Research Engineering & Manufacturing Inc.
25 Enterprise Center • Middletown, RI, 02842, U.S.A.
Tel: (401) 841-8880 • Fax: (401) 841-5008
Website: www.taptite.com • E-mail: reminc@reminc.net

IN-PLACE COST SAVINGS USING TAPTITE 2000® SCREWS IN AN ALUMINUM HEAT SINK

PR-165
09/04/2001

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INTRODUCTION:

An end-user has submitted a proposal to replace RIVSCREW fasteners, currently used in assembly of aluminum heat sinks in computer components, with TAPTITE 2000® fasteners as a means to achieve cost savings. RIVSCREW fasteners form threads as they are pressed in-place, the theory being that riveting permits faster assembly than drilling and tapping holes and that the threads formed upon insertion will allow for serviceability.

The end-user has asked that we evaluate the following parameters in the aluminum heat sinks provided.

- Breakaway torque of TAPTITE 2000® fasteners and RIVSCREW fasteners.
- Drive (thread forming) torque for TAPTITE 2000® fasteners.
- Seating (assembly) torque for TAPTITE 2000® fasteners.
- Driver speed for TAPTITE 2000® fasteners.
- Serviceability of TAPTITE 2000® fasteners and RIVSCREW fasteners.

The following tests were executed to determine the performance of TAPTITE II® fasteners in various hole sizes. 6-32 x 3/8 TAPTITE II® FASTENERS were tested in the following hole sizes and length of engagements:

- Part #332072-.123" dia. Hole,.44 diameter engagement.
- Part #332072-.112" dia. Hole,.44 diameter engagement.
- Part #332068-.127" dia. Hole,.44 diameter engagement.
- Part #332068-.112" dia. Hole,.44 diameter engagement.
- Part #332003-.126" dia. Hole,.44 diameter engagement.

Size 6-32 TAPTITE 2000® fasteners were not available at time of test and would most likely improve upon the results.

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TEST PROCEDURE:

Two fasteners were driven to failure in part #332003 to establish a proper seating torque for subsequent thread forming and breakaway torque testing. This particular part was selected, as there were an abundance of pieces supplied. The average failure torque was determined to be 1.54 Nm. A seating torque of approximately 50% of this value was established at .75 Nm. The screws were driven at 270 RPM for the thread forming tests and 10 RPM for the breakaway torque tests using an electric DC motor. A steel washer was placed under the head to simulate the component being used. Torque/tension and breakaway torque were sensed by an in-line R.S. Technologies, 200.lb/in transducer and a R.S. Technologies FastLab unit analyzed all data.

For part # 332072 there were only four holes of each diameter available for drive torque and breakaway torque testing. There was one RIVSCREW available for breakaway torque testing. For part # 332068 there were five .127" and only four .112" diameter holes available for drive torque and breakaway torque testing. There was one RIVSCREW available for breakaway torque testing. For part # 332003 there were five .126" diameter holes available for drive torque and breakaway torque testing. There were two RIVSCREWS available for breakaway torque testing.

RESULTS:

See charts for all test data.

COMMENTS:

The test results show that the TAPTITE II® screws exhibited low thread forming torque and ultimate torque of sufficient values to be used in this thickness of 6061 Aluminum. TAPTITE II® screws will also satisfy the serviceability requirement as they will form a standard machine thread upon insertion and may be removed and reseated as needed. As the small (1.5mm hex drive) RIVSCREW stripped while attempting to determine breakaway torque, it is questionable as to how "serviceable" the RIVSCREW design is in practice as it is quite soft. The threads formed by the RIVSCREW did not conform to any standard gauge and appeared distorted and not very clean. TAPTITE II® and TAPTITE 2000® screws can be reinserted any number of times and can even be replaced by machine screws, if necessary.

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CONCLUSION:

Utilizing TAPTITE 2000® screws will result in significantly lowering the cost of assembly by eliminating the cost intensive RIVSCREW, chips and associated cleaning operations. TAPTITE 2000® screws will provide a secondary locking feature as TAPTITE 2000® screws posses an inherent locking feature. TAPTITE 2000® screws will also assure the serviceability required for replacing board level components.

The end-user provided the following cost analysis:

6-32 x 3/8 TAPTITE 2000® =$.025 ea
Total installed cost = $.115 ea

6-32 x 3/8 RIVSCREW =$.115 ea
Total installed cost = $.54 ea

The above analysis is for part #332003 and represents a cost savings of $.425 per hole. Total installed cost includes labor. As this was quoted to be in annual volumes of 800,000 pieces, for this particular size, implementing TAPTITE 2000® would result in an annualized cost savings of $340,000.

RECOMMENDATIONS:

The end-user should conduct an in process evaluation with TAPTITE 2000® fasteners of the proper head style, length, and finish as required for their applications.

Report and Test By:

Bill Teixeira
Project Engineer

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RESULTS:

TAPTITE II® THREAD FORMING & BREAKAWAY TORQUE IN ALUMINUM HEAT SINK

#332072 (.123" DIA. HOLE)
Screw Size: 6-32 x 3/8"
Engagement: .062" (.44 dias.)

	Drive Tq (Nm)	Break Away Tq (Nm)
1	0.37	0.15
2	0.41	0.37
3	0.41	0.23
4	0.41	0.52
Avg.	**0.40**	**0.32**

#332072 (.112" DIA. HOLE)
Screw Size: 6-32 x 3/8"
Engagement: .062" (.44 dias.)

	Drive Tq (Nm)	Break Away Tq (Nm)
1	0.54	0.59
2	0.51	0.62
3	0.54	0.55
4	0.56	0.56
Avg.	**0.54**	**0.58**

#332068 (.127" DIA. HOLE)
Screw Size: 6-32 x 3/8"
Engagement: .062" (.44 dias.)

	Drive Tq (Nm)	Break Away Tq (Nm)
1	0.26	0.30
2	0.29	0.44
3	0.34	0.22
4	0.26	0.23
5	0.36	0.43
Avg.	**0.30**	**0.32**

#332068 (.112" DIA. HOLE)
Screw Size: 6-32 x 3/8"
Engagement: .062" (.44 dias.)

	Drive Tq (Nm)	Break Away Tq (Nm)
1	0.26	0.30
2	0.28	0.28
3	0.43	0.37
4	0.30	0.29
Avg.	**0.32**	**0.31**

#332003 (.126" DIA. HOLE)
Screw Size: 6-32 x 3/8"
Engagement: .062" (.44 dias.)

	Drive Tq (Nm)	Break Away Tq (Nm)
1	0.33	0.43
2	0.34	0.37
3	0.34	0.41
4	0.37	0.44
5	0.33	0.4
Avg.	**0.34**	**0.41**

#332003 (.126" DIA. HOLE)
Screw Size: 6-32 x 3/8"
Engagement: .062" (.44 dias.)

TAPTITE II®
Drive to Fail Tq.

1	1.58
2	1.49
Avg.	**1.54**

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RESULTS (cont.):

RIV SCREW BREAKAWAY TORQUE IN ALUMINUM HEAT SINK

#33207D (.112" DIA. HOLE)
Screw Size: 6-32 X 3/16"
Engagement: .062" (.44 dias.)

	RIVSCREW Breakaway Tq (Nm)
1	0.25*

#332003 (.116" DIA. HOLE)
Screw Size: 6-32 X 3/16"
Engagement: .062" (.44 dias.)

	RIVSCREW Breakaway Tq (Nm)
1	1.05

* = 1.5mm hex drive RIVSCREW stripped at .25Nm

#332068 (.127" DIA. HOLE)
Screw Size: 6-32 X 3/8"
Engagement: .062" (.44 dias.)

	RIVSCREW Breakaway Tq (Nm)
1	0.72

#332068 (.123" DIA. HOLE)
Screw Size: 6-32 X 3/8"
Engagement: .062" (.44 dias.)

	RIVSCREW Breakaway Tq (Nm)
1	1.10

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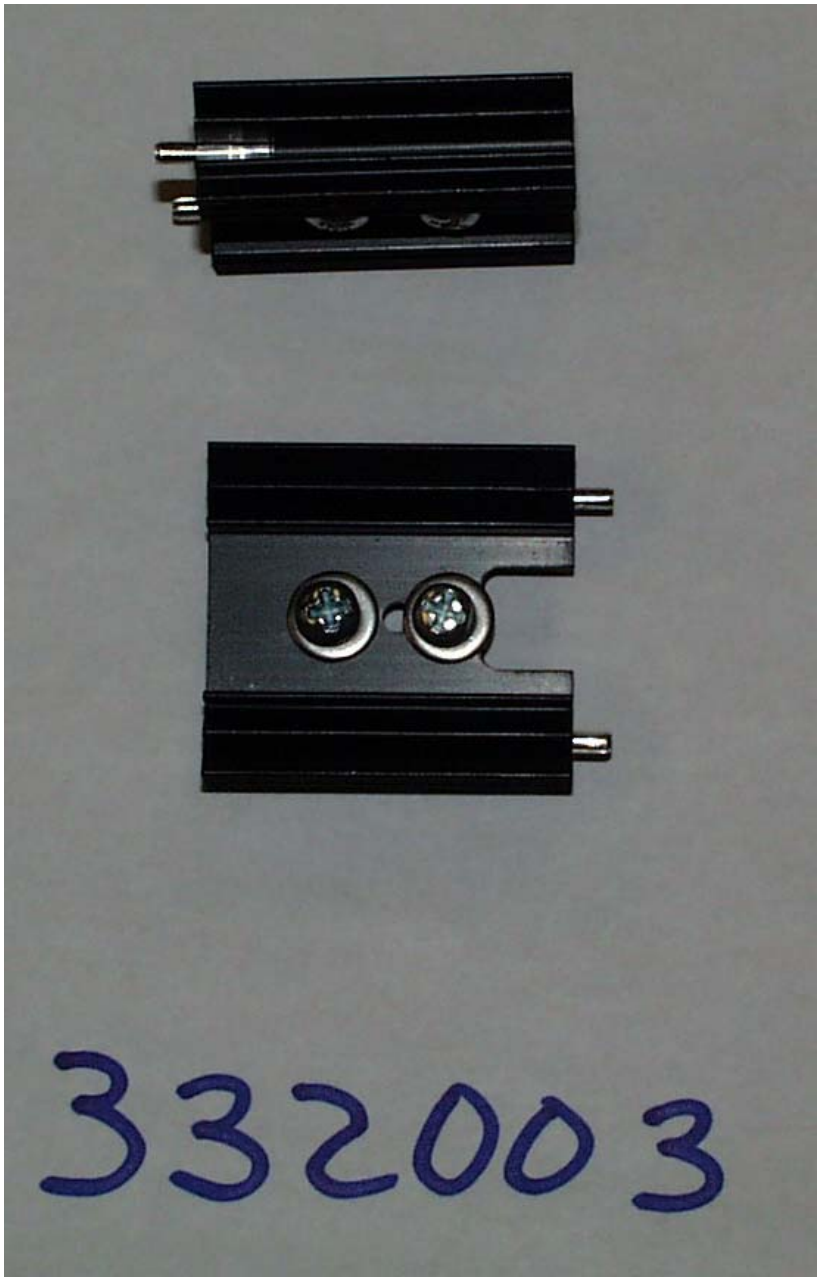

PART NUMBER 332003 POWER COATED 6061 ALUMINUM HEAT SINK