Instructions for

Pressure Diagnostics

[Program "Press"]

February, 1999 (V2.3)

INTRODUCTION

This software program, "Press," is intended to be used as a diagnostic tool for residential and commercial weatherization and new construction analysis.

Procedures included in this program are:

- 1) Calculation of CFM₅₀ for Minneapolis Blower Door®, Model 3. Can't-Reach-Fifty values and temperature adjustments are incorporated into the program.
- 2) Calculation of Building CFM₅₀ Series Leakage Values (Building/Zone, Zone/Outdoors, Total Path):
 - Hole Method.
 - Door Method.
 - Vent Method.
- 3) Calculation of Duct CFM₅₀ Series Leakage Values (Building/Duct, Duct/Outdoors, Total Path):
 - Add-a-Hole Method.
 - Blower-Door-Subtraction Method.
 - Full-Nelson Method.
 - Nelson-with-NFR-Twist Method.
- 4) Calculation of Minneapolis Duct Blaster® Flow Rates, both older (serial numbers from 0-591) and newer (serial numbers from 592 and up) models.

For more information about these test procedures, consult the following documents:

- Minneapolis Blower Door® Manual, Model 3, the Energy Conservatory.
- *Minneapolis Duct Blaster*® *Manual*, the Energy Conservatory.
- *Pressure Diagnostics*, Michael Blasnik and Jim Fitzgerald.
- The Airflow Diagnostic Procedure, John Tooley and Neil Moyer.
- "Building Tightness Guidelines: When Is a House Too Tight?" George Tsongas, *Home Energy*, March/April, 1993

PROGRAM OPERATION

Follow the instructions beginning on page 37. Pictures of the TI-86 screens appear on the left side of pages 37 through 52 with explanations at the right of each picture.

Press-1	NAMES EDIT	Turn the TI-86 calculator on. Press PRGM (Programs). You will see this menu on the screen. Press F1 for "NAMES."
Press-2	NAMES EDIT BTL1 BTUDD DTL Financi Press M	You will see this menu on the screen. Press F1, F2, F3, F4, or F5 for the program "Press." The menu key for this program will depend upon the number of programs loaded into the memory of your TI-86 calculator.
Press- 3	CALCULATIONS FOR DUCT BLASTER, BLOWER DOOR & SERIES LEAKAGE TESTING (c)1999 WxWare (V2.3) Select from Menu Mb43 BLD4PH HELP I MORE I QUIT	You will see this menu on the screen. "Mbd3," F1 , is for the calculation of CFM ₅₀ with the Minneapolis Blower®, Model 3. "BLD P," F2 , is for the calculation of Building Series Leakage Testing. This routine includes the hole, door, and vent methods. "HELP," F3 , lists instructions for this screen. "MORE," F4 , moves you to the next menu screen.
Press-4	CALCULATIONS FOR DUCT BLASTER AND DUCT SERIES-LEAKAGE TESTING Select from Menu BLSTBIDUCAPI HELP I MORE MACKLG	 Select "MORE," F4 and you will see this menu on the screen. "BLSTR," F1, calculates Minneapolis Duct Blaster® Flow Rates. "DUC P," F2, is for the calculation of Duct Series Leakage Testing. "HELP," F3, lists instructions for this screen. "MORE," F4, moves you to the previous (main) screen. "ACKLG," F5, Acknowledgments selection lists the authors of the program, etc.
Press- 5	CALCULATIONS FOR DUCT BLASTER, BLOWER DOOR & SERIES LEAKAGE TESTING (c)1999 WxWare (V2.3) Select from Menu	Select "MORE," F4 and you will see this menu on the screen. As a demonstration, press "Mbd3," F1 , for Minneapolis Blower®, Model 3. Note: This calculation procedure does not work for the Minneapolis Blower Door®, Model 2.
	Tout=?	You will see this on the screen. Enter "Tout," the outdoor temperature (F^{0}). If the temperature is below
Press- 6	Enter outdoor F. temp	zero, enter a negative sign in front of the temperature by using the key, (-) , just to the left of the ENTER key. Notice that there is a short prompt instruction on the screen below the
ē	Minn BD Mod#3	prompt line. Notice that "Minn BD Mod#3" is at the bottom of the screen as a reminder

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Press- 7	Tout=?10 Tin=? Enter indoor F. temp	Enter "Tin," the indoor temperature (F^{0}). If the temperature is different indoors than it is outdoors, the blower door CFM ₅₀ value will be influenced because of the different air densities. The magnitude of the difference is dependent on the degree of temperature difference. Enter "70" and press ENTER .
	Minn BD Mod#3	
Press- 8	Tout=?10 Tin=?70 Test=? Enter Test Type: Depressurization = 1 Pressurization = 2 Minn BD Mod#3	You will see this menu on the screen. Now you must enter "1" for a depressurization blower door test or enter "2" for a pressurization blower door test. If the CFM ₅₀ results were not temperature-corrected, this question would not be necessary. See panel explanation "Press-7" just above for a brief explanation. Enter "1" and then press ENTER.
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Press- 9	BLD⊿P=?∎ Enter ACTUAL Bld9. to Outdoor ⊿P in Pascals	Enter "BLD P," the pressure difference between the inside and the outside of the building, in units of Pascals. Although this pressure will usually be negative, do not enter a negative sign before the pressure difference value. If you are not able to reach 50 Pascals of depressurization difference in a building, enter the lower value. This program will automatically extrapolate the answer to a level of 50 Pascals depressurization difference. In other words, the "Can't Reach Fifty" multipliers are incorporated.
	Depressurization Test	
Press-10	BLD⊿P=?35 FAN⊿P=?∎ Enter Fan ⊿P in Pascals	 "FAN P," fan pressure, in Pascals, is prompted next. Enter a fan pressure of "100" and then press ENTER. Note: If you notice you have made a mistake after you have pressed ENTER, press the "2nd" button, the "QUIT" button (next to the the "2nd" button), and then ENTER. This will return you to the main menu. Notice that "Depressurization Test" is at the bottom of the screen as a reminder of the routine you are calculating.
-	Depressurization Test	
Press- 11	BLD⊿P=?35 0=OPEN FAN⊿P=?100 1=A-RING CONFIG=?∎ 2=B-RING 3=C-RING Enter Rin9 Confi9.	"CONFIG," the Configuration of the blower door fan must be entered now. The four choices are listed on the right side of the screen. Enter "O" for an open fan configuration (no rings used). Note: If you cannot reach a house pressure difference of 50 Pascals, the "CONFIG" will always be "O." Press ENTER.
	Depressurization Test	
Press- 12	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	The Fan Flow and the CFM ₅₀ answers are displayed along with all the data you entered. The "FANFLO" of 4501 is the CFM ₃₅ . The extrapolated "CFM50" displayed is 5675 (Can't-Reach-Fifty values are a part of this calculation procedure). Both of these resulting values, CFM ₃₅ and CFM ₅₀ are temperature-compensated. For most purposes, the "CFM50" value is the most important result.

Press-13	Would You Like to Determine ELA, EqLA, Tar9et CFM, Vent. Required, etc? If so, please use the BTL1/BTLa Pro9ram Press Enter to Return	After pressing ENTER you will see this display. This is a reminder that another program included in the ZipTest Two software can calculate these values and others for you. To get to this program, you must exit from the "Press" program that you are now in and go to the "BTL1" program and then to the "BTLa," (F2 menu item) routine. When you press ENTER , you will be returned to the home screen of the pressure diagnostics program, "Press."
Press-14	1.ELA in ² =61 2.EqLA in ² =118 3.Estim Nat CFM=54 4.Estim Nat ACH=.37 5.Natural CFM/occ=11 6.Tar9et ELAmin=84 7.Tar9et CFMmin=75 8.Vent CFM Needed=52	[Please Note: this panel does not follow the above Panel Press-13, it is a sample from the BTL1 program/BTLa routine] With the "BTL1" program/"BTLa" routine you can calculate: 1. ELA, Effective Leakage Area in square inches (see panel BTL1-29). 2. EqLA, Equivalent Leakage Area in square inches. (see panel BTL1-30). 3. Estimated Natural CFM (see panel BTL1- 31). 4. Estimated Natural ACH (see panel BTL1- 31). 5. Natural CFM/occ (see panel BTL1- 32). [continued next panel]
Press- 15	a)1200 1)61 All b).68 2)118 Data c).96 3)54 d)8800 4).37 e)1100 5)11 f)8.0 6)84 9)8.0 7)75 h)5 8)52 9)1537	 [Please Note: this panel does not follow the above Panel Press-13, it is a sample from the BTL1 program/BTLa routine] 6. Target ELA minimum (see panel BTL1- 33). 7. Target CFM minimum (see panel BTL1- 34). 8. Ventilation CFM needed (see panels BTL1- 34 & 35). 9) Target minimum CFM₅₀ value (see panel BTL1- 39). End of sample screens from the "BTL1" program/"BTLa" routine
Press- 10	CALCULATIONS FOR DUCT BLASTER, BLOWER DOOR & SERIES LEAKAGE TESTING (c)1999 WxWare (V2.3) Select from Menu	Back to the home screen of the pressure diagnostics program, "Press." Now select, "BLD P," F2 for "Building Series Leakage Tests."
	Mbd3 BLDAP HELP MORE QUIT	
Press- 17	BUILDING SERIES-LEAKAGE TESTS Select from Menu HOLE LODOR VENT L QUIT	You will see the Building Series-Leakage Tests menu. "HOLE," F1 , calculates the Hole Method (creating a measured hole between the building and the zone or between the zone and the outdoors). "DOOR," F2 , calculates the Door Method (opening a door between the building and the zone or between the zone and the outdoors). "VENT," F3 , calculates the Vent Method, (used primarily for attics). Press "HOLE," F1 . for the Hole Series Leakage Method.
Press- 18	BLD/ZONE △P1=	You will see this screen, prompting for building/zone P1. The building should be at 50 Pascals of pressure while the building/zone P1 is measured. Note: If you are not able to obtain a building pressure difference of 50 Pascals, this procedure will not work. The Building Hole Method works best when the second measured building/ zone or zone/outdoors pressure is 15-35 Pascals and the pressure drop resulting from the creation of the hole is 15-25 Pascals.
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	BLD/ZONE △P1= 35 ZONE/OUT △P1= 15	Enter "35" as the "BLD/ZONE P1." Press ENTER .
Press- 19		Now you are prompted to enter the "Zone/Out P1."Notice that the number "15" is displayed at the right. This is the value of the building/zone pressure subtracted from 50 building/outdoors pressure.
Ţ	HOLE METHOD	Enter "15" as "ZONE/OUT P1." "BLD/ZONE P1" plus "ZONE/OUT P1" should equal 50, plus or minus 2.
e- 20	BLD/ZONE △P1= 35 ZONE/OUT △P1= 15 15 LOC.= B/Z=1 Z/O=2	Indicate the location of the measured hole, between the building and the zone or between the zone and the outdoors. It is a good idea to create the hole in the tightest air barrier (that between the building and zone or that between the zone and the outdoors). This is because we should drop the
Press-	INDICATE LOCATION OF CREATED HOLE	pressure across the barrier in which the hole is created by 15 or more Pascals. For our example, it is best to create a hole from the building to the zone where we have a P1 of 35 Pascals.
	HOLE METHOD	Enter "1" and press ENTER.
-	BLD/ZONE P1= 35	Enter the square inches of the added hole.
Press- 21	ZONE/OUT P1= 15 15 LOC.= 1 B/Z=1 Z/O=2 ADDED HOLE, IN ² =	For our example, we will use 130 square inches. Press ENTER .
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-	HOLE METHOD	
Press- 22	BLD/ZONE △P1= 35 ZONE/OUT △P1= 15 15 LOC.= 1 B/Z=1 Z/O=2 ADDED HOLE, IN ² = 130 BLD/ZONE △P2= B1d9. △P back to 50?	Enter the new (after-hole) building to zone pressure, "BLD/ZONE P2." NOTE: It is very important that the <i>building to outdoors</i> pressure be brought back up to 50 Pascals after the creation of the hole and before the P2 readings are taken. There is a reminder on the screen. If you are not able to get the building to outside pressure back up to 50 Pascals, make the hole smaller. If you are still not able to get the building to outside pressure back to 50 Pascals, this method is not workable.
-	HOLE METHOD	
Press- 23	BLD/ZONE △P1= 35 ZONE/OUT △P1= 15 15 LOC.= 1 B/Z=1 Z/O=2 ADDED HOLE, IN ² = 130 BLD/ZONE △P2= 28 ZONE/OUT △P2= 22	Enter the new (after-hole) zone to outdoor pressure, "ZONE/OUT P2." Notice that to the right of "ZONE/OUT P2" the suggested pressure is displayed. Your measured "ZONE/OUT P2" should be within 2 Pascals of this displayed number. Enter "22" and press ENTER .
_	HOLE METHOD	
Press- 24	CFM50's BLD/ZONE> 2205 ZONE/OUT> 3824 TOTAL PATH> 1749 ENTERED DATA: 35 15 1 130 28 22	The CFM ₅₀ "BLD/ZONE, ZONE/OUT," and "TOTAL PATH" values are displayed. Notice that the "ENTERED DATA" is displayed in the order in which it was entered on the previous screen. Refer to Panel Press-29 for the input labels. Dividing the "BLD/ZONE" CFM ₅₀ by 10 yields the approximate square inches of leakage between the building and the zone, for this example 220 in ² . This may also be done for the zone-to-outdoor CFM ₅₀ .
	HOLE METHOD	The TOTAL PATH will always be less than the CFM_{50} values of the BLD/ZONE and ZONE/OUT. Press ENTER.
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		The main menu is displayed.
Press- 25	FOR DUCT BLASTER, BLOWER DOOR & SERIES LEAKAGE TESTING (c)1999 WxWare (V2.3)	Press "BLD P," F2 , for Building Series Leakage Tests.
Ð	Select from Menu Mbd3 BLDAPI HELP MORE QUIT	
Press-26	BUILDING SERIES-LEAKAGE TESTS Select from Menu	Press "DOOR," F2 , for the Door Method. For this test, a door or other openable panel is closed for the first set of pressure readings and opened for the second set of pressure readings. The size of the door or openable panel does not need to be measured. If the initial, closed pressure readings are close to 50 or 0, this method may not work well.
	HOLE DOOR VENT	
Press- 27	CLOSED CFM50=	Enter the Closed building CFM_{50} . This is a value that you might already know if you have done a single- or multi-point blower door test on the building. This initial CFM_{50} . should be 200 and preferably 400 or more for this test to work well. Enter "2250" and press ENTER .
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	DOOR METHOD	
Press-28	CLOSED CFM50= 2250 BLD/ZONE ⊴P=	Measure the building-to-zone pressure, "BLD/ZONE P." Enter "32" and press ENTER .
	DOOR METHOD	
Press- 29	CLOSED CFM50= 2250 BLD/ZONE P= 32 ZONE/OUT P= 18	Measure the zone-to-outdoors pressure, "ZONE/OUT P." Notice that the suggested "ZONE/OUT P" pressure is displayed at the right. Your measured "ZONE/OUT P" should be within 2 Pascals of this displayed number. Enter "18" and press ENTER .
	DOOR METHOD	
Press- 30	CLOSED CFM50= 2250 BLD/ZONE △P= 32 ZONE/OUT △P= 18 18 LOC.= B/Z=1 Z/O=2	Indicate the location of the opened door or panel, between the building and the zone or between the zone and the outdoors. It is a good idea to open a door, window, or panel in the tightest air barrier (that between the building and zone or that between the zone and the outdoors). For our example, it is best to create a hole from the building to the zone where we have a P of 32
Ē	INDICATE LOCATION OF OPENED DOOR DOOR METHOD	Pascals. Enter "1" and press ENTER.

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Prese- 31	CLOSED CFM50= 2250 BLD/ZONE △P= 32 ZONE/OUT △P= 18 18 LOC.= 1 B/Z=1 Z/O=2 OPENED CFM50= ■ Bld9. △P back to 50? DOOR METHOD	Now enter the opened CFM ₅₀ . NOTE: It is very important that the <i>building to outdoors</i> pressure be brought back up to 50 Pascals after the door, window, or panel is opened and before the opened CFM ₅₀ reading is taken. The pressure across the barrier in which you created the opening should be less than one (1) Pascal, otherwise the method will not be accurate. Measure the building CFM ₅₀ with the door, window, or panel opened.
Press- 32	CFM50's BLD/ZONE> 1063 ZONE/OUT> 1545 TOTAL PATH> 796 ENTERED DATA: 2250 32 18 1 3000 DOOR METHOD	The CFM ₅₀ "BLD/ZONE, ZONE/OUT," and "TOTAL PATH" values are displayed. Notice that the "ENTERED DATA" is displayed in the order in which it was entered. See panel "Press-37" for the order of entry. Dividing the BLD/ZONE CFM ₅₀ by 10 yields the approximate square inches of leakage between the building and the zone, for this example 106 in ² . This may also be done for the zone-to-outdoor CFM ₅₀ . The "TOTAL PATH" will always be less than the CFM ₅₀ values of the "BLD/
Press- 33	CALCULATIONS FOR DUCT BLASTER, BLOWER DOOR & SERIES LEAKAGE TESTING (c)1999 WxWare (V2.3)	The main menu is displayed. Press "BLD P," F2 , for Building Series Leakage Tests.
-	Select from Menu Mbd3 BLDAPI HELP MORE QUIT	
Press- 34	BUILDING SERIES-LEAKAGE TESTS	Press "VENT," F3 , for the Vent Method. For this test, the openings in the attic are measured or estimated. The building-to-zone and the zone-to-the outdoor pressures are measured. This method is weak because of the difficulty of measuring the openings in most attics (zone to outdoors). However, this method is faster than the other two—"HOLE" or "DOOR."
	Select from Menu HOLE DOOR VENT	The pressure across the ceiling (building-to-zone) should not be much less
35	NET VENT, IN ² = ENTER NET IN ² LEAKAGE AREA OF ROOF/GABLES/	"Enter net square inches of leakage area of roof/gables/vents. This is often difficult to measure or estimate. Do the best you can. For the example, enter "260" and press ENTER .
Press-	VENTS	
-	VENT METHOD	
Press-36	NET UENT, IN²= 260 BLD∕ZONE ⊿P=	With the building to outside pressure at 50 Pascals, measure the building to zone pressure difference. This pressure should be close to 50 Pascals. For the example, enter "28" and press ENTER .
_	VENT METHOD	

Press-37	NET UENT, IN ² = 260 BLD/ZONE △P= 28 ZONE/OUT △P= 22	Enter the zone-to-outdoor pressure difference. The measured zone-to-outdoor pressure should be within 2 of the pressure difference displayed at the right on the screen. Enter "22" and press ENTER.
-	VENT METHOD	The CFM $_{50}$ values are displayed for building-to-zone, zone-to-outdoors, and
s- 38	BLD/ZONE △P= 28 ZONE/OUT △P= 22 22 CFM50's	total path. The Total Path value for the vent method, the hole method, and the door method will always be less than the building-to-zone or the zone-to-outdoor
Press-	BLD/ZONE> 2033 ZONE/OUT> 2192 TOTAL PATH> 1395 VENT METHOD	CFM ₅₀ values. The Total Path figure includes the combined air-flow resistance of the building-to-zone barrier and the zone-to-outdoor barrier. This ends the Building Series Leakage examples.
		You will see the main screen displayed. Press "MORE," F4 , to move to the other primary menu.
Press- 39	BLOWER DOOR & SERIES LEAKAGE TESTING (c)1999 WxWare (V2.3)	
	Select from Menu Mbd3 BLDAPI HELP I MORE I QUIT I	
Press- 40	CALCULATIONS FOR DUCT BLASTER AND DUCT SERIES-LEAKAGE	Press "BLSTR," F1 , for Minneapolis Duct Blaster® Flow Rate calculations. The Duct Blaster is a calibrated air flow measurement system used to test the airtightness of forced air distribution systems. See the <i>Minneapolis</i> <i>Duct Blaster® Operation Manual</i> for discussion of proper use of the Duct
Pres:	TESTING Select from Menu BLSTRIDUCAPI HELP I MORE IACKLGI	Blaster®. The Duct Blaster® may also be used as a powered flow hood and as a small blower door. The Duct Blaster is manufactured by The Energy Conservatory.
-	TYPE=?	As of March 1995, The Energy Conservatory(TEC) began producing a duct blaster with a different calibration than the original. The WxWare ZipTest
Press- 41	SERIAL #s 0-591 = 1 592 & UP = 2	software can calculate flow rates for both types. Serial numbers O - 591 are designated in the ZipTest program as Type 1 (these are white in color), serial numbers from 592 and higher are Type 2 (TEC calls these "series B" duct blasters). They are black in color.
_	Minn DUCT BLASTER	After you enter the Type number, press ENTER to move to the next screen.
ress- 42	FAN⊿P=?∎	Enter the Duct Blaster® fan pressure. For the example, enter "100" and press ENTER.
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	Minn DUCT BLASTER	

Prese- 43	FAN⊿P=?100 DUCT⊿P=?∎ Minn DUCT BLASTER	Now enter the duct pressure. The reference pressures for testing usually are 25 Pascals, 50 Pascals, or the average actual operating pressure of the duct system. If you are not able to reach 25 Pascals, enter the value that was reached. The program will calculate the CFM_{25} from the data that you provide. (The program assumes the flow exponent, n=0.65). Enter "25" and press ENTER .
Press- 44	FAN₄P=?100 0=OPEN DUCT₄P=?25 1=RING 1 CONFIG=? 2=RING 2 3=RING 3	Finally, enter the Duct Blaster® configuration that you used. Enter "1" for this example and press ENTER.
	Minn DUCT BLASTER	The flow of the Duct Blaster® fan is given and the CFM $_{25}$ and CFM $_{50}$ of the
Press- 45	FAN₄P=?100 0=OPEN DUCT₄P=?25 1=RING 1 CONFIG=?1 2=RING 2 ■ 3=RING 3 FANFLO> 393 CFM25> 393 .CFM50> 616	Press ENTER.
-	Minn DUCT BLASTER	
Press- 46	CALCULATIONS FOR DUCT BLASTER, BLOWER DOOR & SERIES LEAKAGE TESTING (c)1999 WxWare (V2.3)	Once again, back to the main menu. Press "MORE," F4 , to go to the other primary menu.
	Select from Menu Mbd3 BLDAPH HELP MDRE QUIT	
	CALCULATIONS FOR DUCT BLASTER	Press "DUC P," F2 , for the Duct Series Leakage Tests menu.
Press- 47	AND DUCT SERIES-LEAKAGE TESTING	
	Select from Menu BLSTRIDUCAPI HELP I MORE IACKLGI	
Press-48	DUCT SERIES-LEAKAGE TESTS	"HOLE," F1 , calculates duct leakage using the Add-a-Hole Method. "MODBD," F2 , calculates duct leakage using the Blower-Door-Subtraction Method. "NELSN," F3 , calculates duct leakage using the Full-Nelson Method. "TWIST," F4 , calculates duct leakage using the Nelson-with-NFR-Twist
	Select from Menu HOLE IMDOSBINELSNITWISTI QUIT I	Method (NFR is Natural Florida Retrofit). The last two methods are experimental at this time (Feb. 1995)

	AIR HANDLER OFF	This screen displays instructions for Add-a-Hole Method.
49	SEAL REG. AND GRILLES	This method is similar to the Building Hole Method. The method works best when the duct leakage is less than 200 CFM ₅₀ and
Press- 4	PRESS ENTER	there is little leakage to the building. The area of the added hole should be less that 50% of the cross-sectional
Ţ	DUCT HOLE METHOD	area of the smallest duct in the path between the hole and the air handler. Press ENTER .
- 50	BLD/DUC △P1= 36 DUC/OUT △P1= 14 14 LOC.= ■ B/D=1 D/O=2	Enter the building-to-duct pressure difference, "36" for our example. Enter the duct-to-outdoors pressure difference, "14" for our example. Indicate the location of added hole, building-to-duct or duct-to-outdoor, "1" for the example.
Press-	INDICATE LOCATION OF CREATED HOLE	
Prese- 51	BLD/DUC △P1= 36 DUC/OUT △P1= 14 14 LOC.= 1 B/D=1 D/O=2 ADDED HOLE, IN ² = 10 HOLE △P= 26 BLD/DUC △P2= 27 DUC/OUT △P2= ■ 23	Enter the size of the added hole. For our example "10" square inches. The hole can be created in a seal that was applied to a register or grille. Measure and enter the hole pressure, "26" for the example. Measure and enter the "BLD/DUC P2," the building to duct pressure after the hole is made. For the example "27." Measure and enter the "DUC/OUT P2," the duct to outdoors pressure after the hole is made. For the example "23."
Press- 52	CFM50's BLD/DUCT> 122 DUCT/OUT> 225 ENTERED DATA: 36 14 1 10 26 27 23	The Building to Duct CFM50 and the Duct to outdoors CFM50 are displayed. Notice that the "ENTERED DATA" is displayed in the order in which it was entered. Refer to Panels Press-50 and Press-51 for the labels for the entered data. Press ENTER .
	DUCT HOLE METHOD	
Press- 53	CALCULATIONS FOR DUCT BLASTER, BLOWER DOOR & SERIES LEAKAGE TESTING (c)1999 WxWare (V2.3)	The main menu is displayed. Press "MORE," F4, for another example of Duct Series Leakage testing.
	Select from Menu Mbd3 BLDAPI HELP MORE QUIT	
Press- 54	CALCULATIONS FOR DUCT BLASTER AND DUCT SERIES-LEAKAGE TESTING	The other primary menu is displayed. Press "DUC P," F2, for the Duct Series Leakage menu.
Ţ	Select from Menu BLSTRIDUCAPI HELP I MORE ACKLG	

Press-55	DUCT SERIES-LEAKAGE TESTS	The Duct Series Leakage menu is displayed. Press "MODSB," F2 , for the Duct Modified Subtraction Method calculation. The method works best when the duct leakage is less than 200 CFM ₅₀
Υ <u></u>	Select from Menu HOLE IMDOSBINELSNITWIST QUIT	
	AIR HANDLER OFF	Air handler should be off. Press ENTER .
Press- 56	PRESS ENTER	TICOS LITER.
	DUCT MOD. SUB. METHOD	
	OPENED CFM50=	With the blower door, measure the CFM $_{\rm 50}$ with the duct system open to the building, i.e. not taped or sealed.
Press- 57		For the example, enter "2000" and press ENTER .
	DUCT MOD. SUB. METHOD	
	OPENED CFM50= 2000	Now seal registers and grilles and measure the CFM_{50} with the blower door. Press <code>ENTER.</code>
Press- 58	SEAL REG. AND GRILLES	
Pre	PRESS ENTER	
	DUCT MOD. SUB. METHOD	
	OPENED CFM50= 2000 CLOSED CFM50= 1856	Now enter the Closed CFM50 (registers and grilles sealed). For the example enter "1856." Press ENTER .
Press- 59	SEAL REG. AND GRILLES	17699 ENTER.
Pre	PRESS ENTER	
	DUCT MOD. SUB. METHOD	
Press- 60	OPENED CFM50= 2000 CLOSED CFM50= 1856 BLD/DUC △P= 38 DUC/OUT △P= 11∎ 12	Enter the building-to-duct pressure difference with the registers and grilles sealed. For the example, enter "38." Press ENTER . Enter the duct-to-outdoor pressure difference with the registers and grilles sealed. Press ENTER .
	DUCT MOD. SUB. METHOD	

Press- 61	CFM50's BLD/DUCT> 103 DUCT/OUT> 230 ENTERED DATA: 2000 1856 38 11 DUCT MOD. SUB. METHOD	The CFM ₅₀ values for the building-to-duct and the duct-to-the outdoor are displayed. Notice that the "ENTERED DATA" is displayed in the order in which it was entered. Refer to Panels Press-59 and Press-60 for the input labels. Press ENTER .
Press- 62	CALCULATIONS FOR DUCT BLASTER, BLOWER DOOR & SERIES LEAKAGE TESTING (c)1999 WxWare (V2.3) Select from Menu	Back to the main menu. Press "MORE," F4 , and we will try another example.
-	CALCULATIONS	Press "DUC P," F2 for Duct Series Leakage Tests.
Press- 63	FOR DUCT BLASTER AND DUCT SERIES-LEAKAGE TESTING	
σ	Select from Menu BLSTRIDUCAPI HELP I MORE MACKLG	
Press- 64	DUCT SERIES-LEAKAGE TESTS	Press "NELSN," F3 , for an example of the Full-Nelson Method. This method is still experimental. Act accordingly with the results. This method provides insight into the relative leakiness of the return and supply sides of the duct system in terms of CFM ₅₀ .
Ð	Select from Menu HOLE IMODSBINELSNI TWISTI QUIT	
	AIR HANDLER ON	Instructions for Full-Nelson Method are displayed.
65	SEAL REG. AND GRILLES	Note that high pressures may be created in the duct system. These pressures could damage the duct system.
Press-	PRESS ENTER	Press ENTER.
	FULL NELSON METHOD	
Press-66	AVE SUPPLY △P1= 65 AVE RETURN △P1= 98 ADD A HOLE SUPPLY HOLE, IN ² = 10 SUPPLY HOLE △P= 50	Enter the average supply duct pressure, for the example, "65" Pascals. Enter the average return duct pressure, for the example, "98" Pascals. Add a hole to either the supply side or the return side. Enter the Supply Hole size, for the example, "10" square inches. Enter the Supply Hole Pressure Difference, for the example, "50" Pascals.

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Press-67	AVE RETURN △P1= 98 ADD A HOLE SUPPLY HOLE, IN ² = 10 SUPPLY HOLE △P= 50 RETURN HOLE, IN ² = 0 RETURN HOLE △P= 0 AVE SUPPLY △P2= 55 AVE RETURN △P2= 102	Enter the return hole size, for the example, no return hole is made, so "O" is entered. Enter the return hole pressure difference. If no return hole is added, the return hole pressure difference will be "O." Enter the average supply pressure, "AVE SUPPLY P2" after the hole is made. For the example enter "55." Enter the average return pressure, "AVE RETURN P2" after the hole is
	CFM50's	The return duct CFM $_{\rm 50}$, supply duct CFM $_{\rm 50}$, and the total CFM $_{\rm 50}$ are
Press-68	RETURN> 375 SUPPLY> 490 TOTAL> 865	displayed. Press ENTER .
	FULL NELSON METHOD	
-		Back to the main menu.
Press- 69	FOR DUCT BLASTER, BLOWER DOOR & SERIES LEAKAGE TESTING (c)1999 WxWare (V2.3)	Press "MORE," F4 , for one last example.
	Select from Menu Mbd318LDAP1HELP1MORE1QUIT	
Press- 70	CALCULATIONS FOR DUCT BLASTER AND DUCT SERIES-LEAKAGE TESTING	The other primary menu is displayed. Press "DUC P," F2 , for Duct Series Leakage Tests.
Ψ.	Select from Menu BLSTRIDUCAPI HELP I MORE LACKLO	
F		Press "TWIST," F4, for an example of the Nelson-with-NFR-Twist Method
	DUCT SERIES-LEAKAGE	(NFR is Natural Florida Retrofit). This method is still experimental. Act accordingly with the results.
6- 71	TESTS	Note: If you make a mistake while entering data before you press ENTER, use
Press-		the arrow buttons to move the cursor over the erroneous entry and type the correct entry. If you notice you have made a mistake after you have pressed
	Select from Menu	ENTER, press the "2nd" button, the "QUIT" button (next to the "2nd" button),
_	HOLE MODSBINELSNI TWIST QUIT	and then ENTER. This will return you to the main menu.
Press- 72	AIR HANDLER ON	Instructions for the Nelson-with-NFR-Twist Method are displayed. Note that high pressures may be created in the duct system. These
	SEAL REG. AND GRILLES	pressure could damage the duct system.
	PRESS ENTER	This method is similar to the Full-Nelson method, except a hole is added to relieve pressure in the ducts. Press ENTER.
	NFR TWIST METHOD	
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Prese- 73	SUPPLY HOLE, IN ² = 10 SUPPLY HOLE △P= 20 RETURN HOLE, IN ² = 0 RETURN HOLE △P= 0	Enter the initial added supply hole. For the example, enter "10" square inches. Enter the pressure across the supply hole. For the example, enter "20." Enter the return hole. In the example, a return hole is not added, so enter "0." Enter the return hole pressure difference. If no return hole is added, the pressure difference across the hold is "0."
Press- 74	SUPPLY HOLE, IN ² = 10 SUPPLY HOLE △P= 20 RETURN HOLE, IN ² = 0 RETURN HOLE △P= 0 AVE SUPPLY △P1= 50 AVE RETURN △P1= 58 ADD A HOLE SUPPLY HOLE, IN ² = 15	Enter the average supply pressure difference, "AVE SUPPLY P1" for the example is "50." Enter the average return pressure difference, "AVE RETURN P1" for the example is "58." Add a hole to either or both sides of the duct system. For the example a supply hole is added, "15." Note that the supply hole went from the initial 20 square inches to 15 square inches. Use the actual hole size, not the change
Press- 75	AVE RETURN △P1= 58 ADD A HOLE SUPPLY HOLE, IN ² = 15 SUPPLY HOLE △P= 18 RETURN HOLE, IN ² = 0 RETURN HOLE △P= 0 AVE SUPPLY △P2= 36 AVE RETURN △P2= 58	(The screen has been scrolled up five lines). Enter the pressure across the supply hole, "SUPPLY HOLE P." For the example enter "18." Enter the return hole size. For the example, enter "O." Enter the return hole pressure difference. If no hole is made, the return hole pressure difference is "O."
Press-76	AVE RETURN △P1= 58 ADD A HOLE SUPPLY HOLE, IN ² = 15 SUPPLY HOLE △P= 18 RETURN HOLE, IN ² = 0 RETURN HOLE △P= 0 AVE SUPPLY △P2= 36 AVE RETURN △P2= 58	Enter the average supply pressure difference after the second hole is added, "AVE SUPPLY P2." For our example this is "36." Enter the average return pressure difference after the second hole is added, "AVE RETURN P2." For our example this is "58." Press ENTER .
Press- 77	CFM50's RETURN> 138 SUPPLY> 104 TOTAL> 242	The return duct CFM ₅₀ , supply duct CFM ₅₀ , and the total CFM ₅₀ are displayed. This ends the Duct Series Leakage Test examples. Press ENTER .
	NFR TWIST METHOD	
Press- 78	CALCULATIONS FOR DUCT BLASTER, BLOWER DOOR & SERIES LEAKAGE TESTING (c)1999 WxWare (V2.3)	Once again, back to the main menu. Press "HELP," F3. This feature gives simple help messages for the main menu shown at the left.
	Select from Menu Mbd3 BLDAPH HELP MORE QUIT	

Press- 79	Mbd3 TEST CALCULATES CFM50 FOR MINNEAPOLIS BLOWER DOOR MODEL 3. CAN'T REACH 50 VALUES ARE INCORPORATED.	The "Mbd3," F1 , menu item. Press ENTER .
	Help Screen	
Press-80	BLD△P TESTS CALCULATE SERIES-LEAKAGE CFM50 VALUES USING HOLE, DOOR & VENT METHODS. IF YOU CAN'T REACH A BUILDING PRESSURE OF 50 Pa,THE CALCULATION IS NOT VALID.	The "BLD P," F2 , menu item. Press ENTER.
Press- 81	'MORE' TAKES YOU TO THE NEXT MENU.	The "MORE," F4 , menu item. Press ENTER .
	Help Screen	
Press- 82	'QUIT' EXITS PROGRAM.	And the "QUIT," F4 , menu item. Always exit this and other TI-86 programs by pressing the "QUIT" menu key. This resets the decimal place to "float" so that you can perform accurate calculations with the calculator functions of the TI-86. Press ENTER.
-	Help Screen	
Press- 83	CALCULATIONS FOR DUCT BLASTER, BLOWER DOOR & SERIES LEAKAGE TESTING (c)1999 WxWare (V2.3)	And, back to the main menu screen. Press "MORE," F4, for the other primary menu screen.
	Select from Menu Mbd3 BLDAPH HELP MDRE QUIT	
Press- 84	CALCULATIONS FOR DUCT BLASTER AND DUCT SERIES-LEAKAGE TESTING	There is a "HELP," F3 , button on this menu also. Go ahead, press it.
	Select from Menu BLSTR DUCAPI HELP I MORE MACKLG	

Press- 85	'BLSTR' TEST IS FOR CALCULATING CFM FLOW WITH THE MINNEAPOLIS DUCT BLASTER. TO FIND CFM FLOW, ENTER FAN PRESSURE, DUCT PRESSURE, & RING CONFIGURATION.	The "BLSTR," F1 , menu item. Press ENTER .
Press-86	'DUC₄P' TESTS ALLOW THE CALCULATION OF DUCT LEAKAGE. ADD-A- HOLE,MODIFIED SUBTRAC TION, NELSON AND NFR TWIST METHODS ARE INCLUDED. Help Screen	The "DUC P," F2 , menu item. Press ENTER .
Press- 87	'MORE' TAKES YOU TO I THE NEXT MENU. Help Screen	The "MORE," F4 , menu item. Press ENTER.
Press- 88	'ACKLG' (ACKNOWLEDG- MENTS),LISTS CREDITS, SUPPORT AND REGISTRA- TION INFORMATION. Help Screen	The "ACKLG," F4, menu item. Press Enter.
Press- 89	CALCULATIONS FOR DUCT BLASTER AND DUCT SERIES-LEAKAGE TESTING Select from Menu BLSTBIDUCAPI HELP I MORE ACKLG	Now we are back to one of the primary screens. Press "ACKLG," F5 . This is the acknowledgments section.
Press- 90	WELCOME TO THE WORLD OF PRESSURES & FLOWS, A GATHERING OF WORKS FROM ENERGY CONSERVA- TORY, GRASP & NATURAL FLORIDA RETROFIT. THIS PROGRAM WAS WRIT TEN BY NEIL MOYER AND	This is the first acknowledgments screen. Press ENTER .

Press- 91	RICK KARG (207) 725- 6723.IF YOU PURCHASED THIS PROGRAM FROM WxWare, YOU ARE A REGISTERED USER,ENTIT LED TO SUPPORT AND UP DATE NOTIFICATION.	This is the second acknowledgments screen. Press ENTER .
Press-92	■O REGISTER YOUR COPY CONTACT WxWare AT 220 MEADOW ROAD, TOPSHAM, MAINE 04086: E-MAIL rjkar90kar9.com: OR 207-725-6723. (Feb, 1999)	This is the third acknowledgments screen. Press ENTER.
Press-93	CALCULATIONS FOR DUCT BLASTER, BLOWER DOOR & SERIES LEAKAGE TESTING (c)1999 WxWare (V2.3) Select from Menu	Once again, back to the main menu screen. Press "QUIT," F5. Note: Always exit the program by pressing QUIT; this automatically resets the decimal place for calculator use.
Press-94	Done	You have now exited from the program. If you want to get back to the program quickly after pressing "QUIT," simply press ENTER. Note: The TI-86 automatically shuts off after two minutes of non-use. When you turn it back on, you will be able to pick up right where it shut off.
Press- 95		
Press- 96		