

SCOPE:

Test Pull-out, Pull-over and Edge Tear (Shear of Assembly) using Alpolic 3mm (.118") and 4mm (.157") ACM panels in conjunction with 4.6mm (.080") thick Aluminum Extrusions. Test materials were supplied by the customer.

TEST MATERIAL:

1247449: SA6/11-PH2-4,8x25 (#10x1" Phil Flat Head SD3 304 SS)
SN4/11-S-7504K-4.8x25 (#10x1" HWH SD3 304 SS)
L1300: SSO-D-32102 (STST 44D Blind Rivet)
6"x12"x3mm thick ACM Panel Samples
6"x12"x4mm thick ACM Panel Samples
12" long Aluminum Extrusions (.080" thick significant surfaces)

EQUIPMENT:

Dillon Model DTM tensile test machine.
Dillon 2000 Lb load cell.
DeWalt DW 284 2500 rpm max Screw Gun.

TEST METHOD:**Pull-out:**

10 fasteners of each type were tested per T-0750
Fasteners pulled from the .180" dimension of the extrusions, minimum 2" separation between pulls
For pull-out results on rivets, see section 'Pull-out / Pull-over Combination for Rivets'

Pull-over:

10 fasteners of each type were tested for each substrate thickness per T-0751
Pull-over was performed using 4"x4" samples of the respective panel types
For pull-out results on rivets, see section 'Pull-out / Pull-over Combination for Rivets'

Edge Tear (Shear of Assembly):

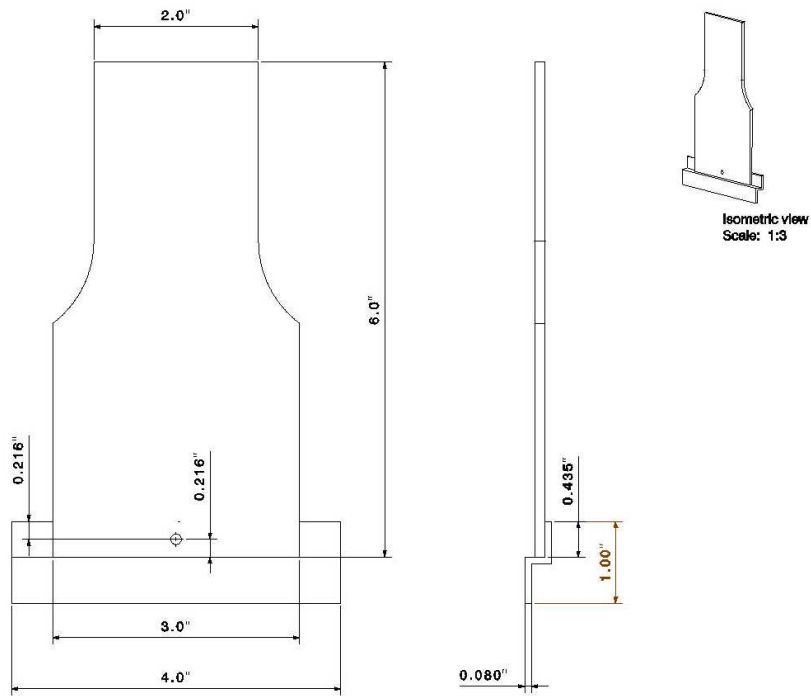
10 fasteners of each type were tested for each substrate thickness; pulling occurred in accordance with T-0750
Fasteners were installed .216" from the edge of the sheet (centered in the lip of the extrusion)
For pre-drill of rivets, a #30 drill bit was used
Test specimens were 3" wide at the bottom x 2" wide at the top dog bones; 6" long (See Figure 1 Below)
Test specimens were fastened into a 4" length of the extrusion

Pull-out / Pull-over Combination for Rivets:

7 rivets were tested for each substrate thickness; pulling occurred in accordance with T-0750
4" length of extrusion was pre-drilled using the #30 drill bit; .216" away from the edge of the flange
Extrusion was mounted to a 6" x 10" panel sample (also pre-drilled with a #30 bit) with the extrusion facing perpendicular to the 10" dimension of the test panel

FIGURES:

Figure 1: Edge Tear Assembly



TEST DATA (all results shown in lbs):

Table 1: Result Summary

Test	#10 Flat	#10 Hex	#44 Rivet
Pull-out	646	677	N/A
3mm Pull-over	385	503	N/A
4mm Pull-over	415	530	N/A
3mm Pull-out / Pull-over Combo	N/A	N/A	313
4mm Pull-out / Pull-over Combo	N/A	N/A	369
3mm Edge Tear	287	390	295
4mm Edge Tear	289	367	301

Table 2: Pull-out Results

Trial	#10 Flat	#10 Hex
1	627	745
2	669	739
3	641	666
4	608	672
5	641	670
6	656	644
7	642	650
8	645	665
9	672	685
10	663	639

Average	646	677
Std Dev	19.5	36.7

Table 3: 3mm Panel Pull-over Results

Trial	#10 Flat	#10 Hex
1	377	510
2	366	517
3	402	511
4	393	504
5	377	493
6	407	485
7	378	507
8	407	506
9	360	495
10	380	504

Average	385	503
Std Dev	16.6	9.7

Table 4: 4mm Panel Pull-over Results

Trial	#10 Flat	#10 Hex
1	421	529
2	421	527
3	391	534
4	425	529
5	418	524
6	423	542
7	420	532
8	417	527
9	422	532
10	396	523

Average	415	530
Std Dev	11.6	5.47

Table 5: 3mm Panel Pull-out / Pull-over Results

Trial	Load	Result
1	323	Pull-over
2	318	Pull-over
3	309	Pull-over
4	316	Pull-over
5	313	Pull-over
6	307	Pull-over
7	304	Pull-over

Average	313
Std Dev	6.78

Table 6: 4mm Panel Pull-out / Pull-over Results

Trial	#44 Rivet	Result
1	358	Pull-over
2	352	Pull-over
3	325	Pull-over
4	335	Pull-over
5	339	Pull-over
6	534	Pull-over
7	337	Pull-over

Average	369
Std Dev	73.7

Table 7: 3mm Panel Edge Tear Results

Trial	#10 Flat	#10 Hex	#44 Rivet
1	303	380	320
2	274	386	295
3	278	390	299
4	297	393	306
5	283	409	276
6	288	388	290
7	297	379	278
8	277	394	277
9	283	399	297
10	285	383	307

Average	287	390	295
Std Dev	9.73	9.33	14.4

Table 8: 4mm Panel Edge Tear Results

Trial	#10 Flat	#10 Hex	#44 Rivet
1	285	348	316
2	314	370	297
3	268	378	288
4	311	374	302
5	264	359	295
6	282	369	295
7	280	370	306
8	276	373	316
9	309	358	292
10	297	373	299
Average	289	367	301
Std Dev	18.0	9.34	9.69

CONCLUSION:

The values expressed herein are ultimate strength values, which were the result of laboratory testing. Appropriate safety factors should always be utilized in design and other possible failure modes should also be considered.