



**HIRAI**  
**SKILLTECH ACADEMY**

**RESIDENTIAL**

**COMMISSIONING**

*Student Reference Guide*

2004 Edition

*Published by:*

Heating, Refrigeration and Air Conditioning  
Institute of Canada

January 2004

Copyright © 2004, All Rights Reserved  
Heating, Refrigeration and Air Conditioning  
Institute of Canada  
5045 Orbitor Drive, Bldg. 11, Suite 300  
Mississauga, ON L4W 4Y4



***HRAI***  
***SKILLTECH ACADEMY***

**RESIDENTIAL**

**COMMISSIONING**

*Student Reference Guide*

2004 Edition

*Published by:*

Heating, Refrigeration and Air Conditioning  
Institute of Canada

January 2004

Copyright © 2004, All Rights Reserved  
Heating, Refrigeration and Air Conditioning  
Institute of Canada  
5045 Orbitor Drive, Bldg. 11, Suite 300  
Mississauga, ON L4W 4Y4

# FOREWORD

This Manual was originally prepared by the Heating Refrigeration and Air Conditioning Institute of Canada.

Reproduction in any form by mechanical or computer means is forbidden.

**Copyright** by the Heating Refrigeration and Air Conditioning Institute of Canada.

Careful use of this manual should result in satisfactory commissioning of residential heating, ventilation and air conditioning systems. However, the end result is in no way warranted by either the Heating Refrigeration and Air Conditioning Institute of Canada or any companies or any persons involved in the preparation or presentation of this manual.

Where manufacturer installation and commissioning procedures differ from those shown in this manual, the manufacturer's installation and commissioning procedures should be followed.

This is the first edition of the HRAI Residential Commissioning manual and is published by The Heating, Refrigeration and Air Conditioning Institute of Canada.

Second Edition

First Printing

January, 2004

# ACKNOWLEDGMENTS

The Heating, Refrigeration and Air Conditioning Institute of Canada would like to thank the following people for their comments and constructive advice which assisted greatly in the production of this manual:

Bruce Gough	Energy Buildings Group
Rick Leniuk	Wirsbo Canada Ltd.
Conrad Baumgartner	Yukon Housing Corp.

Special thanks to the Yukon Housing Corp. for providing the opportunity to pilot the course and to the participants for their assistance in reviewing the manual.

Special thanks to Tom Dyer of Dyer HVAC Services Inc. and Mike Lutman of M. J. Lutman Corporation for their efforts as authors in developing this manual.



# TABLE OF CONTENTS

<b>PURPOSE .....</b>	<b>XI</b>
<b>SCOPE .....</b>	<b>XI</b>
<b>1 BASICS .....</b>	<b>1</b>
<b>1.1 Duct System Pressures .....</b>	<b>1</b>
1.1.1 Static Pressure (SP) .....	1
1.1.2 Velocity Pressure (VP).....	1
1.1.3 Total Pressure (TP) .....	1
1.1.4 External Static Pressure (ESP).....	1
1.1.5 Pressure Drop (PD) .....	2
<b>1.2 Air Pressure Measurement Gauges .....</b>	<b>2</b>
<b>1.3 Equipment Static Pressure Readings.....</b>	<b>3</b>
<b>1.4 Duct Velocity Pressure Readings .....</b>	<b>4</b>
1.4.1 Pitot Tube .....	4
<b>1.5 Air Velocity Interpolation.....</b>	<b>7</b>
<b>1.6 Air Flow Measurement at Outlets / Inlets.....</b>	<b>8</b>
1.6.1 Flow Hoods .....	8
1.6.2 Anemometers.....	9
1.6.3 CMHC Garbage Bage .....	11
1.6.4 Flow Measuring Station (FMS) .....	12
<b>1.7 Fan Motors .....</b>	<b>13</b>
1.7.1 Shaded Pole Motors .....	13
1.7.2 PSC motors.....	13
1.7.3 Electronically Commutated Brushless Permanent Magnet DC Motors.....	14
<b>1.8 Hydronic Flow Measurement.....</b>	<b>15</b>
1.8.1 Measuring Water Flow .....	15
1.8.2 Measuring Temperature Drop .....	15
<b>1.9 Expansion Tank Pressurization .....</b>	<b>16</b>

<b>APPENDIX B TABLES AND CHARTS .....</b>	<b>117</b>
ACCEPTABLE AIR VELOCITIES.....	118
EXTERNAL STATIC PRESSURE APPORTIONING .....	118
ENLARGED EQUAL FRICTION CHART .....	119
TABLE OF AIR FRICTION IN ROUND METAL DUCTS.....	120
RECTANGULAR DUCT EQUIVALENTS.....	121
OVAL DUCT EQUIVALENTS .....	122
MIXED AIR TEMPERATURE CHARTS .....	123
a - Percent House Air .....	123
b - HRV Air Delivery Temperature.....	124
c - Mixed Air Temperature.....	125
VELOCITY PRESSURE TO VELOCITY CONVERSION CHARTS	126
<b>GLOSSARY OF TERMS .....</b>	<b>127</b>

## PURPOSE

The proper Design, Installation and Commissioning of residential heating, ventilating and air conditioning systems has the potential to increase comfort of the homes occupants, increase system efficiency and reduce emissions of greenhouse gases into the environment.

This manual provides a guideline of good engineering practice in the commissioning such systems. This manual is designed as a supplement to the HRAI design and installation courses presently available

## SCOPE

- a) The procedures in this manual are designed for use with residential heating, ventilating and air conditioning systems.
- b) Heating and cooling loads shall be calculated in accordance with the HRAI Residential Heat Loss and Heat Gain Calculation Manual or equivalent computer software.
- c) Duct design shall comply with the HRAI Residential Air System Design Manual or equivalent computer software.
- d) This manual is not designed to be used for small commercial applications.
- e) This manual provides worksheets to be used for the purpose of the commissioning of residential heating, ventilating and air conditioning systems.