Atlas Minerals & Chemicals, Inc.

DATA SHEET

2-23CN (1-98²)
Supersedes 2-23CN (1-93)

DUAL CONSTRUCTION FOR TANKS

DESCRIPTION

A basic principle of corrosion resistant masonry construction requires that an impervious membrane must first be applied to protect the supporting structure from attack. The function of masonry sheathing is to keep excessive heat, abrasion and physical abuse from damaging this membrane. The method and thickness of the construction depends upon physical factors, such as the dimensions and shape of the area to be protected, the maximum operating temperature of the vessel and other such conditions. The selection of the corrosion resistant mortar depends upon the corrosives involved.

When multiple tiers of brick are required to protect the membrane, the use of Dual Construction should be considered. This construction, designed and patented by ATLAS, uses a sulfur cement to join the brick in the tier next to the membrane and a resin mortar to join the brick in the tiers toward the interior of the tank. Dual construction has three major advantages:

1. It is economical. The use of an inexpensive sulfur cement in the tiers next to the membrane reduces total material costs. The heat from the molten sulfur cement also accelerates the setting of the resin mortar so that construction can proceed at a more rapid rate and installation costs are reduced.
2. It saves time. Not only does the installation proceed more rapidly, but the tank can be placed into service more quickly since less time is required for final curing.
3. It protects the membrane. With a plasticized material, like sulfur cement, in the joint next to the membrane the possibility of cutting that membrane when the masonry sheathing expands and contracts is eliminated. This danger always exists when a resin mortar contacts the membrane.

Dual Construction possesses the same advantage of high temperature resistance as does Standard Construction with resin mortar. The construction, however, is not recommended for use when the corrosives involved would attack sulfur cements.

Steel tanks which are to receive this masonry sheathing must be constructed in accordance with ATLAS “Specifications for Welded Steel Tanks, Stacks, Ducts or Other Welded Parts for Lining and Covering” (2-12DN). Concrete tanks must be constructed in accordance with ATLAS “Specifications for Concrete Tanks” (2-11DN). Impervious membranes must always be used and must be properly applied before construction begins. Prior to the application of chemical resistant masonry sheathing, a release agent must be applied to the surface of all resin based and sheet linings. The use of a release agent allows the masonry sheathing to move independent of the lining system preventing a potential tear in the lining. In the case of sheet linings installed with a welded or overlap seam, foam strips must be used on each side of the seam to prevent the sulfur cement or mortar from locking into the seam. Duct tape is usually placed over the foam strips on the floor seams to hold in proper position until the brick are laid. Refer to ATLAS Drawing 2-370DG, “Rubber Lining Lap Joint Detail”. Since resin mortars are used, several precautions must be taken. Most of these mortars are chemical setting and they require an accumulating heat of reaction for proper setting and curing. Even though the molten sulfur cement assists this process, it is still important that the temperature at the time of installation be above 60°F (16°C). Portable heaters should be used to bring the temperature to this minimum. If this is impossible, consult ATLAS’ Engineering Department for special techniques which may be used.

The mortars must be mixed and handled in accordance with the information given in the appropriate Data Sheets. Brick must be clean, dry and at moderate temperature before being laid. During and after the completion of the installation, the area must be kept dry and free from foreign matter such as construction dirt, portland cement, plaster and other contaminants which would interfere with the setting and curing of the resin mortar. The vessel cannot be placed into service until all of the joints are cured.

CONSTRUCTION

A tier is composed of a number of courses of brick laid on top of the other in a broken bond pattern. It is usually 2-1/4" or 3-3/4" wide depending upon whether a single brick, 8" x 3-3/4" x 2-1/4", or a double brick, 8" x 3-3/4" x 4-1/2", is used. In most rectangular or square tank work, a thickness of 3-3/4" is required. If brick sizes other than the red shale brick described above are used, the thickness will vary.

In Dual Construction, a flood coat of sulfur cement is

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first applied over the floor membrane. The hot cement is quickly spread on the bottom with a straight edge, such as a piece of masonite. This thin coat protects the membrane from damage by the spacer chips and must always be used when working with asphaltic membranes. After the cement hardens, the brick is stacked on cardboard at a convenient location within the tank and construction of the walls is started at one corner. The bond course is set on spacer chips around the perimeter with the rough surface of the brick facing into the tank. After the bond course has been set, about 10 square feet of bottom, starting at one corner, is also set on chips. The molten sulfur cement is then poured between the brick until the bed joint in the area has been filled and the material begins to rise in the vertical joints. These joints should be filled to within 1/2" of the top. As the cement hardens, it locks this section of the bond course and the bottom in place. The rest of the bottom is installed in the same manner in approximately 10 square foot sections. The workmen can stand on the courses that have been laid while they are setting the brick and making a new pour. The sulfur cement should be poured at one spot just as long as the material will flow away quickly. The new pour is always made from the point to which the cement has run and the pouring proceeds in this manner so that no air pockets are formed. To make the pouring of the bottom easier, the corner of the brick where the pour is to be made is chipped off. This allows the sulfur cement to flow more rapidly into the joints. It does not affect the performance of the brick since another layer will be set on top in resin mortar and the oversize void which was created is completely filled with cement.

When the bottom has been completed according to this procedure, the area is flooded with molten cement which is worked into the vertical joints with a straight edge. This leaves a very thin layer of cement on the face of the brick. When using sulfur cement, all work should be completed as quickly as possible so that all new pours are made while the cement from the previous pour is still warm. This will assure a good bond between pours.

After the area has been flooded, the side tiers are installed. One course of the brick is set on the spacer chips on top of the bond course around the perimeter of the tank. The brick for the bond course of the second tier is then laid in resin mortar with the smooth surface facing into the tank. The rough surfaces of the adjoining tiers then face each other and provide a maximum of bond between the tiers. Construction is started at one corner and the brick is buttered on the end and the bottom with the bead on the edge of the brick next to the first tier beveled into the tank. The brick is shoved home to the right and the beveled edge prevents the mortar exuding into the joint between the tiers. A 1/4" back joint must be maintained so that later the sulfur cement can be poured. Spacer chips are helpful in maintaining this joint. The resin joints are made 1/8" wide and the excess mortar is struck from the joints with particular emphasis being given to a trim bed joint so that no difficulty will be encountered with the installation of the tank. Work from right to left so that the brick is shoved rather than pulled into place. Since this bond course again sets the pattern of the tier, a corner should never be completed with less than half a brick.

After the second bond course has been set in resin mortar, molten sulfur cement is poured into the joint between the two tiers of brick. The sulfur cement fills the back joint, horizontal joints and vertical joints and locks the tiers together. The course set in resin mortar serves as a dam to hold the sulfur cement in place. The joints are filled to within 1/2" of the top of the course set in resin mortar. Pouring is started in the corners and worked toward the center and is again done in sections, as described, to prevent formation of air pockets. Work continues in this manner, first setting a course of brick on chips next to the membrane, then laying a course of brick in resin mortar on the forward tier and finally filling the joints with sulfur cement until the two side tiers are completed.

The heat from the molten material will hasten the setting of the resin mortar but care must be taken to make sure that the set is firm before a new course is laid. This precaution will prevent the previous course from being moved out of alignment, which might form voids in the brick work and impair its stability. Splits 1-1/8” and singles 2-1/4” should always be on hand during an installation in case they have to be used to course out at the top. Sometimes doubles laid as 8" soldiers can also be used for this purpose.

When the sides are completed, the second layer of the brick is laid on the bottom with resin mortar. The courses are set to run across the smaller dimension for ease of installation. A bed of resin mortar is trowelled on the flood coat of sulfur cement on the bottom. This bed is about two courses wide and 1/8" thick and the brick are laid in it with the smooth surface up. Construction again proceeds from right to left, two courses at a time, and the excess mortar is struck from the joints. When the bottom nears completion and the remaining area becomes difficult to work in, 2 x 4’s braced with struts, are used to block off the brick already laid. This prevents the swimming of the brick which would allow the joints to open. Before putting the 2 x 4’s in place, all the excess mortar must be struck from the bed joint of the final courses to leave a trim corner.

If this is not done, the mortar will set and become difficult to remove without damaging the flood coat. The bracing is kept in place until a final set occurs. It is then removed and the remaining area is laid with the workmen standing on the set courses. It is important that the mortar is set hard before work in the remaining area starts so that there is no chance of damaging the sheathing.

This order of construction keys the side tiers into the

ESTIMATING INFORMATION - Quantities are based on a square foot basis for rectangular and square tanks; data does not apply to cylindrical tanks.

6" DUAL CONSTRUCTION

Sheathing Thickness	Area	Brick Size	1/4" Joints			1/8" Joints			
			Pieces / Sq. Ft.	Vitrobond	Carbo-Vitrobond	Pieces / Sq. Ft.	Alkor	Carbo-Alkor	Carbo-Korez
1st Course 2-1/4"	Wall	8" x 3-3/4" x 2-1/4"	4.37	8.07	8.98	—	—	—	—
	Floor	8" x 3-3/4" x 2-1/4"	4.37	6.64	7.40	—	—	—	—
2nd Course 3-3/4"	Wall	8" x 3-3/4" x 4-1/2"	—	—	—	3.84	1.38	1.34	1.27
	Floor	8" x 3-3/4" x 4-1/2"	—	—	—	3.84	2.37	2.33	2.20

8" DUAL CONSTRUCTION

Sheathing Thickness	Area	Brick Size	1/4" Joints			1/8" Joints			
			Pieces / Sq. Ft.	Vitrobond	Carbo-Vitrobond	Pieces / Sq. Ft.	Alkor	Carbo-Alkor	Carbo-Korez
1st Course 3-3/4"	Wall	8" x 3-3/4" x 4-1/2"	3.68	9.20	10.28	—	—	—	—
	Floor	8" x 3-3/4" x 4-1/2"	3.68	7.77	8.67	—	—	—	—
2nd Course 3-3/4"	Wall	8" x 3-3/4" x 4-1/2"	—	—	—	3.84	1.38	1.34	1.27
	Floor	8" x 3-3/4" x 4-1/2"	—	—	—	3.84	2.37	2.33	2.20

12" DUAL CONSTRUCTION

Sheathing Thickness	Area	Brick Size	1/4" Joints			1/8" Joints			
			Pieces / Sq. Ft.	Vitrobond	Carbo-Vitrobond	Pieces / Sq. Ft.	Alkor	Carbo-Alkor	Carbo-Korez
1st Course 3-3/4"	Wall	8" x 3-3/4" x 4-1/2"	3.68	9.20	10.28	—	—	—	—
	Floor	8" x 3-3/4" x 4-1/2"	3.68	7.77	8.67	—	—	—	—
2nd Course 3-3/4"	Wall	8" x 3-3/4" x 4-1/2"	—	—	—	3.84	1.38	1.34	1.27
	Floor	8" x 3-3/4" x 4-1/2"	—	—	—	3.84	2.37	2.33	2.20
3rd Course 3-3/4"	Wall	8" x 3-3/4" x 4-1/2"	—	—	—	3.84	2.37	2.33	2.20
	Floor	8" x 3-3/4" x 4-1/2"	—	—	—	3.84	2.37	2.33	2.20

Estimating tables are based on theoretical coverages and cannot be guaranteed by ATLAS nor do we assume liability for its use. Contact ATLAS for specific information.

bottom and provides greater stability. When additional tiers are required for adequate protection, they are laid in resin mortar. The bond course for the new tier is set and the side is completed using techniques described under Standard Construction with resin mortar. The bottom is completed as described above.

OTHER CONSTRUCTIONS

When only one tier of brick is required for adequate protection, Modified Dual Construction should be used. Where the corrosives involved prohibit the use of any construction with sulfur cement, Standard Construction with resin mortar should be used.

Cylindrical vessels usually do not require expansion joints but long rectangular tanks, subject to elevated temperatures do use such joints as well as end pads. ATLAS' Engineering Department will be pleased to give specific recommendations and instruction for their use.

OTHER PERTINENT INFORMATION

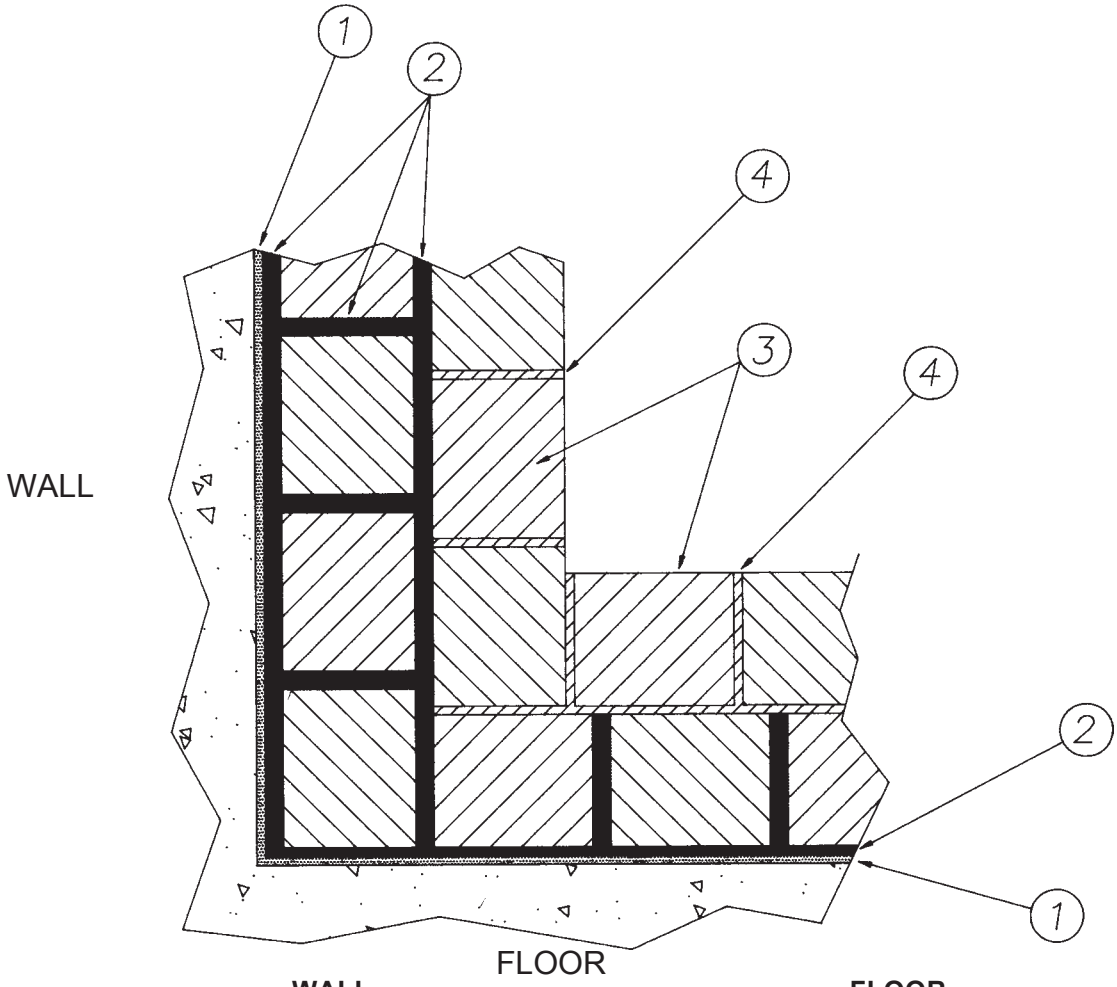
Consult ATLAS' Sales Department for detailed literature for membranes, mortars and brick used in corrosion resistant masonry construction.

TECHNICAL SERVICES

ATLAS maintains a staff of Technical Service Representatives who are available to assist you with the use of ATLAS products. In the event of difficulties with the application of ATLAS materials, the installation should be stopped immediately and ATLAS' Technical Service Department consulted for assistance.

WARRANTY

ATLAS warrants that its products will be free from defects in workmanship and materials under normal use for a period of one (1) year from the date of shipment by ATLAS (provided the products are



WALL		FLOOR	
1	Impervious Membrane	1	Impervious Membrane
2	1/4" Sulfur Cement	2	1/8" Sulfur Flood Coat
3	Corrosion Resistant Brick	3	Corrosion Resistant Brick
4	1/8" Resin Mortar	4	1/8" Resin Mortar

DUAL CONSTRUCTION

Dual Construction is an economical sheathing composed of multiple courses of brick joined with two ATLAS cements. Sulfur cement is used to join the back course and a resin cement is used in the front courses. Dual Construction is mainly used to reduce sheathing costs. It is also recommended when the membrane involved is a natural or synthetic rubber or plastic. In this case, an all resin cement construction might tend to cut the lining upon expansion and contraction of the brick work. To use it, the temperature at the face of the back course must be reduced below 200°F (93°C) by the front brick courses and sulfur cement must be able to withstand the attack of the corrosives.

installed before the expiration of the shelf life). THERE ARE NO EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR THE PURPOSE FOR THIS PRODUCT WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. ATLAS' LIABILITY FOR ALLEGED BREACH OF THIS WARRANTY SHALL BE LIMITED TO REPAIR OR REPLACEMENT OF THE DEFECTIVE PRODUCT (BUT NOT INCLUDING REMOVAL OF THE DEFECTIVE PRODUCT OR INSTALLATION OF REPLACEMENT PRODUCTS). ATLAS SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES DURING THE WARRANTY PERIOD OR THEREAFTER. **ATLAS' WARRANTY IS VOIDED IF PAYMENT FOR PRODUCT IS NOT RECEIVED IN FULL.**

Note: Atlas makes it a practice to continuously update and enhance our CCM (Corrosion Resistant Construction Materials) products. This may result in slight discrepancies between our printed Data Sheets and the current version. For the most recent version of any Data Sheet, please visit our Web site at www.atlasmin.com