

DUCT FREE SPLITS SYSTEMS:

A TACTICAL WEAPON FOR TODAY'S COMPLEX WORLD

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Necessity is the mother of invention!

Duct Free Split systems were developed by the Japanese in the 1970's as a response to the tight constraints and noise of urban Japanese life. A sleepy Japanese engineer one day, fed up with the loud noise emanating from his window unit, decided to cut it in half and place the compressor portion down on the ground level, piping the refrigerant up to the evaporator and fan section. This was the start of a new market that soon would revolutionize much of the world's air conditioning business.

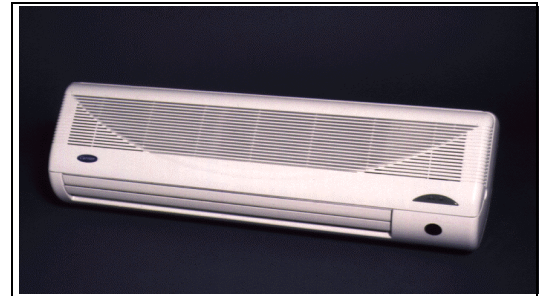
Today Duct Free systems constitute a third of the total world air conditioning market with a growth rate approaching 10% annually. The market has more than doubled in the past decade. Europe and Asia enjoy the largest penetration of these systems followed by Latin America and North America. Carrier corporation is a world leader in these products with 14 factories and sales in 180 countries throughout the world.

Duct Free systems are precision units, made to exacting specifications, they are microprocessor driven for enhanced comfort and efficiency. These units are known for their extreme quiet operation, compressed sizes and efficient performance inside and out.

What are typical Duct Free split configurations?

This category of products usually consist of four basic configurations.

1. **High Wall products**, which hang on the wall much like a speaker or a picture frame. They are piped and wired through a 3" hole leading to the outside where the condensing unit is placed. These models are usually smaller in capacity and begin at approximately 9,000 Btu's and range to 30,000 Btu's. These fan coils are typically very light weight, as low as 28 pounds and can be mounted easily. They are micro processor controlled for precise comfort.





2. **Under Ceiling units**, as the name indicates, are long thin rectangular fan coils that hang directly from the ceiling . The typical dimensions are (38" wide by 28" deep by 12" thick) and grow proportionally as the size increases. Typical capacities range from 12,000 Btu's to 60,000 Btu's. These units also are piped and wired through a 3" hole and have fresh air knock out leading either up to

the roof or directly out to an outside wall.

3. **Cassette units**, are square or rectangular fan coils systems that fit completely recessed into a standard paneled drop ceiling. The units have a concentric design which discharges air flow in 4, 3 or 2 directions away from the fan coil and return air through the center. They are driven by a backward incline axial fan. These units provide excellent air distribution and are aesthetically very appealing. The systems are manufactured with internal condensate pumps that have built in overflow protection. Another feature is the capability to introduce fresh air via branch duct opening in the unit.



4. **Console units**

These systems are equivalent to the under ceiling units but are mounted vertically against the wall. In many instances the console units and under ceiling are one in the same with internal isolation and dual drain pans allowing vertical or horizontal mounting.

The above units are usually are offered as cooling only and heat pump systems and run on either 115V or 208/230 volts. They all have discrete remote controllers or thermostats as part of the system. Many High wall systems come with wireless infra red remote controller with a multitude of features, including timers, programmed dehumidification and variable speed fan motors.



The condensing units that drive the above fan coils are streamlined horizontal discharge units that feature scroll or rotary compressors with efficiencies as high as 12 SEER. These units have low ambient capabilities down to -20f and have line length capability of up to 200 ft. They are designed to operate in extreme conditions and have redundant safeties to protect the compressor from failing.

Why Duct Free Splits?

DFS systems offer many advantages over ducted type and other forms of air conditioning systems.

Ease of Installation:

Duct Free systems are light weight and compact making transportation and set easy on the installer. Many systems can be installed by one individual. The light weight of the systems eliminates the need for flatbed trucks, cranes or hauling equipment on the job site. Because there are no ducts, there is no need for potentially messy cutting into existing structures in retrofit applications. All systems connect through a 3" inch hole that is shielded by a factory provide sleeve. Refrigerant piping, electrical wiring and condensate removal all pass through this opening to the outside. Carrier provides mounting hardware and installation templates with all fan coil units. The condensing units are also designed to be light and operate in tight spaces. They can be bolted down to a pad or roof structure through perforated legs that are standard on bottom of the units.

Sound:

A primary benefit of Duct Free systems are super quiet operation. The Carrier fan coils are designed with tuned tangential blower wheels in the high wall product, axial backward incline fans in the cassettes and centrifugal blower wheels in under ceiling and console systems. Stainless steel shafts with permanently lubricated ball bearing motors. Carrier's advanced engineering team in Aeroacoustics and vibration have helped develop fans that are both low sound power and pressure.

Employing the latest technologies shared with Pratt and Whitney engines and Sikorsky, Carrier condensing units incorporate unique cowl induction shroud design that maximizes air flow performance through the condensing coil to reduce CFM and lower sound power.

High Efficiency:

Duct Free systems are designed to inherently offer efficient operation. Carrier systems range from 10.2 SEER to over 12 SEER. The first aspect of the design is the lack of ductwork and therefore duct loss. Even the high quality duct installation has 5% -10% duct loss. Based on surveys conducted in the U.S. the average duct loss in Residential, light commercial installations is between 20%-25%. This fact bolsters the performance of DFS units in direct comparison to other forms of forced air ducted splits and rooftop installations.

Precise temperature control is another benefit of duct free systems. Microprocessor controls manage indoor fan speed and compressor cycling to minimize large temperature swings. The units usually operate within 1° F +/- tolerance. The fact that the evaporator coil is in the actual space that is being conditioned enhances the ability to remove humidity and achieve set temperatures quickly. Most units have a Sensible/Latent ratio approaching 75%/25% and excellent dehumidifying characteristics.

Multiple sizes and configurations offer a variety of systems for properly matching capacity to the application rather than over sizing of installations to match the generally accepted capacity breaks offered by many manufacturers.

Cost:

There are various components to cost that favor DFS systems to others.

1. **Installed Costs** - On a dollars/Btu of equipment basis, most DFS systems are double that of a typical ducted split system. Calculated as an installed cost however DFS systems are on par with or even lower versus ducted split systems due to the reduced labor and material costs.

Example

	DFS System	Ducted Split system
Equipment	70%	40%
Material	10%	30%
Labor	20%	30%

2. **Opportunity Costs** - Speed of installation is a key benefit to installing DFS systems. An experienced

installer can finish a typical installation in less than three hours. This fact allows DFS installations to be leveraged by batching two or three installations per day. In comparison, a typical ducted split installation usually takes between 6-8 hours.

- 3. Operating cost/Life Cycle costs** - The payback on DFS systems is very economic due to the efficiency and diversity of usage discussed previously. Another important factor is redundancy of operation. In critical use operations, DFS systems offer the user redundancy against massive failures. If a multi room application goes down with a central system the entire facility is off line. If a DFS system goes down, only a fraction of the structure goes off line. The cost of not being able to condition a given space many times outweighs the cost of the system installation.

Typical Applications:

1. Portable structures:

- Tent structures
- Trailers or mobile home

Benefit greatly from the light weight portability of DFS systems. The condensing units can be batched and run in parallel from a central generator.

2. Computer/telecom structures:

These structures are usually cramped for space. The design lends itself for spot cooling and humidity control. The light weight condensing units allow for pre-fab structures to be outfitted with units and shipped to job sites. Computer room units require constant cooling and DFS become a good back up system to a central unit or an independent cooling source that can operate at different cycles from a main system.

3. General office spaces:

DFS units are ideal for individual office control. Heat pump unit allow the occupants to maintain their own comfort levels without disrupting the remainder of the office. Conference rooms, cafeterias, equipment rooms, libraries, etc., all are ideal applications as special use rooms that require specific comfort conditions.

4. Hospitals/Nursing Homes:

Operating rooms with high technology machines such as MRI imaging centers require independent zoning from the balance of the building. The needs of individual patients can be maximized with DFS zone control. These units also prevent the potential spread of germs through ductwork that is prevalent in many healthcare facilities.

5. Schools:

This is another key application for DFS systems. Each classroom can enjoy individual temperature control via independent thermostatic control per zone. Simultaneous heating and cooling is possible through zoning of each room. Fresh air can be induced through the units to manage IAQ concerns.

6. Residential units:

Apartments, condominiums and multi-family housing. Additions to existing homes become easy to negotiate with spot cooling or heating provided by DFS systems.

Above are just a few of thousands of unique applications that are available for DFS systems. There are units installed on everything from aircraft carriers to elevators.

The true advantage of duct free systems are the simplicity of installation, reliable quiet operation, and the flexibility of uses. This segment constitutes the fastest growing area in the air conditioning industry around the world. They offer a differentiated alternative to traditional air conditioning and are a dynamic tool in solving unique comfort control conditions. Duct Free systems truly are a strategic weapon in the fight for individual comfort.

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