osborn®

Energy Conservation

SEALEZE® Brush for Heating Navy Hangars

Purpose

Possible solutions to energy loss problems have been proposed and are being used. These are discussed in this portion of the report.

SEALEZE® Nylon Brush Seals

The Patuxent River Naval Air Station has installed nylon brush seals on hangar aircraft access doors. **The nylon seals were easily installed by Public Works personnel** and have none of the maintenance problems, such as cracking and deformation, normally associated with the rubber seals currently used on most military installations. While the nylon brush seal was cost effective based upon reduction in seal replacement costs, data was not available on its effects upon hangar energy consumption.

Controlled tests were conducted at NCEL to measure the difference if any, in air infiltration rates with rubber seals and with nylon brush seals. These items were used to seal an opening in a pressure chamber; a variable speed blower, calibrated for air flow versus the pressure difference across the blower, was used to pressurize the chamber. The following table represents these test results. From this data, curve fit analyses were used to define the following empirical equations associated with the test results:

For rubber seals: $Q = 782S^{1.0574}$ per 100 ft of seal, ft/min^3

For nylon brush seals: $Q = 521S^{1.0157}$ per 100 ft. of seal, ft/min^3

Air leakage rates using rubber and nylon brush seals were calculated using these equations for wind speeds ranging from 1 to 20 mph, and a curve fit analysis was used to develop the following empirical equation for the differential leakage between the seals:

Differential leakage between rubber and nylon brush seals: $\Delta Q = 266\ S^{-1.1215}$ per 100 ft of seal, ft/min^3 (where S^{-} is the average wind speed during the heating season in miles per hour)

Results of NCEL Leakage Test

Performed on 3$^1/_2$" to 4" gap using 4" brush installed to manufacturers specification.

Wind Speed (mph)	Rubber Seal (cfm/100ft)	Brush Seal (cfm/100ft)	Wind Speed (mph)	Rubber Seal (cfm/100ft)	Brush Seal (cfm/100ft)	Wind Speed (mph)	Rubber Seal (cfm/100ft)	Brush Seal (cfm/100ft)
5.1		3,000	10.5	9,100	5,900	18.2	16,400	
5.1			12.2		6,400	18.7		9,800
5.2	4,800		12.3	10,700		18.9		11,000
5.4	5,000		12.5		7,200	19.2	18,300	
6.3	5,100	3,200	13	12,100		19.5	17,800	
6.6	6,000	3,500	14.4		7,500	20		11,300
7		4,000	14.8	14,000		20.6	19,800	
7.5	6,200		17.7		10,000	17.7		10,000
8	7,300	4,200	18	17,100				
10	7,500	5,600	18.2	16,400				

Blanks indicate data not taken.

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By approximating the average annual heating season inside/outside air temperature difference (by Equation 15 in full report), p = 0.076 lb/ft³. and c_p = 0.24 Btu/lb-°F, the annual energy loss, L_A, can be estimated from: $L_A = pc_p \Delta T_A \Delta Q_Y$ or

$$L_A = \frac{0.007D}{7} S^{-1.1215} \quad \text{MBtu per 100 ft of seal}$$

The following table presents the annual energy reduction obtained by using nylon brush seals versus average heating season wind speed for overall heating system efficiency of 60, 70, 80, and 100%.

Annual Energy Saving with Nylon Brush Seals

Average Wind Speed (mph)	Heating System Efficiency			
	100%	80%	70%	60%
5	40,000	51,000	55,000	75,000
6	50,000	60,000	70,000	90,000
8	70,000	90,000	100,000	125,000
10	90,000	120,000	130,000	155,000
12	112,000	150,000	160,000	190,000
14	140,000	170,000	190,000	225,000
16	160,000	190,000	225,000	260,000

Annual energy savings per degree day per 100 feet of seal (Btu)

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