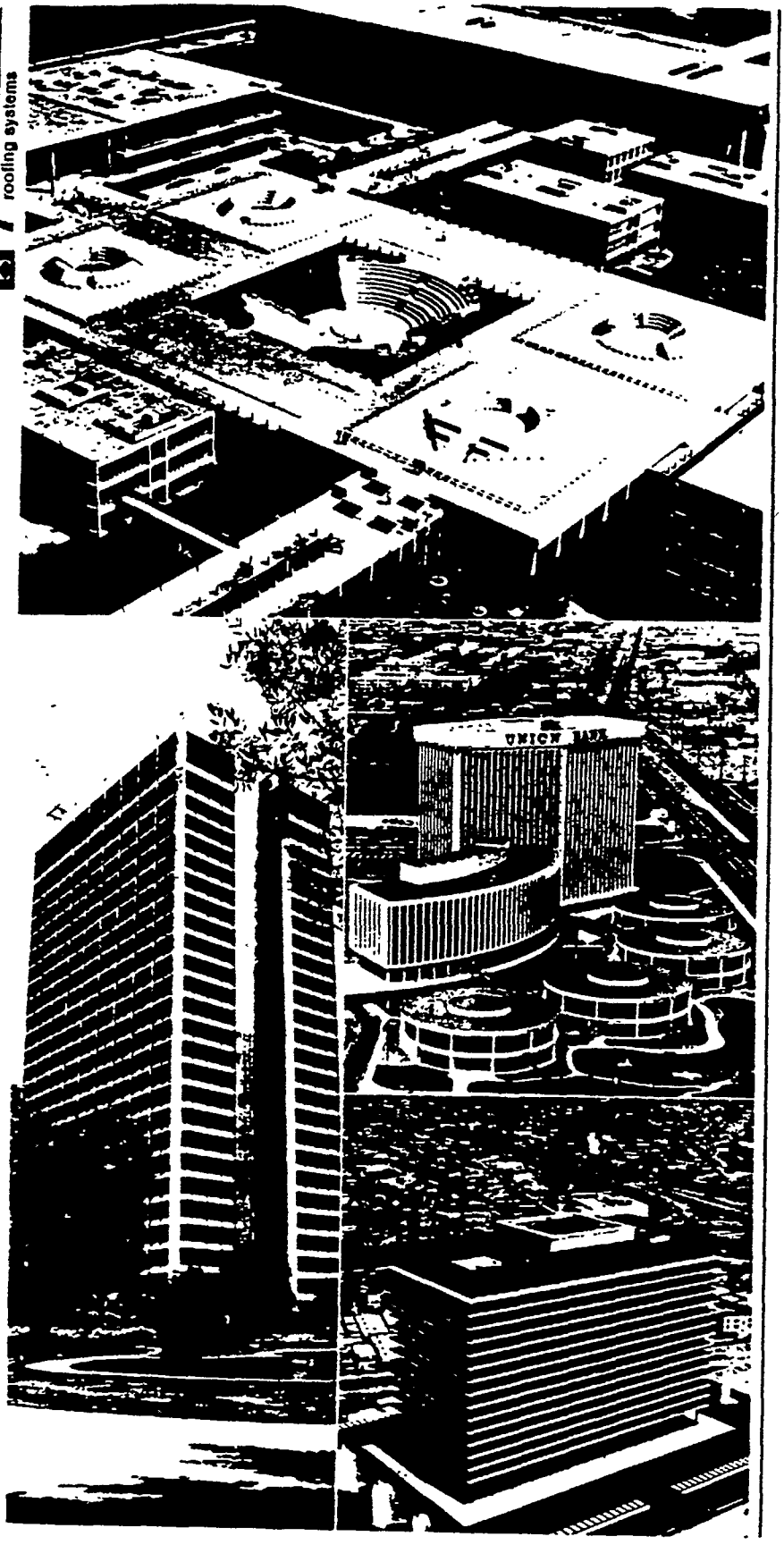
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DIV. 7 MEML roofing systems ROOFING



Koppers
Roof Systems

PENGAD-Bayonne,N.J.
PLAINTIFF'S EXHIBIT
BEA-30

KOPPERS
Architectural and Construction Materials

preface

This manual contains recommended roofing specifications and procedures which are based on the many years of Koppers experience and accepted good roofing practice. They are intended to provide the architect, engineer, general contractor and roofer with the proper information to plan and construct the best roofing systems with the most time-proven materials available today.

The availability of a Koppers surety bond and guarantee for roofing and flashing constructed according to the information contained in this manual under Koppers bond and guarantee procedure, which customarily includes inspection by Koppers during application, 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 bond has not been issued.

This roofing manual supersedes all previous roofing manuals and literature published by Koppers.

The specifications and details contained in this manual have been determined to cover the proper procedures for long lasting roofing systems for most areas of our country. In certain locations, minor variations in details and specifications may be appropriate due to unusual local conditions, such as wind, temperature, humidity, etc. To assure the best application of the proper specifications and details for your area, we recommend consulting our roof structure system specialist . . . your local Koppers sales representative.

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NOTE
For re-roofing, steep and smooth surfaces, and decks or insulations not covered in these specifications, consult your nearest Koppers Sales Office.

1 Old Style Pitch Roofing

Coal Tar Roofing Pitch

Tar is a very familiar word, however it has different meanings for different people. To many it is any black liquid adhesive or plastic substance; however, it is much more than this. It is a hydrocarbon, meaning it is composed primarily of carbon and hydrogen and is therefore an organic compound.

Tar is obtained from the "destructive distillation" of coal, primarily bituminous coal. This means when coal is heated to very high temperatures without contact with air (thus not allowing the combustion of coal and its derivatives) the coal molecules in effect are "cracked" into little molecules (gas), medium molecules (tar) and coke. We see, therefore, that the more proper term is Coal Tar.

Coal tar, through further distillation processes, is refined and separated into products of great commercial usefulness and value:

PITCHES—of various consistencies such as roofing material, waterproofing products, protective coatings for metals, masonry, etc.

CREOSOTE—for wood-preserving.

CHEMICAL OILS—for use in the manufacture of drugs, dyes, paints, varnishes, cosmetics, plastics, synthetic rubber, etc.

Coal tar is indeed a vital and valuable product that produces materials for many industries in our world of today.

In the ever-growing construction industry a very valuable tar derivative is Coal-Tar Roofing Pitch. Its value is found in the fact that it has superb water and corrosive resistance qualities as well as being an excellent adhesive especially applicable in adhering the tarred roofing felts together in built-up-roofing. These qualities are due to the unique property that was endowed to it by nature. Without going into a highly technical chemical analysis it can be most simply stated that Coal Tar Roofing Pitch is a balanced organic compound. The atoms in Roofing Pitch—carbon (C) and hydrogen (H)—have a very strong molecular attraction or bond one to another and hence attacking atoms of oxygen (O) cannot attach themselves to the hydrogen atoms of Roofing Pitch and form a water molecule (H_2O) that will be absorbed into the pitch.

Coal Tar Roofing Pitch is therefore inherently resistant to molecular penetration by water. Coal Tar Roofing Pitch is nature's own balanced answer to waterproofing (roofs and elsewhere), adhesive bonding, and chemical resistance, especially to waterborne chemicals.

Coal Tar Pitch Built-up Roofing

Koppers coal tar pitch built-up roofing systems consist of layers of Koppers Old Style Pitch and Koppers approved tarred felt, surfaced with a heavy top pouring of Koppers Old Style Pitch into which is embedded an aggregate.

Koppers coal tar pitch built-up-roofing systems are used whenever a roof is exposed to water and/or corrosion and on all level or low sloped roofs where long, maintenance-free service is required. Particularly recommended for:

All 'dead' level roofs
All water cooled roofs
Low sloped roofs with retarded drainage
Low sloped roofs with occasional water ponding
(Note: coal tar pitch roofs are especially suitable to withstand the water attack around drainage areas on roofs that are pitched to the drains.)
All buildings with level or low sloped roofs that are built for long service life

Coal tar pitch built-up roofing provides one of the most durable roofing membranes known. The advantages are found in the inherent superior characteristics of coal tar pitch for this purpose. This is the time-proven roofing system for level and low sloped roofs.

Coal tar pitch has a natural resistance to water, air and water vapor penetration. A tight molecular structure enables coal tar pitch to permanently withstand water penetration and resist oxidation of the roof surface. Koppers water-cooled roof specifications take advantage of the unique water-resistant characteristics of coal tar pitch to give you long-term roofing performance.

Another unique 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 pitch 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.

Time and statistics have proven that coal tar roofing pitch when applied in accordance with the specifications in this manual results in the highest acceptable quality level of any built-up roofing system. Coal tar pitch is a nature-formed polynuclear large molecule compound. Coal tar roofing pitch is selectively manufactured fraction which satisfies the basic requirements for long-term roofing service on level and low-sloped roofs.

When you specify Koppers Coal Tar Roofing Systems, you are assuring your building owner-client of long-term roofing performance.

Koppers Old Style Pitch

Koppers Old Style coal tar roofing pitch is carefully manufactured to standards which have been regularly improved over many years. Koppers Old Style Pitch is manufactured to exceed the minimum requirements of the following specifications:

Federal Specification RP381 Type I
ASTM D-450 Type A
Underwriters' Laboratories, Inc.

Koppers No. 15 Tarred Felt

Koppers approved tarred felt is manufactured to meet the following specifications:

Federal Specification HH-R-595
Type I Class I
ASTM D-227
Underwriters' Laboratories, Inc.

Koppers No. 15 Tarred Felt normally contains 432 square feet, covering 4 squares per roll.

IMPORTANT

Roofing System Guarantee

Koppers Company manufactures building materials. It does not practice architecture nor engineering. The roofing systems included hereafter which we believe result in satisfactory installations when properly applied. We make no implied warranties whatsoever as to materials of our manufacture nor performance of the systems herein described. When our Roof Bond is involved the express warranties on our part are only those specifically enumerated therein. No agent, salesman, representative nor employee is empowered to change, alter or amend this provision unless it is done in writing by a duly authorized officer or employee in this corporate headquarters office, Pittsburgh, Pa.

2 Koppers System Roof

Koppers System Roofs

Koppers System Roofs (KSR) are multiple component systems for selected structures designed for board type insulation. These systems are normally for buildings with an interior temperature ranging from 60°F. to 85°F. and a normal relative humidity below 40 (RH) or ventilated space where a vapor barrier is not required. The systems are designed to provide an ideal interface between components to permit ease of application and the best conditions for long service life with ready low cost maintenance features. The systems are kept competitive through the use of the ideal component conditions which permit the use of products from the most advanced Bitumen, Felt, and Insulation Technology which are more expensive to manufacture. The systems consist of Koppers Bitumen, Koppers Felt and Koppers Glass Fiber/Roof Base Insulation, with Koppers Insulation Base Tape.

Koppers Bitumen

In developing Koppers Bitumen, Koppers has analyzed, during the years 1955 through 1969, Coal Tar Pitch Roofs ranging in age from 30 through 43 years and still in good condition. Analysis of the Roofing Pitch from these buildings showed Pitch of excellent retained service life and a material chemically unchanged over the years. Only one change in the original material was noted even in the most severe conditions. As the foremost Coal Tar Refiner, Koppers has adjusted the process used to produce Coal Tar Roofing Pitch to produce a material which minimizes this change. The resultant material is Koppers Bitumen.

Like Koppers Coal Tar Roofing Pitch, its value is found in its superb water and corrosion resistance as well as being an excellent adhesive. This is especially applicable in adhering the Bitumen saturated roofing felts together in built-up roofing. These qualities are due to the unique property that was endowed to it by nature. It can be most simply stated that Koppers Bitumen is a balanced organic compound. The atoms in Koppers Bitumen-carbon (C) and hydrogen (H) have a very strong molecular attraction or bond one to another and hence attacking atoms of oxygen (O) cannot attach themselves to the hydrogen atoms of Koppers Bitumen and form a water molecule (H_2O) that will be absorbed into the Bitumen.

Koppers Bitumen is therefore inherently resistant to molecular penetration by water. Koppers Bitumen is improved by modern manufacturing processes to obtain the best of nature's own balanced answer to roofing, adhesive bonding, and chemical resistance, especially to waterborne chemicals.

Koppers KSR Felts

Koppers KSR Felts are selected to give the greatest strength to thickness ratio available from organic felted membranes. They are heavier and stronger than conventional roofing felts, yet are easy to apply. When applied in an Insulation/Roofing system, two plies develop a roofing skin with Koppers Bitumen which is an advance in roofing concepts.

Koppers KSR Felt normally contains 328 square feet, covering 3 squares per roll.

Koppers Glass Fiber Insulation/Roof Base

Koppers Glass Fiber Insulation/Roof Base is formed of Glass Fiber Roof Insulation with a k value of .25 with a top surfacing of a selected bitumen reinforced with a controlled pattern, continuous filament type, glass fiber. When installed, a glass fiber tape of the same type is placed in a full mopping and surface coated with Steep Asphalt at a rate of approximately 25 lbs. per square.

This roof base (top surface of insulation) when combined with the joint taped system, as described above, provides a monolithic seal which can be maintained water tight during construction periods. It is not subject to organic fiber moisture type of swelling (blisters). This seal is 2 to 15 times thicker than the conventional vapor barriers normally placed beneath the insulation. It becomes an integral part of the finished roof thus providing additional strength and durabiliy to the performance of the Koppers System Roof. The vapor seal is partially produced under factory control and is less susceptible to construction variables than conventional underside seals. Construction damage and later mechanical damage do not have the same devastating effect on the vapor seal. The base is much less susceptible to moisture being trapped during construction.

Koppers Systems in Roofing

Koppers System Roof consists of Koppers Glass Fiber/Roof Base Insulation which is developed into a monolithic substrate by the installation of a special reinforcing glass fiber tape embedded in and coated with steep asphalt at all insulation joints. To this strengthening surface, two layers of Koppers Felt are installed in Koppers Bitumen. The final waterproofing phase is the application of aggregate in a heavy top pouring of Koppers Bitumen. Koppers System Roofs are designed for buildings with a roof slope of 0"-½" per foot. Special construction variations are available for roofs of ½"-1" per foot slope where the superior water and chemical resistance of Koppers Bitumen is a requirement.

Koppers Bitumen is a self-healing material and thus is highly beneficial to successful roofing. There are certain characteristics common to many roofing materials that can cause damage to the roofing membrane: alligatoring; hairline cracks; movement of the building structure, during and after construction due to building settlement as well as temperature and moisture variations. This self-healing or "cold-flow" property of Koppers Bitumen heals these mechanical fractures at normal temperatures before serious damage takes place.

Forces are developed in all structures due to temperature, moisture, and time (aging) changes. Because these forces are very large in relation to the possible strength developed in a roofing membrane; and because severe long-time weather exposure changes all materials, attempts to build roofs with strength comparable to structural forces, or long term elasticity have been rarely successful. KSR is based on superior resistance to water and weather; the "cold flow" feature, and the ability to achieve and retain (even develop through "cold flow") adhesion to substrate, membrane, flashing attachments and aggregate for a long service life.

Applicability is one of the most important characteristics of any construction material. KSR can be readily installed on any building; of the type and design for which it is suited; with existing skills and with the level of competence of contemporary field labor. Further, Koppers System Roofs can be installed in the expected weather conditions to be encountered in most constructions. With the exception of heavy precipitation or uncleanable frozen surfaces they most nearly approach the principle of "all-weather" construction.

3 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 Air Conditions
Roofing System
Peripheral Details (Flashings)
Insulation (if present)
Vapor Barrier (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 is 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.

3.1 BUILT-UP ROOFING

3.1.1 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. In the case of KSR the deck will be the structural base over which the system is 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.

In approving any deck as satisfactory to receive a Koppers roof, only the deck surface is accepted. 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. Koppers will not assume responsibility for deck defects, the affect of deck defects on Koppers roofs, 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 Old Style Pitch, Kopper Bitumen or steep asphalt is used for adhesion, 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.

3.1.2 Conditions of Surface to Receive Roofing

All surfaces must be dry, reasonably smooth, clean, rigid and free from debris, loose materials, projections and holes which might cause rupture of the membrane.

Metal Decks: Decks of this type must also be free from loose rust and oily substances. Deflection should not exceed L/240.

Poured Portland Cement Concrete, Precast Structural Concrete Sections, Poured Gypsum, Lightweight Insulating Concrete: Decks of these types with inclines of one-half (½) inch per foot or more shall permit nailing, or treated nailing strips must be set in the deck and installed prior to roofing. Where insulation is specified, nailing strips may be secured to the deck surface and shall be level with the surface of the insulation. These strips should be spaced not more than three (3) feet apart and placed up and down and not across the slope of the roof. Roof deck shall be properly graded to outlets.

Precast Decks: (concrete, gypsum, wood fiber) Decks of these types, whether grouted or not, shall 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 recommended to assist in leveling uneven joints and bridge the joint openings thus providing a better surface for the roofing materials.

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 shall be a minimum of ½" thickness.

3.1.3 Lightweight Insulating Decks

Lightweight insulating decks include lightweight aggregate concrete (20 to 40 lbs. per cu. ft. oven dry density); foamed concrete, gypsum and thermosetting asphaltic decks. Except for Dycon® Concrete a low water content, closed cell aggregate insulating concrete, all other lightweight insulating deck systems must be capable of venting excess water vapor to the underside. Koppers will not accept these lightweight insulating decks to be placed over vapor barriers, poured concrete substrates, unvented metals, on any type of base which will not permit these materials to vent from the underside. It is necessary to prevent a water vapor pressure build-up under the built-up-roof. Occasional, or spot vents through the roofing as the only venting method are not satisfactory substitutes for underside or continuous vented systems.

In addition, lightweight insulating decks shall have sufficient cohesive strength to provide firm attachment of the roofing to the deck and framing to prevent wind uplift damage or blow-offs. Nailable decks must be capable of developing at the very minimum, a 40 pound nail pull-out or withdrawal strength. If the materials do not achieve this value, additional fasteners will be required over and above those quantities described in the ensuing specification (standard is approximately 100 fasteners per square) to achieve our minimum attachment standard of 30 lb. per square foot. Koppers will not be responsible for failure of the insulating deck to remain integral or for disbonding of the roofing from the surface of the deck.

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.

3.1.4 Roof Slopes

Koppers recommends that Old Style Pitch roofing specification not be used on roof slopes in excess of one (1) inch per foot. For Koppers System Roofs, the maximum slope shall be one-half (½) inch per foot. On slopes for Old Style Pitch roofs one-half (½) inch or more all felts shall be backnailed. However Koppers does permit slopes up to two (2) inches per foot at flashings that incorporate tapered cants and for short run crickets or saddles for drainage provided there is adequate back nailing and these crickets or saddles do not cover more than 15% of the roof area.

3.1.5 Underwriters' Laboratories

Underwriters' Laboratories, Inc. Building Materials Directory, Guide No. (360 018) TFJK—Built-up Roof Covering Materials, has listed Koppers Coal Tar Pitch and tarred felts for use in construction of Classes A and B built-up-roof coverings.

Koppers System Roof (KSR) is also listed as a complete system under Class A designation. This includes Koppers Bitumen, KSR insulation and KSR felts.

Additional References:

Roof Deck Constructions are listed under U.L. Guide No. (360 RO) TGKX.

Roof Deck Construction Materials, such as vapor barriers, insulations and adhesives are listed under U.L. Guide No. (360 R 13), TGYV.

3.1.6 Application of Roofing

All roofing is to be built-up in place with alternate moppings of bitumen and layers of felt over the proper substrate and preliminary work as described or specified in this book under the several sub-heads for various types of deck construction and slope. Application is to be made by experienced workmen in the manner described. The finshed roof is to consist of the number of plies of felt and moppings of bitumen plus top pouring as specified herein. Applicable portions of Koppers precautions for "Food Establishments" apply.

3.1.7 Application of Bitumen

Recommended Weights per 100 sq. ft. (for estimating purposes only)

	Average Interply	Top Coating
Old Style Pitch	25 lbs.	75 lbs.
Koppers Bitumen (KSR)	25 lbs.	75 lbs.
Steep Asphalt	23 lbs.	60 lbs.

Average interply weights are based on long years of experience in good roofing practice, and take into account a reasonable variation in distribution as well as a variation in the amount absorbed in different substrates, and the type of specification. Moppings of bitumen between felts shall be continuous. Felt shall not touch felt. The top pouring is most important, and must be thorough; and must be uniformly covered with specification aggregate embedded in the bitumen while hot.

When solid mopping is not part of the specification and is substituted by strip & spot moppings (sprinkle mopping may be substituted for spot mopping) for installation of vapor barriers, insulation and/or the first ply of the built up roofing, the quantity of bitumen required shall be not less than 10 lbs. per 100 square feet. Strip mopping shall be on 8" centers unless otherwise specified and in one direction.

Recommended Temperature Limitations:

	Temperature °F Heated (max.)	Application (min.)	Application (recom.)
Old Style Pitch	400	300	375
Koppers Bitumen (KSR)	400	300	375
Steep Asphalt	475	350	425

Because Koppers Bitumen (KSR) discharges an extremely small volume of fumes which are only slightly visible at application temperatures, it is necessary to use an accurate thermometer so that the correct temperature will be known.

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 Old Style Pitch and Koppers Bitumen or 425°F for steep asphalt. The kettle should be full. 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 kettle should be shut off.

Prolonged storage in small containers, such as roofing kettles, at temperatures exceeding those detailed above may result in changes in softening point, ductility, and other characteristics which can adversely affect the performance and life of the bitumen.

Old Style Pitch & Koppers Bitumen may be contained in 1000 gallon or greater capacity heated and automatically controlled closed vessel tankers at 375°F for periods, not exceeding 96 hours.

3.1.8 Application of Felt

Plies of felt must be laid shingle fashion, not only because this method produces a stronger membrane, but because it also makes it possible to construct a roof of any desired number of plies in a single progressive operation. 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 uniform mopping of bitumen.

The number of plies are controlled by varying the widths of the edge laps. Three-ply roofing, for example, is achieved by lapping each ply approximately two thirds over the preceding ply; for 4-plies, a lap of approximately three fourths the width is required. Koppers' felts are marked at the factory with lap lines for this purpose. Except as specifically provided for in Koppers specifications, application of felts in a method where two plies are laid over two plies, three plies over one ply, or any combination, other than all plies in shingle fashion, will not be permitted at anytime.

When beginning a membrane roofing installation, appropriate width starting stripe of felt shall be used at the starting point to achieve the specification ply build-up at that point so that successive plies laid shingle fashion 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.

It is advisable on applications of felts on slopes from ½ inch to 1 inch per foot, felts be run with the slope, up and over the ridge of the roof (parallel to the slope line) and each sheet back or blind nailed along the end lap closest to the deck at the high point end of each roll.

Koppers recommends that all felts be backnailed when the slope of the deck is one-half (½) inch per foot or more.

3.1.9 Application of Koppers Glass Fiber Insulation/Roof Base (KSR)

Koppers Glass Fiber Insulation/Roof Base sheets shall be stored with the black side up. For storage the sides of the sheets shall be kept free from exposure to driving rain and snow to prevent excessive moisture pick-up. Sheets shall be stored on platforms above puddles, snow, etc. As used in the Koppers KSR systems the protection required from moisture exposure is not as great as conventional systems.

It is necessary that the edges or perimeters be unsealed for venting the insulation chamber. Ventilated underdeck air spaces are recommended where ceilings are used. It should be noted that the use of ceilings which are insulated will normally require the use of thicker Koppers Glass Fiber Insulation/Roof Base to increase the insulating value and compensate for the lower underside deck temperatures resulting from the insulating value of the ceiling.

Roofing equipment should be rubber (elastomer) tired, free from sharp edges or projections and loaded in a manner to prevent puncture or rupture of the roofing system components applied. Protection, cleaning and repair provisions (such as plywood work and storage areas), must be provided to prevent damage from other trades. Broken or damaged Koppers Glass Fiber Insulation/Roof Base can only be used when the undamaged portion is cut out for application areas where fill-in pieces are required. The end and side joints may be laid in continuous straight lines.

When more than one layer of Koppers Glass Fiber Insulation/Roof Base is used, joints in each layer shall not coincide.

The prime recommended adhesive for installing Koppers Glass Fiber Insulation/Roof Base is Koppers Steep Asphalt. When adhesives other than this are desired they shall comply with Koppers minimum Attachment requirements (Section 3.3.4, page 10). These adhesives shall be applied in accordance with the Specifiers and/or adhesive manufacturers' requirements to achieve proper attachment. However the adhesive must produce a contact point on a minimum of 12" centers with a minimum diameter of one (1) inch contact between the deck and the insulation. For best results the adhesive should be at least ⅛" deep at the contact points.

3.1.10 Application of the Koppers Insulation Base Tape (KSR)

Koppers Insulation Base Tape shall be applied over all of the top joints of the Koppers Glass Fiber Insulation/Roof Base sheets including those at cants, flashings, fascia gravel stops, etc. Where two layers are used, the middle layer must not be stripped at the joints. When applying the Koppers Insulation Base Tape, the Koppers Steep Asphalt used to embed the tape shall be uniformly spread at the prescribed application rate and extend at least 1" on each side of the tape. The tape must be pulled flat to avoid buckles, fishmouths, etc., and thoroughly embedded in the adhesive and surface coated at a rate of 25 lbs. per square. The tape shall be centered on the joint and laid flat without attempt to maintain an exact centerline by causing fishmouths, buckles, etc. If the tape runs off from the centerline of the joint more than two inches, cut the tape, make an end lap and start a new run. End laps shall be a minimum of 2". Where adhesion voids in the taping application appear at the time of application or as water leaks before the final roofing is applied a top glazing with Koppers Steep Asphalt will be a satisfactory means of repair.

Where the Koppers Glass Fiber Insulation substrate is a monolithic poured reinforced Portland Cement Concrete, Koppers Bitumen may be substituted for Koppers Steep Asphalt.

3.1.11 Application of Old Style Pitch or Koppers Bitumen and Aggregate Surface

The final application of the Koppers Specification Roofing is a triple weight application of Old Style Pitch or Koppers Bitumen, 75 lbs./sq., into which is distributed an aggregate of slag or gravel. This aggregate acts as an armor coat against mechanical forces, such as hail, and to deflect the intense radiation of the sun.

The application of the Old Style Pitch or Koppers Bitumen and aggregate must be done at the time the felts are applied; except in periods of hot, dry weather when the top surfacing may be delayed overnight.

When the specifier desires glaze coating and/or all work to be completed the same working day, he shall be responsible to so state this requirement in his specifications.

The aggregate surfacing must be applied into the top pouring while 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.

3.1.12 The Aggregate

The aggregate to be used should meet ASTM Specification D1863-64. The basic requirements for this aggregate are as follows:

Sieve Size	Total Passing, Percent
¾"	100
½"	90-100
⅜"	4-70
No. 4	0-15
No. 8	0-5
Dust, max., percent	0.5
Moisture, max., %	
crushed stone and gravel	0.5
crushed roofing slag	5.0
Unit weight (loose), min. lb. per cu. ft.	60

ASTM D1863-64 covers other properties, such as hardness and includes proper methods for sampling. If any doubt exists, the aggregate supplier should furnish a certified analysis and a certification that the product is produced to conform to ASTM D1863-64.

3.1.13 Cold Weather Application

When roofing is applied at temperatures below 45°F, special precautions must be taken to insure the satisfactory performance of the finished roof. Before applying roofing, the effects of moisture, that is all ice, snow, surface water, etc., must be removed from the deck. Any moisture present at the time the roofing is applied which is not burned off by the heat of the bitumen may result in poor adhesion of the materials and voids in the application.

Hot applied bitumens tend to congeal rapidly in cold weather, even when the deck is dry, so extra care must be taken to set insulation or roofing in as quickly as possible.

Do not heat bitumens above the maximum temperature limit listed above to compensate for rapid chilling. Insulated containers, along with carefully timed material handling methods, must be employed. Whether hand mopping or mechanical distribution equipment is used, lapsed time before contact of felts or aggregate with hot bitumen must be kept to a minimum. In the case of hand mopping, mop no farther than 5 feet in front of felt roll and immediately roll in. Felts should be broomed or pressed in immediately.

3.1.14 Temporary Roofing Old Style Pitch Specifications

Temporary roofing applied for various reasons shall not be considered a part of the permanent built-up roofing. Consult your Koppers representative for recommended specifications over various type decks for temporary roof construction.

3.1.15 Temporary Roofing KSR Specifications

Where it is necessary to cover a building so that the interior is closed in or protected for construction work, the Koppers Glass Fiber Insulation Roof Base stripped with Koppers Insulation Base Tape may be used for this purpose providing the following steps or precautions are taken:

1. Upon completion of the installation of the Koppers Fiber Glass Insulation/Roof Base and Koppers Insulation Base Tape, the Insulation Base Tape shall be covered by a mopping of 25 lbs. per 100 sq. ft. of Koppers adhesive which shall extend at least 2" on each side of the Insulation Base Tape.
2. The temporary roof surface shall be covered with plywood in work areas of other trades and shall be kept clean and free from construction debris.
3. Any accidental damage (leaks) shall be repaired immediately.
4. Any leaks which develop due to inadvertent application discrepancies shall be repaired upon detection. Please note, that occasional discrepancies of this type may be expected as the roof assembly is only partially completed.

Items 2 and 3 are the responsibility of the General Contractor and repairs shall be charged to the contracting party responsible for the damage. Minor repairs shall be made using Koppers Heavy Duty Glass Mesh or GLASFAB® installed in Koppers Steep Asphalt and coated with Koppers Steep Asphalt at a rate of 25 lbs. per square. Where Koppers Glass Fiber Insulation/Roof Base is severely damaged, they shall be removed and replaced.

Do not use the Temporary Roof Procedure for periods exceeding (3) three months. Some water penetration can be expected and valuable interior finish work or interior installations should not be completed during this period of time.

Before proceeding with the installation of the Koppers felts, the base which has been used as a temporary roof must be thoroughly cleaned and allowed to dry.

When temporary roofing is used, all openings and ends of insulation application shall be sealed to eliminate ingress of water into building. At parapet walls, install cant in Koppers Steep Asphalt and cover with Koppers Insulation Base Tape, carrying tape onto wall and insulation surface. Coat surface with Koppers Steep Asphalt.

Note: This system cannot be employed when a vapor barrier is required.

3.1.16 Koppers Steep Roofs

For detailed specifications regarding *steep, smooth surfaced asbestos roofs,* consult your local Koppers representative or contact Koppers Co. in Pittsburgh.

3.2 INSULATION

3.2.1 Board Type Insulations (Old Style Pitch Systems)

These insulations come in varying thicknesses and sizes. The provisions or *manner of attachment which follows in the* various specifications are suggestions only. Should the manner of attachment as suggested, conflict with that specified by the individual insulation manufacture, the insulation manufacturers specifications shall be followed, and in addition, shall be in compliance with Koppers General Requirements.

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 the General Requirements. Work must be scheduled to prevent damage from other trades and equipment. Roofing equipment must be of a type which will not damage the insulation used. Broken or damaged insulation sheets can only be used when the undamaged portion is cut out for application areas where fill-in pieces are required.

If the deck slope is one-half (½) 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. Provision for wood nailers in this fashion will provide both a surface for anchoring of roofing felts which shall be laid perpendicular to the wood nailers as well as an insulation stop. Spacing of nailers must be such that the insulation fits snugly with the nailers but must not be force fitted.

No more insulation shall be laid at any one time than can be protected by pitch and felt in case of sudden weather changes. 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 at least one-half (½) inch clearance.

When more than one (1) layer of insulation is used, joints in each layer shall not coincide. All layers shall be parallel to preceding layers.

3.2.2 Vapor Barrier

Vapor barriers 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 barrier, when installed, provide a continuous seal, including ventilators, skylights, peripheral walls, and other terminations from the source of the water vapor. Ventilation provisions of the insulation chamber, when a vapor barrier is used, are dictated by the heat flow cycle and climatology of the building. Generally a building with a preponderant heat flow-up cycle should have an insulation chamber ventilated to the exterior. A building with a *preponderant heat flow down cycle in a* humid area, should not be ventilated to the exterior if the dew point can be reached above the deck and in the insulation chamber.

Alternate vapor barrier systems to those described on the specification pages are as follows and offered for assistance and reference:

a. Vinyl Type

Fire resistant adhesive and vinyl-type vapor barrier as listed by and applied as specified by Underwriters' Laboratories, Inc., and Factory Mutual may be used. Adequate adhesion of the vapor barrier to the deck and adhesion of the insulation to the vapor barrier for securing the entire system against wind uplift and movement, must be attained. (See Section 3.3.4. Attachments page 9)

Note: When installing *insulation* over vinyl-type vapor barrier apply approved adhesive over the approved vapor barrier in ribbons at the rate specified by U.L. and F.M.

b. Kraft Type

Fire retardant kraft lamination type vapor barriers, applied with Steep Asphalt as listed by and applied as specified by Factory Mutual may be used. Adequate adhesion of vapor barrier to the deck and adhesion of insulation to the vapor barrier for securing the entire system against wind uplift and movement, must be attained. (See Section 3.3.4 Attachments page 9)

Note: This system is rated for insurance purposes by Factory Mutual only.

Care must be exercised so that the vapor barrier is not ruptured during installation. This is particularly true in areas over the flutes of the steel deck.

3.2.3 Water Stops (Temporary Protection)

Water stops consisting of two (2) plies of tarred felt and moppings of Old Style Pitch for flat roofs or asphalt felt and asphalt for steep roofs extending onto the deck at least six (6) inches and four (4) inches on top of the insulation, shall be applied at the end of each day's work over exposed edges of insulation.

Water stops shall be continuous and tight.

In the KSR system, the Koppers Glass Fiber Insulation/Roof Base may be sealed off with a ply of Insulation Base Tape set in Koppers Steep Asphalt along the edge and covered with Koppers Steep Asphalt.

These temporary protective measures *must* be removed cleanly when work is resumed to prevent blocking moisture vapor movement to vented edge details.

3.2.4 Cut-offs (Permanent Installation)

Venting of roof insulation at walls, curbs, eaves, etc., is recommended for all but a few special 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.

3.3 OTHER REQUIREMENTS

3.3.1 Materials Protection

Roll roofing materials and insulation should be stored indoors if possible, otherwise it shall be protected by raised platforms and covered with suitable weatherproof protective coverings such as tarpaulins, plastic sheeting, etc.

3.3.2 Wood Nailing Strips

All non-nailable decks require wood nailing strips at eaves, edges, walls, roof openings, etc. for proper securing 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 decks having a slope of one-half (½) inch per foot or more must be back nailed and therefore non-nailable decks must be furnished with treated wood nailing strips. Wood nailers, installed on or in non-nailable decks for slopes one-half (½) inch per foot or more or when insulation is required of a non-nailable type, shall be run in the direction perpendicular to the direction in which the felts are to be laid.

Nailers should be treated to preserve their condition and hence their nail retentive power for the expected life of the roofing. Creosote or oil born preservatives may affect the roofing they contact and should not be used. Nailers should be pressure treated with a water born preservative such as Wolman salts or with pents applied in a liquified petroleum gas carrier such as the Cellon® Process.

3.3.3. Cold Storage & Freezer Buildings

Koppers will not bond its roofing over these structures if insulation, or insulation and vapor barrier is installed over the deck and unless there is an adequately ventilated air space between the deck and insulated refrigerated area.

For procedures on non-bonded roofing applications, consult your local Koppers representative or Koppers Co. in Pittsburgh.

3.3.4 Attachment

Maximum adhesion or secure attachment of all components in the roofing assembly is necessary to satisfactory long-term performance of the roofing membrane. For proper adhesion of all roof components, Koppers suggests that the adhesive and fasteners, in the quantities specified by the manufacturer, be capable of passing a minimum uplift resistance of 30 pounds per square foot (psf). This uplift resistance translates into adequate lateral attachment of the built-up-roofing system.

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.

Solid mopping has been found to provide an uplift resistance in excess of 120 psf.

Strip mopping, as suggested in the specifications in this manual, has been found to provide an uplift resistance in excess of 60 psf.

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

The following are the names of some manufacturers who provide nail and/or fastening devices for use with built-up roofing:

E/S Products, Inc., New Rochelle, New York
Simplex Nail & Manufacturing Corp., Americus, Ga.
Independent Nail Corp., Bridgewater, Mass.
Wheeling Steel Corp., Wheeling, W. Va.
E. G. Building Fastener Corp., New York, N. Y.

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

For further information contact your local Koppers representative.

3.3.5 Base Sheet Alternate

Koppers Asphalt Coated Base Sheet (ASTM D-2626) may be substituted for the first ply (plies) of the Old Style Pitch System roofing specification. It is not permitted with the Koppers System Roof specifications.

When substituted for the first ply in a solid mop application specification it shall be embedded in a solid mopping of Koppers Steep Asphalt followed by thorough brooming to eliminate air pockets, wrinkles, fish mouths, buckles, etc. The remaining two (2) or three (3) plies shall be solid mopping with Old Style Pitch in accordance with the specification.

When substituted in a nailing application specification it shall be used in lieu of the two nailed No. 15 tarred felts. 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 four (4) inches and end laps shall be six (6) inches. The nailing pattern for the Base sheet shall be on nine (9) inch centers two (2) inches from the edge lap and down the center of each sheet on nine (9) inch centers. (Note: This is approximately 100 nails.)

When specifying the Base Sheet alternate use the designation bs as a subscript to the specification number. For example when substituting base sheet in a roofing specification over Metal Deck—designate as 17 wibs.

3.3.6 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 the roof structure system, should be taken into consideration at the time of original building design.

Although provisions for adequate expansion joints are the responsibility of the building designer, Koppers offers the following recommendations 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 large roof areas at least 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 for continuation 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 the steady state temperature and humidity condition at all times as holiday shut-downs can fracture the roofing, due to the movement of system resulting from temperature/humidity variation.
3. If the occupancy is fairly large, the sudden entrance on a rainy day of many rain-soaked employees may cause moisture movement in the roof structure system which can fracture the roofing.

3.3.7 Notice:

This roofing specification manual contains the latest and best available information as derived from Koppers long experience in the roofing industry. 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 for long, trouble-free service. Responsibility, however, for design of any roofing system, remains with the architect or engineer and building owner. The contents of this manual are subject to change at the discretion of Koppers Company as future developments and experience are achieved.

deck construction:

4.1 Wood Plank/ Plywood

SLOPE • See Section 3.1.4, pg. 5
SURFACE • Aggregate

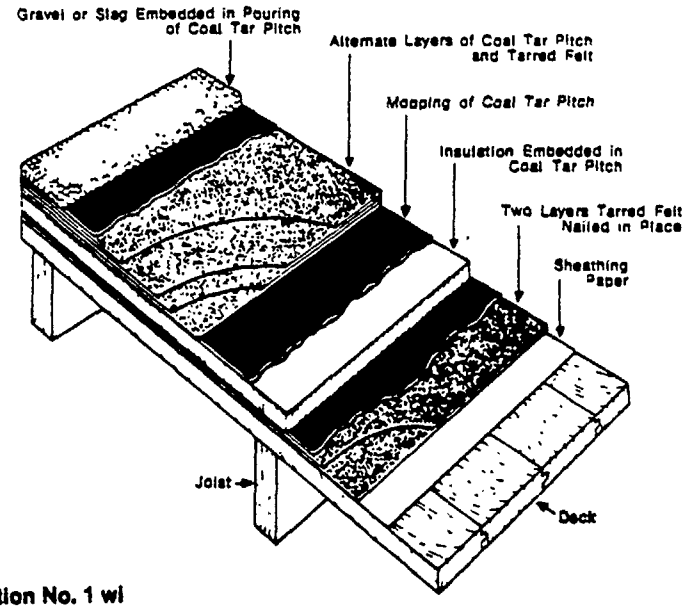
For recommendations on wood and wood treatment, contact: Koppers Company Inc., Forest Products Division, Lumber Sales Dept., 750 Koppers Bldg., Pittsburgh, Pa. 15219

Spec. No. 1—5 ply
Spec. No. 2—4 ply

Spec. No. 1 wi—4 ply
Spec. No. 2 wi—3 ply
board type insulation

Spec. No. 1 wiv—4 ply
Spec. No. 2 wiv—3 ply
board type insulation and vapor barrier

Treated wood should be used where a vapor barrier is required, see Sec. 3.2.2. Page 8.



Detail of Specification No. 1 wi

Hot Coal Tar Pitch 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 practice demands the cushioning and blotting affect of a layer of sheathing paper followed by layers of dry felt. Shiplap and square edge boards should be avoided where possible. If the underside of the roof deck is exposed to air pressure created from open doors or windoors, tongue-and-grooved lumber should be used.

PROCEDURE

Select clauses as required. *Optional clauses in italic.*

Color denotes built-up roofing specification

Condition of Surface to Receive Roofing

See Section 3.1.2. Page 5.

Material Quantity Requirements

See Section 3.1.7. Page 6.

Preparation Below Insulation

1. 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.

2. Two full thicknesses of Tarred Felt shall be laid over the entire surface, lapping each sheet nineteen (19) inches over the preceding sheet and nailing the sheets in place.

Application of Vapor Barrier Below Insulation

Note: When vapor barrier is required, use these procedures in addition to **Preparation Below Insulation** noted above.

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

For other types of vapor barriers see Section 3.2.2. Page 8.

Application of Insulation

1. Mop the entire surface with a uniform coating of Old Style Pitch into which, while hot, firmly embed the insulation. When roofs have an incline of from two (2) inches to six (6) inches per foot, use Steep Roofing Asphalt.

For application of roofing materials over insulation follow Application of Roofing Materials procedure in Section 4.2. Page 11

Application of Roofing Materials Directly on Wood

1st. Lay one ply of rosin sized or other approved sheathing paper weighing not less than five (5) lbs. per 100 square feet lapping each sheet two (2) inches and nail sufficiently to hold in place.

2nd. Spec. No. 1 Spec. No. 2

Install two (2) plies of tarred felts over entire surface lapped nineteen (19) inches. Nail on eight and one-half (8½) inch centers one (1) inch from edge lap. Note. This is approximately 100 nails per 100 sq. ft. Nail shanks are to be of required length for maximum withholding power.

For Base Sheet alternate see Section 3.3.5 Page 9.

3rd. Spec. No. 1

Apply three (3) plies of Koppers Approved Tarred Felt lapping plies twenty-four and two-thirds (24⅔) inches. Where slope of deck is one-half inch per foot or more, nail each sheet of felt six (6) inches from the back edge of twenty-four (24) inch centers. All laps shall be mopped with pitch the full twenty-four and two-thirds (24⅔) inches, so that in no place shall felt touch felt.

3rd. Spec. No. 2

Apply two (2) plies of Koppers Approved Tarred Felt, lapping plies nineteen (19) inches. Where slope of deck is one-half (½) inch per foot or more, nail each sheet six (6) inches from the back edge on twenty-four (24) inch centers. All laps shall be mopped with pitch the full nineteen (19) inches so that in no place shall felt touch felt.

4th. Pour over the entire surface of the roofing membrane a uniform coating of Old Style Pitch into which, 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.

General Requirements on pages 5 through 9 and Detailed Specifications on pages 20 through 25 are a part of this specification and must be adhered to where applicable.

deck construction:

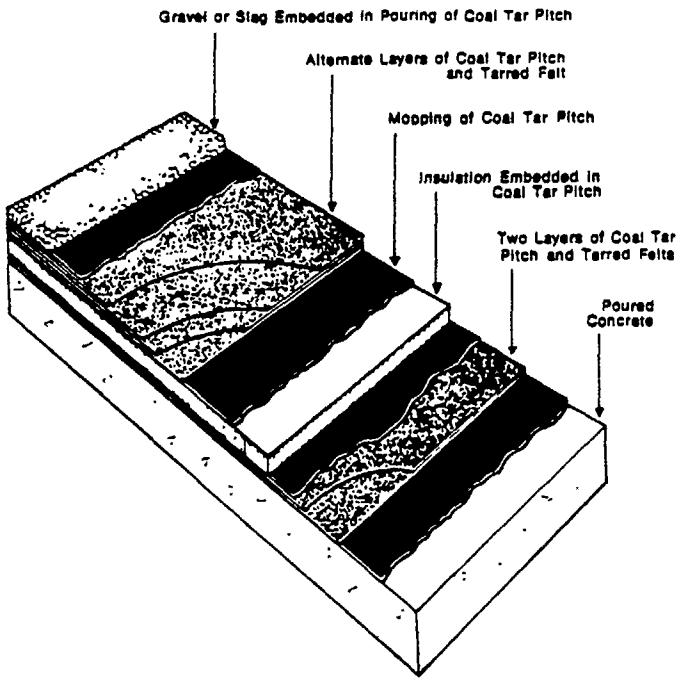
4.2 Poured Portland Cement Concrete

SLOPE • See Section 3.1.4, pg. 5
SURFACE • Aggregate

Spec. No. 5—4 ply
Spec. No. 7—3 ply

Spec. No. 5 wi—4 ply
Spec. No. 7 wi—3 ply
board type insulation

Spec. No. 5 wiv—4 ply
Spec. No. 7 wiv—3 ply
board type insulation and vapor barrier



Detail of Specification No. 5 wiv

Poured concrete decks sometimes cause trouble because the built-up roofing is laid before the deck is thoroughly dry—such as might happen when the general contractor is anxious to get the building under cover and so urges the roofing contractor to begin work shortly after the deck has been poured. When this happens the result is a blistered and buckled membrane or, just as serious, insulation curls and makes an unsatisfactory job. The roofing contractor, backed by the architect, should insist on a thoroughly dry deck before beginning work. He should also see to it that the deck is free of loose sand, frozen scale and other foreign matter. Projections should be removed, low points filled with cement grout or other suitable material, and all cracks pointed up.

PROCEDURE

Select clauses as required. *Optional clauses in italic.*

Copy in color denotes built-up roofing specification

Condition of Surface to Receive Roofing

See Section 3.1.2, Page 5.

Material Quantity Requirements

See Section 3.1.7, Page 6.

Application of Vapor Barrier Below Insulation

1. Apply a uniform coating of Old Style Pitch to the deck.

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

3. Extend all plies of felt up vertical surfaces and cut off at height of insulation.

For other types of vapor barriers see Section 3.2.2, Page 8.

Application of Insulation

Apply a uniform coating of Old Style Pitch over the entire surface into which, while hot, embed the insulation. If there are two (2) layers of insulation mop the entire surface of the first layer with Old Style Pitch into which, while hot, embed the second layer of insulation.

Application of Roofing Materials

1st. Mop deck or insulation—as applicable—completely with Old Style Pitch.

2nd. Spec. No. 5

Apply over the entire surface four (4) plies of Koppers Approved Tarred Felt, lapping plies twenty-seven and one-half (27½) inches. Mop solidly between each 27½ inch lap with Old Style Pitch so that in no place shall felt touch felt.

2nd. Spec. No. 7

Apply over the entire surface three (3) plies of Koppers Approved Tarred Felt, lapping plies twenty-four and two-thirds (24⅔) inches. Mop solidly between each 24⅔ inch lap with Old Style Pitch so that in no place shall felt touch felt.

For base sheet alternate see Section 3.3.5, Page 9.

Where slope of deck is one-half inch per foot or more and deck permits nailing, nail along back or upper edge of each sheet on twenty-four (24) inch centers. Where deck does not permit nailing, nailing strips are required and each sheet nailed along back or upper edge at spacings to assure penetration of nailers.

3rd. Pour over the entire surface of the roofing membrane a uniform coating of Old Style Pitch into which, 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.

General Requirements on pages 5 through 9 and Detailed Specifications on pages 20 through 25 are a part of this specification and must be adhered to where applicable.

deck construction:

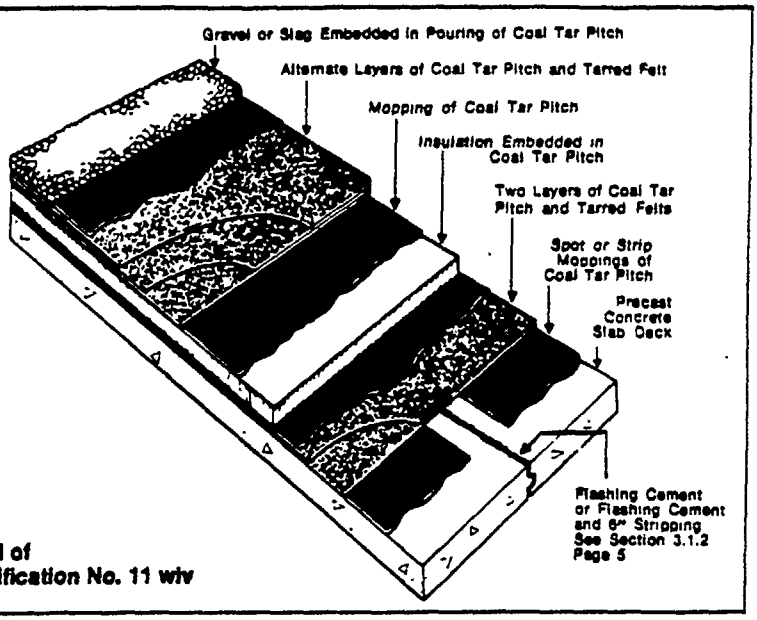
4.3 Precast Structural Concrete Sections

SLOPE • See Section 3.1.4, pg. 5
SURFACE • Aggregate

Spec. No. 10—4 ply
Spec. No. 11—3 ply

Spec. No. 10 wi—4 ply
Spec. No. 11 wi—3 ply
board type insulation

Spec. No. 10 wiv—4 ply
Spec. No. 11 wiv—3 ply
board type insulation and vapor barrier



Detail of Specification No. 11 wiv

Precast concrete structural sections demand the same recommendations as poured concrete decks, although the presence of moisture, due to insufficient drying time, is not 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. Low areas should not be filled with open-cell aggregate for it traps air and moisture, causing it to expand and crack when covered and badly blistering a built-up roofing surface. All joints, grouted or not, should be caulked with trowel-grade asphaltic plastic cement. Slab sides and ends should be square, rest firmly and evenly on supporting members, and be installed to prevent lateral and vertical movement.

PROCEDURE

Select clauses as required. *Optional clauses in italic.*

Copy in color denotes built-up roofing specification

Condition of Surface to Receive Roofing

See Section 3.1.2, Page 5.

Material Quantity Requirements

See Section 3.1.7, Page 6.

Application of Vapor Barrier Below Insulation

1. On precast concrete slab or tile deck, strip mop with Old Style Pitch up to four (4) inches from the edge of each joint. Not less than 30% of the surface must be mopped, at a min. rate of 10 lbs. per 100 square feet.

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

3. Extend all plies of felt up vertical surfaces and cut off at height of insulation.

For other types of vapor barriers see Section 3.2.2, Page 8.

Application of Insulation:

Over Vapor Barrier. Apply a uniform coating of Old Style Pitch over the entire surface into which, while hot, embed the insulation. **If there are two (2) layers of insulation (e.g. as required for pre-stressed concrete sections) mop the entire surface of the first layer with Old Style Pitch into which, while hot, embed the second layer of insulation.**

Over Deck. On precast concrete slab or tile deck, strip mop with Old Style Pitch up to four (4) inches from the edge of each joint. Not less than 30% of the surface must be mopped, at a minimum of 10 lbs. per 100 square feet. While hot, embed the insulation. If there are two (2) layers of insulation (e.g. as required for pre-stressed concrete sections) mop the entire surface of the first layer with Old Style Pitch into which, while hot, embed the second layer of insulation.

For application of roofing materials over insulation follow Application of Roofing Materials procedure in Section 4.2, Page 11.

Application of Roofing Materials

1st. Each slab shall be spot or strip mopped with Old Style Pitch, keeping pitch moppings back at least four (4) inches from all edges of each slab joint. Not less than 30% of the surface must be mopped. When applying over insulation, mop insulation completely with Old Style Pitch.

2nd. Spec. No. 10

Apply over the entire surface four (4) plies of Koppers Approved Tarred Felt, lapping plies twenty-seven and one-half (27½) inches. Mop solidly between each 27½ inch lap with Old Style Pitch so that in no place shall felt touch felt.

2nd. Spec. No. 11

Apply over the entire surface three (3) plies of Koppers Approved Tarred Felt lapping plies twenty-four and two-thirds (24⅔) inches. Mop solidly between the 24⅔-inch lap with Old Style Pitch so that in no place shall felt touch felt.

For base sheet alternate see Section 3.3.5, Page 9.

Where slope of deck is one-half (½) inch per foot or more and deck permits nailing, nail along back or upper edge of each sheet on a maximum of twenty-four (24) inch centers. Where deck does not permit nailing, nailing strips shall be installed and each sheet nailed along back or upper edge at spacings to assure penetration of nailers.

3rd. Pour over the entire surface of the roofing membrane a uniform coating of Old Style Pitch into which, 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.

General Requirements on pages 5 through 9 and Detailed Specifications on pages 20 through 25 are a part of this specification and must be adhered to where applicable.

deck construction:

4.4 Poured Gypsum (Precast Gypsum)

Lightweight Insulating Concrete

SLOPE • See Section 3.1.4, pg. 5
SURFACE • Aggregate

Spec. No. 12—5 ply
Spec. No. 13—4 ply

Spec. No. 12 wi—4 ply
Spec. No. 13 wi—3 ply
board type insulation

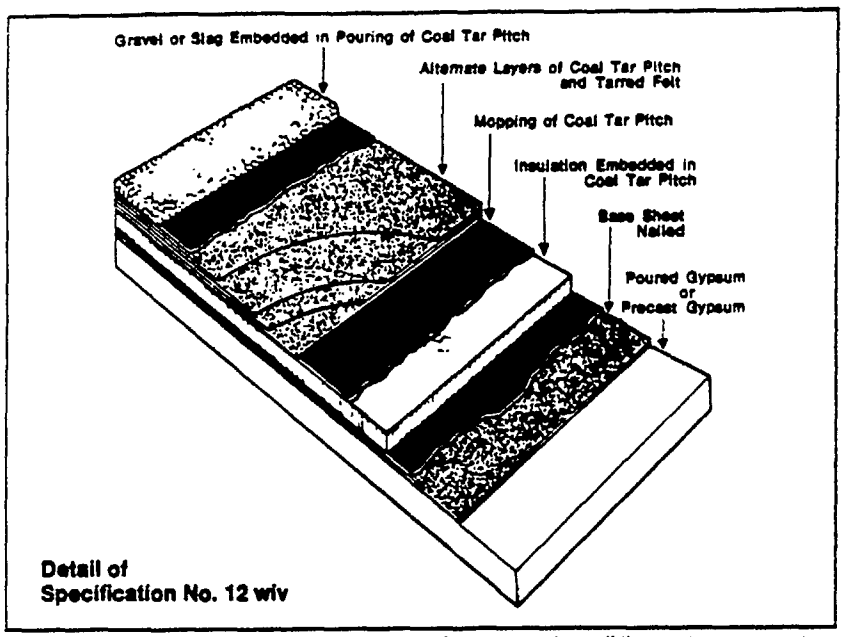
Spec. No. 12 wiv—4 ply
Spec. No. 13 wiv—3 ply
board type insulation and vapor barrier

See Page 5 for Lightweight Insulating Decks Section 3.1.3.

Thermosetting Asphaltic Concrete:

Base sheet must be used as first ply—see Section 3.3.5, page 9.

Use application procedures as described in Section 4.2, page 11.



Detail of Specification No. 12 wiv

The same recommendations applying to precast concrete slabs apply to precast gypsum slabs and gypsum metal bound planks. All uneven slabs should be reset or leveled off so that the roof will be laid on a flat and even surface, free from projections and low areas. Because these slabs are precast, the possibility of a high moisture content being present is more remote than in the poured gypsum deck.

Poured gypsum decks sometimes cause trouble because the built-up roofing is laid before the deck is thoroughly dry—such as might happen when the general contractor is anxious to get the building under cover and so urges the roofing contractor to begin work shortly after the deck has been poured. When this happens the result is a blistered and buckled membrance or, just as serious, insulation curls and makes an unsatisfactory job. The roofing contractor, backed by the architect, should insist on a thoroughly dry deck before beginning work. He should also see to it that the deck is free of loose sand, frozen scale and other foreign matter. Projections should be removed, low points filled with cement grout or other suitable material, and all cracks pointed up.

Select clauses as required. *Optional clauses in italic.*

Copy in color denotes built-up roofing specification

Condition of Surface to Receive Roofing

See Section 3.1.2, Page 5.

Material Quantity Requirements

See Section 3.1.7, Page 5.

Application of Membrane Below 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 down center of each sheet on nine (9) inch centers.

2. Extend plies up vertical surfaces and cut off at height of insulation.

For vapor provisions contact your local Koppers Representative.

Application of Insulation Over Membrane (or Deck)

Apply a uniform coating of Old Style Pitch over the entire surface into which, while hot, embed the insulation. If there are two (2) layers of insulation mop the entire surface of the first layer with Old Style Pitch into which, while hot, embed the second layer of insulation.

For application of roofing materials over insulation follow Application of Roofing Materials procedure in Section 4.2 Page 11.

Application of Roofing Materials to Deck

1st. Install two (2) plies of tarred felt over entire surface lapped nineteen (19) inches with approved nails. Nail on eight and one-half (8½) centers one (1) inch from edge lap. (Note: This is approximately 100 nails per 100 sq. ft.).

Where lightweight insulating concrete cannot be nailed, apply the first ply of felt with spot or straddle mopping using not less than 10 lbs. per square of pitch and on not less than 8" centers.

Alternate: *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 down center of each sheet on nine (9) inch centers.*

2nd. Spec. No. 12

Apply three (3) plies of Koppers Approved Tarred Felt, lapping plies twenty-four and two-thirds (24⅔) inches. Where slope of deck is one-half (½) inch per foot or more, nail each sheet of felt six

PROCEDURE

[illegible] apply from the low edge of [illegible] twenty-four (24) inch centers. All laps shall be mopped with pitch [illegible] and [illegible] twenty-four (24⅔) inches [illegible] type [illegible] specified.

2nd. Spec. No. 13

Apply [illegible] ply of Koppers Approved Tarred Felt, lapping each sheet eighteen (18) inches. [illegible] sheet four (4) inches over preceding sheet and nailing at lap no less than nine (9) inches and down center of each sheet on nine (9) inch centers. All laps shall be mopped with pitch [illegible] eighteen (18) inches to [illegible] felt to felt.

3rd. Pour over the entire [illegible] roofing membrane a uniform [illegible] Pitch [illegible] and embed [illegible] coating [illegible] gallons of pitch per square [illegible] square feet.

General Requirements on pages 5 through 9 and Detailed Specifications on pages 20 through 25 are a part of this specification and must be adhered to where applicable.

deck construction:

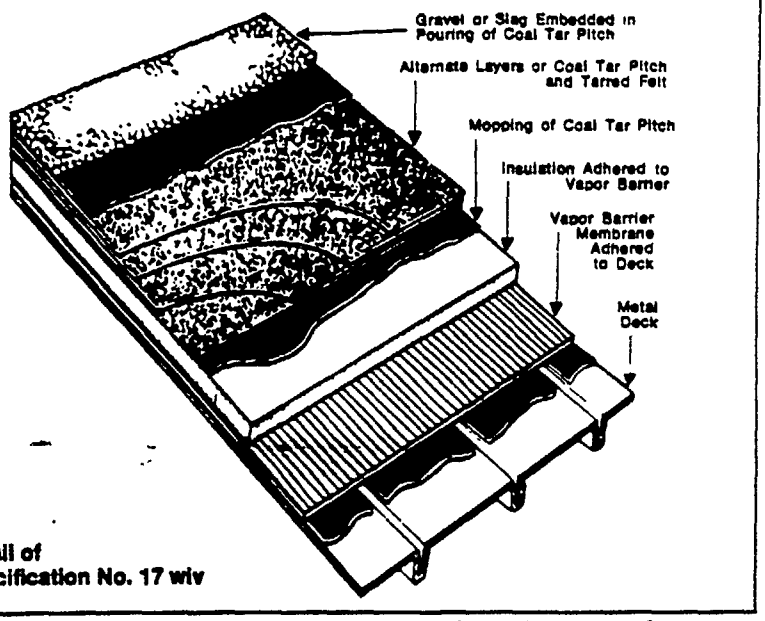
4.5 Metal Decks (Insulation Required)

SLOPE • See Section 3.1.4, pg. 5
SURFACE • Aggregate

Spec. No. 17 wi—4 ply
Spec. No. 18 wi—3 ply
board type insulation

Spec. No. 17 wiv—4 ply
Spec. No. 18 wiv—3 ply
board type insulation and vapor barrier

See Page 5 for Lightweight Insulating Decks Section 3.1.3.



Detail of Specification No. 17 wiv

It is absolutely necessary to install insulation on a metal deck before the built-up roofing is applied.

A metal deck must be clean, smooth, and properly anchored to the steel purlins and all joints correctly lapped and fastened.

Type of metal deck, flute opening and various other factors determine the type and thickness of insulation required. Consult your Koppers representative for recommendations.

Metal 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 roof traffic conditions including mechanical equipment used for roof application.

PROCEDURE

Select clauses as required. *Optional clauses in italic.*

Copy in color denotes built-up roofing specification

Condition of Surface to Receive Roofing

See Section 3.1.2, Page 5.

Material Quantity Requirements

See Section 3.1.7, Page 6.

Application of Vapor Barrier Below Insulation

A. Felt Type

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 all felt up vertical surfaces and cutoff at height of insulation.

For other types of vapor barriers see Section 3.2.2, Page 8.

Application of Insulation and Roofing Materials

1st a. Install insulation in steep asphalt applied to deck at rate of 12 to 15 lbs. per 100 sq. ft. and place insulation while steep asphalt is still molten to provide good adhesion. See Attachment Section 3.3.4, Page 9.

b. If slope of deck is one-half (½) inch per foot or more, insulation must be able to retain nails and, in addition to being set in steep asphalt, insulation must be fastened to the metal deck with approved mechanical fasteners placed at all four (4) corners and the center of each sheet. If two layers of insulation are specified, top layer joints shall not coincide with joints of bottom layer. Fasteners shall be driven after the top layer of insulation is installed.

c. If U.L. and F.M. requirements are a factor for insurance rating, insulation must be listed and approved in accordance with their current data.

2nd. Mop a uniform coating of Old Style Pitch over the insulation preceding the application of roofing membrane.

3rd. Spec. No. 17 wi

Apply over the entire surface, four (4) plies of Koppers Approved Tarred Felt, lapping plies twenty-seven and one-half (27½) inches.

Mop solidly between each 27½ inch lap with Old Style Pitch so that in no place shall felt touch felt.

3rd. Spec. No. 18 wi

Apply over the entire surface, three (3) plies of Koppers Approved Tarred Felt, lapping plies twenty-four and two-thirds (24⅔) inches.

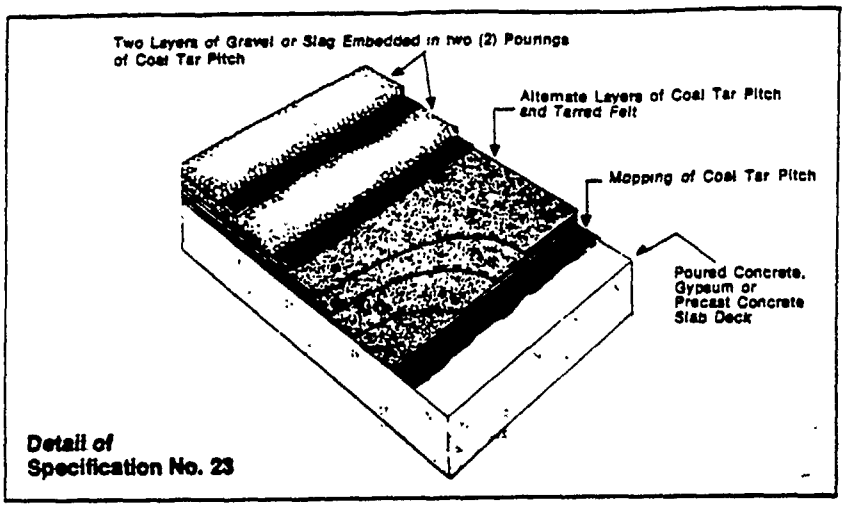
Mop solidly between each 24⅔ inch lap with Old Style Pitch so that in no place shall felt touch felt.

If slope of roof is one-half (½) inch per foot or more, each ply of felt shall be nailed along the back or upper edge on twenty-four (24) inch centers. If base sheet alternate is used, each ply of base sheet shall be nailed two (2) inches from the back or upper edge on twenty-four (24) inch centers.

4th. Pour over the entire surface of the roofing membrane a uniform coating of Old Style Pitch into which, 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.

For base sheet alternate see Section 3.3.5, Page 9.

General Requirements on pages 5 through 9 and Detailed Specifications on pages 20 through 25 are a part of this specification and must be adhered to where applicable.



Detail of Specification No. 23

Water Cooled Roof

Water is designed to be contained on the roof at all times at a constant level by means of a drainage system and a water source. (See note on cold weather conditions.) Water Cooled Roofs also include spray pond roofs where the roof is constantly sprayed with water but not necessarily kept at a constant level. Water Cooled Roofs should be applied over poured concrete, gypsum or pre-cast concrete decks.

It is mandatory that the water cooling system be closed down and the roof drained prior to cold weather. Neither roofing nor the structure will withstand the expansion caused by ice formation.

Water Retaining Roofs

Process Water: Water from manufacturing process, cooling towers, etc., that regularly deliver water across the roof for normal drainage.

Retarded Drainage Ponding: Drains are sized to deliver a controlled amount of water to the storm system and thus regularly necessitate heavy water ponding.

deck construction: Poured Concrete
- Poured Gypsum
- Precast Concrete

4.6 Water Cooled Roofs Water Retaining Roofs

SLOPE • See Section 3.1.4, pg. 5
SURFACE • Double Aggregate (with double pour)

Spec. No. 23—4 ply—on deck
Spec. No. 24—3 ply—on deck

Spec. No. 23 wi—4 ply
Spec. No. 24 wi—3 ply
board type insulation

Spec. No. 23 wiv—4 ply
Spec. No. 24 wiv—3 ply
board type insulation and vapor barrier

NOTE: The base sheet alternate Section 3.3.5 shall not be used.

PROCEDURE

Select clauses as required. *Optional clauses in italic.*

Copy in color denotes built-up roofing specification

Condition of Surface to Receive Roofing

See Section 3.1.2, Page 5.

Material Quantity Requirements

See Section 3.1.7, Page 6.

Application of Built-up Roofing

1st. Mop deck completely with Old Style Pitch

2nd. **Spec. No. 23**

Apply over the entire surface four (4) plies of Koppers Approved Tarred Felt, lapping plies twenty-seven and one-half (27½) inches. Mop solidly between each 27½ inch lap with Old Style Pitch so that in no place shall felt touch felt.

2nd. Spec. No. 24

Apply over the entire surface three (3) plies of Koppers Approved Tarred Felt, lapping plies twenty-four and two-thirds (24⅔) inches. Mop solidly between each (24⅔) inch lap with Old Style Pitch so that in no place shall felt touch felt.

All felt shall be turned up not less than four (4) inches at vertical surfaces.

3rd. Pour over the entire surface of the roofing membrane a uniform coating of Old Style Pitch into which, 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.

If slope of roof is one-half (½) inch per foot or more, each ply of felt shall be nailed along the back or upper edge on twenty-four (24) inch centers.

4th. All loose gravel or slag shall be swept from surface and a second uniform pouring of approximately eighty-five (85) pounds of Old Style Pitch 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.

Note:

a. At points where water pressure from the spray 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.

b. Insulation under a Water Cooled Roof should be of a type which is rigid, dimensionally stable with high compressive strength and of a sealed cellular structure such as Foamglas.®

c. At all points where roofing membrane meets a vertical surface the flashing specifications used shall be as follows:

Water Cooled Roofs—Koppers Flashing Specification No. 110 *only* shall be used. See Pg. 21.

Water Retaining Roofs—Either Koppers Flashing Specifications No. 108 or No. 110 shall be used. See pg. 21.

d. Insulation and vapor barrier, if used, shall be applied according to procedures found in basic specifications 5 & 7 (Pg. 11), 10 & 11 (Pg. 12), 12 & 13 (Pg. 13).

e. Specifications 23 and 24 may be applied over wood deck (Pg. 10) or metal decks (Pg. 14) *only* if used as Water Retaining Roofs. Insulation and vapor barrier, if used shall be applied according to procedures found with these specifications.

f. Roof Structure design live loads for specifications 23 and 24 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. Vapor barriers must be two ply, solid mopped. Use steep asphalt over metal decks. Wood must be treated to prevent warping (see Section 3.3.2 Page 8).

General Requirements on pages 5 through 9 and Detailed Specifications on pages 20 through 25 are a part of this specification and must be adhered to where applicable.

deck construction:

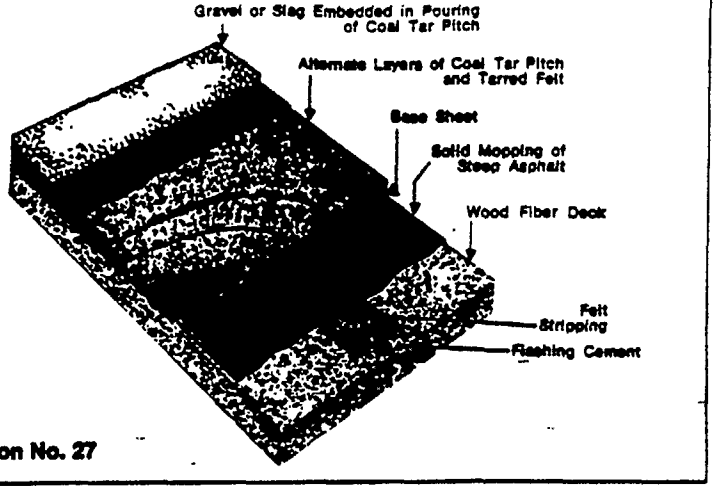
4.7 Wood Fiber

SLOPE • See Section 3.1.4, pg. 5
SURFACE • Aggregate

Spec. No. 27—4 ply
Spec. No. 28—3 ply

Spec. No. 27 wi—4 ply
Spec. No. 28 wi—3 ply
board type insulation

Spec. No. 27 wiv—4 ply
Spec. No. 28 wiv—3 ply
board type insulation and vapor barrier



Detail of Specification No. 27

All decking must be installed in strict accordance with the particular deck manufacturer's recommendations for installation. 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.

PROCEDURE

Select clauses as required. *Optional clauses in italic.*

[illegible] deck for built-up roofing [illegible]

Condition of Surface to Receive Roofing

See Section 3.1.2, Page 5.

Material Quantity Requirements

See Section 3.1.7, Page 6.

Application of Roofing Materials

1st. [illegible] one (1) ply of Koppers approved coated base sheet over entire surface [illegible] mopping of Type III Steep Asphalt so that base sheet shall not touch surface. Form, prism or press entire surface of base sheet into hot steep asphalt [illegible] to prevent wrinkles, buckles or fishmouths. Minimum side laps shall be four (4) inches and minimum end laps shall be six (6) inches. Laps shall be nonstaggered. Sealed the [illegible] width of the lap.

ALTERNATE: As an alternate to mopping [illegible] base sheet, nail base sheet to deck [illegible] inches maximum on center to form a lap. Then lay one (1) ply of Koppers coated base sheet over and into hot steep asphalt [illegible] inches and nail along center of lap not less than nine (9) inches on center into the center of each sheet on nine (9) inch centers with approved galvanized roofing nails or fasteners as recommended by the Structural Wood Fiber Products Association or by the designer such as Simplex Tube-Lok nails.

For nailed roofing applications the base sheet other than Tube-Lok nails must be acceptable to Factory Mutuals and be approved at the minimum rate of one (1) per square foot as recommended by the Structural Wood Fiber Products Association.

2nd. Spec. No. 27

Apply three (3) plies of Koppers Approved Tarred Felt lapping plies twenty-four and two-thirds (24⅔) inches. Where slope of deck is one-half (½) inch per foot or more, nail each sheet of felt six (6) inches from the back edge on twenty-four (24) inch centers. All laps shall be mopped with pitch the full twenty-four and two-thirds (24⅔) inches, so that in no place shall felt touch felt.

2nd. Spec. No. 28

Apply two (2) plies of Koppers Approved Tarred Felt lapping plies nineteen (19) inches. Where slope of deck is one-half (½) inch per foot or more, nail each sheet six (6) inches from the back edge on twenty-four (24) inch centers. All laps shall be mopped with pitch the full nineteen (19) inches so that in no place shall felt touch felt.

3rd. Apply over the entire surface of the roofing membrane a uniform coating of Type III Steep Asphalt [illegible] not [illegible] less than four hundred (400) pounds of asbestos or three hundred (300) pounds of slag for each one hundred (100) square feet.

Insulation and Vapor Barrier

1. Insulation without vapor barrier. Install insulation in Type III steep asphalt in conformance with 1st paragraph. Nailable insulation not exceeding one (1) inch thick may be installed using 1¾ inch Simplex Tube-Lok nails at all four corners and at center of board. Installation of roofing over insulation shall be as per specification outlined above with base sheet mopped solidly to the insulation in steep asphalt.

2. Insulation with vapor barrier. Install two (2) plies of No. 15 asphalt felt lapped nineteen (19) inches in Type III steep asphalt as per 1st paragraph of this specification. Both plies shall be mopped solidly so that in no place shall felt touch felt. Install insulation in solid mopping of steep asphalt. Roofing over insulation is to be in accordance with the details of the specification above with base sheet mopped solidly to the insulation.

General Requirements on pages 5 through 9 and Detailed Specifications on pages 20 through 25 are a part of this specification and must be adhered to where applicable.

5 Koppers System Roof

ONE SOURCE RESPONSIBILITY

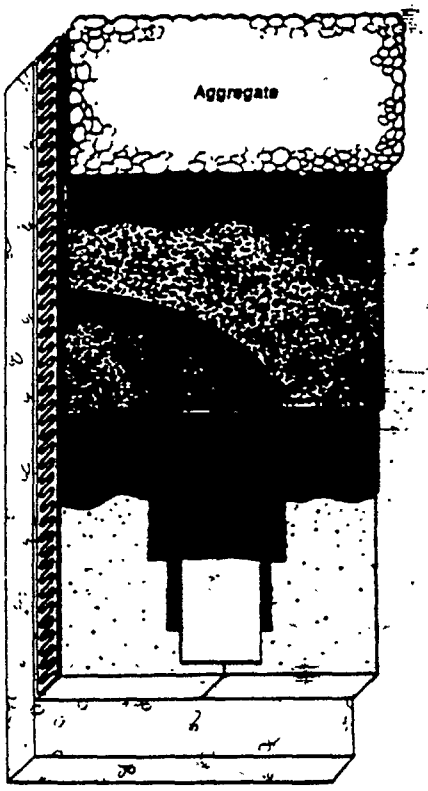
With the new Koppers System Roof all you need is the deck. Koppers provides everything else. The result is an efficient installation of a long-lasting roof. And with Koppers having sole responsibility for all materials, your headaches of the future are a thing of the past.

SYSTEM DESIGN

A one-source system means that the components were planned to work together. They are totally compatible. That's your assurance of a long-lasting, trouble-free roof. And because all the components arrive together, you'll have no costly installation delays.

10 + 10 GUARANTEE

Your Koppers System Roof is totally guaranteed for 10 years with an option for an additional 10 years when it is installed to our specifications. For further details of this unusual guarantee see "Guaranteed Roofing Program" on page 26.



BITUMEN

Koppers Bitumen has superb water and corrosion resistance, and acts as an excellent adhesive. The bitumen has a self-healing ability because of a property known as "cold-flow." This allows hairline cracks to heal automatically. Because Koppers bitumen contains low volatile oils, the surface will not evaporate as fast as conventional roof surfaces.

TWO SEPARATE PLIES OF FELT

Koppers felts are specially selected to give the greatest strength-to-thickness ratio available from organic felted membranes. They are heavier and stronger than conventional roofing felts, yet easy to apply.

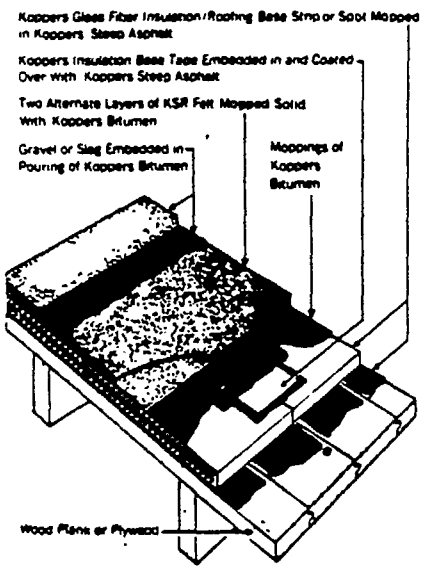
GLASS FIBER INSULATION

Our Glass Fiber Insulation especially designed for the system roof, has two distinct advantages. (1) Because of its great weathering ability, you can close a structure fast and it will serve as a temporary roof. (2) It is not subject to the blistering that is so prevalent with other insulations. Also, once the insulation is seal stripped with our tape, it becomes an integral part of the roof.

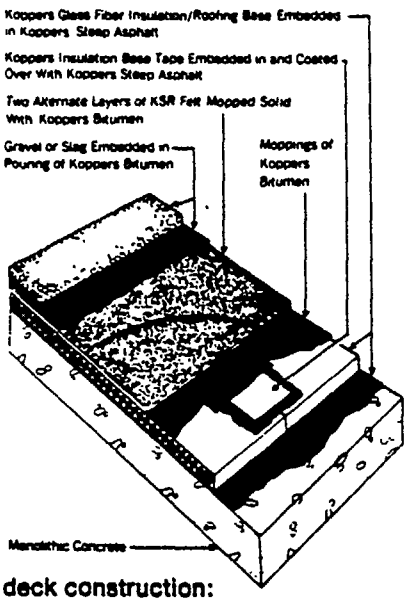
TAPE

Koppers Glass Fiber Tape is set in bitumen at pre-roofed insulation joints. Seal stripping with glass fiber tape helps make insulation more stable.

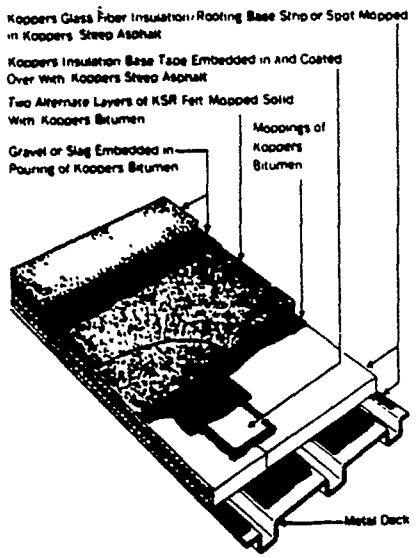
DECK CONSTRUCTION:



deck construction:
KSR—
Wood plank/plywood
Detail of specification No. 30



deck construction:
KSR—
Reinforced Concrete
Detail of specification No. 31



deck construction:
KSR—
Metal Deck
Detail of specification No. 32

KSR

deck construction:

5.1 Spec. No. 30—WOOD PLANK/ PLYWOOD
5.2 Spec. No. 31—REINFORCED PORTLAND CEMENT CONCRETE (Monolithic or pre-cast)
5.3 Spec. No. 32—METAL DECK

SLOPE • See Section 3.1.4, pg. 5
SURFACE • Aggregate

PROCEDURE

Select clauses as required. ***Optional clauses in italic.***

Copy in color denotes KSR Specifications

Conditions of Surface to Receive KSR Materials
See Section 3.1.2, Page 5.

Material Quantity Requirements
See Section 3.1.7, Page 6.

Vapor Barrier
Koppers System Roofs (KSR) are not normally used where vapor barriers are required. When vapor barriers are required contact your Koppers Sales Representative for specific requirements.

Application of KSR System

1st. Application of Koppers Glass Fiber Insulation/Roof Base

Reference: See Section 3.1.9, Page 6.

a. **(all applications)**

Into a uniform coating of hot Koppers Steep Asphalt, install Koppers Glass Fiber Insulation Roof Base immediately pressing firmly into place. When more than one (1) layer of insulation is used, joints in each layer shall not coincide. Each successive layer shall be embedded in a uniform coating of hot Koppers Steep Asphalt.

b. **Spec. 30**

When applying Koppers Steep Asphalt (and/or adhesive) keep material back from edges of wood plank and plywood to prevent asphalt or adhesive drippage.

b. **Spec. 31**

When monolithically placed Portland Cement Concrete is the structural base. Koppers Bitumen may be used as an alternate to Koppers Steep Asphalt, however keep back from edges of perimeter and opening a minimum of four (4) inches.

b. **Spec. 32**

The insulation joints parallel with the flutes of the metal deck shall be centered along the flat portion of the deck to obtain solid adhesion. Refer to Chart 5.6, page 23 to determine the minimum insulation thickness to span the open flute of the metal deck.

2nd. Application of Koppers Insulation Base Tape

Reference: See Section 3.1.10, Page 7.

Apply a solid strip of hot Koppers Steep Asphalt over the joints of the Glass Fiber Insulation/Roof Base at least one (1) inch wider than the Base Tape. Immediately embed the Base Tape in the hot Steep Asphalt. The Base Tape shall be pulled flat to avoid buckles, fishmouths, etc. Use at least two (2) inch end laps and cross over laps. Completely top coat all Base Tape with hot Steep Asphalt. When monolithically placed Portland Cement Concrete is the structural base, Koppers Bitumen may be used as an alternate to Koppers Steep Asphalt. (For temporary roofing follow procedures in Section 3.1.15, page 7.)

3rd. Application of KSR Felts

Apply over the entire surface two (2) plies of Koppers KSR Felts, in a continuous and solid mopping of heated Koppers Bitumen, lapping plies nineteen (19) inches. Bitumen shall be applied so that in no place shall felt touch felt.

Slopes in excess of one-half (½) inch per foot are not permitted.

Base Sheet alternate is not permitted.

4th. Application of Koppers Bitumen and Aggregate Surfacing

Pour over the entire surface of the applied felts a uniform coating of heated Koppers Bitumen into which, while hot, embed not less than four hundred (400) pounds of gravel or three hundred (300) pounds of slag for each 100 sq. ft.

General Requirements on pages 5 through 9 and Detailed Specifications on pages 20 through 25 are a part of this specification and must be adhered to where applicable.



5.4 Calculated Heat Transfer Through Typical Roof Decks With Various Nominal Thicknesses Of Insulation

"U" values	FLAT METAL DECK — No Insulation, U = 0.90			METAL DECK-SUSPENDED CEILING — Non-Vented Space, ½" Fiberglas Ceiling Board			POURED GYPSUM DECK — 2" SLAB and 1" FIBERGLAS BOARD, No Insulation, U = 0.15			2 SLAB and ½" GYPSUM BOARD, No Insulation, U = 0.35			LIGHT WEIGHT CONCRETE DECK — No Insulation, U = 0.25			CONCRETE DECK — 4" SLAB, No Insulation, U = 0.70			WOOD DECK — 1" BDS. (Actual 25/32"), No Insulation, U = 0.48			2" PLANK (Actual 1⅝"), No Insulation, U = 0.32			"U" values
	KSR Insulation	Fiberboard Perlite	Urethane	KSR Insulation	Fiberboard Perlite	Urethane	KSR Insulation	Fiberboard Perlite	Urethane	KSR Insulation	Fiberboard Perlite	Urethane	KSR Insulation	Fiberboard Perlite	Urethane	KSR Insulation	Fiberboard Perlite	Urethane	KSR Insulation	Fiberboard Perlite	Urethane	KSR Insulation	Fiberboard Perlite	Urethane	
.05	2 1/16-2 1/4			1 3/16-1 3/4			1 1/16-1 1/16			1 7/16-2 5/16			1 3/4-1 3/4			2 3/16-2 1/4			2 1/16-2 1/16			1 7/8-1 7/8			.05
.06	1 3/4-1 7/8		2.0	1 3/4-1 3/4			2 1/4		1.4	1 5/16-1 5/8			1 3/4-1 13/16			1 3/4-1 3/4			1 5/8-1 5/8			1 5/16-1 5/16			.06
.07	1 5/16-1 5/16			2 1/4		1.4	1 3/4	3	1.2	1 5/8-1 7/8			2 3/16		1.4	1 5/16-1 3/8			2 1/16			1 5/16-1 5/16			.07
.08	1 5/16-1 3/8		1.4	1 7/8	3	1.2	1 3/8	2 1/2	1.0	2 1/4		1.4	2 3/16	3	1.2	1 5/16-1 5/16			2 1/16		1.4	2 1/4		1.4	.08
.09	2 3/16			1 5/16	2 1/2	1.0	1 1/16	1 1/2	0.65	2 1/16	3	1.2	1 5/8	2 1/2	1.0	2 3/16		1.4	2 1/4			1 7/8	3	1.2	.09
.10	2 1/4			1 1/4	2	0.8	1 5/16			1 3/4			1 5/8			2 1/16	3	1.2	1 7/8	3	1.2	1 5/8	2 1/2	1.0	.10
.11	1 7/8	3	1.2	1 1/16	1 1/2	0.65	5/8	1		1 5/16	2 1/2	1.0	1 5/16	2	0.8	1 7/8			1 5/8	2 1/2	1.0	1 3/4			.11
.12	1 3/4			5/8				3/4		1 5/16	2	0.8	1	1 1/2	0.65	1 5/8	2 1/2	1.0	1 5/16			1 1/4	2	0.8	.12
.13	1 5/8	2 1/2	1.0	13/16	1			1/2		1 3/16			7/8			1 5/16			1 3/8			1 1/4			.13
.14	1 1/16			11/16						1 1/16	1 1/2	0.65	13/16			1 3/8			1 1/4	2	0.8	1	1 1/2	0.65	.14
.15	1 3/8			9/16	3/4					15/16			1 1/16	1		1 3/16	2	0.80	1 3/16			7/8			.15
.16	1 1/4	2	0.8							7/8			9/16	3/4		1 3/16			1	1 1/2	0.65	13/16			.16
.17	1 3/16				1/2					13/16						1 1/8			15/16			3/4	1		.17
.18	1 1/8									3/4	1			1/2		1	1 1/2	0.65	7/8			5/8			.18
.19	1 1/16	1 1/2	0.65							11/16						15/16			13/16			9/16	3/4		.19
.20	1									5/8						7/8									.20
.21	15/16									9/16	3/4								3/4	1					.21
.22	7/8															13/16			11/16				1/2		.22
.23																			5/8						.23
.24	13/16										1/2					3/4	1		9/16	3/4					.24
.25																11/16									.25
.26	3/4	1																							.26
.27	11/16															5/8									.27
.28																									.28
.29	5/8															9/16	3/4			1/2					.29
.30																									.30
.31	9/16	1/2																							.31
.35																	1/2								.35
.40		1/2																							.40

The "U" value measures the heat transmitted through one square foot, in one hour for each degree Fahrenheit difference in temperature between the air on each side.
See "Construction Specifier," summer issue 1958, "Thermal Properties of Walls and Roofs." (Note: Supporting Steel not included in poured gypsum "U" values.)

5.5 THERMAL VALUES

CONDUCTANCE	RESISTANCE	KSR INSUL.	EXP. PERLITE	URETHANE	FIBERBOARD	FOAMGLAS BOARD
.10	10.00	2-7/16"		1.4"		
.12#	8.33	2-1/16"	3"		3"	
.13	7.69	1⅞"*	2¾"	1.2"		
.15#	6.67	1⅝"	2½"		2½"	
.16	6.25	1-9/16"	2¼"	1.0"		
.19#	5.26	1-5/16"*	2"		2"	2"
.21	4.76	1-3/16"	1¾"	0.8"		1¾"
.24#	4.17	1-1/16"*	1½"	0.65"	1½"	
.25	4.00	1"				1½"
.27	3.70	15/16"*				
.29	3.45		1¼"			
.38#	2.78	¾"*	1"		1"	
.48	2.08	9/16"	¾"			
.72	1.39				½"	

— "C" values of Simplified Practice Recommendation R257-55.
* — Standard Stock materials—others made-to-order.

5.6 MINIMUM THICKNESS TO SPAN OPEN FLUTE METAL DECKS

Thickness	Max. Flute Span
Standard Roof Insulation	
¾	¾
¾	1
¾	1¾
15/16	2⅜
1-1/16	2⅝
1-5/16	3½
1-7/16	4"*
Wide Flute Roof Insulation	
¾	1⅛
¾	2⅜
15/16	2⅞
1-1/16	3¼
1-5/16	4¼"*

*Must have a 2" minimum flange bearing surface between flutes.

Koppers Flashing Specifications

1 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. In any case where the design or anchoring system of metal counter flashing is difficult, the top of the flashing system should be double stripped with Koppers Glasfab 4" wide set in Koppers tar base cement for Specification 110 or Koppers flashing cement in Specification 108.

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.

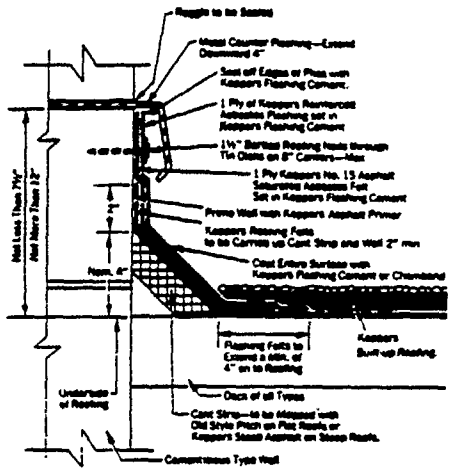
Flashing should be installed as roofing progresses to prevent water damage to insulation or deck under the roofing. If this is not possible water cut-off's must be installed and later removed when flashing is installed. Metal counter flashing or a top seal of Glasfab and flashing cement must be installed as flashing progresses.

The basic Koppers flashings require a metal cap flashing to be inserted in the raggle immediately upon completion of base flashing. The cap flashing is to extend into the raggle not less than two (2) inches and is to have not less than a four (4) inch exposed apron extending down over the base flashing. Completely fill raggle with Koppers flashing cement.

NOTE:

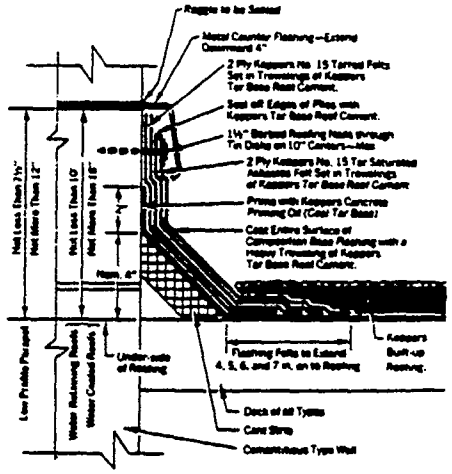
1. If bonded flashing is required, it must be installed in conjunction with a Koppers bonded roof and can be bonded for standard periods up to but not greater than the period for which the roofing is bonded. To be bonded, flashings must be set at least 7½" above the roofing base.
2. Metal Cap flashings are not bondable and are not included under any flashing bond.
3. Metal work of any description used as flashing or a part of a flashing system is not bondable and is not included under any flashing bond.

Application Detail



Specification No. 108

Application Detail



Specification No. 110

6.2 Specification No. 108 (reinforced asbestos)

Recommended where sunlight is the predominant exposure. Should be used for all high flashing.

METAL CAP
ASBESTOS BASE (1 + 1)
COATED SURFACE

Application

Extend plies of roofing felts and pitch or 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 except where capped nailers are used.

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

In a uniform coating of Koppers Flashing Cement, install one (1) ply of Koppers No. 15 Asphalt saturated asbestos felt extending from the raggle to not less than four (4) inches from the base of the cant onto the roof. On top of this apply a second uniform coat of Koppers Flashing Cement into which embed one (1) ply of Koppers reinforced asbestos base flashing (reinforced fabric side down). 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 the two (2) plies shall be not less than three (3) inches and staggered not less than twenty-four (24) inches. End laps of reinforced base shall be nailed vertically a minimum of once into the wall at upper edge and once into the cant at a point not lower than the mid point of the cant.

End laps of reinforced base after nailing shall be covered with a strip of Koppers asbestos felt not less than four (4) inches wide set in a coating of Koppers Flashing Cement.

Coat entire surface of flashing with Koppers Flashing Cement or Koppers Chembond (including nail caps along top edge of flashing as well as top edges of felts to seal at wall).

Interply and top coatings 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.

Install metal cap flashing.

NOTE: Hot applied steep asphalt may be used as an alternate to the two (2) interply trowelings of asphaltic plastic cement. One (1) ply of No. 15 asphalt felt may be used in lieu of the one ply underlayment sheet of No. 15 asphalt asbestos felt when required. All other requirements of this specification must be adhered to.

6.3 Specification No. 110 (for water cooled roofs)

Recommended for water and corrosive atmosphere exposure. Low capped and sealed flashings.

METAL CAP
COMPOSITION BASE (2 + 2)
COATED SURFACE

Application

Cant strips shall be installed at the angle between the roof deck and the parapet wall or any other similar perpendicular surfaces.

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

A raggle of not less than ten (10) inches above the roof deck is to be provided for water cooled roofs and water retaining roofs.

Prime all masonry walls from top of roofing felts to raggle with Koppers Concrete Priming Oil (coal tar base). Allow to dry thoroughly.

Set two plies of Koppers Approved Tarred Felt in trowelings of Koppers tar base roof cement. Have plies extending from the bottom of the raggle; the first extending out onto the deck not less than four inches from the bottom of the cant strip, and the second, one inch beyond the first. Over this apply two layers of tar saturated asbestos felt similarly imbedded in Koppers Tar Base Roof Cement, each ply extending onto the deck one inch beyond the preceding ply.

Nail with one and one-half (1½) inch barbed roofing nails through flat tin discs at upper edge approximately ten (10) inches o.c. (For brick or block construction, nail into vertical mortar joints. For concrete construction, nail to treated wood nailing strips set in flush with the surface.)

Felts are not to exceed ten feet three inches (10'3") in length. Ends of connecting strips are to overlap three (3) inches and are to break at least twenty-four (24) inches with laps of underlying strip.

All plies of felt shall be firmly pressed into the trowelings of Koppers Tar Base Roof Cement so that there will be no wrinkles in the finished surface.

7. Flashing Details

GENERAL INFORMATION

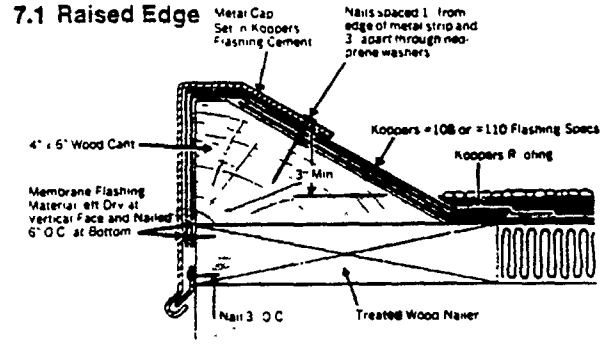
There are numerous flashing details that have been proven by experience over the years. There are normally a number of acceptable construction details for accomplishing one purpose. The architect should select a detail that best serves the purpose under the various and different conditions concerned 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.

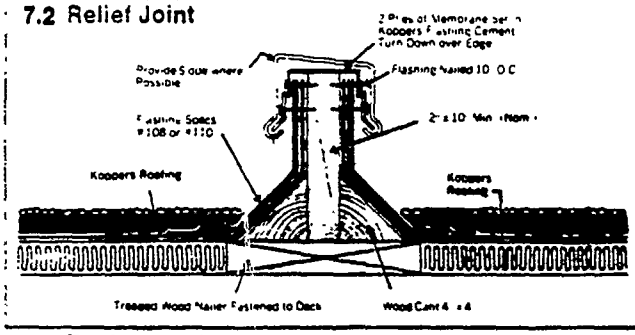
Design or selection is a responsibility of the architect.

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

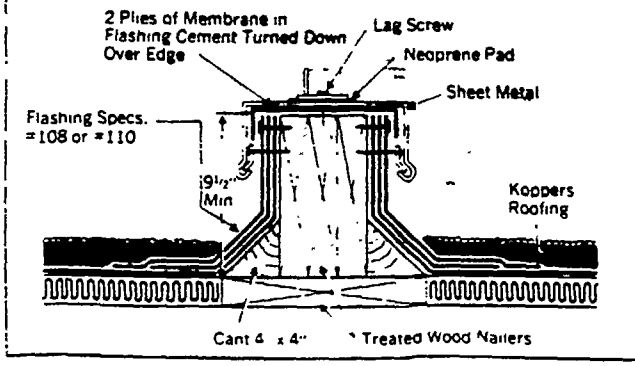
7.1 Raised Edge



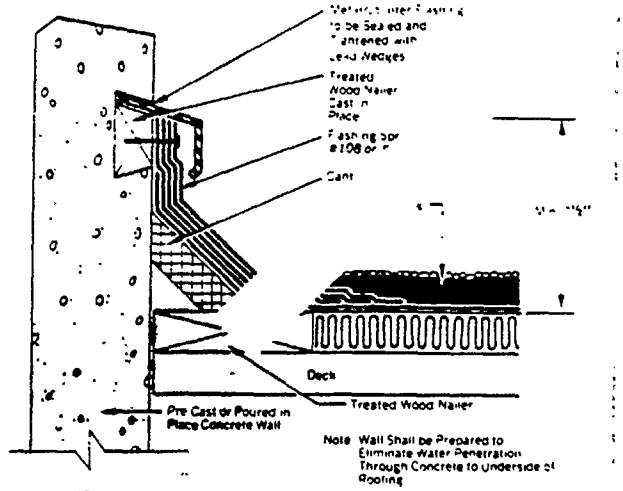
7.2 Relief Joint



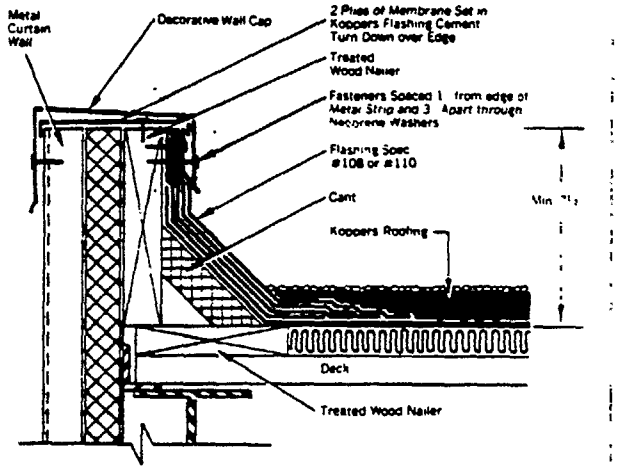
7.3 Equipment Support



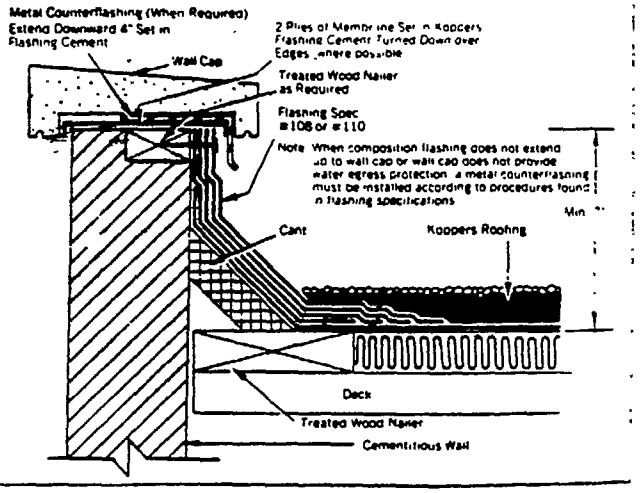
7.4 Parapet/Precast or Poured Concrete



7.5 Parapet/Metal Curtain Wall

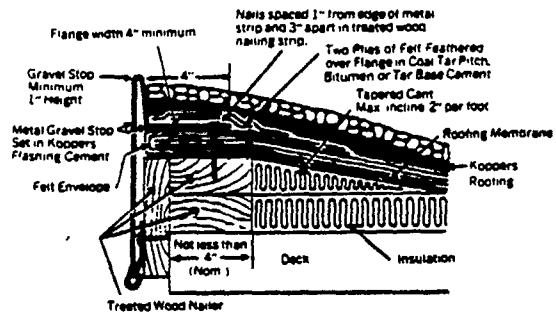


7.6 Parapet/Wall Cap

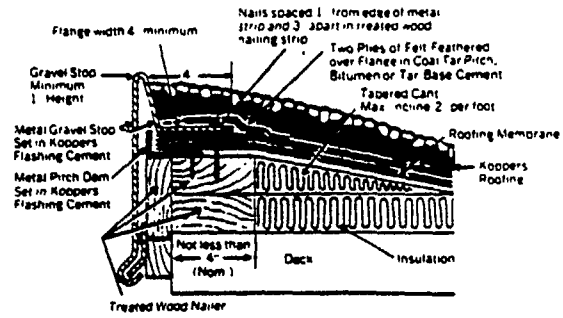


Flashing Details (continued)

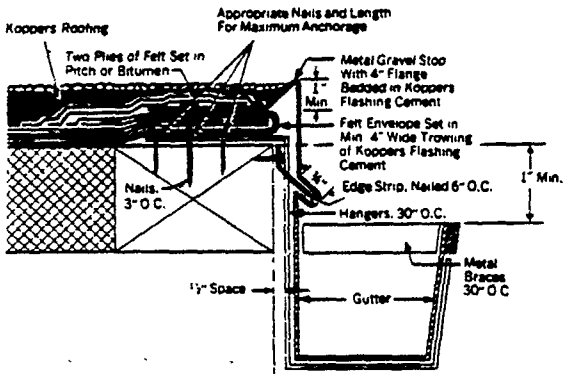
7.7 Tapered Cant



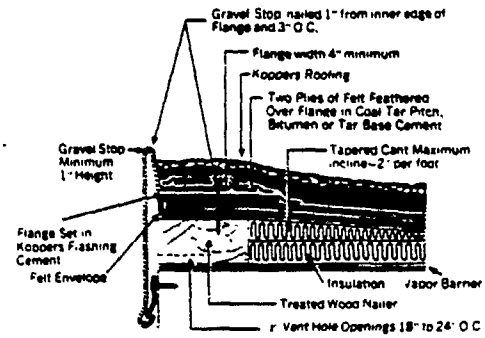
7.8 Tapered Cant



7.9 Hanging Gutter

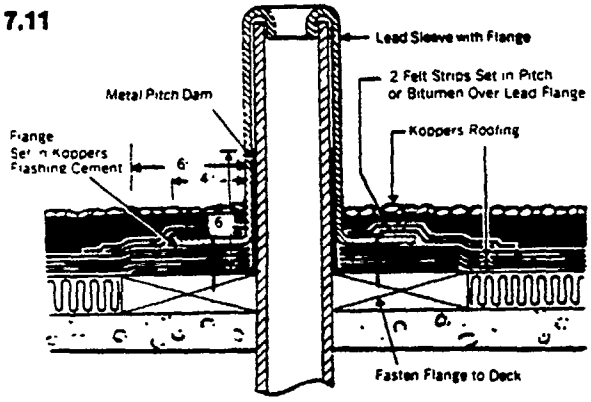


7.10 Vented Edge

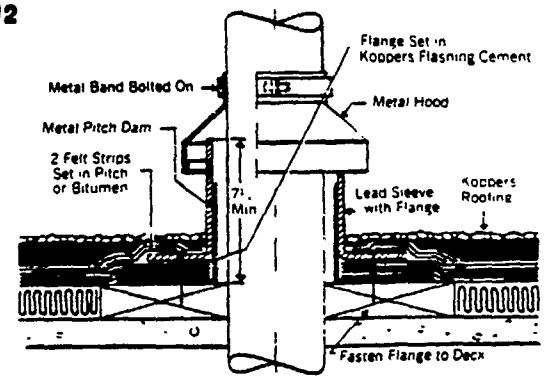


Vent Pipes, Stacks, Flagpoles, and Other Projections

7.11



7.12

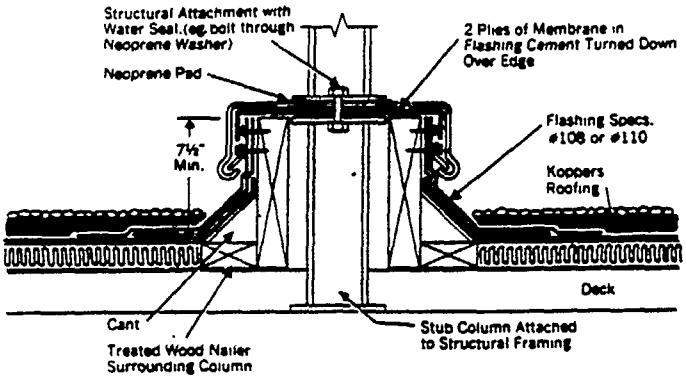


All vent pipes, stacks, flagpoles, or other projections penetrating the built-up roofing, whether indicated on drawings or not, must have a proper metal sleeve flashing with flange, pen flashing with flange or other flanged flashing installed.

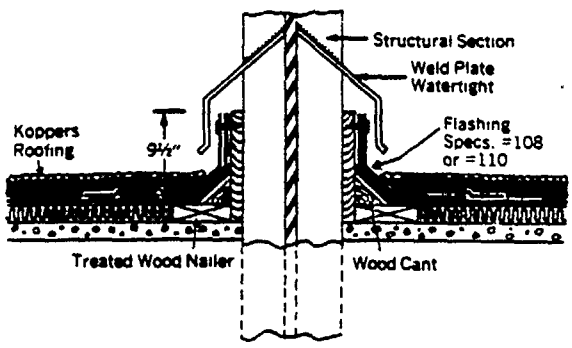
Behind metal sleeve and beneath roofing membrane next to deck install metal pitch dam as shown in detail. The sheet metal flange must be cemented to the surface of the felt with a mopping of hot coal tar pitch or bitumen. Over flange apply, with alternate moppings, two (2) reinforcing plies of felt so 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.

Future Columns, Sign Supports and Angle Irons

7.13



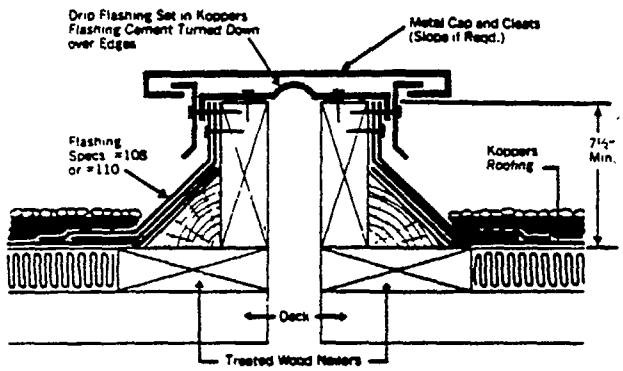
7.14



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 standard built-up composition-flashing system. Where structural steel section extends beyond "stub" height, metal cap flashings with tight fit to the structural section must be fabricated and continuously welded to the projection to assure a watertight metal cap.

For pitch pocket design consult your local Koppers sales representative.

7.15 Curbed Expansion Joint



Curb expansion joints are to be flashed in accordance with Koppers specifications for parapet walls and must provide nailing to hold metal cap and flashing membrane in place. Metal cap must be designed to expand so as not to disturb flashing.

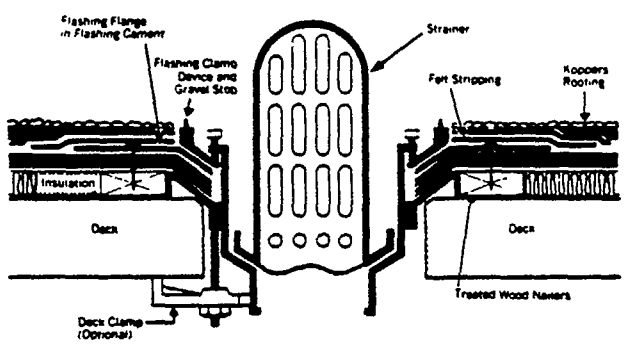
It is the responsibility of the designer of the building to provide for adequate expansion joints.

For the protection of the roofing system against splits caused by expansion and contraction, Koppers recommends that an expansion joint be installed: (1) on large roof areas at least every 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 Section 3.3.6 (Expansion Joints) Page 9.

7.16 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.

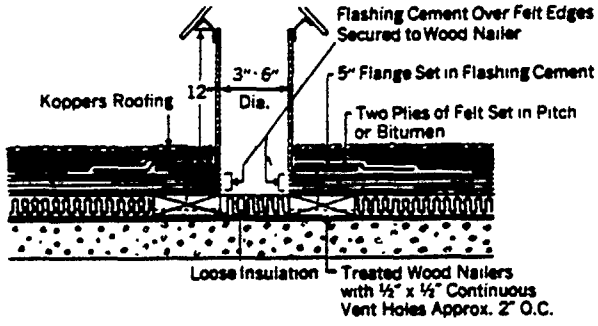
The sheet metal flange furnished with the drain must be cemented to the surface of the felt with hot coal tar pitch or flashing cement. Over the flange apply, with alternate moppings or trowelings, two (2) reinforcing plies of felt so that the first extends not less than three (3) inches beyond the outer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

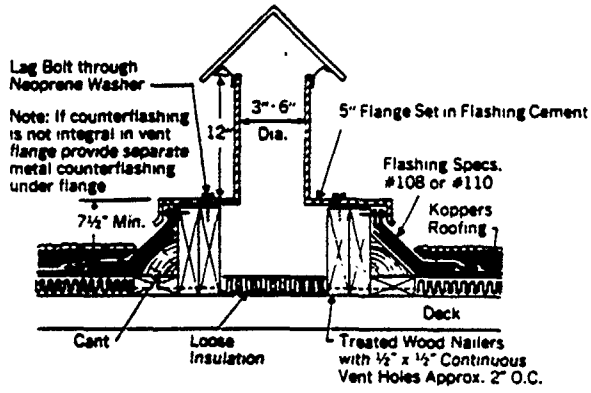
To obtain proper drainage, roof drains should be located at points of lowest expected deflection in roof deck.

Flashing Details (continued)

7.17 Roof Vent (Existing Building)

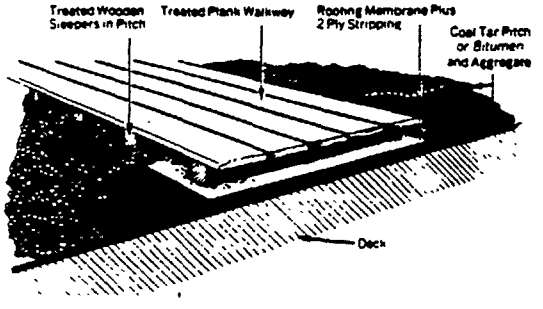


7.18 Roof Vent (New Building)

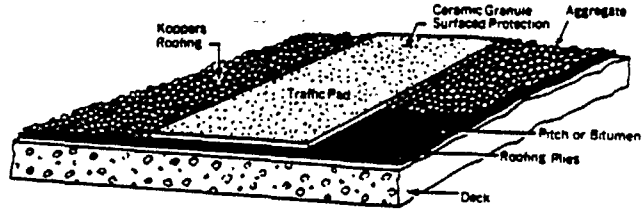


Koppers does not recommend occasional or spot vents through the roof as the only venting method or a substitute for underside or continuous vented systems. There may be certain instances where spot or mushroom type vents might be deemed advisable by the designer for a new building (eg. at expansion joints for vent relief on long run underside continuous venting systems, etc.) For new construction, wooden curbed base units with cant strip to accept a standard built-up composition flashing system is recommended. For existing construction where relief is required to vent the saturated insulation cavity, spot vents may be used without wooden curbs.

7.19 Walkways (Treated Wood Walkway)

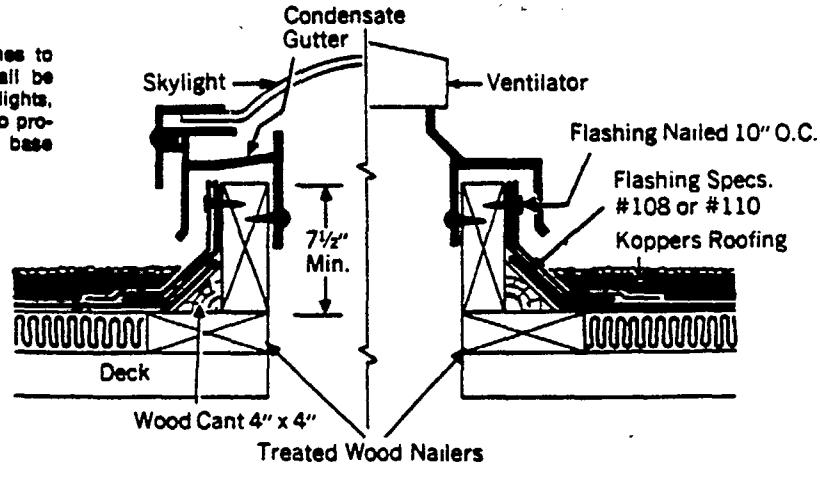


7.20 Traffic Pad



7.21 Roof Opening

Curbs extending a nominal 8 inches to 12 inches above roof surface shall be provided at all openings for skylights, ventilators, expansion joints, etc., to provide for installation of adequate base flashing.



8.1 Guaranteed Roofing Program (KSR only)

Guarantees for KSR Roofing and Flashing systems are available for the listed specifications in this manual. All materials must be constructed in accordance with Koppers specifications, using KSR materials and by a roofing contractor approved, in writing, by Koppers. Any deviations from specifications or requirements of Total Guarantee procedure must be approved by Koppers.

Koppers Total Guarantees are available for KSR System Roofs only and for a 10-year period. Guarantees cover only the materials supplied for the KSR system and their application where approved.

Additional Options Available To The Owner

1. Free Inspection. At any time during the first nine (9) months of the final year in which this Guarantee is in effect, the Owner may request that Koppers Company, Inc. inspect the roof guaranteed herein free of charge and without any obligation in order to determine what repairs, if any, may be required to make the roof eligible for an additional ten (10) year Guarantee. Koppers Company, Inc. shall then perform an inspection, make an inspection report and submit such report to the Owner. The inspection report shall advise the Owner of any maintenance repairs which may be necessary to qualify for renewal of this Guarantee for an additional ten (10) year period.

2. Renewal of Guarantee. Should the Owner elect to renew this Guarantee for an additional ten (10) year period, the Owner shall cause the repairs specified in the inspection report to be made at the Owner's sole expense by a roofing contractor approved by Koppers Company, Inc., and shall notify Koppers Company, Inc. in writing of his desire to renew the Guarantee no later than ninety (90) days after the expiration date of the above Guarantee. Upon payment by the Owner of a guarantee fee for such reinspection of 2/3 of Koppers Company, Inc. then standard guarantee fee, Koppers Company, Inc. shall reinspect the roof in order to determine whether the repairs specified in the inspection report have been satisfactorily completed.

If Koppers Company, Inc. then finds the roof acceptable, this Guarantee will then be extended for an additional ten (10) year period from the above expiration date.

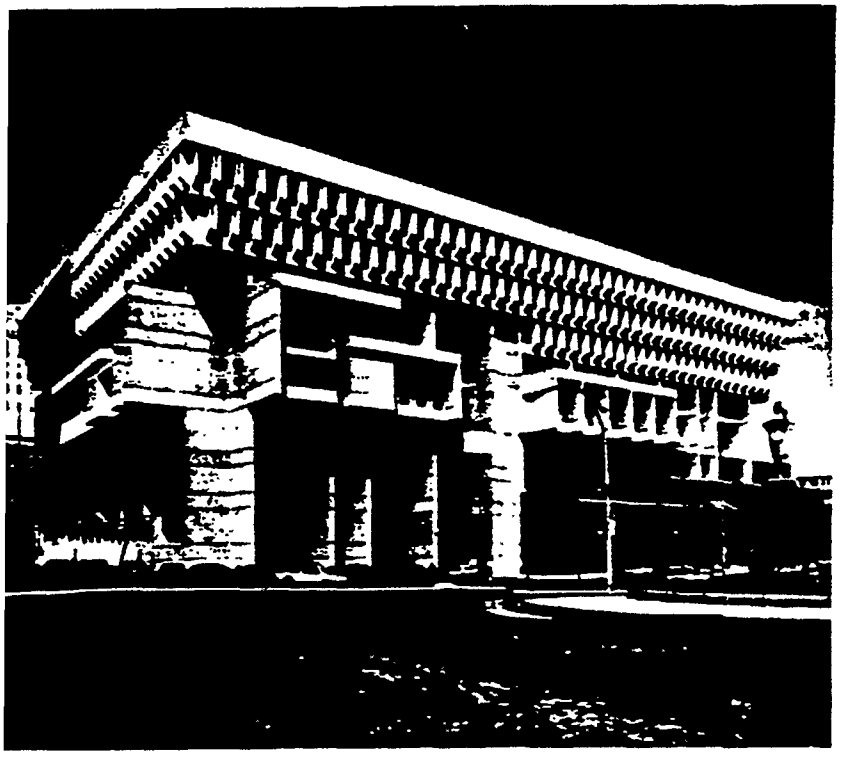


Koppers will issue its KSR Total Guarantee for low sloped or flat roofing. KSR systems, to be guaranteed, must be constructed in conformance with Koppers specifications. Koppers Total Guarantees are not available for residential roofing. Koppers Total Guarantees are transferable upon timely written notification of change of property ownership.

Koppers Total Guarantee roofing program provides for use of proven specifications, quality materials and that the roofing will be applied by a qualified, Koppers approved roofing contractor. It also provides a discussion of specifications during the planning stage, consultation during the construction, and assistance to the owner throughout the guarantee term as may be necessary in relation to leaks, additional items to project through or be placed above the roof, or any matter related to the performance of the total system. It further provides for repairs of leaks to the roofing not occasioned by defects in the building, abuse or extreme weather conditions during the term of the guarantee. Koppers Total Guarantees do not cover repair, installation or the replacement cost of decking materials, metal work or products in the roofing assemble furnished by others. Nor will Koppers assume any responsibility for any damage to the guaranteed roofing system caused by, or the result of, the use of these products, their installation or attachment. KSR Total Guarantees are not effective in cases of vandalism or owner abuse.

Koppers Total Guarantees are available within the continental limits of the United States in all cases except those areas where Koppers does not presently provide inspection service. Charges for KSR Total Guarantees are made up on a per square (100 sq. feet) basis of the roofing system. Guarantee charge payment is due at the time the guarantee is issued and no additional charge is necessary during the term of the guarantee.

Koppers reserves the right to cancel the guarantee if the roof is damaged due to causes not covered by the guarantee if it is determined that its satisfactory performance for the remaining term of the guarantee is impaired. Cancellation due to damage of this type does not provide for any refund of the original charges.



roofing will be applied by a qualified Koppers Approved Roofing Contractor. It also provides for discussion of specifications during the planning stage, consultation during construction and assistance to the owner throughout the bond term as may be necessary in relation to leaks, additional items to project through or be placed above the roof or any matter related to the performance of the roofing. It further provides for repairs of leaks to the roofing not occasioned by defects in the building, abuse, or extreme weather conditions during the term of the bond up to the monetary limit specified in the bond. Flashing membranes may be included on request in riders to the bond.

Koppers bonds do not cover repair, installation or replacement costs of decking materials, vapor barrier materials, insulation products, metal work or products in the roofing assembly furnished by others, nor will Koppers assume responsibility for any damage to the bonded roofing or flashing caused by or the result of the use of these products, their installation or attachment. Bonds are not effective in cases of vandalism or owner abuse.

Koppers bonds are available within the continental limits of the United States in all cases except those areas where Koppers does not presently provide inspection service.

Flashing endorsements when required for bonded roofing may be for terms up to but not exceeding the term for which the roofing is bonded.

Charges for roofing bonds are made on a per square (100 square feet) basis of the roofing membrane. If a flashing endorsement to the bond is required, the area of flashing is included for computing the total bond charge. Information on bond charge fees and minimum charges with relation to monetary coverage limits and terms are available through Koppers Approved Roofing Contractors, Koppers District Offices and local Koppers Roofing Representatives. Bond charge payment is due at the time the bond is issued and no additional charge is necessary during the term of the bond.

Koppers reserves the right to cancel a bond if the roof is damaged due to causes not covered by the bond if it is determined that its satisfactory performance for the remaining term of the bond is impaired. Cancellation due to damage of this type does not provide for any refund of the original charge.