

TECHNICALLY SPEAKING

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ESP - External Static Pressure

Perhaps one of the most frequently ignored factors in setting up a duct system is the external static duct pressure (ESP). Blowers move air throughout the system and are designed to overcome restrictions in the system external to the equipment such as system components and ductwork. They are rated for a given CFM at maximum External Static Pressure on high speed. PSC Motors are generally rated for 0.5" WC. ECM Motors are generally 0.8" WC to 1.0" WC (But typically 0.5" WC).

External Static Pressure is the measurement of all the resistance in the duct system that the fan has to work against. Examples are filters, grills, A/C coils and the ductwork. It is the sum of the suction pressure (negative) and discharge pressure (positive) created by the equipment blower.

External Static pressure is measured using a manometer and is expressed in inches of water column (i.e., # " WC). Readings are taken on a forced air furnace at the inlet of the furnace blower after the filter and exiting the discharge of the furnace blower before the evaporator coil. For an RTU and air handlers, measurements are taken at the inlet of the blower after the filter and the discharge or outlet of the RTU or air handler.

"If you know the ESP you can determine the CFM."

The CFM of a motor is directly related to the external static pressure. The higher the ESP, the lower the CFM. The lower the ESP, the higher the CFM. High ESP readings indicate that there is excessive resistance in the system. This may be caused by dirty filters, a dirty evaporator coil, closed dampers, restricted supply or return grills or undersized duct. If you know the ESP you can determine the CFM.

The fan performance chart shows the relationship between ESP and CFM and is a vital tool in troubleshooting air side problems and calculating CFM.

How much ESP does the fan have to overcome?

Refer to diagram 1 for this example. The system fan has to create a negative pressure of -0.19" WC to pull air into the blower. 0.03" WC is lost across the return grill, 0.08" WC is lost through the return duct system and 0.08" WC is lost across the filter for a total of 0.19" WC.

The system fan has to create a positive pressure of +0.39" WC to push air into the conditioned space. 0.26" WC is lost across the A/C coil (when wet), 0.1" WC is lost through the supply duct system and 0.03" WC is lost across the supply register for a total of 0.39" WC. The total pressure drop of the system equals 0.58" WC. This means that the fan has to be able to overcome at least 0.58" WC of ESP at design CFM for the system to operate properly.

If the fan cannot overcome this ESP at the given CFM from the blower performance curve, then the fan needs to be increased or the resistance of the system lowered.

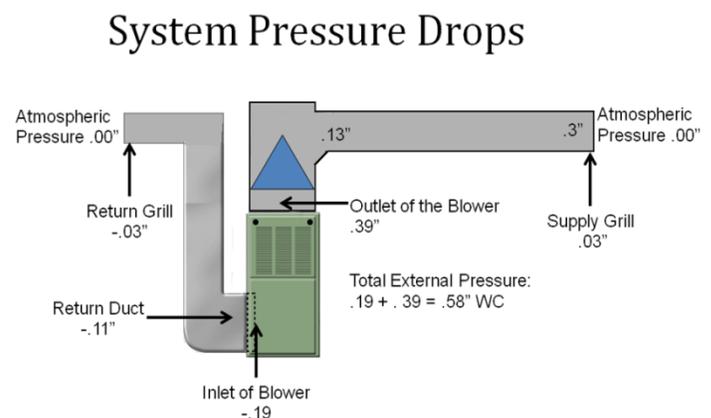


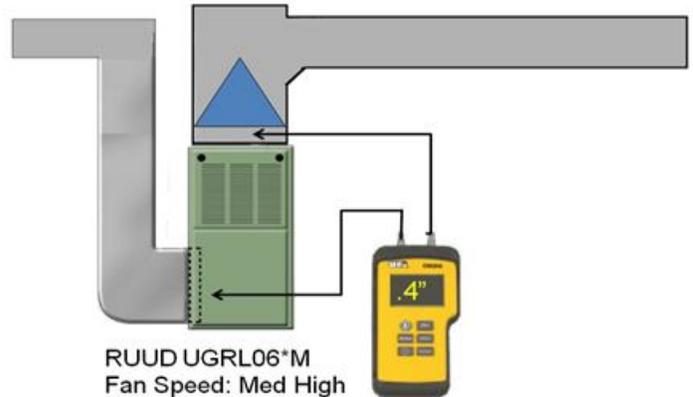
Diagram 1

Example:

What is the actual CFM of the RUUD URGL 06*M furnace with the fan set on Medium High and an ESP of 0.4” WC?

Answer:

The blower performance curve shows that the blower is moving 960 CMF.



BLOWER PERFORMANCE DATA—RGRL MODELS

MODEL RGRL-	BLOWER SIZE [mm]	MOTOR H.P. [W]	BLOWER SPEED	CFM [L/s] AIR DELIVERY EXTERNAL STATIC PRESSURE INCHES WATER COLUMN [kPa]						
				0.1 [.02]	0.2 [.05]	0.3 [.07]	0.4 [.10]	0.5 [.12]	0.6 [.15]	0.7 [.17]
04-M	11 x 7 [279 x 178]	1/2 [373]	LOW	805 [380]	780 [368]	760 [358]	740 [340]	685 [323]	645 [304]	605 [285]
			MED-LO	920 [434]	885 [417]	850 [401]	810 [382]	775 [365]	730 [344]	690 [325]
			MED-HI	1140 [538]	1110 [524]	1085 [512]	1045 [493]	1010 [476]	950 [448]	890 [420]
			HIGH	1360 [642]	1320 [623]	1280 [604]	1235 [583]	1195 [564]	1140 [538]	1080 [500]
06-M	11 x 7 [279 x 178]	1/2 [373]	LOW	770 [363]	740 [349]	710 [335]	675 [318]	645 [304]	605 [285]	570 [269]
			MED-LO	880 [415]	845 [398]	815 [384]	770 [373]	760 [358]	715 [337]	670 [316]
			MED-HI	1080 [500]	1025 [483]	990 [467]	960 [453]	925 [436]	880 [415]	835 [394]
			HIGH	1260 [594]	1215 [573]	1175 [554]	1135 [535]	1100 [519]	1040 [491]	985 [465]
07-Y	12 x 7 [305 x 178]	3/4 [559]	LOW	1105 [522]	1096 [517]	1080 [610]	1050 [498]	1030 [466]	1010 [477]	990 [467]
			MED-LO	1290 [609]	1275 [602]	1280 [605]	1220 [678]	1195 [564]	1170 [552]	1140 [538]
			MED-HI	1480 [698]	1435 [677]	1415 [668]	1390 [658]	1370 [647]	1300 [614]	1255 [592]
			HIGH	1705 [805]	1665 [788]	1615 [762]	1570 [741]	1540 [727]	1475 [696]	1400 [661]
07-M	11 x 7 [279 x 178]	1/2 [373]	LOW	780 [368]	745 [351]	710 [335]	675 [318]	640 [302]	595 [281]	555 [261]
			MED-LO	880 [415]	850 [401]	825 [389]	785 [370]	750 [354]	702 [331]	655 [309]
			MED-HI	1090 [514]	1050 [495]	1010 [477]	970 [458]	925 [436]	875 [413]	825 [389]
			HIGH	1300 [613]	1255 [592]	1210 [571]	1160 [547]	1110 [524]	1055 [498]	1005 [474]
09-Z ***	12 x 11 [305 x 279]	3/4 [559]	LOW	1235 [582]	1210 [571]	1185 [559]	1150 [543]	1120 [528]	1075 [507]	1035 [488]
			MED-LO	1490 [703]	1465 [691]	1440 [679]	1405 [663]	1375 [649]	1315 [620]	1255 [592]
			MED-HI	1720 [811]	1670 [788]	1620 [764]	1600 [755]	1580 [746]	1520 [717]	1460 [689]
			HIGH	2100 [991]	2050 [967]	2000 [944]	1955 [923]	1910 [901]	1825 [861]	1745 [823]
10-Z ***	12 x 11 [305 x 279]	3/4 [559]	LOW	1230 [680]	1205 [567]	1160 [557]	1155 [545]	1130 [583]	1090 [514]	1050 [495]
			MED-LO	1490 [703]	1445 [682]	1405 [663]	1375 [649]	1350 [637]	1295 [611]	1240 [585]
			MED-HI	1710 [807]	1665 [786]	1620 [764]	1570 [746]	1540 [727]	1475 [696]	1410 [665]
			HIGH	2010 [949]	1955 [923]	1900 [897]	1655 [875]	1810 [854]	1710 [607]	1610 [769]

In conclusion, by understanding and using ESP and the proper blower performance, chart technicians can verify unit CFM and the system operation. If the measured ESP is greater than 0.5” WC, or if the measured ESP is beyond the maximum allowable of the blower performance curve this MAY indicate a restrictive system due to undersized duct, dirty components and/or closed branch ducts. If measured ESP is within the allowable range as listed in the blower performance curve then the CFM can be determined.

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