

APPLICATION NOTES



Application Note 2022: Example Application of Concealed Floor-Mounted Indoor Unit

Author **Matt Rash, PE** | Mechanical Engineer, Central Business Unit

Contributors **Pamela Androff, PE** | Product Manager – Commercial Equipment
Gary Nettinger | Director, Application Support

Reference Documents Engineering Manual – PFFY

Introduction

This Application Note describes an application that would be typical for a CITY MULTI, concealed floor-mounted indoor unit. The model number for the indoor unit this Application Note refers to is: **PFFY-P**NRMU-E**.

The intent of this document is to show the typical design process that should be undertaken by the engineer of record when applying a concealed PFFY indoor unit product. The design process may vary based on several factors relating to job conditions, requirements, and duct accessories chosen by the engineer of record. Therefore, this Application Note is not all inclusive. This application note covers:

1. Ducting and Grille considerations
2. Example Component Selection
3. Ventilation considerations

1. Ducting and Grille Considerations

The PFFY concealed units are not suitable for long, extended duct runs with multiple branch duct paths. In fact, the published external static pressure (ESP) on these units is 0 in W.G. Therefore, designers apply external components like ductwork and grilles at their own risk.

Ductwork should match the size of the unit connection. Ductwork should have a maximum of one elbow (sweeping preferred) that connects to the designer's selected supply grille.

Total supply grille and return grille openings should have a free area equal to or greater than the opening size on the PFFY units or such that the total external pressure drop is no more than 0.1 in. W.G.

2. Example Component Selection

The following pages provide an example of accessory selection and pressure drop calculations. These procedures should be completed by the engineer of record to ensure the design for the PFFY unit will yield adequate published airflow.

- A) Example Supply Grille Selection**
- B) Example Return Grille Selection**
- C) Example Pressure Drop Calculation**

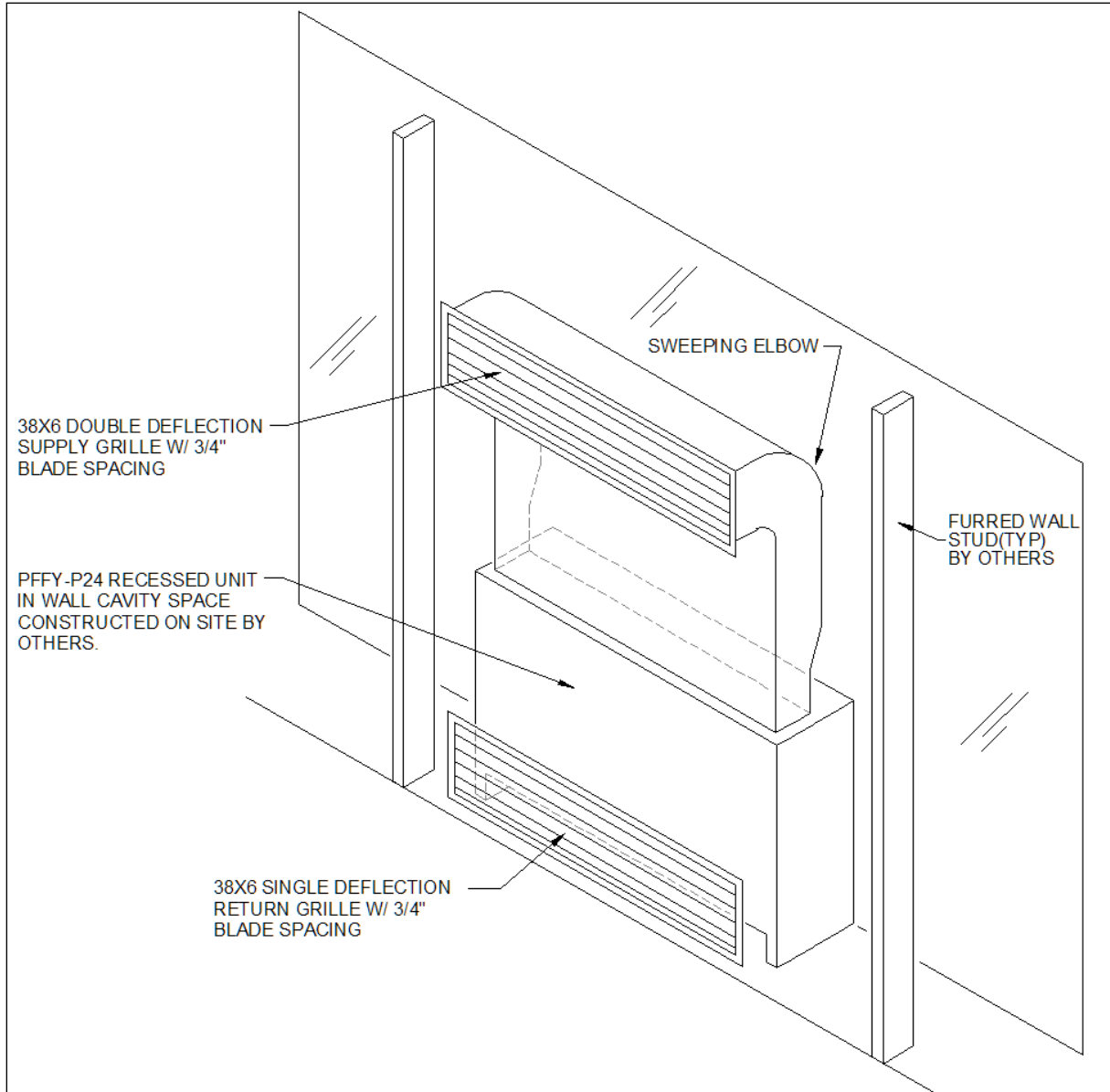


Figure 1 – Example PFFY-P24 (500 CFM) Concealed Installation

A) Example Supply Grille Selection

A double deflection supply grille is selected¹ with 3/4 inch blade spacing. By reviewing the manufacturer data (next page) the supply grille total pressure drop is between 0.028 and 0.042 In. W.G. with deflection angles set between 22-45 deg angles.

Louvered Supply 500 / 600 Series

510 / 520 - Steel
610 / 620 - Aluminum

Double Deflection Models

Steel Construction

Grilles **520**
Register c/w Steel Damper **520D**

Aluminum Construction

Grilles **620**
Register c/w Steel Damper **620D**
Register c/w Alum. Damper **620DAL**

Single Deflection Models

Steel Construction

Grilles **510**
Register c/w Steel Damper **510D**

Aluminum Construction

Grilles **610**
Register c/w Steel Damper **610D**
Register c/w Alum. Damper **610DAL**

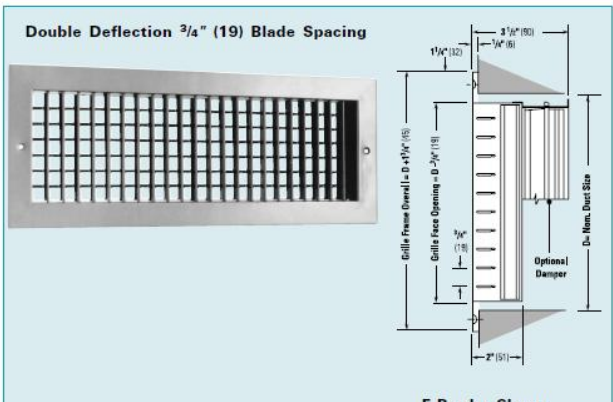
Mounting / Finish Options

Border Style

Surface Mount **F**
1 1/4" (32) Flat (Standard) **N**
1" (25) Narrow **TB**
Lay-in Inverted 1 1/4" (32) Tee **TBP**
Panel Mounted **TBP**

Blade Orientation

Front blades parallel to **L**



Double Deflection 3/4" (19) Blade Spacing

F Border Shown

		Performance Data — Models 510, 520 / 610, 620 / 710, 720 / 910, 920										
		NC 20				30		40		50		
Size	Core Velocity fpm	300	400	500	600	700	800	1000	1200	1400	1600	1800
	Velocity Pressure	.006	.010	.016	.022	.030	.040	.062	.090	.122	.159	.202
	Total Pressure	0° .014	.024	.038	.052	.071	.094	.146	.212	.287	.374	.475
	Pressure	22 1/2° .017	.028	.045	.063	.085	.114	.176	.256	.347	.452	.574
		45° .025	.042	.067	.093	.126	.168	.261	.379	.514	.669	.850
Ac = 1.18 ft. ²	CFM	353	470	590	710	825	945	1180	1420	1650	1890	2120
40 x 5 34 x 6	NC	—	—	—	19	24	28	35	40	45	49	53
24 x 8 20 x 10	Throw	0° 10-17-34	15-23-40	19-28-44	23-35-48	27-38-52	31-40-56	36-45-62	40-48-67	43-52-73	45-56-78	48-59-83
16 x 12 14 x 14	Ft.	22 1/2° 8-14-27	12-18-32	15-22-35	18-28-38	22-30-42	25-32-45	29-35-50	32-38-54	34-42-58	36-45-62	38-47-66
		45° 5-8-17	8-11-20	10-14-22	12-17-24	13-19-26	15-20-28	18-22-31	20-24-34	21-26-36	23-28-39	24-30-41
Ac = 1.34 ft. ²	CFM	400	535	670	805	940	1070	1340	1610	1880	2140	2410
46 x 5 38 x 6	NC	—	—	—	20	24	28	35	41	45	50	53
28 x 8 22 x 10	Throw	0° 11-18-36	16-24-42	20-30-47	24-37-51	28-40-56	32-43-59	39-47-65	42-52-72	45-56-78	48-60-83	51-63-89
18 x 12 16 x 14	Ft.	22 1/2° 9-14-29	13-19-34	16-24-38	19-30-41	22-32-45	26-34-47	31-38-52	34-42-58	36-45-62	38-48-66	41-50-71
		45° 6-9-18	8-12-21	10-15-23	12-18-25	14-20-28	16-21-29	19-23-33	21-26-36	23-28-39	24-30-42	26-32-44

¹ Images shown in this example are sourced from Price Industries' Grilles & Registers catalog. Inclusion in this Application note does not imply preference to this manufacturer; any grille & register manufacturer can be used.

B) Example Return Grille Selection

A single fixed 45° deflection return grille is selected with 3/4" blade spacing. In reviewing the manufacturer's data, the return grille negative pressure drop is around 0.044 In. W.G.

		Performance Data – Models 530, 630, 730 / 530FF, 630FF, 730FF 45° Deflection										
Core Area Sq. ft	Nominal Size	Core Velocity	NC 20									
			200	300	400	500	600	700	800	900	1000	1100
		Velocity Pressure	.002	.006	.010	.016	.022	.031	.040	.050	.062	.075
		Negative s.p.	.011	.025	.044	.069	.100	.136	.177	.224	.277	.335
0.15	7 x 4	cfm	30	45	60	75	90	105	120	135	150	165
	6 x 5	NC	-	-	-	19	24	28	32	35	38	40
0.18	8 x 4	cfm	36	54	72	90	108	126	144	162	180	198
	7 x 5	NC	-	-	-	19	24	28	32	35	38	41
0.22	10 x 4	cfm	44	66	88	110	132	154	176	198	220	242
	8 x 5	NC	-	-	-	20	25	29	33	36	39	41
0.26	12 x 4	cfm	52	78	104	130	156	182	208	234	260	286
	10 x 5	NC	-	-	-	20	25	29	33	36	39	42
0.30	14 x 4	cfm	60	90	120	150	180	210	240	270	300	330
		NC	-	-	15	21	26	30	33	37	40	42
0.34	16 x 4	cfm	68	102	136	170	204	238	272	306	340	374
	12 x 5	NC	-	-	15	21	26	30	34	37	40	43
0.39	18 x 4	cfm	78	117	156	195	234	273	312	351	390	429
	14 x 5	NC	-	-	15	21	26	31	34	37	40	43
0.46	20 x 4	cfm	92	138	184	230	276	322	368	414	460	506
	16 x 5	NC	-	-	16	22	27	31	35	38	41	43
0.52	24 x 4	cfm	104	156	208	260	312	364	416	468	520	572
	18 x 5	NC	-	-	16	22	27	31	35	38	41	44
0.60	28 x 4	cfm	120	180	240	300	360	420	480	540	600	660
	20 x 5	NC	-	-	16	23	28	32	35	39	42	44
0.69	30 x 4	cfm	138	207	276	345	414	483	552	621	690	759
	24 x 5	NC	-	-	17	23	28	32	36	39	42	45
0.81	36 x 4	cfm	162	243	324	405	486	567	648	729	810	891
	28 x 5	NC	-	-	17	23	28	33	36	40	42	45
0.91	40 x 4	cfm	182	273	364	455	546	637	728	819	910	1001
	32 x 5	NC	-	-	18	24	29	33	37	40	43	45
1.07	42 x 4	cfm	214	321	428	535	642	749	856	963	1070	1177
	36 x 5	NC	-	-	18	24	29	33	37	40	43	46
1.18	34 x 6	cfm	236	354	472	590	708	826	944	1062	1180	1298
	24 x 8	NC	-	-	18	25	29	34	37	41	43	46
1.34	38 x 6	cfm	268	402	536	670	804	938	1072	1206	1340	1474
	28 x 8	NC	-	-	19	25	30	34	38	41	44	46

GRILLES AND REGISTERS

C) Example Pressure Drop Calculation

The engineer of record should complete a pressure drop calculation similar to the one shown below to ensure the total external static drop will no more than 0.10 in. W.G.

As a result of our selections in the previous examples, total external static pressure drop is 0.09 in. W.G.

SYSTEM NAME:		PFFY-P24 Recessed Example Pressure Drop															
Duct ABS Rough:		0.0005 FT															
Item Designation	Rect/ Oval/ Rnd (R,O,Rn)	Width In.	Height In.	Round Dia. In.	CFM	Length Ft.	Loss Coef K-value	Special Loss In. wg.	ABS ROUGH FT	AREA SQ. IN	Eq. Dia. In.	Vel. FPM	Vp In.	f' friction factor	Frict. Loss	SP LOSS In. W.C.	Comments
Inlet Grille	R	38	6		500			0.044	0.0005	228.0	15	316	0.01	0.023	0.00	0.044	From manufacturer grille data
Supply Outlet Duct Friction	R	38	6		500	8.0			0.0005	228.0	15	316	0.01	0.023	0.00	0.001	Assumed typical max length of duct.
Suppl duct transition fitting	R	36.75	3.875		500		0.45		0.0005	142.4	11	506	0.02	0.023	0.00	0.007	Expansion Loss Coefficient From ASHRAE Table
Sweeping Elbow No Vanes	R	38	6		500		0.25		0.0005	228.0	15	316	0.01	0.023	0.00	0.002	ASHRAE Table - Sweeping Elbow no vanes
Supply Grille	R	38	6		500			0.035	0.0005	228.0	15	316	0.01	0.023	0.00	0.035	Manf Data - between 22-45 Deg Angle Blade Setting
															Total Loss	0.09	

3. Incorporating Ventilation Air:

Floor mounted indoor units are not equipped with ventilation connections like some of the other CITY MULTI indoor units. Some fresh air can still be incorporated via a separate ventilation fan forced system such as a dedicated outdoor air system (DOAS).

Ventilation amount should be kept below 15-20% of the total airflow for the indoor unit. Due to the minimal static pressure capabilities of PFFY units, provisions must be made to properly design the ventilation ductwork system to allow for proper balance and ensure design ventilation can be provided.

The below example (Figure 2) illustrates one such method that could be employed using a DOAS to serve balanced fan forced tempered fresh air into the return area space behind the furred out wall enclosure.

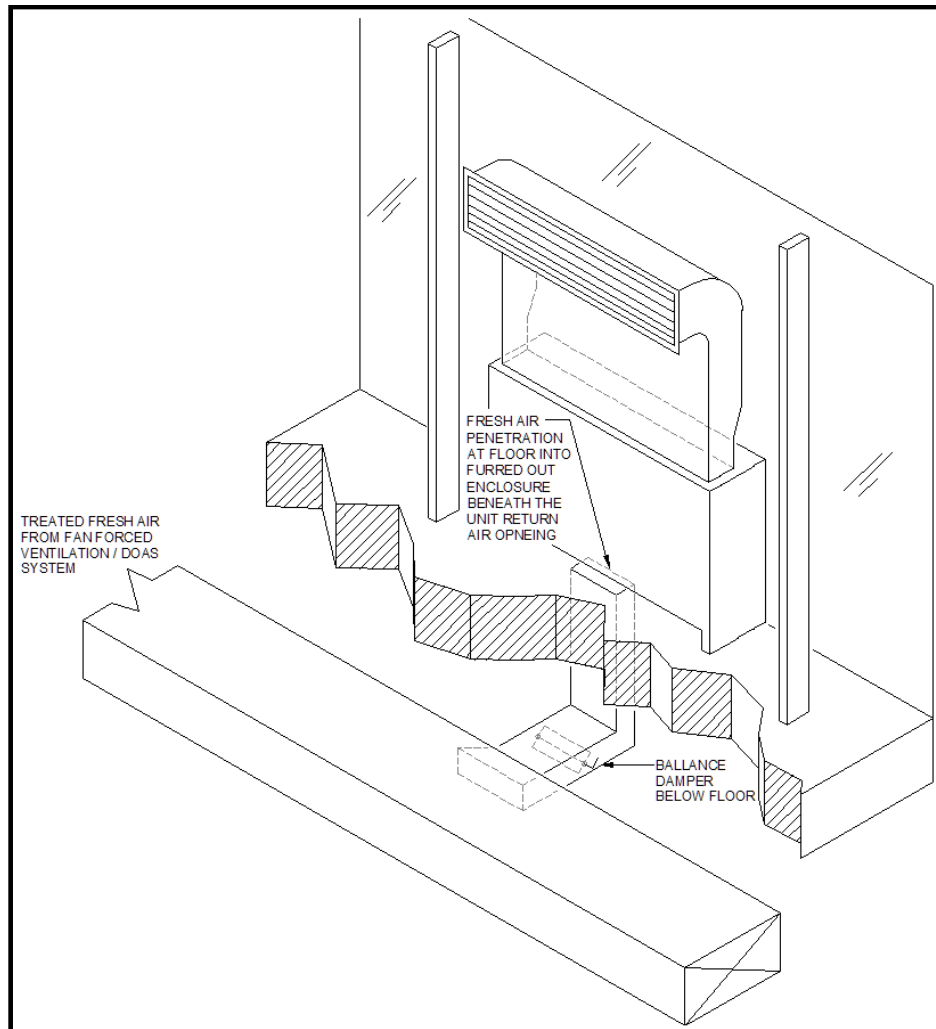


Figure 2 – Example Fresh Air Delivery

Other field methods may be employed by the designer such as elevating units on field erected pedestal bases and introducing ventilation air from brick vents/louvers on outside walls; however, it is imperative that the designer of record ensures adequate balancing capability and performs pressure drop analysis as previously stated to ensure the correct amount of ventilation air can truly be delivered and correctly balanced in the field.