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AS AD No. _____

QUARTERLY PROGRESS REPORT
31 OCTOBER 1962 thru DECEMBER 1962
CONTRACT GR-(XN-25)/U
C. I. 100-PP-53-61-81
LAWSON CONTRACTS CORPORATION

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QUARTERLY PROGRESS REPORT

Period Covered
September 1962 thru December 1962

CRYSTAL UNIT CR-(XM-28)/U

ORDER NO. 7622-PP-59-81-81
CONTRACT NO. DA-36-039-SC-81275

Placed By
U.S. Army Signal Supply Agency
225 South 18th Street
Philadelphia 3, Penna.

Placed With
Keystone Controls Corp.
922 McCarter Highway
Newark, New Jersey

Prepared By
James M. Ronan
Vice President
General Manager

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ABSTRACT

The prototype glass sealing equipment is reported as well as results of preliminary tests of the sealing fixtures.

Crystal blanks to be used in the Aging study have been prepared and details of the finishing techniques of the control groups are presented.

PURPOSE

The contract required that a facility be established to manufacture Crystal Unit CR-(XM-28)/U at the rate of 500 per eight-hour shift, utilizing the HC-27/U all-glass holder, and to produce 500 units at each of five frequencies.

REQUIREMENTS

3.10 Detail requirements for Crystal Unit CR-(XM-28)/U.

3.10.1 Description - Metal plated plate, mounted in glass holder; designed to operate at series resonance on the third overtone mode of the fundamental frequency of the plate, and under noncontrolled temperature conditions.

3.10.2 HOLDERS - Holders shall be glass, type HC-(XM-2)/U, conforming to 3.11 below, and 3.2.2.2 above.

3.10.2.1 Thermal shock of envelope - The glass envelope of Crystal Unit CR-(XM-28)/U shall meet the thermal shock requirements specified in 3.2.2.1 above.

3.10.3 Evacuation - Paragraph 3.4.4 as applicable to glass holders shall apply. Method selected shall be at the contractor's discretion, but shall be such that all performance requirements are met.

3.10.4 Other requirements - Except for the applicable requirements of this document, Crystal Units CR-(XM-28)/U shall meet all the requirements for Crystal Unit CR-52/U as specified in Specification MIL-C-3098.

(Excerpt from SCS-18)

NARRATIVE

1. Subtask 1 A - Prototype Sealing Equipment

During the period, permission was requested of, and granted by the Contracting Officer, to purchase the Lepel Model T-2 1/2G Induction Generator. The unit is complete with a primary saturable reactor and silicon diodes.

The use of semi-conductor diodes is a recent innovation by Lepel, designed to overcome the problems and down-time due to burn-out of the conventional tube-type rectifiers.

We have been assured by the Lepel engineers that the 2 1/2 KW generator is adequate to handle six of the Lepel type C-8322 coils and concentrators mounted in series, since our present plan is to use 5 or 6 sealing fixtures in each vacuum jar of the system, with a transfer switch alternating the power between two vacuum jars.

The first of the sealing fixtures, to be used in determining the optimum sealing time, temperature and current, was prepared in our instrument shop during the month of December. Since this fixture is of an experimental nature, details will be given as soon as we are convinced of its adequacy, rather than to distribute information which may be misleading.

A few preliminary seals were made just prior to the end of the report period. Using a plate current from the generator of 275 ma, a vacuum of .4 microns was maintained during the sealing cycle.

1. Subtask 1 A (continued)

Adequate seals were attained with a power "on" time of 45 to 60 seconds. However, difficulties are being experienced when air is admitted to the vacuum system. Cracks develop in one corner of the holder, starting at the seal area and continuing upward and over to the center of the holder, in approximately 2/3 of those sealed.

It is apparent that one of several factors are causing this problem:

1. Too much heat applied to one corner of the Kovar ring due to misalignment of bulb to base, or holding fixture to work coil;
2. Inadequate annealing time; or
3. The holder for the glass envelope extends too far down the sides of the envelope.

By "annealing time" is meant the period after the power from the induction generator is turned off to the opening of the vacuum chamber. It is felt that by maintaining the heated glass under a vacuum for a short length of time, a gradual cooling of the glass through the annealing point of 480°C and strain point of 435°C will take place. Thus far, we have attempted annealing times ranging from 1/2 minute to 2 minutes. One-half minute is definitely too short a period. However, because of the difficulties encountered thus far, a final determination of what is an adequate period has not been made.

2. Subtask II A - Preparation of Control Groups for Aging Study

In accordance with Subtask II A, the control groups of crystal blanks for the Aging Study were prepared during the reporting period.

It was decided to process these blanks all at the same frequency, since we are primarily interested in the reactions from the use of various processing materials, the effect on aging of the crystal blank itself being of secondary importance.

A total of 1200 blanks were processed at the mid-frequency of the contract range, i. e. 30 mc/s. These were prepared at an angle of $35^{\circ} 24'$, and have been processed through final lapping and etching to a pre-plate frequency $10.070 \text{ mc} \pm 10 \text{ KC}$.

These units are being held at this point in the processing pending completion of the tests and determination of the sealing cycle with the new equipment.

The reason for holding the units at the pre-plating position is apparent from a perusal of our development program which calls for these blanks to be processed concurrently. Until our glass sealing equipment has been optimized, it will be pointless to complete fabrication of the metal enclosed units, if we hope to duplicate, to as great an extent as practicable, the condition of fabrication.

A summary of the techniques and conditions to be enforced during the processing of the units for the aging study is as follows:

2. Subtask II A (continued)

1. Cleaning - All blanks will be cleaned no more than 2 hours prior to base-plating in accordance with the following method:

- a. Ultrasonically cleaned in an Alconox solution for 10 minutes.
- b. Three rinses in tap water.
- c. Ultrasonically rinsed in distilled water for 5 minutes, and
- d. Heat dried.

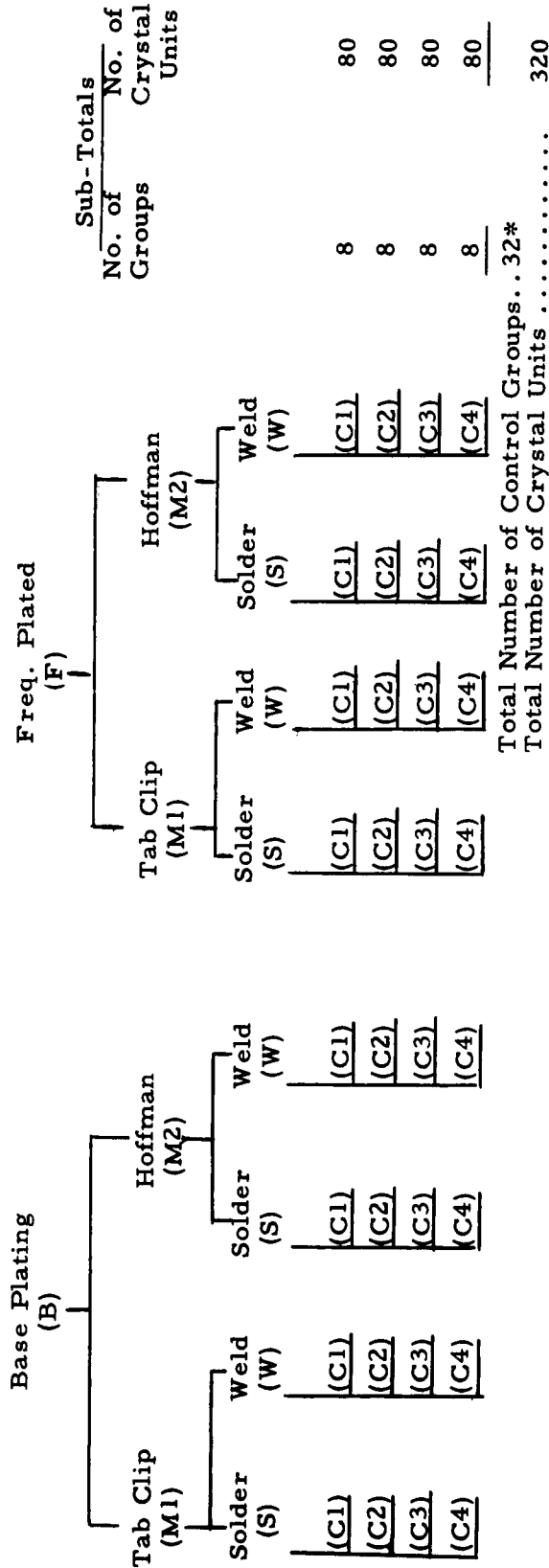
2. All blanks shall be base-plated within a period of 8 hours. Immediately after base-plating the blanks shall be identified, separated into control groups as outlined in Figure II, placed in clean petri dishes and stored at 40°C, to be removed only for further processing.

3. Holder preparation - Holders and bases shall be cleaned ultrasonically before use. Preparation and cleaning techniques are presently being evaluated.

4. Bonding

- a. C-1 groups - Dupont 5504A Cement. These groups (see Figure I) shall be prepared concurrently, using a fresh mixture of cement, air dried for 1 hour and fired at 200°C for 2 hours.
- b. C-2 groups - Bondmaster Cement - Curing time shall be two hours at 200°C.

FIGURE I - SUB-DIVISION OF CONTROL GROUPS FOR AGING STUDY



*Note: Since this program calls for aging studies of control groups both in glass and metal holders, the Total Number of Control Groups becomes 64, and the Total Number of Crystal Units becomes 640.

Each parenthesized letter-numeral above represents a sub-division of the Control Groups.

Code for Control Groups

- B=Base Plated film only.
- F=Frequency Plated film over base plating.
- M1=Mount, tab clip type.
- M2=Mount, P.R. Hoffman type
- W=Welded mounting supports
- S=Soldered Mounting supports.
- C1=Cement, DuPont #5504A.
- C2=Cement, Bondmaster
- C3=No cement applied
- C4=Cement, Pyro-Ceram #95
- M=Metal HC-6/U or HC-18/U holder
- G=Glass HC-6/U or HC-18/U holder.

Example: "BM1WC2G" = Control Group of crystal units which have been plated only (B) and mounted in a Tab Clip type mount (M1) that has been welded (W) to the supporting pins and cemented with Bondmaster cement (C2) and enclosed in an all glass holder (G).

2. Subtask II A (continued)

- c. C-3 groups - No cement applied.
 - d. C-4 groups - Pyro-Ceram #95. Our experience to date indicates a satisfactory mixture is 9 parts of Pyro-Ceram to 2 parts of Handy and Harmon silver-flake, adding sufficient solvent to reach a creamy consistency. Further experiments will be conducted to determine optimum results.
5. After bonding all units shall be washed in alcohol.
6. Frequency plating of those groups which require it shall be completed in one working day, with particular attention to the degree of vacuum and alignment of the spot. Amount of plating shall be uniform with each unit receiving the same plateback in KC.
7. Frequency and resistance readings will be recorded for each unit between each of the fabricating processes. Our present program calls for this phase to be completed prior to 30 April 1963, with the aging study measurements to begin immediately upon its completion.

3. Holder Parts

A review of the glass parts on hand was also made during the reporting period. Because of the inconsistencies in dimensions of these parts, it was decided to order all new parts in accordance with the requirements of Holder HC-27/U, per MIL-H-10056/14A (Sig. C) w/amendment #1, dated 7 March 1962.

After receiving quotations from all known manufacturers of the

3. Holder Parts (continued)

item, an order was placed with Tronex, Inc., Millville, N. J., because of price, delivery and previous references by other manufacturers. The first delivery of 200 pieces was made in December.

Quotations were received from a total of five manufacturers. Of these, two made the envelope only, and were eliminated, since we felt that better control will be exercised by purchasing the complete holder from one source.

A third source, the lowest in price of those quoting, could give only vague delivery dates, "starting within the next 3 to 6 months".

Prices for the entire holder ranged from \$1.50 to \$2.50 in lots of 100, and from .88¢ to \$1.82 in lots of 5000.

Prices for the envelope alone were .97¢ and \$1.65 in small quantities, and .82¢ and \$1.10 in the larger quantity.

CONCLUSION

We are satisfied that our sealing fixture design will be satisfactory provided the alignment of holder parts to each other and to the work coil is correct, and sufficient annealing time is allotted after sealing.

PROGRAM FOR NEXT PERIOD

Sub-task I A "Prototype Sealing Equipment", and I B - "Determination of Requisites for Successful Seals", of the Development Program will be completed during the quarter.

The control groups of crystal units to be used in the Aging studies will be completed, and the necessary measuring equipment will be assembled and tested.

VISITS AND CONFERENCES

In October 1962, Mr. E. Mason, USAEMA, and Mr. E. K. Jones, USAEMSA, visited the plant to view and discuss progress.

Mr. Ronan visited USAEMA on 30 November 1962 to discuss delivery schedules and progress with the Contracting Officer, Mr. G. Munger.

REPORTS AND PUBLICATIONS

The quarterly report for the period of July to September 1962 was completed and submitted.

MANHOURS EXPENDED

| | |
|-----------------------|-----------|
| Mr. J. M. Ronan | 33 hours |
| Mr. G. Dekelbaum | 62 hours |
| Mrs. I. Wells | 18 hours |
| Mr. J. Acquisto | 16 hours |
| Technicians and Labor | 162 hours |