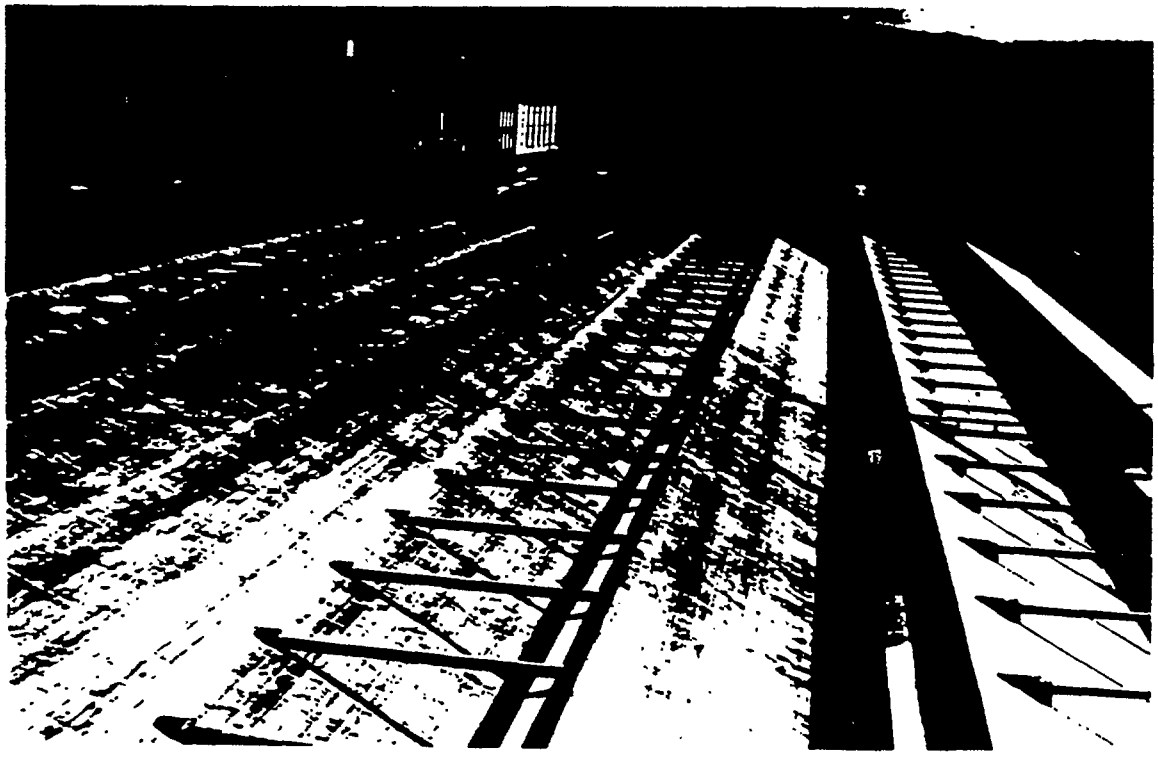
2. **Priming** — Before applying Aluminum Coatings to roofs, dry or dusty felts should be primed with Koppers High-Penetration Primer 452 at the rate of approximately 1 gallon per 100 square feet. This preliminary step insures proper adhesion of the Aluminum Coating.

3. **Coating** — Stir thoroughly before and occasionally during application. Apply with spray or brush.

4. **Curing** — Allow one month curing time before application over new asphalt emulsion coated roofs. Allow three months curing time before application over new asphalt roofs and six months curing time before application over solvent containing asphalt cutback coated roofs. **Do not apply over "dead level" surfaces subject to standing water.**

Guards against moisture penetration
The asphalt base in Koppers aluminum roof coatings provides excellent adhesion to the existing surface. The result is a reflective surface that guards the substrate against moisture penetration.

COVERING CAPACITY	Type of Surface	434 and 444 Non-Fibrated Aluminum	435 and 445 Fibrated Aluminum
Per 100 sq. ft.	Metal	1 to 1 gallon	1 to 1 gallons
	Composition	1 to 1 gallon	2 to 3 gallons



Koppers Heavy Duty Roof Shield System...

Description

Koppers Heavy Duty Roof Shield System combines two Koppers roofing materials Heavy Duty Glass Fiber Mesh and Liquid Asphalt 480

Liquid Asphalt 480 is a filled cold applied high-quality asphalt emulsion containing Bentonite clay It s the waterproofing component of the Heavy Duty Roof Shield System The unique gel structure of Liquid Asphalt 480 will not alligator blister or flow in hot weather

Heavy Duty Glass Fiber Mesh is a patented reinforcing mat of a non-woven jackstraw pattern of short cable strands of glass fiber Each strand is composed of more than 200 glass monofilaments and is completely surrounded with the Liquid Asphalt 480, thereby eliminating water wicking by capillarity into the waterproofed surface

Application

1. **Surface Preparation.** If there is a question to the soundness of the existing roof and insulation a core cut should be made All minor repairs must be made prior to priming ANY blister containing moisture must be allowed to DRY before repair is made

2. **Priming.** Every effort should be made to remove dust from the surface If the dust cannot be completely removed Koppers High Penetration Primer #452 should be applied at the rate of approximately . gallon per 100 sq ft

If a primer is used, it must be allowed to dry thoroughly before proceeding with Roof Shield application

3. **Flashing.** Flashing areas shall be examined, repaired and primed as required Roof Shield should be applied **first** to flashing areas

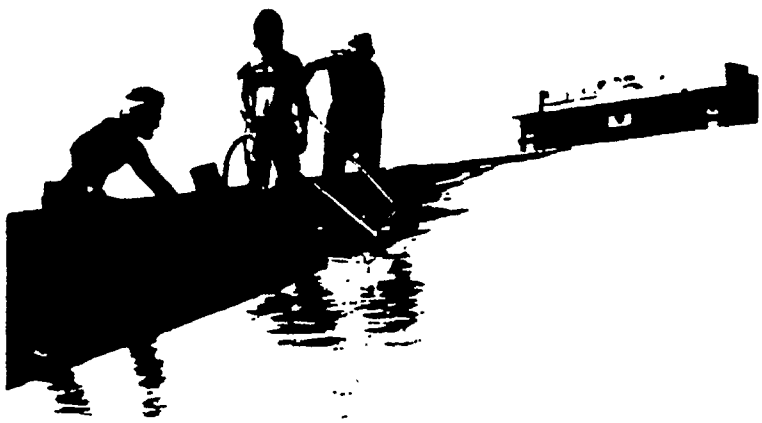
4. **Application.** Brush or spray-on an embedding coat of Liquid Asphalt 480 at the rate of 4 gallons per 100 sq ft Do not apply if temperatures below 40°F are expected within 8 hours or if rain is expected before the emulsion has time to dry

While the emulsion is wet, embed Heavy Duty Glass Fiber Mesh into it with firm brush pressure forcing the emulsion through and around the glass stands Each succeeding glass strip should overlap the preceding one by 2 inches Roll ends of Heavy Duty Glass

Fiber Mesh should overlap 6 inches Do not allow dry or starved laps Permit Liquid Asphalt 480 and Heavy Duty Glass Fiber Mesh to dry sufficiently to permit foot traffic

After the embedding coat is dry a top coat of Liquid Asphalt 480 is sprayed or brushed on at the rate of 3 gallons per 100 sq ft

Do not apply this or any emulsion based coating over "dead level" surfaces subject to standing water.



Effective Maintenance with Tar and Asphalt Roof Resaturants

- **Lowers the softening point of the top pour of bitumen.**
- **Restores flexibility to dried or otherwise brittle felt.**
- **Adds additional waterproofing to the surface.**
- **Provides a means of new gravel embedment.**

Purpose:

Many factors play a part in the service life of a roof Some factors are uncontrollable Others can definitely be controlled There are some aspects of roof degradation that will follow a recognized path and the end result can be predicted

The normal degradation of a built-up roof begins at the top surface This is understandable since it is the top surface that is subjected to the deleterious elements of the atmosphere As soon as a roofing bitumen is exposed to these elements, an age hardening process begins As the softening point of the bitumen increases, cold flow properties diminish and resistance to moisture penetration decreases The volatizing or subliming of a roofing bitumen takes its toll on the performance characteristics of the bitumen

At some time prior to the roof reaching the point when maintenance is no longer feasible, preventive maintenance should be established, even though the roof may not be leaking After considering the age, type of bitumen used to construct the roof and general condition the use of Koppers Roof Resaturants offers an effective means of implementing preventive roof maintenance

Tar:

Koppers Roof Resaturant 410 has a base of coal tar roofing bitumen, blended with nonvolatile oils and selected fibers. Roof Resaturant 410 provides the maximum softening effect and dried felt penetration. There is no addition of volatiles that would rapidly evaporate.

Koppers Roof Resaturant L.O. 410 has the same high quality performance as 410, but has been refined to meet the most stringent air quality standards of the west coast states: the result is **a low odor product for resaturation of roofs.**

Koppers Fiber Coating 415 is a tar base product specially formulated to meet Federal Specification SS-C-540 Fiber Coating 415 contains properly selected fibers plus penetrating oils

Asphalt:

Koppers Roof Resaturant 425 is an asphalt resaturant designed to provide a softening effect to the dried roofing felts. Roof Resaturant 425 is a blend of asphalt and oils combined with fibers to provide a product suitable for flat or sloped graveled roofs

Procedure:

1. All loose gravel must be removed from roof If existing gravel is to be reused, it must be washed free of silt.

2. Silt is removed with water pressure, air pressure or vacuuming. If water is used the roof must be allowed to dry completely before proceeding

3. Drains are covered with screens to prevent clogging of the drain system

4. After the roof is properly cleaned all necessary repairs are made with compatible materials.

5. Koppers Roof Resaturant is applied evenly onto roof at the rate of seven (7) gallons per square The application rate may vary with the condition of the roof

6. Gravel or slag is applied to cover the Koppers Roof Resaturant Gravel shall be in the [illegible] range, and must be washed Care must be taken to avoid exceeding weight limits of the roof deck Gravel should be applied immediately after application of resaturant

7. Precautions must be taken to close off air conditioning air intake ducts during summer heat-load peaks to minimize odor infiltration into occupied buildings during application