



Field Engineering Services

Equipment Evaluation Overview

This overview provides an outline of the steps taken by Underwriters Laboratories when a Field Evaluation project is completed. Field Evaluations are performed on new equipment that is not listed and labeled by a recognized testing laboratory, on equipment that has been modified in the field, and on used equipment being relocated or installed at a new location. The evaluation is to determine conformance to the applicable requirements of nationally recognized product safety standards and the acceptability criteria of the local jurisdiction. Ultimate approval of equipment and its installation lies with the local Authority Having Jurisdiction (AHJ). A third party Field Evaluation mark, similar to a Listing Mark, greatly increases the likelihood of AHJ approval.

Introduction

New or used electrical equipment that is neither “*listed*” nor “*labeled*” as a complete unit is considered to be unevaluated. Such equipment will be subject to a thorough evaluation by the inspection authority themselves, or by a third party such as UL. This equipment may be designed for connections to the facility using either fixed wiring methods (also known as hard wire) or a cord and plug arrangement. The overall evaluation of such non-labeled equipment is for the purpose of attaining “*approval*” of the complete installation including the subject equipment by the AHJ requiring the evaluation.

The process detailed in this overview will not result in a “UL Listing”, “UL Classification”, or “UL Recognition”. The only units of any equipment that will achieve an “evaluated” status are those that undergo this procedure and no assessments are made or assumed for past or future like equipment produced by the manufacturer. UL will complete the necessary inspections, testing and evaluation and provide a complete report to the client and the AHJ so they can make the determination on “approval” of the installation. The major differences between this process and an “UL Listing” or “UL Recognition” are the evaluation process will not include destructive testing, only UL will have labels and will directly apply them, each unit labeled is either installed or identified to a specific installation site, and there is no follow-up service requirements or record keeping required of the manufacturer.

Summary

Evaluation of equipment will typically include these basic areas:

- Review of equipment drawings
- Review of components for certification and proper application
- Environmental Suitability
- Proper and complete nameplate
- Damaged or worn components
- Grounding and bonding
- Electrical clearances
- Guarding of live parts
- Wiring methods and proper ratings
- Overcurrent protection
- Interlocks and EMO
- Electrical testing may include any or all of the following as applicable for the product and the specific application.
 - ❑ Insulation resistance testing of power circuits
 - ❑ Heat rise testing at rated load
 - ❑ Grounding and bonding continuity testing
 - ❑ Dielectric withstand testing where specified by the standard under 'production tests'
 - ❑ Leakage current testing on cord and plug connected equipment
 - ❑ Interlock functional testing including the EMO

Used Equipment

Used equipment presents some additional problems not normally encountered with evaluations of new equipment as follows:

- Manufacturer's data, such as equipment drawings and schematics are not available and support from the manufacturer may no longer be available due to closing of the manufacturer or stopping support for obsolete product lines. Drawings may have to be produced to a degree necessary to complete the evaluation or extra testing of components may be required when component information is not available.
- Components are found damaged. Common examples are 1) wiring that has been exposed to oil in machine tools, 2) enclosures, conduit and transformers that are damaged from mechanical or electrical stresses, or 3) components that

have been replaced with other than original manufacturer's parts and the replacements may not fit into the space provided.

- The initial installation may not have been in a suitable environment such as use of non-oil tight control stations or devices that became soaked in oil. Field modifications may have been made and parts replaced with ones not identified by the manufacturer and not suitable for the application.

Evaluation Standards

The first step is for the evaluator to determine the appropriate product safety standard that applies to the equipment to be evaluated, and ensures suitability to be installed per the National Electrical Code (NEC). Where no one product safety standard can be found, a compilation of applicable parts of other product safety standards is to be assembled.

The applicable product safety standards are those recognized by the American National Standards Institute (ANSI) or Underwriters Laboratories as the primary standard to use. Where there is insufficient information in the product safety standard, or where testing that could be destructive is involved, the NEC or applicable standards such as NFPA 79 "Electrical Standard for Industrial Machinery" are utilized. Other standards such as from the National Fire Protection Association (NFPA), National Electrical Manufacturer's Association (NEMA) or Factory Mutual Research Corporation (FM) are utilized where they provide specialized information not contained in the product safety standard. Where an AHJ has different or special requirements, these are also applied.

The equipment is evaluated for conformance to the applicable product safety standard. Performance, outside of safety performance, is not included in the scope of this type of evaluation. If performance evaluation is desired, this can be completed by UL as a separate project.

Process Sequence

- 1) Establish the contract and request information on the equipment from the client.
 - Drawings of the equipment including layout, schematic, interlock and EMO circuits are needed to guide the evaluator through the various parts of the equipment and to assess items such as overcurrent protection. Drawings should follow industry standards and use symbols as defined by standards such as ANSI/IEEE 315.

- A bill of materials with data of the critical components is required to assess the components. The data required includes:
 - Manufacturer's name
 - Component manufacturer's name
 - Model or part number
 - Electrical ratings
 - Certifications to US recognized standards

2) Jurisdiction Notification Letter to AHJ

A notification letter is sent to the AHJ immediately following the receipt of the order for services. This letter serves two purposes. First, it notifies the jurisdiction that UL has been retained to complete the evaluation and thereby indicates the client has met any time limit that may exist on a correction notice (red tag). Second, it provides the beginning of communications between the AHJ and the evaluator so any specific concerns of the AHJ are understood and will be addressed in the evaluation report.

3) First Inspection

The following scenario describes a 2-visit process. If everything is found to be in compliance, or non-compliant items are resolved on the spot, projects are then completed during the first visit.

The first site visit is scheduled and includes the visual inspection using the supplied drawings and materials list to verify the construction of the equipment. During this part, the equipment must be able to be de-energized for the safety of the evaluator. The client is responsible to have qualified personnel to operate the equipment as well as provide access to components. Field notes as well as digital photographs are used to document this phase. Specific items being checked include:

- Environmental Suitability
- Proper and complete nameplate
- Damaged or worn components
- Grounding and bonding
- Electrical clearances
- Guarding of live parts
- Wiring methods and proper ratings
- Overcurrent protection
- Interlocks and EMO

If there are no discrepancies, then the project proceeds to the electrical testing phase (see follow-up visit in section 4 below). This requires the

equipment to be able to be energized and operated as designed. If there are discrepancies found, they are documented in either a discrepancy report or in a preliminary findings report. The preliminary report is more formal and will provide details of the issue found, what corrective action needs to be taken and will provide a reference clause from the applicable product safety standard.

In the event there is discrepancies found, having a qualified technician available will help reduce costs by allowing immediate corrections and potentially saving the necessity of making another trip. Equipment modifications, if required, must be completed by others such as the client, a manufacturer's representative, a contractor or an electrician. UL cannot perform equipment modifications nor provide direct design information for accomplishing any corrective action. Non-conforming items found and the corrective actions are documented in the final report.

4) Follow-up Inspection

If the non-compliances found require more time to correct or require parts that are not readily available, then a follow-up inspection will be required. This phase will review each discrepancy identified and document the corrective action completed. Electrical testing will then be accomplished including the following:

- ❖ Insulation resistance testing (megger) will be accomplished on all power circuits and all motors. Any sensitive electronic devices connected directly to the power circuits, such as line filters, will be temporarily disconnected
- ❖ Grounding and bonding continuity testing will be completed from all exposed metal surfaces that might become energized and contacted by an operator to the supply circuit equipment grounding terminal
- ❖ With the equipment energized and operating at full design capacity, input voltage and current measurements are taken to validate the nameplate data
- ❖ Once temperature equilibrium is achieved, heat rise testing is conducted on components where heat rise is present and as defined by the applicable product safety standard
- ❖ Interlock and EMO functions are tested
- ❖ As required by the applicable standard, high potential dielectric withstand testing (hipot) is conducted to validate insulation integrity
- ❖ For cord and plug connected equipment only, leakage current in normal and reverse polarity conditions are completed

- ❖ Special testing, such as non-automatic restarting after a power failure in accordance with NFPA 79, are completed where the applicable product standard specifies such testing.
- ❖ Special testing as required by the local AHJ

5) Label Application

Upon successful completion of all the inspections, including correction of any noted discrepancies, and electrical testing a final evaluation is completed. When done, an evaluation label is applied by the UL evaluator to the equipment that signifies the equipment complies with the applicable requirements of the standard, with any conditions of acceptability, as detailed in the final report.

6) Final Report

A final formal report is written and provided to the client and the AHJ. This report along with the label on the equipment provides the basis for the AHJ to “approve” the equipment and its installation. This report will document the findings, including the conditions of acceptability, standards used, results of the inspections and testing as well as the final evaluation. Applicable data sheets, drawings or other pertinent information is included in the appendix.

Conclusion

Underwriters Laboratories has been assessing product compliance for over 100 years and is the most recognized mark in North America. As part of UL’s service line to meet the public needs, Field Evaluations have been completed by UL since the early 1990’s. With a strong field engineering force distributed around North America, the extensive backing of subject matter experts for all kinds of products, and close working relationships with AHJs, UL meets your need to provide the evaluation of the equipment to meet any requirements of law, ordinance or rule being enforced by an Authority Having Jurisdiction.