Declaration of Catherine Vassilkova

1. I, Catherine Vassilkova, am an employee of BEADOX LLC ("BEA").
2. I am over the age of 21 and have personal knowledge of the facts contained herein unless otherwise indicated.
3. I have worked in the field of information research and document retrieval for law firms since 2005.
4. I have been with BEA since I established the company in 2019.
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6. BEA specializes in the research and delivery of materials from the Library of Congress.
7. On September 26, 2025, I was asked by the requester Morrison and Foerster LLP to obtain a scan from the following book: HVAC : handbook of heating, ventilation and air conditioning for design and implementation (1st ed. 2007).
8. On September 30, 2025, I obtained HVAC : handbook of heating, ventilation and air conditioning for design and implementation (1st ed. 2007) from the Library of Congress, and scanned the requested excerpts including book cover, title page, copyright page date-stamped (February 28 2009), table of contents pages, and chapter sections 13-1, 13-2 from HVAC : handbook of heating, ventilation and air conditioning for design and implementation (1st ed. 2007). Those excerpts are included as Exhibit 1019.
9. I confirm that the copyright page of the scanned book has a stamped date of receipt of February 28 2009.
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HVAC:

Handbook of Heating, Ventilation and Air Conditioning for Design and Implementation

BY

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This Handbook provides comprehensive technical information in a modular form to heating, ventilating, and air conditioning (HVAC) designers and practitioners, namely engineers, architects, contractors, and plant engineers. It is also a handy reference for students mastering the intricacies of the HVAC rudiments. Each chapter is self-contained to the extent possible and emphasis is placed on graphical and tabular presentations of data that are useful for easy understanding of fundamentals and solving problems of design, installation, and operation.

This Handbook draws upon the material presented in the *Handbook of Air Conditioning, Heating, and Ventilating, Third Edition*, Industrial Press, which forms the basis of the presentation. New topics and chapters have been introduced and previous information updated or rewritten. Examples using software solution tools have been added alongside traditional solutions using formulae from the handbook. The organization, however, remains, in the literal sense, a handbook.

We gratefully acknowledge the contributors and editors of the aforementioned *Handbook of Air Conditioning, Heating, and Ventilating*, whose knowledge is embedded throughout the present book. We did not have the opportunity to meet any of them, but their written legacy has left an indelible imprint on the present work.

An important source of information is the ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) repertoire of publications. ASHRAE serves as the authoritative, and occasionally the sole, source of up-to-date HVAC related data and analysis. We acknowledge their permission to use material from various publications, especially the latest ASHRAE Handbook series.

ASHRAE Publications
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Web Site: www.ashrae.org

We also acknowledge three corporations for supplying us with material for inclusion in the Handbook. We profusely thank Mr. Michael White of Bell & Gossett (an ITT Division), Mr. Kent Silveria and Mr. Thomas Gorman of Trane Corporation, and Mr. Steven Boediarto of Preferred Utilities, for facilitating the acquisition of these materials.

The Bell & Gossett corporation has graciously provided the ESP-PLUS software package to accompany the Handbook. This software, a $100 value, permits users to select components based on design or operating conditions.

Bell & Gossett (ITT Fluid Handling)
8200 N. Austin Ave
Morton Grove, IL 60053
Web Site: www.bellgossett.com

The Trane corporation has generously allowed us to include their Trace Load 700 load calculation limited capability demonstration version software with the Handbook.

Trane C.D.S. Department
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La Crosse, WI 54601
Web Site: www.trane.com

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AIR CONDITIONING SYSTEMS

A unitary air conditioner is an apparatus consisting of one or more factory made assemblies that normally include an evaporator, a blower, a compressor, and a condenser, designed to be used together. The unit often performs heating as well as cooling functions.

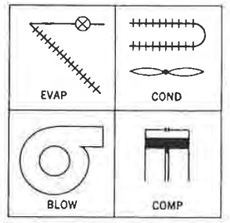

Fig 13-1. Self contained air conditioner

Air Conditioning Systems

Single Package Units.—The single package, or so-called *self-contained* air conditioner, is shown symbolically in Fig. 13-1. All four basic components of the refrigeration cycle are placed in a single *package* or housing. Vertical single-package equipment is usually designed for inside-the-building application. Units often are equipped with line voltage controls, including integral thermostat, all factory prewired. Return air filter and grille are standard with supply air duct flanges usually located at the top of the unit. Most AC units have water-cooled condensers, which can be used with either city water or cooling tower water. Fig. 13-2 is a typical unit of this type. When it is necessary to install a unit without ductwork, a plenum and grille may be fitted to the unit for free air delivery.

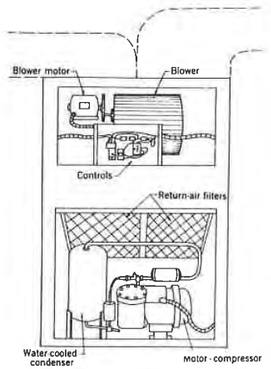

Fig 13-2. Vertical self contained air conditioned unit

Vertical units are available for installation in the space (the traditional *store cooler*) or with more utilitarian cabinets (sometimes designated *commercial*) for remote location; especially where space and noise factors assume extra importance. Commercial units are available in capacities to 50 tons and higher.

Horizontal single package units (Fig. 13-3) are designed for both indoor and outdoor installation, with the majority of units incorporating air cooled or evaporative-cooled condensers. The most common design has supply and return air connections located in the same face with horizontal air flow. Since horizontal units are designed for remote location, they are usually equipped with low voltage thermostat control. Filters are not usually supplied with the unit.

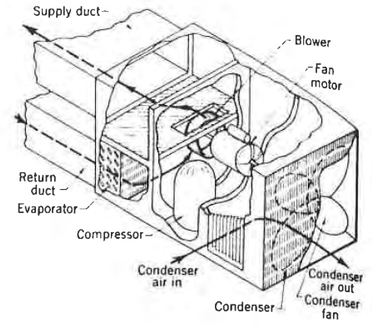

Fig 13-3. Horizontal self contained air conditioned unit

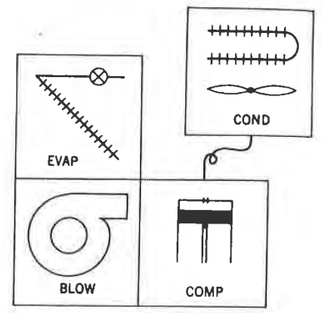

Fig 13-4. Vertical self contained air conditioned unit

Horizontal units are manufactured in capacities from 2 to 20 tons with many modifications for use in residential and light commercial applications. Their outstanding virtue is flexibility, as they can be installed, with ducted air for condensing; outdoors with ducted conditioned air supply and return; and through the wall. Indoors, they can be

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floor, wall, or ceiling-mounted, and placed in the attic, basement, or in the conditioned space.

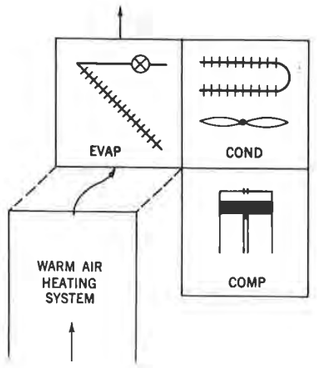

Fig 13-5. Warm air heating system

Units with Remote Condensers: Unitary air conditioners with remote condenser, piped and charged in the field, are basically the same as store coolers but with remote air cooled condensing substituted for integral water cooled condenser.

Refrigeration Chassis: Units in this category are designed to be used with a warm air heating system whose blower supplies the air for the units cooling coil (see Fig. 13-5).

In one version, the compressor-condenser is connected to the evaporator only by several feet of precharged refrigerant line for not too remote location, (see Figs. 13-6 and 13-7). These units are somewhat of a cross between single-package and split systems. Refrigeration chassis are available, also, with (truly) remote air-cooled condensers.

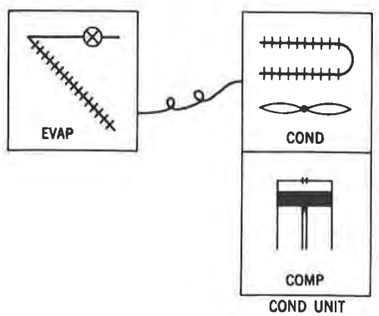

Fig 13-6. Split condenser and evaporator unit

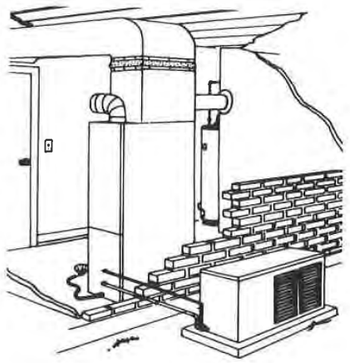

Fig 13-7. Warm air heating system

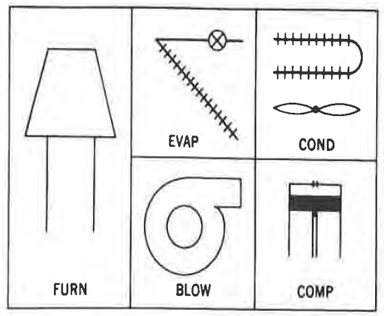

Fig 13-8. Single package year round unit

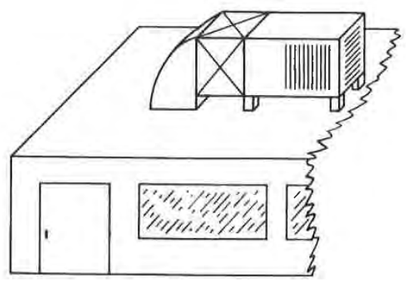

Fig 13-9. Roof mounted A-C unit

Single-Package Year-Round Units: Operated by a factory-wired, interconnected control system through a single heating-cooling thermostat, these units contain a fuel-fired heat exchanger and a factory-sealed and charged refrigeration cycle, (see Fig. 13-8). There are water cooled models designed for installation indoors, but by far the majority are designed for roof mounting with air condensing (see Fig. 13-9). Units are available with natural gas engine compressor drive.

Year-Round Remote Units: These units are the single-package and single package with remote condenser units with heating units attached (see Fig. 13-10).

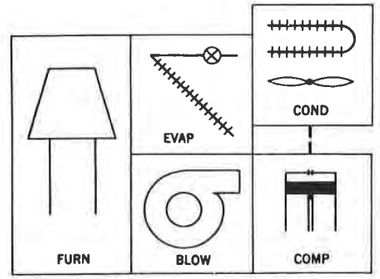

Fig 13-10. Year round air conditioner with remote air cooled conjurers

The round air unit, year-round air conditioner with remote condensing unit (Fig. 13-11) makes the real jump to the *split system*. In the case of both units, interconnecting refrigerant piping is usually field-supplied.

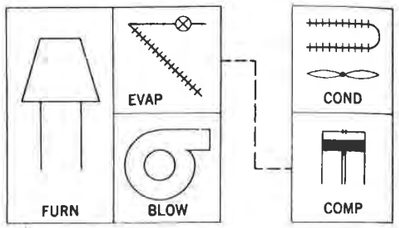

Fig 13-11. Split system year round air conditioner

Remote Condensing Units: A split system air conditioner is a unitary conditioner whose components are assembled in more than one factory made enclosure. The cooling coil is remote from the condensing unit. Because of its similarity to the single package air conditioner units whose condensers only are remote, and refrigeration chassis with or without remote condenser, have already been discussed in conjunction with single-package air conditioners, although they are not truly single package.

Split system components include electric and engine-driven condensing units, remote gas-fired water chillers, cooling coils (evaporators without blowers), and cooling coils with blowers. There is more split-system equipment available than any other type.

Condensing units contain compressor, condenser, and electrical controls. Air cooled and evaporative-cooled condenser models also contain a fan and fan motor. Units are normally designed for outdoor installation, but some models are designed for indoor or through the wall installations (Figs. 13-12 and 13-13).

Evaporator coils (Fig. 13-14) come in a multitude of sizes and designs. Coils for use with warm air heating systems are available for upflow, downflow, and horizontal air patterns, that is, in bonnet units, under the furnace units, and duct units, respectively.

Fig 13-12. Remote condensing unit application

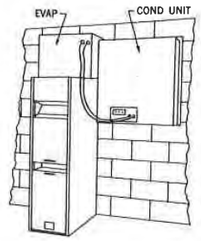

Fig 13-13. Split system, flush wall condensing unit

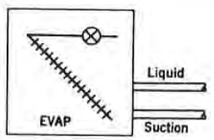

Fig 13-14. Evaporator coils in conjunction with warm air furnace

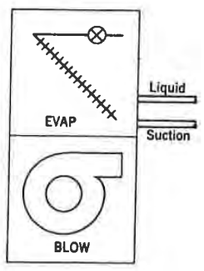

Fig 13-15. Coil with blower units

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