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CQI-17

Special Processes: Soldering System Assessment

1st Edition

»» Insight

»» Expertise

»» Results

The **Catalyst** for Peak Performance



ABOUT AIAG

Purpose Statement

Founded in 1982, AIAG is a globally recognized organization where OEMs and suppliers unite to address and resolve issues affecting the worldwide automotive supply chain. AIAG's goals are to reduce cost and complexity through collaboration; improve product quality, health, safety and the environment; and optimize speed to market throughout the supply chain.

AIAG Organization

AIAG is made up of a board of directors, an executive director, executives on loan from member companies, associate directors, a full-time staff, and volunteers serving on project teams. Directors, department managers, and program managers plan, direct and coordinate the association's activities under the direction of the executive director.

AIAG Projects

Volunteer committees focus on business processes or supporting technologies and methodologies. They conduct research and develop, publish, and provide training on standards, conventions, standard business practices, white papers, and guidelines in the areas of automatic identification, CAD/CAM, EDI/electronic commerce, continuous quality improvement, health focus, materials and project management, occupational health & safety, returnable containers and packaging systems, transportation/customs and truck & heavy equipment.

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Published by:

Automotive Industry Action Group
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APPROVAL STATUS

The AIAG Quality Steering Committee and designated stakeholders approved this document for publication in March 2010.

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ISBN #: 978 1 60534 209 2

CQI-17

Special Process: Soldering System Assessment

Version 1 Issued 3/10



FOREWORD

Automotive Industry Action Group (AIAG) committees are made up of volunteers from member companies in the automotive industry. The work of preparing process audits is done by AIAG technical committees.

The main task of technical committees is to prepare Automotive Standards and System Requirements. Draft documents adopted by the technical committees are circulated to the Steering Committee for review and consensus approval. Publication of the documents requires approval by the Quality Steering Committee.

The Quality Steering Committee would like to acknowledge and thank the following individuals and their companies who have contributed time and effort to the development of this document.

ACKNOWLEDGEMENTS

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INTRODUCTION

General

The work of preparing CQI-17: *Special Process: Soldering System Assessment* (SSA) was carried out through the AIAG Soldering Work Group. These soldering requirements are complementary to customer and product standards.

The SSA can be used to assess an organization's ability to meet the requirements in this assessment, as well as customer, regulatory, and the organization's own requirements. The SSA can also be used between an organization and its suppliers.

In the SSA, the word "shall" indicates a requirement for purposes of the self assessment. Failure to meet the requirements results in an assessment that is either "Not Satisfactory" or "Needs Immediate Action". The word "should" indicates a recommendation. Where the term "such as" is used, any suggestions given are for guidance only.

Process Approach

The SSA supports the automotive process approach as described in ISO/TS 16949.

Soldering System Assessment Goals

The goal of the SSA is the development of a soldering management system that provides for continual improvement, emphasizing defect prevention and the reduction of variation and waste in the supply chain.

The SSA, coupled with an internationally recognized quality management system and applicable customer-specific requirements, defines the fundamental requirements for soldering management systems.

The SSA is intended to provide a common approach to a soldering management system for automotive production and service part organizations.

Assessment Process

Ongoing assessments shall be conducted annually, unless otherwise specified by the customer, to re-examine the continuing compliance with the SSA. Each assessment shall include a review of the organization's systems using the SSA. Successive Job Audits (Section 4.0 of this document) shall sample parts from different automotive component manufacturers that require compliance to the SSA document.

The assessment shall use the process approach to auditing as identified by the requirements of ISO/TS 16949.

Assessor Qualifications

Assessor(s) shall have the following specific experience to conduct the SOLDERING SYSTEM ASSESSMENT:

1. Be an experienced quality management system (QMS) internal auditor (for example, ISO/TS 16949, ISO 9001.)
2. Assessor shall possess soldering knowledge. Evidence shall include a minimum of 5 years experience in soldering or a combination of formal metallurgical training and soldering experience totaling a minimum of 5 years.
3. Assessor shall possess knowledge of and be familiar with the application of automotive quality core tools including statistical process control, measurement systems analysis, part approval, failure mode and effects analysis, and advanced quality planning.

Note: If more than one assessor is required to meet the above qualifications, the lead assessor shall be the person meeting the requirements in item #1.
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Other Requirements

The organization shall keep records as evidence of compliance to the requirements identified in the SSA, as well as all appropriate action plans to address any unsatisfactory ratings. These records shall be readily available for review by any customer requiring compliance to the requirements within this document.

SCOPE

1.1 General

This document specifies process requirements for an organization or its suppliers performing applicable soldering, who need to:

- demonstrate ability to consistently provide product that meets customer and applicable regulatory requirements, and
- enhance customer satisfaction through the effective application of the system, including processes for continual improvement of the system.

The Soldering System Assessment is applicable to sites where customer-specified parts for production and/or service are processed throughout the automotive supply chain.

1.2 Application

All requirements of the SSA are generic and are intended to be applicable to all organizations performing the soldering operations addressed in this document, regardless of type, size, and product.

Nineteen Process Tables have been developed and the appropriate table(s) is to be referenced during the assessment. The Process Tables are specific to soldering processes as noted below:

- Process Table A – Paste Printing
- Process Table B – Inspection
- Process Table C – Surface Mount Device Placement
- Process Table D – Reflow
- Process Table E – Glue Dispensing
- Process Table F – Flux Application for Wave Soldering
- Process Table G – Pre-Heat
- Process Table H – Wave
- Process Table I – Fountain
- Process Table J – Dip
- Process Table K – Selective
- Process Table L – Automated Iron
- Process Table M – Manual Iron
- Process Table N – Laser and Soft Beam
- Process Table O – Induction
- Process Table P – Conformal Coat and Test
- Process Table Q – PCB Separation
- Process Table R – In-Circuit Testing
- Process Table S – Rework

These Process Tables contain requirements for:

1. Process and Equipment
2. Process Monitor Frequencies

The Process Tables specify the tolerances of process parameters and the frequencies for checking process control parameters and parts. The Requirements and Guidance in the SSA form will notify the assessor when to refer to the Process Tables.

1.3 Reference

The following standards are referenced in this document. The applicability is limited to the subject matter referenced.

Standard Number	Title	Standard's Organization
IPC J-STD-001D Copyright Feb 2005	Joint Industry Standards ; Requirements for Soldered electrical and electronic assemblies	IPC - www.ipc.org
IPC-A-610D	Acceptability of Electronic Assemblies	IPC - www.ipc.org
IPC-7711/7721	Rework of Electronic Assemblies/Repair and Modification of Printed Boards and Electronic Assemblies	IPC - www.ipc.org
ANSI/ESD S20.20-2007	For the Development of an Electrostatic Discharge Control Program for – Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)	ESD Association

2 THE SOLDERING SYSTEM ASSESSMENT PROCEDURE

1. Obtain current copy of CQI-17 Special Process: Soldering System Assessment from AIAG.
2. Identify all soldering processes to which CQI-17 Special Process: Soldering System Assessment applies (see CQI-17, 1.2). Record these processes on the SSA.
3. Complete the SSA, determining the level of compliance. A minimum of one job audit (Section 4) shall be performed during each assessment.
4. Address each “Not Satisfactory” item and determine corrective action, including root cause analysis and implementation of the corresponding corrective action(s). The corrective action(s) shall be completed within 90 days. Records of the corrective action, including verification, shall be maintained.
5. “Needs Immediate Action” requires immediate containment of suspect product. Address each “Needs Immediate Action” item and determine corrective action(s), including root cause analysis and implementation of the corresponding corrective action(s). The corrective action(s) shall be completed within 90 days. Records of the corrective action, including verification, shall be maintained.
6. Assessments shall be conducted annually unless otherwise specified by the customer.

3 SPECIAL PROCESS: SOLDERING ASSESSMENT

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Instructions for completing the Cover Sheet

1. **Facility Name:** Name of the facility being assessed.
 One form shall be used for each facility. The facility may have several buildings or physical locations in the same general area. If there is a separate management team or different management system, then these locations shall be considered as separate facilities.
2. **Address:** The street address of the facility being assessed; P.O Box numbers may be given as additional information.
3. **Phone Number:** The phone number of the facility.
 If there is no common phone number for the facility, the phone number of the Operations Manager or Quality Manager shall be used.
4. **Fax Number:** The fax number of the facility.
5. **Number of Soldering Employees at this Facility:** The number of employees, salaried and hourly, associated with the soldering operation at this facility.
6. **Captive Soldering Organization (Y/N):** Enter “Y” if this facility solders components for their own company. Enter “N” if the company does not solder any components for their own company.
7. **Commercial Soldering Organization (Y/N):** Enter “Y” if this facility solders components for companies other than their own company. Enter “N” if this facility does not solder any components for other companies.
8. **Date of Assessment:** Enter the date(s) of the assessment. An alphanumeric format shall be used to avoid confusion with different numeric formats.
 - i. Example: May 3 – 4, 2010
9. **Date of Previous Assessment:** List the date of the previous CQI-17 Special Process: Soldering System Assessment of this facility.
10. **Type(s) of Soldering at this Facility:** Place a checkmark to designate all soldering process(es) performed at this facility. This information determines the appropriate Process Table that shall be used during the assessment. Processes not listed on the cover sheet are not part of the Soldering System Assessment.
11. **Current Quality Certification(s):** The soldering organization shall list their current quality certifications, e.g., ISO/TS 16949, ISO 9001:2008. Certifications may be from 3rd party sources or customer quality certifications. If customer quality certification is given, then the year of the last assessment by the customer shall also be given.
12. **Date of Re-assessment (if necessary):** If “Not Satisfactory” findings were observed from the original assessment, then the soldering organization shall address each item and determine correct action, including root cause analysis and implementation of the corresponding corrective action(s).

The date of the re-assessment shall be given here, and the appropriate Question(s) from Sections 1 – 4, in the original assessment, shall be modified to reflect that the evidence, relating to the implementation of the corrective action(s), has been observed. Also, the “Number of Not Satisfactory Findings” shall be modified as appropriate.

13. **Personnel Contacted:** List the name(s), title(s), phone number(s), and email address(es), if available, of the principal participants from the soldering organization.
14. **Auditors/Assessors:** List the name(s), Company(ies), phone number(s) and email address(es), if available, of the auditor/assessor(s).
15. **Number of “Not Satisfactory” Findings:** Enter the number of “Not Satisfactory” findings observed during the assessment. **Number of “Needs Immediate Action” Findings:** Enter the number of “Needs Immediate Action” findings observed during the assessment.
16. **Number of “Needs Immediate Action” Findings:** Enter the number of “Needs Immediate Action” findings observed during the assessment.
17. **Number of “Fail” Findings in the Job Audit(s):** Enter the number of “Fail” findings observed from the job audit.

Instructions for completing Sections 1 – 3

Sections 1 - 3 contain questions and the requirements and guidance for each question. The Sections are:

- Section 1 – Management Responsibility & Quality Planning
- Section 2 – Floor and Material Handling Responsibility
- Section 3 – Equipment

The assessor shall assess the soldering organization's compliance to Sections 1 – 3 by comparing the evidence presented by the soldering organization to the requirements listed in the "Requirements and Guidance" column.

NOTE 1: In the "Requirements and Guidance" column, the word "shall" indicates a requirement and the term "such as" indicates that any suggestions given are for guidance only.

NOTE 2: The "Requirements and Guidance" column will indicate to the assessor when the Process Tables are pertinent to the Questions. When the Process Tables are pertinent to the Question, the assessor shall assess the soldering organization's compliance to the specified section(s) in the Process Tables.

NOTE 3: If the question is not applicable to the soldering organization, then the assessor shall place a checkmark in the "N/A" Assessment column. If the observed evidence is in compliance to the question, the assessor shall note the evidence in the "Objective Evidence" column and place a check mark in the "Satisfactory" column. If the observed evidence is not in compliance to the question, then the assessor shall note the non-compliance in the "Objective Evidence" column and place a check mark in the "Not Satisfactory" column.

NOTE 4: Where nonconforming product/process is identified in the assessment of a given question the assessor shall place a check mark in the "Needs Immediate Action" (NIA) column. NIA requires immediate containment of suspect product/process.

Special Process: Soldering Process Assessment (General Facility Overview)						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
Section 1 - Management Responsibility and Quality Planning						
1.1	Is there a dedicated and qualified soldering expert on-site?	To ensure readily available expertise, there shall be a dedicated and qualified soldering expert on site. This individual shall be a full-time employee and the position shall be reflected in the organization chart. A job description shall exist identifying the qualifications for the position including metallurgical and soldering knowledge. The qualifications shall include a minimum of 5 years experience in soldering operations or a combination of a minimum of 5 years of formal metallurgical education and soldering experience.				
1.2	Does the soldering organization perform advanced quality planning?	The organization shall incorporate a documented advance quality planning procedure. A feasibility study shall be performed and internally approved for each part. Similar parts can be grouped into part families for this effort as defined by the organization. After the part approval process is approved by the customer, no process changes are allowed unless approved by the customer. The soldering organization shall contact the customer when clarification of process changes is required. This clarification of process changes shall be documented.				

Special Process: Soldering Process Assessment (General Facility Overview)						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
1.3	Are soldering FMEA's up to date and reflecting current processing?	The organization shall incorporate the use of a documented Failure Mode and Effects Analysis (FMEA) procedure and ensure the FMEA's are updated to reflect current part quality status. The FMEA shall be written for each part or part family or they may be process-specific and written for each process. In any case, they shall address all process steps from part receipt to part shipment and all key soldering process parameters as defined by the organization. A cross-functional team shall be used in the development of the FMEA. All special characteristics, as defined by the organization and its customers, shall be identified, defined, and addressed in the FMEA.				

Special Process: Soldering Process Assessment (General Facility Overview)						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
1.4	Are soldering process control plans up to date and reflecting current processing?	The organization shall incorporate the use of a documented Control Plan procedure and ensure the Control Plans are updated to reflect current controls. The Control Plans shall be written for each part or part family or they may be process-specific and written for each process. In any case, they shall address all process steps from part receipt to part shipment and identify all equipment used and all key solder process parameters as defined by the organization. A cross-functional team, including a production operator, shall be used in the development of Control Plans, which shall be consistent with all associated documentation such as work instructions, shop travelers, and FMEA's. All special characteristics, as defined by the organization and its customers, shall be identified, defined, and addressed in the Control Plans. Sample sizes and frequencies for evaluation of process and product characteristics shall also be addressed consistent with the minimum requirements listed in the Process Tables.				

Special Process: Soldering Process Assessment (General Facility Overview)						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
1.5	Are all soldering related and referenced specifications current and available? For example: IPC, SAE, AIAG, ASTM, General Motors, Honda, Ford, and Chrysler.	To ensure all customer requirements are both understood and satisfied, the organization shall have all related solder and customer referenced standards and specifications available for use and a method to ensure that they are current. Such standards and specifications include, but are not limited to, those relevant documents published by IPC, SAE, AIAG, ASTM, General Motors, Honda, Ford, and Chrysler. The organization shall have a process to ensure the timely review, distribution, and implementation of all customer and industry engineering standards / specifications and changes based on customer-required schedule. Timely review should be as soon as possible and shall not exceed two working weeks. The organization shall document this process of review and implementation, and it shall address how customer and industry documents are obtained, how they are maintained within the organization, how the current status is established, and how the relevant information is cascaded to the shop floor within the two-week period. The organization shall identify who is responsible for performing these tasks.				

Special Process: Soldering Process Assessment (General Facility Overview)						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
1.6	Is there a written process specification for all active processes?	The solder organization shall have written process specifications for all active processes and identify all steps of the process including relevant operating parameters. Examples of operating parameters include process temperatures, cycle times, atmosphere or gas flow settings, belt speeds, etc. Such parameters shall not only be defined, they shall have operating tolerances as defined by the organization in order to maintain process control. These process specifications may take the form of work instructions, job card, computer-based recipes, or other similar documents.				

Special Process: Soldering Process Assessment (General Facility Overview)						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
						Needs Immediate Action
1.7	Has a valid process capability study been performed initially and after process equipment has been relocated, or had a major rebuild?	To demonstrate each process is capable of yielding acceptable product the organization shall perform process capability studies for the initial validation of each process, after relocation of any process equipment, & after a major rebuild of any equipment. The organization shall define what constitutes a major rebuild. Initial process capability studies shall be conducted for all solder processes per manufacturing line defined in scope of work & in accordance with customer requirements. A manufacturing line may include a combination of equipment that is integrated in the performance of a solder process, e.g., printing, placement, and reflow. Capability study techniques shall be appropriate for the solder product characteristics, e.g., paste height and thermal profiling. Any specific customer requirements shall be met, in the absence of customer requirements, the organization shall establish acceptable ranges for measures of capability. An action plan shall exist to address the steps to followed in case capability indices fall outside customer requirements or established ranges.				
1.8	Does the solder organization collect and analyze data over time, and react to this data?	The analysis of products and processes over time can yield vital information for defect prevention efforts. The organization shall have a system to collect, analyze, and react to product or process data over time. Methods of analysis shall include ongoing trend or historical data analysis of product or process parameters. The organization shall determine which parameters to include in such analysis.				

Special Process: Soldering Process Assessment (General Facility Overview)						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
1.9	Is management reviewing the soldering process data every 24 hours?	Management shall review the soldering process data at intervals not to exceed 24 hours. The soldering process data includes but is not limited to thermal profiles, SPC, set up sheets and maintenance logs, through-put, etc. The management review shall include efforts to detect out-of-control conditions or alarm conditions. The process of reviewing the soldering process data shall be documented and this requirement also applies to computerized data.				
1.10	Are internal assessments being completed on an annual basis, at a minimum, using AIAG SSA?	The organization shall conduct internal assessments on an annual basis, at a minimum, using the AIAG SSA.				
1.11	Is there a system in place to authorize rework or repair and is it documented?	The quality management system shall include a documented process for rework and repair that shall include authorization from a designated individual, a recognized team of experts, or customer requirement. The rework and repair procedures shall describe product characteristics for which rework and repair is allowed as well as those characteristics for which rework is not permissible. Any rework or repair activity shall require a processing control sheet issued by qualified technical personnel denoting the necessary solder rework or repair. Records shall clearly indicate when and how any material has been reworked or repair. Repaired parts shall meet inspection standards, and must be verified by a secondary process such as in-circuit test.				

Special Process: Soldering Process Assessment (General Facility Overview)						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
1.12	Does the Quality Department review, address, and document customer and internal concerns?	The quality management system shall include a process for documenting, reviewing, and addressing customer concerns and any other concerns internal to the organization. A disciplined problem-solving approach shall be used.				
1.13	Is there a continual improvement plan applicable to each process defined in the scope of the assessment?	The solder organization shall define a process for continual improvement for each solder process identified in the scope of the SSA. The process shall be designed to bring about continual improvement in quality and productivity. Identified actions shall be prioritized and shall include timing (estimated completion dates). The organization shall show evidence of program effectiveness.				
1.14	Does the Quality Manager or designee authorize the disposition of material from quarantine status?	The Quality Manager is responsible for authorizing and documenting appropriate personnel to disposition quarantine material, such as components that are out of tolerance.				
1.15	Are there procedures or work instructions available to the solder personnel that define the soldering process?	There shall be procedures or work instructions available to soldering personnel covering the soldering process. These procedures or work instructions shall include methods of addressing potential emergencies (such as power failure), equipment start-up, equipment shut-down, product segregation (See 2.8), product inspection, and general operating procedures. These procedures or work instructions shall be accessible to shop floor personnel.				

Special Process: Soldering Process Assessment (General Facility Overview)						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
1.16	Is management providing employee training for soldering?	The organization shall provide employee training for all soldering operations. All employees associated with the soldering process, including backup and temporary employees, shall be trained. Documented evidence shall be maintained showing the employees trained and the evidence shall include an assessment of the effectiveness of the training. Management shall define the qualification requirements for each function, and ongoing or follow-up training shall also be addressed.				
1.17	Is there a responsibility matrix to ensure that all key management and supervisory functions are performed by qualified personnel?	The organization shall maintain a responsibility matrix identifying all key management and supervisory functions and the qualified personnel who may perform such functions. It shall identify both primary and secondary (backup) personnel for the key functions (as defined by the organization). This matrix shall be readily available to management at all times.				

Special Process: Soldering Process Assessment (General Facility Overview)						
Question Number	Question	Requirements and Guidance	Objective Evidence	Assessment		
				N/A	Satisfactory	Not Satisfactory
1.18	Is there a preventive maintenance program? Is maintenance data being utilized to form a predictive maintenance program?	The organization shall have a documented preventive maintenance program for key process equipment (as identified by the organization). The program shall be a closed-loop process that tracks maintenance efforts from request to completion to assessment of effectiveness. Equipment operators shall have the opportunity to report problems, and problems shall also be handled in a closed-loop manner. Company data, e.g., downtime, quality rejects, first-time-through capability, recurring maintenance work orders, and operator-reported problems, shall be used to improve the preventive maintenance program. Furnaces and generators shall be scheduled for burn-out at frequencies determined by the organization. Maintenance data shall be collected and analyzed as part of a predictive maintenance program.				
1.19	Has the soldering organization developed a critical spare part list and are the parts available to minimize production disruptions?	The soldering organization shall develop and maintain a critical spare parts list and shall ensure the availability of such parts to minimize production disruptions.				
Section 2 - Floor and Material Handling Responsibility						
2.1	Does the facility ensure that the data entered in the receiving system matches the information on the customer's shipping documents?	Documented processes and evidence of compliance shall exist, e.g., shop travelers, work orders, etc. The facility shall have a detailed process in place to resolve receiving discrepancies.				

Special Process: Soldering Process Assessment (General Facility Overview)						
Assessment						
Question Number	Question	Requirements and Guidance	Objective Evidence	N/A	Satisfactory	Not Satisfactory
						Needs Immediate Action
2.2	Is product clearly identified and staged throughout the manufacturing soldering process?	Procedures for part and container identification help to avoid incorrect processing or mixing of lots. Appropriate location and staging within the facility also help to ensure that orders are not shipped until all required operations are performed. Customer product shall be clearly identified and staged throughout the soldering process. Unsoldered product, in-process, and finished product shall be properly segregated and identified. All material shall be staged in a dedicated and clearly defined area.				
2.3	Is lot traceability and integrity maintained throughout all processes?	Out-going lot(s) shall be traceable to the incoming lot(s). The discipline of precisely identifying lots and linking all pertinent information to them enhances the ability to do root cause analysis and continual improvement. Traceability should include bulk packed components used for manual insertion processes.				
2.4	Are procedures adequate to prevent movement of non-conforming product/material into the production system?	The control of suspect or non-conforming product/material is necessary to prevent inadvertent shipment or contamination of other lots. Procedures shall be adequate to prevent movement of non-conforming product into the production system. Procedures shall exist addressing proper disposition, product identification and tracking of material flow in and out of hold area. Non-conforming hold area shall be clearly designated to maintain segregation of such material. The soldering organization shall have documented procedures to identify and segregate improperly soldered parts for each process/equipment resulting from equipment failures/e-stop/loss of power.				