MECHANICAL DESIGN MANUAL SUMMARY SHEET

SUBJECT: DIFFUSERS AND GRILLES

DESCRIPTION: Selection of diffusers and grilles.

APPLICATION: This information should be understood by all engineers and technicians who design duct systems.

SPECIFICATION SECTIONS AFFECTED: 15936

COST: $20 to $100 per outlet plus labor depending on type chosen.

DATE UPDATED: August 30, 1991

BY: Jeffrey G. Boldt, P.E.

DIFFUSERS AND GRILLES

SELECTION CRITERIA

The following criteria should be considered when selecting diffusers and grilles.

1. Drafts
2. Stagnant areas
3. Temperature variation
4. Noise
5. Lost space
6. Cost
7. Maintenance
8. Appearance

DEFINITIONS

Diffuser: A ceiling mounted supply outlet.

Drop: The distance that the air stream descends between the outlet and the end of its throw.

Entrainment: The movement of room air caused by the airstream discharged from the outlet. Also called **secondary air motion.**

Free Area: The total minimum area of the openings in the inlet or outlet through which air passes.

Primary Air: The air discharged from the outlet.

Register: An outlet which includes a damper.

Terminal Velocity: The maximum airstream velocity at the end of the throw.

Throw: The distance an airstream travels before the maximum airstream velocity is reduced to the specified terminal velocity (usually 50 or 100 fpm).

Ventilating Ceiling: A ceiling consisting of many air openings which discharge vertically.

SUPPLY OUTLET TYPES

Group A: Outlets mounted in or near the ceiling that discharge air horizontally. This group includes high sidewall grilles, sidewall diffusers, ceiling diffusers, and linear ceiling diffusers. See Figure 1.

Cooling: Temperature variations within the room are minimized, with hardly a stagnant region. Since the warmest air in the room is mixed immediately with the cool primary air far above the occupied zone, these outlets are capable of handling large

quantities of air at large temperature differentials. The cooling diagram for the high sidewall outlet shows an **overthrow** condition, causing the total air to drop along the opposite wall and flow across the floor. This should be avoided

Heating: Stratification can occur if flow rate is low. Most modern buildings have perimeter heat loss reduced enough to make Group A outlets satisfactory for heating at full flow, however, stratification often occurs in VAV systems which are at low flow when heat is needed. For optimum comfort flow rate should be higher when heating than when cooling. This is one of the reasons for the increased use of fan-powered VAV boxes in buildings with moderate heating needs.

Group B: Outlets mounted in or near the floor that discharge air vertically in a **nonspreading** jet. This group includes floor registers, baseboard units, low sidewall units, and linear grilles in the floor or windowsill. See Figure 2.

Cooling: The entire space is conditioned evenly if the throw is correct. If the throw is inadequate the area near the grille will be cooler than other areas. This can be a problem with VAV systems.

Heating: Temperature uniformity is better than for Group A outlets. This is because the warm primary air induces cold air at the floor instead of warmer air near the ceiling.

Group B outlets should be located to minimize wasted floor space and to avoid mud entering the outlets. Outlets mounted in the floor are subject to damage due to foot traffic and floor cleaning. They should be constructed of sturdy materials which are resistant to moisture.

Group C: Outlets mounted in or near the floor that discharge air in a vertical **spreading** jet. This group includes floor diffusers, sidewall diffusers, and linear diffusers installed in the floor or windowsill (e.g. residential floor registers). See Figure 3.

Performance is similar to that for Group B outlets except that the stagnant zone is larger during cooling and smaller during heating.

Group D: Outlets mounted in or near the floor that discharge air horizontally. This group includes baseboard and low sidewall registers. See Figure 4.

Cooling: Performance is very poor as cool supply air remains on the floor.

Heating: Temperature uniformity is good, except for areas directly in the air stream (which may be much of the room).

Group E: Outlets mounted in or near the ceiling that project air vertically. This group includes ceiling diffusers, linear grilles, and sidewall diffusers and grilles. See Figure 5.

Cooling: Primary air is projected to the floor and stays there resulting in poor temperature uniformity.

Heating: Primary air is projected to the floor and then rises toward the ceiling. Temperature uniformity is poor, particularly if the primary air does not reach the floor before turning up.

COMFORT CRITERIA

The standard measure of thermal comfort is the **effective draft temperature** which considers air temperature and velocity. See ASHRAE FUNDAMENTALS chapter 31 for a detailed description. Velocity in the occupied portions of the space should be below 50 fpm. There is no minimum velocity requirement.

Air Diffusion Performance Index (ADPI) is the percent of locations in the occupied space where the effective draft temperature is maintained within plus or minus 2.5 degrees of the average space temperature. ADPI values above 80 are acceptable. ADPI is a measure of cooling performance only. It is possible to meet this criteria with Group A, B and C outlets; however, only ceiling mounted diffusers provide a wide range of flow rates with acceptable ADPI values. ADPI is greater if many small outlets are used instead of a few large outlets.

COMMONLY USED OUTLETS

CD-1: The most frequently used outlet at KJWW is the CD-1 described in Figures 7 & 8. This is a louvered face ceiling diffuser. It has the following advantages.

1. It can distribute very large amounts of air per square foot without causing drafts.
2. The cost per diffuser and per cfm is low.
3. Appearance is good.

The following are disadvantages:

1. Ceiling return grilles can be hard to locate to prevent short-circuiting.
2. The pattern is fixed except that one or more quadrants can be **blanked-off**.
3. It is difficult to make and acceptable flexible connection to this type of diffuser.

This diffuser is also available from Tuttle & Bailey in a flush face version which is more attractive, has 10% longer throw, and creates 4 to 6 Db more noise. Krueger and Carnes do not have competitive models.

Some manufacturers make diffusers that look similar to these, but do not have the extended tapered inlet. These diffusers create much more noise and have much higher pressure drop.

LD-1: This slot diffuser is shown in Figures 9, 10 & 11. Some architects prefer the appearance of slot diffusers. There are many variations of length, number of slots and width of slots. It has the following advantages:

1. It can distribute nearly as many cfm per square foot without drafts as CD-1.
2. Appearance is preferred by many architects.
3. The air pattern is adjustable. Each of the slots can be field adjusted for right, left or vertical discharge. A frequent application is to aim two slots at the exterior wall and one toward the interior of a perimeter room.
4. Flexible ducts are easy to install correctly without bends near the diffuser inlet.
5. Ceiling return grilles are easier to locate to prevent short-circuiting.

The following are disadvantages:

1. Cost per diffuser is higher than for CD-1 ($55 vs. $33 for 10" inlet units plus installation).
2. The diffuser can tip over if not installed properly.
3. Throw can be very long preventing location near walls.

LD-2: See Figures 12 & 13. This is a decorative aluminum linear diffuser with fixed blades. It is commonly used in floors and "architectural" areas. It can be ordered with special reinforcement for floor applications and with Pencil Proof grilles for counter-top applications. Various finishes, grille deflections, dampers and mounting frames are available. This is an expensive product.

SG-1: This double-deflection grille is shown in Figures 14 & 15. Its performance is inferior to CD-1 and LD-1, however, many applications require wall mounted outlets. Cost of the grille is low, but installation is expensive as flexible duct is not used. Both vertical and horizontal deflector blades are furnished to provide control of the spread of the jet. The blades which the air passes through last have the greatest ability to control the jet. Normally a jet which spreads horizontally and not vertically is desired and the **face blades** are vertical. When specifying this type of grille it is important that the model listed identifies whether the face blades are horizontal or vertical. These grilles are available in aluminum also for use in shower rooms and other humid areas. Throw and NC values depend greatly on the setting of the blades. When blades are straight the throw is maximized and noise is minimized. One fast way to size supply grilles is to select the size for an inlet velocity of 500 fpm maximum. This

results in NC values around 20 with straight vanes and even inlet distribution.

Often grilles must be installed with the inlet duct perpendicular to the inlet. This results in uneven flow through the grille which increases noise and alters the direction of the flow. The best solution is to turn toward the grille with a full-size elbow with turning vanes. If the elbow can not be full-size then a note should be put on the drawing instructing that the turning vanes be individually positioned parallel to the airflow in an elbow which has a larger outlet than inlet.

RETURN AND EXHAUST GRILLES

Return grilles should be located to minimize short-circuiting of the supply air. This occurs when supply air enters the return grille without mixing with room air. Locating return grilles low in side walls is very effective, but it is expensive, adds pressure drop and limits furniture locations. Most systems use ceiling return grilles located as far from supply outlets as possible.

Return grilles have little effect on temperature uniformity and room airflow patterns, but can be used to "cool" areas with minor loads. If possible return grilles should be located to capture heat off of equipment. In tall spaces grilles can often be located to capture stratified high temperature air. Higher return temperatures reduce the supply cfm needed as the delta-T increases.

Return grilles are sized based on NC values and pressure drop. Pressure drop is often critical in return air systems as there are no VAV boxes to direct the air. Pressure drop must be particularly low for grilles which act as transfer grilles to minimize pressure differentials between rooms. "Normal" design criteria are NC30 or 0.05 inches pressure drop. These criteria result in face velocities of 400 fpm for single-deflection wall grilles handling less than 2000 cfm. Lower velocities are needed for larger grilles to control noise. Perforated ceiling return grilles can handle very large volumes of air. If they are ducted the size of the flexible duct is normally the limiting factor.

Plenum return grilles (**RG-P** See Figure 16) are often used in order to eliminate the expense of return ductwork. Because they are open to the plenum above they must be located away from VAV boxes and other noise sources. Sound transmission between rooms should also be considered when locating plenum return grilles.

When ducted return is desired **RG-1** which is a perforated face with a round duct collar is normally used. See Figure 17.

EG-1 is normally used for wall mounted return and exhaust grilles. The 40 degree deflection blades make the grille sight tight from most locations. See Figure 18.

Return air can be taken through light fixtures. Two types are available - those which take the air through the lamp cavity and those which take the air around the lamp cavity. Either of these designs can eliminate or reduce the number of return grilles. This saves money and is often desirable to the architect. The units which take return air through the lamp cavity remove much of the lamp heat before it reaches the occupied space. This reduces the supply flow rate needed. This also cools the lamps which causes their light output and energy consumption to decrease. Efficiency may go up or down. If you use light fixtures for return inlets, coordinate the types and locations with the electrical engineer. The inlets are generally knockouts and he must specify that they be opened.

Door grilles such as **DG-1** (Figure 19) are often used to transfer air between spaces which do not require acoustical privacy. Door grilles are generally sized for 100 fpm face velocity. Doors without gasketing will generally pass 40 cfm at 0.03" pressure drop through edge cracks. With a 3/4" undercut 100 cfm is possible at 0.03". Undercuts and door grilles must be coordinated with the architect.

CALCULATING THROW

Throw values are normally taken from manufacturer's literature. If you must extrapolate data the throw is proportional to cfm and inversely proportional to the terminal velocity selected. ASHRAE Fundamentals gives detailed calculations of the throw of isothermal jets.

The throw of exposed outlets is approximately 70% of the throw of outlets located at the ceiling.

The characteristic length of a space is the distance in plan view from the center of the outlet to the edge of the area which the diffuser must condition. Outlets should be selected so that the throw listed in Figure 6 is between 1 and 2 times the characteristic length for rooms with 8 foot ceilings.

If obstructions occur in the ceiling the supply air can be directed directly downward. This is the most common cause of dumping complaints.

SOUND DATA

All diffuser sound data should be based on 8dB room attenuation and referenced to 10EE-12 watts. Check catalogs carefully. Many use much higher room attenuation values. Uneven entrance conditions

can add 15 dB to the rated NC values. Volume dampers in outlets can cause very high noise levels when throttled and also increase noise greatly when open. Dampers should be located in the ductwork as far as possible from the outlets.

FIRE RATED CEILINGS

Diffusers which penetrate rated ceilings must have UL listed **ceiling dampers** installed. Ceiling dampers differ from fire dampers in that they contain insulation to prevent radiated heat from igniting the construction above. Special ceiling diffuser are manufactured by several companies.

1. Exterior walls are shown with heavy lines.
2. The primary air is shown by the clear envelopes.
3. The total air is shown by the diagonally lined envelopes.

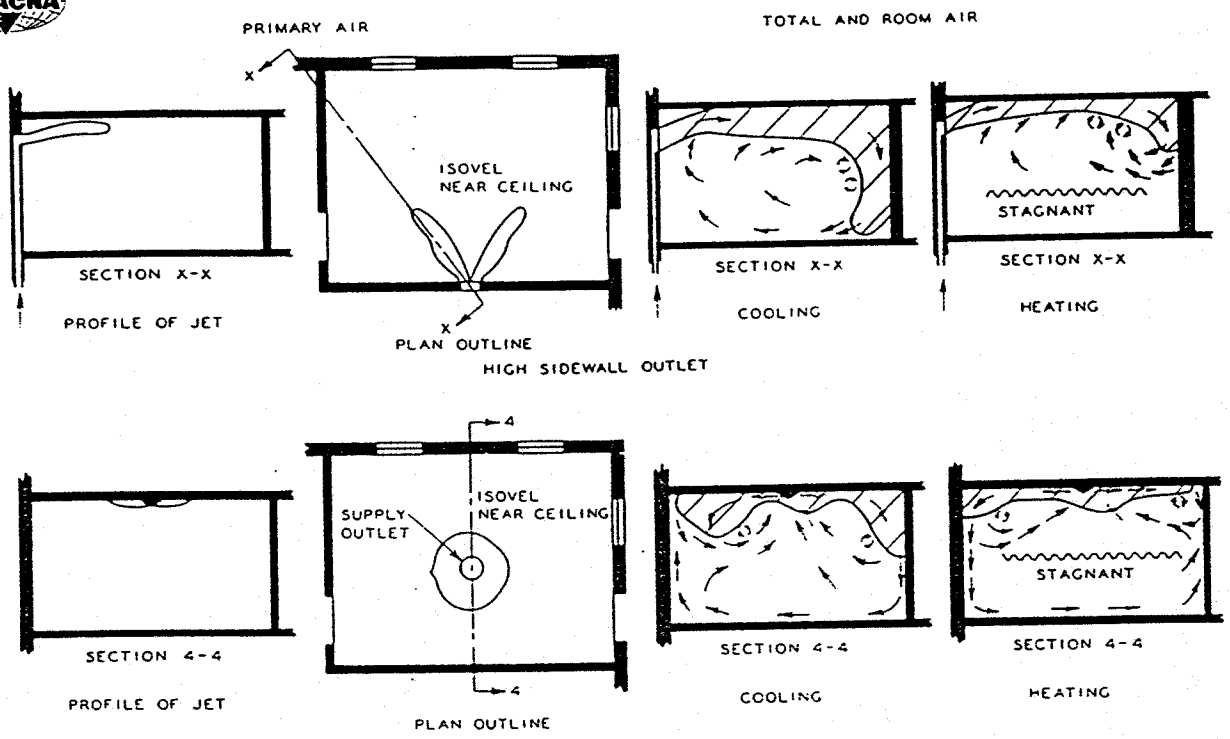

Figure 3-5 AIR MOTION CHARACTERISTICS OF GROUP A OUTLETS (2) Figure 1

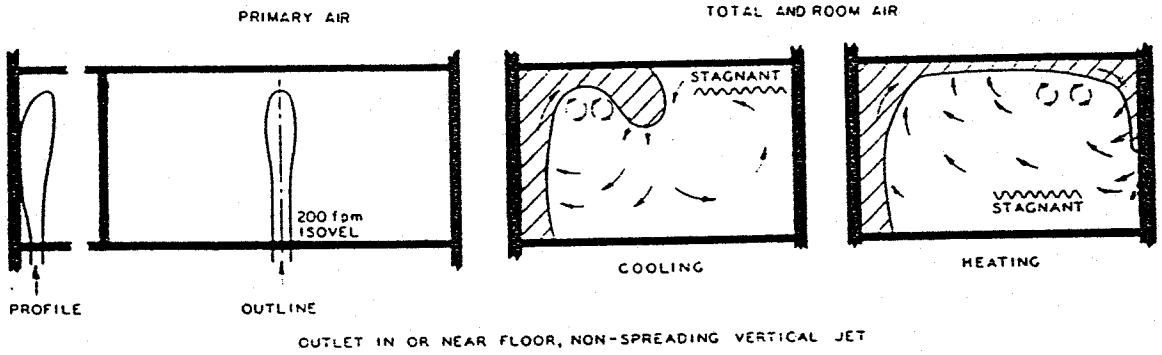

FIGURE 3-6 AIR MOTION CHARACTERISTICS OF GROUP B OUTLETS (2)

Figure 2

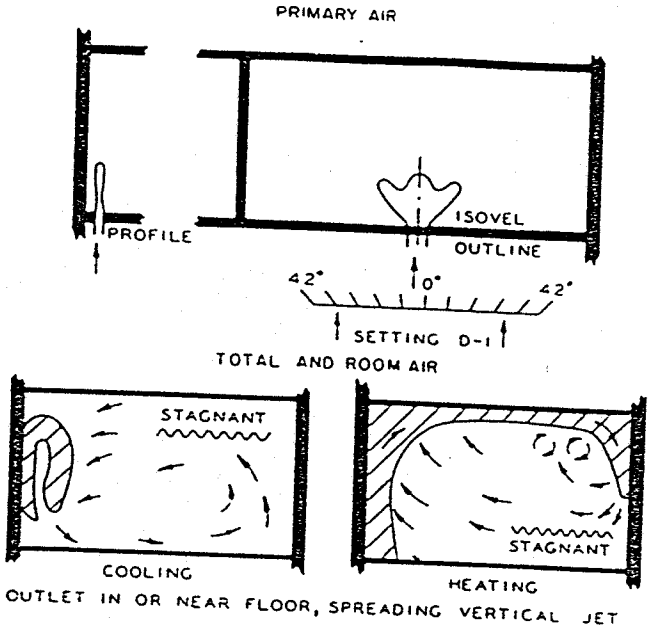

Figure 3-7 AIR MOTION CHARACTERISTICS OF GROUP C OUTLETS (2)

Figure 3

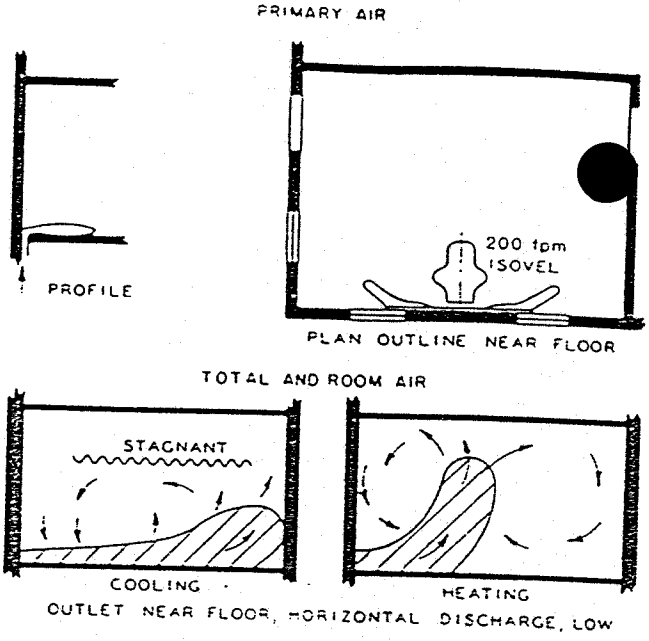

Figure 3-8 AIR MOTION CHARACTERISTICS OF GROUP D OUTLETS (2)

Figure 4

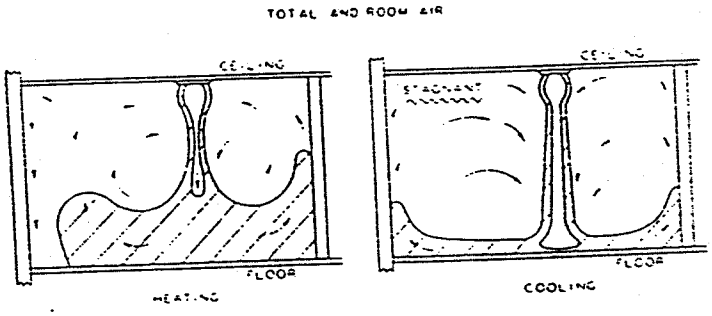

Figure 3-9 AIR MOTION CHARACTERISTICS OF GROUP E OUTLETS (2)

Figure 5

1. Exterior walls are shown with heavy lines.
2. The primary air is shown by the clear envelopes.
3. The total air is shown by the diagonally lined envelopes.

GRILLES REGISTERS & DIFFUSERS SCHEDULE NOTE 2

MBOL	MAT'L.	TYPE	MARGIN	INLET SIZE	FACE SIZE	FINISH	MANUFACTURER	MODEL	REMARKS	ALTERNATE MANUFACTURERS AND MODELS	MAX. CFM NOTE 10	TOTAL PRESSURE ΔP_T DROP (11)	NOTE 7 T_{50}
CD-1	STEEL	LAY-IN	–	6"ø	24X24	WHITE	TUTTLE & BAILEY	DM 2406	NOTES 5, 8, & 10	KRUEGER 1400 CARNES SFTA 2406	140	0.05	8
CD-1				8"ø				DM 2408		KRUEGER 1400 CARNES SFTA 2408	220	0.09	11
CD-1				10"ø				DM 2410		KRUEGER 1400 CARNES SFTA 2410	380	0.06	14
CD-1				12"ø				DM 2412		KRUEGER 1400 CARNES SFTA 2412	500	0.05	14
LD-1	STEEL	SLOT	–	8"ø	48X4 1/2	WHITE	KRUEGER	PTBSI 50 3 SLOT	NOTES 1, 3, & 11	TUTTLE & BAILEY PCD-H2	200	0.13	20
LD-1				10"ø	48X5 1/4			PTBSI 75 3 SLOT	NOTES 1, 3, 4, & 11		300	0.15	27
LD-1				12"ø	48X6			PTBSI 150 3 SLOT			400	0.16	32
LD-2	ALUM.	SLOT	1"	SEE DRAWINGS	–	–	TUTTLE & BAILEY	4100-E0	NOTE 9			NOTE 9	NOTE 9
SG-1	STEEL	DOUBLE DEFLECTION	1 1/4"	SEE DRAWINGS	–		TUTTLE & BAILEY	T64	NOTE 9	KRUEGER 880V CARNES RSDAV	500 FPM	NOTE 9	NOTE 9
=													
RG-P	STEEL	PERFORATED	–	24X24	24X24	WHITE	KRUEGER	1196-A	NOTES 5 & 6	TUTTLE & BAILEY CTPVL4 CARNES SPHB 22400	1000	0.027	–
RG-1	STEEL	PERFORATED	–	8"ø	24X24		CARNES	SPRB 22408	NOTES 5		250	0.063	–
RG-1			–	10"ø	24X24		CARNES	SPRB 22410			400	0.067	–
RG-1			–	12"ø	24X24		CARNES	SPRB 22412			550	0.07	–
RG-2	STEEL	PERFORATED	–	22X22	24X24		KRUGER	1196	NOTES 5	TUTTLE & BAILEY CTRL4 CARNES SPIB 22422	1000	0.027	–
DG-1	ALUM.	SIGHT-TIGHT	1"	SEE DRAWINGS	–	NOTE 12	TUTTLE & BAILEY	A980WF			100 fpm	0.020	—
EG-1	STEEL	40° DEFLECTION	1 1/4"	SEE DRAWINGS	–		TUTTLE & BAILEY	T70D	NOTE 9	KRUEGER S80H	3-500 FPM	NOTE 9	NOTE 9

TES:

WITH 1/4" INTERNAL INSULATION. PATTERN ADJUSTABLE RIGHT, LEFT AND DOWN FOR EACH SLOT. BLACK INTERIOR. WHITE CENTER TEES FURNISHED. SIDE TEES BY G.C. FOR T-BAR CEILING.

NO GRILLE OR DIFFUSER SHALL HAVE A VOLUME DAMPER INCLUDED UNLESS SPECIFICALLY NOTED ON THE PLANS OR IN THIS SCHEDULE.

THROW BASED ON 2 SLOTS IN ONE DIRECTION.

TALLER THAN STANDARD CONSTRUCTION TO ALLOW ROUND INLET. OVAL INLET IS NOT ACCEPTABLE.

WITH FRAME FOR T-BAR CEILING.

FOR RETURN AIR PLENUM. NO DUCT CONNECTION.

THROW BASED ON ISOTHERMAL AIR WITH 50 FPM TERMINAL VELOCITY PER ADC STANDARD 1062-GRD-84.

STAMPED CONSTRUCTION, 4-WAY PATTERN, REMOVABLE INNER CORE.

MUST BE SPECIFIED ON AN INDIVIDUAL BASIS, BECAUSE OF THE VARIABILITY IN SIZE.

MAXIMUM CFM BASED ON 700 FPM INLET VELOCITY OR NC32 WHICHEVER IS LESS. NC BASED ON 8dB ROOM EFFECT RE:10^{-12} WATTS.

. MAXIMUM CFM BASED ON 600 FPM INLET VELOCITY OR NC32 WHICHEVER IS LESS. NC BASED ON 8dB ROOM EFFECT RE:10^{-12} WATTS.

2. WHITE OR GRAY FINISH SUITABLE FOR FIELD PAINTING BY GC.

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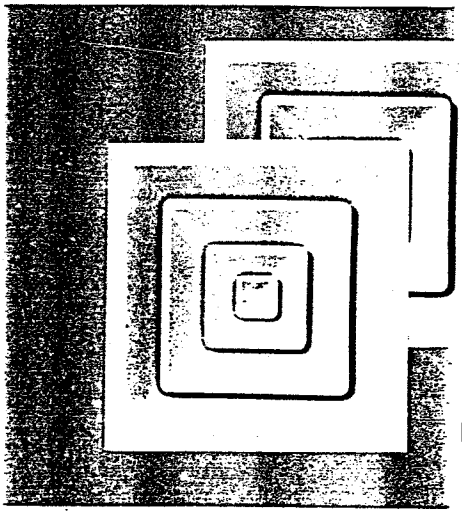
Figure 6

SQUARE DIFFUSERS W/FIXED PATTERN STEP DOWN CORE
DM

CD-1

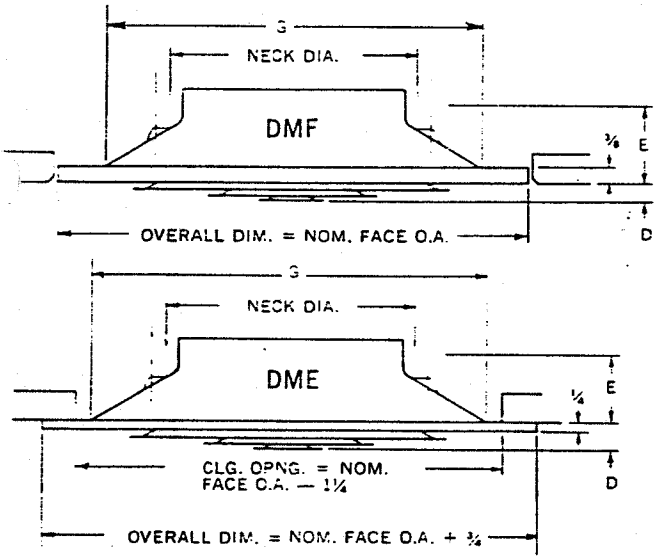
Tuttle & Bailey

STEEL



DMF Diffuser

DME Diffuser



DIMENSIONS

Listed Size	Neck Dia.	Nominal Face Overall	D		E ± 1/8		G
			DME	DMF	DME	DMF	
1206	6	12 x 12	1	¾	1 1/16	1 5/16	10¼
1208	8	12 x 12	1	¾	1 1/16	1 7/16	10¼
1608	8	16 x 16	1	—	2 1/16	—	14½
2010	10	20 x 20	1 1/16	—	3 1/16	—	18⅛
2406	6	24 x 24	1	⅞	1 1/16	1 5/16	10¼
2408	8	24 x 24	1	⅞	1 1/16	1 7/16	10¼
2410	10	24 x 24	1 1/16	15/16	3 1/16	3⅛	18⅛
2412	12	24 x 24	1 1/16	15/16	3 1/16	4 1/16	22¼
2415	15	24 x 24	1 1/16	15/16	3 1/16	3⅛	22¼

All Dimensions in Inches

ACCESSORIES

Dampers
Control Grids
Duct Rings

For Ceiling or Exposed Duct Installation

DM Supply Diffusers with integral round necks are recommended for heating, ventilating and cooling, and are equipped with moderately stepped down cores for moderate increase of performance range. Round-neck-to-square-face construction results in a 360° air diffusion pattern similar to a full round diffuser. High diffusion induction rates result in rapid temperature and velocity equalization of the mixed air mass well above the zone of occupancy. Horizontal performance assures confident use of cooling temperature differentials of 30°F and greater, at predicted low air motion (35 fpm) in the zone of occupancy. DM Supply Diffusers perform efficiency with air loadings of 6 to 24 air changes per hour (based on 10-ft. ceiling height), and sound level range of NC 25 to 35.

FEATURES

- Removable center core affords access to accessories. All accessory adjustments easily made without disturbing ceiling.
- Cores are interchangeable with DF diffusers in the field. Changeover cores without disturbing ceiling.
- DME diffusers are equipped with overlap margins designed to cover ceiling opening and minimize dirt development on ceiling.
- DMF diffusers are styled to fit flush tile ceilings; overall diffuser dimensions match standard tile size.
- Duct straps for mounting furnished as standard on overlap and flush tile ceiling mountings. Diffuser duct strap fastens directly to duct with concealed fasteners; margins fit tight to ceiling for optimum ceiling appearance.
- DM diffusers can be equipped with margins and leveling clips for installation on lay-in T-Bar ceilings (DML4, DML2, DMLS); concealed spline (DMSP); snap-in metal pan (DMST); Simplex metal pan (DMSX); radiant metal pan (DMBM); other ceiling system coordinations available. Contact factory for margin submittals. When specified as DML4, DML2, DMLS or DMSP, the diffuser neck is a collar which fits rigid or flexible connecting ducting. (See page 14 for panel sizes.)
- Diffusers and accessories are constructed of steel.
- Baked White enamel finish.

HOW TO SPECIFY

Listed size, W finish.

Notes:

1. See Engineering Section for diffuser application data.
2. See Accessory Section, page 41.

Figure 7

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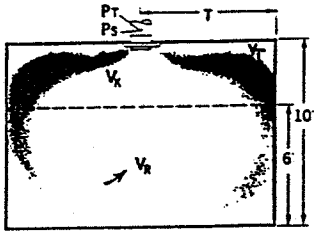
CD-1

ENGINEERING PERFORMANCE DATA

Listed Size Outlet Area		FACE VELOCITY 400	500	600	700	800	1000	1200	1400	1600	1800
1206	CFM	55	70	85	100	110	140	170	195	225	250
2406	P_s	<.01	.01	.015	.02	.025	.04	.06	.08	.10	.13
	Throw	1.5	2	2.5	3	3.5	4	5	5.5	6.5	7.5
A_K .14	NC	X	X	X	X	X	X	X	X	20	23
1208	CFM	70	90	110	125	145	180	215	250	290	325
2408	P_s	<.01	.01	.017	.02	.03	.045	.064	.086	.11	.14
	Throw	2	2.5	3	3.5	4	4.5	5.5	6.5	7.5	8.5
A_K .18	NC	X	X	X	X	X	X	X	20	22	28
1608	CFM	100	125	150	175	200	250	300	350	400	450
	P_s	<.01	.012	.02	.025	.033	.05	.072	.10	.13	.17
A_K .25	Throw	2.5	3	3.5	4	4.5	5.5	6.5	7.5	9	10
	NC	X	X	X	X	X	X	X	22	27	32
2010	CFM	155	195	235	275	310	390	470	545	625	700
2410	P_s	.01	.015	.022	.03	.04	.06	.09	.12	.15	.20
	Throw	2.5	3.5	4	5	5.5	7	8.5	9.5	11	12.5
A_K .39	NC	X	X	X	X	X	20	24	30	34	39
2412	CFM	235	295	355	415	470	590	710	825	945	1060
	P_s	.01	.018	.025	.035	.045	.07	.10	.14	.18	.24
A_K .59	Throw	3.5	4	5	6	6.5	8.5	10	12	13.5	15
	NC	X	X	X	X	X	20	24	28	33	36
2415	CFM	300	375	450	525	600	750	900	1050	1200	1350
	P_s	.013	.02	.03	.038	.05	.075	.11	.16	.24	.34
A_K .75	Throw	4	5	5.5	6.5	7.5	9.5	11.5	13.5	15	17
	NC	X	X	X	X	X	20	25	30	34	38

Terminal velocity 100 FPM.
X indicates < NC 20.



Listed Size	1206	1208	1608	2010	2406	2408	2410	2412	2415
V_o Outlet Velocity	500	600	700	800	900	1000	1200	1400	1600
P_T w/#4 Damper	.02	.03	.04	.05	.06	.08	.11	.16	.20
P_S w/#4 Damper	.01	.02	.02	.03	.04	.05	.07	.09	.12
P_T w/o #4 Damper	.02	.02	.03	.04	.05	.06	.09	.12	.16
P_S w/o #4 Damper	.01	.01	.02	.02	.03	.03	.04	.06	.08

NOTES:

- Pressure Accuracy ± .01" or 10% whichever is greater.
- When Diffusers are used on exposed duct, multiply the throw (T) by .7.
- Terminal velocity 100 FPM.

SYMBOLS P_s Static Pressure Inches H_2O
NC Re 8db Room Attenuation

Add 10 to NC values

Figure 8

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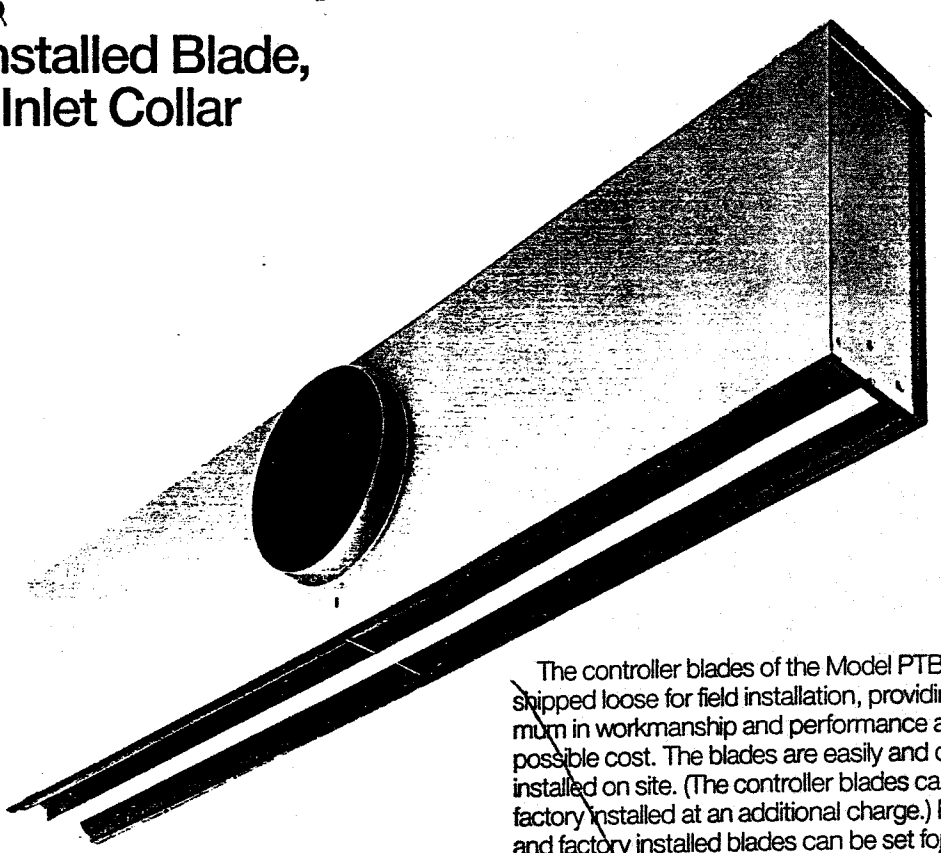
LD-1

PTBSS
Field-Installed Blade, Drawn Inlet Collar



The controller blades of the Model PTBSS are shipped loose for field installation, providing the optimum in workmanship and performance at the lowest possible cost. The blades are easily and quickly installed on site. (The controller blades can also be factory installed at an additional charge.) Both loose and factory installed blades can be set for left, right or vertical airflow after the diffuser is installed.

The PTBSS also features an inlet collar that is drawn from the diffuser plenum wall, eliminating the leakage that can occur at a mechanically fastened collar. A generous 1⅛" or greater depth of collar makes duct connections easy.

A high capacity slot diffuser, the PTBSS can handle a large volume of air at low pressure drops and noise levels. The PTBSS is well suited for variable air volume operation. With its aerodynamically curved blade design, the diffuser projects a tight blanket of air across the ceiling, from minimum to maximum flow.

Features

- Inlet collar drawn from diffuser plenum wall, eliminating leakage
- Steel curved blade
- Economical—blades shipped loose for field installation
- Double metal thickness at slot face for rigidity and straightness
- Choice of one or two slots
- Slot width selections: 1" (PTBS100S) and 1½" (PTBS150S)
- Available lengths: 24", 30", 36", 48" and 60"
- Standard finish: black face, deflectors and factory installed center tee; white optional T-bars

Additional Models

- PTBSSI insulated
- PTBSS-FB factory installed blades
- PTBSSI-FB factory installed blades with insulation

Figure 9

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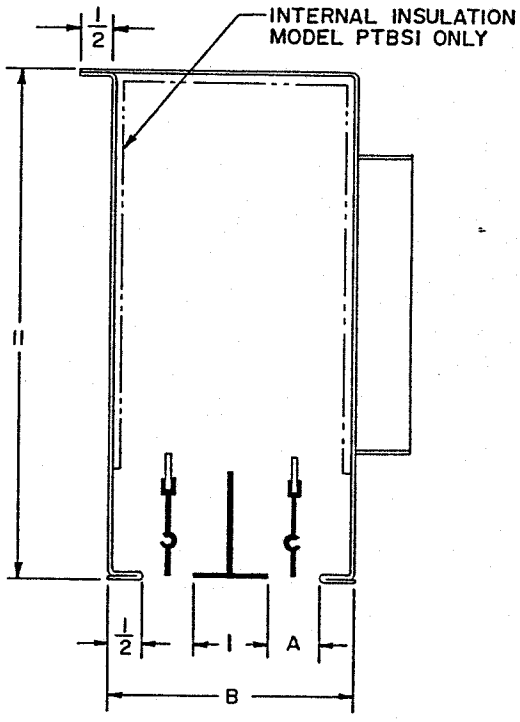
LD-1

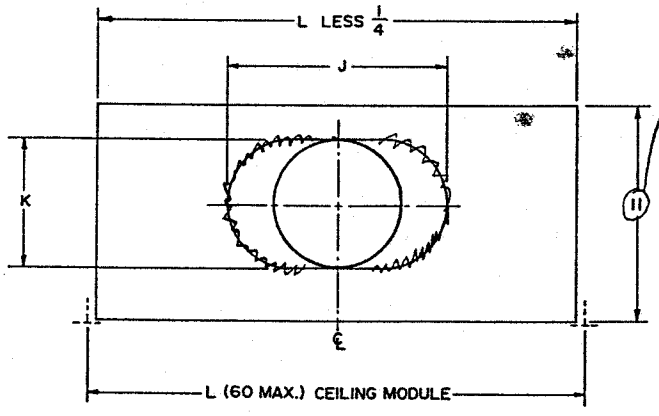
4 # Specification Drawings

PTBS50, 75, 100, 125, 150
PTBSI50, 75, 100, 125, 150
One, Two, Three and Four Slot

"I" Indicates Insulated Unit



Model	A	B			
		1 Slot	2 Slot	3 Slot	4 Slot
PTBS-PTBSI50	½	1½	3	4½	6
PTBS-PTBSI75	¾	1¾	3½	5¼	7
PTBS-PTBSI100	1	2	4	6	8
PTBS-PTBSI125	1¼	2¼	4½	6¾	9
PTBS-PTBSI150	1½	2½	5	7½	10



VARIES

Inlet Size	J	K	L
~~5 Round~~	~~4⅞~~		~~24, 30, 36~~
6 Round	5⅞	–	24, 30, 36, 48, 60
~~7 Round~~	~~6⅞~~	–	~~24, 30, 36, 48, 60~~
8 Round	7⅞	–	24, 30, 36, 48, 60
~~9 Oval~~	~~9⅞~~	~~7⅞~~	~~24, 30, 36, 48, 60~~
10 ~~Oval~~ Round	~~10~~	~~7⅞~~	24, 30, 36, 48, 60
12 ~~Oval~~ Round	~~12~~	~~7⅞~~	48, 60

Figure 10

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LD-1

PTBS • ¾" Slot

		3 Slot							4 Slot						
	CFM	75	112	150	187	225	262	300	100	150	200	250	300	350	400
	NC	12	20	26	31	35	38	41	12	20	26	31	35	38	41
	Throw	5-8-16	8-12-20	11-16-24	13-19-27	16-20-29	18-22-32	19-24-34	6-9-19	9-14-24	12-19-27	16-22-31	19-24-34	21-26-37	22-27-39
24" Long	Total Press. at Inlet Size 5	.06	.14	.25	.40	.58	.79	1.03	.08	.19	.34	.54	.77	1.06	1.38
	Total Press. at Inlet Size 6	.04	.10	.17	.28	.40	.54	.71	.05	.13	.23	.37	.53	.73	.95
	Total Press. at Inlet Size 7	.03	.07	.13	.20	.29	.40	.52	.04	.09	.17	.27	.39	.53	.69
	Total Press. at Inlet Size 8	.02	.05	.09	.15	.22	.30	.39	.03	.07	.13	.20	.29	.40	.53
	Total Press. at Inlet Size 9	.02	.05	.09	.14	.20	.27	.36	.02	.06	.11	.17	.25	.35	.45
	Total Press. at Inlet Size 10	.02	.05	.09	.14	.20	.27	.36	.02	.05	.10	.15	.22	.30	.40
	CFM	93	140	187	234	281	328	375	125	187	250	312	375	437	500
	NC	12	20	26	31	35	38	41	12	20	26	31	35	38	41
	Throw	6-9-18	9-13-23	12-18-27	15-21-30	18-23-33	20-25-35	22-27-38	7-10-21	10-16-27	14-21-31	17-24-34	21-27-38	23-29-41	25-32-44
30" Long	Total Press. at Inlet Size 5	.08	.18	.32	.50	.73	.99	1.29	.10	.24	.43	.67	.97	1.32	1.73
	Total Press. at Inlet Size 6	.05	.12	.22	.35	.50	.68	.89	.07	.16	.29	.46	.67	.91	1.19
	Total Press. at Inlet Size 7	.04	.09	.16	.25	.36	.50	.65	.05	.12	.21	.34	.49	.66	.87
	Total Press. at Inlet Size 8	.03	.07	.12	.19	.28	.38	.49	.04	.09	.16	.26	.37	.50	.66
	Total Press. at Inlet Size 9	.02	.06	.10	.16	.24	.32	.42	.03	.08	.14	.22	.32	.43	.57
	Total Press. at Inlet Size 10	.02	.05	.09	.14	.20	.27	.36	.03	.07	.12	.19	.28	.38	.50
	CFM	112	168	225	281	337	393	450	150	225	300	375	450	525	600
	NC	12	20	26	31	35	38	41	12	20	26	31	35	38	41
	Throw	6-10-20	10-15-25	13-20-29	16-23-33	20-25-36	22-27-39	24-29-41	7-11-23	11-17-29	15-23-34	19-27-38	23-29-41	26-32-45	27-34-48
36" Long	Total Press. at Inlet Size 5	.09	.21	.38	.60	.87	1.19	1.55	.12	.29	.51	.81	1.16	1.59	2.07
	Total Press. at Inlet Size 6	.06	.15	.26	.42	.60	.82	1.07	.08	.20	.35	.56	.80	1.09	1.43
	Total Press. at Inlet Size 7	.04	.11	.19	.30	.44	.60	.78	.06	.14	.26	.40	.58	.80	1.04
	Total Press. at Inlet Size 8	.03	.08	.14	.23	.33	.45	.59	.04	.11	.19	.31	.44	.61	.79
	Total Press. at Inlet Size 9	.03	.07	.12	.20	.28	.39	.51	.04	.09	.17	.26	.38	.52	.68
	Total Press. at Inlet Size 10	.02	.06	.11	.17	.25	.34	.45	.03	.08	.15	.23	.33	.46	.60
	CFM	150	225	300	375	450	525	600	200	300	400	500	600	700	800
	NC	12	20	26	31	35	38	41	12	20	26	31	35	38	41
	Throw	7-11-23	11-17-29	15-23-34	19-27-38	23-29-41	26-32-45	27-34-48	9-13-27	13-20-34	18-27-39	22-31-44	27-34-48	30-37-52	32-39-55
48" Long	Total Press. at Inlet Size 6	.08	.20	.35	.56	.80	1.09	1.43	.11	.26	.47	.74	1.07	1.46	1.91
	Total Press. at Inlet Size 7	.06	.14	.26	.40	.58	.80	1.04	.08	.19	.34	.54	.78	1.06	1.39
	Total Press. at Inlet Size 8	.04	.11	.19	.31	.44	.61	.79	.06	.14	.26	.41	.59	.81	1.06
	Total Press. at Inlet Size 9	.04	.09	.17	.26	.38	.52	.68	.05	.12	.22	.35	.51	.70	.91
	Total Press. at Inlet Size 10	.03	.08	.15	.23	.33	.46	.60	.05	.11	.20	.31	.45	.61	.80
	Total Press. at Inlet Size 12	.03	.06	.12	.18	.27	.37	.48	.04	.09	.16	.25	.36	.49	.64
	CFM	187	281	375	468	562	656	750	250	375	500	625	750	875	1000
	NC	12	20	26	31	35	38	41	12	20	26	31	35	38	41
	Throw	8-13-26	13-19-33	17-26-38	21-30-42	26-33-46	29-35-50	31-38-54	10-15-30	15-22-38	20-30-44	25-34-49	30-38-54	33-41-58	36-44-62
60" Long	Total Press. at Inlet Size 6	.11	.25	.44	.70	1.00	1.37	1.79	.14	.33	.59	.93	1.34	1.85	2.39
	Total Press. at Inlet Size 7	.08	.18	.32	.51	.73	1.00	1.30	.10	.24	.43	.68	.98	1.33	1.74
	Total Press. at Inlet Size 8	.06	.14	.24	.39	.56	.76	.99	.08	.18	.33	.52	.74	1.01	1.33
	Total Press. at Inlet Size 9	.05	.12	.21	.33	.48	.65	.85	.07	.16	.28	.44	.64	.87	1.14
	Total Press. at Inlet Size 10	.04	.10	.18	.29	.42	.57	.75	.06	.14	.25	.39	.56	.76	1.00
	Total Press. at Inlet Size 12	.03	.08	.15	.23	.34	.46	.60	.05	.11	.20	.31	.45	.61	.80

Notes

1. Total pressures are in inches of water.
2. Data were obtained from tests conducted in accordance with ISO Standard 5279, ISO Standard 3741 and ADC Test Code 1062 GRD84.
3. Throw values are given for terminal velocities of 150, 100 and 50 FPM.
4. Throws listed for multi-slot diffusers are one-way. For divided airflow, select the throw in each direction according to the number of slots aimed in that direction, with the total airflow apportioned between slots. For example, a three-slot PTBS with ¾" slots 48" long handles a total of 375 CFM. Two slots blow left, the other blows right. From the table for two slots at 250 CFM, the throw is 16-22-31. From the table for one slot at 125 CFM, the throw is 11-15-22.
5. NC values are based on a room absorption of 10 dB, re 10^{-12} watts and an uninsulated diffuser.

NC ratings do not include the inlets

Figure 11

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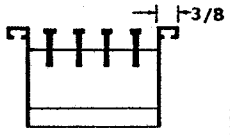
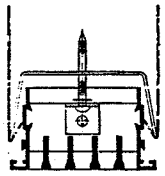
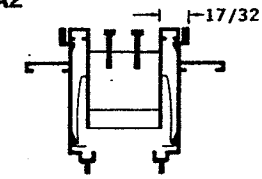
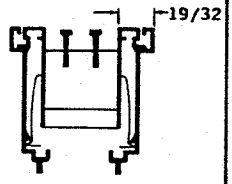
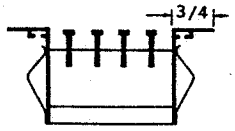
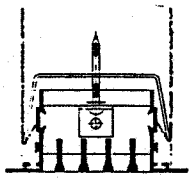
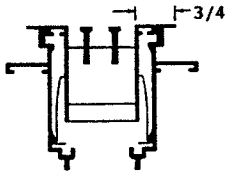
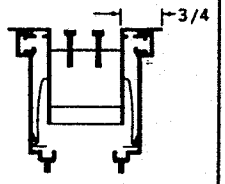
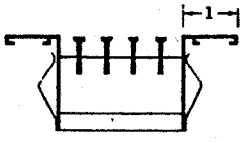
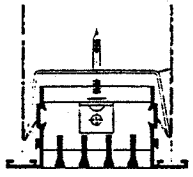
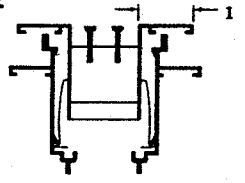
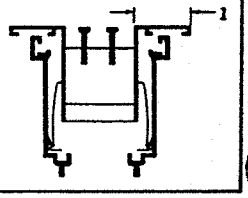
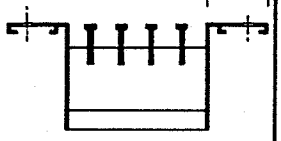
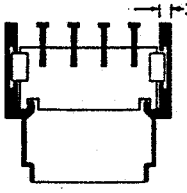
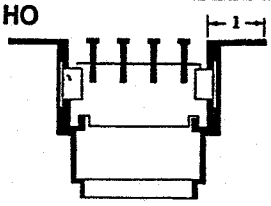
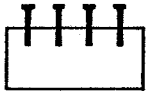
LD-2

4000 SERIES ARCHITECTURAL STYLES

Tuttle & Bailey

MARGIN STYLE	GRILLE ONLY	with HANGER BRACKET	with No. 2 Installation Frame	with No. 3 Installation Frame
	AO 	A1 	A2 	A3 
	BO 	B1 	B2 	B3 
	EO 	E1 	E2 	E3 
	FO 			
	GO 	HO 	OO 	

LISTED SIZES AVAILABLE	
Minimum L x H	Maximum L x H
4 x 1 1/2	72 x 24
Any fractional inch increment of length. One half inch increments of height.	
Sizes longer than maximum will be furnished in multiple sections for field butting.	

All Dimensions in Inches.

Imperialine™ Series products include a 1/32" tolerance on each section for thermal expansion based on a +40°F temperature differential. End margins are part of the construction and are included on each end. For every ~~20°F above the 40°F, 1/64" must be taken off every 6'~~ piece.

HOW TO SPECIFY

43 — Model
41 — Grille Only
42 — Grille w/Control Grid
43 — Grille w/Damper
44 — Grille w/Control Grid & Damper

.00 — Bar Style
00 — Straight
01 — Pencil Proof
15 — 15° Deflection
30 — 30° Deflection

"R" — R-Floor Application* (E, F, H style only)

B — Margin Style
A, B, E, F, G, H, O

1 — Mounting Style
0 — No Installation Frame
1 — Hanger Bracket
Note: #1 mounting style requires inside hemmed duct for hanger bracket
2 — No. 2 Installation Frame
3 — No. 3 Installation Frame

24 x 1.5 — Size
Length x Height (inches)

SA — Finish
SA — Satin Anodized
W — Painted White

*8" Maximum width constant traffic; 12" maximum width occasional traffic; maximum one-piece length 72". Also available in 15° or 30° deflection. See page 8 for G and H margin installation details.

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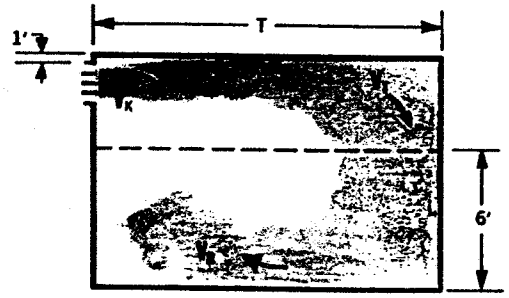
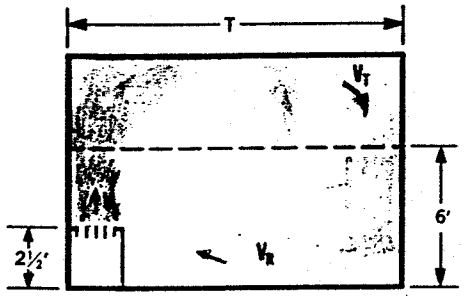
LD-2

4000 SERIES ENGINEERING PERFORMANCE DATA

Tuttle & Bailey.



SIDEWALL



SILL

TABLE 1—SUPPLY AIR

CFM per Foot	Listed Height in Inches	Min. P_S in H_2O Bar Style		Face Velocity (V_K) FPM Bar Style		Throw (T) in Feet		Minimum Ceiling Height in Feet		
						Sidewall	Sill			
		00 and 15	30 and 01	00 and 15	30 and 01	Min.-Max.	Min.-Max.	@ −18F△T	@ −25F△T	NC
20	1½	.01	.01	500	575	6-9	1-2	8	9	<20
30	1½	.03	.04	750	865	7-10	2-3	9	10	25
	2	.01	.01	475	545	6-9	1-2			20
40	1½	.05	.07	1000	1150	9-13	3-5	9	11	30
	2	.02	.03	635	730	8-11	2-4			25
	2½	.01	.01	460	530	7-10	2-3			20
50	1½	.09	.12	1250	1440	11-16	4-9	9½	11	30
	2	.03	.04	790	910	10-14	3-7			25
	2½	.02	.03	575	660	9-13	2-6			20
	3	<.01	.01	440	505	8-12	2-5			<20
60	2	.05	.07	950	1090	12-18	5-11	9½	12	30
	2½	.02	.03	690	795	11-16	4-9			25
	3	.01	.01	530	610	10-14	3-7			20
	4	<.01	.01	370	425	8-12	2-5			<20
70	2	.06	.08	1110	1275	14-20	7-13	10	12	30
	2½	.03	.04	810	935	13-19	6-12			30
	3	.02	.03	660	760	11-16	4-9			25
	4	<.01	.01	435	500	10-14	3-7			<20
80	2	.08	.10	1275	1450	16-23	9-16	10½	12½	30
	2½	.04	.05	920	1060	15-21	8-14			30
	3	.03	.04	700	805	13-18	6-11			25
	4	.01	.01	495	570	11-16	4-9			20
90	2½	.05	.07	1030	1185	17-24	10-17	11	13	30
	3	.04	.05	785	905	15-21	8-14			30
	4	.01	.02	550	635	13-18	6-11			25
	5	<.01	.01	450	520	11-16	4-9			20
100	2½	.06	.08	1150	1325	19-27	12-20	11	13	30
	3	.04	.05	875	1010	16-23	9-16			30
	4	.02	.03	620	715	14-20	7-13			25
	5	.01	.01	500	575	12-18	5-11			20
120	3	.06	.08	1050	1210	19-28	11-20	11½	13	30
	4	.03	.04	745	855	17-24	9-16			30
	5	.02	.03	600	680	15-22	7-14			25
	6	<.01	.01	480	550	13-19	5-11			20
140	3	.08	.11	1220	1410	22-32	14-24	11½	14	35
	4	.04	.05	870	1000	19-28	11-20			30
	5	.02	.03	700	810	17-25	9-17			25
	6	.01	.01	560	645	15-22	7-14			20
160	4	.05	.07	990	1140	22-32	13-23	12	15	35
	5	.03	.04	800	925	19-29	10-20			30
	6	.02	.03	640	735	18-26	9-17			25
	8	.01	.01	460	530	15-22	6-13			20
180	4	.07	.09	1110	1275	25-36	16-27	12	15	35
	5	.04	.05	900	1035	22-33	13-24			30
	6	.03	.04	725	835	20-30	11-21			25
	8	.02	.03	520	600	17-25	8-16			20
200	4	.08	.11	1240	1425	28-41		12	15	40
	5	.05	.07	1000	1150	24-36	–			35
	6	.04	.05	800	925	23-33				30
	8	.02	.03	575	665	20-28				25
250	5	.08	.11	1250	1440	30-46		13	15	40
	6	.05	.07	1000	1150	27-39	–			35
	8	.03	.04	720	830	25-35				30
	10	.01	.01	550	635	21-32				25
300	6	.07	.09	1200	1375	33-48		13	15	40
	8	.04	.05	865	1000	29-42	–			35
	10	.02	.03	665	765	25-39				30
	12	.01	.01	545	630	23-33				25
350	8	.05	.08	1020	1175	34-48		13	15	40
	10	.03	.04	780	900	29-45	–			35
	12	.02	.03	640	735	26-38				30
400	8	.08	.11	1170	1350	40-55		14	16	45
	10	.04	.05	890	1025	33-50	–			40
	12	.03	.04	730	845	30-44				35

SYMBOLS:
- V_t Terminal Velocity in FPM
- V_r Room Velocity in FPM
- V_k Face Velocity in FPM
- A_k Outlet Area in Sq. Ft
- A_n Neck Area in Sq. Ft
- P_s Static Pressure in H O
- NC re 18db Room Attenuation
- T Throw in Feet, see note f.
- △T Temperature Differential

See General Engineering Catalog for additional application information.

Figure 13

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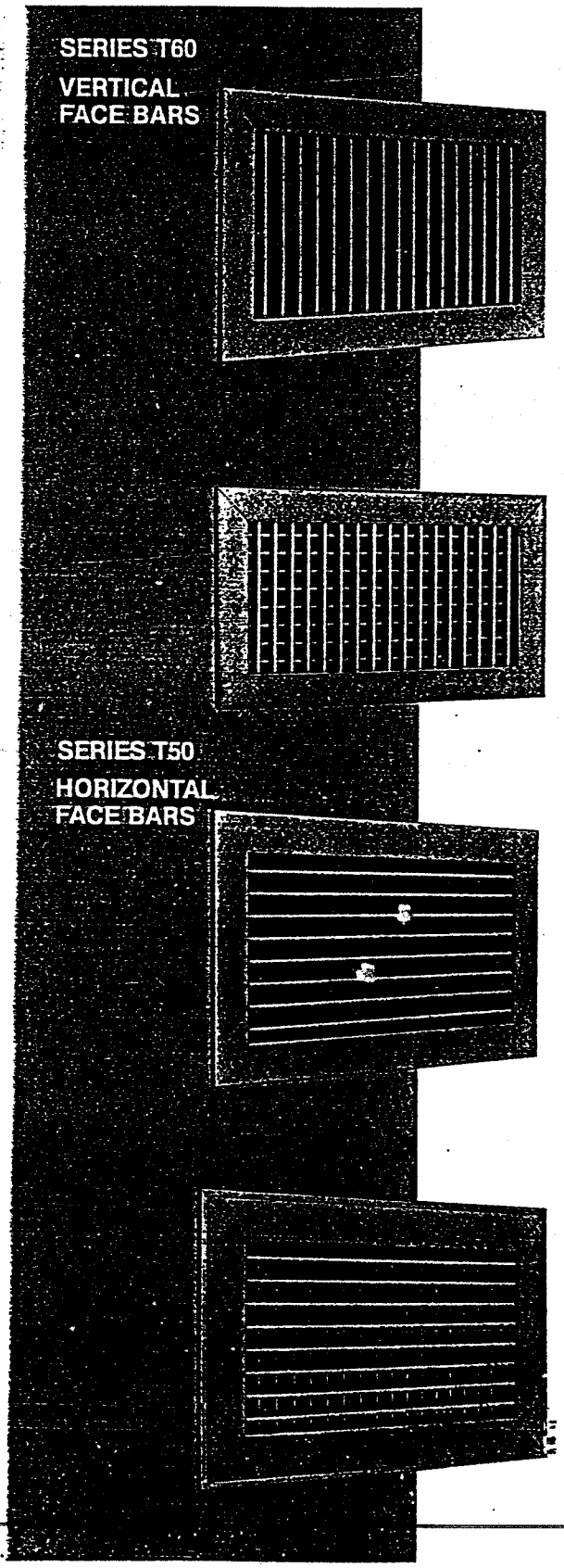
SG-1

SUPPLY GRILLES & REGISTERS
T60, T50 SERIES

Tuttle & Bailey



1¼ inch Nominal Margin

STEEL

Series T60 and T50 single-deflection supply grilles and registers are recommended for applications requiring pattern adjustability in a single horizontal or vertical plane — sill grilles, sidewall location at ceiling line, or heating applications only. They perform efficiently with temperatur differentials of up to 18-20°F cooling, 20-50°F heating and for ventilating while handling .75 to 1.75 cfm per square foo of room area with draftless distribution.

Series T64 and T54 double-deflection supply grilles and registers are recommended for application in systems requiring optimum flexibility of pattern change to accommodate changing job conditions. They perform efficiently with temperature differentials of 20-22°F cooling 20-50°F heating and for ventilating while handling 1.0 to 2.(cfm per square foot with draftless distribution.

The combination of streamlined foil shaped bars and ⅔-inc bar spacing maintains a high effective area capacity of greater than 80% which minimizes outlet velocity, reduces pressure drop requirement and assures quiet operation. Individually adjustable bars are capable of shortening throv up to one-half with a wide spread deflection requiring only 20% increase in outlet velocity at a fixed volume.

Features

- Overlap margin – 1¼-inch nominal width, with gasket to minimize smudging. Furnished with countersunk screw holes and mounting screws.
- All-steel construction – rigid heavy-gauge welded margins with reinforced mitered corners.
- Roll-formed bars – streamlined shaped rigid steel bars on ⅔-inch centers. Bars driven on swaged pivot pins positively hold deflection setting under all conditions of velocity and pressure.
- Mounting frame – available for use as plaster stop or separable frame to facilitate grille removal. Matching screw holes in grille and frame factory-pierced for easy installation.
- Integral dampers – double thickness roll-formed steel blades. Opposed blade damper designed for key or screwdriver operation.
- Adjustable pattern – grille bars easily pivotable with deflection key provides pattern with 0° to 100° horizontal arc and up to 30° deflection up or down.
- Baked white enamel finish.

LISTED SIZES AVAILABLE in one piece

Min. W x H	Max. W x H
4 x 4	36 x 36
Two-inch increments of width and height.	
Multiple sections furnished for sizes greater than maximum width and height.	

All Dimensions in Inches.
Engineering Performance Data on pages 8, 9.
Multiple Section Details, See SD-1422, Screw Hole Locations page 55.

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Figure 14

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ENGINEERING PERFORMANCE DATA

Supply Air Grilles and Registers

Single and Double Deflection
Adjustable Bar Type
Series T60 T50 Series A60 A50

Tuttle & Bailey

TABLE 1

LISTED HEIGHT	LISTED WIDTH	Outlet Velocity 450-600 FPM					Outlet Velocity 550-700 FPM					Outlet Velocity 600-800 FPM					Out Velocity 700-1000 FPM				
		CFM	Deflection 0° Vk 450 Pt .01	22° Vk 500 Pt .01	42° Vk 550 Pt .02	55° Vk 600 Pt .02	CFM	Deflection 0° Vk 550 Pt .02	22° Vk 600 Pt .02	42° Vk 650 Pt .03	55° Vk 700 Pt .03	CFM	Deflection 0° Vk 600 Pt .02	22° Vk 700 Pt .03	42° Vk 750 Pt .04	55° Vk 800 Pt .04	CFM	Deflection 0° Vk 700 Pt .03	22° Vk 800 Pt .04	42° Vk 900 Pt .05	55° Vk 1000 Pt .06
			Throw (T) Vt 75					Throw (T) Vt 75					Throw (T) Vt 75					Throw (T) Vt 75			
4 5 6	8 10 12 14 16 18 20 24																				
6 5		40	6	5	4	3	45	8	7	6	4	60	10	9	7	5	65	11	10	8	6
8 6		50	7	6	5	4	60	9	11	6	5	70	11	10	8	6	80	12	11	9	7
10 8 6		75	9	7	6	5	90	10	9	7	6	100	12	11	9	7	125	13	12	10	8
12 10 8		100	10	8	6	5	125	11	9	8	7	150	13	12	9	8	175	14	13	11	8
14 12 10	8	125	11	9	7	6	150	12	11	9	7	175	14	13	10	8	200	16	14	11	9
18 14 12		150	11	10	8	7	175	13	11	10	8	200	15	14	11	9	250	17	15	12	10
20 16 14	10	175	12	11	9	7	200	15	13	11	9	250	17	15	12	9	275	19	17	14	11
24 20 16	12 10	225	13	12	10	8	275	16	14	12	10	300	19	16	13	10	350	21	18	15	12
30 24 20	14 12	300	14	13	11	9	350	18	15	13	10	425	20	17	15	11	475	24	20	17	13
38 30 24	18 14 12	350	17	14	12	9	425	20	17	13	11	500	22	20	17	12	550	26	22	18	14
40 32 26	20 16 14	400	18	16	13	10	475	21	18	15	12	550	24	21	18	13	650	28	24	20	15
44 36 30	24 18 16 14	450	19	17	13	11	550	22	19	17	13	625	26	22	19	14	725	30	25	22	17
44 36	26 22 18 16	500	20	17	14	12	600	24	20	18	13	700	27	24	20	15	800	32	27	23	18
48 40	30 24 20 18 16	600	21	18	15	12	700	25	22	18	14	850	29	25	22	16	950	34	29	25	19
48	38 30 24 22 18	700	23	20	17	13	850	28	24	20	15	975	33	28	24	18	1125	37	31	27	21
	40 32 28 24 20 18	800	25	21	18	14	950	31	26	22	17	1125	35	30	26	20	1275	39	34	29	22
	42 36 30 26 24 22 20	900	27	22	19	15	1100	32	27	23	18	1250	36	31	27	21	1450	42	36	31	23
	46 42 36 30 26 24 22	1000	29	25	21	16	1200	34	29	25	19	1400	40	34	29	22	1600	45	39	34	25
	44 38 34 30 28 24	1250	32	27	23	18	1500	36	30	27	23	1750	43	37	31	24	2000	48	43	36	27
	48 42 36 34 28	1500	34	29	25	19	1800	39	32	29	25	2100	45	40	34	26	2400	52	46	39	30
	44 40 36 30	1750	37	32	27	21	2100	42	35	32	27	2450	48	44	37	28	2800	55	49	42	32
	48 42 36	2000	39	34	29	22	2400	45	38	34	29	2800	52	46	40	30	3200	58	52	44	34
	48 40	2250	41	36	30	24	2700	48	40	36	31	3150	54	48	42	32	3600	61	54	46	37
	42	2500	43	38	32	25	3000	51	42	38	33	3500	57	51	44	33	4000	64	57	49	39
	48	3000	46	40	34	27	3600	54	45	40	35	4200	60	53	47	35	4800	68	60	52	42

≤ NC30 NC35 NC40 ≥ NC45

Add 10db to all NC values

SYMBOLS V_T Terminal Velocity in FPM
V_R Room Velocity in FPM
V_K Outlet Velocity in FPM
A_K Outlet Area in Sq. Ft.
P_T Total Pressure in. H_2O
P_S Static Pressure in. H_2O

NC re 18db room attenuation
T Throw in Feet

The indicated air paths may be easily obtained by using the appropriate notch on the bar deflecting key. The bars should be adjusted as shown for the required pattern.

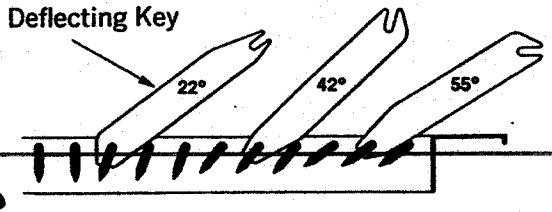

Figure 15-20

See General Engineering Catalog for additional application information.

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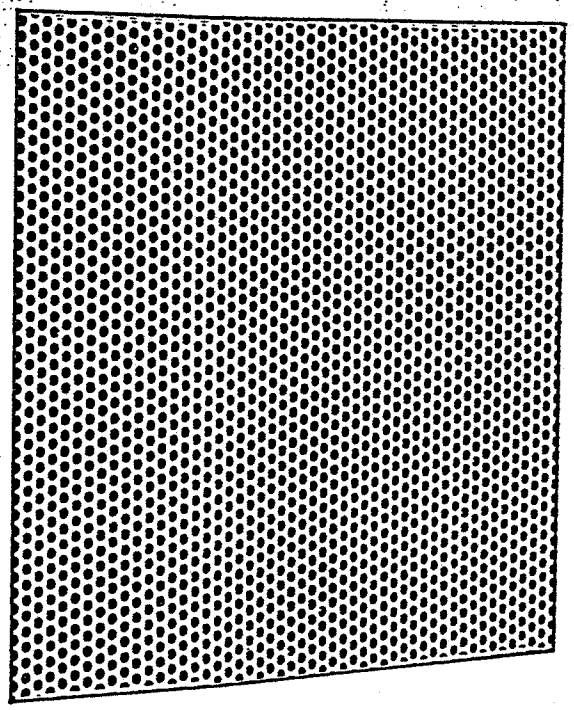
RG-P #21

PERFORATED DIFFUSERS
Square Inlets



	NECK VELOCITY		200	300	400	500	600	650	700	750	800	900
	S. P. Drop with OBD		.012	.027	.049	.078	.11	.13	.15	.17	.19	.24
SIZE	A_k ALNOR	A_k 4" ROT. VANES	AIR CAPACITIES — C. F. M.									
10 x 10	.39	.55	140	210	285	350	415	450	485	520		
12 x 12	.46	.79	200	300	400	500	600	650				900
14 x 14	.62	1.07	270	410	545	680	815			1020	1090	1225
10 x 22	.71	1.21	305	460	610	765	915			1150	1220	1375
16 x 16	.82	1.40	355	530	710	890			1245	1335	1425	1600
18 x 18	1.05	1.77	450	675	900	1125		1460	1575	1690	1800	2030
20 x 20	1.28	2.25	555	835	1110		1665	1805	1945	2080	2220	2500
22 x 22	1.55	2.70	670	1010	1345		2020	2180	2350	2520	2690	

NC SOUND DATA COLOR CODE
- NC LEVEL LESS THAN 20
- NC LEVEL LESS THAN 30
- NC LEVEL LESS THAN 35
- NC LEVEL LESS THAN 40
- NC LEVEL LESS THAN 50
- NC LEVEL MORE THAN 50

For recommended ranges of NC sound data for various applications refer to page 309 Table 25 of the ASHRAE Handbook

Throw data shown in the above charts are based on Terminal Velocities of 150 fpm, 100 fpm and 75 fpm respectively using isothermal air and standard blade settings. Refer to Figure 1 for standard blade setting indicated in performance charts. For definition of terms used in the above charts refer to Page 39.

Figure 16 21

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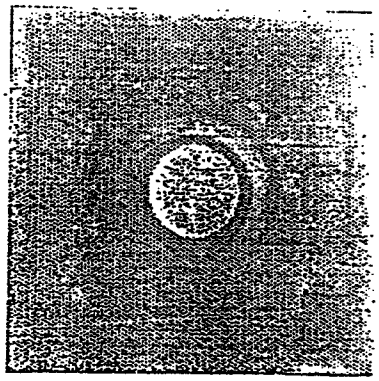
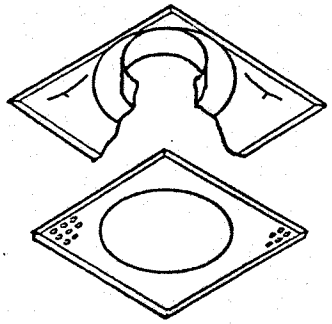
RG-1, [redacted]





SPRB *24x24 Face*

- **Return**
- **Round Neck**
- **Flush Face**

Neck Size (Inches)		Duct Velocity — FPM								
		200	300	400	500	600	700	800	900	1000
8	CFM	69	104	139	174	209	244	279	314	349
	Neg. PS	.01	.01	.02	.03	.04	.06	.08	.10	.12
	NC	L	L	L	L	L	L	L	L	L
10	CFM	109	163	218	272	327	381	436	490	545
	Neg. PS	.01	.01	.02	.03	.05	.06	.08	.11	.17
	NC	L	L	L	L	L	L	L	L	L
12	CFM	157	235	314	392	471	549	628	706	785
	Neg. PS	.01	.01	.02	.03	.05	.07	.09	.11	.14
	NC	L	L	L	L	L	L	L	L	L

NOTES:
1. *X designates pressure of less than .010 W.G. in inches.*
2. *Throw data is measured in feet.*
3. *Dash mark (—) indicates throw of less than one foot.*
4. *NC ratings reflect 10 db compensation for room attenuation.*
5. *L designates sound measured at less than 20 db.*

Figure 17 22

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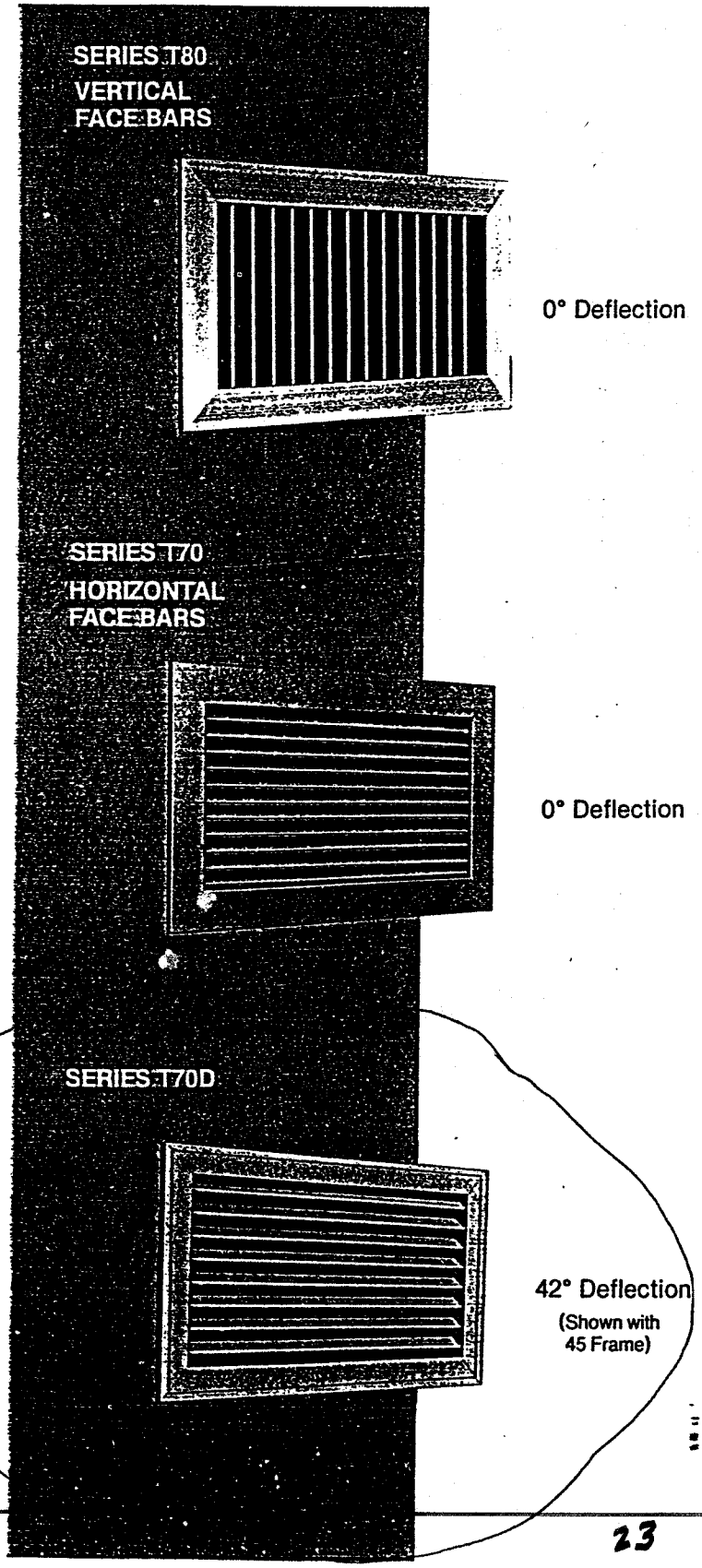
EG-1

RETURN GRILLES & REGISTERS
T80, T70 SERIES

Tuttle & Bailey.



1¼ inch Nominal Margin

STEEL

Series T80 return grilles have fixed vertical bars spaced on ⅔-inch centers with 0° straight deflection The appearance matches the supply grille and register Series T50 and T60.

Series T70 return grilles and registers have fixed horizontal bars spaced on ⅔-inch centers with 0° straight or 42° face deflection.

The streamlined foil shaped bars and open bar spacing maintains an effective area capacity of greater than 75% which minimizes intake velocity, reduces inlet pressure and provides quiet operation. The smooth bar shapes do not accumulate lint and plug up as with sharp-edge, core-type returns. Deflected bar grilles installed in a low or high sidewall location are vision proof with the grille deflection facing away from the line of sight.

Features

- Overlap margin – 1¼-inch nominal width. Furnished with countersunk screw holes and mounting screws.
- All-steel construction – rigid heavy-gauge margins with reinforced mitered corners.
- Roll-formed bars – streamlined shaped rigid steel bars on ⅔-inch centers, straight or deflected. Bars driven on swaged pins are firmly held at the grille face and locking tabs firmly hold the rear edge of the bar – doubly reinforced
- Mounting frame – available for use as plaster stop or separable frame to facilitate grille removal. Matching screw holes in grille and frame factory-pierced for easy installation.
- Integral dampers – double thickness roll-formed steel blades. Opposed blade damper designed for key or screwdriver operation.
- Baked white enamel finish.

LISTED SIZES AVAILABLE in one piece

Min. W × H	Max. W × H
4 × 4	36 × 36
Two-inch increments of width and height.	
Multiple sections furnished for sizes greater than maximum width and height.	

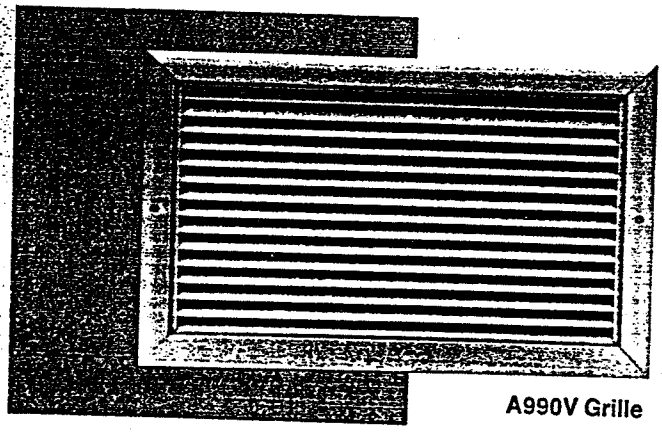
All Dimensions in Inches.
Engineering Performance Data on page 32.
Multiple Section Details, See SD 1422, Screw Hole Locations page 55.

Figure 18

DG-1

TRANSFER AND DOOR GRILLES
A980, A990 SERIES

Tuttle & Bailey



A990V Grille

EXTRUDED ALUMINUM

Series A980 transfer grilles and registers have fixed horizontal Y-shaped louvers spaced on 1-inch centers. Series A990 V-shaped louvers are on ½-inch centers. The louvers are arranged to overlap each other to be sight tight when viewed from any angle.

The Y or V shaped louvers maintain an effective area capacity of approximately 25%. The smooth edges on the louvers present a linear face appearance which is easily maintained. Constructed of aluminum, the grilles are light in weight and are adaptable for use in ceilings.

Features

- Overlap margin – 1-inch wide. Furnished with pierced screw holes and mounting screws. Margins available to fit both sides of the door panel.
- Aluminum construction – heavy-gauge extruded aluminum margins, mechanically interlocked with hairline corners, quality moisture-proof construction throughout.
- Extruded louvers are screwed into the side margins for extra strength.
- Satin anodized finish (SA)

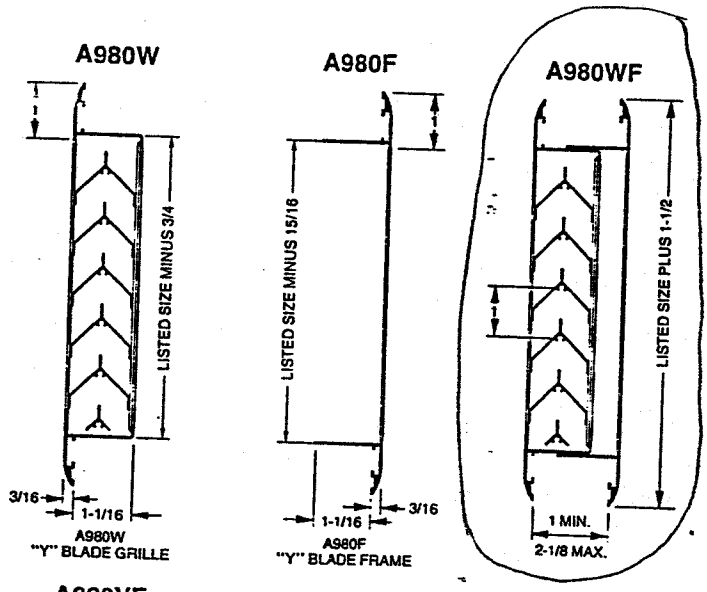
LISTED SIZES AVAILABLE in one piece

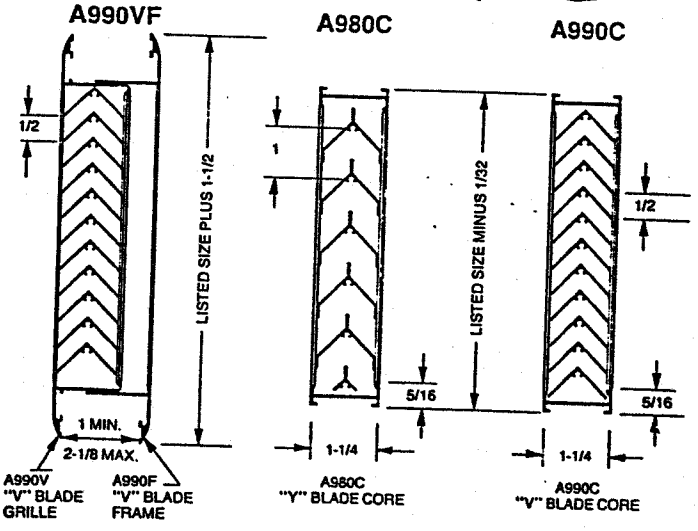
Min. W x H	Max. W x H
6 x 4	36 x 72
One-inch increments of width and height	

All Dimensions in Inches

HOW TO SPECIFY

Style, listed size W x H, finish.
Example: A980WF 14 x 6 SA.





All A990 dimensions not shown are identical to the A980 products.
Security lugs are available as a special order option.
Specify as A__SL. See SD-1193.
EXAMPLE: A990VF 10 x 6 W SL

24

Figure 19

Engineering Data

SIZE	Net Ak		Average Face Velocity FPM						
			200	300	400	500	600	700	800
8 x 8	.44	cfm	90	130	180	220	265	310	350
		PL	.06	.17	.30	.47	.68	.93	1.2
14 x 6	.55	cfm	110	165	220	275	330	385	440
		PL	.07	.16	.30	.46	.65	.90	1.2
12 x 8	.64	cfm	130	190	255	320	385	450	510
		PL	.07	.16	.29	.45	.64	.88	1.1
14 x 8	.74	cfm	150	220	295	370	445	520	590
		PL	.07	.16	.28	.44	.63	.87	1.1
28 x 6	.78	cfm	155	235	310	390	470	545	625
		PL	.07	.16	.28	.44	.62	.86	1.1
12 x 12	.93	cfm	185	280	370	465	560	650	745
		PL	.07	.15	.27	.43	.61	.84	1.1
30 x 6	1.12	cfm	225	335	450	560	670	785	895
		PL	.07	.15	.26	.42	.60	.82	1.1
16 x 12	1.19	cfm	240	360	475	595	715	835	950
		PL	.07	.15	.26	.41	.59	.81	1.1
18 x 12	1.33	cfm	265	400	530	665	800	930	1065
		PL	.07	.15	.26	.41	.58	.80	1.0
28 x 12	1.46	cfm	290	440	585	730	875	1020	1170
		PL	.06	.15	.26	.40	.58	.79	1.0
16 x 16	1.54	cfm	310	460	615	770	925	1080	1230
		PL	.06	.14	.25	.40	.57	.78	1.0
24 x 12	1.75	cfm	350	525	700	875	1050	1225	1400
		PL	.06	.14	.25	.39	.56	.77	1.0
18 x 18	1.85	cfm	390	585	780	975	1170	1365	1560
		PL	.06	.14	.25	.39	.55	.76	.99
30 x 12	2.17	cfm	435	650	870	1085	1300	1520	1740
		PL	.06	.14	.25	.38	.54	.75	98
28 x 28	2.42	cfm	485	730	970	1210	1450	1690	1940
		PL	.06	.14	.24	.38	.54	.74	.97
24 x 18	2.55	cfm	510	765	1020	1275	1530	1785	2040
		PL	.06	.14	.24	.37	.53	.73	.96
30 x 18	3.23	cfm	650	970	1290	1620	1940	2260	2580
		PL	06	13	.23	.36	.51	.71	.93
24 x 24	3.48	cfm	695	1050	1395	1745	2090	2440	2790
		PL	06	13	.23	.36	51	70	92
30 x 24	4.18	cfm	840	1250	1670	2090	2510	2930	3340
		PL	06	13	22	.35	50	68	89
30 x 30	5.15	cfm	1030	1550	2060	2580	3090	3610	4120
		PL	05	12	22	34	48	66	86

PL = Static Pressure Loss — See General Engineering Catalog

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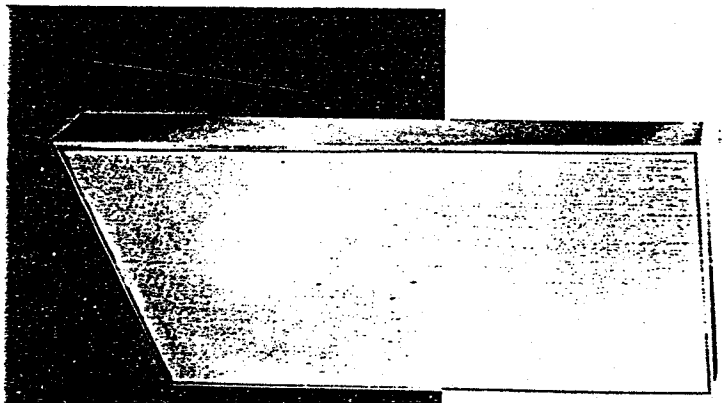
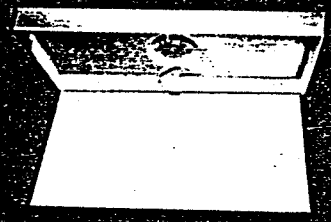
CLEAN ROOM DIFFUSERS
CRD

Tuttle & Bai

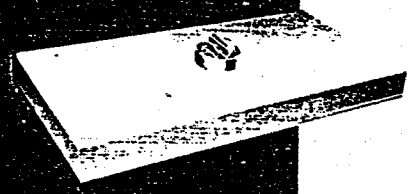


CRD-L4 Diffusers

Accessories



Safety Chain



CRD-4 Damper

Clean Room Diffusers

CRD perforated supply air diffusers (vertical discharge) are designed for nonaspirating flow requiring minimum cleaning and/or sterilization. The diffusers are recommended for coo ventilation and for conditions requiring the cleanest air avail into the clean room (surgical suite and/or industrial clean ro

The diffusers are nominal sizes 48 x 24 or 48 x 12, etc., and designed for use in lay-in tee bar ceiling and conventional ceilings. The outlet is constructed of aluminum perforated m complete with aluminum air chamber, inlet collar and dampe airflow volume balancing.

CRD diffusers have low aspirating characteristics resulting i rapid temperature and velocity equalization of the air mass i the zone of occupancy.

The vertical performance of the CRD diffuser ensures confic use of cooling differentials of 25°F at predicted low air motior FPM in the zone of occupancy. CRD supply diffusers perforn efficiently with air loadings of 25 to 50 air changes per hour (based on 10' ceiling heights) and sound level range of NC 25 to 35.

CRD diffusers are available with overlap margin (CRD-E) an lay-in tee bar ceilings (CRD-L4).

Standard color is baked white enamel finish.

Features

- Aluminum construction of perforated face and air chamber along with a finish painted surface for corrosion resistance.
- Removable aluminum perforated face for internal access tc diffuser for cleaning, etc.
- Damper for volume control is operable from face of diffuser.
- Round necks and dampers for flexible duct connectors.
- Nonaspirating performance for minimum secondary air entrainment.
- Mounting holes available in margins for overlap margin (wh specified).
- Optional accessories available.

Figure 20

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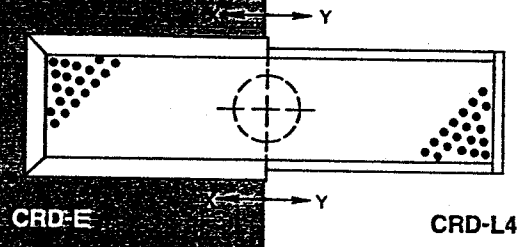
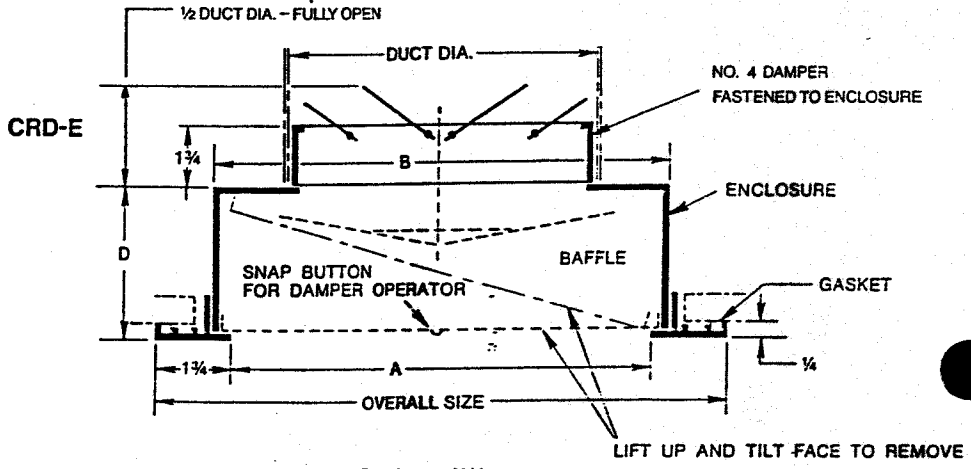
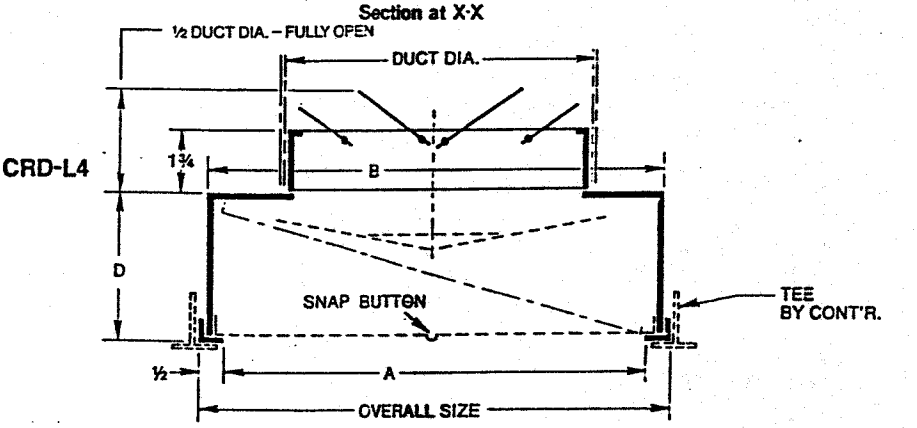


CRD-E

CRD-L4



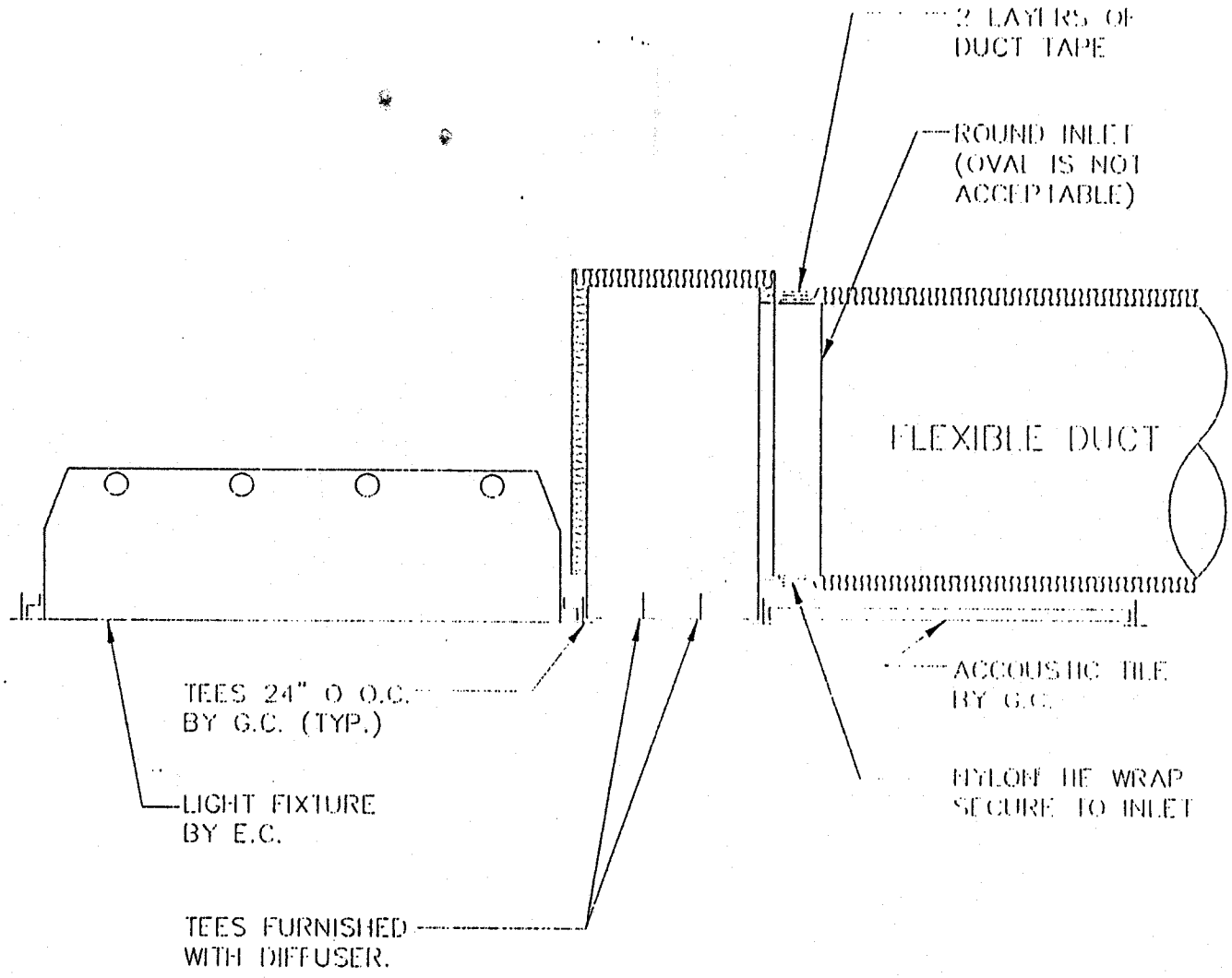
Section at X-X



Section at Y-Y

Nom. Size (In.)	Duct Dia.	A		B		CRD-E Overall Size		CRD-L4 Overall Size		D
		L	W	L	W	L	W	L	W	
24x12	6 or 8	22¾	10¾	23⅝	11⅝	26¼	14¼	23¾	11¾	4
48x12	6 or 8	46¾	10¾	47⅝	11⅝	50¼	14¼	47¾	11¾	4
24x24	6 or 8	22¾	22¾	23⅝	23⅝	26¼	26¼	23¾	23¾	4
36x24	6 or 8	34¾	22¾	35⅝	23⅝	38¼	26¼	35¾	23¾	4
48x24	6 or 8	46¾	22¾	47⅝	23⅝	50¼	26¼	47¾	23¾	4
60x24	6 or 8	58¾	22¾	59⅝	23⅝	62¼	26¼	59¾	23¾	4

Figure 21



SLOT DIFFUSER MOUNTING DETAIL

NO SCALE

Figure 22

h/b/h-90

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GRILLES, REGISTERS & DIFFUSERS SCHEDULE (NOTES 1&2)

SYMBOL	MAT'L.	TYPE	MARGIN	INLET SIZE	FACE SIZE	FINISH	MANUFACTURER	MODEL	REMARKS	ALTERNATE MANUFACTURERS AND MODELS	MAX. CFM NOTE 10	TOTAL PRESSURE DROP	NOTE 12 T_{50}
CD-1	STEEL	LAY-IN	–	6"ø	24X24	WHITE	TUTTLE & BAILEY	DM	NOTES 3	KRUEGER 1400 CARNES SFTA 24 NOTE 10	140	0.05	8
CD-1				8"ø				DM		KRUEGER 1400 CARNES SFTA 24 NOTE 10	220	0.09	11
CD-1				10"ø				DM		KRUEGER 1400 CARNES SFTA 24 NOTE 10	380	0.06	14
CD-1				12"ø				DM		KRUEGER 1400 CARNES SFTA 24 NOTE 10	500	0.05	14
LD-1	STEEL	SLOT	–	8"ø	48X4 1/2	WHITE	KRUEGER	PTBSI 50 3 SLOT	NOTES 5	TUTTLE & BAILEY PCD-H2 NOTE 11 & 13	200	0.13	20
LD-1				10"ø	48X5 1/4			PTBSI 75 3 SLOT		TUTTLE & BAILEY PCD-H2 NOTE 11 & 13	300	0.15	27
LD-1				12"ø	48X6			PTBSI 150 3 SLOT		TUTTLE & BAILEY PCD-H2 NOTE 11 & 13	400	0.16	32
SD-2	ALUM.	SLOT	1"	SEE DRAWINGS	–	–	TUTTLE & BAILEY	4100-EO	–				
SG-1	STEEL	DOUBLE DEFLECTION	1 1/4"	SEE DRAWINGS	–	WHITE	TUTTLE & BAILEY	T64	–	KRUEGER 880V CARNES RSDAV	500 FPM		
RG-P	STEEL	PERFORATED	–	24X24	24X24	WHITE	KRUEGER	1196-A	NOTES 4	TUTTLE & BAILEY CTPVL4 CARNES SPIB 22400	1000	0.027	–
RG-1	STEEL	PERFORATED	–	8"ø	24X24	WHITE	CARNES	SPRB 224			250	0.063	–
RG-1			–	10"ø							400	0.067	–
RG-1			–	12"ø							550	0.07	–
RG-2	STEEL	PERFORATED	–	22X22	24X24	WHITE	KRUGER	1196		TUTTLE & BAILEY CTRL4 CARNES SPIB 22422	1000	0.027	–
EG-1	STEEL	40° DEFLECTION	1 1/4"	SEE DRAWINGS	–	WHITE	TUTTLE & BAILEY	T70D	–	KRUEGER S80H	3-500 FPM		
BG-1	ALUM.	SIGHT-TIGHT	1"	SEE DRAWINGS	–	NOTE 6	TUTTLE & BAILEY	A980WF	–		100 FPM	0.020	–

NOTES:

1. NO GRILLE OR DIFFUSER SHALL HAVE A VOLUME DAMPER INCLUDED UNLESS SPECIFICALLY NOTED ON THE PLANS OR IN THIS SCHEDULE.
2. ALL INLETS AND OUTLETS SHALL HAVE FRAMES SELECTED TO MATCH THE CONSTRUCTION IN WHICH THEY ARE LOCATED.
3. STAMPED CONSTRUCTION, 4-WAY PATTERN, REMOVABLE INNER CORE.
4. FOR RETURN AIR PLENUM. NO DUCT CONNECTION.
5. WITH 1/4" INTERNAL INSULATION. PATTERN ADJUSTABLE RIGHT, LEFT OR DOWN FOR EACH SLOT. BLACK INTERIOR. WHITE CENTER TEES FURNISHED. SIDE TEES BY G.C. FOR T-BAR CEILING. ALL SIZES SHALL HAVE ROUND INLETS. OVAL INLETS ARE NOT ACCEPTABLE. SOME SIZES MAY REQUIRE TALLER THAN STANDARD CONSTRUCTION.
6. WHITE OR GRAY FINISH SUITABLE FOR FIELD PAINTING BY G.C.
10. MAXIMUM CFM BASED ON 700 FPM INLET VELOCITY OR NC32 WHICHEVER IS LESS. NC BASED ON 8dB ROOM EFFECT RE: 10^{-12} WATTS.
11. MAXIMUM CFM BASED ON 600 FPM INLET VELOCITY OR NC32 WHICHEVER IS LESS. NC BASED ON 8dB ROOM EFFECT RE: 10^{-12} WATTS.
12. THROW BASED ON ISOTHERMAL AIR WITH 50 FPM TERMINAL VELOCITY PER ADC STANDARD 1062-GRD-84
13. THROW BASED ON 2 SLOTS IN ONE DIRECTION.

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