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## Flair Homes Project REPORT NO. 5 Airtightness Performance of Twenty Detached Houses Over a Two-Year Period

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For more information on this report or to obtain additional copies write to:

Energy, Mines and Resources Canada Residential Energy Management Division Ottawa, Ontario KIA 0E4

This report was prepared by:

G. Proskiw, P.Eng., and J. Beckman Unies Limited 1666 Dublin Avenue Winnipeg, Manitoba R3H OH1

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# AIRTIGHTNESS PERFORMANCE OF TWENTY DETACHED HOUSES OVER A TWO YEAR PERIOD

### PART OF THE

## FLAIR HOMES ENERGY DEMO/CHBA FLAIR MARK XIV PROJECT

BY

e: (4)

G. PROSKIW, P.Eng.

UNIES Ltd.

## SEPTEMBER, 1988



#### SUMMARY

Airtightness tests were performed on 20 new houses over a two year period as part of the Flair Homes Energy Demo/CHBA Flair Mark XIV project in Winnipeg. The houses were constructed with a variety of air/vapour barrier systems and three different types of main walls: 38x140 (2x6), framed walls with exterior insulated sheathing, and double wall construction. Polyethylene was used as the air/vapour barrier in six of the houses while the remaining 14 used the Airtight Drywall Approach (ADA). The houses had similar floor plans and were constructed by the same builder.

Both the polyethylene and ADA systems were found to be capable of meeting the airtightness requirements of the R-2000 Standard with the tightest structures being the double wall houses. No significant or permanent change in airtightness was observed for any of the houses over the two year monitoring period. Variations which did occur were judged to be due to normal house behaviour.

The application of stucco as an exterior wall finish was found to produce a noticeable improvement in airtightness for the ADA houses. Stucco was not observed to have a significant impact on airtightness of the double wall houses which used polyethylene as the air/vapour barrier.

Consistent sources of air leakage in the ADA houses were found to be the electrical outlets on exterior walls, despite the presence of commercially manufactured poly pans and cover plate foam gaskets. Window leakage was also noted in many houses and the frequency of this leakage increased over the monitoring period. A significant leakage source was also found to be an integrated mechanical system, which ducted large volumes of outdoor air into the house.

It was also concluded there is a need to re-examine the design pressure requirements for residential air barrier systems. Specifically, this should investigate how transient wind-induced pressure loads are resisted by air barrier systems and whether some portion of the load is taken by other envelope components such as the exterior finish, sheathing and the interior surface.

An air leakage detection system was proposed which would be suitable for use by builders to aid in the construction of low leakage houses. It would consist of a simple non-instrumented blower which would exhaust through a suitable opening such as a floor drain/sump pump or dryer vent to permit easy installation and use.

The airtightness testing program will continue until March, 1989.



#### RÉSUMÉ

Des mesures de l'étanchéité à l'air ont été effectuées sur une période de deux ans dans 20 maisons neuves construites à Winnipeg dans le cadre du projet Flair Mark XIV de Flair Homes Energy Demo et de l'AOCH. Différents systèmes pare-air-vapeur ont été incorporés à la construction de ces maisons. On a aussi fait appel à trois types de murs : à ossature de poteaux de 38 x 140 (2 x 6), à ossature de poteaux avec revêtement extérieur isolé et le double mur. Le polyéthylène a été utilisé dans six des maisons alors que la cloison sèche étanche à l'air a été incorporée aux 14 autres maisons. Les maisons avaient des plans d'étage semblables et ont été construites par le même entrepreneur.

Le polyéthylène et la cloison sèche étanche se sont tous deux avérés capables de satisfaire aux exigences d'étanchéité à l'air de la norme R-2000. Les maisons les plus étanches étaient celles à doubles murs. Aucun changement important ni permanent n'est survenu dans l'étanchéité à l'air des maisons au cours de la période de monitorage de deux ans. Les variations qui ont effectivement été mesurées sont attribuées au comportement normal d'une maison.

Les mesures indiquent que l'application de stucco comme revêtement extérieur de mur améliorait considérablement l'étanchéité à l'air des maisons à cloison sèche étanche. Le stucco n'avait pas d'effet significatif sur l'étanchéité à l'air des maisons à doubles murs dont le pare-air-vapeur est en polyéthylène.

Dans le cas des maisons à cloison sèche étanche à l'air, des fuites d'air importantes ont été localisées aux prises de courant sur des murs extérieurs malgré la présence de boîtiers de polystyrène commerciaux et de garnitures de mousse aux joints des plaques-couvercles. Des fuites par les fenêtres ont aussi été détectées dans de nombreuses maisons et la fréquence de ces fuites a augmenté au cours de la période de monitorage. D'importantes fuites d'air ont aussi été attribuées à un système mécanique intégré qui injectait d'importants volumes d'air extérieur dans la maison.

Les conclusions de l'étude indiquent la nécessité de réévaluer les pressions de calcul pour les systèmes pare-air. Plus précisément, il faudrait analyser de quelle façon les pare-air résistent aux pressions transitoires produites par le vent et déterminer si une partie de cette pression est absorbée par les éléments de l'enveloppe comme le revêtement extérieur, le revêtement intermédiaire et la surface intérieure.

Un système de détection des fuites d'air a été proposé. Ce système pourrait être utilisé par les constructeurs afin de réaliser des maisons très étanches. Le système serait constitué d'une simple soufflante sans instruments qui évacuerait l'air par une ouverture appropriée comme un avaloir de sol, une pompe d'épuisement ou le tuyau d'une sécheuse, ce qui en faciliterait l'installation et l'utilisation.

Le programme de mesure de l'étanchéité à l'air continuera jusqu'en mars 1989.

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#### National Steering Committee

Mr. W. Bryant of Energy, Mines and Resources Canada (Chairman) Dr. J. Kenward of the Canadian Home Builders Association Mr. W. McDonald of Manitoba Energy and Mines

#### Technical Advisory Committee

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Mr. L. Nakatsui of the Residential Construction Group Inc.

Mr. P. Piersol of Ortech International

Mr. T. Robinson of Canada Mortgage and Housing Corporation

Dr. J. Timusk of the University of Toronto

#### Resource Individuals

Mr. O. Drerup of the Canadian Home Builders Association

Mr. T. Hamlin of Energy, Mines and Resources Canada Mr. B. Maybank of Flair Homes (Manitoba) Ltd. Mr. N. Shymko of Today Homes (East) Ltd. Mr. R. Slasor of Energy, Mines and Resources Canada

Mr. B. Sloat of the Canadian Home Builders Association Mr. D. Verville of Today Homes (East) Ltd.



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## SECTION 1 INTRODUCTION

#### 1.1 AIRTIGHTNESS

Airtightness is a measure of the resistance to air leakage provided by the building envelope. For leakage to occur, physical openings must be present in the envelope along with a pressure differential to drive the flow. In residential construction, pressure differentials are created by natural forces, specifically wind and stack action, and by mechanical systems such as ventilation equipment, furnaces and other household appliances.

From a building science perspective, air leakage has several negative effects. The most obvious is increased energy consumption for both the heating and cooling loads of the structure. This is most evident with "plug flow" leakage in which the air moves through discrete, relatively large holes in the envelope. If the leakage sites are dispersed over the envelope (such as in the dynamic wall approach), a portion of the heat moving through the insulated shell is recaptured as the infiltrating air moving through it is warmed. The second and perhaps most important effect is moisture movement into the envelope. It is generally recognized that the prime mechanism for moisture transport is air exfiltration. This process can deposit significant quantities of water in the envelope, usually in concentrated locations around the leakage sites. Moisture accumulations can lead to accelerated rotting of wood components, insulation wetting and staining/destruction of interior surfaces.

Leakage can reduce comfort levels in a home if infiltrating cold air is noticed by the occupants. Holes and cracks can also increase the transmission of outdoor noise to the interior since sound will travel through physical discontinuities in the envelope in a manner analogous to air flow.

Air infiltration can also degrade the quality of the indoor air if leakage occurs through an area where pollutants are present, such as through the surrounding soil (radon) or attached garages (various chemicals).

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Thus, building science, comfort and air quality considerations all would suggest that it is desirable to maximize the airtightness of a house. In practice, of course, air leakage cannot be eliminated, but only controlled within prescribed limits. At present, the National Building Code of Canada does not contain any quantitative requirements for residential airtightness (Ref. 1). The R-2000 Home Program requires that all houses registered under the Program must have a measured leakage which does not exceed 1.5 air changes per hour at a pressure differential of 50 Pascals (ac/hr<sub>50</sub>) or that the Normalized Leakage Area at 10 Pascals (NLA<sub>10</sub>) does not exceed 0.7 cm<sup>2</sup>/m<sup>2</sup> (Ref. 2). Compliance with the requirement must be verified by a blower door test performed in accordance with CAN/CGSB-149.10-M86 (Ref. 3).

#### 1.2 OBJECTIVES

The objectives of the work described in this report were to monitor the airtightness of the 20 houses in the Flair Homes Energy Demo/CHBA Flair Mark XIV Project, to compare the performance of the different envelope systems used in the houses, and to identify opportunities for improving the design of airtightness systems in new construction.

#### 1.3 THE FLAIR HOMES ENERGY DEMO/CHBA FLAIR MARK XIV PROJECT

The Flair Homes Energy Demo/CHBA Flair Mark XIV Project has three objectives:

- To demonstrate and evaluate the performance of various low energy building envelope systems.
- To demonstrate and evaluate the performance of various residential mechanical systems with particular emphasis on ventilation systems.
- To transfer the knowledge gained in the project to the Canadian home building industry.

In addition, the project is structured to support the R-2000 Home Program funded by Energy, Mines and Resources Canada and administered by the Canadian Home Builders Association. The project acquired the Mark XIV designation when a substantial portion of the research priorities identified by the Technical Research Committee of the CHBA in 1983/84 were incorporated into the project.

Support for the project has been provided by Energy, Mines and Resources Canada under the Energy Demo Program and by Manitoba Energy & Mines under the Manitoba/Canada Conservation and Renewable Energy Demonstration Agreement (CREDA). Project management is the responsibility of Flair Homes (Manitoba) Ltd. Monitoring of the project houses is the responsibility of UNIES Ltd. and will continue until the spring of 1989.

To meet the project objectives, 20 houses employing various envelope and mechanical systems were constructed in 1985 and 1986 in the Genstar Development Co. Lakeside Meadows subdivision of Winnipeg. The houses were built by Flair Homes (Manitoba) Ltd. using two of their standard floor plans. The houses are divided into 10 pairs, with each pair having a different combination of envelope and mechanical systems. Conservation levels range from those of conventional Canadian houses to those which meet or exceed the R-2000 Standard. All of the houses were constructed with stucco as the exterior finish on three walls and wood, brick or stone was used on the fourth. A summary of the project houses is shown in Table 1 and more detailed descriptions are given in Ref. 4. A sample floor plan is shown in Figure 1. TABLE 1 SUMMARY OF PROJECT HOUSES

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| HOUSE | 5   | BUTI DING ENVELOPE                              |  |                     | 10<br>10   | MECHAN  | ICAL SYSTEMS  |  |
|-------|---|---|--|---------------------|--|---|---|--|
| NO.   | WALL<br>CONSTRUCTION  | AIR/VAPOUR<br>BARRIER                           | BASEMENT<br>INSULATION   | ATTIC<br>INSULATION | SPACE<br>HEATING   | DHW<br>HEATING  | VENTILATION<br>SYSTEM   | VENT. DIST-<br>RIBUTION SYSTEM                                 |
| 1,2   | 38x140 (2x6), 38 mm (11*)<br>Glasclad Insulated Sheathing<br>c/w Tyvek Air Retarder<br>(Reversed)         | ADA, Paint Vapour<br>Barrier                    | Interior<br>Batts/Framing  | Cellulose<br>Fibre  | Forced Air<br>Electric<br>Furnace                                | Electric Tank   | HRV   | Indirect Connection<br>to Forced Air Meating<br>System         |
| 3,4   | 38x140 (2x6), 38 mm (1½")<br>Glasclad Insulated Sheathing<br>c/w Tyvek Air Retarder<br>(Reversed)         | ADA, Paint Vapour<br>Barrier                    | Interior<br>Batts/Framing  | Cellulose<br>Fibre  | Forced Air<br>Electric<br>Furnace                                | Electric Tank   | HRV   | Indirect Connection<br>to Forced Air Meating<br>System         |
| 5,6   | 38x140 (2x6), 38 mm (14")<br>Glasclad Insulated Sheathing<br>c/w Tyvek Air Retarder<br>(Reversed)         | ADA, Paint Vapour<br>Barrier                    | Interior<br>Batts/Framing  | Cellulose<br>Fibre  | Forced Air<br>Electric<br>Furnace                                | Electric Tank   | HRV   | Indirect Connection<br>to Forced Air Meating<br>System         |
| 7,8   | 38x140 (2x6)  | ADA, Paint Vapour<br>Barrier                    | Interior<br>Batts/Framing  | Cellulose<br>Fibre  | Forced Air<br>Electric<br>Furnace                                | Electric Tank   | Centra I<br>Exhaust   | Fresh Air Intake to<br>Return Air Plenum of<br>Furnace         |
| 9,10  | 38x140 (2x6)  | 6 mil Poly                                      | Interior<br>Batts/Framing  | Cellulose<br>Fibre  | Forced Air<br>Naturally<br>Aspirated,<br>Gas Furnace             | Gas Tank  | Bathroom<br>Exhaust Fan   | None   |
| 11,12 | 38x140 (2x6), 51 mm (2 <sup>4</sup> )<br>Glasclad Insulated Sheating<br>c/w Tyvek Air Retarder<br>(Taped) | ADA Limited<br>Gaskets, Paint<br>Vapour Barrier | 76mm (3 <sup>w</sup> )<br>Exterior<br>Baseclad and<br>25mm (1")<br>Glasclad<br>Underslab | Blown<br>Fiberglass | Electric<br>Baseboards<br>and Heat<br>Pump                       | Heat Pump,<br>Int. with<br>Vent. System                             | Exhaust-only<br>Heat Pump Int.<br>with Space and<br>DHW Systems | Envelope Leakage and<br>Exhaust Vent. Heat<br>Recovery         |
| 13,14 | 38x140 (2x6), 51 mm (2*)<br>Glasclad Insulated Sheating<br>c/w Tyvek Air Retarder<br>(Taped)              | ADA Limited<br>Gaskets, Paint<br>Vapour Barrier | Interior<br>Batts/Framing  | Blown<br>Fiberglass | Forced Air<br>Electric<br>Furnace                                | Electric Tank   | HRV .   | Envelope Leakage and<br>Unbalanced Heat<br>Recovery Ventilator |
| 15,16 | Double Wall   | 6 mil Poly                                      | Interior<br>Batts/Framing  | Cellulose<br>Fibre  | Air-to-Air<br>Heat Pump<br>Int. with<br>Vent. and<br>DHW Systems | 2 Tank System<br>Int. with<br>Space Heating<br>and Vent.<br>Systems | A/A Heat Pump<br>Int. with<br>Forced Air<br>Heating System      | Combined Forced Air<br>Heating and<br>Ventilation System       |
| 17,18 | Double Wall   | 6 mil Poly                                      | Interior<br>Batts/Framing  | Cellulose<br>Fibre  | Electric<br>Baseboards   | Electric Tank   | A/A Heat Pump<br>HRV and Duct<br>Heater                         | Dedicated Supply-only<br>Ventilation System                    |
| 19,20 | 38x89 (2x4), 51 mm (2")<br>SM Insulated Sheathing   | ADA, Paint Vapour<br>Barrier                    | 51mm (2")<br>Exterior SM and<br>Interior Batts/<br>Framing                               | Cellulose<br>Fibre  | Electric<br>Baseboards   | Electric Tank   | HRV   | Dedicated Supply-only<br>Ventilation System                    |

<u>LEGEND</u> Int. c/w ADA

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- Integrated - Complete With - Airtight Drywall Approach

Vent. DHW A/A

- Ventilation - Domestic Hot Water - Air to Air

- Heat Recovery Ventilator HRV

10/88



FIGURE 1 -5-

### SECTION 2 AIR BARRIERS

#### 2.1 AIR BARRIER THEORY

The primary mechanism used to control air leakage through building envelopes is the air barrier which may consist of a single material or an assembly of materials. The main requirements for air barriers are generally defined as:

- 1. Low permeability to air flow
- 2. Structural strength to withstand the pressure loads
- Continuity to reduce leakage
- 4. Durability to last the life of the building
- 5. Rigidity to provide pressure equalization behind exterior cladding

In new residential construction sheet polyethylene is the most commonly used material. Joints in the poly may be sealed with caulking or simply stapled in place. In most applications, it is also used as the vapour barrier.

A second system which has gained acceptance is the Airtight Drywall Approach (ADA) which relies upon the drywall to function as the air barrier with paint or poly as the vapour barrier. Leakage at joints between major envelope components is controlled through the use of strategically located gaskets.

In the last few years, sheet materials such as spun-bonded polyolefin (SBPO), which function as air retarders but not vapour barriers, have also come into wider use. This system has the advantage that it can be placed at any location within the envelope assembly whereas poly must be located close to the warm side of the assembly to prevent condensation. If an SBPO layer is used as an exterior air barrier, it has the further advantage of protecting the insulation from "wind-washing".

At present, there is considerable debate about which system is the most appropriate for Canadian conditions. The so-called "poly approach" is usually viewed as a more traditional and hence better-understood technique for new construction while the ADA approach is argued to be better able to

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withstand the pressure forces to which the air barrier will be exposed. The sheet SBPO approach meanwhile, is finding application in combination with both systems.

One reason for the debate over residential air barrier design is the requirement for structural strength, specifically the maximum load the air barrier must be designed to resist. These loads, as previously noted, are due to wind action, stack effect and the operation of mechanical systems. In residential construction, pressure loads due to stack effect seldom exceed 10 to 20 Pascals while loads due to the mechanical systems may be slightly larger. Wind action however, can generate pressures on an exposed building surface of over 1000 Pascals. If the air barrier is intended to withstand the entire pressure differential experienced by the envelope assembly, then its structural design will be dictated by the wind loading.

#### 2.2 BUILDING CODE REQUIREMENTS

Part 9 of the 1985 Building Code of Canada requires conformance of structural members and connections with Part 4 which deals with structural design (see Subsection 9.4.1). Subsection 4.1.8.1 describes how live loads due to wind are to be calculated:

| D |  |
|---|--|
| D |  |

(1)

where:

P = the specified external pressure

q = the reference velocity pressure

Ce = the exposure factor

Cg = the gust factor

Cp = the external pressure coefficient averaged over the area under consideration

The velocity pressure, q, used for the design of structural members is based on the wind speed which has 1 chance in 30 of being exceeded in any one year. Values for q are found in the Supplement to the National Building Code (Ref. 5) which tabulates appropriate values for over 600 locations in Canada. These values are typically based on measurements taken at a height of 10 m (30 ft.) above the ground in an area clear of significant obstructions. No credit is given to structures built in

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locations, such as in urban environments, where shading from the wind may occur. Some typical as well as extreme values of q are:

| Location H                 | lourly Wind | l Pressures | (1/30), | Pascals |
|----------------------------|-------------|-------------|---------|---------|
| Winnipeg                   |             | 420         |         |         |
| Vancouver                  |             | 550         |         |         |
| Edmonton                   |             | 400         |         |         |
| Toronto                    |             | 480         |         |         |
| Halifax                    |             | 520         |         |         |
| Minimum (several locations | )           | 240         |         |         |
| Maximum (Coral Harbour, N. | W.T.)       | 1200        | (*)     |         |

The exposure factor, Ce, accounts for the increase in wind speed with increasing height above the ground. For heights up to 6 m (20 ft.), it is equal to 0.9 and for building heights between 6 and 12 m (20 to 39 ft.), its value is 1.0.

The gust factor, Cg, accounts for the gusting action of wind and is typically equal to 2.0 for entire buildings.

The pressure coefficient, Cp, accounts for the non-uniformity of wind loads on exposed surfaces and the fact that the entire velocity pressure is not converted into an applied load because of the aerodynamic effects of wind blowing over an immersed body. Appropriate values are usually determined empirically based on wind tunnel data and field measurements.

In practice, the major uncertainty lies in defining values for Cp and, to a lesser degree, Cg. Values for the product CpCg have been determined and are documented in Chapter 4 of the Supplement. Using this source, the maximum value of CpCg likely to be encountered by a typical house wall would be approximately -2.1 (the minus sign indicating a suction force).

Using the above information, one can determine the design pressures

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which the envelope will be structurally required to withstand:

| Location                       | Design Pressure, Pascals |
|--------------------------------|--------------------------|
| Winnipeg                       | 880                      |
| Vancouver                      | 1160                     |
| Edmonton                       | 840                      |
| Toronto                        | 1010                     |
| Halifax                        | 1090                     |
| Minimum (several locations)    | 500                      |
| Maximum (Coral Harbour, N.W.T. | .) 2520                  |

### 2.3 VARIATIONS IN AIRTIGHTNESS

Airtightness is not a fixed performance characteristic of a structure but can increase, decrease or fluctuate over time. Persily (Ref. 6) observed seasonal variations of 25% in a single, unoccupied wood frame structure located in New Jersey using  $ac/hr_{50}$  as the measurement parameter. He postulated that the changing moisture content of framing members was responsible for these variations since it might vary the crack dimensions along leakage routes. Kim and Shaw (Ref. 7) explored this issue in more detail in two unoccupied structures in Ottawa and reported seasonal variations of approximately 20% with the maximum  $ac/hr_{50}$  values occurring in late winter and minimum values in late summer and early fall. They also found a strong relationship between the level of airtightness and the humidity ratio of the indoor air which further supports the swelling/shrinking of wood frame members theory.

Howell and Mayhew (Ref. 8) tested six houses in Edmonton over a period of 1.5 to 2 years. They found that the four houses constructed with the ADA system were tighter than the two built using conventional practice (although "conventional" was different from that of the "conventional" houses in this project). At the end of the test period, the ADA houses were observed to have become leakier while the conventional houses were unchanged. The change was attributed to degradation of the caulked joints between the basement drywall and the floor joists (this technique was not used on the Flair houses).

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European experiences seem to be slightly different. The Air Infiltration Centre publication TN 16 (Ref. 9) observed that changes usually occur in the first year after construction. They report examples of five Swedish houses which averaged a 70% increase in  $ac/hr_{50}$  values in the first year and then remained constant. Three British houses were reported to have experienced an average 83% increase in the first year. Carlsson and Kronvall (Ref. 10) described measurements on 15 Swedish "timber-framed" houses tested at the time of completion and then after a period of from 1.5 to 4.5 years. They found that airtightness levels generally remained constant. It is unknown how applicable these results are to North American construction.

### SECTION 3 MONITORING

#### 3.1 DESCRIPTION OF THE AIRTIGHTNESS MONITORING PROGRAM

Airtightness testing has been conducted on the 20 houses in the Flair project since March, 1986 and will continue until March, 1989. Tests are conducted two to four times per year and are performed in accordance with CAN/CGSB-149.10-M86 "Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method".

At the time of the initial tests in March, 1986, Houses #1 to #10 were complete while #11 to #20 were complete except for the stucco which was applied shortly afterwards.

Houses #1 to #10 were framed by a single crew while Houses #11 to #20 were framed by a second crew. Both were very experienced with energy-efficient construction.

During the testing period, regular monthly contact has been maintained with the houses and their occupants to identify changes which may have affected the structures. Those changes which have occurred are considered typical for new houses, such as degradation of door and window weatherstripping, cracking of the basement floor slab and general movement of the structure. Some development of the basement has taken place in eight of the houses (#1, #9, #10, #13, #14, #15, #17 and #20), but this is not considered to have had a major impact on the airtightness.

## SECTION 4 RESULTS

#### 4.1 INTRODUCTION

Summaries of the airtightness test results are shown in Tables 2 and 3 which give measured values of the air change rates at 50 Pascals  $(ac/hr_{50})$  and the Normalized Leakage Areas  $(NLA_{10})$ . Table 4 gives the absolute and percentage changes in airtightness between the initial test (defined as the test conducted with the house complete and the stucco in place) and the most recent test. A negative percentage change in airtightness is defined as that produced by the house becoming more airtight.

Maximum monthly wind speeds and the corresponding velocity pressures recorded during the monitoring period are shown in Figs. 2 and 3. These were measured at 10 m above ground level at Winnipeg International Airport, located approximately 15 km from the project site. It should be noted that 19 of the 20 project houses were located on the extreme northern edge of urban development with little protection against winds from that direction.

### 4.2 HOUSES #1 TO #6

The ADA system was used for the main walls and ceilings with paint serving as the vapour barrier on these houses. An interstitial air retarder was incorporated using an untaped SBPO layer attached to the warm side of the rigid insulated sheathing (reversed Glasclad). The basements used interior framing and insulation with poly as the vapour barrier and concrete as the air barrier.

The airtightness results are plotted in Fig. 4. As shown, the initial airtightness performance of the houses was at or slightly below the R-2000 requirement. Airtightness levels then fluctuated over the monitoring period and while some noticeable variations did occur, particularly in the  $NLA_{10}$ , no permanent, systematic change was observed.

#### 4.3 HOUSES #7 AND #8

These two houses also used the ADA system for the main walls and

| HOUSE # | DATE OF TEST       |            |                     |            |            |                       |           |  |  |
|---------|--------------------|------------|---------------------|------------|------------|-----------------------|-----------|--|--|
| 1       | Mar.25/86          |            | Nov.21/86           | Feb. 14/87 | ·          |                       | Feb.29/88 |  |  |
|         | 1.009              | 1.1.16.000 | 1.4/5               | 1.508      | 1.1.6707   | 10/07                 | 1.4/9     |  |  |
| 2       |                    | JUI.10/80  | NOV.24/86           | Feb. 18/8/ | Jul.6/8/   | NOV, 18/8/            | Mar.8/88  |  |  |
|         | Now 15/06 1        | 1.053      | 1.1/1<br>Nov. 25/05 | I.119      | 0.9//      | 1.047                 | 1.109     |  |  |
| 3       | Mar.15/80          | ÷          | NOV.25/80           | red.15/8/  | JUI.8/8/   |                       | Mar.4/88  |  |  |
|         | 1.509<br>Man 25/06 |            | Nov 26/06           | L.032      | 1.400      |                       | Mam 3/00  |  |  |
| 4       | 1 455              |            | 1 311               | 1 200      | 1 115      |                       | 1 415     |  |  |
| 5       | Man 24/86          |            | Nov 26786           | Feb 20/87  | 1.115      |                       | Man 2/88  |  |  |
| 5       | 1 118              |            | 1 264               | 1 104      | 1 144      |                       | 1 049     |  |  |
| 6       | Mar 15/86          |            | Nov 24/86           | Feb 14/87  | .111 10/87 |                       | Feb 29/88 |  |  |
|         | 1 205              |            | 1 255               | 1 306      | 1 187      |                       | 1 417     |  |  |
| 7       | Mar 25/86          |            | Nov 26/86           | Feb 16/87  | 1.10/      |                       | 4.74/     |  |  |
|         | 1,166              |            | 1 522               | 2,196      | a 9        |                       |           |  |  |
| 8       | Mar. 14/86         |            | Dec. 1/86           | Feb. 20/87 | Jul 20/87  | and the second second | Mar 2/88  |  |  |
| U U     | 1.588              |            | 1.392               | 1.740      | 1.342      |                       | 1.444     |  |  |
| 9       | Mar. 24/86         | Jul. 16/86 | Nov. 24/86          | Feb. 15/87 | Jul. 23/87 | Nov. 25/87            | Mar. 2/88 |  |  |
| -       | 1.622              | 1,655      | 1.741               | 1.838      | 1,484      | 1.684                 | 1,781     |  |  |
| 10      | Mar. 26/86         | Ju1.14/86  | Nov.21/86           | Feb. 21/87 | Ju1.14/87  | Nov.30/87             | Mar. 8/88 |  |  |
|         | 1.281              | 1.152      | 1.429               | 1.386      | 1.167      | 1.038                 | 1.032     |  |  |
| 11      | Mar. 22/86 ·       | Jun.11/86  | Nov.26/86           | Feb. 16/87 | Ju1.9/87   |                       | Mar.2/88  |  |  |
|         | 1.694*             | 0.892      | 0.962               | 0.881      | 0.879      |                       | 1.007     |  |  |
| 12      | Mar.23/86          | May 28/86  | Nov.20/86           | Feb.16/87  | Jul.8/87   |                       | Mar.9/88  |  |  |
|         | 1.593*             | 1.120      | 0.960               | 0.979      | 0.878      |                       | 0.980     |  |  |
| 13      | Apr.25/86          | Jul.18/86  | Dec.8/86            | Feb. 18/87 | Jul.8/87   |                       | Mar.9/88  |  |  |
|         | 1.268*             | 0.836      | 0.830               | 0.761      | 1.043      |                       | 0.938     |  |  |
| 14      | Mar.22/86          | Jun.10/86  |                     | Feb.19/87  | Jul.15/87  |                       | Mar.3/88  |  |  |
|         | 1.319*             | 1.136      |                     | 0.955      | 0.989      |                       | 1.155     |  |  |
| 15      | Mar.15/86          | May 7/86   | Nov.20/86           | Feb.20/87  |            |                       | Mar.3/88  |  |  |
|         | 1.473*             | 1.328      | 1.257               | 1.152      | (#)        | · · · · · ·           | 1.104     |  |  |
| 16      | Mar.26/86          | Jul.14/86  | Nov.21/86           | Feb.17/87  |            |                       | Mar.9/88  |  |  |
| A-145-  | 1.258*             | 1.292      | 1.382               | 1.405      |            | F                     | 1.519     |  |  |
| 17      | Mar.24/86          | Jul.29/86  | Nov.20/86           | Feb.13/87  | Aug. 25/87 | Dec.1/87              | Mar.24/88 |  |  |
|         | 0.549*             | 0.363      | 0.713               | 0.437      | 0.570      | 0.384                 | 0.564     |  |  |
| 18      | Mar.16/86          | Jul.28/86  | Nov.29/86           | Feb.19/87  | Jul.22/87  | Nov.24/87             | Mar.2/88  |  |  |
|         | 0.486*             | 0.416      | 0.478               | 0.480      | 0.385      | 0.418                 | 0.434     |  |  |
| 19      | Mar.23/86          | Jul.14/86  | Dec.8/86            | Feb.17/87  | Jul.16/87  |                       | Feb.29/88 |  |  |
|         | 1.049*             | 0.807      | 0.842               | 0.908      | 0.715      | 4                     | 1.038     |  |  |
| 20      | Mar.23/86          | Jul.25/86  | Nov.25/86           | Feb.13/87  | Jul.17/87  |                       | Mar.8/88  |  |  |
|         | 1.126*             | 0.708      | 0.815               | 0.731      | 1.008      |                       | 0.797     |  |  |

## TABLE 2 AIRTIGHTNESS TEST RESULTS Air Changes Per Hour @ 50 Pascals (ac/hr<sub>50</sub>)

NOTES

1. \* Indicates no stucco.

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TABLE 3 AIRTIGHTNESS TEST RESULTS Normalized Leakage Area @ 10 Pascals (NLA<sub>10</sub>)

| HOUSE # |           |   |            | DATE OF TEST |            |           |           |
|---------|-----------|---|------------|--------------|------------|-----------|-----------|
|         | Mar 25/86 | *                                       | Nov 21/86  | Feb 14/87    |            |           | Feb 20/88 |
| -       | 0 577     | 2                                       | 0 467      | 0 380        |            | ×         | 0 477     |
| 2       | 0.0//     | Jul 16/86                               | Nov 24/86  | Feb. 18/87   | Jul 6/87   | Nov 18/87 | Mar 8/88  |
| -       |           | 0.410                                   | 0.603      | 0.451        | 0.400      | 0.425     | 0.503     |
| 3       | Mar.15/86 |   | Nov. 25/86 | Feb. 15/87   | Ju1.8/87   |           | Mar. 4/88 |
|         | 0.513     |   | 0.517      | 0.762        | 0.564      |           | 0.656     |
| 4       | Mar.25/86 |   | Nov.26/86  | Feb. 17/87   | Jul.13/87  |           | Mar.3/88  |
|         | 0.585     |   | 0.482      | 0.551        | 0.437      |           | 0.643     |
| 5       | Mar.24/86 | Second Constitution                     | Nov.26/86  | Feb.20/87    | Ju1.9/87   |           | Mar.2/88  |
|         | 0.444     | 18.                                     | 0.450      | 0.432        | 0.334      |           | 0.341     |
| 6       | Mar.15/86 | 19 - 19 - 19 - 19 - 19 - 19 - 19 - 19 - | Nov.24/86  | Feb.14/87    | Jul. 10/87 |           | Feb.29/88 |
|         | 0.473     |   | 0.488      | 0.613        | 0.366      |           | 0.581     |
| 7       | Mar.25/86 |   | Nov.26/86  | Feb.16/87    | -          |           |           |
|         | 0.433     |   | 0.637      | 0.981        | 392        |           |           |
| 8       | Mar.14/86 |   | Dec.1/86   | Feb.20/87    | Jul.20/87  | 24        | Mar.2/88  |
|         | 0.857     |   | 0.636      | 0.745        | 0.620      |           | 0.664     |
| 9       | Mar.24/86 | Jul.16/86                               | Nov.24/86  | Feb.15/87    | Jul.23/87  | Nov.25/87 | Mar.2/88  |
|         | 0.560     | 0.587                                   | 0.566      | 0.623        | 0.596      | 0.641     | 0.659     |
| 10      | Mar.26/86 | Jul.14/86                               | Nov.21/86  | Feb.21/87    | Jul.14/87  | Nov.30/87 | Mar.8/88  |
|         | 0.588     | 0.418                                   | 0.642      | 0.805        | 0.404      | 0.441     | 0.392     |
| 11      | Mar.22/86 | Jun.11/86                               | Nov.26/86  | Feb. 16/87   | Jul.9/87   |           | Mar.2/88  |
|         | 0.753*    | 0.345                                   | 0.396      | 0.317        | 0.282      |           | 0.370     |
| 12      | Mar.23/86 | May 28/86                               | Nov.20/86  | Feb.16/87    | Ju1.8/87   |           | Mar.9/88  |
|         | 0.835*    | 0.468                                   | 0.417      | 0.329        | 0.318      |           | 0.405     |
| 13      | Apr.25/86 | Jul.18/86                               | Dec.8/86   | Feb. 18/87   | Jul.8/87   |           | Mar.9/88  |
|         | 0.569*    | 0.360                                   | 0.314      | 0.401        | 0.437      |           | 0.403     |
| 14      | Mar.22/86 | Jun.10/86                               |            | Feb.19/87    | Jul. 15/87 |           | Mar.3/88  |
|         | 0.754*    | 0.490                                   |            | 0.516        | 0.393      |           | 0.467     |
| 15      | Mar.15/86 | May 7/86                                | Nov.20/86  | Feb.20/87    |            |           | Mar.3/88  |
|         | 0.774*    | 0.655                                   | 0.597      | 0.547        |            |           | 0.539     |
| 16      | Mar.26/86 | Jul.14/86                               | Nov.21/86  | Feb.17/87    |            |           | Mar.9/88  |
|         | 0.677*    | 0.675                                   | 0.714      | 0.711        |            |           | 0.777     |
| 17      | Mar.24/86 | Ju1.29/86                               | Nov.20/86  | Feb.13/87    | Aug. 25/87 | Dec.1/87  | Mar.24/88 |
|         | 0.278*    | 0.154                                   | 0.340      | 0.166        | 0.250      | 0.132     | 0.307     |
| 18      | Mar.16/86 | Jul.28/86                               | Nov.29/86  | Feb.19/87    | Jul.22/87  | Nov.24/87 | Mar.2/88  |
|         | 0.259*    | 0.227                                   | 0.190      | .0.192       | 0.155      | 0.138     | 0.171     |
| 19      | Mar.23/86 | Jul.14/86                               | Dec.8/86   | Feb.17/87    | Jul.16/87  |           | Feb.29/88 |
|         | 0.444*    | 0.232                                   | 0.320      | 0.347        | 0.279      |           | 0.402     |
| 20      | Mar.23/86 | Ju1.25/86                               | Nov.25/86  | Feb.13/87    | Jul.17/87  |           | Mar.8/88  |
|         | 0.560*    | 0.298                                   | 0.287      | 0.208        | 0.444      | ×         | 0.299     |

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## NOTES

1. \* Indicates no stucco.

| T | A | B | L | E | 4 |
|---|---|---|---|---|---|
|   |   |   |   |   |   |

| HOUSE # | INITIAL | AC/<br>FINAL | HR <sub>50</sub><br>ABS. CHG. | %                  | INITIAL | NL<br>FINAL | A <sub>10</sub><br>ABS. CHG. | %      | MONTHS BETWEEN INITIAL<br>AND MOST RECENT TEST |
|---------|---------|--------------|-------------------------------|--------------------|---------|-------------|------------------------------|--------|--|
| 1       | 1.669   | 1.479        | -0.189                        | -11.4              | 0.577   | 0.477       | -0.101                       | - 17.5 | 23   |
| 2       | 1.053   | 1.169        | 0.117                         | 11.1               | 0.410   | 0.503       | 0.093                        | 22.7   | 20   |
| 3       | 1.509   | 1.689        | 0.180                         | 11.0               | 0.513   | 0.656       | 0.143                        | 27.9   | 24   |
| 4       | 1.455   | 1.415        | -0.040                        | - 2.8              | 0.585   | 0.643       | 0.058                        | 9.9    | 23   |
| 5       | 1.118   | 1.049        | -0.069                        | - 6.2              | 0.444   | 0.341       | -0.103                       | - 23.2 | 23   |
| 6       | 1.205   | 1.417        | 0.212                         | 17.6               | 0.473   | 0.581       | 0.108                        | 22.9   | 23   |
| 7       | 1.166   | 2.196        | 1.029                         | 88.3               | 0.433   | 0.981       | 0.548                        | 126.4  | 11   |
| 8       | 1.588   | 1.444        | -0.145                        | - 9.1              | 0.857   | 0.664       | -0.193                       | - 22.5 | 24   |
| 9       | 1.622   | 1.781        | 0.160                         | 9.9                | 0.559   | 0.659       | 0.100                        | 17.0   | 23   |
| 10      | 1.281   | 1.032        | -0.248                        | -19.4              | 0.588   | 0.392       | -0.197                       | - 33.4 | 23   |
| 11      | 0.892   | 1.007        | 0.115                         | 12.8               | 0.345   | 0.370       | 0.026                        | 7.5    | 21   |
| 12      | 1.120   | 0.980        | -0.140                        | -12.5              | 0.468   | 0.405       | -0.063                       | - 13.4 | 21   |
| 13      | 0.836   | 0.938        | 0.101                         | 12.1               | 0.360   | 0.403       | 0.043                        | 12.1   | 20   |
| 14      | 1.136   | 1.155        | 0.019                         | 1.7                | 0.490   | 0.467       | -0.023                       | - 4.7  | 21   |
| 15      | 1.328   | 1.104        | -0.225                        | -16.9              | 0.655   | 0.539       | -0.115                       | - 17.6 | 22   |
| 16      | 1.292   | 1.519        | 0.227                         | 17.6               | 0.675   | 0.777       | 0.102                        | 15.1   | 20   |
| 17      | 0.363   | 0.564        | 0.200                         | 55.2               | 0.154   | 0.307       | 0.153                        | 99.9   | 20   |
| 18      | 0.416   | 0.434        | 0.018                         | 4.3                | 0.227   | 0.171       | -0.056                       | - 24.7 | 20   |
| 19      | 0.807   | 1.038        | 0.231                         | 28.6               | 0.232   | 0.402       | 0.170                        | 73.4   | 20   |
| 20      | 0.708   | 0.797        | 0.089                         | 12.6               | 0.298   | 0.299       | 0.001                        | 0.4    | 20   |
| •       | MEANS   | :            | AC/H                          | IR <sub>50 v</sub> |         |             | NL/                          | 10 "   |  |
|         |         |              | ADS. CHU.                     | k                  |         |             | ADS. CHG.                    | h      |  |
|         | #1      | - #6         | 0.035                         | 3.4                |         |             | 0.033                        | 7.1    |  |
|         | #7      | & #8         | 0.442                         | 39.6               |         | 3           | 0.177                        | 51.9   |  |
|         | #9      | & #10        | -0.044                        | - 4.8              |         |             | -0.048                       | - 7.7  |  |
|         | #1      | 1 - #14      | 0.024                         | 3.5                |         |             | -0.004                       | 0.3    |  |
|         | #1      | 5 - #18      | 0.055                         | 15.0               |         |             | 0.021                        | 18.2   |  |
|         | #1      | 9 & #20      | 0.160                         | 20.6               |         |             | 0.086                        | 36.9   |  |

### CHANGE IN AIRTIGHTNESS BETWEEN INITIAL AND MOST RECENT TESTS

NOTES

1. Nomenclature convention: a negative (-) change in airtightness indicates the structure became more airtight.

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MAXIMUM MONTHLY WIND PRESSURES (AIRPORT DATA)

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ceilings but differed from the previous ones by using a standard  $38\times140$  (2x6) wall without any insulated sheathing or an SBPO air retarder. The basement configurations were the same as Houses #1 to #6. The houses were not designed to the R-2000 Standard.

The airtightness results, plotted in Fig. 5 were less consistent, with House #7 displaying slightly erratic behaviour although the last test was performed in February, 1987. Results for House #8 were more stable over the monitoring period.

#### 4.4 HOUSES #9 AND #10

These two houses were conventional structures typical of current Manitoba construction. A 6 mil poly vapour barrier was used throughout but no extra effort was made to seal joints or otherwise make the structure airtight. Joints were overlapped and stapled but no caulking was used. Basement details were the same as those on Houses #1 to #8.

As expected, these were the leakiest structures in the project, as Fig. 6 indicates. Although not designed to the R-2000 Standard, both initially met the airtightness requirement using the NLA<sub>10</sub> parameter. This can likely be attributed to the builder's previous experience with energy-efficient construction and the use of stucco and the cast-in-place floor system which minimizes leakage at the critical wall/floor/foundation intersection.

#### 4.5 HOUSES #11 TO #14

These four houses were built using the Fiberglas Canada Inc. Low Energy House System (FCI LEHS). This can be broadly described as a modified ADA technique which relies upon a taped, SBPO exterior air retarder against a rigid board insulation. The system is not designed to form a tight air barrier but rather is intended to permit controlled amounts of leakage to occur such that infiltrating air is preheated by heat being conducted outwards through the building's envelope. Gaskets were used only around electrical fixtures on exterior walls and around windows and doors. Houses #11 and #12 used exterior rigid glass fibre insulation for the basement walls and floor slab while #13 and #14 used conventional



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interior framing and insulation for the walls and no sub-slab insulation. The stucco was applied between the first and second tests on all four houses. The airtightness results are plotted in Fig. 7.

Stucco was observed to have a significant impact on airtightness, producing an average reduction of 31% in ac/hr<sub>50</sub> and 43% in NLA<sub>10</sub>. Following application of the stucco, the airtightness remained constant with no indication of significant degradation or improvement. The two different methods of insulating the basement do not appear to have had a major impact on performance.

### 4.6 HOUSES #15 TO #18

These four houses were built using the double wall technique in which poly, sandwiched between the inner and outer walls, serves as both the air and vapour barrier. Poly was also used as the air/vapour barrier on the ceiling. All joints were carefully caulked to minimize leakage. Conventional framing and insulation were used in the basement with a poly vapour barrier. The stucco was applied between the first and second airtightness tests. Envelope construction was identical for the four houses, but two different types of mechanical systems were installed: in Houses #15 and #16, an integrated mechanical system which ducted large volumes of outdoor air through the house; while in Houses #17 and #18, conventional Heat Recovery Ventilators.

The airtightness results, plotted in Fig. 8 are quite interesting. Despite identical construction of the envelopes, Houses #15 and #16 were consistently leakier during all tests. Examination revealed significant air leakage through the (outdoor air) ductwork of the mechanical system as well as the unit itself. In particular, leakage was noted at the filter housings and vibration isolators.

Houses #17 and #18 were the tightest in the project, with measured airtightness values approximately one third of the maximum permitted by the R-2000 Standard. There was no evidence of significant change in airtightness during the monitoring period. The application of stucco had no apparent effect on the airtightness.



HOUSES #11 TO #14 (MARCH/86 TO FEBRUARY/88)



HOUSES #15 TO #18 (MARCH/86 TO FEBRUARY/88)

### 4.7 HOUSES #19 AND #20

These houses were constructed using the ADA system with 51 mm (2") of rigid extruded polystyrene insulated sheathing on the main floor and basement walls. House #20 used a layer of fibreboard sheathing between the wall framing and insulated sheathing. The stucco was applied between the first and second airtightness tests.

As shown in Fig. 9, these houses performed in a manner similar to Houses #11 and #14 with initial (pre-stucco) airtightness levels below the R-2000 Standard and with a significant improvement attributable to the application of the stucco. Measured levels were relatively stable after this point. The fibreboard sheathing used on House #20 does not appear to have had an impact on the airtightness.


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# SECTION 5 DISCUSSION OF TEST RESULTS

#### 5.1 GENERAL OBSERVATIONS

The monitoring results lead to some interesting observations concerning the air barrier systems demonstrated in the project. First, it is clear that both the poly and ADA systems (with or without the SBPO air retarder) are capable of meeting the airtightness requirements of the R-2000 Standard. All of the systems, with the exception of the FCI LEHS, met the Standard prior to the application of stucco which indicates they could also have met it if other, more permeable cladding systems had been used. The FCI LEHS, which is not designed to meet the airtightness requirement, was in fact very close and did reach this level once the stucco was applied.

The results, in general, are typical of R-2000 construction. Riley (Ref. 11) reported that average values for houses built to date under the program are about half the maximum permissible value of 1.50  $ac/hr_{50}$  at the time of construction.

Also of note, each pair or group of houses with the same air barrier system behaved in a similar fashion suggesting a degree of reproducability which is significant from a codes and standards perspective. Although the project houses were conventional bungalows, the airtightness details could be extrapolated to more architecturally complicated structures.

None of the air barrier systems demonstrated any significant change in airtightness during the monitoring period once the stucco had been applied. Although the airtightness levels were observed to fluctuate, there was no systematic tendency to increase or decrease. Note that the observed variations in airtightness for the project houses were small compared to the range of airtightness levels measured for new, conventional Canadian construction. For example, Sulatisky (Ref. 12) reported typical  $ac/hr_{50}$  values ranging from 2.12 to 9.33 for 200 conventional new houses constructed in different parts of the country between 1980 and 1982. His results are summarized in Fig. 10 using a scale of 0 to 10  $ac/hr_{50}$ . For comparison purposes, airtightness results for Houses #9, #10, #17, #18, #19

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and #20 are also shown using the same scale instead of the 0 to 2.6  $ac/hr_{50}$  scale used in Figs. 4 to 9. When viewed in this manner, the variation in airtightness of the project houses appears very slight.

The observed variations in airtightness of the project houses could have resulted from several factors including: swelling and shrinking of wood framing members, degradation of weatherstripping, differential movement of the foundation, and measurement error. It should be noted that the poly used in Houses #9, #10 and #15 to #18 was manufactured prior to, and therefore did not meet the requirements of, the new Canadian standard CGSB CAN2-51.34-M86 "Vapour Barrier, Polyethylene Sheet, for Use in Building Construction" (Ref. 13).

Stucco, which was used on three of the four walls of each house, was observed to have a significant effect on the airtightness of all but the double wall houses. The ADA houses, with or without the SBPO air retarder, displayed significant reductions in their measured airtightness with the application of stucco while the double wall houses using poly did not exhibit equivalent reductions. This implies that leakage sites existed in the ADA envelopes which were sealable with the stucco while in the double wall houses, the same potential leakage sites had already been sealed with the poly. A similar effect is believed to have been demonstrated by Sulatisky (Ref. 12) during airtightness testing of conventional houses in 1982. Tests were conducted in each province and the most airtight structures were found in Manitoba and Saskatchewan, areas in which the use of stucco is more common.

### 5.2 POSSIBLE IMPLICATIONS ON AIR BARRIER THEORY

The purpose of the following discussion is to review the requirement that residential air barriers be required to withstand the full anticipated wind loading, i.e. their structural requirements.

The current debate on the structural requirements of air barriers has focused on the need to withstand the pressure loading created by gusting wind conditions such as those in Figs. 2 and 3. During the monitoring period, the maximum gust recorded at the airport weather station was 96 km/h from the north, equivalent to a pressure loading of 460 Pascals compared to the Winnipeg design value of 880 Pascals. The loading actually experienced by the houses is unknown but would have likely been less than that at the airport. However it should be noted that 19 of the 20 project houses were located on the extreme north edge of urban development with very little protection against winds from that direction.

The project houses have yet to be exposed to the structural design wind loads, hence it is not possible to predict their response to such an event. However, the loads which have been applied have not produced an identifiable degradation in airtightness for any of the houses including those with flexible air barriers such as the poly or SBPO (with rigid board backing) systems.

Shaw (Ref. 14) examined the behaviour of 4 and 6 mil poly membranes in wood frame wall sections using various techniques to fasten and secur the poly. Continuous pressure differentials were applied and the partial pressure differentials were measured across both the poly and the entire wall section to determine if the poly was functioning as a continuous air barrier. He found that while sheet poly without any joints exhibited considerable strength (resisting up to 781 Pascals), the staple fastening system used at joints could initiate tears in the material. Timusk and Seskus (Ref. 15) also explored the behaviour of built-up wall sections using poly and found that, under a negative pressure differential, the classic orifice-flow relationship was followed up to about 1000 Pa, after which the leakage rate increased. The pressure was ultimately taken to 2000 Pa. Thus, at least under laboratory conditions, poly can be expected to exhibit considerable strength provided its integrity is not compromised by the fastening system.

Ganguli (Ref. 16) described an experiment in which pressure differentials were measured across the wall assembly of a wood frame house. When a constant indoor-to-outdoor pressure differential was generated with a blower door, 50% of the total pressure drop was observed across the poly and 10% across the sheathing. However when the pressure differential was generated by gusting wind conditions, only 10% occurred across the poly with 50% across the siding. The test house used a strapped wall in which the poly was sandwiched between the vertical studs and the horizontal

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strapping. This system provides minimal structural support for the poly since it does not provide solid backing and leaves most of the stapled joints unprotected. His results suggest that the loads generated by transient wind gusts were not fully transferred to the flexible poly air barrier.

This raises an interesting point in our knowledge base on loadings of air barriers. Current practice, as dictated by the National Building Code is to design the air barrier to take the full anticipated gust load without any assistance from other components of the envelope assembly such as the exterior finish, sheathing or interior surface. In practice, a perfect air barrier is never attained since all components and assemblies demonstrate some degree of air leakiness. As a result, if a steady-state pressure differential is imposed across an assembly, each of these components will take some of the pressure drop. If a varying, dynamic pressure loading is applied, typical of gusting winds, then each of these components will again take some of the pressure drop. However, since the maximum load is of short duration, a steady-state condition may not be attained. As a result we need to consider the transient air leakage behaviour of the individual components, as well as the complete assembly, and to investigate component distribution of pressure differentials. Unfortunately, most of the available literature on envelope leakage deals with steady-state behaviour with little insight on transient characteristics.

Another issue which needs examination is the mechanics of air barrier failure. If the air barrier is exposed to a load which exceeds its structural capacity, then it will fail and its level of airtightness will be reduced. However, unlike the failure of conventional structural components, this failure may not be catastrophic. Once a failure occurs, for example a tear opens in a sheet of poly, a degree of pressure equalization will occur to reduce the forces to which the air barrier is exposed. This will have two effects. First, the airtightness of the air barrier will be degraded and second, further damage will be minimized by the reduced loading. The first result is of course undesirable but does have the advantage of controlling damage. Since design loads for residential air barriers are determined by short-duration wind loads, this

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initial failure may limit further failure to permit the peak loading to pass.

The previous discussion has been a largely theoretical consideration of the behaviour of residential air barrier systems. However, it was also noted that the airtightness monitoring program described in this report has not observed any significant change or degradation in measured airtightness in 20 relatively airtight houses over a two year period. Although testing is continuing, the results to date, coupled with the previous discussion, indicate that there is a need to examine the structural requirements for residential air barrier systems. Specifically, the response of actual envelope systems under transient pressure conditions typical of gusting winds needs to be studied. In addition, the ability of non-air barrier components to take a portion of transient pressure loadings should be investigated plus an examination of the effects of air barrier failure as it relates to load reduction and damage control.

# SECTION 6 AIR LEAKAGE LOCATIONS

#### 6.1 SOURCES OF AIR LEAKAGE

During the airtightness tests on the project houses, inspections were done to identify major sources of air leakage and to highlight any patterns in the distribution of sources around the envelope. Categorization of a leakage source as "major" was objectively determined by the testing technician. Results for the first and most recent inspections on each house are summarized in Appendix A.

It is evident that only a few areas were consistently noted as sources. The most obvious were electrical outlets on exterior and interior walls of the ADA houses. Commercially available semi-rigid "poly pans" with a foam gasket under the cover plate were used in these houses. Wire penetrations into the pan were caulked and reasonable care was taken to insure a tight fit between the pan and drywall. However, the flexibility of the pan material is believed to have permitted leakage between the flange face and the drywall (which was not controlled by the plate gasket). (Electrical outlet leakage has also been frequently noted during routine airtightness testing of R-2000 houses which use a poly air barrier underneath the drywall). Leakage at interior outlets was also noted despite the use of continuous ceiling drywall. It appears that an improved design or installation procedure is required for manufactured poly pans.

Window leakage was also frequently noted, particularly through joints in the frame, between the frame and casing and along the weatherstripping. The frequency of window source leakage has increased in the houses during the monitoring period indicating a gradual degradation of performance at this location.

Leakage was also noted along baseboards in the cantilevered bay windows in bedrooms in some houses. Similar leakage has been observed in other R-2000 houses due to problems with sealing the underside of the cantilever.

Other leakage areas less frequently noted were service penetrations for ventilation ducts and, on the two conventional houses, plumbing stacks and chimney penetrations. Also, as previously described, significant ductwork and case leakage was noted through the mechanical systems in Houses #15 and #16.

# SECTION 7 OPPORTUNITIES FOR IMPROVING AIRTIGHTNESS

### 7.1 PROPOSED LEAK DETECTION SYSTEM

Research over the last 10 years has identified many techniques, systems and details by which desired levels of airtightness can be achieved. Design and construction experience from the R-2000 Program has refined many of these details to the point where they are routinely practiced by hundreds of builders. However, to produce such results on a consistent and reliable basis, an airtightness test is required both to verify compliance with the R-2000 requirements and to find leakage areas which may exist so that corrective action can be taken. The cost of the test varies but averages around \$150 in urban areas and can be considerably more in rural and northern locations. In contrast, the incremental cost of constructing the house to this level of airtightness is around \$100 to \$200 for an experienced builder (Ref. 17). Thus the cost to construct the product is roughly the same as the cost to verify compliance. Within the R-2000 Program, this is acceptable but for large scale application of these techniques, it may not be.

Over the past eight years, UNIES Ltd. has performed approximately 1000 airtightness tests, complete with inspections to identify leakage areas. Some of these have been performed for builders constructing their first "airtight" house while others were for very experienced builders. In general, the performance of builders tends to follow a characteristic pattern or learning curve. In the first few houses significant leakage will be found at certain locations (depending on the envelope systems). Once these major leakage areas are identified, the builder is usually able to reach the R-2000 requirement for airtightness fairly consistently, only deviating when a new system or new subtrades are used or a "blunder" is made.

Houses which do not meet the R-2000 requirement usually fail because a few major "holes" have been left unsealed. One way for builders to reduce the cost of "airtight construction" may be through the use of a simple "leak detection system". Its purpose would be to identify significant

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leakage areas so they could be sealed. Compliance with an airtightness standard could, if necessary, be achieved through random airtightness testing. The proposed leak detector would not replace the conventional blower door because it would not have any measurement capability because the cost of measurement equipment is significant, the time required to perform a test and the necessary calculations (even if simplified) are considerable, and builders are not interested in performing airtightness tests. The industry traditionally uses subtrades wherever necessary and an airtightness tester is simply viewed as another subtrade.

The proposed leak detector would consist of a blower of sufficient capacity to depressurize the house by approximately 20 to 30 Pascals, sufficient for finding leaks. Since a major component of a blower door test, in terms of weight, bulk and time to set up, is the door itself, the leak detector would use a more accessible penetration through the envelope. Possible locations include the floor drain or sump with air being exhausted through the weeping tiles (provided the pressure drops were not excessive), or the dryer vent (which may require a quick-connect duct to the blower). To prevent excessive depressurization, a simple pressure relief valve would be incorporated into the device. The production cost of such a device has not been determined, but is estimated at under \$500 (an important figure psychologically since builders routinely purchase tools around this cost).

## SECTION 8

## CONCLUSIONS

- Airtightness tests were conducted on 20 houses constructed using polyethylene and Airtight Drywall Approach air barrier systems. The poly and ADA systems were both found to be capable of meeting the R-2000 Standard for airtightness. The tightest building envelopes were those constructed using the double wall technique.
- Airtightness levels were measured over a two year period and while variations were noted, no significant or permanent change in airtightness was observed for any of the houses.
- 3. The application of stucco was observed to produce a noticeable improvement in airtightness for the ADA houses. This was noted for houses constructed with or without an exterior flexible SBPO air retarder. The airtightness of the double wall houses constructed with well-sealed poly air barriers was not significantly affected by the use of stucco.
- 4. Electrical outlets on exterior walls of ADA houses were consistently found to be sources of air leakage, despite the presence of poly pans and cover plate foam gaskets. Window leakage was also noted in many houses and the frequency of this leakage increased over the monitoring period. An integrated mechanical system which ducted large volumes of outdoor air through the houses was also found to be a major source of leakage.
- 5. It was concluded there is a need to re-examine the design pressure requirements for residential air barrier systems. Specifically, this should investigate how transient wind-induced pressure loads are resisted by an air barrier system and whether some portion of the load can be expected to be taken by other envelope components such as the exterior finish, sheathing and the interior surface.
- 6. An inexpensive air leakage detection system was proposed, suitable for use by builders. It would consist of a non-instrumented blower exhausting through a suitable opening such as a floor drain, sump pump hole, or dryer vent.

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APPENDIX A

| UNIES Ltd. AIR   | TIGHTNESS TEST DATA            | FOF    | RM -      | AI      | RL      | .EAK         | AGE      | SE             | ALI            | NG       | CHE  | CKL    | IST    | ۱      | 10    | بى  | >E   | #      | = |   |
|--|--------------------------------|--------|-----------|---------|---------|--------------|----------|----------------|----------------|----------|------|--------|--------|--------|-------|-----|------|--------|---|---|
| LEAKAGE POINT  | = Jan '85<br>= FEB '88         | Living | Kitchen   | Dining  | Bedroom | Bedroom<br>2 | Bedroom  | Bathroom       | Bathroom       | Basement |      |        |        |        |       |     |      |        |   |   |
| WINDOWS:   | MOULDING                       | Γ      |           |         |         |              |          |                |                |          |      |        | 1      |        |       |     |      |        |   |   |
|  | FRAMES                         |        |           | i.      |         | -            |          | 1              | -              | *        | FR   | PLIT   | ¢.     | tex    |       | -   |      |        |   |   |
|  | LATCHES                        |        |           |         |         |              |          |                |                | 196      | 101  | 1      |        |        |       |     |      |        |   |   |
|  | WEATHERSTRIPPING               |        |           |         |         | 1            | 1        |                |                | 100      |      | 6      |        |        |       |     |      |        |   |   |
| EXTERIOR   | MOULDING                       |        |           |         |         |              | B        |                | 2              | 1        |      |        |        |        | RE    | 1   | salt | 1      | 2 |   |
| DOORS:   | FRAMES                         |        |           |         |         | j.           | 5-63     | -              | 1              |          | 100  | Sec.   | 62     | (inter | izh:  | 1.5 | 100  | -      | 1 |   |
|  | LATCHES                        |        |           |         | 1       | A start      | - Sala   | 1              |                |          |      |        | Sec.15 |        |       |     |      |        |   |   |
|  | WEATHERSTRIPPING               |        |           | 1       | 18      | 3            | 1        |                |                |          |      | 2      |        |        |       |     |      |        |   |   |
| EXTERIOR WALL  | OUTLETS                        |        |           |         |         |              |          |                |                |          | 18.1 |        | -      |        |       |     |      |        |   |   |
| ELECTRICAL:  | SWITCHES                       | đ      |           |         | in the  | SA.          |          |                | 4              |          | 1.17 | 1      | -      |        |       |     | -    |        |   | - |
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| INTERIOR WALL  | OUTLETS                        |        | Eng.      |         |         | A. C.        | 10       |                | 2.0            | V        |      |        | 1.1    |        |       |     |      |        |   | - |
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| 14 M   | WIRES THRU WALL                | 德      | 2         |         |         |              |          | -              |                | A        |      |        |        |        | e lie | h.  | Q.   |        |   |   |
| FIREPLACE:   | AROUND UNIT                    |        | 前         | 2       | 1       |              | 100      | 1              |                | A        |      |        |        | din.   |       | 8   |      |        |   |   |
|  | DAMPER/DOORS                   |        | Out State |         | 0       | 1            | 1.4      |                | No.            |          |      | 1.50   | 15     |        | 1     |     |      |        |   | - |
| ATTIC HATCH:   | MOULDING                       |        | 1         | 日時      |         | 1            | 100      |                | 13             | ( ALLE   |      | 1. Sen | 1      | *      |       |     |      |        |   |   |
|  | FRAME                          |        | -         |         |         | 1345         | 2        | 100            | 100            | in.      |      | 1      |        |        |       |     |      |        |   |   |
| de la competition de la competitiva de la competition de la compet | WEATHERSTRIPPING               |        |           |         |         | E.           | 1.43     |                | 1              | 1.22     | 13   | -      |        | -      |       |     |      |        |   |   |
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| AREAS:   | BASEBOARDS                     | 2      |           |         |         |              |          | and the second | and the second | -        |      |        |        |        |       |     |      | 1      |   |   |
| es.  | FLOOR DRAIN/SUMP               |        | 2         |         | -       |              |          | 1              | 1              |          |      | -      |        | -      |       |     |      |        |   | - |
| Contraction and Contraction  | ELECTRICAL PANEL               | 1000   | 13        |         |         |              | 1        |                |                |          |      | -      |        |        |       |     |      |        |   |   |
|  | CHIMNEY                        | 1      |           |         | 6       |              |          |                |                | 1        |      | -      |        |        |       | -   |      |        |   | - |
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|  | HEADER AREA                    | 1.13   |           |         |         |              | e        |                |                |          |      |        |        |        |       |     |      |        |   | - |
| and the second se  | HAN INTAKE & EXHAUST           | 1.12   | 1         | -       |         |              |          | -              |                |          |      | -      |        | -      |       |     |      |        |   | - |
|  | Indui Couc. WALL               | 1      |           |         | 1       | -            |          | -              |                |          |      | 1      |        |        | -     |     |      |        |   |   |
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| LEAKAGE<br>POINT | = DEC '84<br>= FEB '88   | Living     | Kitchen  | Dining  | Bedroom | Bedroom | Bedroom    | Bathroom | Bathroom   | Basement           |           |             |                   |                    |  |        |       |      |      |            |
| WINDOWS:         | MOULDING   |            |          |         |         |         | 1          |          |            |                    | 3         | Sign States | 12                |                    |  |        |       |      |      |            |
|                  | FRAMES   |            | -        |         |         | 1       |            | 1        |            |                    | 1         | 12.00       | Jan and           |                    |  |        |       |      |      |            |
|                  | LATCHES  |            |          | -       |         | 1       | 1          |          |            | 32                 | 69        | 6           |                   |                    |  |        |       |      |      |            |
|                  | WEATHERSTRIPPING   | 1          |          |         |         |         | 1          | -        |            | 200 A              |           | 4           | 1                 |                    |  |        |       | -    |      |            |
| EXTERIOR         | MOULDING   |            |          | -       |         |         | 1          | Geo      |            | C.VPT              |           | 12          |                   |                    |  | 32     | No.   | 1.19 |      | A.         |
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|                  | LATCHES  |            |          |         | B       |         | 1          | 1        |            |                    |           |             | -                 | -                  | - Allow                                  |        |       |      |      |            |
|                  | WEATHERSTRIPPING   |            |          | 1       | 198     | 1       | -          |          |            |                    |           | B.,         |                   |                    |  |        |       |      |      | 制度         |
| EXTERIOR WALL    | OUTLETS  |            |          |         |         |         | ×          |          |            | 1                  | 常服        |             | -                 |                    |  |        |       |      |      |            |
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| INTERIOR WALL    | OUTLETS  |            | 1        | 100     |         | C.C.    |            | - 18     | (4.4)      | 100 m              |           |             |                   |                    |  |        | - 200 |      |      |            |
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| FIREPLACE:       | AROUND UNIT  | 22.5       |          | n.      | 2030    | 1000    | 22.        | 100      | 1284       | No.                |           |             |                   | din s              |  | gy.    | -     |      |      |            |
|                  | DAMPER/DOORS   | -96-       | 1000     | 12.95   | Da.     | 100.45  | 100        | 100      | 1000       | Constant<br>No. 19 |           | ANTE:       |                   |                    | an a |        | -     |      |      |            |
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|                  | FRAME  | -          |          | 4       | 4       | 23      |            | 1.200    |            | 1332               |           | -           | -                 | -                  |  | -      | -     |      |      |            |
| 411              | WEATHERSTRIPPING   | $\vdash$   |          | -       | 불       | 83      |            | 5        | A a        |                    |           |             | -                 | -                  |  |        | -     |      |      | _          |
| OTHER LEAKAGE    | PLUMBING THRU WALL   |            |          | -       | 94      | 24      | -          | 1.11     | h.         | 1000               | 1. Sector |             |                   | -                  |  | -      |       |      |      | _          |
| AREAS:           | BASEBOARDS   | 5          |          | 1       | 0.      | 1       | 360        | 5.84     | · 病意       | -                  |           | *           | -                 | -                  |  | -      |       |      |      |            |
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| UNIES Ltd. AIR   | TIGHTNESS TEST DATA   | FOR                         | RM -                | AI             | RL                 | EAK          | AGE          | SE       | ALI      | NG       | CHE         | CKL           | IST   | H       | oc     | 35      | E  | #        | 3  |     |
|--|---|-----------------------------|---------------------|----------------|--------------------|--------------|--------------|----------|----------|----------|-------------|---------------|-------|---------|--------|---------|----|----------|----|-----|
| LEAKAGE<br>POINT   | = dec'84<br>= feb '88   | Living                      | Kitchen             | Dining         | Bedroom            | Bedroom<br>2 | Bedroom<br>3 | Bathroom | Bathroom | Basement |             |               |       |         |        |         |    |          |    |     |
| WINDOWS:   | MOULDING  |                             |                     |                |                    |              |              |          |          |          |             | -             |       |         |        |         |    |          |    |     |
|  | FRAMES  |                             |                     |                |                    |              |              |          |          | P**      | 1           |               | -     |         |        |         |    |          |    |     |
|  | LATCHES   |                             |                     |                |                    |              |              |          |          | 10       | 8-10        | Ten           |       |         |        |         |    |          |    |     |
|  | WEATHERSTRIPPING  |                             |                     |                |                    |              |              |          |          | 1982     |             |               |       |         |        |         |    | -04h     |    |     |
| EXTERIOR   | MOULDING  |                             |                     | -              |                    |              | 10           |          | A.       | 1        | 調売          | 1             |       | -195    | 11/2   | 100     | 19 | s della  | 1- | n.  |
| DOORS:   | FRAMES  |                             |                     |                |                    | A            |              | 1        | 1        |          | N           | E.S.          |       | B.S     | in the | au-     |    | 1        | 54 |     |
|  | LATCHES   | -                           |                     |                | 1                  | the set      | a lin        | r        |          |          |             |               |       | 8 m m   |        |         |    |          |    | e.P |
|  | WEATHERSTRIPPING  | -                           |                     |                |                    | 1            | 1            |          |          |          |             | A             |       |         |        |         |    |          |    |     |
| EXTERIOR WALL  | OUTLETS   |                             |                     |                |                    | K            |              |          |          |          | 1           | 6-3           |       |         |        | +       |    |          | ×  |     |
| ELECTRICAL:  | SWITCHES  | 1                           | 6                   |                | 1                  | 1            |              | 1        | di di    | 1. Silo  | 2.87        | 2.            |       |         |        |         |    |          |    | -   |
|  | WIRES THRU WALL   | R S                         | 120                 |                | 100                | 13255        | Rines        | and a    | 1.36     | 同時       | 1           | 1             |       | -       |        | -       |    | 5.       |    | -   |
| INTERIOR WALL  | OUTLETS   | 1 1                         |                     |                |                    | AL AND       |              | R.C.     |          | 1        | -           |               |       |         |        |         |    |          | -  | 1   |
| ELECTRICAL:  | SWITCHES  | +                           | 1                   | N              |                    |              | 1000000      | 30074    | 1        | -        |             | -             |       | -       |        | all and | 2  | $\vdash$ |    | -   |
|  | WIRES THRU WALL   | HE P                        | 6                   |                |                    |              |              | 「        |          | 1        |             | -             |       |         | alle . | 1438    | Ŧ  | 1        |    |     |
| FIREPLACE:   | AROUND UNIT   | a series<br>analite<br>atao | State of the second | A              | 198                |              | en .         | 1        |          |          |             |               |       | e de la |        | 1       | -  | 1        | -  | 1:  |
| 2.41   | DAMPER/DOORS  | 196                         | 100                 | 200            | A                  | 1993         |              | 100      | 1000     | 2547G1   | A CHE       | 100           | 10534 | 1002    | 10     |         | -  | -        | -  |     |
| ATTIC HATCH:   | MOULDING  | -                           | 100                 | 5200<br>6111 6 | Service<br>Service | A .          | 1000         |          | 100      | 4655     | Color Color | in the second | 2000  | Cals    |        | -       | -  |          |    |     |
|  | FRAME   |                             |                     | -120           |                    |              | 0            | - 12 C   | 4        |          |             | -             |       | -       | -      |         | -  | 1        | -  | -   |
| - Carlor   | WEATHERSTRIPPING  | -                           |                     | -              | 1945               | Viana a      | 記録           | 6        | 141.42   |          |             | -             |       | -       | -      |         | -  | -        | -  | -   |
| OTHER LEAKAGE  | PLUMBING THRU WALL  | +                           | -                   | -              |                    | -444         |              | 100      | 6        |          | 51          | Lex.          | TH    | 20      | FLO    | DA      | -  | 1        | -  | -   |
| AREAS:   | BASEBOARDS  | 1                           |                     | 1              | -                  |              | 75           |          |          |          |             | -             | -     | -       |        |         | -  | $\vdash$ |    | -   |
| ilh.   | FLOOR DRAIN/SUMP  | 100                         |                     |                | -                  |              | -            | 1950     | 100      | 1        |             | -             |       | -       |        |         | -  | $\vdash$ | -  | -   |
|  | ELECTRICAL PANEL  | C. A.S.                     |                     |                | -                  |              | -            | -        | -        |          |             | -             | -     | -       | 1      |         |    | -        |    | -   |
|  | CHIMNEY   | 194                         | The H               | 100            |                    | -            | -            | -        | -        |          |             | -             |       |         | -      |         | -  | $\vdash$ | -  | -   |
|  | JOISTS OVER<br>ATTACHED GARAGE  | 2                           | 78                  | ALL R          | P                  |              |              |          | F        |          | -           |               |       |         |        |         |    |          |    |     |
| Sec. 1   | HEADER AREA   |                             |                     |                | F                  |              | -            |          |          |          |             |               |       |         |        |         |    |          |    | -   |
| the second s | HAN INTAKE SEXHAUS  | 192                         | and a               |                |                    |              |              |          |          |          |             |               |       |         |        |         |    |          | -  |     |
|  |   | 1                           |                     |                |                    |              |              |          |          |          |             |               |       |         |        |         |    |          |    |     |
|  | No. of the second se |                             |                     |                |                    |              | _            |          |          |          |             |               |       |         |        |         |    |          |    |     |
|  |   | -                           |                     | -              | $\vdash$           | -            |              | $\vdash$ |          |          |             | $\vdash$      | -     | -       | -      | -       | -  | -        | -  | -   |
|  |   | -                           |                     |                |                    |              |              |          |          |          |             |               |       |         |        |         |    |          |    |     |
|  | -   |                             |                     |                |                    |              |              |          |          |          |             |               |       |         |        |         |    |          |    |     |
|  |   |                             |                     |                |                    |              |              |          |          |          |             |               |       |         |        |         |    |          |    |     |

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| UNIES Ltd. AIR   | TIGHTNESS TEST DATA                | FOR      | RM -   | AI             | RL      | EAK            | AGE         | SE       | ALI      | NG                | CHE            | CKL       | IST         | F             | 10     | U≦      | E       | #        | 4     |      |
|------------------|------------------------------------|----------|--|----------------|---------|----------------|-------------|----------|----------|-------------------|----------------|-----------|-------------|---------------|--------|---------|---------|----------|-------|------|
| LEAKAGE<br>POINT | = 027'84<br>= MAR'88               | Living   | Kitchen  | Dining         | Bedroom | Bedroom        | Bedroom     | Bathroom | Bathroom | Basement          |                |           |             |               |        |         |         |          |       |      |
| WINDOWS:         | MOULDING                           |          |  |                |         |                |             |          |          |                   | - 2            | 1. Sector | Silli       |               |        | 1       |         |          |       |      |
|                  | FRAMES                             |          |  | 1              |         |                |             |          |          |                   | Sich           | 1.20      | (a).4       |               |        |         |         |          | 1     |      |
|                  | LATCHES                            |          |  |                |         |                |             |          |          | il.               | 家心             | 7         |             |               |        |         |         |          |       |      |
|                  | WEATHERSTRIPPING                   | 1        |  |                |         |                |             |          |          | 1300              | 12.55          | k         |             |               |        |         |         | -        |       |      |
| EXTERIOR         | MOULDING                           |          |  |                |         |                | 4           |          | 2        | 1                 | and the second | 10        |             |               |        |         | -05     | N.C.     | iter. | As.  |
| DOORS:           | FRAMES                             |          | 1  | -              |         | ,dž            | Tur.        | 1.31     | 1        |                   | 199            | (中国)      | 122.00      | 1.10          | alle a | Real Co | liama   | -        | A.    | 1.   |
| *                | LATCHES                            |          |  |                | 1       |                | Sac.        | 1        |          |                   |                |           | -           | and the state | 1.5404 |         |         |          |       | 1500 |
| 1                | WEATHERSTRIPPING                   | 1        |  |                |         |                | 1           |          |          |                   | 1              | à.        | -           |               |        |         |         |          |       | 100  |
| EXTERIOR WALL    | OUTLETS                            |          |  |                |         |                |             |          |          | 4                 |                | ing the   | •           |               |        |         |         |          |       |      |
| ELECTRICAL:      | SWITCHES                           | 1        | ÷.,  | 84             | BA      | K              |             |          | i        |                   | 2.6            | 1         | 1           |               |        |         | 1.25.04 | anter    |       | den  |
|                  | WIRES THRU WALL                    | 1        | 1244   | Lee            | No.     | and the second | 1000        | VER      |          |                   | £.             |           |             |               |        |         | 100     | 12.4     | 1.00  | 14   |
| INTERIOR WALL    | OUTLETS                            | -        |  | (A)            |         | 14             | <b>新</b> 夏夏 |          | 1        | dine.             |                |           |             |               | 1      |         | 19.3    | -        | 1.182 |      |
| ELECTRICAL:      | SWITCHES                           |          |  |                | 1       |                | HEREPSE     | 靈        | 1        | -                 |                |           | -           |               |        | 4       | 1       |          | -     |      |
|                  | WIRES THRU WALL                    | 12       | 2  | 9              | ax in   | 198            |             | 1        | いた       | 1                 |                |           |             |               | 编      | 1       | 100     |          |       |      |
| FIREPLACE:       | AROUND UNIT                        |          |  | 2              | 100     |                | 1           | 100      | and the  |                   |                |           |             | Alter         |        | 7       |         | •        |       |      |
|                  | DAMPER/DOORS                       | - 442    | No.  |                | 5.0     |                | 1.50        | A.       | affer    |                   | 10             |           | 1981 B      | 1.125         | 1      |         |         | -        |       |      |
| ATTIC HATCH:     | MOULDING                           |          |  | V.L.S.         | N 8     | 3              | 100         | a star   | 1        | AND IN            | 5              | CALCE!    | all all and | -             |        |         |         |          |       |      |
| 1                | FRAME                              |          |  |                | 94      | E8             | 3           | 122      |          | a<br>Ala<br>Tatri |                |           | -           |               |        | -       |         | -        |       | -    |
| V.               | WEATHERSTRIPPING                   |          |  |                | 12      | 30             |             | 2        | 14       | - AL              | 183            |           |             |               |        |         |         |          |       |      |
| OTHER LEAKAGE    | PLUMBING THRU WALL                 | -        | -  |                | 39      | 22             | Call?       |          | 2        | 1                 | 1.1            |           |             |               |        |         |         |          |       |      |
| AREAS:           | BASEBOARDS                         | 5        |  |                |         |                | 10          |          | No. 1    |                   |                |           |             |               |        |         |         | <u> </u> |       |      |
|                  | FLOOR DRAIN/SUMP-                  |          |  | -              |         |                |             |          | þ        |                   |                |           |             |               |        |         |         |          |       |      |
| Terra :          | ELECTRICAL PANEL                   | 1 - Carl |  | 4              |         |                | 1           |          |          |                   | 14             |           |             |               |        |         |         | _        |       | -    |
| S. Park          | CHIMNEY                            | 1962     | 1/0011   |                | en.     |                |             | -        |          |                   |                | -         |             |               |        |         |         | -        |       |      |
|                  | JOISTS OVER<br>ATTACHED GARAGE     | A        |  | and the second | 10      |                |             |          | 14       |                   |                |           |             |               | -      | N.      |         |          |       |      |
|                  | HEADER AREA                        | (Mar)    |  |                |         |                |             |          |          |                   |                |           |             |               |        |         |         |          |       |      |
|                  | HAN. EXHAUST THAN<br>COUCRETE WALL |          | Control of the second s |                |         |                |             |          |          |                   |                |           |             |               |        |         | ÷       |          |       |      |
|                  | The second second                  | S.       |  |                |         |                |             |          |          |                   |                |           |             |               |        |         |         |          |       |      |
|                  | and the second second              |          |  |                |         |                |             |          |          |                   |                |           |             |               |        |         |         |          |       |      |
|                  |                                    |          |  |                |         |                |             |          |          |                   |                |           |             |               |        |         |         |          |       |      |
|                  |                                    |          |  |                |         |                |             |          |          |                   |                |           |             |               |        |         |         |          |       |      |
|                  |                                    |          |  |                |         |                |             |          |          |                   |                |           |             |               |        |         |         |          |       |      |
|                  |                                    |          |  |                |         |                |             |          |          |                   |                |           |             |               | 3      |         |         |          |       |      |
|                  |                                    |          |  |                |         |                |             |          |          |                   |                |           |             |               |        |         |         |          |       |      |

| UNIES Ltd. AIR   | TIGHTNESS TEST DATA  | FOR    | RM -    | AI     | RL                | EAK         | AGE     | SE         | ALI             | NG   | CHE           | CKL   | IST   | H            | 0        | ڪد          | E     | #  | 5   |        |
|------------------|--|--------|---------|--------|-------------------|-------------|---------|------------|-----------------|--|---------------|-------|-------|--------------|----------|-------------|-------|--|-----|--------|
| LEAKAGE<br>POINT | = DEC '89<br>= FEB '88   | Living | Kitchen | Dining | Bedroom           | Bedroom     | Bedroom | Bathroom   | Bathroom        | Basement   |               |       |       |              |          |             |       |  |     |        |
| WINDOWS:         | MOULDING   |        |         |        |                   |             |         |            |                 |  |               | in.   |       |              |          |             |       |  |     |        |
|                  | FRAMES   |        |         |        |                   |             |         |            |                 |  | 12            | i di  | -     |              |          |             |       |  |     |        |
|                  | LATCHES  | T      |         |        |                   |             |         |            |                 | Abs.   |               | i.    |       |              |          |             |       |  |     |        |
|                  | WEATHERSTRIPPING   |        | $\sim$  | 4      |                   |             |         |            |                 | 1157   |               | A     |       |              |          |             |       |  |     |        |
| EXTERIOR         | MOULDING   |        |         |        |                   |             | 13      | 100        | 1               |  |               | 1     | -     |              | 1        | 新行          |       | 新华                                       | -   |        |
| DOORS:           | FRAMES   |        |         |        | 1                 | A           |         | 1          | 1               |  | A.            | i sui | が生    | t vice       | 101      | Sale of     | 9.14° | -  | No. |        |
|                  | LATCHES  |        |         |        | A                 | No.         | 1       | P          |                 |  | 1             |       | 12412 | -            |          |             |       |  |     | 0.250* |
| -                | WEATHERSTRIPPING -   | 1      | -       |        | 68                | 1           | P       |            |                 |  |               | 10.   |       |              |          |             |       |  |     |        |
| EXTERIOR WALL    | OUTLETS  |        |         |        | -                 | No.         | -       | 1.         |                 |  | (A)           |       | -     |              |          |             |       | -  |     | -      |
| ELECTRICAL:      | SWITCHES   | 4      |         |        | 1200              |             |         |            | 1               |  | the second    | 1     |       |              | -        | 1           |       |  |     |        |
|                  | WIRES THRU WALL  | 100    | 1       | -      | . 1999            | Carlor a    | Beton   | -          | and the second  | 1  | 1019          | -     | -     | -            |          | -           | 10    | 1200                                     |     | -      |
| INTERIOR WALL    | OUTLETS  | 3      | a loot  |        | 10                | L'ante      | C.C.    | 100        | Contra Contra   | 1  | -             |       | -     | -            |          | -           | 1.000 | 10 10 10 10 10 10 10 10 10 10 10 10 10 1 |     |        |
| ELECTRICAL:      | SWITCHES   | -      | -4698   | 19,523 | High              | -           | GAR!    | 調整         | 10.18           | -  |               | -     | -     | -            |          | 1.<br>Alife | 6     |  |     |        |
|                  | WIRES THRU WALL  |        | 6       | - 1    | C-27              | 0           |         | 100        | C. A            |  |               | -     | -     |              | di       | では          | 2     | -  |     |        |
| FIREPLACE:       | AROUND UNIT  | 10000  | R.A.T   | 0      | 468               | 1.42        | HA      | 100        | TSUR<br>SOLE    | A  |               |       |       | ्र<br>तीर्थि | ANTERS - | 100         |       |  |     |        |
|                  | DAMPER/DOORS   | 14665  |         |        | 6                 | 1           |         | (D)        | 1923            | の記述  | Sing and      | 1     | 1220  | GP-53        | 1998     | -           |       | -  |     | -      |
| ATTIC HATCH:     | MOULDING   | -      | - Mark  | 1999   | A. A.             | 6           | 10000   | in the     | ASS -           | 2502   | 1792)<br>4427 |       |       | 20802        | -        | -           |       |  |     | -      |
|                  | FRAME  | -      | -       | 100    | <b>同时间</b><br>和定任 | 100         | 4       | 1990<br>19 | areny.<br>Metza | 1  | -             | -     |       | -            | -        | -           | -     | -  |     | -      |
|                  | WEATHERSTRIPPING   | -      | -       |        | 59                | Colores and | 1       |            | 1000            | Lange Star   | e ita         |       |       |              | -        |             |       |  | _   |        |
| OTHER LEAKAGE    | PLUMBING THRU WALL   | -      |         | -      | -                 | 263         | A. C.   | 12A.       | -               | 14<br>19<br>19<br>19<br>19<br>19<br>19<br>19<br>19<br>19<br>19<br>19<br>19<br>19 | 5989          | -     |       | -            |          | -           |       |  |     | _      |
| ARFAS:           | BASEBOARDS   | 1      | -       | -      |                   | co          | ALE     | 35         | oF              | -  |               | -     |       | _            |          | -           | -     | -  | _   |        |
| A.               | FLOOR DRAIN/SUMP   | ân     |         | *      | 1.1               | BA          | 47      | DIN        | 1001            | 4  |               | -     |       |              | -        | -           |       |  |     | -      |
|                  | FLECTRICAL PANEL   |        | 100     |        | -                 | -           | -       | -          | -               | -  |               |       |       | -            | -        | -           |       |  |     |        |
|                  | CHIMNEY  | 1      | ALL PR  |        | -                 |             | -       | -          | -               | -  |               | -     | -     | 8            |          | $\vdash$    |       |  |     |        |
| A second         | JOISTS OVER  | -      | 潮       |        | R                 |             | -       |            | -               |  | -             |       | -     | -            |          | -           |       |  |     |        |
| E S              | ATTACHED GARAGE  |        |         | A CAN  | 1                 | 1           | (*)     |            |                 |  |               |       | 1     |              |          |             |       |  |     |        |
|                  | HEADER AREA  | 1.5    |         |        |                   |             | 1       |            |                 |  |               |       |       | -            |          |             |       |  |     | -      |
| A DISH           |  | C.C.S. | 1       |        | -                 | -           | -       |            | 1               |  |               | -     |       | -            |          | -           |       |  |     |        |
|                  | No. of the second secon | 12     | -       |        |                   |             | -       |            |                 |  |               |       |       | -            | -        | -           |       |  |     | -      |
|                  |  | -      | -       | -      | -                 | -           | -       |            | -               |  | -             | -     | -     | -            | -        | -           |       |  |     | -      |
|                  |  |        | -       |        |                   | -           | -       | $\vdash$   |                 |  | -             |       | -     | -            | -        | -           | -     | -  |     | -      |
|                  |  |        |         |        | -                 | -           | -       | -          | -               |  | -             | -     |       | -            | -        | -           |       |  |     | _      |
|                  | and the second s |        | -       |        | -                 | -           | -       | -          | $\vdash$        |  | -             | -     |       | -            | -        | -           |       | -  |     |        |
|                  |  |        | -       | -      | -                 | -           | -       | -          | -               |  | -             |       | -     | -            | -        | -           |       |  |     |        |
|                  |  | -      |         | -      | -                 | -           | -       | -          | $\vdash$        |  | -             | -     |       | -            | -        | $\vdash$    | -     | -  | -   |        |
|                  | and the second   |        |         |        |                   |             |         |            |                 |  |               |       |       | _            |          |             |       |  |     |        |

| UNIES Ltd. AIR                            | TIGHTNESS TEST DATA            | FOF       | RM -    | - A1          | IR L          | EAK             | AGE     | SE                 | ALI                                     | NG           | CHE            | CKL      | IST               | F              | 101 | JS               | E     | #    | 6      |        |
|---|--------------------------------|-----------|---------|---------------|---------------|-----------------|---------|--------------------|---|--------------|----------------|----------|-------------------|----------------|-----|------------------|-------|------|--------|--------|
| LEAKAGE<br>POINT                          | = MARCH '86<br>= FEB '88       | Living    | Kitchen | Dining        | Bedroom       | Bedroom         | Bedroom | Bathroom           | Bathroom                                | Basement     |                |          |                   |                |     |                  |       |      |        |        |
| WINDOWS:                                  | MOULDING                       | N         |         |               |               |                 |         |                    |   |              | 1              | en la    | 1.4               |                |     |                  |       |      |        |        |
|   | FRAMES                         |           |         |               |               |                 |         |                    |   |              | Critics.       | 3.85     | - netin           | -              |     |                  |       |      |        |        |
| 1. A. | LATCHES                        | $\square$ |         |               |               |                 | 1       |                    | 1                                       | 100          | and the second | 2        |                   |                |     |                  |       |      |        |        |
|   | WEATHERSTRIPPING               |           |         |               |               |                 |         | 4                  |   |              | (10)           |          |                   | -              |     |                  | -     | -    |        |        |
| EXTERIOR                                  | MOULDING                       |           |         |               |               |                 | Alt     |                    | 3                                       |              | 1              |          |                   | -              | 100 | 2005             |       |      |        | AC.    |
| DOORS:                                    | FRAMES                         |           |         |               | 1             | Å               |         | See.               | 1                                       |              | N.N.C.         | 100      | 1 Carl            | 1500           | 1   | 1                | () () |      | 12     |        |
|   | LATCHES                        | $\square$ |         |               | 1             |                 | 13      | 1                  |   |              |                | 1000     | Cistoria Cistoria | and the second |     |                  |       |      |        | (B))   |
|   | WEATHERSTRIPPING               | <u> </u>  |         |               | 1             |                 | 1       |                    |   |              | 1              | 1        |                   |                |     |                  |       |      |        | 192    |
| EXTERIOR WALL                             | OUTLETS                        |           |         |               |               |                 |         |                    |   |              | RE             | CD,      | por               | £.,            |     |                  | 1     |      | 1.4    | (57.5) |
| ELECTRICAL:                               | SWITCHES                       | 1         |         |               | 10-24         |                 |         |                    | A                                       |              | 20             | FIL      | 1                 |                | F   |                  | 70-   |      | dille. | BER.   |
|   | WIRES THRU WALL                | AND I     | の       |               | 1             | 1998).<br>1988) | litan   | 1000               |   | C.S.S.       | 1              |          |                   |                |     |                  |       | etra | 3.4    | P      |
| INTERIOR WALL                             | OUTLETS                        | 1         | 100     |               |               | 100             |         | 134                |   | Sec.         |                |          |                   |                |     |                  | 51    | -    | (Hegen |        |
| ELECTRICAL:                               | SWITCHES                       |           | 30      | 19.33         | and           |                 | 1200    | 福                  | THOMAS IN THE REAL PROPERTY AND INCOMES | -            |                | -        |                   | -              |     | <del>di</del> la | 3     |      |        |        |
|   | WIRES THRU WALL                | 1         | 20.     | 3100          | 1             | Es.             |         | 100                |   |              |                |          |                   |                |     | E.C.             | 1.    |      |        |        |
| FIREPLACE:                                | AROUND UNIT                    | 100       | Lines.  | A             | 65            | NAL P           |         | 1 1                |   |              |                | $\vdash$ |                   | tes            |     |                  | -     |      |        | -      |
| *   | DAMPER/DOORS                   | -         | ALCONT. | in the second | 1             | 4000            | and a   | 2                  | 100                                     | inac<br>Rigi | 1970           |          | and the second    |                | 1   |                  |       |      | -      | -      |
| ATTIC HATCH:                              | MOULDING                       |           | .425    |               | 18 A          | 4               | 1000    | Contraction of the | 10                                      | 201945       | - 442          | in the s | - Aller           | 1              | -   | -                |       | -    | -      | -      |
| ·   | FRAME                          |           | -       | 100           | ANOTH<br>ANDI | in the          |         | 19/20              | 2750<br>4469                            | A.           |                |          | -                 | -              | -   | -                | -     | -    |        | -      |
|   | WEATHERSTRIPPING               |           |         | -             | -20           |                 | Hall    |                    | 1000                                    | 言語           | 113            |          | -                 | -              | -   |                  | -     |      | -      | -      |
| OTHER LEAKAGE                             | PLUMBING THRU WALL             |           |         |               |               | ्युत            | 1000    | 13.<br>(188)       |   | 1000         | 1              |          | -                 |                | -   |                  | -     |      | -      | -      |
| AREAS:                                    | BASEBOARDS                     | -         | -       | -             | $\vdash$      | -               | 1602    | and a second       | 1                                       | -            |                |          |                   | -              |     | -                |       |      |        | -      |
| 1   | FLOOR DRAIN/SUMP               | ACC -     | 84      |               |               | -               | -       | 100                | 1                                       | -            | -              |          | -                 | -              |     |                  | -     |      | -      |        |
| Sec.                                      | ELECTRICAL PANEL               | Tields.   | 122     |               | -             | -               | 1       |                    |   | -            |                |          | 1                 |                | -   | -                |       |      |        |        |
|   | CHIMNEY                        | -69       |         |               |               |                 | -       | -                  |   |              | -              | -        | -                 |                | -   | -                | -     |      | -      |        |
|   | JOISTS OVER<br>ATTACHED GARAGE | A         | 195     | A. C. L.      | Transe        |                 | 1       |                    |   | 5            |                |          | 18                |                |     |                  |       |      |        |        |
|   | HEADER AREA                    | 1         |         |               |               |                 |         |                    |   | -            |                | -        |                   |                |     | -                | -     |      |        |        |
| 0   | BETWEEN CENNE<br>& WALL        |           | 1986 Y  |               |               |                 |         |                    |   |              |                |          |                   |                |     |                  |       |      |        |        |
|   |                                |           |         |               |               |                 |         |                    |   |              |                |          |                   |                |     |                  |       |      |        |        |
|   |                                |           |         |               |               |                 |         |                    | _                                       |              |                |          |                   |                |     |                  |       |      |        |        |

| UNIES Ltd. AIR | TIGHTNESS TEST DATA       | FOR            | M -     | AI       | RL      | EAK          | AGE  | SE            | ALI                | NG           | CHE            | CKL            | IST        | H      | ou              | 3           | Ξ       | #-           | 7   |    |
|----------------|---------------------------|----------------|---------|----------|---------|--------------|--|---------------|--------------------|--------------|----------------|----------------|------------|--------|-----------------|-------------|---------|--------------|-----|----|
| LEAKAGE NOINT  | = APBIL 185<br>= FEB 188  | Living         | Kitchen | Dining   | Bedroom | Bedroom<br>2 | Bedroom 3  | Bathroom      | Bathroom           | Basement     |                |                |            |        |                 |             |         |              |     |    |
| WINDOWS:       | MOULDING                  |                |         |          |         |              |  |               |                    |              |                |                |            |        |                 |             |         |              |     |    |
|                | FRAMES                    |                |         |          |         |              |  |               |                    |              | 1              | 1.57           | -          |        |                 |             |         |              |     |    |
|                | LATCHES                   |                |         |          |         |              |  |               |                    | 近ち           | and a          | 1.San          |            | -      |                 |             |         |              |     |    |
| e              | WEATHERSTRIPPING          |                |         |          |         |              |  | -             |                    | 1. AL        |                | A              |            |        |                 |             |         |              |     |    |
| EXTERIOR       | MOULDING                  |                |         |          |         |              | A  |               | 2                  | 1            | SPS.           |                | -          | and .  | atte            |             | gir all | -            | 000 | e. |
| DOORS:         | FRAMES                    |                |         |          |         | .58          |  | 1             | 1                  |              | 18             |                |            | E and  | in.             | Sultri L    | -       |              | -   |    |
|                | LATCHES                   |                |         |          |         |              | 2.77   | 1             |                    |              |                |                | Augus      | -      |                 |             |         |              |     |    |
|                | WEATHERSTRIPPING          | -              |         |          | 6       | 1            | 1  |               |                    |              |                | 6              |            |        |                 |             |         |              |     |    |
| EXTERIOR WALL  | OUTLETS                   |                |         | 1        |         | and and      |  | -             |                    | 1            | 1000           |                |            |        |                 |             | -       |              |     | 0  |
| ELECTRICAL:    | SWITCHES                  | 1              |         |          |         | 抵            | -  |               |                    | の法           | ing.           | 1              | $\vdash$   |        |                 |             |         |              |     |    |
|                | WIRES THRU WALL           | 100            | 1000    |          | THE .   | Billion of   | 377  | 200           | 100                | 1000<br>1000 | 1              | -              |            | -      | -               | -           | 1       | 1.<br>(* * ) | 1   | -  |
| INTERIOR WALL  | OUTLETS                   | -200           | a fact  |          |         |              | a dest   |               | and the second     | and a        |                | -              |            | -      |                 |             |         |              |     |    |
| ELECTRICAL:    | SWITCHES                  | -              | 385     | 120      | 1       |              | ST Sec   | 1000 A        | 12/3               | -            | -              | -              |            | -      | -               | - 384       | 2       | -            |     | -  |
|                | WIRES THRU WALL           | 30             |         | 19463    | ALSIN A | 2            | -  | 1             | Concellant of the  |              |                |                |            |        | 19              | Real P      | 9       |              |     |    |
| FIREPLACE:     | AROUND UNIT               | 944()<br>1945) | 1       | A        | 400     | 1000         | A  | 1             | CATES<br>CARD      | A            |                | -              |            | Alle . | inger<br>Kriffe | Souther and | -       |              |     |    |
|                | DAMPER/DOORS              |                | ALC: N  |          | 6       | 1.000        | 19-19-<br>19-19-19-19-19-19-19-19-19-19-19-19-19-1 | No.           | Contraction of the | 10060        |                | 1              | 280        | 10.00  | i stand         |             | -       |              | -   |    |
| ATTIC HATCH:   | MOULDING                  |                | .424    | C. Inter |         | 4            | 0.000  | 100           | and a              | 86-3×        | 0.05%<br>92466 | nergy<br>Nergy | The series | 51.34  |                 |             |         |              |     |    |
| A              | FRAME                     | -              | -       | . 42     | No.     | 1997<br>1999 | -  | A.            | 99930<br>4060      | 6.<br>83     |                | -              | -          |        |                 |             | -       | -            |     | -  |
|                | WEATHERSTRIPPING          | -              | -       | -        | .45     | the sector   | 201  | -             | 195                | ting<br>til8 | 12/20          |                | -          | -      | -               |             | -       |              | -   |    |
| OTHER LEAKAGE  | PITIMBING THRU WALL       | -              | -       | -        | -       | 95           | ar in se   | 2.02          | -                  | 2.00         | TH             | RO             |            | -      |                 | $\vdash$    | -       | -            |     | -  |
| AREAS:         | BASEBOARDS                |                | -       | -        | 1       | -            | 1995   | Provide State | 2.000              |              | U              | <u>au</u>      | LX3        | -      | -               |             | -       | -            |     |    |
| A.             | FLOOR DRATN/SUMP          | 2              |         |          | -       |              | -  | 1999          | 1                  |              |                | -              | -          | -      |                 | $\vdash$    |         | -            | -   |    |
|                | FLECTRICAL PANEL          | and a          | 1       |          | -       | -            |  | -             |                    |              |                | -              |            |        | -               |             | -       | -            | -   | _  |
| A Share        | CHIMNEY                   | 100            | たで      | 1        | -       | -            | - R  |               | -                  |              | -              | -              | -          | -      | -               | -           | -       | -            | -   |    |
|                | JOISTS OVER               | 1              | 1993    | ALC: NO  |         | +            |  | -             |                    |              |                |                | -          |        | 4               |             |         |              |     | _  |
| 1 1 A.         | ATTACHED GARAGE           | 1.20           | A       | .4       | 1       |              |  | L             |                    | _            |                |                | (d)        | 11     | -               |             | _       |              |     |    |
|                | HEADER AREA               |                | 建設      |          |         |              |  |               |                    |              |                |                |            | -      |                 |             |         |              |     | _  |
|                | All All                   |                | 1       |          |         |              | _  |               |                    |              |                | 12             |            |        |                 |             |         |              |     |    |
|                | Mary and Strange Research | 1              |         |          |         |              | -  |               |                    |              |                |                |            |        |                 |             | 1       |              |     |    |
|                | and the second second     | -              |         | _        | -       |              |  |               |                    |              | _              |                |            |        | _               |             |         |              |     |    |
|                |                           | -              | -       | -        | -       | -            | -  | -             |                    | -            |                | -              | -          | -      | -               |             | -       |              |     |    |
|                | ****                      |                |         |          |         |              |  |               |                    | -            |                |                |            |        |                 |             |         |              |     | *  |
|                |                           |                |         |          |         |              |  |               |                    |              |                |                |            |        |                 |             |         |              |     |    |
|                |                           |                |         |          |         |              |  |               |                    |              |                |                |            |        |                 |             |         |              |     |    |
|                |                           | -              |         | -        | -       | -            |  | -             | -                  |              |                | -              |            | -      | -               |             |         |              |     |    |

| UNIES Ltd. AIR | TIGHTNESS TEST DATA            | FOF       | RM -        | - A:   | IR L    | EAK     | AGE     | SE       | ALI      | NG         | CHE  | CKL   | IST       | +    | 10       | Ut          | E        | #        | 8        |           |
|----------------|--------------------------------|-----------|-------------|--------|---------|---------|---------|----------|----------|------------|------|-------|-----------|------|----------|-------------|----------|----------|----------|-----------|
| LEAKAGE        | = MAR '85<br>= FED '88         | Living    | Kitchen     | Dining | Bedroom | Bedroom | Bedroom | Bathroom | Bathroom | Basement   |      |       |           |      |          |             |          |          |          |           |
| WINDOWS:       | MOULDING                       | $\square$ |             |        | 1       |         |         |          |          | 1          | 1    | 20    | 1. Sector |      |          |             |          |          |          |           |
|                | FRAMES                         | -         |             |        | 1       | 1       |         | 1        |          |            | 42   | Sint  | 1232      | 1    | $\vdash$ |             |          | $\vdash$ |          |           |
|                | LATCHES                        | $\square$ |             | 1      |         |         |         |          |          | 6          | 0.50 | 5     |           |      | 1        |             |          | -        |          |           |
|                | WEATHERSTRIPPING               | 1         |             |        | -       |         |         |          |          | SNC:       | 1    | 1     |           | 1    |          |             |          |          |          | -         |
| EXTERIOR       | MOULDING                       | 1         |             |        | -       |         | A       | La Sala  | 3        | 1          |      | CA.   |           | -    | 1        | 1000        |          | 1021     | P        | 30.       |
| DOORS:         | FRAMES                         |           |             | 1      |         | d       | theida  | 15       | 1        | 1          | 199  | 12.79 |           | 105  | 1200     | No.         | -        |          | 1        | 101       |
|                | LATCHES                        |           |             |        | 1       | 1 de    | 10      | 1        |          |            |      | -     | -         |      | 100      | -           | -        |          |          | Carti     |
|                | WEATHERSTRIPPING               | 1         |             |        |         | 10      | 1       |          |          |            |      | 2     |           |      |          |             |          |          |          |           |
| EXTERIOR WALL  | OUTLETS                        |           |             |        |         | 10      |         |          |          | 1          |      |       |           |      |          |             |          |          |          | 伯告        |
| ELECTRICAL:    | SWITCHES                       |           |             |        |         | 藏       |         |          | - 4      | 國          |      | 1     |           |      |          |             | -        | 1.00     | and in   | Carlos de |
|                | WIRES THRU WALL                |           | 9           |        | 1       |         | 3       | CUTES    |          | 1          | au . | -     |           |      |          | -           |          | N.S.M    | CTAGE 1  | 12        |
| INTERIOR WALL  | OUTLETS                        | 1         | 34          |        | -       | ASH     |         | 1        | 1000     | 1          |      |       |           |      |          |             | -        |          | CORP.    | -         |
| ELECTRICAL:    | SWITCHES                       | -         | 619         |        | 10.3    |         |         | -        |          | -          | -    |       |           |      |          | 154         | 6        |          |          |           |
|                | WIRES THRU WALL                | 1.A       | -           | -405   | 100     |         |         |          | 1        |            |      |       |           |      | dia ta   | 1200        | 100      |          |          |           |
| FIREPLACE:     | AROUND UNIT                    |           | 1           | 4      | - 14    | 0.7     | 2       | 190      | AND I    | 1          |      |       |           | 49   | 潮        | and a state | -        |          |          |           |
|                | DAMPER/DOORS                   | -39       | Sec.        | 120    | A.      | 1       |         | 22       | No.      |            |      | 1993  | 00000     | 103  | 12       |             | $\vdash$ | -        |          |           |
| ATTIC HATCH:   | MOULDING                       | $\vdash$  | - 44        |        | 100     | h.      | 1000    |          | AS .     |            | TRUC | Sec.  | -         | 1000 |          |             | -        |          |          |           |
| ·              | FRAME                          | -         | -           | 100    | NT      | 3       |         | 100      | に思い      | the second |      |       |           |      |          |             |          | -        | $\vdash$ |           |
| -              | WEATHERSTRIPPING               | 1         | -           | -      | 24      | 8       | 経験      | 5        | 1000     |            | 123  |       |           |      | -        |             | -        |          |          |           |
| OTHER LEAKAGE  | PLUMBING THRU WALL             | $\vdash$  | -           | -      | 34      | 2       | 1.00    | 1        | à.'      | A          | 7    |       | -         | -    | -        |             | -        |          |          |           |
| AREAS:         | BASEBOARDS                     |           | -           |        |         | É       | 205     | 1        |          |            |      |       |           |      | -        |             | -        |          |          |           |
|                | FLOOR DRAIN/SUMP               |           | the t       |        |         |         |         | 100      | 1        |            |      | -     |           |      | -        |             | -        |          |          |           |
| - Stranger     | ELECTRICAL PANEL               | 14        | Che C       | k.,    |         | -       | -       |          |          |            | -    |       | 1         |      |          |             |          |          |          |           |
|                | CHIMNEY                        | 45        | Contract of | 100    |         | -       | -       |          |          |            |      |       |           | -    |          |             | -        |          |          |           |
|                | JOISTS OVER<br>ATTACHED GARAGE |           | 195         | All I  | A STATE |         |         |          | 4        |            |      |       |           |      |          |             |          |          |          |           |
|                | HEADER AREA                    | i and     | 3A          |        |         |         | •       |          |          |            |      |       |           |      |          |             |          |          |          |           |
|                | DAYER VENT THRU CONCRETE WALL  | 1.1       | al dan      |        |         |         |         |          |          |            |      |       |           |      |          |             |          |          |          |           |
|                | BELOW BAY IN<br>BEDROOM #2     | 7         |             |        |         |         |         |          |          |            |      |       |           |      |          |             |          |          |          |           |
|                |                                | -         |             | _      |         |         |         |          |          |            |      |       |           |      |          |             |          |          |          |           |
|                |                                |           |             |        |         |         |         |          |          |            |      |       |           |      | -        |             |          |          |          |           |
|                |                                |           |             |        |         |         |         |          |          |            |      |       |           |      |          |             |          |          |          |           |

| TIGHTNESS TEST DATA            | FOR   | M -  | AI  | RL   | EAK   | AGE   | SE.   | ALI   | NG  | CHE   | CKL  | IST   | ٢  |   | 25   | E  | #  | 9  | 1   |
|--------------------------------|---|--|---|--|---|---|---|---|---|---|--|---|--|---|--|--|--|--|---|
| = APBIL '85<br>= FEB '88       | Living  | Kitchen  | Dining  | Bedroom  | Bedroom<br>2  | Bedroom   | Bathroom  | Bathroom  | Basement  |   |  |   |  |   |  |  |  |  |   |
| MOULDING                       |   |  |   |  |   |   |   |   |   |   |  | 1   |  |   |  |  |  |  | T   |
| FRAMES                         |   |  |   |  |   |   |   |   |   |   | in a   | F   |  |   |  |  |  |  | t   |
| LATCHES                        |   |  |   |  |   |   |   |   | 當   |   | 1  |   |  |   |  |  | -  |  | t   |
| WEATHERSTRIPPING               |   | - 7  |   |  |   |   |   |   | 福雪  | 感想  | A  |   |  |   |  |  |  |  | t   |
| MOULDING                       |   |  |   |  |   | J.  | 福家  | A.  | -   |   | 12   | -   | and the  | 25th  | iv-  | 1.3  |  |  | t   |
| FRAMES                         |   |  |   |  | G   |   | 财   | 1   |   | ÷   |  |   |  | 4   | 100  | -  | ·  | 12.  | t   |
| LATCHES                        |   |  |   |  |   | 1   | ŕ   | 1   |   |   |  | a langer  | 4-   |   |  | 4  |  |  | t   |
| WEATHERSTRIPPING               | -   | 1.0  | 4   |  | Sec. 19   | 1   |   |   |   | 1   | à  |   |  |   | -  |  |  |  | t   |
| OUTLETS                        | 1   |  |   | 12   |   |   |   |   | 1   | iai.  |  | r   |  |   |  |  |  |  | t   |
| SWITCHES                       |   |  | 1   | 1.31   | 品   |   |   |   | R.LP  | 1000  | 1  |   |  |   |  |  |  |  | t   |
| CEILING FIXTURE                | 1   |  |   | 100  |   | Peters  | हिहि  |   |   | 1   |  |   |  |   |  | - 55   |  |  | t   |
| OUTLETS .                      |   | Carlo I  | 1   | - cir  |   |   |   |   | 1   |   |  |   |  |   |  |  |  | 11 W.  | t   |
| SWITCHES                       | 1   | 1  | No.   |  |   | CARGE C   | 國   |   | -   |   |  |   |  |   | 20   | in.  |  |  | t   |
| WIRES THRU WALL                | 1000  | 3  | 4   | Call   |   |   | 100   |   | 1   | 1   |  |   |  | dili  |  | 10   | - 1  | -  | t   |
| AROUND UNIT                    | 1.00  | 記録   | 2   | 100  |   |   | 1   | 1400 C  |   |   | -  |   | eller.   | COM.  | V  |  |  |  | t   |
| DAMPER/DOORS                   | -05   | ALC: NO  |   | A  | 4959  | and and a   | 1   | - Start   | 12  | 10.50   | 新聞   | 100   | Corres<br>A Carlos                                       | 2   | -  |  |  | -  | t   |
| MOULDING                       |   | THE  | 1   | STOR A   | A   | 199   |   | A   | 27 X M L  | 1.5   | 2.2.34   | Carlor Ch   | 1  |   | $\vdash$   |  |  |  | t   |
| FRAME                          | -   |  | 10  |  | in the second   | 6   | -MBB  |   | 100   |   | -  | -   |  | -   |  | -  | -  |  | t   |
| WEATHERSTRIPPING               |   |  |   | 33.4   | 10  | ta.   | 5   | 20  |   | 100   | -  |   | -  |   |  | -  | -  |  | t   |
| PLUMBING THRU WALL             |   |  | -   | -  | -   | 4.35  | 行法  |   | 100   | TH  | au   | -   |  | -   |  |  |  |  | t   |
| BASEBOARDS                     | 4   |  | -   |  |   | - 4960  | E TA  |   |   | CE  | -iCh   | 10  | <u> </u>   |   |  | -  |  | -  | t   |
| FLOOR DRAIN/SUMP               |   | 6  |   |  | -   | 2   | 1400  | 1   | -   |   | -  |   | -  |   |  | 1  | -  | 1  | t   |
| ELECTRICAL PANEL               |   |  |   | -  | -   | -   | -   | -   |   |   |  | -   | -  | -   |  | -  | -  |  | t   |
| CHIMNEY                        | 100   | できた  |   |  |   | -   |   |   | -   | THP   | to   |   | -  |   |  | 1  |  |  | ł   |
| JOISTS OVER<br>ATTACHED GARAGE | 1   | 187  | 60  | and the second s | -   |   |   | +   |   | CE  |  | uG  |  |   |  |  |  |  | ł   |
| HEADER AREA                    |   | 20   |   | -  | -   | -   |   |   |   |   |  |   |  |   |  | -  | -  |  | t   |
|                                | 1000  | ALCONT S   | F   | -  |   |   | -   | -   | -   |   | -  | -   | -  | -   | -  |  |  |  | t   |
|                                | No.   | -  | -   | -  |   | -   |   |   | -   |   |  | -   | -  |   | -  | -  | -  | -  | ł   |
|                                |   |  | -   | -  |   |   | -   |   | -   |   | -  | -   |  | -   | -  | -  | -  |  | ł   |
| 144457-C-185877-0944           | -   | -  | -   |  | -   | -   | -   |   | -   |   | -  |   | -  |   | -  | -  |  | _  | ł   |
|                                | -   | -  | -   | -  | -   | -   | -   | -   | _   | -   | -  | -   | -  | -   | -  | -  | -  | -  | ł   |
|                                |   |  | -   | -  | -   |   |   | -   |   | -   |  | -   | -  | -   | -  | -  |  | -  | ł   |
| -                              | -   |  | -   | -  | -   |   |   | -   |   | -   | -  |   | -  | -   | -  | -  |  |  | ł   |
|                                | -   |  |   | -  |   |   |   |   | _   | -   | -  | -   | -  | -   | -  |  | _  |  | ł   |
|                                | TIGHTNESS TEST DATA<br>= APAIL '85<br>= FEB '88<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>OUTLETS<br>SWITCHES<br>CEILING FIXTUAE<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>WEATHERSTRIPPING<br>PLUMBING THRU WALL<br>BASEBOARDS<br>FLOOR DRAIN/SUMP<br>ELECTRICAL PANEL<br>CHIMNEY<br>JOISTS OVER<br>ATTACHED GARAGE<br>HEADER AREA | TIGHTNESS TEST DATA FOR         = APPIL '85         = FEB '88         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         CELLING FIXTUAE         OUTLETS         SWITCHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         PLUMBING THRU WALL         BASEBOARDS         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA | TIGHTNESS TEST DATA FORM -         = APAIL '25         = FEB '88         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         CEICINCS         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         PLUMBING THRU WALL         BASEBOARDS         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA | TIGHTNESS TEST DATA FORM - AI         = APAIL '85         = FEB '88         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         CELCINGC; FIXTOAE         OUTLETS         SWITCHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         VIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA  | TIGHTNESS TEST DATA FORM - AIR L<br>= APPAIL '25<br>= FEB '28<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>OUTLETS<br>SWITCHES<br>CELLICG FIXTUAL<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>WEATHERSTRIPPING<br>PLUMBING THRU WALL<br>BASEBOARDS<br>FLOOR DRAIN/SUMP<br>ELECTRICAL PANEL<br>CHIMNEY<br>JOISTS OVER<br>ATTACHED GARAGE<br>HEADER AREA | TIGHTNESS TEST DATA FORM - AIR LEAK         = APP-1L '25         = FEB '28         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         CELCICCT FIXTURE         OUTLETS         SWITCHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         PLUMBING THRU WALL         BASEBOARDS         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA | TIGHTNESS TEST DATA FORM - AIR LEAKAGE         = APPAIL '25         = FEB '26         Image: Strain Str | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SE         = APAIL '25         = FEB '80         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         SWITCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         OUTLETS         SWITCHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALI         = APPAIL '25         = FEB '26         PEB '25'         mOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         CELCUCG FIXTUAE         OUTLETS         SWITCHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         UTLETS         SWITCHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         PLUMBING THRU WALL         BASEBOARDS         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING         =       APPLIL '25         FEB '26       Point '25         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         CELLICS         WEATHERSTRIPPING         OUTLETS         SWITCHES         CELLICS         WIRES         HIRES         JUIL         AROUND_UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         PLUMBING THRU WALL         BASEBOARDS         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHE | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKL | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKLIST | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKLIST         = ApPAIL '25         = ApPAIL '25         = FE.5 '26         Figst '25'         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         WEATHERSTRIPPING         OUTLETS         SWITCHES         CELALUSC, FINTUAL         DAMPER/DOORS         MOULDING         FRAME         UTLEY         SWITCHES         SWITCHES         CELUSC         SWITCHES         DAMPER/DOORS         MOULDING         FLADE         SUTLES         SU | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKLIST Hext         = APPAIL '25         = APPAIL '25 | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKLIST HCDD         = APA:LL '25         = APA:LL '25         = B'B'B'         PEB'B'B'         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FLACHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FLACHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHINNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA         ATACHED GARAGE         HEADER AREA | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKLIST HOUSE         = APAIL '25         = APAIL '25         = EE' '26         Image: Sealing the sealing of the sealing | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKLIST HCC/SE         = APPAIL_'C5         = APPAIL_'C5 | IIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKLIST HOUSE # 9         = APP-IL-'95         = APP-IL-'95         = EB''80         = APP-IL-'95         = APB-IL-'95         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         WIRES THRU'WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         OUTLETS         SWITCHES         WIRES THRU'WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         PLUMBING THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         MEATHERSTRIPPING         PLUMBING THRU WALL |

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| UNIES Ltd. AIR   | TIGHTNESS TEST DATA            | FOF            | RM -           | • A1         | IRL      | EAK             | AGE       | SE            | ALI  | NG             | CHE        | CKL       | IST            | Ч     | a     | SE  | . : | #11     | 0     |           |
|--|--------------------------------|----------------|----------------|--------------|----------|-----------------|-----------|---------------|--|----------------|------------|-----------|----------------|-------|-------|-----|-----|---------|-------|-----------|
| LEAKAGE<br>POINT   | = March '86<br>= Fer '88       | Living         | Kitchen        | Dining       | Bedroom  | Bedroom         | Bedroom   | Bathroom      | Bathroom   | Basement       |            |           |                |       |       |     |     |         |       |           |
| WINDOWS:   | MOULDING                       |                |                |              | 1        | 1               | 1         |               |  |                | 2          | 2.0       |                |       |       |     |     | 1       |       |           |
|  | FRAMES                         |                |                | 1            | 1        |                 | 1         |               |  |                | に彼         | 1000      | -              |       |       |     |     | 1       |       |           |
|  | LATCHES                        |                |                |              | 1        |                 | 1         |               |  | 幕              |            | 1         |                |       |       |     |     | 1       |       |           |
|  | WEATHERSTRIPPING               |                |                |              |          |                 | $\square$ |               |  | COLOR IN       | Sec.       | 6         |                |       |       |     |     | -       |       |           |
| EXTERIOR   | MOULDING                       |                |                |              |          |                 | A         | 靈             | 1  | 1              |            | an.       |                | -     | 1     | 14. | -   | 德       | -     | Mrs.      |
| DOORS:   | FRAMES                         |                |                | 1            |          |                 | 1         | 130           | 1  |                | 1          | and the   |                |       | A.    | -   | -   | -       | 2.433 | 1000      |
|  | LATCHES                        |                |                |              | 1        | 100             | 120       | 1             |  |                |            | -         | -              | -     |       | 1   |     |         |       | 120       |
|  | WEATHERSTRIPPING               |                |                |              | Sille    | 100             | 1         |               |  |                |            | the state |                |       |       | 1   |     |         |       | 122       |
| EXTERIOR WALL  | OUTLETS                        |                |                |              |          |                 |           |               |  |                | ou         | NE        | 2-B            | UIL   | T     |     |     | -       |       | 1. Second |
| ELECTRICAL:  | SWITCHES                       | £              |                |              | V-state  | 2A              |           | -             | 1  | 1              | 100        | 1         | The second     | n     |       |     | -   |         | 1925  | 3.1       |
|  | WIRES THRU WALL                | 1000           | र्ष            |              | 1        | 1               | No.       | west?         | and<br>Distant   | 心影             | 1          |           |                |       |       | -   | 機   | all all |       | 2         |
| INTERIOR WALL  | OUTLETS                        | 101            | a a            | Sec.         | à        | 100             |           | 1             | and the second s | and a          |            |           |                |       |       |     | 825 |         |       |           |
| ELECTRICAL:  | SWITCHES                       | $\vdash$       | K K            | 調整           | 1        |                 | - HEARDER | 化的            | 刘治   | -              |            |           |                |       |       | 1   |     |         |       | -         |
|  | WIRES THRU WALL                | 1              | 200            | 1000         | A. A.    |                 |           |               |  |                |            |           |                |       |       | 11  | 1   |         |       |           |
| FIREPLACE:   | AROUND UNIT                    |                |                | A            | 19214    | 1992)<br>19(9-3 |           | 198           | 100  | 1              |            |           |                |       | AND N | Y   |     |         |       | -         |
|  | DAMPER/DOORS                   | -654           |                |              | 1        | 1               | Spingt    | -Cer          | 000  |                | The second |           |                | 1.5.4 | 14    | -   |     |         |       |           |
| ATTIC HATCH:   | MOULDING                       |                | 1612           |              | 法庭       | b.              | Atto      |               | -  | 10000          | 1000       | 12.25     | and the second | Side  |       | -   | -   | -       | -     |           |
| · A.   | FRAME                          |                |                | 199          |          | 122             | 2         | ANG AN        |  | N.             |            | -         |                |       | -     |     | -   | -       | -     | -         |
|  | WEATHERSTRIPPING               | -              |                | -            | -183     | 14              | 1.26      | -             | 19854  | 1001           | 104        | -         |                | -     | -     |     |     |         | -     | -         |
| OTHER LEAKAGE  | PLUMBING THRU WALL             | -              |                | -            | -        | .69             | 1000      | 10.<br>10.000 |  | 1966 (1)<br>17 | ester<br>V |           |                | -     | -     |     | -   |         | -     |           |
| AREAS:   | BASEBOARDS                     |                | •              |              | -        |                 | 100       | 224           | A.   | -              | -          | -         |                | -     |       |     |     | -       | -     |           |
|  | FLOOR DRAIN/SUMP               | tin.           |                | 1            | -        |                 | -         | 1002          | -  | -              |            |           | -              | -     | -     |     |     | -       | -     |           |
| Sec.   | ELECTRICAL PANEL               | Contraction of | Carlos and     | -            | $\vdash$ | -               |           |               |  |                |            | -         |                | -     | -     |     | -   |         | -     | -         |
| A State of the second s | CHIMNEY                        | 125            | 1.985<br>1.500 | 19.<br>19.18 |          | -               |           | -             | -  | -              | τн         | 80        |                | -     |       | -   | -   |         | -     |           |
|  | JOISTS OVER<br>ATTACHED GARAGE | .A             | 192            | 1000         | and and  |                 |           |               |  |                | CE         | 1CIA      | G              |       |       |     |     |         |       |           |
|  | HEADER AREA                    |                |                |              |          |                 |           | -             | •  |                |            |           |                |       |       |     |     |         |       |           |
| 1945<br>19   | harms de                       | 1200           | SF.            |              |          |                 |           |               |  | _              |            |           |                |       |       |     |     |         |       |           |
|  | Will be Remaining the state    | 1              |                |              |          |                 |           |               |  |                |            |           |                |       |       |     |     |         |       | _         |
|  | and the second state           |                |                |              |          |                 |           |               |  |                |            |           |                |       | a.    | -   |     |         |       |           |
|  |                                |                |                |              |          |                 |           |               |  |                |            |           |                |       |       |     |     |         |       |           |
|  |                                |                |                |              |          |                 |           |               |  |                | _          |           |                |       |       |     |     |         |       |           |
|  | -                              |                |                |              |          | -               |           |               |  |                |            |           |                |       |       |     |     |         |       |           |
|  |                                |                |                |              |          |                 |           |               |  |                |            |           |                |       |       |     | _   |         | -     |           |
|  |                                |                |                |              |          |                 |           |               |  |                |            |           |                |       |       |     |     |         |       |           |

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| UNIES Ltd. AIR   | TIGHTNESS TEST DATA  | FOF    | RM -            | AI     | RL           | EAK      | AGE     | SE         | ALI      | NG       | CHE          | CKL            | IST      | H      | 0        | ڪر  | Æ     | -#       | 11   |     |
|--|--|--------|-----------------|--------|--------------|----------|---------|------------|----------|----------|--------------|----------------|----------|--------|----------|---|-------|----------|------|-----|
| LEAKAGE NOINT  | = JULY '87<br>= FEB '88  | Living | Kitchen         | Dining | Bedroom      | Bedroom  | Bedroom | Bathroom   | Bathroom | Basement |              |                |          |        |          |   |       |          |      |     |
| WINDOWS:   | MOULDING   |        |                 |        |              |          |         |            |          |          |              | 1              |          |        |          |   |       |          |      |     |
|  | FRAMES   |        |                 |        |              |          |         |            |          |          | 1.3          | 125            |          |        |          |   | 1     |          |      |     |
|  | LATCHES  |        |                 | 1      |              |          |         |            |          | No.      | 1            | 1              |          |        |          |   |       |          |      |     |
|  | WEATHERSTRIPPING   |        |                 |        |              |          |         |            | -        | 109      | ALANGE STATE |                |          |        |          |   | -     | -        |      |     |
| EXTERIOR   | MOULDING   |        |                 |        |              | 1        | A       | 1          | 6        |          |              |                |          |        | 15.<br>1 | Parts.                                    | 120   | 1        |      | 1   |
| DOORS:   | FRAMES   |        |                 |        |              | 1.       | Sea     | 21         | 1        |          | 100          | at the         |          | 的彩     | E.       | 14 14 14 14 14 14 14 14 14 14 14 14 14 1  | 1-1-1 | A.b./    | 5.07 | 1   |
| Sec.   | LATCHES  |        |                 |        | 1            |          | 1       | 1          |          |          |              |                | Sec. and | 134    |          |   |       |          |      | 1.0 |
|  | WEATHERSTRIPPING .   | -      |                 |        | 1            |          | 1       |            | 1        |          |              | 2              |          |        |          | 1   |       |          |      |     |
| EXTERIOR WALL  | OUTLETS  |        | 1               |        |              |          |         |            |          |          |              |                | -        |        |          |   |       |          |      |     |
| ELECTRICAL:  | SWITCHES   | 1      |                 |        | the second   | ES.      | -       |            | 1        |          |              | 1              | 5        | -      |          |   |       |          |      |     |
|  | WIRES THRU WALL  |        | 8               |        | and a second |          | 610-x   | 10.90      |          |          | 2.<br>2      | -              | -        |        |          |   | 14    | 1.2      | -    |     |
| INTERIOR WALL  | OUTLETS  | 400    | 8 3             |        |              | 100      | 11200   | L.         |          | 4        |              | -              |          |        |          |   | -     | -        |      | -   |
| ELECTRICAL:  | SWITCHES   |        | A F             |        |              |          | 148,237 | 部門         | 100      | -        |              | -              | -        | -      | -        | 120                                       | 6     | -        | -    |     |
|  | WIRES THRU WALL  |        | -               | 1.2554 | 100          | Gr A     | -       | 1000       | 1.15     |          | -            | -              |          |        | enti-    | AND STREET                                | 1     |          | -    |     |
| FIREPLACE:   | AROUND UNIT  |        | 1000            | A      | 100          |          | 15A     | 1          |          | NA<br>PA |              | -              | -        | 088    | A STATE  | er en | -     |          |      |     |
|  | DAMPER/DOORS   | 1.48   | NUMBER<br>VERSE | 9      | 6            | 446.64   | 12-97   | N.         | 1000     |          | 10.5         | and the second | 1000     | 1700 H | 2003     |   | -     |          | 1    |     |
| ATTIC HATCH:   | MOULDING   |        | 90              | P YOR  | 100          | 6        | 1988    | The second | A SEA    | Westlage | 10.2         | and the        | C.C.C.   | 100    | -        |   | -     |          | -    |     |
| ۵  | FRAME  | -      | -               | .95    | 21/20        | 0914     |         | 1945       |          | 1.       | -            | -              |          |        |          |   | -     | -        |      |     |
|  | WEATHERSTRIPPING   |        |                 |        |              | A. S. S. | 644.    | 6          | 4325     | 行為       | 1.00         | -              | -        | -      | -        | -   | -     | $\vdash$ |      |     |
| OTHER LEAKAGE  | PLUMBING THRU WALL   |        |                 | -      | -            | - 39     | 同時期     | SA.        |          | 1385     | N N          | -              | -        |        | $\vdash$ | -   | -     | -        | -    |     |
| AREAS:   | BASEBOARDS   | -      |                 | -      | -            | -        | 1       | 使高         | 10       | -        |              | -              | -        | -      | -        | -   | -     | -        | -    | -   |
| A  | FLOOR DRATN/SUMP   | A Sec  |                 | -      | -            | -        | -       | time t     | 1        |          |              | -              | -        |        | -        | -   | -     | -        |      | -   |
|  | FLECTRICAL PANEL   |        | 8.5             | -      | -            | -        | -       |            | -        |          | -            | 1.25           |          |        | -        | -   | -     | -        |      | -   |
| and the second second  | CHIMNEY  | 200    | 49              | Sale   |              | -        |         | -          | -        | -        | -            | -              | -        | -      |          | -   |       | •        |      |     |
|  | JOISTS OVED  |        | 22              | の展     | P            | -        | -       | -          | -        |          |              | -              |          | -      |          | _   |       | -        |      |     |
| A  | ATTACHED GARAGE  |        |                 | 197    | S. Mark      |          |         |            |          | -        |              |                |          |        |          |   |       |          |      |     |
| No. of the second s | HEADER AREA  | 1.0%   | 1               | -      |              |          |         |            |          |          |              |                |          |        |          | -   |       |          |      |     |
|  | OWNER-INSTALLED  | 2014   | 1.1             | F      |              | 1        | -       | -          | -        |          | -            | -              | -        |        |          | -   |       | -        | -    | -   |
|  | COUL WALL  | 0      | -               |        | -            | -        |         |            | -        |          | -            | -              |          |        | -        | -   | -     |          | -    | -   |
| ,  | A State of the second s | -      | -               | -      | -            | -        | -       | 0          | -        | -        | -            | -              |          | -      | -        | -   | -     | -        |      | -   |
|  |  |        | -               | -      | -            | -        | -       | -          |          | -        |              | -              |          |        | -        |   | -     | -        | -    |     |
|  |  | -      | -               | -      | -            | -        |         | -          |          | -        | -            | -              |          | -      | -        | -   | -     | -        |      |     |
|  |  | -      | -               | -      | -            | -        | -       | -          |          | -        | -            | -              | -        | -      | -        | -   | -     | $\vdash$ |      |     |
|  |  | -      | -               | -      | -            | -        | -       | -          | -        | -        | -            | -              | _        | -      | -        | -   | -     | -        |      |     |
|  |  |        | -               | -      | -            | -        | -       | -          |          | -        | -            | -              | -        |        | -        | -   | -     | -        |      | -   |
|  |  |        |                 |        |              |          |         |            |          |          |              |                |          |        |          |   |       |          |      |     |

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| UNIES Ltd. AIR           | TIGHTNESS TEST DATA                 | FOF    | RM -    | - A1          | RL           | EAK                     | AGE      | SE            | ALI                 | NG             | CHE                 | CKL         | IST            | Н                    | ou      | 3       | E '      | #1         | 2     |      |
|--------------------------|-------------------------------------|--------|---------|---------------|--------------|-------------------------|----------|---------------|---------------------|----------------|---------------------|-------------|----------------|----------------------|---------|---------|----------|------------|-------|------|
| LEAKAGE<br>POINT         | = MAR(H'86<br>= FEB '88             | Living | Kitchen | Dining        | Bedroom      | Bedroom                 | Bedroom  | Bathroom      | Bathroom            | Basement       |                     |             |                |                      |         |         |          |            |       |      |
| WINDOWS:                 | MOULDING                            | r      | DPA     | EA            | 5            | 1                       | RA       | AT.           | K                   | -              | De                  | 5.00        | Selvi .        |                      |         |         |          |            |       |      |
|                          | FRAMES                              | K      | HOL     | DIL           | G            | 44                      | 4.55     | in            |                     | K              | Call.               | 1. Carlin   | ي.<br>المدينية |                      |         |         |          |            |       |      |
|                          | LATCHES                             |        |         |               |              | F                       |          |               |                     | NHC.           | 1                   | 10          |                |                      |         |         |          |            |       |      |
|                          | WEATHERSTRIPPING                    |        |         |               |              |                         | 1.20     | 4             |                     | の思想            | State of the second | 4           |                |                      |         |         |          | -          |       |      |
| EXTERIOR                 | MOULDING                            |        |         | 1             |              | - 41                    | đ        | A.S.          | 2                   | 1              | (Angenta)           | 2           |                | met                  | -       |         |          | 100        | はない   | in.  |
| DOORS:                   | FRAMES                              |        |         |               |              | d                       | i di più | 1154          | 1                   |                | 2.00                |             | 1              | 2.20<br>2.20<br>2.20 |         | and a   | Server 1 | - complete | 4     | 111  |
|                          | LATCHES                             |        |         |               | A            |                         | 1 Same   | 1             |                     |                |                     | -           | -              | and .                | 6       |         |          |            |       | NO.  |
|                          | WEATHERSTRIPPING                    | 1      |         | -             |              | 11/1                    | 1        |               |                     |                |                     | 8           |                |                      |         |         |          |            |       | 144  |
| EXTERIOR WALL            | OUTLETS                             |        |         |               |              |                         |          | -             | -                   |                | 196                 | 0000        |                |                      | -       |         |          |            |       | 1 in |
| ELECTRICAL:              | SWITCHES                            | ß      |         |               | 1            | ià.                     | -        | -             | A                   | 100            |                     | 1           |                |                      | -       | -       | -        |            | 1     | Sel. |
|                          | WIRES THRU WALL                     |        | 4       | 1             | 1995<br>1995 | - त्याचा,<br>- त्याच्या | Barro    |               | 1998)<br>1998)      | 124            | an.                 |             |                | -                    | -       |         | 的        | 130        |       | 290  |
| INTERIOR WALL            | OUTLETS                             | 100    | No R    |               | 1987         | Carlos and              |          | N.S.          | Sec.                | ener<br>H      | -                   | -           |                |                      |         |         | 100      | area.      | 1.365 | -    |
| ELECTRICAL:              | SWITCHES                            | 1      | 33      | 1000          | 1.22         |                         |          | 100           | 14                  | -              |                     |             |                | -                    |         | and the |          |            |       | -    |
|                          | WIRES THRU WALL                     |        | en m    | -CER          |              | 100                     |          | 劉             | and and a           |                | 14-1                |             |                |                      | ALC: NO | 1       | S.       |            | -     | -    |
| FIREPLACE:               | AROUND UNIT                         | 1000   | 105.00  | 6             | 4963         | 100                     | An.      | 100           | * 209<br>(1)<br>(1) | R.             |                     |             | -              | 1                    | 44      | 2. Con  | -        |            | -     |      |
|                          | DAMPER/DOORS                        | 100    | 1000    | AP.           | 5            | New York                | 1.4.4.4  | 1             | 100                 | en de<br>Sande | -                   | (STAR)      | and the second | 100                  | N.      | -       | -        |            | -     | 100  |
| ATTIC HATCH:             | MOLILIDING                          | -      | 418+1   |               |              |                         | 1000     | 1000          | Site.               | 4697           | 1.40                | 27 - 17<br> |                | -                    | -       |         | -        | -          | -     | -    |
|                          | FRAME                               | -      | -       | 100           | Sec.         | ALL ALL                 |          | 100           | 的。<br>例如            | 9.<br>1990.,   | -                   |             |                |                      | -       |         | -        |            | -     | -    |
| .0%                      | WEATHERSTRIPPING                    |        | -       |               | -30          | 25 (94)<br>6225 (35     | から、      |               | 6.92                | 100.H          | tones.              |             |                | -                    | -       | -       |          |            | -     |      |
| OTHER LEAKAGE            | PI LIMBING THRIL WALL               | -      |         | -             | -            | 1000                    | Surday.  | 29.<br>141923 | _                   | 100            | 5388°               | -           |                | -                    | -       |         | -        | -          | -     |      |
| ARFAS+                   | BASEBOARDS                          |        |         | -             |              | -                       | 1.460    | Jecon         | 10                  | -              | -                   | -           |                |                      | -       | -       | -        | -          | -     | -    |
| AREAJ.                   | FLOOP DPATN/SUMP                    | 1.00   |         | -             | -            | -                       | -        | 12/10         | S.                  | -              |                     | -           | _              | _                    | -       | -       | -        | -          |       |      |
| Bay .                    | ELECTRICAL DANEL                    |        | 12.0    | -             | -            | -                       |          | -             |                     |                | -                   | -           | _              | -                    | -       | -       |          | -          | -     | -    |
| Calles.                  |                                     | 1      | · 1000  | CA.           | -            | -                       | -        |               | _                   | -              | -                   | _           |                | _                    | _       | _       | -        | -          |       | _    |
| A DAY                    |                                     | -      | A STORE | 1997)<br>4.30 | A.           |                         | -        | _             | _                   |                |                     |             |                | 1. 4                 | -       | _       |          |            | _     |      |
|                          | ATTACHED GARAGE                     | A.     |         | A.C.          | 1            |                         | 1        |               | 945                 |                |                     |             |                |                      | _       |         |          | ·          |       |      |
| Provention of the second | HEADER AREA                         |        |         |               |              | -                       |          |               |                     |                |                     |             |                |                      | -       |         | 1        |            |       | -    |
| 1                        | DAYER VENT THEN                     | 100    | 100     | -             | -            |                         |          |               |                     |                |                     | -           |                |                      | -       |         | -        | -          | -     | -    |
|                          | HAB. EXHAUST VENT                   | 1990   | -       |               | -            | -                       | -        |               | -                   |                | -                   | -           |                |                      |         |         | -        |            | -     |      |
|                          | THEU. COLL. WALL                    | -      | -       | -             | -            |                         | -        | -             | -                   |                | -                   | -           | -              | -                    |         |         | -        |            | -     | -    |
|                          | <ul> <li>Estado - Silvar</li> </ul> | -      |         |               | -            | -                       | -        | -             | -                   | -              | -                   | -           | -              |                      |         |         | -        |            | -     | -    |
|                          |                                     | -      | -       |               | -            | -                       | -        | -             | -                   | -              |                     | _           |                |                      | -       | -       | -        | -          | -     | 1    |
|                          |                                     | -      | -       |               | -            | -                       | -        | -             |                     | -              | -                   | -           |                |                      | -       |         | -        | -          | -     |      |
|                          |                                     | -      | -       | -             | -            | -                       | -        | -             |                     | -              | -                   |             | -              |                      | -       | -       |          | -          |       |      |
|                          |                                     | -      |         | -             | -            |                         | -        |               | -                   |                |                     | _           | _              |                      | _       | -       | _        | _          | -     | -    |

| UNIES Ltd. AIR   | TIGHTNESS TEST DATA            | FOF           | M -     | AI               | RL       | EAK       | AGE            | SE       | ALI      | NG       | CHE  | CKL     | IST    | H     | ou      | 5     | =       | #        | 13   | _   |
|--|--------------------------------|---------------|---------|------------------|----------|-----------|----------------|----------|----------|----------|------|---------|--------|-------|---------|-------|---------|----------|------|-----|
| LEAKAGE  | = JULY '80<br>= FEB '88        | Living        | Kitchen | Dining           | Bedroom  | Bedroom 2 | Bedroom        | Bathroom | Bathroom | Basement |      |         |        |       |         |       |         |          |      |     |
| WINDOWS:   | MOULDING                       | 30            | TT      | 15 C             | PFF      | ING       | TIC            | GL       | IN       | 15 R     | Lus  | 5       |        |       |         |       |         |          |      |     |
|  | FRAMES                         |               | 7       |                  | 2        |           | 2              |          |          |          | 1    | 2-31    |        |       |         |       |         |          |      |     |
|  | LATCHES                        |               |         |                  |          |           |                |          |          | 100      |      | 1       |        |       |         |       |         |          |      |     |
|  | WEATHERSTRIPPING               |               |         |                  | (        |           |                |          |          |          | 1.6  | 6       |        |       |         |       | isen    |          |      |     |
| EXTERIOR   | MOULDING                       |               |         |                  |          |           | 19             |          | 1        |          | 1000 |         | -      | entil |         |       |         | 1        | e d' |     |
| DOORS:   | FRAMES                         |               |         |                  |          |           |                | 1        | 1        |          | AN'S |         |        | i ci  |         | and a | g state |          |      |     |
|  | LATCHES                        |               |         |                  | 1        | A MARK    | 1              | 1        |          |          |      |         | 101025 | 2     |         |       |         |          |      | 1   |
| · · ·  | WEATHERSTRIPPING               |               |         |                  |          | 144       | -              |          |          |          | 3    | BA.     |        |       |         |       |         |          |      |     |
| EXTERIOR WALL  | OUTLETS                        |               |         |                  |          |           |                |          |          |          | bd   | NNE     | 12-    | BUI   | LT      |       |         |          |      |     |
| ELECTRICAL:  | SWITCHES                       | đ             |         | 1                |          | A         |                |          | đ        | 職員       | 1000 | Y       |        | -     |         |       | - 40    | aleren . |      |     |
|  | WIRES THRU WALL                | 100           | a       | 4                | Ser.     |           | Real           | 1        | 1        |          | 1    |         |        |       |         |       | 1       | 25%      |      | 1.1 |
| INTERIOR WALL  | OUTLETS                        | 1             | 43      |                  |          | ALC: NO   |                | 12       | 6.2      | 1        |      |         |        |       |         |       |         |          |      |     |
| ELECTRICAL:  | SWITCHES                       |               | W.S     | Carrie<br>Carrie |          |           | - and -        | 144 A    |          |          |      |         |        |       |         | 190   | 2       |          |      |     |
|  | WIRES THRU WALL                | 渝             | Pra.    | 1                | 1        | 金         |                | 「花園      | al an    | A        |      |         |        |       | and the |       | \$P'    |          |      |     |
| FIREPLACE:   | AROUND UNIT                    |               |         | 1.1              | 1        |           | 1              |          | 2.54     |          |      | •       |        |       |         | 7     |         |          |      |     |
|  | DAMPER/DOORS                   |               | 1 111   |                  | 0        | - 2       |                | 2009     | 10       | 1        |      |         |        | 1915  | 1       |       |         |          | 1    |     |
| ATTIC HATCH:   | MOULDING                       | •             |         |                  | 1        | 5         | THE OWNER      |          | 1        |          | King | S. Sola | (Genel | -     |         | 1     |         |          |      |     |
| A  | FRAME                          |               | -       |                  | 1965     |           |                |          |          |          |      |         |        |       |         |       |         |          |      | -   |
| -  | WEATHERSTRIPPING               |               |         |                  | 1        | La Last   |                |          | 100      | a.达      |      |         |        |       |         | -     |         |          |      |     |
| OTHER LEAKAGE  | PLUMBING THRU WALL             | -             |         |                  | 1        | 1         | all the second | 1        | 6        | 1000     | 4    |         | -      | -     |         |       | -       |          |      | -   |
| AREAS:   | BASEBOARDS                     | 4             |         |                  |          |           | . 3            | 1        | 1        | -        |      |         |        |       |         |       | -       | 14       |      | -   |
| ab.  | FLOOR DRAIN/SUMP               | 1             | 6       | -                |          | - 6       |                | 100      | 1        |          |      |         |        |       |         |       | -       |          | 4    | -   |
|  | ELECTRICAL PANEL               | 642           | 1202    |                  |          |           | -              | -        | -        |          | -    | -       | -      |       |         |       | -       |          |      |     |
| A State of the sta | CHIMNEY                        | 20            | - AND   |                  | 6        |           |                |          | -        |          |      | -       | -      |       |         |       | -       |          |      |     |
|  | JOISTS OVER<br>ATTACHED GARAGE | A             | 1       | a liter          | Ì        | 1         |                |          |          | F        |      |         |        |       |         |       |         |          |      |     |
| tae  | HEADER AREA                    | 1.44          | 1       |                  |          |           |                |          |          |          |      |         |        |       |         |       |         |          |      | -   |
| the second   | ALL ALL                        | in the second | 1       | -                | -        | -         | -              | -        | -        | -        |      | -       |        | -     |         | -     |         |          |      | -   |
|  | Contraction of the second      | and a start   |         |                  | $\vdash$ |           |                |          |          |          |      |         |        |       |         |       |         |          |      |     |
|  |                                |               |         |                  |          |           |                |          |          |          |      |         |        |       |         |       |         | _        |      |     |
| 2  |                                | -             | -       | -                |          |           |                | -        | -        | -        | -    | -       | -      |       | -       |       | -       | -        | -    | -   |
|  |                                | 1             |         |                  |          |           |                |          |          |          |      |         |        |       |         |       |         |          |      |     |
|  |                                |               |         |                  |          |           |                |          |          |          |      |         |        |       |         |       |         |          |      |     |
|  |                                |               |         |                  |          | 1         |                |          |          |          |      |         |        |       |         |       |         |          |      |     |

| RTIGHTNESS TEST DATA  | FOR   | RM -  | AI   | RL  | EAK   | AGE   | SE  | ALI  | NG  | CHE  | CKL  | IST   | ł  | 10  | US  | Ē  | #  | 14   |  |
|---|---|---|--|---|---|---|---|--|---|--|--|---|--|---|---|--|--|--|--|
| = March'86<br>= FEB '88   | Living  | Kitchen   | Dining   | Bedroom   | Bedroom   | Bedroom   | Bathroom  | Bathroom   | Basement  |  |  |   |  |   |   |  |  |  | -  |
| MOULDING  |   |   |  |   |   |   |   |  |   | 3  |  | 100.14  |  |   |   |  |  |  |  |
| FRAMES  |   |   |  |   |   |   | $\vdash$  |  |   | Tant   | (2.845)  |   |  | 1   |   | 1  |  |  |  |
| LATCHES   | 1   | 1   |  |   |   |   |   |  | 橋   | 1000   | 1  |   |  |   |   | -  |  |  |  |
| WEATHERSTRIPPING  |   |   |  |   | 1   |   |   |  | 122   |  | 1  |   |  |   |   |  | -  |  | -  |
| MOULDING  |   |   |  |   |   | S.  | ())   | 05   | 1   |  | in the second  |   | -  | 100   |   | 1234   | Sec.   |  | San.   |
| FRAMES  | · · ·   |   |  |   | .A.   | 100   | 1   | 1  |   | N.   | and the second   | 1925  | <b>推</b> 定   | STOCK ST  |   | - And  | -  | Seler.   | 読品   |
| LATCHES   |   |   |  | A   |   | 199   | -   |  |   |  |  | - and   | and the second   | 420   |   |  |  |  | (MAR)  |
| WEATHERSTRIPPING  | <u> </u>  |   |  | 篇   | 1   | 1   |   |  |   | A  | 2  |   |  |   |   |  |  |  | -  |
| OUTLETS   |   |   |  |   |   |   |   |  |   | AN   | 1.4  | -   |  |   |   |  |  |  | 相归   |
| SWITCHES  | A   |   |  | 235   | jan ja  |   |   | 1  | 100   |  | ST.  |   |  | -   |   | -  |  | di Pili  | 1  |
| WIRES THRU WALL   | 1   | - 4   |  | 1000  | Robert  | 200   | जरताही)<br>जराही  | No.  |   | 1  | -  |   | -  |   |   | 創  | 行法。  | - Caller   | 2º   |
| OUTLETS   | 9   | 0   |  |   |   | 1.36  | 1.000   | 244  | 1   |  |  |   |  |   |   |  | -  | C.S.B.   | -  |
| SWITCHES  |   | S A   | en el  | 1   |   | CAL!  | - Contraction   | and the second   |   |  |  | -   |  |   | all.  | 1.   | -  |  | _  |
| WIRES THRU WALL   | 1980  | 135 ·   | 1  | 123   | 1   |   |   |  |   |  |  |   |  |   | 200   | y  |  |  |  |
| AROUND UNIT   | 1000  | 122   | Sec. 1   | - C   | and a second  | 40  | · \$  | Ale a  |   |  | -  |   |  | 1   | 7   |  | -  |  |  |
| DAMPER/DOORS  | -623  | Cran.   | 1.2  | 1   | 100   | Calco   | 100   | 100  | en angle<br>en angle  |  | and a  |   | in the second  | Y   | -   |  | -  |  |  |
| MOULDING  |   | - 15/   | 488  | and and   | ia.   | 100   | 1   | inter-   | anere   | and the second   |  | and the second  | - Dian   | -   | ┢   |  | -  |  |  |
| FRAME   |   | -   | 5  | 45  | - State   | 2   | 1000  |  | 4-0   |  |  | -   | -  |   |   |  | -  |  |  |
| WEATHERSTRIPPING  |   | -   |  | -95   | 100   | and and a   |   | 1000   | L YRS   | 100  |  |   | -  | -   |   | -  | 1  |  |  |
| PLUMBING THRU WALL  |   |   | -  |   | -940  |   |   | 2  | 1000  | 2  |  |   | -  |   |   |  |  |  |  |
| BASEBOARDS  |   |   |  |   |   | 1997  | and   | 14   | -   |  |  |   |  |   |   |  | -  |  |  |
| FLOOR DRAIN/SUMP  | AND I   |   |  |   | -   | -   | 4   | 1  | -   |  |  | -   |  | -   |   |  |  |  |  |
| ELECTRICAL PANEL  | 1   | 1   | 2  |   | -   |   | -   |  |   |  |  |   |  |   |   |  |  | -  |  |
| CHIMNEY   | UDE   |   |  | ų.,   | -   |   |   |  |   |  |  |   |  |   |   |  |  |  |  |
| JOISTS OVER<br>ATTACHED GARAGE  |   |   | A Star   | and the second  |   |   |   |  |   | •  |  |   |  |   |   |  |  |  | -  |
| HEADER AREA   | 家族  | 19962   |  | -   |   |   | -   |  |   |  | -  |   |  |   |   |  |  |  |  |
| HAU INTAKE & EXHAUST  | 1.00  | 1.000 C   |  |   | -   |   |   |  |   |  | -  |   |  |   | -   |  |  |  |  |
| THEO COLC. WALL   | 14  | -   |  |   | -   |   | -   | -  |   |  | -  | ·   |  |   |   |  |  |  |  |
| A. Complete   |   |   | -  |   |   |   | -   |  | -   |  |  | -   |  |   | -   | -  |  |  |  |
| 4900 and 1000 and 100 |   |   |  |   |   |   |   |  |   | -  |  |   |  |   |   |  |  |  |  |
|   |   |   | -  |   | -   | -   |   |  | -   |  | -  |   | 1  | -   |   |  |  |  | _  |
|   |   |   |  |   | -   |   |   |  |   |  | -  |   |  |   |   |  | _  |  |  |
|   |   |   | -  |   |   |   |   |  |   |  | -  |   |  |   |   | $\vdash$   |  |  |  |
|   |   |   |  | -   | -   |   |   |  |   |  |  |   |  | -   |   | $\vdash$   |  |  |  |
|   | TIGHTNESS TEST DATA<br>= MARCH'86<br>= FEE'88<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>ARQUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>WEATHERSTRIPPING<br>PLUMBING THRU WALL<br>BASEBOARDS<br>FLOOR DRAIN/SUMP<br>ELECTRICAL PANEL<br>CHIMNEY<br>JOISTS OVER<br>ATTACHED GARAGE<br>HEADER AREA<br>HEADER AREA<br>HEADER AREA | TIGHTNESS TEST DATA FOF<br>= AAARCH'86<br>= FEE '88<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>WEATHERSTRIPPING<br>PLUMBING THRU WALL<br>BASEBOARDS<br>FLOOR DRAIN/SUMP<br>ELECTRICAL PANEL<br>CHIMNEY<br>JOISTS OVER<br>ATTACHED GARAGE<br>HEADER AREA<br>HRVJ INTAXE & EXHAUST<br>THOM COLL | TIGHTNESS TEST DATA FORM -         =       MARCH'86         =       FEE'88         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         WIRES THRU WALL         OUTLETS         SWITCHES         WIRES THRU WALL         OUTLETS         SWITCHES         WIRES THRU WALL         ARQUND UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         PLUMBING THRU WALL         BASEBOARDS         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA         HEADER AREA         HEADER AREA         HEADER AREA | TIGHTNESS TEST DATA FORM - AI         =       MARCH '86         =       FEE '88         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         WIRES THRU WALL         OUTLETS         SWITCHES         WIRES THRU WALL         ARQUND UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         PLUMBING THRU WALL         BASEBOARDS         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA         HEADER AREA         HEADER AREA         HEADER AREA         HEADER AREA | TIGHTNESS TEST DATA FORM - AIR L         =       MARCH'86         =       FEE         FEE       '88         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         WIRES THRU WALL         OUTLETS         SWITCHES         WIRES THRU WALL         OUTLETS         SWITCHES         WIRES THRU WALL         ARQUND UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         PLUMBING THRU WALL         BASEBOARDS         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA         HRU, UNTALE & EXHAUST | TIGHTNESS TEST DATA FORM - AIR LEAK         • MARCH'86         • HEB'88         • HEB'88         • MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         WIRES THRU WALL         OUTLETS         SWITCHES         WIRES THRU WALL         OUTLETS         SWITCHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         PLUMBING THRU WALL         BASEBOARDS         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA         HEADER AREA         HEADER AREA         HEADER AREA         HEADER AREA | TIGHTNESS TEST DATA FORM - AIR LEAKAGE         * MARCH'86         * FEE''88         * MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         WIRES THRU WALL         OUTLETS         SWITCHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         PLUMBING THRU WALL         BASEBOARDS         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA         HRY, MITALE EXMANST         HRAGE | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SE         • MARCH'86         • FEE''88         • MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         WIRES THRU WALL         OUTLETS         SWITCHES         WIRES THRU WALL         OUTLETS         SWITCHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         VIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA         HPAU, INTALE & EXHAUST | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALI         • MARCH'86         • FELD'88         • MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         WIRES THRU WALL         OUTLETS         SWITCHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         PLUMBING THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHE GARAGE         HEADER AREA         HEADER AREA         HEADER AREA         HEADER AREA         HEADER AREA         HEADER AREA | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING<br>- MARCH'86<br>FEE '88<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>ELECTRICAL PANEL<br>CHIMNEY<br>JOISTS OVER<br>ATTACHED GARAGE<br>HEADER AREA<br>MEATHERSTRIPPING<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>WEATHERSTRIPPING<br>PLUMBING THRU WALL<br>BASEBOARDS<br>FLOOR DRAIN/SUMP<br>ELECTRICAL PANEL<br>CHIMNEY<br>JOISTS OVER<br>ATTACHED GARAGE<br>HEADER AREA<br>MEATHER AREA<br>MEAT | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHE         • MARACH'86         • FEE '88         • I I I I I I I I I I I I I I I I I I I | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKL         • MARCH'86         • MARCH'86         • Harden Sealing         • | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKLIST         • MARACH '86         • FED '88         Image: State of the state | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKLIST +         = MAPCH'86         = FED '88         Discrete         Discrete         Frames         LATCHES         WeATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SwiTCHES         WIRES THRU WALL         OUTLETS         SwiTCHES         WIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         OUTLETS         SWITCHES         WARES         MIRES THRU WALL         AROUND UNIT         DAMPER/DOORS         MOULDING         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA         HEADER AREA         HEADER AREA         HEADER AREA | ITIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKLIST         IMARCH'86         FED'88         Image: Sealing constraints         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         WIRES THRU WALL         AAMPER/DOORS         MOUDD UNIT         DAMPER/DOORS         MUMES THRU WALL         BASEBOARDS         FLOOR DRAIN/SUMP         ELECTRICAL PANEL         CHIMNEY         JOISTS OVER         ATTACHED GARAGE         HEADER AREA         HEADER AREA         HEADER AREA         HEADER AREA | ITIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKLIST HOOSE         - MARCH'86         FEE.'88         B | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKLIST       Hoose         • MARCH'86       Image: Sealing Checklist       Hoose         • MOULDING       Image: Sealing Checklist       Hoose         FRAMES       Image: Sealing Checklist       Hoose         LATCHES       Image: Sealing Checklist       Hoose         Weatherstripping       Image: Sealing Checklist       Hoose         MOULDING       FRAMES       Image: Sealing Checklist       Image: Sealing Checklist         LATCHES       Image: Sealing Checklist       Image: Sealing Checklist       Image: Sealing Checklist         Weatherstripping       Image: Sealing Checklist       Image: Sealing Checklist       Image: Sealing Checklist         Outlets       Image: Sealing Checklist       Image: Sealing Checklist       Image: Sealing Checklist       Image: Sealing Checklist         Switches       Image: Sealing Checklist       Image: Sealing Checklist       Image: Sealing Checklist       Image: Sealing Checklist         Outlets       Image: Sealing Checklist         Image: Sealing Checklist       Image: Sealing Checklist       Image: Sealing Checklist       Image: Sealing Checklist       Image: Sealing Checklist       Image: Sealing Checklist       Image: Se | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKLIST HOUSE #         • MARCH*86         • FEE* '58         • MOULDING         FRAMES         LATCHES         WATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         MOULDING         FRAMES         LATCHES         WEATHERSTRIPPING         OUTLETS         SWITCHES         WIRES THRU WALL         DAMPER/DOORS         MOULDING         FRAME         WEATHERSTRIPPING         PLUOR DRAIN/SUMP | TIGHTNESS TEST DATA FORM - AIR LEAKAGE SEALING CHECKLIST       Hooke #14         • MARACH'86       • • • • • • • • • • • • • • • • • • • |

| UNIES Ltd. AIR   | TIGHTNESS TEST DATA            | FOR          | M -      | AI                                       | RL       | EAK          | AGE      | SE.            | ALI                                   | NG       | CHE          | CKL   | IST | H                | 00        | 155              |          | #1       | 5        |   |
|------------------|--------------------------------|--------------|----------|--|----------|--------------|----------|----------------|---------------------------------------|----------|--------------|-------|-----|------------------|-----------|------------------|----------|----------|----------|---|
| LEAKAGE<br>POINT | = JULY '86<br>= FEB '88        | Living       | Ki tchen | Dining                                   | Bedroom  | Bedroom<br>2 | Bedroom  | Bathroom       | Bathroom                              | Basement |              |       |     |                  |           |                  |          |          |          |   |
| WINDOWS:         | MOULDING                       |              |          |  |          |              |          |                |                                       |          |              |       |     |                  |           |                  |          |          |          |   |
|                  | FRAMES                         |              | 1        |  |          |              |          |                |                                       |          |              | in a  | -   |                  |           |                  |          |          |          |   |
|                  | LATCHES                        |              |          |  |          |              |          |                | •                                     | 100      | 1            | 1     |     |                  |           |                  |          |          |          |   |
|                  | WEATHERSTRIPPING               |              |          |  |          | 541          |          | -              |                                       | 1000     | 16           |       |     |                  |           |                  | 1.000    |          |          |   |
| EXTERIOR         | MOULDING                       |              |          |  |          |              | đ        | ing the second | 3                                     | 1        |              | (a)   |     | -                | N.S.      |                  | 2.60     | all a    | 1        | 1 |
| DOORS:           | FRAMES                         |              | -        |  |          | 12           |          | 1              | 1                                     | -        | 1.96         |       | 1.1 | 3.241)<br>5.396) |           | 1000             |          |          | × .      | 2 |
|                  | LATCHES                        |              |          |  | 6        | Racio        | 1        | 1              |                                       |          |              |       |     | -                |           |                  |          |          |          | 1 |
|                  | WEATHERSTRIPPING               | -            |          | -  |          | 1            | 1        |                |                                       |          |              | A.    |     |                  |           |                  |          |          |          |   |
| EXTERIOR WALL    | OUTLETS                        |              |          | 1  | BALLS.   | · ·          | -        |                |                                       | 1        | e la         | 618-9 | +   |                  |           |                  |          |          |          |   |
| ELECTRICAL:      | SWITCHES                       |              | 6        |  | -        | SA.          | -        |                |                                       | 100      | 198          | V     |     |                  | -         |                  |          | -        | 1        |   |
| 1                | WIRES THRU WALL                | 1990<br>1990 | 1 A      |  | THE REAL | 100          | Alter .  | x.756          | 100                                   |          | 1            |       | -   |                  |           | -                | 54       | aut.     |          | 1 |
| INTERIOR WALL    | OUTLETS                        | 3            | ELER.    |  | 4        | 100 A        | 1        |                | 1                                     | 1        | -            |       |     |                  |           |                  |          |          | -        | - |
| ELECTRICAL:      | SWITCHES                       | -            | 385      | 12.63                                    |          |              | Decision | 1000           | 12.5                                  | $\vdash$ |              | 2     |     |                  |           | AN AL            | A        |          | -        |   |
|                  | WIRES THRU WALL                | 120          | ~        | 199                                      | -        | A            |          |                | C C C C C C C C C C C C C C C C C C C |          | -            | -     | -   |                  | al R      | 676.55<br>26.252 | 10       | -        |          |   |
| FIREPLACE:       | AROUND HINT                    |              | NA.      | 1  | 1        | 1            | A        | 133            | Anne of                               | 1        | -            | -     |     | 100              | 和同时       | 10.00            | -        | -        |          |   |
|                  | DAMPER/DOORS                   | -494         |          | 100                                      | 4        | AFFE         |          | 1              | 450050<br>10 <sup>+</sup>             | 語いる      | en a         | 1.225 | AN. | 223<br>2007 d    | 848-<br>7 | -                | -        | -        | -        |   |
| ATTIC HATCH:     | MOULDING                       | -            |          | 中語                                       | 4        | 6            | 1972     | の市             |                                       | 2832     | D.<br>Hallai |       |     | 1363             | ŀ         | -                | -        |          | -        |   |
| đ                | FRAME                          |              | -        | 725                                      |          | No T         | A        | 1000           | 100                                   |          | -            | -     |     |                  | -         | -                | -        | -        | -        |   |
|                  | WEATHERSTRIPPING               |              | -        |  | 49.8     | e anno       | 2.25     |                | 19                                    | 1977 (A. | 13           | -     | -   |                  | -         |                  | -        |          | -        |   |
| OTHER LEAKAGE    | PLUMBING THRU WALL             | +            | -        | -  | -        | -499         | -        | 記名             | -                                     | 1224     | 1            | -     |     |                  | -         |                  | -        |          | -        |   |
| AREAS:           | BASEBOARDS                     |              | -        |  |          | -            | 185      |                | DA.                                   | -        | -            | -     | -   |                  |           |                  | -        |          | -        |   |
| A.               | FLOOR DRATN/SUMP               | A            | -        | -  |          | -            |          |                | 1                                     | $\vdash$ | -            | -     | -   | -                | -         | -                | -        | -        | -        |   |
| A                | FLECTRICAL PANEL               |              | A DE     |  |          | -            |          | -              |                                       |          | -            |       |     |                  | -         | -                |          | -        | -        |   |
|                  | CHIMNEY                        | 100          | 0        |  |          | -            | -        | -              | -                                     | -        | -            | -     | -   |                  | -         | -                | -        | -        | -        | - |
|                  | JOISTS OVER<br>ATTACHED GARAGE | 1            | 488      | 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1 |          |              |          |                |                                       |          |              |       |     |                  |           |                  |          |          |          |   |
|                  | HEADER AREA                    | 1            | A        |  | ſ        |              |          |                | -                                     |          |              | -     |     | -                |           |                  | -        |          |          |   |
| A CONTRACTOR     | CORNER OF FRAMING              | 10,00        | 1        | r  |          | -            | -        | -              |                                       |          |              | -     |     |                  | -         |                  | -        | $\vdash$ |          |   |
|                  | ENTRANCE LANDING               | T.           | r_       | -  | -        | -            | -        | -              | -                                     |          | -            | -     |     | -                | -         |                  | -        | -        | -        |   |
|                  | PEACH                          | 1            | -        | -  | -        | -            | -        | -              | -                                     |          |              | -     | -   | -                | $\vdash$  | $\vdash$         | -        | $\vdash$ | -        |   |
|                  |                                | $\vdash$     | -        | -  | -        | -            | -        | -              | -                                     | -        | -            | -     | -   | -                | -         | -                | -        | -        | -        | _ |
|                  |                                | $\vdash$     | -        | -  | -        | -            | -        | -              | -                                     | -        | -            | -     |     | -                | $\vdash$  | $\vdash$         | $\vdash$ | $\vdash$ | $\vdash$ |   |
|                  |                                | +            | -        | $\vdash$                                 | -        | -            | -        | -              | -                                     | -        |              | -     | -   | -                | -         | -                | -        | -        | -        |   |
| ,                |                                | $\vdash$     | -        | 1  | -        | -            | -        | -              |                                       | -        | -            |       | -   | -                | $\vdash$  | -                | -        | -        |          |   |
|                  |                                | -            | -        | -  | -        | -            | -        |                | -                                     | -        | -            | -     |     |                  | $\vdash$  |                  |          | -        |          |   |
|                  |                                |              | 1        |  |          |              |          |                |                                       |          |              |       |     |                  |           |                  |          |          | 1        |   |

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| UNIES Ltd. AIF   | RTIGHTNESS TEST DATA           | FOF      | M -                       | - A1      | RL      | EAK     | AGE           | SE       | ALI      | NG       | CHE            | CKL            | IST                                       | Н     | ou       | SE     | -       | <u>#1</u> | 6     |           |
|------------------|--------------------------------|----------|---------------------------|-----------|---------|---------|---------------|----------|----------|----------|----------------|----------------|---|-------|----------|--------|---------|-----------|-------|-----------|
| LEAKAGE<br>POINT | = MARCH'86<br>= FEB '88        | Living   | Kitchen                   | Dining    | Bedroom | Bedroom | Bedroom       | Bathroom | Bathroom | Basement |                |                |   |       |          |        |         |           |       |           |
| WINDOWS:         | MOULDING                       |          |                           |           |         |         |               |          |          |          | 1              | R.Caro         | 0.0                                       |       |          |        |         |           |       |           |
|                  | FRAMES                         |          |                           |           |         |         |               |          |          |          | 0.36           | 1.50           | yans                                      |       | ×        |        |         |           |       |           |
|                  | LATCHES                        |          |                           |           |         |         | 30            |          |          | fatter.  | 1              | 94             |   |       |          |        |         |           |       |           |
|                  | WEATHERSTRIPPING               |          |                           |           | 1       |         |               |          |          | 1000     |                | 1              |   |       |          |        |         | _         |       |           |
| EXTERIOR         | MOULDING                       |          | 1                         |           |         |         | di la         | 明婚       | 100      | 4        | - All          | 1              | -   | -     | THE REAL | 125    | 130     | ALC IN    |       | A.        |
| DOORS:           | FRAMES .                       |          |                           |           |         | d       | 1             | a line   | 1        |          | S.             | が高い            | 1   |       | E AL     | 1      | and and |           |       | C.S.      |
|                  | LATCHES                        |          |                           |           | 1       |         | 1.10          | r        |          |          |                |                | inguis                                    |       |          |        |         |           |       |           |
|                  | WEATHERSTRIPPING               |          |                           |           | 6       | 100     | F             |          |          |          | 1              | 4              | -   |       |          |        |         |           |       | New Color |
| EXTERIOR WALL    | OUTLETS                        |          |                           |           | 1       | 唐       |               | 2        |          |          | and the second |                |   |       |          |        |         |           |       | 相關        |
| ELECTRICAL:      | SWITCHES                       | k        |                           |           | 15 IS   | 124     |               |          | A        |          | 10.20          | 1 and          |   |       | -        |        | 5000    |           | 1     |           |
|                  | WIRES THRU WALL                | 63       | に始                        |           | 92.00   | 17 Jack | in the second | an th    |          |          | 8              |                | -   |       |          |        | 22 633  | 100       | 100   | and the   |
| INTERIOR WALL    | OUTLETS                        | 200      |                           | 133.      |         | - And   | いい            |          | 福        | di la    |                |                | -   |       |          |        | 114     |           | 10.84 |           |
| ELECTRICAL:      | SWITCHES                       |          | 900                       |           | inde    |         | 1420622       | 福        |          | $\vdash$ |                |                | -   |       |          | alle . | t.      |           | -     | -         |
|                  | WIRES THRU WALL                |          | 3                         | 1990      | 100     | 1A      |               | の時間      | 100      | 1        |                |                | -   |       |          |        | 17      |           |       | -         |
| FIREPLACE:       | AROUND UNIT                    | 1.37     | 2.1000<br>2.1000<br>2.000 | 1         | 1.1     | ( inter | 11 A          | 1        |          |          |                |                |   |       |          | it     |         |           |       |           |
|                  | DAMPER/DOORS ·                 | 25       | 19900<br>19900<br>19900   |           | 2.      | 1884    | -45           | 1        | 100      | 1000     | 1.32           |                |   | PLC T | 94<br>94 |        | -       | -         |       | -         |
| ATTIC HATCH:     | MOULDING                       | -        | 1965                      | 14        | 138     | in.     | 100           | Keril    |          | 1        | -              | and the second | C. S. | 1000  |          |        | -       |           | 1     | -         |
| <i>A</i>         | FRAME                          |          |                           | 1.20      |         | 1       | 4             | A.       | Fair     | - 5      |                | -              | _   |       | -        |        | -       |           |       | -         |
|                  | WEATHERSTRIPPING               | -        |                           |           | 200     |         | 1             | 2        | 12381    | in al    | 1.             | -              |   | -     |          |        | -       |           | -     | -         |
| OTHER LEAKAGE    | PLUMBING THRU WALL             | $\vdash$ |                           | -         | -       | - Star  | hard          | 初離       |          | 100      | ar .           |                |   |       | -        | -      | -       |           | -     |           |
| AREAS:           | BASEBOARDS                     | h.,      |                           |           | -       |         | 400           | States   | 1160     | -        |                |                |   | -     | -        |        |         |           | -     | -         |
|                  | FLOOR DRAIN/SUMP               | 489      |                           | -         | -       |         | +             | 1000     | 1007     |          |                |                |   |       | -        |        |         |           | -     | -         |
| - Sector         | ELECTRICAL PANEL               | A HERE   |                           |           | -       | 1       | -             |          | -        | -        |                | -              | -   |       | -        |        | -       |           | -     | -         |
|                  | CHIMNEY                        | -30      | 1999 - C                  |           | 5       | -       | -             | 1        |          |          | -              | -              |   |       | -        | -      | -       |           |       | -         |
|                  | JOISTS OVER<br>ATTACHED GARAGE |          | 100                       | ALC AND A | C. Star |         |               |          |          |          |                |                | 8   | -     |          |        |         |           |       |           |
| A State          | HEADER AREA                    | 読む       | 34                        |           |         | -       |               |          | -        | -        |                | +1             |   |       |          |        | -       |           |       |           |
|                  | PEACH INTAKE SEXHAUST          | 140      | 1989)<br>19 <sup>9</sup>  |           |         |         |               |          |          |          |                |                |   |       |          |        |         |           |       |           |
|                  | PEACH                          | 21       |                           |           |         |         |               |          |          |          |                |                |   |       |          |        |         |           |       |           |
|                  | and the light with an          |          |                           |           |         |         |               |          |          |          |                |                |   |       |          |        |         |           |       |           |
|                  |                                |          |                           |           |         |         |               |          |          |          |                |                |   |       |          | _      |         |           |       |           |
|                  |                                |          |                           | •         |         | -       |               |          |          |          |                |                |   |       |          |        |         |           |       |           |
|                  |                                |          |                           |           |         |         |               |          |          |          |                |                |   |       |          |        |         |           |       |           |
|                  |                                |          |                           |           |         |         |               |          |          |          |                |                |   |       |          | 17     |         |           |       |           |
|                  |                                |          |                           |           |         |         |               |          |          |          |                |                |   |       |          |        |         |           |       |           |

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| UNIES Ltd. AIR  | TIGHTNESS TEST DATA            | FOR    | M -      | AI           | RL  | EAK          | AGE     | SE        | ALI      | NG       | CHE     | CKL     | IST            | t      | 0   | <u>جر</u> | E    | #    | 17       |   |
|---|--------------------------------|--------|----------|--------------|---|--------------|---------|-----------|----------|----------|---------|---------|----------------|--------|-----|-----------|------|------|----------|---|
| LEAKAGE<br>POINT  | = MARCH '86<br>= MARCH '88     | Living | Kitchen  | Dining       | Bedroom                                   | Bedroom<br>2 | Bedroom | Bathroom  | Bathroom | Basement |         |         |                |        |     |           |      |      |          |   |
| WINDOWS:  | MOULDING                       |        |          |              | Sto                                       | BA           | EA      | 50        | F        | PL       | 45      | TIC     | JU             | BA     | RIA | IG<br>ES  | "P   | DT   | TY       | * |
|   | FRAMES                         |        |          |              |   |              |         |           |          |          |         | 1.20    | -              |        |     |           |      | 8    |          |   |
|   | LATCHES                        |        |          |              |   |              |         |           |          | 1961     |         | 1       |                |        |     |           |      |      |          |   |
| 18  | WEATHERSTRIPPING               |        |          |              |   |              |         | 4         |          | 1945     | 潮       |         |                |        |     |           | -    |      | 42<br>42 |   |
| EXTERIOR  | MOULDING                       |        |          |              |   |              | 0       | <b>接信</b> | 0        | 1        | 1001    | 1       | -              | appirt |     |           | Sel. | gai- |          |   |
| DOORS:  | FRAMES                         |        |          |              |   | 1            |         | . 4       |          |          | 120     | and and | 編編             |        | 100 |           | 2    |      | 2        |   |
|   | LATCHES                        |        |          |              | -   |              | 1       | ſ         |          |          |         |         | friend Carrier |        |     |           |      |      |          | 1 |
| ÷ *   | WEATHERSTRIPPING               |        |          |              |   | 1            | r       |           |          |          | 14      | a.      |                |        | 1   |           |      |      |          |   |
| EXTERIOR WALL   | OUTLETS                        |        |          |              |   | 福            |         |           | -15      | . 3      |         | 44      |                |        |     |           |      |      |          |   |
| ELECTRICAL:   | SWITCHES                       | A      |          |              |   | is.          |         |           | di.      | 1        | and the | 8       |                |        |     |           | 10   |      |          |   |
|   | WIRES THRU WALL                | 10.0   | C. C. C. |              | N.  |              | ALC: NO | -The      | 1        | 1        | 1       |         |                |        |     | -         | 1    | 3    | 2 -      |   |
| INTERIOR WALL   | OUTLETS                        | 3      | 1        |              |   | a all        |         | 臟         |          | 1        |         |         |                |        |     |           |      | -    |          |   |
| ELECTRICAL:   | SWITCHES                       |        | - 26     | CENTRAL INC. |   |              |         | 12E       | 1        |          |         |         | -              |        |     | 藏         | 2    |      |          |   |
|   | WIRES THRU WALL                | 10.00  | 2        | 14           | C. S. | 1            |         | 小酒        |          | 4        |         |         |                |        | 1   | 10        | 1    |      |          | 1 |
| FIREPLACE:  | AROUND UNIT                    |        |          | A            | - 9                                       | 1111         |         | 1         |          |          | -       | 1       |                |        |     | 1         |      |      |          |   |
| +   | DAMPER/DOORS                   | 140    | 1257     | 1            | A   | 1.4          |         | 3         | 1 and    |          |         | 1933    | 自然             | 的总     | 1   |           |      |      |          |   |
| ATTIC HATCH:  | MOULDING                       |        |          | -Qal         | 4   | 6            | 1       |           | 12       |          | and the | No.     | and the second | -      |     |           | -    |      |          |   |
| 1   | FRAME                          |        | -        |              | 1   | in the       | S.      | *k        | 1        | 1        |         |         |                |        |     |           |      | -    |          |   |
|   | WEATHERSTRIPPING               | -      | İ        |              | 1.90                                      | August -     | 12.36   | 2         | 100      |          | 1.10    |         |                |        |     |           |      | -    | -        |   |
| OTHER LEAKAGE   | PLUMBING THRU WALL             |        |          |              |   |              | 1       | a line    | 6        |          | 1       |         |                | -      |     | -         |      | -    |          | - |
| AREAS:  | BASEBOARDS                     | 5      |          |              | 1   |              | -       | E.s.      | Tu       | -        |         |         |                |        |     |           |      |      | -        |   |
| da.   | FLOOR DRAIN/SUMP               |        | 5        |              | 1   | -            |         | 1000      |          |          |         |         |                | -      |     |           |      |      |          | 1 |
| ALC: NO DE CONTROL DE C | ELECTRICAL PANEL               |        | 14       | A            |   | -            |         |           |          |          |         |         |                |        |     |           | 1 1  |      |          | _ |
|   | CHIMNEY                        |        | 111721   |              | 5.  | -            | -       |           | -        |          |         |         | -              |        |     |           |      | -    |          |   |
|   | JOISTS OVER<br>ATTACHED GARAGE |        |          | A.S.         |   |              |         |           |          |          |         | 4       |                |        |     |           |      |      | •        |   |
|   | HEADER AREA                    | 24     | 84       |              |   |              |         |           | -        |          |         |         |                |        |     |           |      |      |          |   |
|   | AULAN INTAKES EXHAN            | T      | 7        | -            | 1   | -            | -       |           | 1        |          | -       |         |                |        |     |           | -    | -    | -        |   |
|   | WHER-INSTALLED                 |        |          | -            | -   | -            |         |           | -        | F        |         | -       | -              | -      |     | -         |      |      |          |   |
|   | THRU CONC. WALL                | 05     | -        |              | -   |              | -       |           | -        |          | -       |         | -              |        |     | -         | -    | -    |          |   |
|   | "Mulanyana water               |        | -        | $\vdash$     | -   |              | -       |           | -        | -        | -       | -       | -              | -      |     | -         |      | _    |          |   |
|   |                                | -      | -        | -            | -   | -            | -       | -         | -        | -        | -       | -       | -              | -      | -   | -         |      | _    | _        |   |
|   |                                | -      | -        |              | -   |              |         | -         | -        |          |         | -       | -              |        | -   | -         |      | _    | -        |   |
|   |                                | -      | -        | -            | -   | -            | -       |           | -        | -        | -       | -       | -              |        | -   | -         |      |      | -        |   |
|   |                                | -      | -        | -            | -   |              | -       | -         | -        |          | -       | -       |                | -      | -   | -         |      |      |          | _ |
|   | and the first state where a    |        | <u> </u> |              | 1   |              |         |           |          |          |         | L.,     |                |        | _   |           |      |      |          |   |

| TUNINESS TEST DATA             | FUT   | <m -<="" th=""><th>• A.</th><th>IR L</th><th>EAK</th><th>AGE</th><th>SE</th><th>ALI</th><th>NG</th><th>CHE</th><th>CKL</th><th>IST</th><th>F</th><th>10</th><th>ບ<del>≤</del></th><th>PE-</th><th>. т</th><th>-15</th><th>5</th></m>  | • A.  | IR L  | EAK   | AGE   | SE   | ALI   | NG   | CHE  | CKL  | IST  | F   | 10  | ບ <del>≤</del>  | PE-   | . т   | -15  | 5   |
|--------------------------------|---|---|---|---|---|---|--|---|--|--|--|--|---|---|---|---|---|--|---|
| = JULY '860<br>= FEB '88       | Living  | Kitchen   | Dining  | Bedroom   | Bedroom   | Bedroom   | Bathroom   | Bathroom  | Basement   |  |  |  |   |   |   |   |   |  |   |
| MOULDING                       |   |   |   |   |   |   |  |   |  | 1  | 1.   | 11.2   |   |   |   |   |   |  |   |
| FRAMES                         |   |   |   |   |   |   |  |   |  | 1  | 13.4   | and a  |   |   | 1   |   |   |  |   |
| LATCHES                        |   | 1.1   |   |   |   |   |  |   | NUS.   | 1  | 1  |  |   |   |   |   |   | 1  |   |
| WEATHERSTRIPPING               |   |   |   | 94.7  |   |   |  |   | E.T.   |  |  |  |   |   |   | _   |   |  |   |
| MOULDING                       |   |   |   | $\square$   |   | 100   |  | 1.  | 1  | 1000   |  | -  | TRA   | Contra State  |   |   | 海道  | See.   | in.   |
| FRAMES                         |   |   |   |   | A   | Lange St.   | 1.30   | 1.  |  | - Col  | N.C.   |  | 1   | 3   | 12340   | -   |   | 1  | 品出  |
| LATCHES                        |   |   |   | 5   | Column<br>Press   | 1   | 1  |   |  |  |  | Column .   | 0.24  |   |   |   |   |  | <b>茶店</b>   |
| WEATHERSTRIPPING               | +   | 1   |   | 1   | 1.34  | 1 and   |  |   |  | 1  | à.   |  |   |   |   |   | £.,   |  | 第   |
| OUTLETS                        |   |   |   | 1   |   | -4  |  |   |  |  |  | -  |   |   | -   |   |   |  | 、   |
| SWITCHES                       | 1   |   |   | 1.00  | 影   | 1   |  | B   |  | 100  | 1  |  |   |   |   | 304.0   | mart  | al an  | 190   |
| WIRES THRU WALL                | 100   | 8   |   | A Carlos  |   | 19000   | erest.   |   | 191  | a.<br>Con  | -  |  |   |   |   | 副   | 网络  |  | 30  |
| OUTLETS                        | 1   | 23  |   |   | 1   |   | 1  |   | 14   |  |  |  |   |   | 1   | -   |   |  | -   |
| SWITCHES                       | -   | N. W.   |   |   |   | V-coles   | シシシ  |   |  |  | -  |  |   |   | 1   | A   |   | 4.   |   |
| WIRES THRU WALL                | 金   | Da.   | 1000  | Catal.  | and the   |   | 1  |   |  |  |  |  |   | All all   | 2   | P   |   |  |   |
| AROUND UNIT                    | 1432  | Carlin Carling  | 14  | 620   |   | 1   | 4  |   | 1  |  |  |  | 10  | Te  | and a   |   |   |  | -   |
| DAMPER/DOORS                   | 199   | Contraction of the second   |   | th.   | 10460   | (the  | 123  | 1   | je je  |  |  | CORO.  | 18.   | Canto<br>V  | -   | -   |   |  | -   |
| MOULDING                       |   | - 40  | 1   | 1   | 2   | 14200   | 100  | Siz.  | · ·  | -  | - alies  | SUN  | 1000  | 1   |   |   |   |  |   |
| FRAME                          | -   | -   | 2   | 1953  | NG.   | 5.  | 100  |   | A.   |  | -  | -  |   | -   |   | -   | *   |  | -   |
| WEATHERSTRIPPING               |   | -   |   | 190   | ARE:  | 15.22A  |  | da a  |  | ALL S  | -  | -  |   | -   |   | -   |   |  | -   |
| PLUMBING THRU WALL             |   |   |   | 1   | - 42  |   | And A  |   | 1000   | 1  |  | -  |   | -   |   | -   |   | -  |   |
| BASEBOARDS                     |   |   | -   |   |   | 100   | -Englis  |   | -  |  |  | -  | -   |   |   | -   | -   |  | -   |
| FLOOR DRAIN/SUMP               | 14  | 12  | -   |   | -   |   | 192  | 1   | -  |  |  |  | -   |   |   |   | -   |  |   |
| ELECTRICAL PANEL               | 1400  | なる  | in.   |   | -   |   | -  |   |  | -  |  |  |   | -   |   | -   | -   | -  |   |
| CHIMNEY                        | 46  | Clark   | 100   |   |   |   |  | -   | -  | -  | -  |  |   |   |   | -   |   |  |   |
| JOISTS OVER<br>ATTACHED GARAGE |   | 13  | A COL   | - Co  |   |   |  |   |  |  |  |  |   |   |   |   |   |  |   |
| HEADER AREA                    | 1   | 1   |   |   |   |   |  |   |  | -  | -  | -  |   | -   |   | -   |   |  |   |
| TEARS IN A.V.B. APOU           | DU  | 150.75  | -   | -   |   | -   | -  | -   |  | -  | -  | -  | -   |   |   | -   |   |  |   |
| WILLOW OPENINGS                | 100   | -   | -   | -   | -   | -   | -  | -   |  |  |  |  | -   |   |   |   |   |  | -   |
| There are a straight of the    | -   | -   |   | -   |   |   | -  | -   | -  |  | -  |  | -   |   |   | -   | -   | -  |   |
|                                |   | -   | -   | -   |   | -   |  | -   |  | -  |  |  |   |   |   | -   | -   |  |   |
|                                |   | -   |   | -   | -   | -   | -  | -   | -  |  | -  | -  | -   |   | -   | -   | -   | -  |   |
|                                | -   | -   |   | -   | -   | -   |  | -   | -  | -  |  | -  | -   |   | -   |   | -   | -  |   |
|                                | -   | -   | -   | -   |   | -   | -  | -   | -  | -  | -  | -  | -   |   |   |   |   | -  | _   |
|                                |   | -   | -   |   | -   | -   | -  | -   | -  | -  | -  | -  | -   |   |   |   |   | -  |   |
|                                | = JOLY '86<br>= FEE '88<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>WEATHERSTRIPPING<br>PLUMBING THRU WALL<br>BASEBOARDS<br>FLOOR DRAIN/SUMP<br>ELECTRICAL PANEL<br>CHIMNEY<br>JOISTS OVER<br>ATTACHED GARAGE<br>HEADER AREA<br>TEAPS IN A.V.B. APON | JULY '80<br>FEB '88<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>WEATHERSTRIPPING<br>PLUMBING THRU WALL<br>BASEBOARDS<br>FLOOR DRAIN/SUMP<br>ELECTRICAL PANEL<br>CHIMNEY<br>JOISTS OVER<br>ATTACHED GARAGE<br>HEADER AREA<br>TEAPS IN A.V.B. APOUND<br>MINES AROUND<br>MOULDING | JULY '86     FEB '88      MOULDING     FRAMES     LATCHES     WEATHERSTRIPPING     MOULDING     FRAMES     LATCHES     WEATHERSTRIPPING     OUTLETS     SWITCHES     WIRES THRU WALL     OUTLETS     SWITCHES     WIRES THRU WALL     AROUND UNIT     DAMPER/DOORS     MOULDING     FRAME     WEATHERSTRIPPING     PLUMBING THRU WALL     BASEBOARDS     FLOOR DRAIN/SUMP     ELECTRICAL PANEL     CHIMNEY     JOISTS OVER     ATTACHED GARAGE     HEADER AREA     TEAPS INJ A.V.B. APOONDP     SUILEDS     SUILES     SUILES     SUILES     SUILES     SUITCHES     SUICHES     SUIC | JULY '86<br>FEB '88<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>WEATHERSTRIPPING<br>PLUMBING THRU WALL<br>BASEBOARDS<br>FLOOR DRAIN/SUMP<br>ELECTRICAL PANEL<br>CHIMNEY<br>JOISTS OVER<br>ATTACHED GARAGE<br>HEADER AREA<br>TEAPS IN A.V.B. APOUND<br>MOULDING<br>FLOOR DRAIN/SUMP<br>ELECTRICAL PANEL<br>CHIMNEY<br>JOISTS OVER<br>ATTACHED GARAGE<br>HEADER AREA<br>TEAPS IN A.V.B. APOUND<br>MOULDING<br>FLOOR DRAIN/SUMP<br>ELECTRICAL PANEL<br>CHIMNEY<br>JOISTS OVER<br>ATTACHED GARAGE<br>HEADER AREA<br>TEAPS IN A.V.B. APOUND<br>MOULDING<br>FLOOR DRAIN/SUMP<br>CHIMNEY<br>JOISTS OVER<br>ATTACHED GARAGE<br>HEADER AREA | JULY '80     FEE '88     FEE '88     FEE '88     MOULDING     FRAMES     LATCHES     WEATHERSTRIPPING     MOULDING     FRAMES     LATCHES     WEATHERSTRIPPING     OUTLETS     SWITCHES     WIRES THRU WALL     OUTLETS     SWITCHES     WIRES THRU WALL     AROUND UNIT     DAMPER/DOORS     MOULDING     FRAME     WEATHERSTRIPPING     PLUMBING THRU WALL     BASEBOARDS     FLOOR DRAIN/SUMP     ELECTRICAL PANEL     CHIMNEY     JOISTS OVER     ATTACHED GARAGE     HEADER AREA     TEAPE INI A.Y.E. APPONNO     SONAL DOWN OF ELILILICIS | JULY '86     FEB '88     Figure 1     F | JULY '800       Image: Section of the sec | JULY '86     FEE '88     Provide Structure Structur | JULY '80     FEE '88     Fee '88 | = JULY '86<br>= FEB '88<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>OUTLOUTETS<br>SWITCHES<br>WIRES THRU WALL<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>UTLETS<br>SWITCHES<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>ELECTRICAL PANEL<br>CHIMNEY<br>JOISTS OVER<br>ATTACHED GARAGE<br>HEADER AREA<br>SUN AND AND AND AND AND AND AND AND AND AN | = JULY '86<br>= FEB '88<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>E<br>E<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCH | = JOLY '86<br>= PEB '88<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>OUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>MOULDING<br>FRAME<br>SWITCHES<br>WIRES THRU WALL<br>AROUND 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MOULDING     FRAME     SUITCHES     SUITCHE | JULY '86     FRE' 88     Figure 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | JULY '86       B< | JULY '86     PEB '88     Peg 19 11 11 10 10 10 10 10 10 10 10 10 10 10 | UNULDING<br>FRAMES<br>MOULDING<br>FRAMES<br>LATCHES<br>WEATHERSTRIPPING<br>WEATHERSTRIPPING<br>UUTLETS<br>SWITCHES<br>WIRES THRU WALL<br>AROUND UNIT<br>DAMPER/DOORS<br>FLOOR DRAIN/SUMP<br>ELECTRICE ARAGE<br>FLOOR DRAIN/SUMP<br>ELECTRICE ARAGE<br>FLOOR DRAIN/SUMP<br>ELECTRICE ARAGE<br>ATLACHED GARAGE<br>HEADER AREA<br>TEAMES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES<br>SWITCHES 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| UNIES Ltd. AIR   | TIGHTNESS TEST DATA                    | FOR        | M -  | AI     | RL      | EAK                                      | AGE          | SE       | ALI        | NG                | СНЕ     | CKL   | IST           | H         | de la     | SE         | . ‡ | + ۱۹ | Э  |     |
|------------------|--|------------|--|--------|---------|--|--------------|----------|------------|-------------------|---------|-------|---------------|-----------|-----------|------------|-----|------|----|-----|
| LEAKAGE<br>POINT | = MARCH`86<br>= FEB. '88               | Living     | Kitchen  | Dining | Bedroom | Bedroom<br>2                             | Bedroom<br>3 | Bathroom | Bathroom   | Basement          |         |       |               |           |           |            |     |      |    |     |
| WINDOWS:         | MOULDING                               |            |  |        |         |  |              |          |            |                   |         |       |               |           |           |            |     |      |    |     |
| 4                | FRAMES                                 |            |  |        | Î       | 1  |              |          |            |                   | 1       | 1.78  |               |           |           |            |     |      |    |     |
|                  | LATCHES                                |            |  |        |         |  |              |          |            | 11                | a the s | Y     |               |           |           |            |     |      |    |     |
|                  | WEATHERSTRIPPING                       | <i>x</i> . |  |        |         |  |              |          |            | North Contraction | 物品      | K     |               |           |           |            |     | -    |    |     |
| EXTERIOR         | MOULDING                               |            |  |        |         |  | de           |          | 6          | 1                 |         | 1     | -             | anotic la | and a     | 195        | 100 | 2.78 |    | Ē., |
| DOORS:           | FRAMES                                 |            |  |        |         | 1  | 15           | 1        | 1          | 1                 | 100     |       | 1946          | 16 B      |           | a contract |     | 1    | 6  | 1   |
|                  | LATCHES                                |            |  |        | A       | 199                                      | 2            | r        |            |                   |         |       | -             | ec. are   | -Lar      |            |     |      |    |     |
|                  | WEATHERSTRIPPING                       |            | 1  |        |         | 14                                       | 1            |          | ·          |                   |         | 1     |               |           |           |            |     |      |    |     |
| EXTERIOR WALL    | OUTLETS                                |            |  |        |         |  |              |          |            |                   |         | 記録    | •             |           |           |            |     |      |    |     |
| ELECTRICAL:      | SWITCHES                               | Å          |  | -      | 影響和     | E.                                       | -            | -        | 1          |                   | EV.BH   | 1     |               | -         |           |            | -   | -    | t. |     |
|                  | WIRES THRU WALL                        | Carlo      |  |        | 1999 A. | ECIA                                     | 23502        | 15555    | Brack      | N.C.S.            | 1       |       |               |           |           |            | -97 |      |    | -   |
| INTERIOR WALL    | OUTLETS                                | 4100       | 0  |        | 64      | C. C | New York     | 1        | the second | 1                 |         |       |               |           | -         | -          | -   | -    |    | -   |
| ELECTRICAL:      | SWITCHES                               |            | 22   | A X    |         |  |              | 138      | を読         | -                 |         |       |               | -         | 1         | 188        | ·   |      |    |     |
|                  | WIRES THRU WALL                        | 1          | 01 01  | 1      |         |  |              | 100      | and the    |                   |         |       |               |           | all'al    | 2 Car      | 1   |      |    |     |
| FIREPLACE:       | AROUND UNIT                            |            | 記念の  | 6      | - EBR   | 1000 A                                   | 100          | 35       | 1          |                   |         | -     |               | and the   | EN PER    | alle "     | -   |      |    |     |
|                  | DAMPER/DOORS                           | 1986       | and a state of the | il del | 6       | 1314                                     | 1.345<br>642 | A.       | 1000       | 1718              | 100     | 1000  | art<br>Antist |           | UHRS<br>V | -          | -   |      |    |     |
| ATTIC HATCH:     | MOULDING                               | -          | 90   |        |         | A  | - March      |          | 語          | 1000              | 12000   | EL/GR | 1.2.1.P       | Sec.      |           |            | -   | -    | _  |     |
|                  | FRAME                                  |            |  |        | 6.388   | Post and                                 | 6            |          | 100        | 1                 |         |       |               | -         |           |            | -   |      |    |     |
|                  | WEATHERSTRIPPING                       |            | -  |        |         | Contraction of the second                | and a        | 6        | 1000       | 1                 |         |       |               | -         |           |            | -   | -    |    |     |
| OTHER LEAKAGE    | PLUMBING THRU WALL                     |            |  |        |         | 1  |              | 100      | 6          | 1                 | 1       |       |               |           |           |            | -   | -    |    | -   |
| AREAS:           | BASEBOARDS                             | K          | -  | -      |         | -  | 3            |          |            |                   | -       |       |               |           |           | -          |     |      |    | -   |
| a.               | FLOOR DRAIN/SUMP                       | 100        | 6  | 12     |         |  | -            | 19       | 1          |                   |         |       |               |           | -         | -          |     | -    |    | -   |
|                  | ELECTRICAL PANEL                       |            | 2000   |        |         | -  |              |          | 1          |                   | -       |       |               |           | -         |            | -   |      |    |     |
| Anne             | CHIMNEY                                | -90        | 1  | 1      |         | -  | -            | -        | -          |                   |         |       | -             | -         |           |            |     |      |    |     |
| N. W. W.         | JOISTS OVER<br>ATTACHED GARAGE         | A          |  | ASS OF |         |  | Γ            |          |            |                   |         |       |               |           |           |            |     |      |    |     |
|                  | HEADER AREA                            | 14         | A  |        |         |  | -            |          |            |                   | -       |       |               |           | -         |            | -   | -    |    |     |
| a starter        | HAN ILTAKE & EXHOUSE<br>THE COLL. WALL |            | are a  |        |         |  |              |          |            |                   |         |       | _             |           |           |            |     |      |    |     |
|                  | WIRING UNDER CANT<br>FLOOR BAY WINDOW  | LE:        | ER   | -      | -       | -  | -            | -        | ┝          |                   |         | -     | -             | _         | -         |            |     | -    | _  | _   |
|                  |  |            |  |        | 4       |  |              |          |            |                   |         |       |               |           |           |            |     |      |    |     |
|                  |  | -          | -  | -      | -       | -  |              | -        | $\vdash$   |                   |         | -     | -             | -         | -         |            | -   | -    | -  | -   |
|                  |  |            |  |        |         |  |              |          |            |                   |         |       |               |           |           |            |     |      |    |     |
|                  |  |            |  |        |         |  |              |          |            |                   |         |       |               |           |           |            |     |      |    |     |

| UNIES Ltd. AIF        | RTIGHTNESS TEST DATA   | FOF           | RM -          | - A1    | IR I          | EAK     | AGE     | SE            | ALI               | NG           | CHE       | CKL   | IST            | Н         | α        | 151    | 2           | #:  | 20      |      |
|-----------------------|--|---------------|---------------|---------|---------------|---------|---------|---------------|-------------------|--------------|-----------|-------|----------------|-----------|----------|--------|-------------|-----|---------|------|
| LEAKAGE<br>POINT      | = MARCH'86<br>= FEB '88  | Living        | Kitchen       | Dining  | Bedroom       | Bedroom | Bedroom | Bathroom      | Bathroom          | Basement     |           |       |                |           |          |        |             | -   |         |      |
| WINDOWS:              | MOULDING   |               |               |         | 4             | BA      | ER      | 50            | F                 | PL-          | 45        | nc    | 41             | AZ        | 1H       | 4      | PU          | TT  | 1       |      |
|                       | FRAMES   |               |               |         |               | 1       | TAI     | A             | 10                | 15           | 1.2.2     |       | -              | -         |          | -      |             |     |         |      |
|                       | LATCHES  |               |               |         |               |         |         |               |                   | 1            | A THE     | 1     |                |           |          |        |             |     |         | -    |
|                       | WEATHERSTRIPPING   | 1             |               |         |               |         |         |               | 1                 | 126          | NAR B.    | 6     |                |           |          |        |             |     |         |      |
| EXTERIOR              | MOULDING   | $\vdash$      |               |         |               | 1       | 4       | 1             | 5                 |              | Nation of | -     |                |           | antin    |        | (a)is       | 125 |         | in a |
| DOORS:                | FRAMES   |               | -             |         | $\top$        | A       | 1       | 1             | 1                 |              | V         | 122   |                | 100       |          | 1000   | -           | -   | AND A   |      |
|                       | LATCHES  |               | 1             |         | 1             |         | 1       | 1             | -                 |              |           | 10000 | -              | diabers ? | 1        |        |             |     |         |      |
|                       | WEATHERSTRIPPING   | +             |               |         |               | -       | 1       |               |                   |              | 1         | R.    |                |           |          |        | 18.5        |     |         | n:   |
| EXTERIOR WALL         | OUTLETS  |               | 1             |         |               | 1       |         |               |                   |              | 199       | - m.  | F              |           | 1        | 1      |             |     | -       | 15h  |
| ELECTRICAL:           | SWITCHES BESIDE  | i.            |               |         | 64            | 1       |         |               | A                 |              |           | 1     |                |           |          |        |             | -   | alian a | 1    |
|                       | WIRES THRU WALL  |               | 1             |         | THE R         | COLOR.  | Sale -  | anth.         |                   | 14/6         | 1000      |       |                |           | $\vdash$ |        | 978<br>1941 | in  | 12/11   | G.   |
| INTERIOR WALL         | OUTLETS  | 1             | Sec.          | 1       |               | and and |         | 33            | 1                 | and and      |           |       |                |           | 1        |        | - 200       |     |         | -    |
| ELECTRICAL:           | SWITCHES   |               |               |         | 1078          |         |         | 1             | in the            | -            |           |       |                |           |          | æ      | 5           |     | -       |      |
|                       | WIRES THRU WALL  | 1             | 6             | X       | Carlos Carlos | 山谷      |         | 100           | 1                 |              | 1         |       |                |           |          |        | 1           |     |         | -    |
| FIREPLACE:            | AROUND UNIT  |               | 2.74          | 1       | 100           | 24.A    | 100     | 1             | 14.62             | C.A.         |           |       |                | 1         | 1222     | areans |             |     |         | -    |
|                       | DAMPER/DOORS   | -60           | Calling State | 120     | the second    | 1400    | いたが     | 1             | Carellon Carellon | 6-D          | Sec.      | 100   | 1310           | TV de     | 1000     | -      | -           |     |         | -    |
| ATTIC HATCH:          | MOULDING   | $\vdash$      | 1             | -Tere   | 100           | 1       | 100     | arud<br>Safat | 196               |              | 100       | 1.4   | and the second | Ciller.   |          |        | -           |     |         | -    |
| . A                   | FRAME  | -             |               | -10     |               | COLON.  | 2       | 12.25         | 4465              | 1            |           | -     |                | -         | -        |        |             |     |         |      |
|                       | WEATHERSTRIPPING   | -             | -             |         | - 105         |         | 100     |               | 1000              | and a second |           | -     | -              | -         | -        |        | -           |     |         | -    |
| OTHER LEAKAGE         | PLUMBING THRU WALL   |               |               |         |               | 1       |         | 100           | 6                 | 19           | 1         |       |                |           |          |        | -           |     |         | -    |
| AREAS:                | BASEBOARDS   | 2.            | 1             | -       | -             | -       | (atta)  |               | 13                | -            |           | -     | -              |           |          |        | -           |     |         | -    |
|                       | FLOOR DRAIN/SUMP   | in the second | 3.            |         | -             | -       | -       | 1419-1        | X                 |              |           | -     |                | 7         |          |        |             |     |         |      |
| and the second second | ELECTRICAL PANEL   | 1000          | 10120         | 4       | 1             | -       | -       |               |                   |              | -         |       | -              | -         |          | -      |             |     |         | -    |
| C. C. S. C.           | CHIMNEY  | 100           | ALC: NOR      | 1.95    | k.,           |         |         |               |                   |              |           |       |                |           |          | -      | -           |     | -       |      |
|                       | JOISTS OVER<br>ATTACHED GARAGE   | A             | 100           | and the | 100           |         | 1       |               |                   |              |           |       |                |           |          |        |             |     |         |      |
|                       | HEADER AREA  | 135           | 1             |         |               |         |         |               |                   |              |           |       |                |           | -        |        |             |     |         |      |
|                       | HAU INTAKE EXHAUST<br>THEN COLL. WALL<br>DANES VENT<br>THEN COLL. WALL | 1             |               |         |               |         |         |               |                   |              |           |       |                |           |          |        |             |     |         |      |
|                       |  |               |               |         |               |         |         | _             |                   |              |           |       |                |           |          |        |             |     |         |      |
|                       |  |               |               |         |               |         |         |               |                   |              |           |       |                |           |          |        |             |     |         |      |
|                       |  |               |               |         |               |         | -       |               |                   |              |           |       |                |           |          |        |             |     |         |      |
| HOUSE #                  | DATE OF TEST                  |             |            |            |            |           |            |  |  |
|--------------------------|-------------------------------|-------------|------------|------------|------------|-----------|------------|--|--|
| 1                        | Mar.25/86 Nov.21/86 Feb.14/87 |             |            |            |            |           |            |  |  |
|                          | 1.669                         | 6.          | 1.475      | 1.568      |            |           | 1.479      |  |  |
| 2                        |                               | Jul.16/86   | Nov.24/86  | Feb.18/87  | Ju1.6/87   | Nov.18/87 | Mar.8/88   |  |  |
|                          |                               | 1.053       | 1.171      | 1.119      | 0.977      | 1.047     | 1.169      |  |  |
| 3                        | Mar.15/86                     |             | Nov.25/86  | Feb.15/87  | Jul.8/87   |           | Mar.4/88   |  |  |
|                          | 1.509                         |             | 1.539      | 1.852      | 1.486      |           | 1.689      |  |  |
| 4                        | Mar.25/86                     |             | Nov.26/86  | Feb.17/87  | Jul.13/87  |           | Mar.3/88   |  |  |
|                          | 1.455                         |             | 1.311      | 1.299      | 1.115      |           | 1.415      |  |  |
| 5                        | Mar.24/86                     |             | Nov.26/86  | Feb.20/87  | Ju1.9/87   |           | Mar.2/88   |  |  |
|                          | 1.118                         |             | 1.264      | 1.104      | 1.144      |           | 1.049      |  |  |
| 6                        | Mar.15/86                     |             | Nov.24/86  | Feb.14/87  | Jul.10/87  |           | Feb.29/88  |  |  |
|                          | 1.205                         |             | 1.255      | 1.306      | 1.187      |           | 1.417      |  |  |
| 7                        | Mar.25/86                     |             | Nov.26/86  | Feb.16/87  |            |           |            |  |  |
|                          | 1.166                         |             | 1.522      | 2.196      |            |           |            |  |  |
| 8                        | Mar.14/86                     |             | Dec.1/86   | Feb.20/87  | Jul.20/87  |           | Mar.2/88   |  |  |
|                          | 1.588                         |             | 1.392      | 1.740      | 1.342      |           | 1.444      |  |  |
| 9                        | Mar.24/86                     | Jul.16/86   | Nov.24/86  | Feb.15/87  | Jul.23/87  | Nov.25/87 | Mar.2/88   |  |  |
| 101                      | 1.622                         | 1.655       | 1.741      | 1.838      | 1.484      | 1.684     | 1.781      |  |  |
| 10                       | Mar.26/86                     | Jul.14/86   | Nov.21/86  | Feb.21/87  | Jul. 14/87 | Nov.30/87 | Mar.8/88   |  |  |
|                          | 1.281                         | 1.152       | 1.429      | 1.386      | 1.167      | 1.038     | 1.032      |  |  |
| 11                       | Mar.22/86 ·                   | . Jun.11/86 | Nov.26/86  | Feb. 16/87 | Jul.9/87   |           | Mar.2/88   |  |  |
|                          | 1.694*                        | 0.892       | 0.962      | 0.881      | 0.879      |           | 1.007      |  |  |
| 12                       | Mar.23/86                     | May 28/86   | Nov.20/86  | Feb.16/87  | Jul.8/87   |           | Mar.9/88   |  |  |
|                          | 1.593*                        | 1.120       | 0.960      | 0.979      | 0.878      |           | 0.980      |  |  |
| 13                       | Apr.25/86                     | Jul.18/86   | Dec.8/86   | Feb.18/87  | Jul.8/87   |           | Mar.9/88   |  |  |
|                          | 1.268*                        | 0.836       | 0.830      | 0.761      | 1.043      |           | 0.938      |  |  |
| 14                       | Mar.22/86                     | Jun.10/86   |            | Feb.19/87  | Jul.15/87  |           | Mar.3/88   |  |  |
|                          | 1.319*                        | 1.136       |            | 0.955      | 0.989      |           | 1.155      |  |  |
| 15                       | Mar.15/86                     | May 7/86    | Nov.20/86  | Feb.20/87  |            |           | Mar.3/88   |  |  |
|                          | 1.473*                        | 1.328       | 1.257      | 1.152      |            |           | 1.104      |  |  |
| 16                       | Mar.26/86                     | Jul.14/86   | Nov.21/86  | Feb.17/87  |            |           | Mar.9/88   |  |  |
|                          | 1.258*                        | 1.292       | 1.382      | 1.405      |            |           | 1.519      |  |  |
| 17                       | Mar.24/86                     | Jul.29/86   | Nov.20/86  | Feb.13/87  | Aug. 25/87 | Dec.1/87  | Mar.24/88  |  |  |
|                          | 0.549*                        | 0.363       | 0.713      | 0.437      | 0.570      | 0.384     | 0.564      |  |  |
| 18                       | Mar.16/86                     | Ju1.28/86   | Nov.29/86  | Feb.19/87  | Jul.22/87  | Nov.24/87 | Mar.2/88   |  |  |
|                          | 0.486*                        | 0.416       | 0.478      | 0.480      | 0.385      | 0.418     | 0.434      |  |  |
| 19                       | Mar.23/86                     | Jul.14/86   | Dec.8/86   | Feb. 17/87 | Jul. 16/87 |           | Feb. 29/88 |  |  |
|                          | 1.049*                        | 0.807       | 0.842      | 0.908      | 0.715      |           | 1.038      |  |  |
| 20                       | Mar.23/86                     | Ju1.25/86   | Nov. 25/86 | Feb. 13/87 | Jul. 17/87 |           | Mar . 8/88 |  |  |
| a contract of the second | 1.126*                        | 0,708       | 0.815      | 0.731      | 1.008      |           | 0.797      |  |  |

### TABLE 2 AIRTIGHTNESS TEST RESULTS Air Changes Per Hour @ 50 Pascals (ac/hr<sub>50</sub>)

## NOTES

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1. \* Indicates no stucco.

| HOUSE # | DATE OF TEST |           |                     |            |            |           |           |  |  |  |
|---------|--------------|-----------|---------------------|------------|------------|-----------|-----------|--|--|--|
| 1       | Mar.25/86    |           | Nov.21/86 Feb.14/87 |            |            |           | Feb.29/88 |  |  |  |
|         | 0.577        |           | 0.467               | 0.380      |            |           | 0.477     |  |  |  |
| 2       |              | Jul.16/86 | Nov.24/86           | Feb.18/87  | Ju1.6/87   | Nov.18/87 | Mar.8/88  |  |  |  |
|         |              | 0.410     | 0.603               | 0.451      | 0.400      | 0.425     | 0.503     |  |  |  |
| 3       | Mar.15/86    |           | Nov.25/86           | Feb.15/87  | Jul.8/87   |           | Mar.4/88  |  |  |  |
|         | 0.513        |           | 0.517               | 0.762      | 0.564      |           | 0.656     |  |  |  |
| 4       | Mar.25/86    |           | Nov.26/86           | Feb.17/87  | Jul.13/87  | 1.        | Mar.3/88  |  |  |  |
|         | 0.585        |           | 0.482               | 0.551      | 0.437      |           | 0.643     |  |  |  |
| 5       | Mar.24/86    |           | Nov.26/86           | Feb.20/87  | Jul.9/87   |           | Mar.2/88  |  |  |  |
|         | 0.444        |           | 0.450               | 0.432      | 0.334      |           | 0.341     |  |  |  |
| 6       | Mar.15/86    |           | Nov.24/86           | Feb.14/87  | Jul. 10/87 |           | Feb.29/88 |  |  |  |
|         | 0.473        |           | 0.488               | 0.613      | 0.366      |           | 0.581     |  |  |  |
| 7       | Mar.25/86    |           | Nov.26/86           | Feb.16/87  |            |           |           |  |  |  |
|         | 0.433        |           | 0.637               | 0.981      |            |           |           |  |  |  |
| 8       | Mar.14/86    |           | Dec.1/86            | Feb.20/87  | Jul.20/87  |           | Mar.2/88  |  |  |  |
|         | 0.857        |           | 0.636               | 0.745      | 0.620      |           | 0.664     |  |  |  |
| 9       | Mar.24/86    | Jul.16/86 | Nov.24/86           | Feb. 15/87 | Jul.23/87  | Nov.25/87 | Mar.2/88  |  |  |  |
|         | 0.560        | 0.587     | 0.566               | 0.623      | 0.596      | 0.641     | 0.659     |  |  |  |
| 10      | Mar.26/86    | Jul.14/86 | Nov.21/86           | Feb.21/87  | Jul.14/87  | Nov.30/87 | Mar.8/88  |  |  |  |
|         | 0.588        | 0.418     | 0.642               | 0.805      | 0.404      | 0.441     | 0.392     |  |  |  |
| 11      | Mar.22/86    | Jun.11/86 | Nov.26/86           | Feb. 16/87 | Ju1.9/87   |           | Mar.2/88  |  |  |  |
|         | 0.753*       | 0.345     | 0.396               | 0.317      | 0.282      |           | 0.370     |  |  |  |
| 12      | Mar.23/86    | May 28/86 | Nov.20/86           | Feb. 16/87 | Jul.8/87   |           | Mar. 9/88 |  |  |  |
|         | 0.835*       | 0.468     | 0.417               | 0.329      | 0.318      |           | 0.405     |  |  |  |
| 13      | Apr.25/86    | Jul.18/86 | Dec.8/86            | Feb. 18/87 | Jul.8/87   |           | Mar.9/88  |  |  |  |
|         | 0.569*       | 0.360     | 0.314               | 0.401      | 0.437      |           | 0.403     |  |  |  |
| 14      | Mar.22/86    | Jun.10/86 |                     | Feb.19/87  | Jul. 15/87 |           | Mar.3/88  |  |  |  |
|         | 0.754*       | 0.490     |                     | 0.516      | 0.393      |           | 0.467     |  |  |  |
| 15      | Mar.15/86    | May 7/86  | Nov.20/86           | Feb.20/87  |            |           | Mar.3/88  |  |  |  |
| 10.550  | 0.774*       | 0.655     | 0.597               | 0.547      |            |           | 0.539     |  |  |  |
| 16      | Mar.26/86    | Jul.14/86 | Nov.21/86           | Feb.17/87  |            |           | Mar.9/88  |  |  |  |
|         | 0.677*       | 0.675     | 0.714               | 0.711      |            |           | 0.777     |  |  |  |
| 17      | Mar.24/86    | Jul.29/86 | Nov.20/86           | Feb.13/87  | Aug. 25/87 | Dec.1/87  | Mar.24/88 |  |  |  |
|         | 0.278*       | 0.154     | 0.340               | 0.166      | 0.250      | 0.132     | 0.307     |  |  |  |
| 18      | Mar.16/86    | Jul.28/86 | Nov.29/86           | Feb.19/87  | Jul.22/87  | Nov.24/87 | Mar.2/88  |  |  |  |
|         | 0.259*       | 0.227     | 0.190               | 0.192      | 0.155      | 0.138     | 0.171     |  |  |  |
| 19      | Mar.23/86    | Jul.14/86 | Dec.8/86            | Feb. 17/87 | Jul. 16/87 |           | Feb.29/88 |  |  |  |
|         | 0.444*       | 0.232     | 0.320               | 0.347      | 0.279      | ž.        | 0.402     |  |  |  |
| 20      | Mar.23/86    | Jul.25/86 | Nov.25/86           | Feb.13/87  | Jul.17/87  |           | Mar.8/88  |  |  |  |
|         | 0.560*       | 0.298     | 0.287               | 0.208      | 0.444      |           | 0.299     |  |  |  |

TABLE 3 AIRTIGHTNESS TEST RESULTS Normalized Leakage Area @ 10 Pascals (NLA<sub>10</sub>)

## NOTES

1. \* Indicates no stucco.

#### TABLE 4

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CHANGE IN AIRTIGHTNESS BETWEEN INITIAL AND MOST RECENT TESTS

| HOUSE #   | AC<br>INITIAL FINAL   | /HR <sub>50</sub><br>ABS. CHG. %  | INITIAL   | NL<br>FINAL  | A <sub>10</sub><br>ABS. CHG.  | %   | MONTHS BETWEEN INITIAL<br>AND MOST RECENT TEST   |
|---|---|---|---|--|---|---|--|
| 1<br>2<br>3<br>4<br>5<br>6<br>7<br>8<br>9<br>10<br>11<br>12<br>13<br>14<br>15<br>16<br>17<br>18<br>19<br>20 | $\begin{array}{cccccccccccccccccccccccccccccccccccc$                            | $\begin{array}{cccccccccccccccccccccccccccccccccccc$  | 0.577<br>0.410<br>0.513<br>0.585<br>0.444<br>0.473<br>0.433<br>0.433<br>0.857<br>0.559<br>0.588<br>0.345<br>0.468<br>0.345<br>0.468<br>0.360<br>0.490<br>0.655<br>0.675<br>0.154<br>0.227<br>0.232<br>0.298 | 0.477<br>0.503<br>0.656<br>0.643<br>0.341<br>0.581<br>0.981<br>0.664<br>0.659<br>0.392<br>0.370<br>0.405<br>0.403<br>0.405<br>0.403<br>0.467<br>0.539<br>0.777<br>0.307<br>0.171<br>0.402<br>0.299 | $\begin{array}{c} -0.101\\ 0.093\\ 0.143\\ 0.058\\ -0.103\\ 0.108\\ 0.548\\ -0.193\\ 0.100\\ -0.197\\ 0.026\\ -0.063\\ 0.043\\ -0.023\\ -0.015\\ 0.102\\ 0.153\\ -0.056\\ 0.170\\ 0.001\end{array}$ | - 17.5<br>22.7<br>27.9<br>9.9<br>- 23.2<br>22.9<br>126.4<br>- 22.5<br>17.0<br>- 33.4<br>7.5<br>- 13.4<br>12.1<br>- 4.7<br>- 17.6<br>15.1<br>99.9<br>- 24.7<br>73.4<br>0.4 | 23<br>20<br>24<br>23<br>23<br>23<br>23<br>11<br>24<br>23<br>23<br>23<br>21<br>21<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20<br>20 |
|   | MEANS:<br>#1 - #6<br>#7 & #8<br>#9 & #10<br>#11 - #14<br>#15 - #18<br>#19 & #20 | AC/HR <sub>50</sub> %<br>ABS. CHG. 50 %<br>0.035 3.4<br>0.442 39.6<br>-0.044 - 4.8<br>0.024 3.5<br>0.055 15.0<br>0.160 20.6 |   |  | NLA<br>ABS. CHG.<br>0.033<br>0.177<br>-0.048<br>-0.004<br>0.021<br>0.086  | 7.1<br>51.9<br>- 7.7<br>0.3<br>18.2<br>36.9   |  |

NOTES

1. Nomenclature convention: a negative (-) change in airtightness indicates the structure became more airtight.

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# TABLE 4 (b)

# N20-DETERMINED APPARENT ZONE VENTILATION RATES (LITRES/SECOND)

| HOUSE VENTIL | VENTILATION SYSTEM   | 2 .            | MODE OF OPERATION<br>OF VENTILATION<br>SYSTEM DURING<br>TESTS | DESIGN<br>ZVR | ZONE 1           | ZONE 2           | ZONE 3             | ZONE 4              |
|--------------|--|----------------|---|---------------|------------------|------------------|--------------------|---------------------|
|              |  |                |   | LOW           | 8.8              | 10.6             | 26.4               | 10.4                |
|              |  | POSITION       |   | HIGH          | 11.8             | 14.3             | 35.5               | 14.3                |
| 11           | 11<br>Exhaust-Only Heat<br>12 Pump HRV                         | Open<br>Closed | Speed 4<br>Speed 4  |               | 7.2<br>8.0       | 9.2<br>6.8       | 24.7<br>14.9       | 0<br>31.9           |
| 12           |  | Open<br>Closed | Speed 1<br>Speed 1  |               | 2.9<br>2.7       | 5.4<br>3.4       | 9.1<br>8.5         | 0<br>11.7           |
| 13           | 3<br>Combined HRV/Forced<br>Air Heating System                 | Open<br>Closed | Low<br>Low  | 3             | 4.7<br>5.6       | 7.5<br>9.2       | 32.4<br>21.0       | 41.0<br>41.6        |
| 14           |  | Open<br>Closed | Low   |               | 4.3<br>4.5       | 6.7<br>6.9       | 17.2<br>15.9       | 35.8<br>32.5        |
| 15           | 5 Integrated Heat Pump<br>HRV, Space & DHW<br>6 Heating System | Open<br>Closed | High<br>Low   |               | 5.5 (5.5)<br>2.2 | 8.2 (8.3)<br>3.7 | 20.3 (23.7)<br>8.5 | 37.7 (17.6)<br>15.0 |
| 16           |  | Open<br>Closed | High<br>Low   |               | 4.6 2.3          | 6.9<br>3.3       | 14.9<br>9.1        | 20.8<br>16.9        |
| 17           | 17 Heat Pump HRV with<br>Dedicated Ventilation<br>18 System    | Open<br>Closed | Low<br>Low  | 2             | 5.3<br>9.3       | 8.2<br>7.2       | 19.6<br>14.5       | 41.6<br>42.9        |
| 18           |  | Open<br>Closed | Low<br>Low  |               | 5.0<br>8.2       | 7.9<br>6.0       | 15.9<br>17.2       | 44.9<br>42.9        |
| 19           | 19<br>HRV with Dedicated<br>20 Ventilation System              | Open<br>Closed | High<br>High  |               | 10.8<br>12.5     | 17.0<br>12.5     | 37.5<br>29.4       | 16.9<br>37.7        |
| 20           |  | Open<br>Closed | High<br>High  | 1. A. A.      | 4.4<br>12.9      | 7.5<br>4.2       | 32.8<br>24.7       | 54.6<br>55.3        |

#### Notes

Apparent ZVR values include natural air infiltration.
Bracketted figures for House #15 were re-test values, with drain holes in bottom of HRV cabinet blocked.