

A STUDY TO DETERMINE THE MATERIAL TO BE INCLUDED
IN A REFERENCE BOOK FOR WELDERS AND FABRICATORS

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ABSTRACT

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A Study to Determine the Material to be Included
in a Reference Book for Welders and Fabricators

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In many industries, workers often require reference materials to help them perform their jobs more effectively and efficiently. With 23 years of experience working as a welder and fabricator, the researcher has learned that welders and fabricators in industry find themselves in the same situation. At this time there is no all-inclusive general reference book in publication for the average welder or fabricator that deals specifically with the reference material, subject matter, and data needed to support the welding and fabrication trade.

The purpose of this study is to verify the lack of an all-inclusive reference guide for welders and fabricators, and to identify and rank in importance the specific content areas that deal with the trade and could be incorporated into a general welding reference book. A review of

literature showed that although there are many reference books available to welders and fabricators, no single book contains all of the information necessary for them to perform their jobs in the most effective and efficient manner.

A formal survey of a representative sample of people in welding training and in the trade was conducted to identify what they thought should be included in an all-inclusive welding reference book. The population surveyed were: welders and fabricators, fabrication supervisors, and welding engineers at six welding and fabrication industries in the Eau Claire, Wisconsin metropolitan area; the students enrolled in the summer 2003 Welding Program at Chippewa Valley Technical College and their instructor; and 30 welding instructors at the other 15 Wisconsin Technical Colleges.

The study found that 92 percent of those surveyed thought it was important to include as main content areas: layout and fabrication hints, steel specifications, electrode identification and specifications, conversion tables, and mathematical formulas. The study also found that 79 percent believed that the 19 subtopics on the survey were important or somewhat important. The demographic data indicates that the survey population has enough years of experience, 11.9 per person, to make their input on the topics relevant to the study. From the results of the research it is concluded that there is a need for an all-inclusive general welding reference book for welders and fabricators and that all of the topics in the survey are important to the respondents and should be incorporated into the book.

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Chapter 1

Introduction

Background of the Study

In many industries, workers often require reference materials to help them perform their jobs more effectively and efficiently. According to Robert E. Green, editor of Machinery's Handbook, a reference book or handbook makes a practical tool and can be used just like any other tool, to work faster, to be less costly, and to produce a product of better quality (p. v). Those new to the workforce or to a different occupation are especially in need of the technical content included in reference books dealing with their area of work. Occupations that require reference books are numerous and wide-ranging, from the medical and legal fields to the engineering and manufacturing fields. Researchers and writers also use manuals such as the Publication Manual of the American Psychological Association, which help them use the correct format and style in their writing. A reference book is intended to help those who are attempting to solve a problem, perform a task, or to do a better quality job using the correct methods to get the correct results. The welding and fabrication industry is also one of the occupations where reference manuals are crucial.

The researcher is currently a welding instructor at Chippewa Valley Technical College (CVTC). The welding department requires students in the layout and fabrication class to purchase reference material that will be useful to them in class. Students report difficulty in finding a single book containing all the material they need. A student needs several books to access the required information. With 23 years of experience working as a welder and fabricator, the researcher has learned that welders and fabricators in industry find themselves in the same situation, often needing to access several different reference manuals or books in order

to do their job properly. In addition, it is often necessary to carry reference material to various job sites. Not only is it cumbersome to carry more than one book, the books are often too large to fit into the average toolbox.

It would be helpful if the information required were in a single, general welding reference book measuring no wider than 6 inches and no longer than 12 inches. This raises the following questions: what reference manuals or books are currently available, what information in the current materials is useful, and what is missing?

Student feedback indicates that current books on the market are either too specific, are written for education, or are too general. An example of a book that is too specific is the Pipe Fitter's Handbook, which pertains only to pipefitting, a small subset of welders' and fabricators' tasks. The reference data section in the book contains 86 pages of formulas and conversion charts. The remaining 333 pages deal with pipe welding, pipe fabrication, pipe fittings, and flanges. The book is a convenient size, measuring 4 1/2 inches by 7 inches with a total of 419 pages, and can be carried easily to various job sites. This is a book published for “steamfitters, pipe welders, plumbers, hydraulic fitters” Lindsey (1967), not for the general welder or fabricator.

Textbooks designed specifically for the education of welders and fabricators deal with the theory of welding and the basic processes used in the welding trades. Textbooks such as Modern Welding, Advanced Welding, Welding Principals and Applications, Welder's Handbook a Complete Guide to MIG, TIG, ARC & Oxyacetylene Welding, Welding Technology, Modern Welding Technology, Welder/Fitter's Training Guide, are used by many welding instructors. These books introduce the student to welding by covering the history of welding, the definition of welding, and welding uses (Cary, 1998, Jeffus, 1999, Kennedy, 1982). They also offer

specific training exercises such as those in the Welder/Fitter's Training Guide (Stewart, 1994) and the Welder's Handbook a Complete Guide to MIG, TIG, ARC & Oxyacetylene Welding (Finch, 1997). The reference sections containing formulas and conversion charts vary in length from 6 pages (Cary, 1998), to 13 pages in Modern Welding (Althouse, Turnquist, Bowditch, Bowditch, 1997), and 22 pages in Advanced Welding (Gibson, 1997). The size of these books are all 8 1/2 inches by 11 1/2 inches and range in number of pages from 169 pages (Finch, 1997) to 901 pages (Jeffus, 1999) making them cumbersome to carry and use at various job sites.

One pocket-sized general reference book on the market that is valuable and easy to use for trades people (Anderson, 1993) is the Pocket Ref., by Thomas J. Glover. The size of the book is 3 1/4 inches by 5 1/2 inches and contains 542 pages. It dedicates 8 pages to welding information like electrodes, welding gases, soldering, and brazing. It has 18 pages for steel and metal specifications, covering steel dimensions and weights of various different mild steel shapes. It also contains a 39-page math formula and functions table section. This reference book covers some of the topics important to welders, such as sections on welding information, steel specifications, and references, but these sections are limited to 65 pages out of 542 pages of other broad content areas not dealing with welding and fabrication.

To get the same information in the depth needed to be valuable and productive for welders and fabricators, a student or trades person needs to purchase at least three books: a steel specification book such as Ryerson Stock List from steel distributors like Joseph T. Ryerson & Son, Inc.; an electrode and welding wire specification book like Hobart Pocket Welding Guide published by welding distributors and manufactures such as Hobart Brothers Company; and a book that has a reference data section like the Pipe Fitter's Handbook, which contains a math and trigonometric section plus conversion tables. The necessity to reference several books is

currently the only option available, making welders' and fabricators' jobs more cumbersome and ultimately affecting both effectiveness and efficiency.

Problem Statement

There is no all-inclusive general reference book in current publication for the average welder or fabricator that deals specifically with the reference material, subject matter, and data needed to support the welding and fabrication trade. The importance of such a reference book is well said by John P. Stewart in The Welder's Handbook.

The welder will find the key to the skills necessary for performing work of professional quality, where requirements dictate the need for scores of variable welding processes and applications to suit the many varied types of alloys to be welded. Welding procedures, guidelines, recommended machine settings, charts and illustrations, and troubleshooting guides all serve not to only facilitate the operator's struggle to meet present-day job demands effectively, but also to pave the way in preparing for appointments to the positions of greater importance (1981, p. vii).

Richard S. Sabo, Assistant to the CEO, The Lincoln Electric Company states The Procedure Handbook of Arc Welding "will be of practical value to ... welding operators, their supervisors and managers, and owners of fabrication shops and steel erection firms." (1994 preface) which indicates the importance of a reference book for many related people in different areas of a trade. The material in reference books is designed to help a worker meet job demands effectively as well as to increase efficiency. It would be faster and easier to have the materials that help welders and fabricators be more effective available in one reference book instead of several.

Purpose of the Study

The purpose of this study is to identify and rank in importance the specific content areas that deal with the welding and fabrication trade that could be incorporated into a general welding reference book.

Objectives

The objectives for the study are:

1. To identify the major content areas of a general welding reference book that would be useful to welders and fabricators both in education and industry.
2. To rank the content areas in order of importance to determine if the content area is significantly relevant to the reference book.
3. To determine subtopics which should be incorporated under each of the content areas indicated as the most important and relevant by the survey population.

Significance of the Study

1. A significant factor of the study is to validate the need for a general welding reference book to support the content of the research. The pretense is that welders and fabricators now need several books to cover the reference data they need. Time is money and efficiency reduces time spent on a task, therefore it is logical that it would be beneficial to have a single reference book available to welders and fabricators containing the necessary information for their occupation. Reducing time spent looking for information will increase both efficiency and productivity.
2. The study gathered from the survey population the material, information areas, and topics most often utilized by welders and fabricators. Defining the most important topics will help to categorize the information more effectively and keep it relevant to the nature of the reference book design.

Limitations of the Study

1. The researcher developed the measuring instrument used for the study. All attempts were made to keep the instrument valid and reliable.
2. The survey population was limited to welding trades' people in the general area in and around Eau Claire, Wisconsin, welding instructors in state of Wisconsin, and CVTC welding students.
3. The range of educational background and work experience in the population used in the survey.

Summary and Methodology

Through many years working as a welder and fabricator in the field and as a welding instructor, the researcher has perceived a need for one all-inclusive reference manual for both students and trades people in the welding and fabricating industry.

Currently, both professionals and students need to reference as many as three books in order to perform their jobs properly. This reduces efficiency and productivity.

The study attempts to identify the material useful to welders and fabricators by surveying welders and fabricators, fabrication supervisors, welding engineers, welding students, and welding instructors. The researcher intends, thereby, to validate the hypothesis that there is a need for an all-inclusive reference manual for welders and fabricators in industry and education.

The following chapters will include an exhaustive literature review conducted to enhance the researcher's already extensive knowledge on the topic. Detailed information on the methodology of the study including subjects, instrumentation, procedures, and data analysis follow. The study concludes with a sample of the survey as well as references used in preparing the paper.

Chapter 2

Review of Literature

The review of literature relating to the topic of one concise reference manual for welders and fabricators was twofold. First, an extensive search was conducted to locate pre-existing studies similar to this one. Second, thorough research was done to identify the welding and fabricating reference material currently available to CVTC welding students and to the general welding population, then to choose and analyze a representative sample of those materials.

The researcher explored the Internet, Dakota County Minnesota Public Library System, University of Wisconsin Stout Library System, and CVTC Library System for studies analyzing the problem of no single, concise reference manual for welders and fabricators. After a comprehensive search, no similar studies were found. Therefore, the review of literature will consist of an analysis of a representative sample of the reference materials currently available to welders and fabricators.

The literature is grouped into six major categories:

1. Textbooks
2. Training manuals
3. General reference books
4. Welding reference books
5. Steel specification books
6. Electrode and welding wire classification books

A book from each category will be analyzed according to a set of criteria so each book will be subjected to the same standards. The purpose of this process is to determine what is now available, how it is useful, and how it is lacking.

The criteria for analysis will be:

1. Content areas
2. Lack of certain content areas

Once a sample book in each of the categories has been analyzed a determination can be made as to its practical use for both students and trades people. The review process will cover representative books from each category starting with the textbook category. For purposes of this mini proposal only one book will be covered in each category.

Textbooks

For purposes of this study textbook will be defined as "a book used in the study of a subject" (Webster, p. 913). The subject matter referred to will be welding. The textbook selected is a common book used in the teaching field and is authored by a recognized expert in the publication industry. The book is Welding Technology second edition, G.A. Kennedy (1982) and is the book currently used at CVTC.

Welding Technology second edition

1. Content areas

Welding Technology second edition consists of 6 parts sub-divided into 28 chapters and includes an appendix, a glossary, and an index. It measures 8 1/2 inches by 11 1/2 inches.

The book begins by covering the basics of welding, such as an introduction to the welding processes, careers in welding, metallurgy, metal testing properties and identification, effects of heating and cooling, weld positions, and safety in welding.

Other sections contain information on specific types of welding such as oxyacetylene welding, shielded metal arc welding (SMAW), tungsten inert gas (TIG) welding, flux-core arc welding (FCAW), and metal inert gas (MIG) welding. Topics covered for each type of

welding include the equipment needed and how to set it up, and the procedures that can be performed. Additional information on filler rods and fluxes, electrode classification and selection, filler metals, and shielding gases is also covered.

The appendix section consists of 12 pages of conversion charts and TIG welding procedures. There is also a pipe specification chart and a heat transformation chart. The majority of the section is dedicated to the TIG charts, 7 pages of the 12 total pages. The glossary and index sections are complete and useful additions to the book.

2. Lack of certain content areas

There are a number of important content areas lacking in the textbook Welding Technology second edition. Math references, detailed electrode and filler material guides, steel specifications, dimensions, sizes, and weights are all inadequate. The book dedicates only 3 pages to stick electrode selection and identification. Only 10 charts in 3 chapters on TIG welding are for selecting weld polarity, tungsten, and filler metals. The book also contains only 12 charts for the MIG welding and FCAW processes, and welding wire selection. As well as being inadequate, the charts are scattered throughout the book making them difficult to locate quickly. There are only a few reference charts that show the selection of filler metals according to base metal properties.

The math section consists of six charts on metric conversion to the U.S. system and temperature equivalents. There is no information on math formulas for area, volume, circumference, or any other needed formula used in the fabrication trade. There are no trigonometric tables or charts used in the layout processes, including the essential tables and charts for triangles.

The steel specification chart is limited to only one for standard pipe specifications. There are no charts for weights of steels and alloys or for the size and dimensions of the various shapes of steel members. The book also lacks specifications on steel selection for specified applications and intended purposes.

Though Welding Technology second edition does contain much of the information needed for welding students, it is still inadequate on its own as a good general welding reference book. It is also inadequate on its own for welders and fabricators in industry and is not organized in a way that makes it easy to reference. In addition, the size is large, making it impossible to fit into most toolboxes.

All books grouped into the textbook category follow a similar format as Welding Technology second edition. Although textbooks are excellent for teaching welding principles and practices, they are less than ideal for a general welding reference book.

Training Manuals

Training manuals teach skills in a specific discipline. They begin by introducing the reader to basic concepts, and progress to complex practices. There are many styles of manuals on the market, and although textbooks could be grouped into this category, they are covered separately because textbooks deal more with the theory of a discipline than hands-on learning. For the purpose of this research, training manuals will be referred to as those reference materials that deal with specific fields of study, and include written and hands-on exercises for students. The book analyzed in this section is Welder/Fitter's Training Guide, J.P. Stewart (1994) which is widely used in the welding field.

Welder/Fitter's Training Guide

1. Content areas

Welder/Fitter's Training Guide has 33 lessons covered in 168 pages and measures 8 1/2 inches by 10 3/4 inches. It contains a small three-page glossary of welding terms, an index section, and a page listing other books by the author.

The training manual begins with an introduction to basic fabrication alignment tools and is followed by lessons that increase in complexity. The majority of the lessons are designed to be hands-on learning exercises. The lessons are structured very well in that they provide a list of the supplies needed to perform the lesson and the step-by-step procedures to complete them.

Lessons 1, 6, 7, 8, 31, and 32 are written lessons. Even though these lessons are designed for reading knowledge, the author provides sample hands-on exercises to help increase the reader's comprehension. Although the written exercises are not laid out with a detailed procedure like the other chapters, they are still very useful.

Welder/Fitter's Training Guide is an excellent book for teaching welding students and for beginning fabrication people to better prepare themselves for the welding and fabrication trade. It contains good information about the tools and methods used in the metal working environment. Many of the fabrication tips and tricks of the trade are helpful to the beginner, as well as the experienced welder and fabricator.

2. Lack of certain content areas

Although Welder/Fitter's Training Guide is an excellent training guide, it lacks important areas necessary in a general reference book for welders and fabricators. There are no math formulas or trigonometric functions in the book. The book contains no information on steel

specifications or material selection, electrode identification and electrode selection. The book contains no conversion charts, such as metric conversion, which are useful to welders and fabricators. The book's size also makes it less than ideal, as it is difficult to carry in a toolbox.

The other books in this category closely follow the format of the Welder/Fitter's Training Guide, making them all inadequate for a general welding and fabrication reference book.

General Reference Books

General reference books contain information that can be useful to a person in any trade or area of work. These books are more general in nature and cover a wider range of topics. One such book for the welding and fabrication trade is the Pocket Ref. by Thomas J. Glover (1992), of which Anderson wrote, "The contents lean toward the applied sciences and industrial trades, although there is a general information section" (Anderson, 1993, p. 614). The book covers many topics, which appeal to many different areas of interest; it is not designed for one specific trade area, such as welding. It does have a small section that deals with welding but it is limited in content.

There are many such books on the market, some of which are more trade-oriented than others. The book reviewed in this area is Pocket Ref. second edition, Thomas J. Glover (2001). The reason for selecting this particular book is that it is commonly used in welding and fabrication education as well as in the field.

Pocket Ref. second edition

1. Content areas

Pocket Ref. second edition contains 27 topic sections and an index section with a total of 542 pages, and measures 3 1/4 inches by 5 1/2 inches. The book dedicates 8 pages to

welding information such as electrode identification, amperage suggestions for electrode size, welding gases, soldering and brazing alloys, and fluxes. It has 18 pages for steel and metal specifications, covering steel dimensions and weights of various mild steel shapes. It also contains 39 pages of math formulas and function tables. The book has a 64-page section on various conversion factors, and a small section containing 12 pages of plumbing and pipe information.

Pocket Ref. second edition is one of the better general reference books on the market for welders and fabricators as it includes much of the detailed information needed in a reference book. The math reference section is almost ideal and the conversion factors are very good. Its size is right for carrying in a toolbox and the addition of tabs makes the information easy to locate.

2. Lack of certain content areas

Although Pocket Ref. second edition contains many of the content areas needed for a general welding reference book, those areas are limited, lacking electrode and welding wire selection charts for given applications and materials, and specific electrode and welding wire compositions. The steel specification section lacks material application for intended use, and the math section lacks the ranges necessary in the decimal conversion charts.

The book also lacks layout and fabrication information helpful to welders and fabricators. There are no welding procedure specifications, weld symbol identification charts, or fabrication procedures. There is no section on welding equipment and maintenance, or on welding processes.

Therefore, although Pocket Ref. second edition contains some of the detailed information lacking in other types of books on the market, it has shortcomings and several important

areas are not included in the book at all, making it inadequate as a general welding reference guide.

Welding Reference Books

Welding reference books deal specifically with welding and the welding trade. These books help people working in the field of welding and fabrication by providing “welding procedures, guidelines, recommended machine settings, charts and illustrations, and trouble shooting guides ... to meet present day job demands” (Stewart, 1981, p.vii). The book that will be reviewed in this category is Pipe Fitter’s Handbook, F. R. Lindsey (1967).

Pipe Fitter’s Handbook

1. Content areas

Pipe Fitter’s Handbook consists of 5 parts and an index for a total of 419 pages, and is a convenient carrying size, measuring 4 1/2 inches by 7 inches. The reference data section, Part 5, is very good as it contains an impressive 86 pages of math formulas, trigonometric functions, decimal equivalents of fractions, and conversion charts. Part 5 also contains other reference data such as spark identification of metals, weights and measures of materials, pipe systems identification, and tank capacities. The remaining 4 parts and 333 pages deal with pipe bending, pipe fabrication, soldering and brazing, pipe fittings, and flanges. This is a book published for “steamfitters, pipe welders, plumbers, hydraulic fitters” Lindsey (1967), rather than the general welder or fabricator.

2. Lack of certain content areas

Pipe Fitter’s Handbook does not include electrode and welding wire selection charts for given applications and materials, specific electrode and welding wire compositions, or steel specifications including material application for intended use. The book lacks layout and

fabrication information, welding procedure specifications, weld symbol identification charts, and fabrication procedures. There is no section on welding equipment and maintenance, or welding processes.

Although this book contains a good math section, overall it is too specific to the pipe fitting trade and not general enough for the average welder or fabricator.

Steel Specification Books

Steel specification books are published by steel distributors and steel manufactures to illustrate the material they supply. This type of book is valuable to welders, supervisors, purchasing agents, design engineers, and many other people in the metal working field. They contain details on weight, size, and dimensions of the various shapes of steel. Depending on the supplier or manufacturer, the books will contain information covering everything from mild steel plate to aluminum pipe and plastics. The information in this type of book is valuable to welders and fabricators for selecting the correct material for a given application, calculating weight of a structure for rigging and lifting, and to correctly match material sizes and types with each other. The book reviewed in this section will be Ryerson Stock List, Joseph T. Ryerson & Son, Inc. (1968).

Ryerson Stock List

1. Content areas

Ryerson Stock List contains 11 tabbed sections covering steel shapes, weights, dimensions, and plates. These sections include steel, stainless steel, aluminum, nickel, and plastic. The book also contains one small data section of conversion information including fractions to decimal, metric to standard, and steel tolerances. It is very useful for project designs, and identifying and choosing the proper materials. The book is a convenient

carrying size measuring 5 1/2 inches by 8 1/2 inches. It is also very convenient to use because it is spiral bound, allowing it to lay flat when opened, and has the tabbed sections making finding the information easy.

2. Lack of certain content areas

Ryerson Stock List lacks math and trigonometric formula sections as well as electrode classification and selection charts. It also does not have any welding procedure specifications, welding equipment or process information, or any layout and fabrication information.

Although its size and design are ideal, and it offers necessary information on materials, Ryerson Stock List is far too specific to steel and does not offer the more general guides and specifications needed in a general welding and fabricating reference manual.

Electrode and Welding Wire Classification Books

Electrode and welding wire classification books are reference materials typically published by manufactures of welding materials and provide a complete list of their product line. These types of books supply the user with the means to determine filler metal composition and selection for specific welding tasks. They also supply the user with information about weld polarity selection, position the electrode can be used in, and the codes and specifications the electrodes and filler metals comply with (ESAB, p. iii). This type of information is important to welders, supervisors, and engineers to insure the proper selection of filler material for the type of metal being joined and the application used. The book analyzed in this section is Hobart's Pocket Welding Guide, Hobart Brothers Company (1988).

Hobart's Pocket Welding Guide

1. Content areas

Hobart's Pocket Welding Guide contains 224 pages divided into 5 sections. The first section covers general information such as the five essentials for proper welding, weld types and positions, material identification methods, and weld symbol charts. Another section contains 116 pages of information on electrodes, welding wire, and fluxes. The book also includes a technical section, an equipment section, and a miscellaneous section. The information contained in this book or, similar books, is a must-have for welders and fabricators in order for them to make informed decisions about filler metal selection and properties. The book is a convenient carrying size, measuring 4 3/8 inches by 7 inches.

2. Lack of certain content areas

Hobart's Pocket Welding Guide does not contain information on steel specification, dimensions, and weights. It has no math reference section. There is no section on layout and fabrication procedures, or weld procedure specifications.

Although the book contains crucial information about filler metals, its complete lack of so many other crucial areas makes it inadequate as a general reference guide for welders and fabricators.

Summary

Although an extensive search was done, no study looking at the problem of no one all-inclusive reference manual for welders and fabricators was found. Therefore the review of literature consisted of books and manuals currently available and an analysis of how each of them covered the information necessary for a reference manual for welders and fabricators.

The review of literature shows that there currently is no book available that includes all the information necessary for welders and fabricators in industry or in education. Books analyzed ranged from textbooks and training manuals to such specialized material as steel specification books. All were found to lack crucial information.

Chapter 3

Methodology

The study will be conducted in the Eau Claire, Wisconsin metropolitan area in the summer of 2003. As stated earlier, the purpose of the study is to identify and rank in importance the specific content areas that deal with the welding and fabrication trade, which could be incorporated into a general welding reference book. This section will be divided into four areas: subjects, instrumentation, procedures, and data analysis.

Survey Population

The study will survey the following population: welders and fabricators, fabrication supervisors, and welding engineers at six welding and fabrication industries in the Eau Claire, Wisconsin metropolitan area; the students enrolled in the summer 2003 Welding Program at CVTC and their instructor; and 30 welding instructors at the other 15 Wisconsin Technical Colleges. All subjects will be 18 years old or older with a minimum of one year of welding experience or welding training. These subjects were selected because they use reference books like those discussed earlier, or have the expertise to make a judgment on what content should be included in a general reference book for welders and fabricators.

Instrumentation

Two methods will be used to gather information, the internet e-mail and personal interviews. The instrument is in the form of a formal survey and begins by requesting demographic data from the subjects, such as title/position, years of experience, level of education, and welding training. This information is necessary, as it will indicate whether or not the subject has the experience to make knowledgeable choices on the survey. The rest of the survey consists of a list of content areas related to welding and fabrication. There are five main

topics and supporting subtopics, which the subjects are asked to rate as important, somewhat important, or not important to include in a reference manual for welders and fabricators. The survey concludes with a write-in question asking the subject if there are any other topics that they think should be included.

Procedures

A total of 95 surveys were either e-mailed or completed in a personal interview. The 30 welding instructors at the other 15 Wisconsin Technical Colleges were e-mailed surveys on June 26, 2003 with a return request date of July 8, 2003. The 65 personal interviews were completed from June 26, 2003 to July 8, 2003 at six manufacturing industries in the Eau Claire, Wisconsin metropolitan area and at CVTC.

Data Analysis

The information gathered will be organized to answer each of the objectives of the study. The ranking of the major content areas as important, somewhat important, or not important will indicate whether or not the content areas on the survey are important to those who have completed it, thus fulfilling objective number one: To identify the major content areas of a general welding reference book that would be useful to welders and fabricators both in education and industry.

The ranking of the major content areas as important, somewhat important, or not important will indicate whether or not the survey items should be included in a reference book, thus fulfilling objective number two: To rank the content areas in order of importance to determine if the content area is significantly relevant to the reference book.

The ranking of the subtopic items as important or somewhat important will fulfill objective number three: To determine subtopics, which should be incorporated under each of the content areas indicated as the most important and relevant by the survey population.

The write-in suggestions the survey population offered as topics that also should be included will be listed in chapter four and will not be ranked in importance.

Chapter 4

Data Analysis

The purpose of this study is to identify and rank in importance the specific content areas that deal with the welding and fabrication trade that could be incorporated into a general welding reference book. At this time, there is no all-inclusive general reference book in current publication for the average welder and fabricator that deals specifically with the reference material, subject matter, and data needed to support the general welding trade.

The pretense is that welders now need several books to access the reference data required to perform their jobs in the welding and fabrication trade. Time is money and efficiency reduces time spent on a task, therefore it is logical that it would be beneficial to have a single reference book available to welders and fabricators containing the necessary information for their occupation. Reducing time spent looking for information will increase both efficiency and productivity.

The study gathered data from the survey population using a formal survey instrument. The study surveyed the following population: welders and fabricators, fabrication supervisors, and welding engineers at six welding and fabrication industries in the Eau Claire, Wisconsin metropolitan area; the students enrolled in the summer 2003 Welding Program at CVTC and their instructor; and 30 welding instructors at the other 15 Wisconsin Technical Colleges.

The survey instrument was designed to gather the material, information areas, and topics most often utilized by welders and fabricators. The survey was two pages long and began with demographic questions. The type of information gathered in this section was job title or position, years of experience in the welding or fabrication trade, level of education completed, and what type of welding training the respondent had. The remainder of the survey asked the

respondent to rank five main topics and 19 subtopics as important, somewhat important, or not important to include in a reference guide for welders and fabricators. The survey ended by asking the respondent to indicate any information that was not in the topics already listed that they thought should be. The data collection period took approximately two weeks allowing time for the e-mail respondents to reply and the personal interviews to be completed.

Research Results

There were a total of 95 surveys used in this study. There were 30 surveys e-mailed to welding instructors at 15 technical colleges in the state of Wisconsin. The e-mail responses were 6 out of the 30 sent equaling a 20 percent return; two of the surveys returned by email were unreadable, making 4 of the 6 usable and dropping the email response rate to 13.3 percent. A total of 65 personal interviews were completed with a 100 percent return rate. Excluding the 2 unreadable e-mail surveys the total responses for the survey was 69 out of 95 surveys resulting in a 72.6 percent return rate. Tables 4.1 and 4.2 contain a breakdown of responses by question.

Demographic data

The demographic data can be found in Table 4.1. The first demographic question asked the respondents to state their job title or position. The responses to that question were 16 welding students, 33 welders, 6 fabricators, 5 welding instructors, 5 supervisors, 1 engineer, and 3 as other. The next question asked for years of work experience. Among respondents there are a total of 821 years of combined work experience and an average of 11.9 years per person. The levels of education were 24 from high school, 41 from technical college, 2 from undergraduate school, and 2 at the graduate school level. The last demographic question asked for the respondents' welding training, which resulted in 4 from high school, 44 from the technical college system, 19 with on the job training, and 2 listed other.

Table 4.1 Demographic Data

Demographic Data							
Title/ Position	Student	Welder	Fabricator	Instructor	Supervisor	Engineer	Other
	16	33	6	5	5	1	3
Years Experience	Total surveys sent	Number of surveys returned	Percent replied	Total years exp.	Average years exp.		
	95	69	72.6%	821	11.9		
Level of Education	High School	Technical College	Community College	Undergraduate School	Graduate School		
	24	41		2	2		
Welding Training	High School	Technical College	On the job	Other			
	4	44	19	2			

Survey Data

The survey data can be viewed in Table 4.2. The survey data was divided into five main topics with several subtopics listed under each main topic. The respondents were asked to circle or put an “X” next to the number that best represented what they thought about the topics' importance to be included in the reference book. The number 1 represented important, meaning they thought it was important to include this topic in the reference book. The number 2 represented somewhat important that the topic be included, and number 3 represented that the topic was not important to the book.

The first main topic was steel specifications and 51 respondents, or 73.91 percent, marked it as important; 16, or 23.19 percent, marked it as somewhat important; and 2, or 2.90 percent, marked it as not important. The first of the three subtopics under steel specifications was steel dimensions which 50 respondents, or 72.46 percent, marked as important; 16, or 23.19 percent, marked as somewhat important; and 3, or 4.35 percent, marked as not important. The second subtopic under steel specifications was steel weights which

28 respondents, or 40.58 percent, marked as important; 30, or 43.48 percent, marked as somewhat important; and 11, or 15.94 percent, marked as not important. The last subtopic under steel specifications was steel tolerances which 41 respondents, or 59.42 percent, marked as important; 26, or 37.68 percent, marked as somewhat important; and 2, or 2.90 percent, marked as not important.

The second main topic was electrode identification and specifications and 50 respondents, or 72.46 percent, marked it as important; 17, or 24.64 percent, marked it as somewhat important; and 2, or 2.90 percent, marked it as not important. The first of the four subtopics under electrode identification and specifications was selection charts for mild steel which 46 respondents, or 66.67 percent, marked as important; 18, or 26.09 percent, marked as somewhat important; and 5, or 7.25 percent, marked as not important. The second subtopic was selection charts for stainless steel which 49 respondents, or 71.01 percent, marked as important; 18, or 26.09 percent, marked as somewhat important; and 2, or 2.90 percent, marked as not important. The third subtopic under electrode identification and specifications was selection charts for aluminum which 47 respondents, or 68.12 percent, marked as important; 15, or 21.74 percent, marked as somewhat important; and 7, or 10.14 percent, marked as not important. The last subtopic for this section was amperage ranges which 47 respondents, or 68.12 percent, marked as important; 18, or 26.09 percent, marked as somewhat important; and 4, or 5.80 percent, marked as not important.

The third main topic was mathematical formulas and 36 respondents, or 52.17 percent, marked it as important; 28, or 40.58 percent, marked it as somewhat important; and 5, or

7.25 percent, marked it as not important. The first of the five subtopics under mathematical formulas was trigonometry functions which 31 respondents, or 44.93 percent, marked as important; 25, or 36.23 percent, marked as somewhat important; and 13, or 18.84 percent, marked as not important. The second subtopic was angle formulas which 46 respondents, or 66.67 percent, marked as important; 16, or 23.19 percent, marked as somewhat important; and 7, or 10.14 percent, marked as not important. The third subtopic under mathematical formulas was areas which 36 respondents, or 52.17 percent, marked as important; 25, or 36.23 percent, marked as somewhat important; and 8, or 11.59 percent, marked as not important. The fourth subtopic was circumferences which 39 respondents, or 56.52 percent, marked as important; 19, or 27.54 percent, marked as somewhat important; and 11, or 15.94 percent, marked as not important. The last subtopic was volumes which 29 respondents, or 42.03 percent, marked as important; 26, or 37.68 percent, marked as somewhat important; and 14, or 20.29 percent, marked as not important.

Conversion tables was the fourth main topic on the survey instrument and 47 respondents, or 68.12 percent, marked it as important; 19, or 27.54 percent, marked it as somewhat important; and 3, or 4.35 percent, marked it as not important. The first of the three subtopics under conversion tables was inch/decimal/foot conversions which 56 respondents, or 81.16 percent, marked as important; 13, or 18.84 percent, marked as somewhat important; and 0 marked as not important. The second subtopic was metric conversions which 33 respondents, or 47.83 percent, marked as important; 24, or 34.78 percent, marked as somewhat important; and 12, or 17.39 percent, marked as not important. The last subtopic under conversion tables was temperature conversions which 32 respondents, or 46.38 percent, marked as important; 27, or

39.13 percent, marked as somewhat important; and 10, or 14.49 percent, marked as not important.

The fifth and last main topic was layout and fabrication hints and 57 respondents, or 82.61 percent, marked it as important; 12, or 17.39 percent, marked it as somewhat important; and 0 marked it as not important. The first of the four subtopics under layout and fabrication hints was welding procedure specifications which 56 respondents, or 81.16 percent, marked as important; 13, or 18.84 percent, marked as somewhat important; and 0 marked as not important. The second subtopic was weld symbols which 55 respondents, or 79.71 percent, marked as important; 11, or 15.94 percent, marked as somewhat important; and 3, or 4.35 percent, marked as not important. The third subtopic was welding equipment and processes which 47 respondents, or 68.12 percent, marked as important; 22, or 31.88 percent, marked as somewhat important; and 0 marked as not important. The last subtopic under layout and fabrication hints was fabrication procedures which 46 respondents, or 66.67 percent, marked as important; 22, or 31.88 percent, marked as somewhat important; and 1, or 1.45 percent, marked as not important.

The last item on the survey instrument asked the respondents to indicate any information that was not listed in the topic section that they thought should be included in a welding reference book. Eleven suggestions were written in and they were, welding equipment maintenance, weld ability of various types of metals, heat affected zone and distortion of weldments, how to read a tape measure, recommended gases for different metals and processes, gas flow setting, electrodes for combining dissimilar metals, preheat and post heat information, volt and amperage settings for different thicknesses of metal, weld positions, and safety issues for grinders, cranes and rigging.

Table 4.2 Survey Data

Survey Items	Important	Somewhat Important	Not Important	Total surveys sent	Total respondents	% replied	% Important	% Somewhat Important	% Not Important
Steel Specifications	51	16	2	95	69	72.63%	73.91%	23.19%	2.90%
Steel dimensions	50	16	3	95	69	72.63%	72.46%	23.19%	4.35%
Steel weights	28	30	11	95	69	72.63%	40.58%	43.48%	15.94%
Steel tolerances	41	26	2	95	69	72.63%	59.42%	37.68%	2.90%
Electrode Identification & Specifications	50	17	2	95	69	72.63%	72.46%	24.64%	2.90%
Selection charts for mild steel	46	18	5	95	69	72.63%	66.67%	26.09%	7.25%
Selection charts for stainless steel	49	18	2	95	69	72.63%	71.01%	26.09%	2.90%
Selection charts for aluminum	47	15	7	95	69	72.63%	68.12%	21.74%	10.14%
Amperage ranges	47	18	4	95	69	72.63%	68.12%	26.09%	5.80%
Mathematical Formulas	36	28	5	95	69	72.63%	52.17%	40.58%	7.25%
Trigonometry Functions	31	25	13	95	69	72.63%	44.93%	36.23%	18.84%
Angle formulas	46	16	7	95	69	72.63%	66.67%	23.19%	10.14%
Areas	36	25	8	95	69	72.63%	52.17%	36.23%	11.59%
Circumferences	39	19	11	95	69	72.63%	56.52%	27.54%	15.94%
Volumes	29	26	14	95	69	72.63%	42.03%	37.68%	20.29%
Conversion Tables	47	19	3	95	69	72.63%	68.12%	27.54%	4.35%
Inch/decimal/foot	56	13	0	95	69	72.63%	81.16%	18.84%	0.00%
Metric	33	24	12	95	69	72.63%	47.83%	34.78%	17.39%
Temperature	32	27	10	95	69	72.63%	46.38%	39.13%	14.49%
Layout & Fabrication Hints	57	12	0	95	69	72.63%	82.61%	17.39%	0.00%
Welding Procedure Specifications	56	13	0	95	69	72.63%	81.16%	18.84%	0.00%
Weld symbols	55	11	3	95	69	72.63%	79.71%	15.94%	4.35%
Welding equipment & processes	47	22	0	95	69	72.63%	68.12%	31.88%	0.00%
Fabrication procedures	46	22	1	95	69	72.63%	66.67%	31.88%	1.45%

Analysis

The information gathered will be discussed and organized to answer each of the objectives of the study. The demographic data indicates that the survey population has enough years of experience, 11.9 per person, to make their input on the topics relevant to the study. The study gathered information from a broad spectrum of those in the metal fabrication industry to

get a good opinion from the different job duties of this trade. The study received surveys from students, welders, fabricators, instructors, supervisors, and engineers all who need access to the type of reference materials discussed in previous chapters. The level of education and welding training was predominantly from the technical college system, 61.6 percent completed this level of education and training. The survey population was found to be qualified to possess the expertise to make judgments on the topic material of the survey.

The survey data collected on the topics ranked as important, somewhat important, or not important will be organized to answer the objectives of the study. The ranking of the major content areas as important, somewhat important, or not important will indicate whether or not the content areas on the survey are important to those who have completed it, thus fulfilling objective number one: To identify the major content areas of a general welding reference book that would be useful to welders and fabricators both in education and industry.

The ranking of the major content areas as important, somewhat important, or not important will indicate whether or not the survey items should be included in a reference book, thus fulfilling objective number two: To rank the content areas in order of importance to determine if the content area is significantly relevant to the reference book.

The ranking of the subtopic items as important, somewhat important, or not important will fulfill objective number three: To determine subtopics, which should be incorporated under each of the content areas indicated as the most important and relevant by the survey population.

Objective number one

Objective number one is to identify the major content areas of a general welding reference book that would be useful to welders and fabricators both in education and industry. The survey instrument indicated five major content areas for the respondents to rank. The vast

majority of the respondents ranked the five main topics or content areas as either important or somewhat important. The major content areas were steel specifications, electrode identification and specifications, mathematical formulas, conversion tables, and layout and fabrication hints. With the high percentage of respondents ranking the five major content areas as important or somewhat important, all of them would be important to include in a general welding reference book.

Objective number two

Objective number two is to rank the content areas in order of importance to determine if the content area is significantly relevant to the reference book. All major content areas were found to be important to the reference book in objective number one. These content areas were given a percentage rating as to being important, somewhat important, and not important. In order to determine how relevant the respondents thought these topics were the important and somewhat important answers were combined in order to get a better picture where these topics fall in order of importance to the respondents (see Table 4.3).

The main topic layout and fabrication hints had a combined percentage of 100 percent, ranking it as most important to the respondents. Second were both steel specifications and electrode identification and specifications, each with a combined 97.10 percent. Third were conversion tables with a combined percent of 95.65. And forth were mathematical formulas with 92.75 percent. All main topics ranked very high with the respondents, in the 90th percentile, making them relevant to be included in a general welding reference book.

Table 4.3 Survey Data Ranking

Survey Items	Important	Somewhat Important	Not Important	Important	% Somewhat Important	% Not Important	Combined important/ somewhat important %	Ranking
Steel Specifications	51	16	2	73.91%	23.19%	2.90%	97.10%	2
Steel dimensions	50	16	3	72.46%	23.19%	4.35%	95.65%	4
Steel weights	28	30	11	40.58%	43.48%	15.94%	84.06%	10
Steel tolerances	41	26	2	59.42%	37.68%	2.90%	97.10%	3
Electrode Identification & Specifications	50	17	2	72.46%	24.64%	2.90%	97.10%	2
Selection charts for mild steel	46	18	5	66.67%	26.09%	7.25%	92.75%	6
Selection charts for stainless steel	49	18	2	71.01%	26.09%	2.90%	97.10%	3
Selection charts for aluminum	47	15	7	68.12%	21.74%	10.14%	89.86%	7
Amperage ranges	47	18	4	68.12%	26.09%	5.80%	94.20%	5
Mathematical Formulas	36	28	5	52.17%	40.58%	7.25%	92.75%	4
Trigonometry Functions	31	25	13	44.93%	36.23%	18.84%	81.16%	12
Angle formulas	46	16	7	66.67%	23.19%	10.14%	89.86%	7
Areas	36	25	8	52.17%	36.23%	11.59%	88.41%	8
Circumferences	39	19	11	56.52%	27.54%	15.94%	84.06%	10
Volumes	29	26	14	42.03%	37.68%	20.29%	79.71%	13
Conversion Tables	47	19	3	68.12%	27.54%	4.35%	95.65%	3
Inch/decimal/foot	56	13	0	81.16%	18.84%	0.00%	100.00%	1
Metric	33	24	12	47.83%	34.78%	17.39%	82.61%	11
Temperature	32	27	10	46.38%	39.13%	14.49%	85.51%	9
Layout & Fabrication Hints	57	12	0	82.61%	17.39%	0.00%	100.00%	1
Welding Procedure Specifications	56	13	0	81.16%	18.84%	0.00%	100.00%	1
Weld symbols	55	11	3	79.71%	15.94%	4.35%	95.65%	4
Welding equipment & processes	47	22	0	68.12%	31.88%	0.00%	100.00%	1
Fabrication procedures	46	22	1	66.67%	31.88%	1.45%	98.55%	2

Objective number three

Objective number three is to determine subtopics, which should be incorporated under each of the content areas indicated as the most important and relevant by the survey population. There were 19 subtopics on the survey instrument for the respondents to rank as important, somewhat important, or not important. As seen in Table 4.3, all but one of the subtopics ranked in the 80th percentile as being important or somewhat important to the respondents. The only

subtopic that had a lower ranking was volumes under the mathematical formulas main topic. Volumes still has a combined percentage of 79.71 percent but ranked last by the respondents. Even with its last place ranking its percentage is high enough that it would be a relevant subtopic to be included in a welding reference book. All of the other subtopics were seen by the respondents to be very relevant.

Many of the respondents suggested subtopics that were not on the instrument that they thought should be considered. These responses were, welding equipment maintenance, weld ability of various types of metals, heat affected zone and distortion of weldments, how to read a tape measure, recommended gases for different metals and processes, gas flow setting, electrodes for combining dissimilar metals, preheat and post heat information, volt and amperage settings for different thicknesses of metal, weld positions, and safety issues for grinders, cranes and rigging. All of these are very good topics and will be taken into consideration.

Summary

The information gathered indicates that the majority of the respondents thought all the survey items were either important or somewhat important to include in a general welding reference book. The demographical data suggests that the survey population was qualified to make a determination of the importance of the topic matter on the survey instrument. From the review of literature and the survey result there seems to be a general consensus that there is a need for a one all-inclusive general welding reference book.

Chapter 5

Summary, Conclusions, and Recommendations

This chapter will conclude the study by bringing all the information together in one clear and concise chapter. The chapter will be divided into three different sections, a summary of the preceding four chapters, the conclusions derived from the study, and recommendations from the researcher.

Summary

At this time, there is no all-inclusive general welding reference book in publication for the average welder and fabricator that deals specifically with the reference material, subject matter, and data needed to support the general welding trade. The pretense is that welders now need several books to cover the reference data, which they use in the welding and fabrication trade. A review of literature was conducted to verify this statement.

The review of literature in chapter two found that there are many books and reference materials available to those in the welding and fabrication trades. The problem that was revealed is that none of them had all of the information utilized by welders and fabricators in one concise book. Each book reviewed had different material that would be valuable to a person in the metal trades. This being the case, it proves the fact that several books are now needed in order to access the required information for a welder or fabricator to perform their job to the best of their ability. Time is money and efficiency reduces time spent on a task, therefore it is logical that it would be beneficial to have a single reference book available to welders and fabricators containing the necessary information for their occupation. Reducing time spent looking for information will increase both efficiency and productivity. This being the premise of the research study a survey was conducted to answer three objectives.

The objectives for the study are:

1. To identify the major content areas of a general welding reference book that would be useful to welders and fabricators both in education and industry.
2. To rank the content areas in order of importance to determine if the content area is significantly relevant to the reference book.
3. To determine subtopics which should be incorporated under each of the content areas indicated as the most important and relevant by the survey population.

To fulfill the objectives of the study formal surveys were sent to the following population: welders and fabricators, fabrication supervisors, and welding engineers at six welding and fabrication industries in the Eau Claire, Wisconsin metropolitan area; the students enrolled in the summer 2003 Welding Program at CVTC and their instructor; and 30 welding instructors at the other 15 Wisconsin Technical Colleges. The returned surveys were compiled into three different tables: Table 4.1, which contains the demographic data of the survey; Table 4.2, which contains the survey data; and Table 4.3, which contains the survey data ranked in order of importance.

The survey was performed using personal interviews at the six welding and fabrication industries in the Eau Claire, Wisconsin metropolitan area and the students and instructor at CVTC. Questionnaires were sent by e-mail to the 30 welding instructors at the other technical colleges in Wisconsin. The return percentage for the study was 72.6 percent (Table 4.1).

The demographic data indicates that the survey population has enough years of experience, 11.9 on average per person, to make their input on the topics relevant to the study. The study gathered information from a broad spectrum of those in the metal fabrication industry to get a good opinion from the different job duties of this trade. The level of education and

welding training was predominantly from the technical college system; 61.6 percent completed this level of education and training. The survey population was found to be qualified and to possess the expertise to make judgments on the topic material of the survey.

Objective number one

Objective number one was to identify the major content areas of a general welding reference book that would be useful to welders and fabricators both in education and industry. The survey instrument had five major content areas for the respondents to rank. The content areas were steel specifications, electrode identification and specifications, mathematical formulas, conversion tables, and layout and fabrication hints. A total of 92 percent of the respondents responded that these content areas were either important or somewhat important (Table 4.3).

Conclusion. According to the survey data it is determined that all of the major content areas would be important main topics for a general welding reference book. The respondents ranked these five areas above the 90th percentile in order of importance to them.

Recommendation. It is recommended that these five content areas be the five main chapters for a general welding reference book for welders and fabricators. With the five main chapters being steel specifications, electrode identification and specifications, mathematical formulas, conversion tables, and layout and fabrication hints the subtopics will be easily organized under each corresponding chapter heading.

Objective Number Two

Objective number two was to rank the content areas in order of importance to determine if the content area was significantly relevant to the reference book. All major content areas were found to be important to the reference book in objective number one. In order to see how

relevant these topics are to the reference book, the important and somewhat important answers were combined in order to get a better picture of where these topics fall in order of importance to the respondents (Table 4.3). The main topic layout and fabrication hints had a combined percentage of 100 percent, making it the most important to the respondents. Second were both steel specifications and electrode identification and specifications, each with a combined 97.10 percent. Third was conversion tables with a combined percent of 95.65, and fourth was mathematical formulas with 92.75 percent.

Conclusion. All main topics ranked very high with the respondents, in the 90th percentile, making them relevant to be included in a general welding reference book. The survey results show that layout and fabrication hints was considered to be the most important topic. Both steel specifications, and electrode identification and specifications ranked second in importance. Conversion tables ranked third by the respondents, and mathematical formulas ranked fourth.

Recommendation. It is recommended that layout and fabrication hints be the first chapter in a general welding reference book. Chapters two through five should be steel specifications, electrode identification and specifications, conversion tables, and mathematical formulas respectively.

Objective Number Three

Objective number three was to determine subtopics, which should be incorporated under each of the content areas indicated as the most important and relevant by the survey population. There were 19 subtopics on the survey instrument for the respondents to rank as important, somewhat important, or not important. As seen on Table 4.3, all but one of the subtopics ranked in the 80th percentile as being important or somewhat important to the respondents. The only subtopic that had a lower ranking was volumes under the mathematical formulas main topic.

Volumes still has a combined percentage of 79.71 percent which is high enough to be considered important.

The respondents also suggested subtopics that were not listed on the survey and that they thought should be considered. These responses were, welding equipment maintenance, weld ability of various types of metals, heat affected zone and distortion of weldments, how to read a tape measure, recommended gases for different metals and processes, gas flow setting, electrodes for combining dissimilar metals, preheat and post heat information, volt and amperage settings for different thicknesses of metal, weld positions, and safety issues for grinders, cranes and rigging.

Conclusion. From the survey results it is concluded that all 19 subtopics are important, making them relevant to be included in a general welding reference book. The items suggested by the respondents are significant topics and would be of great value to a welder or fabricator.

Recommendation. It is recommended that all 19 subtopics be included in a reference book under their respective content areas. It is also recommended that the topics suggested by the respondents be included.

Conclusions

It was concluded by the review of literature that there is currently no all-inclusive general welding reference book for welders and fabricators. With the premise that using one reference manual would be more efficient and thereby increase worker productivity, the study attempted to identify topics that would be useful to include in one general reference book for welders and fabricators.

A formal survey was conducted of people who would most likely use such a book. The study found that 92 percent of those surveyed thought it was important to include as main

content areas, layout and fabrication hints, steel specifications, electrode identification and specifications, conversion tables, and mathematical formulas. The study also found that 79 percent believed that the 19 subtopics on the survey were important or somewhat important. The respondents offered 11 suggestions they considered important to include as well.

Recommendations

It is recommended that all five main content areas and their respective subtopics be included in a general welding reference book for welders and fabricators. It is also recommended that the additional information suggested by the respondents be included.

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Appendix A – Survey Instrument

June 26, 2003

Jon Will
Welding Instructor
Chippewa Valley Technical College
620 W. Clairemont Ave.
Eau Claire, WI 54701-6162

Mr. John Doe
Title
Company
Street
City, State, Zip

Dear Mr. Doe,

In an effort to gather data for my thesis, I have enclosed a survey that I hope you will take a few moments to complete.

I am conducting a study to determine the material to be included in a reference book for welders and fabricators. It is my contention that in order to perform their job in the highest quality manner, workers in the welding and fabrication trades need to reference a variety of specifications and guidelines regarding such areas as steel specifications, electrode identification, math formulas, and conversion tables.

Currently a welder or fabricator must reference at least three different manuals to obtain the necessary information to perform his/her job properly. A job should not only be done well but also be performed in the most efficient manner possible. I contend that it would be helpful to be able to access all the reference material needed in one concise and easy to use manual.

Enclosed please find consent information and the survey questionnaire. The questionnaire begins with general demographic questions necessary for the study. The bulk of the survey consists of a list of materials for you to rate as Important, Somewhat Important, or Not Important to include in a general reference guide for workers in the welding and fabrication trades. Lastly there is an area provided for any suggestions you may have.

Thank you in advance for taking time to complete the questionnaire. As I will be analyzing the data during the week of July 14th 2003, I would appreciate your prompt response.

Sincerely,

Jon Will

June 26, 2003
Mr. John Doe
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Consent Information:

I understand that by returning this questionnaire, I am giving my informed consent as a participating volunteer in this study. I understand the basic nature of the study and agree that any potential risks are exceedingly small. I also understand the potential benefits that might be realized from the successful completion of this study. I am aware that the information is being sought in a specific manner so that no identifiers are needed and so that confidentiality is guaranteed. I realize that I have the right to refuse to participate and that my right to withdraw from participation at any time during the study will be respected with no coercion or prejudice.

NOTE: Questions or concerns about participation in the research or subsequent complaints should be addressed first to the researcher or research advisor Dr. Michael J. Galloy, and second to Sue Foxwell, Human Protections Administrator, UW-Stout Institutional Review Board for the Protection of Human Subjects in Research, 11 Harvey Hall, UW-Stout, Menomonie, WI 54751, phone (715)232-1126.

**A Study to Determine the Material to be Included in a Reference Book
for the Welding and Fabrication Trades**

Please complete the following survey. Thank you for your time and assistance.

Demographic Data:

Title/Position _____

Years of Experience in the Welding/Fabrication Trade _____

Level of Education Completed (circle one below)

High School Technical College Community College Undergraduate School Graduate School

Welding Training (circle one below)

High School Technical College On-The-Job Other _____

Survey Data:

In the following survey section you will find a list of content areas related to welding and fabrication. In an effort to determine which areas would be beneficial compiled in one resource, please rate your opinion of their importance by circling the corresponding number. At the end of this list you will be given an opportunity to write in any other information you feel would be important to include in a reference manual to be used by welders and fabricators.

Content areas to include in a reference manual to be used by Welders and Fabricators:

	Somewhat Important	Somewhat Important	Not Important
Steel Specifications	1	2	3
Steel dimensions	1	2	3
Steel weights	1	2	3
Steel tolerances	1	2	3
Electrode Identification & Specifications	1	2	3
Selection charts for mild steel	1	2	3
Selection charts for stainless steel	1	2	3
Selection charts for aluminum	1	2	3
Amperage ranges	1	2	3
Mathematical Formulas	1	2	3
Trigonometry functions	1	2	3
Angle formulas	1	2	3

Areas	1	2	3
Circumferences	1	2	3
Volumes	1	2	3
Conversion Tables	1	2	3
Inch/decimal/foot	1	2	3
Metric	1	2	3
Temperature	1	2	3
Layout and Fabrication Hints	1	2	3
Welding Procedure Specifications	1	2	3
Weld symbols	1	2	3
Welding equipment & processes	1	2	3
Fabrication procedures	1	2	3
		Somewhat	Not
		Important	Important

Please indicate any information not listed above that you feel would be important to include:
