

# Ruskin Rooftop Systems vs. Opposed Blade Damper Controls

## Gear Drive Damper Systems

The following is a comparison of the design of the Ruskin Rooftop Systems Inc. (RRS) gear drive damper system to Opposed Blade Damper systems that uses interconnecting plastic gears for each blade. Each system is used in a rooftop packaged air conditioning unit.

### Basic Damper Design:

**OBD** - Damper is designed with either three-inch or six-inch gears that interlock with each other. The gears are attached to the damper blades inside the air stream.

**RRS** - Damper is designed with a rack and gear system. They are installed outside of the air stream.

### Gear Design:

**OBD** - The gear is manufactured from a plastic material that has a square probe. The probe is press fitted into a damper blade opening to connect the gear to the damper.

**Pro** - 6" gear adds stability to the side by side twist of the damper outside of the rooftop unit.

**Con** - Gear forces all damper blades to be the same width as the gear. If the gear breaks for any reason, the entire blade assembly must be replaced, because the plastic "probe" cannot be removed from the damper. To replace the damper blade, the entire damper assembly must be disassembled in order to remove the blade, since the gear is in the air stream. On most OBD dampers, the frame is assembled with "toggle locks". The only way to "unlock" them is to "drill them out" (like a spot weld). To reassemble, screws must be bought to replace the toggle locks.

**RRS** - The gear is manufactured out of metal. These gears have been tested at over 135,000 cycles. They have also been tested inside a calorimeter room down to 0°F operation. The gear is attached to the damper blade via a metal bearing on steel dampers, or via a metal probe on aluminum airfoil blade dampers.

**Pro** - The gear and rack design allows damper blade widths to vary from blade to blade. The blades can also have their centerline offset. These two features are important when considering the limited space inside a rooftop units return air section. Since the gears are located outside of the air stream, replacing a gear can be done easily. It is not required to disassemble the damper or replace the whole damper blade should a problem arise. Less damper leakage is also a result of having the gears out of the air stream. *Airflow tests have shown a 53% reduction in leakage at the same static conditions.*

**Con** - The completed large damper is not as rigid as the OBD when not installed in the unit. Once installed, both dampers have the same rigidity.

### Airflow Design:

**OBD** - The damper *gear to gear* design requires the dampers to have an Opposed Blade Design (OBD). This means that blades next to each other open in opposite directions with the tips of the damper moving toward each other (see attached sheet).

**Pro** - None in this application. OBD dampers originally were designed for single airflow systems for controlling airflow.

**Con** - Since the tips of the dampers get closer together as they move, at 50% open, the amount of free airflow area is reduced by 38%. Since the area is reduced the static on the unit is increased, which increases operational cost. The full open area of the damper is only found when the return damper is 100% open and the outside air damper is 100% closed. The OBD design also creates air stratification, because the mixing of air is difficult with this design (see page 3).

**RRS** - The damper *gear to rack* design allows the dampers to be a Parallel Blade Design (PBD). This means the blades move parallel to each other. In this design the tips of the blades stay the same distance apart during their rotation (see page 3).

**Pro** - Since the outside air blades open as the return air blades close, the static pressure drop is lower than the OBD damper. This lower static allows the unit to operate more efficiently, thereby saving operating cost. Another additional advantage of the PDB system, is that the outside air and the return air damper direct each air flow together so better mixed air can be achieved. This results in more consistent airflow across the evaporator coil.

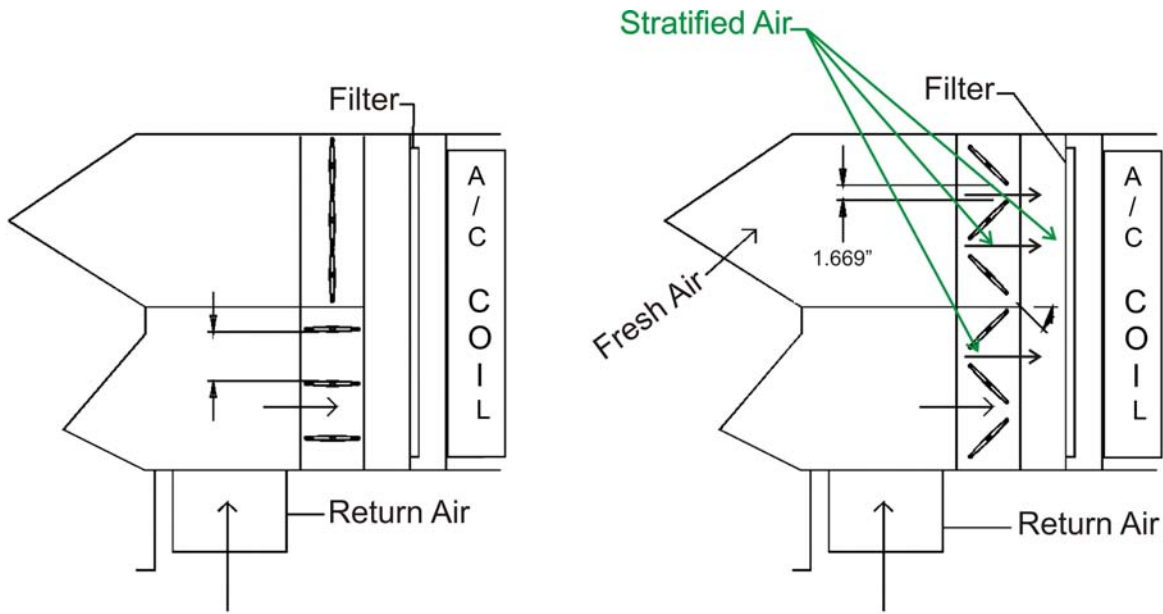
**Con** - ???

### **RRS vs. Opposed Blade Damper System Conclusions:**

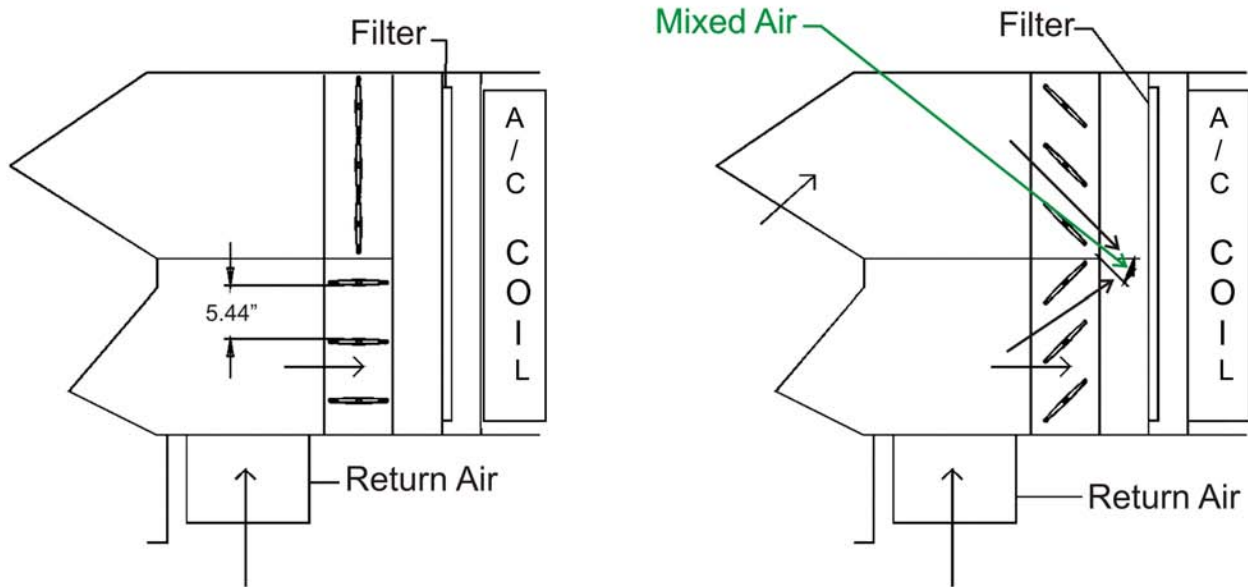
- 1. RRS Damper System has lower air leakage than the OBD damper.**
- 2. RRS Damper System has lower pressure drop than OBD damper.**
- 3. RRS Damper System provides a lower operating cost.**
- 4. RRS Damper System has greater design flexibility.**
- 5. RRS Damper System has metal versus plastic components.**
- 6. RRS Damper System has gears out of the air stream to prevent maintenance problems.**
- 7. RRS Damper System is easier to maintain.**

# Ruskin Rooftop Systems Inc.

## Opposed vs. Parallel Blade Dampers



**Opposed Blade Dampers (OBD)** create air stratification and higher pressure during the mixing mode (or minimum position) of the economizer. *When the blades are 45° open, the area of the opening is reduced by 38%.* When the blades are in that position, fresh air is not directed at the return air so the two air flows do not mix. The air has a tendency to stratify creating hot/cold areas of the evaporator coil.



**Parallel Blade Dampers (PBD)** provide better mixing of fresh air and return air by directing the two airflows toward each other during the mixing mode (minimum position) of the economizer. They also have lower pressure through the blades during this operation, since one blade opens as the other blade closes, unlike OBD dampers that have both fresh air and return air open 45° at one time during their cycle.