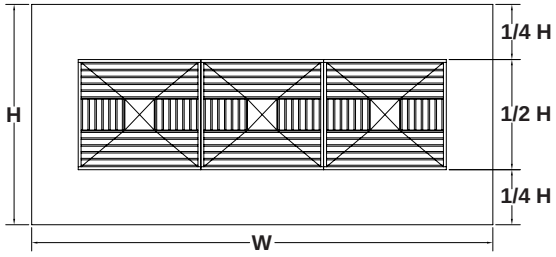
KEES AIR MIX^{X}ER APPLICATION GUIDE

MIX^{X}ER DESCRIPTION

- The KEES MIX^{x}ER has no moving or adjustable parts and consists of a heavy gauge all welded channel frame containing a set of directional changing vanes and a cone designed for almost perfect mixing of air streams of different temperatures and velocities.
- Materials: Standard construction is 0.081" 5052-H34 aluminum. Steel and stainless steel construction are available. Shipping size limitations: Units over 102 inches in either dimension are shipped in two sections for field bolting.
- Optional construction can be of all welded painted galvanized steel with a prime coat, or optional finish coat of high moisture resisting epoxy paint. Also of 100% 304 or 316 stainless steel.
- Air capacities from 600 through 216,000 C.F.M.
- Low pressure drops varying from 0.07 to 0.34 in. water gauge.
- Velocity of air at entering face of MIX^{x}ER can range from 350 F.P.M. thru 1,500 F.P.M.. The optimal range is 800-1,100 F.P.M. for a constant air volume system and 1,000-1,200 F.P.M. for a variable air volume system.
- Mixes air streams of different temperatures to within ± 6°F. of theoretical exact mixing temperature. See page 4 for typical test results of air mixer performance.
- Available in square sizes 12" x 12" through 144" x 144" in all increments. Rectangular sizes available 24" x 12" thru 144" x 138" in all increments where one side is not more than 2 times the other side.

SELECTION PROCEDURE

- Select the mixer size using Table 1 based on the air flow and pressure drop requirements.
- Mixers can be square or rectangular (2:1 Ratio).
- Bank of mixers can be comprised of 2 or more mixers placed side by side. Refer to Table 2 for examples of single and multiple mixer selections. Optimal mixer shape and placement is as shown below.



Height of mixer to be approximately 1/2 of height of plenum with blank-offs above and below the mixer each 1/4 of plenum height. Width of mixer can then be adjusted to provide proper mixer area and be as much as the full width of the plenum. Multiple units work best when minimum fresh air, economizer fresh air and return air duct connections run the full width of an air handler and insure that each mixer see equal quantities of both incoming air streams.

INSTALLATION LENGTH REQUIREMENTS

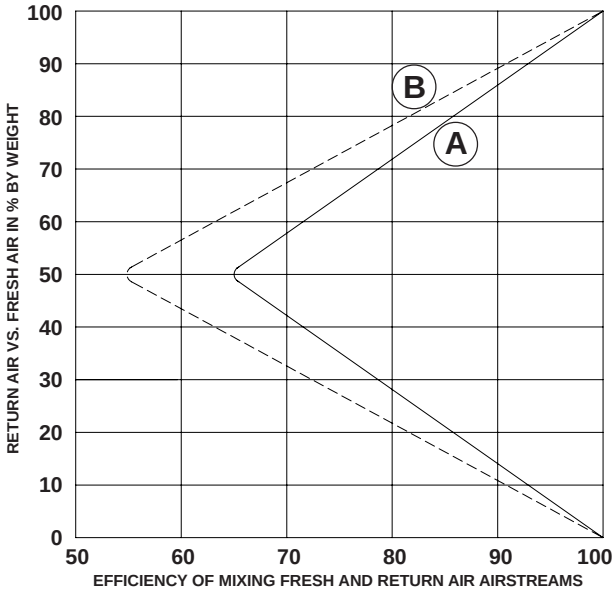
The advantage of the air mixer over rotary type blenders is the smaller upstream distance required for guaranteed mixing performance. While rotary devices call for upstream distances equal to as much as 1/2 the diameter of the device, the air mixer requires only 2 inches downstream length from an air entering damper. For example, a 48 inch diameter rotary device could call for a 24 inch space on its entering side, the Kees mixer can reduce this by 22 inches in the direction of the air flow. The downstream distance leaving the mixing device is recommended to be equal to the dimension of the side of a square unit or average of two adjoining sides of a rectangular unit. Limited space might require a lesser distance whose mixing efficiency is shown in the graph to the right.

KEES, INC.
ELKHART LAKE, WI 53020
TEST: 101 DATE: 1-16-91

AIR MIXER EFFICIENCY BASED ON DOWNSTREAM DISTANCE AND PERCENT BY WEIGHT OF RETURN AIR.

Ⓐ Distance from mixer to next downstream component is equal to one side of square mixer or average of two adjacent sides.

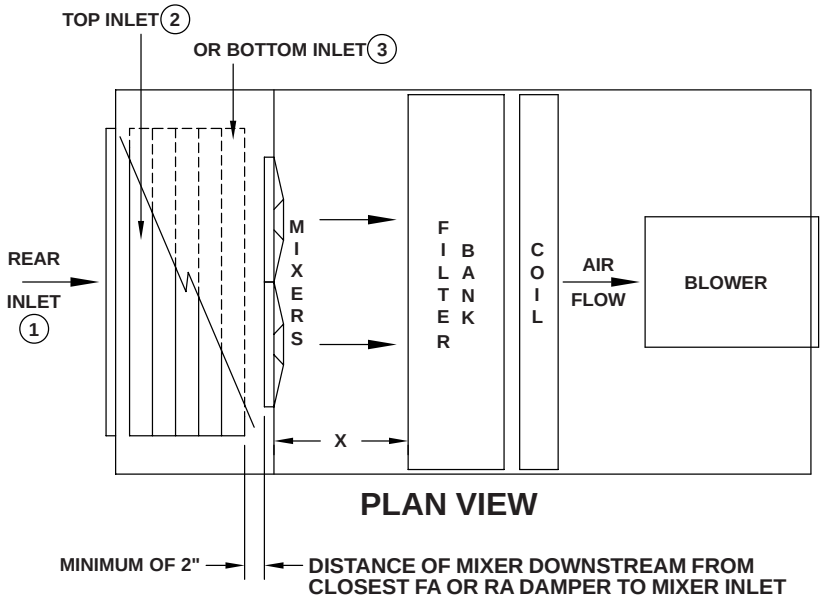
Ⓑ Distance above reduced to 3/4.



INLET ARRANGEMENTS

Correct and incorrect inlet arrangements are as shown.

CORRECT APPLICATION FOR DRAW-THRU AIR HANDLER



Combinations of FA and RA connections using one or more mixers

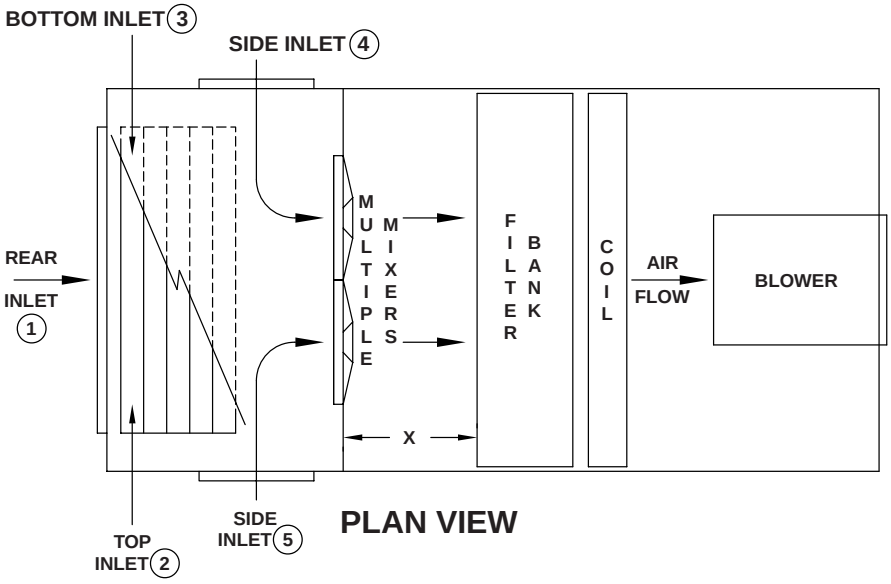
1 and 2,

1 and 3, or

2 and 3.

INCORRECT APPLICATION FOR DRAW-THRU AIR HANDLER

When one or more side inlets to the mixer is necessitated, only a single mixer can be employed.



Do <u>not</u> use <u>multiple mixers</u> for any combination of

4 and 1, 4 and 5,

4 and 2, 4 and 3,

1 and 5, 5 and 2,

or 5 and 3.

<u>USE ONE MIXER IF THERE IS A SIDE INLET.</u>

TABLE 1

MIXER AIR CAPACITY IN CUBIC FEET PER MINUTE (C.F.M.) VERSUS AIR VELOCITY AT ENTERING FACE OF MIXER IN FT. PER MINUTE PRESSURE DROP IN INCHES W.G.

VELOCITY	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500
MIXER P.D.*	0.07	0.09	0.11	0.13	0.15	0.18	0.21	0.25	0.29	0.34
CAPACITY CFM/SQ. FT.	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500
SIZE **										
12 x 12	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500
18 x 18	1,350	1,575	1,800	2,025	2,250	2,475	2,700	2,925	3,150	3,375
24 x 24	2,400	2,800	3,200	3,600	4,000	4,400	4,800	5,200	5,600	6,000
30 x 30	3,750	4,375	5,000	5,625	6,250	6,875	7,500	8,125	8,750	9,375
36 x 36	5,400	6,300	7,200	8,100	9,000	9,900	10,800	11,700	12,600	13,500
42 x 42	7,350	8,575	9,800	11,025	12,250	13,475	14,700	15,925	17,150	18,375
48 x 48	9,600	11,200	12,800	14,400	16,000	17,600	19,200	20,800	22,400	24,000
54 x 54	12,150	14,175	16,200	18,225	20,250	22,275	24,300	26,325	28,350	30,375
60 x 60	15,000	17,500	20,000	22,500	25,000	27,500	30,000	32,500	35,000	37,500
66 x 66	18,150	21,175	24,200	27,225	30,250	33,275	36,300	39,325	42,350	45,375
72 x 72	21,600	25,200	28,800	32,400	36,000	39,600	43,200	46,800	50,400	54,000
78 x 78	25,350	29,575	33,800	38,025	42,250	46,475	50,700	54,925	59,150	63,375
84 x 84	29,400	34,300	39,200	44,100	49,000	53,900	58,800	63,700	68,600	73,500
90 x 90	33,750	39,375	45,000	50,625	56,250	61,875	67,500	73,125	78,750	84,375
96 x 96	38,400	44,800	51,200	58,500	64,000	70,400	76,800	83,200	89,600	96,000
102 x 102	43,350	50,575	57,800	65,025	72,250	79,475	86,700	93,925	101,150	108,375
108 x 108	48,600	56,700	64,800	72,900	81,000	89,100	97,200	105,300	113,400	121,500
114 x 114	54,150	63,175	72,200	81,225	90,250	99,275	108,300	117,325	126,350	135,375
120 x 120	60,000	70,000	80,000	90,000	100,000	110,000	120,000	130,000	140,000	150,000
126 x 126	66,150	77,175	88,200	99,225	110,250	121,275	132,300	143,325	154,350	165,375
132 x 132	72,600	84,700	96,800	108,900	121,000	133,100	145,200	157,300	169,400	181,500
138 x 138	79,350	92,575	105,800	119,025	132,250	145,475	158,700	171,925	185,150	198,375
144 x 144	86,400	100,800	115,200	129,600	144,000	158,400	172,800	187,200	201,600	216,000

* The pressure drop shown is for the mixer only. Additional panel safing pressure drop occurs. Refer to the table below for this additional pressure drop for typical applications. Total pressure drop is the sum of mixer and panel safing pressure drops.

A: 1,000 F.P.M. optimum for constant volume systems.

B: 1,200 F.P.M. optimum for variable volume systems.

PANEL SAFING PRESSURE DROP FOR PANEL MIXER (PM) & PLENUM MIXER (PMP), INCHES W.G.						
PLENUM VELOCITY, F.P.M.						
400	450	500	550	600	650	700
0.02	0.03	0.04	0.05	0.07	0.08	0.1

** For rectangular shapes, convert area to approximate equivalent square shape and enter table above. One side of rectangular unit cannot be more than two times the other side. Capacity per square foot of face area is the same, square or rectangular.

TABLE 2

	SELECTION AT APPROXIMATELY 1,000 F.P.M. AND PRESSURE DROP OF 0.15 IN. WATER		
BEST C.F.M. RANGE	ONE MIXER	TWO MIXERS	THREE MIXERS
800 - 1,100	12 x 12	- - - - - - -	- - - - - - -
1,100 - 1,500	14 x 14	- - - - - - -	- - - - - - -
1,500 - 1,900	16 x 16	2- 12 x 12	- - - - - - -
1,900 - 2,500	18 x 18	2- 14 x 14	- - - - - - -
2,500 - 3,100	21 x 21	2- 15 x 15	3- 12 x 12
3,100 - 3,700	23 x 23	2- 16 x 16	3- 14 x 14
3,700 - 4,300	25 x 25	2- 18 x 18	3- 15 x 15
4,300 - 5,100	27 x 27	2- 19 x 19	3- 16 x 16
5,100 - 6,400	30 x 30	2- 21 x 21	3- 17 x 17
6,400 - 8,100	34 x 34	2- 24 x 24	3- 20 x 20
8,100 - 10,000	36 x 36	2- 25 x 25	3- 21 x 21
10,000 - 14,000	44 x 44	2- 31 x 31	3- 26 x 26

	SELECTION AT APPROXIMATELY 1,000 F.P.M. AND PRESSURE DROP OF 0.15 IN. WATER		
BEST C.F.M. RANGE	ONE MIXER	TWO MIXERS	THREE MIXERS
14,000 - 17,000	48 x 48	2- 34 x 34	3- 28 x 28
17,000 - 21,000	54 x 54	2- 39 x 39	3- 31 x 31
21,000 - 26,000	60 x 60	2- 42 x 42	3- 35 x 35
26,000 - 35,000	70 x 70	2- 50 x 50	3- 40 x 40
35,000 - 44,000	78 x 78	2- 56 x 56	3- 46 x 46
44,000 - 53,000	86 x 86	2- 62 x 62	3- 50 x 50
53,000 - 60,000	92 x 92	2- 65 x 65	3- 54 x 54
60,000 - 75,000	104 x 104	2- 73 x 73	3- 61 x 61
75,000 - 90,000	114 x 114	2- 81 x 81	3- 66 x 66
90,000 - 100,000	120 x 120	2- 93 x 93	3- 69 x 69
100,000 - 125,000	134 x 134	2- 95 x 95	3- 77 x 77
125,000 - 142,000	144 x144	2- 102 x 102	3- 83 x 83

CAUTION: When two or more mixers are used, the same amount of outside air and return air must go through each mixer in order to get similar leaving results.

TYPICAL AIR MIX^{x}ER PERFORMANCE TEST DATA

TEST RESULTS USING COLD OUTSIDE AIR

The following is a comparison of temperature and velocity differentials of fresh and return air leaving an air inlet plenum with and without a KEES AIR MIX^{x}ER.

50% return air volume at 60°F. 50% outside air volume at 24°F.. Theoretical exact mixed air temperature is 41°F.. Test chamber 10 ft. x 8 ft. - 49,000 C.F.M. total. Velocity through plenum 612 F.P.M.. MIX^{x}ER size 84 x 84. Velocity through MIX^{x}ER 1,000 F.P.M.. MIX^{x}ER pressure drop 0.15 in. water gauge (See Table 1).

AIR TEMPERATURES LEAVING INLET PLENUM WITH AND WITHOUT KEES MIX^{x}ER					
With MIX^{x}ER	40	42	41	42	43*
Without MIX^{x}ER	(34)	(44)	(47)	(43)	(40)
With MIX^{x}ER	38	36*	36	36	40
Without MIX^{x}ER	(32)	(29)	(29)	(32)	(34)
With MIX^{x}ER	37	36	38	40	41
Without MIX^{x}ER	(24)	(27)	(31)	(31)	(32)
With MIX^{x}ER	40	41	43	42	41
Without MIX^{x}ER	(24)	(25)	(24)	(29)	(31)

AIR VELOCITIES APPROACHING FILTERS WITH AND WITHOUT KEES MIX^{x}ER					
With MIX^{x}ER	590	605	617	635	625
Without MIX^{x}ER	(495)	(492)	(530)	(540)	(540)
With MIX^{x}ER	610	590	595	570*	580
Without MIX^{x}ER	(590)	(630)	(570)	(540)	(530)
With MIX^{x}ER	636	621	583	580	585
Without MIX^{x}ER	(660)	(675)	(530)	(525)	(510)
With MIX^{x}ER	640	645*	637	595	590
Without MIX^{x}ER	(740)	(670)	(658)	(642)	(620)

WITHOUT MIX^{x}ER

(____) Maximum temperature over theoretical mixed air temperature 47-41=6°

(____) Maximum temperature under theoretical mixed air temperature 41-24=17°

(____) Maximum difference in velocities without MIX^{x}ER (740-492) = 248 F.P.M.

WITH MIX^{x}ER

* Maximum temperature over theoretical mixed air temperature 43-41=2°

* Maximum temperature under theoretical mixed air temperature 41-36=5°

* Maximum difference in velocities with MIX^{x}ER (645-570) = 75 F.P.M.

TEST RESULTS USING WARM OUTSIDE AIR

The following is a comparison of temperature and velocity differentials of fresh and return air leaving an air inlet plenum with and without a KEES AIR MIX^{x}ER.

50% return air volume at 63°F. 50% outside air volume at 112°F.. Theoretical exact mixed air temperature is 85°F.. Test chamber 5 ft. x 4 ft. - 14,000 C.F.M. total. Velocity through plenum 700 F.P.M.. MIX^{x}ER size 60 x 48. Velocity through MIX^{x}ER 700 F.P.M.. MIX^{x}ER pressure drop 0.09 in. water gauge (See Table 1).

MIXED AIR TEMPERATURES WITH AND WITHOUT KEES MIX^{x}ER					
With MIX^{x}ER	85	84	87	88*	82
Without MIX^{x}ER	(73)	(87)	(86)	(102)	(94)
With MIX^{x}ER	83	84	85	82	84
Without MIX^{x}ER	(76)	(84)	(88)	(101)	(96)
With MIX^{x}ER	86	87	86	84	83
Without MIX^{x}ER	(72)	(81)	(93)	(102)	(92)
With MIX^{x}ER	82	84	83	83	81*
Without MIX^{x}ER	(79)	(83)	(86)	(94)	(99)

AIR VELOCITIES APPROACHING FILTERS WITH AND WITHOUT KEES MIX^{x}ER					
With MIX^{x}ER	665	685	705	735*	725
Without MIX^{x}ER	(440)	(480)	(655)	(880)	(875)
With MIX^{x}ER	655	655	690	730	715
Without MIX^{x}ER	(460)	(465)	(570)	(855)	(890)
With MIX^{x}ER	670	690	715	730	705
Without MIX^{x}ER	(440)	(550)	(710)	(770)	(745)
With MIX^{x}ER	645*	650	725	735	690
Without MIX^{x}ER	(445)	(470)	(640)	(700)	(720)

WITHOUT MIX^{x}ER

(____) Maximum temperature over theoretical mixed air temperature 102-85=17°

(____) Maximum temperature under theoretical mixed air temperature 85-72=13°

(____) Maximum difference in velocities without MIX^{x}ER (890-440) = 450 F.P.M.

WITH MIX^{x}ER

* Maximum temperature over theoretical mixed air temperature 88-85=3°

* Maximum temperature under theoretical mixed air temperature 85-81=4°

* Maximum difference in velocities with MIX^{x}ER (735-645) = 90 F.P.M.