

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594



October 3, 2003

MATERIALS LABORATORY FACTUAL REPORT

Report No. 03-099

A. ACCIDENT

Place : Everglade City, Florida
Date : December 30, 2002
Vehicle : Tour boat "Panther"
NTSB No. : DCA03MM018
Investigator : Robert Ford

B. COMPONENTS EXAMINED

Bilge pump.

C. DETAILS OF THE EXAMINATION

The body of the bilge pump submitted for examination identified it as a "rule computerized 1500" (manufactured by Rule Industries) as illustrated in figure 1. The upper cap, where the electrical cord entered the pump, was flat and displayed the identifications "submersible bilge pump", "fully automatic", "rule 12 vdc" and "self contained computer switch". A web search revealed that this pump operated on the principle of impeller resistance. The pump switches itself on every 2¹/₂ minutes for about one second to check for water. If water is present the pump senses the resistance and continues to run until the water is removed. The pump then returns to its 2¹/₂ minute checking routine.

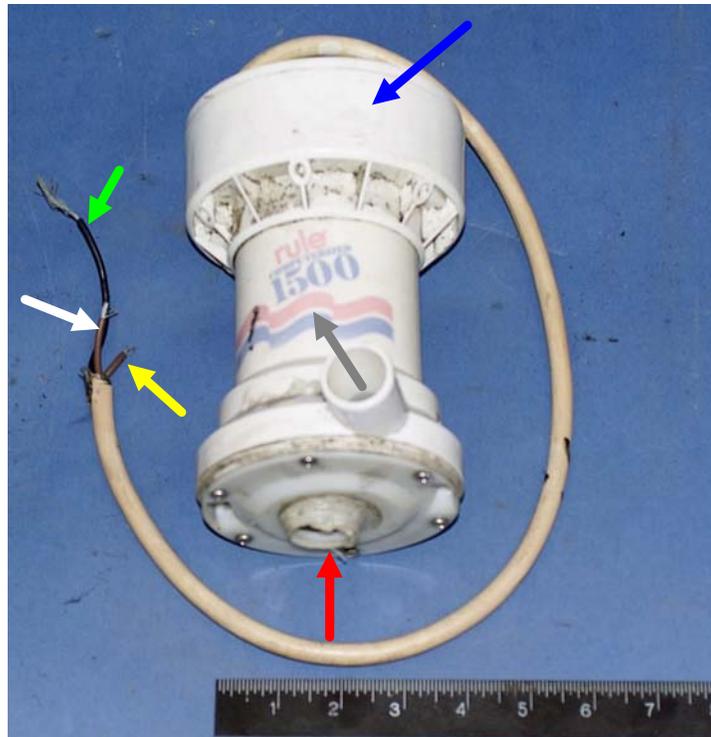
Examination of the lower portion of the pump revealed a housing containing an impeller. Water would be induced into the intake, indicated by the red arrow in figure 1, and expelled out of the outlet, indicated by the gray arrow in figure 1. The impeller rotated freely in the housing and the housing contained no debris or projections to impede water flow. The center of the intake was offset approximately 1/4-inch to the center of the impeller and displayed an uneven swirled pattern on its inner and outer surfaces.

The electrical cord contained the three conductors colored black, brown and brown/white that are indicated in figure 1 by the green, yellow and white arrows respectively. Contact with a Rule Industries representative revealed that the black conductor was the ground, the brown conductor was the power and the brown/white conductor was the power wire to an alarm, which indicates that the pump is operating. The pump was tested by applying a 12-vdc supply to the black and brown conductors, and it did not operate.

The upper cap was removed to reveal the printed circuit board (PCB) that controlled the pump. Examination of the PCB revealed that the three conductors (black, brown and brown/white) in the electric cord were firmly attached. Two other conductors, colored black and brown, were also firmly attached to the PCB and continued into the pump body. The PCB is identified in figure 2. A 12-vdc supply was connected to the two other conductors indicated by the green and yellow arrows in figure 2 and the pump motor operated.

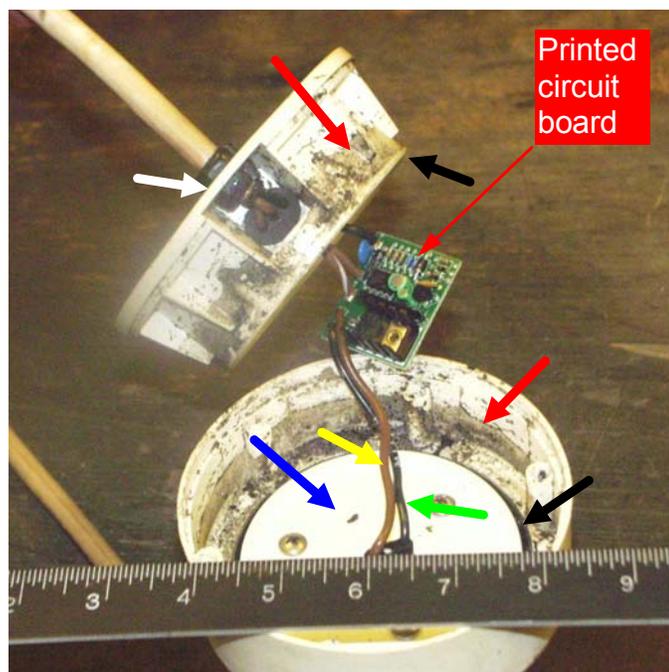
Examination of the PCB cavity surface, indicated by the blue arrow in figure 2, revealed that it was dry and displayed no indications of immersion. An annular chamber around the PCB cavity did display indications of immersion as indicated by the red arrows in figure 2. The white arrow indicates a snap-in cord grip fitting retaining the electrical cord in the upper cap. Such fittings provide strain-relief for the cord in applications that do not require a moisture proof seal. The annular chamber is isolated from the PCB cavity when the upper cap is installed and the lower edge of the upper cap, indicated by the black arrow, contacts the seal in the pump body, also indicated by a black arrow.

Derek Nash
Mechanical Engineer



ImageNo:301A0563, Project No:A00472

Figure 1. The Rule 1500 bilge pump received for examination.



ImageNo: 306A0835, Project No:A00472

Figure 2. The disassembled upper portion of the pump indicated by the blue arrow in figure 1.