NOV 24 1997
24

INCH-POUND
MIL-PRF-3098H
27 August 1997
SUPERSEDING
MIL-C-3098G
12 October 1979

PERFORMANCE SPECIFICATION

CRYSTAL UNITS, QUARTZ
GENERAL SPECIFICATION FOR

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements for quartz crystal units.

1.2 Part or Identifying Number (PIN). The PIN for crystal units meeting all the requirements of this specification are coded as shown and as specified (see 3.1):

CR	15	/U	1M000000
Component (see 1.2.1)	Number (see 1.2.2)	Basic indicator (see 1.2.3)	Specified frequency (see 1.2.4)

1.2.1 Component. Crystal units are identified by the two letter symbol "CR".

1.2.2 Number. The number identifies a type of crystal unit which has certain electrical and physical characteristics covered as described in the specification sheet (see 3.1). The number comprises one or more digits and a letter (if applicable) indicates a modification of the basic type (e.g., 15B).

1.2.3 Basic indicator. The basic application for which a crystal unit has been designed is indicated by the symbol "/U" denoting "general utility".

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Communications-Electronics Command, ATTN: AMSEL-LC-LEO-E-EP, Fort Monmouth, NJ 07703-5023 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 5955

1.2.4 Specified frequency. The specified frequency expressed in hertz (Hz) is identified by eight characters, consisting of seven digits and a letter. The letter is used simultaneously as a decimal point and as a multiplier. For frequency values:

a. Greater than or equal to 1,000 Hz but less than 1 megahertz, the letter "K" is used to represent a decimal point.

b. Greater than or equal to 1 megahertz, the letter "M" is used to represent a decimal point.

All digits preceding and following the letter (K or M) of the group represent significant figures. The following are examples of using the eight characters in constructing the specified frequency:

Designation	Frequency
1K000000 to 9K999999	1 to 9.999999 kilohertz, inclusive
10K00000 to 99K99999	10 to 99.99999 kilohertz, inclusive
100K0000 to 999K9999	100 to 999.9999 kilohertz, inclusive
1M000000 to 9M999999	1 to 9.999999 megahertz, inclusive
10M00000 to 99M99999	10 to 99.99999 megahertz, inclusive
100M0000 to 999M9999	100 to 999.9999 megahertz, inclusive

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

DEPARTMENT OF DEFENSE

SPECIFICATIONS

(See supplement 1 for a list of specification sheets.)

STANDARDS

MIL-STD-202	-	Test Methods for Electronic and Electrical Component Parts
MIL-STD-1285	-	Marking of Electrical and Electronic Parts.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Defense Printing Service Detachment Office, Building 4D Customer Service, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are issues of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/NCSL Z540-1 - Calibration Laboratories and Measuring and Test Equipment-General Requirements.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC-444-1 - Measurement of Quartz Crystal Unit by Parameters by Zero Phase Technique in π- Network. Part 1: Basic Method for the Measurement of Resonance Frequency and Resonance Resistance of Quartz Units by Zero Phase Techniques in π- Networks.

INTERNATIONAL STANDARDS INSTITUTE (ISO)

ISO 10012-1 - Quality Assurance Requirements for Measuring Equipment - Part 1: Metrological Confirmation System for Measuring Equipment.

(Applications for copies should be addressed to the American National Standards Institute (ANSI), 11 West 42nd Street, New York, NY 10036-8002).

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA-512 - Standard Methods for Measurement of the Equivalent Electrical Parameters of Quartz Crystal Units, 1 kHz to 1GHz.

(Application for copies should be addressed to the Electronics Industries Association, 2500 Wilson Boulevard, Arlington, VA 22201-3834).

2.4 Order of precedence. In the event of conflict between the text of this document and the references cited herein (except for related associated specifications, specification sheets, or MS standards), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 Qualification. Crystal units furnished under this specification shall be products that are manufactured by a contractor authorized by the qualifying activity for listing on the applicable Qualified Products List (QPL) before contract award.

3.3 Materials. Materials shall be used which will enable the crystal units to meet the performance requirements of this specification. Acceptance of approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product.

3.3.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements and promotes economically advantageous life cycle costs.

3.3.2 Soldering and soldering flux. When soldering and soldering flux are used in the fabrication of crystal units, they shall be of such a quality as to enable the unit to meet all the requirements of this specification. Flux residue shall be removed completely from all surfaces.

3.4 Interface, construction, and physical dimension requirements. Crystal units shall meet the interface, construction, and physical dimensions specified (see 3.1).

3.4.1 Glass parts. Glass seals shall be free from cracks. Minute flaking around the feather edge of a meniscus shall not be considered a crack.

3.4.2 Pin alignment The pins in the base of the crystal unit shall freely and completely enter the pin-alignment test gage. If a physical gage is not used, the dimensions and spacing of the pins shall conform to the limiting dimensions of pin-alignment test gage as viewed on a shadow-graph (see 4.7.2.1.2). The pin undercut may be omitted.

3.4.3 Final frequency adjustment. The final frequency adjustment shall not be accomplished by means of abrasion of the electrode, exposure of the crystal resonator to a halogen vapor, or by mechanical application of any loading material.

3.4.4 Tin plated finishes. Use of tin plating is prohibited as a final finish and as an undercoat (see 6.7). Use of tin-lead (Sn-Pb) finishes are acceptable provided that the minimum lead content is 3 percent.

3.4.5 Solderable terminals. Solderable terminals shall be as specified (see 3.1) and shall meet the solderability requirements specified herein (see 3.5).

3.5 Solderability. When crystal units are tested as specified in 4.7.3, the solderable terminals shall meet the criteria specified in the test method.

3.6 Shock (specified pulse). When crystal units are tested as specified in 4.7.4, changes in frequency and equivalent resistance shall not exceed specified values (see 3.1). Measurements of frequency and resistance shall be made immediately before and immediately after the test (see 4.7.1.2), except that for group A inspection, these measurements of frequency and resistance are not required.

3.7 Vibration. When tested as specified in 4.7.5, changes in frequency and equivalent resistance of the crystal unit shall not exceed specified values (see 3.1). Measurements of frequency and resistance shall be made immediately before and immediately after the test (see 4.7.1.2).

3.8 Reduced drive level (overtone units, and when specified, fundamental units). When tested as specified in 4.7.6, the resistance shall not exceed the maximum specified (see 3.1).

3.9 Capacitance, shunt (when specified, see 3.1). When tested as specified in 4.7.7, the shunt capacitance shall be as specified (see 3.1).

3.10 Frequency and equivalent resistance. The frequency and equivalent resistance of the crystal unit shall be within the limits specified when tested under the following conditions as applicable (see 3.1 and 4.7.8).

3.10.1 Frequency stability (controlled). Throughout the operating temperature range (see 6.4.6), the frequency of crystal units designed for operation under controlled temperature conditions shall not deviate from the measured frequency at the reference temperature by more than the value specified (see 3.1), and shall also be within the specified frequency tolerance limits, when crystal units are tested as specified in 4.7.8.2.

3.10.2 Operable temperature range (controlled). Crystal units designed for operation under controlled temperature conditions shall be required to oscillate over the operable temperature range of the unit (see 6.4.7), but not necessarily within the specified frequency and resistance limits, when tested in accordance with 4.7.8.3.

3.10.3 Low temperature storage. When crystal units are tested as specified in 4.7.8.4, the resistance shall not exceed the maximum specified when the unit is operated at the rated drive level (see 3.1), except when performed in conjunction with reduced drive level (see 4.7.6).

3.11 Unwanted modes (fundamental mode or overtone units). When tested as specified in 4.7.9, all unwanted modes shall have resistance that exceeds two times the main mode resistance.

3.12 Thermal shock. When tested as specified in 4.7.10, changes in frequency and equivalent resistance of the crystal unit shall not exceed specified values (see 3.1). A minimum of 30 minutes shall be allowed for units to return to thermal equilibrium before and after measurements of frequency and equivalent resistance are made (see 4.7.1.2)

3.13 Seal. When tested as specified in 4.7.11.1, the leakage rate of crystal units shall not exceed 10^{-8} atmospheric cubic centimeters per second (atm cc/sec).

3.14 Salt spray (corrosion). When tested as specified in 4.7.12, there shall be no evidence of excessive corrosion. Corrosion that causes impairment of the electrical or mechanical performance of the unit shall be considered excessive.

3.15 Moisture resistance. When tested as specified in 4.7.13, the frequency and equivalent resistance of the crystal units shall be within the limits specified in 3.10, and the insulation resistance shall be not less than 500 megohms.

3.16 Aging. When tested as specified in 4.7.14, the difference between the highest and lowest frequencies measured shall not exceed the value specified (see 3.1).

3.16.1 Accelerated aging (above 800 kHz crystal units). When tested as specified in 4.7.14.1, the difference in frequency between the measurements made immediately prior to and immediately after conditioning shall not exceed 5 parts per million (ppm) or the value specified (see 3.1) and shall not exceed the maximum resistance specified (see 3.1).

3.17 Terminal strength.

3.17.1 Terminal pull. When tested as specified in 4.7.15.1, there shall be no evidence of damage to the terminal or glass seal, or movement of the terminal relative to the glass at the point of seal.

3.17.2 Terminal bend (applicable to crystal units with undercut pins). When tested as specified in 4.7.15.2, terminals shall not break and glass seals shall not crack or chip.

3.17.3 Wire-lead bend (applicable to crystal units with wire-lead terminals). When tested as specified in 4.7.15.3, there shall be no severing of the terminal, or cracking or chipping of the glass.

3.18 Bond strength (when specified, see 3.1). When tested as specified in 4.7.16, the junction between each supporting wire or other supports and the surface of the resonator shall have a minimum bond strength as specified (see 3.1).

3.19 Marking. As a minimum, the PIN and contractor's identification shall be marked on the crystal unit in accordance with method I of MIL-STD-1285. The marking shall be located on the largest visible surface of the crystal unit. The PIN may be marked on more than one line provided the PIN is continuous except where it "breaks" from one line to another. The break shall not occur within the "specified frequency" marking. The PIN specified in 1.2 shall not be marked on any crystal unit which the contractual requirements shall be considered a deviation. Crystal units shall also be marked with the year and week of the final test in accordance with MIL-STD-1285. The contractor's designated symbol or Commercial and Government Entity (CAGE) code shall also marked on the unit.

3.20 Workmanship. Crystal units shall be processed in such a manner as to be of uniform quality and free from any defects that would adversely affect life, serviceability, or appearance. The interior of the crystal shall contain no flux, quartz or grinding particles, residue, or other foreign or unapproved materials. There shall be no evidence of fractures in the resonator, cracks, or flaked edges. Electrode material shall be clean and untarnished. There shall be no evidence of final frequency adjustment by means of abrasion of the electrode, exposure of the crystal element to a halogen vapor, or mechanically applied loading materials

4. VERIFICATION

4.1 Classification of inspection. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.4).

b. Conformance inspection (see 4.5).

c. Periodic inspection/group B inspection (see 4.6.1).

4.2 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with ANSI/NCSL Z540-1, ISO 10012-1, or an equivalent system approved by the qualifying activity.

4.2.1 Test sets.

4.2.1.1 Frequency correlation. The frequency of a given crystal unit shall be within 5 ppm of the frequency (see 3.1) measured in the reference standard test set (see 4.2.1.3).

4.2.1.2 Resistance correlation. The equivalent resistance of a given crystal unit shall be within 10 percent of its resistance as measured in the reference standard test set (see 4.2.1.3).

4.2.1.3 Reference standard test sets. The reference standard test set shall be furnished by the contractor. The reference standard test set shall conform to IEC-444-1 or be correlatable to EIA-512. The contractor is responsible for certifying to the qualifying activity that the reference standard test set conforms to the appropriate standard (see 4.2.1.3.1). The reference standard test standard set shall be used to check the characteristics and accuracy of the contractor's equivalent test set.

4.2.1.3.1 Certification of reference standard test sets. Certification of compliance with IEC-444-1 and EIA-512 shall consist of the following:

a. Functional diagram of the contractor's system showing interconnection, equipment manufacturer, and model designations.

b. Flow charts and descriptions of all software modules used in the control of equipment and estimation of parameter values.

c. Flow charts and descriptions of instrument calibration and error correction routines.

d. Traceability for test fixtures and reference impedance devices required for the calibration, verification, and use of the standard test set.

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the "GENERAL REQUIREMENTS" of MIL-STD-202.

4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government on sample units produced with equipment and procedures normally used in production.

4.4.1 Sample size. Thirty samples shall be subjected to qualification inspection as specified in the appendix to this specification.

4.4.2 Inspection routine. Samples shall be subjected to the qualification inspection specified in table I in the order shown.

4.4.3 Failures. One or more failures may be the basis for refusing to grant qualification approval.

4.4.4 Extension of qualification. Qualification by similarity for qualification of similar crystal units is specified in the appendix. The contractor also has the option of recommending additional qualification by similarity proposals for approval by the qualifying activity.

4.4.5 Retention of qualification. To retain qualification, the contractor shall provide verification to the qualifying activity of the following items every 12 months:

a. Design of the crystal unit has not changed.

b. Verification that the conformance inspections (i.e., group A inspections) have been performed on inspection lots supplied to the requirements of this specification.

c. The contractor retains the capability to manufacture and test crystal units to this specification.

d. Verification that the periodic group B inspections have been performed as applicable.

In the event that no production has occurred in this period, the contractor shall still verify to the qualifying activity that the capacity to manufacture and test QPL crystal units still exists and that the contractor wants to remain on the QPL.

4.5 Conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A inspection.

4.5.1.1 Testing after storage. When a crystal unit is stored for 30 days or longer after group A inspection and before shipment, it shall be subjected to the frequency test for controlled and noncontrolled crystal units (see 4.7.8). Those crystal units failing this test shall not be delivered on the contract. Failure in excess of 10 percent of the lot shall be cause for rejection of the lot.

4.5.1.2 Inspection lot. An inspection lot shall consist of all crystal units of similar types and one frequency or assorted frequencies within the range covered by that type produced under essentially the same conditions, and offered for inspection at one time (see appendix for preferred groupings).

4.5.1.3 Group A inspection. Group A inspection shall consist of the inspections specified in table II. The tests in subgroup 1 shall be performed in the order shown and on the same set of sample units. The test in subgroup 2 may be performed on a separate set of sample units.

4.5.1.3.1 Sampling plan. A sample of parts shall be randomly selected from each inspection lot in accordance with table III. If one or more defects are found, the lot shall be rescreened for that defect and the defects removed. After screening and removal of defects, a new sample of parts shall be randomly selected again in accordance with table III. If one or more defects are found in the second sample for the same defect or rejection cause, the lot shall be rejected and shall not be supplied to this specification. When the lots, as defined in 4.5.1.2, consists of less than 90 units, two or more such lots may be combined into grand lots. The grand lots may contain inspection lots from different groups. The sample selected from those grand lots shall be, to the greatest extent possible, representative of the crystal types in each component lot. There shall be a minimum of one type from each group and the choice of sample shall be proportional.

4.5.1.3.2 Manufacturer's production inspection. If the manufacturer performs tests similar to those specified in group A, subgroup 1, as the final step of his manufacturing process, the subgroup 1 test may be eliminated when approved by the qualifying activity. The following criteria must be complied with:

a. The production tests are identical to, or more stringent than, the subgroup 1 tests.

b. One hundred percent of the product supplied to these tests.

c. Failure criteria are identical to, or more stringent than, the subgroup 1 tests.

d. Lot rejection criteria are documented.

e. Once approved, future changes require approval from the qualifying activity.

4.5.1.4 Disposition of sample units. Sample units which have passed all group A inspections may be delivered on the contract if the lot is accepted and sample units are still within specified electrical tolerances (see 3.1).

TABLE I. Qualification inspection.

Inspection	Requirement paragraph	Method paragraph
Visual and mechanical inspection	3.3, 3.4, 3.19, 3.20	4.7.2
Solderability	3.5	4.7.3
Shock (specified pulse)	3.6	4.7.4
Vibration	3.7	4.7.5
Low temperature storage	3.10.3	4.7.8.4
Reduced drive level 1/	3.8	4.7.6
Frequency and equivalent resistance	3.10	4.7.8
Frequency stability (controlled)	3.10.1	4.7.8.2
Operable temperature range (controlled)	3.10.2	4.7.8.3
Capacitance shunt (when specified)	3.9	4.7.7
Unwanted modes	3.11	4.7.9
Thermal shock	3.12	4.7.10
Seal	3.13	4.7.11
Salt spray corrosion	3.14	4.7.12
Moisture resistance	3.15	4.7.13
Aging	3.16	4.7.14
Terminal strength 2/	3.17	4.7.15
Visual and mechanical inspection (internal) 3/	3.3, 3.4,3.20	4.7.2.2
Bond strength (when specified)	3.18	4.7.16

1/ Applicable to overtone units and, when specified, fundamental units.
2/ Two sample units only from those to be used for visual and mechanical inspection (internal).
3/ Six sample units, two each from the lower end, middle, and upper frequency.

TABLE II. Group A inspection.

Inspection	Requirement paragraph	Method paragraph
Subgroup 1		
Visual and mechanical inspection (external) 1/	3.3, 3.4, 3.19, 3.20	4.7.2
Low temperature storage	3.10.3	4.7.8.4
Reduced drive level 2/	3.8	4.7.6
Frequency and equivalent resistance	3.10	4.7.8
Frequency stability (controlled)	3.10.1	4.7.8.2
Operable temperature range (controlled)	3.10.2	4.7.8.3
Capacitance shunt (when specified)	3.9	4.7.7
Unwanted modes	3.11	4.7.9
Seal	3.13	4.7.11
Subgroup 2		
Accelerated aging	3.16.1	4.7.14.1

1/ Two sample units only for external dimensions.
2/ Applicable to overtone units and, when specified, fundamental units.

TABLE III. Group A sampling plan.

Lot size	Sample Size
1 to 13	100 percent
14 to 150	13
151 to 280	20
281 to 500	29
501 to 1,200	34
1,201 to 3,200	42
3,201 to 10,000	50
10,001 to 35,000	60
35,001 to 150,000	74
150,000 to 500,000	90
500,001 and over	102

4.6 Periodic inspection.

4.6.1 Group B inspection. Group B inspections shall consist of the inspections specified in table IV. Group B inspections shall be performed on sample units that have passed group A inspections. Every 12 months the tests of subgroup 1 shall be performed on at least 13 units in the order shown. Subgroup 2 tests shall be performed on at least 13 units every 6 months. At the manufacture's option and risk, the same 13 samples may be used for both subgroup 1 and subgroup 2. The aging test shall be performed after moisture resistance and prior to terminal strength testing. No defects are allowed. The contractor shall test representative samples for each type or group (see table VII) for which original qualification was granted. When extension of qualification was used to qualify a broad grouping of types, then periodic inspection may be performed on only one of the groups to remain qualified under retention of qualification. The contractor may also propose alternative style/groupings for approval by the qualifying activity for the group B inspections. The frequency of group B inspections may be reduced as shown in table IV with the approval of the qualifying activity.

4.6.1.1 Disposition of sample units. Sample units subjected to the group B inspections shall not be delivered on contracts.

4.6.1.2 Noncompliance. If a sample fails to pass group B inspection, the contractor shall notify the qualifying activity of such failure and take corrective action on the materials and processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, etc., and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action acceptable to the qualifying activity has been taken.

TABLE IV. Group B inspection.

Inspection	Requirement paragraph	Method paragraph
Subgroup 1 1/		
Solderability	3.5	4.7.3
Shock (specified pulse)	3.6	4.7.4
Vibration	3.7	4.7.5
Thermal shock	3.12	4.7.10
Seal	3.13	4.7.11
Salt spray	3.14	4.7.12
Moisture resistance	3.15	4.7.13
Terminal strength 2/	3.17	4.7.15
Visual and mechanical examination (internal) 2/	3.3, 3.4, 3.20	4.7.2.2
Bond strength (when specified)	3.18	4.7.16
Subgroup 2 3/		
Aging	3.16	4.7.14

1/ If the contractor can demonstrate that any of these tests have been performed for three consecutive periods with zero failures, the frequency of this test, with the approval of the qualifying activity, can performed every 36 months. If the design, material, construction, or processing of the crystal units change, or if there are any quality problems or failures, the qualifying activity may require resumption of the original test frequency.

2/ Only two units required. These two sample units shall be subjected to terminal strength, visual and mechanical (internal) and bond strength (when specified see 3.1).

3/ If the contractor can demonstrate that any of these tests have been performed for six consecutive periods with zero failures, the frequency of this test, with the approval of the qualifying activity, can be performed every 36 months. If the design, material, construction, or processing of the crystal units change, or if there are any quality problems or failures, the qualifying activity may require resumption of the original test frequency.

4.7 Methods of inspection.

4.7.1 General test criteria. The following general test criteria apply, unless otherwise specified, when testing crystal units.

4.7.1.1 Frequency and equivalent resistance measurements. For crystal units with long wire-lead terminals, the test point shall be .125 inch ±.0625 inch (3.17 mm ±1.587 mm) from the holder base. The remainder of the lead shall be shielded. For crystal units with metal holders, measurement of frequency or equivalent resistance, or both, shall be made with the holder grounded.

4.7.1.1.1 At room or other reference temperature (see 6.4.8). With the crystal unit operating in the applicable test set (see 3.1 and 4.2.1.3.1) and in thermal equilibrium at the specified reference temperature, the frequency and equivalent resistance shall be measured (see 6.4.4 and 6.4.5).

a. For crystal units designed for operation under noncontrolled temperature conditions, measurements shall be made with the units in thermal equilibrium at room temperature.

b. For crystal units designed for operation under controlled temperature conditions, measurements shall be made with the units in thermal equilibrium at the reference temperature specified (see 3.1).

4.7.1.2 Measurements before and after a test. When frequency and equivalent resistance are measured before and after a test for determining change during the test, both measurements shall be made with the crystal unit in thermal equilibrium at the same temperature ±1°C, and the drive level set at the same practical minimum. Measured changes in frequency and equivalent resistance during the test shall not exceed the respective maximum changes specified for the particular test. However, at the minimum drive level, it is not necessary that the unit operate within the overall tolerances for frequency and equivalent resistance since a change in drive level does affect the operating characteristics of the crystal, especially its frequency. All crystal units (included those designed for operation at antiresonance) shall be measured at series resonance.

4.7.1.3 Measurements after test. When frequency and equivalent resistance are to be measured after a test to determine compliance with specified tolerances, the measurement shall be made at the specified drive level. For crystal units designed for operation under noncontrolled temperature conditions, measurements shall be made with the units in thermal equilibrium at room temperature. For crystal units designed for operation under controlled temperature conditions, measurements shall be made with the units in thermal equilibrium at the reference temperature. A minimum of 30 minutes for noncontrolled units, and a minimum of 5 minutes for controlled units shall be allowed in order for the units to return to thermal equilibrium before making frequency and equivalent resistance measurements.

4.7.1.4 Drive level adjustment. When rated drive level (see 3.1 and 6.4.9) is specified for a test, it shall be adjusted immediately before each test. No further adjustment shall be made between measurements during a temperature-run test (except in case of line voltage fluctuation or a test lasting longer than an hour).

4.7.2 Visual and mechanical inspection.

4.7.2 .1 External. Crystal units shall be examined to verify that the external interface, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3, 3.19, 3.20 and table V).

4.7.2.1.1 Glass seals. Ten power magnification maximum shall be used to examine the glass parts (see 3.4.1).

4.7.2.1.2 Pin alignment. An applicable pin alignment test gage or shadowgraph shall be used to determine pin alignment (see 3.4.2). When bosses appear on the crystal unit, the gage must be relieved to admit them.

TABLE V. Defect classification for visual and mechanical inspection (external).

Requirement	Requirement paragraph
Interface, construction and physical dimensions:	
Dimensional tolerances, including pin-diameter and pin spacing tolerances	3.1, 3.3 and 3.4
Glass seals, cracks (see 4.7.2.1.1)	3.4.1
Pin alignment (see 4.7.2.1.2)	3.4.2
Marking:	
Incorrect or incomplete information marked	3.19
Incorrect method, size, location, or center of marking	3.19
Workmanship:	
Missing, wrong, or defective parts	3.20
Soldering fluxes and their residues not removed after soldering	3.20
Loose solder or other foreign particles in crystal unit (checked by shaking the unit)	3.20
Burrs and sharp edges not removed from metal parts	3.20
Incorrect mounting of holder cover to base	3.20
Metal corroded	3.20
Metal soiled or dented	3.20

4.7.2.2 Internal. Crystal units shall be disassembled to verify that the internal design, construction, and workmanship are in accordance with applicable requirements (see 3.1, 3.3, 3.4, and 3.20). The crystal resonator shall be inspected with a 10X magnification while illuminated. When internal inspection is required (see table I), two crystal units from each ten sample units of the frequency range for which qualification is sought shall be subjected to the internal inspection specified (see table VI).

TABLE VI. Defects for visual and mechanical examination (internal).

Requirement	Requirement paragraph
Interface, construction and physical dimension requirements:	
Unit does not meet requirements	3.1, 3.3, and 3.4
Frequency adjustment by abrasion halogen vapor coating, or mechanically applied loading materials	3.4.3
Bond strength does not meet requirement	3.18
Workmanship:	
Rosin, flux, or other foreign matter present	3.20
Missing, wrong, or defective parts	3.20
Part corroded, soiled, or finger marked	3.20

4.7.3 Solderability (see 3.5). Each wire lead terminal shall be subjected to method 208 of MIL-STD-202.

4.7.4 Shock (specified pulse) (see 3.6). Crystal units shall be tested in accordance with method 213 of MIL-STD-202. The following details shall apply:

a. Test condition: C (100G).

b. Measurements are not required in group A inspection.

c. Measurements before and after test.

4.7.5 Vibration (see 3.7). Crystal units shall be tested in accordance with MIL-STD-202 using the method specified (see 3.1). The following details and exceptions shall apply:

a. Test and measurements before vibration: The frequency and equivalent resistance shall be measured as specified in 4.7.1.2 and 4.7.8.

b. Test method as specified (see 3.1):

(1) Method 201: 2 hours, or

(2) Method 204: Test condition A, 3 hours.

c. Direction of motion: Specimens shall be rigidly mounted on the horizontal platform of a vibration machine so that the applied vibration shall be as follows:

(1) One-third of the units (to the nearest integral number) shall have the direction of vibration parallel to the pin length.

(2) The same sample of units shall have the direction of vibration perpendicular to the largest surface.

(3) The remainder of the sample units shall have the direction of vibration perpendicular to the pin length and parallel to the largest surface.

d. Time of traverse of frequency range: 1 minute to 2 minutes (method 201).

e. Tests and measurements after vibration: The frequency and equivalent resistance shall be measured as specified in 4.7.1.2 and 4.7.8.

4.7.6 Reduced drive level (overtone units, and when specified, fundamental units, see 3.1 or 3.8). Crystal units shall be tested as specified in 4.7.6.1. This test may be performed as part of the low temperature storage test (see 4.7.8.4).

4.7.6.1 Drive level and resistance. Crystal units shall be tested at a level that is 25 percent of the test drive level or ≤100 microwatts, whichever is less. The crystal units shall not exceed the maximum specified resistance when tested at the reduced drive level.

4.7.7 Capacitance, shunt (when specified, see 3.1) (see 3.9). Crystal units shall be tested in accordance with method 305 of MIL-STD-202. The capacitance shall be measured from pin to pin, with the crystal holder ungrounded, at a frequency which is lower than the fundamental frequency of the unit, and at which the unit shows no oscillation response.

4.7.8 Frequency and equivalent resistance (see 3.10). Crystal units shall be inserted into the applicable test set and measurements shall be taken under the following conditions as applicable:

4.7.8.1 Operating range (noncontrolled) (see 3.10). Measurements of frequency and equivalent resistance of crystal units, designed for operation under noncontrolled temperature conditions, shall be performed at the specific resonance and rated drive level (see 3.1 and 4.7.1.4). The temperature of the crystal unit shall be varied so as to traverse the entire operating range from low temperature to high temperature. For the operating temperature range of -55°C to 105°C, the temperature range shall be traversed for a minimum of 7 minutes unless otherwise specified (see 3.1). For other operating temperature ranges, the time shall be proportional. Measurements of frequency and equivalent resistance shall be recorded continuously or at intervals to ascertain that tolerances are not exceeded at any instant. The temperature of the end points shall be accurate to within ±1°C of specified temperatures. The end point frequencies shall be within ±5 percent of the specified overall frequency tolerance when compared to the equilibrium frequency at these end-point temperatures. For example, if the specified frequency tolerance is ±0.005 percent (overall 100 ppm) then the end point tolerance is 5 ppm. The temperature run shall be performed automatically from the low temperature to the high temperature using T/C analyzer, Winslow Teletronics, Inc., Model TCA-1070, or equal. No manual adjustments shall be made to the test setup once the temperature run has begun. The unit shall not be disassembled, and indirect means shall be used for determining the temperature of the resonator. (NOTE: This type of temperature run may cause some distortion of the frequency temperature characteristics).

4.7.8.2 Operating range (controlled) and frequency stability (see 3.10.1). The units shall not be disassembled, and indirect means shall be used for determining the temperature of the resonator. Measurements of frequency and equivalent resistance of a crystal unit, designed for operation under controlled temperature conditions, shall be performed at specified resonance (see 3.1) and rated drive levels specified in 4.7.8.2.1 or 4.7.8.2.2.

4.7.8.2.1 Method A - continuous. Measurement shall be taken continuously over the operating temperature range. The rate of temperature change shall not exceed 2°C per minute.

4.7.8.2.2 Method B - incremental. Measurements shall be taken over the operating temperature range at intervals no greater than 2.5°C. These measurements shall include the two extremes as well as the reference temperature, assuring that the resonator has reached thermal equilibrium before each measurement is made.

4.7.8.3 Operable range (controlled) (see 3.10.2). Crystal units designed for operating under controlled temperature conditions shall be subjected to a temperature run over the operable range (see 3.1). The rate of change of temperature shall not exceed 2.5°C per second. The units shall be monitored for continuous oscillation, however, measurements of frequency and equivalent resistance are not required.

4.7.8.4 Low temperature storage (see 3.10.3). Crystal units shall be subjected for 2 hours to a temperature equal to or lower than the low end of the operable temperature range specified (see 3.1) and shall be measured with the crystal unit at a temperature no higher than the low end of the operable temperature range. Unless otherwise specified (see 3.1), fundamental mode crystals shall be measured for resistance as specified 4.2.1.3.1 at nominal drive level. Crystals units for which a low drive level test is required (overtone units and fundamental units, when specified (see 3.1)) shall be measured at reduced drive level (see 4.7.6).

4.7.9 Unwanted modes (fundamental mode or overtone units) (see 3.11). The resistance of any unwanted mode in the frequency range of ±20 percent around the main mode shall not exceed two times the main mode resistance when measured at the test drive level.

4.7.10 Thermal shock.

4.7.10.1 Method I (see 3.12). Crystal units shall be tested in accordance with method 107 of MIL-STD-202, test condition B (with one-half hour for step 1 and step 3). Wire mounted low frequency crystal units (under 800 kHz) shall have a high ambient temperature of 100°C, +3°C, -0°C for each temperature cycle. Measurements before and after the test shall be made in accordance with 4.7.1.2.

4.7.11 Seal (see 3.13). Crystal units shall be tested as specified in 4.7.11.1 as applicable.

4.7.11.1 Crystal units in metal holders. Crystal units in metal holders shall be tested in accordance with method 112 of MIL-STD-202. The following details and exceptions shall apply:

a. Test condition: C.

b. Procedure III for evacuated metal holders and procedure IV for backfilled metal holders.

c. Leakage rate sensitivity: 1×10^{-8} atm cm ^{3}/s.

4.7.12 Salt spray (corrosion) (see 3.14). Crystal units shall be tested in accordance with method 101 of MIL-STD-202, test condition B. After this test, the unit shall be visually examined for evidence of excessive corrosion and the frequency and equivalent resistance shall be measured as specified in 4.7.1.3 and 4.7.8

4.7.13 Moisture resistance (see 3.15). Crystal units shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply:

a. Mounting: Normal mounting means, except during measurements.

b. Initial measurements: Not applicable.

c. Subcycle: Step 7B, the vibration subcycle, shall be omitted.

d. Polarization and loading voltage: Not applicable.

e. Final measurement: After drying period, frequency, equivalent resistance, and insulation resistance shall be measured. Insulation resistance shall be measured in accordance with method 302 of MIL-STD-202, using a test potential of 50 volts to 55 volts. This measurement shall be made from pin to pin and from each pin to the holder case.

4.7.14 Aging (see 3.16). Crystal units shall be maintained at the aging temperature for a continuous period of 30 days as follows:

Crystal type	Aging	Temperature
Noncontrolled	±5 ppm	85°C ±2°C
Controlled	±5 ppm	85°C ±2°C or referenced temperature
Controlled	Less than ±5 ppm	Reference temperature

The frequency shall be measured twice a week at intervals of not less than 2 days nor more than 4 days. The initial measurement of frequency shall be taken at the end of the first 24 hours, and the final measurement at the end of the 30-day test. The difference between the initial aging measurement temperature and subsequent measurement temperatures shall not exceed 0.5°C. All crystal units (including those designed for operation at antiresonance) shall be measured at series resonance whenever crystal impedance meters are used (see 4.2.1). When other test oscillators are employed, the crystal unit may be operated above the series-resonant frequency.

The frequency resetability of the test set system shall be 5×10^{-7} for those crystal units which are rated at 5 ppm/month (0.0005 percent). The frequency resetability for other crystal units shall be as specified (see 3.1). The drive level shall be as specified in 4.7.1.4. The same test set shall be used throughout the test. The crystal unit should remain in the test chamber throughout the test. If a condition brings the temperature of the units below the aging temperature for a time interval of more than 1 hour, no measurement shall be made until 24 hours after temperature restoration, and the 30-day test period shall be lengthened by the length of time the temperature failed.

4.7.14.1 Accelerated aging (see 3.16.1). Crystal units shall be measured for frequency and resistance at room ambient temperature and then conditioned in an oven at 105°C ±3°C for 168 hours minimum. The crystal units shall then be removed from the oven and allowed to stabilize at the same room ambient temperature (±2°C). The crystal units shall then be measured again for frequency and resistance (see 4.7.8). As an alternative, with the approval of the qualifying activity, the contractor may condition the crystal units in an oven at a temperature of 125°C ±3°C for 72 hours minimum.

4.7.15 Terminal strength.

4.7.15.1 Terminal pull (see 3.17.1). Crystal units shall be tested in accordance with method 211 of MIL-STD-202. The following details shall apply:

a. Test condition: A.

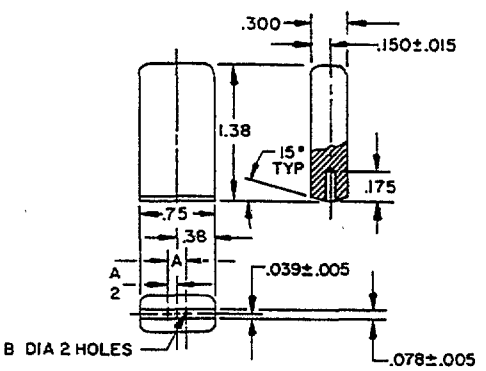
b. Applied force: 4 pounds for pin terminals, and 2 pounds for wire-lead terminals, applied to each terminal.

4.7.15.2 Terminal bend (applicable to crystal units with undercut pins) (see 3.17.2). Each terminal shall be subjected to method 211of MIL-STD-202, test condition B. The following details and exceptions shall apply:

a. Applicable bending tool to be in accordance with figure 3 or equivalent. (Any convenient means may be used for holding the body or base of the crystal unit.) The tool shall engage that segment of the pin-terminals beyond the undercut portion.

b. Number of bending operations: Two (see 3.17.2).

c. The bending cycle shall start with a 15 degree bend ±2 degree bend in one direction, followed by a bend of 30 degrees ±2 degrees in the opposite direction, and completed by a bend of 15 degrees ±2 degrees back to the starting position.



Nominal pin diameter	A	B
.040	.1920	.0520
.050	.4860	.0630

Inches	mm	Inches	mm
.005	0.13	.150	3.81
.015	0.38	.175	4.44
.039	0.99	.1920	4.877
.040	1.02	.300	7.62
.050	1.27	.38	9.7
.0520	1.321	.4860	12.344
.0630	1.600	.75	19.0
.078	1.98	1.38	35.1

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerances are ±.02 (0.5 mm), ±.003 (0.08 mm) and ±.0005 (0.013 mm).

FIGURE 1. Tool for terminal bend test.

4.7.15.3 Wire-lead bend (applicable to crystal units with wire-lead terminals) (see 3.17.3). Crystal units shall be tested in accordance with method 211 of MIL-STD-202. The following details shall apply:

a. Test condition: C.

b. Applied load: 1 pound.

4.7.16 Bond strength (when specified, see 3.1) (see 3.18). The strength of the bond between each wire, ribbon, or other support structure and the quartz resonator shall be tested in shear for "AT" resonators and in tension for resonators below 800 kHz, by gradually applying a force along the support member unit the specified bond strength is reached (see 3.1). The full force shall be applied for not more than 1 minute. Breakage of the quartz resonator, during this test, shall not be construed as bond-strength failure.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. These crystal units are intended for use in military equipment systems for frequency control.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, date of the specification, the applicable specification sheet, and the complete PIN (see 1.2 and 3.1).

b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).

c. Packaging requirements (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the QPL is the US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-LC-LEO-E-EP, Fort Monmouth, NJ 07703-5023; however, information pertaining to qualification of products may be obtained from the Defense Supply Center, Columbus (DSCC-VQP), 3990 East Broad Street, Columbus, OH 43216-5000.

6.4 Definitions. The following definitions shall apply:

6.4.1 Crystal unit. A crystal unit is an assembly that consists of a quartz resonator suitably mounted in a crystal holder.

6.4.2 Crystal holder. A crystal holder is the sealed enclosure in which a quartz resonator is mounted; it includes a cover, a base or other means of closure, and suitably insulated pins or terminals.

6.4.3 Frequency range. The frequency range of a crystal unit is the range from minimum to maximum in which any frequency within this range may be specified.

6.4.4 Specified frequency. The specified frequency is the frequency at which the crystal unit is designed to operate under the conditions specified by the specification sheet.

6.4.5 Equivalent resistance. The equivalent resistance of a crystal unit is defined as follows:

a. For crystal units designed to operate at series resonance, equivalent resistance is defined as the equivalent resistance ohmic resistance of the unit when operating in the specified crystal impedance meter adjusted for the rated drive level and tuned to the specified crystal unit frequency.

b. For crystal units designed to operate at parallel or antiresonance, equivalent resistance is defined as the equivalent ohmic resistance of the unit and a series capacitor of the specified load value, when operating in the specified crystal impedance meter adjusted for rated drive level and tuned to the specified crystal unit frequency.

6.4.6 Operating temperature range. The operating temperature range of a crystal unit is the ambient temperature range over which the unit will oscillate in accordance with the specified frequency and equivalent resistance requirements.

6.4.7 Operable temperature range. The operable temperature range of a crystal unit is the temperature range over which units designed for controlled temperature conditions will oscillate.

6.4.8 Reference temperature. The reference temperature is the ambient temperature at which certain crystal parameter measurements are made.

a. For controlled temperature units, the reference temperature is the midpoint of the controlled operating temperature range.

b. For noncontrolled temperature units, the reference temperature selected is normally room ambient temperature 23°C ±1°C.

6.4.9 Rated drive level. The rated drive level is the power dissipation level at which the crystal unit is designed to operate.

6.5 Subject term (keyword) listing.

Crystal blank
Crystal holder
Quartz crystal
Quartz resonator

6.6 International standardization agreement. Certain provisions of this specification are the subject of international standardization agreement, NATO NEPR 39. When amendment, revision, or cancellation of this specification is proposed, which will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels, including departmental standardization offices, to change the agreement or make other appropriate accommodations.

6.7 Tin plated finishes. Tin plating is prohibited (see 3.4.4) since it may result in tin whisker growth. Tin whisker growth could adversely affect the operation of electronic equipment systems. For additional information on this matter, refer to ASTM B545 (Standard Specification for Electrodeposited Coating of Tin).

6.8 Filling and sealing. Previous experience on these types of products has shown that filling and sealing the crystal unit as described herein has allowed the crystal to meet the performance requirements of this specification. Crystal units can be evacuated, filled with a mixture of 90 percent dry nitrogen and 10 percent dry helium, and sealed. This evacuation, filling, and seal process should be completed in an appropriate chamber. This chamber should be evacuated to an absolute pressure of not greater than 1 torr prior to filling and sealing. The dew point of the gas should be -55°C or lower. Glass holders should be evacuated to pressure of less than 0.1 torr.

6.9 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to extensiveness of the changes.

PROCEDURE FOR QUALIFICATION INSPECTION

10. SCOPE

10.1 Scope. This specification covers the procedures for submitting samples of crystal units for qualification inspection by this specification. This appendix is a mandatory part of this specification. The information contained herein is intended for compliance only.

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

30. SUBMISSION

30.1 Sample. Unless otherwise specified, 30 sample units of each crystal type, except for grouping permitted in table VI (or other groupings approved by the qualifying activity) shall be submitted. If it is desired to qualify for a limited frequency band within the crystal unit range, 30 sample units shall be required in the band. Ten of the 30 unit group shall be at the lower end, 10 near the middle, and 10 at the upper end of the frequency range over which qualification is sought. A single frequency crystal unit may be qualified upon submission of 10 samples at the desired frequency. No failures are permitted.

30.2 Certification of material. When submitting samples for qualification, the contractor shall submit certification that the materials used in the components are in accordance with the applicable specification requirements.

40. EXTENT OF QUALIFICATION

40.1 Extent of qualification. Extent of qualification shall be as follows:

a. Qualification obtained for one group type crystal shall be the basis for extending qualification to other crystal unit groups as identified in table VII. The contractor has the option of proposing alternative groupings for approval by the qualifying activity.

b. Extension of qualification will usually be restricted to the frequency range of the group originally qualified. The contractor may request approval for a greater frequency range band than that qualified provided additional data is submitted demonstrating the contractor's capability to manufacture these units. Data from tests similar to the group A electrical tests, seal test, and visual and mechanical test may be the basis for approval by the qualifying activity.

c. Extension of qualification shall be restricted to the same manufacturing facility, using the same or similar manufacturing processing and materials.

TABLE VII. Grouping for qualification. 1/

Group number 2/ 3/	Crystal unit types 2/ 4/
1	CR16B/U
2	CR37A/U†
2A	CR42A/U
3	CR45/U†
5	CR63B/U†, CR46B/U, CR25B/U, CR147/U
5A	CR104/U, CR47A/U, CR26A/U
7	CR69A/U†, CR78A/U, CR64/U, CR79/U, CR97/U
7A	CR60A/U, CR106/U, CR139/U
8	CR85/U†, CR130/U, CR125/U, CR119/U, CR18A/U, CR58A/U, CR19A/U, CR140/U, CR157/U, CR89/U, CR6A/U, CR5A/U, CR8A/U,
8A	CR62/U, CR36A/U, CR27A/U, CR35A/U, CR28A/U, CR131/U
9	CR1D/U†, CR91/U, CR96/U, CR95/U
10	CR114/U†, CR124/U
11	CR112/U†, CR134/U, CR136/U, CR118/U, CR129/U, CR137/U
11A	CR135/U, CR109/U
12	CR148/U†, CR52A/U
12A	CR65/U
13	CR152/U†, CR76A/U, CR77/U, CR67A/U, CR117/U, CR55A/U, CR72/U, CR81/U
13A	CR84/U, CR61/U
14	CR111/U†, CR128/U
14A	CR113/U
15	CR54A/U†
15A	CR75/U
16	CR80/U†, CR83/U, CR141/U, CR56A/U, CR82/U
16A	CR59A/U
17	CR116/U†, CR105/U, CR110A/U, CR149/U, CR98/U, CR151/U, CR107/U
17A	CR123/U, CR122/U
18	CR145/U†
18A	CR74/U, CR108/U
19	CR150/U, CR159/U, CR165/U
These crystal units must be individually qualified (unless an alternative plan is approved by the qualifying activity)	CR33A/U, CR71/U, CR73/U, CR86/U, CR87/U, CR90/U, CR94/U, CR99A/U, CR100/U, CR101/U, CR102/U, CR103/U, CR127/U, CR133/U, CR138/U, CR144/U, CR146/U, CR150/U

1/ See 40.1.
2/ The pair of groups (e.g., 2 and 2A) may be qualified by a single set of samples for each pair, provided: (1) The samples are for the type indicated by the symbol "†", and (2) The samples are tested for and successfully pass the temperature-run test over the operating range for the controlled types. As an alternative procedure, when one group of noncontrolled crystal unit have been qualified, a separate set of samples may be submitted for the leading item of the bracketed controlled group in the event only the temperature-run test need be performed.
3/ Some group numbers have been omitted due to the cancellation of some crystal unit types.
4/ Qualification of one crystal unit type constitutes qualification of all others of the same group that follow it in the group listing.

Custodians:
Army - CR
Navy - EC
Air Force - 85

Review activities:
Army - AR, MI, SM
Navy - AS, CG, MC, OS, SH
Air Force - 17,19, 99
DLA - CC

Preparing activity:
Army - CR

Agent:
DLA - CC

(Project 5955-0690)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-3098H	2. DOCUMENT DATE (YYMMDD) 27 August 1997

3. DOCUMENT TITLE
Crystal Units, Quartz, General Specification for.

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER		
a. NAME (Last, First, Middle initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Incl Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY	
a. NAME US Army Communications-Electronics Command	b. TELEPHONE (Include Area Code) (1) Commercial (732) 532-9104 (2) AUTOVON 992-9104
c. ADDRESS (Include Zip Code) ATTN: AMSEL-LC-LEO-E-EP Ft. Monmouth, NJ 07703-5023	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Quality and Standardization Office 5803 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340