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TDX ULTRA
Marketing Guide

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General

This document covers marketing and application highlights for TDX Ultimate Low Throw Rapid Aspirating™ (ULTRA™) diffuser.

Additional information may be found at www.titus-hvac.com.

Introduction

We are pleased to add the TDX ULTRA, a high-mixing, high-induction diffuser with short throws and excellent ADPI characteristics, to Titus' square and rectangular ceiling diffuser product line. The TDX ULTRA is a louvered-face, high-induction square, or round-neck diffuser, constructed in either steel or aluminum. The TDX ULTRA diffuser has the highest mixing ratio in the industry.

Research and Development

Titus began the development process for the new diffuser using an engineering approach to provide maximum induction and entrainment of room air with supply air. At the same time, reducing throws and maximizing ADPI to improve comfort levels.

Titus' engineers used Kestel's equations to make ultimate use of air induction by designing a patent-pending nozzle/baffle system. This produces high and low velocity zones where room air is induces and mixed rapidly.

Titus' TDX ULTRA handles high loads with a consistent circular pattern that reduces the time required to reach desired-occupant comfort levels. The result is exceptional indoor air quality unmatched by any diffuser in the market.

Extensive research was done to evaluate and review at all areas of the design including aesthetics. Titus incorporated the results in a diffuser with a clean unobtrusive appearance and exceptional performance.

Features and Benefits

TDX offers the following features and benefits:

- Faster temperature equalization throughout the occupied space.
- Maintains an unbroken horizontal flow from maximum CFM down to a minimum CFM for excellent variable air volume application.
- Minimizes short-circuiting of the primary air to the return.
- Handles heavier loads with higher comfort levels achieved.
- Improves air quality in the occupied space.
- Eliminates the sinking of primary air into the occupied zone (drop).
- Increases ventilation effectiveness.
- Spring-loaded removable core, accessible from the diffuser's face.
- Steel or aluminum construction.

Product Attributes

The TDX is extremely versatile to meet field application needs. Size and border types are shown in Table 1.

Table 1. Product Attributes

Attribute	Detail
Borders	Five available, they are: 1 = Surface mount 2 = Snap-in 3 = Lay-in 4 = Spline 5 = Dropped face 6 = Bevel drop face
Duct Sizes	• Square or rectangular duct neck sizes from 9 x 9 to 18 x 18 inches. • Special sizes of square or rectangular neck sizes for modules 24 x and 48 x 24-inch sizes. • Round duct neck sizes from 6 to 16 inches.
Horizontal Throw Patterns	Five available, they are: • One-way • Two-way • Two-way corner • Three-way • Four-way
***Note**: Refer to the Titus eCatalog for the most current product information.*	

Airflow Patterns

Ceiling diffusers exhibit airflow in either circular or cross flow patterns. The greater spread from a circular pattern results in more uniform temperatures during cooling than with those obtained with the cross flow pattern.

TDX ULTRA produces a *modified circular* pattern with several distinct air jets (spikes) that provide for ultimate room induction.

The cross flow pattern has four distinct jets with longer throws. In contrast, the unique pattern of the TDX produces shorter throws and higher induction of room air. See Figure 1 for air flow examples.

When evaluating diffusers to satisfy design requirements where comfort is paramount, the modified circular pattern of the TDX ULTRA produces higher inductions than any other diffuser on the market.

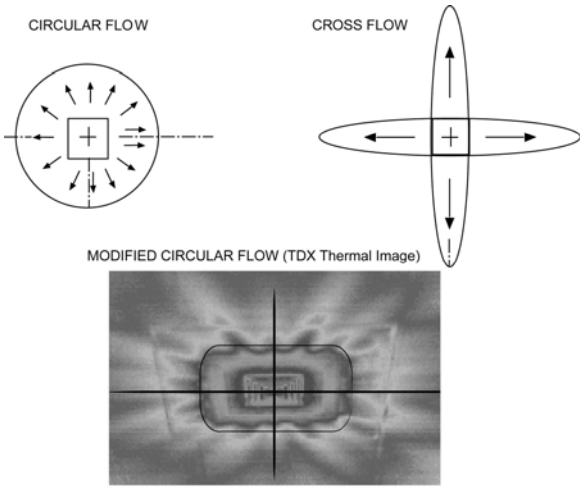


Figure 1. Airflow Patterns

ADPI

When occupancy specifications are designed to an Air Diffusion Performance Index (ADPI) level of 80 or greater, occupancy comfort is achieved. The concept of ADPI is based on the acceptance and recognition that 100% is an unachievable number, but an 80% acceptance is achievable and measurable. A high ADPI level also increases the probability of ventilation air mixing.

ADPI is a method of relating space conditions of the occupied zone to the occupant thermal comfort level (specifically the local traverse temperatures and air velocities). It is a one number comfort index for a space and relates comfort level similar to the way noise criteria (NC) relates to local sound conditions. ADPI is then the percentage of movement points satisfying an effective draft temperature between –3 and +2 degrees at a velocity less than 70 fpm.

Figure 2 shows the ADPI characteristic of the TDX to other air distribution outlets. This data shows an ADPI above 80 throughout its entire operating range. This makes the TDX an ideal choice for maintaining high comfort levels when selecting VAV application.

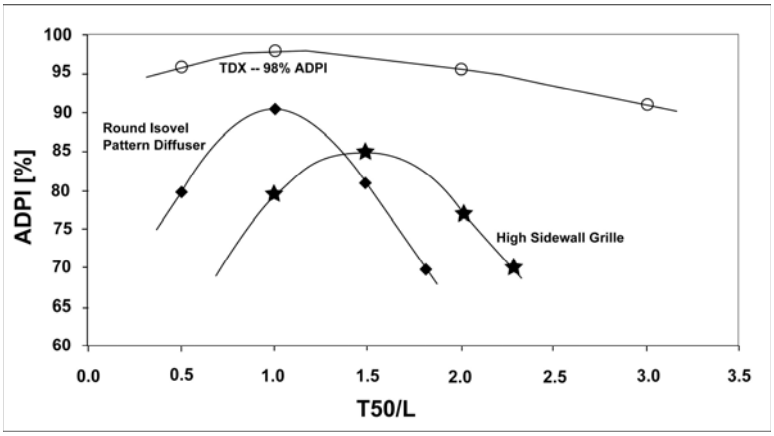


Figure 2. ADPI Characteristics

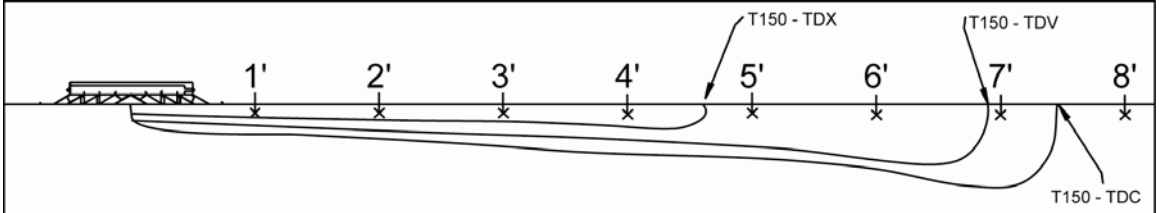
80 ADPI is an ideal way of designing your air distribution systems knowing a high percentage of occupants will be comfortable. Therefore, the 80 ADPI index is recommended to be the lowest acceptable design value for office space. TDX provides one of the highest ADPI ratings in the market.

Product Comparison to TDX, TDV and TDC

The 4-way TDX, TDV and TDC comparison table shows temperature equalization comparisons between TDX, TDV, and TDC. At 55 degree supply air, jet temperature from the TDX increases more rapidly than from the TDV and TDC diffusers illustrating the effect of the higher induction rate of the TDX diffuser. At one foot from the center of diffuser supply temp of the TDX has increased 11 degrees compared to 5 degrees for TDV and 2 degrees for TDC. In each scenario, a 12 x 12-inch, A4 pattern diffuser was used.

4-Way TDX, TDV & TDC Comparison Table

(250 CFM, 12 x 12 Core, A4 Pattern)



Distance from Diffuser Center		1'	2'	3'	4'	5'	6'	7'	8'
TDX (20 deg. F, ΔT) 55 deg F Supply temp.	Jet Velocity (fpm)	326	245	200	172	144	123	105	90
	Jet Tempurature (deg. F)	66	67	68	70	71	73	74	75
TDV (20 deg. F, ΔT) 55 deg F Supply temp.	Jet Velocity (fpm)	555	427	316	273	231	183	154	119
	Jet Tempurature (deg. F)	60	62	64	66	68	69	71	72
TDC (20 deg. F, ΔT) 55 deg F Supply temp.	Jet Velocity (fpm)	564	436	330	292	240	199	161	128
	Jet Tempurature (deg. F)	57	58	62	63	66	67	69	70

Notes:
1. Test per ASHRAE 70-1991.
2. Jet velocity and temperature measured one inch below ceiling.
3. Temperature: Room = 75 degrees F and Supply = 55 degrees F.

Thermal Image Comparisons

The following thermal-image photos (Figures 3, 4, and 5) offer a comparison of the TDX ULTRA diffuser to Titus' TDC and TDV diffusers at 30 degrees temperature differential at a constant flow rate of 250 CFM with a 12 x 12-inch neck. Note the multitude of distinct jets creating a circular pattern from the TDX diffuser. This air pattern produces higher mixed air temperatures from the discharge of the diffuser than the TDV and TDC shown.

TDX

Thermal image of TDX shows circular air pattern with distinct jets (spikes) that provide rapid mixing of primary air with room air. The shading from dark to light depicts rapid temperature equalization. This illustrates the enhanced mixing characteristics of the TDX at a higher ΔT.

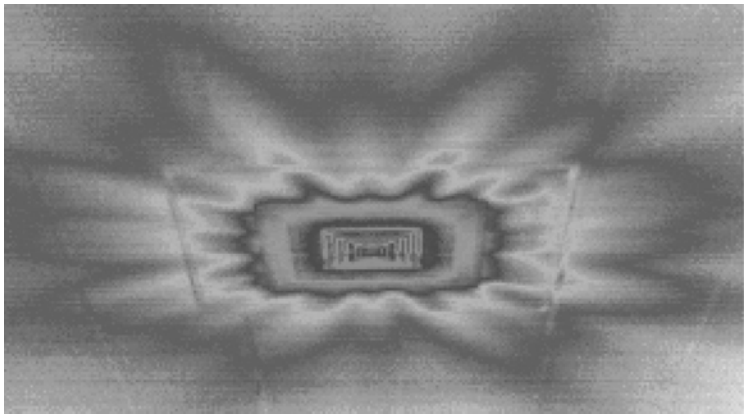


Figure 3. TDX Thermal Image

TDV

Thermal image of TDV shows crossflow air pattern with four distinct air jets. Note equalization occurs much further from diffuser than the TDX.

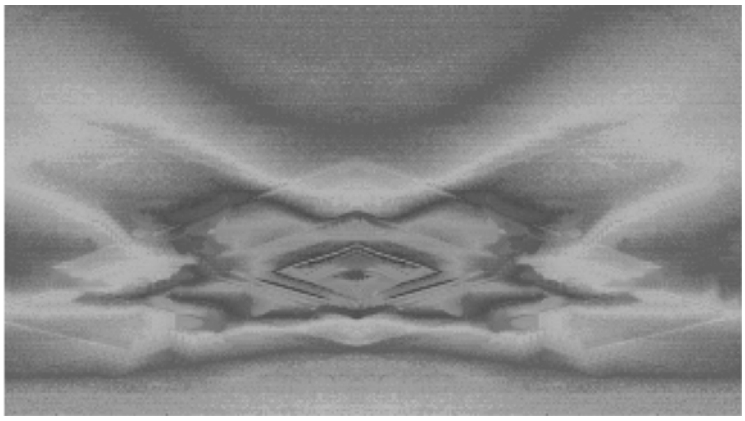


Figure 4. TDV Thermal Image

TDC

Thermal image of TDC shows similar crossflow pattern to that TDV with four distinct air jets. Again equalization occurs much further from diffuser than the TDX.

T_{ROOM} = 75° F, T_{SUPPLY} = 45° F.

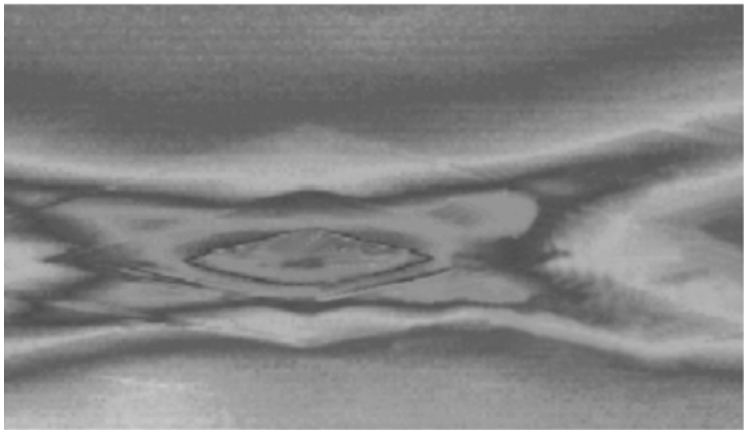


Figure 5. TDC Thermal Image

Applications

Ideal usage scenarios for TDX ULTRA are museums, restaurants/bars, and hospital patient and dormitory rooms, anywhere that high loads, comfort, and background noise are issues. TDX works exceptionally well in variable air volume (VAV) applications as it delivers up to a 60 percent VAV turn down ratio while maintaining a 90 percent or better ADPI level. Additional applications include:

- Open office (cubicle) environment
- Halls, corridors, lobbies
- Perimeter offices
- Churches
- Libraries
- Conference areas
- Service/support areas
- Computer rooms and computer classrooms
- Hospital patient and dormitory rooms
- Corner blow applications
- Conference rooms
- Small offices
- Training rooms

Tradeoffs exist between comfort and sound In order to achieve the high induction rates and high comfort levels of the TDX. The TDX has a noise criteria 3 to 4 NC value higher than the TDV for comparable volumes. However, when staying within the design parameters of the TDX this is not an issue.

Marketing

Chapter 32 of the ASHRAE Fundamentals Handbook recommends that ceiling diffusers be selected so as to meet ADPI guidelines at both minimum and maximum air flow. Additionally, ASHRAE recommends ceiling diffusers should be selected for maximum mixing. This results in a diffuser that mixes room air with primary air at a rate that achieves the quickest temperature equalization possible. The product that best achieves this mixture will prove the most effective selection for high-load applications, providing the highest level of comfort possible.

Why should you select a TDX diffuser? The most important of these features are shorter throws and rapid mixing of room air. These features allow the placement of more BTUs of cooling per square foot in a room than with conventional diffusers. Additionally, the rapid mixing allows the design of lower ceiling heights without the issues of primary air dropping into the occupied zone. Finally, the TDX can perform at a greater range of temperature differentials. Easily, this range can be as high as 30 degrees achieving ultimate comfort.

The TDX is the ideal answer where any application where aesthetics, load requirements, and comfort are primary design concerns.

Suggested Specification

Ceiling diffusers shall be Titus models TDX ULTRA (steel) or TDX-AA ULTRA (aluminum with miscellaneous steel components) for fixed, horizontal discharge pattern. These diffusers shall consist of an outer frame assembly of the sizes and mounting types shown on the plans and outlet schedule. A square inlet shall be an integral part of the frame assembly and a transition piece shall be available to facilitate attachment of round duct. An inner core assembly consisting of fixed deflection louvers shall be available in one-, two-, three-, or four-way horizontal discharge patterns. Steel (TDX ULTRA) or aluminum (TDX-AA ULTRA) induction nozzles shall be welded to each wing of the inner core. The induction baffles shall be oriented at 45-degree angles in opposite directions to ensure rapid mixing of primary and room air. The inner core assembly must be removable in the field without tools for easy installation, cleaning, or damper adjustment.

The finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315 degrees Fahrenheit for 30 minutes. The pencil hardness index of the paint must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must base a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch/pound force applied.

Optional damper shall be constructed of heavy gauge steel (aluminum also available). Damper must be operable from the face of the diffuser by removing the spring-loaded inner core assembly.

The manufacturer shall provide published performance data for the diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

Abbreviations

The following table lists abbreviations used within this document.

Abbrev.	Term
ADPI	Air Diffusion Performance Index
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
ASTM	American Society for Testing and Materials
CFM	cubic feet per minute
ΔT	temperature differential
F	Fahrenheit
fpm	feet per minute
IAQ	indoor air quality
NC	Noise Criteria
ULTRA	Ultimate Low Throw Rapid Aspirating
VAV	variable air volume