2022 Basic Duct Sizing Simplified

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Carrier

CE

bryant
Heating & Cooling Systems

INTRODUCTION TO DUCT DIAGNOSTICS

- **Terminology**
  - Learn the key words and what they mean
- **Residential Duct System Classifications**
  - Understand what an Extended Plenum System, Radial System, Metal, Ductboard, Flex System, . . . is
- **Dampers, Boots, Grills, Wye's, Takeoff's, . . .**
  - Learn the components that make up a duct system
- **The Duct Calculator(s)**
  - Learn the Basics of
  - Correct use and application
  - What it can tell you

INTRODUCTION TO DUCT DIAGNOSTICS

- **Equivalent Lengths**
  - Affect on Blower (Air Mover) Selection
  - Learn about the pressure drops of Fittings / Takeoffs / . . .
  - Adjustment Equations to Customize your Design to the Decimal Point!

- **Blower Static** and **Available Static Pressure**
  - Learn the Effect on Duct Size
  - The influence and effect of Accessories
  - Why Selection and Data Interpretation Affects Cost and Customer Satisfaction

IF ITS AN EXISTING SYSTEM, OUR GOALS

Will Be Able to Recognize

“Pinch and Problem Points” in the Duct System

Needing Corrections!

These Pinch and Problem Points restrict airflow

and create excessive pressure drops and noise that

reduce delivered airflow

COMFORT

Just the Right Amount of Properly Conditioned Air

Delivered In the Correct Volume (CFM)

Properly Distributed and Mixed throughout the Room!

COMFORT

Just the Right Amount of Properly Conditioned Air

(Load Calculation) (equipment and accessory selection)

Delivered In the Correct Volume (CFM)

(duct design) (balanced)

Properly Distributed and Mixed throughout the Room!

(diffuser, register & grill selection) (placement)

“COMFORT” requires a lot more than “Temperature Control”

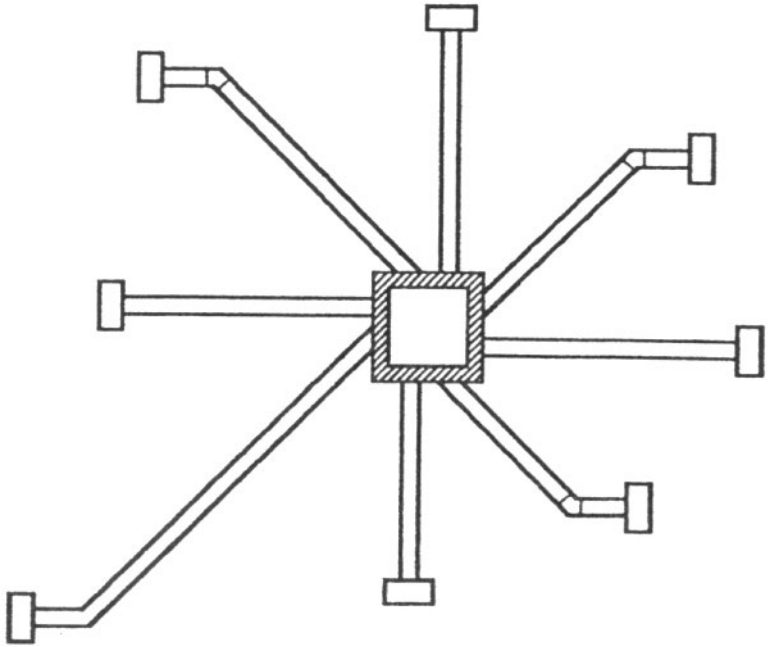
Comfort requires Design, Installation & Equipment Integration

DUCT SYSTEM CLASSIFICATIONS

Many Ways to Classify a Duct System

- Materials Galvanized or Stainless Steel, Fiberglass Board and Round, PVC (code issues), Flexible Wire Helix (Flex)
- Geometry Trunk and Branch, Radial, Perimeter
- Supply and Return System Ceiling, Floor, Sidewall (high or low), Perimeter (blanket outside walls)
- Location Attic, Basement, Crawl Space, Under the Slab, Dropped or Furred In Ceilings

RADIAL SYSTEMS

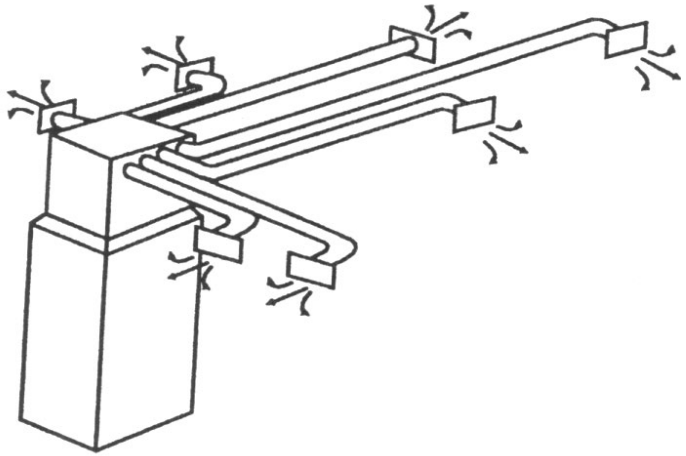


Easy to install

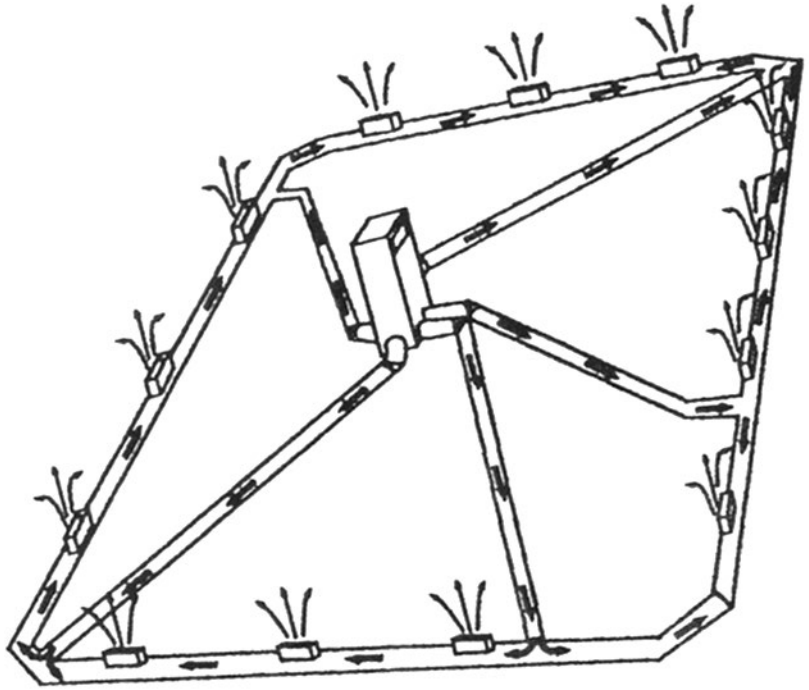
Central Supply plenum feeding branch ducts

Ground slab, Crawl Space & Attic

Metal or Flex Duct



PERIMETER LOOP SYSTEM



Cold climate

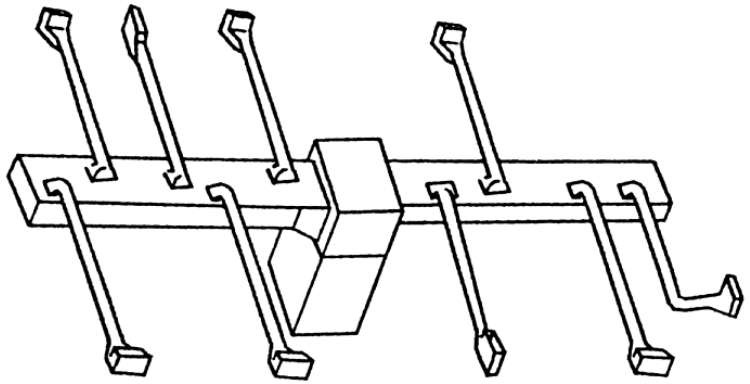
Ground Slab

Good Heating Comfort

Difficult to design

High heat losses

EXTENDED PLENUM



Easy to install

Easy to fabricate

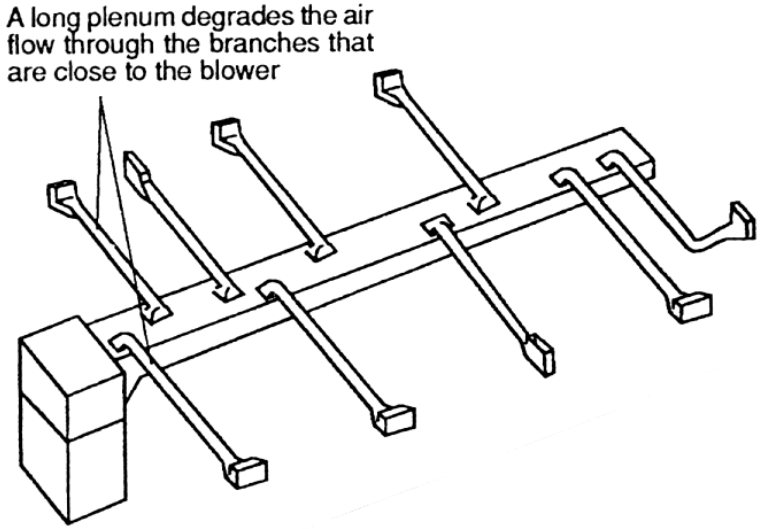
Simple & common fittings

Runouts closest to blower are hardest to get air into

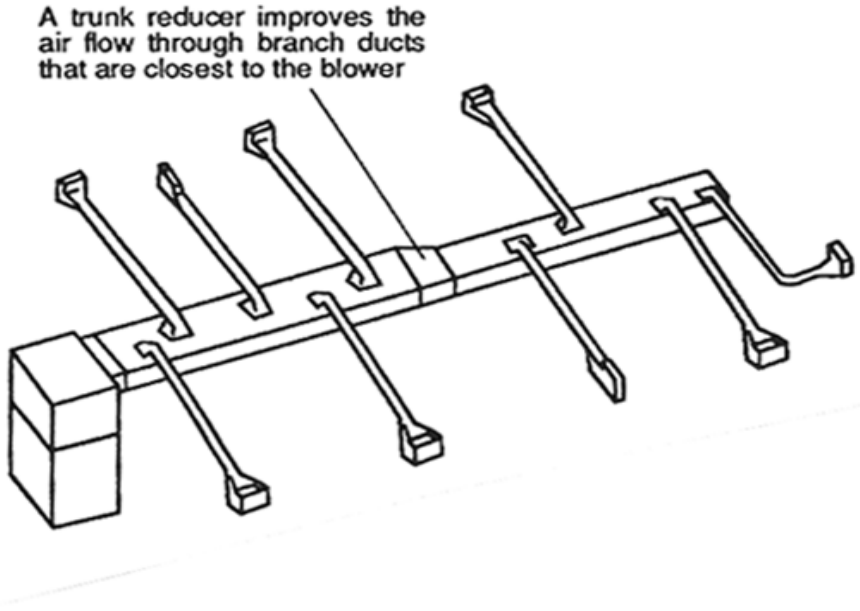
Very common residential system

Trunk serves as elongated plenum

Branch duct deliver air to each room



REDUCING PLENUM



Improves performance of Extended Plenum

Branch ducts deliver air to each room

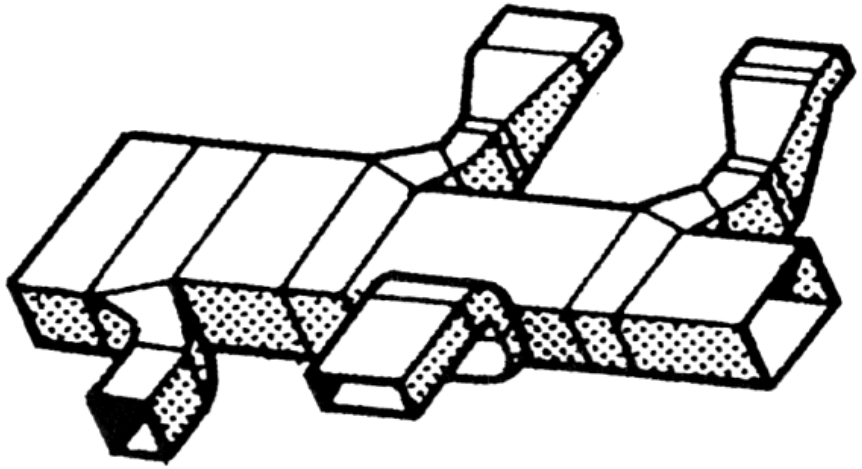
Easy to fabricate

Easy to install

Simple & common fittings

Trunk reduction helps turn air

REDUCING TRUNK



Improves performance of Reducing Plenum

Branch ducts deliver air to each room

Most labor to fabricate and install

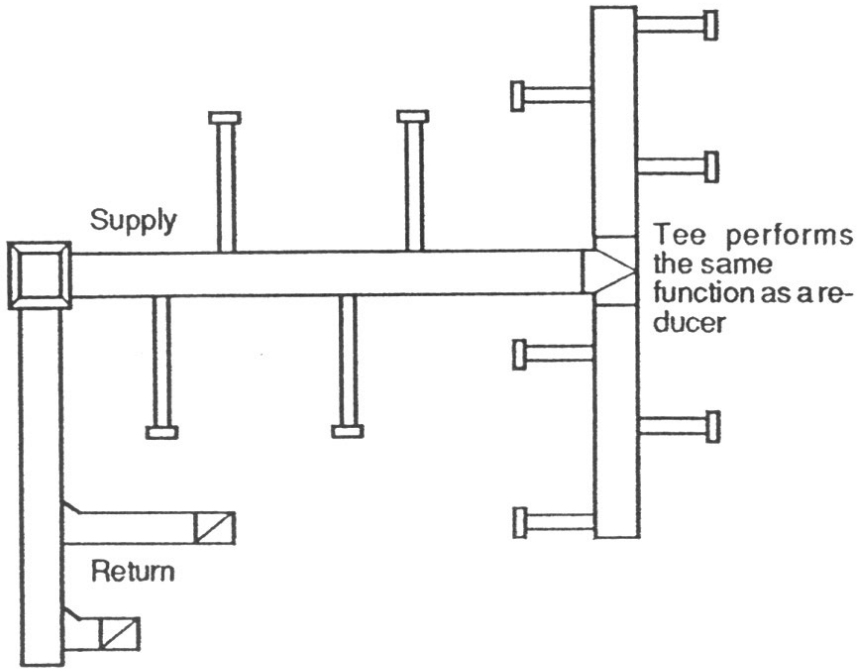
Trunk is reduced after every take-off

Trunk reduction helps turn air

High Design Complexity

Very Best Type of Duct System but Most Expensive

PRIMARY-SECONDARY TRUNK



"T" at end of duct acts as a reducer

Branch ducts deliver air to each room

Can be compared to "Reducing Plenum or Trunk System"

Greater Design Complexity

FLEX DUCT

Central Supply plenum feeding branch ducts

High versatility & movability

Easy to install

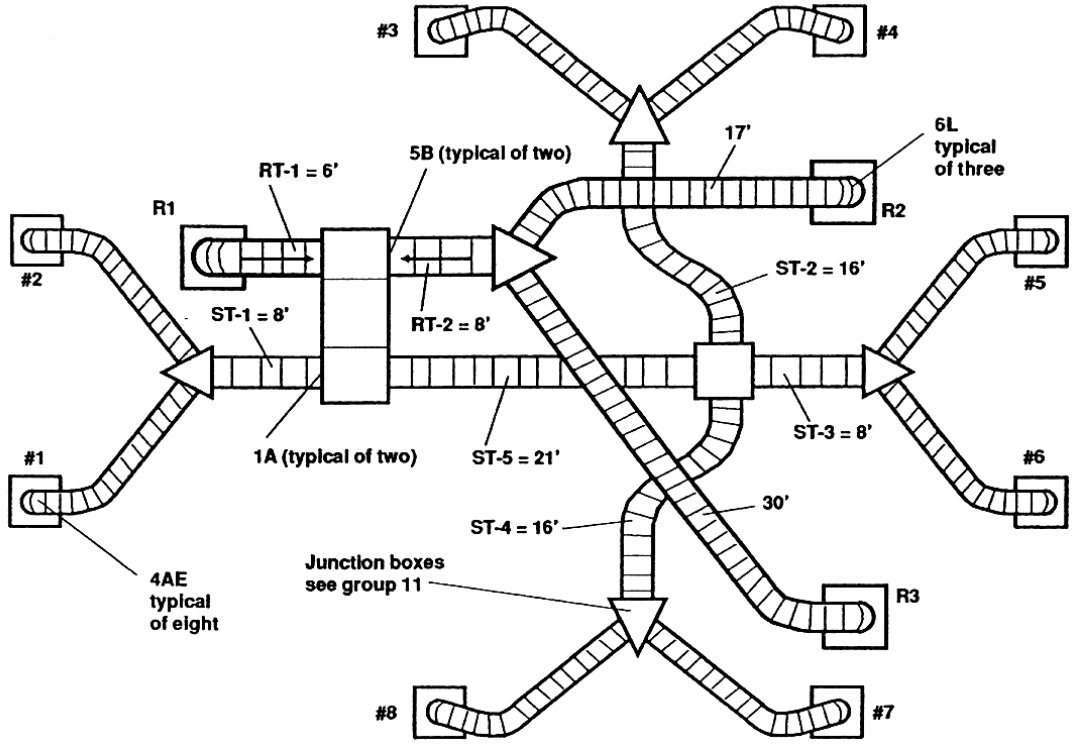
Crawl Space & Attic

Central location

Inexpensive

Coils & loops create high pressure drops

Easy to kink (high P.D.)



ACCESSORIES

Cased Coil

Whole House Air Cleaner

Humidifiers

Fan Powered

and Bypass

UV Lights

ERV/HRV

Dehumidifer

Media Air Cleaner

EL- EQUIVALENT LENGTH

What does it mean? Duct runs consist of straight lengths and fittings. Pressure losses occur in both.

Normally, the pressure loss in fittings is greater than the pressure loss in a straight length of ductwork.

EL or Equivalent Length is a convenient method to try to express and equate the fitting loss to an equal or equivalent loss in a straight run of duct.

In short, a fitting having an equivalent length(EL) of 22 feet. This fitting would produce the same pressure drop as it would a straight run of duct 22 feet long.

RULES OF THUMB FOR STATIC PRESSURE

What have we been told we should set our duct calculators too?

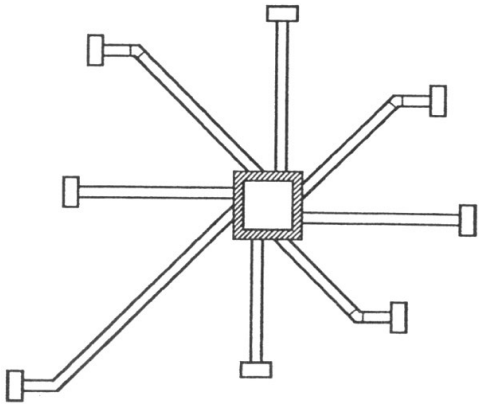
Supply	Return
0.10”	**0.08”**
0.08”	**0.05”**

But where did these numbers come from?

1940 AND 50'S DUCT DESIGNS

In the early days of home central systems, heating only systems dominated the market.

The typical house in the north was either a single- or two-story structure with a basement. The house footprint was 20 or 25 ft by 40 to 50 ft. The furnace was usually centrally located in the basement and the main trunk for the ductwork ran down the center of the basement with runouts to either a sidewall or floor diffuser. Total required fan pressure to overcome the ductwork friction losses normally ran 0.08" to 0.12" w.g., with most @ 0.10".



Remember, these early systems were designed and installed by contractors who were in the commercial heating and air conditioning business and had their own sheet metal shops building the fittings and ductwork.

COMMERCIAL DESIGNERS

- **Commercial systems** usually have the Fan and Motor Horsepower selected to meet the required static and airflow requirement of the system.
  - The Designer's starting point is recommended at around 0.10" w.g./100ft or higher. Duct runs can be over 1000 equivalent ft and require larger and more powerful blowers than most residential systems.
  - In summary, ductwork sizing is independent of the equipment. In the early days of home central systems, all contractors were commercial. Residential contracting developed out of this base into what it is today.

- **Residential systems** on the other hand, must have the ductwork designed to work with the blower supplied with the equipment.
  - In summary, ductwork sizing is dependent on the equipment blower.

RULES OF THUMB/UN-SUPPORTABLE CUSTOMS

Normally we started with a guideline that worked most of the time for a situation.

The Situation: Two story house with a basement, furnace located in center of basement. Simple duct system, 0.10”wg worked almost all the time.

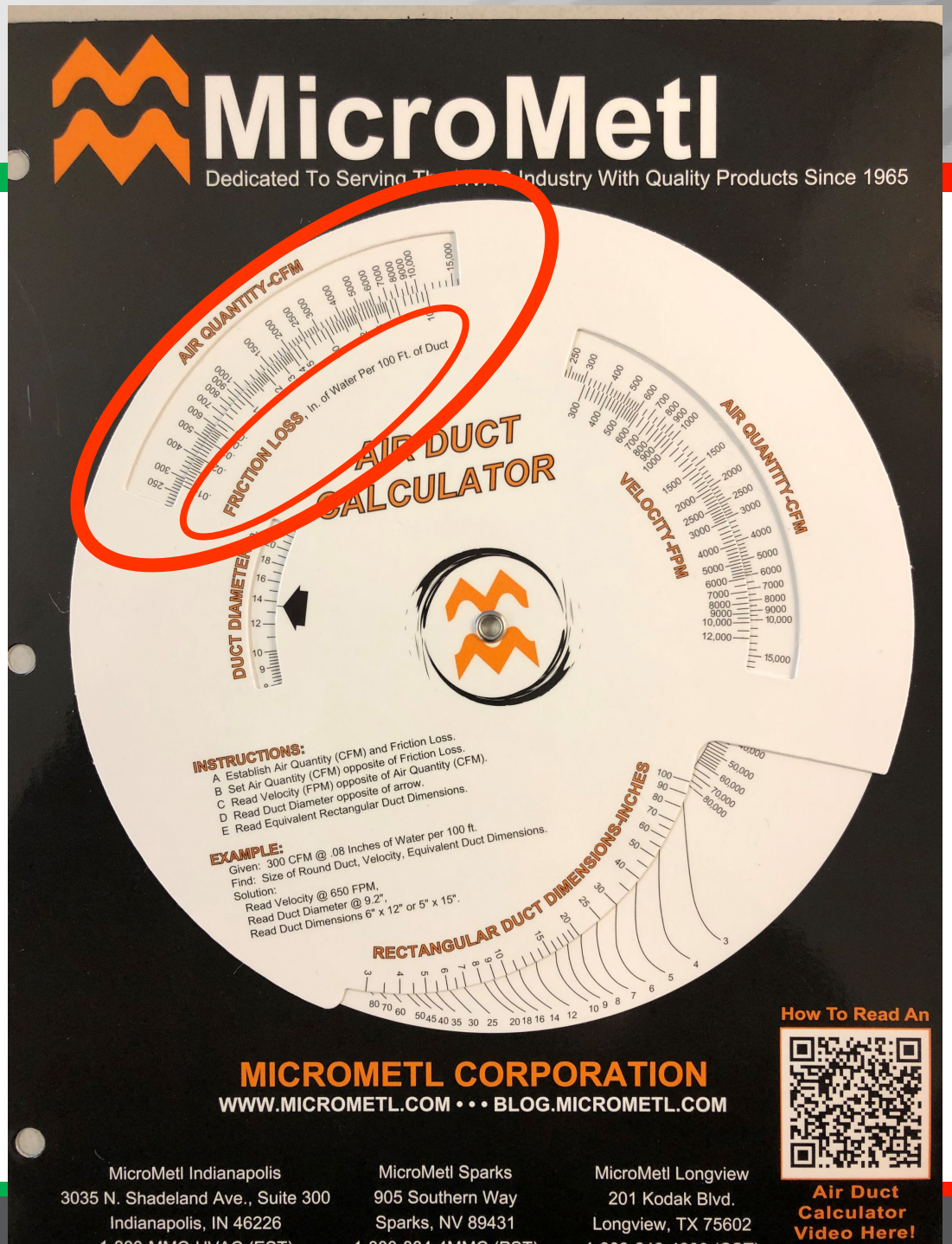
In the late 70’s / early 80’s the house layout changed, they became larger which means more duct, along with furnace the location changed.

Results showed that the old rule no longer worked as good, and more complaints were being reported.

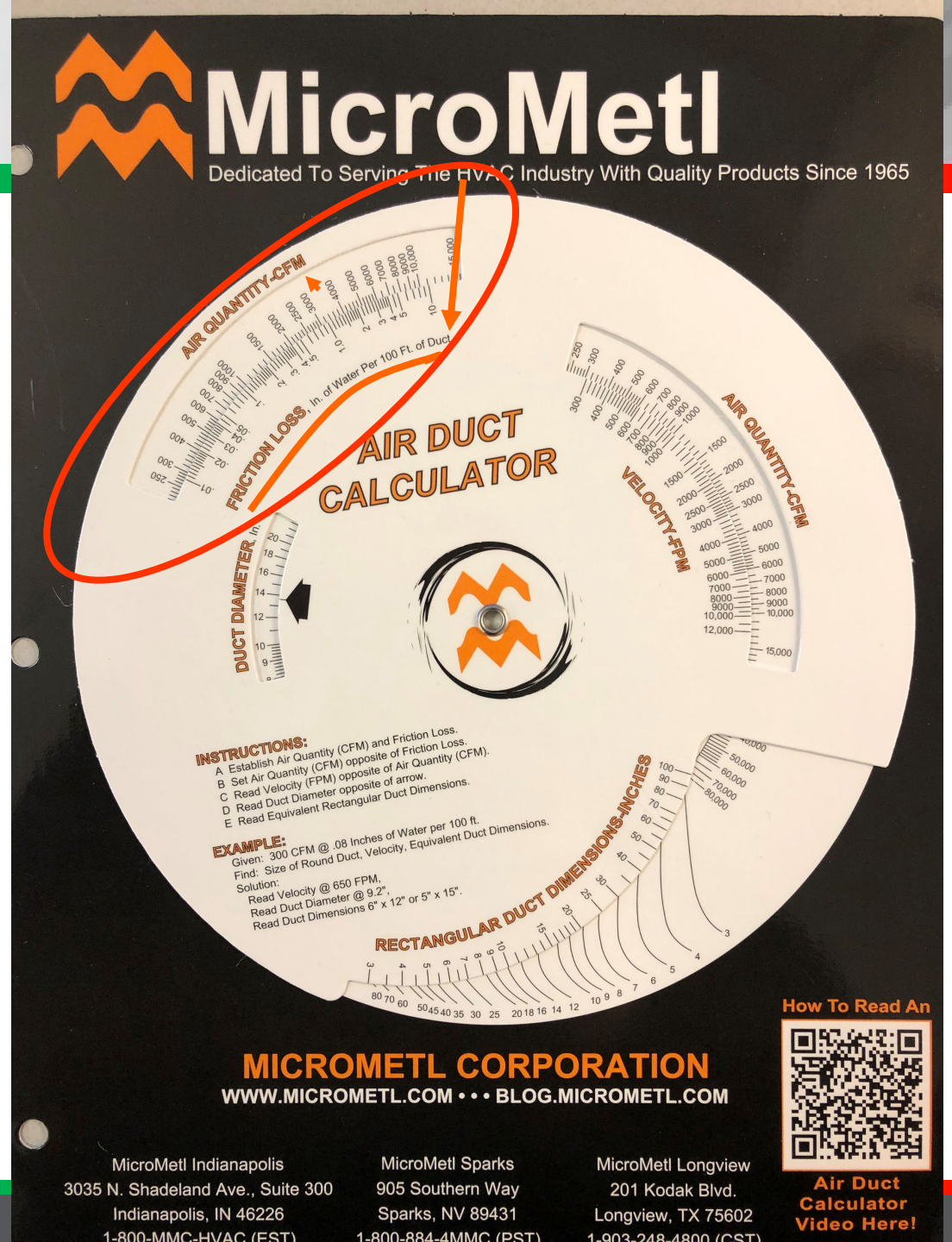
So, if 0.10” created problems, we used 0.08” that seemed to make everything ok, and the customers did not complain.

Until the 2000’s

Duct Calculator Mis-(Missed) Conceptions

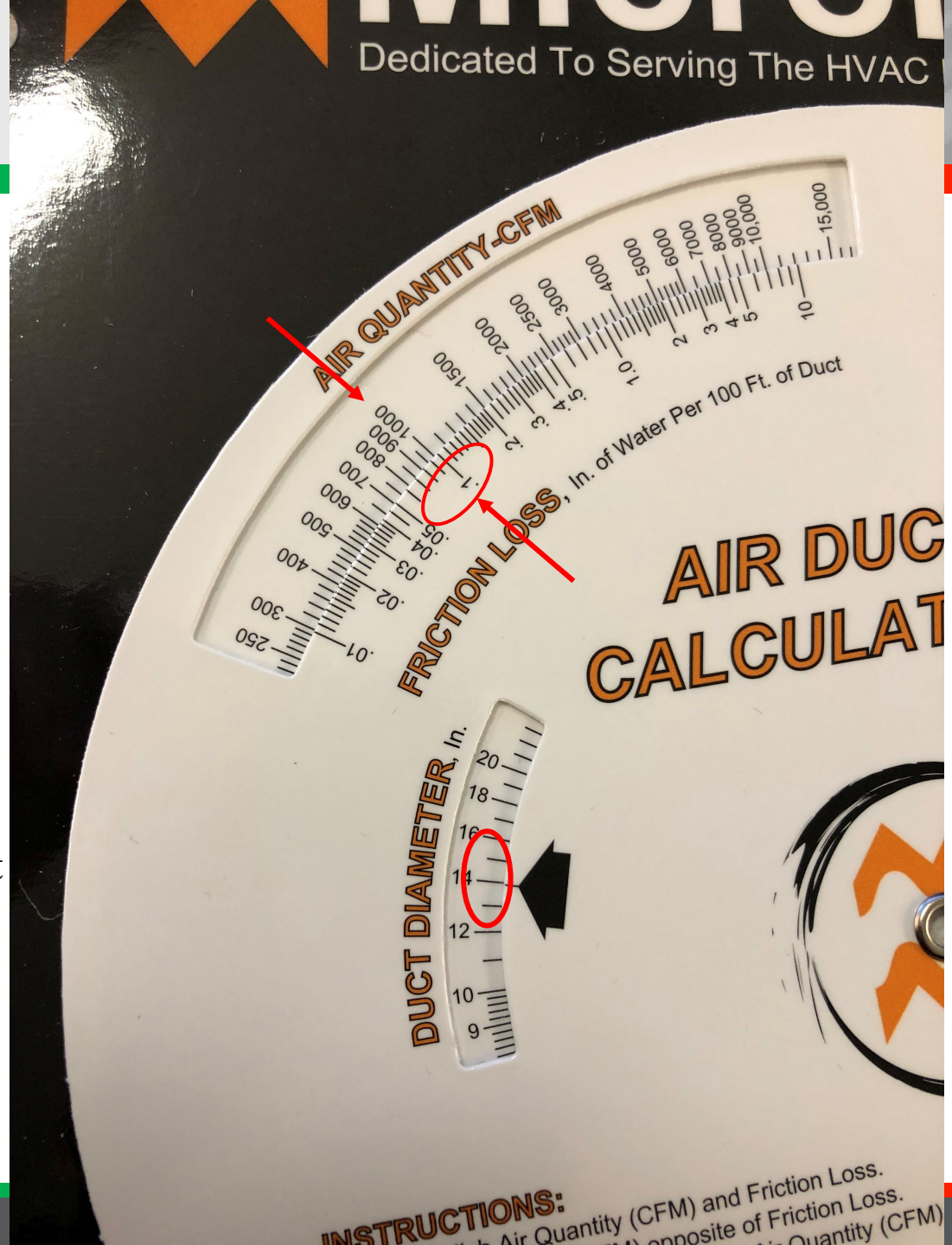


Setting @ 0.10” or .08”
just means
the designer has determined
that his design can handle a
Static Pressure Loss
of 0.10 inch w.g.
per 100 equivalent ft
of duct work and
NOT THAT THE DUCTWORK WILL ONLY HAVE A 0.10” TOTAL PRESSURE LOSS

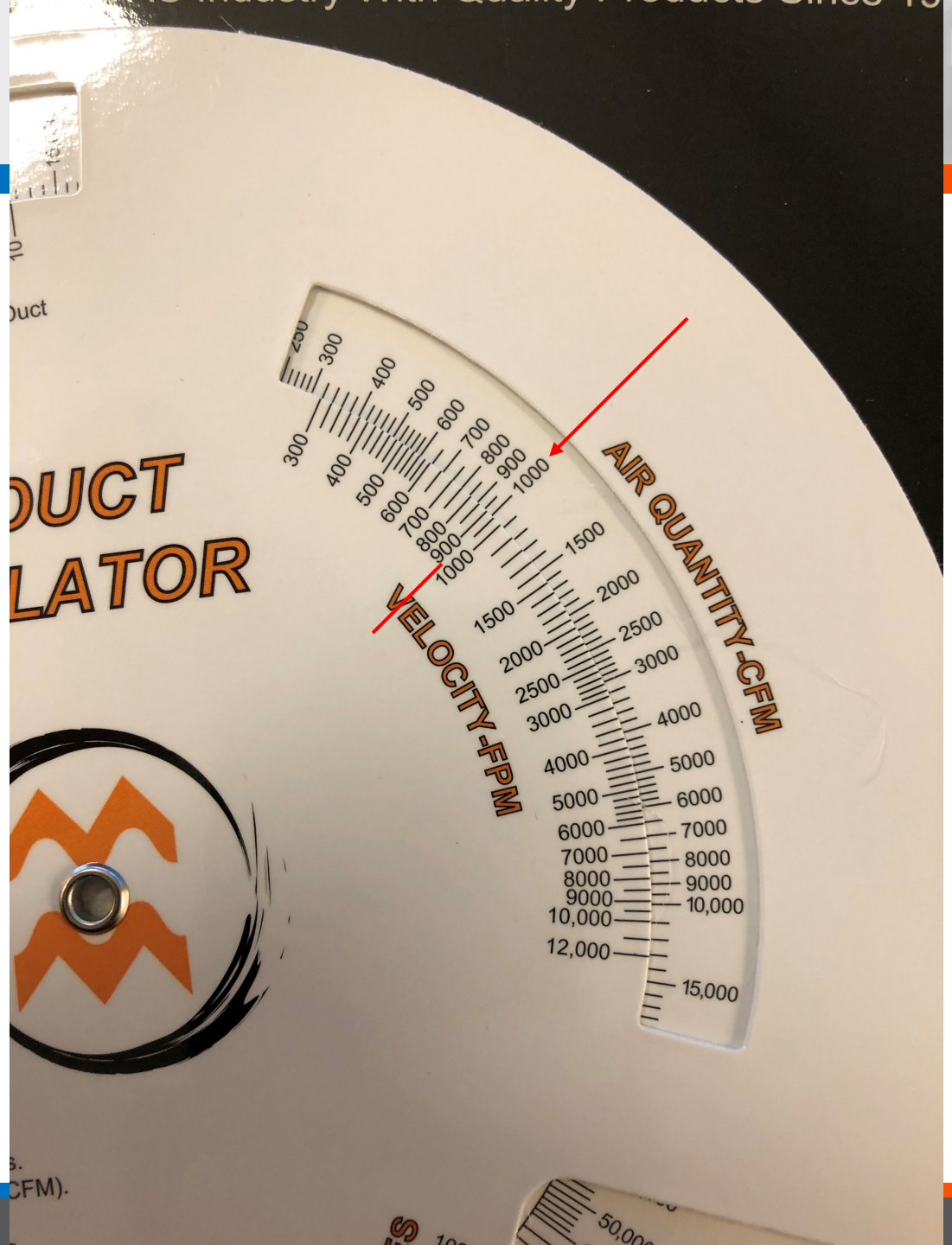


Let's look at how to use the duct calculator

Set @ 14-inch duct



Read CFM @ 0.10”

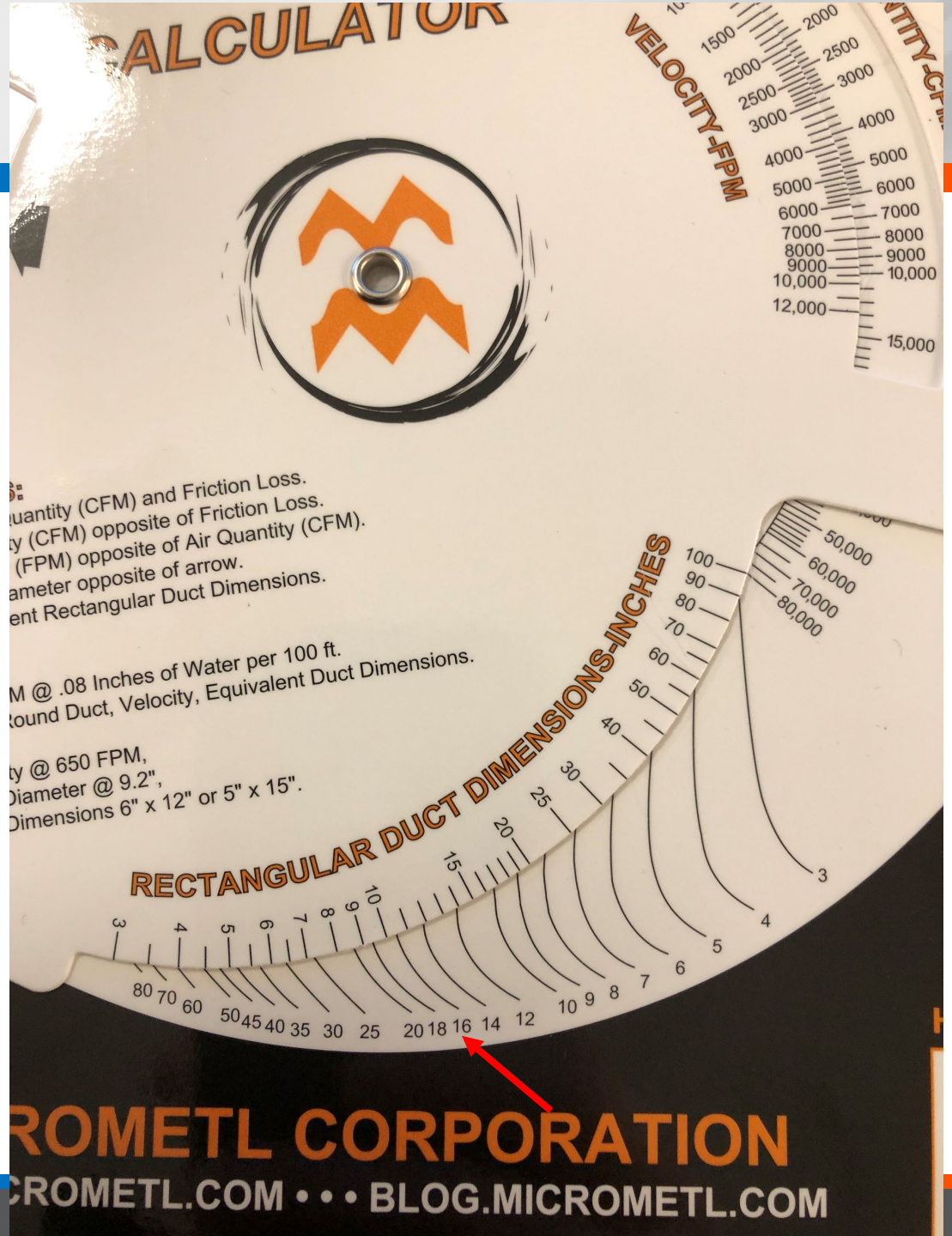


On the other side, read the velocity associated with 1,000 CFM

Velocity is associated with sound.

This is important to us this will tell us how loud the air will be traveling thru the duct and or the grills.

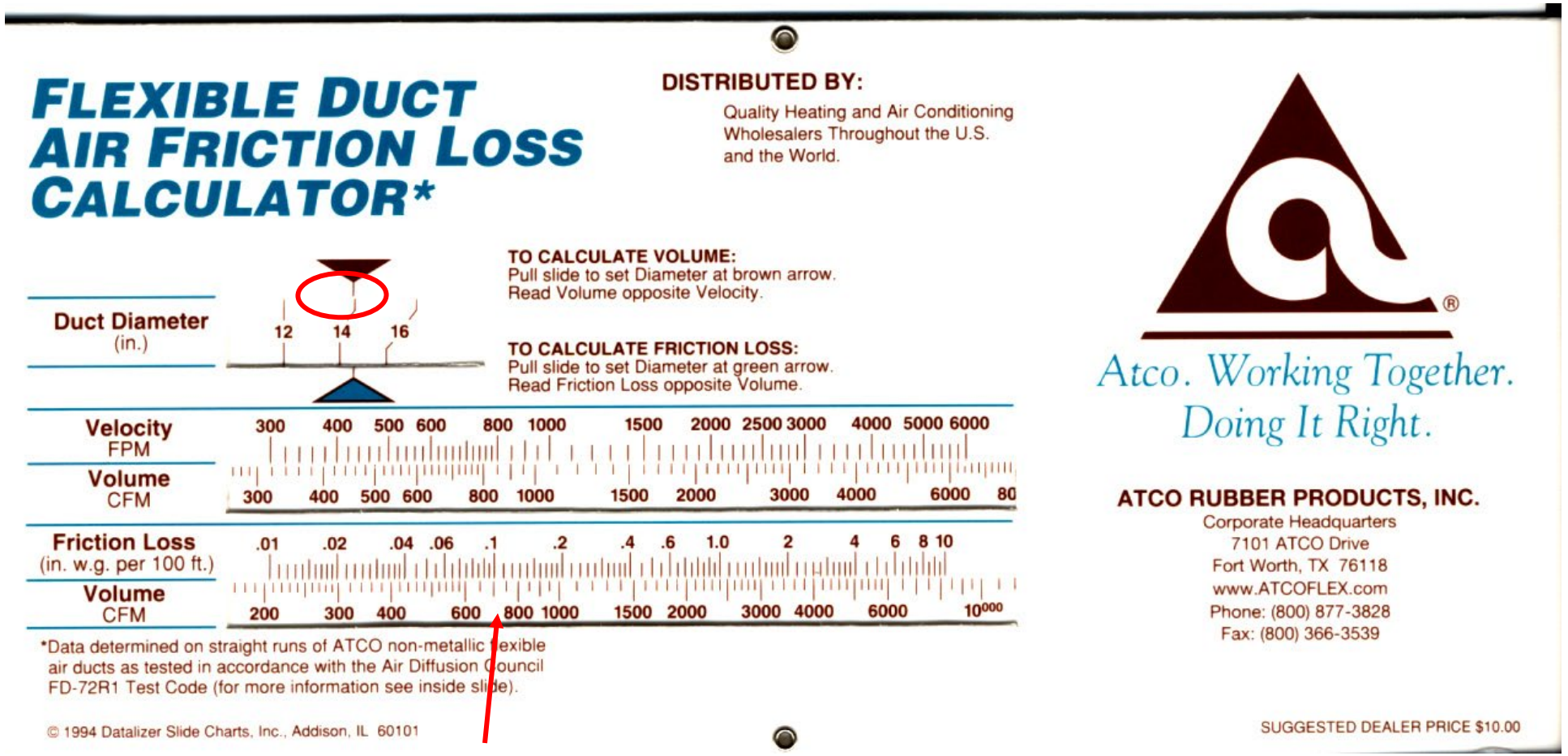
The higher the number the more sound that will be generated.



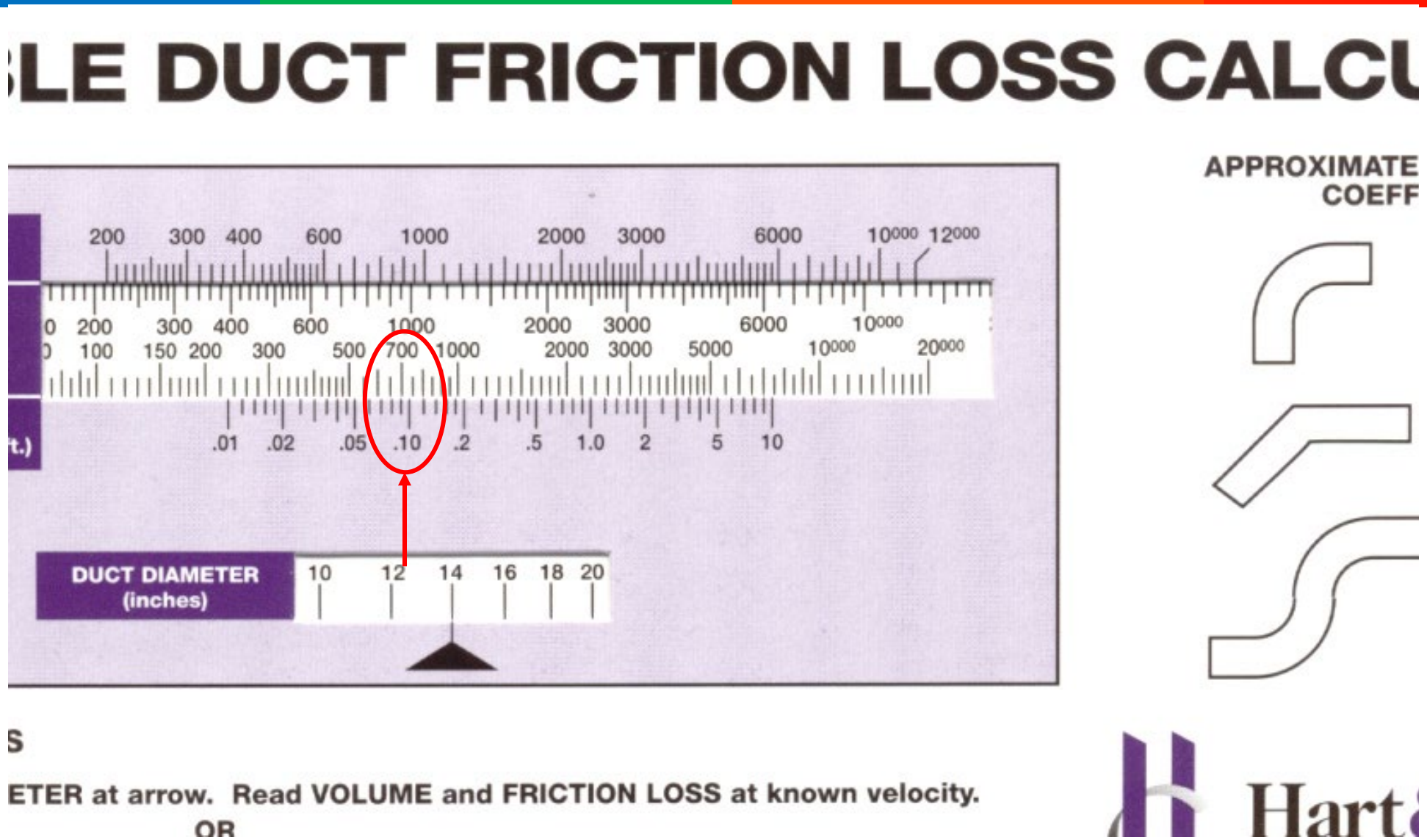
Read a Rectangular Duct Size

Say 10” x ?

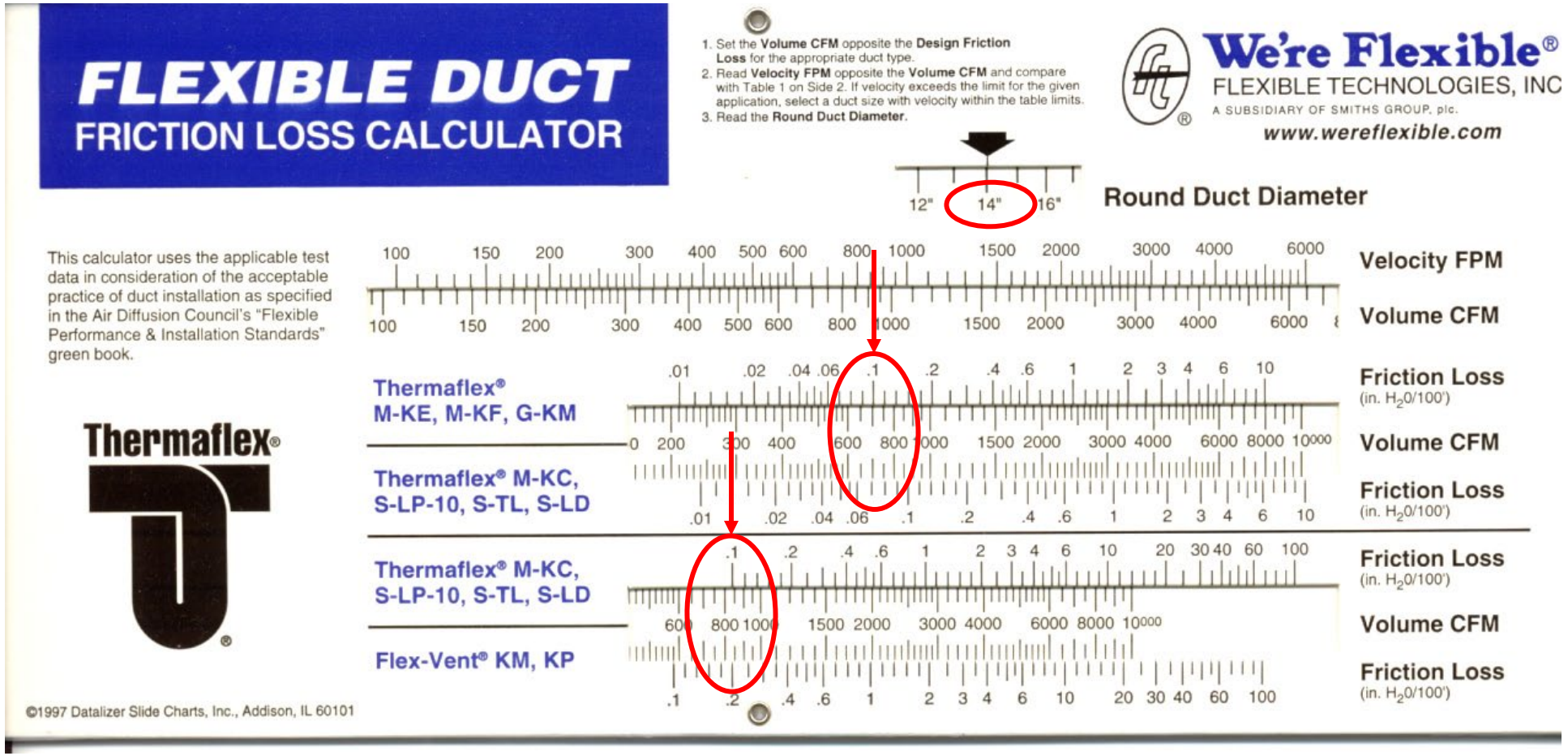
FLEXIBLE DUCT WORK



FLEXIBLE DUCT WORK



FLEXIBLE DUCT WORK



FLEXIBLE DUCT WORK

B. GENERAL

1. The routing and length of flexible duct, the number of degrees of each bend and the amount of sag allowed between support joints will have serious effects on system performance due to the increased resistance each introduces. Use the minimum length of flexible duct to make connections. It is not recommended that excess lengths of ducts be installed to allow for possible future relocations of air terminal devices.

Keynotes from the installation instructions
No runs longer then 14’
Bends and turns will add increased pressure
Support every 4’ - max ½” sag per a foot
No more then a 2” inch sag between supports
UV lights will break down the inner liner

Recommendation from the instructions
Use the minimum length to make connections

GUIDELINES FOR INSTALLING FLEXIBLE DUCT

A. CODE REFERENCE

1. The “authority having jurisdiction” should be referenced to determine what law, ordinance or code shall apply in the use of flexible “Air Ducts” and “Air Connectors.”

2. Air Ducts, identified by a rectangular shape listing mark, have no installed length limitation. Air Connectors, identified by a round shape listing mark, shall not be installed in lengths greater than 14 feet.

B. GENERAL

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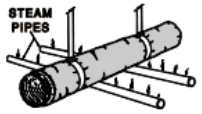
2. This product is for indoor use only. Do not install product where exposure to direct sunlight can occur. Prolonged exposure to sunlight may cause degradation of vapor barrier.
3. The inner core may degrade if the duct is positioned near a bio-treatment lamp (UV emitter) installed within the HVAC system
4. Terminal devices shall be supported independently of the flexible duct.
5. Repair torn or damaged vapor barrier/jacket with duct tape listed and labeled to Standard UL 181B. If internal core is penetrated, replace flexible duct or treat as a connection.

C. INSTALLATION

1. Install duct fully extended, do not install in the compressed state or use excess lengths. This will noticeably increase friction losses.

2. Avoid bending ducts across sharp corners or incidental contact with metal fixtures, pipes or conduits. Radius at center line shall not be less than one duct diameter.

3. Do not install near hot equipment (e.g., furnaces, boilers, steam pipes, etc.) that is above the recommended flexible duct use temperature.

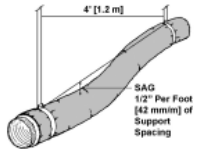


D. CONNECTING, JOINING AND SPLICING FLEXIBLE DUCT

1. All connections, joints and splices shall be made in accordance with the manufacturer's installation instructions.
2. All tapes, mastics, and non-metallic fasteners (plastic clamps) used for field installation of flexible ducts shall be listed and labeled to Standard UL 181B – Closure Systems for use with Flexible Air Ducts and Air Connectors. Non-metallic fasteners are limited to 6 inch w.g. maximum positive pressure.
3. Sheet metal collars to which the flexible ducts are attached shall be a minimum of two inches in length and shall be beaded.
4. Sheet metal sleeves used for joining two sections of flexible duct shall be a minimum of 4 inches in length and shall be beaded on both ends.

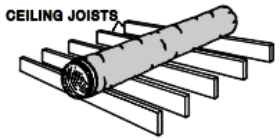
E. SUPPORTING FLEXIBLE DUCT

1. Flexible duct shall be supported at manufacturer's recommended intervals, but at no greater distance than four feet. Maximum permissible sag is 1/2 inch per foot of spacing between supports.
A connection to rigid ducting or equipment shall be considered a support joint.
Long horizontal duct runs with sharp bends shall have additional supports before and after the bend approximately one duct diameter distance from the center line of the bend.

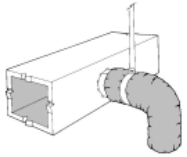


2. Hanger or saddle material in contact with the flexible duct shall be of sufficient width to prevent any restriction of the internal diameter of the duct when the weight of supported section rests on the hanger or saddle material. In no case will the material contacting the flexible duct be less than 1-1/2 inch wide.

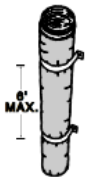
3. Flexible ducts may rest on ceiling joists or truss supports. A maximum spacing between supports shall not exceed the maximum spacing per manufacturer's installation instructions.



4. Support the duct between a metal connection and a bend by allowing the duct to extend straight for a few inches before making the bend. This will avoid possible damage of the flexible duct by the edge of the sheet metal collar.



5. Vertically installed duct shall be stabilized by support straps at a maximum of 6 feet on center.
NOTE: Factory-made air ducts may not be used for vertical risers in air duct systems serving more than two stories.



F. INSTALLATION RESTRICTIONS AND USE LIMITATIONS

There are specific restrictions and limitations related to the use of flexible duct. Some are due to NFPA Standards, model codes and various state/local codes. Others are due to end use performance where the product was not designed for that specific use. Some, but not all inclusive, are as follows:

1. Cannot be used for vertical risers serving more than two stories in height when conformance to NFPA 90A or 90B is required.

2. Cannot be used in systems with entering air temperature higher than 250° F [121° C]

3. Must be installed in accordance with conditions of listing.

4. When installed in a fire-rated floor/roof ceiling assembly, ducts shall conform with the design of the tested fire-resistive assembly.

5. Should be interrupted at the immediate area of operation of electric, fossil fuel or solar energy collection heat sources to meet listed equipment clearances specified.

6. Air connectors (does not apply to air ducts) shall not be installed in lengths greater than 14 feet [4.3 m] for any given run; shall not pass through any wall, partition or enclosure of a vertical shaft with a 1 hour or more fire resistive rating; shall not pass through floors.

7. Should not penetrate walls where fire dampers are required.

8. Should not be used outdoors unless specifically designed to withstand exposure to direct sunlight and the weathering elements.

9. Should not be used to vent appliances for cooking, heating and clothes drying unless approved and recommended by the appliance manufacturer.

10. Should not be installed in concrete, buried below grade or in contact with the ground.

Atco. Working Together. Doing It Right

CORRECTLY USING THE DUCT CALCULATOR

What we need to know before we pick up the Duct Calculator!

- Required room CFM to satisfy the load
- Available Blower (Static) Pressure @ Design CFM
- Accessory / Component Air Side Pressure Drops
- Total (Static) Pressure Available to Move the Air thru the Duct System
  - (This is different than Blower (Static) Pressure)
- Total Feet of Duct Work Resistance
  - Equivalent Feet of Fittings (Manual “D” / Appendix 3)
  - Straight Runs of Duct
- Available Static / 100 Equivalent Feet

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DATA AND INFORMATION GATHERING AND ANALYSIS

EXAMPLE / Gas Furnace

Ranch Over Crawl Space

Cooling Load = 21,331 BTUH Sensible heat
6,399 BTUH Latent heat
27,730 BTUH Total capacity

1085 CFM of Airflow

Heating Load = 39,445 BTUH Total

We will be using the 1085 CFM as our “Design Airflow”
and a 70,000 BTUH 80% Furnace!

HEAT LOAD CALCULATION

Any heat load calculation software, always consult the instructions of your software supplier to ensure correct data entry.

Whole House Worksheet – New Construction

Customer's Name Ray Zarback Address 1996 Yorkshire Blvd.

City Little Rock State Arkansas Zip _____ Telephone Number _____

WINTER: Inside Design Temp 70 °F—Outside Design Temp 20 °F = Heating Temp Difference 50 °F

SUMMER: Outside Design Temp 95 °F—Inside Design Temp 75 °F = Cooling Temp Difference 20 °F

HEATING		COMMON DATA SECTION		COOLING	
BTUH LOSS	HEATING FACTOR	SUBJECT	SQ. FT.	COOLING FACTOR	BTUH GAIN
	FROM TABLE E	GROSS WALL	1520	FROM TABLE E	
1135		DOORS & WINDOWS (Table A or B)	213		5384
915	0.70	NET WALL	1307	1.7	2222
936	0.48	CEILING	1950	2.1	4095
1014	0.52	FLOORS	1950	0.8	1560
Infiltration Btu/hr =	Heating Table D	x 10 x 1.1/60 x Volume (Cu. Ft.)	Volume (Cu. Ft.) x 1.1/60 x ΔT x	Cooling Table D	= Infiltration Btu/hr
2860 =	1.0	x 0.18333 x 15600	15600 x 0.018333 x 20 x	0.4	= 2288
6860		SUB-TOTAL BTUH LOSS (per 10°F)			
x 5		ADJUSTMENT FACTOR (Table C)			
34300		TOTAL BTUH LOSS			
		PEOPLE 6 X 300 BTUH GAIN (Assume 2 persons per bedroom)			1800
		APPLIANCES BTUH			1200
		SUB-TOTAL BTUH GAIN (room sensible only)			18549
x 1.15		DUCT LOSS/GAIN FACTOR (Table F)			x 1.15
		SUB-TOTAL BTUH (Sensible Gain)			21331
		MOISTURE REMOVAL (sub total x 1.3)			x 1.3
39445		TOTAL BTUH LOSS/GAIN			27730

TABLE A–HEATING–DOORS & WOOD FRAME WINDOWS (PER 10°F)

For sliding glass doors – use factors for the same type window construction

Window & Door Types	Frames: Wood	TIM	Metal	x Area	= Btuh Loss
Single Pane Clear	9.90	10.45	11.55		
With Storm	4.75	5.25	6.50		
Double Pane Clear	5.51	6.09	7.25	171	942
With Storm	3.41	3.85	4.90		
Triple Pane Clear	3.80	4.39	5.46		
Jalousie					

TABLE B – COOLING - DOORS & WINDOWS

Factors assume windows have inside shading by draperies or venetian blinds and sliding glass doors are treated as windows.

	SINGLE GLASS					DOUBLE GLASS					TRIPLE GLASS						
	TEMP. DIFF.					TEMP. DIFF.					TEMP. DIFF.					x Area	= Btuh Gain
Direction	15°	20°	25°	30°	35°	15°	20°	25°	30°	35°	15°	20°	25°	30°	35°		
N	18	22	26	30	34	14	16	18	20	22	11	12	13	14	15	56	896
NE & NW	37	41	45	49	53	31	33	35	37	39	26	27	28	29	30		
E & W	52	56	60	64	68	44	46	48	50	52	38	39	40	41	42	55	2530

CORRECTLY USING THE DUCT CALCULATOR

What we need to know before we pick up the Duct Calculator!

- Required room CFM's to satisfy the load = 1085 CFM
- **Available Blower (Static) Pressure @ Design CFM – Gas Furnace**
  - Determine Fan Blower Performance Static Capability at a given CFM
- Accessory / Component Air Side Pressure Drops
- Total (Static) Pressure Available to Move the Air thru the Duct System
  - (This is different than Blower (Static) Pressure)
- Total Feet of Duct Work Resistance
  - Equivalent Feet of Fittings (Manual "D" / Appendix 3)
  - Straight Runs of Duct
- Available Static / 100 Equivalent Feet

DETERMINE BLOWER PERFORMANCE

1st:

Let’s look at the blower Performance table

- Normally found in “Product Data or Installation Instructions”

- Looking for 1085 CFM

DETERMINE BLOWER PERFORMANCE

Let's look at this furnace

Furnace	Wire Lead Color	Function	Test Airflow Delivery @ Various External Static Pressures									
			0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
045E14–12	Gray	Cooling. Do not use for heating.	1230	1190	1155	1120	1080	1045	1010	975	935	895
	Yellow	Alt Cooling or alt Heating	980	945	920	890	855	815	770	735	690	645
	Orange	Alt Cooling or alt Heating	770	720	685	640	600	560	520	475	430	385
	Blue	Heating or alt Cooling	710	660	620	580	540	490	455	415	375	335
	Red	Alt Cooling. Do not use for heating.	600	540	500	455	415	385	345	305	235	–
045E17–12	Gray	Cooling. Do not use for heating.	1370	1335	1295	1255	1215	1175	1135	1095	1055	1020
	Yellow	Alt Cooling or alt Heating	1130	1085	1040	995	955	910	865	825	780	730
	Orange	Alt Cooling or alt Heating	930	885	835	795	745	700	655	600	545	495
	Blue	Heating or alt Cooling	760	720	670	625	580	515	460	410	355	300
070E14–12	Gray	Cooling. Do not use for heating.	1205	1170	1143	1105	1070	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Blue	Heating or alt Cooling	1095	1060	1030	[illegible]	[illegible]	925	885	840	800	735
	Yellow	Alt Cooling or alt Heating	920	880	845	805	765	730	685	620	560	510
	Orange	Alt Cooling. Do not use for heating.	715	650	610	575	520	465	410	380	305	245
	Red	Alt Cooling. Do not use for heating.	635	490	445	375	315	270	205	230	190	140
070E17–12	Gray	Cooling. Do not use for heating.	1185	1140	1095	105[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Yellow	Alt Cooling or alt Heating	1000	940	[illegible]	850	800	750	695	650	600	555
	Blue	Heating or alt Cooling	990	935	895	845	790	740	690	640	590	535
	Orange	Alt Cooling or alt Heating	855	775	720	660	605	560	495	435	385	335
	Red	Alt Cooling. Do not use for heating.	860	685	515	445	385	340	275	205	–	–
070E21–16	Gray	Cooling. Do not use for heating.	1735	1685	1640	1595	1545	1495	1450	1405	[illegible]	1310
	Yellow	Alt Cooling or alt Heating	1480	1435	1395	1340	1290	1240	1190	1[illegible]35	1085	10[illegible]
	Blue	Heating or alt Cooling	1315	1275	1225	1180	1135	1085	1030	975	[illegible]	860
	Orange	Alt Cooling or alt Heating	1135	1080	1030	985	935	885	835	770	705	645
	Red	Alt Cooling. Do not use for heating.	980	930	875	820	775	715	665	595	530	455
090E17–14	Yellow	Alt Cooling or alt Heating	1295	1255	1220	1185	1140	1100	1055	1005	955	815
	Blue	Heating or alt Cooling	1220	1185	1150	1105	1065	1025	975	915	840	740
	Orange	Alt Cooling or alt Heating	1030	985	940	900	845	790	715	655	590	535
	Red	Alt Cooling. Do not use for heating.	945	905	855	800	750	670	600	540	490	435
090E21–16	Gray	Cooling. Do not use for heating.	1625	1580	1535	1490	1445	1395	1340	1260	1135	995
	Yellow	Alt Cooling or alt Heating	1425	1380	1335	1290	1235	1185	1125	1075	1020	640
	Blue	Heating or alt Cooling	1440	1395	1350	1305	1255	1200	1145	1090	1040	950
	Orange	Alt Cooling or alt Heating	1260	1210	1160	1105	1050	990	935	880	820	755
	Red	Alt Cooling. Do not use for heating.	1095	1040	980	905	845	780	720	650	585	520
090E21–20	Gray	Cooling. Do not use for heating.	2180	2130	2080	2030	1980	1925	1870	1805	1745	1680
	Yellow	Alt Cooling or alt Heating	1900	1845	1795	1740	1685	1635	1570	1500	1435	1375
	Blue	Heating or alt Cooling	1685	1620	1565	1505	1455	1385	1320	1260	1200	1140
	Orange	Alt Cooling or alt Heating	1390	1315	1240	1175	1095	1030	970	900	825	760
	Red	Alt Cooling. Do not use for heating.	1240	1155	1075	990	915	835	765	690	615	555
	Gray	Cooling. Do not use for heating.	2190	2135	2075	2015	1960	1900	1835	1775	1705	1630

58SC0A

Gray speed tap

Gray speed tap

Yellow speed tap

DETERMINE BLOWER PERFORMANCE

Select the 21-inch-wide furnace with

the Greater Static Pressure Capability @ 1085 CFM

* Med-Hi Speed Tap Data Shows 1085 CFM @ 0.90” w.g.

* Med Speed Tap Data Shows 1085 CFM @ 0.60” w.g.

We will 1st try the 1085 CFM @ 0.90” w.g.

CORRECTLY USING THE DUCT CALCULATOR

What we need to know before we pick up the Duct Calculator!

- Required room CFM's to satisfy the load = 1085 CFM
- Available Blower (Static) Pressure @ Design CFM = .90"wc @ 1085 CFM
- **Accessory / Component Air Side Pressure Drops**
  - Cooling Coil, Diffusers, Dampers, Airside Accessories.
- Total (Static) Pressure Available to Move the Air thru the Duct System
  - (This is different than Blower (Static) Pressure)
- Total Feet of Duct Work Resistance
  - Equivalent Feet of Fittings (Manual "D" / Appendix 3)
  - Straight Runs of Duct
- Available Static / 100 Equivalent Feet

AVAILABLE STATIC TO MOVE AIR

- Available Static @ Furnace = **0.90”**
- Pressure Drops

Cooling Coil	0.??”	
Supply Grill	0.03”	per Manual “D”
Return Grill	0.03”	per Manual “D”
Damper(Balancing)	0.03”	per Manual “D”
High Eff Filter	0.??+”	
Totals =	**0.??” =>**	**-0.??”**

Available To Deliver Air = 0.??”

DETERMINE COIL PRESSURE DROP

CNPV

COIL STATIC PRESSURE DROP (in. w.c.) R-410A and R-22 REFRIGERANTS

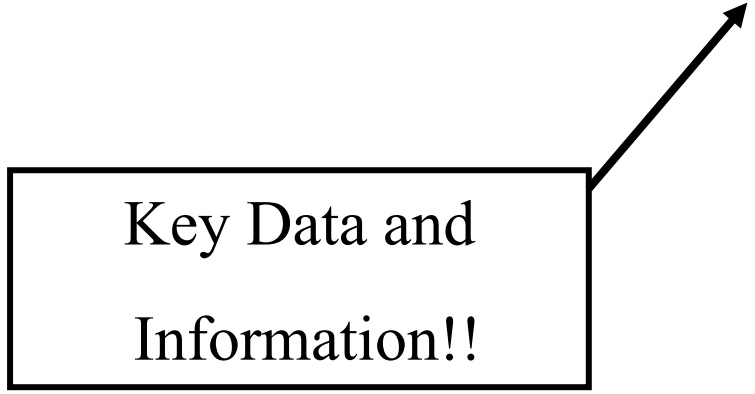
UNIT SIZE	Standard CFM																		
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
1814	Dry																		
	0.078	0.114	0.156	0.198	0.253														
	Wet																		
	0.096	0.138	0.183	0.213	0.277														
1917	Dry																		
	0.042	0.060	0.080	0.102	0.128														
	Wet																		
	0.055	0.076	0.104	0.127	0.158														
2414	Dry																		
	0.070	0.103	0.143	0.182	0.233	0.290	0.354												
	Wet																		
	0.089	0.128	0.171	0.214	0.269	0.336	0.413												
2417	Dry																		
	0.048	0.068	0.090	0.112	0.140	0.170	0.203												
	Wet																		
	0.064	0.091	0.122	0.150	0.188	0.224	0.263												
3014	Dry																		
	0.065	0.097	0.135	0.173	0.223	0.278	0.339	0.405	0.478										
	Wet																		
	0.078	0.114	0.160	0.206	0.260	0.321	0.388	0.461	0.540										
3017	Dry																		
	0.042	0.060	0.080	0.102	0.128	0.157	0.188	0.222	0.259										
	Wet																		
	0.055	0.076	0.104	0.127	0.158	0.190	0.225	0.266	0.309										
3117	Dry																		
	0.031	0.046	0.063	0.083	0.105	0.130	0.156	0.193	0.230										
	Wet																		
	0.039	0.056	0.075	0.097	0.121	0.149	0.179	0.212	0.249										
3617 T3617	Dry																		
	0.043	0.061	0.082	0.103	0.128	0.157	0.189	0.221	0.259	0.299	0.341								
	Wet																		
	0.056	0.079	0.107	0.133	0.166	0.200	0.236	0.276	0.315	0.361	0.413								
3621	Dry																		
	0.035	0.048	0.062	0.076	0.093	0.111	0.132	0.153	0.177	0.20[illegible]	0.228								
	Wet																		
	0.049	0.066	0.085	0.100	0.122	0.144	0.171	0.192	0.217	0.245	0.276								
3717	Dry																		
	0.025	0.038	0.054	0.072	0.093	0.117	0.143	0.171	0.205	0.233	0.273								
	Wet																		
	0.030	0.044	0.061	0.079	0.103	0.125	0.154	0.182	0.216	0.251	0.288								

DETERMINE COIL PRESSURE DROP

We will use the 3621 coil to match the furnace

1100 CFM @ 0.19” w.g.

Pressure Drop across coil is 0.19” w.g.



AVAILABLE STATIC TO MOVE AIR

- Available Static @ Furnace = **0.90”**
- Pressure Drops

Cooling Coil	0.19”
Supply Grill	0.03”
Return Grill	0.03”
Damper (Balancing)	0.03”
High Eff Filter	NONE
Totals =	**0.28” =>** **-0.28”**
Available To Deliver Air and Design Ductwork =	**0.62”**

DETERMINE FILTER PRESSURE DROP

PRESSURE DROP AT VARIOUS AIRFLOWS (CLEAN)

Airflow (CFM)	FACTORY SUPPLIED FURNACE/FAN COIL FILTER	EXPXXFIL0016	EXPXXFIL0020
	Resistance (inches of water) (Clean filter)		
600	0.015	0.045	0.025
800	0.020	0.070	0.045
1000	0.030	0.110	0.075
1200	0.035	0.150	0.100
1400	0.045	0.210	0.130
1600	0.055	0.250	0.160
1800	0.062	—	0.200
2000	0.070	—	0.220
2200	—	—	—

NOTE: When applying the EZ Flex, attention must be given to the duct and system design because all these components affect system static pressure. The EZ Flex has a higher static pressure drop than the typical factory supplied furnace and/or fan coil filter (as shown above), but is designed to ensure proper system efficiency and reliability when applied to a properly designed duct system and properly sized HVAC equipment.

Using Interpolation, @ 1100 CFM,

Pressure Drop across filter will be 0.13” w.g.

More Key Data and Information!!

AVAILABLE STATIC TO MOVE AIR

- Available Static @ Furnace = **0.90”**
- Pressure Drops

Cooling Coil	0.19”
Supply Grill	0.03”
Return Grill	0.03”
Damper (Balancing)	0.03”
High Eff Filter	0.13”
Totals =	**0.41” =>** **-0.41”**
Available To Deliver Air and Design Ductwork =	**0.49”**

DETERMINE BLOWER PERFORMANCE

Now let's look at this furnace

We are changing from a 21" wide furnace to a 14" wide furnace

Furnace	Wire Lead Color	Function	Test Airflow Delivery @ Various External Static Pressures									
			0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
045E14–12	Gray	Cooling. Do not use for heating.	1230	1190	1155	1120	1080	1045	1010	975	935	895
	Yellow	Alt Cooling or alt Heating	980	945	920	890	855	815	770	735	690	645
	Orange	Alt Cooling or alt Heating	770	720	685	640	600	560	520	475	430	385
	Blue	Heating or alt Cooling	710	660	620	580	540	490	455	415	375	335
	Red	Alt Cooling. Do not use for heating.	600	540	500	455	415	385	345	305	235	–
045E17–12	Gray	Cooling. Do not use for heating.	1370	1335	1295	1255	1215	1175	1135	1095	1055	1020
	Yellow	Alt Cooling or alt Heating	1130	1085	1040	995	955	910	865	825	780	730
	Orange	Alt Cooling or alt Heating	930	885	835	795	745	700	655	600	545	495
	Blue	Heating or alt Cooling	760	720	670	625	580	515	460	410	355	300
070E14–12	Gray	Cooling. Do not use for heating.	1205	1170	1145	1105	1070	1035	1000	960	925	885
	Blue	Heating or alt Cooling	1095	1060	1030	995	960	925	885	840	800	735
	Yellow	Alt Cooling or alt Heating	920	880	845	805	765	730	685	620	560	510
	Orange	Alt Cooling. Do not use for heating.	715	650	610	575	520	465	410	380	305	245
	Red	Alt Cooling. Do not use for heating.	635	490	445	375	315	270	205	230	190	140
070E17–12	Gray	Cooling. Do not use for heating.	1185	1140	1095	1055	1005	960	915	865	820	780
	Yellow	Alt Cooling or alt Heating	1000	940	895	850	800	750	695	650	600	555
	Blue	Heating or alt Cooling	990	935	895	845	790	740	690	640	590	535
	Orange	Alt Cooling or alt Heating	855	775	720	660	605	560	495	435	385	335
	Red	Alt Cooling. Do not use for heating.	860	685	515	445	385	340	275	205	–	–
070E21–16	Gray	Cooling. Do not use for heating.	1735	1685	1640	1595	1545	1495	1450	1405	1360	1310
	Yellow	Alt Cooling or alt Heating	1480	1435	1395	1340	1290	1240	1190	1135	1085	1035
	Blue	Heating or alt Cooling	1315	1275	1225	1180	1135	1085	1030	975	915	860
	Orange	Alt Cooling or alt Heating	1135	1080	1030	985	935	885	835	770	705	645
	Red	Alt Cooling. Do not use for heating.	980	930	875	820	775	715	665	595	530	455
090E17–14	Yellow	Alt Cooling or alt Heating	1295	1255	1220	1185	1140	1100	1055	1005	955	815
	Blue	Heating or alt Cooling	1220	1185	1150	1105	1065	1025	975	915	840	740
	Orange	Alt Cooling or alt Heating	1030	985	940	900	845	790	715	655	590	535
	Red	Alt Cooling. Do not use for heating.	945	905	855	800	750	670	600	540	490	435
090E21–16	Gray	Cooling. Do not use for heating.	1625	1580	1535	1490	1445	1395	1340	1260	1135	995
	Yellow	Alt Cooling or alt Heating	1425	1380	1335	1290	1235	1185	1125	1075	1020	640
	Blue	Heating or alt Cooling	1440	1395	1350	1305	1255	1200	1145	1090	1040	950
	Orange	Alt Cooling or alt Heating	1260	1210	1160	1105	1050	990	935	880	820	755
	Red	Alt Cooling. Do not use for heating.	1095	1040	980	905	845	780	720	650	585	520
090E21–20	Gray	Cooling. Do not use for heating.	2180	2130	2080	2030	1980	1925	1870	1805	1745	1680
	Yellow	Alt Cooling or alt Heating	1900	1845	1795	1740	1685	1635	1570	1500	1435	1375
	Blue	Heating or alt Cooling	1685	1620	1565	1505	1455	1385	1320	1260	1200	1140
	Orange	Alt Cooling or alt Heating	1390	1315	1240	1175	1095	1030	970	900	825	760
	Red	Alt Cooling. Do not use for heating.	1240	1155	1075	980	915	835	765	680	615	555

58SC0A

Gray speed tap

Yellow speed tap

DETERMINE COIL PRESSURE DROP

CNPV

We are changing from a 21” wide furnace to a 14” wide furnace.

Why not have the coil match the width of the furnace?

We need to get new static pressure drop ratings.

COIL STATIC PRESSURE DROP (in. w.c.) R-410A and R-22 REFRIGERANTS

UNIT SIZE	Standard CFM	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
1814	Dry	0.078	0.114	0.156	0.198	0.253														
	Wet	0.096	0.138	0.183	0.213	0.277														
1917	Dry	0.042	0.060	0.080	0.102	0.128														
	Wet	0.055	0.076	0.104	0.127	0.158														
2414	Dry	0.070	0.103	0.143	0.182	0.233	0.290	0.354												
	Wet	0.089	0.128	0.171	0.214	0.269	0.336	0.413												
2417	Dry	0.048	0.068	0.090	0.112	0.140	0.170	0.203												
	Wet	0.064	0.091	0.122	0.150	0.188	0.224	0.263												
3014	Dry	0.065	0.097	0.135	0.173	0.223	0.278	0.339	0.405	0.478										
	Wet	0.078	0.114	0.160	0.206	0.260	0.321	0.388	0.461	0.540										
3017	Dry	0.042	0.060	0.080	0.102	0.128	0.157	0.188	0.222	0.259										
	Wet	0.055	0.076	0.104	0.127	0.158	0.190	0.225	0.266	0.309										
3117	Dry	0.031	0.046	0.063	0.083	0.105	0.130	0.156	0.193	0.230										
	Wet	0.039	0.056	0.075	0.097	0.121	0.149	0.179	0.212	0.249										
3617 T3617	Dry	0.043	0.061	0.082	0.103	0.128	0.157	0.189	0.221	0.259	0.299	0.341								
	Wet	0.056	0.079	0.107	0.133	0.166	0.200	0.236	0.276	0.315	0.361	0.413								
3621	Dry	0.035	0.048	0.062	0.076	0.093	0.111	0.132	0.153	0.177	0.201	0.228								
	Wet	0.049	0.066	0.085	0.100	0.122	0.144	0.171	0.192	0.217	0.245	0.276								
3717	Dry	0.025	0.038	0.054	0.072	0.093	0.117	0.143	0.171	0.205	0.233	0.273								
	Wet	0.030	0.044	0.061	0.079	0.103	0.125	0.154	0.182	0.216	0.251	0.288								

AVAILABLE STATIC TO MOVE AIR

- Available Static @ Furnace = **0.50”**
- Pressure Drops

Cooling Coil	0.46”
Supply Grill	0.03”
Return Grill	0.03”
Damper (Balancing)	0.03”
High Eff Filter	NONE
Totals =	**0.55” =>** **-0.55”**

Available To Deliver Air and Design Ductwork = -.05”

AVAILABLE STATIC TO MOVE AIR

- Available Static @ Furnace = **0.50”**
- Pressure Drops

Cooling Coil	0.46”
Supply Grill	0.03”
Return Grill	0.03”
Damper (Balancing)	0.03”
High Eff Filter	0.13”
Totals =	**0.68” =>** **-0.68”**

Available To Deliver Air and Design Ductwork = -.18”

DETERMINE COIL PRESSURE DROP

We only change the coil
From a 14” coil to a 17” coil

COIL STATIC PRESSURE DROP (in. w.c.) R-410A and R-22 REFRIGERANTS

UNIT SIZE	Standard CFM																		
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
1814	Dry																		
	0.078	0.114	0.156	0.198	0.253														
	Wet																		
	0.096	0.138	0.183	0.213	0.277														
1917	Dry																		
	0.042	0.060	0.080	0.102	0.128														
	Wet																		
	0.055	0.076	0.104	0.127	0.158														
2414	Dry																		
	0.070	0.103	0.143	0.182	0.233	0.290	0.354												
	Wet																		
	0.089	0.128	0.171	0.214	0.269	0.336	0.413												
2417	Dry																		
	0.048	0.068	0.090	0.112	0.140	0.170	0.203												
	Wet																		
	0.064	0.091	0.122	0.150	0.188	0.224	0.263												
3014	Dry																		
	0.065	0.097	0.135	0.173	0.223	0.278	0.339	0.405	0.478										
	Wet																		
	0.078	0.114	0.160	0.206	0.260	0.321	0.388	0.461	0.540										
3017	Dry																		
	0.042	0.060	0.080	0.102	0.128	0.157	0.188	0.222	0.259										
	Wet																		
	0.055	0.076	0.104	0.127	0.158	0.193	0.225	0.266	0.309										
3117	Dry																		
	0.031	0.046	0.063	0.083	0.105	0.130	0.156	0.193	0.230										
	Wet																		
	0.039	0.056	0.075	0.097	0.121	0.149	0.179	0.212	0.249										
3617 T3617	Dry																		
	0.043	0.061	0.082	0.103	0.128	0.157	0.189	0.221	0.259	0.299	0.341								
	Wet																		
	0.056	0.079	0.107	0.133	0.166	0.200	0.236	0.276	0.315	0.361	0.413								
3621	Dry																		
	0.035	0.048	0.062	0.076	0.093	0.111	0.132	0.153	0.177	0.201	0.228								
	Wet																		
	0.049	0.066	0.085	0.100	0.122	0.144	0.171	0.192	0.217	0.245	0.276								
3717	Dry																		
	0.025	0.038	0.054	0.072	0.093	0.117	0.143	0.171	0.205	0.233	0.273								
	Wet																		

AVAILABLE STATIC TO MOVE AIR

- Available Static @ Furnace = **0.50”**
- Pressure Drops

Cooling Coil	0.26”
Supply Grill	0.03”
Return Grill	0.03”
Damper (Balancing)	0.03”
High Eff Filter	NONE
Totals =	**0.35” => -0.35”**

Available To Deliver Air and Design Ductwork = .15”

DATA AND INFORMATION GATHERING AND ANALYSIS

EXAMPLE / Fan coil / Air handler

Ranch Over Crawl Space

Cooling Load = 21,331 BTUH Sensible heat

6,399 BTUH Latent heat

27,730 BTUH Total capacity

1085 CFM of Airflow

Heating Load = 39,445 BTUH

Auxiliary Heater = 7.68 KW

We will be using the 1085 CFM as our “Design Airflow”!

CORRECTLY USING THE DUCT CALCULATOR

What we need to know before we pick up the Duct Calculator!

- Required room CFM to satisfy the load = 1085 CFM
- **Available Blower (Static) Pressure @ Design CFM – Fan Coil/Air Handler**
  - Determine Fan Blower Performance Static Capability at a given CFM
- Accessory / Component Air Side Pressure Drops
- Total (Static) Pressure Available to Move the Air thru the Duct System
  - (This is different than Blower (Static) Pressure)
- Total Feet of Duct Work Resistance
  - Equivalent Feet of Fittings (Manual “D” / Appendix 3)
  - Straight Runs of Duct
- Available Static / 100 Equivalent Feet

DETERMINE BLOWER PERFORMANCE

1st:

Let’s look at the blower Performance table

- Normally found in “Product Data”

Looking for 1085 CFM

DETERMINE BLOWER PERFORMANCE

FB4C AIRFLOW PERFORMANCE (CFM)

MODEL & SIZE	BLOWER SPEED	0.10	0.20	0.30	0.40	0.50	0.60
FB4C 018	Tap 5	767	739	702	669	620	565
	Tap 4	614	569	534	486	436	398
	Tap 3	701	660	616	581	537	499
	Tap 2	614	569	534	486	436	398
	Tap 1	614	569	534	486	436	398
FB4C 024	Tap 5	969	936	892	835	763	676
	Tap 4	826	795	766	743	706	660
	Tap 3	826	795	766	743	706	660
	Tap 2	701	660	616	581	537	499
	Tap 1	617	582	552	507	472	420
FB4C 030	Tap 5	1108	1090	1065	1034	1009	974
	Tap 4	1026	1000	969	938	899	865
	Tap 3	1026	1000	969	938	899	865
	Tap 2	909	873	842	799	762	724
	Tap 1	825	795	757	722	674	634
FB4C 036	Tap 5	1301	1276	1245	1218	1176	1121
	Tap 4	1227	1191	1169	1143	1105	1074
	Tap 3	1227	1191	1169	1143	1105	1074
	Tap 2	1087	1062	1030	1001	966	930
	Tap 1	1026	1000	969	938	899	865
FB4C 042	Tap 5	1560	1544	1507	1464	1424	1358
	Tap 4	1419	1397	1358	1320	1279	1239
	Tap 3	1419	1397	1358	1320	1279	1239
	Tap 2	1249	1220	1184	1142	1093	1052
	Tap 1	1242	1205	1158	1110	1069	1026

Speed tap 5

Speed tap 4

Key Data and Information!!

DETERMINE BLOWER PERFORMANCE

MAXIMUM STATIC TABLE

MODEL	AIRFLOW DELIVERY	AVAILABLE STATIC PRESSURE
FE4ANF002	525 CFM	1.00 in wc
	700 CFM	1.00 in wc
	875 CFM	1.00 in wc
	1050 CFM	0.80 in wc
	1200 CFM	0.60 in wc
FE4AN(B,F)003	700 CFM	1.00 in wc
	875 CFM	1.00 in wc
	1050 CFM	1.00 in wc
	1225 CFM	1.00 in wc
	1400 CFM	0.80 in wc
FE4AN(B,F)005	875 CFM	1.00 in wc
	1050 CFM	1.00 in wc
	1225 CFM	1.00 in wc
	1400 CFM	1.00 in wc
	1600 CFM	0.50 in wc
FE4ANB006	1050 CFM	1.00 in wc
	1225 CFM	1.00 in wc
	1400 CFM	1.00 in wc
	1750 CFM	1.00 in wc
	2000 CFM	0.60 in wc
FE5ANB004	700 CFM	1.00 in wc
	875 CFM	1.00 in wc
	1050 CFM	1.00 in wc
	1225 CFM	1.00 in wc
	1400 CFM	1.00 in wc

CORRECTLY USING THE DUCT CALCULATOR

What we need to know before we pick up the Duct Calculator!

- Required room CFM's to satisfy the load = 1085 CFM
- Available Blower (Static) Pressure @ Design CFM = **0.60" w.g. @ 1085 CFM or 1.0" with variable speed**
- **Accessory / Component Air Side Pressure Drops**
  - Electric Heat, Hydronic Coils, Diffusers, Dampers, Airside Accessories . . .
- Total (Static) Pressure Available to Move the Air thru the Duct System
  - (This is different than Blower (Static) Pressure)
- Total Feet of Duct Work Resistance
  - Equivalent Feet of Fittings (Manual "D" / Appendix 3)
  - Straight Runs of Duct
- Available Static / 100 Equivalent Feet

AVAILABLE STATIC TO MOVE AIR

- Available Static @ Air Handler = **0.60”**
- Pressure Drops

Electric Heater	0.??”	
Supply Grill	0.03”	per Manual “D”
Return Grill	0.03”	per Manual “D”
Damper (Balancing)	0.03”	per Manual “D”
High Eff Filters	0.??”	
Totals =	**0.??” =>**	**-0.??”**

Available To Deliver Air = 0.??”

DETERMINE AUX HEAT PRESSURE DROP

AIRFLOW PERFORMANCE CORRECTION FACTORS

HEATER kW	ELEMENTS	STATIC PRESSURE CORRECTION (in wc)	
		Sizes 002–005	Size 006
0	0	+.02	+.03
5	1	+.01	+.02
8, 10	2	0	0
9, 15	3	–.02	–.03
20	4	–.04	–.06
18, 24, 30	6	–.06	–.10

The airflow performance table was developed using fan coils with 10kW electric heaters (2 elements) in the units. For fan coils with heaters made up of a different number of elements, the external available static at a given CFM from the table may be corrected by adding or subtracting pressure. Use table for this correction.

Not all manufactures are like this, for some you do have pressure drop to add.

AVAILABLE STATIC TO MOVE AIR

- Available Static @ Air Handler = **0.60”**
- Pressure Drops

Electric Heater	0.00”	
Supply Grill	0.03”	per Manual “D”
Return Grill	0.03”	per Manual “D”
Damper (Balancing)	0.03”	per Manual “D”
High Eff Filters	NONE	
Totals =	**0.09” =>**	**-0.09”**
Available To Deliver Air =		**0.51”**

DETERMINE FILTER PRESSURE DROP

PRESSURE DROP AT VARIOUS AIRFLOWS (CLEAN)

Airflow (CFM)	FACTORY SUPPLIED FURNACE/FAN COIL FILTER	EXPXXFIL0016	EXPXXFIL0020
	Resistance (inches of water) (Clean filter)		
600	0.015	0.045	0.025
800	0.020	0.070	0.045
1000	0.030	0.110	0.075
1200	0.035	0.150	0.100
1400	0.045	0.210	0.130
1600	0.055	0.250	0.160
1800	0.062	—	0.200
2000	0.070	—	0.220
2200	—	—	—

NOTE: When applying the EZ Flex, attention must be given to the duct and system design because all these components affect system static pressure. The EZ Flex has a higher static pressure drop than the typical factory supplied furnace and/or fan coil filter (as shown above), but is designed to ensure proper system efficiency and reliability when applied to a properly designed duct system and properly sized HVAC equipment.

Using Interpolation, @ 1085 CFM,

Pressure Drop across filter will be 0.13” w.g.

More Key Data and Information!!

AVAILABLE STATIC TO MOVE AIR

- Available Static @ Air Handler = **0.60”**
- Pressure Drops

Electric Heater	0.00”	
Supply Grill	0.03”	per Manual “D”
Return Grill	0.03”	per Manual “D”
Damper (Balancing)	0.03”	per Manual “D”
High Eff Filters	0.13”	
Totals =	**0.22” =>**	**-0.22”**
Available To Deliver Air =		**0.38”**

CORRECTLY USING THE DUCT CALCULATOR

- ✓ **Required room CFM to satisfy the load**
- ✓ **Available Blower (Static) Pressure @ Design CFM**
- ✓ **Accessory / Component Air Side Pressure Drops**
- ✓ **Total (Static) Pressure Available to Move the Air thru the Duct System**

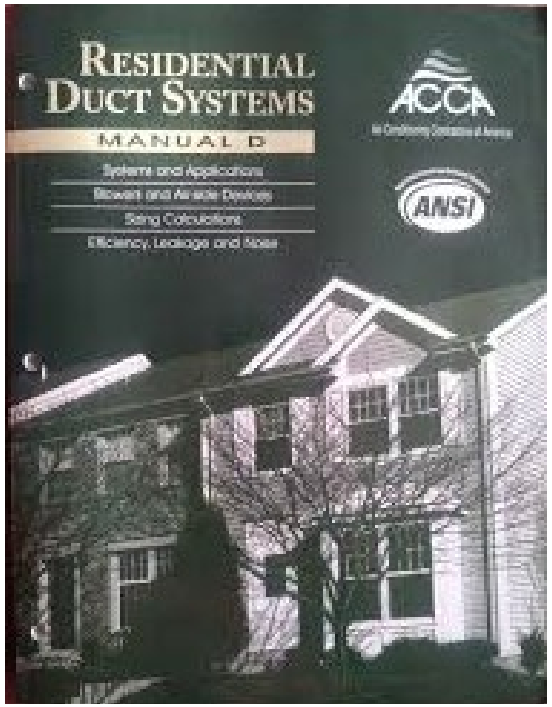
Total Feet of Duct Work Resistance

a) Equivalent Feet of Fittings (Manual “D” / Appendix 3) plus (+)

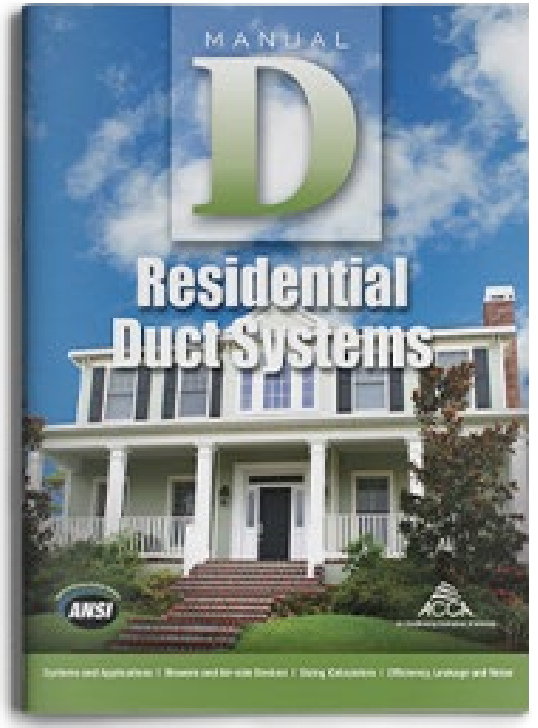
b) Straight Runs of Duct

Available Static / 100 Equivalent Feet

Before We Pick Up the Duct Calculator!



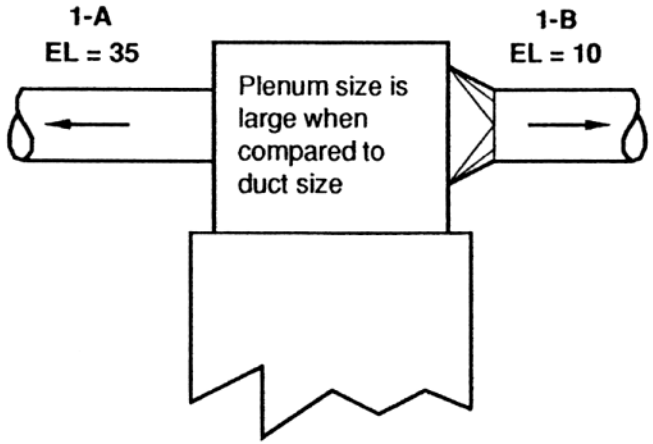
MANUAL "D" APPENDIX 3
EQUIVALENT LENGTH
EFFECTIVE LENGTH

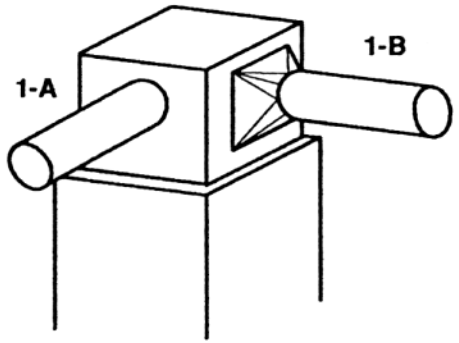


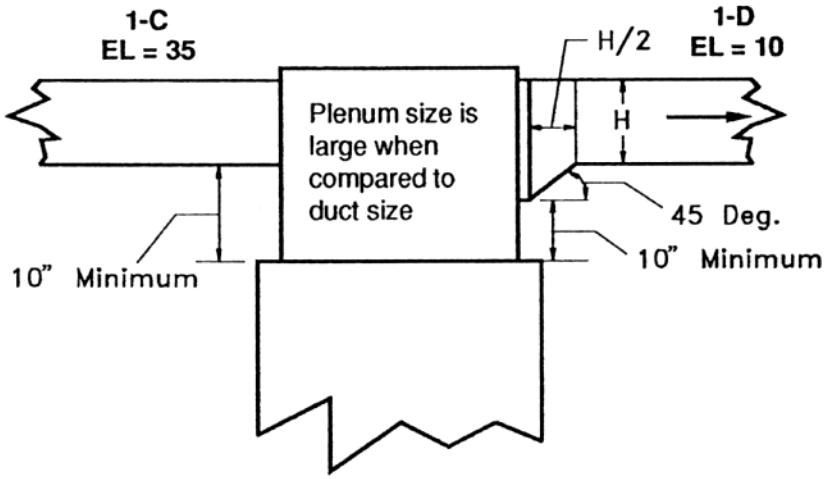
Group 1
Supply Air Fittings at the Air Handling Equipment

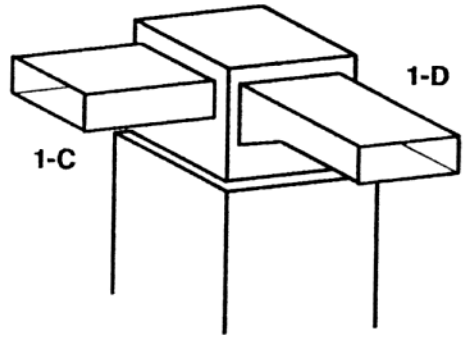
Reference Velocity = 900 FPM

Reference Friction Rate = 0.08 In.Wg. per 100 Feet





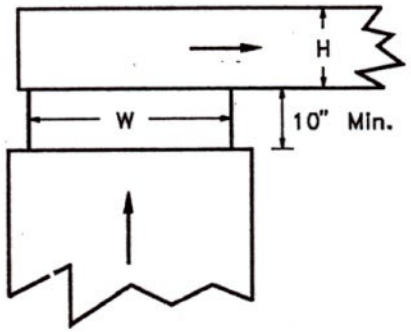


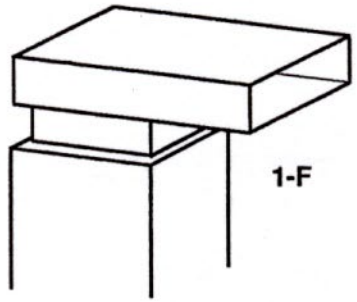


Group 1 — Continued
Supply Air Fittings at the Air Handling Equipment

Reference Velocity = 900 FPM

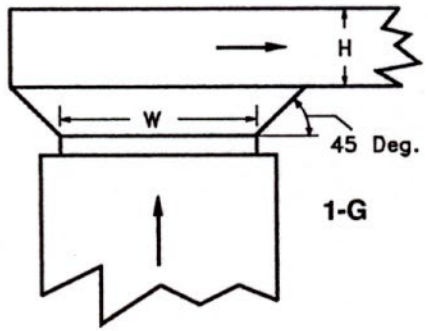
Reference Friction Rate = 0.08 In.Wg. per 100 Feet

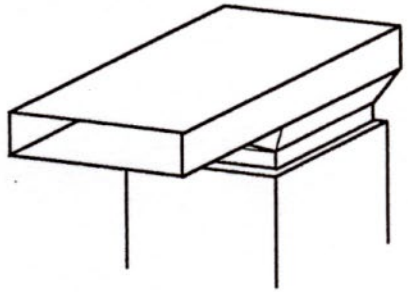




Bull Head 1-F	H / W	EL
	0.50	120
	1.0	85

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

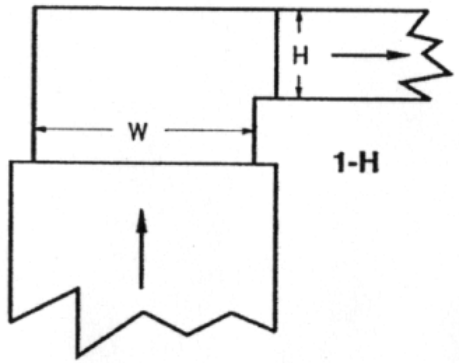




Group 1 — Continued
Supply Air Fittings at the Air Handling Equipment

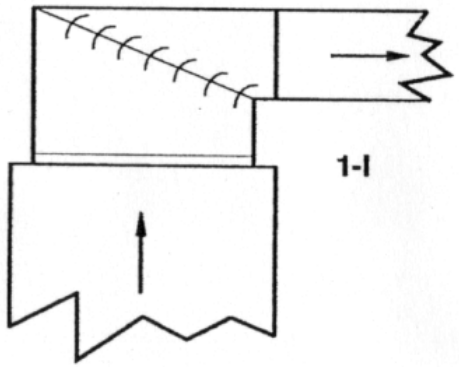
Reference Velocity = 900 FPM

Reference Friction Rate = 0.08 In.Wg. per 100 Feet



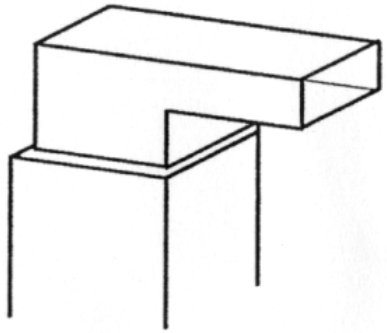
1-H

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



1-I

With Vanes 1-I	EL = 20

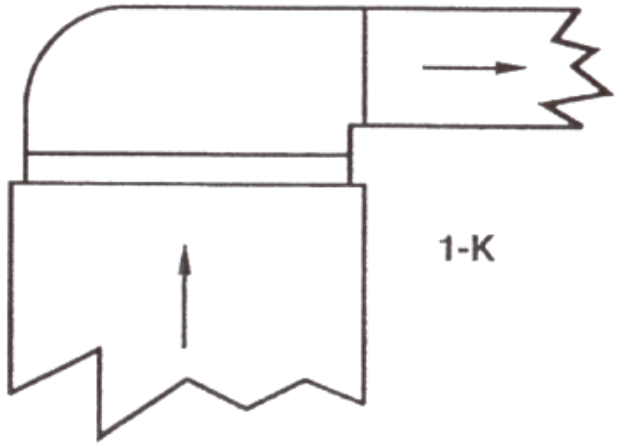


Vanes reduce resistance by 5/6 or 83%!!

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

Reference Velocity = 900 FPM

Reference Friction Rate = 0.08 In.Wg. per 100 Feet



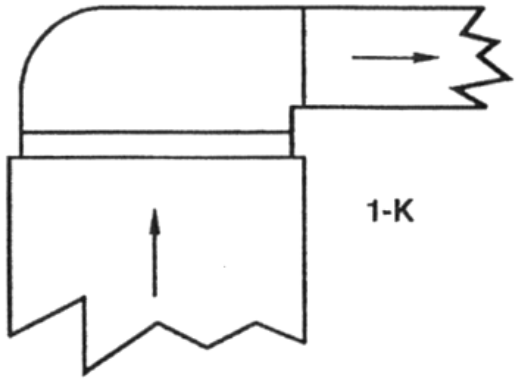
1-K

Mitered Inside Corner 1-K	EL = 85

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

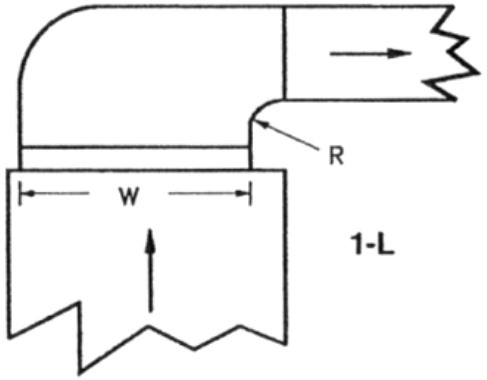
Reference Velocity = 900 FPM

Reference Friction Rate = 0.08 In.Wg. per 100 Feet

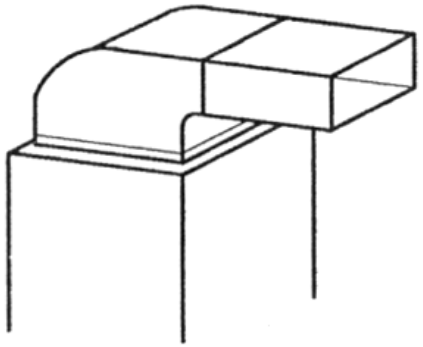


1-K

Mitered Inside Corner 1-K	EL = 85



1-L

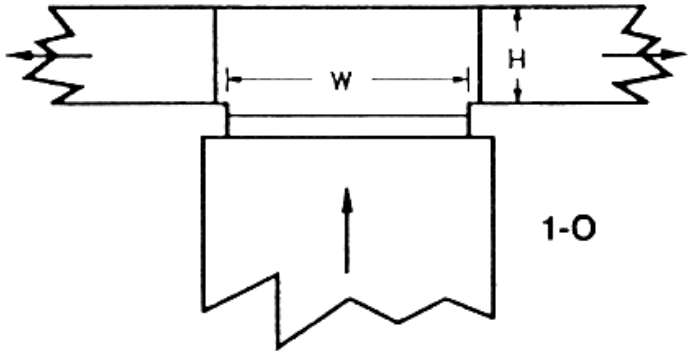


Radius Ell No Vanes 1-L	R / W	EL
	0.25	40
	0.50	20
	1.0	10

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

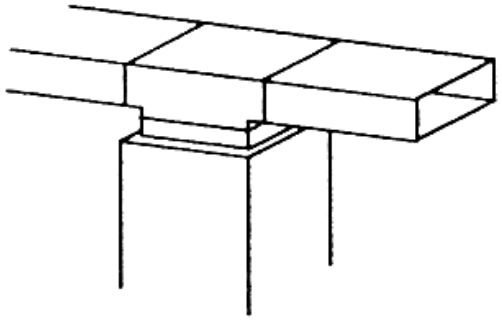
Reference Velocity = 900 FPM

Reference Friction Rate = 0.08 In.Wg. per 100 Feet



1-O

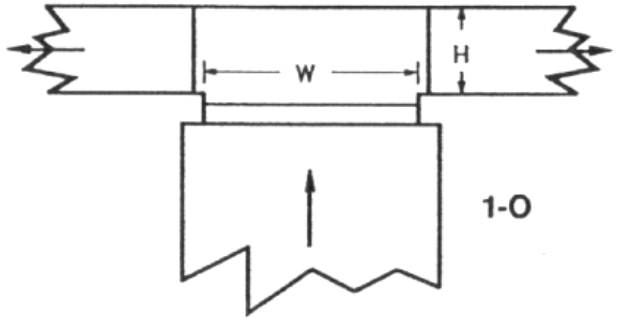
Bull Head No Vanes 1-O	H / W	EL
	0.50	120
	1.0	85



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

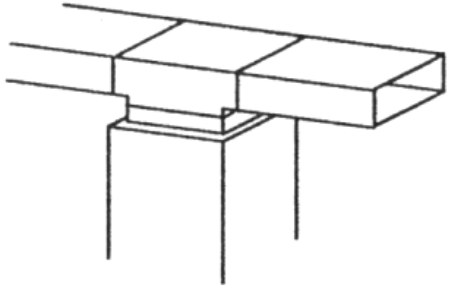
Reference Velocity = 900 FPM

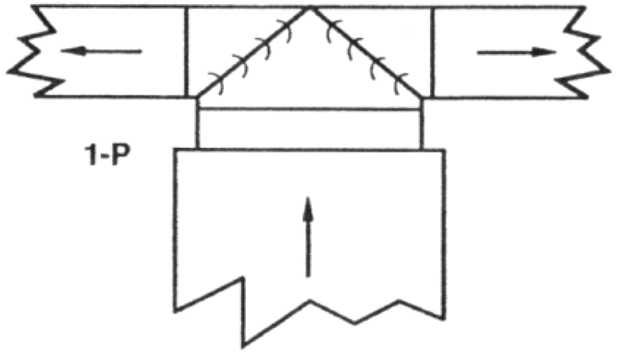
Reference Friction Rate = 0.08 In.Wg. per 100 Feet



1-O

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





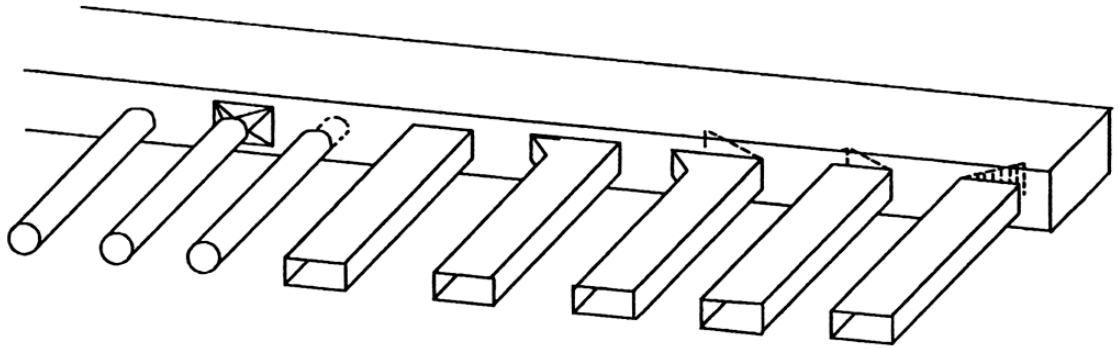
1-P

Vaned Tee 1-P	
	EL = 20

Group 2
Branch Take-Off Fittings at the Supply Trunk

Reference Velocity = 900 FPM

Reference Friction Rate = 0.08 In.Wg. per 100 Feet



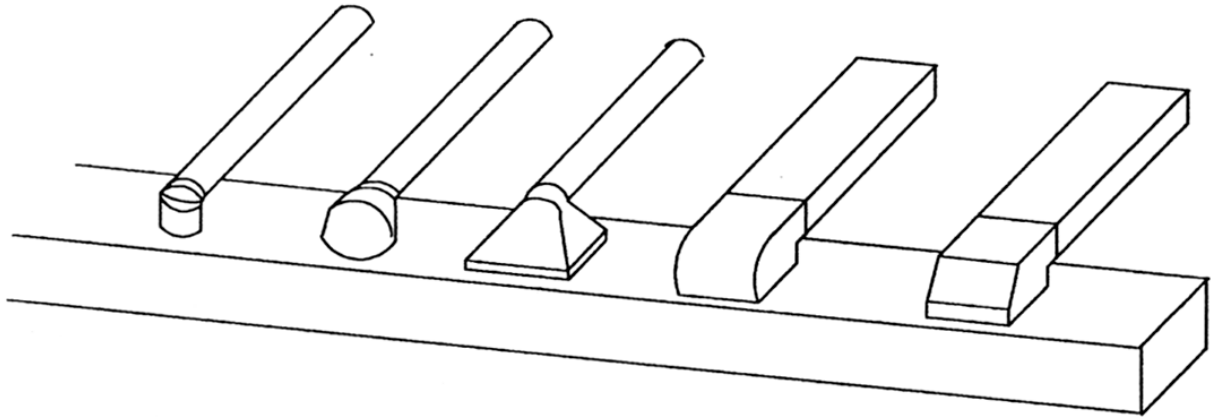
EL Values		Number of Down Stream Branches to End of Trunk Duct or Number of Down Stream Branches to a Trunk Reducer					
Fitting		0	1	2	3	4	5 or More
	2-A	35	45	55	65	70	80
	2-B	20	30	35	40	45	50
	2-C	65	65	65	65	70	80
	2-D	40	50	60	65	75	85
	2-E	25	30	35	40	45	50
	2-F	20	20	20	20	25	25
	2-G	65	65	65	70	80	90
	2-H	70	70	70	75	85	95

Note: If the trunk has a reducer — count down to the reducer; then begin counting (again) after the reducer

Group 2 — Continued
Branch Take-Off Fittings at the Supply Trunk

Reference Velocity = 900 FPM

Reference Friction Rate = 0.08 In.Wg. per 100 Feet

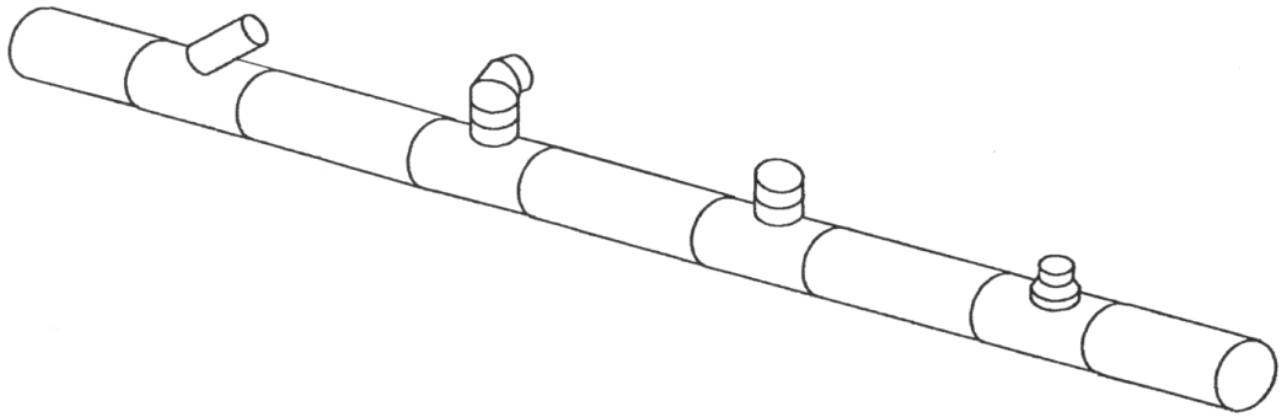


EL Values		Number of Down Stream Branches to End of Trunk Duct or Number of Down Stream Branches to a Trunk Reducer					
Fitting		0	1	2	3	4	5 or More
	2-I	65	75	85	95	100	110
	2-J	50	60	65	70	75	80
	2-K	50	60	65	70	75	80
	2-L	70	80	90	95	105	115
	2-M	70	80	90	95	105	115
Note: If the trunk has a reducer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

Group 2 — Continued
Branch Take-Off Fittings at the Supply Trunk

Reference Velocity = 900 FPM

Reference Friction Rate = 0.08 In.Wg. per 100 Feet



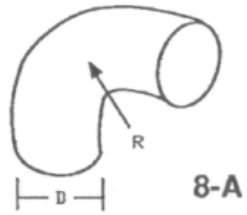
EL Values		Number of Down Stream Branches to End of Trunk Duct or Number of Down Stream Branches to a Trunk Reducer					
Fitting		0	1	2	3	4	5 or More
	2-N	35	35	40	40	40	40
	2-O	55	65	75	85	90	100
	2-P	50	55	60	65	70	75
	2-Q	10	10	15	20	20	25

Note: If the trunk has a reducer — count down to the reducer; then begin counting (again) after the reducer

Group 8
Elbows and Offsets

Reference Velocity = 900 FPM

Reference Friction Rate = 0.08 In.Wg. per 100 Feet



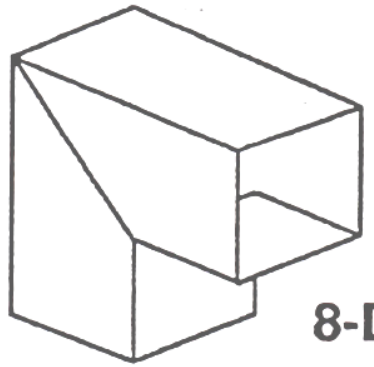
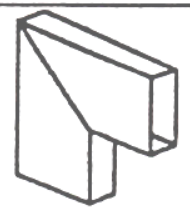
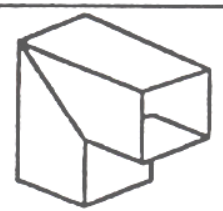
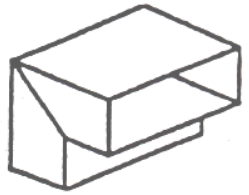
8-A

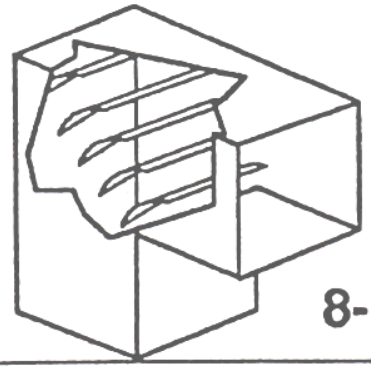
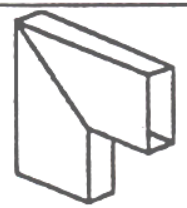
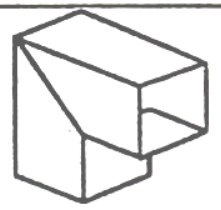
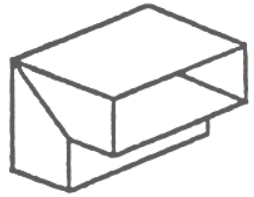
R/D	Round and Oval Elbow EL Values							
	Smooth	4 or 5 Piece	3 Piece	Smooth Mitered	Easy Bend	Hard Bend	3-Piece 45°	2-Piece 45o
Mitered (R = 0)	—	—	—	75	4 Piece 25	4 Piece 30	10	15
0.75	20	30	35	—				
1.0	15	20	25	—	3 Piece 30	3 Piece 35		
1.5 or Larger	10	15	20	—				

8-A — Continued

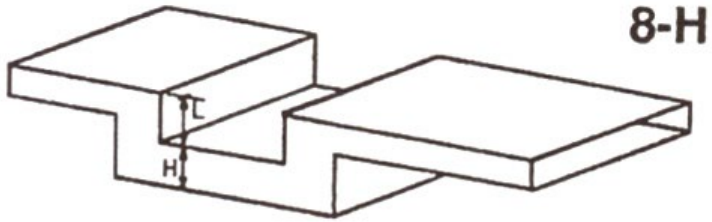
For Smooth Radius Round Elbows
— Angles (θ) Less Than 90° —
Multiply EL by the Following Factor

20°	300	45°	60°	75°	110°	130°	150°
0.31	0.45	0.60	0.78	0.90	1.13	1.20	1.28

 8-D No Vanes	Square Elbow EL Values		
			
	Hard Bend	H / W = 1	Easy Bend
	80	80	65

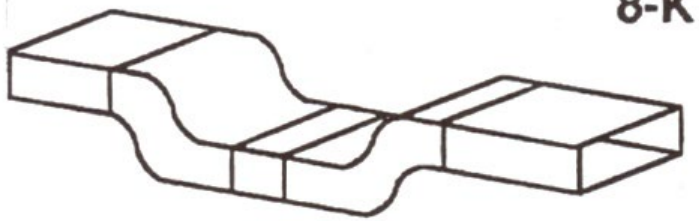
 8-E SingleThickness Turning Vanes	Square Elbow EL Values		
			
	Hard Bend	H / W = 1	Easy Bend
	10	10	10

8-H



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

8-K



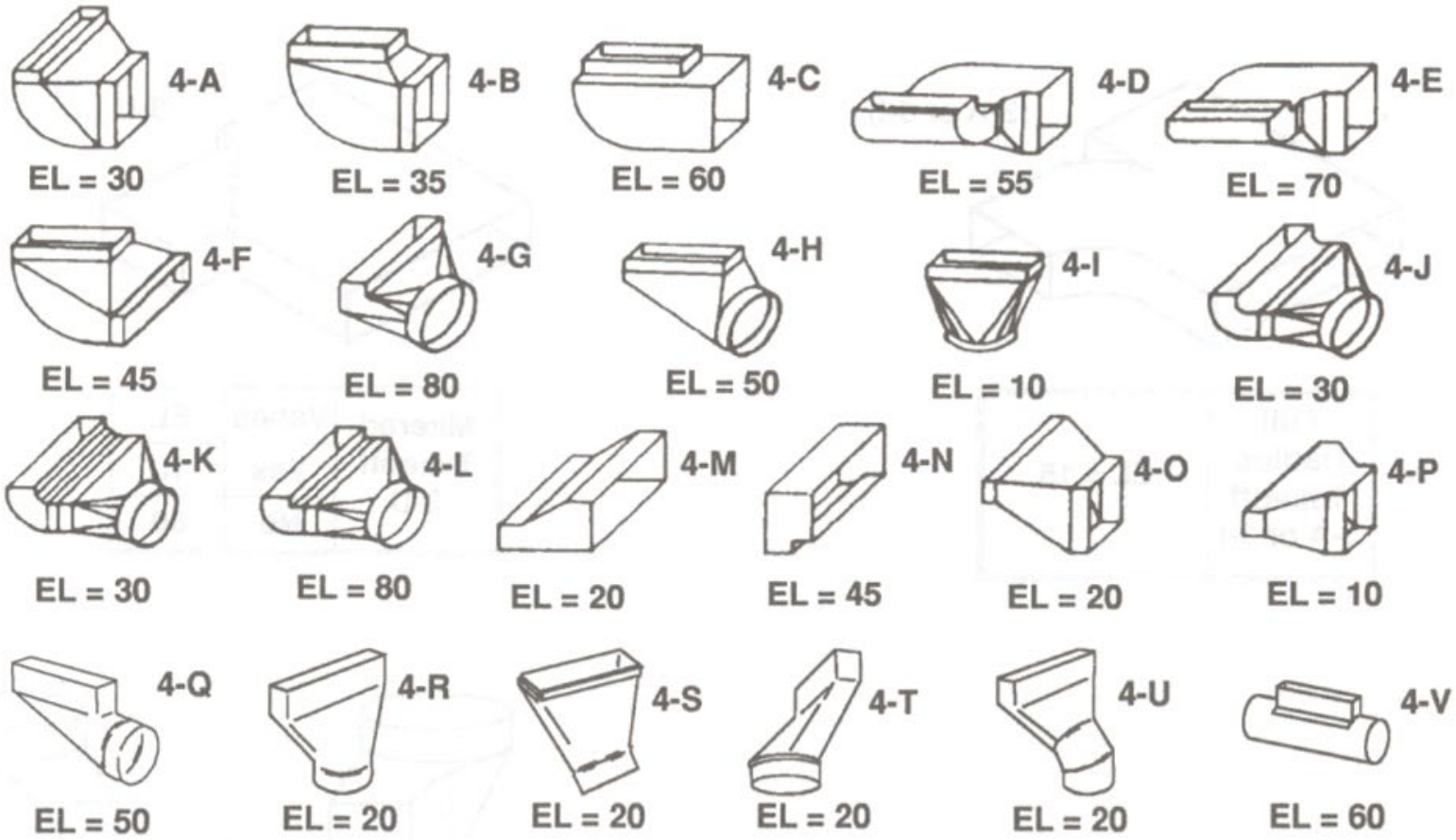
4 — 90° Ells

R/H	EL
Mitered (R=0)	250
0.25	100
0.50	20
1	20

Group 4
Supply Air Boot and Stack Head Fittings

Reference Velocity = 900 FPM

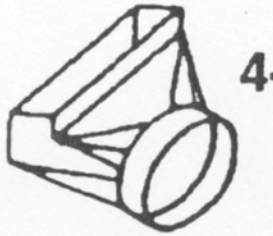
Reference Friction Rate = 0.08 In.Wg. per 100 Feet



Group 4
Supply Air Boot and Stack Head Fittings

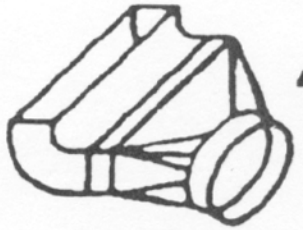
Reference Velocity = 900 FPM

Reference Friction Rate = 0.08 In.Wg. per 100 Feet



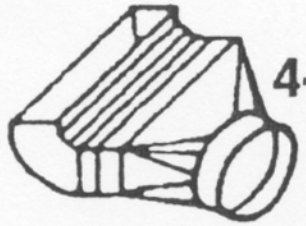
4-G

EL = 80



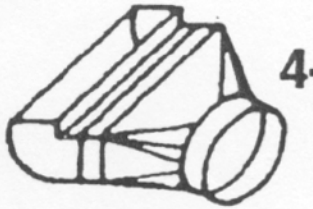
4-J

EL = 30



4-K

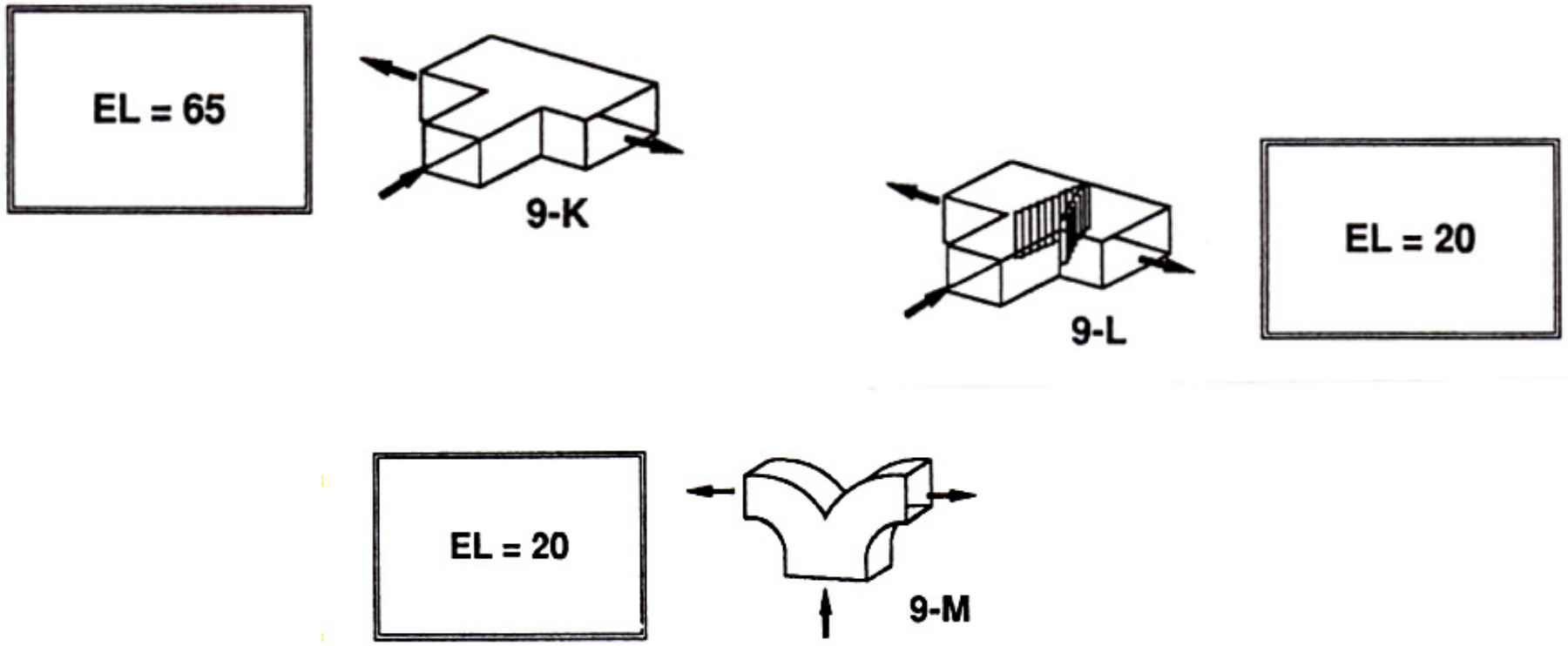
EL = 30



4-L

EL = 80

Note How the
Mitered Inside Corner
Increases the EL



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. Refer to Group 2 Branch Takeoff Fittings for information above the equivalent lengths that are associated with branch runouts.

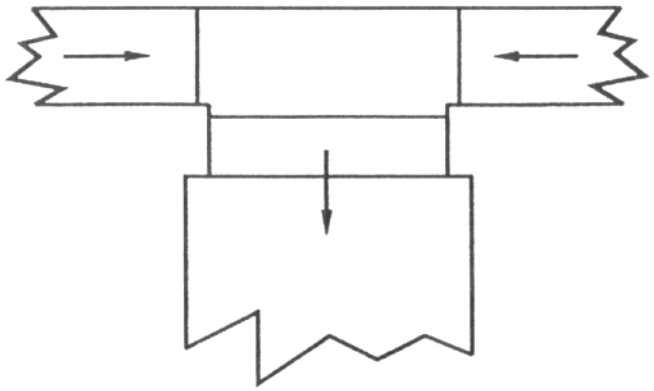
Group 5 — Continued
Return Air Fittings at the Air Handling Equipment

Reference Velocity = 700 FPM

Reference Friction Rate = 0.08 In.Wg. per 100 Feet

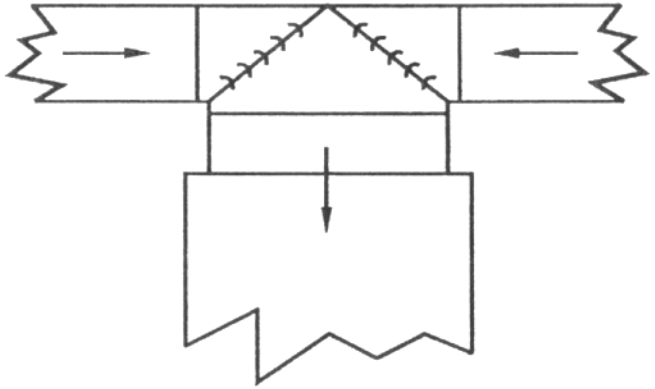
5-L

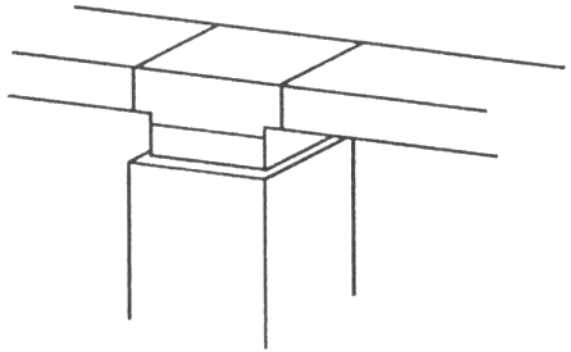
EL = 75



5-M

EL = 10





MANUAL “D” RECOMMENDED VELOCITIES

Recommended Velocities in FPM								
	Supply Ducts				Return Ducts			
	Recommended		Maximum		Recommended		Maximum	
	Rigid	Flex	Rigid	Flex	Rigid	Flex	Rigid	Flex
Main Plenum	700	600	900	700	600	600	700	700
Branch Ducts	600	600	900	700	400	400	700	700
Registers, Diffusers & Grills	Size for Throw		700		400		500	
Filter Grill (face velocity)	N/A				300		300	

The above velocities do not guaranty a quite system. Turbulence generated by un-insulated ductwork takeoffs, abrupt fittings and transitions as well as any object placed in the airstream can and will generate noise.

SUMMARY EQUIVALENT LENGTH

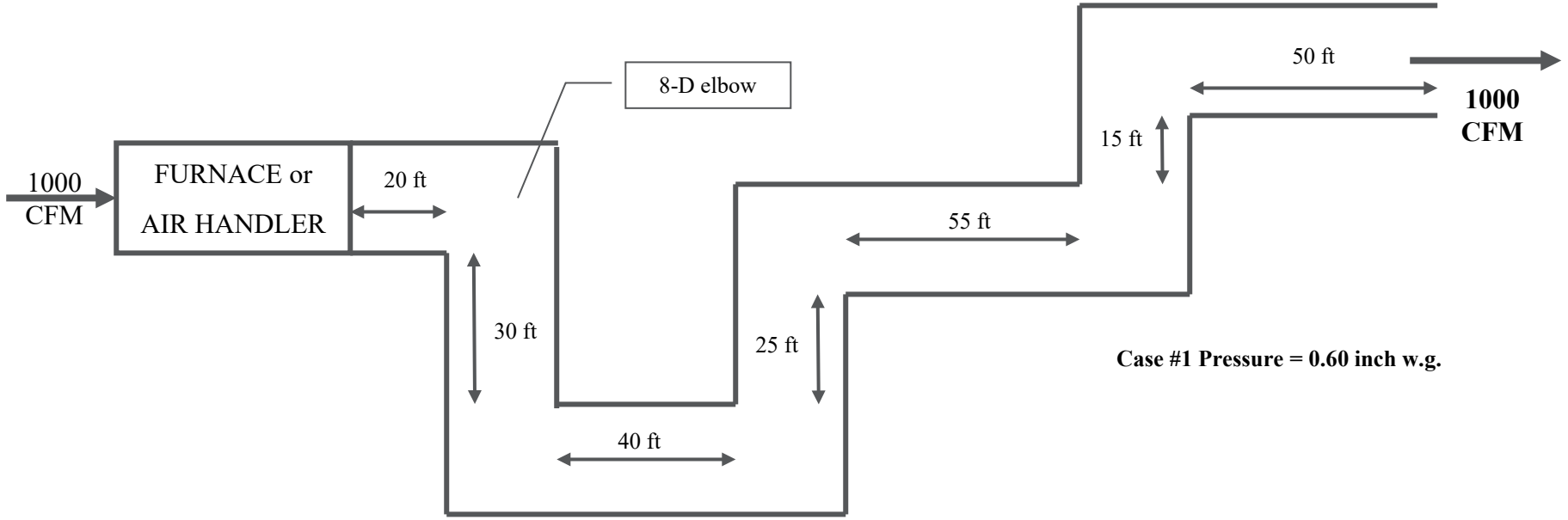
Manual “D” Equivalent Length should be the highest (safety factor) vs actual design with standard duct sizes

Can be adjusted for actual design once
- Friction / 100 ft
- Velocities are known

Provides a quick and simplified method to assure CFM delivery (with a safety factor) to account for actual installation vs design variances.

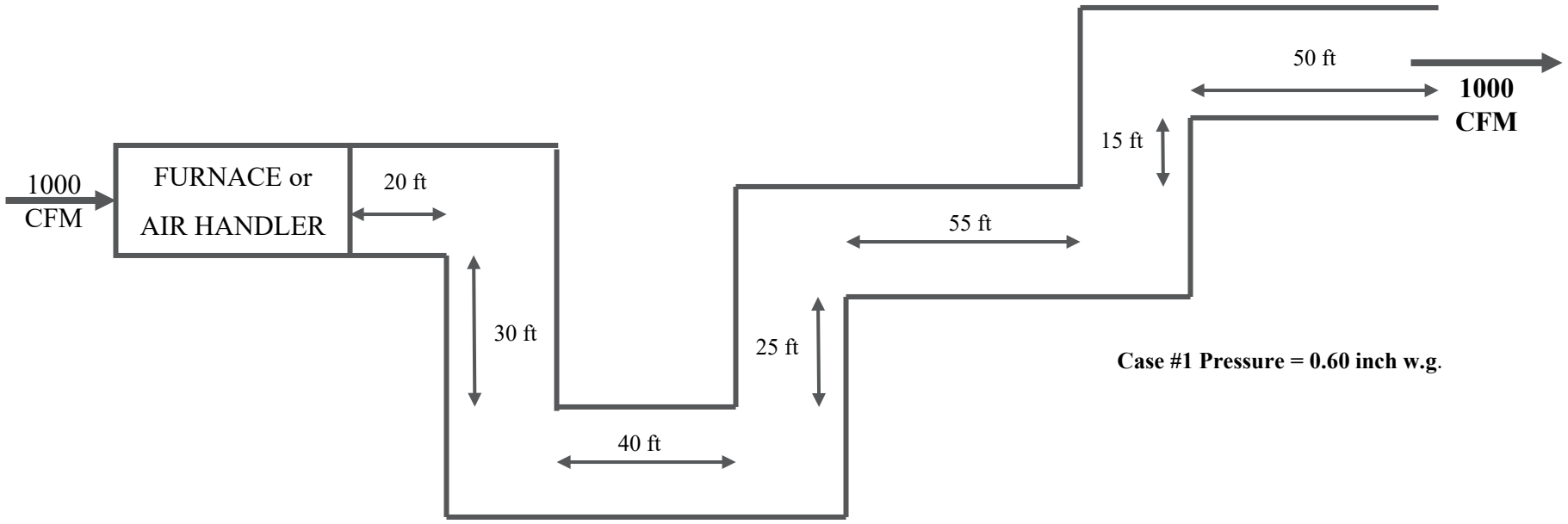
Requires use of balancing dampers to balance airflow in less restrictive runs.

EVALUATE YOUR DUCT SYSTEM

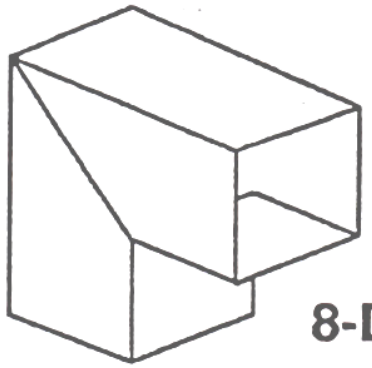
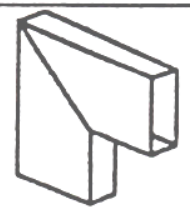
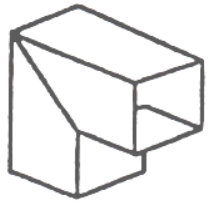
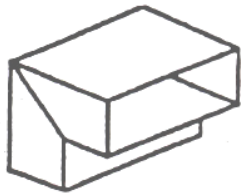


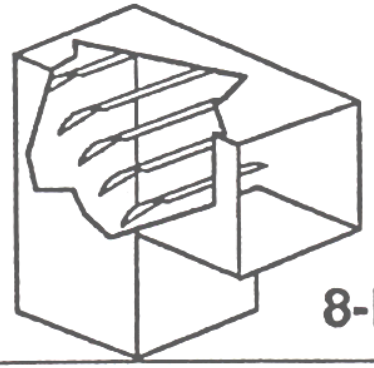
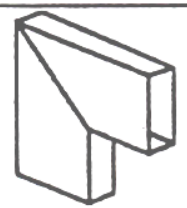
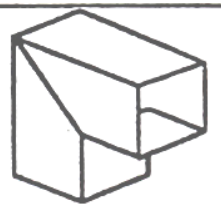
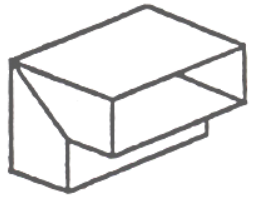
- Linear lengths = _____
- Elbow Equivalent Length = _____
- # Elbows (8-D H/W=1) = _____
- Total Equivalent Length of Elbows = _____
- Total Equivalent Length of Supply Duct = _____

EVALUATE YOUR DUCT SYSTEM

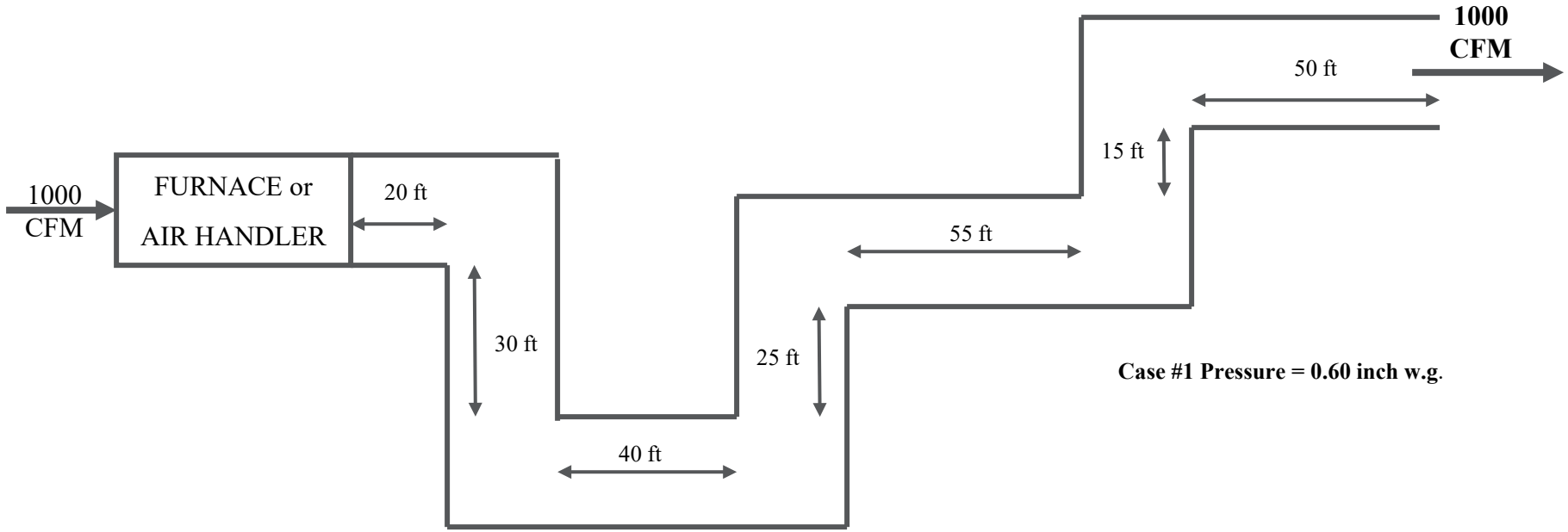


- Linear lengths = 20 + 30 + 40 + 25 + 55 + 15 + 50 = 235
- Elbow Equivalent Length = _____
- # Elbows (8-D H/W=1) = _____
- Total Equivalent Length of Elbows = _____
- Total Equivalent Length of Supply Duct = _____

 8-D No Vanes	Square Elbow EL Values		
			
	Hard Bend	H / W = 1	Easy Bend
	80	80	65

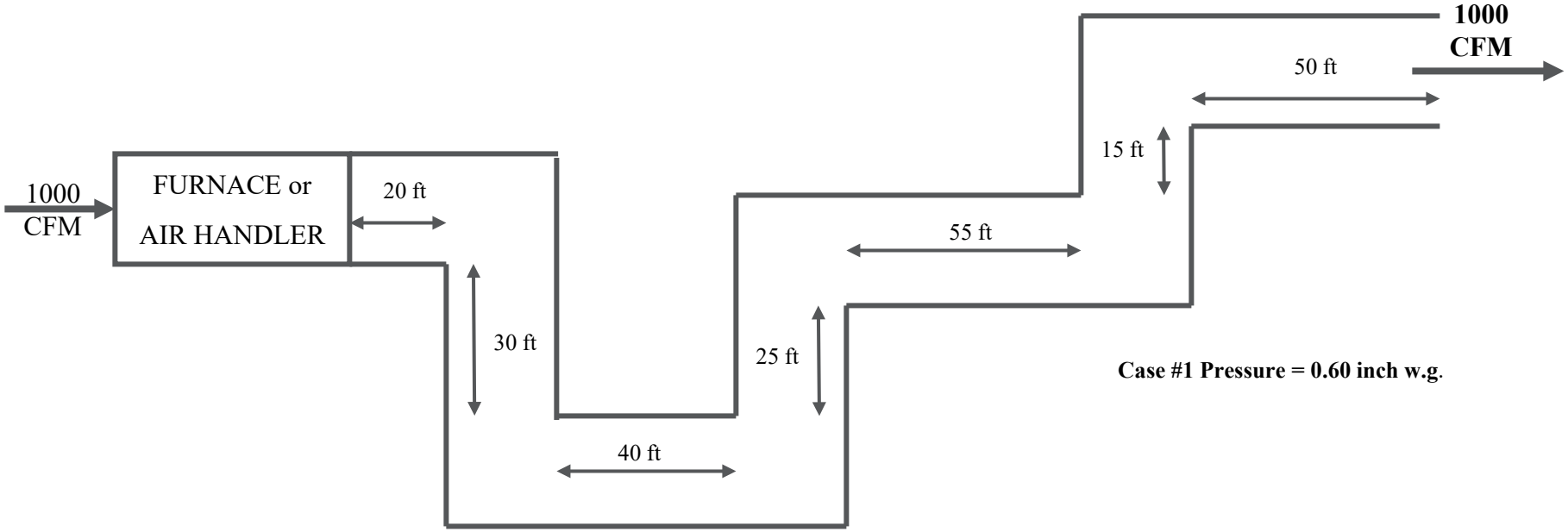
 8-E SingleThickness Turning Vanes	Square Elbow EL Values		
			
	Hard Bend	H / W = 1	Easy Bend
	10	10	10

EVALUATE YOUR DUCT SYSTEM



- Linear lengths = 20 + 30 + 40 + 25 + 55 + 15 + 50 = 235
- Elbow Equivalent Length = 80
- # Elbows (8-D H/W=1) = 6
- Total Equivalent Length of Elbows = _____
- Total Equivalent Length of Supply Duct = _____

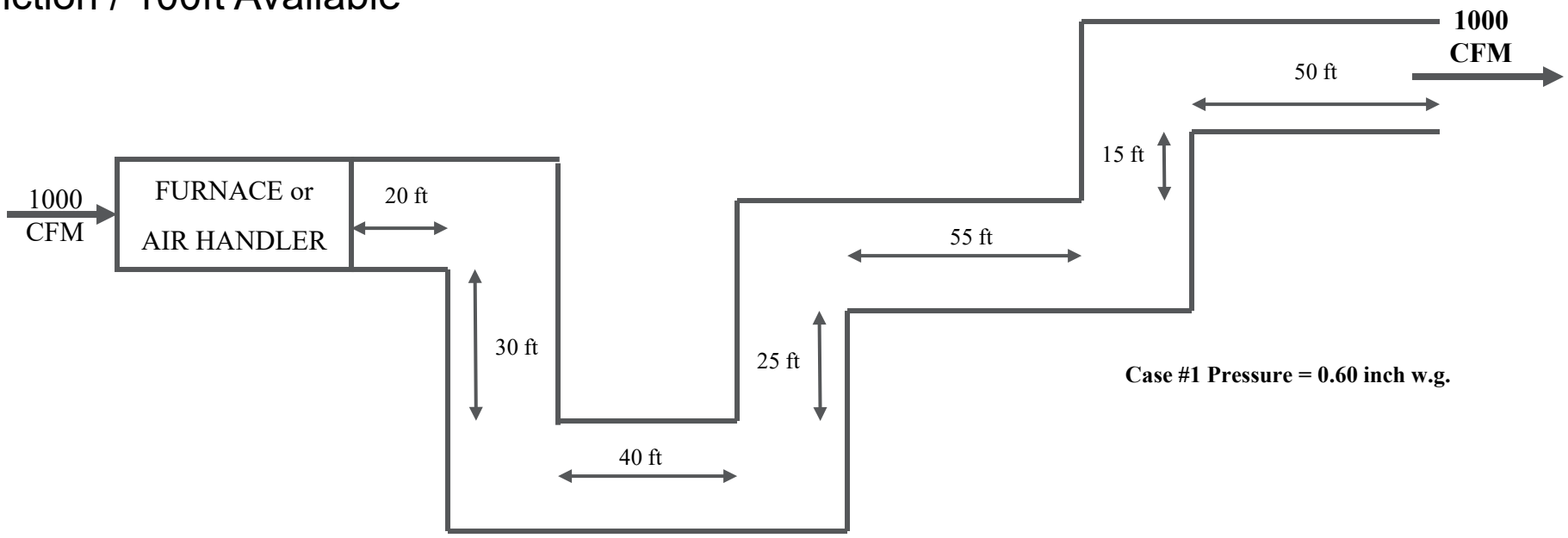
EVALUATE YOUR DUCT SYSTEM



- Linear lengths = 20 + 30 + 40 + 25 + 55 + 15 + 50 = 235
- Elbow Equivalent Length = 80
- # Elbows (8-D H/W=1) = 6
- Total Equivalent Length of Elbows = **480**
- Total Equivalent Length of Supply Duct = 235 + **480** = 715

DUCT CALCULATOR SETTING

1st Determine Friction / 100ft Available



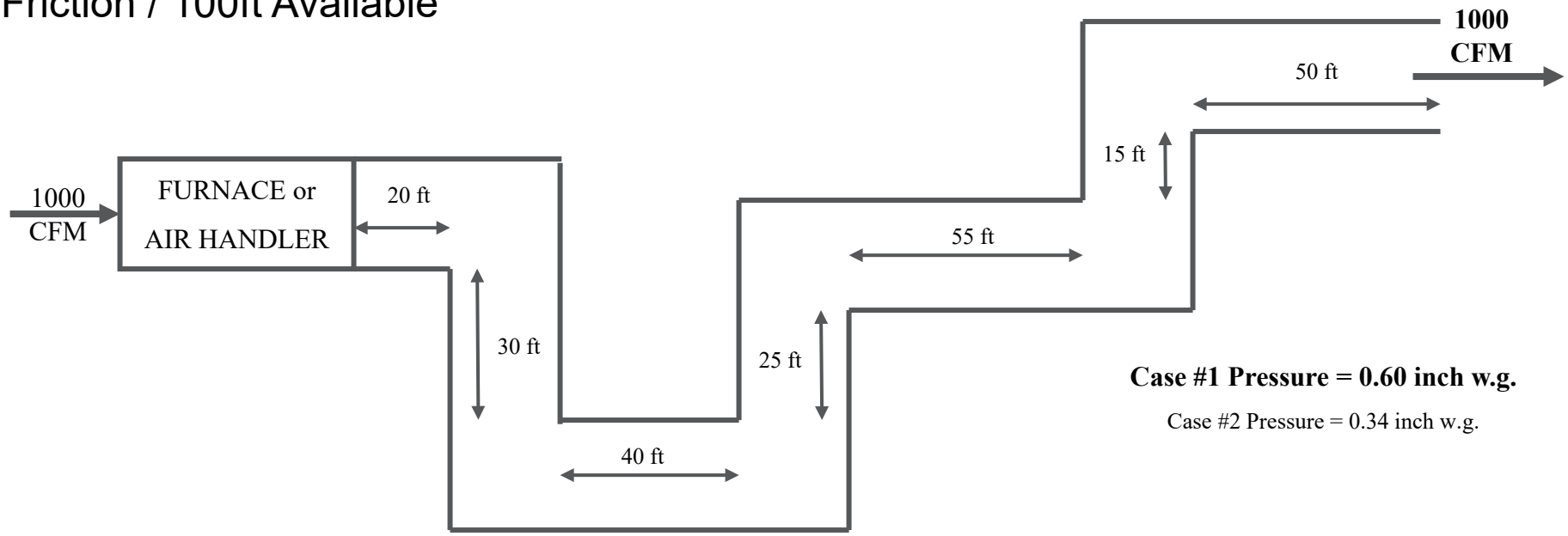
Total (Static) Pressure Available = _____

Total Equivalent Feet = _____

Friction / 100 Ft = _____

DUCT CALCULATOR SETTING

1st Determine Friction / 100ft Available



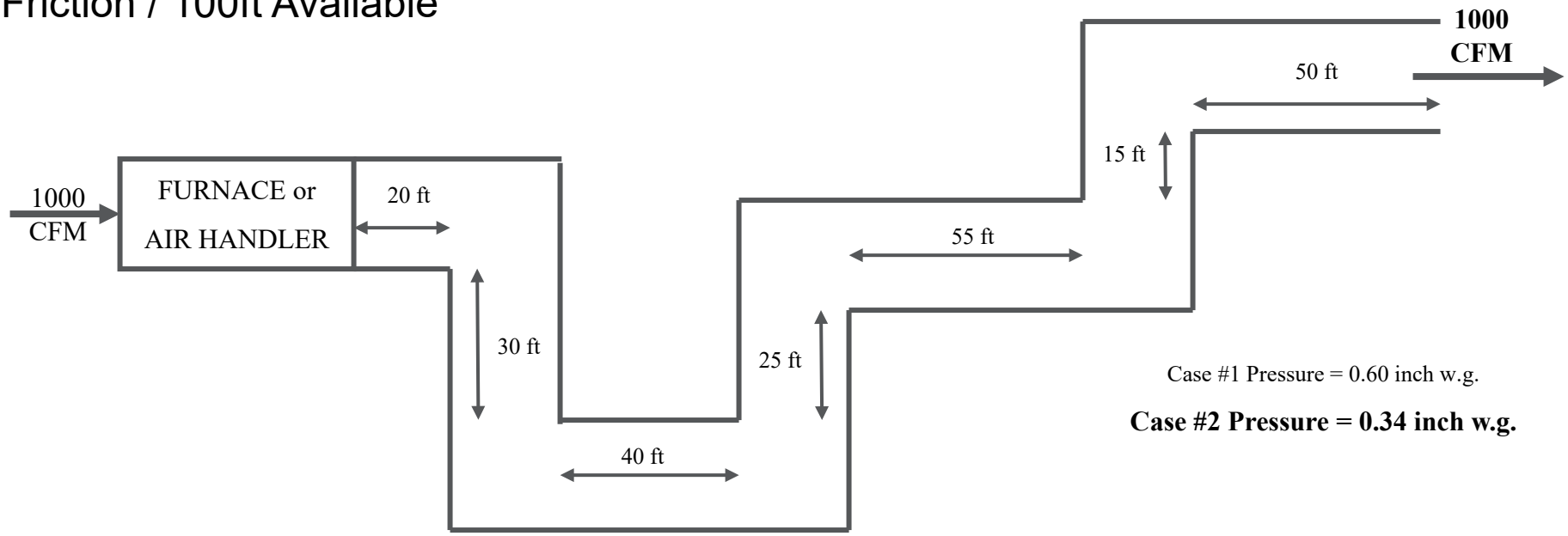
Total (Static) Pressure Available = **0.60”**

Total Equivalent Feet = **715**

Friction / 100 Ft = **0.60” / 715 ft x 100 = 0.08”**

DUCT CALCULATOR SETTING

1st Determine Friction / 100ft Available



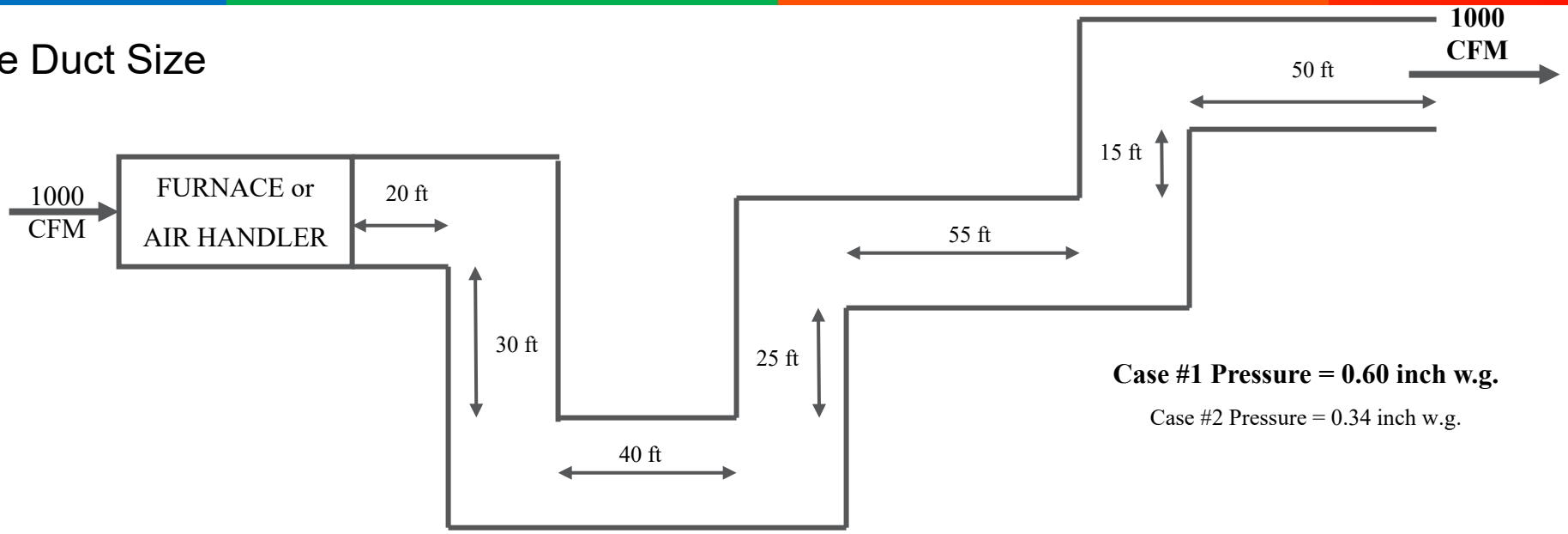
Total (Static) Pressure Available = **0.34”**

Total Equivalent Feet = **715**

Friction / 100 Ft = **0.34” / 715 ft x 100 = 0.04”**

DUCT CALCULATOR SETTING

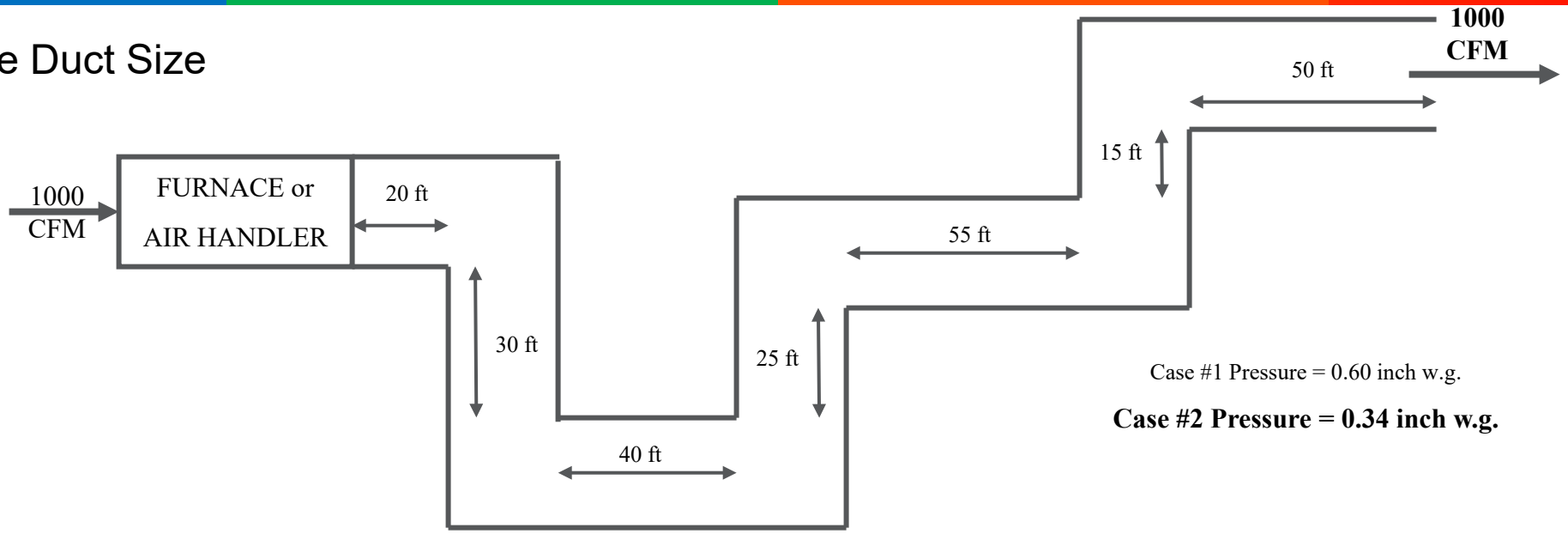
2nd Determine Duct Size



- **Friction / 100 Ft = 0.08”**
- **CFM = 1000**
- 1st) Set Friction/100 ft @ Desired CFM
- 2nd) Read Round or Rectangular Duct Size
- 3rd) Adjust Duct Size Up to Standard Size = 12X16

DUCT CALCULATOR SETTING

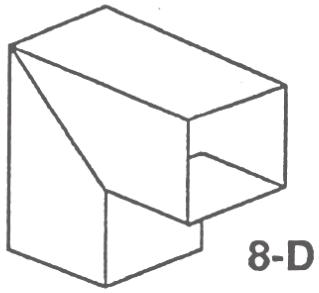
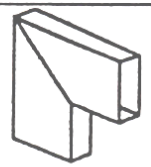
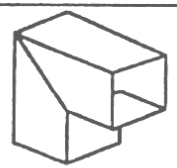
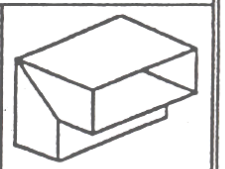
2nd Determine Duct Size

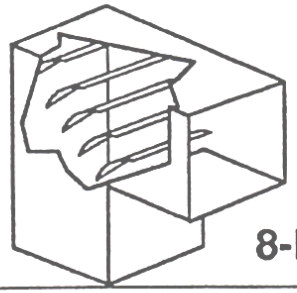
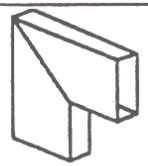
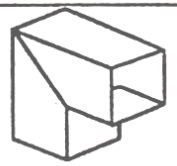
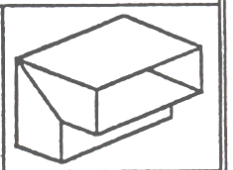


- **Friction / 100 Ft = 0.04”**
- **CFM = 1000**
- 1st) Set Friction/100 ft @ Desired CFM
- 2nd) Read Round or Rectangular Duct Size
- 3rd) Adjust Duct Size Up to Standard Size = 12X20

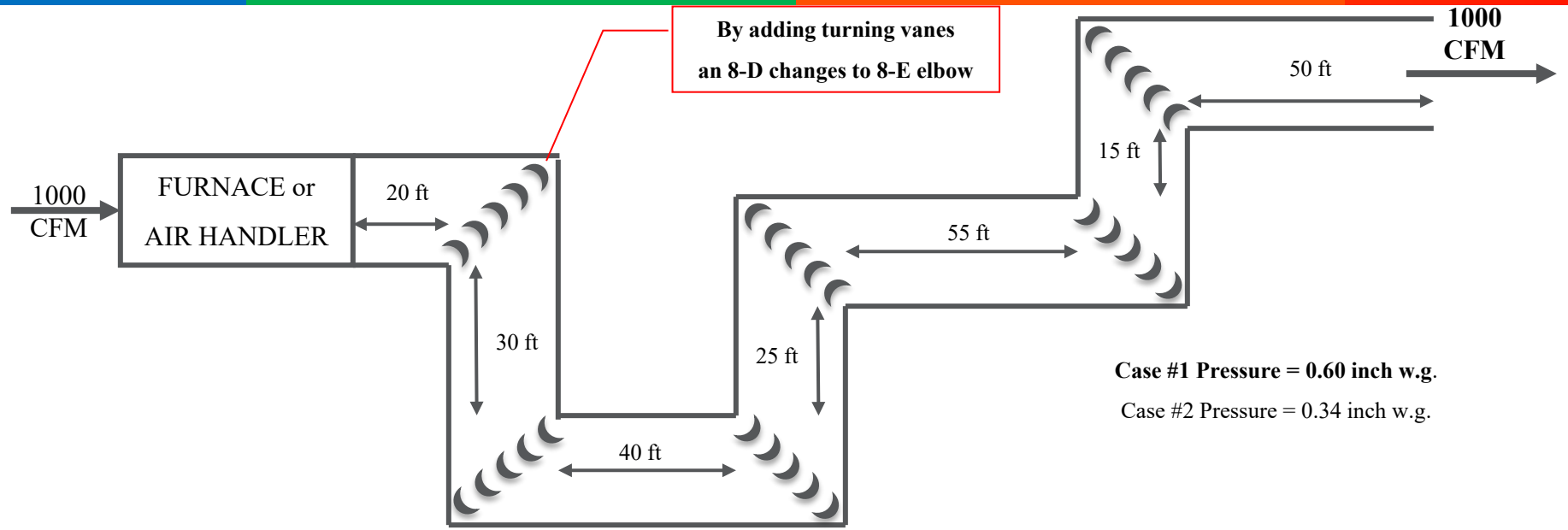
IMPROVE THE SITUATION

Only adding turning vanes to each elbow

 8-D No Vanes	Square Elbow EL Values		
			
	Hard Bend	H / W = 1	Easy Bend
	80	80	65

 8-E SingleThickness Turning Vanes	Square Elbow EL Values		
			
	Hard Bend	H / W = 1	Easy Bend
	10	10	10

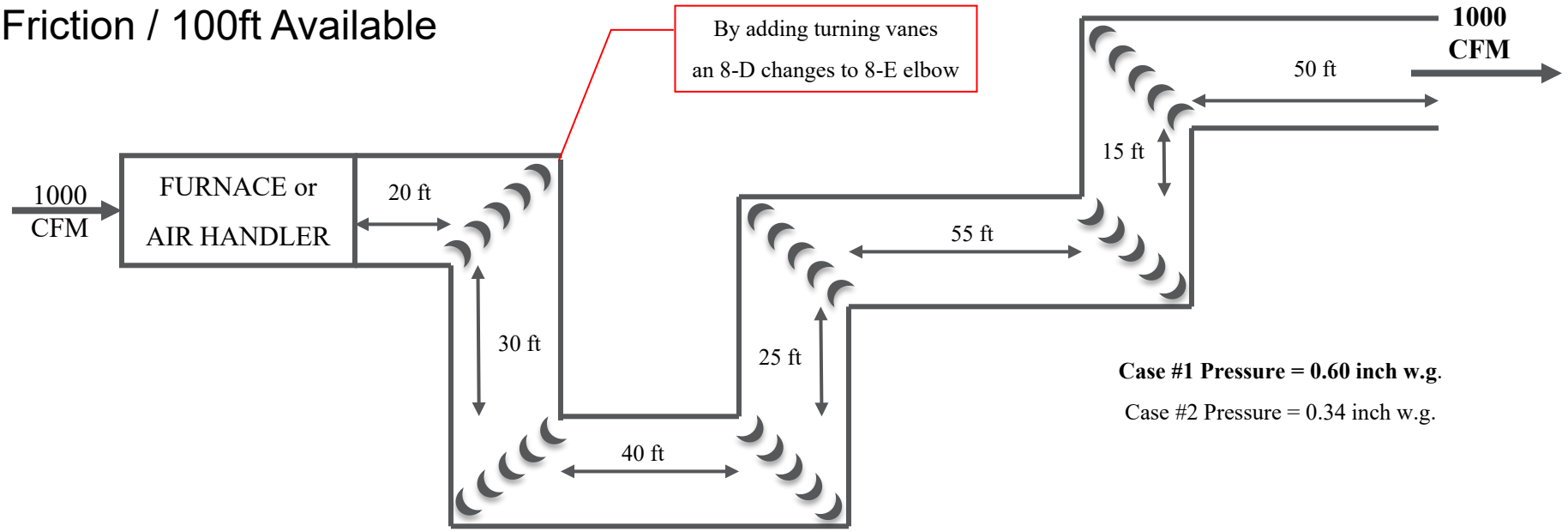
IMPROVE THE SITUATION



- Linear lengths = 20 + 30 + 40 + 25 + 55 + 15 + 50 = **235**
- Elbow Equivalent Length = add turning vanes **80 EL** changes to **10 EL**
- # Elbows (8-D goes to an 8-E H/W=1) = **6**
- Total Equivalent Length of Elbows = **480 EL goes to 60 EL**
- Total Equivalent Length of Supply Duct = **235 + 60** = Drops from **715 EL to 295 EL**

IMPROVE THE SITUATION

1st Determine Friction / 100ft Available



Total (Static) Pressure Available = **0.60”**

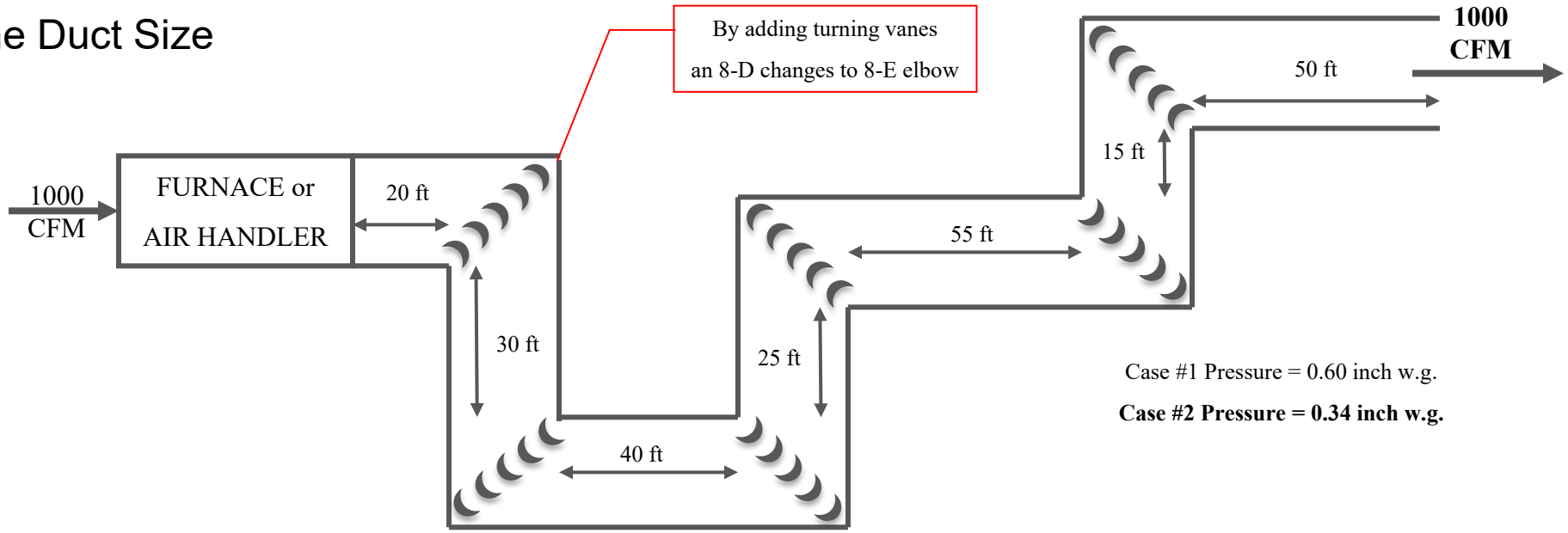
Total Equivalent Feet = **295**

Friction / 100 Ft = **0.60” / 295 ft x 100 = 0.20”**

NOTE: BY ADDING TURNING VANES, OUR AVAILABLE PRESSURE INCREASED BY 250%

DUCT CALCULATOR SETTING

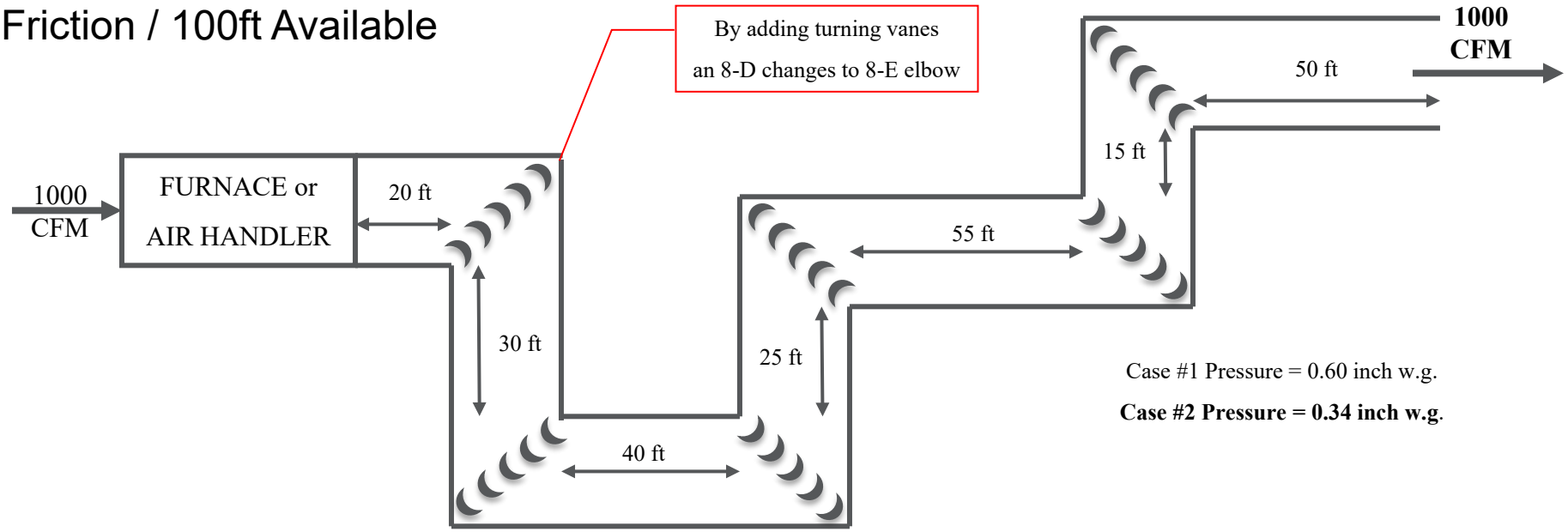
2nd Determine Duct Size



- **Friction / 100 Ft = 0.20”**
- **CFM = 1000**
- 1st) Set Friction/100 ft @ Desired CFM
- 2nd) Read Round or Rectangular Duct Size
- 3rd) Adjust Duct Size Up to Standard Size = 12X10

IMPROVE THE SITUATION

1st Determine Friction / 100ft Available



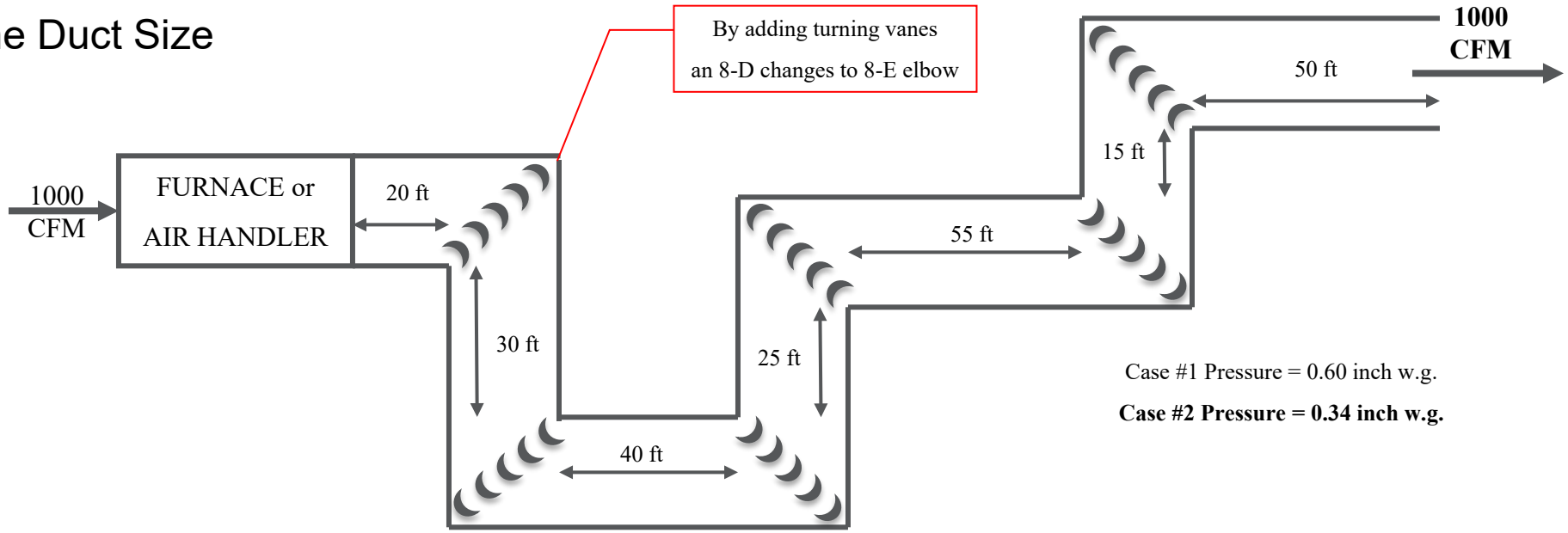
Total (Static) Pressure Available = **0.34”**

Total Equivalent Feet = **295**

Friction / 100 Ft = **0.34” / 295 ft x 100 = 0.11”**

DUCT CALCULATOR SETTING

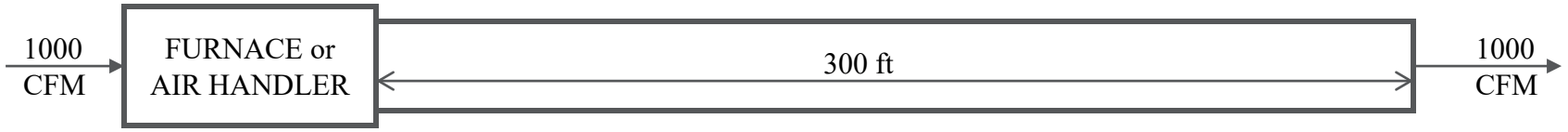
2nd Determine Duct Size



- **Friction / 100 Ft = 0.11”**
- **CFM = 1000**
- 1st) Set Friction/100 ft @ Desired CFM
- 2nd) Read Round or Rectangular Duct Size
- 3rd) Adjust Duct Size Up to Standard Size = 12X14

DUCT CALCULATOR SETTING

1st Determine Friction / 100ft Available



Case #1 Pressure = 0.50 inch w.g.

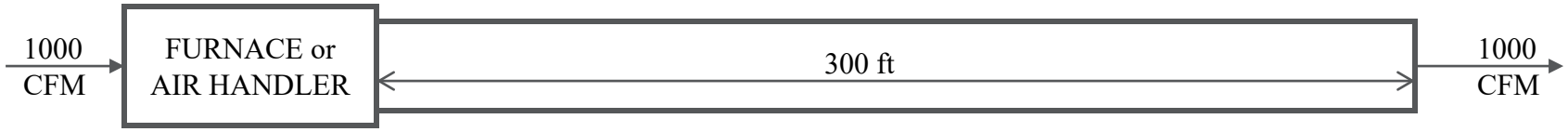
Case #2 Pressure = 0.38 inch w.g.

Case #3 Pressure = 0.24 inch w.g.

- Total (Static) Pressure Available = **0.50”**
- Total Equivalent Feet = **300ft**
- Friction / 100 Ft = **0.50” / 300 ft x 100 = 0.16”**

DUCT CALCULATOR SETTING

2nd Determine Duct Size

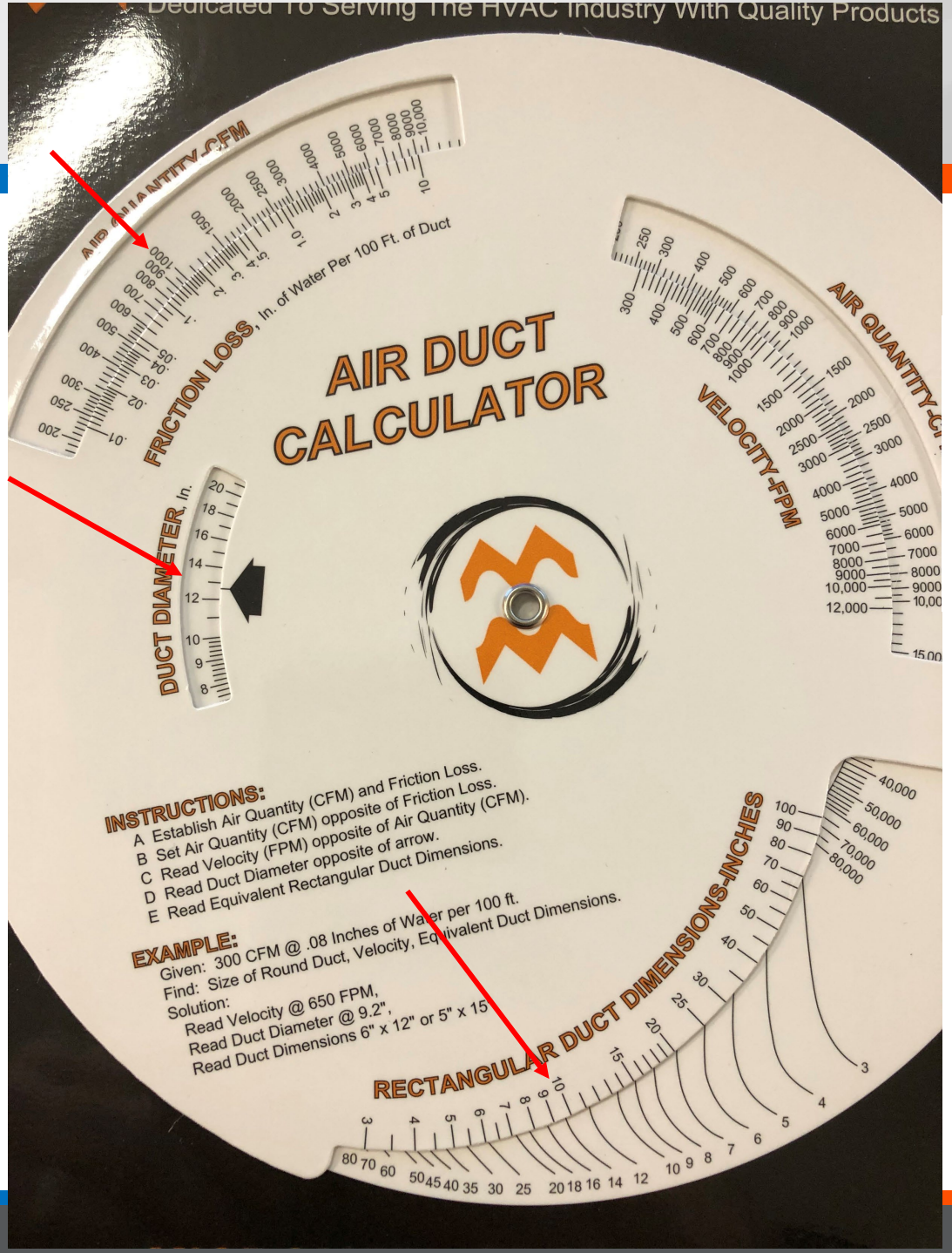


Case #1 Pressure = 0.50 inch w.g.

Case #2 Pressure = 0.38 inch w.g.

Case #3 Pressure = 0.24 inch w.g.

- Friction / 100 Ft = **0.16”**
- CFM = **1000**
- 1st) Set Friction/100 ft @ Desired CFM
- 2nd) Read Round or Rectangular Duct Size 12.6ϕ / 10 x 13.8
- 3rd) Adjust Duct Size Up to Standard Size 14ϕ / 10 x 14



1) Set 1,000 CFM across from 0.167 Friction Loss

2) Read required duct size to ideally match

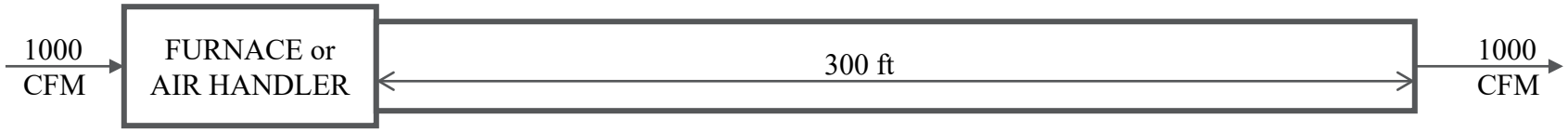
3)Round up to a nominal size!

12.6ϕ / 10 x 13.8

14ϕ / 10 x 14

DUCT CALCULATOR SETTING

1st Determine Friction / 100ft Available



Case #1 Pressure = 0.50 inch w.g.

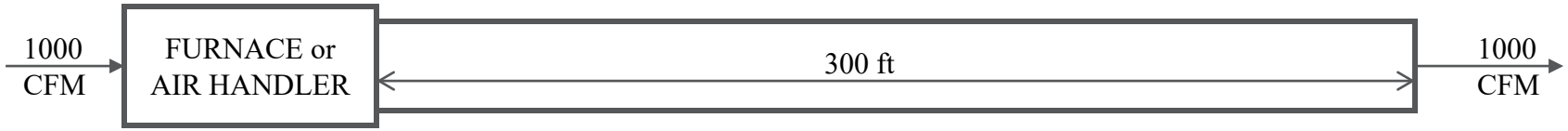
Case #2 Pressure = 0.38 inch w.g.

Case #3 Pressure = 0.24 inch w.g.

- Total (Static) Pressure Available = **0.38”**
- Total Equivalent Feet = **300ft**
- Friction / 100 Ft = **0.38” / 300 ft x 100 = 0.12”**

DUCT CALCULATOR SETTING

2nd Determine Duct Size

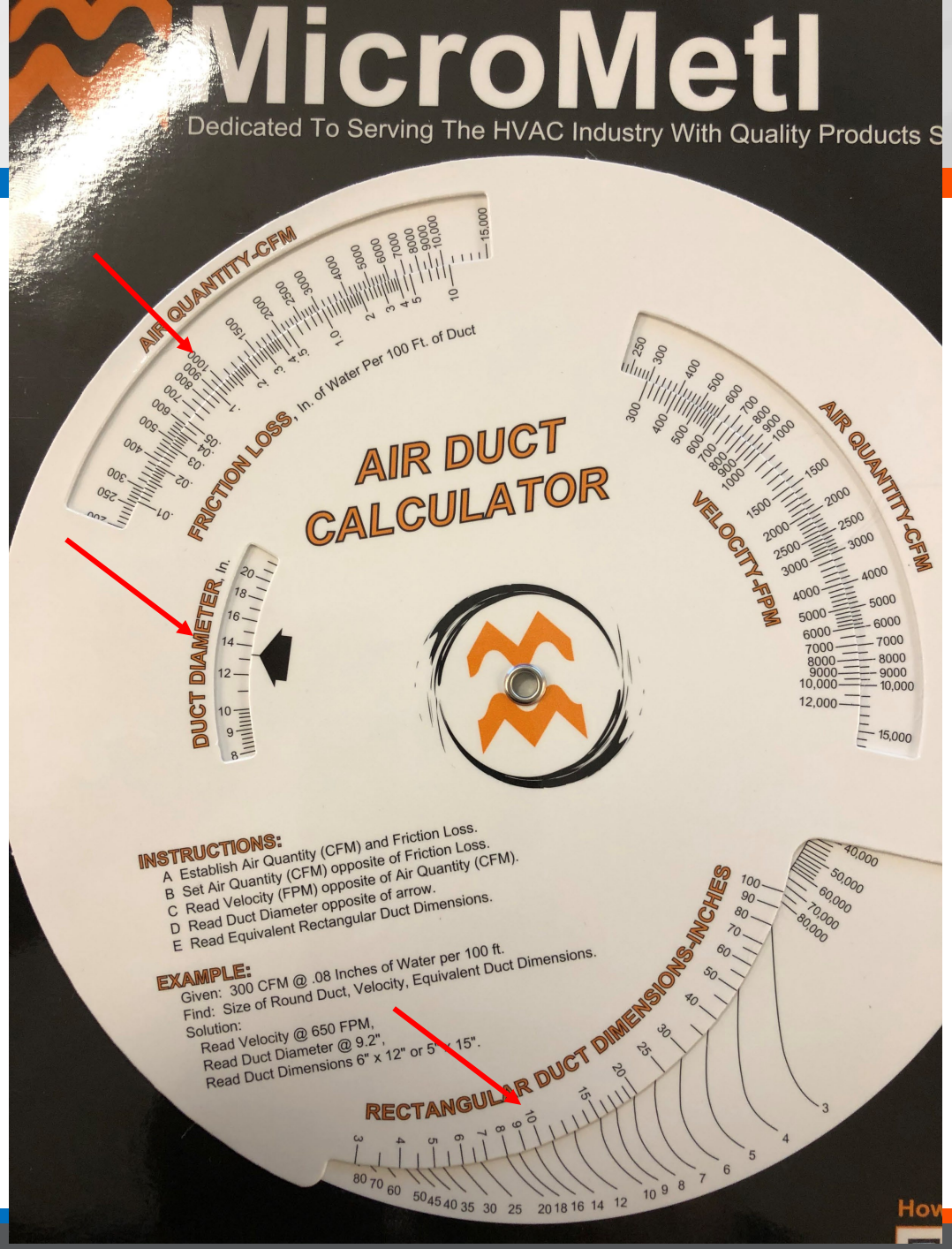


Case #1 Pressure = 0.50 inch w.g.

Case #2 Pressure = 0.38 inch w.g.

Case #3 Pressure = 0.24 inch w.g.

- Friction / 100 Ft = **0.12”**
- CFM = **1000**
- 1st) Set Friction/100 ft @ Desired CFM
- 2nd) Read Round or Rectangular Duct Size 13.2ϕ / 10 x 15.2
- 3rd) Adjust Duct Size Up to Standard Size 14ϕ / 10 x 16



1) Set 1,000 CFM across from 0.12 Friction Loss

2) Read required duct size to ideally match

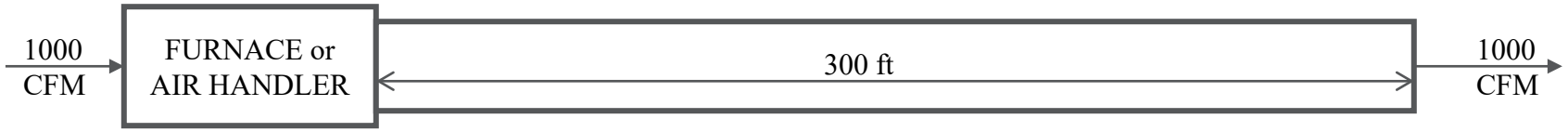
3)Round up to a nominal size!

13.2ϕ / 10 x 15.2

14ϕ / 10 x 16

DUCT CALCULATOR SETTING

1st Determine Friction / 100ft Available



Case #1 Pressure = 0.50 inch w.g.

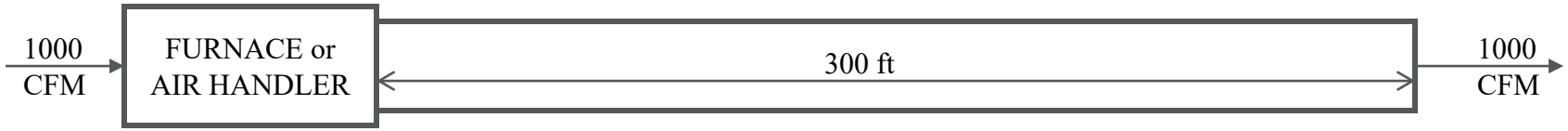
Case #2 Pressure = 0.38 inch w.g.

Case #3 Pressure = 0.24 inch w.g.

- Total (Static) Pressure Available = **0.24”**
- Total Equivalent Feet = **300ft**
- Friction / 100 Ft = **0.24” / 300 ft x 100 = 0.08”**

DUCT CALCULATOR SETTING

2nd Determine Duct Size

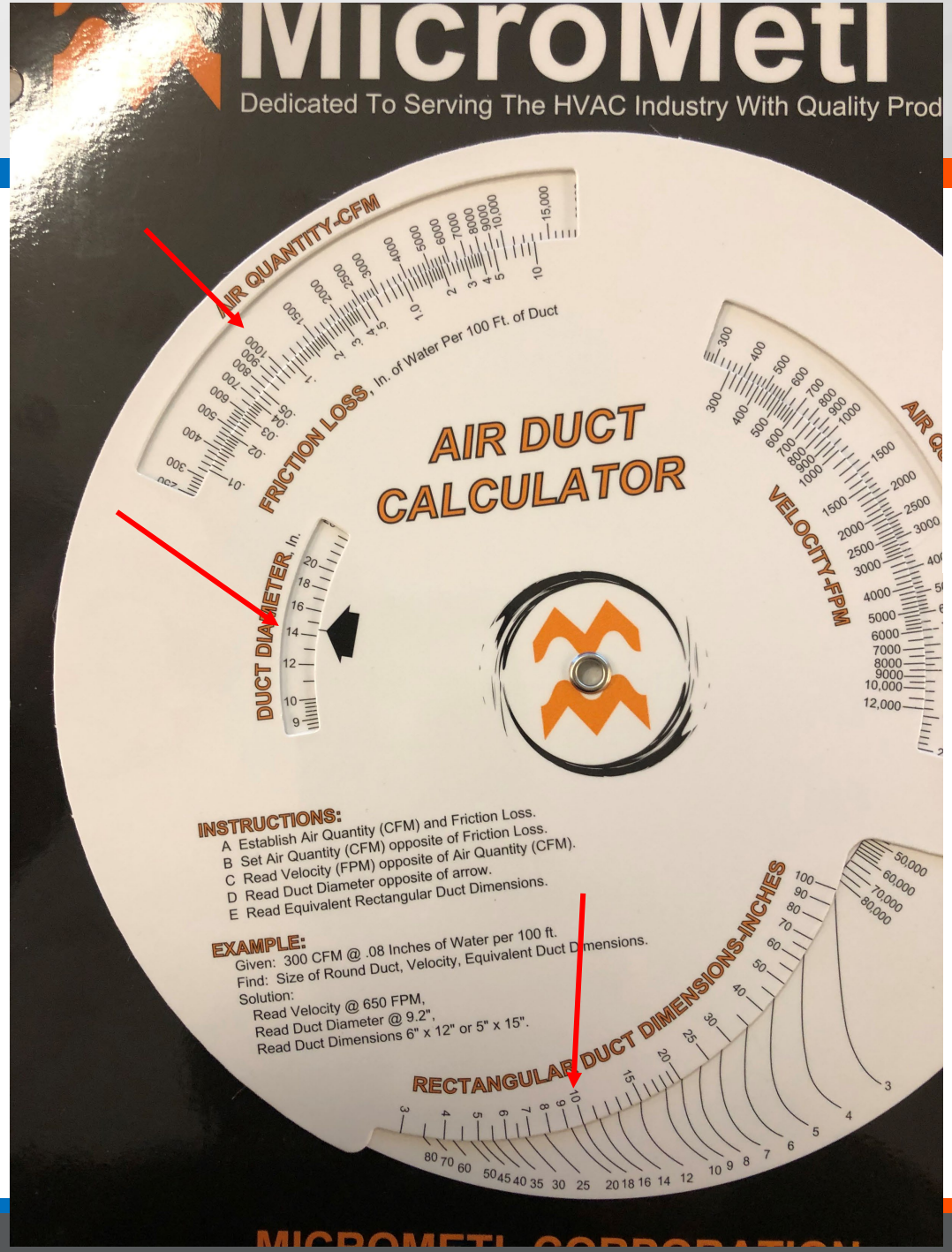


Case #1 Pressure = 0.50 inch w.g.

Case #2 Pressure = 0.38 inch w.g.

Case #3 Pressure = 0.24 inch w.g.

- Friction / 100 Ft = **0.08”**
- CFM = **1000**
- 1st) Set Friction/100 ft @ Desired CFM
- 2nd) Read Round or Rectangular Duct Size 14.4 ϕ / 10 x 18.3
- 3rd) Adjust Duct Size Up to Standard Size 16 ϕ / 10 x 20



1) Set 1,000 CFM across from 0.08 Friction Loss

2) Read required duct size to ideally match

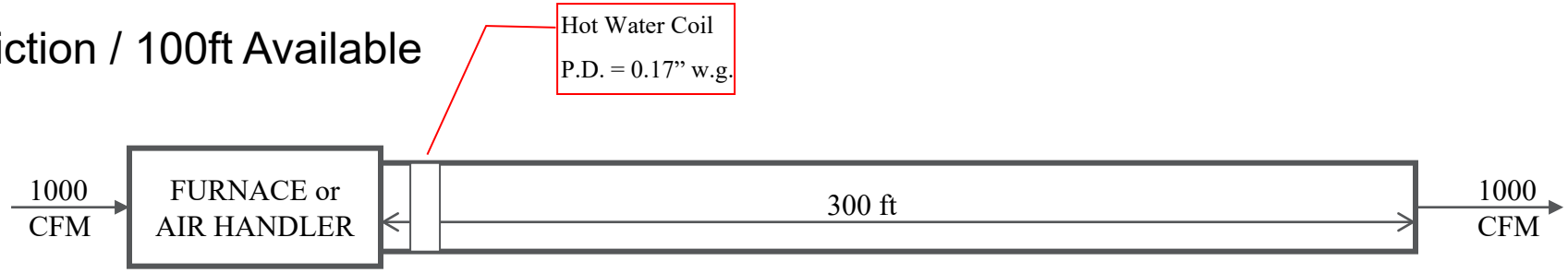
3)Round up to a nominal size!

14.4 ϕ / 10 x 18.3

16 ϕ / 10 x 20

DUCT CALCULATOR SETTING

1st Determine Friction / 100ft Available



Case #1 Pressure = 0.50 inch w.g.

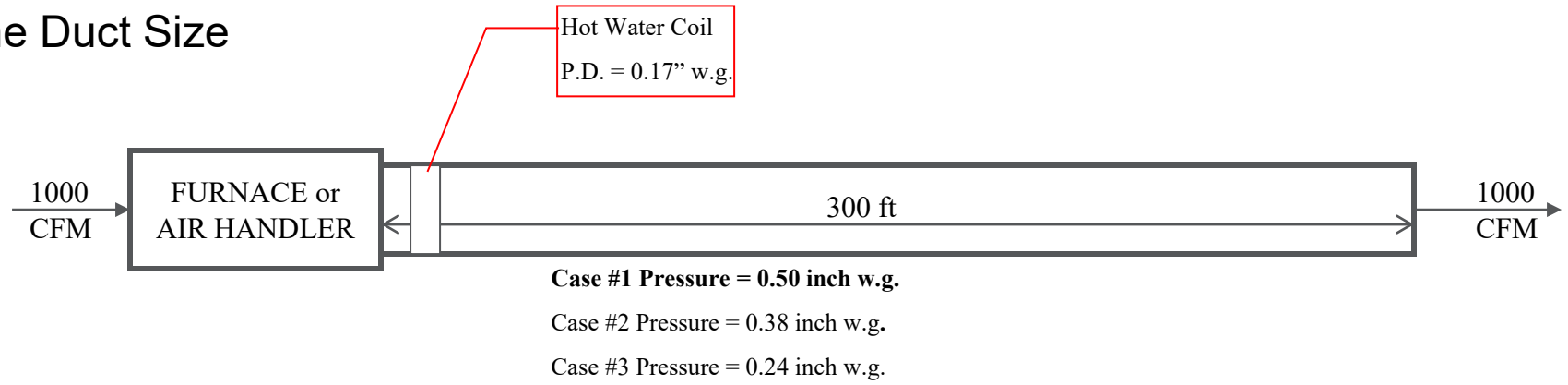
Case #2 Pressure = 0.38 inch w.g.

Case #3 Pressure = 0.24 inch w.g.

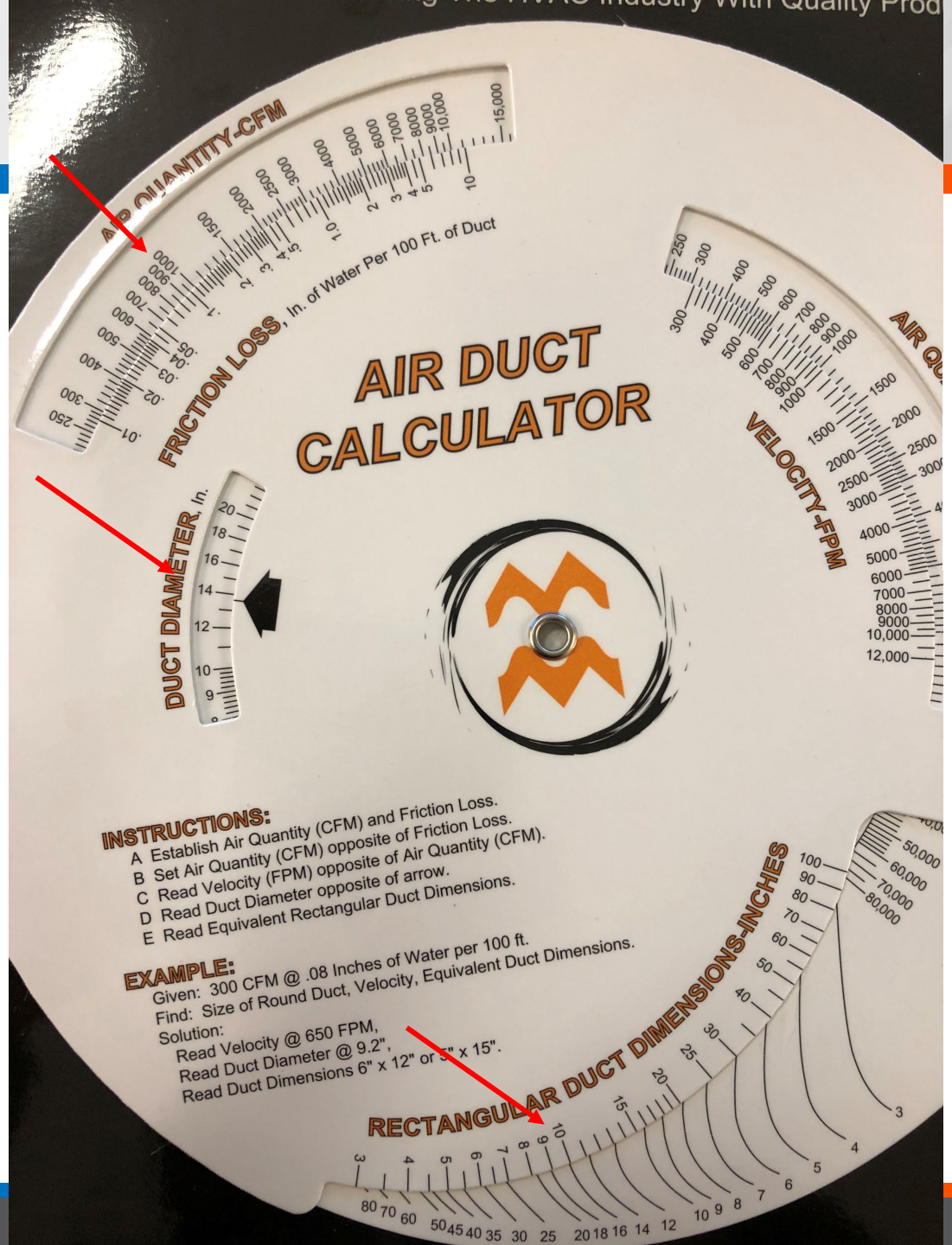
- Blower Static Available = **0.50"**
- less coil pressure drop = **0.17"**
- Available Static for Ductwork = **0.33"**
- Total Equivalent Feet = **300**
- Friction / 100 Ft = **0.33" / 300 ft x 100 = 0.11"**

DUCT CALCULATOR SETTING

2nd Determine Duct Size



- Friction / 100 Ft = **0.11"**
- CFM = **1000**
- 1st) Set Friction/100 ft @ Desired CFM
- 2nd) Read Round or Rectangular Duct Size 14 ϕ / 10 x 16
- 3rd) Adjust Duct Size Up to Standard Size



1) Set 1,000 CFM across from 0.11 Friction Loss

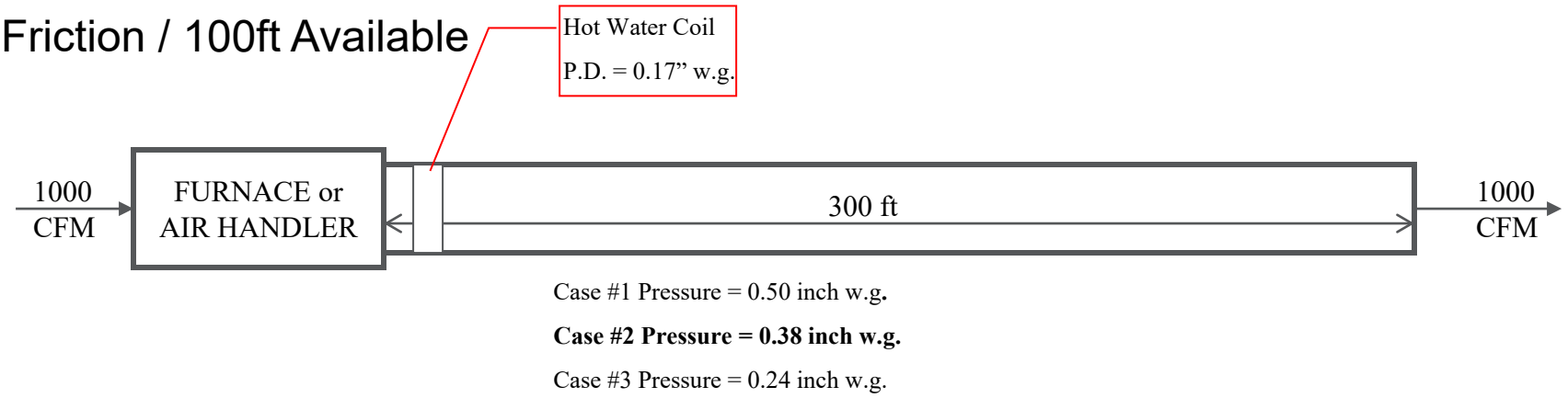
2) Read required duct size to ideally match

3)Round up to a nominal size!

14 ϕ / 10 x 16

DUCT CALCULATOR SETTING

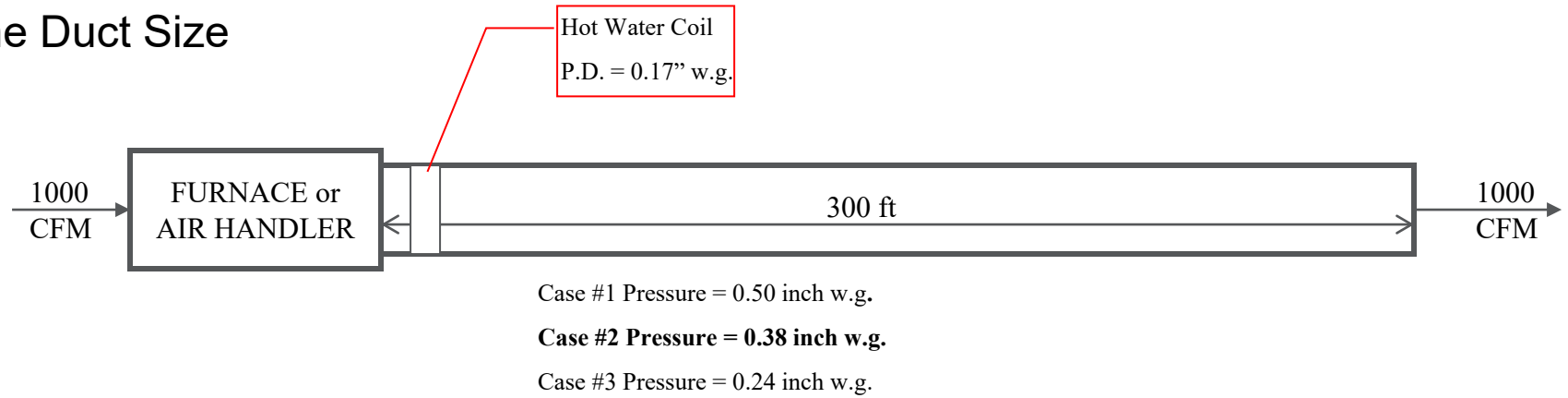
1st Determine Friction / 100ft Available



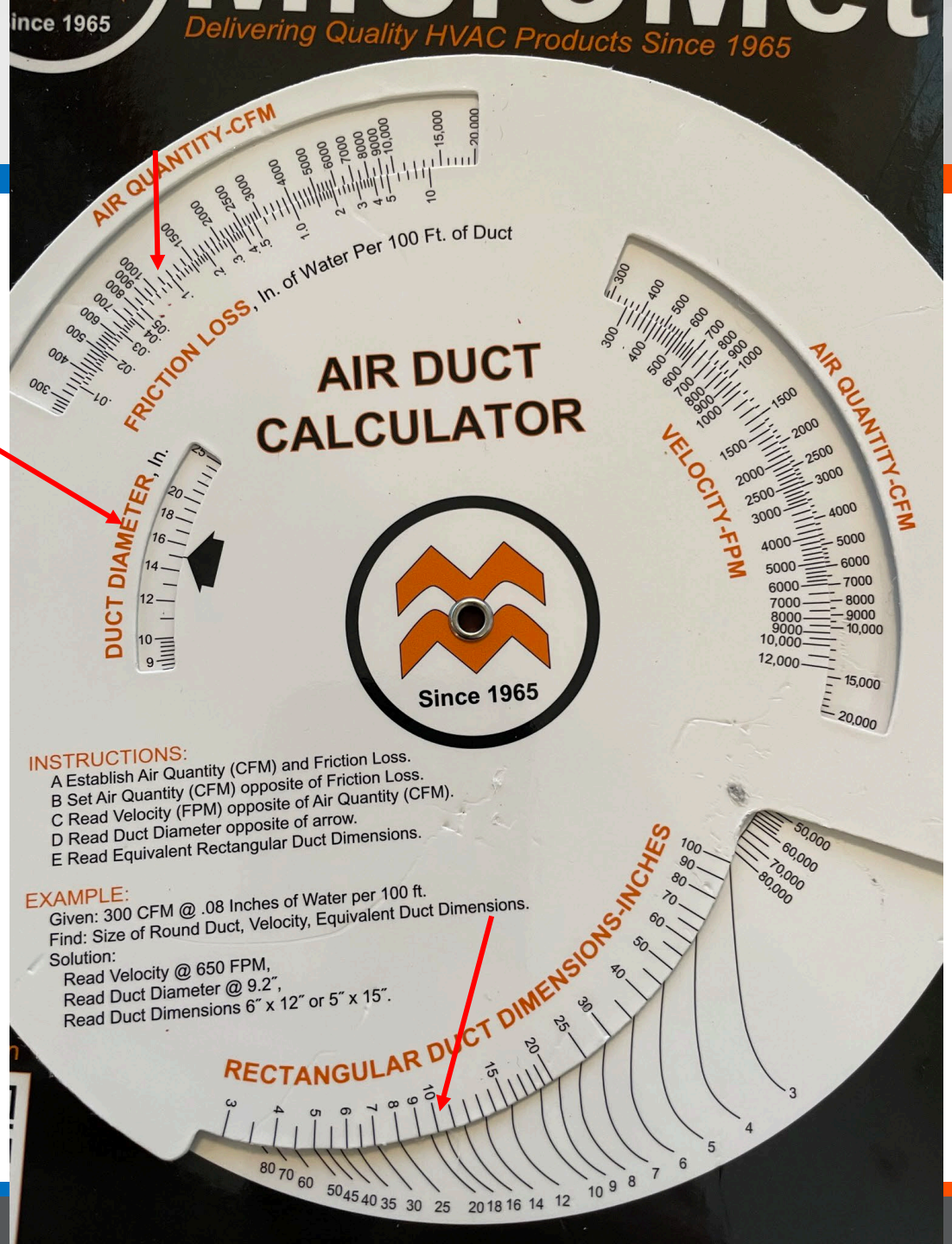
- Blower Static Available = **0.38"**
- less coil pressure drop = **-0.17"**
- Available Static for Ductwork = **0.21"**
- Total Equivalent Feet = **300**
- Friction / 100 Ft = **0.21" / 300 ft x 100 = 0.07"**

DUCT CALCULATOR SETTING

2nd Determine Duct Size



- Friction / 100 Ft = **0.07"**
- CFM = **1000**
- 1st) Set Friction/100 ft @ Desired CFM
- 2nd) Read Round or Rectangular Duct Size — 15 ϕ / 10 x 19
- 3rd) Adjust Duct Size Up to Standard Size — 16 ϕ / 10 x 20



1) Set 1,000 CFM across from 0.07 Friction Loss

2) Read required duct size to ideally match

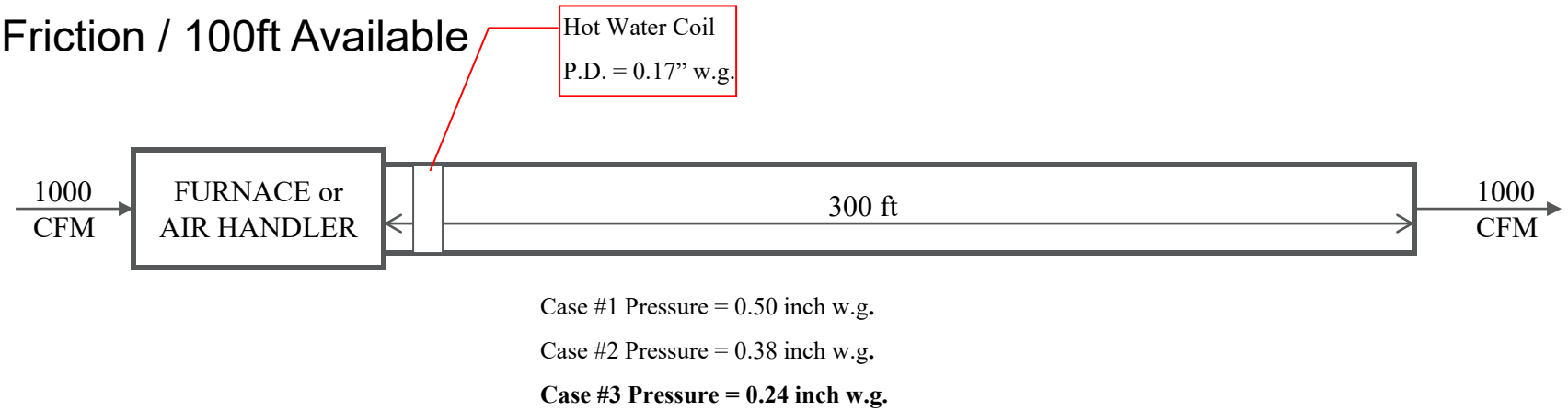
3)Round up to a nominal size!

15 ϕ / 10 x 19

16 ϕ / 10 x 20

DUCT CALCULATOR SETTING

1st Determine Friction / 100ft Available



Case #1 Pressure = 0.50 inch w.g.

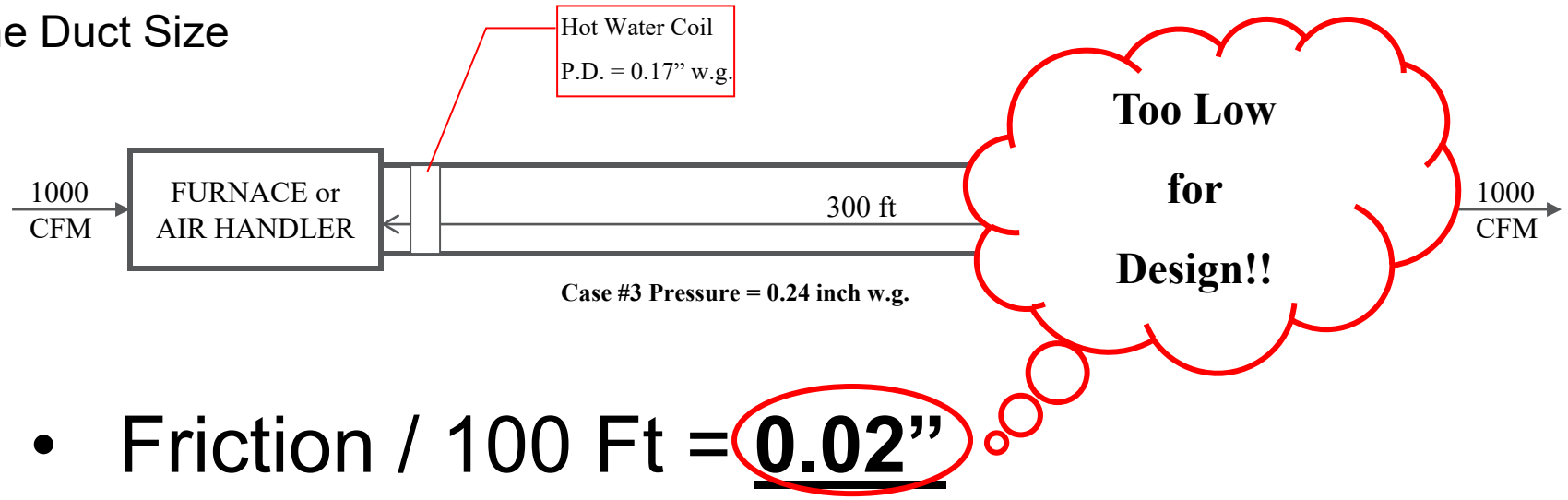
Case #2 Pressure = 0.38 inch w.g.

Case #3 Pressure = 0.24 inch w.g.

- Blower Static Available = **0.24"**
- less coil pressure drop = **-0.17"**
- Available Static for Ductwork = **0.07"**
- Total Equivalent Feet = **300**
- Friction / 100 Ft = **0.07" / 300 ft x 100 = 0.02"**

DUCT CALCULATOR SETTING

2nd Determine Duct Size



- Friction / 100 Ft = **0.02"**
- CFM = **1000**
- Manual "D" recommends that when the design static starts to go below **0.06"/100 ft**, that either the **blower speed be increased**, or the air mover be changed to an **air mover with a stronger blower**!

SOME KEY OBSERVATIONS

As available static changed

What Happen to the Duct Size?

As available static Increased, duct sizes went down

As available static Decreased, duct sizes increased

Adding Components/Accessories

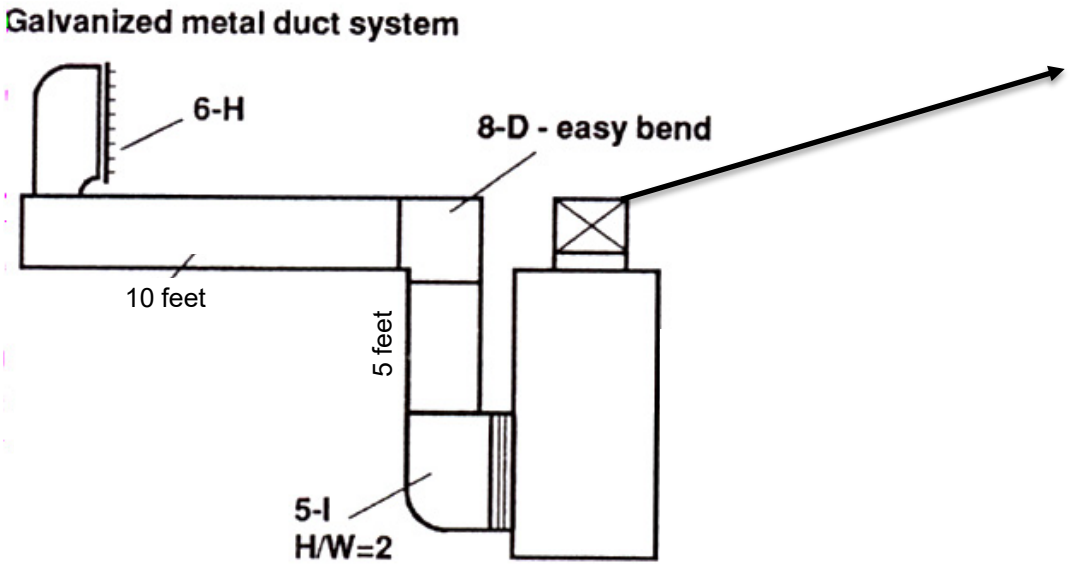
Reduces Available Static and

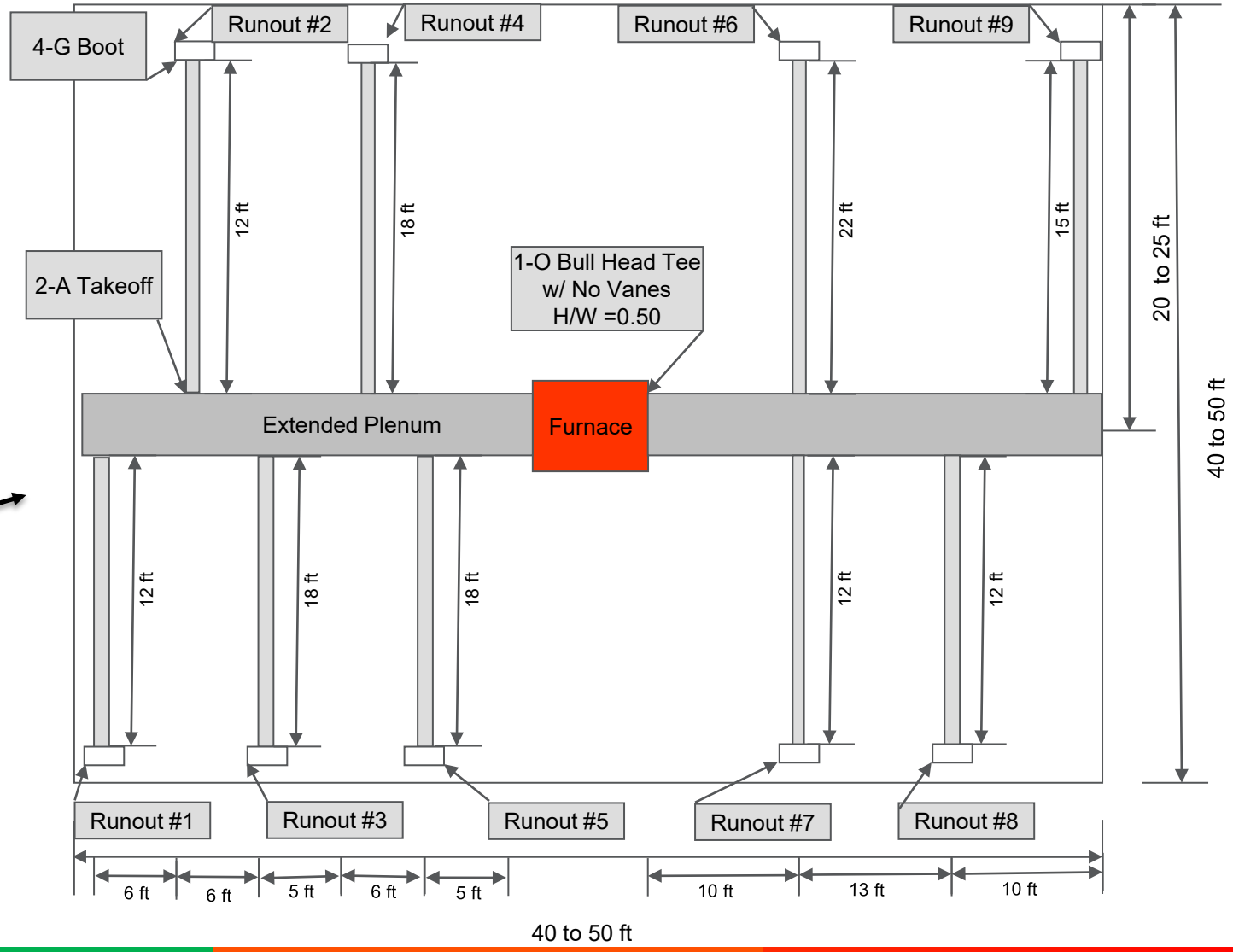
Requires Larger Ducts ($$$)

HOW DO WE USE THIS DURING A SERVICE CALL

While on a service call or PM draw a sketch of the duct system to help you determine the existing EL.

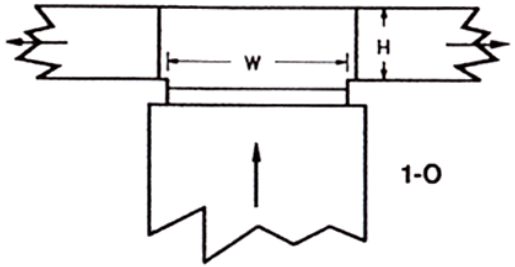
You do not have to get fancy this is for you



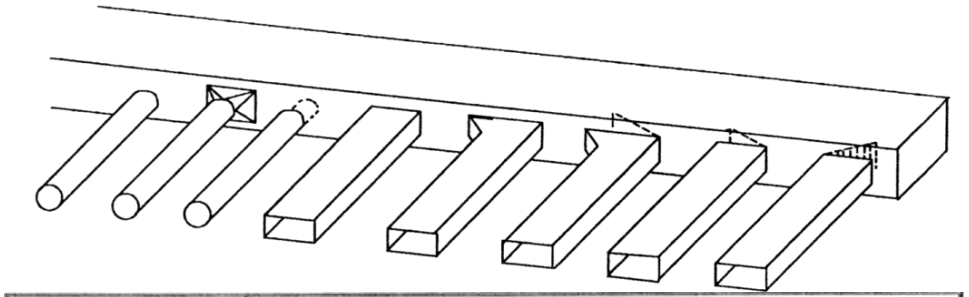


GO TO MANUAL D AND GET EL'S FOR FITTINGS

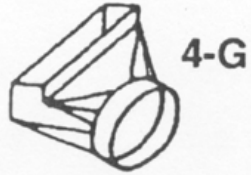
Supply fittings



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

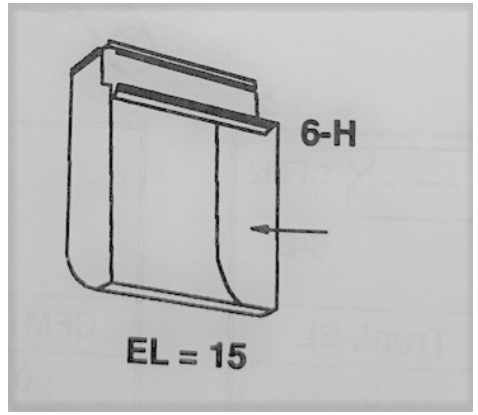


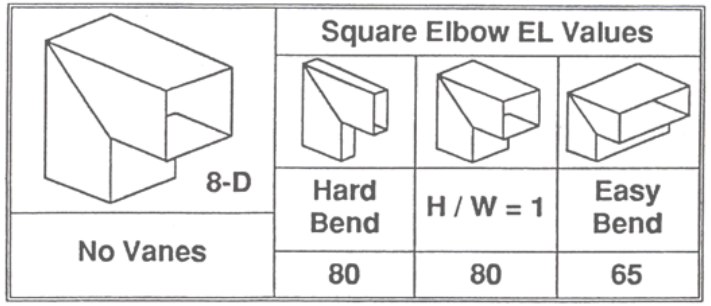
EL Values		Number of Down Stream Branches to End of Trunk Duct or Number of Down Stream Branches to a Trunk Reducer					
Fitting		0	1	2	3	4	5 or More
	2-A	35	45	55	65	70	80

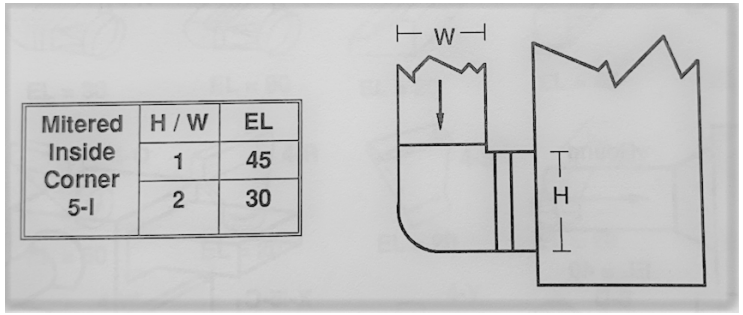


EL = 80

Return fittings







MAKE YOUR NOTES & START THE MATH

Now you do not need to run the numbers on all the supplies, pick the closest 2 and the furthest 2.

Actual and Equivalent Length (EL) Takeoff Summary Sheet									
	Supply Duct Runs					Return Duct Runs			
	# 1	# 5	# 6	# 9		# R-1	#	#	#
Straight Length(A)	28’	5’	10’	33’	Straight Length(A)	5’			
Straight Length(A)	12’	18’	22’	15’	Straight Length(A)	10’			
Group(B) 1-O	120’	120’	120’	120’	Group(B) 6-H	15’			
Group(B) 2-A	35’	70’	65’	35’	Group(B) 8-D	65’			
Group(B) 4-G	80’	80’	80’	80’	Group(B) 5-I	30’			
Group(B)					Group(B)				
Totals	**275’**	**293’**	**297’**	**283’**	**Totals**	**125’**			

A) **Enter the length of the Trunk & Branch runouts.**

B) **Enter “Fitting Group Number” from 1 to 13 from Manual “D” Appendix 3 and EL.**

Now take the longest of your supply runs and the return and add them together for total system EL

297’ + 125’ = 422’ EL duct system

AVAILABLE STATIC TO MOVE AIR

- Available Static @ Furnace = **0.50”**
- Pressure Drops

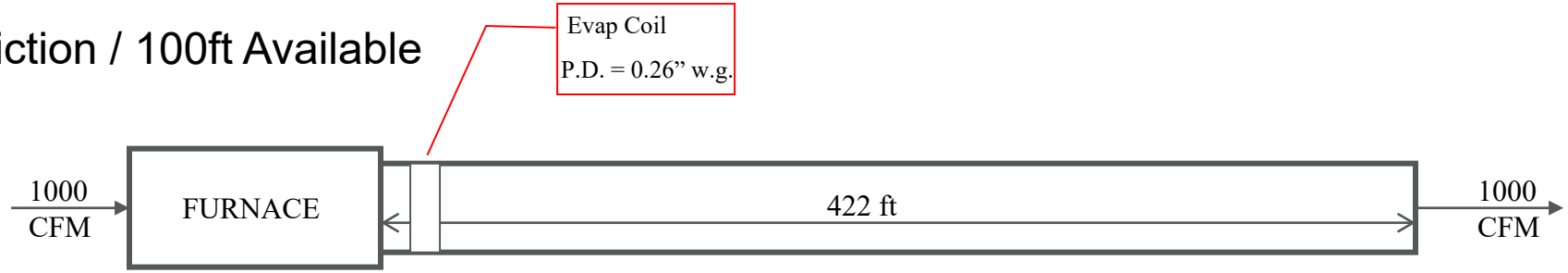
Cooling Coil	0.26”
Supply Grill	0.03”
Return Grill	0.03”
Damper (Balancing)	0.03”
High Eff Filter	NONE
Totals =	**0.35” =>** **-0.35”**

Available To Deliver Air and Design Ductwork = .15”

Remember the job we changed from a 14” coil to a 17” coil and we thought that fixed our issue?

DUCT CALCULATOR SETTING

1st Determine Friction / 100ft Available



Case #1 Pressure = 0.50 inch w.g.

Remember the job we changed from a 14" coil to a 17" coil and we thought that fixed our issue?

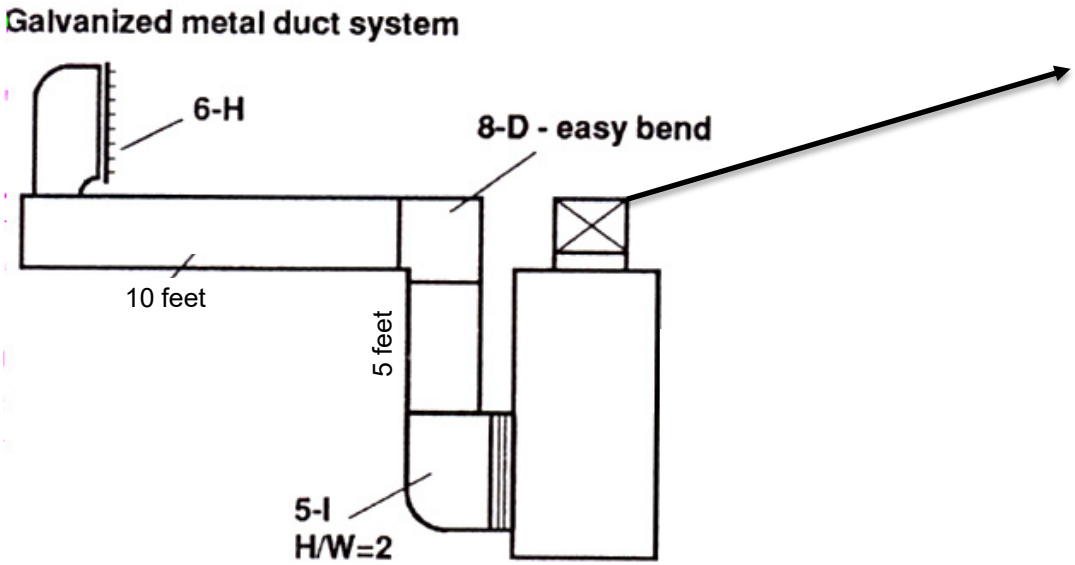
- Blower Static Available = **0.50"**
- less pressure drops = **-0.35"**
- Available Static for Ductwork = **0.15"**
- Total Equivalent Feet = **422**
- Friction / 100 Ft = **0.15" / 422 ft x 100 = 0.04"**

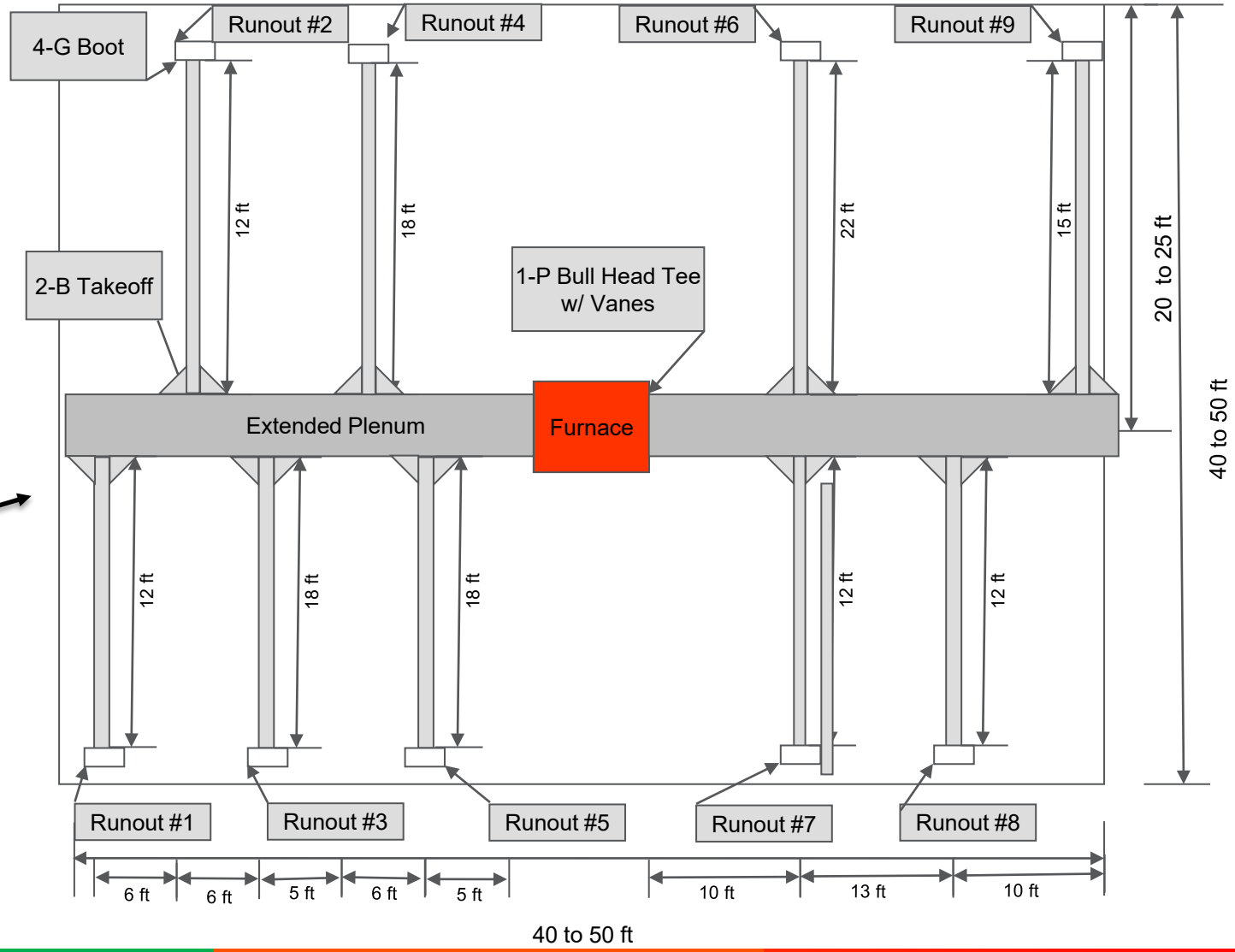
This needs to be above 0.06" Per Manual D

WE MAKE SOME FITTING CHANGES

We changed our takeoffs from 2-A to 2-B. Removed 6” round air-tight and replaced with 8” inch round air-tight and a 8X6 reducer.

We changed our Bull Head Tee from 1-O to 1-P just by adding turning vanes inside the box.





MAKE ADJUSTMENTS TO YOUR NOTES & RE-DO THE MATH

Now you do not need to run the numbers on all the supplies, pick the closest 2 and the furthest 2.

Actual and Equivalent Length (EL) Takeoff Summary Sheet									
	Supply Duct Runs					Return Duct Runs			
	# 1	# 5	# 6	# 9		# R-1	#	#	#
Straight Length(A)	28’	5’	10’	33’	Straight Length(A)	5’			
Straight Length(A)	12’	18’	22’	15’	Straight Length(A)	10’			
Group(B) 1-P	20’	20’	20’	20’	Group(B) 6-H	15’			
Group(B) 2-B	20’	45’	40’	20’	Group(B) 8-D	65’			
Group(B) 4-G	80’	80’	80’	80’	Group(B) 5-I	30’			
Totals	**160’**	**168’**	**172’**	**168’**	**Totals**	**125’**			

A) **Enter the length of the Trunk & Branch runouts.**

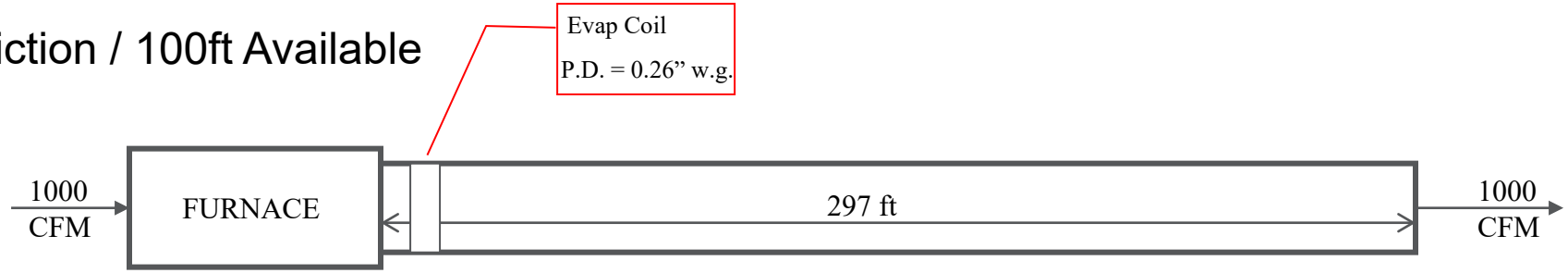
B) **Enter “Fitting Group Number” from 1 to 13 from Manual “D” Appendix 3 and EL.**

Now take the longest of your supply runs and the return and add them together for total system EL

172’ + 125’ = 297’ EL duct system

DUCT CALCULATOR SETTING

1st Determine Friction / 100ft Available



Case #1 Pressure = 0.50 inch w.g.

Remember the job we changed the from 14" coil to a 17" coil and we thought that fixed our issue?

- Blower Static Available = **0.50"**
- less pressure drops = **-0.35"**
- Available Static for Ductwork = **0.15"**
- Total Equivalent Feet = **297**
- Friction / 100 Ft = **0.15" / 297 ft x 100 = 0.05"**

This needs to be above 0.06" Per Manual D

CLOSING THOUGHTS

We hope this simplified course has helped answer some questions or may have given you a new way of thinking about solving an airflow concern. There is so much more to Duct design, and so many variables, please consult ACCA Manual D.

Not ever situation can you just add more duct, a return or a supply, but also where they are added can affect airflow.

Sometimes using any one of the following strategies can help correct an airflow concern.

- Change speed tap on blower motor
- Change the Evaporator Coil to a larger width and install a transition to reduce the pressure drop
- Change duct fittings to reduce EL
- Replace the existing duct system
- Worst case scenario you may have to change the furnace to the next larger blower, like for our last example.

You may have a situation where you must use multiple solutions.

And keep in mind the numbers we just covered in our examples are in a situation where the duct system is installed perfectly according to ACCA standards.

Of course, field conditions will always affect the true numbers.

CLOSING THOUGHTS

I know we do not like math or using Manual D.

But when addressing an airflow concern, and by doing the math you can make sure you are correcting the concern the first time. And not wasting any one's money with things that did not work.

Measure twice, cut once! Its cheaper.

Questions?
Thank You