BULLETIN

Carrier Corporation

Carrier
A United Technologies Company

North American Operations

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Title: Corrective Action Process – Heavy Chillers
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Models Affected: CAC: ALL
BDP: None

Overview

Heavy Chillers (Charlotte) has established a corrective action process that is dedicated to making a significant improvement in product quality. Currently, the heavy business has dedicated three design engineers to this process with strong additional involvement by service engineering, supplier and factory quality engineering and other design engineers on an as-needed basis. These persons collaborate in solving problems as members of Corrective Action Teams (CATs). This document outlines the corrective action process used, the role of the field in the corrective action process and how to find out the details of known problems and our corrective action on an ongoing basis.

Corrective action progress is reviewed at the monthly operations review meeting. There is a monthly CAT meeting including design engineering, quality engineering, service engineering and field service engineers to obtain feedback from the field on problems communicate corrective action progress and eliminate roadblocks. There are also weekly CAT leader meeting to monitor progress and provide support.

Input to the Corrective Action Process

Input on product problems is obtained from several sources:

FACTORY DEFECTS are the most immediate indication of problems. They are dealt with through process and design changes and by the use of “One Minute Lesson” sheets which are intended to help correct workmanship problems. Supplier defects are also identified and defective components are returned for corrective action. Factory and supplier defects are recorded and the data is analyzed to identify the highest priority problems.

QUALITY ASSURANCE AND CERTIFICATION LAB findings are documented by the lab manager. This lab tests betweens 20% to 30% of the units as part of normal quality audits, certified tests and customer witness tests. The lab manager identifies the source of the problem found between suppliers, design, and manufacturing. Quality Engineering, Design Engineering and the lab jointly determine the root cause of the problem. When manufacturing problems exist, production associates are invited into the lab to observe workmanship problems first hand. Each chiller audited in the lab has a detailed report written and archived. These audit reports are available to field service and sales if issues arise on the chillers after leaving the factory. Service Engineering can easily determine, by serial number, if a chiller was tested in the audit lab prior to

shipment. Product quality information from the quality assurance and certification lab also feeds the CAT process.

COMMISSIONING REPORTS document problems found at start-up. These are reviewed and the data is entered into a database. An engineer reads each report. Each problem is identified and the source of the problem indicated, (design, factory, supplier, etc.). Phone contact is made with the service technician who wrote the report if there is any question on the details of a failure. This is a primary source of information for the CAT process. We want to urge all Carrier operations to file the commissioning reports immediately (service bulletin C0010). Filing the commissioning report gives us up to the minute information on our quality issues in a simple format. DOA claims are honored when the commissioning report is filed. Top Management receives an overview of the data from the commissioning reports monthly.

SERVICE ENGINEERING LOGS and the FIELD FEEDBACK REPORT FORM provide excellent insight into field problems, particularly those that do not occur at start-up. This data is also used to determine priorities for the CAT process. We urge all Carrier operations to call service engineering to report problems and to use the FIELD FEEDBACK REPORT FORM (bulletin C0011). These simple actions help engineering determine the extent of the problem. In exchange, we make sure that we have provided the field with the latest information on any fixes that we may have, even if preliminary. This is documented on the service intranet.

Input received in the MONTHLY CAT MEETING helps in the understanding of problems and in establishing CAT priorities. The information in these meetings comes from Service Engineering and the field service engineers (District Managers). A list of the District Managers is attached. The District Manager can be an effective advocate in determining the priority for a particular problem. Keeping the District Manager informed of product issues helps engineering prioritize problems correctly. Inside the USA, the warranty authorization process (bulleting C9924) assures that the district manager has all the information available about major problems.

The SAMS WARRANTY DATA is useful for breaking down warranty expense by product and major problem areas. This data is especially useful for finding small dollar, but high frequency problems which cause customer pain, but which might not generate a complaint from the field due to the relative ease of fixing the problem. When filing SAMS warranty claims, it is very important that correct fault codes are used. When you receive a warranty authorization, the District Manager has attached the correct fault code to be used. For units outside of the USA, complete warranty data is not gathered by CSS automatically. Any country that has summarized warranty data for heavy chillers is encouraged to share that data with their District Manager or CSS Quality. This will ensure that the data is used as input to the CAT process.

Problem Selection Process

High priority problems are assigned to a specific individual CAT leader for corrective action at the monthly and weekly CAT meetings based on all of the above sources of information. Each problem is logged into the CAT database which identifies: problem description, symptoms, root cause, field fix, short term solution and long term solution. A CAT leader will typically have the support of a service engineer and other engineers whose expertise can help identify root cause and

solutions. Drafting and lab support are also available as needed. The CAT leader is responsible for tracking progress throughout the organization to insure timely implementation.

Problem Tracking

CAT projects progress through an 8-step process

1 PROBLEM ASSIGNED
Individual is assigned responsibility for resolving the problem

2 ISSUE IDENTIFIED
Investigation of field reports, lab test data etc., is done to determine the nature of the problem. Field contact will generally be initiated at this time. It may be necessary to break down the problem into discrete problems. Improvement target is set. Target implementation date is established.

When reviewing the problem list at this step in the process, field service may feel that they have a job that is subject to the problem being identified. When this occurs, please contact Service Engineering so that the job can be tracked and additional details gathered from the job site.

The identification of an issue IN NO WAY means that we expect a problem to happen on any given unit. We are now identifying issues that have occurred on only 1 or 2 units. Thus, the identification of an issue does not mean there is an epidemic. Identification of an issue is not authorization to fix a machine in the sense of the warranty process.

3 ROOT CAUSE(S) DETERMINED
Identify the root cause or causes through analysis, testing, etc. This step usually involves application of several standard techniques including fishbone diagrams and the “5 Whys”. True root cause means finding the system problem which created the symptom which was identified in step 2.

Field service can be helpful in this step through careful analysis of the symptoms reported at the job site. The more complete the analysis at the job site, including the use of the “5 Whys” results in a much better field fix as well as a much more complete problem description in step 2. As an example, describing a problem as “circuit breaker tripped” does not contain enough information to define an issue or its root cause. This problem description would lead to the action of resetting the circuit breaker. However, if the cause of the circuit breaker tripping is found, then the resulting corrective action is much more likely to be effective. Although simplistic, this example is real: one of the leading fault codes found in the warranty system is “circuit breaker tripped”.

4 CORRECTIVE ACTION(S) ESTABLISHED
Determine the corrective action for both factory and field fix. These corrective actions fix the root causes of the problem. Typically, more than one corrective action is necessary as multiple items contribute to any given issue. The fix is often different in the field than the factory. This difference is due to the fact that at a given job site, conditions are more controlled and a wider range of fixes can be applied. The factory fix must work under all anticipated job site conditions.

5 CORRECTIVE ACTION(S) QUALIFIED

Prove that the proposed factory and field corrective action is effective. This will typically involve additional lab testing as well as field test sites. Service Engineering is the primary interface to field service at this step. Product Change Authorization (PCA) is initiated where needed. The Product Change Authorization is the process by which all changes to drawings are made. This frequently requires changes in supplier processes as well as manufacturing processes in the factory. As such, both manufacturing, engineering and purchasing is typically involved in this step of the process.

6 CORRECTIVE ACTION(S) IMPLEMENTED

Put the change into effect in current production. Implement improved procedures to correct the problem. PCA is in effect. Service Bulletin is issued where needed. In general, a service bulletin is a description of a situation, and NOT a declaration of an epidemic.

7 LESSONS LEARNED DOCUMENTED

Document the corrective action in the Lessons Learned database where applicable. This database is held in product engineering in order to try and capture field experience so that any mistakes made are not repeated and best practices are captured.

8 EFFECTIVENESS CONFIRMED

Collect field data to confirm the effectiveness of the corrective action.

Field Feedback

Feedback to the field on corrective action is accomplished through service bulletins and by means of a link between the Service Intranet and the CAT Database. For each problem, a form is established in the database such as the one in appendix B. Using the Service Intranet, service personnel will be able to keep abreast of current problems and corrective action progress. The search capabilities will enable the user to find all CAT projects that might be related to the symptoms that are being seen at a particular job site. Since relevant service bulletins are contained in text for a CAT issue, service personnel can quickly find bulletins that are required. Service Bulletins for CSS products are on the Service Intranet as well.

While it is not unusual for engineers in the CAT process to contact field personnel for help on CAT problems as well as to clarify input received from the commissioning report process, we regret that we can not get back to everyone who supplies input to us. We hope that by tracking our progress via the Service Intranet that field service personnel can understand how helpful their input has been, how valuable the time taken to fill out the commissioning reports is from engineering perspective, and just how seriously we take our commitment to building a quality product.

Appendix A: Map of district managers

Appendix B: Typical CAT Project Form from the database