CENTER FOR ELECTRONIC WATCHES, Division of
HAMILTON WATCH CO., INC.
LANCASTER, PENNSYLVANIA 17604, U.S.A. (717)394-7161

October 31, 1977

Mr. Frederick Combs
Radioisotopes Licensing Branch
Division of Fuel Cycle & Material Safety
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

REF: File No. 89036, FCMS:RLB:FC, your letter of September 20, 1977.

Dear Sir:

In reference to your letter dated September 20, 1977, please find below the appropriate answers to your questions.

Question 1.

We shall use only watches containing one light source. We shall therefore not use modules containing two light sources. The identification number for the one source LCD watch module shall be Suncrux #DM-522-012-30A.

Question 2.

We shall use only modules containg one tritium light source. Part number for a typical light source containing one light source made by American Atomics is 60307. The American Atomic Corporation Model #60297 shall not be used for this license application and is therefore obsolete.

Question 3.

Screw type casebacks are obsolete and shall not be used in this application. Only cases using snap-on type casebacks without battery hatches shall be used. Photographs shown on the application are only for snap-on casebacks without battery hatches and there are no changes in this regard. Prototype tests have all been done on snap-on type casebacks without battery hatches.

Question 4.

Access to the tritium luminous sources is restricted by the presence of both RTV silicone rubber incapsulant around the tritium source, and an epoxy seal between the back pan and the LCD display. The pan is therefore glued to the backside of the display. Access is

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further restricted by assembly into the module shown on figure 1. The tritium display light assembly cannot be removed through the front of the module without destruction of the module. The display is retained in the module by a plastic lip around the perimeter of the display opening. The assembled module is forcibly inserted into the watch case by means of a press fit. Disassembly of the module by removal of the assembly screws is impeded by covering the complete four screw heads with epoxy to the display frame. Enclosed photograph shows the epoxy seal on top of the four screw heads and display frame. Also enclosed alteration done on print #SX200727, Revision A. The epoxy used shall be extremely hard, and shall therefore not be removed by any tool.

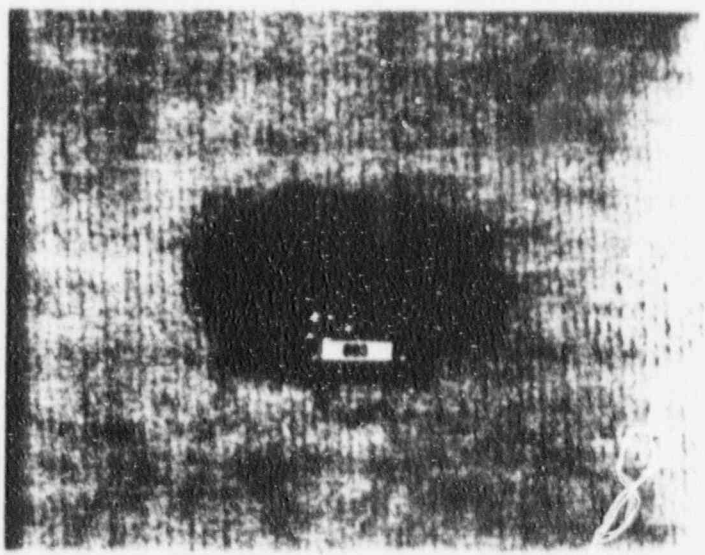
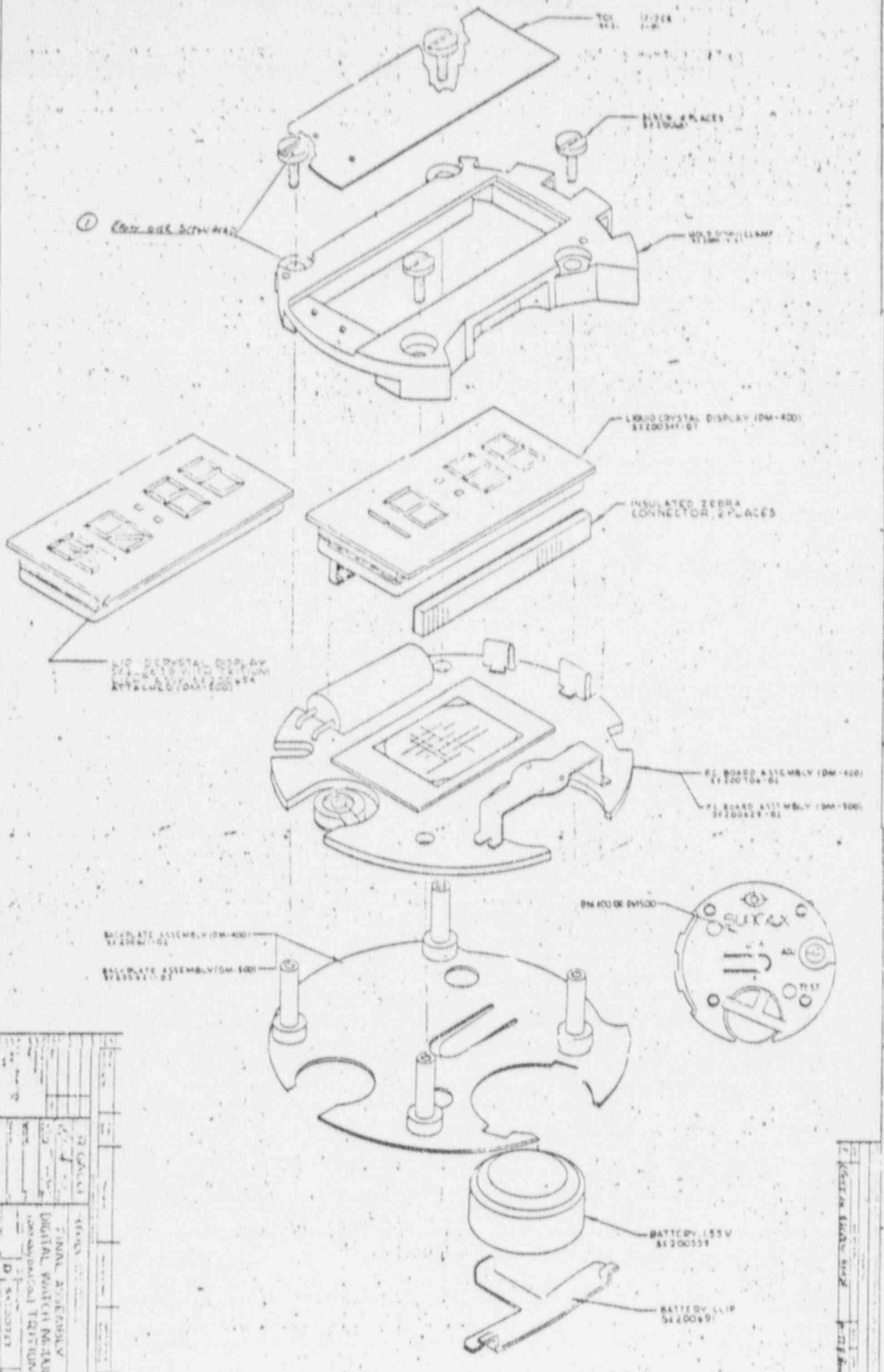


Fig. 1

Question 5.

There are two types of cases. The LCQ I includes three product numbers - 98701, 98702, 98710 - all of which are made of brass. The difference between the three are cosmetics only. Model 98701 is gold plated with a black and gold crystal. Model 98702 is gold plated with cognac and gold type crystal and Model 98710 is rhodium plated with gray and silver filter.


LIQUID CRYSTAL DISPLAY (DM-400)
INSULATED ZEBRA CONNECTOR, 2 PLACES
PC BOARD ASSEMBLY (DM-400)
PC BOARD ASSEMBLY (DM-500)
BACKPLATE ASSEMBLY (DM-400)
BACKPLATE ASSEMBLY (DM-500)
BATTERY, 1.55 V
BATTERY CLIP
FINAL ASSEMBLY
DIGITAL WATCH MODULE

The second case is the type LCQ II, product numbers - 98720 and 98730 - are both made of brass. Model 98720 is gold plated with a gold and black filter, while Model 98730 is rhodium plated with a silver and black filter. The difference between the two are cosmetics only. (A crystal is the glass on top of the case.)

Question 6.

The watch case does not contain any liquid crystal watch module or any watch bracelet. A watch case consists of a caseback, the crystal, the buttons and the forging of the case itself. The watchhead consists of a watchcase including a liquid crystal watch module.

Question 7.

It is not the distributors name that appears on the caseback of the watch, but the manufacturers name. The word "Hamilton" shall appear on the outside of the casebacks on watches using tritium, including the letters $^{3}_{H}$.

Question 1, Page 2.

The prototype test report from American Atomics was performed on five (5) watchhead models #98711 and 98731, each.

Question 2, Page 2.

We have re-submitted new one source modules to American Atomics for five prototype testing for watch head numbers 98711 and 98731. As indicated on Question #5, the only difference between any other model number is only a matter of cosmetics. Enclosed are two new prototype reports made on watchhead numbers 98711 and 98731.

Skin Dose Calculations.

The terms used in skin dose calculation on paragraph 19.3 shall be read as follows:

S_d = Skin Dosage in MREM/hr.

D_r = Dose Rate or Unit Radiation = 1.3×10^{2} MREM/MIN/μCi

R_c = Room Concentration Tritium = 7.1×10^{-3} μCi/cc

T_2% = Percentage Elemental Tritium: 95 = 9.5×10^{-1}

Paragraph 20.2, Skin Dosage T_2

S_d = Skin Dosage in MREM/hr.

D_r = Dose Rate or Unit Radiation = 1.3 x 10 to MREM/MIN/μCi

R_c = Room Concentration = 1.43×10^{-1} μCi/cc

$T_2\%$ = Percentage Elemental Tritium: 9.5×10^{-1}

Paragraph 20.1, page 14 of License Application. Dosage Commitment, Inhalation and Absorption T_20.

D_c = 24 MREM/MIN.

With an equivalent dose received due to absorption, the dose commitment would be 48 MREM/MIN. An individual remaining at this location for one hour with 10 air changes would receive a dose commitment of 288 MREM. The external dosage and dose commitment as calculated are less than the maximum permissible levels as stated in Column III, Table 32.24 U S.NRC, 10CFR32.

Calculations have shown that the tritium facility shall be ventilated at a minimum hourly rate of 10 air changes, and not 5 as previously mentioned on paragraph 20.1.

Question 1, Page 3.

Quality Assurance Testing Procedures shall be as follows: Inspection of a production lot for purpose of selecting a sample of watches to be tested shall be done according to acceptance sampling procedures under certain specific licenses, Title 10, Chapter 1 CFR paragraph 32, .110 of the USNRC (8) Lot Tolerance Percent Defective, 10.0 percent.

Question 2, Page 3.

Sources and finished watches shall be submitted to the following Quality-Control.
1. The source vendor shall soak test for leakage of tritium for twenty-four hours each tritium source.

2. In accordance with Lot Tolerance Percent Defective (LTPD), 10 percent as listed in Section 32.110 of 10CFR, Part 32, finished watch shall undergo the following tests:
2.1. The watches shall be subjected to vibration at 60 HZ for 30 minutes.

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2.2 The watches shall be dropped twice from a height of one meter on to a hardwood (Oak, Maple, beech) block, 4 inches thick.

2.3 The tested watches shall then be soaked in water for 24 hours, after which an alignot of water shall be analized for tritium content, if any, by any licensed outfit, such as American Atomics. The remaining units shall be cased and held in inventory until the results of the LTP are obtained. The level of tritium in any sample shall not exceed 0.15 μCi per watch. Each watch shall be inspected individually for visual damage at the completion of each test.

If the results of the test show an unacceptable tritium level, or loss in darkness, the entire lot which has been held in inventory shall be 100% inspected and repaired if feasible or the usable components will be salvaged. Any units which have been deemed acceptable by Quality Control will be re-submitted to the LTPD 10%. All units from the LTPD rejected lots, while awaiting disposition, shall be clearly identified to eliminate the possibility of mixing these units with units that have acceptable LTPD results.

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Question 3, Page 3.

Hamilton Watch Co. Quality-Control Inspection Report for Tritium LCD Modules

Product #
Product Description:
Start Sheet #
Lot Quantity:
Samples Tested:

TYPE OF TEST	DATE	ACCEPTED	REJECTED	OPERATOR (Name & #)
1. Visual 100%				
2. Drop (sample)				
3. Vibration (sample)				
4. Soak (sample)				

Lot Accepted _____ Lot Rejected _____

Soak Test Report From American Atomics.

Signature: Radiation Safety Officer.

Signature: Assistant Radiation Safety Officer.

Filing by: Radiation Safety Officer.

Audited by: _____. Date _____

Comments:

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We hope we have answered these questions to your satisfaction. Please call me if there are any questions at, (717) 394-7161, Ext. 130.

Sincerely,

Olivier D. Barrelet, Mgr.
Research & Development
Hamilton Watch Company

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REFERENCES

1. Safe Handling of Radioactive Materials, National Bureau of Standards Handbook 92.

2. Safe Handling of Radioactive Luminous Compound, National Bureau of Standards Handbook H27.

3. Safe Handling of Radioactive Isotopes, National Bureau of Standards Handbook 42.

4. Radiological Monitoring Methods and Instruments, National Bureau of Standards Handbook 51.

5. Permissible Dose From External Sources of Ionizing Radiation, National Bureau of Standards Handbook 59.

6. Safe Handling of Bodies Containing Radioactive Isotopes, National Bureau of Standards Handbook 65.

7. Safe Design and Use of Industrial Beta-Ray Sources, National Bureau of Standards Handbook 66.

8. Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and In Water for Occupational Exposure, National Bureau of Standards Handbook 69.

9. A Manual of Radioactivity Procedures, National Bureau of Standards Handbook 80.

10. NARM Guide 7 - Radioluminous Products, U.S. Department of Health, Education, and Welfare.

11. Evaluation of Occupational Hazards From Industrial Radiation: A Survey of Selected States, U.S. Department of Health, Education, and Welfare.

12. Measurements for the Safe Use of Radiation, National Bureau of Standards NBS Special Publication 456.

13. Control & Removal of Radioactive Contamination in Laboratories, National Bureau of Standards Handbook 48.

14. A Reliable Calibration Program for Ionizing Radiation Measurement, University of Louisville Radiation Center, Louisville, Kentucky.

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15. Personnel Monitoring Measurements, Lawrence-Livermore Laboratory, Livermore, California.

16. Monitoring Performance Standards, U.S. Nuclear Regulatory Commission, Washington, D.C.

17. Miscellaneous Articles regarding Monitor Equipment from the Tritium Control Technology, by Monsanto Research Corporation Mound Laboratory.

18. Radiation Safety Technician Course, Argonne National Laboratory.