The Quality Problem Solving Method
And its Effectiveness at Nortech Inc.

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WHAT IS QUALITY?

Quality does not have one clear-cut definition. Quality is not a singular object, but is more of an ever changing concept or idea. The foundations of quality will forever stay the same, but quality itself will constantly change with the demands of the customer and new cutting-edge technology. Quality in manufacturing has a different meaning for every different point-of-view.

According to Dr. Brauer's Quality Assurance class at Bemidji State University, quality is: 1) fitness for use and 2) conformance to specifications. This definition gives quality the ability to be flexible enough to fit within the desired outcome of a business or individual. According to Gitlow and Oppenheim (1989), "quality is a judgment by customers or users of a product or service; it is the extent to which the customers or users believe the product or service surpasses their needs and expectations" (3). This definition is directed toward the consumer, who ultimately holds the final decision whether a product or service is quality or not. Dr. W. Edward Deming, a well-known consultant on the issue of quality, describes quality as non-faulty systems (Summers, 1997). However the concept of quality is viewed by different individuals, it has to be incorporated and performed at all levels of the job.

In the manufacturing field, quality is not the responsibility of any one person or department; it is everyone's job from the president to the line worker. A quality product cannot be achieved if one or more areas in the company fall short of the specific level of quality that needs to be achieved. The departments that are responsible for quality control are marketing, product engineering, purchasing, manufacturing engineering, inspection and test, packaging and shipping, and product service.

Each industrial department contributes differently toward the creation of a quality product.

- Marketing helps to evaluate the level of product quality that the consumer wants, needs, and is willing to pay for and also provides vital data that helps set the quality standards.
- Product engineering transforms the customer's quality requirements into specifications, characteristics, and tolerances. They must also find the simplest and least costly design that will meet the customer's needs, which will ultimately be the best design.
- Purchasing has the responsibility of gathering the necessary quality components and materials according to the product engineering requirements. The responsibility of developing procedures and processes that will produce a quality project belongs to manufacturing engineering.
- Manufacturing has the responsibility to product quality products, a procedure that must be built into the product.
- The packaging and shipping department has the duty to ensure that the product will reach the desired destination intact with its quality preserved.
- Product service has the responsibility to provide the customer with future questions and problems that may arise within the project (Besterfield, 1990).

A couple of key areas that can directly affect the quality of the product but are not included within the quality loop are the quality assurance department and the chief executive officer. The quality assurance department continually evaluates and improves the total quality system that involves the other departments. Its overall objective is to improve the quality within the product by working with the other departments. The other area of influence is the chief executive officer, also referred to as the CEO. The CEO must be directly involved with all departments and every aspect of the quality loop. They are ultimately responsible for a quality product (Besterfield, 1990).

All of the departments must work together to form a quality product. All of the employees within each department must also work together to make sure that they are producing at the desired quality level. It is an order of checks and balances to keep every department in line with the other and to focus on the quality goal.

A BRIEF HISTORY OF QUALITY

Issues about quality date back to the time when the pharaohs ruled. A good example of an ancient quality issue is found in the Code of Hammurabi, dating from 2150 B.C. The code states, "If a builder has built a house for a man, and his work is not strong, and the house falls in and kills the householder, the builder shall be slain" (Gitlow and Oppenheim, 1989, p.8). Some inspectors eliminated any repeat violations by chopping off the hand of the maker of the defective product. Such ancient inspectors accepted or rejected products based on the local government's specifications. The main emphasis was on the fairness of the trade: a quality product for a fair price (Gitlow and Oppenheim, 1989).

Later on during the 13th century, apprenticeships and guilds developed. The craftsmen were both the teachers and inspectors since they knew how to incorporate quality into their trade and products. The individual tradesman could inspect the work to establish a quality standard. This idyllic state of quality would have lasted if the world had remained small and localized; however, as the world became more populated, more products were needed (Gitlow and Oppenheim, 1989).

As the world population grew, so did the consumer's demand for better crafted products. In 1798, Eli Whitney began designing and manufacturing muskets with interchangeable barrels, firing mechanisms, and other parts. In order for the parts to be interchangeable, they needed to be nearly identical with as little variation as possible. This situation created the need for quality control. If the parts are not made to the specifications during assembly, a randomly selected part may or may not fit together with another part. Quality evolved to meet the needs of making a nearly identical part with very little variation (Summers, 1997).

The modern industrial system emerged during the 19th century. Frederick Taylor pioneered scientific management by removing the work of planning out of the hands of the workers and placing it with the industrial engineers. The 20th century opened the door to products that were only available for the wealthy. Henry Ford introduced the moving assembly line and the concept of mass production at the Ford Motor Company. Assembly line production broke down the complex tasks so they could be performed by unskilled laborers, which resulted in highly technical products at a low cost. An inspection operation was included into the assembly operation to separate the good parts from the bad parts, while quality still remained under the manufacturing department.

Quality began to suffer in the hands of the manufacturing department. The production manager's primary priority was to meet manufacturing deadlines. They could get fired if the set quotas were not reached, while they would only be reprimanded if the quality was poor. Upper management noticed the decrease in quality and developed a position of "chief inspector," a person who was placed in charge of quality (Gitlow and Oppenheim, 1989).

Technology in the industrial world changed rapidly during the twenty years from 1920 to 1940. The companies of Bell System and Western Electric led the way in quality control by creating an Inspection Engineering Department to deal with the problems resulting from defective products and lack of departmental coordination (Gitlow and Oppenheim, 1989). Dr. Walter Shewhart emerged from Bell Laboratories as the first person to encourage the use of statistics to identify, monitor and eventually remove the sources of variation found in repetitive processes. He identified two different sources of variation that occur within a process. Controlled variation is a common cause that is present due to the very nature of the project. This variation can only be corrected by changing the whole process. The other type is called uncontrolled variation. These problems come from external sources to the process and are often called special causes. These variations can be identified, isolated, and removed from the process. Dr. Shewhart was one of the pioneers for statistical quality control (Summers, 1997).

The next large breakthrough in quality came from W. Edwards Deming after the end of World War II. Dr. Deming encouraged the upper management levels to get involved in the process of creating an environment that supports continuous improvement. Unfortunately, this was a concept that was not accepted in the United States due to the war time industrial boom. During the early reconstruction stages of Japan after the war, Dr. Deming was invited to speak to Japan's top industrialists to aid the rebuilding process after the war. Japan wanted to break into foreign markets and improve their reputation of producing poor-quality goods. Deming convinced them that they could do those things and more if they were to implement his quality methods. When the industrialists implemented Deming's techniques, the Japanese quality, productivity, and competitive position improved and strengthened greatly (Gitlow and Oppenheim, 1989).

Dr. Deming considered that quality improving activities were the catalyst to start an economic chain reaction. Improving quality leads to decreased costs, fewer mistakes, fewer delays, and better use of resources, which will lead to improved productivity. With this quality system in motion, a company will be able to capture more of the market, which enables the company to remain in business and provide more jobs. He felt that the consumer was the most critical part in the production of the product. Dr. Deming's theories focus on management involvement, continuous improvement, statistical analysis, goal setting, and communication, all of which were aimed primarily at management. His philosophy consisted of 14 points that would help in the short and long term quality of a product and services (Summers, 1997).

Foreign competition began to threaten the U.S. marketplace in the 1970's. Japan began to rival or even surpass U.S. companies in the production of quality products. The outlook for U.S. management changed due to this foreign competition and the increased demand for quality by the consumer. The late 1970's and throughout the 1980's were marked by a rise in quality in all aspects of businesses and services. With the ongoing conflicts of reduced productivity, high costs, strikes, and the fluctuating unemployment rate, companies were forced to improve quality standards. There are many different tools that can be used to improve the quality of a product and the overall business (Gitlow and Oppenheim, 1989).

SOLVING QUALITY PROBLEMS

Quality problem solving, also known as QPS, has been traditionally defined as the link between the existing state and the desired state. To break the definition down further, a problem is a situation that needs improvement and problem-solving is the action that one goes to get from the current position to an improved position. Summers (1997) defines quality as "the isolation and analysis of a problem and the development of a permanent solution" (66). Sometimes a problem can be solved by the hit-or-miss approach. Occasionally this process works, but it mostly corrects the symptoms instead of finding a cure for the root of the problem. Problem solving is not an automatic process, but is something that needs to be worked at by trained individuals. Once the root causes of the problem are found, they can be isolated and corrected to prevent any future reoccurrence. Dr. Deming's Plan-Do-Study-Act cycle, also referred to as PDSA, is the most common systematic approach to problem solving (Summers, 1997).

The problem-solving steps that are involved with PDSA can be broken down into smaller categories. The planning stage consists of six individual steps: recognize the problem, form quality teams, define the problem, develop performance measures, analyze the problem, and determine possible causes. The “do” stage consists of implementing the chosen solution. The study stage evaluates the implemented solution. The last stage of cycle, the act stage, helps to ensure performance and calls for continuous improvement. The PDSA cycle is a continuous cycle that keeps revolving due to the ever changing industrial world and needs of the consumers. The steps and the quality tools used to define the steps will be described more thoroughly under their respective titles later on.

There are several different types of quality problems that can be addressed with the PDSA technique (Summers, 1997).

QUALITY PROBLEMS

A set of traditional quality problems where a highly structured system of standardized inputs, processes, and outputs that perform unacceptably from the standpoint of the users is labeled as conformance problems. The major challenge posed by conformance problems is the diagnosis -determining the cause of the non-conformities. Once this diagnosis is completed, the corrective action is simple: Return the system to its specified performance routine (Smith, 1998).

Unstructured performance problems, or UPPs, is a type of problem that involves systems or processes that are not well specified by standards and that are not performing acceptably from the standpoint of product users or other stakeholders. A sales below the budget is a typical UPP. Problem identification is the most difficult step of the process, since one cannot simply monitor for deviations from the standard. The major challenges in solving this problem are determining customer need and finding the causes of the poor performance (Smith, 1998).

Another type of problem that reflects the interests of system owners and operators is an efficiency problem. This problem consists of operations that are more costly than the system owners desire them to be and can pose unsafe or undesirable conditions for the workers. Cost efficiency is the most common concern for this category. Employees have a critical role in the identification of the problem since they know more about the wasteful and unsafe production procedures. When solving efficiency problems, one must center on identifying and eliminating unnecessary activities and finding less costly ways of performing the needed functions (Smith, 1998).

Product design problems involve the design of products that satisfy the user needs. Though product design work can be started as the result of an occurring problem, problem solving usually occurs as a natural part of the organizational life in a competitive market environment. Quality management teams major challenge is determining the customer's needs and how the company will satisfy them (Smith, 1998).

A process is an organized set of activities or a certain way of doing something. Process design problems involve the development of new processes and the redesign of current ones. Problem identification is prompted by recognition of performance problems and new technology that can possibly improve processes. The key problem-solving challenge is generating enough ideas that can later be developed into effective processes. Process design has become a permanent item on many companies quality management agendas (Smith, 1998).

THE QUALITY PROBLEM-SOLVING METHOD

Different views of the problem-solving method exist. Some experts believe that the method involves a standard sequence of functionally defined activities, which presents the process as a stage or a phase model. They argue that one step must first be completely finished before the next step or stage is started. Unfortunately experience suggests that problem-solving is not a strict linear process. Information that is received from memory or outside sources can prompt a return to previously addressed functions. Most of the common functional models now contain procedures for backtracking within the problem-solving method (Smith, 1998).

A more modest view of the method consists of a standard set of functions. Experts claim that every step falls into one of four categories: problem formation, alternative generation, evaluation, and choice. It is hard to organize these certain steps of this activity since they are so loosely defined. Not all of the steps are necessary to attack a quality problem, but the overall theory is the same for all who use the method (Smith, 1998).

Whether the quality problem-solving method is viewed as clearly defined activities or a standard set of functions, they all consist of the same basic steps. These steps, which will be explained in more detail throughout the rest of the thesis, are problem identification, problem definition, research, diagnosis, alternative generation, design, planning, prediction, evaluation, and negotiation (Smith, 1998).

The problem-solving method that was used at Nortech Industries consists of six different steps. Several of the different standard functions were combined to help to develop an easier approach to the problem solving method since it was the first time it was conducted by myself in a real life situation. The following explains the particular steps that were used and the information gathered from them.

PROBLEM DEFINITION

The process of forming a definition to the problem is directly related to the identification the problem. Problem identification is the process by which one comes to believe that a problem exists (Smith, 1998). I took a tour of Nortech and was able to see the existing assembly method. From this observation and the frequent questions that were asked, I was able to identify the problem. I could clearly see that the assembly method was awkward for the assembler due to the order of the steps and the instructions that accompanied them.

Problem definition answers the question, "What is the problem?" A properly defined problem guides and helps to set up the rest of the problem solving process. Without a clearly defined problem, the process may stray from the designated path. Poor or unclear results may come from continuing a process without a clear definition of the problem (Smith, 1998). The problem with the Nortech assembly is associated with the methods of assembly and the clarity of the information that is presented to the employee in the current process.

INFORMATION GATHERED

The next quality problem-solving step that I used was to research all of the available materials. The research step consists of determining all knowable facts about the situation. Information gathered during the process should just be compiled without discarding any particular piece. Any of the information that is gathered could possibly be used during the process or even at a later date (Smith, 1998).

The information that I compiled came from different areas of the company. I was allowed to see how the fuse box was assembled with the current instructional manual. When trying to find out the problems in a process it is often better to ask the one who deals with it on a regular basis then the one who may be in charge. I asked the assembly team numerous questions on how the process could be improved. Many thoughts were generated that would all be beneficial in helping to improve the process. I also analyzed an assembled kit and an unassembled kit along with the fuse box's bill of materials. When the new process had been thoroughly thought out and developed, I was given twenty unassembled kits to help conduct a time study to evaluate the newly proposed method.

EXISTING METHOD DESCRIPTION

The process of describing Nortech's existing method of assembly is not a step in the quality problem-solving method. It helps to put the assembly method in writing or even on a video tape so it can be used as a reference later on in the process. One of the most important things to remember when working with any problem solving process is to document everything! It is better to have it and not use it then not have it at all.

The current method used for this production assembly was presented through a trial run of the fuse box and the instructional manual that accompanied it. First, a cart containing the unassembled kits was rolled into the production area with the production order on how many units were to be assembled at this time. The parts for all of the kits were labeled with a slip of paper and placed within separate bags according to the part number. Each of the individual employees that were involved in the assembly process would work on one fuse box at a time until the unit was completed. Upon completion, the employee would subsequently start a new fuse box assembly until the proposed order was complete. Once all of the units were complete, they were move on to the quality control area where they were tested for defects.

The current process was very confusing to decipher and understand. The instruction manual consisted of part numbers, directional arrows and minimal directions on how to install the part. Some of the parts were assembled at the beginning of the process, only later to be removed to fit in another part. After I witnessed the assembly of the fuse box, I realized that a change in the method of assembly would greatly help the ease of production.

GENERATED ALTERNATIVES

Alternative generation in simplified terms is brainstorming. The problem-solving team must think about the problem to identify the possible solutions. Many different idea generation strategies and methods exist to aid with the brainstorming technique. There are five prescriptions that are recommended when generating alternatives (Smith, 1998).

The first recommendation is to challenge the assumptions. One of the major blocks to creativity is the assumption that things have to be a certain way because that is how they are now. Opportunities of improvement arise when assumptions are challenged. The second recommendation is to exploit the distinctive features of a product. Marketing breakthroughs are often based on distinct attributes that allow a product to be marketed a certain way. Another recommendation is to use everyday experiences. The problem solving team must ask, "How would we deal with this situation in our daily lives?" Many good solutions come from personal experience. The fourth recommendation is to adopt multiple and partial solutions. Sometime trying to find a one single cure to a complex problem can hinder alternative generation. The final recommendation is to avoid premature closure. Try to create a large list of different solutions and avoid accepting one of the first options proposed. Set a quota for alternatives to guarantee that premature closure does not happen (Smith, 1998).

After careful examination of the material that was gathered, I was confident that substantial gains could be made in the production of the fuse box assembly. There are many different ways to get from the hypothesis to the conclusion. I wanted to make sure that all possible modifications were analyzed before a conclusion was made, keeping the Nortech's best interests in mind.

Several different alternatives were initially considered. Different materials could be used to help increase production. New mechanical fasteners, for example, might possibly cut down on the production time due to the ease of installation. With the use of jigs and fixtures, assembly time could be decreased and both hands free to manipulate the parts into the proper position. New or custom tooling, such as magnetic tipped screwdrivers, could be implemented that would be more adequate for the assembly. A new ergonomically correct workstation design would benefit the employee by offering a brighter, more assembly friendly workplace. A change in the assembly process would greatly benefit production. The assembler at Nortech appeared to have difficulty in comprehending the instructional information. If the process could be shown with the best method of assembly and easy to follow directions, it would produce substantial gains and be the most beneficial choice for production.

EVALUATING PROPOSED SOLUTIONS

Evaluation is a judgmental task. Each alternative has its own set of benefits and faults. The problem-solving group must take into consideration all of the different aspects that are associated with the product. They must determine the costs, benefits, and the overall acceptance of all of the proposed solutions. Several decision-making tools exist to help the problem-solving team evaluate the different ideas. If none of the proposed solutions are beneficial enough to be implemented, then its back to the drawing board. It is better to generate different alternative then to implement a faulty plan (Smith, 1998).

Upon careful study and review, substantial gains could be made with the Nortech fuse box assembly with a change in the methods of assembly. Proper presentation could be achieved through detailed diagrams as well as thorough proofreading in common problem areas. I noticed that certain areas within the process always caused confusion for the assembler. The presentation of the information to the employee through the instructional manual could be clarified to ease the process of assembly. Major subassemblies, such as the filter and the power supply, could be kept unattached until the wire spades and fast-ons were connected. For greater ease in assembly and to create uniformity, I arranged the subassemblies to be attached in order of top to bottom, starting at the left and moving to the right. The combination of these ideas are proposed in order to decrease the overall assembly time and to increase efficiency at Nortech.

IMPLEMENTATION

The problem-solving method somewhat ends when a course of action is taken. When a proposed solution has been evaluated and selected, it then needs to be implemented into the product or process. There are two challenges that face the implementation process. First, the change must receive the support of all relevant parties. Secondly, some solutions are more complicated then others to implement. Implementation becomes a matter of planning and coordinating a complex set of activities (Smith, 1998).

The quality problem-solving method is a continuous process, even though it was mentioned earlier that it ended with implementation. The implementation process is the end of that particular portion of Dr. Deming's Plan-Do-Study-Act cycle. Unfortunately, the work is never completely done because the PDSA cycle is a continuously moving problem solving wheel. Once the solution has been implemented, it proceeds back into the first stage of the cycle for reevaluation. It is a continuous process that keeps corporations producing more effective and efficient products and services.

Two different solutions were generated to give Nortech options on current and future needs on the assembly line. The first process involved an overall uniform AutoCAD drawing on each page, with the detailed information within the drawing to be varied depending on the process step. There was also detailed information within the step to coincide with the drawing to clarify any possible questions that might arise. Upon close review of the current push in the flow line process, a second process was developed to target Nortech's future needs. This process consisted primarily of detailed drawings with very little back up verbal information. Using the twenty unassembled kits, I constructed a time study to show how the new assembly manuals compared to the Nortech manual.

FLOW LINE

After completing the time studies, there were twelve assemblies left over that needed to be completed to fill the work order. I decided that it would be a good idea to run a flow line with the new process, since that was the general purpose of the design. I set up the flow line with seven stations, but unfortunately had only six people to work with. That problem was corrected by having the last person finish two steps. The process worked out to be a relatively well-balanced flow line. A couple of bottlenecks appeared within the flow-line, but it was easily corrected with a quick switch of duties. It took the majority of two hours to build the twelve assemblies. The flow line yielded a 38% efficiency. There were other benefits that came from running the flow line. The employees were able to easily detect and correct the others mistakes, a number that decreased throughout the process. The workers were also able to quickly reference parts and placement instead of having to carefully read through the process each time they had a question. Overall, it was beneficial to see the implemented process in action and it will show higher gains in a shorter period of time.

Benefits

- 1 person per station
- 1 process page at each station, with the quick reference pictures
- Efficiency was better than what was yielded during the time studies
- One person assembly= 1.5 hours each, 25.33% efficiency
- Flow line= 1 hour each, 38% efficiency
- Errors were noticed before completion

- People easily understood what they were doing and how to do it
- Set-up of the flow line was easy since it corresponds with each page in the process

Flow-line efficiency

- Time standard- .38 hours per assembly
- Number of assemblies- 12
- Earned hours- 4.56
- Actual time- 2 hours
- Number of people- 6
- Actual hours- 12
- Efficiency- (4.56/12) x 100= 38%
- Nortech Calculated Efficiency- 42%

CONCLUSION

The quality problem solving method can greatly benefit anyone who uses it. If it doesn't correct a problem on the first try, it helps to gather important information and generate possible solutions. It also helps organize information in a way that is easily referenced for later projects. Quality is a concept that will continually change, but will always be an important issue for companies and the consumer.

Quality in manufacturing is defined differently by every person due to the different situations and applications. Quality is also not the responsibility of one person, but the whole company. Many different departments work together to create a quality product.

As the world evolved, so did the concept of quality. Quality dates back to ancient times, long before the age of modern man. During the most recent years, tremendous improvements in quality can be attributed to Eli Whitney, Henry Ford, Dr. Shewhart, and Dr. Deming. Each individual greatly contributed in their own unique way.

Different quality problems exist with several different methods to correct them. The quality problem-solving method is a universal tool that can be used to attack any industrial situation. It is flexible and able to change with different applications, but yet it has guidelines that must be followed for a higher success rate. The quality problem-solving method can either be an individual or a group effort and has no set time limit. It would be very beneficial for any person in the industrial field to study, practice, use and master the quality problem-solving method.

REFERENCES

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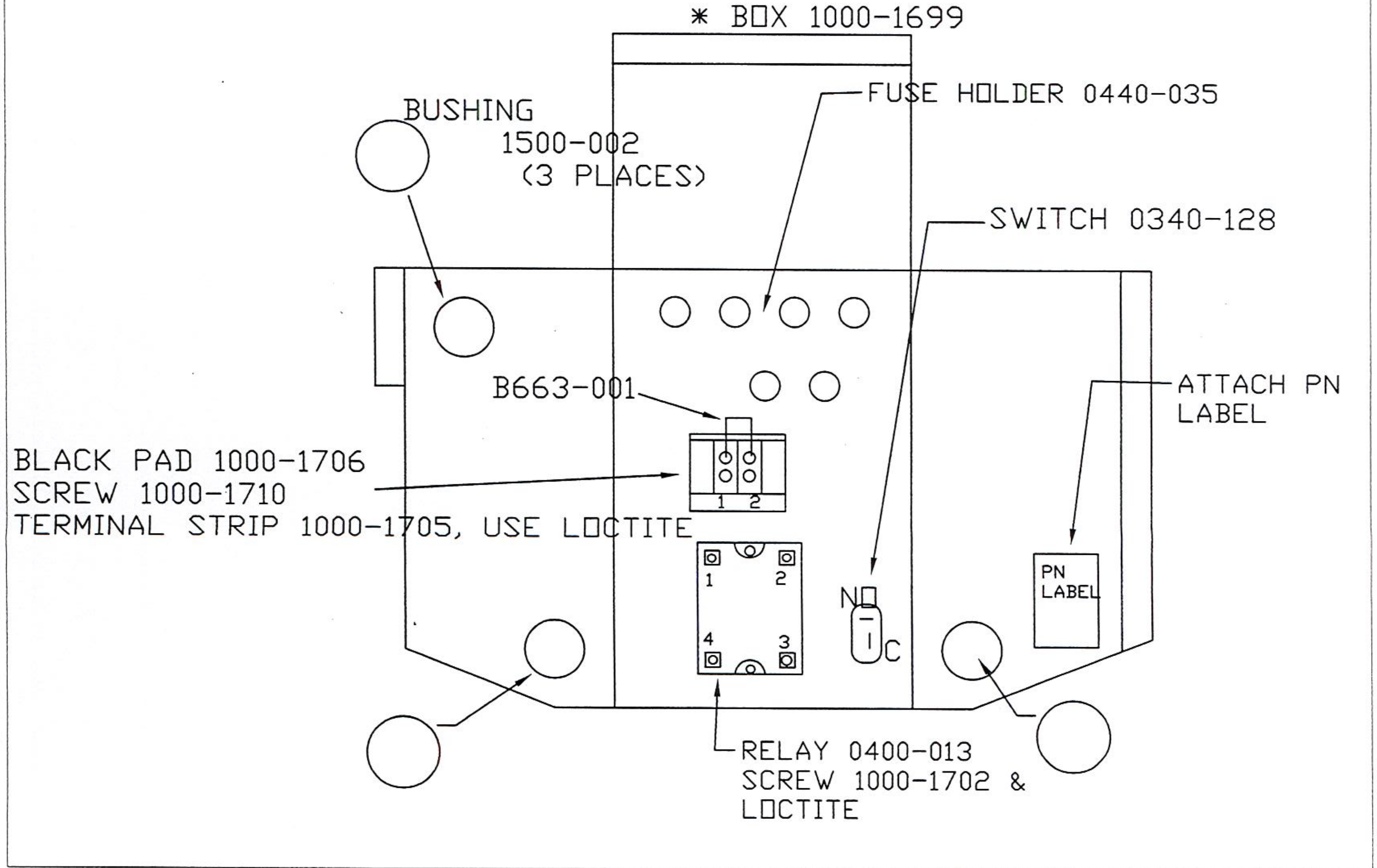
Gitlow, H. S. & Oppenheim, A. R. (1989). *Tools and Methods for the Improvement of Quality*. Boston: Richard D. Irwin, Inc.

Smith, G. F. (1998). *Quality Problem Solving*. Milwaukee: ASQ Quality Press.

Summers, D. C. (1997). *Quality*. (2nd ed.) New Jersey: Prentice-Hall, Inc.

ATTACHMENTS

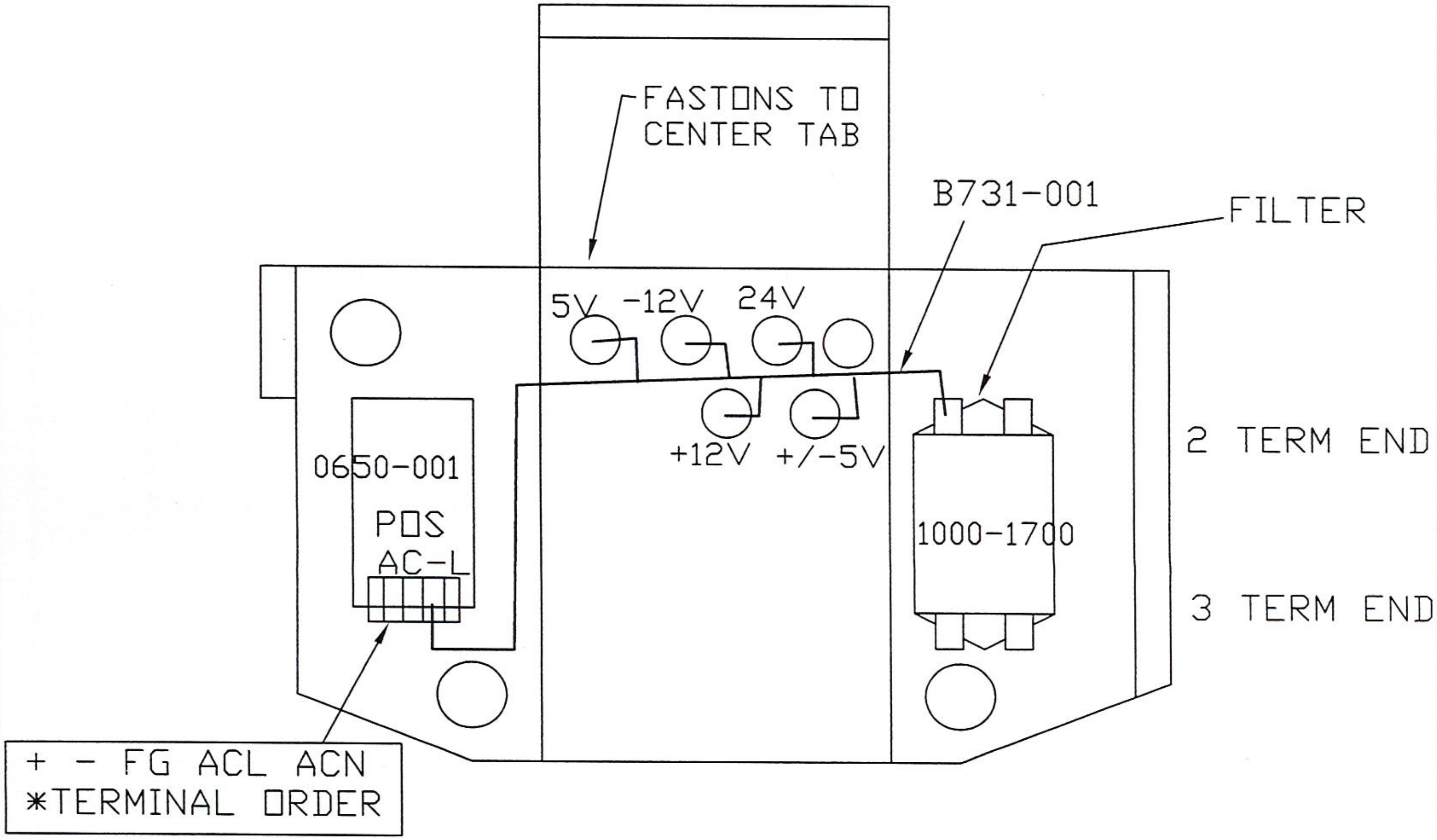
* ATTACH IDENTIFIED PARTS



STEP #1

* CONNECT ASS. B731-001

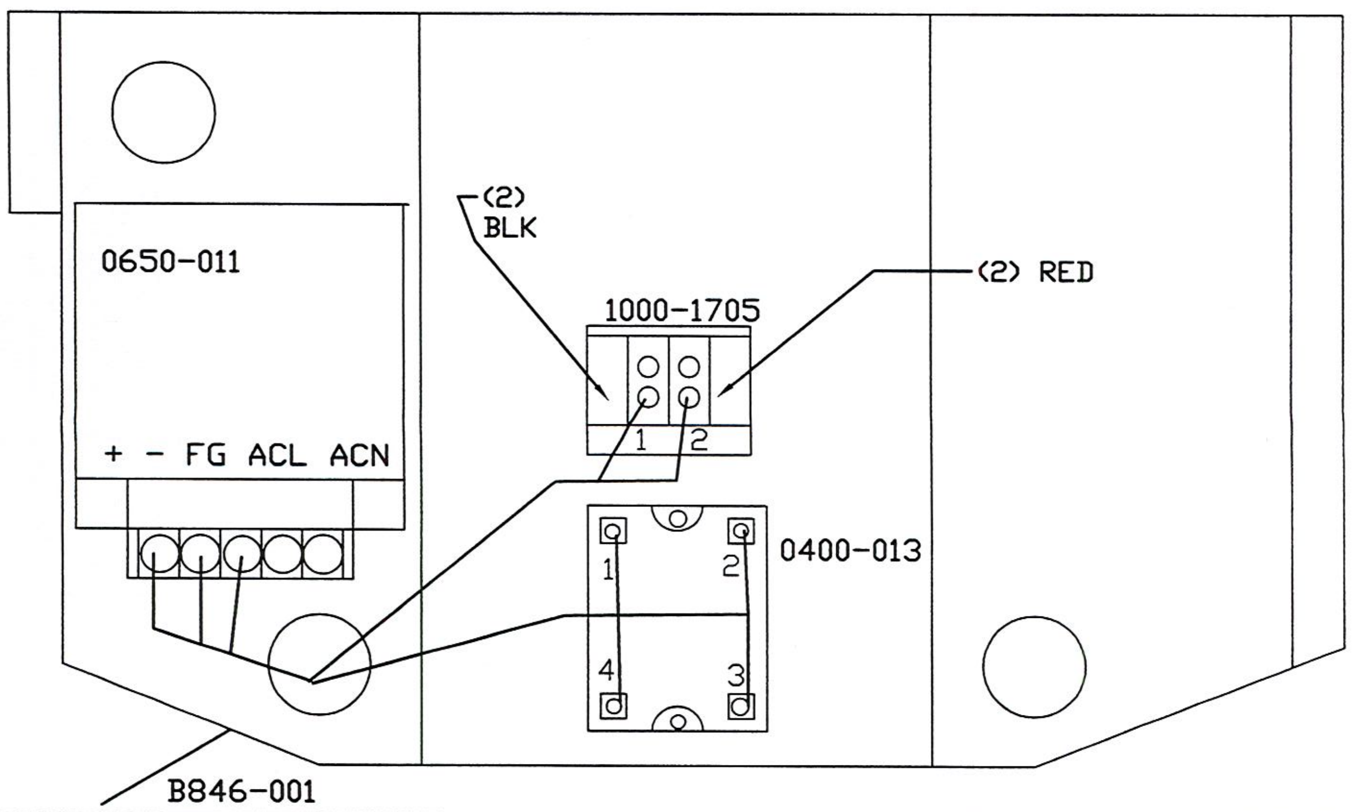
* ALL WIRES LABLED



STEP #2

* CONNECT ASS. B846-001

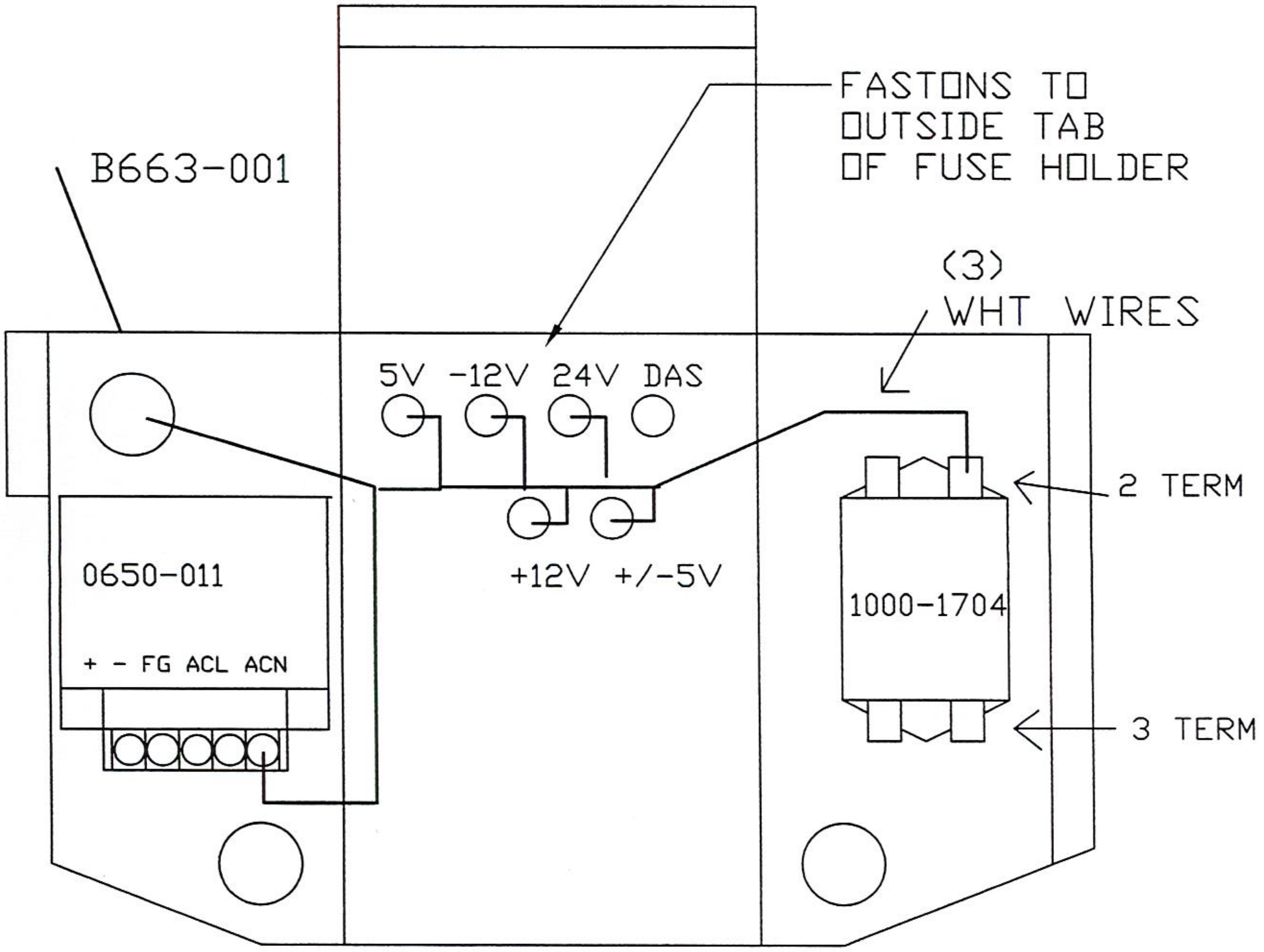
* ALL WIRES LABLED



STEP #3

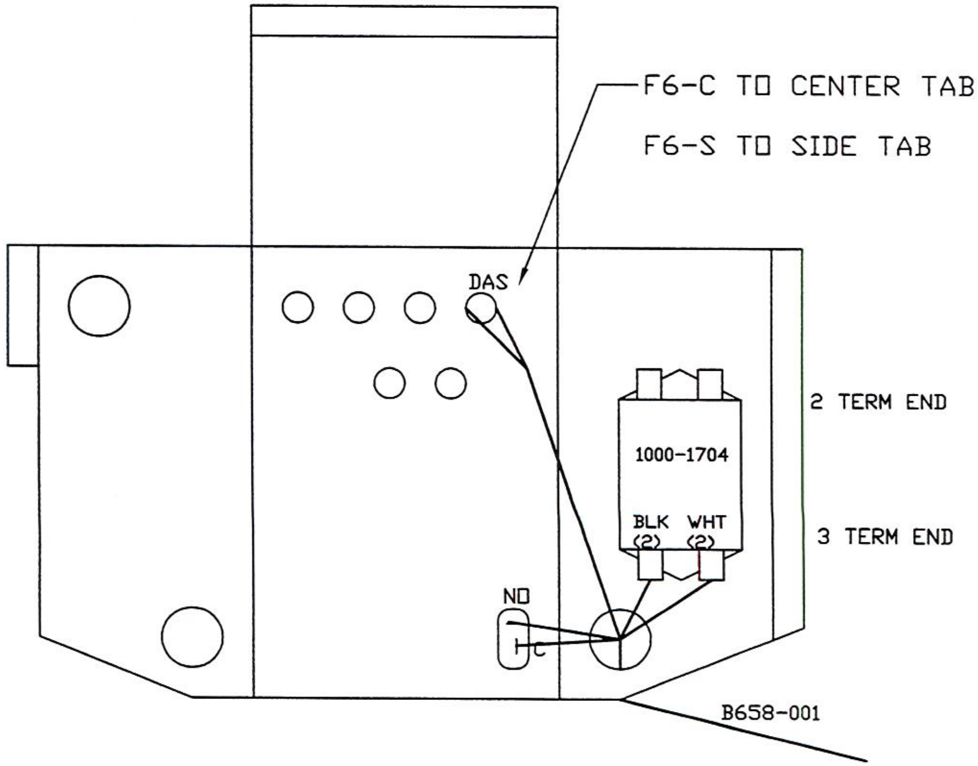
* CONNECT ASS. B663-001

* All WIRES LABLED



STEP #4

* CONNECT ASS. B658-001
* ALL WIRES LABLED

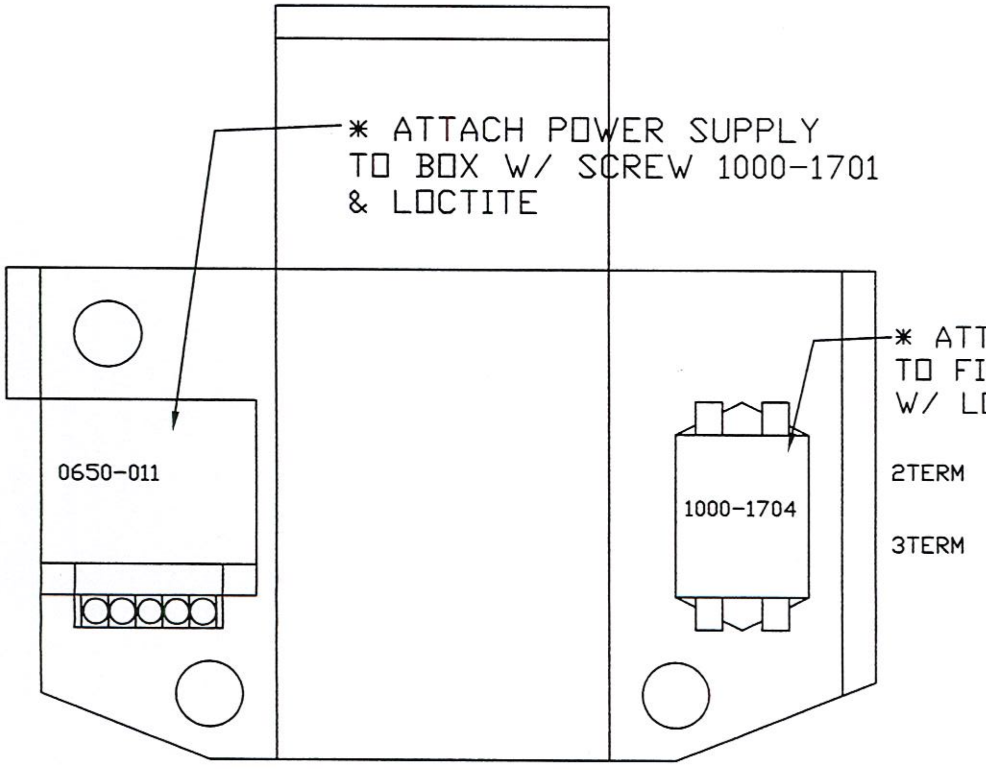


F6-C TO CENTER TAB

F6-S TO SIDE TAB

STEP #5

* ATTACH FILTER & POWER SUPPLY

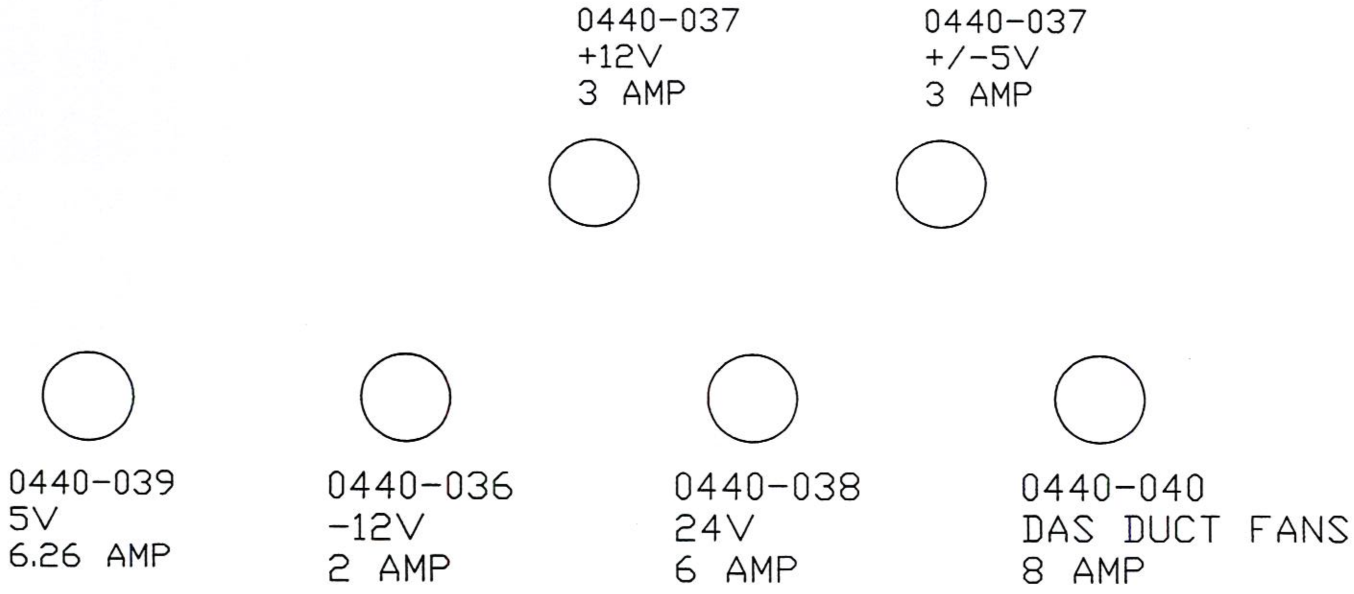


* ATTACH POWER SUPPLY
TO BOX W/ SCREW 1000-1701
& LOCTITE

* ATTACH CLIP 1000-1704 QTY(2)
TO FILTER, & MOUNT FILTER TO BOX
W/ LOCTITE

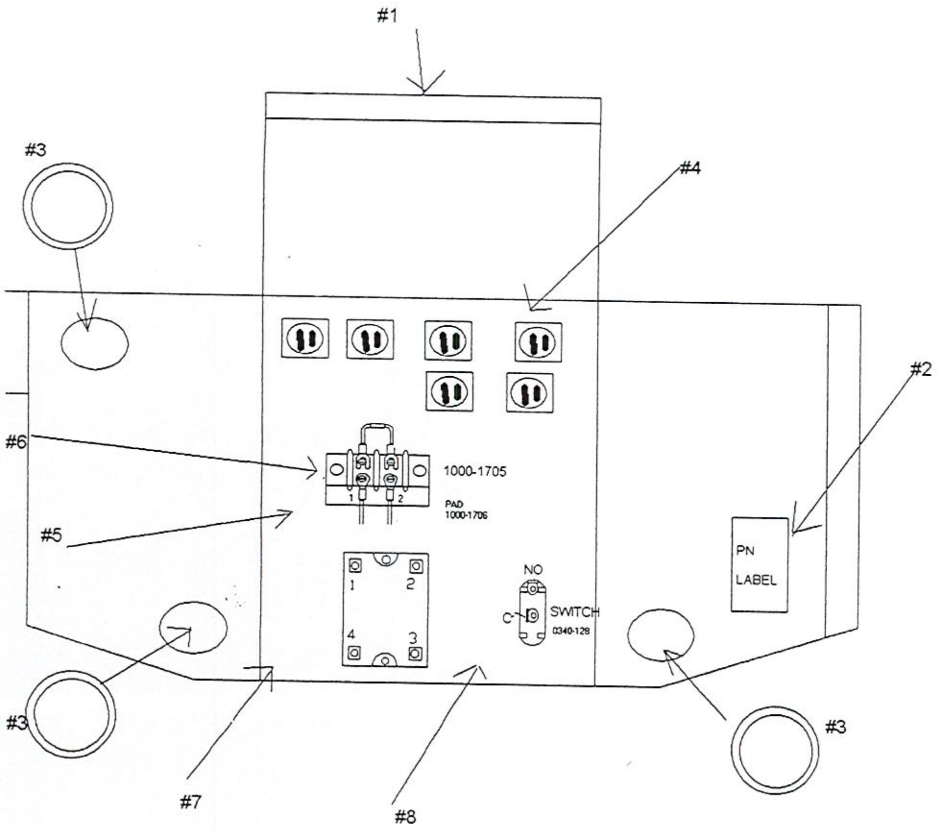
STEP #6

* REMOVE COVERS FROM FUSE HOLDERS
INSERT FUSES
REPLACE COVERS



NSI PROCESS DETAIL

SEQ 20 FINAL ASSY



1. OBTAIN BOX 1000-1699 (QTY 1)

2. ATTACH P/N LABEL INSIDE BOX WHERE IT WILL NOT BE COVERED.

3. INSERT BUSHINGS 1500-002 (3 PLACES)
   - FROM OUTSIDE IN

4. INSERT FUSE HOLDER 0440-035 (6 PLACES) & RUBBER WASHER (QTY 6). SECURE WITH WASHER (QTY 6) & NUTS (QTY 6) (PROVIDED WITH FUSE HOLDER)
   - REFER TO MASTER FOR DETAIL
     - DO NOT INSTALL FUSES

5. ATTATCH WIRE TO TERMINAL STRIP1000-1705

6. PLACE BLACK PAD 1000-1706 BEHIND TERMINAL STRIP AS SHOWN MOUNT TERMINAL STRIP 1000-1705 TO BOX W/ SCREW # 1000-1710, W/ LOCTITE 6850-399

7. MOUNT RELAY 0400-013 (QTY1), USING SCREW 1000-1702 AND LOCTITE 6850-339

8. ATTATCH SWITCH 0340-128(QTY 1) USING JAM NUT PROVIDED, WASHER1000-1703 (QTY1) AND NUT PROVIDED

PROCESSOR	SEQUENCE TITLE	ISSUE	REV	PART NUMBER	SEQ. NO.	
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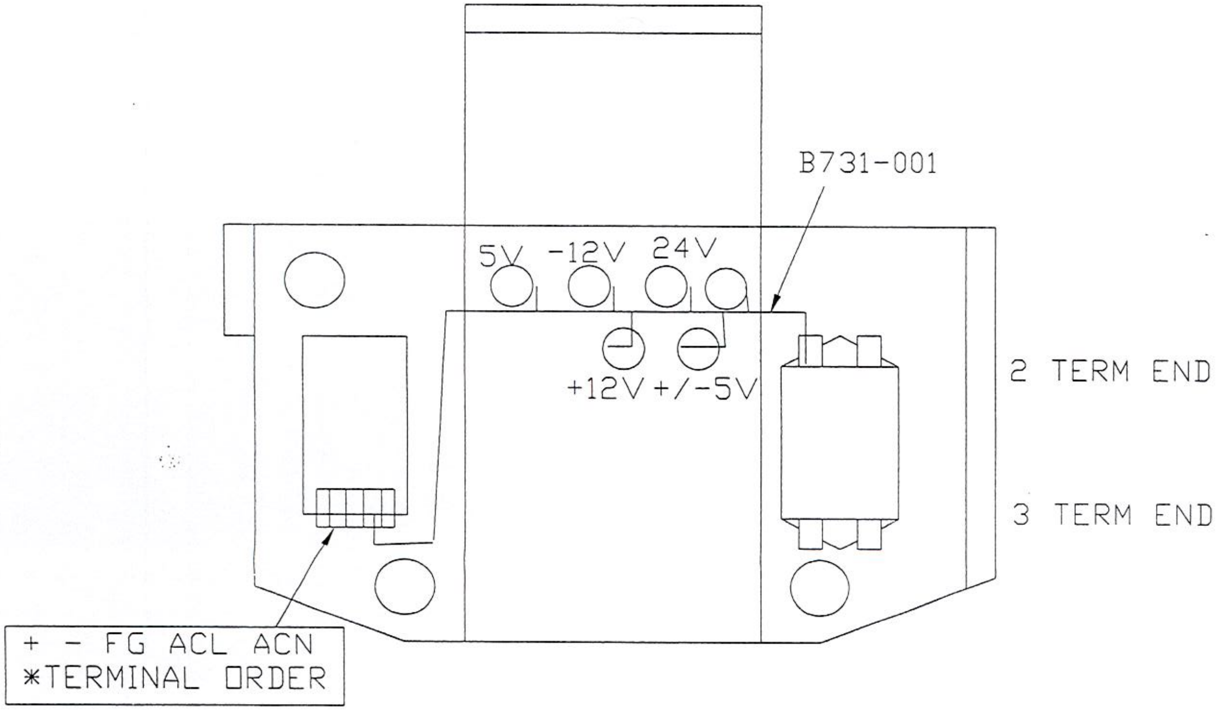


9) OBTAIN FUSE HARNESS B731-001 & PLUG FASTONS TO CENTER TAB OF FUSE HOLDERS AS SHOWN IN THIS ORDER
24V +/-5V –12V +12V 5V

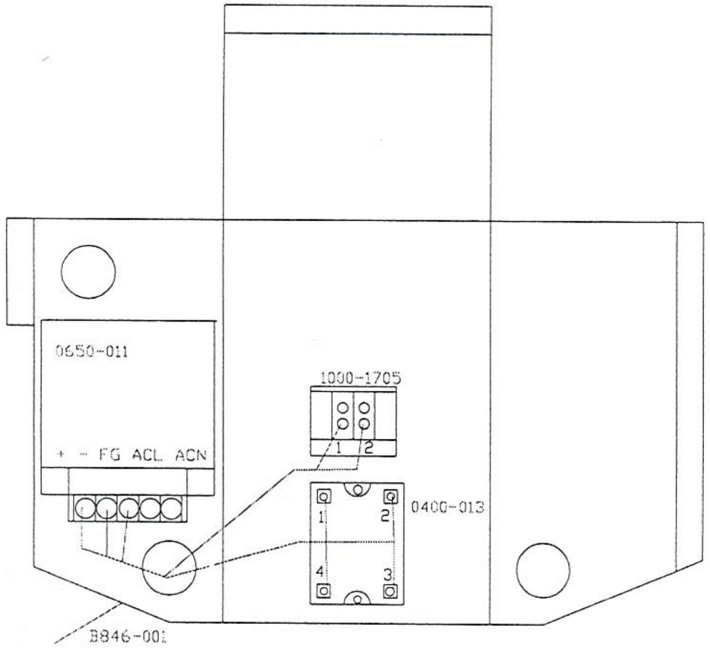
10) OBTAIN POWER SUPPLY 0650-011
- DO NOT CONNECT TO BOX

11) PLUG BLACK WIRE MARKED AC-L TO POWER SUPPLY AS SHOWN

12) OBTAIN FILTER 1000-1700
- DO NOT CONNECT TO BOX

13) PLUG BLACK WIRE MARKED FILTER TO FILTER 1000-1704 AS SHOWN

PROCESSOR	SEQUENCE TITLE	ISSUE	REV	PART NUMBER	SEQ. NO.	
M FLADEBOE	LABEL/COMP	1	0	B851-001	10	SHT: 2 OF: 1



14)- OBTAIN ASSEMBLEY
B846-001

15) PASS THROUGH HOLE AS SHOWN

16) CONNECT WIRES TO TERM STRIP
1000-1705 AS SHOWN
- POS 1- (2)BLACK
- POS 2- (2) RED

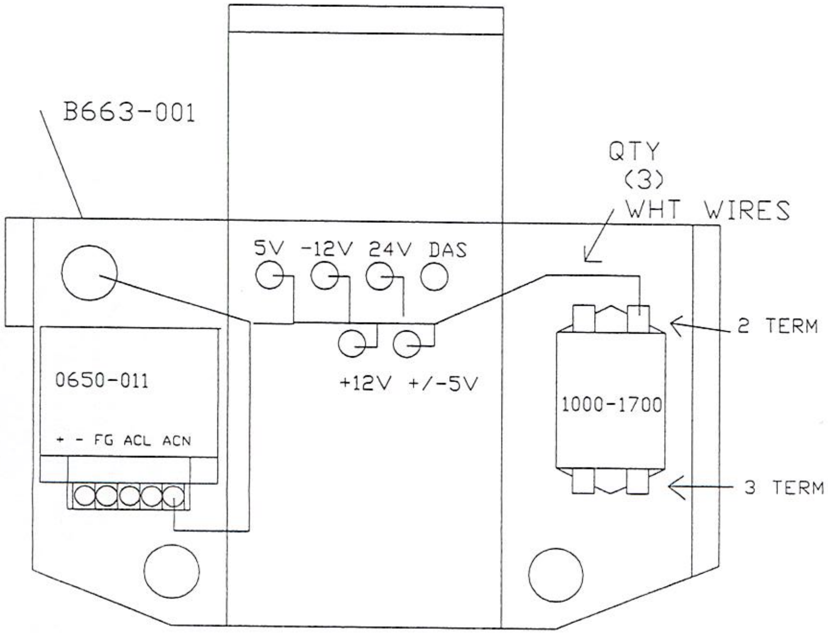
17) CONNETC WIRES TO RELAY
0400-013 AS SHOWN
- WIRES MARKED 1,2,3,4 TO MATCH POSITION ON RELAY

18) OBTAIN POWER SUPPLY 0650-001
- DO NOT CONNECT TO BOX
- REMOVE PLASTIC SHEILD & KEEP

19) CONNECT WIRES TO POWER SUPPLY
0650-011 AS SHOWN
- WIRES ARE MARKED- +, -, FG
- PLUG TERMINAL FROM TOP WITH TERMINAL FACING DOWN

PROCESSOR	SEQUENCE TITLE	ISSUE	REV	PART NUMBER	SEQ. NO.	
M FLADEBOE	LABEL/COMP	1	0	B851-001	10	SHT: 3 OF: 1

NSI PROCESS DETAIL



20) OBTAIN ASSEMBLY B633-001, AND PASS THROUGH HOLE AS SHOWN

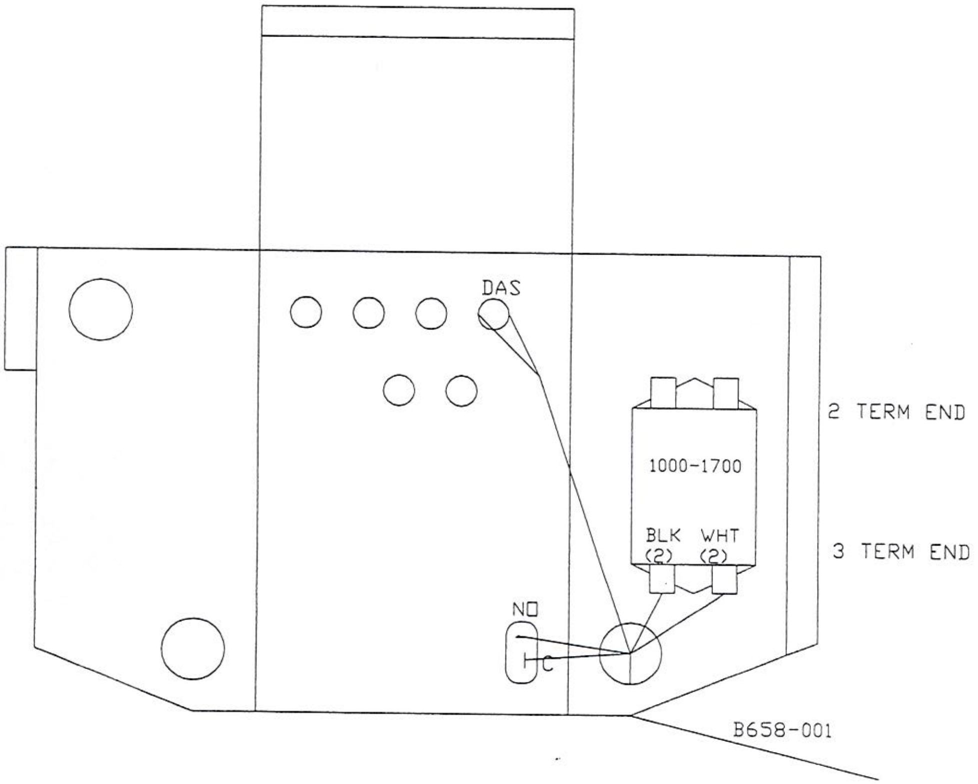
21) CONNECT FASTONS TO OUTSIDE TAB OF FUSE HOLDERS AS SHOW

- WIRES ARE MARKED ACORDINLY TO POSITION OF PLACEMENT
- 5V, -12V, 24V, +12V, +/-5V

22) CONNECT RED SPADE MARKED AC-N TO AC-N TERMINAL CONNECTION ON POWER SUPPLEY B663-001

23) PLUG (3) WHITE WIRES (WITH BLUE SPADES) TO FILTER 1000-1700 AS SHOWN

PROCESSOR	SEQUENCE TITLE	ISSUE	REV	PART NUMBER	SEQ. NO.	
M FLADEBOE	LABEL/COMP	1	0	B851-001	10	SHT: 4 OF: 1



24) OBTAIN ASSEMBLY B658-001

25) PASS THROUGH HOLE AS SHOWN

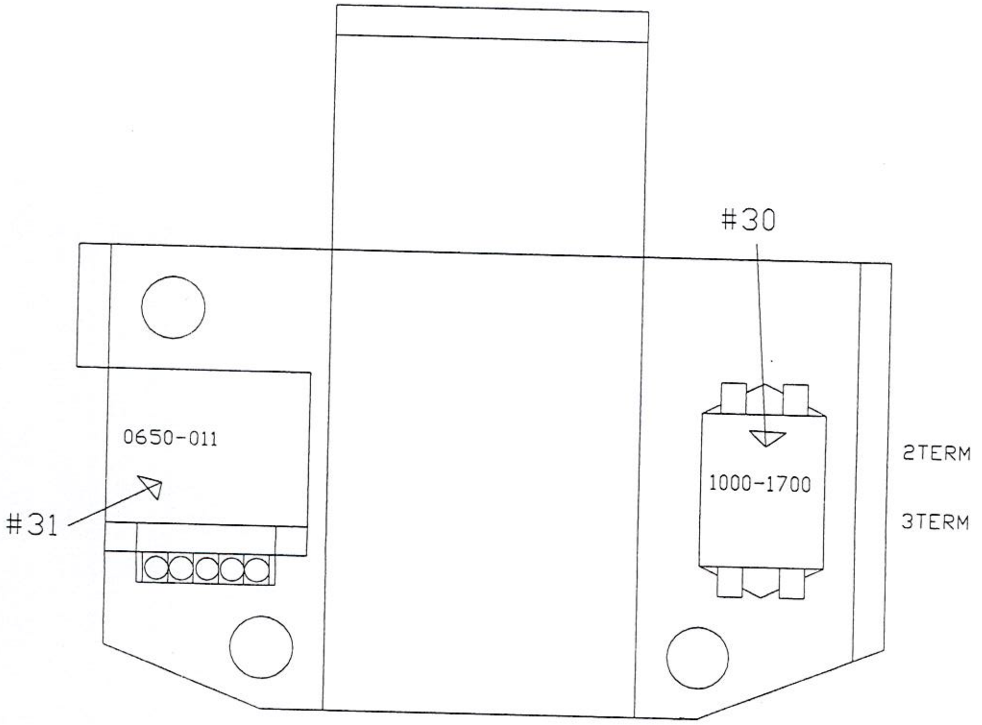
26) PLUG FASTONS MARKED (F6-S & F6-C) TO DAS FUSE HOLDER AS SHOWN
- F6-C TO CENTER TAB
- F6-S TO SIDE TAB

27) PLUG FASTONS MARKED (SW-NO & SW-C) TO SWITCH 0340-128 AS SHOWN

28) PLUG (2) WHITE SPADES TO FILTER 1000-1700

29) PLUG (2) BLACK SPADES TO FILTER 1000-1700 AS SHOWN

PROCESSOR	SEQUENCE TITLE	ISSUE	REV	PART NUMBER	SEQ. NO.	
M FLADEBOE	LABEL/COMP	1	0	B851-001	10	SHT: 5 OF: 1



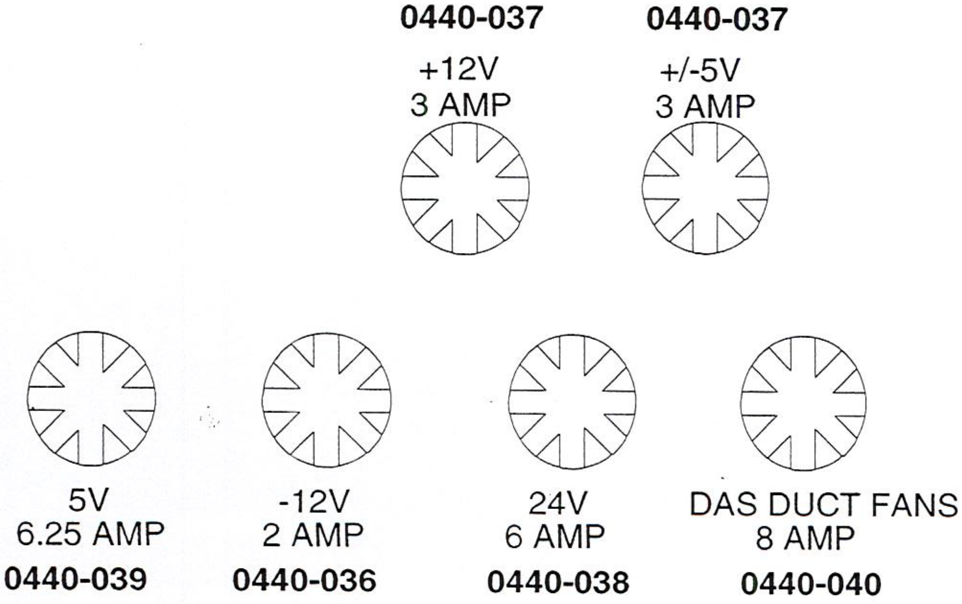
30) ATTATCH CLIP 1000-1704 QTY (2) TO FILTER & MOUNT TO BOX AS SHOWN USING SCREW 1000-1710 & LOCTITE 6850-399

31) OBTAIN POWER SUPPLY 0650-011 AND ATTATCH TO BOX USING SCREW 1000-1701 & LOCTITE 6850-399 AS SHOWN

32) REPLACE PLASTIC COVER IN POSITION COVERING SCREW HEADS

OCESSOR	SEQUENCE TITLE	ISSUE	REV	PART NUMBER	SEQ. NO.	
M FLADEBOE	LABEL/COMP	1	0	B851-001	10	SHT: 6 OF: 1

21. REMOVE COVERS FROM FUSE HOLDERS & INSERT FUSES. REPLACE FUSE COVERS



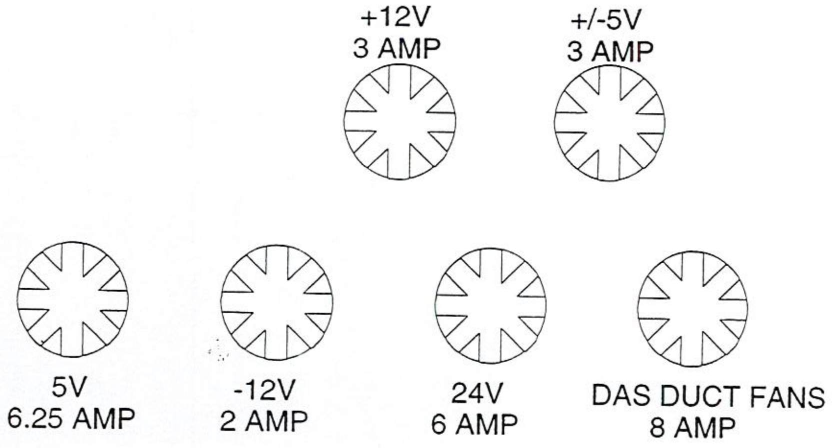
PROCESSOR	SEQUENCE TITLE	ISSUE	REV	PART NUMBER	SEQ. NO.	
M FLADEBOE	LABEL/COMP	1	0	B851-001	10	SHT: 7 OF: 1

[redacted] PROCESS DETAIL

SEQ 30 TEST

SEQ 40 FINAL AUDIT SEE ATTACHED PRINT

NOTE: VERIFY THAT EACH FUSE HOLDER HAS THE CORRECT FUSE



PROCESSOR	SEQUENCE TITLE	ISSUE	REV	PART NUMBER	SEQ. NO.	
M FLADEBOE	LABEL/COMP	1	0	B851-001	10	SHT: 8 OF: 1