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TEST REPORT

Report Number: 2505-18001 **Project No.:** 28936

Report Issued: January 4, 2018

Client: Daldorado, LLC
4327 Arnold Avenue
Naples, Florida 34104

Contact: Mr. Jeff Steuber

Source of Samples: The samples were sent by Daldorado, LLC and received by IAPMO R&T Lab in good condition on August 7, 2017.

Date of Testing: October 19, 2017 through December 22, 2017

Sample Description: Suction fittings

Model No.: See page 2.

See figures for sample construction and test configurations.

Scope of Testing: The purpose of the testing was to determine if the sample tested suction fitting met requirements of APSP 16-2011 entitled, "Suction Fittings for use In Swimming Pools, Wading Pools, Spas, and Hot Tubs."

CONCLUSION: **The samples tested of the suction fitting models listed on page 2 from Daldorado, LLC, COMPLIED with the applicable requirements of APSP 16-2011.**

Tested By,

Jason Tsan, Test Engineer

Reviewed By,

Tony Zhou, VP-Electrical Engineering

Model No.:	Description
*DalMax-SG-1836	Sump and two grate model DalMax-GO-1818
DalMax-SO-1836	Sump (18” x 36” x 34”) with 12” outlet
DalMax-FG-1836	Retrofit Frame and two grate model DalMax-GO-1818
DalMax-GO-1818	18x18 Flat Grate
*DalMax-SG-1854	Sump and three grate model DalMax-GO-1818
DalMax-SO-1854	Sump (18” x 54” x 34”) with 14” outlet
DalMax-FG-1854	Retrofit Frame and three grate model DalMax-GO-1818

*Note: Model Tested

Primary Standard: **APSP 16-2011**

Sections tested/evaluated:

2	Fitting Design, Assembly, and Material Requirements
3	Physical Testing
3.1	General
3.2	Ultraviolet Light Exposure Test
3.3	Vertical Load and Deformation Test
3.4	Horizontal Load and Deformation Test
3.5	Point Load to Excess Test
3.6	Shear Load Test
3.7	Pressure Differential and Point Impact Test
3.9	Mold Stress Relief Distortion
4	Hair Entrapment
5	Body Entrapment
6	Finger and Limb Entrapment
7	Packaging and Installation Instructions

Test Results: All tests and evaluations were conducted per the written procedures in the specified standard.

APSP 16-2011

2 Fitting Design, Assembly, and Material Requirements

2.1 General Requirements – COMPLIED

2.1.1 The suction fittings were provided with fasteners that require tools for disassembly. Phillips head machine screws were used for affixing cover/ grates to the suction fitting body. Fasteners were made of grade 316 stainless steel and are corrosion resistant to the intended environment.

Threaded fasteners were provided with minimum of three threads of engagement. The strength of the fastening system conformed to the requirements of this Standard.

2.1.2 The suction fitting assembly was tested connecting to a manufacturer provided sump that has been evaluated for compliance to ASTM D2466.

2.1.3 There were no accessible sharp edges to constitute a hazard with fully assembled suction fittings.

2.1.4 Suction fittings did not protrude from the installed surface more than 2 inches. The suction fitting was flush with the surface.

2.2 Fitting Exposure – COMPLIED

Polymeric material suction fitting components shall be tested as described in Clause 3.2 and be rated for service life in accordance with Clause 7.1.1(b)(5).

Finding: The suction fittings were made of plastic material. The service life rating was provided and specified replacement of fitting every 10 years.

2.3 Specific Design Requirements

2.3.1 Field Fabricated Outlets. Field fabricated outlets are intended as but are not limited to a single suction outlet and are limited to 1.5 ft/sec (0.46 m/s) of flow through the open area of the cover/grate unless rated at a lower flow rate by the Registered Design Professional. They shall be of such a size that the 18 in. x 23 in. (457 mm x 584 mm) body-blocking element will not cause a differential pressure that could cause body entrapment as defined below. They are further governed by the stipulations of Mandatory Appendix II.

3 Physical Testing

3.1 General – FOLLOWED

All specimens were conditioned and inking procedures followed.

3.2 Ultraviolet Light Exposure Test – COMPLIED

Test Method 2 was utilized to evaluate the material. Samples of the fitting polymeric materials were exposed to ultraviolet light in accordance with ASTM G 154, using the Common Exposure condition, Cycle 1, found in Table X2.1 of ASTM G 154 for a period of 750 hr. Samples of the material shall retain at least 70 percent of the unconditioned value when evaluated for Tensile Strength and Izod Impact in accordance with ASTM D638 and ASTM D256, respectively.

Finding: The black samples of the material retained 86% and 90% of the unconditioned value for the tensile strength test and the Izod Impact test, respectively. The higher K factor was selected as the intensification factor and determined to be 1.16. The results were obtained from CRT Laboratories, Inc., Report #20448.

3.3 Vertical Load and Deformation - COMPLIED

Six fittings intended for installation in the floor or wall were tested. A point load of 300 lbf x 1.16 was applied at the following locations using the tup and a 2 inch diameter "Skin Pad" on the face of the tup on the fitting face, at two points midway between the center and edge, and at two points between stiffeners.

Finding: Suction fitting did not permanently deform, crack, or lose any material from the fitting.

3.4 Horizontal Load and Deformation Test - COMPLIED

Fittings to be tested shall be the six as previously tested in para. 3.3. This test is identical to the Vertical Test except that the load is 150-lbf ±5 lbf (667 N ±22 N) x K (1.16). This applies only to fittings intended for and marked “Wall Only” or “Wall or Floor.”

Finding: Suction fittings did not have deformation, crack, or lose any material after the Horizontal Load and Deformation test has been performed.

3.5 Point Load to Excess – COMPLIED

The test equipment to be used shall be the same and positioned as described in para. 3.3, with “Skin Pad.” The units shall be subjected to additional loading, with a load speed of 0.20 in./min to 0.25 in./min (5.1 mm/min to 6.4 mm/min), until the tup protrudes through the cover/grate or until a value of 600 lbf × K ±10 lbf (2 669 N × K ±44 N) x K (1.16) is reached.

Finding: Suction fitting did not sustain loss of any material from the fitting at 696 lbf.

3.6 Shear Load Test – NOT APPLICABLE

Six fittings were tested by the application of a 150 lbf x K (1.16) test load applied 30 degrees from the mounting plane by a loading face 2 inch square covered with a 2 inch “Skin Pad” on its face. Three fittings were tested with fasteners directly in line with the load to test the fastener's strength, and three were tested with the load midway between fasteners for general strength.

Findings: Suction fittings did not protrude ½” or more.

3.7 Pressure Differential and Point Impact – COMPLIED

The same six fittings used in the Shear Load Test (Clause 3.6) were used. The fitting were mounted on a horizontal surface and covered with a 20 mil (0.5 mm) plastic material or other suitable material. The fitting outlet shall be connected to a pressure and subjected to a 28.5 in. (724 mm) Hg × K pressure within 60 sec ±5 sec. The pressure was sustained for 5 min ±10 sec.

The pressure was then stopped, the plastic film removed, and the fitting was impacted at 15 ft-lbf x 1.16 using the test method in ASTM D 2444, with a 5 lb, 2 inch diameter, 2 inch radius nose steel tup. The fitting shall be again connected to the pressure system and again it shall be subjected to the 28.5 in. (724 mm) Hg × K differential pressure within 60 sec ±5 sec.

After removal from the test fixture, water-soluble contrasting ink shall be applied in accordance with paras. 3.1.6 and 3.1.6.1 and the fitting shall be inspected for cracks, breaks, or fractures in accordance with para. 3.1.6.2.

Findings: The cover remained in place. The fitting did have permanently deform, crack, or lose any material from the fitting. The differential pressure of 28.5 in. Hg x K (1.16) = 33.06 in. Hg was applied before and after.

3.8 Pull Load – COMPLIED

The same six fittings in the Pressure Differential and Point Impact Test (see Clause 3.7) shall be used. The cover/grate shall be tested by the application of a 150 lbf x K (1.16) test load to the underside of the cover/grate assembly and perpendicular to the mounting surface directly adjacent to the fasteners, and midway between fasteners when the fitting is installed in accordance with the manufacturer's instructions. The distortion under load shall not compromise the fasteners, loosen the cover/grate, permanently deform, or crack the fitting.

Findings: The cover remained in place. The fitting did not permanently deform, crack, or lose any material.

3.9 Mold Stress Relief Distortion – FOLLOWED

One sample of non-UV exposed fitting was maintained at a uniform temperature of 140 F for a period of 7 hours then used for the Hair and Body Entrapment Test.

4 Hair Entrapment Test

Two types of hair were used in this test and separate tests were run with each type. Type 1 hair consisted of a full head of natural, fine, straight, blond European, human hair with cuticle on hair stems, 16 inch in length (5.5 oz) and was firmly affixed in a manner approximating the normal distribution of hair with "hook and loop" to a Professional Wig Display Mannequin. Type 2 hair consisted of a natural, medium to fine, straight, light-brown colored human hair

weighing 2 oz and having a length of 16 inches and was affixed to a 1 inch diameter by 12 inch wooden dowel. The suction fittings were installed in the test container and tested per the conditions described in section 4.2.

Findings: Testing was conducted using manufacturer provided sump. Test conducted using a pneumatic pull method. See Table 1 for complete test results.

Model	Floor	Wall
DalMax-SG-1836	2869 GPM	2080 GPM
DalMax-SG-1854	4412 GPM*	-

The results were obtained from NSF, Report IAPMOFI-FI20180104133259-J-00270475-C0355892.

5 Body Entrapment

A torso specimen consisting of the body block element foam identified as Closed Cell NBR/PVC Foam was mounted against a waterproofed plywood backing, with the skin side away from the plywood, with an eyebolt, hitching ring, or equivalent at the centroid.

With the outlet flowing at the smaller of the maximum flow specified by the manufacturer or as determined in Clause 4.3, the body block element was placed on the cover/grate with an applied force of 120 lbf. The maximum allowable removal force, immediately after the 120 lbf applied force is released, did not exceed the maximum allowable removal force as specified in Table 1 in three consecutive tests.

Findings: The alternate option of calculating the flow rate was used. The results are as follows:

Model	Calculated Body Entrapment Results
DalMax-SG-1836	2869 GPM
*DalMax-SG-1854	6563 GPM

6 Finger and Limb Entrapment - COMPLIED

When fully assembled, suction fittings shall not have any accessible opening that allows the passage of the 1 in. *(25 mm)* cylindrical end of the UL Articulate Probe. Each aperture on the assembled suction fitting shall be subjected to the insertion of both ends of an UL Articulate Probe. Using 3lbf *(12 N)* ±5%, the Articulate Probe shall be urged through all exposed apertures of the assembled suction fitting.

The Finger Entrapment Tests was conducted on one new suction fitting and conditioned at room temperature. Testing was conducted with the UL Articulate Probe in accordance with Figs. 1, 13, 14, 15, and 16. Each aperture on the assembled suction fitting was subjected to the insertion of both ends of an UL Articulate Probe with a force of 3 lbf.

Finding: A small or large aperture did not allow the 1 in. cylindrical end of the UL Articulate Probe to penetrate through to the inside surface of the aperture.

In addition,

(a) Large aperture(s) did not permit the second articulation joint to pass beyond an apposed edge or pinch point that is located inside the aperture being tested.

(b) Large aperture(s) shall be permitted when the centerline of the second articulation joint, located 2.36 in. (59.9 mm) from the point end of the UL Articulate Probe, cannot be made to pass beyond an apposed edge or pinch point that is located inside the aperture being tested.

(c) Edges and pinch points within the aperture and within range of the first articulate joint in accordance with Fig. 1 were less than 0.311 inch wide, measured parallel to the aperture opening and have no protrusions above the aperture surface. No edges wider than 0.311 inch were outside of the aperture.

(d) Edges and pinch points created by molding lines, engraved text, and symbols within the aperture did not exceed a height of 0.025 inch for all models.

7 Packaging and Installation Instructions

7.1 Marking of Suction Fittings – COMPLIED

The fitting was permanently marked with the following in sequence and was visible in the installed position with 10 pt font (0.1-in tall) minimum:

(1) the statement, “Single or Multiple Drain Use”
(2) the maximum flow rate in gpm,

Model	Floor	Wall
DalMax-SG-1836	2869 GPM	2080 GPM
DalMax-SG-1854	4412 GPM	-

(3) the “Type" of the fitting, “Submerged Suction Outlets”
(4) Life: X Years, "Life: 10 Year"
(5) installation position, "Floor or Wall"
(6) manufacturer's name, “Daldorado”
(7) model designation, “DalMax-SG-1836” and “DalMax-SG-1854”

Finding: The actual font size was 0.13 in. tall according to drawings provided.

7.2 Packaging of Suction Fittings – COMPLIED

(a) information on installation and service including:

(1) type designation, “For single or multiple drain use”

(2) instructions not to locate suction outlets on seating areas or on the backrests for such seating areas

(3) instructions stating that when two or more suction fittings are used on a common suction line they shall be separated by a minimum of 3 ft, or if any are located closer they shall be located on two different planes

(4) instructions stating that in the event of one suction outlet being completely blocked, the remaining suction outlets serving that system shall have a flow rating capable of the full flow of the pump(s) for the specific suction system

(5) maximum flow rating with head loss curve,

(6) acceptable connecting pipe sizes,

(7) mounting positions, “Floor or Wall”.

(8) part numbers and/or model numbers, See Pg. 1 for model designation.

(9) part number and “Replace within 10 years for cover and screws”

(10) tools required, “#2 Square screwdriver”

(11) service and winterizing instructions

(b) a cautionary note not to exceed the maximum allowable flow rate stated on the suction fitting

(c) a note that the suction fitting including fasteners should be observed for damage or tampering before each use of this facility

(d) a statement that missing, broken, or cracked suction fittings shall be replaced before using this facility

(e) a statement that loose suction fittings shall be reattached or replaced before using this facility

(f) a statement “Read, then keep these instructions for future reference”

(g) a cautionary note about increasing flow by increasing pump size.

Finding: The installation instruction was provided for review and contained the required above Items.

Table 1 – Hair Entrapment Test Results: Suction Fitting Model No. DalMax-SG-1836 connected to 12" Diameter Pipe.

Flow Rate GPM	Mounting Position / Hair Type	Hair Pulls	1	2	3	4	5	6	7	8	9	10
3420	Wall/1	Pull Lbs	4.17	4.36	4.33	4.20	3.96	4.02	4.14	4.09	4.19	4.09
3520	Wall/1	Pull Lbs	4.57	3.83	4.58	3.95	4.06	3.98	4.34	3.97	4.01	4.08
3620	Wall/1	Pull Lbs	4.16	4.21	4.31	4.32	4.03	9.87	3.93	4.41	4.13	4.12
3420	Wall/2	Pull Lbs	1.05	1.00	1.14	1.08	1.17	1.06	1.11	1.18	1.09	1.18
3520	Wall/2	Pull Lbs	1.06	0.94	1.18	1.32	1.05	0.91	1.00	0.94	1.01	1.07
3620	Wall/2	Pull Lbs	1.47	1.43	1.73	1.63	1.31	1.06	1.08	1.19	1.39	1.16

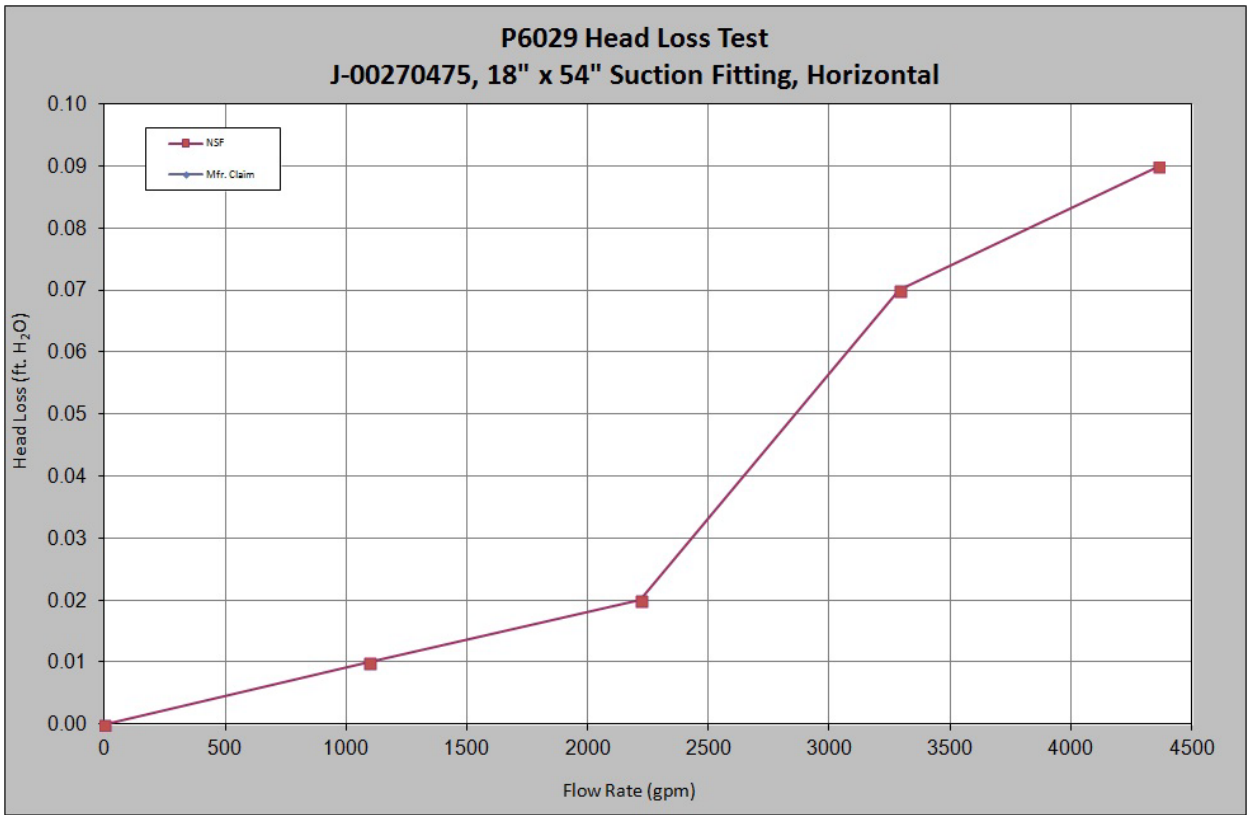
Table 2 – Hair Entrapment Test Results: Suction Fitting Model No. DalMax-SG-1854 connected to 14" Diameter Pipe.

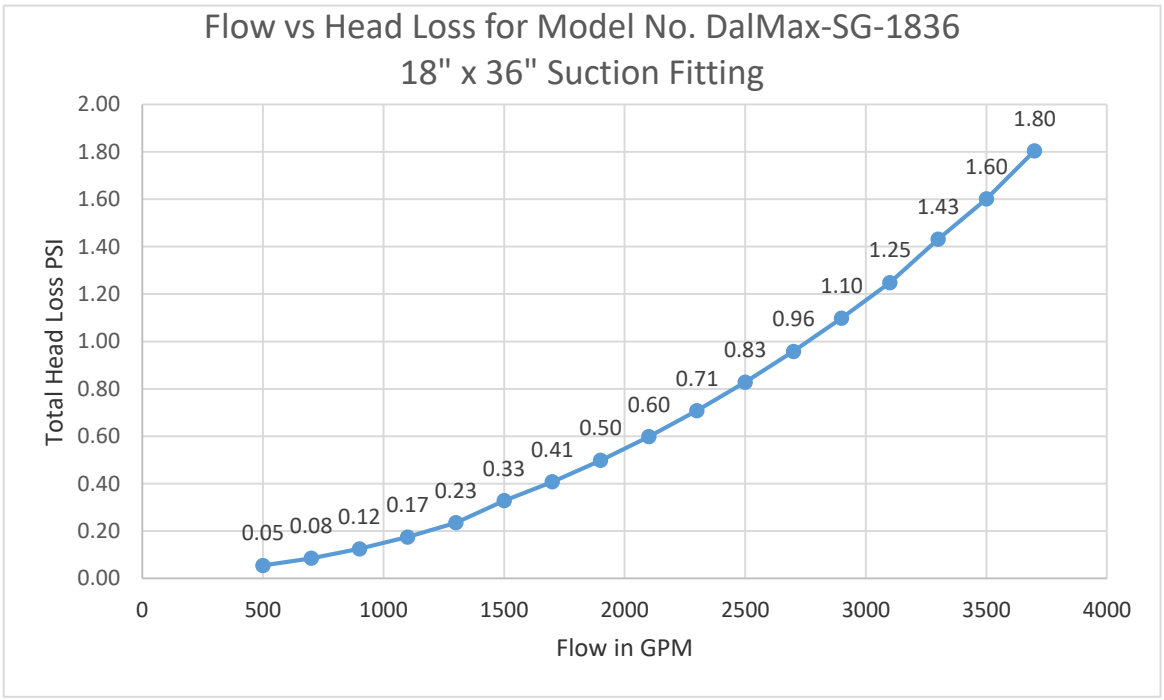
Test Flow Rate (GPM)	# Pulls	# Pulls ≥ 5 lbs.	Max Pull Force (lbs)	Hair Type
5515	10	0	4.780	I
5515	10	0	1.220	II

The results were obtained from NSF, Report IAPMOFI-FI20180104133259-J-00270475-C0355892.

Table 3 – Head Loss Results: Suction Fitting Model No. DalMax-SG-1854 connected to 14" Diameter Pipe.

Flow rate (GPM)	4362	3289	2218	1095	0.0
Total Head Loss (ft. H2O)	0.09	0.07	0.02	0.01	0.00


P6029 Head Loss Test
J-00270475, 18" x 54" Suction Fitting, Horizontal
NSF
Mfr. Claim
Head Loss (ft. H2O)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Flow Rate (gpm)

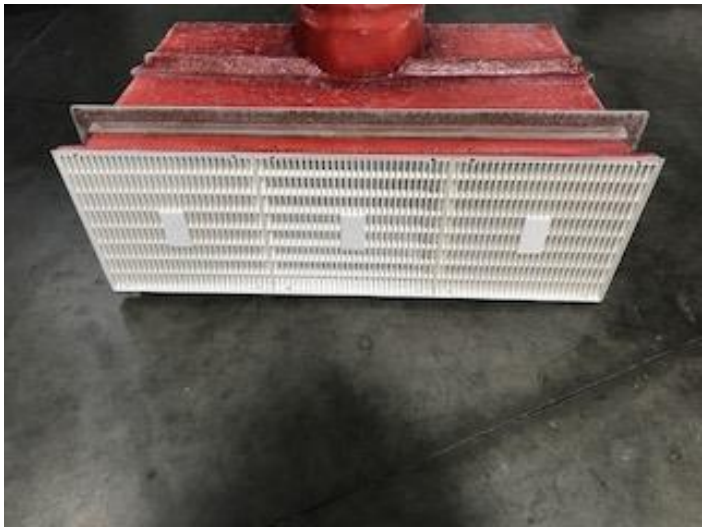

Flow vs Head Loss for Model No. DalMax-SG-1836
18" x 36" Suction Fitting
Total Head Loss PSI
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.05
0.08
0.12
0.17
0.23
0.33
0.41
0.50
0.60
0.71
0.83
0.96
1.10
1.25
1.43
1.60
1.80
0
500
1000
1500
2000
2500
3000
3500
4000
Flow in GPM

Photograph of tested samples.

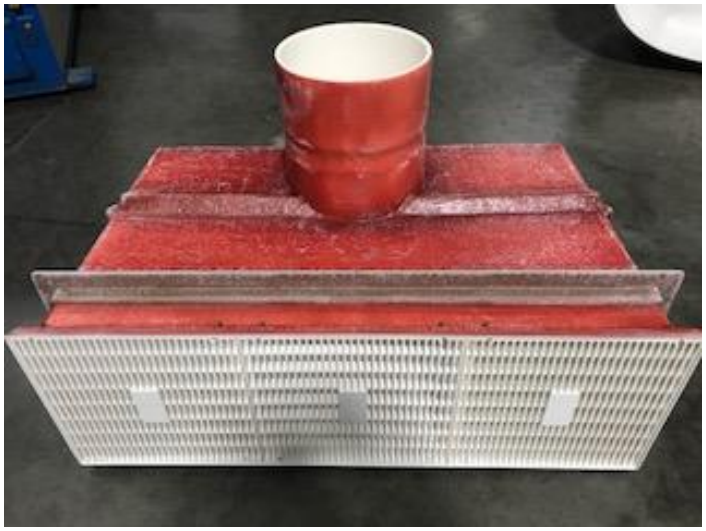
Model No. DalMax-SG-1836

Model No. DalMax-SG-1836

Model No. DalMax-SG-1836



Model No. DalMax-SG-1854



Model No. DalMax-SG-1854

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