#5386

THE POLY AIR DAM IMPROVED PERFORMANCE AND COST EFFECTIVENESS

March 1991

Prepared by:

William L. Powis

The views and conclusions expressed and the recommendations made in this report are entirely those of the authors and should not be construed as expressing the opinions of Alberta Municipal Affairs.

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FOREWORD

The project documented in this report received funding under the Innovative Housing Grants Program of Alberta Municipal Affairs. The Innovative Housing Grants Program is intended to encourage and assist housing research and development which will reduce housing costs, improve the quality and performance of dwelling units and subdivisions, or increase the long term viability and competitiveness of Alberta's housing industry.

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As the type of project and level of resources vary from applicant to applicant, the resulting documents are also varied. Comments and suggestions on this report are welcome. Please send comments or requests for further information to:

Innovative Housing Grants Program
Alberta Municipal Affairs
Housing Division
Research and Technical Support
16th Floor, CityCentre
10155 - 102 Street
Edmonton, Alberta
T5J 4L4

Telephone: (403) 427-8150

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EXECUTIVE SUMMARY

In 1987, a report titled "The POLY AIR DAM: A New Plastic Gasket to Improve Airtightness" was published by Alberta Municipal Affairs. It documented the development of a product which improved the air seal at:

1) the window/door jamb to building frame junction and,

2) the exterior wall/subfloor junction.

This report describes a continuation of that earlier work. The objectives of this project were to improve the cost effectiveness of the POLY AIR DAM and augment its ability to produce an air seal.

To lower costs, alternate gaskets and a co-extrusion were studied. It was subsequently determined that an alternate gasket material was the best approach as the co-extrusion suffered from severe production problems.

Hardy BBT Limited, an engineering firm in Calgary, performed air seal tests utilizing a specially constructed chamber, an electric blower for pressurization, and Dwyer Air Flow Meter and Incline Manometer to monitor the tests. Test pressures up to 250 Pa were used.

One of the alternate gaskets was found to have superior performance to 250 Pa and did so at a lower cost for materials and installation. It had the additional benefit of being usable where the POLY AIR DAM had to be stapled to the framing (such as the case of a concrete floor) and still be very effective. Installation procedure

changes are discusseded and include a simplified corner detail for window and door jambs and 24 inch on centre gyproc screw placement to reduce air leakage at the bottom plate of the exterior wall.

This report is divided into four sections which deal with an introduction, , review of air sealing techniques and testing details, basic approach to laboratory testin and results , and conclusions respectively. Installation procedures are covered in the appendices.

It was concluded that the performance of the POLY AIR DAM was enhanced by the use of a 6 lb. density PVC gasket in place of the neoprene gasket which had been the focus of the earlier study. Further, a combination of material costs and manufacturing techniques has permitted a nearly 45% reduction in product cost.

1.0 INTRODUCTION

A very important factor in national energy consumption is residential housing (1). Over the past ten years, new construction has become more energy efficient, in part because of more airtight buildings (2).

The POLY AIR DAM (Figure 1(a), Page 3) was developed to simplify the creation of an airtight, economical joint, between the air/vapour barrier and penetrations at; a) the window and door jambs and, b) the wall plate/subfloor junction. This is discussed in depth in "The POLY AIR DAM: A New Plastic Gasket to Improve Airtightness" (3). The purpose of this study is to reduce the cost of production of the POLY AIR DAM (PAD) while maintaining or even improving it's effectiveness. Such changes would make it a more marketable product.

A co-extruded flexible PVC bulb (Figure 1(b), Page 3) and four different gaskets were studied. The alternate gaskets were adhered to the extrusion in the same manner as the original neoprene gasket. All the PAD configurations tested were incorporated in a construction assembly that mirrored the Airtight Drywall Approach and tested in a laboratory pressure chamber. Each configuration was stapled to the test chamber using two methods (one of which duplicates attachment of the PAD to framing members on a concrete floor). The results are presented in tabular form and discussed in relationship to the results observed in the original study. Further, the findings were related to field construction practice. Production problems and subsequent deletion of the co-extrusion are discussed. Detailed and revised installation instructions are presented in Appendices A and B, excerpts from the original report (3) in Appendix C, and a copy of the engineers' report of the current laboratory testing in Appendix D.

In January of 1991 the Canadian Patent Office approved the issuance of a patent for the POLY AIR DAM (though not under that name). This is the last step before a patent serial number is issued. The United States government issued patent number 4,995,207 to the POLY AIR DAM in March of 1991. These patents are for the generic concept on a profile extruded plastic (polymeric) moulding which creates air-vapour barrier continuity and is sealingly attached to the framing members. This means that installing the PAD incorporating gaskets, caulk, or adhesive is covered by the patent.

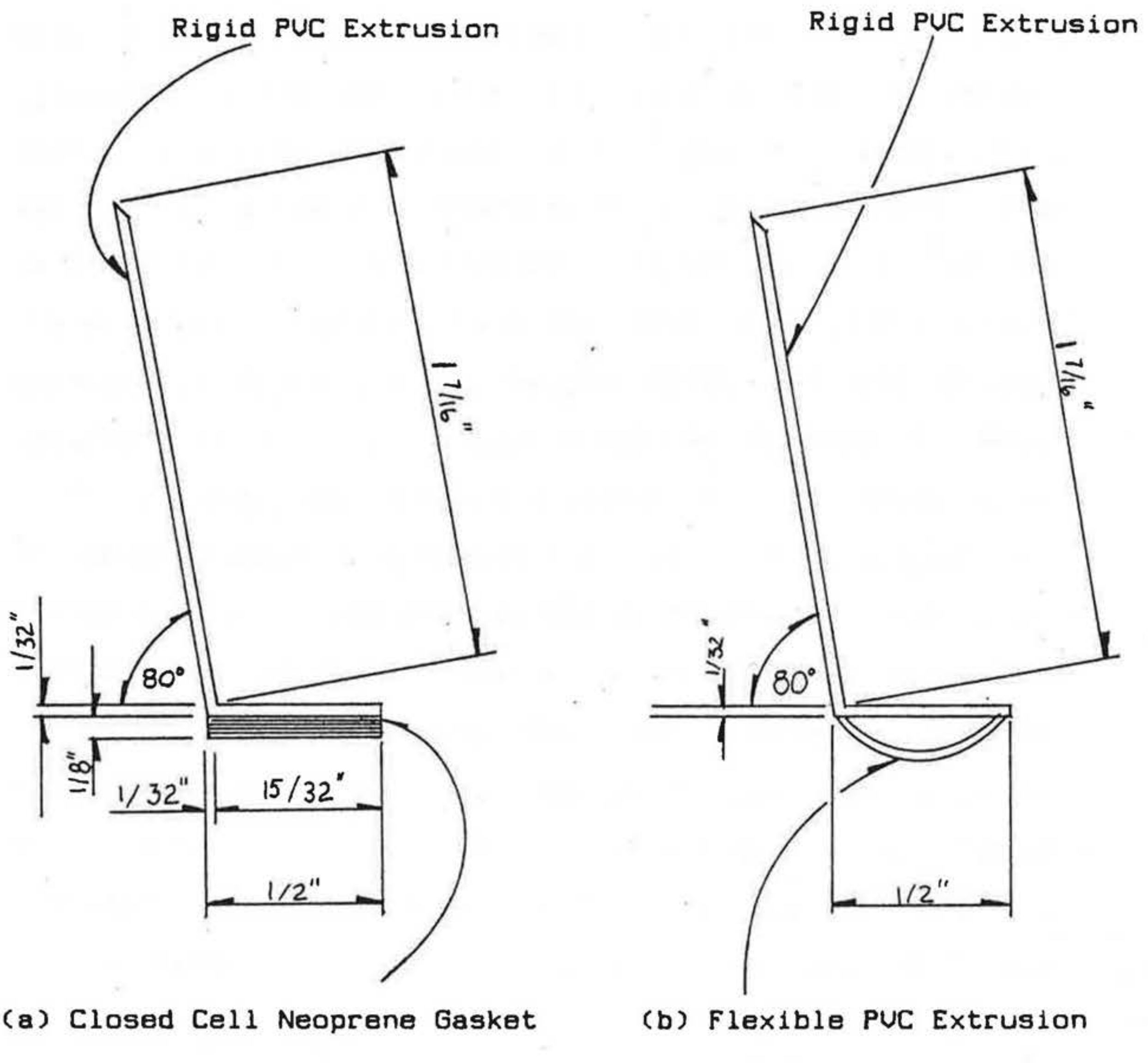

FIGURE 1: Cross section of the POLY AIR DAM comparing (a) the neoprene gasket version and (b) the co-extruded version which utilizes a flexible PVC bulb to replace the gasket.

2.0 REVIEW OF AIR SEALING TECHNIQUES AND TESTING DETAILS

In conventional construction, the cavity between the rough opening and the window or door jamb is filled with insulation, and a poly air/vapour barrier is installed, with little, if any, effort being made to seal it to the jamb. Techniques such as urethane foam spray, caulk, foam gaskets, and the polyethylene collar exist to correct this problem, but they have achieved limited acceptance or success and then often only at considerable cost. The same types of materials and techniques are used to seal the gaps which exist at the subfloor/exterior wall junction. Only the polyethylene collar and the poly or Tyvek wrapped rim joist make an attempt to connect the sealing method to the air/vapour barrier, and while these latter two are the most effective systems, they are also the most expensive. Previous work has discussed these sealing techniques in detail (3,4), with the POLY AIR DAM having been shown to be a functional and cost effective product which creates a good air seal at these points while connecting to the air/vapour barrier.

Despite its reasonable cost, the POLY AIR DAM would have a greater market potential at a lower price point. One purpose of the current testing program was to ascertain if a less expensive PAD could meet or exceed the performance of the existing product. The PAD currently sells for $0.42 per lineal foot. The goal of this program was to reduce that cost by 30%.

Since it had been suggested by two plastics manufacturers that PVC is the best material for the extrusion, in terms of cost and workability, it will continue to be used. Potential cost reductions can come from changing to a gasket other than neoprene (Figure 1(a), Page 3), or changing the gasket to a co-extruded PVC bulb (Figure 1(b), Page 3). Results for Test #3 presented on page 33 and Test #5 presented on page 56 of original report (3), and reproduced in Appendix C here, demonstrate reduced effectiveness when the PAD was stapled to the framing members. Changing to a more compressible gasket, which should follow the roughness of the surface it is in contact with better, may also make the PAD effective when stapled this way, rather than through the gasket. This would not only simplify installation of the PAD in conventional wood frame construction, but it would make it effective for sealing walls to concrete floors and sealing metal or plastic windows which will not readily accept a staple, but which are framed in a wood wall.

2.1 PRODUCTION OF CO-EXTRUSION POLY AIR DAM PROFILE

Precision Plastics of Edmonton was contracted to manufacture the die and co-extrusion for the bulbed PAD. This company had previously manufactured POLY AIR DAM inventory with the neoprene gasket. Preliminary cost estimates indicated that a 30% reduction in price was obtainable with the co-extrusion. Efforts to produce this profile began in July of 1990 and continued until January of 1991. Several attempts were made to produce this POLY

AIR DAM profile but the same problem kept recurring - as the profile left the extruder the flexible bulb would collapse inward as a result of uneven cooling. Changes were made to the die in attempts to resolve the problem, which resulted from the small size of the co-extrusion, however, it was eventually decided to abandon attempts to manufacture this product.

Several other factors reinforced the decision to abandon this manufacturing process. Early in the project, an inexpensive jig was developed to place the gasket on the rigid extrusion and when coupled with suppliers' discounts for volume purchases of gasket and extrusions, brought prices under the project goal thus eliminating the need to develop a new, cheaper profile.

3.0 BASIC APPROACH TO LABORATORY TESTING

Hardy BBT Limited of Calgary conducted laboratory testing of the POLY AIR DAM in conformance with ASTM Test Procedure E283 entitled "Standard Test Method For Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors".

Initial tests were run on the same test equipment and airtight chamber that was used for testing in the earlier project reported in "THE POLY AIR DAM: A New Plastic Gasket to Improve Airtightness" (3). The chamber, however, was found to have developed a severe air leak which could not be corrected. It was, therefore, decided that two courses of action were open to accomplish the aims of the current testing program;

1) rebuild the chamber and carry on with window testing, or

2) build a small chamber and test straight lengths of POLY AIR DAM.

Since the first testing program had resolved the larger issues of installation details, it was concluded that testing the air barrier effectiveness of the various gaskets by using the second procedure would not only be easier, but would facilitate locating leakage points and fine tuning the installation procedures (as the results eventually demonstrated).

Although air pressures ranged higher in the current testing program, the results are related to the original ones through current Test #1 and Test Section #11B of the original study (3), contained in this report as Appendix C. In both tests, the PAD was stapled through the gasket (which was neoprene) and the only air leakage pathways were past the gasket and between the top of the PAD and the gyproc.

The test chamber was made of 2x4, 2x6, and plywood, and was completely sealed (Figures 2 and 3, Page 9). It is 72 inches long, 10 inches wide, and 4 inches deep. A 1/4 inch by 72 inch opening was left in one side where the POLY AIR DAM was installed for testing.

A removable gyproc panel was installed over the POLY AIR DAM to act as the interior wall cladding. It was attached to the test chamber with gyproc screws placed 24 inches on centre and sealed with duct tape. The poly air/vapour barrier was deleted in order for the tests to be directly applicable to the Airtight Drywall Approach.

Airtightness of the chamber was confirmed by sealing the opening with duct tape and checking for leaks with a smoke pencil and pressure differential gauge. Chamber leakage was found to be negligible.

In the earlier series of tests it had been noted that pressurization tests produced higher leakage rates than depressurization tests; consequently most configurations were tested this way. The various PAD configurations were stapled to the test bed which was 1/2 inch (12 mm) higher on one side to simulate the extended window jamb and allow for the installation of a 1/2 " drywall cover strip.

A 3/4 horsepower, variable speed, electric blower

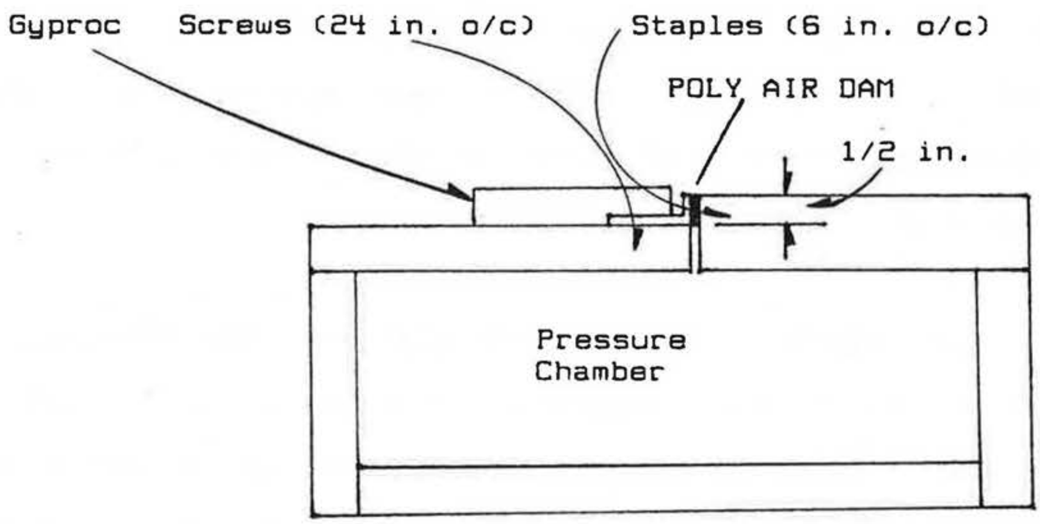

FIGURE 2: POLY AIR DAM stapled through gasket to test chamber. This is analogous to stapling the PAD to the window jamb or subfloor. [NOTE: This is similar to Test Section #11B performed in the original study (3) and acts as a baseline comparison between the two works.]

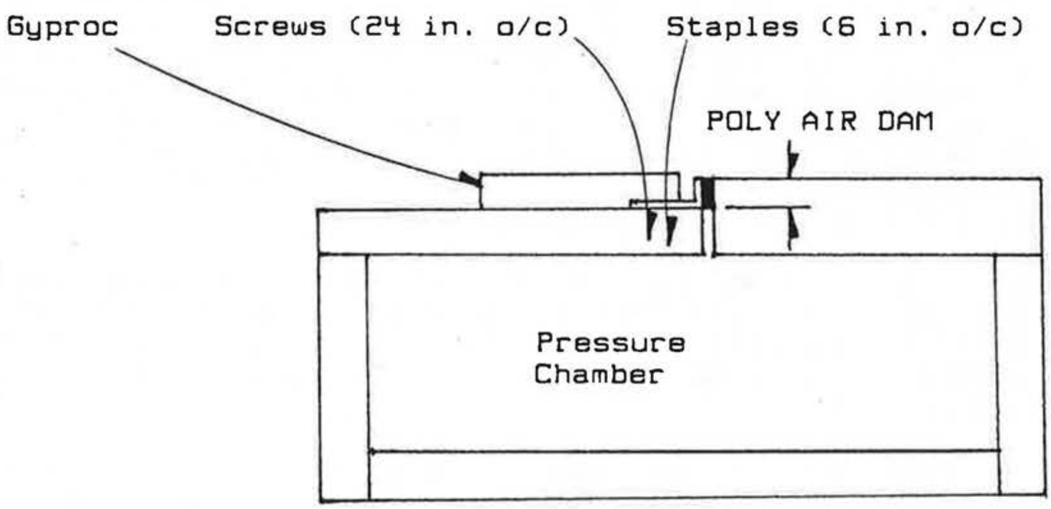

FIGURE 3: POLY AIR DAM stapled through long leg to test chamber. This is analogous to stapling the PAD to the framing members.

produced the air pressures which were monitored with a Dwyer 0-5 SCFM air flow meter and a Dwyer Incline Manometer. For each test, pressure was increased past 50 Pa in an attempt to reach the failure point. Checks with smoke pencils located actual leakage points.

3.1 LABORATORY TESTING OF AIR SEALING TECHNIQUES AND MATERIALS

Nine air sealing techniques were tested. In the first test, the opening in the test chamber was sealed with duct tape. This was used to determine the leakage of the chamber, which was found to be negligable. Eight remaining tests evaluated the POLY AIR DAM with alternate gaskets and installation techniques as follows:

1) Test #1: PAD with closed-cell neoprene gasket stapled through the gasket to the frame (analagous to stapling into the subfloor or window jamb - See Figure 2, Page 9) at 6 inch (150 mm) on center. The same 1/2 inch by 1/8 inch gasket as in the original testing was used and the extrusion was made of the same formulation of PVC. This is the baseline test which connects this study to the original study (3) through Test Section #11B (See Appendix C),

2) Test #2: PAD with closed-cell neoprene gasket held against the wall (analagous to stapling into the wall framing members - See Figure 3, Page 9) and stapled through the long PAD leg at 6 inches (150 mm) on centre,

3) Test #3: As per Test #1, neoprene gasket replaced with 7 lb. density Bituthene gasket; 1/2 inch X 1/4 inch,

4) Test #4: As per Test #2, neoprene gasket replaced with 7 lb. density Bituthene gasket; 1/2 inch X 1/4 inch,

5) Test #5: As per Test #1, neoprene gasket replaced with 8 lb. density PVC gasket; 1/2 inch X 1/8 inch. This gasket is a foam PVC as opposed to a semi-rigid PVC as used in the PAD extrusion,

6) Test #6: As per Test #2, neoprene gasket replaced with 8 lb. density PVC gasket; 1/2 inch X 1/8 inch,

7) Test #7: As per Test #1, neoprene gasket replaced with 6 lb. density PVC gasket; 1/2 inch X 1/4 inch; and,

8) Test #8: As per Test #2, replace neoprene gasket with 6 lb. density PVC gasket; 1/2 inch X 1/4 inch.

3.2 TEST RESULTS

All test results showed that the POLY AIR DAM is very effective at controlling air leakage, with the least expensive gasket showing the best performance (Tests #5 and #6, Table 1, Page 12). The engineers' report is presented in Appendix D.

Test #1 showed considerably less leakage than Test Section #11B of the original project, but this was due to the ease of sealing the smaller chamber used in second generation testing. An access door and water drain were incorporated into the larger chamber to facilitate evaluation of a variety of installations. Though these factors contributed to leakage rates, they do not diminish the value of drawing parallels between the two studies.

When stapled to the framing (Test #2), the neoprene gasket performed well compared to the more compressible gaskets when pressures were lower. As pressure increased, performance deteriorated somewhat and this may have been due to its limited flexiblity not allowing conforming to the irregularities in the surface it abutted.

The Bituthene gasket was tested in the hope that it would offer a good seal when the PAD was stapled to wall

TABLE 1: POLY AIR DAM test results using different gaskets and attachment techniques. [NOTE: Test #7 results are from a retest. In the initial test air leakage was very high. A second section of PAD was installed with the staples not driven as deeply, thus causing less distortion to the gasket and extrusion. See the engineers report in Appendix D for complete test results.]

LEAKAGE (CU.M./HR./M. X10^{-3})

	NEOPRENE GASKET		BITUTHENE GASKET		POLYVINYL CHLORIDE 1/8 IN. GASKET		POLYVINYL CHLORIDE 1/4 IN. GASKET	
TEST NUMBER	#1	#2	#3	#4	#5	#6	#7	#8
SECURED TO	JAMB OR SUBFLOOR	WALL FRAMING	JAMB OR SUBFLOOR	WALL FRAMING	JAMB OR SUBFLOOR	WALL FRAMING	JAMB OR SUBFLOOR	WALL FRAMING
PRESSURE (PA)								
50	<2.5	<2.5	<0.5	<0.5	<0.5	<0.5	10.3	<0.5
75	<2.5	<2.5	<0.5	<0.5	<0.5	<0.5	33.5	<0.5
100	<2.5	<2.5	<0.5	<0.5	<0.5	<0.5	59.3	<0.5
125	<2.5	<2.5	1.0	<0.5	<0.5	<0.5	72.2	<0.5
150	<2.5	<2.5	7.7	<0.5	0.5	<0.5	87.7	<0.5
175	<2.5	<2.5	11.4	1.0	1.0	<0.5	103.2	<0.5
200	7.7	5.2	18.1	2.6	2.6	<0.5	116.1	<0.5
225	9.3	7.7	25.8	4.1	6.2	<0.5	136.8	0.5
250	12.9	9.3	34.6	7.7	10.3	<0.5	144.5	5.2
400	-	-	-	-	-	1.0		15.4

framing members, but this was not found to be the case (Test #4). Since the gasket compressed very easily, it did not have enough resilience to conform to the surface it was against. This is thought to be the reason for the higher leakage exhibited in Test #3. A second problem encountered with this gasket was that dirt and sawdust adhered to it easily and contaminated the sealing surface. This would be a major problem on a jobsite.

When compared to the same fastening technique, the 1/8 in. PVC gasket produced better results than the other gaskets at any pressure (Tests #5 and #6). A reduction in air leakage of 80% at 50 Pa over the neoprene gasket was observed (Table 2, Page 14). The best performance, particularly at higher pressures, was achieved by this gasket when stapled through the long flange (analagous to being stapled to the wall framing) and produced a 94.6% reduction over the neoprene gasket. This installation method allowed the PAD to be installed with the least distortion and required only slight compression of the gasket. The gasket had enough resilience to follow the contours of the surface it was on.

The worst performance was delivered by the 1/4 inch thick PVC gasket when the staple was placed through the gasket (Test #7). This caused the long leg of the PAD to deform above each staple and reduce the effectiveness of the seal. Placing the staples more carefully so as not to drive them as deep improved perfomance because of less distortion to the PAD (See Retest in Appendix D). Stapling

TABLE 2: Comparison of the effectiveness of the POLY AIR DAM using the Neoprene gasket from the original study and the 1/8 inch PVC gasket.

	LEAKAGE (CU.M./HR./M. X10^{-3})					
	NEOPRENE GASKET		POLYVINYL CHLORIDE 1/8 IN. GASKET		LEAKAGE REDUCTION FROM NEOPRENE GASKET TO 1/8 INCH PVC GASKET (PER CENT)	
TEST NUMBER	#1	#2	#5	#6		
SECURED TO	JAMB OR SUBFLOOR	WALL FRAMING	JAMB OR SUBFLOOR	WALL FRAMING	JAMB OR SUBFLOOR	WALL FRAMING
PRESSURE (PA)						
50	<2.5	<2.5	<0.5	<0.5	80.0	80.0
75	<2.5	<2.5	<0.5	<0.5	80.0	80.0
100	<2.5	<2.5	<0.5	<0.5	80.0	80.0
125	<2.5	<2.5	<0.5	<0.5	80.0	80.0
150	<2.5	<2.5	0.5	<0.5	<80.0	80.0
175	<2.5	<2.5	1.0	<0.5	<60.0	80.0
200	7.7	5.2	2.6	<0.5	66.2	90.3
225	9.3	7.7	6.2	<0.5	33.3	93.5
250	12.9	9.3	10.3	<0.5	20.1	94.6
400	-	-	-	1.0	# NEOPRENE # # GASKET # # FAILURE #	

through the long leg dramatically improved the seal (Test #8), as the deformation was eliminated. At higher pressures, leakage increases were probably due t observed lateral movement of the gasket.

In the first testing program (3), stapling through the long flange did not produce results that were as good as stapling through the gasket. The reasons for the success of this technique in the current program are:

1) staples were placed close to the angle in the extrusion (within 1/4 in.) and did not allow significant movement of the extrusion; and,

2) gyproc screws were within 1 in. of the edge of the gyproc and a maximum of 24 in. on centre. This created a constant pressure between the PAD and the gyproc, and therefore contributed to the air seal.

An important part of controlling air leakage was placement of the screws securing the gyproc to the test chamber. During the original study, these installation parameters were not closely monitored or tested. As what was anticipated to be Test #1 was begun, smoke pencil checks were done. Air leaks were noted between the screws securing the gyproc which were placed on approximately 30 inch centres. Applying pressure midway between the screws duplicated an additional fastener and enhanced the air seal. Screw placement was therefore changed to 24 inch centres for all tests. This corresponds to placing a screw at the bottom of each stud of the wall framing since stud spacing is either 16 or 24 inches (as allowed by building code). Smoke pencil checks confirmed that air leakage between the gyproc and PAD had been substantially eliminated.

4.0 CONCLUSIONS

The original impetus for this project was to develop and test an alternate manufacturing technique employing a co-extrusion to lower costs and simplify PAD installation. However the co-extrusion was impossible to manufacture and, after several months the effort was abandoned. However, concurrent efforts to explore new materials, production techniques, and product sourcing proved effective and permitted development of an alternate cost-efficient approach.

By changing to a lower cost but better performing gasket and developing a jig to install the gasket on the extrusion the selling price of the PAD was reduced by 45%.

Product effectiveness was improved by changing the gasket material and the installation technique (fastening through the long leg of the extrusion instead of stapling it through the gasket). As a result of these changes, the POLY AIR DAM is capable of creating a better air seal. Use of the product can be extended to sealing walls to concrete floors and to metel framed windows. Research has found that, though there are a large number of leakage pathways in a house, the most prolific leakage occurs at the bottom of the drywall (5). Because the POLY AIR DAM can now effectively control leakage at this point (when the adjacent drywall is installed with screws no more than 24 inches on centre) as well as at window and door jambs and wall/subfloor junctions, at less cost than the original version, its effectiveness has been greatly expanded.

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APPENDIX A

POLY AIR DAM Installation Procedures:

Window and Door Jamb

APPENDIX A

POLY AIR DAM INSTALLATION PROCEDURES: WINDOW/DOOR JAMB

Figure A-1 (Page 21) shows a typical POLY AIR DAM installation between the window/door jamb and studs, rough sills, or headers. This illustration also shows interior wall cladding (ie- gyproc) installed. The air dam must be installed before the interior cladding and, if applicable, the poly air/vapour barrier.

Once an exterior wall is framed, the doors and windows are installed in the conventional manner. Air dams are then applied to the extension jamb as in Figure A-1 (Page 21). They are fixed into position using a 3/8 inch X 3/8 inch staple spaced 6 inches on center into the jamb or framing. It is preferable to staple to the rough opening framing unless the distance across the rough opening to the window jamb is greater than 1/4 inch in which case, one should staple through the gasket. For best performance, when not stapling through the gasket, staples should be placed close to the gasketed edge of the PAD.

Poly Air Dams are trimmed on site to a 45 degree angle at each corner. Each air dam is first cut 3 inches longer than the jamb length, to overhang 1.5 inches past each end of the jamb. Either both sides or the top and bottom air dam pieces MUST be installed first, and in pairs. The short legs of the PAD are trimmed from each overhanging portion of the first pair. The second pair of PADs are installed, and the angle formed where the long and short legs meet is

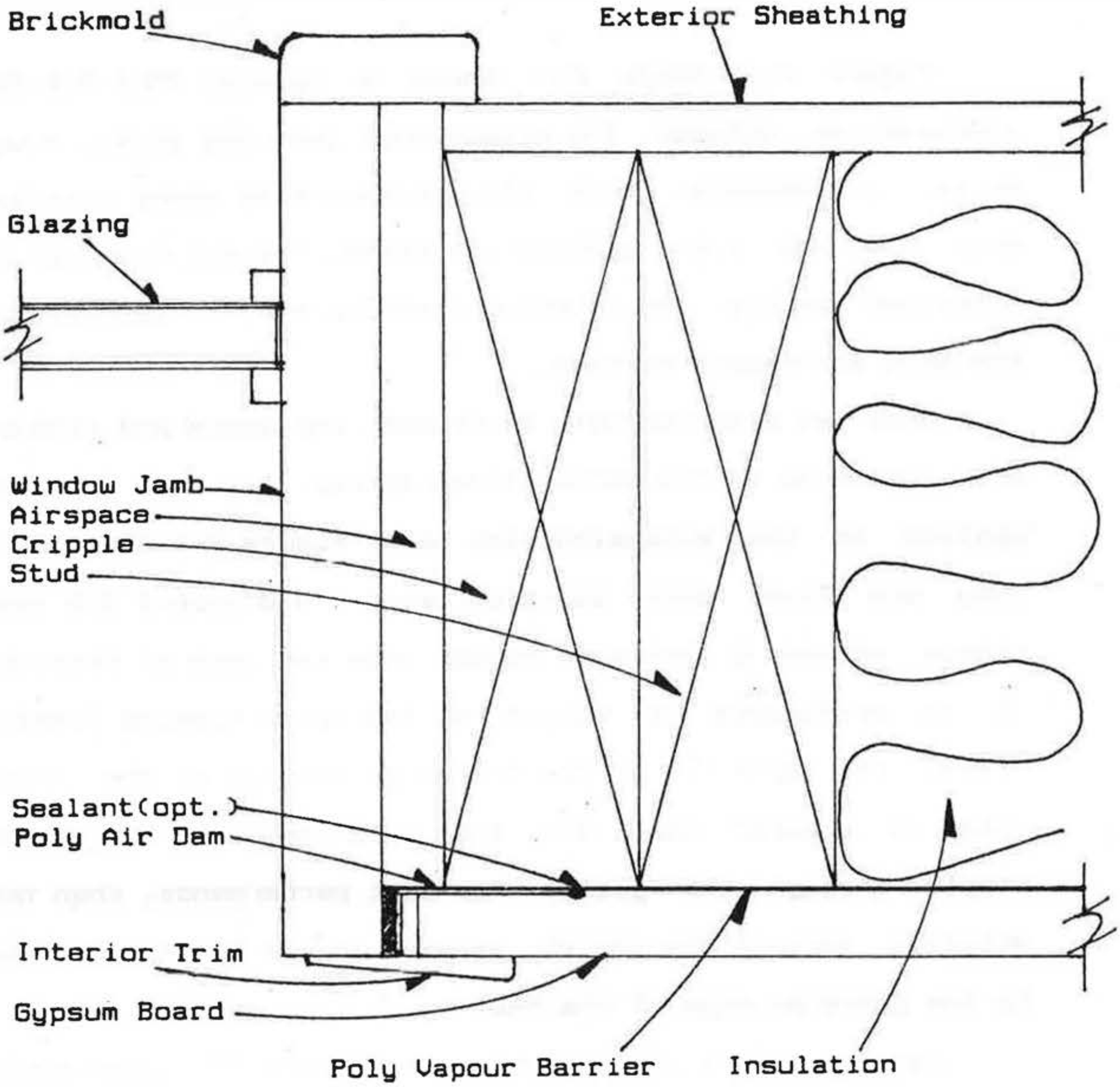


FIGURE A-1: Top cross sectional view of POLY AIR DAM installation at studs (NOTE: staple PAD to framing or window jamb).

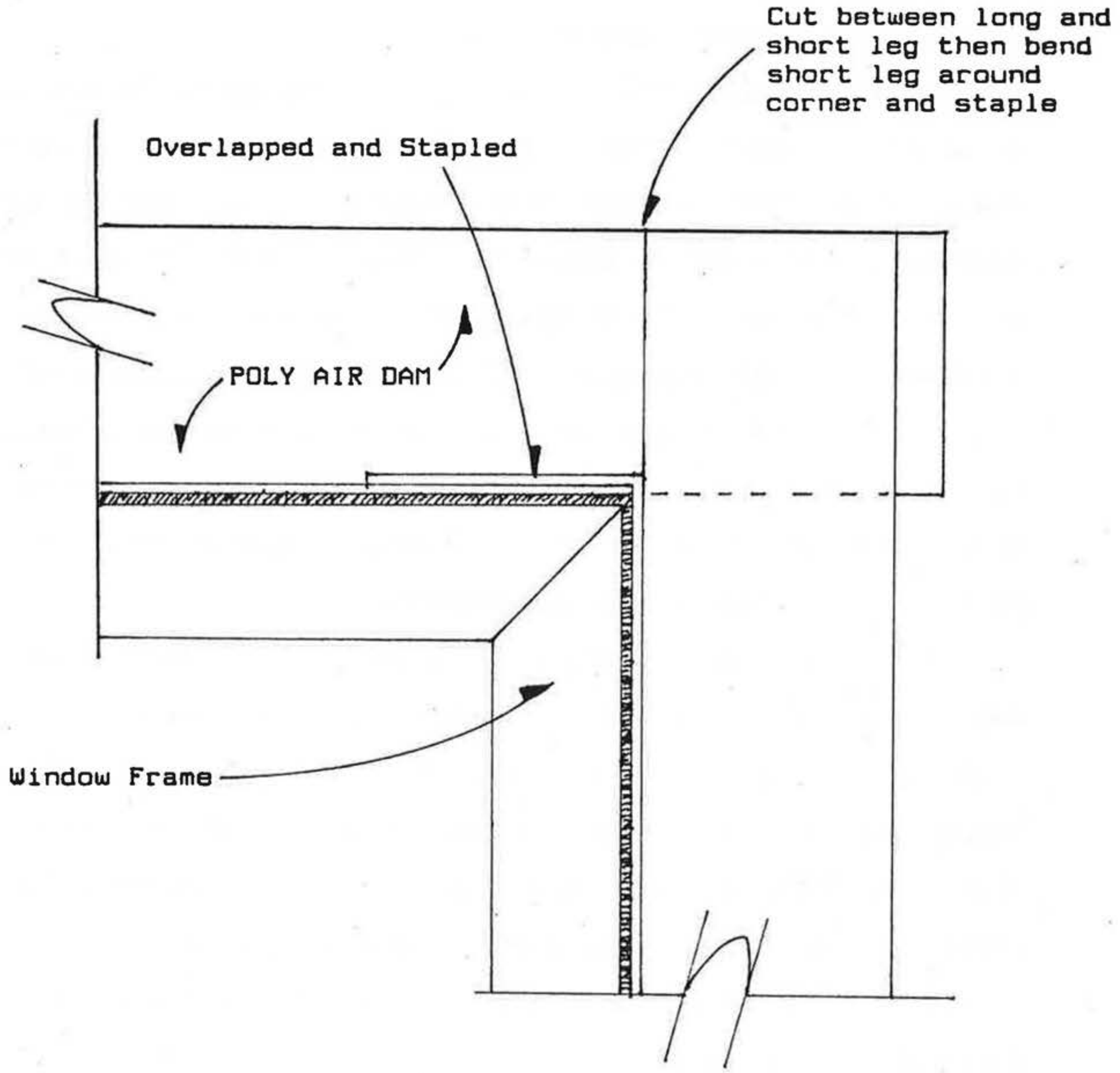


FIGURE A-2: Corner detail of overlapped and stapled POLY AIR DAM attaching strip.

cut out from the corner to the center intersection of the long legs. The short legs are bent around the corner and stapled (Figure A-2, Page 22).

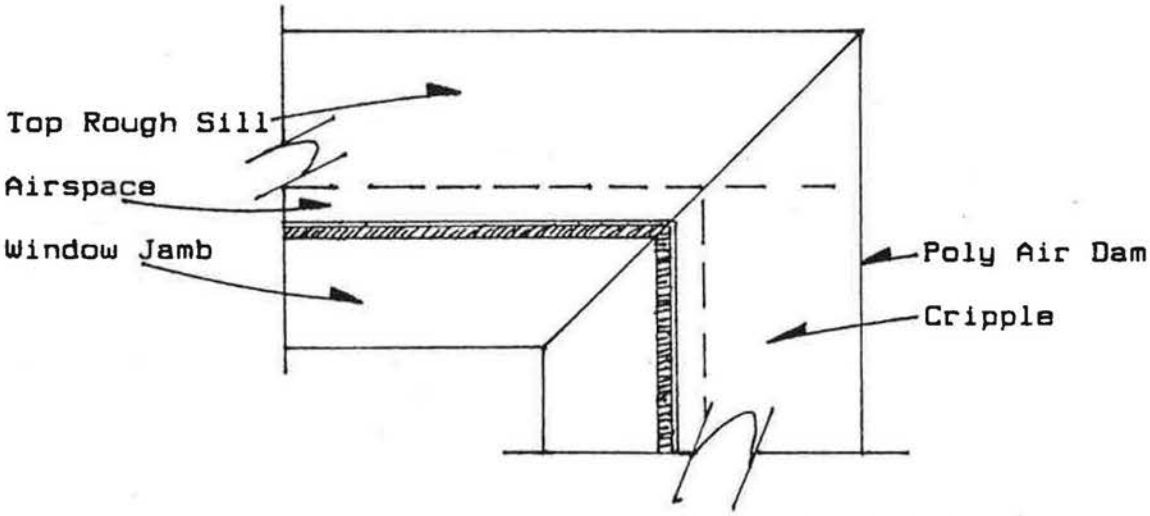
After installation, there is a double thickness of material at the corner overlaps. A wide chisel is held along line "BB" (Figure A-3, Page 24), at each corner location, and a cut is made. Only hand pressure is required to make the cut. This procedure insures that the cut surfaces at the corners will be matched. A bead of caulk can be applied to the perimeter and corner joints of each air dam, but this is not essential to forming a good air seal. Insulation, air/vapour barrier, drywall, trim, and paint are then applied in the conventional manner.

A simpler method of installation involves cutting the PAD to length, with a 45 degree angle at each end, in a power mitre saw. The blade should be reversed to prevent damage to the plastic extrusion. The pieces of air dam are then installed, and although slightly more air leakage will result this way, the performance is still acceptable.

Some drywallers use routers to cut the window and door openings while the gyproc sheets are held in place. Because there is potential for damage to the air/vapour barrier and any air seal applied to the jamb, including the POLY AIR DAM, this procedure MUST NOT be used.

Tools commonly available on any jobsite are used to install PADs. Cutting and trimming are accomplished with a utility knife, chisel, and side cutters. A hand, electric, or air powered stapler capable of handling 3/8 X 3/8 inch

Chisel is held along Line "B-B" and pressure is applied to make corner cut.



OPTIONAL: Apply sealant at corner cuts and where poly vapour barrier overlaps Poly Air Dam.

FIGURE A-3: Cutting and caulking procedures at corners and for air/vapour barrier sealing to Poly Air Dam.

staples are used for attachment. Caution should be used to insure that staples are not driven through the PAD material.

APPENDIX B

POLY AIR DAM Installation Procedures:

Rim Joist

APPENDIX B

POLY AIR DAM INSTALLATION PROCEDURES: RIM JOIST

Figure B-1 (Page 28) shows typical installations at the rim joist. The air dam must be installed prior to application of interior cladding and, if applicable, the poly air/vapour barrier.

Floor framing and exterior wall construction proceed in the conventional manner. Once walls are erected, the PAD is placed along the bottom plate and stapled to the subfloor (Figure B-2, Page 29) or for improved performance in extreme conditions, to the bottom plate (Figure B-3, Page 29). Staples are placed 6 inches on center.

An air dam is butted into a corner and fastened as described. A second air dam is butted into the same corner, but perpendicular to the first PAD length. After installation, there is a double thickness of material at the corner which overlaps. The excess material is trimmed with a side cutter and discarded. Ends are butted together along straight wall runs. Drywall, trim, and paint can now be applied in the conventional manner. To complete the seal of the floor frame, the junction between the rim joist and foundation can be sealed using a compressible gasket (eg- 3/8 inch X 3 inch PVC) in the manner shown (Figure B-1, Page 28).

Tools commonly available on any jobsite are used to install PADs. Cutting and trimming are accomplished with a utility knife, chisel, and side cutters. A hand, electric,

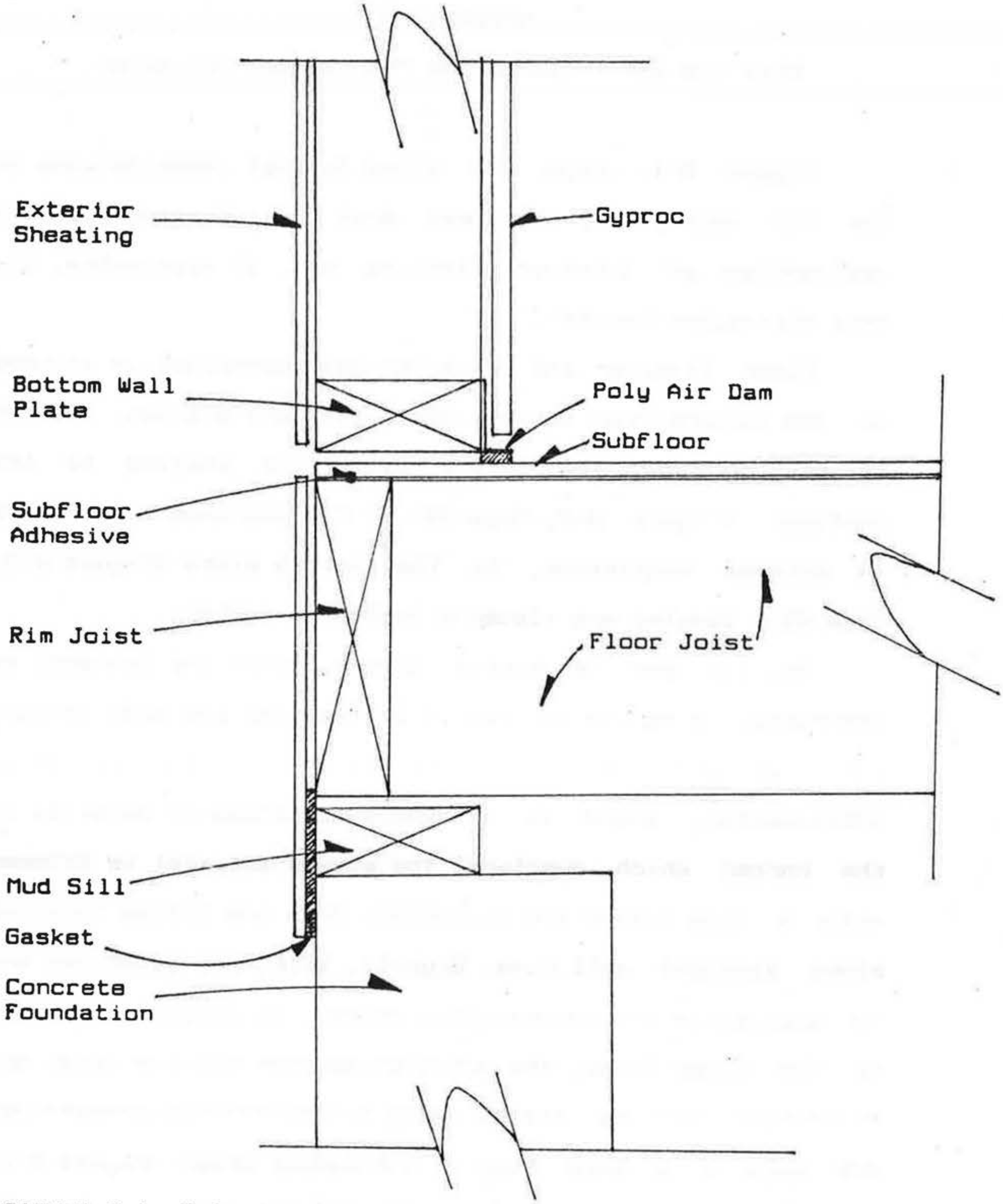


FIGURE B-1: Poly Air Dam and compressible gasket used as a system to stop air leakage at the rim joist.

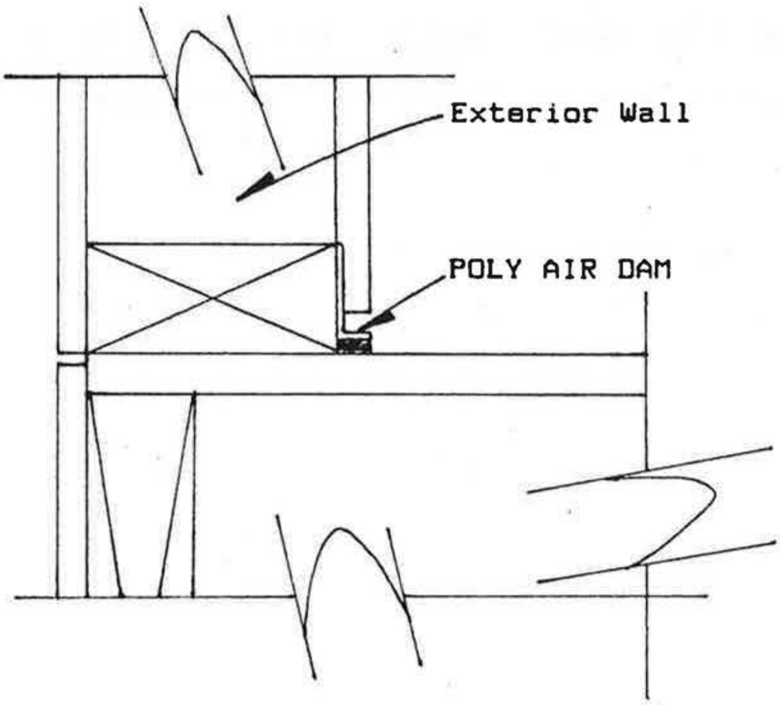


FIGURE B-2: POLY AIR DAM installed at sill plate on wooden subfloor (staple to either subfloor or framing).

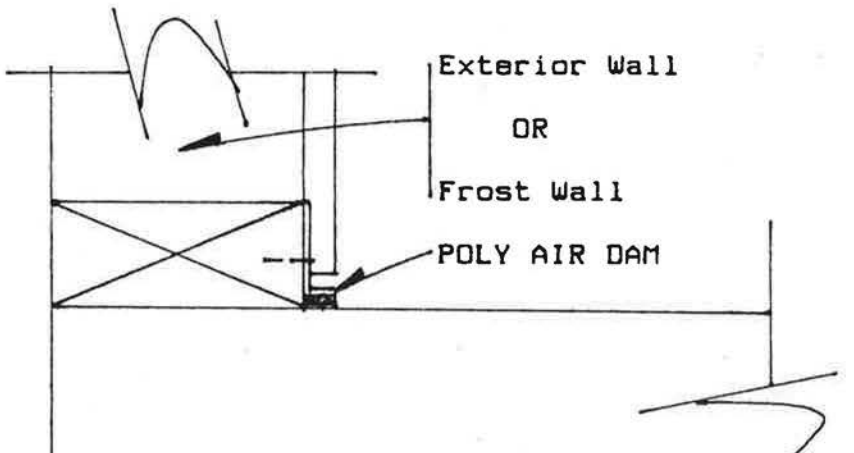


FIGURE B-3: POLY AIR DAM installed at sill plate on concrete subfloor.

or air powered stapler capable of handling 3/8 X 3/8 inch staples is used for attachment. Caution should be used to insure that the stapler does not drive the staples through the PAD material.

APPENDIX C

Excerpts from "The POLY AIR DAM: A New Plastic Gasket to Improve Airtightness".

TEST SECTION NUMBER	DESCRIPTION	AIR LEAKAGE (CUBIC M/HR/M CRACK LENGTH)	AIR LEAKAGE REDUCTION AS COMPARED TO CONVENTIONAL PRACTISE:TEST SECTION #1 (PER CENT)
1	CONVENTIONAL: R/O SPACE FILLED WITH INSULATION	1.80	-
2	PAD: STAPLED TO WALL FRAME 150 MM O/C, NO CAULK	1.41	21.7
3	PAD WITH GASKET: STAPLED TO WALL FRAME ON 150 MM O/C, NO CAULK	1.06	41.0
4	PAD AS PER #3: WRAPPED AND STAPLED CORNERS, NO CAULK	0.67	62.8
5	PAD: STAPLED TO JAMB 200 MM O/C NO CAULK	0.86	52.2
6	AS PER #5: 100 MM O/C	0.48	73.3
7	PAD WITH GASKET: STAPLED TO JAMB 150 MM O/C, NO CAULK	0.32	82.2
8	AS PER #7: CORNER CUTS CAULKED	0.18	90.0
9	AS PER #8: OUTER EDGE OF PAD CAULKED	0.19	89.4
10	PAD: STAPLED TO JAMB ON 150 MM O/C JAMB CONTACT SURFACE, CORNER CUTS, AND OUTER EDGE OF PAD CAULKED	0.22	87.9
11	POLY COLLAR AS PER R-2000 LITERATURE	0.36	80.0
12A	WET TEST: WOOD MOISTURE CONTENT AT 20 %, PAD AS PER #7: MITRE CORNER JOINT REPLACED BY BUTT JOINT	0.66	63.3
12B	REPEAT 12A: WOOD MOISTURE CONTENT AT 12 %	0.75	58.3

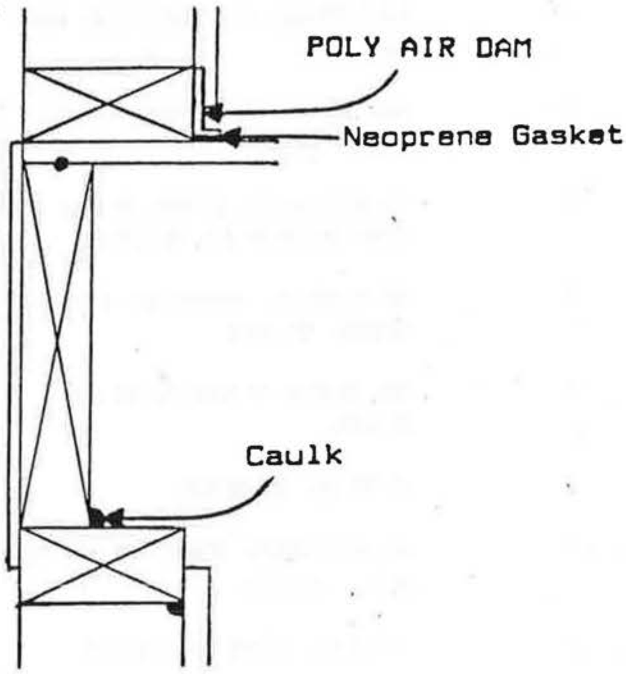
ALL PAD TESTS SUBSEQUENT TO #4 INCORPORATED WRAPPED AND STAPLED CORNERS

TABLE 1: Air leakage test results of test sections at 50 Pa as compared to conventional practice: window jamb.

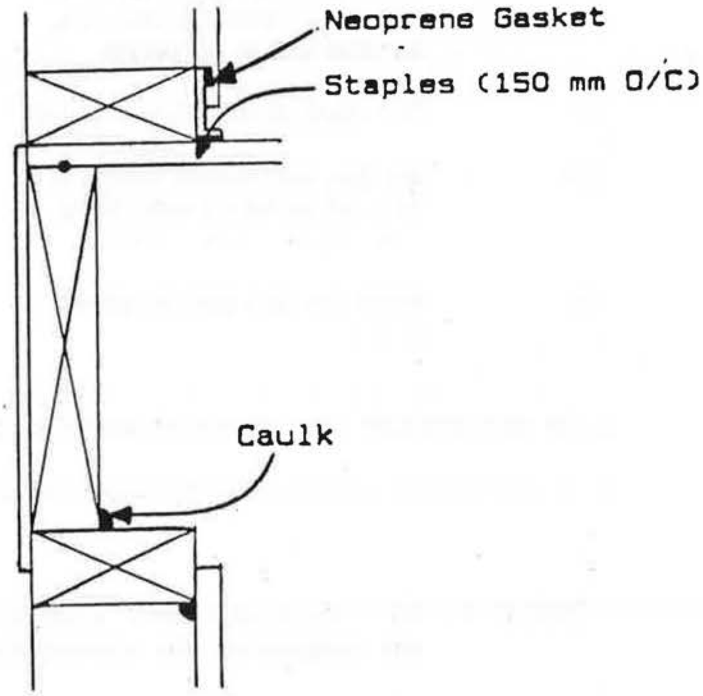
9) Poly wrapped rim joist as used in R-2000 houses (Figure 22, Page 41) (Test Section #9).

10) Repeat of test #1 (Test Sections #10A and #10B).

11) Repeat Test Section #1, caulk bottom of rim joist (Test Sections #11A and #11B).



12) As per #11B, add Gasket to top edge of Poly Air Dam (Test Section #12).



TEST SECTION NUMBER	DESCRIPTION	AIR LEAKAGE (CUBIC M/HR/M CRACK LENGTH)	AIR LEAKAGE REDUCTION AS COMPARED TO CONVENTIONAL PRACTISE:TEST SECTION #7 (PER CENT)
1	GASKETTED PAD STAPLED TO SUBFLOOR 150MM O/C	5.54	17.4
2	PAD AS #1 WITH SILL PLATE GASKET AS #6	1.08	83.9
3	AS #2 WITH TOP EDGE OF PAD CAUKED	1.13	83.2
4	AS #2, DELETE PAD GASKET, STAPLED 100MM O/C	1.30	80.6
5	AS #2, PAD STAPLED TO BOTTOM PLATE 100MM O/C SUBFLOOR STAPLES DELETED	3.62	46.1
6	SILL PLATE GASKET INSTALLED VERTICALLY AT BOTTOM OF RIM JOIST	10.00	-
7	CONVENTIONAL PRACTICE: CAULK SUBFLOOR/BOTTOM PLATE JUNCTION ONLY	6.71	-
8 *	CONVENTIONAL PRACTICE: SILL PLATE GASKET USED TO SEAL SUBFLOOR/BOTTOM PLATE JUNCTION	1.00	*
9	POLY WRAPPED RIM JOISTS AS PER R-2000 LITERATURE	0.71	89.4
10A	REPEAT TEST #1	9.34	-
10B	REPEAT TEST #10A, CLEAN HARDENED CAULK FROM BACK OF GYPROC	2.53	-
11A	REPEAT TEST #1, CAULK BOTTOM OF RIM JOIST	2.07	-
11B	REPEAT TEST #11A, CLEAN HARDENED CAULK FROM BACK OF GYPROC	0.93	86.1
12	AS #11B, ADD GASKET TO TOP EDGE OF POLY AIR DAM	0.76	88.7
13	REPEAT TEST #8, CAULK BOTTOM OF RIM JOIST	1.34	80.0

* TEST 8: RIM JOIST COMPONENTS WERE TIGHT FITTING BEFORE THE INCLUSION OF THE SILL PLATE GASKET. AFTER ITS INSTALLATION, JOINT TIGHTNESS WAS EXTREME. TEST WAS RERUN. FOR FURTHER DISCUSSION, SEE TEXT ON PAGE 54.

TABLE 2: Air leakage test results of test sections at 50 Pa as compared to conventional practice: rim joist.

APPENDIX D

Hardy BBT Limited

Letter of January 31, 1991

RE: Test Results

Hardy BBT Limited

CONSULTING ENGINEERING & ENVIRONMENTAL SERVICES

Our Project No.
Your Reference No. CA-09966

January 31, 1991

Airtightness Consultants
1304 - 13 Street North
Lethbridge, Alberta
T1H 2T9

Attention: Mr. W. Powis

Dear Sir:

Re: Air Dam Leakage Study

In response to your request, tests were conducted to evaluate effectiveness of three different types of air seals made of Neoprene, Bituthene and Polyvinyl Chloride. These tests were conducted at Hardy BBT Limited laboratories December 18, 1990.

The tests have utilized a chamber designed to test only straight lengths of the air seal material. The chamber was pressurized by a 3/4 horsepower electric blower; flow was monitored by a Dwyer 0-5 SCFM air flow meter, and pressure was indicated by a Dwyer Inclined Manometer. The seals were placed and fastened by you. The spacing of fasteners was roughly 6 inches on centre.

The results of the tests are summarized in Table I, attached. This data indicates the effect of attaching the air seal to either a wall member or to the frame of a window. It should be noted that attachment to the wall generally produced the best air seal. The thicker air seals, particularly the 1/4 inch thick polyvinyl chloride air barrier, when attached to the window frame through the seal material, deformed considerably. This deformation was the reason for higher air leakages. Figure I depicts the two methods of air seal attachment. It should also be noted that the

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CANADA

number of fasteners placed and the depth to which they were driven also affected the seal. This phenomenon is demonstrated in the retest of the PVC 1/4" thick seal where the fasteners were further apart and not driven as deep.

We trust that this information meets your present requirements with regard to the air seals tested. If you have any questions, however, please do not hesitate to contact this office at your convenience.

Yours very truly,

Hardy BBT Limited

D. Empey, P. Eng.
Senior Project Engineer

Reviewed by:

V. Yogendran, Ph.D., P. Ecg.

DE/bb
CA-09966.DE

PERMIT TO PRACTICE
HARDY BBT LIMITED
Signature
Date
PERMIT NUMBER: P 4546
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

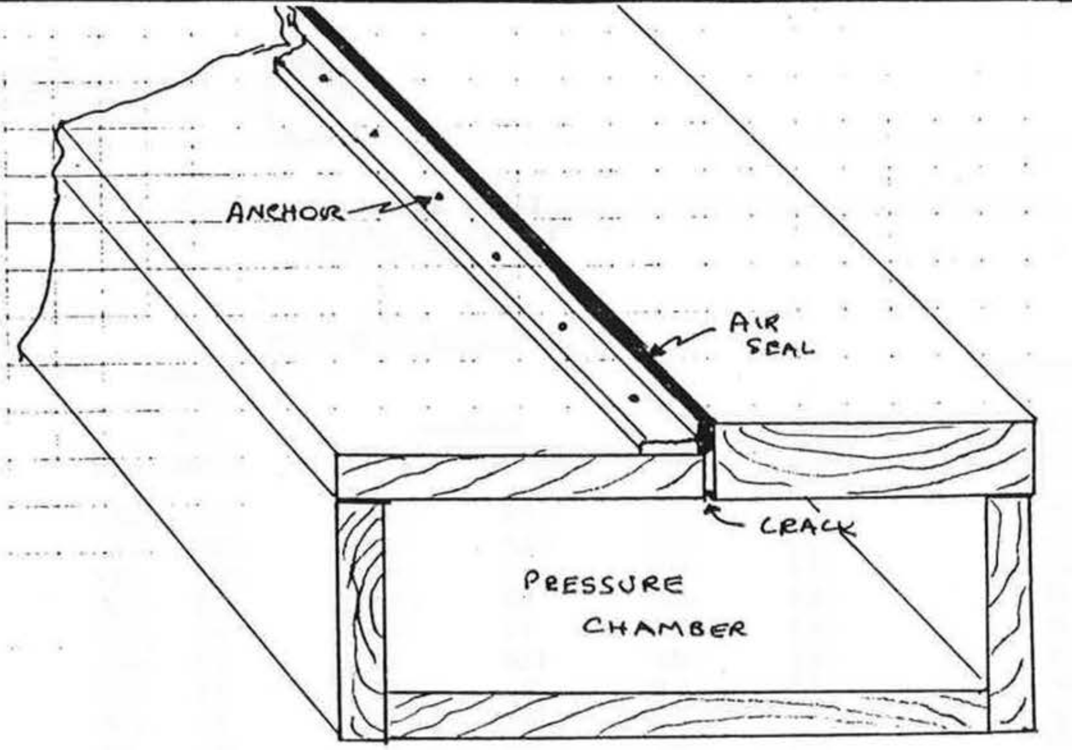
Hardy BBT Limited
CONSULTING ENGINEERING & ENVIRONMENTAL SERVICES

POLY AIR DAM
LEAKAGE STUDY

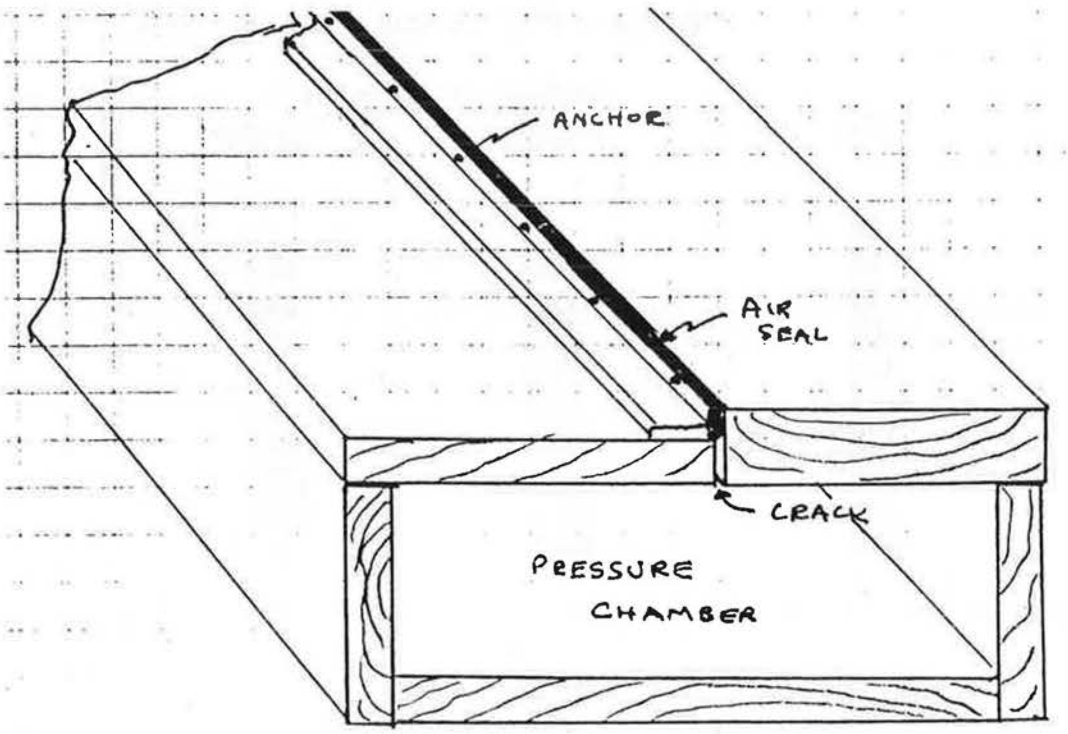
Pressure (Pa)	Leakage ($m^3/hr/m$ $x10^{-3}$)							
	Neoprene		Bituthene		Polyvinyl Chloride 1/8"		Polyvinyl Chloride 1/4"	
Secured To	Frame	Wall	Frame	Wall	Frame	Wall	Frame	Wall
50	<2.5	<2.5	<0.5	<0.5	<0.5	<0.5	77.4	<0.5
75	<2.5	<2.5	<0.5	<0.5	<0.5	<0.5	121.3	<0.5
100	<2.5	<2.5	<0.5	<0.5	<0.5	<0.5	152.2	<0.5
125	<2.5	<2.5	1.0	<0.5	<0.5	<0.5	-	<0.5
150	<2.5	<2.5	7.7	<0.5	0.5	<0.5	-	<0.5
175	<2.5	<2.5	11.4	1.0	1.0	<0.5	-	<0.5
200	7.7	5.2	18.1	2.6	2.6	<0.5	-	<0.5
225	9.3	7.7	25.8	4.1	6.2	<0.5	-	0.5
250	12.9	9.3	34.6	7.7	10.3	<0.5	-	5.2
400	-	-	-	-	-	1.0	-	15.4

Retest of PVC 1/4 inch attached to frame

(Pa)	Leakage ($m^3/hr/m$ $x10^{-3}$) Pressure	Vacuum
25	1.0	1.0
50	10.3	10.3
75	33.5	25.8
100	59.3	46.4
125	72.2	64.5
150	87.7	74.8
175	103.2	90.3
200	116.1	103.2
225	136.8	123.8
250	144.5	-



A) Anchored To Wall



B) Anchored To Frame

Hardy BBT Limited
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

AIR DAM LEAKAGE TESTS

CA-09966

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