

## ANSI / CSA / IGSHPA C448 Series-16

# “Design and installation of ground source heat pump systems for commercial and residential buildings”

(A Bi-National Standard by Canada and the United States)

This code book is available in searchable (digital) format for download at \$155 from its publisher, the [Canadian Standards Group](#). It is also available to members of IGSHPA for \$100 on the [IGSHPA website](#).

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## **CSA / ANSI / IGSHPA 448 [ Reference publications ]**

This Standard refers to the following publications and where such reference is made it shall be to the edition listed below, including all amendments published thereto.

### **CSA Group**

B52-13

*Mechanical refrigeration code*

B64 Series-11

*Backflow preventers and vacuum breakers*

B137 Series-13

*Thermoplastic pressure piping compendium*

B137.0-13

*Definitions, general requirements, and methods of testing for thermoplastic pressure piping*

B137.1-13

*Polyethylene pipe, tubing, and fittings for cold-water pressure services*

B137.5-13

*Crosslinked polyethylene (PEX) tubing systems for pressure applications*

C748-13

*Performance of direct-expansion (DX) ground-source heat pumps*

CAN/CSA-C13256-1-01 (R2011)

*Water-source heat pumps — Testing and rating for performance — Part 1: Water-to-air and brine-to-air heat pumps*

CAN/CSA-C13256-2-01 (R2010)

*Water-source heat pumps — Testing and rating for performance — Part 2: Water-to-water and brine-to-water heat pumps*

C22.2 No. 236-11

*Heating and cooling equipment*

CAN/CSA-C22.2 No. 60335-1:11

*Safety of Household and Similar Appliances — Part 1: General Requirements*

CAN/CSA-C22.2 No. 60355-2-40-12

*Safety of Household and Similar Electrical Appliances — Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers*

F280-12

*Determining the required capacity of residential space heating and cooling appliances*

### **ACCA (Air Conditioning Contractors of America)**

*ANSI/ACCA Manual D (Residential Duct Design), 2009*

*ANSI/ACCA Manual J (Residential Load Calculation), 2011*

*ANSI/ACCA Manual S (Residential Equipment Selection), 2<sup>nd</sup> Edition*

### **AHRI (Air-Conditioning, Heating, and Refrigeration Institute)**

870 (I-P)/871 (SI)-2015 (under development)

*Performance Rating of Direct Geoexchange Heat Pumps*

**AHRI (Air-Conditioning, Heating, and Refrigeration Institute)/ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers)/ISO (International Organization for Standardization)**

ANSI/AHRI/ASHRAE/ISO 13256-1:1998 (R2012)

*Water-source heat pumps — Testing and rating for performance — Part 1: Water-to-air and brine-to-air heat pumps*

ANSI/AHRI/ASHRAE/ISO 13256-2:1998

*Water-source heat pumps – Testing and rating for performance — Part 2: Water-to-water and brine-to-water heat pumps*

**ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers)**

*2012 ASHRAE Handbook — HVAC Systems and Equipment*

*2013 ASHRAE Handbook — Fundamentals*

*2014 ASHRAE Handbook — Refrigeration*

*2011 ASHRAE Handbook — HVAC Applications*

ANSI/ASHRAE 34-2013

*Designation and Safety Classification of Refrigerants*

ANSI/ASHRAE 90.2-2007

*Energy-Efficient Design of Low-Rise Residential Buildings*

DA-00-13-1, “A Comparison of Vertical Ground Heat Exchanger Design Software for Commercial Applications”, *ASHRAE Transactions 2000*, Vol. 106, Part 1, pp. 831–8412.

SE-99-20-1, “A New Comparison of Vertical Ground Heat Exchanger Design Methods for Residential Applications”, *ASHRAE Transactions 1999*, Vol. 105, Part 2, pp. 1179–1188.

SP-94-2001

*Commissioning, preventative maintenance and troubleshooting guide for commercial GSHP systems*

Heinonen, E.W. and R.E. Tapscott (1996) “Assessment of anti-freeze solutions for ground-source heat pumps systems.” *ASHRAE Research Project RP-908, Report.*

**ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers)/IES (Illuminating Engineering Society)**

ANSI/ASHRAE/IES 90.1-2013

*Energy Standard for Buildings Except Low-Rise Residential Buildings, I-P Edition*

ANSI/ASHRAE/IES 90.1-2013

*Energy Standard for Buildings Except Low-Rise Residential Buildings, (SI Edition)*

**ASME (American Society of Mechanical Engineers)**

B16.22-2013

*Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings*

**ASSE International (American Society of Sanitary Engineering)**

*Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies, January 2010*

**ASTM International**

B280-13

*Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*

C150/C150M-12

*Standard Specification for Portland Cement*

C177-13

*Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus*  
D92-12b  
*Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester*  
D1177-12  
*Standard Test Method for Freezing Point of Aqueous Engine Coolants*  
D1384-05 (2012)  
*Standard Test Method for Corrosion Test for Engine Coolants in Glassware*  
D2447-03  
*Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter (Withdrawn 2010)*  
D2513-14e1  
*Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings*  
D2657-07  
*Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings*  
D2683-14  
*Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing*  
D2737-12a  
*Standard Specification for Polyethylene (PE) Plastic Tubing*  
D2765-11  
*Standard Test Methods for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics*  
D2837-13e1  
*Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products*  
D3013-14a  
*Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter*  
D3035-14a  
*Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter*  
D3261-12  
*Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing*  
D3350-14  
*Standard Specification for Polyethylene Plastics Pipe and Fittings Materials*  
D5084-10  
*Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter*  
D5334-08  
*Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe Procedure*  
F714-13  
*Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter*  
F876-13a  
*Standard Specification for Crosslinked Polyethylene (PEX) Tubing*  
F877-11a  
*Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems*

F1055-13

*Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing*

F1807-14

*Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing*

F1960-14

*Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing*

F2080-12

*Standard Specification for Cold-Expansion Fittings with Metal Compression-Sleeves for Crosslinked Polyethylene (PEX) Pipe*

F2159-14

*Standard Specification for Plastic Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing*

F2164-13

*Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure*

F2620-13

*Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings*

#### **AWWA (American Water Works Association)**

AWWA C901-08

*Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) 3 In. Through (76 mm) for Water Service*

AWWA C510-07

*Double Check Valve Backflow Prevention Assembly*

#### **AWS (American Welding Society)**

A5.8M/A5.8:2011-AMD 1, second printing, January 2012

*Specification for Filler Metals for Brazing and Braze Welding*

#### **DIN (Deutsches Institut für Normung)**

DIN 16892-00

*Crosslinked polyethylene (PE-X) pipes — General requirements, testing*

DIN 16893-00

*Crosslinked polyethylene (PE-X) pipes — Dimensions*

#### **Government of Canada**

*Canada Fisheries Act, R.S.C., 1985, c. F-14*

*Canada Labour Code, R.S.C., 1985, c. L-2*

Health Canada. *Reference Manual for the WHMIS Requirements of the Hazardous Products Act and Controlled Products Regulations*, 2000

**HRAI (Heating, Refrigeration and Air Conditioning Institute of Canada)**

*HRAI Digest, 2005*

**IGSHPA (International Ground Source Heat Pump Association)**

*Closed-loop/geothermal heat pump systems design and installation standards, 2013*

*IGSHPA Residential and Light Commercial Design and Installation Manual*

**ISO (International Organization for Standardization)**

14531-2:2004

*Plastics pipes and fittings — Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels — Metric series — Specifications — Part 2: Fittings for heat-fusion jointing*

**NACE (National Association of Corrosion Engineers)**

SP0169-2013

*Control of External Corrosion on Underground or Submerged Metallic Piping Systems*

**NGWA (National Ground Water Association)**

ANSI/NGWA-01-14

*Water Well Construction Standard*

**NRCC (National Research Council Canada)**

*National Building Code of Canada, 2010*

*National Plumbing Code of Canada, 2010*

**NSF International**

ANSI/NSF 60

*Drinking Water Treatment Chemicals—Health Effects*

ANSI/NSF 61-2013

*Drinking Water System Components—Health Effects*

**UL (Underwriters' Laboratories)**

1995-2011

*Heating and Cooling Equipment*