



File E71611

Vol T

Auth. Page 1

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FOLLOW-UP SERVICE PROCEDURE
(TYPE R)

COMPONENT - SPECIAL-PURPOSE FUSES
(JFHR2)

Manufacturer: SEE ADDENDUM FOR MANUFACTURER LOCATIONS

104923 (Party Site)
Applicant: LITTELFUSE INC
(491993-001) SUITE 500
8755 W HIGGINS RD
CHICAGO IL 60631

This Follow-Up Service Procedure authorizes the above Manufacturer(s) to use the marking specified by UL LLC, or any authorized licensee of UL LLC, including the UL Contracting Party, only on products when constructed, tested and found to be in compliance with the requirements of this Follow-Up Service Procedure and in accordance with the terms of the applicable service agreement with UL Contracting Party and any applicable Service Terms. The UL Contracting Party for Follow-Up Services is listed on addendum to this Follow-Up Service Procedure ("UL Contracting Party"). UL Contracting Party and UL LLC are referred to jointly herein as "UL."

UL further defines responsibilities, duties and requirements for both Manufacturers and UL representatives in the document titled, "UL Mark Surveillance Requirements" that can be located at the following web-site: <http://www.ul.com/fus> and in the document titled "UL and Subscriber Responsibilities" that can be located at the following website: <http://www.ul.com/responsibilities>. Manufacturers without Internet access may obtain the current version of these documents from their local UL customer service representative or UL field representative. For assistance, or to obtain a paper copy of these documents or the applicable Service Terms, please contact UL's Customer Service at <http://www.ul.com/global/eng/pages/corporate/contactus>, select a location and enter your request, or call the number listed for that location.

The Applicant, the specified Manufacturer(s) and any Recognized Company in this Follow-Up Service Procedure must agree to receive Follow-Up Services from UL Contracting Party. If your applicable agreement is a Global Services Agreement ("GSA") with an effective date of January 1, 2012 or later and this Follow-Up Service Procedure is issued on or after that effective date, the Applicant, the specified Manufacturer(s) and any Recognized Company will be bound to a Service Agreement for Follow-Up Services upon the earliest by any Subscriber of use of the prescribed UL Mark, acceptance of the factory inspection, or payment of the Follow-Up Service fees which will incorporate such GSA, this Follow-Up Service Procedure and the Follow-Up Service Terms which can be accessed by clicking here: <http://www.ul.com/contracts/Terms-After-12-31-2011>. In all other events, Follow-Up Services will be governed by and incorporate the terms of your applicable service agreement and this Follow-Up Service Procedure.

It is the responsibility of the Recognized Company to make sure that only the products meeting the aforementioned requirements bear the authorized Marks of UL LLC, or any authorized licensee of UL LLC.

This Follow-Up Service Procedure contains information for the use of the above Manufacturer(s) and representatives of UL and is not to be used for any other purpose. It is provided to the Manufacturer with the understanding that it will be returned upon request and is not to be copied in whole or in part.

This Follow-Up Service Procedure, and any subsequent revisions, is the property of UL and is not transferable. This Follow-Up Service Procedure contains confidential information for use only by the above named Manufacturer(s) and representatives of UL and is not to be used for any other purpose. It is provided to the Subscribers with the understanding that it is not to be copied, either wholly or in part unless specifically allowed, and that it will be returned to UL, upon request.

Capitalized terms used but not defined herein have the meanings set forth in the GSA and the applicable Service Terms or any other applicable UL service agreement.

UL shall not incur any obligation or liability for any loss, expense or damages, including incidental, consequential or punitive damages arising out of or in connection with the use or reliance upon this Follow-Up Service Procedure to anyone other than the above Manufacturer(s) as provided in the agreement between UL LLC or an authorized licensee of UL LLC, including UL Contracting Party, and the Manufacturer(s).

UL LLC has signed below solely in its capacity as the accredited entity to indicate that this Follow-Up Service Procedure is in compliance with the accreditation requirements.

William R. Carney
Director
North American Certification Program

LOCATION

(114961-001) 4688 (Party Site)
SUZHOU LITTELFUSE OVS LTD
SUZHOU INDUSTRIAL PARK
6 XINGHAI ST
SUZHOU JIANGSU CHINA

Factory ID:
UL Contracting Party for above site is: UL AG

(479717-001) 102306 (Party Site)
ZHEJIANG MINGRONG ELECTRICAL
PROTECTION CO LTD
WEI 11TH RD
ECONOMIC DEVELOPING ZONE
YUEQING,
ZHEJIANG 325600 CHINA

Factory ID:
UL Contracting Party for above site is: UL AG

(854697-001) 189530 (Party Site)
LITTELFUSE INC
PODER JUDICIAL 1005
26056 PIEDRAS NEGRAS
COAH MEXICO

Factory ID:
UL Contracting Party for above site is: UL AG

Recognized Component Marking Data Page (RCMDP)

(FILE IMMEDIATELY AFTER AUTHORIZATION PAGE)

RECOGNIZED COMPONENT MARKING

Products Recognized under UL's Component Recognition Service are identified by marking elements consisting of:

1. The Recognized Company's identification specified in this document.
2. A catalog, model or other applicable product designation specified in the descriptive sections of this document.
3. The UL Recognized Component Mark shown below is optional unless required elsewhere in the Procedure.

Only those components, which actually bear the Marking, should be considered as being covered under the Recognition Program. The UL Listing or Classification Mark is not authorized for use on or in connection with Recognized Components.

Recognized Component Mark



Minimum size of the Recognized Component Mark is not specified as long as it is legible. Minimum height of the registered symbol ® shall be 3/64 inch but may be omitted if it is out of proportion to the Recognized Component Mark or not legible to the naked eye.

The manufacturer may reproduce the Mark electronically. Any decision regarding the acceptability of the manufacturer's Mark reproduction will be made at the Reviewing Office.

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Subject 248

333 Pfingsten Road
Northbrook, IL 60062-2096
Issued: November 15, 2001
Revised: January 1, 2012

UL 248
FUSES
FOLLOW-UP AND INSPECTION INSTRUCTIONS

Supersedes Issues Dated November 1989 & June 1993
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GENERAL

A. As a part of UL's follow-up inspection, it is required that a member of the UL staff periodically visit the factory and select, for test or examination or both, samples of the most recent production of the product covered.

B. The Follow-Up Service Procedure covering the product is loaned to the manufacturer and constitutes the basis on which the product is judged for compliance with the applicable requirements.

RESPONSIBILITIES OF THE MANUFACTURER

C. Restrict the use of markings that reference UL (either directly by use of the name, an abbreviation of it, or the UL symbol, or indirectly by means of agreed upon markings that are understood to indicate acceptance by UL) to those products that are found by the manufacturer's own inspection to comply with the Follow-Up Service Procedure description. The use of such markings is further limited by the agreements that have been executed by the subscriber and UL.

D. Confine the markings referencing UL as indicated in Paragraph C, to the location or locations authorized in these instructions or the Follow-Up Service Procedure.

E. During hours in which the factory is in operation, permit the UL Representative with free access to any portion of the premises where the product or components thereof are being fabricated, processed, finished or stored, and to the test area assigned for the UL Representative's use. The UL Representative shall be permitted to inspect and subject to prescribed tests, prior to shipment, any product bearing or intended to bear markings referencing UL as indicated in Paragraph C.

F. Provide, at a convenient location, all required test equipment and facilities and any required personnel for conducting all tests that are to be performed at the factory. These shall be available when needed so that the inspection work can proceed without undue delay.

G. Where so specified by these Follow-Up and Inspection Instructions, forward samples selected by the UL Representative to the specified UL Testing Laboratory for Follow-Up Test, within five working days of the UL Representative's inspection visit, packaging and shipment of the samples are the responsibility of the manufacturer.

H. Determine that required test equipment is functioning properly at least daily and that it is calibrated at least annually, or whenever it has been subject to abuse (such as being dropped or struck with an object) or its accuracy is questionable. The test equipment and instruments shall be calibrated by either the manufacturer or an outside laboratory. In either case, it shall be calibrated by comparison with a standard that is traceable to the applicable U.S. or Foreign National Standard. A letter from the outside laboratory or from an off-site manufacturer's calibration lab stating that their lab standards are directly traceable to their country's National Standard and outlining their traceability pathway is considered adequate proof of traceability. For in-house calibrations, the Standard (weight and gauge blocks, etc.) used shall be calibrated every three years, or whenever the Standard has been subject to some form of abuse that may affect the Standard's fitness for use. The Standard shall be stored to protect it from damage or deterioration per the Standard manufacturer's recommendations. Records of the calibration of the test equipment and Standard(s) shall be maintained until the next required calibration is completed and recorded, and shall be readily available for review by the UL Representative.

RESPONSIBILITIES OF THE UL REPRESENTATIVE

I. Examine representative samples of production bearing, or intended to bear, the UL Mark or Marking to determine compliance with the provisions of the Follow-Up Service Procedure, the applicable UL Standard(s) and these Follow-Up and Inspection Instructions. A product which is found to have features that make it unacceptable to bear a marking referencing UL, shall be acceptably corrected if the marking is to be retained. Carefully check subsequent production for such features until conditions are again considered normal.

J. A product that does not comply with the requirements of the Standard, the Follow-Up Service Procedure and these Follow-Up and Inspection Instructions shall have each UL referencing mark removed from the product, or obliterated from the product where the marking is imprinted, die-stamped, molded, or the like. If the rejection of the product is questioned by the manufacturer and Applicant, the material may be held at the point of inspection, typically at the factory, pending an appeal. The manufacturer and the Applicant have the right to appeal a decision with which they disagree. Provide the name of the UL engineer to whom the appeal is to be made. To resolve issues involving variations in construction, the manufacturer and Applicant may also be offered the option of contacting their New Work assignment engineer. Held shipment appeals involving Follow-Up Services issues (e.g. - improper labeling, etc.) should be directed to an appropriate staff member designated by the Reviewing Office. Should UL grant temporary authorization for the continued use of the UL Mark, such temporary authorization shall only be for the time needed to review and/or process the Procedure revisions, or as otherwise specified to cover a particular lot or production run. The manufacturer shall demonstrate that all marks referencing UL are removed from the rejected material. Those marks referencing UL not destroyed during their removal from the product shall be retrieved over to the UL Representative for destruction.

K. Report to the manufacturer and the UL Reviewing Office by means of a Variation Notice (VN) if:

- a. Variations in construction are found,
- b. The manufacturer's method and/or frequency of a test is not as described,
- c. The manufacturer's test program is not being performed as described,
- d. Nonconforming test results are witnessed during required tests conducted specifically for the UL Representative, or
- e. Nonconforming results are reported by the manufacturer during tests performed without the UL Field Representative presence, or
- f. Other items not in compliance with UL requirements (e.g. calibration of equipment, access to the factory, etc.).

Explain to the manufacturer that a Variation Notice is a means of communication with the manufacturer and documents those items where nonconformance to the Procedure has been encountered. Also explain that it is the manufacturer's responsibility to forward a copy of the Variation Notice to the Applicant.

L. Where so specified by these Follow-Up and Inspection Instructions, select samples to be forwarded to the appropriate UL Testing Laboratory for Follow-Up Tests.

M. Review the Manufacturer's Test Program to assure that:

- a. The required tests are being performed correctly,
- b. The instruments being used for the tests have been calibrated at the prescribed interval and are in good working order,
- c. The proper number of samples is being subjected to the required tests, and
- d. The proper information is being recorded and is up to date.

N. When reviewing Certificates of Calibration for test equipment, verify that the Certificate indicates that all reference standards used to calibrate the test equipment are traceable to the applicable U.S. or Foreign National Standard.

GENERAL INSTRUCTIONS


L1. These Follow-Up and Inspection Instructions cover fuses that have been evaluated to the requirements described in the UL Standard for Fuses, UL 248.

L2. Ratings of fuses covered by these instructions are as described in the Follow-Up Service Procedure.

L3. For the purpose of any inspection, a "lot" is considered to comprise all fuses, which are represented by the particular set being tested. The lot includes all such fuses which bear or are intended to bear the Listing Mark which have not been previously subjected to inspection by the UL Representative.

L4. At each visit to the factory, the UL Representative shall select representative samples available from the lot of fuses which have passed the manufacturer's final inspection and bear or are eligible to bear the UL Mark, and shall then select representative samples. The UL Representative shall select samples, choosing them from whatever bins, cartons, containers or production lines necessary in order to obtain random samples, and from lots which are large enough to be representative of production. These samples shall be examined for compliance with the description, and special instructions, if any, in the Follow-Up Service Procedure, the referenced Standard, and these Follow-Up Inspection Instructions.

LISTING MARKS


L5. The UL Mark for Listed fuses consists of a Listing Mark for fuses of the combination type only. One Listing Mark bears the UL symbol  or "UND. LAB. Inc.". The Listing Mark also includes the word "LISTED", an issue number, and the following product name: "FUSE".

L6. The ampere rating is stamped by the fuse manufacturer or preprinted in a space provided on the Listing Mark for this purpose.

L7. Combination Listing Marks may be of any design and material, which are acceptable to the manufacturer and to UL.


L8. One Listing Mark is to be applied to the casing of each fuse.

IMPRINTED LISTING MARKS

L9. As an alternate method of applying the Listing Mark to fuses, the manufacturer may utilize a machine that imprints on the casing of each fuse  or "UND. LAB. Inc.", "LISTED FUSE", and an issue number.

L10. A manufacturer desiring to employ imprinted application of Listing Marks for fuses should make application to UL at the Reviewing Office which will supply the necessary information regarding equipment that is acceptable and arrangements for its use.

LISTING MARKS FOR RENEWALS

L11 Listing Marks for the fusible element (renewals) for renewable fuses bear the UL symbol  or "UND. LAB. Inc.". The Listing Mark includes the word "LISTED", the issue number, and the following product name "FUSE RENEWAL".

L12 One renewal Listing Mark is to be applied to the smallest container in which fusible elements are packaged. An additional Listing Mark may be applied to a larger container in which several containers are packaged for shipment.

PROCEDURE COVERAGE

L13. In certain paragraphs of the referenced Standard UL 248, it is indicated or implied that the acceptability of a material or construction will involve an investigation to determine its suitability for the purpose. In such cases, the product is not to bear the Listing Mark until it has been submitted to the Conformity Assessment Services Department and the material or construction has been described in the Follow-Up Service Procedure.

MARKINGS

L14. The UL Representative shall determine that all markings and electrical ratings on fuses are in strict conformity with the described markings and electrical ratings as required in the Follow-Up Service Procedure.

TEST EQUIPMENT

L15. Instruments shall be calibrated annually, or more frequently when the accuracy is questionable, and the calibrations shall be traceable to a nationally or internationally recognized standard. Certification of this calibration shall be maintained by the manufacturer. After initial acceptance by the UL Conformity Assessment Services Department, any revisions to or relocations of the equipment shall be brought in writing to the attention of UL.

INITIAL PRODUCTION INSPECTION

L16. When samples used for the initial investigation by the UL Conformity Assessment Services Department were not selected from lots using production methods and tooling, the UL Representative is to select samples from the first production lot at the request of the UL Conformity Assessment Services Department. Lot sizes shall not be smaller than indicated in Table L1. A complete follow-up test program is to be conducted. UL shall be contacted by the UL Representative to arrange for the rated voltage tests to be conducted under the direction of the UL Conformity Assessment Services Department.

FOLLOW-UP TEST PROGRAM

L17. Samples to be used for the follow-up test program are to be selected by the UL Representative from lots of the minimum sizes shown in Table L1 and shall have been produced using production methods and tooling. Fuses shall be subjected to the tests and frequencies of tests indicated in Table L2 and Table L3. The sample size of fuses required for each test shall consist of the number of fuses specified in Table L2 and Table L3. Refer to the relevant parts in the Standard UL 248, for the method of each test.

TABLE L1

MINIMUM LOT SIZES(+)

| Case Size | Minimum Lot Size |
|----------------------|------------------|
| 100 amperes and less | 100 |
| 101 to 200 amperes | 50 |
| 201 to 600 amperes | 15 |
| 601 to 2000 amperes | 6 |
| 2001 to 6000 amperes | 3 |

- (+) Minimum lot sizes may be smaller if the smaller lot size is greater than or equal to a years production of that fuse rating.
- a year's production of that fuse rating for annual tests.
 - one half of a year's production of that fuse rating for semiannual tests.
 - one quarter of a year's production of that fuse rating for quarterly tests.

L18. The same ratings of any specific fuse model or code number shall not be selected twice in any 1 year unless: (a) the manufacturer's production of different ratings is limited or, (b) a particular rating exhibited nonconforming results during the previous inspection.

L19. During one quarter each year, the ratings selected shall be the highest rating within the range and the highest rating representing a construction change as tabulated in the Follow-Up Service Procedure. The fuses shall be subjected to the tests specified in Table L2 and Table L3. If the highest ratings within the range are not available, the next lower available rating may be selected. The UL Representative shall notify the manufacturer, using a Variation Notice, of the need to test the maximum rating. If the next lower rating available is tested, the maximum rating must be subjected to the specified tests as soon as they become available.

During the remaining three quarterly inspections, the UL Representative shall select intermediate ratings that are representative of production. The intermediate rating selected shall be different each quarter. These fuses shall be subjected to the quarterly tests specified in table L2

L20. Verification of operation at rated voltage tests are to be conducted under the direction of the UL Conformity Assessment Services Department at such location(s) mutually acceptable to the manufacturer and UL. If authorized in the Follow-Up service Procedure, the UL Representative may witness tests in alternating current circuits up to 10,000 A rms when requested by the manufacturer or the UL Conformity Assessment Services Department.

TABLE L2

FOLLOW-UP TEST PROGRAM
NUMBER OF SAMPLES AND FREQUENCY OF TEST
FOR FUSES WITH AC VOLTAGE RATING

| Current Rating I_n , (A) | Verification of Overload Operation | | | | | Verification of Operation at Rated Voltage | | | | | | |
|----------------------------|------------------------------------|------------|-----------|-----------|--------------------------------------|--|-------------------|-------------|-----------------------|-------|---------|--------|
| | $1.0 I_n / 1.1 I_n$ | $1.35 I_n$ | $1.5 I_n$ | $2.0 I_n$ | $2.0 I_n$ $5.0 I_n$ Time Delay | $2.0 I_n$ @ RV | $3.0 I_n$ @ RV | Max. Energy | 10 kA (see note f) | 50 kA | 100 kA | 200 kA |
| 0-30 | 2 (Q) | 2 (Q) | | 2 (S) | 1 (A) | 2 (A) | | 1 (A) | 5 (A) | 1 (T) | 1 (T) | 1 (T) |
| 31-60 | 2 (Q) | 2 (Q) | | 2 (S) | 1 (A) | 2 (A) | | 1 (A) | 5 (A) | 1 (T) | 1 (T) | 1 (T) |
| 61-100 | 2 (Q) | 2 (Q) | | 2 (S) | 1 (A) | 2 (A) | | 1 (A) | 5 (A) | 1 (T) | 1 (T) | 1 (T) |
| 101-200 | 2 (Q) | 2 (Q) | | 1 (S) | 1 (A) | 1 (A) | | 1 (A) | 5 (A) | 1 (T) | 1 (T) | 1 (T) |
| 201-400 | 2 (Q) | 2 (Q) | | 1 (S) | 1 (A) | 1 (A) | | 1 (A) | 5 (A) | 1 (T) | 1 (T) | 1 (T) |
| 401-600 | 2 (Q) | 2 (Q) | | 1 (S) | 1 (A) | 1 (A) | | 1 (A) | 5 (A) | 1 (T) | 1 (T) | 1 (T) |
| 601-800 | 2 (A) | | 2 (A) | | | | 1 (A) | 1 (A) | | 1 (T) | 1 (T) | 1 (T) |
| 801-1200 | 1 (A) | | 1 (A) | | | | 1 (A) | 1 (A) | | 1 (T) | 1 (T) | 1 (T) |
| 1201-1600 | 1 (A) | | 1 (A) | | | | 1 (A) | | | 1 (T) | 1 (T) | 1 (T) |
| 1601-2000 | 1 (A) | | 1 (A) | | | | 1 (A) | | | 1 (T) | 1 (T) | 1 (T) |
| 2001-3000 | 1 (A) | | 1 (A) | | | | 1 (A) | | | 1 (T) | 1 (T) | 1 (T) |
| 3001-4000 | 1 (A) | | 1 (A) | | | | 1 (A) | | | 1 (T) | 1 (T) | 1 (T) |
| 4001-6000 | 1 (A) | | 1 (A) | | | | 1 (A) | | | | 1 (T) | 1 (T) |
| Notes: | | | | | | b, c | g | d, e | a | c | c, h, i | c |

Q - Quarterly

S - Semiannual

A - Annual

B - Biennial

T - Triennial

Note a: The Verification of Operation at Rated Voltage test at 10 kA is not required for fuses with interrupting ratings above 10kA.

Note b: The Verification of Operation at Rated Voltage test at $2.0I_n$ is required only on fuse constructions that employ a filler.

Note c: For the Verification of Operation at Rated Voltage tests at $2.0I_n$, 50 kA, 100 kA, and 200 kA, each fuse is to be tested within 1 h of removal from a $90 \pm 3^\circ$ oven after at least 24 h of conditioning (Exception: Oven conditioning is not required on fuses with tubing material of glass, ceramic, melamine impregnated glass fiber, or equivalent non-hygroscopic material, and when the fuse employs a sand filler or no filler.)

Note d: The Verification of Operation at Rated Voltage Maximum Energy Test is not required for ratings less than 30 A, if they employ the same filler as the 30 A fuses. Fuses rated 1 A or less that do not employ a filler, are represented by the 30 A rating. For the Maximum Energy Test, humidity conditioning is not required.

Note e: Plug Fuses and Class H Fuses are exempt from the Verification of Operation at Rated Voltage Maximum Energy Test.

Note f: Sample set requirement for the verification of operation at rated voltage test at 10 kA for Class H fuses is:

| Current Rating, In (A) | Class H Fuses | | |
|------------------------|---------------|------------------|---------|
| | Non-Renewable | Renewable | |
| | | Fusible Elements | Casings |
| 0-30 | 5 | 10 | 5 |
| 31-60 | 4 | 8 | 4 |
| 61-100 | 3 | 6 | 3 |
| 101-200 | 2 | 4 | 2 |
| 201-400 | 2 | 4 | 2 |
| 401-600 | 2 | 4 | 2 |

Note g: Only required for Class T Fuses rated 601-1200A.

Note h: For 300V Class T fuses, every four years it will be necessary to test two 300 V fuses of the maximum current rating of each case size in series at 100 kA, 480 V. The let-through currents shall be compared to the results of testing one fuse at 300 V. If the results of the tests are considered acceptable and let-through currents are comparable, no further testing is necessary for two-in-series. However, if unacceptable results are obtained or if the let-through currents for testing at 480 V are much greater than testing at 300 V, it will be necessary to complete the balance of the required tests two-in-series at 480 V.

Note i: Class T and Class J fuses require intermediate testing at 100 kA every three years.

For Class J fuses, intermediate samples shall be selected from the following ranges: 0-29A, 31-59A, 61-99A, 101-199A, 210-399A, 401-599A.

For Class T fuses, intermediate samples shall be selected from the following ranges: 0-25A, 35-50A, 70-90A, 110-175A, 225-350A, 450-500A, 700A, 1000A.

TABLE L3

FOLLOW-UP TEST PROGRAM
NUMBER OF SAMPLES AND FREQUENCY OF TEST
FOR FUSES WITH DC VOLTAGE RATINGS

| Current Rating In, (A) | Verification of Operation at Rated Voltage | | | |
|---------------------------|--|-----------|-------|-------------------------|
| | 2.0In @RV | 9.0In @RV | 10 kA | Interrupting Ability |
| 0-30 | 2 (B) | 2 (B) | 5 (B) | 3 (B) |
| 31-60 | 2 (B) | 2 (B) | 4 (B) | 3 (B) |
| 61-100 | 2 (B) | 2 (B) | 3 (B) | 3 (B) |
| 101-200 | 1 (B) | 1 (B) | 2 (B) | 3 (B) |
| 201-400 | 1 (B) | 1 (B) | 2 (B) | 3 (B) |
| 401-600 | 1 (B) | 1 (B) | 2 (B) | 3 (B) |
| 601-800 | 1 (B) | | 1 (B) | 1 (B) |
| 801-1200 | 1 (B) | | 1 (B) | 1 (B) |
| 1201-1600 | 1 (B) | | 1 (B) | 1 (B) |
| 1601-2000 | 1 (B) | | 1 (B) | 1 (B) |
| 2001-3000 | 1 (B) | | 1 (B) | 1 (B) |
| 3001-4000 | 1 (B) | | 1 (B) | 1 (B) |
| 4001-6000 | 1 (B) | | 1 (B) | 1 (B) |
| Notes | a, c | b, c | c | c |

B - Biennial

Note a: For test on fuses rated 601-6000, test level is 2.0 In or any current in range of 2.0In - 3.0In at rated DC Voltage.

Note b: Applicable for fuses with Time-Delay characteristic only.

Note c: Each fuse may be tested within 1 h of removal from a 90°C oven after at least 24 h of conditioning.

Reduced Schedule for Quarterly, Semiannual,
and Annual Follow-Up Tests

L21. If a manufacturer needs to use the following reduced schedule because of limited production, production data is required to be presented to the UL Representative.

L22. Quarterly Follow-Up Tests may be omitted if the total production of all fuses in a family and current range, is less than 10 times the required lot size for the 3 months since the end of the last quarter in which tests were performed. No more than two consecutive Quarterly Follow-Up Test programs shall be omitted if there is any production. If no production is available after two consecutive omissions for Quarterly Tests, affected fuses shall not be shipped as Listed until production is available and the required tests have been conducted with acceptable results. In the event that maximum ratings of fuses were not tested per paragraph L19, the UL Representative shall document on a year ending Variation Notice that maximum ratings were not available, and affected fuses shall not be shipped as Listed until production is available and the required tests have been conducted with acceptable results.

L23. Semiannual Follow-Up Tests may be omitted if the total production of all fuses in a family and current range, is less than 20 times the required lot size for the 6 months since the end of the quarter in which the semiannual Follow-Up Tests were last performed. No more than one Semiannual Follow-Up Test program shall be omitted if there is any production. If no production is available after one omission for Semiannual Tests, affected fuses shall not be shipped as Listed until production is available and the required tests have been conducted with acceptable results. In the event that maximum ratings of fuses were not tested per paragraph L19, the UL Representative shall document on a year ending Variation Notice that maximum ratings were not available, and affected fuses shall not be shipped as Listed until production is available and the required tests have been conducted with acceptable results.

L24. Annual tests may be omitted only if there is no production of any fuses in a family and current range by the end of the calendar year. Fuses shall not be shipped as Listed during the following year until production is available and the required tests have been conducted with acceptable results. In the event that maximum ratings of fuses were not tested per paragraph L19, the UL Representative shall document on a year ending Variation Notice that maximum ratings were not available, and affected fuses shall not be shipped as Listed until production is available and the required tests have been conducted with acceptable results.

Program for Follow-Up Tests Conducted by the Manufacturer
Without the UL Field Representative Presence

L25. Upon request, a manufacturer may be evaluated under a qualified UL Client Interactive Program to become eligible to conduct limited Follow-Up Tests without the UL Field Representative's presence. Authorization and program requirements for the manufacturer will be provided in detail in a Special Appendix in the Follow-Up Service Procedure. This authorization shall be coordinated with the Conformity Assessment Services Department. Each manufacturing facility shall be evaluated under the appropriate UL Client Interactive Program.

L26. Upon receiving authorization, the manufacturer would be limited to conducting the Verification of temperature rise and I_{nf} test, and the Verification of overload operation test at $1.35 I_n$ only, during alternating quarters. This interval is the maximum allowed, independent of any UL Client Interactive Program in which the manufacturer participates. At the beginning of each calendar year, the Field Representative and the manufacturer may agree during which alternating quarters the testing would be performed without the Field Representative's presence. Records for these tests are required to be maintained for review by the UL Field Representative. The manufacturer is required to select samples in accordance with the lot and sample sizes specified in these pages.

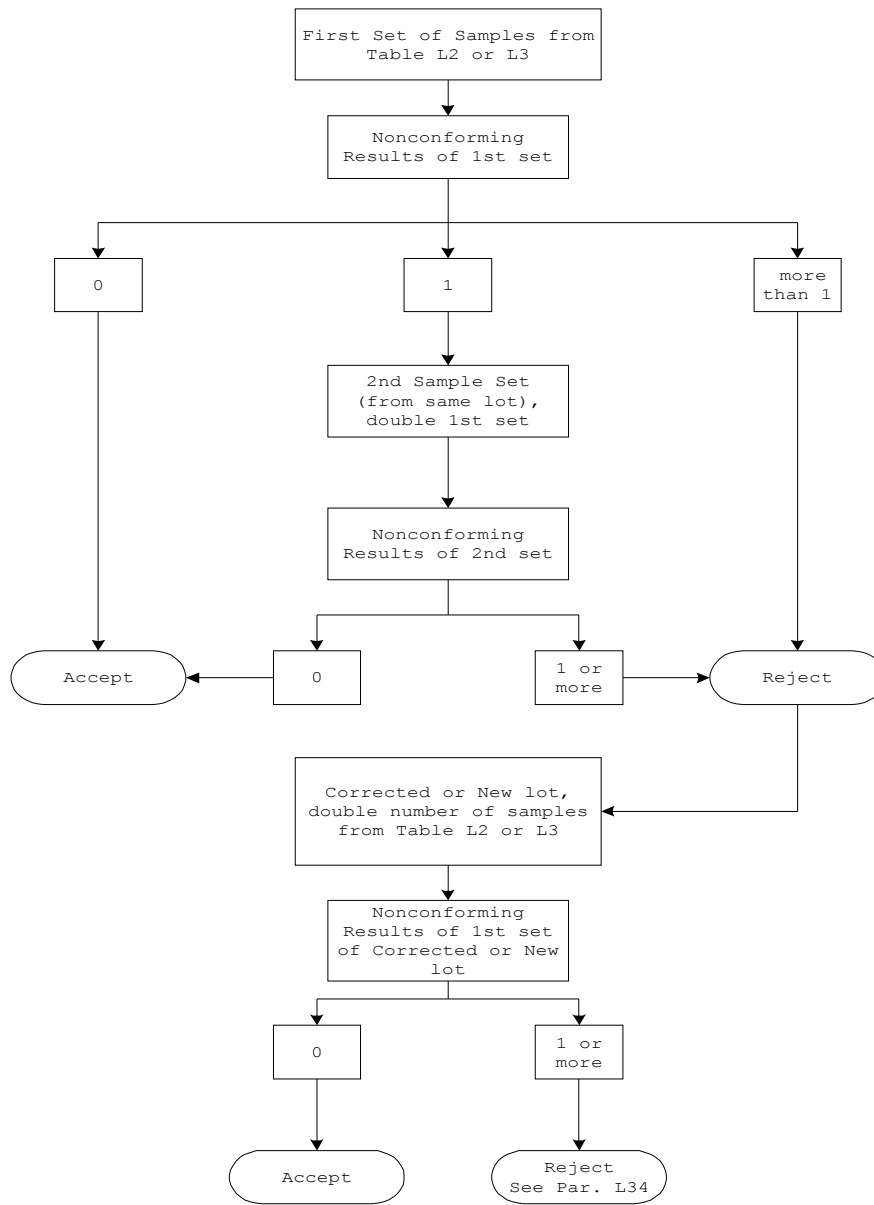
L27. In the event of a nonconforming test result, the manufacturer is required to immediately suspend the use of the UL Mark on affected production and contact the local UL Field Representative to request a visit. Upon availability, the UL Representative will visit the manufacturer to witness testing on new samples in accordance with the requirements in these pages.

CRITERIA FOR LOT ACCEPTANCE AND
PROCEDURE IN CASE OF NONCONFORMING TEST RESULTS

L28. The procedure to determine conformance of a production lot of fuses to the Follow-Up Test Program is described in the following paragraphs.

L29. A lot will be determined acceptable and in conformance with the Follow-Up Test Program, if representative fuses tested from the lot, complete the required tests with conforming results.

L30. If a nonconforming test result occurs, the test may be repeated on a second set of samples from the same lot, double the original sample size specified in Table L2 and Table L3. The lot shall be determined acceptable if the test results of all samples of the second set are determined to be acceptable. The lot shall be rejected if a nonconforming test result occurs in any sample of the second set.



L31. When a lot of fuses is rejected, the use of the UL Mark is considered to be suspended for the specific fuse rating and model and other ratings that the rejected fuse represents. The use of the UL Mark may not be resumed until a new lot is submitted and is found to conform to the Follow-Up Test Program as required below.

L32. A lot of fuses that is rejected, and all production from which the lot of fuses was selected, shall have the UL Mark removed or obliterated. Refer to Par. J of these FUIIs for instructions on an appeal process if the manufacturer disagrees with the rejection of a lot.

L33. Other ratings represented by the rejected rating may be tested to determine eligibility to bear the UL Mark. The next lower rating, if the highest rating was tested, or the highest rating below the intermediate/lower rating tested, may be tested to represent other lower homogeneous ratings. These tests do not represent the rejected fuse rating.

L34. If the original lot is rejected, a second lot, corrected or new, may be submitted. The sample size for the second lot shall be double the original sample size specified in Table L2 and Table L3. The second lot shall be determined acceptable if the test results of all samples of the second set are determined to be acceptable. The second lot shall be rejected if a nonconforming test result occurs in any sample of the second set. If this second lot is rejected, the use of the UL Mark is considered to be suspended as detailed above, and the UL Conformity Assessment Services Department shall reinvestigate the affected fuse construction. The use of the UL Mark shall be reinstated if the fuse is found to comply with the requirements upon completion of the reinvestigation.

SPECIAL INVESTIGATIONS

L36. If more than one-third of the ratings tested during any quarterly inspection, or if more than one-fourth of the ratings tested during any four consecutive quarterly inspections exhibit nonconforming test results in the Verification of temperature rise and I_{nf} test, or the Verification of overload operation test at $1.35I_n$ or $2.0I_n$, UL at the Reviewing Office shall immediately be notified and a special investigation initiated.

L37. If more than one-third of the ratings tested exhibit nonconforming test results in the interrupting ratings tests during any inspection in which these tests are made, UL at the Reviewing Office shall immediately be notified and a special investigation initiated.

L38. During the special investigation, conditions at the factory are investigated carefully by a UL Engineer. Use of the Listing Mark on fuses is permitted only after representative samples from each lot have been inspected and found to comply with all of the requirements of the referenced Standard which apply.

L39. The special investigation is concluded when UL has determined that the conditions responsible for the special investigation have been corrected.

L40. All costs relating to the special investigation, which exceed the normal cost of operating the service, are billed to the manufacturer.

MARKET SAMPLE PROGRAM

L41. To supplement the UL factory inspection program and to further assure uniform acceptability of the Listed product as well as the proper application of UL Mark, UL may choose to secure samples of the products after shipment from the factory. The samples are secured by UL Engineers and UL Representatives from manufacturer's agents, jobbers, contractors, retail outlets and users. These samples, known as "Market Samples", are taken only from Listed material, are carefully tagged for identification, and forwarded to the UL test facility indicated on the written request for samples. These samples are to be secured only on written requests furnished to the UL Engineers or UL Representatives.

L42. When tests on "Market Samples" are completed, the results are reported to the manufacturer.

GENERAL

PRODUCT COVERED:

No specific product is covered. This is a supplement to the Follow-Up Service Procedure on fuses manufactured in Arcola, Illinois. It is intended to be provided as a guide to cover the testing and test sequence of the different type fuses covered in Vol. 2 of this file.

TEST EQUIPMENT PROVIDED BY MANUFACTURER:

*Provided in accordance with the Standard for low voltage fuses, UL 248-1.

TESTS TO BE CONDUCTED BY MANUFACTURER:

The testing program for these fuses shall consist of the following:

1. Clearing At Full Voltage - Included as part of the interrupting ability tests under Item 3. Conducted annually.
2. Interrupting Ability Test - Normally witnessed by a representative of UL Electrical Department - The amount of sampling is detailed in the tabulations in each section.

If initial sample fails in any of the above tests, three additional samples are to be tested. If any of the additional samples fail, the lot of fuses shall be rejected.

3. Let-Through Current Measurements - Included as part of the interrupting ability test under Item 2 above.

SELECTION OF SAMPLES:

A minimum amount of samples are to be selected from current production or stock samples from the most recent production in accordance with the applicable Standard for Fuses and Follow-Up Inspection Instructions.

* Samples should be selected by the Field Representative in accordance with the following sections of this Procedure and as outlined in the Follow-Up Inspection Instructions. The samples to be selected for short circuit testing shall be sealed and marked to indicate that they are UL samples for short circuit tests to be witnessed by **Conformity Assessment** Services and shipped to the Littelfuse **Champaign, IL High Power Lab** . The samples shall be marked to be opened only by a representative of Underwriters Laboratories Inc. The address for the **Champaign High Power Lab** is:

Littelfuse, Inc.
Attn: High Power Lab - UL Representative
* **2110 S. Oak Street**
* **Champaign, IL 61820**

These fuses shall be properly marked for their intended purpose. Enough samples shall be selected so in the event of failure, the schedule outlined in these Grey Pages can be completed. A Follow-Up sample tag is not to be used in conjunction with these samples.

SAMPLE REJECTION:

As described in this Procedure.

INSTRUCTIONS TO THE FIELD REPRESENTATIVE
FOR FOLLOW-UP TESTS AT FULL VOLTAGE

When requested by the manufacturer or the UL Electrical Department, the Field Representative may witness AC tests at full rated voltage up to 10,000 A rms. The F.U.I.I. pages are to be consulted with the following additional requirements.

Short Circuit Tests -

1. The test circuit shall have been calibrated within the past year by a member of the Electrical Department. Evidence of calibration shall be the date and engineer's signature on the calibration card.
2. The test circuit set-up is to be reviewed to assure the correct transformer taps, circuit connections, resistors, inductors, etc. are provided as shown on the calibration card.
3. Test results are to be evaluated and returned to the Electrical Department.

Overload Tests -

1. The test circuit may be evaluated the same as the above short-circuit test set-up.
2. Alternatively, meters may be used for circuit calibrations. Three calibrated meters are needed: Voltage (V), Current (A), and Power (W). Power factor is to be calculated as follows: $\text{Power Factor (\%)} = 100 \times \frac{W}{A \times V}$. Additional multipliers may be needed to account for any voltage dividers or current transformers.
- * 3. The test current is to be -10 to 0 percent of the minimum interrupting rating of the fuse.
- *4. The fuse may be preheated on a low voltage circuit of nearly the same current as the overload test. When full voltage is applied to the fuse, current must be maintained long enough to accurately read each meter.
- *5. Test results are to be evaluated and returned to the Electrical Department

DESCRIPTION

PRODUCT COVERED:

Follow-Up Test Program for Component - Special Purpose Fuses, types as follows:

| Fuse Type | A Ratings | File Description |
|------------|-------------|------------------|
| Series 481 | 0.18 - 20 A | Vol. 3, Sec. 1 |

TESTS:

Tests, test methods, number of samples selected and procedure for acceptance or rejection are in accordance with UL 248-1 and Follow-Up inspection instructions.

TEST SCHEDULE

| Test | Tested |
|--|--------|
| Verification of Temperature Rise and Current-Carrying Capacity | Annual |
| 150 percent clearing time current | Annual |
| Interrupting Ability | Annual |

SAMPLE SELECTION:

The samples noted below are to be selected from Recognized production by the Field Representative.

At the completion of the tests, the Follow-up Services Department shall be notified of the results. The following are the fuse ratings to be tested.

| Fuse Type | Rating, A | Voltage Rating V | Interrupting Rating | Pf/tc | Minimum Number of Samples Required ^a | | | Rejected Ratings |
|-----------|-----------|------------------|---------------------|--------|---|--|----------------------------|------------------|
| | | | | | Interrupting Ability Test | Current Carrying Capacity And Temperature Test (b) | Clearing Time Current Test | |
| 481 | 0.5 | 175 dc | 40A | 1.84ms | 5 | - | - | 0.18-0.5 |
| 481 | 5 | 125 ac | 300A | unity | 5 | 2 (90%) | 2 | 0.18-5 |
| 481 | 5 | 125 dc | 300A | 0.1 ms | 5 | - | - | 0.18-5 |
| 481 | 5 | 60 dc | 460A | 0.4 ms | 5 | - | - | 0.18-5 |
| 481 | 7.5 | 125 ac | 300A | unity | 5 | 2 (90%) | 2 | 7.5 |
| 481 | 7.5 | 125 dc | 300A | 0.1 ms | 5 | - | - | 7.5 |
| 481 | 7.5 | 60 dc | 460A | 0.4 ms | 5 | - | - | 7.5 |
| 481 | 7.5 | 125 ac | 300A | unity | 5 | 2 (90%) | 2 | 10 |
| 481 | 10 | 125 dc | 300A | 0.1 ms | 5 | - | - | 10 |
| 481 | 10 | 60 dc | 460A | 0.4 ms | 5 | - | - | 10 |

| Fuse Type | Rating, A | Voltage Rating V | Interrupting Rating | Pf/tc | Minimum Number of Samples Required ^a | | | Rejected Ratings |
|-----------|-----------|------------------|---------------------|--------|---|--|----------------------------|----------------------------------|
| | | | | | Interrupting Ability Test | Current Carrying Capacity And Temperature Test (b) | Clearing Time Current Test | |
| 481 | 12 | 125 ac | 300A | unity | 5 | 2 (80%) | 2 | 12 |
| 481 | 12 | 125 dc | 300A | 0.1 ms | 5 | - | - | 12 |
| 481 | 12 | 60 dc | 460A | 0.4 ms | 5 | - | - | 12 |
| 481 | 15 | 125 ac | 300A | unity | 5 | 2 (80%) | 2 | 15 |
| 481 | 15 | 125 dc | 300A | 0.1 ms | 5 | - | - | 15 |
| 481 | 15 | 60 dc | 460A | 0.4 ms | 5 | - | - | 15 |
| 481 | 20 | 125 ac | 300A | unity | 5 | 2 (80%) | 2 | 10 (IR Test Only), 15 & 20 |
| 481 | 20 | 125 dc | 200A | 0.1 ms | 5 | - | - | 20 |
| 481 | 20 | 60 dc | 460A | 0.4 ms | 5 | - | - | 20 |

a - Indicates minimum number of samples required to complete follow-up tests, if any initial sample selected fails, three additional samples shall be tested at the failure level. Also assumes let-through tests are combined with interrupting tests.

b - The value in parenthesis indicates the percentage of the fuses rated current is will carry indefinitely. This current shall be used for the current carrying capacity test.

INTERRUPTING ABILITY TEST:

METHOD

Samples of each fuse tabulated above shall be tested on a circuit adjusted to obtain the indicated current. Each test circuit shall have open circuit and recovery voltages not less than the fuse rating.

For each test, the voltage shall be maintained across the fuse for 30 s after the fuse has cleared the circuit.

The DC tests shall be obtained from recording produced by a magnetic oscillograph which has been previously qualified per the requirements contained in UL 248-1.

BASIS OF ACCEPTABILITY

1. The fuse shall permanently clear the circuit.
2. There shall be no molten solder emitted, no body rupture, and no movement or deformation of the case.
3. The fuse body may discolor but shall be readily identifiable for replacement purposes.

If a fuse does not comply with the above, the manufacturer shall be instructed immediately in writing to remove the Recognized Marking from all fuses of that rating in stock which were manufactured subsequent to the last acceptable test, and to discontinue forthwith the use of Recognized Marking in connection with that rating until samples from new production have been submitted and tested with acceptable results. This shall apply to all ratings represented by the tested fuse.

CURRENT CARRYING CAPACITY AND TEMPERATURE TEST:

METHOD

Two representative samples of each catalog number indicated are to be subjected to this test. Each of the fuses is to be mounted in their intended single-pole fuseholder. Each fuseholder is to be mounted on a horizontal, nonmetallic surface such that each fuse under test is held in a horizontal position above the fuseholder. The fuseholders shall be spaced so there is a minimum of 6 in. between any two fuseholders. The fuseholders are to be connected in a series circuit using conductors sized in accordance with the standard. The resulting circuit shall be connected to a low voltage, 60 Hz power source with sufficient ampacity to deliver a current of twice the rating of the fuse. The cable connections to the power supply shall not be less than 4 ft, with a minimum of 2 ft of conductor between fuseholders. A current as noted above, was passed through the resulting circuit until constant temperatures were measured by means of thermocouples until 4 consecutive readings taken at 5 min intervals exceeded the average of these 4 readings by more than 2°C and no indication of increasing temperature rise was observed. This average temperature rise reading was deemed to be the temperature rise of the fuse.

The maximum allowable rises are as follows:

| <u>Catalog Number</u> | <u>Contact</u> | <u>Body</u> |
|-----------------------|----------------|-------------|
| 481005 | 26 | 14 |
| 48107.5 | 30 | 14 |
| 481010 | 34 | 15 |
| 481012 | - | 65 |
| 481015 | - | 70 |
| 481020 | - | 71 |

CLEARING TIME CURRENT TEST:

METHOD

The ratings of the fuses shown in the table above shall be subjected to overload tests. The circuits should be the same as indicated in the temperature test, except the low-voltage source should be adjusted to deliver the percent indicated as noted below of the rating in amperes and caused to carry current until the fuse opens.

| Catalog No. | Ampere Rating | Number of Samples 150% |
|-------------|---------------|---------------------------|
| 481 | 5 | 2 |
| 481 | 7.5 | 2 |
| 481 | 10 | 2 |
| 481 | 12 | 2 |
| 481 | 15 | 2 |
| 481 | 20 | 2 |

RESULTS

The maximum opening times noted below shall not exceed.

150 percent - 5 minutes