

Cork is composed of millions of 14-sided cells which fit together perfectly, with no air spaces between the individual cell walls. Each tiny cell is filled with still air.

An insulation buyer can guard against the moisture infiltration problem by making sure that the work is properly planned. Then he can select insulation that has inherent resistance to moisture. Finally he can deal with a contractor who has workmen trained to do everything practical to seal moisture out of the construction.

### Armstrong's Corkboard

Through its many years of proved and dependable service, corkboard has become the recognized standard of comparison for all low-temperature insulating materials. Corkboard's low thermal conductivity, combined with its natural resistance to moisture and its other desirable physical characteristics, makes it a most practical and efficient insulating material for every low-temperature installation.

Armstrong's Corkboard is made of carefully sized granules of pure cork. These granules are compressed and baked at very high temperatures into large blocks. In the baking process the natural resins of cork are released and serve as an adhesive, firmly bonding the granules together. After the large, homogeneous cork block is removed from the mold, it is cut into the various accurately sized pieces of Armstrong's Corkboard Insulation.

Actually more than 75% of the volume of a piece of corkboard is air. This still air gives to cork insulation its low thermal conductivity of 0.27 Btu. per square foot per hour per degree temperature difference at 60° F. mean temperature. (See Conductivity Curve on Page 19.)

The tough walls of the tiny cells which make up each cork granule effectively seal moisture out of the material. Also, because of the unique cellular structure of cork, water cannot be drawn through the material by capillary action. Thus it does not have the blotting paper effect which causes materials of fibrous composition to become water soaked rapidly when exposed to the moisture conditions of cold room work.

In addition to its high insulating efficiency and great natural moisture resistance, Armstrong's Corkboard offers the following advantages:

**Resistance to Decay**—Armstrong's Corkboard has outstanding resistance to decay, mold, or other structural change.

**Structural Strength**—The structural strength of corkboard is good. Solid corkboard walls can be erected to a height of 14' without being held in place by expensive supporting construction.

**Light Weight**—The weight of Armstrong's Corkboard averages from 0.55 to 0.65 lb. per board foot. It is easily and quickly handled and erected in any kind of low-temperature construction.

**Good Key for Finishes**—Armstrong's Corkboard provides a good key for finishing materials. There is no need to use metal lath or hexagonal wire mesh to hold finishes in place over corkboard surfaces.

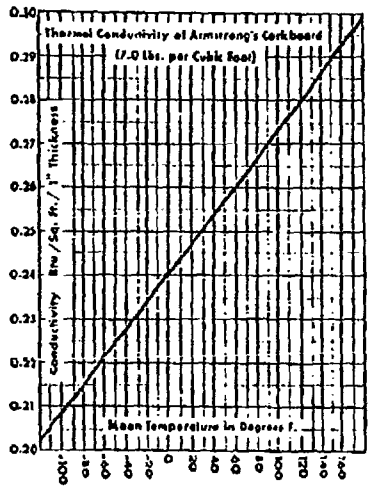
**Fire Resistance**—Corkboard is classified as a fire-retardant material. It will not take fire from sparks or embers. It can be ignited only by flame and then burns very slowly and only as long as it is in direct contact with the flame. When the flame is removed, combustion ceases immediately. Corkboard will not smolder or carry fire. In fact, the fire-retardant properties of corkboard have served to check the spread of fire.

**Structural Stability**—Corkboard insulation does not buckle or swell, shrink or warp, either while being erected or afterward. It lies flat and stays flat, providing smooth, even surfaces, free from humps and waves.

**Resistance to Settling**—Rigid corkboard insulation will not settle and pack down, even under the most severe conditions of vibration. It stays permanently in place, leaving no empty spaces where heat and moisture can work their way through the insulated construction.

**Free from Odor**—Armstrong's Corkboard is sanitary and free from any objectionable or contaminating odor. It does not provide a harboring place for vermin.

**Federal Specification**—This material equals or exceeds Federal Specification HH-C-581b for corkboard insulation.




### Types of Armstrong's Corkboard

Armstrong's Corkboard is supplied in three types:

1. Standard Corkboard, which is accurately sized boards of pure cork insulation ready for application.

2. Super-Service Corkboard, which is factory sealed on both sides with a special ironed-on asphalt mastic coating. This coating is firmly keyed to the surface and is entirely free from breaks and "pinholes." It is used where extremely severe moisture conditions make the special protection afforded by the extra asphaltic coating desirable for longer insulation life.

3. Armstrong's Mastic Finish Corkboard, which has a ⅛" asphalt mastic coating on one face. This coating serves as a finish and provides extra protection against moisture from within the insulated room.

### Sizes of Armstrong's Corkboard

Armstrong's Corkboard Insulation is manufactured in 12" x 36", 18" x 36", 24" x 36", and 36" x 36" sizes. Thicknesses of the product are 1", 1½", 2", 3", 4", and 6".

### Packaging and Shipping Information

Quantities less than 30,000 board feet of Armstrong's Corkboard are shipped in bulk, tubes, or cartons, at the customer's option, subject only to the regulations of the carrier.

Larger quantities are ordinarily shipped in bulk or in tubes, but can be shipped in cartons at slight additional charge.

### Container Contents

Armstrong's Corkboard

| | |
|---|---|
| Cartons (all sizes) | 72 bd. ft. |
| Tubes (1", 1½", 2", 3") | 54 bd. ft. |
| Tubes (4") | 48 bd. ft. |

### Approx. Weights

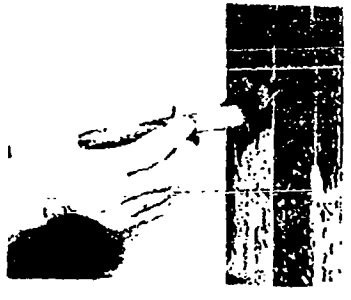
| Bulk or tubes | Cartons |
|---|---|
| .60 lb. | .65 lb. |



# Sundry Materials for Use in Cold Room Construction

The importance of using correct sundry materials to erect, finish, and maintain Armstrong's Corkboard insulations cannot be overemphasized. For satisfactory results only sundry materials formulated to withstand conditions found in low-temperature construction should be used.

Armstrong's insulation sundries are the result of years of experiment and research in the most effective methods of installing insulation. Each product described on the following pages has been developed specifically for the phase of the job where its use is recommended.



Armstrong's No. 4 Asphaltic Paint—This asphaltic primer is non-corrosive and rust preventing. It should be used on steel or other metal surfaces before application of low-temperature insulation in either hot asphalt or adhesives. No. 4 Asphaltic Paint forms a strong and long-lasting film which is extremely resistant to moisture, as well as acids, alkalis, and chemical fumes.

Coverage—Approximately 150 sq. ft. per gallon of No. 4 Paint.

Packaging—1- and 5-gallon cans and 30- and 55 gallon drums. Weight is 9 lbs. per gallon.





Armstrong's No. 3 Asphaltic Paint—This asphaltic paint has been especially developed for priming masonry, concrete, or portland cement plaster surfaces prior to erecting insulation in hot asphalt or cold erection plastic. It penetrates the pores and forms a tough film which helps seal the surface against air and vapor penetration and provides a strong bond with the hot asphalt or cold plastic. Armstrong's No. 3 Asphaltic Paint is unaffected by temperature change and becomes stronger with age.

Coverage—100 sq. ft. per gallon sprayed on in two coats, 75 sq. ft. per gallon brushed on in one coat.

Packaging—1- and 5-gallon pails and 30- and 55-gallon drums. Weight is 8½ lbs. per gallon.



Armstrong's Erection Asphalt—This is a 180° to 200° F. melting point odorless asphalt specially formulated for erecting Armstrong's Corkboard. For wall, floor, and ceiling insulation, as well as ducts, columns, and in other applications, Armstrong's Erection Asphalt furnishes a tough, lasting bond and a tight seal against air.

This asphalt handles well with today's hot erection methods. It is not subject to chemical change, resists cracking or softening under extreme temperature variations, and maintains these qualities for many years.

Coverage—Four-tenths of a pound of Armstrong's Erection Asphalt will cover approximately one square foot.

Packaging—450-lb. drums displacing about 8.6 cubic feet, and in 100-lb. paper wrapped rolls.



Cold Erection Plastic—This material is used in erecting Armstrong's Corkboard Insulation where the use of hot asphalt is impractical or hazardous. The material possesses virtually the same properties as Armstrong's Erection Asphalt.

The basic ingredient of cold erection plastic is erection asphalt, dissolved in a solvent and mixed with an inert filler. The solvent odor disappears when the material is thoroughly dry. Cold erection plastic can be used in rooms designed to operate in any temperature range. It is not recommended as a cold room finish.

Armstrong's No. 340 Waterproof Cement–This medium body cement is recommended for the erection of corkboard insulation against metal surfaces. It also adheres tightly to concrete and plaster. Armstrong's No. 340 Cement should be spread with a special square notched trowel over one entire surface of the insulation board before it is put in place.

No. 340 Cement is easy to work and possesses the high initial strength necessary to support the weight of the insulation without reinforcing. It remains plastic after drying and shrinks only slightly during the setting and drying period.

Coverage–30 sq. feet per gallon, applied with a notched trowel.

Packaging–1- and 5-gallon cans. This cement weighs 12½ lbs. per gallon.



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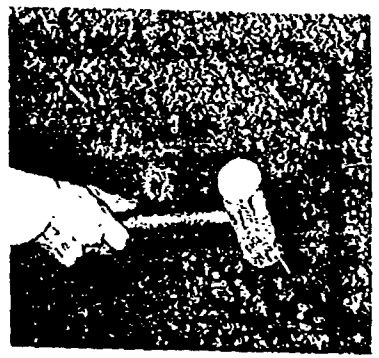
Hardwood Skewers–These hardwood skewers are especially treated with an odorless preservative to prevent mold growth and dry rot. They are used to secure the second and succeeding layers of corkboard insulation to the preceding layer. Two skewers should be used per square foot for wall insulation and partitions of solid insulation, three per sq. ft. for ceilings. Treated hardwood skewers are available in the following lengths and diameters:

| Length | Diameter | Weight per M |
|---|---|---|
| 4" | 1/4" | 3 lbs. |
| 5½" | 1/4" | 6½ lbs. |
| 7" | 1/4" | 10 lbs. |



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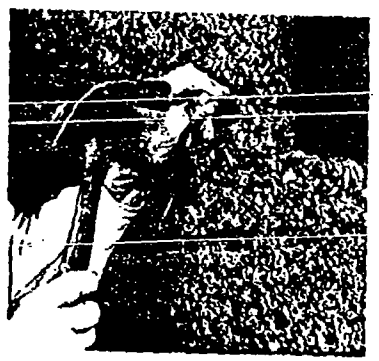
Galvanized Nails–These specially hot-galvanized nails, with ½" diameter heads and thin shanks, are used for the erection of Armstrong's Corkboard. They are recommended to secure the first layer of insulation against wood surfaces and for toenailing the first layer in partitions of solid corkboard insulation. Two nails should be used per square foot of wall, three per square foot of ceilings. Available in the following sizes:

| Length and Sizes | No. per 100-lb. Keg |
|---|---|
| 3" x No. 9 | 6,000 |
| 4" x No. 9 | 4,500 |
| 5½" x No. 8 | 2,900 |
| 7½" x No. 8 | 2,000 |







Armstrong's Asphalt Emulsion–This material is the basic ingredient for Armstrong's Plastic Emulsion and S. P. Emulsion Finishes. Asphalt Emulsion is a clay emulsion of high grade, finely dispersed asphalt which when mixed on the job according to the following formula, can be trowelled directly to the surface of the insulating material. For plastic emulsion (sand-finish) mix according to the following:

50 gallons Armstrong's Asphalt Emulsion
112 lbs. asbestos fibers
275 lbs. (2¾ cu. ft.) dry, screened sand
15 gallons clean water

For S. P. Emulsion (smooth finish) mix as follows:

50 gallons Armstrong's Asphalt Emulsion
115 lbs. asbestos floats
15 gallons clean water

Packaging–Armstrong's Asphalt Emulsion is packed in 1- and 5-gallon cans and in 30- and 55-gallon drums. It weighs 9½ lbs. per gallon. (See Footnote 1 on Page 24.)

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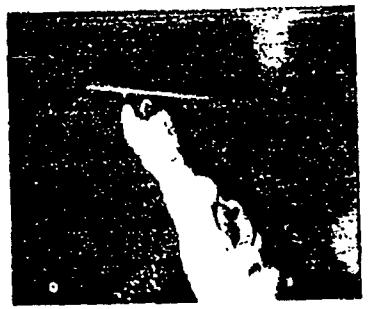

Armstrong's Plastic Emulsion–This product is a complete asphalt plastic finish ready for application as received. It is a mixture of Armstrong's Asphalt Emulsion, asbestos fibers, sand, and water. Plastic Emulsion is trowelled directly to the insulation surface in two coats.

Coverage–8 sq. ft. per gallon of Armstrong's Plastic Emulsion for a two-coat surface.

Packaging–1- and 5-gallon cans and 30- and 55-gallon drums. Armstrong's Plastic Emulsion weighs 11 lbs. per gallon. (See Footnote 1 on Page 24.)

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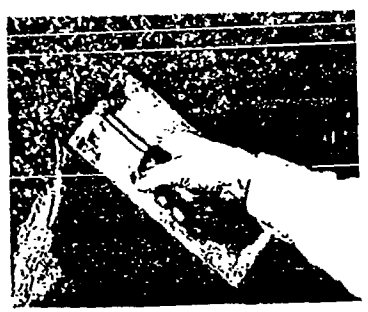


Armstrong's S. P. Emulsion–This is a factory mixed combination of Armstrong's Asphalt Emulsion and asbestos fibers, ready for application to insulation surfaces. It is used when a smooth, plastic finish is desired. The emulsion is trowelled on directly in two coats to a final thickness of approximately 1/8" when dry.

Coverage–9 sq. ft. of two coat surface for each gallon of Armstrong's S. P. Emulsion.

Packaging–1- and 5-gallon cans and 30- and 55-gallon drums. Weight is 10 lbs. per gallon. (See Footnote 1 on Page 24.)



Armstrong's Aluminum Cold Storage Paint—This paint provides a light-reflective finish for asphaltic surfaces. It does not discolor due to bleeding through of the asphalt, is odorless when dry, and does not crack at low temperatures. This Aluminum Cold Storage Paint should not be used on wood, metal, or any surfaces other than asphaltic ones. It is shipped as liquid and powder, packaged separately, which must be thoroughly mixed just prior to using.

Coverage—one gallon will cover 250 square feet in two coats.

Packaging—½-, 1-, and 5-gallon cans. It weighs 9 lbs. per gallon.



Armstrong's No. 27-B Seam Filler—This is an asphalt mastic compound designed to fill and seal the joints between pieces of Armstrong's Mastic Finish Corkboard. It has been specially developed to withstand the low temperatures used in refrigerated construction, and will not shrink out of joints in the insulation.

Coverage—One gallon of No. 27-B Seam Filler is shipped as a sundry with every 150 square feet of Armstrong's Mastic Finish Corkboard.

Packaging—½-, 1-, and 5-gallon cans. Weight is 13½ lbs. per gallon.



Insulating Paper—This is a black paper saturated and coated with pure asphalt. It is used as a vapor seal when erecting Armstrong's Corkboard insulation against wood and frame construction. In application, joints of insulating paper should be lapped not less than 3".

Packaging—36" wide rolls, each containing 500 sq. ft. Weight is 35 lbs. per roll.



Asbestos Floats—These floats are a special grade of asbestos fiber used for mixing with asphalt emulsion. They give a dense, tough, hard quality to the final asphalt plastic finish applied to walls or ceilings of low-temperature rooms.

Packaging—100-lb. bags.

L. Armstrong's S. E. Plastic and Asphalt Emulsions should not be applied when the temperature is below 10° F. Heat and lights should be provided if necessary to maintain this temperature until the finish is thoroughly dry. When dry the finish can be used in rooms operating at temperatures as low as 25° below zero.

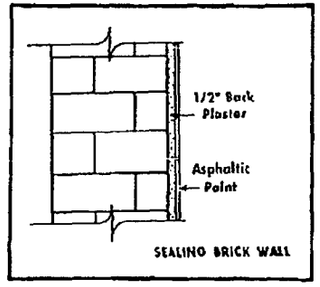


# General Recommendations For Construction of Cold Rooms

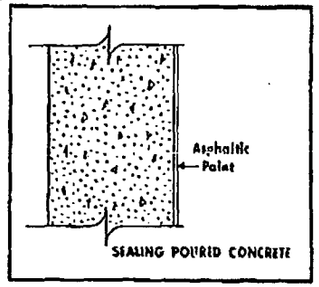
Not so many years ago the majority of all refrigerated space operated at temperatures above the freezing point. Today that situation is completely reversed. Frozen foods, and lower processing temperatures, have brought about a tremendous expansion of freezing and storage facilities that operate at temperatures well below freezing. Widespread use of low-temperature test facilities in manufacturing industries, the steady increase in the demand for ice cream, and many other factors have all contributed toward this change. These lower temperatures not only call for greater thicknesses of insulation to reduce refrigeration costs, but they also increase the severity of the service conditions imposed on insulation. The greater the difference in temperature between the refrigerated space and the outside air, the stronger are the natural forces driving moisture into insulated construction. The very fact that temperatures are low also adds an additional hazard to cold room construction. That hazard is ice, which will form wherever moisture collects in an insulating material under below-freezing conditions. The pressure exerted by freezing can bulge the walls of a cold room or heave up a concrete wearing floor. Under these conditions, sealing moisture out of the insulation becomes of paramount importance. (See Section 1, The Moisture Problem in Low-Temperature Insulation, Page 14.)

## Building Construction Important

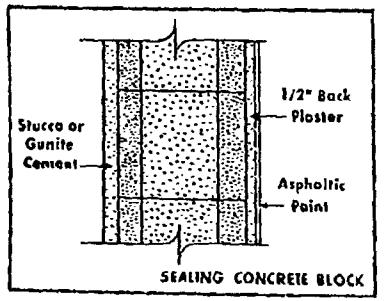
Keeping moisture out of insulation begins with the building itself. Wherever possible, walls, floors, and ceilings should be of solid brick or poured concrete construction. Air spaces that occur in hollow tile, or sheathed studs, or joists should be avoided. Air in these spaces contains moisture, which is likely to condense on the colder surfaces. This condensation will not only rot wooden construction, or drip down through the ceiling insulation, but will also freeze and build up into large ice formations when extremely low temperatures are used. When this construction cannot be avoided, as in existing buildings, hollow spaces must be ventilated so that the air can circulate and carry off moisture. When porous construction, such as concrete block or cinder block, or a porous type stone is used, coat the outer surface of the wall with Gunite Cement to reduce the air infiltration.



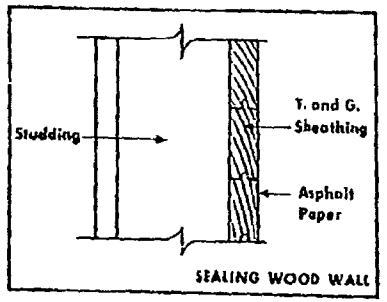
SEALING BRICK WALL



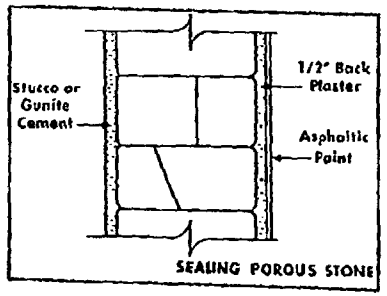
SEALING POURED CONCRETE



SEALING CONCRETE BLOCK



SEALING WOOD WALL



SEALING POROUS STONE

### Apply Insulation to Even Surface

Next step in the fight to keep moisture out is to make the surface to which the insulation is to be applied even and true. In the case of brick, concrete or cinder block, or hollow tile or stone construction, this can be done with a coat of portland cement plaster in one or more coats, depending upon the irregularities of the surface. The plaster should be thick enough so that it is at least ¼" in thickness at all high points. In the case of smooth poured concrete surfaces, the back plaster may be omitted. In addition to greatly reducing air infiltration, back plaster seals the masonry joints in the wall, and provides a tight, smooth surface for application of the priming paint which follows. It also provides a smooth surface against which to erect the insulation, thereby reducing voids between the insulation and the wall.

### Priming the Wall

Then Armstrong's No. 3 Asphaltic Priming Paint should be applied to the dry plaster surface. The solvent in this priming paint decreases its viscosity, and the low viscosity allows the paint to penetrate the pores of the wall. When the solvent evaporates, the asphalt remains in the pores as a vapor and air seal.

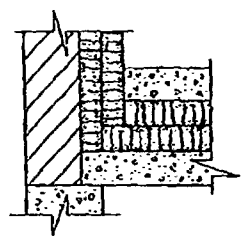
In addition to sealing the wall, the priming paint used must not soften under the temperatures produced when the sun is shining on the wall. In some cases these temperatures are as high as 150° F. on the outside of the wall, and it is possible that this can produce a temperature of 105° F. at the paint film. Obviously, an ordinary priming paint cannot be relied upon under these conditions. The paint used must have high film strength, as well as resistance to flow at maximum wall temperatures, and must withstand cracking or deterioration as it ages.

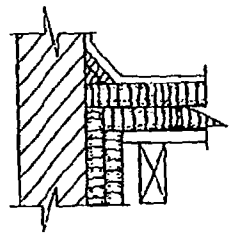
For best results, corkboard insulation should then be applied in hot asphalt. Since the bond between the priming paint and the asphalt is only as good as the asphalt used, the selection of the proper asphalt is a matter of prime importance. Armstrong's Erection Asphalt, for example, is tough and strong, has a minimum susceptibility to temperature changes, is not subject in itself to further chemical change, and maintains these qualities for many years.

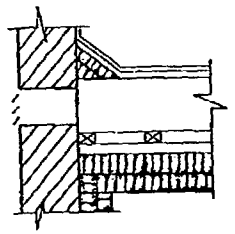
### Full Thickness Required at All Points

Building construction should take into account the fact that greater efficiency and longer life can be attained when space is allowed for full insulation thickness at all points. Foundation walls of low-temperature rooms should be poured short so that when the depressed subfloor of the room is poured it will overlap the top of the foundation wall. This permits application of full




Foundation wall poured short with subfloor lapping over it allows full insulation thickness.


Clearance between building wall and first ceiling joist should allow for full insulation.


Stringers between joists and sheathing to which insulation is applied permit air flow.

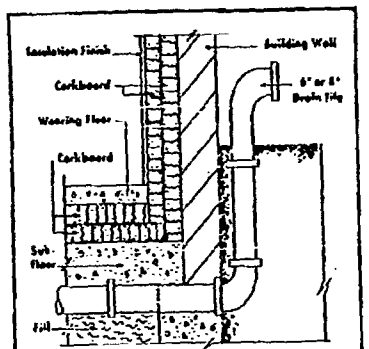
thickness of insulation at the point where wall and floor meet. In envelope construction, care should be taken to obtain sufficient clearance between the masonry wall and the adjacent ceiling joists, so that full insulation thickness may be applied at that point. The same precaution should be taken where a slot is required for a concrete ceiling slab in curtain wall construction.

Insulation should not be applied to wood sheathing placed directly on the underside of ceiling joists forming a roof deck. This sheathing boxes in the air space between joists, cutting down circulation and allowing damaging condensation to form in these spaces. The sheathing should be placed on 2" x 3" stringers, on 16" centers, running at right angles to the direction of the joists. Louvers should then be planned for opposite outside walls. The stringers will permit the free circulation of air over the entire ceiling.

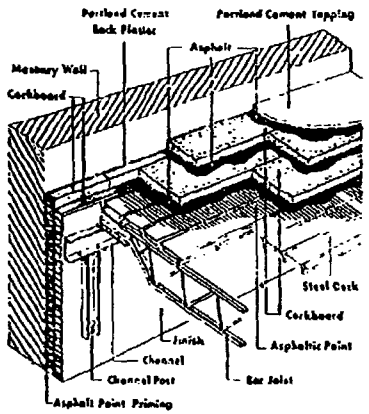
### Freezing Under Subfloors

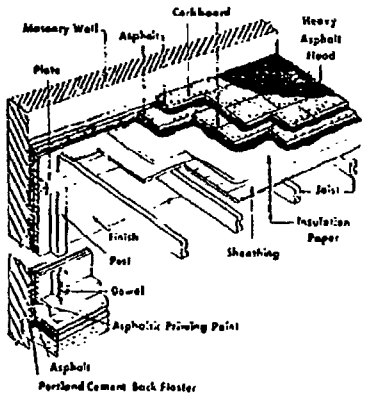
One of the great danger points in freezer construction is ice formation in the ground under the floor of on-grade or below-grade freezer rooms. Over long periods of time, particularly with larger freezers, refrigeration in the room draws heat from the ground through the floor slab faster than it can be replaced by natural forces. No amount of insulation will prevent this flow of heat from the sub-soil, as insulation retards but does not eliminate heat flow. As the ground becomes colder, frost forms first under the center of the room, and then gradually works its way toward the edges until the ground is frozen solid in the form of a huge cone. After a while, cracks appear in the subfloor, then the walls. As the pressure grows, the walls and floor buckle and heave, and the space becomes unusable. The best way to guard against this trouble is to ventilate the sub-soil underneath on-grade or below-grade freezers with a system of air ducts. They can introduce sufficient warm air to keep the ground above the freezing point and prevent the formation of frost. Terra cotta tile ducts 6' on centers or 2' x 3' concrete tunnels 16' on centers can be used. They should be laid across the short dimension of the room.

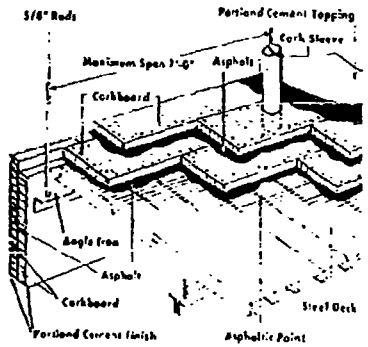
Soil composition, drainage, climatic locale, and floor dimensions all should be considered. Maximum dimensions of unventilated floors should not exceed 20' x 20'. Under average conditions, natural heat from sun and earth will penetrate under the floor 10' from the outside walls.



Detail of Subfloor Vent




Typical Suspended Ceiling Constructions

## Cooler Rooms

Freezer rooms should never be located under cooler rooms operating at above freezing temperatures. In spite of the insulation between, floor temperatures may become so low in the cooler that products on the floor will freeze.

Coolers are usually insulated with 4" or 5" of Armstrong's Corkboard, depending on temperatures being held. Since temperatures are above 32°, moisture is not so serious a problem in cooler construction as in building freezers. However, avoidance of hollows in construction, and the use of back plaster and priming paint on the wall will pay their cost many times in increased efficiency and longer life for cooler rooms.

## Free Standing Walls

Many freezers and coolers are built on the side of the building or in the corner of a larger room. The partition walls of these rooms can be built without wood or masonry. Self-supporting or solid corkboard walls are strong and substantial, have no air spaces, and take up much less space than an insulated partition built of ordinary construction materials.

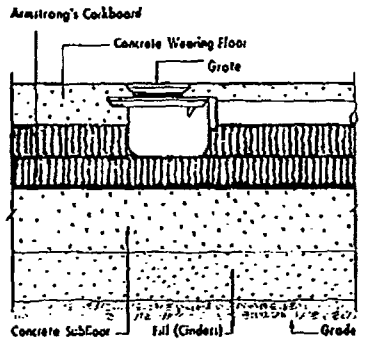
## False Ceilings

When the height of the room is greater than necessary for the cold room, a false ceiling is recommended to conserve refrigeration. This ceiling can be of tee-iron construction, or the cork can be laid in fabricated sheet metal pans or on wood sheathing. When it is necessary to suspend the ceiling from the construction above, hanger rods should be insulated with cork covering for a distance of about three feet above the ceiling to prevent frost formation on them.

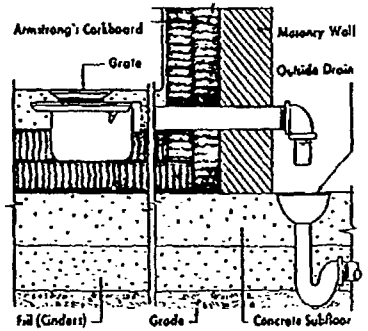
## Single or Double Layer Construction

In cooler rooms double layer construction is almost invariably used. It has the advantage of being more airproof than single layer construction due to the lapping of joints and the additional layer of asphalt between the layers of corkboard. Single layer work is somewhat less expensive to erect and for this reason is sometimes used in coolers. For freezer rooms double layer construction is always recommended.






A properly designed cold storage room drain can be installed without breaking through the floor insulation.




Well designed drain installed in converted cold room. Drip drain outside wall meets health code requirements.

## Floor Drains

Floor drains in cooler and freezer rooms also require special attention. A drain especially designed for cold storage room installation should be used. The significant feature of these drains is their short, squat dimensions. The vertical space between the outlet and the base is much shorter than that in a common drain fixture. This means that the trap can be placed on top of at least several inches of floor insulation in the refrigerated room. Thus the drain and its piping can be installed without puncturing and weakening the insulating envelope.

To avoid contaminating odors, most metropolitan areas have strict sanitary codes which forbid the direct connection of cooler room drains to sewer systems. Coolers in these localities must be drained into sewer lines through an open drip drain, located outside the walls of the low-temperature room.

Floor drains are included in the specifications for freezer rooms, when the freezer is designed to serve also as a cooler during certain seasons of the year. Freezer rooms which might be subsequently converted into coolers should also be equipped with properly designed floor drains.

Drains for freezer rooms are installed in the same manner as the cooler room drains. After a freezer has been cleaned and scrubbed down, glycerine should be poured into the drain to clear the trap of water before the room is put under refrigeration again. This glycerine must be replaced after every subsequent cleaning.

## Electrical Wiring

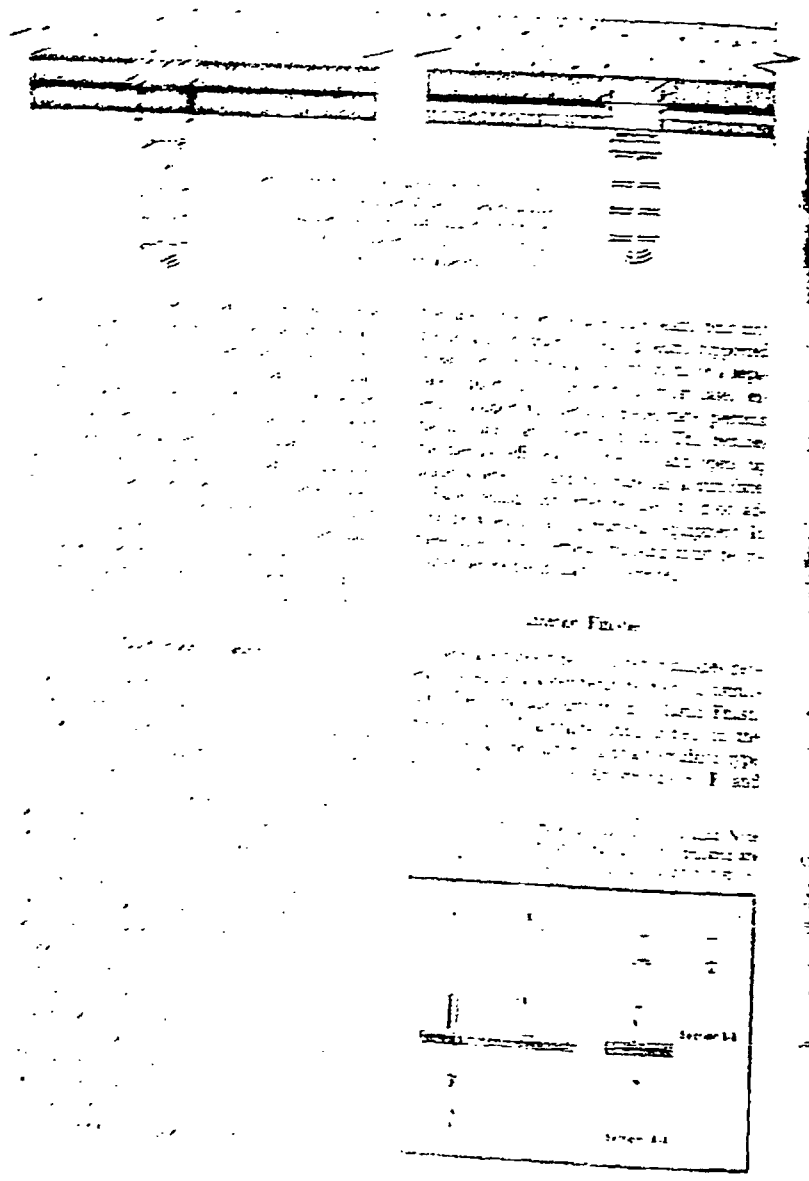
Electrical wiring of low-temperature rooms also should be given special consideration. Too many times, when the electrician arrives on the job, everything is complete except for the final insulation finish and sometimes that is already applied. No provision has been made for the wiring. Faced with this problem, the electrician can do nothing but wire the room from the outside, dropping outlets from the ceiling at those points where lights are required in the freezer.

Metal conduits are good conductors of warm air and heat and each conduit reduces the efficiency of the room. Moisture and warm air flowing into the room through the break made by the conduit will condense, turning to ice on the surrounding insulation and on the outer surfaces of electrical fixtures. The moisture and the warm air inside the conduit will do the same thing, forming more ice inside the conduits and fixtures. This condensation and freezing will damage the insulation and the electrical work.

The best recommended practice is to bring the electrical wiring into the freezer through one conduit, piercing the wall insulation only once, just under the ceiling insulation.

It is good practice to seal the inside of the conduit at the point where it goes through the wall. Special sealing conduilets, which can be poured with wax, will prevent the infiltration of air through the conduit into the room.

Suspending light fixtures and electrical conduits on the underside of the ceiling often pre-



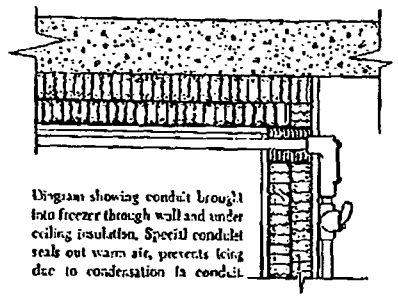


Diagram showing conduit brought into freezer through wall and under ceiling insulation. Special conduit seals out warm air, prevents icing due to condensation in conduit

Armstrong's Plastic Emulsions; and portland cement plaster interior finish.

The desired finished appearance of the low-temperature space, and the service conditions to be encountered in the room will determine which of these finishes should be used.

All three finishes provide good protection for the insulation from moisture within the refrigerated space. When unusually high humidity conditions prevail, the factory mastic finish on corkboard provides extremely high resistance.

Plastic and S. P. Emulsion finishes may be used on walls and ceilings in rooms operating to 25° F. below zero. These black finishes can be brightened by the application of aluminum cold storage paint if brighter room interiors are desired. When asphaltic finishes are subjected to bumping or abrasion, they should be protected with bump rails or wainscoting.

Portland cement plaster is a durable, hard, light colored finish for cold room walls. Because of its weight, this finish should not be used on ceilings, unless temperatures lower than 25° below zero are held. Then, the portland cement should be reinforced with metal lath. For temperatures above -25° F. emulsion finishes are easier and less expensive to apply to ceilings.

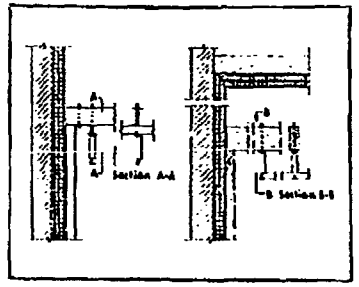
Portland cement plaster on walls will withstand moderate bumping and abrasion without damage. When unusually severe service conditions prevail, the portland cement should also be protected with bump rails or wainscoting.

### Thickness of Insulation

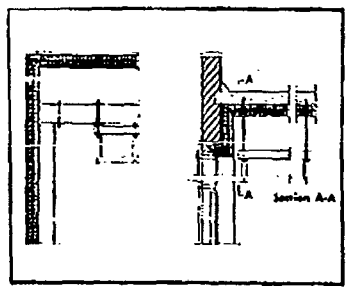
The thickness of insulation will vary with the temperatures held within the refrigerated space. Generally speaking, freezer storages operating at temperatures from 5° below to 5° above zero should be insulated with 7" of corkboard. Sharp freezers and hardening rooms operating from 5° below to 20° below zero, the insulation thickness should be increased to 8". Ten inches are usually recommended for temperatures from minus 20° to minus 35°. At temperatures below 35° below zero, the thickness should be increased as the temperature drops. These same recommendations apply to hardening and freezing tunnels.

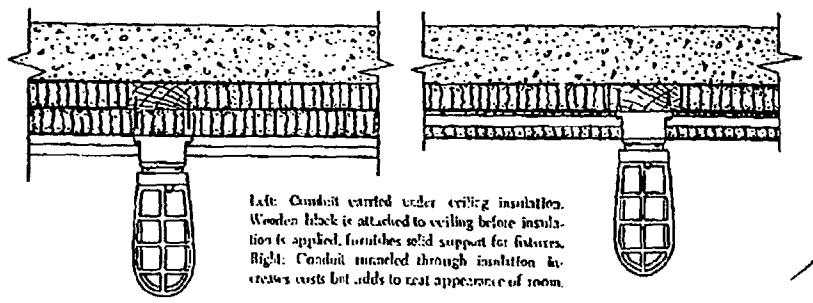
In some cases, greater thicknesses than those outlined above may be necessary. For example, in the South outside temperatures may run high, requiring more insulation, particularly on the sunny side of the building. Where the ceiling of the cold room is also the building roof, insulation thicknesses must also be calculated to offset the effects of direct exposure to the sun's rays.

Tracking can be carried within the room by either wood or steel members. At no point is the insulation punctured, as all the weight is carried by the concrete wearing floor.




Two methods of hanging tracking within the cold room are detailed here. Note in the drawing at right that the tracking is bolted directly to the concrete ceiling slab.





Left: Conduit carried under ceiling insulation. Wooden block is attached to ceiling before insulation is applied, furnishes solid support for fixtures. Right: Conduit tunneled through insulation increases costs but adds to neat appearance of room.

sents a problem. The insulation does not provide firm support for the weight of the fixtures and conduits, and it is hardly feasible to drill 6 or 8 inches through this ceiling insulation to obtain solid support in the concrete or wood ceiling.

This problem is solved by the use of wood blocks placed at predetermined locations on the ceiling in the first layer of insulation. Conduits and fixtures can then be hung to these blocks.

All wiring in a low-temperature room should be moistureproof, although it is not necess to use lead cables. Conduits may be thin threaded pipe, galvanized to prevent ru Fixtures and light switches should be vaporpr

### Cold Room Tracking

Overhead tracking is a vital accessory for cold storage rooms built for the storage of heavy and cumbersome foodstuffs such as meat. Strong structural ceiling supports are needed to carry overhead tram-rail loads. Wooden beams are most commonly used because they are less expensive and do not require the special tools and skill required for handling structural steel. However, steel is more durable and is recommended for rooms where moisture is a problem. In the hands of competent mechanics, fabricated steel beams are installed more rapidly than wooden supports, and the labor costs saved will help make up the difference in original price.

Wherever possible, the tracking supports should be erected within the insulated room, entirely independent of the building structure. This places all the weight on the cold room floor, rather than from the roof structure, or overhead members, and maintenance is simplified.

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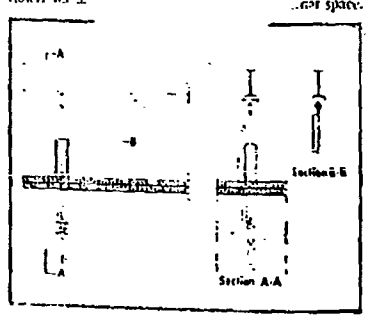
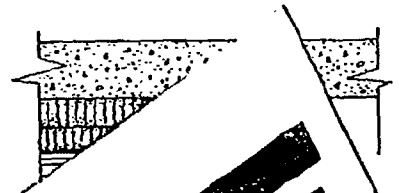





RETAKE
ALPHA SYSTEMS



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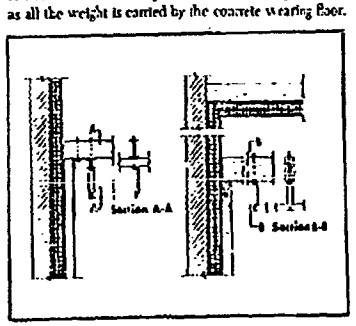


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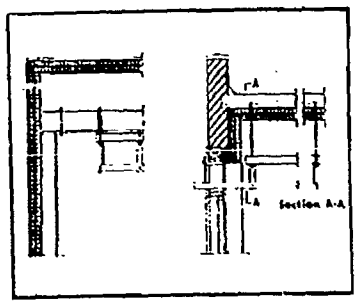

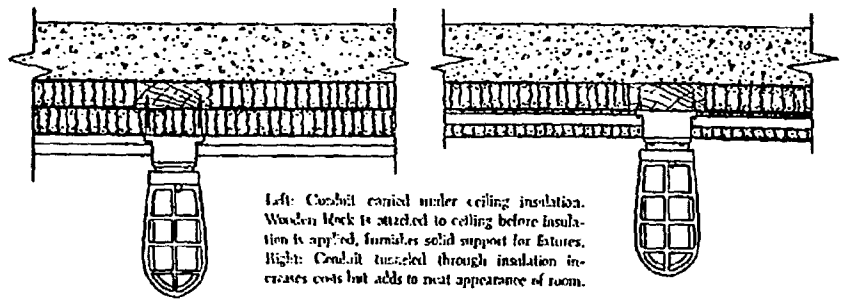

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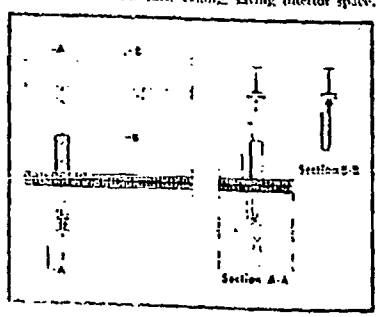
When external supporting framework is used, they are in the form of adequate beams built into the ceiling construction, ceiling beams supported at each end by the wall construction, or a separate supporting construction. In most cases, external supporting methods necessitate piercing the insulation at numerous points. This reduces the thermal efficiency of the job and opens up places where frost and moisture can accumulate.

False ceilings can often be used to good advantage when installing tram-rail equipment. In these cases, the overhead tracking must be installed before the insulation is erected.

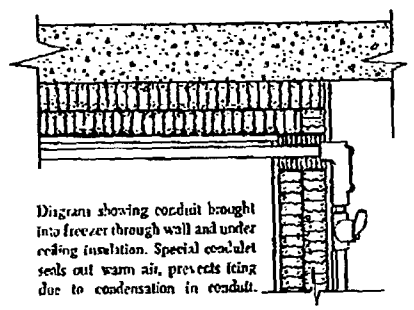
### Interior Finishes

There are three types of interior finishes generally used in low-temperature room construction. These include Armstrong's Mastic Finish, which is a ⅛" asphalt-coating ironed on the insulation at the factory; asphalt emulsion type finishes, which include Armstrong's S. P. and

Detail of cold room tracking under a false ceiling. Note that structural supports and bracing for the tracking are closed off above the false ceiling, saving interior space.





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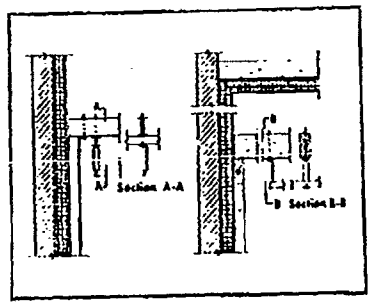


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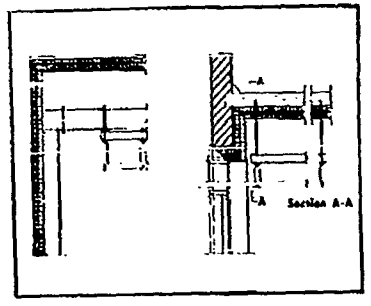


## Recommended Storage Temperatures and Humidities

| Commodity | Storage temperature, °F. | Relative humidity, per cent | Approximate storage life |
|---|---|---|---|
| Apples | 30–32 | 85–85 | —* |
| Asparagus | 32 | 85–90 | 3–4 weeks |
| Bananas (Hedling) | 56 | —* | 7–10 days |
| Beans | | | |
| Green or snap | 32–40 | 85–90 | 2–4 weeks |
| Lima | 32–40 | 85–90 | 2–4 weeks |
| Beets | | | |
| Topped | 32–35 | 95–98 | 1–3 months |
| Bunch | 32 | 95–98 | 10–14 days |
| Blackberries | 31–32 | 80–85 | 7–10 days |
| Broccoli (Italian) | 32–35 | 90–95 | 7–10 days |
| Brussels Sprouts | 32–35 | 90–95 | 3–4 weeks |
| Cabbage | 32 | 90–95 | 3–4 months |
| Carrots | | | |
| Topped | 32 | 95–98 | 4–5 months |
| Bunch | 32 | 85–90 | 10–14 days |
| Cauliflower | 32 | 85–90 | 2–3 weeks |
| Celery | 31–32 | 90–95 | 2–4 months |
| Cherries | 31–32 | 80–85 | 10–14 days |
| Corn (sweet) | 31–32 | 85–90 | —* |
| Cranberries | 36–40 | 85–90 | 1–3 months |
| Cucumbers | 45–50 | 80–85 | 10–14 days |
| Dried fruits | 32–50 | 70–75 | 9–12 months |
| Eggplants | 45–50 | 85–90 | 10 days |
| Endive | 32 | 90–95 | 2–4 weeks |
| Frozen-pack fruits | 10–0 | — | 6–12 months |
| Frozen-pack vegetables | 10–0 | — | 6–12 months |
| Garlic | 32 | 70–75 | 6–8 months |
| Grapefruit | 45–55 | 85–90 | 6–8 weeks |
| Grapes | | | |
| European type | 30–31 | 85–85 | 3–6 months |
| American type | 31–32 | 85–85 | 3–8 weeks |
| Horseradish | 32 | 95–98 | 10–12 months |
| Leeks | 32 | 90–95 | 1–3 months |
| Lemons | 55–58 | 90–95 | 1–4 months |
| Lettuce | 32 | 90–95 | 2–3 weeks |
| Limes | 45–48 | 85–90 | 6–8 weeks |
| Melons | | | |
| Watermelons | 36–40 | 75–85 | 2–3 weeks |
| Muskmelons | 32–34 | 75–75 | 7–10 days |
| Honey Dew and Honey Ball | 40–50 | 75–85 | 2–4 weeks |
| Casaba and Persian | 46–50 | 75–85 | 4–6 weeks |
| Mushrooms (cultivated) | 42–45 | 85–85 | 2–3 days |
| Onions and onion sets | 32 | 70–75 | 6–8 months |
| Oranges | 32–34 | 85–90 | 8–10 weeks |
| Parsnips | 32 | 90–95 | 2–4 months |
| Peaches | 31–32 | 85–90 | 2–4 weeks |
| Pears | | | |
| Bartlett | 29–30 | 85–90 | 15–90 days |
| Fall and winter varieties | 30–31 | 85–90 | —* |
| Peas (green) | 32 | 85–90 | 1–2 weeks |
| Pineapples | | | |
| Mature green | 50–60 | 85–90 | 3–4 weeks |
| Ripe | 40–45 | 85–90 | 2–4 weeks |
| Plums and fresh prunes | 31–32 | 80–85 | 2–4 weeks |
| Potatoes | 38–50 | 85–90 | 1–8 weeks |
| Raspberries | | | —* |
| Black | 31–32 | 80–85 | 7–10 days |
| Red | 31–32 | 80–85 | 7–10 days |
| Rhubarb | 32 | 80–95 | 2–3 weeks |
| Squash (winter) | 50–55 | 70–75 | 4–6 months |
| Strawberries | 31–32 | 80–85 | 7–10 days |
| Sweet potatoes | 55–60 | 75–80 | 4–6 months |
| Tomatoes | | | |
| Ripe | 40–50 | 85–90 | 7–10 days |
| Mature green | 55–70 | 85–90 | 3–5 weeks |
| Turnips (without tops) | 32 | 95–98 | 4–5 months |

* Variety and handling during storage are called because life that no figures can be given.



# Specifications for the Erection of Armstrong's Corkboard

These specifications are included for the convenience of architects, engineers, and owners who desire to write specifications for low-temperature work.

### 1. General

The following applications are the ones most generally used in the construction of cold storage rooms. Cooperation in the engineering of special problems is freely offered by the Armstrong Cork Company. Call any Armstrong Office.

**a. Single and Multiple Layer Construction**

The following sections make reference to two layer construction. When more than two layers of corkboard are specified, the additional layers shall be applied as described for the second layer, unless otherwise noted. When only one layer of corkboard is specified, it shall be erected as described for the first layer. Though two layer construction is preferred to eliminate through joints, single layer construction may be used.

**b. Back Plaster**

Where corkboard insulation is to be applied against masonry walls in asphalt, the walls must be made true and even, if necessary, with portland cement mortar, mixed:

1 part portland cement
3 parts clean, sharp sand
(Use no lime in back plaster)

Immediately preceding the application of plaster, wet the walls evenly with clean water. Apply the plaster in one or more coats to ½" minimum thickness on all high points, straighten with a straightedge, and float smooth. Where necessary to insure a good bond, the existing wall surfaces must be roughened or hacked before applying the portland cement back plaster.

**c. Asphaltic Priming Paint**

All brick, concrete, or plastered surfaces to which corkboard is to be applied in hot asphalt must be primed with Armstrong's No. 3 Asphaltic Paint, applied with either brush or spray. The surfaces must be thoroughly dry before the priming paint is applied. This paint must be allowed to dry before erection of the insulation.

**d. Temperature of Asphalt**

The hot asphalt in which corkboard is dipped shall be held between 350° and 375° F. Do not heat asphalt to temperatures higher than these.

**e. Broken Joints**

In the following specifications, the method of application of corkboard provides that vertical joints in the first layer and all joints in the successive layers shall be broken with respect to each other and that all joints shall be tight.

**f. Nails and Skewers**

Drive nails and skewers obliquely at different angles to provide maximum holding power. Use nails for the attachment of the first layer of corkboard to wood and frame construction, or for the attachment of the second layer to wood stripped concrete ceiling, or for toenailing first layer of solid cork walls. Galvanized nails should always be used and should be about 1" longer than the thickness of insulation being nailed in place.

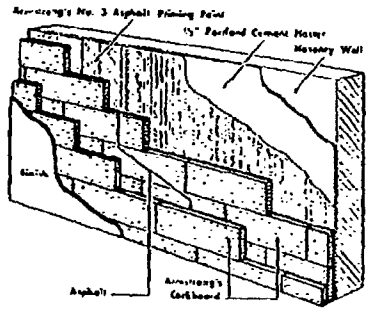
Treated hardwood skewers are used for the attachment of the second and subsequent layers of corkboard and are approximately equal in length to the combined thickness of two layers.

Use two nails or skewers per square foot for securing corkboard to walls and 3 per square foot for ceilings and solid cork walls.

In order not to indent the surface of the corkboard, avoid setting nails or skewers with heavy hammer blows—light blows are more effective. It is preferable to use a mallet or large headed hammer to drive skewers.

## 2. Walls

### 2a. Masonry Walls–Two Layers of Corkboard–Both in Hot Asphalt




All masonry wall surfaces shall be thoroughly cleaned of dirt, dust, loose mortar, etc., and, where necessary, the wall surfaces shall be made true and even as described under Item 1b.

After the plaster is dry, prime the wall as described under Item 1c.

Apply the first layer of corkboard directly to this surface in hot asphalt.

Apply the second layer in hot asphalt and additionally secure it to the first layer with treated hardwood skewers of proper length.

Finish the exposed corkboard surfaces (as specified under FINISHES).

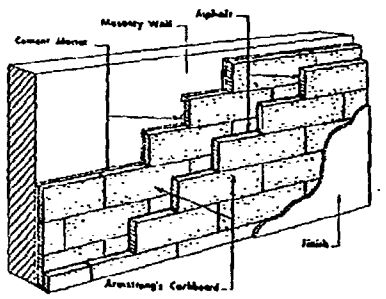
#### Wall Heights Over 14'

Vertical sleepers–Reinforce insulation on masonry walls with treated vertical wood sleepers 1½" x (thickness of the first layer of corkboard) 3' apart and embedded in the first layer. Fasten to the masonry wall with suitable anchors on 5' centers. Bolt heads or nuts and washers shall be countersunk into the wood sleepers and covered with a cork plug.

Horizontal girths–Reinforce insulation on masonry walls with treated horizontal wood girths 1½" x (thickness of the first layer of corkboard) or steel angle irons, 6' to 7' apart, embedded in the first layer and fastened to the masonry walls with suitable anchors on 5'0" centers. Bolt heads or nuts and washers shall be countersunk into the wood sleepers and covered with a cork plug.

Buckstays–Reinforce insulation on masonry walls with 3" wood buckstays erected on 4'0" centers. Buckstays shall be bolted on not over 8'0" centers with ¾" bolts anchored in the masonry walls. Bolt heads or nuts and washers shall be countersunk into the buckstays and covered with a cork plug.

### 2b. Masonry Walls–Two Layers of Corkboard–First Layer in Cement Mortar; Second Layer in Hot Asphalt




All masonry walls must be thoroughly cleaned of dirt, dust, loose mortar, etc., and, where necessary, roughened or hacked to ensure a bond.

Erect the first layer of corkboard, applying ½" of portland cement mortar to the board, mixed:

1 part portland cement
3 parts clean, sharp sand

Apply the second layer of corkboard in hot asphalt and additionally secure it to the first layer with treated hardwood skewers of proper length.

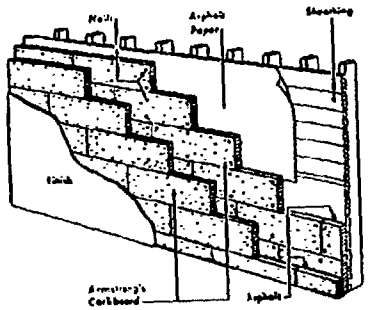
Finish the exposed corkboard surfaces (as specified under FINISHES).

Wall heights over 14' (see Specification 2a).

### 2c. Wood Walls–Two Layers of Corkboard–Both in Hot Asphalt

Directly against the sheathing of the wood walls apply one layer of heavy asphalt paper securely tacked in place with edges lapped not less than 3".

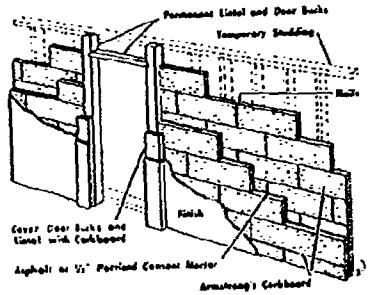





Apply the first layer of corkboard directly to this paper in hot asphalt and secure it to the wood wall with special galvanized nails of proper length. Apply the second layer in hot asphalt and additionally secure it to the first layer with treated hardwood skewers of proper length.

Finish the exposed corkboard surfaces (as specified under FINISHES).

### 2d. Solid Corkboard Walls–Two Layers of Corkboard–Asphalt or Cement Core




Erect temporary 2" x 4" studs on 16" centers in alignment as a guide for self-supporting, solid corkboard walls. Erect first layer of corkboard against temporary studs. Toenail each piece of corkboard to abutting ones, and where possible to walls, floor, and ceiling with special galvanized nails of the proper length.

Erect the second layer against the first in hot asphalt and additionally secure it to the first layer with treated hardwood skewers of proper length.

Finish the exposed cork surfaces (as specified under FINISHES).

Do not remove the temporary studs until the finish on the opposite face of the wall has set.

### 2e. Solid Corkboard Walls–Two Layers of Corkboard–Cement Core (See illustration under Paragraph 2d).

Erect temporary 2 x 4 studs on 18" centers in alignment as a guide for the self-supporting solid corkboard walls. Erect the first layer of corkboard against the temporary studs, securely toenailing each sheet of corkboard to the abutting one, and wherever possible, to walls, floor, and ceiling with special galvanized nails of proper length.

Erect the second layer against the first one, applying ½" of portland cement mortar to the board, mixed

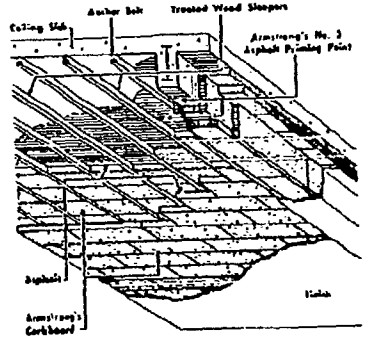
1 part portland cement
3 parts clean, sharp sand

and additionally secure it to the first layer with treated hardwood skewers of proper length.

Finish the exposed corkboard surfaces (as specified under FINISHES).

## 3. Ceilings, Roofs, and Beams

### 3a. Concrete Slab–Two Layers of Corkboard–Both in Hot Asphalt




Before any insulation is applied, fasten to the underside of the concrete ceiling 1⅝" x (thick-

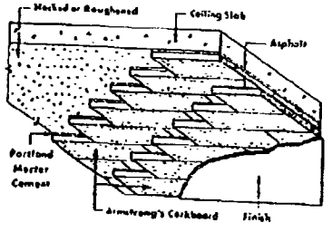
ness of first layer of corkboard) sleepers with suitable anchors. The sleepers must be spaced with 12" or 18" between so that the corkboard will fit tightly between them.

The concrete ceiling slab and sleepers must be thoroughly cleaned of all dirt, dust, loose plaster, etc., and primed (as described under Item 1c).

Apply the first layer of corkboard in hot asphalt between the sleepers and toenail it to the sleepers with special galvanized nails. Apply the second layer in hot asphalt and additionally secure it to the first layer with treated hardwood skewers of proper length. Where the second layer crosses the sleepers, nail it with special galvanized nails of proper length.

Finish the exposed corkboard surfaces (as described under FINISHES).

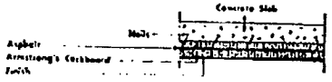
### 3b. Concrete Slab–Two Layers of Corkboard–First Layer Applied in Portland Cement Mortar; Second Layer in Hot Asphalt




The concrete ceiling must be thoroughly cleaned of dirt, dust, loose mortar, etc., and be roughened or hacked to ensure a good bond. Wet the concrete and erect the first layer of corkboard, applying ½" of portland cement mortar to the board, mixed with 1 part portland cement, 2 parts clean, sharp sand and prop in place until securely bonded to the concrete ceiling slab. Apply the second layer of corkboard in hot asphalt and additionally secure it to the first layer with treated hardwood skewers of proper length.

Finish the exposed corkboard surfaces (as specified under FINISHES).

### 3c. Concrete Slab–Two Layers of Corkboard–First Layer in Forms; Second Layer in Hot Asphalt After Forms Are Removed

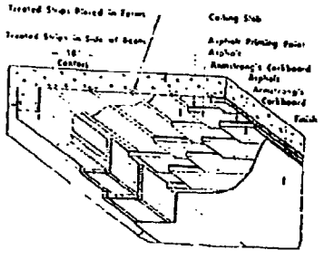



The building contractor shall depress the concrete forms to the proper elevations to receive the first layer of corkboard and shall remove them after the concrete slab has set, care being taken that the corkboard is left undamaged.

Set the first layer of corkboard directly in the forms with all joints tight. Three nails per square foot shall be driven obliquely into the top surface with heads protruding. After the forms have been removed, apply the second layer of corkboard in hot asphalt against the underside of the first layer and additionally secure it with treated hardwood skewers of proper length.

Finish the exposed corkboard surfaces (as specified under FINISHES).

### 3d. Concrete Slab–Two Layers of Corkboard–Both in Hot Asphalt; Beveled Wood Strips in Concrete




Treated beveled wood strips shall be placed in the concrete forms on 18" (or otherwise specified) centers.

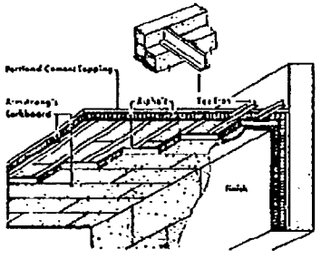
After the forms have been removed and the concrete has seasoned, the surface to receive the insulation shall be thoroughly cleaned of dirt, loose concrete, etc. The concrete surface shall be primed (as described under Item 1c).



Apply the first layer of corkboard in hot asphalt and secure it to the wood strips with special galvanized nails of proper length. Apply the second layer in hot asphalt and additionally secure it to the first layer with treated hardwood skewers of proper length.

Finish the exposed corkboard surfaces (as described under FINISHES).

### 3e. Tee-Iron Ceilings–Two Layers of Corkboard–First Layer Fitted Between Tees; Second Layer Beneath in Hot Asphalt




Tee-irons shall be spaced 12" (or 16") apart. Place the first layer of corkboard between the tee-irons, notching the edges to fit snugly between the flanges.

Flood the top surface with a heavy coat of hot asphalt and apply approximately 1" of portland cement topping, mixed with 1 part portland cement, 3 parts clean, sharp sand.

Apply the second layer in hot asphalt against the underside of the first layer and additionally secure it to the first layer with treated hardwood skewers of proper length.

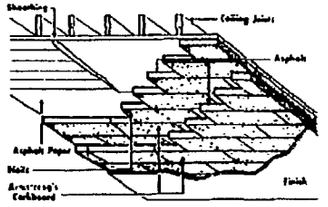
When more than two layers are used, apply the additional layers above the first one in hot asphalt, finishing with cement topping.

NOTE: This specification is not recommended for one-layer work.

Finish the exposed corkboard surfaces (as specified under FINISHES).

### 3f. Wood Ceilings–(Insulation Underneath)–Two Layers of Corkboard–Both Layers in Hot Asphalt

Directly against the underside of the wood ceiling apply one layer of heavy asphalt paper

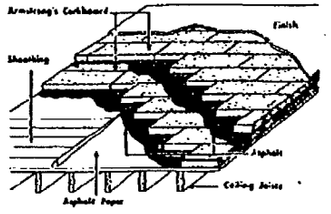



securely tacked in place with edges lapped not less than 3".

Apply first layer of corkboard to this paper in hot asphalt and secure it to the wood ceiling with special galvanized nails of proper length. Apply the second layer in hot asphalt and additionally secure it to the first layer with treated hardwood skewers of proper length.

Finish the exposed corkboard surfaces (as specified under FINISHES).

### 3g. Wood Ceiling or Roof Deck–(Insulation on Top)–Two Layers of Corkboard–Both in Hot Asphalt*




Provide a slot one inch (1") wider than the thickness of the wall insulation along all walls so that the wall and ceiling (roof) insulation will join without a break.

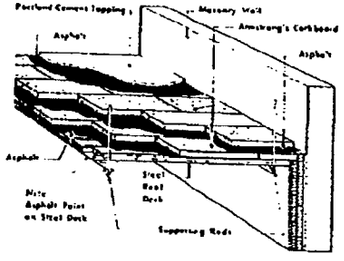
On top of the wood ceiling structure tack one layer of heavy asphalt paper with the edges lapped at least 3" and sealed with hot asphalt.

Over this apply corkboard, each layer being laid in and flooded with hot asphalt.

Alternate Finish–Mop over the corkboard with hot asphalt, one layer of 15-pound saturated roofing felt. Lap and seal all edges of the felt (and flash wherever possible).

*NOTE: When this specification applies to a roof deck, it is understood that the owner or another contractor shall protect the insulation immediately as it is laid, with at least one layer of roofing felt thoroughly mopped on with hot asphalt or pitch. Unless adequate protection is provided, the insulation contractor cannot accept responsibility for any failure that may develop.

3h. Steel Ceiling or Roof Deck–(Insulation on Top)–Two Layers of Corkboard–Both in Hot Asphalt*




Provide a slot 1 inch (1") wider than the thickness of the wall insulation along all walls so that the wall and ceiling (roof) insulation will join without a break.

Set steel roof deck with flanges up and prime with #3 or #4 Asphaltic Paint. Set special corkboard fillers between flanges.

Over this apply corkboard, each layer being laid in and flooded with hot asphalt.

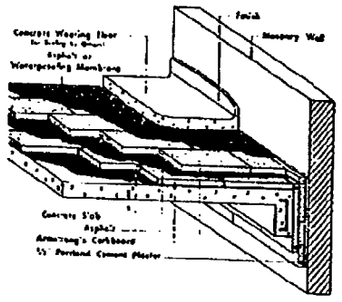
Alternate finishes

(a) Apply a ½" coat of portland cement mortar, mixed with 1 part portland cement and 3 parts clean, sharp sand.

(b) Mop over corkboard with hot asphalt, one layer of 15-pound saturated roofing felt. Lap and seal all edges (and flash where possible).

3i. Concrete Ceiling or Roof Slab–Two Layers of Corkboard–Both in Hot Asphalt*

Provide in the concrete slab a slot 1" wider

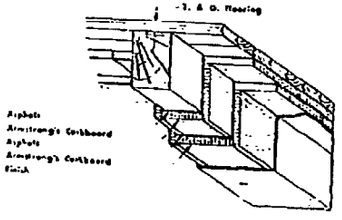



than the thickness of the wall insulation along all walls so that wall and ceiling insulation will join without a break.

Apply the corkboard directly to the concrete slab, each layer of insulation being laid in and flooded with hot asphalt.

Mop over the corkboard with hot asphalt, one layer of 15-pound saturated roofing felt. Lap and seal all edges (and flash where possible).

3j. Wood Beams–Two Layers of Corkboard–Both in Hot Asphalt

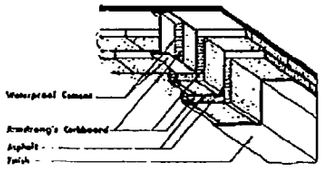



Prime the wood beams with Armstrong's No. 3 Asphaltic Paint. Apply the first layer of corkboard in hot asphalt and secure it to the beams with special galvanized nails of proper length, three per square foot. Apply the second layer in hot asphalt and additionally secure it to the first layer with treated wood skewers of proper length three per square foot.

Finish the exposed corkboard surfaces with an asphalt finish (as specified under FINISHES).



3k. Steel Beams–Two Layers of Corkboard–First Layer in Waterproof Cement–Second Layer in Hot Asphalt




Steel beams shall be cleaned of all dirt or rust where the insulation is to be applied.

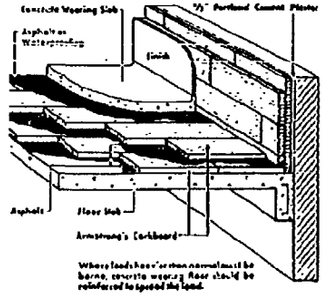
Apply the corkboard against the steel beams in waterproof cement, filling all web spaces, and prop in place until the cement has set. Apply subsequent layers in hot asphalt and additionally secure them with treated wood skewers of proper length, three per square foot.

Finish the exposed corkboard surfaces with an asphalt finish (as specified under FINISHES).

## 4. Floors

NOTE: Where extreme moisture conditions prevail, apply over the corkboard a waterproofing membrane consisting of two layers of 15-pound saturated roofing felt, each layer being mopped in hot asphalt, flashed nine inches (9"), and sealed along all walls and around all columns.

4a. Concrete Floor–Two Layers of Corkboard–Both in Hot Asphalt

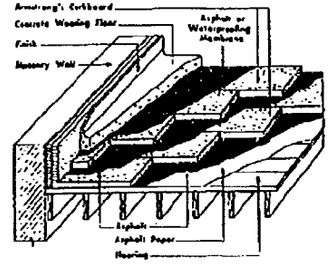



The concrete base or floor on which the insulation is to be laid shall be dry and reasonably smooth and level.

Over this apply corkboard, each layer being laid in and flooded with hot asphalt.

Install a concrete wearing floor on top of the insulation or membrane. (As specified under CONCRETE WEARING FLOORS).

4b. Wood Floor–Two Layers of Corkboard–Both in Hot Asphalt




Directly on top of the wood floor apply one layer of heavy asphalt paper with all edges lapped not less than 3" and sealed with hot asphalt.

Over this apply corkboard, each layer being laid in and flooded with hot asphalt.

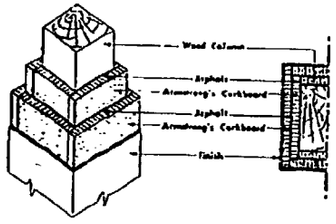
Install a concrete wearing floor on top of the insulation or membrane (as specified under CONCRETE WEARING FLOORS).

## 5. Columns

NOTE: All vertical corners shall be protected with suitable angle corner guards, securely fastened to the column before the finish is applied. Round columns shall have sheet metal guards.

5a. Square Wood Columns–Two Layers of Corkboard–Both in Hot Asphalt

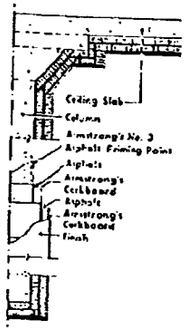
Prime the wood column with Armstrong's No. 3 Asphaltic Paint. Apply the first layer of corkboard in hot asphalt and secure it to the wood columns with special galvanized nails of proper length, three per square foot. Apply the second layer in hot asphalt and additionally secure it




to the first layer with treated hardwood skewers of proper length, three per square foot.

Finish the exposed corkboard surfaces (as specified under FINISHES).

5b. Square Concrete Columns and Flares—Two Layers of Corkboard—Both in Hot Asphalt



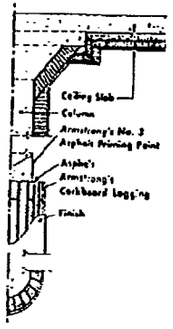

The concrete columns shall be primed (as described under Item 1c).

Apply the first layer of corkboard in hot asphalt.

Apply the second layer in hot asphalt and additionally secure it to the first layer with treated hardwood skewers of proper length, using three skewers per square foot.

Finish the exposed corkboard surfaces (as specified under FINISHES).

5c. Round Concrete Columns and Flares—One Layer of Cork Lagging Applied in Hot Asphalt

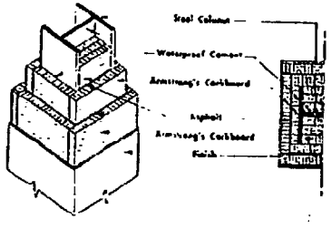



The concrete surfaces shall be primed as described under Item 1c.

Apply the cork lagging, properly beveled to fit the column, in hot asphalt, and toenail each cork lagging to the abutting one with treated wood skewers of proper length.

Finish the exposed corkboard surfaces (as specified under FINISHES).

5d. Steel Columns—Two Layers of Corkboard—First Layer in Waterproof Cement—Second Layer in Hot Asphalt




The steel columns shall be clean of all dirt or rust where the insulation is to be applied.

Apply the corkboard against the column in waterproof cement, filling all web spaces, and prop in place *until the cement has set*. Apply subsequent layers in hot asphalt and additionally secure them with treated wood skewers of proper length, two per square foot.

Finish the exposed corkboard surfaces (as specified under FINISHES).



## 6. Finishes

6a. Asphalt Emulsion Finishes

These finishes shall be applied directly to the corkboard in two coats, each ⅛" thick. Before applying the first coat, all voids, open joints, or broken corners must be pointed with emulsion finish. The first coat must be hard dry before the second coat is applied. Trowel the second coat smooth. The final thickness of the finish shall be approximately ¼" when dry. Finish all corners true and clean. Do not use where operating temperatures will be lower than 25° below zero.

NOTE: Do not apply asphalt emulsion finish when the temperature is below 40° F. In cold weather, provide heat to warm the spaces where the finish is being applied.

(1) Armstrong's Asphalt Emulsion Finish

Finish the exposed corkboard surfaces with Armstrong's Asphalt Emulsion, mixed:

50 gallons Armstrong's Asphalt Emulsion
115 pounds asbestos floats
275 pounds (2¾ cu. ft.) dry, screened sand
15 gallons clean water

Apply as described under Item 6a.

(2) Armstrong's S. P. Emulsion Finish

(Smooth finish): Finish the exposed corkboard surface with Armstrong's S. P. Emulsion in accordance with Item 6a.

(Sand Finish): Finish the exposed corkboard with Armstrong's S. P. Emulsion, mixed:

50 gallons Armstrong's S. P. Emulsion
175 lbs. (1¾ cu. ft.) dry, screened sand
a small amount of clean water for tempering

This mixture shall be applied in accordance with Item 6a.

(3) Armstrong's Plastic Emulsion

Finish the exposed corkboard with Armstrong's Plastic Emulsion, which is a complete asphalt plastic finish ready for application as received from the factory. This mixture shall be used as supplied and shall be troweled on in two coats to a final thickness of ⅛", as described under Item 6a.

6b. Armstrong's Mastic Finish

The exposed corkboard surfaces shall have a mastic finish approximately ⅛" thick ironed on the corkboard at the factory. After the boards are in place, the joints and the holes made by nails or skewers shall be sealed with mastic seam filler in a neat and workmanlike manner.

The convex corners may be finished with Armstrong's Mastic Finish Quarter Round.

6c. Portland Cement Finish

Portland cement finish shall be applied to corkboard walls in two coats, each approximately ¼" thick. First coat shall be keyed to corkboard and thoroughly scratched. Second coat shall be brought to a float or trowel finish. When applied to corkboard ceilings, portland cement finish shall be reinforced with expanded metal lath.

Portland cement finish shall be mixed:

1 part portland cement
3 parts clean, screened sand
5% hydrated lime

Corner beads. All outside corners shall be protected with metal corner beads, fastened securely in place, before the finish is applied.

NOTE: Portland cement finish contracts in setting, causing shrinkage cracks, a condition that cannot be avoided but which will not impair the insulation efficiency. To reduce cracking to a minimum, finish coat of plaster shall be scored each way approximately on 4'0" centers.

## 7. Painting

7a. Armstrong's Aluminum Paint—Over asphaltic surfaces only, apply the paint in two coats, flowing on each coat. Allow the first coat to dry before the second coat is applied. The aluminum paint shall not be mixed until just before application.

## 8. Concrete Wearing Floors

8a. Over the insulation install a monolithic concrete wearing floor 3" thick at the low point (unless otherwise specified) sloped 1" in 10'0".

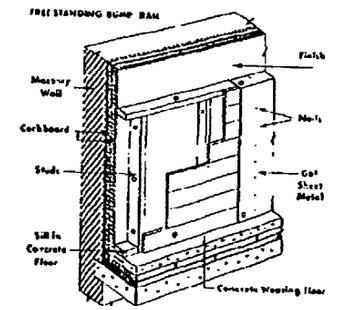
(Slope shall be increased for floors subject to extreme moisture conditions.)

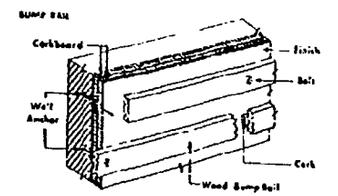
The concrete shall be mixed:

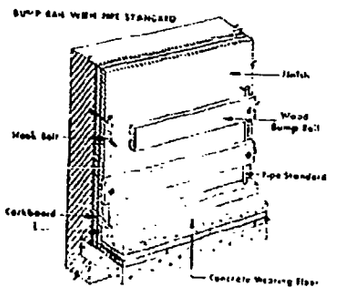
1 part portland cement
2 parts clean, sharp sand
3 parts crushed stone

The concrete shall be floated and troweled to a smooth surface and slightly coved at all vertical surfaces.

# Preventing Damage to Cold Room Insulation




Damage to insulation from wheeled trucks, abrasions by stored goods and ordinary wear and tear can be more costly than the relatively little expense entailed in preventing it in the first place. Punctures in insulation finish allow moisture penetration, with a resulting drop in insulating efficiency and rise in refrigeration costs. Freezing of the collected moisture will eventually destroy the insulation structure.

Prevention of this damage is comparatively easy and relatively inexpensive if the work is done at the time of original construction. The diagrams on these pages show the construction details of many of the protective devices used today. Most of them can be readily added to existing installations at any time.

The illustration at the top left shows a free standing bump rail covered with galvanized sheet metal. The 2 x 4 studs rest on a 2 x 4 sill imbedded in the concrete wearing floor. The studs are anchored at the bottom by a 2 x 4 blocking cut to length and wedged between each stud. Another 2 x 4 runs across the top of the studs to add rigidity to the construction. Tongue-and-groove sheathing is nailed on this framework and covered with metal sheeting. Holes should be drilled through the metal and the sheathing to provide for air circulation between the studs.

Next is shown a bump rail construction for a moderate temperature room. Here horizontal rails are anchored by bolts through the insulation into the masonry walls. A 2" piece of corkboard coated with asphalt or emulsion is slipped over each bolt and is installed between the finish on the wall and the rail. This not only acts as a shock absorber, but the insulating efficiency of the cork minimizes frosting on the bolt.

Lower illustration is also a type of bump rail for moderate temperature rooms. The horizontal wooden rails here are fastened to pipe standards sunk into the concrete curb. The bolts at the top



of the pipe standards are anchored into the masonry wall and the bump rails are fastened to the upright standards with hook bolts.

At the top of this page is shown a protective wainscoting of portland cement plaster in a low-temperature room which has been finished with asphalt emulsion. As a key to hold the portland cement plaster, expanded metal lath is stapled to the insulation over the emulsion finish and is topped with a cap strip. The plaster is then trowelled on in two coats to a ⅞" thickness.

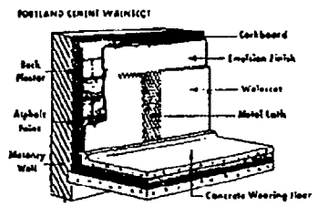
Columns are particularly exposed to damage. Round columns are usually protected with sheet steel as shown at the right. The steel may be either riveted or welded around the column. If the welding method is used, asbestos pads should be applied over the insulation finish before the steel guards are put in place to prevent heat damage to the finish on the insulation.

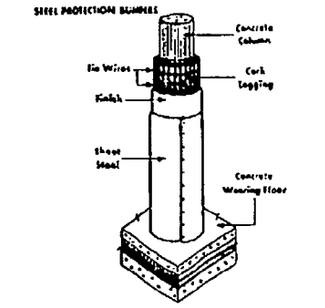
The corners of square metal columns are usually protected with iron angle guards approximately 8 feet high, with expansion corner beads above the guards as high as desired. The angle irons are embedded into the concrete wearing floor and are bolted together at the top with a tie-strap, usually ¼" thick.

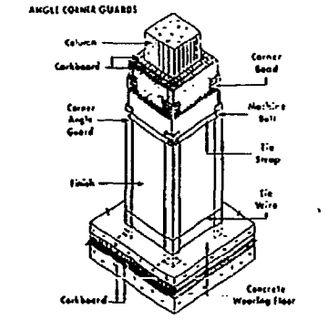
An expansion corner bead is shown on the square column at left. These corner beads are installed in the same manner, whether they are used on square columns or on the outside corner of a wall. They are firmly anchored to the cork insulation with staples and then the plaster is applied to the beading.

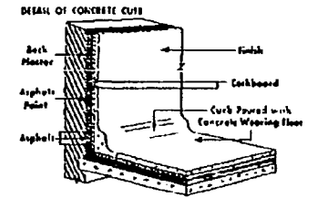
Concrete wearing floors in all cold rooms should be slightly coved to the side walls to prevent moisture which may collect on the floor from seeping into the insulation at the junction of the wall and the floor. The cove is easy to install when the floor is poured. A relatively shallow coving is all that is necessary, unless damage by bumping is likely to occur.

A concrete curb, illustrated at left, poured at the same time as the concrete wearing floor will protect the insulation finish and the insulation beneath it from many damaging blows from wheeled trucks. At the same time, it protects the insulation from water seepage at the floor level. These concrete curbs are usually 4" x 4", unless unusual operating conditions prevail. Then they can be poured larger or smaller to meet the special requirements of a particular job.



# Maintenance and Care of Cold Room Insulation



After low-temperature insulation is properly installed, following the simple maintenance procedures outlined below will result in long-lasting and efficient operating conditions. Excessive power consumption and costly shutdowns for expensive repairs will be avoided.

Proper maintenance is relatively simple and very inexpensive. Actually only two things have to be done. One is to inspect regularly all surfaces for breaks, cracks, or openings that would permit infiltration of moisture-laden warm air. The second is to patch any breaks before appreciable moisture or frost damage is done. In following out this formula, the following points should be checked:

### Exterior Walls

Exterior walls should be checked regularly for any cracks or flaws. Wall joints should be pointed when necessary. Under ordinary circumstances, masonry walls require some pointing almost every year to keep them in top condition.

### Interior Walls

Patch all cracked or chipped places in the wall finish as soon as they develop. Armstrong's Asphalt Emulsion or Armstrong's Seam Filler or both can be used to treat such spots. Generally, the asphalt emulsion is used for relatively small breaks, while large gouges or breaks are filled first with seam filler and then finished with a coat of asphalt emulsion.

When the interior finish is of portland cement plaster, all loose plaster should be removed and new plaster, mixed one part portland cement, two parts clean screened sand, and no more than 5% hydrated lime, should be applied.

### Roof Surfaces

Examine roof surfaces above top floor cold rooms at frequent intervals. Repair the roofing immediately if any leaks develop. Give special attention to all flashings at parapets and at junctions with other vertical walls. Flashings should be free from breaks and tight to parapets or walls to prevent storm-water seepage.

### Wood Fixtures

Paint all wood fixtures, such as door frames, racks, shelves, false ceilings, supports, bunkers, and catwalks, at least once a year to prevent rotting and deterioration. Use an odorless paint and brush on one good covering coat.

### Doors

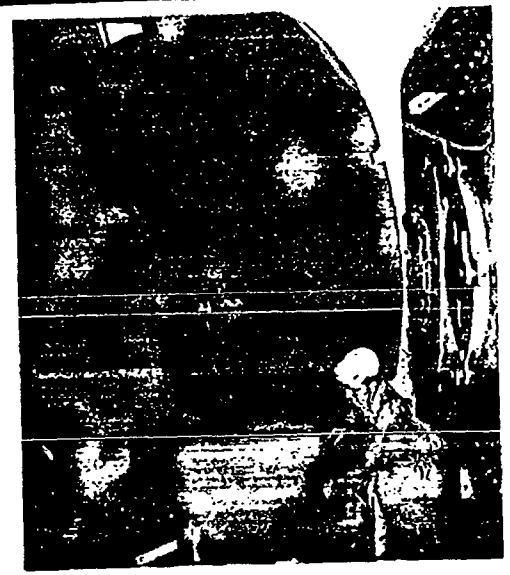
Check alignment of doors. Be sure they fit snugly and evenly. Replace bent or flat gaskets in order to get a true seal when the door is shut.

Tighten all hardware, including hinges, latches, and springs. Replace promptly any damaged or worn hardware. Also check door sills, casings, and other wooden fixtures for rotting, and if they are either rotted or worn excessively they should be replaced without delay.

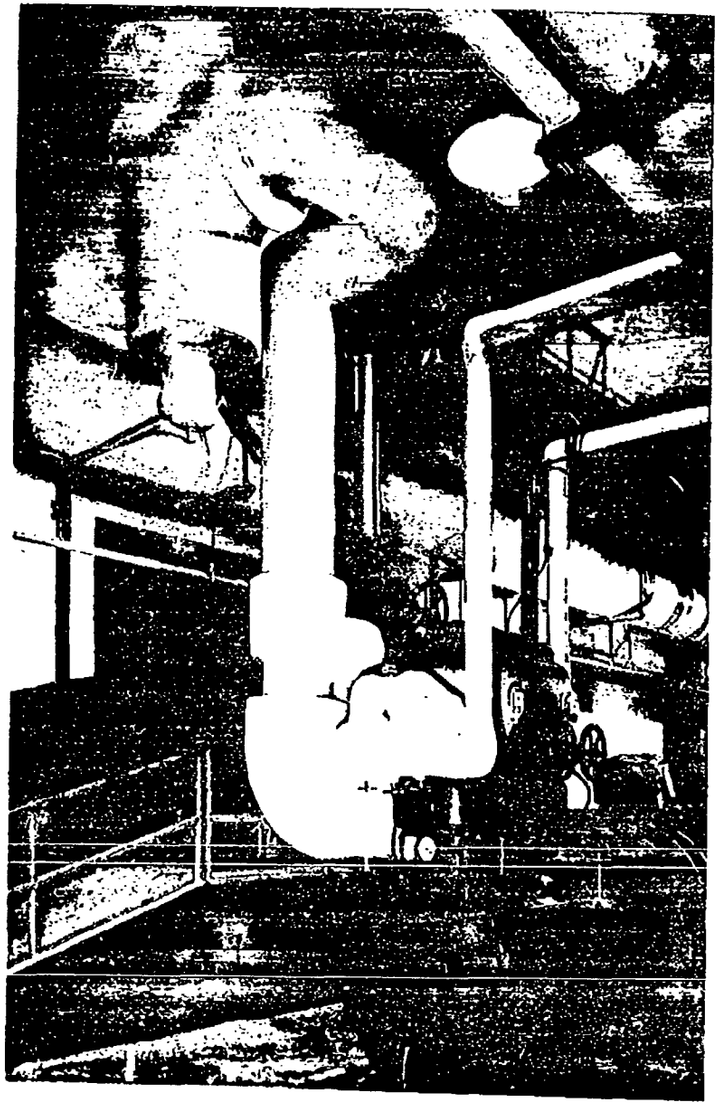




Above: This ten-foot-high food freezing tunnel is built entirely of Armstrong's Corkboard. The walls are self-supporting, and carry the weight of the ceiling, which is of Tee-iron construction. The tunnel is sixty feet long and operates at 30° F. below zero.



At right: The ease with which corkboard can be bent and handled to fit curved or unusual contours is demonstrated by this illustration. Here a workman is building a cork-insulated door for a stratosphere test chamber.





Section II

# COLD LINES

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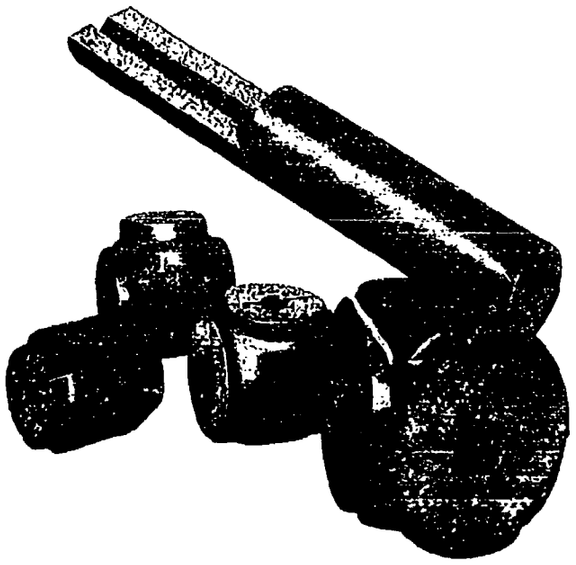
General Recommendations for Insulation of Cold Lines..... 54

Specifications for Application of Cork Covering..... 62

Maintenance of Cold Line Insulation..... 64

Types of Cork Fitting Covers..... 65



# Armstrong's Cork Covering For All Cold Lines

Armstrong's Cork Covering is made from clean granules of pure cork, compressed in molds of the proper shape for various sizes of pipe and fittings, and then baked into strong and homogeneous shapes. The sections then are machined to accurate size and factory finished inside and out with a moisture-proof, airtight asphalt mastic finish. Armstrong's Cork Covering possesses virtually the same physical properties as Armstrong's Corkboard, Page 17. This covering equals or exceeds Federal Specification HH-P-381 for pipe-covering; cork, molded.

High natural resistance to moisture and heat flow are as essential to cold line insulation as to the insulation of cold rooms. (See "Moisture Problem in Low-Temperature Insulation," Page 14.) Unless a moisture-resistant insulation is used on cold lines, moisture from the surrounding air will be forced into any break or opening and work its way into the insulating material. Moisture is a good conductor of heat, and the heat retarding properties of the insulation will decrease in direct proportion to the moisture present. If the insulation on the line is of fibrous material, as moisture is absorbed capillary attraction will carry that moisture far from the original point of contact, and in time the whole length of the insulation will become saturated.

If the lines are cold enough, the moisture will turn to frost, and in due time the formation of ice will break up the insulation and cause it to lose its efficiency entirely.



High resistance to damaging moisture is one of the outstanding characteristics of Armstrong's Cork Covering. This is due to the natural cellular structure of cork. (See "The Properties of Cork" on Page 17.) The factory-applied asphalt mastic finish on the covering is a further protection against moisture infiltration.

On all cold lines, highly efficient Armstrong's Cork Covering, when applied in proper thicknesses, reduces refrigeration loss by 80 to 90 percent. High efficiency is maintained through long years of service because of cork's unusual ability to withstand the damaging effects of moisture. The savings that can be realized through the use of cork covering on low-temperature lines can be quickly calculated from the "Comparative Heat Loss Data" on Page 60.

## Thicknesses

Armstrong's Cork Covering is manufactured in three regular thicknesses and in special thicknesses to meet various service conditions. As shown below, the actual thickness varies with the pipe size between the minimum and maximum given in each case.

Light-Duty Thickness—1.20 to 1.93 inches thick, depending on pipe size, for use on refrigerated drinking water or other cold lines, and generally where temperatures of 35° F. and above are maintained.

Standard Thickness—1.70 to 3.50 inches thick, depending on pipe size, for brine, ammonia, carbon dioxide, or other gas or liquid lines operating at temperatures from 0° to 35° F. This thickness should also be used where the maximum temperature difference between the refrigerant and surrounding air is less than 100° F.

Heavy-Duty Thickness—2.63 to 4.19 inches thick, depending on pipe size, for cold lines operating at temperatures from 0° to 25° F. below zero. This thickness should also be used where temperatures surrounding the cold lines are unusually high, as in boiler rooms or adjacent to steam lines, or in tunnels or pipe shafts.

Special Thickness—3.89 inches or more in thickness, as required for special process cold lines where extremely low temperatures are specified. Chart on Page 61 gives special recommended wall thicknesses of cork covering for different refrigerant line temperatures.

## Pipe Coverings

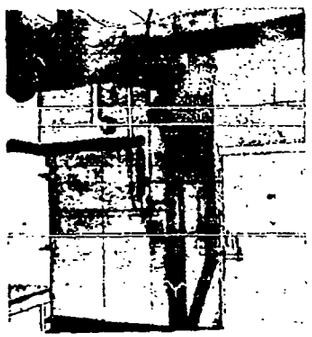
All pipe covering thicknesses are made to fit exactly any size of standard pipe and tubing from ¼" up and are furnished in 36" long molded sections. For larger pipe sizes, Armstrong's Cork Covering is supplied in 36" long sections built up at the factory from beveled lagging, ready to apply on the job.

The pipe sizes for which built-up lagged covering is furnished are as follows:

Light-Duty Thickness —all pipe sizes above 12"
Standard Thickness —all pipe sizes above 14"
Heavy-Duty Thickness—all pipe sizes above 12"

## Fitting Covers

Fitting covers are made in the same thicknesses as are pipe coverings and are designed for all types of standard fittings, such as ells, tees, valves, flanges, unions, weld and sweat fittings, etc. Fitting covers are rigid and will not sag. They are made to join accurately with the pipe covering, thus providing the same dependable protection for fittings that straight lengths of covering provide for all other parts of the line. For the most generally used sizes, cork fitting covers are furnished in two molded sections designed to fit the exact contour of the fitting and ready to apply in the same manner as pipe covering. For the larger sizes, fitting covers are furnished in sections built up at the factory and ready to apply when received on the job.



Cork covering accurately fits all size pipe and fittings.

## Armstrong's Cork Covering Dimensions

### Nominal Pipe Size Covering

The dimensions of Armstrong's Cork Covering for nominal pipe sizes from ⅛" to 30" and for tubing sizes from ⅜" O. D. to 6⅛" O. D. are as shown in the tables below. For sizes above single heavy liners, moulded cork covering is furnished. For sizes below single heavy liners, assembled cork lagging sections are furnished in half sections. For sizes below double heavy liners, quarter sections of assembled cork lagging are furnished.

| Nominal Pipe Size | Light-Duty Thickness | | Standard Thickness | | Heavy-Duty Thickness | | Nominal 4" Wall Thickness | | Nominal 5" Wall Thickness | | Nominal 6" Wall Thickness | | Nominal 7" Wall Thickness | | Nominal 8" Wall Thickness | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Thickness Inches | O. D. Covering Inches | Thickness Inches | O. D. Covering Inches | Thickness Inches | O. D. Covering Inches | Thickness Inches | O. D. Covering Inches | Thickness Inches | O. D. Covering Inches | Thickness Inches | O. D. Covering Inches | Thickness Inches | O. D. Covering Inches | Thickness Inches | O. D. Covering Inches |
| ⅛ | 1.15 | 3.25 | 1.43 | 4.25 | 2.88 | 6.31 | 7.04 | 14.62 | 5.82 | 12.19 | 6.48 | 14.62 | 7.29 | 16.25 | 7.41 | 16.25 |
| ¼ | 1.15 | 3.25 | 1.43 | 4.25 | 2.82 | 6.31 | 6.97 | 14.62 | 5.72 | 12.19 | 6.37 | 14.62 | 7.17 | 16.25 | 7.29 | 16.25 |
| ⅜ | 1.20 | 3.25 | 1.70 | 4.25 | 2.73 | 6.31 | 6.80 | 14.62 | 5.54 | 12.19 | 6.12 | 14.62 | 6.90 | 16.25 | 7.01 | 16.25 |
| ½ | 1.15 | 3.25 | 1.67 | 4.25 | 2.64 | 6.31 | 6.78 | 14.62 | 5.52 | 12.19 | 6.10 | 14.62 | 6.87 | 16.25 | 6.98 | 16.25 |
| ¾ | 1.42 | 4.25 | 2.00 | 5.31 | 2.97 | 7.25 | 7.41 | 16.25 | 6.00 | 13.12 | 6.63 | 16.25 | 7.41 | 16.25 | 7.53 | 16.25 |
| 1 | 1.50 | 4.69 | 2.22 | 6.31 | 3.10 | 7.87 | 7.29 | 16.25 | 5.90 | 14.62 | 6.48 | 16.25 | 7.29 | 16.25 | 7.41 | 16.25 |
| 1¼ | 1.50 | 4.69 | 2.42 | 6.75 | 3.20 | 7.87 | 7.17 | 16.25 | 5.80 | 14.62 | 6.37 | 16.25 | 7.17 | 16.25 | 7.29 | 16.25 |
| 1½ | 1.50 | 4.69 | 2.44 | 7.25 | 3.25 | 8.87 | 6.94 | 16.25 | 5.61 | 14.62 | 6.12 | 16.25 | 6.90 | 16.25 | 7.01 | 16.25 |
| 2 | 1.50 | 5.31 | 2.50 | 7.87 | 3.60 | 8.87 | 7.25 | 17.37 | 5.87 | 14.62 | 6.37 | 17.37 | 7.17 | 17.37 | 7.29 | 17.37 |
| 2½ | 1.50 | 5.31 | 2.68 | 8.87 | 3.65 | 9.62 | 7.06 | 19.12 | 6.00 | 16.25 | 6.48 | 19.12 | 7.06 | 19.12 | 7.17 | 19.12 |
| 3 | 1.50 | 6.75 | 2.81 | 9.64 | 3.90 | 11.12 | 7.29 | 19.12 | 6.00 | 17.37 | 6.75 | 19.12 | 7.29 | 19.12 | 7.41 | 19.12 |
| 3½ | 1.50 | 7.25 | 2.90 | 9.62 | 3.91 | 11.12 | 7.23 | 19.12 | 6.00 | 17.37 | 6.75 | 19.12 | 7.23 | 19.12 | 7.35 | 19.12 |
| 4 | 1.50 | 7.87 | 2.98 | 11.12 | 3.78 | 13.12 | 6.77 | 19.12 | 6.00 | 17.37 | 6.75 | 19.12 | 7.23 | 19.12 | 7.35 | 19.12 |
| 4½ | 1.50 | 8.87 | 3.00 | 12.19 | 4.00 | 14.62 | 7.00 | 22.00 | 6.00 | 19.12 | 6.75 | 21.00 | 7.00 | 21.00 | 7.12 | 21.00 |
| 5 | 1.50 | 9.62 | 3.00 | 12.19 | 4.00 | 14.62 | 7.00 | 22.00 | 6.00 | 19.12 | 6.75 | 21.00 | 7.00 | 21.00 | 7.12 | 21.00 |
| 6 | 1.50 | 11.12 | 3.00 | 13.12 | 4.00 | 16.25 | 7.00 | 24.00 | 6.00 | 21.00 | 6.75 | 22.63 | 7.00 | 22.63 | 7.12 | 22.63 |
| 7 | 1.50 | 12.19 | 3.00 | 14.62 | 4.00 | 16.25 | 7.00 | 26.00 | 6.00 | 22.63 | 6.75 | 24.25 | 7.00 | 24.25 | 7.12 | 24.25 |
| 8 | 1.50 | 13.12 | 3.00 | 16.25 | 4.00 | 18.00 | 7.00 | 28.00 | 6.00 | 24.25 | 6.75 | 26.25 | 7.00 | 26.25 | 7.12 | 26.25 |
| 10 | 1.50 | 14.62 | 3.00 | 18.00 | 4.00 | 20.00 | 7.00 | 30.00 | 6.00 | 26.25 | 6.75 | 28.00 | 7.00 | 28.00 | 7.12 | 28.00 |
| 12 | 1.50 | 16.25 | 3.00 | 20.00 | 4.00 | 22.00 | 7.00 | 32.00 | 6.00 | 28.00 | 6.75 | 30.00 | 7.00 | 30.00 | 7.12 | 30.00 |
| 14 | 1.50 | 17.00 | 3.00 | 21.00 | 4.00 | 23.00 | 7.00 | 34.00 | 6.00 | 30.00 | 6.75 | 32.00 | 7.00 | 32.00 | 7.12 | 32.00 |
| 15 | 1.50 | 19.00 | 3.00 | 22.00 | 4.00 | 24.00 | 7.00 | 36.00 | 6.00 | 32.00 | 6.75 | 34.00 | 7.00 | 34.00 | 7.12 | 34.00 |
| 16 | 1.50 | 21.00 | 3.00 | 24.00 | 4.00 | 26.00 | 7.00 | 38.00 | 6.00 | 34.00 | 6.75 | 36.00 | 7.00 | 36.00 | 7.12 | 36.00 |
| 18 | 1.50 | 23.00 | 3.00 | 26.00 | 4.00 | 28.00 | 7.00 | 40.00 | 6.00 | 36.00 | 6.75 | 38.00 | 7.00 | 38.00 | 7.12 | 38.00 |
| 20 | 1.50 | 25.00 | 3.00 | 28.00 | 4.00 | 30.00 | 7.00 | 42.00 | 6.00 | 38.00 | 6.75 | 40.00 | 7.00 | 40.00 | 7.12 | 40.00 |
| 22 | 1.50 | 27.00 | 3.00 | 30.00 | 4.00 | 32.00 | 7.00 | 44.00 | 6.00 | 40.00 | 6.75 | 42.00 | 7.00 | 42.00 | 7.12 | 42.00 |
| 24 | 1.50 | 29.00 | 3.00 | 32.00 | 4.00 | 34.00 | 7.00 | 46.00 | 6.00 | 42.00 | 6.75 | 44.00 | 7.00 | 44.00 | 7.12 | 44.00 |
| 26 | 1.50 | 31.00 | 3.00 | 34.00 | 4.00 | 36.00 | 7.00 | 48.00 | 6.00 | 44.00 | 6.75 | 46.00 | 7.00 | 46.00 | 7.12 | 46.00 |
| 28 | 1.50 | 33.00 | 3.00 | 36.00 | 4.00 | 38.00 | 7.00 | 50.00 | 6.00 | 46.00 | 6.75 | 48.00 | 7.00 | 48.00 | 7.12 | 48.00 |
| 30 | 1.50 | 35.00 | 3.00 | 38.00 | 4.00 | 40.00 | 7.00 | 52.00 | 6.00 | 48.00 | 6.75 | 50.00 | 7.00 | 50.00 | 7.12 | 50.00 |
| 32 | 1.50 | 37.00 | 3.00 | 40.00 | 4.00 | 42.00 | 7.00 | 54.00 | 6.00 | 50.00 | 6.75 | 52.00 | 7.00 | 52.00 | 7.12 | 52.00 |
| 34 | 1.50 | 39.00 | 3.00 | 42.00 | 4.00 | 44.00 | 7.00 | 56.00 | 6.00 | 52.00 | 6.75 | 54.00 | 7.00 | 54.00 | 7.12 | 54.00 |
| 36 | 1.50 | 41.00 | 3.00 | 44.00 | 4.00 | 46.00 | 7.00 | 58.00 | 6.00 | 54.00 | 6.75 | 56.00 | 7.00 | 56.00 | 7.12 | 56.00 |

### Tubing Covering

| Tubing O. D. Pipe Inches | Light-Duty Thickness | | Standard Thickness | | Heavy-Duty Thickness | |
|---|---|---|---|---|---|---|
| | Thickness Inches | O. D. Covering Inches | Thickness Inches | O. D. Covering Inches | Thickness Inches | O. D. Covering Inches |
| ⅜ | 1.43 | 3.25 | 1.93 | 4.25 | 2.95 | 6.31 |
| ½ | 1.37 | 3.25 | 1.87 | 4.25 | 2.90 | 6.31 |
| ⅝ | 1.31 | 3.25 | 1.81 | 4.25 | 2.84 | 6.31 |
| ¾ | 1.43 | 3.25 | 1.90 | 4.69 | 2.71 | 6.31 |
| 1⅛ | 1.56 | 4.25 | 2.09 | 5.31 | 3.06 | 7.25 |
| 1⅜ | 1.65 | 4.69 | 2.46 | 6.31 | 3.24 | 7.87 |
| 1⅝ | 1.53 | 4.69 | 2.56 | 6.75 | 3.12 | 7.87 |
| 2⅛ | 1.59 | 5.31 | 2.56 | 7.25 | 3.37 | 8.87 |
| 2⅝ | 1.34 | 5.31 | 2.62 | 7.87 | 3.12 | 8.87 |
| 3⅛ | 1.81 | 6.75 | 2.87 | 8.87 | 3.24 | 9.62 |
| 3⅝ | 1.81 | 7.25 | 2.99 | 9.62 | 3.74 | 11.12 |
| 4⅛ | 1.87 | 7.87 | 2.74 | 9.62 | 3.49 | 11.12 |
| 5⅛ | 1.87 | 8.87 | 3.00 | 11.12 | 3.99 | 13.12 |
| 6⅛ | 2.06 | 10.25 | 3.02 | 12.19 | 4.24 | 14.62 |

## How to Order Armstrong's Cork Covering

To insure the correct listing of materials, orders for Armstrong's Cork Covering should be specific with regard to the following points:

### Thickness of Covering

Light-Duty Thickness
Standard Thickness
Heavy-Duty Thickness
Special Wall Thickness (refer to minimum thickness table on Page 61)

### Quantity

List number of lineal feet of each thickness of covering and number of fittings by types.

### Pipe Size

Pipe sizes should be carefully measured and accurately determined. Sizes are assumed to be "nominal inside pipe diameter" *unless otherwise specified*, i.e., as "Size O.D." copper and steel tubing, etc.

### Size and Type of Fitting or Valve

Specify if screwed or flanged. *Unless otherwise specified*, all fittings are assumed to be screwed.

Specify if Standard, Extra Heavy (250#), Ammonia, Sweat, Weld. *Unless otherwise specified*, all fittings are assumed to be 125# standard. Unless maker's name and catalog number are specified, 150# fittings are considered the same as standard. 300# fittings are considered same as Extra Heavy, with the exception of 300# valves, which are considered as "Special Fittings."

Specify type fitting, i.e., 90° ell, 45° ell, union, tee, etc. *Unless otherwise specified*, all ells are assumed to be 90°, standard radius. Composite fitting covers designed to fit all makes of weld and sweat ells and tees are furnished for pipe sizes up to and including 6". For weld and sweat ells and tees over 6", Special Fitting Covers are furnished and maker's name and catalog number are required with orders.

Specify type of valve—gate, angle, globe, and whether screwed or bolted bonnet. *Unless otherwise specified*, standard valves under 2" are assumed to be screwed bonnet; 2" and over are assumed to be bolted bonnet. Ammonia valves under 1" are assumed to be screwed bonnet; 1" and over are assumed to be bolted bonnet.

"Special Fittings." Specify manufacturer's name and catalog number of fitting. Where this information is not available, include dimensioned prints with the cork covering order.