

Bypass Humidifier

Pre Installation Set-Up and Checkout Procedure

The purpose of this procedure is to insure that a Bypass Humidifier will not adversely effect the operation of a forced air heating system. (The term forced air heating system will be referred to as a furnace in this procedure).

Bypass Humidifier's can bypass excessive air back into the return air duct and increase the entering return air temperature to the furnace. This elevated entering air temperature to the heat exchanger can cause the furnace "High Temperature Limit Switch to Trip" and shut the furnace down to protect the product. If the thermostat is still calling for heat, after the blower cools off the heat exchanger the cycle repeats itself. This repetitive cycle is often referred to as nuisance limit tripping and may cause limit failure leading to a "no heat" service call. These types of situations can be avoided with a simple check out procedure. The checkout allows the installer to either a) adjust the heating fan speed to overcome the Bypass air effect or to b) make a determination that a "Fan Power Humidifier" is the correct type of Humidifier for the application.

See "Checkout Procedure" drawing for reference points and locations.

Overview:

Bypass Humidifiers operate by "robbing" a small amount of the blower supply air [CFM (b)], running it across a wet pad and Bypassing this air [CFM (a)] into the return. Since this air is heated air, when it mixes with the return air from the house [CFM (c)], it increases the return air temperature [CFM (a) + CFM (c)], that enters the furnace. If the mixed air temperature of this return air [CFM (b)] can be maintained below 80 degrees, the furnace should operate without exceeding the manufacturer's maximum temperature and not trip the furnace limit or other safety control. To avoid nuisance high temperature limit control tripping use this procedure to determine if a Bypass Humidifier will work with the furnace prior to installation of the bypass humidifier.

Pre-Installation Checkout:

Furnace must be set up to run in the heating mode and heating airflow speed tap set at either the medium or medium-high tap or lower. **If the heating airflow tap is set on the high-speed tap, STOP and use a "Fan Powered Humidifier."** To assure proper furnace operation, the manufacturer's temperature rise shown in the "CFM vs. Temperature Rise" Table in the Service Facts must be met with the blower fan set at the medium/med-high motor tap or lower.

1st Determine the Pressure Differential between the Supply (S) and the Return (R)

Before installing the Bypass Humidifier, drill a small hole at points (R) and (S) as shown on the drawing. With the fan running and delivering the desired heating CFM [CFM (c)] to the house, use an air pressure gage (Manometer or Magnehelic® differential pressure gage) to determine the pressure differential between points (R) and (S). Record this pressure [item "A"].

2nd Determine the CFM that would be Bypassed thru the Bypass Humidifier

Using the pressure difference "A" recorded in step 1, go to Table 1 (column "A") and estimate the Bypass CFM from column (a). If the pressure difference recorded in step 1 does not exactly match a value, then use straight-line interpolation to determine a CFM value. Record this CFM requirement. This requirement is "CFM (a)".

TABLE 1

BYPASS HUMIDIFIER Bypassed Air (CFM)			
PRESSURE INCH W.G.(1) "A"	BYPASSED CFM(2) (a)	VELOCITY fpm(3)	AIRFLOW
0.05	74	377	Acceptable
0.10	108	550	Acceptable
0.15	135	688	Acceptable
0.20	155	790	Caution (4)
0.25	175	892	Caution (4)
0.30	190	968	Caution (4)
0.35	208	1060	Caution (4)
0.40	223	1187	Excessive (5)
0.45	240	1223	Excessive (5)
0.50	253	1289	Excessive (5)

(1) Pressure differential as measured between points(R) and (S).
 (2) CFM Bypassed through a 6 inch round duct from "supply" to "Return" side.
 (3) Velocity of air in 6 inch round duct.
 (4) Noise may be a problem.
 (5) Noise may be a problem. Excessive bypass air may cause furnace limit to trip. Follow checkout procedure. Verify temperature rise is within acceptable range.
 NOTE: Pressure difference in excess of .5" may cause water blowoff because of mineral build-up.

Since the manufacturer has a policy of continuous product and product data improvement, it reserves the right to change design and specification without notice.

3rd) Determine if the furnace blower can deliver sufficient airflow to supply the Bypass Humidifier and House

Drill a small hole at points (X) or (Xalternate) and (Y) [most furnaces have a small hole as shipped at the “Y” point] as shown on the drawing. With the fan running and delivering the desired heating airflow [CFM (c)] to the house, use an air pressure gage (Manometer or Magnehelic® differential pressure gage) to determine the pressure differential between points (X) and (Y). Record this pressure [item “B”]. Using the “Service Facts” shipped with the Furnace, go to the “FURNACE AIRFLOW (CFM) vs. EXTERNAL STATIC PRESSURE (IN. W.C.)” TABLE and determine the airflow (CFM) the furnace is delivering to the house. Record this value. This value is labeled “CFM (c).”

4th) Establish the Airflow the Blower must Deliver thru the Furnace to Supply the House and the Bypass Humidifier.

Add the airflows established in Steps #2 & #3 [CFM (a) + CFM (c)]. *This becomes the new blower airflow delivery requirement* [CFM (b)].

5th) Determine if Furnace/Heating Plant Blower can deliver sufficient Airflow

Using the “Service Facts” shipped with the Furnace, go back to the “FURNACE AIRFLOW (CFM) vs. EXTERNAL STATIC PRESSURE (IN. W.C.)” TABLE and determine the airflow (CFM) the furnace will deliver if the fan speed tap is increased. Use “Pressure “B”” recorded in step #3 to determine the new blower CFM from the table. If this CFM is within ± 50 to 70 CFM of the required CFM (b), set the blower tap for the higher heating airflow (CFM) and install the Bypass Humidifier. From the “CFM vs. Temperature Rise” table in the Service Facts, verify that the temperature rise at the new tap is within the acceptable range.

6th) Determine New Furnace/Heating System Blower Airflow and Temperature Rise

To verify that you are within the acceptable operating ranges with the Bypass Humidifier installed, run the furnace in the heating mode and record the new pressure differential between points (X) and (Y). This pressure is [new item “B”]. Using the “Service Facts” shipped with the Furnace, go to the “FURNACE AIRFLOW (CFM) vs. EXTERNAL STATIC PRESSURE (IN. W.C.)” TABLE and determine the airflow (CFM) the furnace is delivering. If this CFM is within ± 50 to 70 CFM of the required CFM (b) established in Step #5, stop and determine if the Temperature Rise falls within the table values. You can also measure the temperature rise across points “S” and “R”.

For our example, we have a TUE/CUB060A936L gas furnace and our heating design is for a Temperature Rise of around 44 degrees and 1000 CFM. Looking at the Service Facts, this calls for a “Heating Motor Speed Tap” of either MED-LOW or MED-HIGH depending on the External Static Pressure.

Example Step #1: Reading the Magnehelic® gage, we see the gage is at 0.15 inch water. This is reading “A”.

Example Step #2: Going to Table #1, @ 0.15 inch, we would expect 135 CFM of air to be Bypassed from the Supply Duct to the Return Duct. This 135 CFM of Bypassed Air is “CFM (a)”.

Example Step #3: Taking a pressure reading between points (X) & (Y), we get a reading of 0.50 inch with the Heating Speed Tap at the MED-LOW tap. This is our “B” reading. Going into the Service Facts, we find a TUE060A936L furnace with the motor tap in the MED-LOW will produce 973 CFM of airflow.

Example Step #4: Adding the airflows established in Steps #2 & #3 [CFM (a) + CFM (c), we get a new blower airflow requirement of 1108 CFM with the Bypass Humidifier installed.

Example Step #5: For the blower to deliver 1108 CFM at the “B” pressure reading, the blower motor tap has to be moved to the MED-HIGH tap. Going into the Service Facts, we see the blower will deliver 1113 CFM of air. This is within ± 50 to 70 CFM of the required CFM (b) of 1108. Set the “Heating Motor Tap to MED-HIGH” and install the Bypass Humidifier.

Example Step #6: With the Bypass Humidifier installed, and running the furnace in the heating mode or heating air flow only mode, the new pressure differential between points (X) and (Y) is 0.48”. Using the “Service Facts” shipped with the Furnace, go to the “FURNACE AIRFLOW (CFM) vs. EXTERNAL STATIC PRESSURE (IN. W.C.)” TABLE and @ 0.48” we determine the blower airflow is 1151 CFM. At 1151 CFM, the expected temperature rise should be around 37 to 38 degrees. We check the temperature rise across points “S” and “R” and this is 38 degrees. This agrees with the expected temperature rise and is within the table’s acceptable range.

EXAMPLE: Service Facts Table (Partial Table)

FURNACE AIRFLOW (CFM) VS. EXTERNAL STATIC PRESSURE (IN. W.C.)										
MODEL	SPEED TAP SPEED TAP	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90
3 Ton Furnace	4 - HIGH - Black	1426	1389	1345	1298	1236	1171	1099	1020	934
	3 - MED.-HIGH - Blue	1243	1225	1197	1160	1113	1057	991	916	831
	2 - MED.-LOW - Yellow	1042	1039	1027	1005	973	931	879	817	745
	1 - LOW - Red	900	903	895	877	848	809	760	700	629

EXAMPLE and TABLE					
STEP		EXAMPLE		JOB SITE 1 st Try	JOB SITE 2nd try
#1	"A" reading	0.15"	Pressure reading		
#2	"a" from table 1	135 CFM	By-Passed Air		
#3	"B" reading	0.50"	Pressure reading		
#3	Service Facts	973 CFM	Table CFM		
#4	Step #2 & #3 CFM	1108 CFM	135 + 973		
#5	Service Facts	1113 CFM	MED HIGH TAP		
#6	New "B" reading	0.48"	Pressure reading		
#6	Service Facts	1151	MED HIGH TAP		

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For more information contact
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CHECKOUT PROCEDURE DRAWING

