

Smudging Around Air Distribution Diffusers

The problem of dirt collecting around ceiling diffusers has been a concern in the air distribution industry for a long time. Some people have asked about this dirt and its effect on the indoor air quality (IAQ) in a given building.

Analysis of the dirt states that it's comprised of skin swims from the human body and silicon fibers from volcanic action that become airborne throughout the world. This dirt around the diffusers accumulates from two sources.

Primary Air

Secondary Air (room air)

Induction of dirty room air at the ceiling or on the ceiling is the key! In most buildings, smudging is the result of secondary room air being induced or pulled into the primary air stream along the ceiling.

Most primary air systems are filtered. Therefore, dirt in the primary air system is not normally the problem that causes dirty black smudge areas on our ceilings. Primary air filters are in place to provide acceptable building hygiene and these remove much of the dirt that may be in a building. As stated before, the black spots around various diffusers are the result of dirt in the room air being deposited on the ceiling next to the diffuser where induction occurs. The darker areas indicate the areas of maximum induction on the ceiling.

The key to keeping a ceiling clean is to avoid induction of room air on the ceiling next to the supply diffuser.

Various diffusers have much more dirt or more pronounced black areas around them than others. The design of the diffuser and the path of induction of the room air to the diffuser is critical.

Figure 1 shows an Isovel of the Titus TDC-4A along with its typical smudging pattern. Note that most of the dirt accumulated in the corners. This is where the room air moves toward the diffuser to be induced into the primary air stream. The more dirt there is in the room air, the more dirt accumulates on the ceiling with this type of diffuser. Additionally, no induction occurs next to the ceiling when

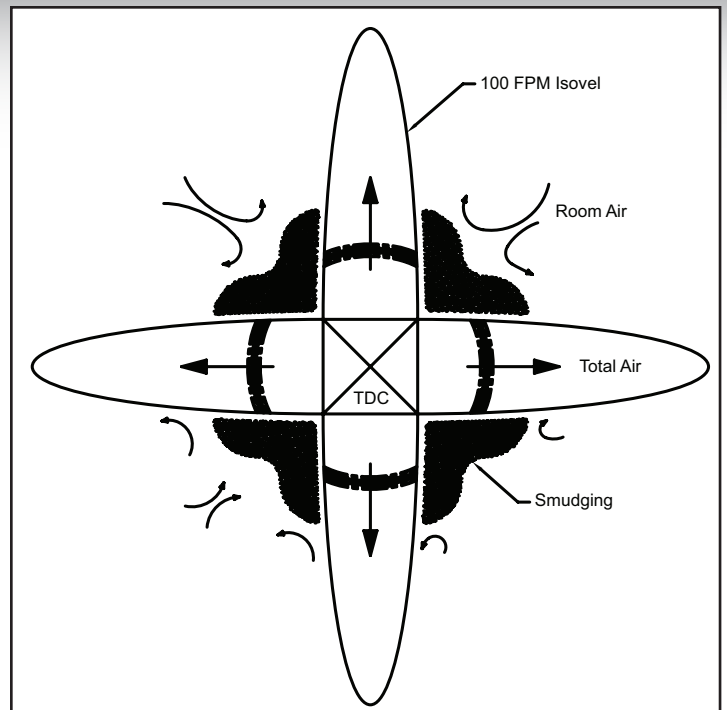


Figure 1 - Isovel of Titus TDC-4A with typical smudging pattern.

there are clean areas along the ceiling. This is an area where secondary air has not penetrated the primary air stream. If room air is mixed with the clean primary air, smudging in the center of the Isovel can occur.

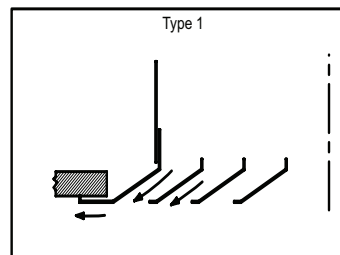


Figure 2

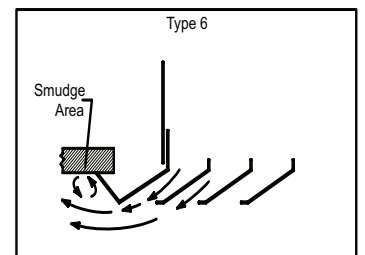


Figure 3

The frame style or border around a diffuser will also affect the dirt on the ceiling. As shown in Figure 2, the Type 1 Frame will have less smudge than the Figure 3 Type 6 Frame. The Type 6 Frame increases the low pressure zone

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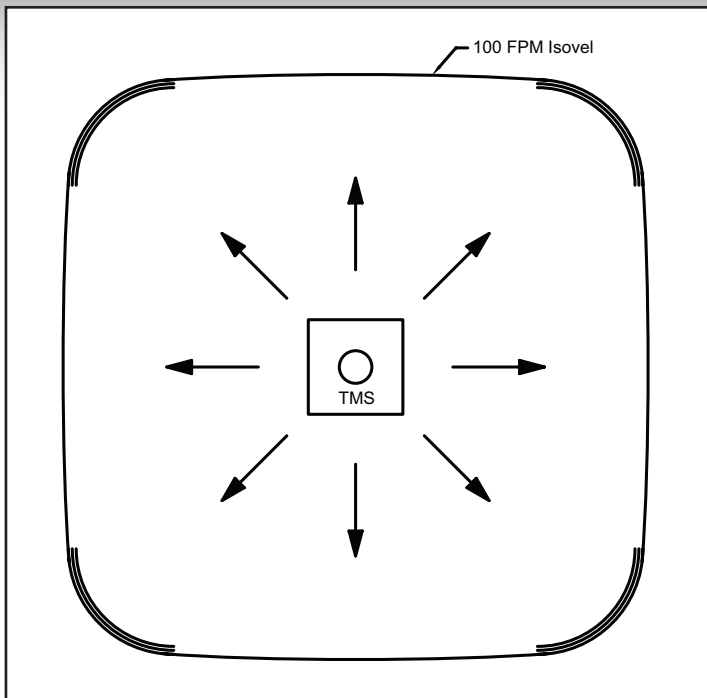


Figure4 - Isovel of Titus TMS with typical smudging pattern.

next to the diffuser and increases the induction of room air into the primary air stream next to the diffuser and smudge area. The frame in this case will increase the turbulence next to the diffuser and increase the amount of smudge on the ceiling.

Diffusers with the least amount of smudge are those which have a smooth, low velocity circular flow pattern and very little or no induction of room air is on the ceiling next to the diffuser. For best results, the air stream should be in a 360-degree pattern around the diffuser.

The diffuser with the best Isovel and the least smudging tendency is the Titus TMS. The TMS diffuser is designed to distribute the air flow out of its cones in a 360-degree pattern with very low turbulence at the ceiling. The smooth velocity next to the ceiling reduces the soiling of the ceiling surface. The room air is induced into the lower portion of the diffuser jet and the dirt is not deposited on the ceiling.

The Isovel for this diffuser is shown in Figure 4. Voids and low pressure induction areas along the ceiling and adjacent to the diffuser have been reduced to a minimum. The airflow from this diffuser is smooth with little turbulence. Because of this product superiority in design, the Titus TMS diffuser will produce less smudging and streaking than any other type of ceiling diffuser!

This makes this diffuser a great choice to use in restaurants, airports and heavy traffic areas with a great amount of dirt in the secondary room air.

It should also be noted that the airflow from the inlet duct attachment can also affect smudging. For the best results airflow should be uniform. Poor results can be seen even with the best diffuser if the airflow is not uniform due to poor inlet conditions. As reported in the previous publication of *On Air*, ASHRAE test are now being conducted dealing with the effect of variable inlet conditions to ceiling diffusers.

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