

Results of Friction Coefficient Test

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Eight (8) base assemblies were tested for coefficient of static friction. The tests were performed by Professional Service Industries, Inc. in their laboratory in Pittsburgh, Pa. Three configurations were tested on four different surfaces.

The three assemblies were:

- HDPE Base
- HPDE Base on Rubberized Bearing Pad (Epoxyed to the base)
- HPDE Base on Rubberized Bearing Pad (Non-Epoxyed)

The four surfaces were:

- Dry Concrete
- Wet Concrete
- Dry Rubber Membrane
- Wet Rubber Membrane

A fifty (50) pound weight was placed on the center of the base assembly. A Chantillon Digital Force Gauge, Model #DRC 100, was used to pull the base. The horizontal force required to put the base into motion was then recorded. The coefficient of static friction is simply the horizontal force in pound divided by 50 pounds.

The results of the above test are tabulated as follows:

HDPE Base			
Test No.	Surface Condition	Force Applied	Coefficient of Friction
1	Dry Concrete	32.2	0.64
2	Dry Concrete	30.8	0.62
3	Dry Concrete	30.9	0.62
4	Dry Concrete	29.1	0.58
5	Dry Concrete	29.3	0.59
Average		30.5	0.61
HDPE Base/Rubberized Pad (Epoxyed)			
Test No.	Surface Condition	Force Applied	Coefficient of Friction
1	Dry Concrete	51.4	1.03
2	Dry Concrete	49.8	1.00
3	Dry Concrete	50.5	1.01
4	Dry Concrete	52.6	1.05
5	Dry Concrete	50.6	1.01
Average		51.0	1.02
HDPE Base/Rubberized Pad (Non-Epoxyed)			
Test No.	Surface Condition	Force Applied	Coefficient of Friction
1	Dry Concrete	37.7	0.75
2	Dry Concrete	38.4	0.77

3	Dry Concrete	39.3	0.79
4	Dry Concrete	38.1	0.76
5	Dry Concrete	37.5	0.75
Average		38.2	0.76
HDPE Base			
Test No.	Surface Condition	Force Applied	Coefficient of Friction
1	Wet Concrete	30.3	0.61
2	Wet Concrete	28.3	0.57
3	Wet Concrete	26.6	0.53
4	Wet Concrete	30.0	0.60
5	Wet Concrete	26.7	0.53
Average		28.4	0.57
HDPE Base/Rubberized Bearing Pad (Epoxyed)			
Test No.	Surface Condition	Force Applied	Coefficient of Friction
1	Wet Concrete	34.8	.070
2	Wet Concrete	36.3	0.73
3	Wet Concrete	38.1	0.76
4	Wet Concrete	37.5	0.75
5	Wet Concrete	38.3	0.77
Average		37.0	0.74
HDPE Base/Rubberized Bearing Pad (Non-Epoxyed)			
Test No.	Surface Condition	Force Applied	Coefficient of Friction
1	Wet Concrete	36.7	0.73
2	Wet Concrete	38.2	0.76
3	Wet Concrete	38.3	0.77
4	Wet Concrete	39.4	0.79
5	Wet Concrete	39.1	0.78
Average		38.3	0.77
HDPE Base			
Test No.	Surface Condition	Force Applied	Coefficient of Friction
1	Dry Rubber	52.2	1.04
2	Dry Rubber	52.8	1.06
3	Dry Rubber	50.6	1.01
4	Dry Rubber	51.1	1.02
5	Dry Rubber	52.1	1.04
Average		51.8	1.04
HDPE Base/Rubberized Bearing Pad (Epoxyed)			
Test No.	Surface Condition	Force Applied	Coefficient of Friction
1	Dry Rubber	46.9	0.94
2	Dry Rubber	43.4	0.87
3	Dry Rubber	43.9	0.88
4	Dry Rubber	43.2	.086
5	Dry Rubber	43.5	0.87
Average		44.2	0.88
HDPE Base/Rubberized Bearing Pad (Non-Epoxyed)			
Test No.	Surface Condition	Force Applied	Coefficient of Friction
1	Dry Rubber	36.5	0.73

2	Dry Rubber	40.4	0.81
3	Dry Rubber	37.8	0.76
4	Dry Rubber	41.6	0.83
5	Dry Rubber	39.4	0.79
Average		39.1	0.78
HDPE Base			
Test No.	Surface Condition	Force Applied	Coefficient of Friction
1	Wet Rubber	35.5	0.71
2	Wet Rubber	37.5	0.75
3	Wet Rubber	38.2	0.76
4	Wet Rubber	35.1	0.70
5	Wet Rubber	34.4	0.69
Average		36.1	0.72
HDPE Base/Rubberized Bearing Pad (Epoxyed)			
Test No.	Surface Condition	Force Applied	Coefficient of Friction
1	Wet Rubber	35.7	0.71
2	Wet Rubber	34.1	0.68
3	Wet Rubber	33.4	0.67
4	Wet Rubber	33.8	0.68
5	Wet Rubber	34.1	0.68
Average		34.2	0.68
HDPE Base/Rubberized Bearing Pad (Non-Epoxyed)			
Test No.	Surface Condition	Force Applied	Coefficient of Friction
1	Wet Rubber	37.4	0.75
2	Wet Rubber	37.8	0.76
3	Wet Rubber	38.7	0.77
4	Wet Rubber	38.3	0.77
5	Wet Rubber	37.3	0.75
Average		37.9	0.76

From these results, it is clear that a coefficient of static friction of .053 is conservative. The lowest individual reading of any of the 60 test pulls has a coefficient of .053. This is in the case of a bare HDPE base on wet concrete. It is the understanding of this engineering firm that the bare base is never in contact with the roof. A bearing pad is always utilized.

The highest average reading for a bare HDPE Base with Rubberized Epoxyed Bearing Pad was 1.02 on dry concrete. The lowest average reading was .076 on wet rubber. This assembly was very consistent for all surfaces.

Applying epoxy to the pad did not improve the friction factor for all of the utilizations that the product is likely to encounter. It is therefore recommended that the pad not be epoxyed to the base. This is the typical application.

Using a coefficient of static friction of .053 is conservative. Using a coefficient of .070 is recommended.