



TEST REPORT

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Report Number: 2505-18004

Project No.: 30704

Report Issued: November 14, 2018

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

Contact: Mr. Robert Lawson

Source of Samples: The samples were sent by Daldorado, LLC and received by IAPMO R&T Lab in good condition on July 23, 2018.

Date of Testing: September 23, 2018 through October 16, 2018

Sample Description: Suction fittings
Model No.: See page 2.

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 above from Daldorado, LLC, COMPLIED with the applicable requirements of APSP 16-2011.**

Tested By,

Victor Soria, Test Engineer

Reviewed By,

Tony Zhou, VP-Electrical Engineering

Model No.:	Description
*DalMax-SG-183628	Sump model DalMax-SO-183628 and two grate model DalMax-GO-1818
DalMax-FG-183628	Retrofit Frame and two grate model DalMax-GO-1818 (for use in field-built sump with 28 Inch depth, 10" outlet)
*DalMax-SG-183624	Sump model DalMax-SO-183624 and two grate model DalMax-GO-1818
DalMax-FG-183624	Retrofit Frame and two grate model DalMax-GO-1818 (for use in field-built sump with 24 Inch depth, 8" outlet)

*Model Tested, where model DalMax-GO-1818 is 18 inches by 18 inches Flat Grate, model DalMax-SO-183628 is the sump (18" x 36" x 28") with 10" outlet and model DalMax-SO-183624 is the sump (18" x 36" x 24") with 8" outlet.

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 25 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: Test results extended from IAPMO R&T Lab Test Report No. 2505-18001-002. The white 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 No. 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: Test results extended from IAPMO R&T Lab Test Report No. 2505-18001-002. 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 \pm 5 lbf (667 N \pm 22 N) x K (1.16). This applies only to fittings intended for and marked "Wall Only" or "Wall or Floor."

Finding: Test results extended from IAPMO R&T Lab Test Report No. 2505-18001-002. 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 \times K \pm 10 lbf (2 669 N \times K \pm 44 N) x K (1.16) is reached.

Finding: Test results extended from IAPMO R&T Lab Test Report No. 2505-18001-002.
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: Test results extended from IAPMO R&T Lab Test Report No. 2505-18001-002.
Since the suction fittings did not protrude ½” or more, the shear load test was not applicable.

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 x 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 x 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: Test results extended from IAPMO R&T Lab Test Report No. 2505-18001-002. The cover remained in place. The fitting did not 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: Test results extended from IAPMO R&T Lab Test Report No. 2505-18001-002. 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. The marked flow rating is lesser of the Hair or Body Entrapment Test result.

Model	Floor	Wall
DalMax-SG-183628	2720 GPM	1909 GPM
DalMax-SG-183624	1984 GPM	1440 GPM

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: See Table 2 for complete test results. The marked flow rating is lesser of the Hair or Body Entrapment Test result.

Model	Body Entrapment Results
DalMax-SG-183628	2480 GPM
DalMax-SG-183624	2240 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) \pm 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 Drain Use”

(2) the maximum flow rate in gpm,

Model	Floor	Wall
DalMax-SG-183628	2480 GPM	1909 GPM
DalMax-SG-183624	1984 GPM	1440 GPM

(3) the “Type” of the fitting, “Submerged Suction Outlets”

(4) Life: X Years, "Life: 25 Years"

(5) installation position, "Floor or Wall"

(6) manufacturer's name, “Daldorado”

(7) model designation, “DalMax-SG-183634” and “DalMax-SG-183628”

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 25 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. DalMax-SG-183628 and DalMax-SG-183624

Table 1a – Hair Entrapment Test Results: Suction Fitting Model No. DalMax-SG-183628 with a 10” port, connected with a reducer to a 12” Diameter Pipe.

	Flow Rate GPM	Mounting Position / Hair Type	Hair Pulls	1	2	3	4	5	6	7	8	9	10
1	2180	Wall/1	Pull Lbs.	3.89	4.04	3.91	4.05	3.96	3.49	3.91	4.15	4.65	4.44
2	2280	Wall/1	Pull Lbs.	4.25	4.01	3.98	3.78	4.49	4.15	3.86	4.25	4.11	4.14
3	2387	Wall/1	Pull Lbs.	4.33	4.03	4.69	4.86	4.69	3.98	4.21	4.89	4.92	3.98
4	2480	Wall/1	Pull Lbs.	5.24	5.42	6.38							
1	3300	Wall/2	Pull Lbs.	2.48	2.98	2.75	3.15	3.25	1.98	1.55	2.96	3.45	3.61
2	3400	Wall/2	Pull Lbs.	3.23	2.55	3.63	1.98	1.45	2.48	3.15	2.23	1.69	1.89
3	3500	Wall/2	Pull Lbs.	2.55	2.01	2.98	2.61	2.98	2.22	2.03	2.45	2.48	3.95

Note: Hair type one represents hair with mannequin head, hair type 2 is the hair with dowel, for wall with type 2 hair the max that the pump would reach is 3500 gpm.

Table 1b – Hair Entrapment Test Results: Suction Fitting Model No. DalMax-SG-183628 with a 10” port, connected with a reducer to a 12” Diameter Pipe.

	Flow Rate GPM	Mounting Position / Hair Type	Hair Pulls	1	2	3	4	5	6	7	8	9	10
1	3270	Floor/1	Pull Lbs.	3.79	4.16	3.62	4.64	4.29	3.51	4.25	3.72	3.78	3.90
2	3380	Floor/1	Pull Lbs.	4.76	3.96	4.53	3.75	4.46	4.42	5.17	4.72	3.79	5.17
3	3380	Floor/1	Pull Lbs.	4.72	3.79	4.63	4.73	4.48	4.25	4.38	4.56	4.48	4.42
4	3400	Floor/1	Pull Lbs.	4.58	4.64	4.29	4.49	4.23	4.30	4.90	3.94	4.29	4.85
5	3460	Floor/1	Pull Lbs.	5.03	4.62	5.28							
6	3535	Floor/1	Pull Lbs.	4.23	4.41	4.40	4.08	4.40	4.37	4.41	4.70	4.45	5.38 / 5.01
1	3300	Floor/2	Pull Lbs.	1.57	1.35	1.13	1.13	1.14	1.20	1.41	1.45	1.45	1.51
2	3400	Floor/2	Pull Lbs.	1.66	1.33	1.73	1.21	2.22	1.22	1.46	1.89	1.60	1.43
3	3500	Floor/2	Pull Lbs.	2.21	2.14	2.01	1.97	1.98	1.96	2.23	2.35	2.05	2.09

Note: Hair type one represents hair with mannequin head, hair type 2 is the hair with dowel, for floor with type 2 hair the max that the pump would reach is 3500 gpm.

Table 1c – Hair Entrapment Test Results: Suction Fitting Model No. DalMax-SG-183624 with a 8” port, connected with a reducer to a 12” Diameter Pipe.

	Flow Rate GPM	Mounting Position / Hair Type	Hair Pulls	1	2	3	4	5	6	7	8	9	10
1	1600	Wall/1	Pull Lbs.	3.75	3.91	3.86	2.80	3.69	3.89	4.63	4.15	3.13	2.98
2	1700	Wall/1	Pull Lbs.	4.53	3.85	4.89	3.83	3.69	4.88	4.09	3.86	3.89	4.78
3	1800	Wall/1	Pull Lbs.	3.78	3.57	4.89	4.68	4.72	3.22	4.25	4.41	3.87	4.32
4	1900	Wall/1	Pull Lbs.	5.75	4.98	5.01							
1	3300	Wall/2	Pull Lbs.	2.46	3.09	3.25	3.05	3.25	3.98	2.52	3.92	3.55	3.65
2	3400	Wall/2	Pull Lbs.	2.65	2.43	2.22	3.12	3.03	4.03	4.15	4.72	2.34	4.42

3	3500	Wall/2	Pull Lbs.	1.98	2.02	2.15	3.83	3.22	3.36	2.63	2.99	3.45	3.50
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Note: Hair type one represents hair with mannequin head, hair type 2 is the hair with dowel, for wall with type 2 hair the max that the pump would reach is 3500 gpm.

Table 1d – Hair Entrapment Test Results: Suction Fitting Model No. DalMax-SG-183624 with a 8” port, connected with a reducer to a 12” Diameter Pipe.

	Flow Rate GPM	Mounting Position / Hair Type	Hair Pulls	1	2	3	4	5	6	7	8	9	10
1	2280	Floor/1	Pull Lbs.	3.41	3.68	3.51	3.21	3.17	3.11	2.98	3.76	3.58	3.41
2	2380	Floor/1	Pull Lbs.	3.78	3.21	4.05	3.60	3.58	4.41	4.21	3.78	4.76	4.41
3	2480	Floor/1	Pull Lbs.	3.26	3.72	3.78	3.60	4.58	4.55	4.89	3.98	4.88	4.13
4	2580	Floor/1	Pull Lbs.	4.90	4.48	4.13	4.70	4.98	5.05	5.48	5.12		
1	3300	Floor/2	Pull Lbs.	2.48	2.98	2.75	3.15	3.25	1.98	1.55	2.96	3.45	3.61
2	3400	Floor/2	Pull Lbs.	3.23	2.55	3.63	1.98	1.45	2.48	3.15	2.23	1.69	1.89
3	3500	Floor/2	Pull Lbs.	2.55	2.01	2.98	2.61	2.98	2.22	2.03	2.45	2.48	3.95

Note: Hair type one represents hair with mannequin head, hair type 2 is the hair with dowel, for floor with type 2 hair the max that the pump would reach is 3500 gpm.

Table 2a – Body Entrapment Test Results: Suction Fitting Model No. DalMax-SG-183628 with a 10” port, with reducer connected to 12” Diameter Pipe.

Model	Flow Rate GPM	Body Element Pulls	1	2	3	Max Pull Force
DalMax-SG-183628	2880 GPM	Pull Lbs.	160	-	-	120
DalMax-SG-183628	2480 GPM	Pull Lbs.	119.2	88.6	99.3	120

Table 2b – Body Entrapment Test Results: Suction Fitting Model No. DalMax-SG-183624 with a 8” port, with reducer connected to 12” Diameter Pipe.

Model	Flow Rate GPM	Body Element Pulls	1	2	3	Max Pull Force
DalMax-SG-183624	2480	Pull Lbs.	130.1	154.5	-	120
DalMax-SG-183624	2180 GPM	Pull Lbs.	106.8	112.9	115.9	120

Photograph of tested samples.

Model No. DalMax-SG-183628



Model No. DalMax-SG-183624

