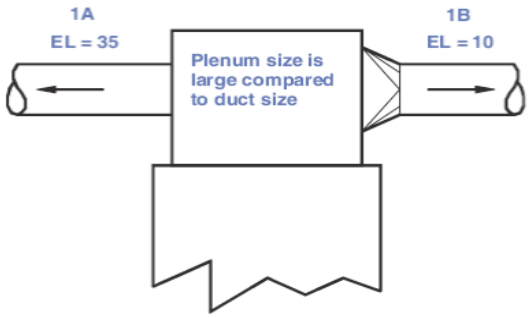
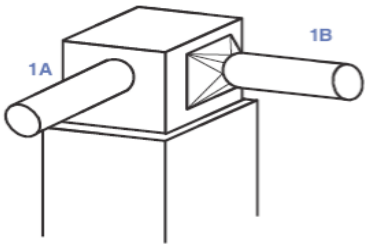
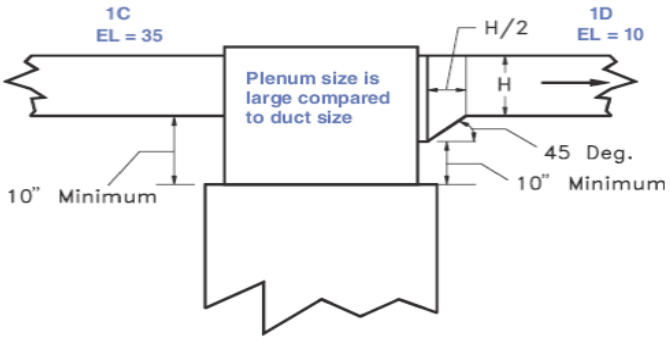
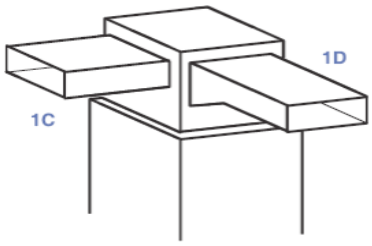
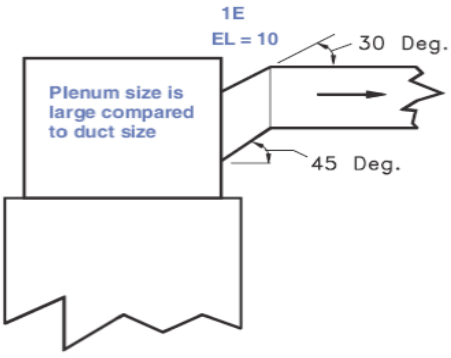
Group 1
Supply Air Fittings at the Air Handling Equipment
Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet

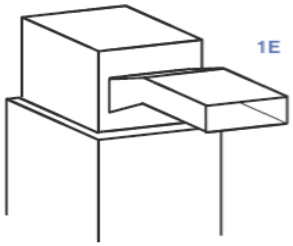












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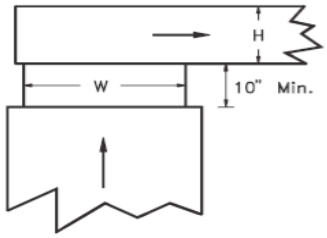
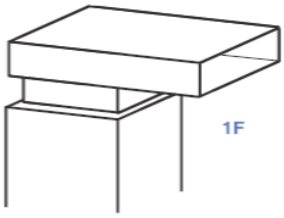
Appendix 3

Group 1 — Continued
Supply Air Fittings at the Air Handling Equipment

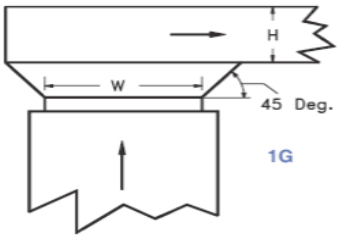
Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet

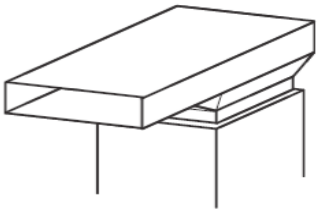


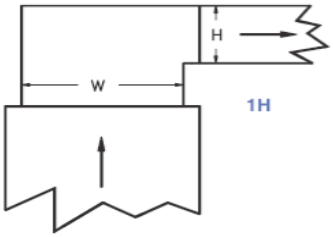


Bull Head 1F	H / W	EL
	0.50	120
	1.0	85

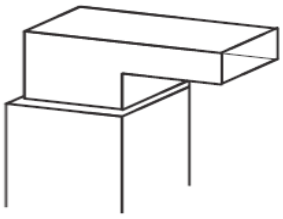
Tapered Head 1G	H / W	EL
	0.50	35
	1.0	25

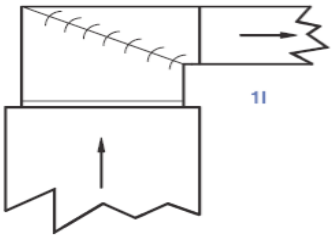






No Vanes 1H	H / W	EL
	0.5	120
	1.0	85





With Vanes 1I	EL = 20

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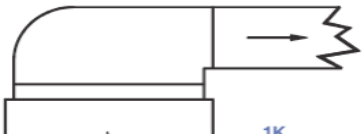
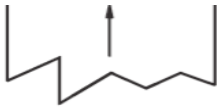
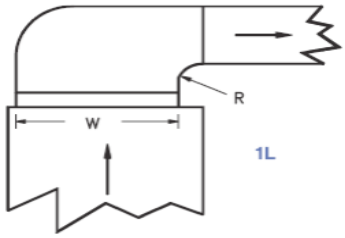
Appendix 3

Group 1 — Continued
Supply Air Fittings at the Air Handling Equipment
Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet

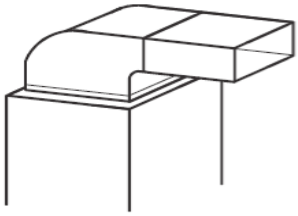


Mitered Inside Corner 1K	EL = 85

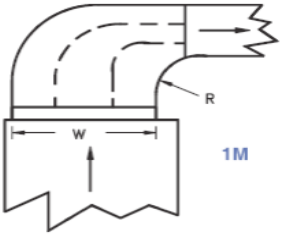




1L



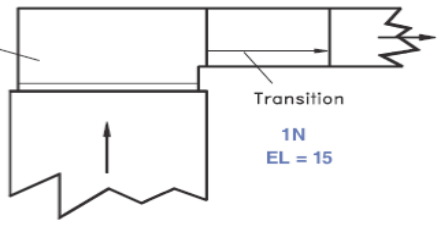
Radius Ell No Vanes 1L	R / W	EL
	0.25	40
	0.50	20
	1.0	10



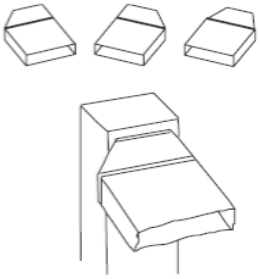
1M

Radius Ell with Vanes 1M	R / W	1-Vane EL	2-Vane EL
	0.05	30	20
	0.25	20	10
	0.50	10	10

Add the transition EL to the upstream elbow EL (or tee EL)



1N
EL = 15



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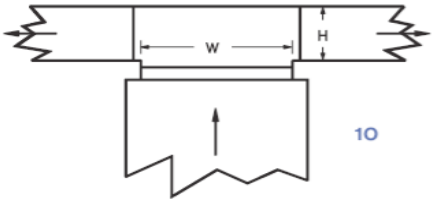
Appendix 3

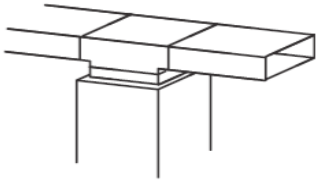
Group 1 — Continued
Supply Air Fittings at the Air Handling Equipment

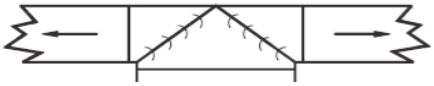
Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet

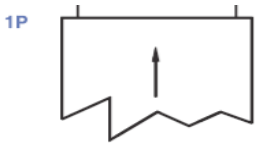


1O

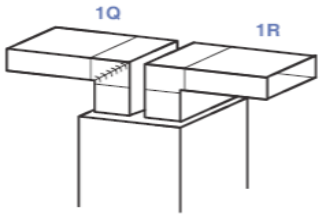
Bull Head No Vanes 1O	H / W	EL
	0.50	120
	1.0	85

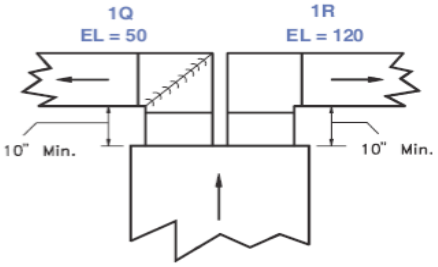




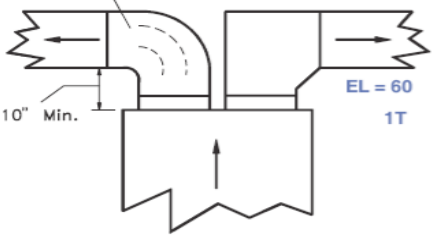


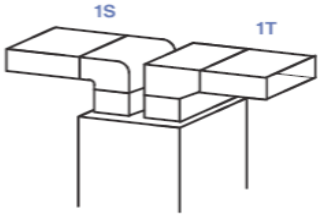
Vaned Tee 1P	EL = 20





Radius Elbow 1S	Vanes	EL
	0	60
	1	40
	2	30





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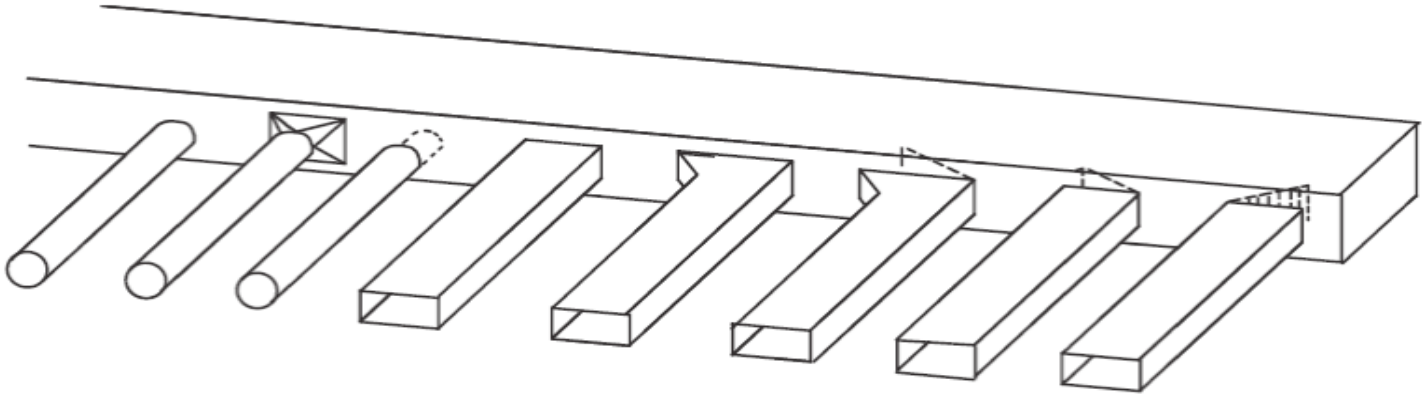
Return

Appendix 3

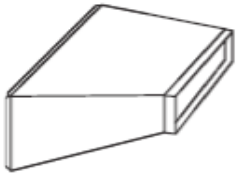
Group 2
Branch Takeoff Fittings at the Supply Trunk

Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet

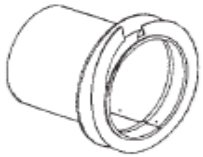


EL Values		Number of Downstream Branches to End of Trunk Duct or Number of Downstream Branches to a Trunk Reducer					
Fitting		0	1	2	3	4	5 or More
	2A	35	45	55	65	70	80
	2B	20	30	35	40	45	50
	2C	65	65	65	65	70	80

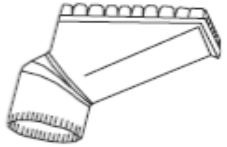
	2D	40	50	60	65	75	85
	2E	25	30	35	40	45	50
	2F	20	20	20	20	25	25
	2G	65	65	65	70	80	90
	2H	70	70	70	75	85	95
Note: If the trunk has a reducer, count down to the reducer; then begin a new count after the reducer.							



Refer to Fitting 2D



Refer to Fitting 2A or 2C



Refer to Fitting 2E

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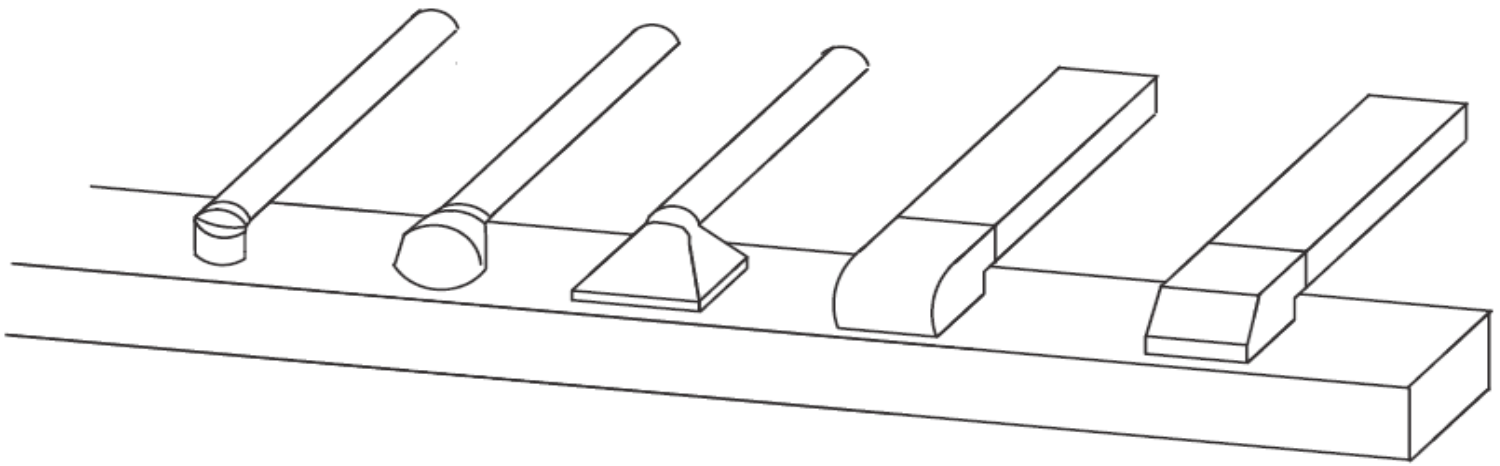
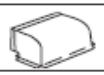
Appendix 3

Group 2 — Continued
Branch Takeoff Fittings at the Supply Trunk

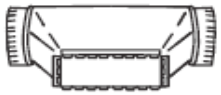
Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet



EL Values		Number of Downstream Branches to End of Trunk Duct or Number of Downstream Branches to a Trunk Reducer					
Fitting		0	1	2	3	4	5 or More
	2I	65	75	85	95	100	110
	2J	50	60	65	70	75	80
	2K	50	60	65	70	75	80
	2L	70	80	90	95	105	115
	2M	70	80	90	95	105	115
Note: If the trunk has a reducer, count down to the reducer; then begin a new count after the reducer.							

Refer to
Fitting 2J

Refer to
Fitting 2J



Refer to
Fitting 2I

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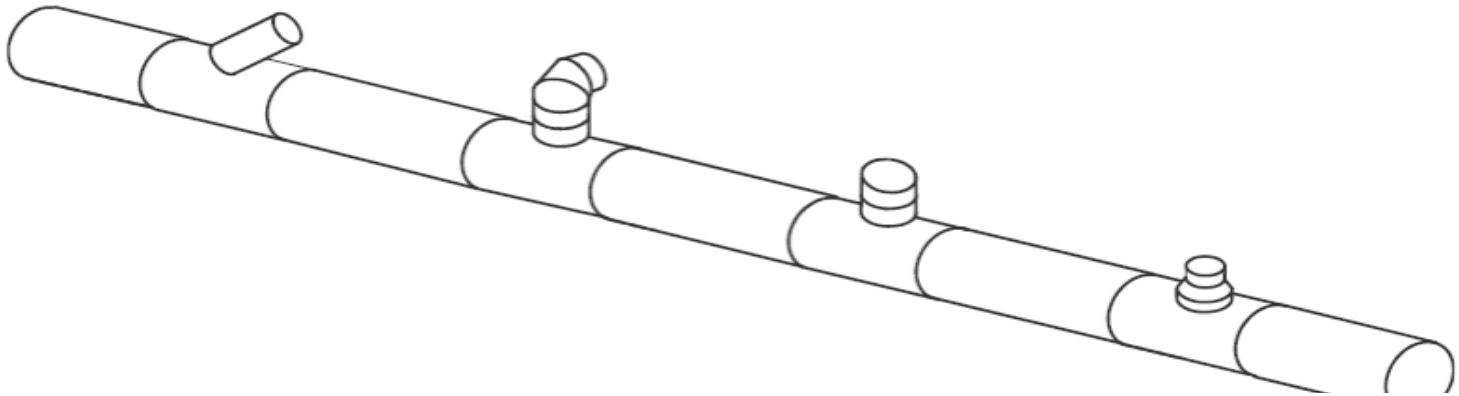
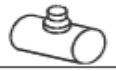
Appendix 3

Group 2 — Continued
Branch Takeoff Fittings at the Supply Trunk

Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet



EL Values		Number of Downstream Branches to End of Trunk Duct or Number of Downstream Branches to a Trunk Reducer					
Fitting		0	1	2	3	4	5 or More
	2N	35	35	40	40	40	40
	2O	55	65	75	85	90	100
	2P	50	55	60	65	70	75
	2Q	10	10	15	20	20	25
Note: If the trunk has a reducer, count down to the reducer; then begin a new count after the reducer.							

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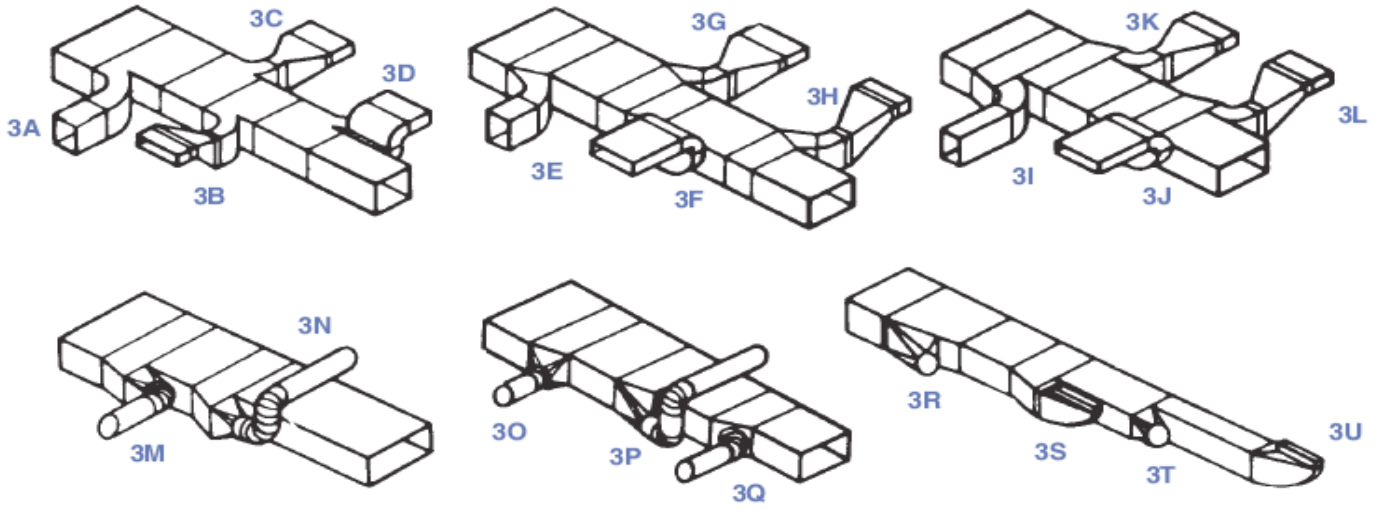
Return

Appendix 3

Group 3
Reducing Trunk Takeoff Fittings

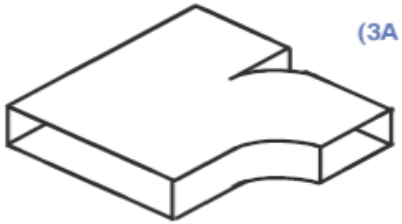
Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet



Fitting ID	EL	Description of Assembly
3A and 3I	15	Full radius takeoff
3B and 3L	30	Full radius takeoff plus offset transition
3C and 3K	20	Full radius takeoff plus straight transition

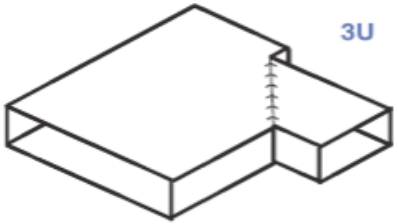
3D and 3J	35	Radius takeoff elbow (see 3S) plus easy-bend elbow
	55	Tight radius takeoff elbow (see 3S) plus easy-bend elbow
	110	Mitered inside corner takeoff elbow (see 3S) plus easy-bend elbow
3E	30	Transition wall takeoff
3F	3D + 15	Transition wall takeoff elbow (radius, tight radius or mitered corner) plus easy-bend elbow
3G	35	Transition wall takeoff plus straight-aspect transition
3H	35	Transition wall takeoff plus offset-aspect transition
3M	25	In line eased takeoff fitting (see 3T) plus one elbow
3N	40	In line eased takeoff fitting (see 3T) plus two elbows
3O and 3R	20	Transition wall eased takeoff fitting (see note)
3P	50	Transition wall eased takeoff fitting plus two elbows (see note)
3Q	35	Transition wall eased takeoff fitting plus one elbow (see note)
3S and 3U	15	Full radius takeoff elbow
	35	Tight inside radius takeoff elbow
	90	Mitered inside corner takeoff elbow
3T	10	In line eased takeoff fitting
Note: Add 15 feet to the equivalent length if a round sleeve is simply butted to the transition wall.		

Group 3 — Continued
Reducing Trunk Takeoff Fittings
Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC. per 100 Feet



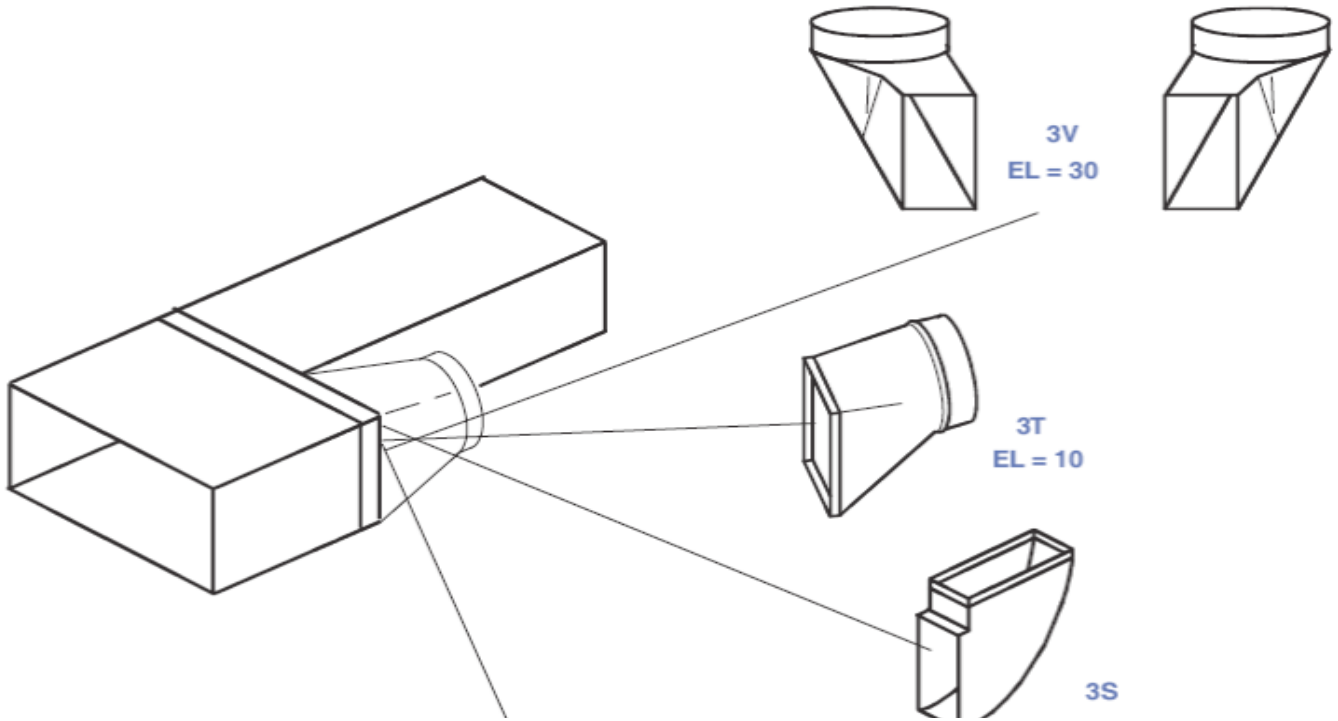
(3A or 3I)

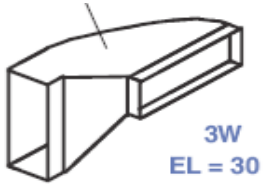
Full Radius Takeoff 3A or 3I	EL = 15



3U

Mitered Takeoff 3U	Vanes	EL
	Yes	10
	No	80





3W
EL = 30

Hard Bend Takeoff 3S	Corner	EL
	Mitered	90
	Tight	35
	Full	15

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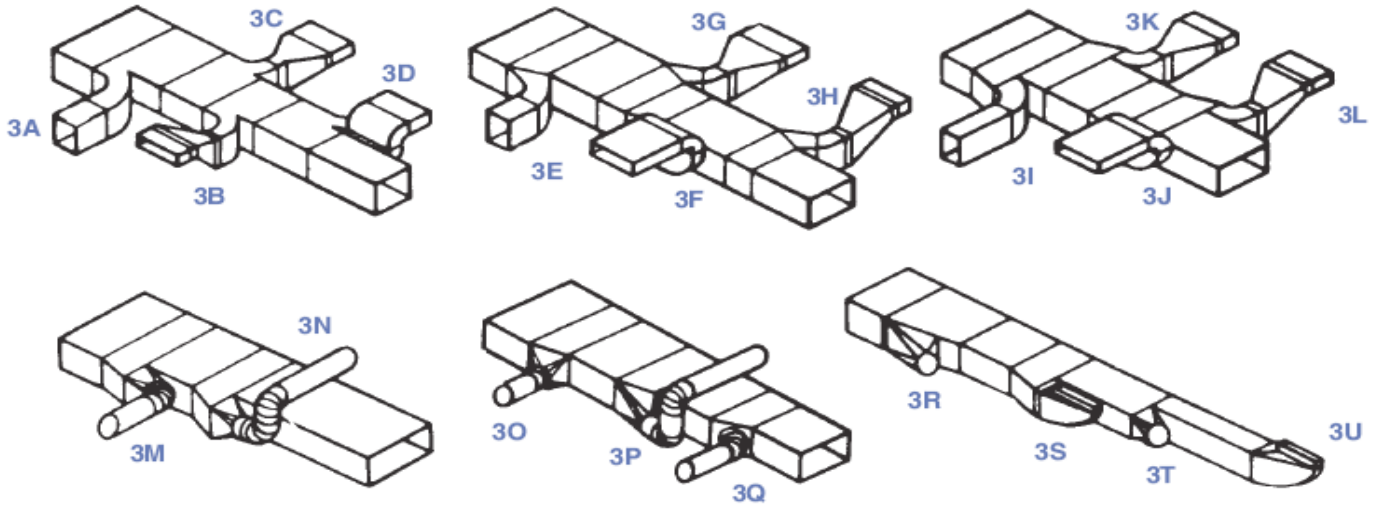
Return

Appendix 3

Group 3
Reducing Trunk Takeoff Fittings

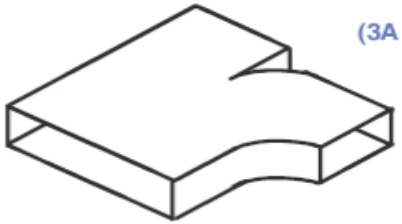
Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet



Fitting ID	EL	Description of Assembly
3A and 3I	15	Full radius takeoff
3B and 3L	30	Full radius takeoff plus offset transition
3C and 3K	20	Full radius takeoff plus straight transition

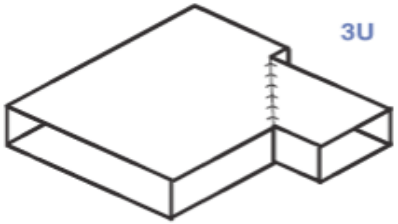
3D and 3J	35	Radius takeoff elbow (see 3S) plus easy-bend elbow
	55	Tight radius takeoff elbow (see 3S) plus easy-bend elbow
	110	Mitered inside corner takeoff elbow (see 3S) plus easy-bend elbow
3E	30	Transition wall takeoff
3F	3D + 15	Transition wall takeoff elbow (radius, tight radius or mitered corner) plus easy-bend elbow
3G	35	Transition wall takeoff plus straight-aspect transition
3H	35	Transition wall takeoff plus offset-aspect transition
3M	25	In line eased takeoff fitting (see 3T) plus one elbow
3N	40	In line eased takeoff fitting (see 3T) plus two elbows
3O and 3R	20	Transition wall eased takeoff fitting (see note)
3P	50	Transition wall eased takeoff fitting plus two elbows (see note)
3Q	35	Transition wall eased takeoff fitting plus one elbow (see note)
3S and 3U	15	Full radius takeoff elbow
	35	Tight inside radius takeoff elbow
	90	Mitered inside corner takeoff elbow
3T	10	In line eased takeoff fitting
Note: Add 15 feet to the equivalent length if a round sleeve is simply butted to the transition wall.		

Group 3 — Continued
Reducing Trunk Takeoff Fittings
Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC. per 100 Feet



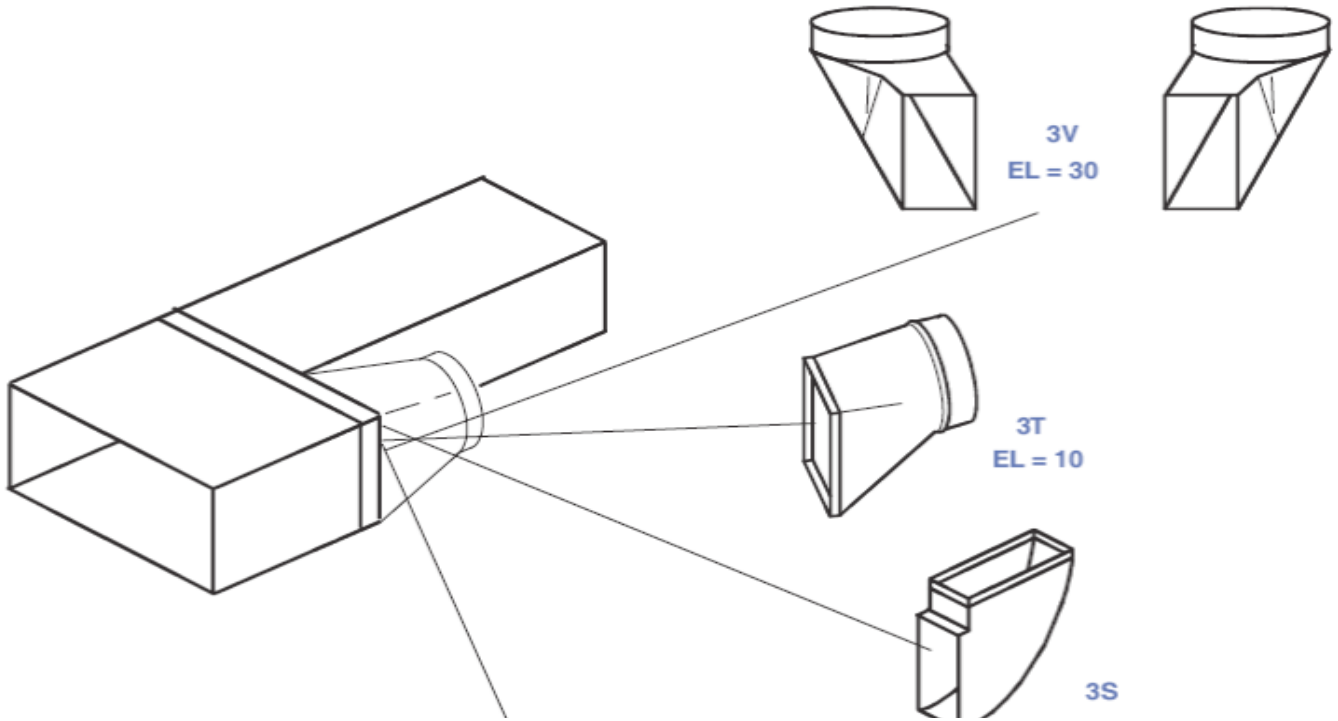
(3A or 3I)

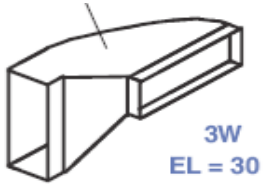
Full Radius Takeoff 3A or 3I	EL = 15



3U

Mitered Takeoff 3U	Vanes	EL
	Yes	10
	No	80





3W
EL = 30

Hard Bend Takeoff 3S	Corner	EL
	Mitered	90
	Tight	35
	Full	15

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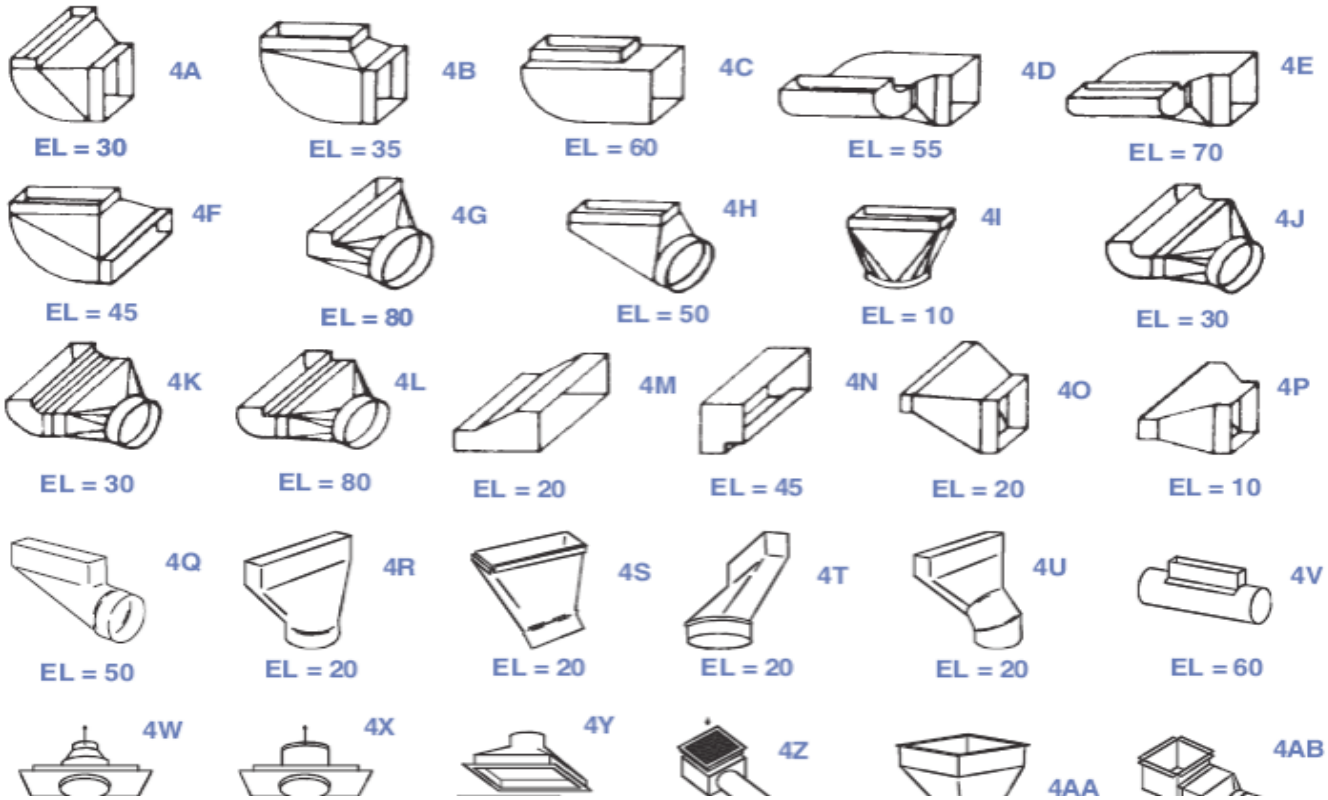
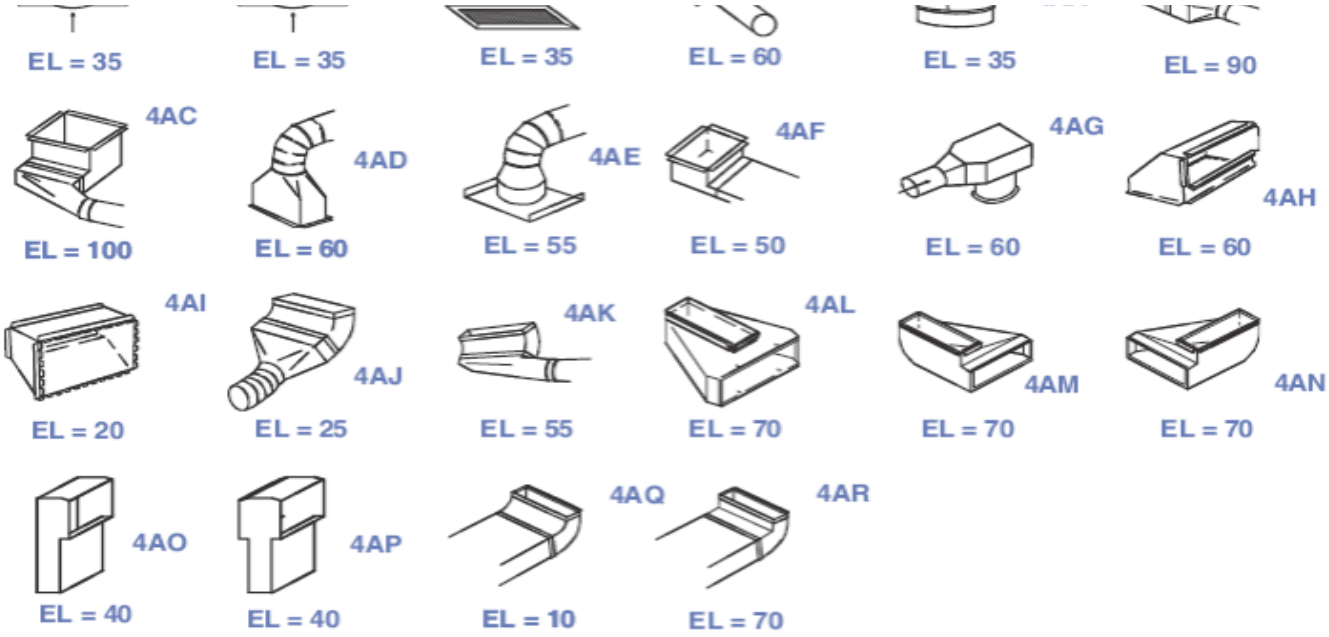
Return

Appendix 3

Group 4
Supply Air Boot and Stack Head Fittings

Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet




EL = 35
EL = 35
EL = 35
EL = 60
EL = 35
EL = 90
4AC
EL = 100
4AD
EL = 60
4AE
EL = 55
4AF
EL = 50
4AG
EL = 60
4AH
EL = 60
4AI
EL = 20
4AJ
EL = 25
4AK
EL = 55
4AL
EL = 70
4AM
EL = 70
4AN
EL = 70
4AO
EL = 40
4AP
EL = 40
4AQ
EL = 10
4AR
EL = 70

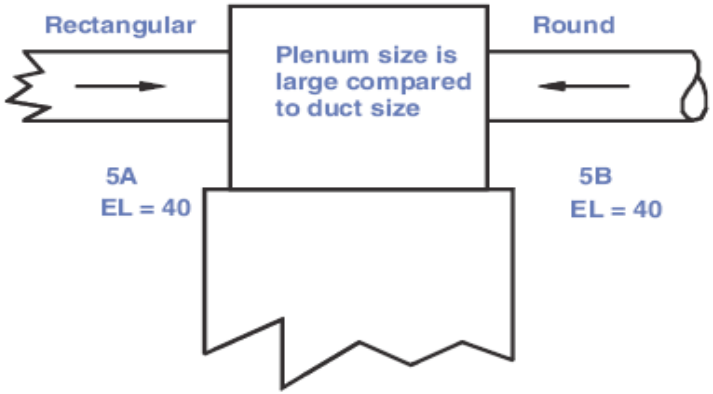
168

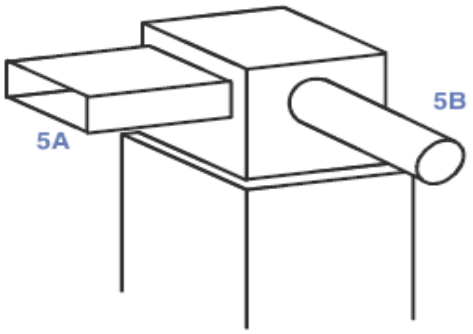
Return

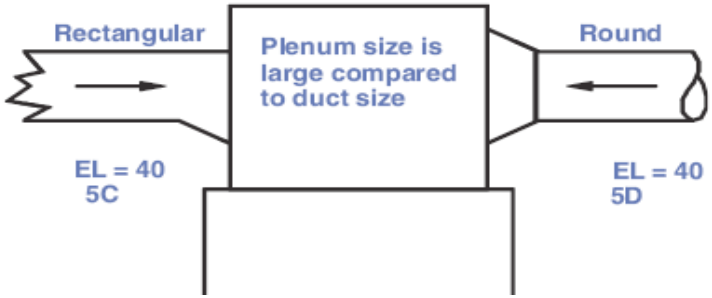
Appendix 3

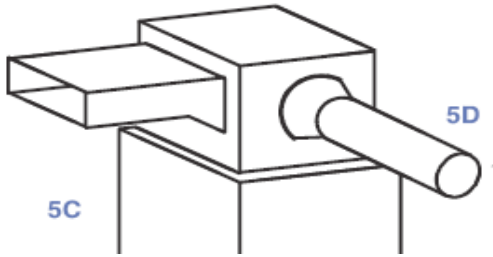
Group 5
Return Air Fittings at the Air Handling Equipment

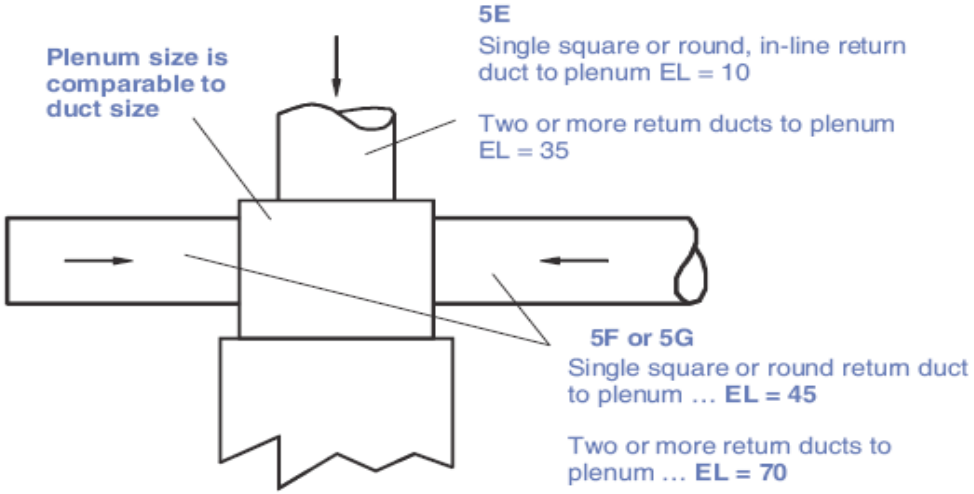
Reference Velocity = 700 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet

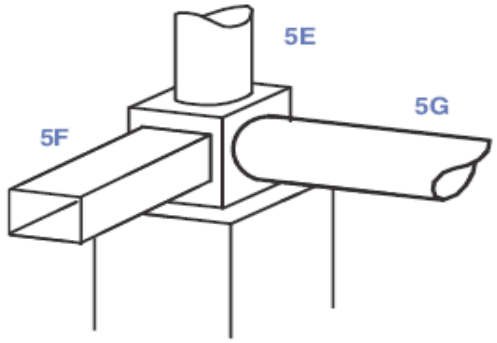












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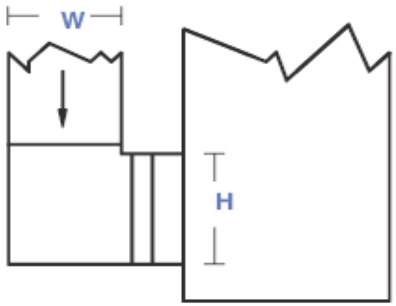
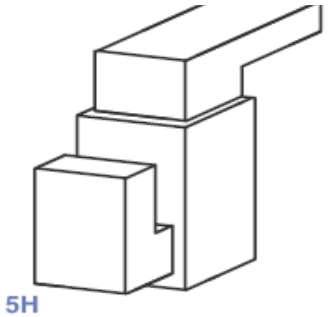
Appendix 3

Group 5 — Continued
Return Air Fittings at the Air Handling Equipment

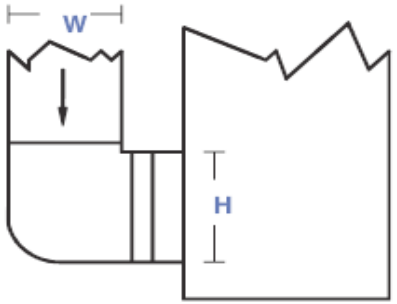
Reference Velocity = 700 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet

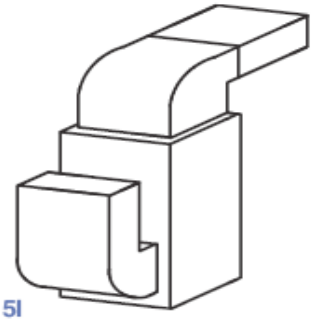


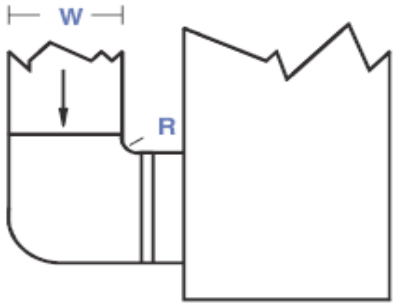


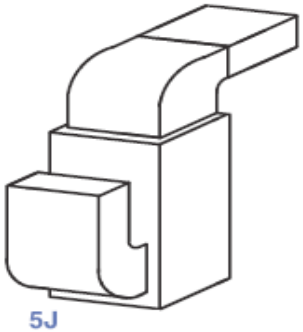
Square Elbow 5H	H / W	EL
	1	45
	2	30

Mitered Inside Corner 5I	H / W	EL
	1	45
	2	30



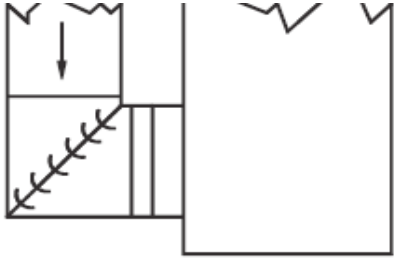


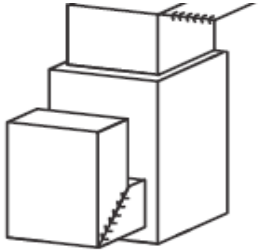




Radius Elbow 5J	R / W	EL
	0.25	20
	0.50	15
	1.00	10

Square Elbow with Vanes 5K	EL
	10





5K

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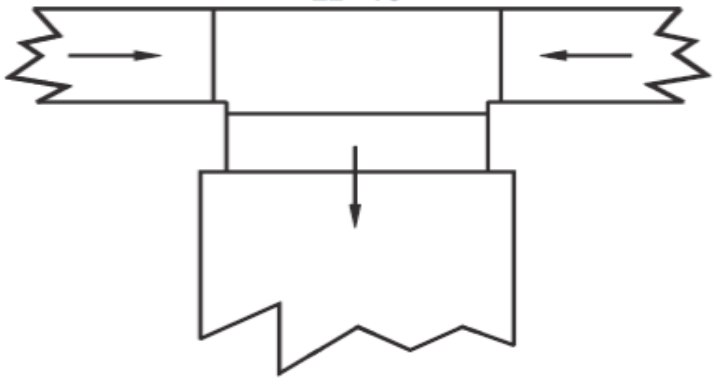
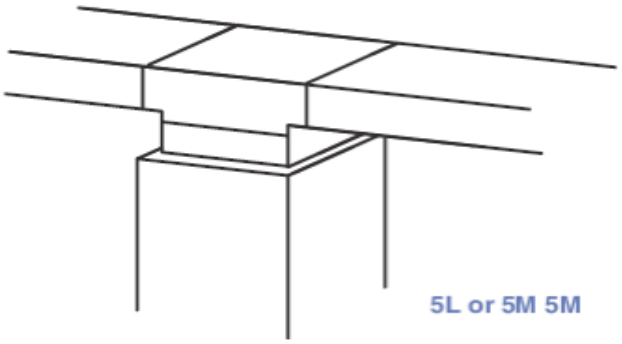
Appendix 3

Group 5 — Continued
Return Air Fittings at the Air Handling Equipment

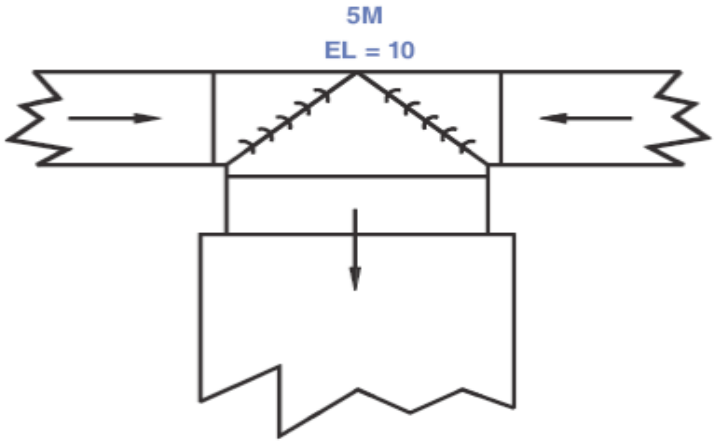
Reference Velocity = 700 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet

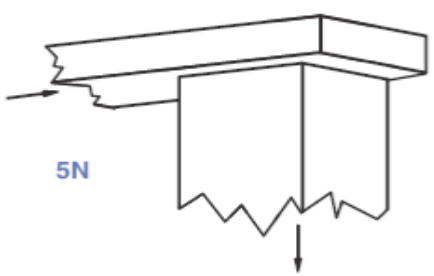
5L
EL = 75



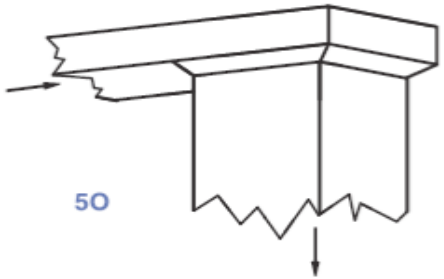


5L or 5M 5M





EL = 55



EL = 35

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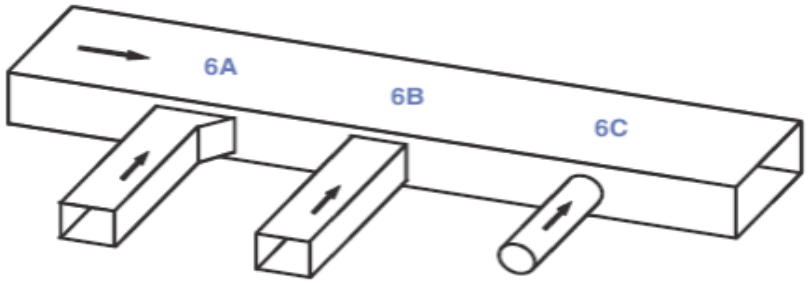
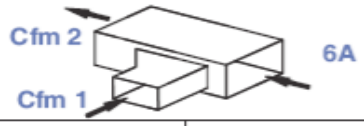
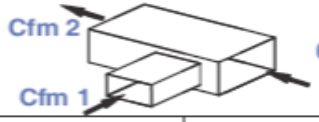
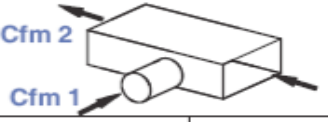
Return

Appendix 3

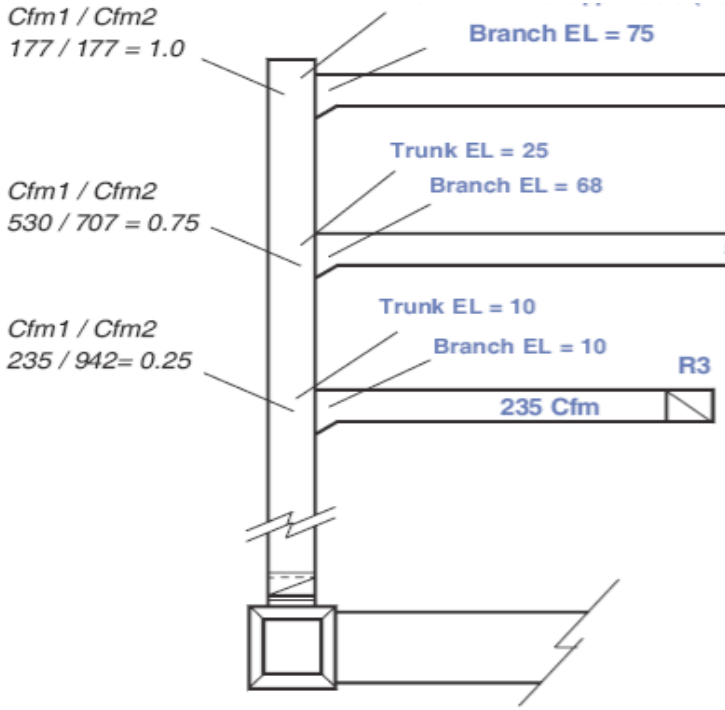
Group 6
Branch Return Air Fittings at the Return Trunk

Reference Velocity = 700 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet



						
Cfm1/Cfm2	**Branch EL**	**Trunk EL**	**Branch EL**	**Trunk EL**	**Branch EL**	**Trunk EL**
0.40 or less	10	10	10	10	10	10
0.50	25	25	40	25	30	25
0.60	40	25	40	25	50	25
0.70	60	25	75	25	75	25
0.80	75	25	110	25	115	25
1.00	75	NA	110	NA	115	NA
The branch EL value applies to the turn and the trunk EL value applies to the upstream fittings (see example below).						

Trunk EL = Not applicable (no upstream branch)



EL Values Associated with Return Trunk Fittings			
Run	Branch EL	Trunk EL	Total EL
R1 to AH	75	25 + 10	110
R2 to AH	68	10	78
R3 to AH	10	0	10

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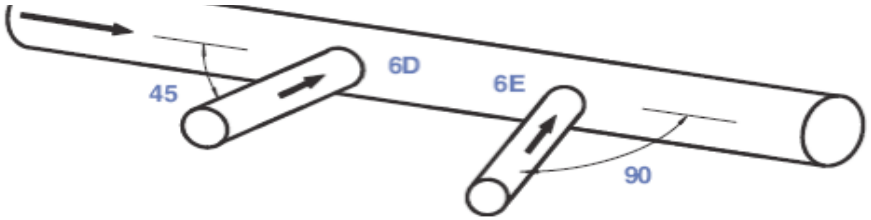
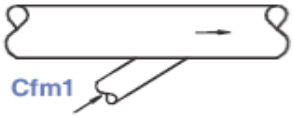
Appendix 3

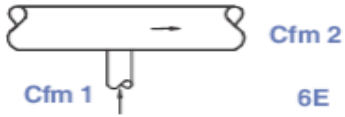
Group 6 — Continued
Branch Return Air Fittings at the Return Trunk

Reference Velocity = 700 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet

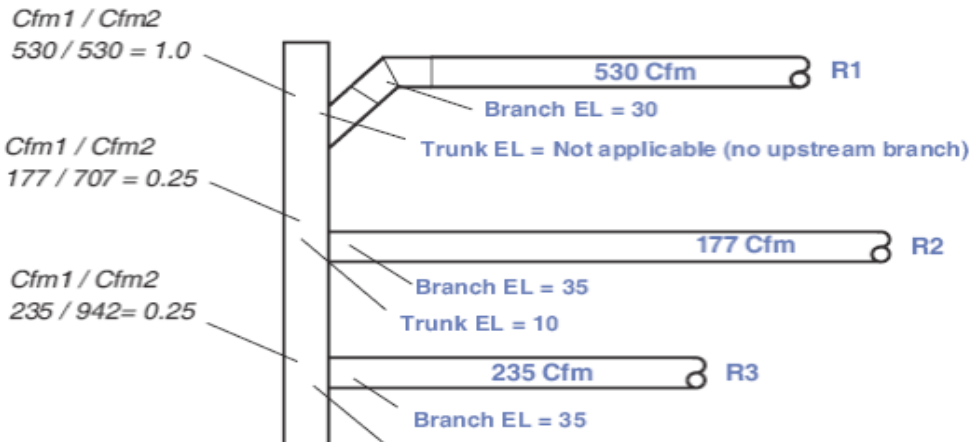


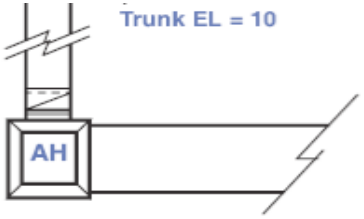


Cfm1/Cfm2	Branch EL	Trunk EL
0.10	10	5
0.20	15	5
0.30	20	5
0.40	30	5
0.60	30	5
0.80	30	5
1.00	30	NA
Refer to example below		



Cfm1/Cfm2	Branch EL	Trunk EL
0.10	15	10
0.20	30	10
0.30	40	10
0.40	40	10
0.50	40	25
0.80	40	25
1.00	40	NA
Refer to example below		





EL Values Associated with Return Trunk Fittings			
Run	Branch EL	Trunk EL	Total EL
R1 to AH	30	10 + 10	50
R2 to AH	35	10	45
R3 to AH	35	0	35

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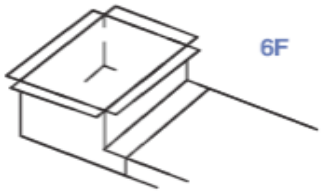
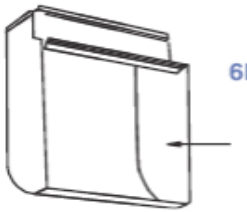
Appendix 3

Group 6 — Continued
Return Air Boot Fittings

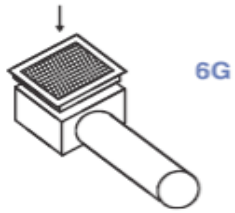
Reference Velocity = 700 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet



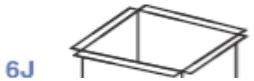
EL = 25

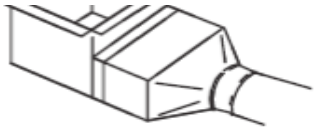


EL = 15

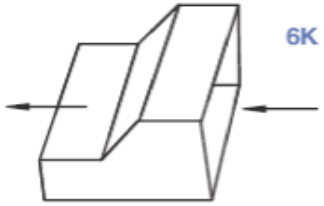


EL = 30



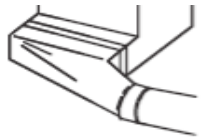


EL = 30

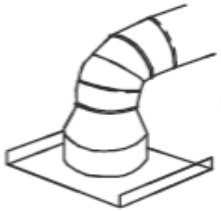


6K

EL = 10



EL = 55

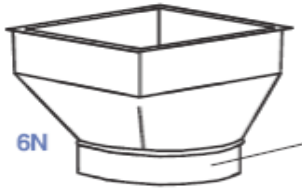


6L

EL = 20

6M

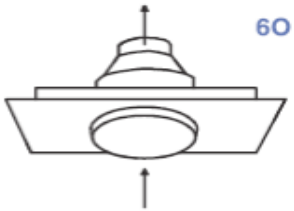
EL = 20



6N

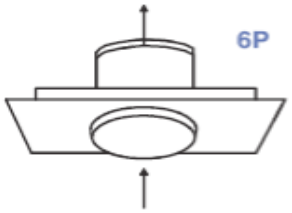
Round or Square

EL = 10



6O

EL = 10



6P

EL = 5

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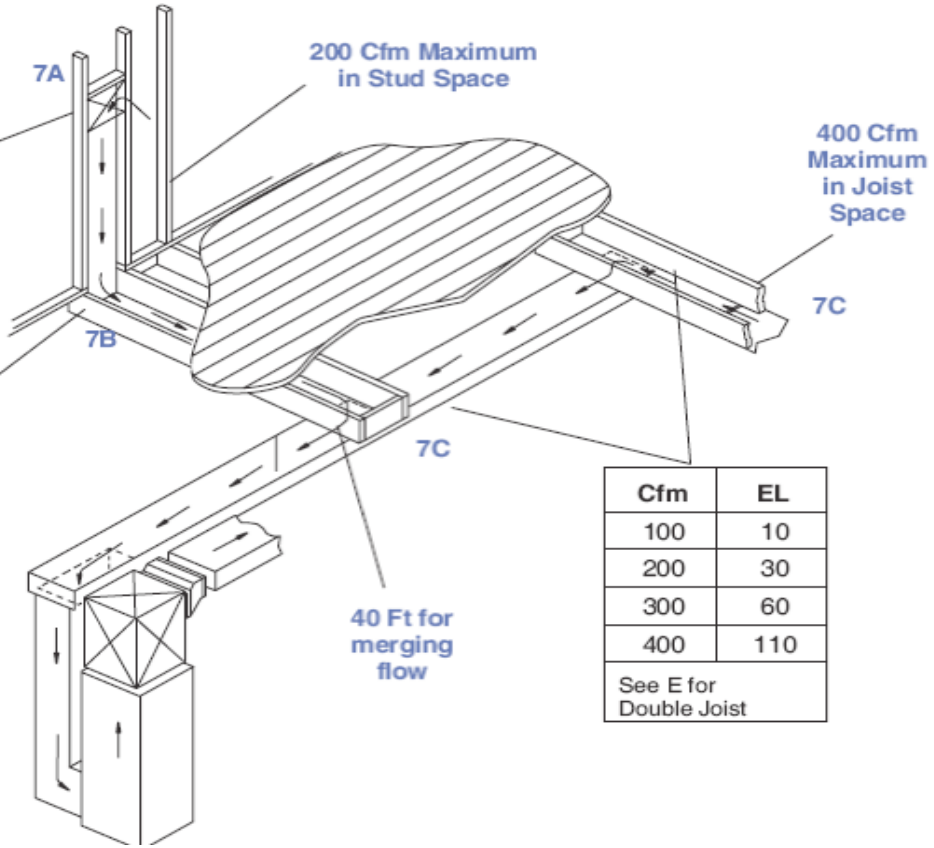
Return

Appendix 3

Group 7
Panned Joists and Panned Stud Return Air Fittings

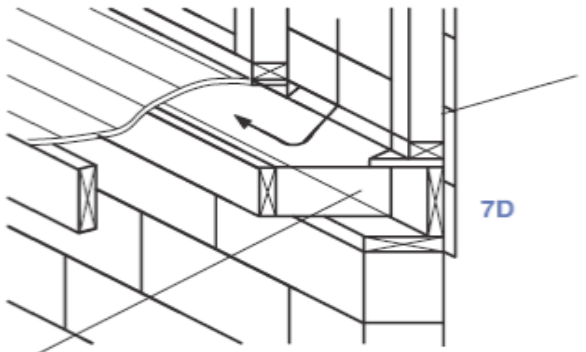
Reference Velocity = 700 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet



Cfm	EL
100	25
150	
200	

Cfm	EL
100	10
150	15
200	25
See D for Double Turn	

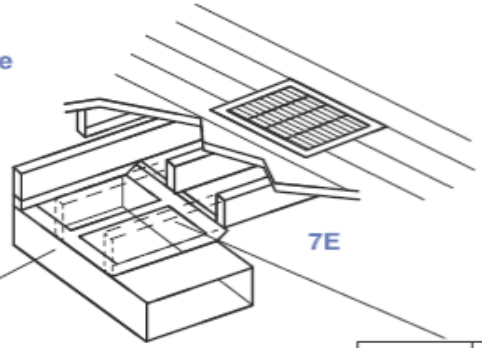
Cfm	EL
100	10
200	30
300	60
400	110
See E for Double Joist	



200 Cfm
Maximum
in Stud Space

7D

Cfm	EL
100	20
150	50
200	90



7E

800 Cfm
Maximum
in Double
Joist Space

Cfm	EL
200	10
400	30
600	60
800	110

Panning is not recommended by *Manual D*. Panned joist and stud space airway leakage increases duct loads, may cause space pressure problems, and may cause indoor air quality problems. Equivalent length and airway sizing procedures are approximate, and there is no sizing procedure if there are obstructions in the airway. Group 7 equivalent length values are used to evaluate existing systems. See Section 4-5 for more discussion.

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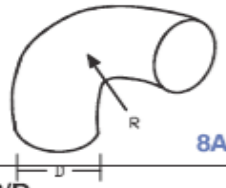
Return

Appendix 3

Group 8
Elbows and Offsets

Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet



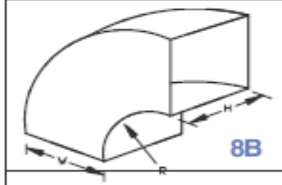
8A

R/D	Round and Oval Elbow EL Values							
	Smooth	4 or 5 Piece	3 Piece	Smooth Mitered	Easy Bend	Hard Bend	3-Piece 45°	2-Piece 45°
Mitered (R = 0)	—	—	—	75	4-Piece 25	4-Piece 30	10	15
0.75	20	30	35	—				
1.0	15	20	25	—	3-Piece 30	3-Piece 35		
1.5 or Larger	10	15	20	—				

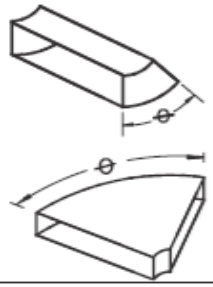
8A — Continued

For Smooth Radius Round Elbows
Angles (θ) Less Than 90°
Multiply EL by One of the Following Factors

20°	30°	45°	60°	75°	110°	130°	150°
0.31	0.45	0.60	0.78	0.90	1.13	1.20	1.28

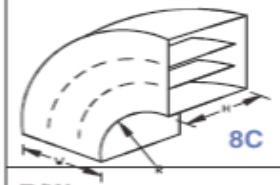


R/W	Radius Elbow EL Values		
	Hard Bend	H / W = 1	Easy Bend
Mitered (R = 0)	90	75	65
0.25	35	30	25
0.5 or Larger	20	15	10

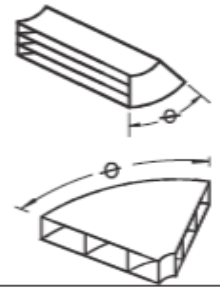


For Angles (θ) Less Than 90° Multiply EL by One of the Following Factors

30°	45°	60°
0.45	0.60	0.78



R/W	Radius Elbow EL Values		
	Hard Bend	H / W = 1	Easy Bend
Mitered (R = 0)	30	25	40
0.25	10	10	10
0.5 or Larger	5	5	5



For Angles (θ) Less Than 90° Multiply EL by One of the Following Factors

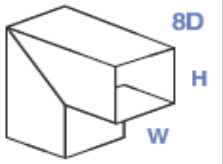
30°	45°	60°
0.45	0.60	0.78

176

Appendix 3

Group 8 — Continued
Elbows and Offsets

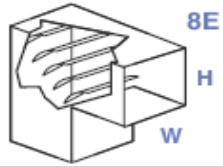
Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet



8D

Square Elbow EL Values		
Hard Bend	H / W = 1	Easy Bend
80	80	65

No Vanes

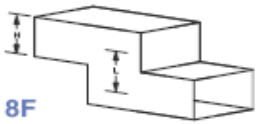


8E

Square Elbow EL Values		
Hard Bend	H / W = 1	Easy Bend
10	10	10

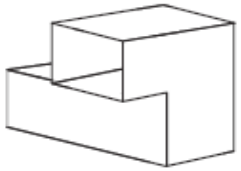
Single Thickness Turning Vanes

L/H	EL
1	160
2	260
4	190



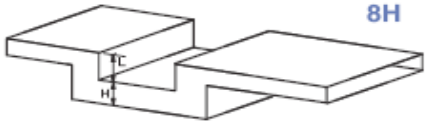
8F

No Vanes



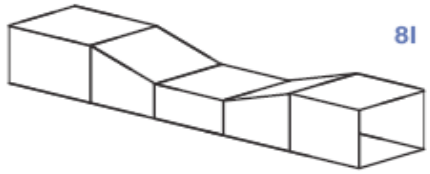
8G

EL = 200
No Vanes



8H

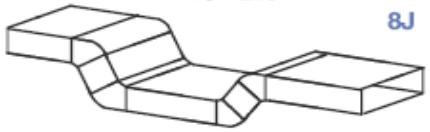
EL's H/L	No Vanes	With Vanes
0.5	55	—
1.0	330	55
1.5	430	55
2.0	470	55



8I

EL = 20

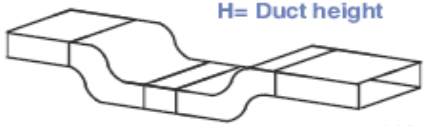
4 — 45° Ells



8J

EL = 20

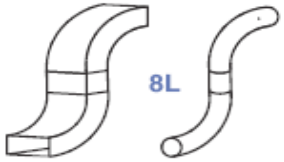
R = Inside radius
H= Duct height



4 — 90° Ells

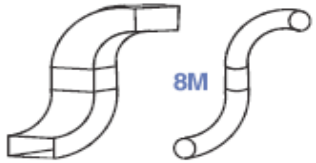
8K

R/H	EL
Mitered (R=0)	250
0.25	100
0.50	20
1.00	20



8L

Double Ell — 1 Plane
1.7 x EL value for single elbow

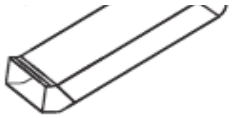


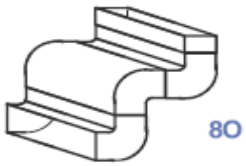
8M

Double Ell — 2 Plane
2.0 x EL value for single elbow

8N

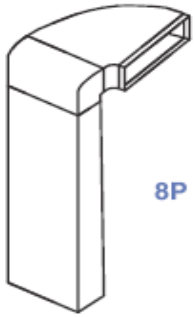
EL = 10





8O

Inside Corner	EL
Miter (R=0)	235
R = 0.25	90
R > 0.50	45



8P

EL Values	Inside Corners	
Riser	Miter	Radius
3-1/4 x 10	75	60
3-1/4 x 12	90	75
3-1/4 x 14	90	75

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Return

Appendix 3

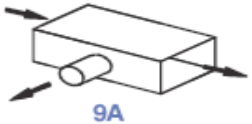
Group 9
Supply Trunk Junction Fittings

Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet

The equivalent lengths in this group apply when the flow in a secondary trunk duct is a substantial percentage of the flow in the upstream (primary) duct. See Group 2, Branch Takeoff Fittings for branch runout equivalent length values.

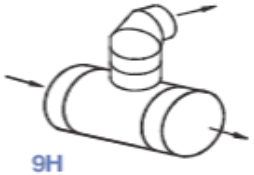
	EL
Branch	35
Main	5

9G



9A

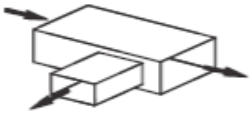
	EL
Branch	80
Main	5



9H

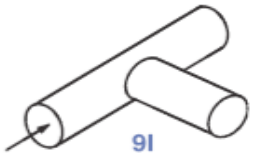
	EL
Branch	100
Main	5

	EL
Branch	80
Main	5



9B

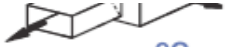
	EL
Branch	85
Main	5



9I

	EL
Branch	80

	EL
Branch	25



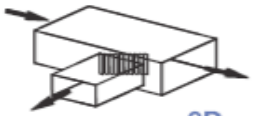
9C

Main	5

9J

Main	5

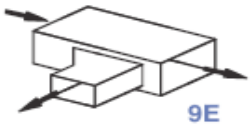
	EL
Branch	75
Main	5



9D

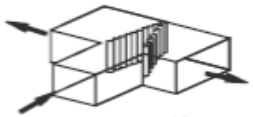
EL = 65

9K



9E

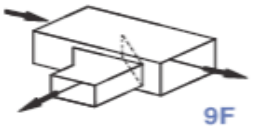
	EL
Branch	50
Main	5



9L

EL = 20

	EL
Branch	45
Main	5



9F

EL = 20

9M

178

Appendix 3

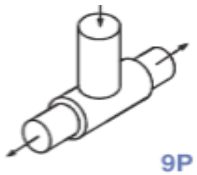
Group 9 — Continued
Supply Trunk Junction Fittings

Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet

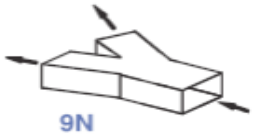
The equivalent lengths in this group apply when the flow

The equivalent lengths in this group apply when the flow in a secondary trunk duct is a substantial percentage of the flow in the upstream (primary) duct. See Group 2, Branch Takeoff Fittings for branch runout equivalent length values.

EL = 70

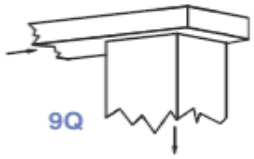


9P



9N

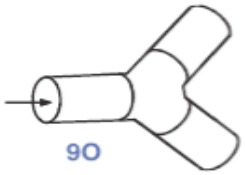
EL = 15



9Q

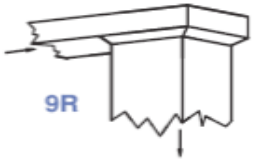
EL = 55

EL = 15



9O

EL = 35



9R

179

Return

Appendix 3

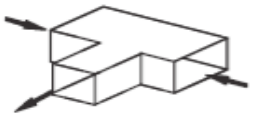
Group 10
Return Trunk Junction Fittings

Reference Velocity = 700 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet

The equivalent lengths in this group apply when the flow in two return trunks merge. See Group 6, Branch Return Fittings, for branch return equivalent length values.

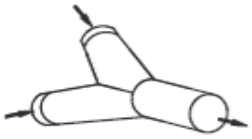
EL = 25

10E



10A

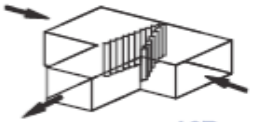
EL = 75



10F

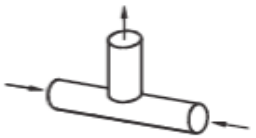
EL = 35

EL = 10



10B

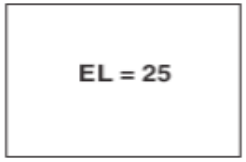
EL = 75

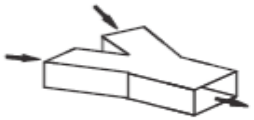


10G

EL = 10

10C





10D

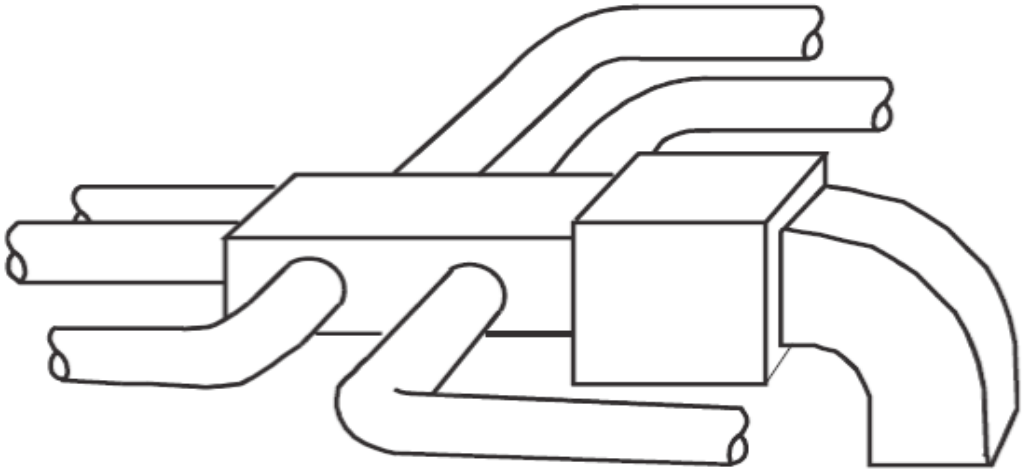
180

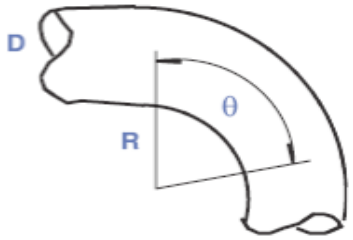
Return

Appendix 3

Group 11
Flexible Duct Junction Boxes and Radius Bends

Reference Velocity = As Indicated
Reference Friction Rate = 0.08 IWC per 100 Feet

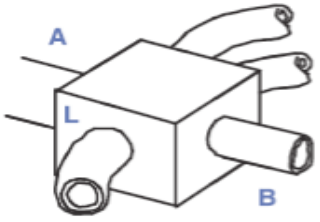


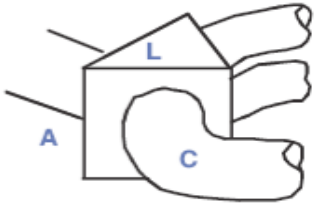


For bends that are not equal to 90°, multiply the 90° equivalent length by the ratio of the desired angle to the 90° angle.

Example: IF R/D = 1.0, find the EL for a 45° bend if the velocity equals 700 Fpm.

15 x 45 / 90 = 7.5 Ft





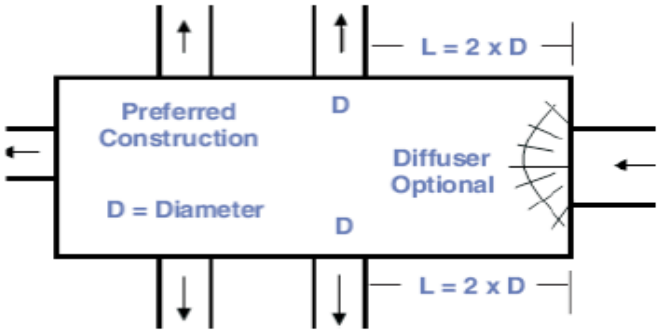
Recommended (compatible with Group 11 EL values)

Equivalent Length Values					
Velocity in Flex Duct (Fpm)	Junction Box (Ft) Notes 1, 2 and 3	90° Bend (Ft) R / D Ratio (In / In) [4]			
		1.0	1.5	2 to 3	4 to 5
400	20	5	5	5	5
500	30	5	5	5	5

- Entrance (A) has a diffuser fitting that recovers velocity pressures and prevents swirl (optional).
- Straight approach(A) and straight exit (B)
- Exit opening on side (no top or bottom exits)
- Exit opening at least two diameters from entrance (L)
- Make box as small as possible, but comply with L = 2 x D

Not Recommended (Group 11 EL values may be too small)

- Turn or bend near entrance or exit (C).
- Top or bottom exits <-tentative, may be deleted after investigation
- Exit opening less than two diameters from entrance (L)



600	40	10	5	5	5
700	60	15	10	5	5
800	75	15	10	10	8
900	95	20	15	10	8

1) No anti-swirl regain diffuser at entrance.
   - Swirl tends to feed one side of the box and starve the other side.
   - Swirl may be induced by spiral wire geometry.
   - Swirl attributes (such as direction) may change when the blower shuts down and restarts.
2) Straight-run approach and a straight-run departures (no turns in duct runs near the junction box).
3) Entrance and exits on side of box (no top or bottom openings).
4) Radius of turn divided by diameter of duct.

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Return

Appendix 3

Group 12
Transitions (Diverging)

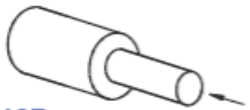
Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet

12A

EL Values	A1/A2	A1/A2
Slope	2	4
1:1	20	40
2:1	20	40
4:1	20	30

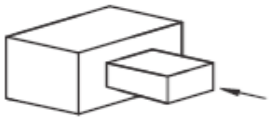
12F

EL Values	A1/A2	A1/A2
Slope	2	4
1:1	20	40
2:1	20	40
4:1	15	30



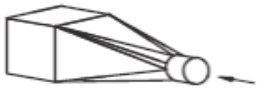
12B

EL Values	A1/A2	A1/A2
Slope	2	4
Abrupt	20	40

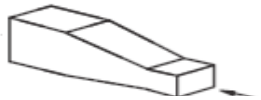


12G

EL Values	A1/A2	A1/A2
Slope	2	4
Abrupt	20	40



EL Values	A1/A2	A1/A2
Slope	2	4
1:1	20	40
2:1	20	40



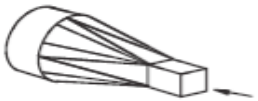
EL Values	A1/A2	A1/A2
Slope	2	4
1:1	20	40
2:1	20	40

12C

4:1	20	30

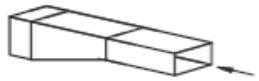
12H

4:1	15	25



12D

EL Values	A1/A2	A1/A2
Slope	2	4
1:1	20	40
2:1	20	40
4:1	20	30

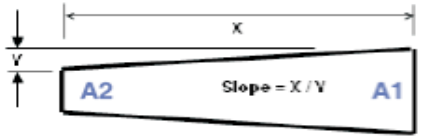


12I

EL Values	A1/A2	A1/A2
Slope	2	4
1:1	20	35
2:1	15	25
4:1	10	10

12E

EL = 25



A1 / A2 = Larger Area / Smaller Area

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Appendix 3

Group 12
Transitions (Converging)

Reference Velocity = 900 Fpm
Reference Friction Rate = 0.08 IWC per 100 Feet

EL Values	A1/A2	A1/A2

EL Values	A1/A2	A1/A2

12J

Slope	2	4
1:1	10	10
2:1	5	5
4:1	5	5

12O

Slope	2	4
1:1	10	10
2:1	5	5
4:1	5	5

12K

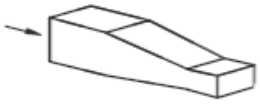
EL Values	A1/A2	A1/A2
Slope	2	4
Abrupt	25	25

12P

EL Values	A1/A2	A1/A2
Slope	2	4
Abrupt	30	30

12L

EL Values	A1/A2	A1/A2
Slope	2	4
1:1	10	10
2:1	5	5
4:1	5	5

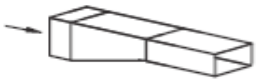


12Q

EL Values	A1/A2	A1/A2
Slope	2	4
1:1	10	10
2:1	5	5
4:1	5	5

12M

EL Values	A1/A2	A1/A2
Slope	2	4
1:1	10	10
2:1	5	5
4:1	5	5

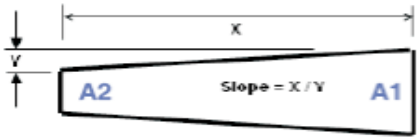


12R

EL Values	A1/A2	A1/A2
Slope	2	4
1:1	5	5
2:1	5	5
4:1	5	5

12N

EL = 10



A1 / A2 = Larger Area / Smaller Area

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Appendix 3

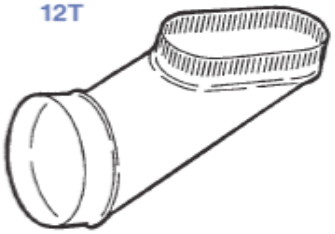
Group 12
Oval Transition Plenums and Abrupt Squeezes

Reference Velocity = 900 Fpm or as Indicated
Reference Friction Rate = 0.08 IWC per 100 Feet

12S

EL = 30

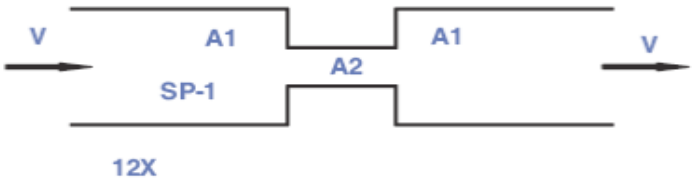
12T



EL = 30

EL = 25

EL = 30



EL Values for Flow Through Large Plenum				
V_{out} (Fpm)	V_{in} (Fpm)			
	600	700	800	900
600	40	40	35	35
700	55	55	50	50
800	70	70	70	65
900	90	90	90	85

Abrupt Squeeze				
Velocity (Fpm)	A1 / A2 = 2		A1 / A2 = 4	
	EL	Min SP-1	EL	Min SP-1
600	65	0.12	245	0.52
700	90	0.16	330	0.71
800	115	0.20	430	0.92
900	145	0.26	545	1.17
Min SP-1 = Minimum upstream static pressure (IWC) for positive static pressure at A2 (air velocity doubles or quadruples at A2).				

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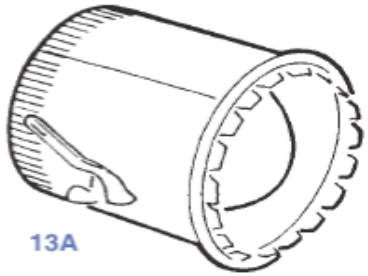
Return

Appendix 3

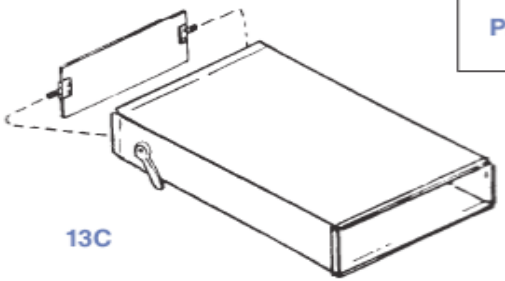
Group 13
Manual Balancing Dampers

Reference Velocity = 900 Fpm
(Damper Blade in Wide Open Position)



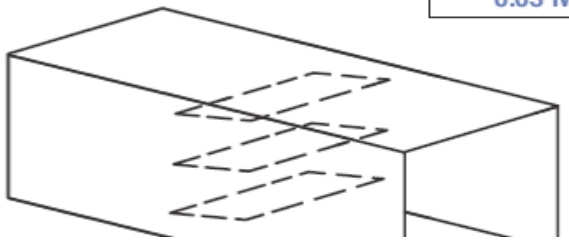
13A

Device
Pressure Loss
0.03 IWC

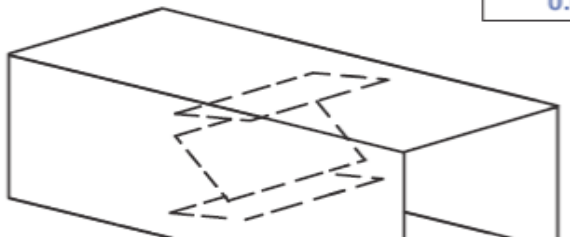


13C

Device
Pressure Loss
0.03 IWC



Device
Pressure Loss
0.03 IWC



Device
Pressure Loss
0.03 IWC

13B

13D

185