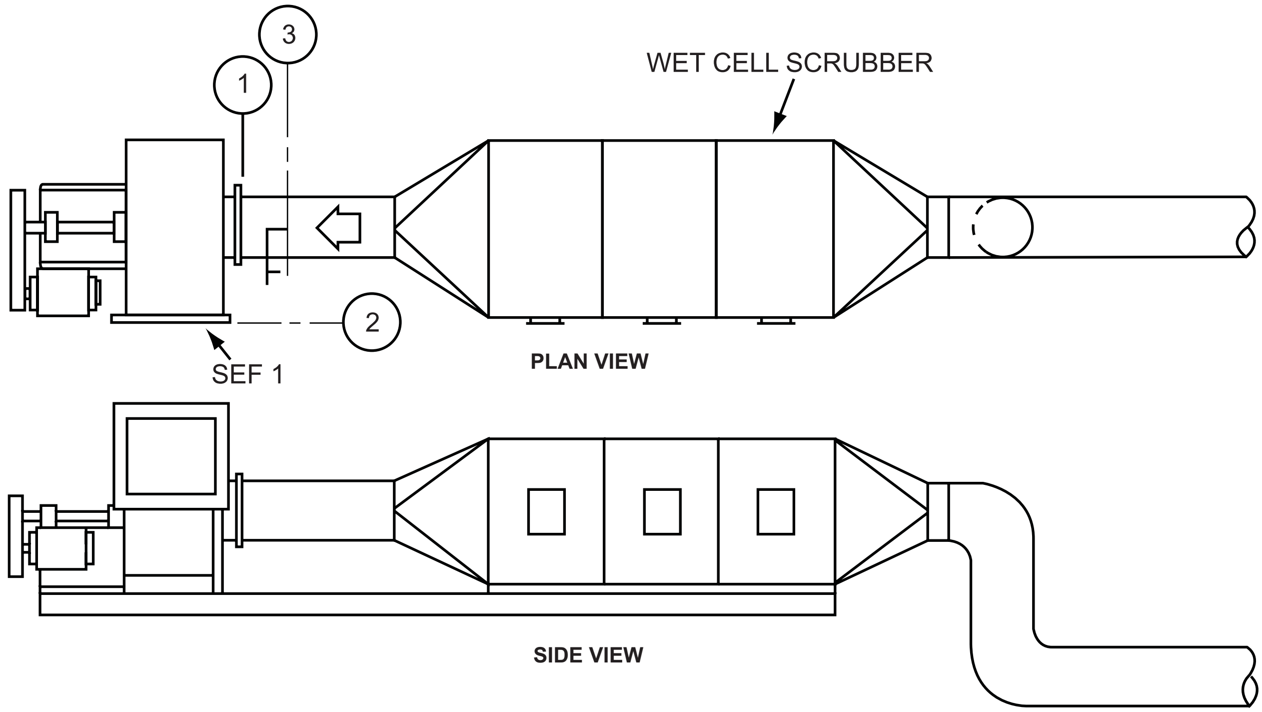
CONVERSION TO SPECIFIED CONDITIONS

Q_c = 6384 (1730/1710)
= 6459 cfm

P_{sc} = 2.00 $(1730/1710)^2$ (0.075/0.0719)
= 2.14 in. wg

H_c = 3.79 $(1730/1710)^3$ (0.075/0.0719)
= 4.09 hp

EXAMPLE 3C: CENTRIFUGAL FAN IN A SCRUBBER SYSTEM



COMMENTS

1. Determine P_{v3} by using the root mean square of the velocity pressure measurements made in a traverse of Plane 3, located in the duct connection at the fan inlet, as shown in the diagram. Determine P_{s3} by averaging the static pressure measurements made in the same traverse. Procedures for traverses are described in Section 9.4. P_{s3} is used in determining the density at the traverse plane. Measure the area of the traverse plane, A_3, which is located at the tip of the Pitot-static tube. In locating Plane 3 downstream of the scrubber, changes in the composition of the air as a result of the action of the scrubber are properly taken into account in the determination of fan air flow rate. Due to the close proximity of Planes 1 and 3, and the fact that there is no change in area between the two planes, the conditions which exist at Plane 3 are assumed to exist at Plane 1.

2. P_{s2}, the static pressure at the fan outlet, is zero.

3. Measure t_{d3} and t_{w3} in the traverse plane. Determine p_b for the general vicinity of the fan. Measure t_{d2}. These measurements are used in determining densities at the planes of interest.

4. Measure the fan speed and the motor amps, volts, and if possible, watts. Record all pertinent motor nameplate data, including volts (NPV), and full load amps (FLA). If the motor power output is to be estimated by using the phase current method described in Annex K, it is not necessary to measure motor watts; however, it may be necessary to disconnect the drive and measure the no load amps (NLA) if the motor is not operating at or near its full load point. Refer to Annex K.

5. SEF 1 is due to the effect of there being no duct at the fan outlet. In order to calculate the value of SEF 1, it is necessary to measure the outlet area of the fan, A_2, and the blast area of the fan.

6. To calculate the Fan Static Pressure:

$$P_s = P_{s2} - P_{s1} - P_{v1} + \text{SEF 1}$$

Where:

$P_{v1} = P_{v3}$
$P_{s1} = P_{s3}$
$P_{s2} = 0$

7. In order to compare the test results to the quoted fan curve drawn for operation at 1700 rpm and 0.071 lbm/ft^3 density, it is necessary to convert the results to the specified conditions. The basis for the calculations is described in Section 14.

OBSERVATIONS

SITE MEASUREMENTS

p_b = 29.80 in. Hg
t_{d3} = 65°F
t_{w3} = 64°F
t_{d2} = 70°F
P_{s3} = -8.0 in. wg
P_{v3} = 0.337 in. wg
N = 1672 rpm
A_1 = A_3
= 7.06 ft^2
A_2 = 5.15 ft^2
Blast Area = 3.67 ft^2

MEASURED MOTOR DATA

Volts = 450, 458, 462
= 457 av
Amps = 44, 45, 44.5
= 44.5 av

MOTOR NAMEPLATE DATA

40 hp, 3 phase, 60 hertz
460 volts, 1780 rpm, 49 FLA

GENERAL

Fan connected to motor through belt drive.

CALCULATIONS

DENSITIES

For Plane 3 conditions of:
t_{d3} = 65°F
t_{w3} = 64°F

$p_3 = p_b + (P_{s3}/13.6)$
= 29.80 + (-8.0/13.6)
= 29.21 in. Hg

Use Figure N.1 in Annex N to obtain ρ_3 = 0.0732 lbm/ft^3.

It is assumed that:
$t_{d1} = t_{d3}$
$P_{s1} = P_{s3}$
$\rho_1 = \rho_3$

$$\rho_2 = \rho_3\left(\frac{P_{s2}+13.6p_b}{13.6p_3}\right)\left(\frac{t_{d3}+460}{t_{d2}+460}\right)$$

$$= 0.0732\left(\frac{0+13.6\times29.80}{13.6\times29.21}\right)\left(\frac{525}{530}\right)$$

$$= 0.0740 \text{ lbm/ft}^3$$

FLOW RATES

$V_3 = 1096\,(P_{v3}/\rho_3)^{0.5}$
= 1096 (0.337/0.0732)$^{0.5}$
= 2352 fpm

$Q_3 = V_3A_3$
= 2353 × 7.06
= 16605 cfm

$Q = Q_1$
= $Q_3\,(\rho_3/\rho_1)$
= 16605 (0.0732/0.0732)
= 16605 cfm

$Q_2 = Q_3\,(\rho_3/\rho_2)$
= 16605 (0.0732/0.0740)
= 16425 cfm

FAN POWER INPUT

Measured amps/FLA = (44.5/49)
= 0.91
= 91%

Annex K indicates that Equation A will provide a reasonably accurate estimate of motor power output for a 40 hp motor operating at 91% FLA.

H_{mo} = 40 (44.5/49) (457/460)
= 36.1 hp

Figure L.1 in Annex L indicates estimate belt drive loss of 4.5%.

$H_L = 0.045\,H_{mo}$
= 0.045 × 36.1
= 1.6 hp

$H = H_{mo} - H_L$
= 36.1 - 1.6
= 34.5 hp

SYSTEM EFFECT FACTOR

AMCA Publication 201-90, Figures 7.1 and 8.3, indicate the following calculations:

$V_2 = (Q_2/A_2)$
$= (16425/5.15)$
$= 3189$ fpm

Blast area ratio = Blast area/A_2
= 3.67/5.15
= 0.71

For a blast area ratio of 0.7 and no duct, Figure 8.3 shows *System Effect Curve* S applies. For 3189 fpm velocity and curve S, Figure 7.1 shows SEF 1 = 0.5 in. wg at 0.075 lbm/ft^3 density. At 0.0740 lbm/ft^3:

SEF 1 = 0.5 (0.074/0.075)
= 0.49 in. wg

FAN STATIC PRESSURE

$P_{v1} = P_{v3}$
$= 0.337$ in. wg

$P_s = P_{s2} - P_{s1} - P_{v1} + \text{SEF 1}$
$= 0 - (-8.0) - 0.337 + 0.49$
$= 8.15$ in. wg

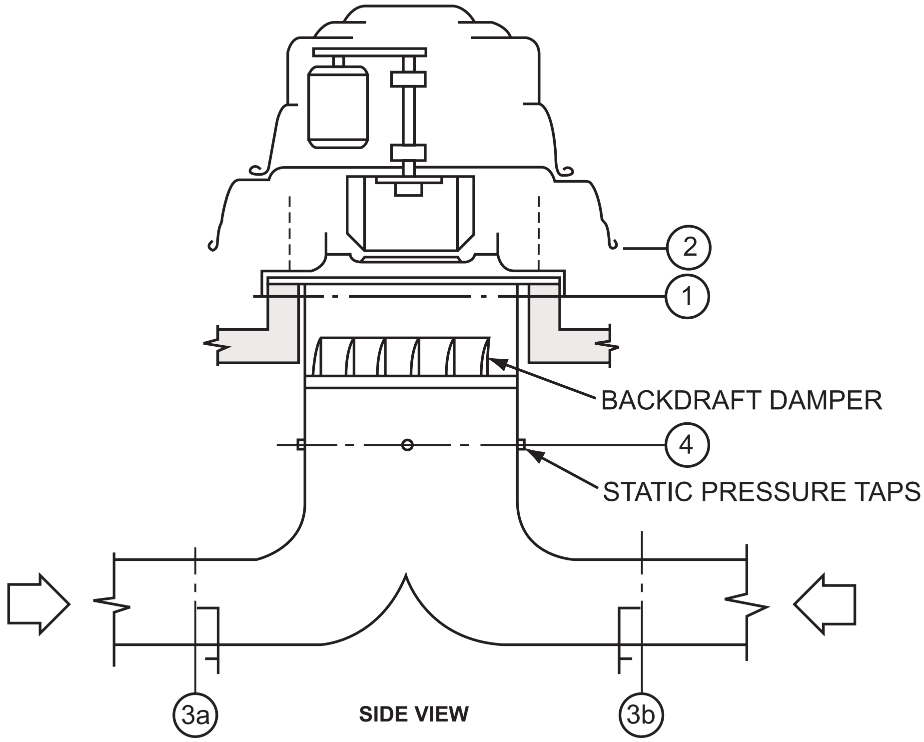
CONVERSION TO SPECIFIED CONDITIONS

$Q_c = 16605\ (1700/1672)$
$= 16883$ cfm

$P_{sc} = 8.15\ (1700/1672)^2\ (0.071/0.0732)$
$= 8.17$ in. wg

$H_c = 34.5\ (1700/1672)^3\ (0.071/0.0732)$
$= 35.2$ hp

EXAMPLE 3D: CENTRIFUGAL ROOF VENTILATOR WITH DUCTED INLET



COMMENTS

1. This centrifugal roof ventilator, as supplied and rated by the manufacturer, does not include the backdraft damper. It is essential that the backdraft damper blades be fixed in their full open positions, otherwise uneven velocity distribution will occur at the inlet to the ventilator, adversely affecting its performance.

2. Normally, velocity pressure measurements would be made in a single plane, located in a duct common to all branches. In this example, a measurement plane which provides a satisfactory velocity profile cannot be located within the short length of duct between the point of connection of the branch ducts and the ventilator inlet. The alternative, as indicated in the diagram, is to make a velocity pressure measurement traverse in each branch. The velocity pressure for each branch is determined by using the root mean square of the velocity pressure measurements made in the traverse. The static pressure at each traverse plane is determined by averaging the static pressure measurements made in the same traverse. These static pressure values are used in determining the densities at the traverse planes. Procedures for traverses are described in Section 9.4. In order to determine the air flow rates, it is necessary to measure the area of each traverse plane.

3. P_{s4} may be determined by averaging the static pressure measurements at each of four static pressure taps or by averaging the static pressure measurements made in a Pitot-static tube traverse of Plane 4. If a Pitot-static tube is used, it should be positioned well within the duct in which Plane 4 is located, and not project into the upstream elbows. Measure the area of Plane 1 for use in calculating P_{v1}. In this example, $A_4 = A_1$. P_{s2}, the static pressure at the outlet of the ventilator, is zero gauge pressure, referred to the atmospheric pressure in the region of the ventilator outlet. In situations such as this example, the air may be discharging from the ventilator into a region in which the atmospheric pressure is somewhat different from that to which all other pressure measurements are referred. When this possibility exists, it is essential that the static pressure in the region of the discharging air be measured, referred to the same atmospheric pressure as used in all other pressure measurements. In this case, P_{s2} was measured as zero.

4. Measure the dry-bulb and wet-bulb temperatures at each velocity traverse plane. In this example, t_{d1} and t_{d4} are assumed to be equal to t_{d3a}. Determine p_b for the general vicinity of the fan. These measurements are used in determining densities at the planes of interest.

5. Measure the fan speed and the motor amps, volts, and if possible, watts. Record all pertinent motor nameplate data, including volts (NPV) and full load amps (FLA). If the motor power output is to be estimated by using the phase current method described in Annex K, it is not necessary to measure motor watts; however, it may be necessary to disconnect the drive and measure the no load amps (NLA) if the motor is not operating at or near its full load point. Refer to Annex K.

6. Determine the backdraft damper pressure loss by using the performance ratings supplied by the manufacturer.

7. To calculate the Fan Static Pressure:

$P_s = P_{s2} - P_{s1} - P_{v1}$

Where:

$P_{v1} = (Q_1/1096\ A_1)^2\ \rho_1$

$Q_1 = Q_{3a}\ (\rho_{3a}/\rho_1) + Q_{3b}\ (\rho_{3b}/\rho_1)$

$P_{s1} = P_{s4}$ - backdraft damper pressure loss
$P_{s2} = 0$

8. In order to compare the test results to the quoted fan curve drawn for operation at 620 rpm and 0.075 lbm/ft^3 density, it is necessary to convert the results to the specified conditions. The basis for the calculations is described in Section 14.

OBSERVATIONS

SITE MEASUREMENTS

p_b = 29.20 in. Hg
$t_{d3a} = t_{d3b}$
= 72°F
$t_{w3a} = t_{w3b}$
= 66°F
P_{s2} = 0 in. wg
P_{s4} = -0.88 in. wg
$P_{s3a} = P_{s3b}$
= -0.85 in. wg
P_{v3a} = 0.27 in. wg
P_{v3b} = 0.275 in. wg
N = 625 rpm
$A_1 = A_4$
= 7.9 ft^2
A_{3a} = 3.4 ft^2
A_{3b} = 3.3 ft^2

MEASURED MOTOR DATA

Volts = 450, 455, 460
= 455 av
Amps = 5.7, 5.85, 5.9
= 5.82 av

MOTOR NAMEPLATE DATA

5 hp, 3 phase, 60 hertz
460 volts, 1780 rpm, 5.95 FLA

GENERAL

Fan connected to motor through belt drive. Pressure loss data supplied by manufacturer of backdraft damper.

CALCULATIONS

DENSITIES

For Planes 3a and 3b conditions of:

$t_{d3a} = t_{d3b}$
= 72°F
$t_{w3a} = t_{w3b}$
= 66°F

$p_{3a} = p_{3b}$
$= p_b + (P_{s3a}/13.6)$
= 29.20 + (-0.85/13.6)
= 29.14 in. Hg

Use Figure N.1 in Annex N to obtain:

$\rho_{3a} = \rho_{3b}$
= 0.0721 lbm/ft^3

It is assumed that:

$t_{d1} = t_{d4} = t_{d3a} = t_{d3b}$

Since the differences in the static pressures at Planes 1, 3a, and 4 are very small, no appreciable error will occur by assuming:

$\rho_1 = \rho_4 = \rho_{3a} = \rho_{3b}$

FLOW RATES

$V_{3a} = 1096\ (P_{v3a}/\rho_{3a})^{0.5}$
$= 1096\ (0.27/0.0721)^{0.5}$
= 2121 fpm

$V_{3b} = 1096\ (P_{v3b}/\rho_{3b})^{0.5}$
$= 1096\ (0.275/0.0721)^{0.5}$
$= 2140$ fpm

$Q_{3a} = V_{3a}A_{3a}$
$= 2121 \times 3.4$
$= 7211$ cfm

$Q_{3b} = V_{3b}A_{3b}$
$= 2140 \times 3.3$
$= 7062$ cfm

$Q = Q_1$
$= Q_{3a}\ (\rho_{3a}/\rho_1) + Q_{3b}\ (\rho_{3b}/\rho_1)$
$= 7211\ (0.0721/0.0721) + 7062\ (0.0721/0.0721)$
$= 14273$ cfm

FAN POWER INPUT

Measured amps/FLA = (5.82/5.95)
= 0.98
= 98%

Annex K indicates that Equation A will provide a reasonably accurate estimate of motor power output for a 5 hp motor operating at 98% FLA.

$H_{mo} = 5\ (5.82/5.95)\ (455/460)$
$= 4.84$ hp

Figure L.1 in Annex L indicates estimated belt drive loss of 5.8%.

$H_L = 0.058\ H_{mo}$
$= 0.058 \times 4.84$
$= 0.28$ hp

$H = H_{mo} - H_L$
$= 4.84 - 0.28$
$= 4.56$ hp

BACKDRAFT DAMPER LOSS

The data supplied by the manufacturer of the damper indicate that the pressure loss for the damper, ΔP_s, is 0.22 in. wg at the flow rate of 14273 cfm at 0.075 lbm/ft^3 density.

Backdraft damper loss $= \Delta P_s\ (\rho_4/0.075)$
$= 0.22\ (0.0721/0.075)$
$= 0.21$ in. wg

FAN STATIC PRESSURE

$P_{v1} = (Q_1/1096\ A_1)^2\ \rho_1$
$= [14273/(1096 \times 7.9)]^2\ 0.0721$
$= 0.20$ in. wg

$P_{s1} = P_{s4}$ - damper loss
$= -0.88 - 0.21$
$= -1.09$ in. wg

$P_s = P_{s2} - P_{s1} - P_{v1}$
$= 0 - (-1.09) - 0.20$
$= 0.89$ in. wg

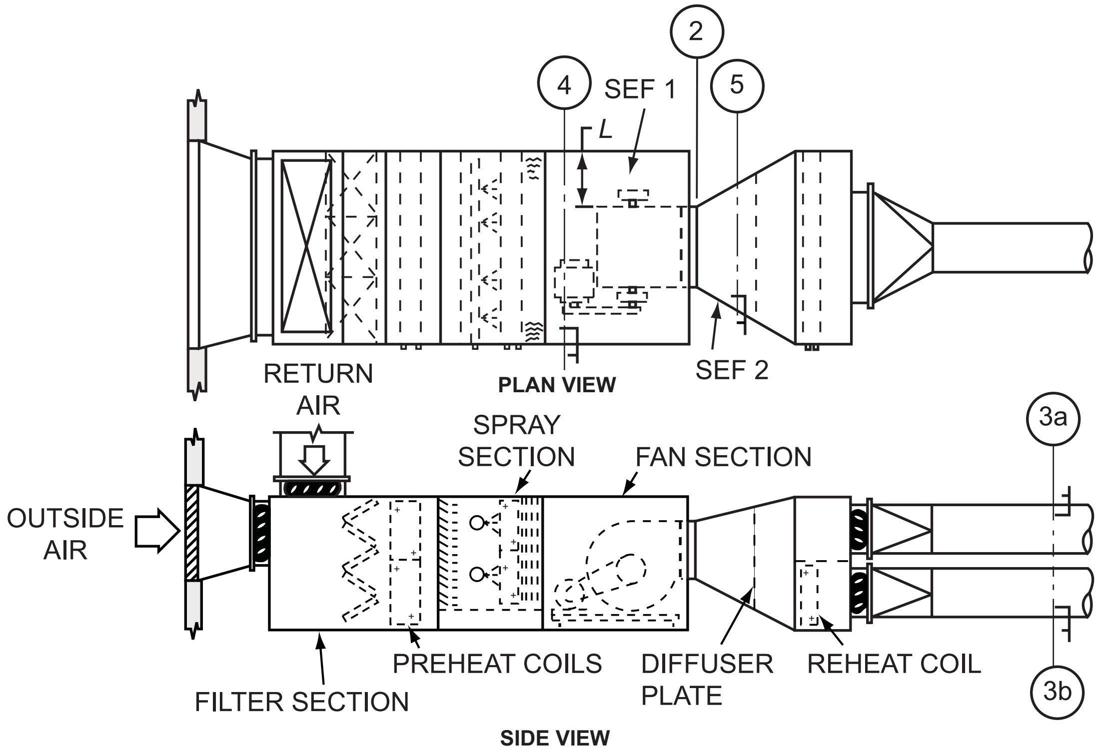
CONVERSION TO SPECIFIED CONDITIONS

$Q_c = 14273\ (620/625)$
$= 14159$ cfm

$P_{sc} = 0.89\ (620/625)^2\ (0.075/0.0721)$
$= 0.91$ in. wg

$H_c = 4.56\ (620/625)^3\ (0.075/0.0721)$
$= 4.63$ hp

EXAMPLE 4A: CENTRIFUGAL FAN IN A BUILT-UP AIR CONDITIONING UNIT



COMMENTS

1. This is an air conditioning unit which has been assembled at the installation site. The subject of the test is the fan, which is rated by the manufacturer as free-standing, unencumbered by the cabinet in which it has been installed. The fan performance ratings are based on operation with the fan outlet ducted. Before proceeding with the test, it is essential that all dampers--outside air, return air, mixing box, multizone, face and bypass or volume control--be fixed in the positions agreed upon by all interested parties as being applicable for the installation. Also, the temperatures of the heating coils must be kept constant throughout the test period. It may be necessary to lock out, disconnect, or otherwise modify automatic control devices in order to prevent the positions of the dampers and temperatures of the coils from changing during the test. Refer to Section 17.4.3 for additional considerations affecting the test procedure for fans in this type of installation.

2. Normally, velocity pressure measurements would be made in a single plane, located in a duct common to all branches. In this example, a measurement plane which provides a satisfactory velocity profile cannot be located upstream of the fan or between the point of connection of the branch ducts and the fan outlet. The alternative, as indicated in the diagram, is to make a velocity pressure measurement traverse in each branch. The velocity pressure for each branch is determined by using the root mean square of the velocity pressure measurements made in the traverse. the static pressure at each traverse plane is determined by averaging the static pressure measurements made in the same traverse. These static pressure values are used in determining the densities at the traverse planes. Procedures for traverses are described in Section 9.4. In order to determine the air flow rates, it is necessary to measure the area of each traverse plane.

3. Determine P_{s4} by averaging the static pressure measurements made in a traverse of Plane 4. Determine P_{s5} in a similar manner. Pitot-static tube traverses are used in determining these static pressures because the installation of suitable pressure taps is usually prevented by the insulating material encountered in this type of equipment. Due to the abrupt expansion in area from Plane 2 to Plane 5, it is assumed that there is no conversion of velocity pressure at Plane 2 to static pressure at Plane 5. Therefore, it is assumed that $P_{s2} = P_{s5}$. Measure the area of Plane 4 for use in calculating P_{v4}.

4. Measure the dry-bulb and wet-bulb temperatures at Plane 4 and the dry-bulb temperatures at Planes 3a, 3b, and 5. Determine p_b for the general vicinity of the air conditioning unit. These measurements are used in determining densities at the planes of interest.

5. Measure the fan speed and motor amps, volts, and if possible, watts. Record all pertinent motor nameplate data, including volts (NPV), and full load amps (FLA). If the motor power output is to be estimated by using the phase current method described in Annex K, it is not necessary to measure motor watts; however, it may be necessary to disconnect the drive and measure the no load amps (NLA) if the motor is not operating at or near its full load point. Refer to Annex K.

6. SEF 1 is due to the effect of insufficient distance between the fan inlets and the side walls of the fan cabinet. SEF 2 is attributed to the high degree of divergence of the transition fitting at the fan outlet. The effect created by this fitting is considered to be equivalent to the effect created by having no duct at the fan outlet. In order to determine the values of the SEFs, it is necessary to measure the diameter of an inlet of the fan, the distance between a fan inlet and a side wall of the fan cabinet, and the outlet area and blast area of the fan.

7. To calculate the Fan Static Pressure:

$$P_s = P_{s2} - P_{s1} - P_{v1} + \text{SEF 1} + \text{SEF 2}$$
$$= P_{s2} - (P_{s1} + P_{v1}) + \text{SEF 1} + \text{SEF 2}$$

Where:

$$P_{s2} = P_{s5}$$
$$P_{s1} + P_{v1} = P_{s4} + P_{v4}$$

$$P_{v4} = (Q_4/1096\ A_4)^2\ \rho_4$$

$$Q_4 = Q_1$$
$$= Q_{3a}\ (\rho_{3a}/\rho_1) + Q_{3b}\ (\rho_{3b}/\rho_1)$$

The calculation of P_{v4} is often ignored in instances similar to this example on the basis that the calculated value of P_{v4} is relatively small and its omission does not affect the test results significantly.

8. In order to compare the test results to the quoted fan curve drawn for operation at 1170 rpm and 0.075 lbm/ft^3 density, it is necessary to convert the results to the specified conditions. The basis for the calculations is described in Section 14.

OBSERVATIONS

SITE MEASUREMENTS

p_b = 28.72 in. Hg
t_{d3a} = 59°F
t_{d3b} = 90°F
t_{d4} = 56°F
t_{d5} = 58°F
P_{s4} = -1.75 in. wg
P_{s3a} = 3.65 in. wg
P_{s3b} = 3.45 in. wg
P_{v3a} = 0.60 in. wg
P_{v3b} = 0.47 in. wg
P_{s5} = 3.77 in. wg
N = 1160 rpm
A_2 = 18.9 ft^2
A_{3a} = 7.2 ft^2
A_{3b} = 9.7 ft^2
A_4 = 93.2 ft^2
Blast Area = 13.3 ft^2
D_1 = 3.92 ft, fan inlet diameter
L = 2.83 ft

MEASURED MOTOR DATA

Volts = 462, 465, 465
= 464 av
Amps = 82, 81, 83
= 82 av

MOTOR NAMEPLATE DATA

75 hp, 3 phase, 60 hertz
460 volts, 1780 rpm, 90.3 FLA

GENERAL

Fan connected to motor through belt drive.

CALCULATIONS

DENSITIES

For Plane 4 conditions of:

t_{d4} = 56°F
t_{w4} = 54°F

$$p_4 = p_b + (P_{s4}/13.6)$$
$$= 28.72 + (-1.75/13.6)$$
$$= 28.59 \text{ in. Hg}$$

Use Figure N.1 in Annex N to obtain ρ_4 = 0.0731 lbm/ft^3.

It is assumed that $\rho_1 = \rho_4$.

$$\rho_5 = \rho_4 \left(\frac{P_{s5} + 13.6p_b}{13.6p_4}\right)\left(\frac{t_{d4} + 460}{t_{d5} + 460}\right)$$
$$= 0.0731\left(\frac{3.77 + 13.6 \times 28.72}{13.6 \times 28.59}\right)\left(\frac{516}{518}\right)$$
$$= 0.0739 \text{ lbm/ft}^3$$

$$\rho_{3a} = \rho_4 \left(\frac{P_{s3a} + 13.6p_b}{13.6p_4}\right)\left(\frac{t_{d4} + 460}{t_{d3a} + 460}\right)$$
$$= 0.0731\left(\frac{3.65 + 13.6 \times 28.72}{13.6 \times 28.59}\right)\left(\frac{516}{519}\right)$$
$$= 0.0737 \text{ lbm/ft}^3$$

$$\rho_{3b} = \rho_4 \left(\frac{P_{s3b} + 13.6p_b}{13.6p_4}\right)\left(\frac{t_{d4} + 460}{t_{d3b} + 460}\right)$$
$$= 0.0731\left(\frac{3.45 + 13.6 \times 28.72}{13.6 \times 28.59}\right)\left(\frac{516}{550}\right)$$
$$= 0.0695 \text{ lbm/ft}^3$$

FLOW RATES

V_{3a} = 1096 $(P_{v3a}/\rho_{3a})^{0.5}$
= 1096 $(0.60/0.0737)^{0.5}$
= 3127 fpm

V_{3b} = 1096 $(P_{v3b}/\rho_{3b})^{0.5}$
= 1096 $(0.47/0.0695)^{0.5}$
= 2850 fpm

$Q_{3a} = V_{3a}A_{3a}$
= 3127 × 7.2
= 22514 cfm

$Q_{3b} = V_{3b}A_{3b}$
= 2850 × 9.7
= 27645 cfm

$Q = Q_1$
= Q_{3a} (ρ_{3a}/ρ_1) + Q_{3b} (ρ_{3b}/ρ_1)
= 22514 (0.0737/0.0731) + 27645 (0.0695/0.0731)
= 48982 cfm

$Q_2 = Q_1$ (ρ_1/ρ_2)
= 48982 (0.0731/0.0739)
= 48452 cfm

FAN POWER INPUT

Measured amps/FLA = (82/90.3)
= 0.91
= 91%

Annex K indicates that Equation A will provide a reasonably accurate estimate of motor power output for a 75 hp motor operating at 91% FLA.

H_{mo} = 75 (82/90.3) (464/460)
= 68.7 hp

Figure L.1 in Annex L indicates estimated belt drive loss of 4.3%.

H_L = 0.043 H_{mo}
= 0.043 × 68.7
= 2.95 hp

$H = H_{mo} - H_L$
= 68.7 - 2.95
= 68.75 hp

SYSTEM EFFECT FACTORS

SEF 1 is due to the effect of insufficient distance between the fan inlets and the side walls of the fan plenum. The distance is 2.83 ft, or:

(2.83/3.92) = 0.72
= 72%

Of the fan inlet diameter. The area of the fan inlets:

A_1 = 2 $(\pi D_1^2/4)$
= 2 $(\pi \times 3.92^2/4)$
= 24.1 ft^2

The fan inlet velocity:

$V_1 = (Q_1/A_1)$
= (48982/24.1)
= 2032 fpm

AMCA Publication 201-90, Figure 9.11A, indicates that for a plenum wall spacing of 72% of the fan inlet diameter *System Effect Curve* V applies. For 2032 fpm inlet velocity and curve V, Figure 7.1 shows SEF 1 = 0.06 in. wg at 0.075 lbm/ft^3 density. At 0.0731 lbm/ft^3:

SEF 1 = 0.06 (0.0731/0.075)
= 0.06 in. wg

For SEF 2, AMCA Publication 201-90, Figures 7.1 and 8.3, indicate the following calculations:

$V_2 = (Q_2/A_2)$
$= (48452/18.9)$
$= 2564$ fpm

Blast area ratio $=$ Blast Area/A_2
$= 13.3/18.9$
$= 0.70$

For a blast area ratio of 0.7 and no duct, Figure 8.3 shows *System Effect Curve* S applies. For 2564 fpm velocity and curve S, Figure 7.1 shows SEF 2 = 0.33 in. wg at 0.075 lbm/ft^3 density. At 0.0739 lbm/ft^3:

SEF 2 = 0.33 (0.0739/0.075)
= 0.33 in. wg

FAN STATIC PRESSURE

$P_{v4} = (Q_4/1096\ A_4)^2\ \rho_4$

Since:

$\rho_4 = \rho_1$
$Q_4 = Q_1$

$P_{v4} = (48982/1096 \times 93.2)^2\ 0.0731$
$= 0.02$ in. wg

$P_{s1} + P_{v1} = P_{s4} + P_{v4}$
$= -1.75 + 0.02$
$= -1.73$ in. wg

$P_s = P_{s2} - P_{s1} - P_{v1} +$ SEF 1 + SEF 2
$= P_{s2} - (P_{s1} + P_{v1}) +$ SEF 1 + SEF 2
$= 3.77 - (-1.73) + 0.06 + 0.33$
$= 5.89$ in. wg

CONVERSION TO SPECIFIED CONDITIONS

$Q_c = 48982\ (1170/1160)$
$= 49404$ cfm

$P_{sc} = 5.89\ (1170/1160)^2\ (0.075/0.0731)$
$= 6.15$ in. wg

$H_c = 65.75\ (1170/1160)^3\ (0.075/0.0731)$
$= 69.22$ hp