

AIRSTAGE



Fujitsu Split Terminal Heat Pump vs. Packaged Terminal Air Conditioners

White Paper
H20221001A
October, 2022



STHP– Split Terminal Heat Pump

Introduction

The majority of hotels and motels in North America utilize Packaged Terminal Air Conditioners (PTACs) to heat and cool their guest rooms. These PTACs, that use very traditional HVAC technology, are also commonly used to air condition nursing homes, dorms, offices, and apartment buildings.

However, the HVAC market is rapidly changing. Inverter compressor technology is the most energy efficient technology and is revolutionizing the way air conditioning systems are being designed and built to meet climate control needs around the world.

This document gives a brief overview of the legacy technology and the inverter compressor technology applied in traditional PTAC applications, lists and analyzes the main differences between the technologies while focusing on advantages and disadvantages.

Packaged Terminal Air Conditioner (PTAC)

A PTAC is a room air conditioning unit designed for through-outside-wall installation. A PTAC is sometimes also referred to as a "through-the-wall unit" or "hotel air conditioner". A PTAC is self-contained, and has all the mechanics for cooling and heating within one unit that is mounted in a sleeve in the exterior wall.

See PTAC image below:



As experienced by most hotel guests, legacy PTACs have several drawbacks. The most obvious is that they are loud, typically create an uncomfortable draft, and an uneven temperature in the room.

For the owner PTACs have one advantage, they have a relatively low up-front cost compared to other HVAC solutions. However, in addition to the comfort related drawbacks listed above, PTACs have disadvantages that

impacts the owner. They are not energy efficient and they also require a substantial amount of maintenance and repair. PTACs have been shown to typically have a short lifespan, often necessitating a replacement after 5 to 7 years.

When cooling is needed in a room, the PTAC unit transfers heat from the room to the outside air. When heating is needed in the room, electric heat strips inside the PTAC provides heat to the circulating air. Some PTACs are available with a built-in heat pump function. They are often called Packaged Terminal Heat Pumps (PTHP). The PTHP can reverse its operation by transferring usable heat from the outside air into the room. However, when heat is needed in the room, the outside air temperature is typically low and the heating capacity of the heat pump PTAC unit decreases with the lower outside temperature. Therefore, when a heat pump unit is installed in colder regions, it is often combined with an electrical heat option. This can work alongside a PTAC in case the heating capacity of the heat pump is not sufficient in locations with low outside temperatures. However, at rated conditions, a heat pump in heating mode is typically several times more energy efficient than electric heat.

Fujitsu Split Terminal Heat Pump (STHP)

Fujitsu Split Terminal Heat Pump (STHP) is a state-of-the-art PTAC alternative. It is a high efficiency mini-split type system that is designed both for retrofit in existing installations and for new construction. It consists of a wall mount indoor fan coil and an outdoor compressor unit mounted in a sleeve in the exterior wall. The physical size is the same as a PTAC, so the compressor unit fits perfectly in a 42" wide PTAC opening. Since the STHP from Fujitsu uses advanced inverter compressor technology, it has many advantages compared to legacy PTACs.

The image rendering below illustrates an installed STHP system, with the ASUH series Wall Mount unit and concealed AOUH series outdoor unit, where the sleeve which can be used for decorative and other minimal weight bearing purposes.



Fujitsu STHP has much better energy efficiency, has an ultra-quiet operation, can provide both cooling and heating even at low outside temperatures, delivers comfortable air supply temperatures with minimum temperature fluctuations, and has many different installation configurations and options.

For controls, the STHP has the capability to be controlled via wireless or wired remote control, Wi-Fi control, and by "front desk" or a building/home automation system.

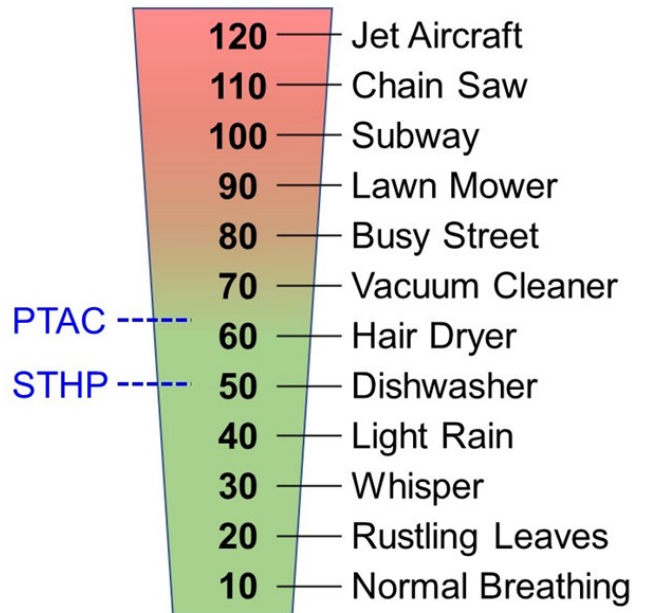
Sound level

Legacy PTAC units typically have sound levels of up to 60 dBA in the room and 70 dBA, or higher, outside the building. This means that the sound level can be similar to the noise from a hair dryer or vacuum cleaner when the PTAC is running in cooling mode. See the sound level reference chart below:

Fujitsu STHP system’s indoor unit and compressor unit are comparatively much quieter than a PTAC. The sound pressure level for the indoor unit is below 40 dBA and the sound pressure levels for the compressor unit without the mounting sleeve is 50 to 52 dBA in cooling mode.

Furthermore, when the STHP outdoor unit is mounted in the insulated mounting sleeve, the sleeve works as an additional barrier to stop both operational noise and outside noise from transmitting into the room.

The standard unit of sound measurement is in decibels due to the non-linear nature of sound to the human ear. Decibels are a logarithmic unit based on the threshold of human hearing.



Therefore, one single legacy PTAC unit is louder than over 10 installed STHP systems inside a room.

Energy efficiency

Energy Efficiency Ratio (EER) – A room air conditioner’s cooling efficiency is measured by the EER. It shows the ratio of the cooling capacity to the power input at the cooling ambient temperature of 95°F. The higher the EER rating, the more efficient the air conditioner.

Legacy PTACs typically have an EER of 9 to 11 BTU/h/W while the **Fujitsu STHP have a certified EER of up to 12.5.**

There are no official efficiency standards for Seasonal Energy Efficiency Rating (SEER), Heating Seasonal Performance Factor (HSPF) or Coefficient of Performance (COP) for PTAC units. However, the following comparison shows the unrivaled energy efficiency of Fujitsu STHP compared to a PTAC.

Seasonal Energy Efficiency Rating (SEER) – The SEER measures an air conditioner’s cooling efficiency throughout an entire cooling season, with temperatures ranging from 65°F to 104°F. Therefore, the SEER rating is more meaningful to an owner than the EER that has only one rating point.

Based on published technical data for PTACs, the calculated SEER for a typical PTAC can be up to 13.1 BTU/h/W. Meanwhile, **the certified SEER for Fujitsu STHP is up to 21.3.**

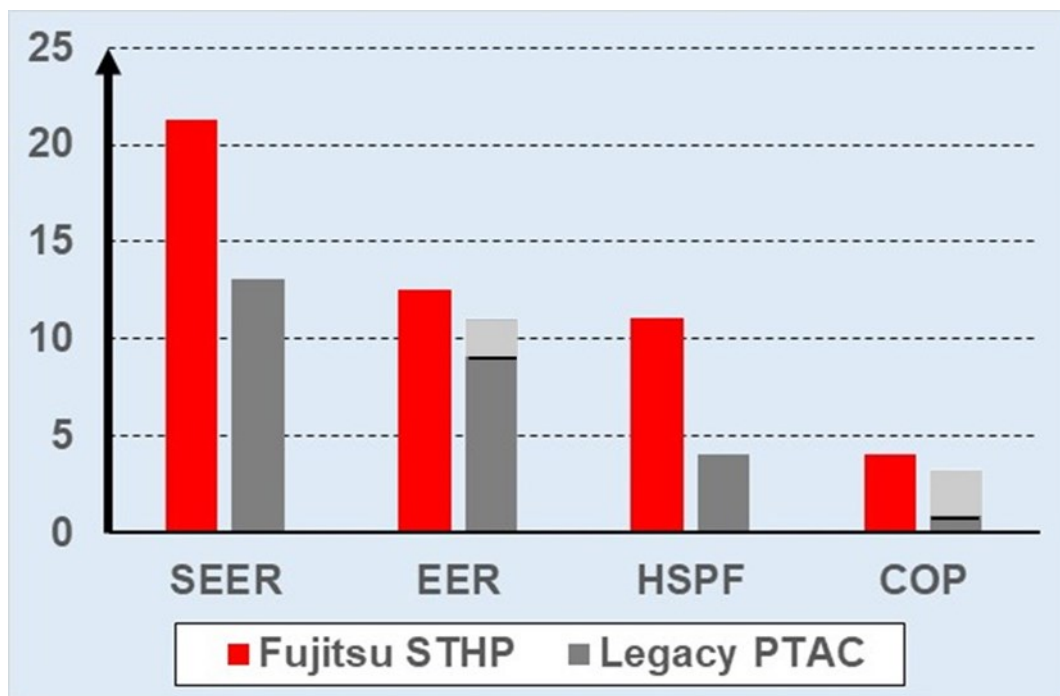
Heating Seasonal Performance Factor (HSPF) – Based on published technical data for legacy PTACs, the calculated HSPF is approximately 4 BTU/h/W. However, the **certified HSPF for Fujitsu STHP is 11.1.**

Coefficient of Performance (COP) – By definition, the COP for a PTAC with electric heat is 1. Based on published technical data for PTACs with heat pump function, the calculated COP for heating is approximately 3.2.

In comparison, the heating **COP equivalent for the Fujitsu STHP is up to 4.04.**

Summary of energy efficiency comparison

(The higher the value, the more efficient the air conditioner.)



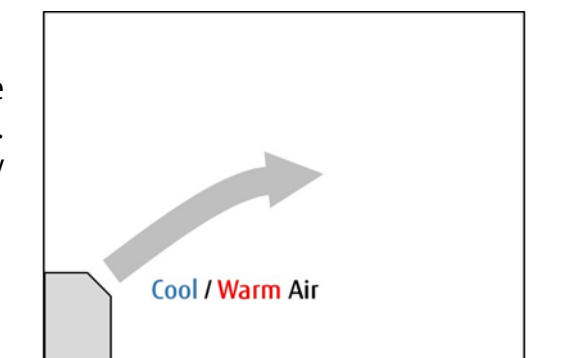
Flexible layout

By design, a PTAC unit must be installed in the outside wall and therefore the supply of conditioned air is limited to always be from that wall. This design limit can restrict comfortable air distribution throughout the whole room.

The indoor unit in the Fujitsu STHP can be mounted on any wall in the room which makes it possible to optimize the layout in the room for individual comfort.

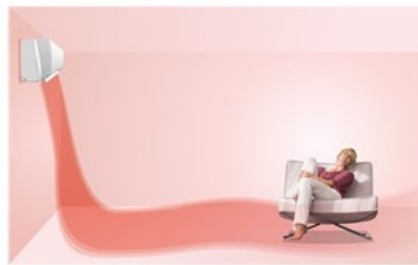
Comfortable air distribution

A PTAC unit only allows both the cool and the warm air to be distributed the same upwards direction due to its design. See image at the right. The comfort of the room is negatively impacted by this limitation.



Comfortable air distribution, cont.

The Fujitsu STHP's mini split system structure gives the owner the freedom to mount it on any wall in the room. In addition, the wall mounted indoor unit also allows the cool air and the warm air to automatically be distributed in the best direction for comfort in the whole room.



Heating



Cooling

See airflow direction images above right.

Maintenance and repair

The frequent start-and-stop operation of compressors and fans leads to more frequent repairs and replacements of HVAC units. For legacy PTACs, the start and stop frequency mainly depends on the load and the size (capacity) of the unit. Therefore, to keep a comfortable climate in the room and minimize repairs, a legacy PTAC unit must always be properly sized for the application

Oversizing PTAC – If a PTAC unit is oversized (heating or cooling capacity is greater than specified load for the application), the unit heats or cools the room too quickly to reach the desired set-point temperature. This results in excessive start and stop of the unit compared to a properly sized air conditioner leading to lower energy efficiency and increased repair/replacements. In addition, an oversized PTAC unit in a hot or humid climate would lead to a cool but excessively humid space.

Undersizing PTAC – If a PTAC unit is undersized (capacity is less than the specified load), the unit will not be able to heat or cool the room to the desired temperature during very cold or hot days despite operating constantly.

With the energy efficient inverter compressor technology, speed-controlled fans and advanced system controls, the Fujitsu STHP automatically adjusts the cooling and heating capacity depending on the actual need of the room. This means that even if the system is oversized, it has no negative impact on system reliability or the comfort in the room.

Life span

Typically, even well-maintained legacy PTACs have a technical lifespan of less than 10 years. However, the financial lifespan can be much shorter since advancements in energy efficiency and smart technology could justify replacing them earlier.

Due to the advanced controls, inverter compressor technology, and speed-controlled fans in the Fujitsu STHP, the expected technical and financial lifespan is considerably longer than the life span for a PTAC.

Summary

PTACs have been used for room cooling and heating for many years in North America, especially in hotels/ motels, nursing homes, dorms, offices, and apartment buildings.

However, by implementing state of the art technology, such as inverter compressors, speed-controlled fans, and advanced controls, Fujitsu's newly introduced STHP (Split Terminal Heat Pump) distinguishes it from PTACs. The advantages with the STHP compared to legacy PTACs are much better energy efficiency, lower sound levels, better comfort in the room, flexibility to optimize the room layout, less maintenance and repair, and longer technical and financial lifespan.

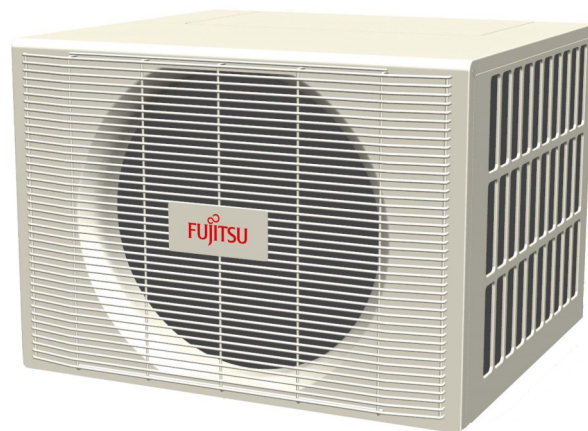
STHP Image gallery



Indoor unit models: ASUH09LMAS & ASUH12LMAS



Stylish remote control included



Outdoor unit models: AOUH09LEAS1 & AOUH12LEAS1