

## C-21 REFRIGERATION AND AIR CONDITIONING CONTRACTOR

### SCOPE OF WORK

The construction, erection and installation of devices, machinery and units for the control of air temperatures below 50°F in refrigerators, refrigerated rooms and insulated spaces, and installation of any related insulation, ducts, blowers, registers, controls over humidity and thermostatic controls, lines for supplying natural gas from the unit to the point of connection in the existing line for natural gas at the meter or at any point thereafter, electrical service from the unit's device to protect against excessive current to the main electrical panel, but not the installation of other gas or electric services for the devices, machinery or units, the installation, repair, service and maintenance of equipment, devices, machinery, units and related ductwork which use evaporation, refrigeration, boilers or combustion for the control of air temperatures in structures where people live, work or assemble or animals are kept, the selection, cutting, shaping, fabrication and installation of sheet metal in such forms as cornices, flashings, gutters, leaders, downspouts for rainwater, pans, kitchen equipment, ducts, louvers, patented chimneys and metal flues, the repair and replacement of any parts of existing units or systems of air-conditioning and refrigeration, including the compressors, motors, relays, coils, heat exchangers and other appurtenances and equipment, but not the replacement of complete condenser assemblies on remote systems, air handlers or any work that may alter the design of an existing system, the installation of the collectors, piping, storage and other equipment used in the conversion of solar energy to energy used for the control of air temperatures, the installation of the chiller, piping, pumps, storage tanks, coils, cooling tower and other equipment used in the production and use of chilled water for the control of temperatures, the fabrication, installation, repair and removal of pipes, pumps, valves and other equipment used in the transfer of hot water for the control of temperatures.

# of Questions	Minimum Passing Score	Time Allowed
85	60	3 Hours

### CONTENT OUTLINE

Subject Area	# of Items
Piping	<u>6</u>
Insulation	1
Hangers and Supports	3
Sound, Vibration and Seismic Control	<u>1</u>
Heating and Cooling Principles	<u>3</u>
Refrigerants and Refrigeration	<u>7</u>
Load Calculations	<u>6</u>

Testing, Adjusting and Balancing	<u>3</u>
Controls	<u>5</u>
Machine Room	<u>1</u>
A/C and Heat Pump Equipment	<u>4</u>
Furnaces and Heaters	<u>4</u>
Hydronics	<u>2</u>
Chimneys, Flues and Vents	<u>5</u>
Combustion Air	<u>2</u>
Fuel Systems	<u>10</u>
Ducts	<u>6</u>
Evaporative Cooling	<u>2</u>
Chillers	<u>3</u>
Solar	4
Ventilation and Exhausts	3
Safety	4

### REFERENCE LIST

The reference material listed below was used to prepare the questions for this examination. The examination may also contain questions based on trade knowledge, or general industry practices. **Except for Code books**, you can use later editions of references as they become available. For Code questions, the examination will be based **only** on the edition of the Code book that is listed.

Candidates may use a silent, nonprinting, non-programmable calculator in the examination center.

This examination is OPEN BOOK.

*The following reference material is allowed in the examination center:*

1. *Uniform Mechanical Code*, 1997, International Association of Plumbing and Mechanical Officials, IAPMO World Headquarters, 5001 E Philadelphia St, Ontario, CA 91761 USA, 800.85.IAPMO, ISBN: 884590-77-2 www.iapmo.org

Reference material may be highlighted, underlined, and/or indexed. They must be otherwise unmarked (not written in) and may not contain additional papers (loose or attached). THESE REFERENCES WILL NOT BE AVAILABLE IN THE EXAMINATION CENTER.

*The following reference materials are not allowed in the examination center:*

1. *Code of Federal Regulations* - 29 CFR Part 1926 Revised as of 2002 or later (OSHA), Superintendent of Documents, PO Box 371954, Pittsburgh, PA 15250-7954, **OR** *Code of Federal Regulations* - 29 CFR Part 1926 Selections as of 2003 by PSI, (800) 733-9267, (See order form at the end of the Candidate Information Bulletin.)



2. *Modern Refrigeration and Air Conditioning*, Althouse, Turnquist, Bracciano, 2000, Goodheart-Willcox, ISBN: 1566377242
3. *HVAC Duct Construction Standards-Metal and Flexible*, (SMACNA), 4201 Lafayette Center Dr, Chantilly, VA 20151, ISBN: 999424695X
4. *Manual N*, 4th Edition, 1988, ACCA, 2800 Shirlington Rd, Ste 300, Arlington, VA 22206, (703) 575-4477, [www.acca.org](http://www.acca.org)
5. *Solar Water and Pool Heating Design and Installation Manual*, 1992, Florida Solar Energy Center, 1670 Clearlake Road, Cocoa, FL 32922, (321) 638-1015, [www.fsec.ucf.edu](http://www.fsec.ucf.edu)
6. *NFPA 54 National Fuel Gas Code*, 1999, National Fire Protection Assn, 1 Batterymarch, Quincy, MA 02269, (617) 770-3000, [www.nfpa.org](http://www.nfpa.org)
7. *NFPA 85 Boiler and Combustion Systems Hazard Code*, National Fire Protection Assn, 1 Batterymarch, Quincy, MA 02269, (617) 770-3000, [www.nfpa.org](http://www.nfpa.org)
8. *Evaporative Air Conditioning Handbook*, 3<sup>rd</sup> Edition, 1997, John R. Watt, Will K. Brown, Prentice Hall PTR, Fairmont Press, 700 Indian Trail, Liburn, GA 30247, ISBN: 0-88173-193-5 FP

