Intended for teachers of adult basic education as well as teachers in job retraining programs, this book focuses on the development of written and oral language competencies required in occupational and training settings. The first four chapters offer a concise synthesis of recent research on adult learning and workplace literacy for ten occupations: account clerk, auto mechanic, draftsman, electrician, heating/air conditioning mechanic, industrial maintenance mechanic, licensed practical nurse, machine tool operator, secretary, and welder. The fifth chapter presents instructional strategies and techniques for the development of job related skills in these occupations, and the sixth chapter discusses methods and information for technical vocabulary development. The appendixes include lists of high frequency and technical words often used in the ten occupations. (HOD)
OCCUPATIONAL LITERACY EDUCATION

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY IRA TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)"

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The research on which this book is based was funded by an Adult Education Special Projects grant to Purdue University from the Indiana Department of Public Instruction

Cover design by Boni Nash
In Occupation: Literacy Education, Timothy Rush, Alden Moe, and Rebecca Storlie perform a needed service for educators everywhere. Most educators are aware that the workplace is changing and that service and technical professions are growing. Few educators are aware, in specific, of what this means for the adults and adolescents they teach. Occupational Literacy Education provides glimpses of the sorts of reading, writing, and oral language adults face during training and on the job for ten different occupations ranging from account clerk to auto mechanic to licensed practical nurse.

High school teachers and reading specialists may be surprised at the difficult and complex literacy tasks which will confront their noncollege-bound students. Students anxious to leave high school so they can escape reading and writing should be brought face to face with the reality of on-the-job and training reading materials gathered in Occupational Literacy Education. Reading specialists will want to share portions of the book with vocational education, science, mathematics, and business education teachers who can borrow ideas to improve the real world basic skills of their students.

Occupational Literacy Education also will be useful to adult educators. Teachers of adult basic education as well as teachers in job retraining programs will appreciate the book's concise synthesis of recent research on adult learning and on workplace literacy. The recommendations of applications oriented instructional methods presented in the fifth chapter are particularly useful. Many adult educators who prepare students to take high school equivalency examinations (GED) have complained about the dearth of job oriented literacy materials to help adults see the connection between their learning and a chance to get a good job and improve the quality of
their lives. A mixture of GED materials and ideas from *Occupational Literacy Education* should provide a useful balance of learning experiences to keep adults motivated with practical reading tasks while they are also preparing for the less immediate academic reading tasks on the GED examination.

I have shared portions of this text with a number of experienced teachers. For many, the last direct experience with nonteaching work was a summer job held years ago during college days. Most are startled by the wide gap between their own memories of simple job literacy tasks of a decade or more ago and the complexities of the ten occupations studied by Rush and his colleagues. This startling glimpse of current workplace reality may, in the final analysis, be the most valuable contribution of *Occupational Literacy Education*.

Larry Mikulecky
Indiana University
Bloomington, Indiana
This book has been prepared for a varied audience of educators. Our primary goal, however, has been to provide adult and occupational educators with basic information for developing literacy and related occupational competencies. Chapters 1 through 4 present foundational knowledge as a basis for instruction.

We believe that teachers at every level of the educational process should recognize the value of applying literacy and literacy related competencies in work related contexts. Recommendations of applications oriented instructional methods are made in Chapter 5.

The vocabulary of work, with its combination of purely technical and multiple meaning words, should provide a basis for instruction in reading and basic occupational knowledge. Chapter 6 is devoted to methods of vocabulary development and lists of high frequency and technical words are presented in the Appendices.

Finally, we are grateful to our students, colleagues, and reviewers who have questioned our ideas and critiqued our work. Since this project began with all three authors working together in Indiana, and has been completed with the authors working in Wyoming, Louisiana, and Minnesota, respectively, it is difficult to recognize all who have helped. Nevertheless, we express thanks to the many individuals who contributed.
The International Reading Association attempts, through its publications, to provide a forum for a wide spectrum of opinions on reading. This policy permits divergent viewpoints without assuming the endorsement of the Association.
Preparing people for success in occupational roles is a complex and difficult process. Functional competencies must be developed in critical areas ranging from affective characteristics, manual arts, and technical knowledge to mathematics, written language, and oral language. This book focuses on the development of written and oral language competencies required in occupational and training settings. Occupational literacy and the literacy competencies necessary for success in work and training environments are described. Building on the summary of human cognition, we offer instructional recommendations for developing occupational literacy and related competencies. The last chapter is devoted to methods of vocabulary development, and may be used in conjunction with the technical vocabularies listed in the Appendices.

The ability to competently read required, work related materials is defined here as occupational literacy. This definition, based on a concept of functional literacy (Kirsch & Guthrie, 1977-1978), is limited to competence with printed materials of all sorts. By definition, functional literacy varies according to individual demands of divergent roles, settings, and materials. Occupational literacy competencies comprise a subset of functional literacy. Required competencies vary from occupation to occupation and from job to job within occupations.

Occupational literacy development is an important aspect of prevocational, vocational, and on-the-job education. Occupational literacy related linguistic competencies—writing and oral language—also require instructional attention.
Literacy and Work

Until recently, little research has been done on the subject of work related literacy. The lack of information about the literacy requirements of specific occupations has been cited (Kirsch & Guthrie, 1977-1978; Sticht, 1980) as a serious obstruction to the development of effective occupational and literacy training programs. In their review of literacy programs in industrial, military, and penal settings, Ryan and Furlong (1975) noted only scattered reports related to the literacy requirements of industrial occupations. Systematic analysis of the literacy requirements of jobs, though relatively easy to conduct, has received little attention from researchers. Ryan and Furlong argued that, although many programs intended to improve adult literacy have been motivated by economic interests, the lack of research on occupational literacy makes it impossible to know if literacy training has any effect on successful employment.

Research on occupational literacy, sponsored largely by the United States Armed Forces, has provided insight about the extent to which reading is used in work and training settings and the nature of reading tasks in those settings. Sticht (1975) reported that incumbents in military jobs are consistently confronted with reading tasks which average two hours per work day. In the same report, Sticht noted that the difficulty of required reading materials often exceeded the measured reading abilities of successful workers. Kern (1970) observed results similar to those noted by Sticht. Disparities between reading requirements and reading abilities resulted in the disuse of technical manuals by military technicians.

In an examination of reading in the Navy, Sticht et al. (1977a) distinguished between two dominant uses of reading in occupational settings; reading-to-do tasks differ from reading-to-learn tasks in that the former are used to accomplish work while the latter involve retention of information for later use. According to this research, 75 percent of the reading tasks done by military personnel involve reading-to-do. In these tasks, written and graphic information is referred to and used, but is not learned. Sticht also noted that 1) materials encountered in reading-to-do are rarely unfamiliar to the worker; 2) such materials are commonly reread on a daily basis; and 3) the permanence of printed materials enables them to serve as a kind of external memory for workers.

A second study by Sticht et al. (1977b) analyzed reading-to-do tasks required of Navy personnel in ten occupations and training programs. The authors reported that fact finding and following directions are the most frequent reading-to-do tasks. Job related reading typically involves finding
facts or following directions presented in combined graphic and text formats. Workers and instructors used fact finding skills twice as often as they used skills in following directions; students used following directions skills twice as much as fact finding skills.

Literacy research on civilian occupations is less plentiful than research involving military occupations. Recent studies, however, indicate that the requirements of civilian occupations are similar to those of military occupations. Diehl and Mikulecky (1980) reported that, for a broad cross section of occupations, daily reading is almost universally required.

The amount of time spent on daily occupational reading in civilian contexts is substantial. In describing the reading habits of adults, Sharon (1973-1974) reported a median of 61 minutes spent on work related reading tasks. Mikulecky, Shanklin, and Caverly (1979) reported a mean of 73 minutes per day of work related reading. Diehl (1980) observed a mean work related reading time of 113 minutes per day. Diehl's figure is similar to the two hours per day reported by Sticht (1975) for military occupations.

Sticht et al. (1977a) and Diehl and Mikulecky (1980) called attention to important differences between the reading materials and processes observed in occupational settings compared to materials and processes observed in school settings. Reading-to-do tasks occur in about the same proportion in civilian occupational reading as in military contexts; reading-to-learn predominates in civilian occupational training settings.

In suggesting reasons why civilian and military workers can cope with reading demands which exceed their abilities, Diehl (1980) and Diehl and Mikulecky note the highly repetitive nature of on-the-job reading tasks and the influence of worker interest, motivation, experience, and specialized knowledge. They emphasize that workers can use extralinguistic cues (equipment and tools) to aid understanding. Diehl, however, observed that it may be inappropriate to view on-the-job reading materials as indicators of literacy demands, suggesting that such materials reflect only "opportunities" to use reading as a tool for increasing job efficiency and success. In most cases, workers have recourse to other sources (supervisors and co-workers, for instance) of necessary information.

Writing and Other Competencies

Diehl (1980) reported that in 64.7 percent of occupational writing examined, the task involved completing simple forms or preparing brief
memoranda. Writing tasks were repeated frequently enough for workers to master the most complex forms. Memoranda were simple, concise, and relatively easy to write. Diehl suggested that further research may show that writing competencies required for successful job performance are simple, and unrelated to the writing tasks observed in schools.

The nature of listening competencies required at work has received little attention from researchers. Sticht (1975), however, described studies which show that military personnel learn equally well through listening or reading and noted that it is possible for such personnel to learn from tape recordings played at accelerated rates.

A general sense of the importance of listening skills in occupational settings can be inferred from studies of adults in general. Rankin's study (1926) indicated that 70 percent of daily adult activities involve oral communication and 45 percent of communication involves listening. The amount of oral communication time typical of occupations varies considerably, but it seems likely that about 50 percent of such time requires listening.

It might also be inferred that the nature of reading and listening tasks in on-the-job and school settings is similar. Possible parallels between occupational listening and reading competencies, however, require examination through research.

Summary

Research dealing with the literacy competencies of occupations and training programs indicates that:

• reading tasks are part of virtually all occupations studied;
• workers perform reading tasks for major portions of the work day;
• reading materials and processes observed in work settings are distinctly different from those found in school settings; and
• occupational materials are successfully read by workers who seem to lack the necessary reading abilities.

Little is known about competencies related to occupational literacy. While writing tasks seem to be brief and highly repetitive in nature, occupational uses of oral language remain largely unexamined.
References


Rankin, P. *The measurement of the ability to understand spoken language.* Doctoral dissertation, University of Michigan, 1926.


Studies of Occupational Literacy Requirements

The studies which form the basis of this book were conducted in response to a need expressed by employment and guidance counselors, adult educators, and students in adult basic education, for information about the literacy demands of specific occupations. The occupations studied are frequently chosen as career goals by adult basic education students. Officials of educational and social service agencies confirmed the need to examine the following ten occupations:

- Account Clerk
- Auto Mechanic
- Draftsman
- Electrician
- Heating/Air Conditioning Mechanic
- Industrial Maintenance Mechanic
- Licensed Practical Nurse
- Machine Tool Operator
- Secretary
- Welder

Goals

While the work of researchers such as those cited previously has contributed to important knowledge about the nature of occupational reading requirements and abilities, much in depth study of reading and other linguistic requirements of work remains to be done. Knowledge of such factors, their interrelatedness, and their effects on job performance are...
essential to those concerned with prevocational, vocational, and on-the-job training.

The goals of the studies discussed here were to 1) identify the reading, writing, listening, and speaking competencies required in ten skilled and semiskilled occupations; 2) compare those requirements with those in corresponding vocational training programs; and 3) evaluate the relative importance of the identified competencies to successful job performance.

Definitions and Assumptions

Occupational literacy, like functional literacy, can be a confusing concept. Functional literacy, for example, has been defined to include speaking, listening, writing, and computational competencies. Job success depends on many levels of competence. In occupational settings, job knowledge, experience, dependability, motivation, cooperativeness, and perseverance are important cognitive and affective qualities. Though not directly involved with literacy, competence with language and numerical processes is often necessary for successful job performance.

As mentioned earlier, the definition of occupational literacy used in these studies—functional competence in reading job related materials—was derived from Kirsch and Guthrie (1977-1978) who proposed that functional literacy be defined according to the demands of specific situations in terms of competency in reading alone. In their view, listening, speaking, writing, and computation involve functional cognitive competence. In these studies, listening, speaking, and writing were defined as literacy related competencies.

The following assumptions prompted and guided the investigations.

1. Reading, writing, listening, and speaking competencies are essential to worker success in the occupations examined.
2. Job supervisors view occupational literacy and related competencies as essential to successful worker performance.
4. Higher levels of literacy and literacy related competencies are required for success in occupational training programs than are necessary for success on the job.
5. The literacy and literacy related competencies required for success on the job and in vocational training programs are attainable by adults whose levels of literacy place them in adult basic education programs.
Population

The population in each study represented two groups, workers at job sites and students in training program courses. For each of the ten occupational categories, three job sites and three courses from a related training program curriculum were studied.

The thirty job sites studied were selected at random from an exhaustive list of employees representing a broad spectrum of business and industry in the greater Lafayette, Indiana (population approximately 115,000), area. At each job site, one worker and an immediate supervisor were involved. Workers were selected from pools of employees who had spent a minimum of six months on the job and who were judged by their employers to be functioning successfully in their work roles.

For each occupational category, three courses from a corresponding postsecondary vocational training program were studied. For the categories of electrician and heating/air conditioning mechanic, one course from an appropriate trade union apprenticeship program was studied. Each occupational category was involved with three courses from the curriculum of a state supported, postsecondary occupational training program. A total of twenty-five different courses were studied because the curricula of several of the occupational training programs had common course requirements.

Data Collection

Methods of data collection were similar in both job site and occupational training settings. Two thousand word samples of required reading materials were obtained from job site and occupational training program courses, including samples of textbooks, technical manuals, handbooks, instructional manuals for the installation and repair of equipment, memoranda and checklists written in informal and nonstandard English, and diagrams accompanied by clarifying words and phrases. When possible, passages were selected from materials according to the guidelines of the Dale-Chall (Dale & Chall, 1948) readability formula and the Fry Readability Graph (Fry, 1977). When samples were too brief for such guidelines to apply, entire samples were transcribed and analyzed. Some of the samples, such as memoranda and diagrams, were inappropriate or valid evaluation with the readability formulas used; such samples were, however, included as part of the corpus of language used to establish occupational vocabulary lists which appear in the appendices of this book.
Oral language requirements of the occupations studied were obtained by tape recording the oral language of workers or instructors and their coworkers or students during a typical one hour period of a workday. Oral language samples from training programs included both classroom and laboratory settings. Language recorded in this way was subsequently transcribed and keypunched for computer analysis.

Writing samples produced by workers and students in conjunction with their work and training activities were collected at each site.

Data Analysis Procedures

To determine the readability of required reading materials from the job and occupational training program sites, two well-known instruments were used. The Dale-Chall formula and the Fry Readability Graph were programmed in the FORTRAN language compatible with the Purdue University CDC 6600 mainframe computer. Each sample of required reading material was analyzed with both readability instruments. The readability results for each of the materials were then used to establish a readability range for work and training materials for each occupation.

Reading materials were examined with respect to the way in which they were used on site. Sticht's distinction (1975) between purposes for reading guided this aspect of the studies. The degree to which reading was used to accomplish work or to learn information was evaluated. Reading-to-do as opposed to reading-to-learn distinctions were made for required reading at each job and training program site. All required reading materials from job and training program sites were rated according to the level of formality of usage in which they were written.

Tape recordings of oral language produced on the job were transcribed and visually analyzed to establish the general level of English usage (Pooley, 1974).

Writing samples collected at each of the sites were evaluated for level of usage; legibility; and special characteristics such as inclusion of diagrams, sketches, and other aids to reader comprehension. Written and oral language samples were then combined. Computer programs were used to prepare technical vocabulary lists for each occupation as well as lists of the highest frequency words for each occupation and for the entire language sample.

Results of the studies are discussed in the following chapter.
References


This chapter presents and discusses the findings of studies of the reading, writing, and oral language requirements of the ten occupations and related training programs described in Chapter 2. The studies focused on the importance of reading to job performance, the amount of time spent reading, and how reading was used on the job. Reading and literacy related competencies necessary to successful job performance were examined through analysis of sample reading materials, handwritten communications, and tape recordings.

Data on competences required for success in occupational training programs were obtained through observations and from samples of reading, writing, and oral language from the curriculum of relevant vocational college programs.

On the Job

Literacy Requirements

Work related reading was performed daily by each of the workers involved in the studies. Consistent with the findings of Diehl (1980), Table 1 shows that reading was universally required of those studied, though there were variations in time spent reading and the nature of the reading task.
<table>
<thead>
<tr>
<th>Occupation</th>
<th>Average Daily Reading Time (minutes)</th>
<th>Type Material</th>
<th>Readability Score</th>
<th>Use</th>
<th>Frequency</th>
<th>Prose Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account Clerk</td>
<td>120</td>
<td>Correspondence, ledgers, lists, tables</td>
<td>Grade 13 to College Grad</td>
<td>To do</td>
<td>Daily</td>
<td>Informal, formal</td>
</tr>
<tr>
<td>Auto Mechanic</td>
<td>60</td>
<td>Technical references, memos, work orders</td>
<td>Grade 10 to College Grad</td>
<td>To learn, to do</td>
<td>Daily</td>
<td>Informal, formal</td>
</tr>
<tr>
<td>Draftsman</td>
<td>45</td>
<td>Technical references, blueprints, code books, reference books, memos</td>
<td>Grade 10 to College Grad</td>
<td>To do</td>
<td>Daily</td>
<td>Informal, formal</td>
</tr>
<tr>
<td>Electrician</td>
<td>120</td>
<td>Technical references, blueprints, schematics</td>
<td>College Graduate</td>
<td>To do</td>
<td>Daily</td>
<td>Informal, formal, technical</td>
</tr>
<tr>
<td>Heating/Air Conditioning Mechanic</td>
<td>45</td>
<td>Manuals, blueprints, memos</td>
<td>Grade 10 to College Grad</td>
<td>To learn, to do</td>
<td>Daily</td>
<td>Informal, formal</td>
</tr>
<tr>
<td>Industry</td>
<td>Grade</td>
<td>Learning Level</td>
<td>Frequency</td>
<td>Type</td>
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</tr>
<tr>
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<td>----------------</td>
<td>-----------</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Maintenance Mechanic</td>
<td>42</td>
<td>Grade 10 to College Grad</td>
<td>Daily, to do</td>
<td>Informal, technical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Licensed Practical Nurse</td>
<td>78</td>
<td>Grade 10 to College Junior</td>
<td>Daily, to do</td>
<td>Informal, formal</td>
<td></td>
<td></td>
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<tr>
<td>Machine Tool Operator</td>
<td>36</td>
<td>Grade 9 to College Grad</td>
<td>Daily</td>
<td>Informal, technical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secretary</td>
<td>168</td>
<td>Grade 16 to College Grad</td>
<td>Daily</td>
<td>Informal, formal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Welder</td>
<td>24</td>
<td>N/A</td>
<td>Daily</td>
<td>Informal</td>
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</table>
Workers reported that they sometimes reread the same material several times per workday, and that such repetition was necessary. Repeated reading was recognized as a means of avoiding costly memory related errors. Workers' statements reflected the consistent view that careful readings of checklists, instructions, and directions were necessary to job success and security. For example, when asked if careless reading of on-the-job materials could affect work, a draftsman replied, "Definitely! The entire reliability of our finished product may rely on proper sizes and testing requirements derived from [reading] the [building] code."

The average time spent reading work related materials during the workday was 66 minutes, with a range of 24 minutes to 4 hours per day. This average reading time is similar to the 61 minutes reported by Sharon (1973). Studies by Diehl (1980) and Sticht (1975) found that workers engaged in work related reading for approximately 2 hours per day.

The difference between the findings of Diehl and Sticht compared to those of Sharon and the studies discussed here may be due to the use of differing definitions of reading. Lacking a comprehensive definition of reading, workers and supervisors probably did not include time spent reading information in formats other than printed discourse; the use of labels, tables, charts, figures, blueprints, schematics and checklists, may not have been considered aspects of reading. In fact, all of these studies may underestimate the actual amount of reading done by workers. Recent research by Mikulecky (1982) indicates that workers themselves underestimated by an average of 45 percent the amount of time they spent reading.

Reading-to-do work was the predominant use of reading in all occupations. Only licensed practical nurses and industrial maintenance mechanics reported reading on the job in order to learn information. Nevertheless, in these, as in the other occupations, reading-to-do was the dominant use of reading. Similar findings were obtained by Diehl (1980) and Sticht (1975) who, respectively, reported that reading-to-do constituted 66 percent and 75 percent of on-the-job reading.

Reading materials encountered by workers participating in the studies discussed here were varied in length, type, level of usage, and format. Table 1 reflects this diversity. Materials included single page memoranda, forms, procedural checklists, and lengthy handbooks. Memoranda and forms often employed informal, truncated usage. Example 1 presents samples from the account clerk and machine tool operator occupations which are typical of materials found in all occupations studied.
Example 1. Informal styles of reading materials: Account clerk and machine tool operator.

**Account Clerk**
1. Check paid invoice file.
2. Check completed purchase order.
3. Go back to original receiving order.

**Machine Tool Operator**
1. Clean shavings from table.
2. Release locating pilots and clamp.
3. Remove pieces and lay them aside.
4. Position clamp bar, align stops, partly secure clamps.

The level of longer documents was generally formal, highly technical, and complex. Workers frequently were required to read texts such as those shown in Example 2.


**Heating/Air Conditioning**
Room thermostats and remote bulb insertion and immersion thermostats shall be two pipe, of the proportional relay type, except where two positioned action is necessary, and the temperature settings and reset ranges shall be adjustable to best meet the actual operation conditions.

**Nursing**
Attached to the trachea, this gland is located beneath the larynx and above the sternum. It is U-shaped (two lobes connected by an isthmus) and secretes a hormone called thyroxine.

Rating of the English used in materials read by workers on the job was done using Pooley's varieties (1974) of English usage. For all occupations, except welder, the range of usage varied from nonstandard, informal, and ungrammatical through formal and highly technical.

The format of on-the-job reading materials, whether informal or formal and technical in style, usually involved graphic presentation of information. Tables, charts, graphs and figures appeared both in conjunction with and apart from written text. Workers were required to find and inter-
pret such combinations of text and graphic information to perform daily routines. Skill in reading graphic information in formats such as those shown in Examples 3 and 4 is an important occupational literacy competency.

Example 3. Text and graphic format.

**Textual Format**

**Inspection Openings**

All pressure vessels for use with compressed air, except as permitted otherwise in this paragraph, and those subjected to internal corrosion, or having parts subject to erosion or mechanical abrasion (see ug-25) shall be provided with a suitable manhole, handhole, or other inspection opening for examination and cleaning. (Pressure Vessel Codebook, p. 42)

**Tabled Information**

<table>
<thead>
<tr>
<th>Building Element</th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
<th>Type IV</th>
<th>Type V</th>
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<td>Fire Resistive</td>
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<td>4</td>
<td>4</td>
<td>1</td>
<td>N</td>
<td>4</td>
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<tr>
<td>Interior Bearing Walls</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>N</td>
<td>1</td>
</tr>
<tr>
<td>Exterior Nonbearing Walls</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>N</td>
<td>4</td>
</tr>
</tbody>
</table>

(Understanding Building Code)

Graphic formats involving illustrations were found in each occupation. Example 4 shows a typical illustration.

Technical vocabulary presented special demands to workers in each occupation. Necessary words were sometimes purely technical, having single occupation specific meanings. More often workers had to recognize the occupational meanings of everyday words with multiple meanings.
Example 4. Typical illustration.

Wheel bearing adjustment can be checked by a push-pull procedure. Place one hand at ten o'clock on the outboard side of the tire. Place the other hand on the inside. Push and pull. Note any play. Adjust as necessary.

Placement of Hands in Checking Wheel Bearing Play

Literacy Related Requirements

Samples of written language from the studies revealed that only rudimentary skills were required. When Pooley's criteria (1974) for levels of English usage were applied to the writing produced at job sites, distinctions between printed and handwritten prose were clearly evident. Whereas the level of printed reading materials was usually formal and highly technical, handwritten materials were informally written and could sometimes be classified as nonstandard English. The secretarial occupation stood alone in requiring a formal level of writing.

Clarity was the chief requirement of on-the-job writing. Typical handwritten communications were done in concise, ungrammatical, nonstandard English containing only essential information. Messages and memoranda omitted articles (a, an, the) and resembled the style of English found in telegrams. Example 5 shows typical written communications from occupational settings.

Example 5. On-the-job writing.

*Nature of Trouble:* Two lights out.

*Action Taken:*
1. Replaced tube in one light fixture.
2. Replaced ballast in light fixture.

Light operating now, but still needs new ceramic end connection.
Diversity of legibility in handwriting was tolerated as long as it did not detract from communication of important information. In most occupations, workers produced scripts which would probably be considered marginal by elementary and secondary school standards. Higher standards of legibility were expected in the drafting and secretarial occupations in which quality of handwriting represented the employer to outsiders.

Oral Language

Oral language use on the job involved the production and interpretation of clear but informally constructed English utterances. Much language encountered was social and not directly related to work. When talk was work related, it focused on specific tasks, tools, and equipment.

Speakers often worked at being understood—repeating, rewording, referring to similar tasks, and demonstrating as necessary. Listeners questioned, restated instructions, and ted out tasks to make sure they understood what they had heard. Then they acted on the information and instructions they had heard. Example 6 presents typical work related conversation.


Account Clerk

“I think the credit is more than the debit. We would end up not writing a check, because we would get a debit from them for thirty-three eighty-four for two of these. We paid them because they gave us past due notices on them and Jones-Perkins finally put them through.”

Secretary

“Yes, may I talk to Mr. Jones, please? I’m calling in reference to your telephone etiquette seminar. We don’t have enough people to hold the class, so we’re going to have to cancel.”

Except in the secretarial jobs, in which formal usage was frequently employed, an informal level of usage typified on-the-job oral language. Clarity of communication was clearly more important than what might be termed “good grammar.”
The Training Programs

Literacy Requirements

Reading was a daily requirement of students in all training program courses associated with the ten occupations. As in the research reported by Sticht (1975) and Mikulecky (1982), reading was required in both training and work settings, but the nature of reading differed in these settings.

In contrast to the job sites where reading-to-do prevailed, reading-to-learn was dominant in the training programs. In reading-to-do, short term memory serves to temporarily store the information for immediate use. In reading-to-learn, short term memory functions to organize information for storage in long term memory.

Compared to workers, students spent much more time per day reading. During the school day and after hours, students read in classroom and laboratory situations, as well as during periods of independent study. Student reading, as estimated by instructors, ranged from forty-two minutes to six hours per day. Table 2 shows the estimated reading load for training programs corresponding to each occupation studied. The actual reading time for individual students was probably greater than the estimates shown. The table shows ranges based on estimates from three courses; most students were enrolled in more than three courses.

Reading in the training programs required extensive use of expository and descriptive prose. Textbooks, reference books, and sets of complex instructions were part of the daily required reading. In most required reading, students carefully studied and learned the information presented in text, graphic, and text/graphic formats similar to those found at the job sites.

Book length materials were used by students in classroom, laboratory, and independent study. Shorter materials in the form of quizzes, instruction sets, and chalkboard notes written by instructors were frequently encountered in the school settings. These materials, too, presented information in combinations of text and graphic formats.

The usage observed in the required reading materials was varied. As with materials from the job sites, styles ranged from informal and ungrammatical to formal, highly technical prose. Example 7 shows instances of informal and technical usage.
<table>
<thead>
<tr>
<th>Occupation</th>
<th>Average Daily Reading Time (minutes)</th>
<th>Type Material</th>
<th>Readability Score</th>
<th>Use</th>
<th>Frequency</th>
<th>Prose Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account Clerk</td>
<td>187</td>
<td>Textbooks, references, ledgers, chalkboard notes</td>
<td>Grade 11 to College Grad</td>
<td>To learn, to do</td>
<td>Daily</td>
<td>Informal, formal, technical</td>
</tr>
<tr>
<td>Auto Mechanic</td>
<td>108</td>
<td>Textbooks, references, figures, tables, chalkboard notes</td>
<td>Grade 9 to College Grad</td>
<td>To learn, to do</td>
<td>Daily</td>
<td>Informal, formal, technical</td>
</tr>
<tr>
<td>Draftsman</td>
<td>174</td>
<td>Textbooks, references, blueprints, figures, tables</td>
<td>Grade 9 to College Grad</td>
<td>To learn, to do</td>
<td>Daily</td>
<td>Informal, formal, technical</td>
</tr>
<tr>
<td>Electrician</td>
<td>280</td>
<td>Textbooks, references, figures, tables, chalkboard notes</td>
<td>Grade 10 to College Grad</td>
<td>To learn, to do</td>
<td>Daily</td>
<td>Informal, formal, technical</td>
</tr>
<tr>
<td>Heating/Air Conditioning Mechanic</td>
<td>120</td>
<td>Textbooks, references, figures, tables, blueprints</td>
<td>Grade 11 to College Grad</td>
<td>To learn, to do</td>
<td>Daily</td>
<td>Informal, formal, technical</td>
</tr>
<tr>
<td>Occupational Title</td>
<td>Textbooks, References, Figures, Tables, Blueprints</td>
<td>Grade Level</td>
<td>To Learn, To Do</td>
<td>Format</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-----------------------------------------------------</td>
<td>-------------</td>
<td>-----------------</td>
<td>--------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Maintenance Mechanic</td>
<td>Textbooks, references, figures, tables, blueprints</td>
<td>Grade 10 to College Grad</td>
<td>To learn, to do</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Licensed Practical Nurse</td>
<td>Textbooks, references, figures, tables, charts, procedures</td>
<td>Grade 12 to College Grad</td>
<td>To learn, to do</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machine Tool Operator</td>
<td>Textbooks, references, figures, tables, blueprints</td>
<td>Grade 9 to College Grad</td>
<td>To learn, to do</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secretary</td>
<td>Textbooks, references, figures, tables</td>
<td>Grade 10 to College Grad</td>
<td>To learn, to do</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Welder</td>
<td>Textbooks, references blueprints, figures, tables</td>
<td>Grade 8 to College Grad</td>
<td>To learn, to do</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example 7. Informal and technical usage.

**Informal**

Instructor (referring to a chalkboard diagram)

"Let's go back to those...to what's happening inside that stator winding. We've got a rotor with magnetic poles rotating. Right? Okay, what happens when all of a sudden we've got no magnetic load? Here we were inducing some current and now we don't have anything to induce against...."

**Technical Specifications**

Work required for installation of electrical rough-in in precast concrete slabs.

1. In general, the electrical contractor shall
   - Provide all layout of holes through the precast concrete slabs to the general contractor for approval by the precaster.
   - Core drill through the voids in the precast slabs for installation of conduits and boxes.
   - Conceal all conduits for lighting, outlets, etc., in the fill above the precast concrete slabs.

In each of the training programs, a specialized vocabulary was present. Words which made up these technical vocabularies took two forms. True technical words, peculiar to each occupation, formed one class of technical vocabulary; the second component involved everyday words with special occupational meanings. Mastery of both types of technical vocabulary was essential to student success.

**Writing**

In occupational training, writing took the form of note taking and writing examinations and assignments. In all cases, accuracy of information was more important than standard English usage. Instructional emphasis on grammatical correctness was present in the secretarial courses, but was not apparent in other courses. There was similarity between training program and on-the-job requirements in this regard; only when poor writing interfered with clear communication was it considered a problem. Example 8 shows samples of written language produced by training program students.
Example 8. Typical student writing.

Examination Questions

**Automotive Mechanic**

Question: One cause of failure of an engine to start is?
Response: Wet distributor.

**Welder**

Question: What is the function of a regulator?
Response: Controls gas flow.

Handwriting produced by students, like that produced by workers, was often marginally legible. As with grammar and usage, poor handwriting was accepted unless it caused communication problems.

**Oral Language**

Oral language in training program classrooms and laboratories was less social than was the case at the job sites. Instructor-to-student and student-to-student interaction during formal meetings was consistently subject oriented.

The level of oral language usage during instruction was typically informal. Instructors did not read from prepared notes during lectures; their language was repetitive and often conversational as they presented and demonstrated concepts and methods.

Student talk during instructional sessions was normally restricted to brief questions and responses to questions. When directed toward peers, student talk was informal, but predominantly task oriented. Like those of their instructors, student utterances were informal and sometimes nonstandard. Example 9 shows excerpts of classroom and laboratory talk.

Example 9. Classroom oral language.

**Heating/Air Conditioning Mechanic**

Instructor: Does anybody need help getting started? Do you want to go through the problem where you find static?
Student: I have a question. Can you run your bathroom—our small bathroom—and the utility together?
Instructor: No. The proper way to do that is to put the utility room separate from the kitchen.
Electrician

Instructor: A thousand? Okay, a mill is going back to being one hundredth of a cent. It's going back to like property tax. Like one tenth of a cent, there are one hundred cents in a dollar. So, one tenth of one hundredth is what a thousand mills to a dollar is. It goes back to a tax rate.

Note taking was an important adjunct to listening in all training programs. Students regularly took notes during instructional sessions, those notes were similar to other forms of occupational writing produced by students and workers—in informal and marginally legible.

Occupational Literacy and Readability Estimates

Readability refers to ease of understanding or comprehension of written text. Readability formulas have been developed to gauge the appropriateness of written materials for intended audiences. Popular formulas address two text based factors—sentence complexity and vocabulary diversity—in predicting readability. The Dale-Chall Formula (1948) and Fry Readability Graph (1977) were used to assess the difficulty of required reading material in these studies.

The scores of these formula methods require careful interpretation because text understandability or comprehensibility can be influenced by nontext factors such as reader interest and motivation, familiarity with text, task repetition, and the availability of information from graphics and other sources. Nontext factors may reduce the effective difficulty of any given text. The moderating effects of these factors are probably reflected in studies such as one by Sacher and Duffy (1978), who found that workers were capable of using information obtained from materials two grade levels above the measured reading abilities of the workers.

It seems likely that the scores of the Dale-Chall formula and the Fry Graph overestimate the reading skill levels necessary for successful performance by workers and students. It is not that these instruments were in error; they are widely used and accepted tools. However, they are among the popular readability formulas which rely solely on easily quantifiable aspects of printed materials. In occupational reading, whether on the job or during training, nontext factors enable workers and students to understand material which would be incomprehensible to persons who are disinter-
ested, unmotivated, or unfamiliar with the subject matter and nontext sources of information.

While teachers can have confidence in readability formulas as predictors of general levels of text comprehensibility, the limitations of formulas must be borne in mind. Many factors which contribute to the comprehension of written text are not assessed by formulas and some of these factors can be addressed instructionally. Methods of developing occupational reading skills during preoccupational and occupational training are described in Chapter 5.

Summary

Literacy and literacy related competencies were required in each of the workplace and training program settings examined in studies of ten occupations. Reading, writing, and oral language were used to meet work and training requirements by all workers and students who participated.

Work related reading involved slightly more than an hour a day on the job and more than twice that time in the training program. Reading materials were written in several varieties, ranging from informal to formal, technical styles. Important information was presented in text, graphic, and combinations of text/graphic formats. Readability formulas indicated high levels of text difficulty.

The difficulty of reading requirements was moderated by the nature of reading in occupational settings. On the job, reading involved repetitive use of the same materials from day to day. Once mastered, apparently difficult reading materials seemed inconsequential. Training program reading involved vocabulary, concepts, and information formats which were introduced and mediated through the instructional process. Like workers, students probably faced less severe reading demands than formula scores suggest.

Literacy related competencies—writing and oral language communication—required only rudimentary skills. Written communications, on the job and in the training programs, typically employed nonstandard or informal usage. Marginally legible handwriting was accepted in most work and training settings. Nonstandard usage and marginal handwriting were accepted unless they interfered with clear communication.

In oral language, clarity of expression, not standard English usage, was the criterion for competence. Speakers and listeners needed to be concerned about understanding, not usage.
The reading demands of the occupations examined were probably overestimated. The methods used to assess readability did not account for worker/student familiarity with the vocabulary and concepts found in required reading materials. The repetitive nature of on-the-job reading was not considered during the assessment of readability.

References


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Moe, A.J., Rush, R.T., and Storlie, R.L. *The literacy requirements of a secretary on the job and in a vocational training program.* 1980. (cs 005 249)


During the past two decades, research has contributed much to the understanding of the processes of learning and memory in human beings. It may never be possible to describe exactly how these processes operate, but studies from the fields of cognitive psychology, computer science, and education suggest possible structures of memory and several factors which are involved in learning and remembering. This chapter provides a foundation for the instructional recommendations contained in Chapters 5 and 6. Here the discussion focuses on the structure and organization of human memory, the process of learning and memory, factors which affect learning and memory, and implications for literacy education and occupational training.

Understanding Learners

The Structure of Memory

Human memory is described in terms of three interactive component systems: immediate, short term, and long term. The efficiency with which any of the systems operates affects efficiency of the others.

Immediate memory, which is sometimes called perceptual trace (Travers, 1977) and described as a temporary sensory store, is very limited in both capacity and duration. An example of immediate memory in action
(or inaction) can be taken from the daily experience of listening to the weather forecast. It is quite common for listeners to be aware of the broadcast without noting any of the key information. Similarly, most adults can recall the experience of having been introduced to a stranger, hearing the person's name, and forgetting it almost immediately.

Short term memory serves two important functions. First, it enables us to efficiently perform routine tasks requiring temporary storage of information. Second, short term memory enables us to store information in long term memory.

Short term memory is employed in tasks such as looking up and remembering a telephone number or remembering a list of tools and hardware which must be retrieved from one's basement or garage. Information is often rehearsed or organized in some way to facilitate retention in short term memory. Rehearsal of information is an effective means of facilitating memory for information over brief periods.

In cases where numbers or lists contain more than seven discrete items, reorganizing the items into smaller groups is known to be an effective means of enhancing short term memory. Telephone numbers and social security numbers are examples of long numbers which have been conveniently "chunked" for easy storage in short term memory.

It is also possible to organize nonnumeric information according to common characteristics. A long grocery list, for example, might be organized according to categories such as vegetables, meats, and dairy products. Similarly, such a list might be chunked according to the various aisles on which the items are located in a familiar grocery store. Organization of information in short term memory is critically important if that information is to be transferred to long term memory.

Long term memory was once thought to have unlimited capacity and duration; the existence of billions of cells in the human central nervous system suggested to many psychologists and educators that an equal number of bits of information could be stored. Reports of long forgotten memories being recalled in vivid detail as the result of surgical stimulation (Penfield, 1951) suggested that all experience was permanently stored in memory. Recent theory and research concerning human memory discount these once widely held beliefs. The capacity and duration of long term memory, though substantial, is limited and is affected by many factors, such as organization and practice.

Research suggests different models of the structure of long term memory, each dealing with the way in which information is organized to make efficient recall possible. Current models suggest that long term memory
may be viewed as a system involving: 1) hierarchical classifications; 2) simplified base structure representations of ideas expressed through complex language (Kintsch & Keenan, 1973); or 3) as dual systems which process events and incidents differently from semantic information (Tulving, 1972). In each model, the central importance of organization is clear.

As a potential tool for educators, each model of long term memory merits discussion. The hierarchical classification model is familiar in that it is similar to the way in which school curricula are organized; dogs and cats are classified as mammals which are classified with fish and birds as animals. Organization involving categories and subcategories makes retrieval straightforward because the information has been stored in a predictable place in memory.

The model of memory which proposes that semantic information (typically emphasized in educational settings) is stored in a form simpler than the surface structure in which it is perceived is based on experiments such as those conducted by Kintsch (1974). These studies indicate that it takes longer to comprehend information presented in complex sentences than the same information presented in simple sentences. In either case, while the syntax is soon forgotten the basic information—the base structure—is remembered. Kintsch's term proposition denotes the base structure stored in memory. In propositional form, the sentences "The boy threw the ball" and "The ball was thrown by the boy" are represented by:

\text{Throw: \text{AGENT (boy), OBJECT (ball)}.}

Tulving's dual system model of long term memory is based on evidence that incidents or episodes are stored differently from other forms of information. Episodic memory seems to be organized chronologically; events are stored in the order in which they occur. Semantic memory involves facts, formulas, and language oriented information which must be organized in some way before it can be stored in memory.

Information retrieved from episodic memory tends to be modified. Successive accounts of eye witness experiences, given by the same person, tend to differ. Knowledge such as facts, formulas, poems, or songs—the domain of semantic memory—tend to be unmodified in recall.

Episodic and semantic memory systems are parallel with iconic and symbolic memory categories posited by Piaget and Inhelder (1973). Iconic memory consists of images derived from perception, and iconic memories, like episodic memories, are prone to inaccuracy. Symbolic memories can be characterized as typically verbal and, like semantic memories, tend to be accurate and stable.
Factors Affecting Learning and Remembering

At least five factors are important to the processes of learning and memory: attention, meaning, involvement, organization, and practice.

Attention is the key factor in learning and remembering information from any source. Efficient learners pay attention. In listening, reading, or other activities they look for connections between their knowledge of the world and what they observe. An important characteristic of efficient learning and remembering is the use of prior knowledge and experience to guide and focus attention. Research by Kintsch and Keenan (1973) suggests that information stored in short term memory may be used to organize information for storage in long term memory.

Meaning implies that information, in order to be learned and remembered, must be personally meaningful to the learner. It is important for the learner to “see” how information to be learned is related to what is already known. Verbal or written instructions for the operation of a tractor are understandable only to the extent that the person hearing or reading the instructions is familiar with tractors or similar machines.

Involvement refers to the need for physical or mental manipulation of new information. Information which is consciously compared and contrasted with previously acquired knowledge is more effectively learned and remembered than information which is more passively processed. Involvement, in the form of mentally rewording information, is an effective way to personalize and thereby learn and remember.

Organization of information seems to be an important factor and function of short term memory. Indeed, a major function of short term memory seems to be the organizing of information for storage in long term memory (Kintsch, 1977). Through this process, effective learners arrange new information according to cues which allow it to be connected to prior knowledge and, thus, remembered and recalled. In order to better organize and store new information, the search for connections between new and old should be a conscious component of the learning and teaching processes.

Practice, or application, is a critical factor in tasks which demand that information be remembered. In short term memory, new information must be rehearsed if it is to be remembered even briefly. Long term memory for information depends on periodic review. When too much time elapses after the use of information stored in long term memory, the information is lost and must be obtained from sources other than memory.

Clearly, immediate short term and long term memory systems are interactive. Short term memory borrows information from long term storage.
and uses it to guide attention toward relevant information being processed by immediate memory. Appropriate information from immediate memory is then held in short term memory and, if the learning task demands, organized for storage in long term memory. Each phase of the process—attention, meaning, involvement, organization, and practice—affects learning and remembering. The three systems of memory and the factors involved in them interact in the processing of semantic information.

Learning and Remembering Semantic Information

Reading is a process which requires active mental involvement with the information presented. Effective readers pay careful attention to the meaning of the text they are reading. They actively involve themselves in connecting what they are reading with their existing knowledge and prior experience. They evaluate and interpret information as they read and either assimilate the information into their existing knowledge structures or, when the new information outweighs existing knowledge, accommodate the new information by modifying their knowledge structures (Pearson & Johnson, 1978).

In terms of their occurrence in daily work, activities involving reading account for substantial amounts of time. Results of the studies discussed in Chapters 2 and 3 indicate that workers are involved with tasks requiring work related reading for more than an hour each workday. Diehl and Mikulecky (1980) reported that workers in various occupational roles spend an average of 113 minutes per day reading.

Occupational training requires that students spend far more time reading than is spent by workers on the job. The average student in the training programs studied by the authors, spent approximately 3.4 hours per day reading occupationally related materials. This figure is probably a low estimate since only three courses from each of the full-time training programs were examined.

Reading tasks can be classified according to reader purposes. On the job, reading to obtain information for the accomplishment of work—reading-to-do (Sticht, 1975)—predominates. In educational settings, reading to acquire knowledge for later application—reading-to-learn—is most common. In neither setting, however, is reading-to-do nor reading-to-learn used exclusively.

Listening

It is not possible to discuss listening without also discussing understanding, learning, and memory. More than a passive perception of audi-
tory stimuli, listening is a process which requires a listener's active mental involvement. Effective listening depends on careful attention, meaningful involvement and organization, and frequent summarization of information, as listeners reconstruct the meaning of what is heard in light of their existing knowledge and prior experience.

Research on listening suggests that language use requires listening 45 percent of the time in daily adult activity. Classroom lecture settings require students to listen approximately 70 percent of the time at the elementary school level and 90 percent of the time at the college level. Yet, school students in lecture settings may listen only about 30 percent of the time (Nichols & Stevens, 1957). Adults tend to forget 50 percent of lecture content within 24 hours of hearing it. Typically, 80 percent of information presented in lectures is forgotten after two weeks.

Listening tasks have been categorized as monitoring, information getting, and critical listening. Monitoring corresponds to immediate memory. Auditory information seemingly "goes in one ear and out the other" until some external or internal factor causes attention to be focused.

Listening to acquire information can be divided into tasks which require that information be obtained for immediate use, and tasks which require the learning of information for later use. Listening to instructions for completing a written examination is a listening-to-do task. Listening-to-learn involves tasks such as note taking during classroom lectures.

Critical listening deeply involves the listener with the information being presented. Evaluation of the speaker's motives and of the information presented are important aspects of critical listening. Emotional factors may influence the listening process during critical listening; because of the emotional impact of the speaker's presentation, listeners may be influenced to accept or reject the message.

Implications

Whether in traditional classroom and laboratory settings or in adult basic education or on-the-job training programs, instruction should consider current theory and knowledge of learning and the implications for reading and listening. Understanding, learning, and remembering information require active involvement of the learner in the process of linking new information with existing knowledge and prior experience.

The concept of comprehension as a process of constructing meaning from new and old information (Pearson & Johnson, 1978) has important implications for all educators. It is particularly important in occupational
education where there are so many possibilities for concretely connecting the new and the old. Equipment, raw materials, and tools which can be used to help relate new information to existing knowledge and experience, are readily available in occupational and training environments.

Evidence of the structure and function of human memory suggests that instruction should be concerned with helping students to use their knowledge and experience to aid in the understanding and learning of new concepts and processes. It seems essential that teachers carefully consider the backgrounds of their students in preparing instruction, and include preview and review activities which call attention to the relationships between information learned earlier and that which is to be learned.

Instruction should also address the need for learner attention to the information which is to be learned. Motivation and interest are important to maintenance of attention so, whenever possible, teachers should use devices which help students to focus attention on relevant information. In occupationally related education, it may be enough to point out situations in which the information will be crucial, or how ignorance of the information might be dangerous or otherwise costly. In cases where the information cannot be readily related to work activities, teachers should at least indicate possible applications of the new information.

Meaningful involvement of the learner with new information is important to understanding and learning. When learners are actively engaged in relating new information to their personal experience, they tend to comprehend and remember it better than if they do not try to find such relationships.

Organization of information is an important consideration in the instructional process because research shows that clear, consistent organization of material to be learned aids both comprehension and memory. According to Bransford (1979), several factors seem important to good organization and comprehension. Clear expression of new concepts, main ideas, and relationships between ideas enhances understanding. Careful use of examples and nonexamples which represent important concepts is an important aspect of good organization which aids comprehension. Avoidance of irrelevant detail is valuable in the presentation of understandable information to learners. Finally, the language used to communicate new information should be syntactically simple; learners may be confused by sentence structures which are unfamiliar to them.

The conclusions of Irwin and Davis (1980) about comprehension and learning from text should be considered. They summarize several factors which contribute to the retention of written information: 1) information which is motivating and interesting is more easily understood and remem-
bered than information which is unmotivating and dull; 2) student familiar-
ity with the pattern of organization of a written text is a valuable aid to
understanding and learning; 3) immediate and periodic reinforcement, or
review, of learned information aids recall; 4) graphic and pictorial aids
which support textual information can assist understanding and memory;
5) questions which focus on personal application of new concepts, ideas,
and processes contribute positively to learning; and 6) student use of newly
acquired information contributes to retention. The similarity of these con-
clusions to those of Rosenshine (1983) and Berliner (1981) about effective
teaching suggests that such factors contribute to the learning of both writ-
ten and auditory information.

The learning of information can be enhanced through the use of effec-
tive strategies for learning. Bransford (1979) notes that effective learners
actively monitor their understanding of information and seek clarification
when in doubt. They are better able to use their experience to evaluate and
elaborate information. They can identify the potential significance of new
information better than less able learners can. This is consistent with re-
search by Mikulecky and Winchester (1983), who observe that superior
workers in nursing occupations are better at thinking through tasks and
applying appropriate reading and writing strategies, than are less proficient
workers. Moreover, effective learners seem able to put new information
into personally meaningful contexts. Theoretically, teachers who provide
exposure to and practice in the use of self-monitoring strategies will have a
positive effect on learning by teaching students how to learn.

Summary

This chapter discussed the structure of human memory, human learn-
ing, and factors important to those processes. A description of the structure
of memory posited the existence of three systems: immediate, short term,
and long term. In any task requiring understanding, learning, and remem-
bering, the three systems of memory interact with one another. Key factors
in learning and memory are attention, meaning, involvement, organization,
and practice. These factors can be managed by presenters of informa-
tion (teachers and writers), as well as by learners.

Comprehension and learning are viewed as processes in which learn-
ers must be actively involved in seeking connections between new informa-
tion and that which they already know. In both reading and listening tasks,
instruction should focus on the establishment of such connections.
References


The previous chapter discussed the structure of human memory and
the nature of comprehension and learning. It was suggested that
teachers and students can enhance the processes of comprehension and
learning through careful attention, meaningful involvement with the infor-
mation to be learned, and the use of organizational strategies to form per-
sonally meaningful links between new information and existing
knowledge.

This chapter presents instructional strategies and techniques consistent
with current theory and research concerning comprehension, learning, and
memory. Major headings within the chapter identify key occupational liter-
acy and linguistic competencies: reading, writing, and oral language. Be-
neath each major heading, aspects of instruction are presented for a general
audience of educators who might contribute to the development of essential
job related skills. Specific references are made to teaching at prevoca-
tional, vocational, adult basic, and on-the-job education levels.

Reading

In this section, a distinction is made between the reading skills neces-
sary to meaningfully interpret visual information and the cognitive proc-
eses required to put that information to work or to learn and remember the
information for later use.
Occupational literacy requires skill in learning from written materials as well as skill in reading to accomplish specific tasks. Reading-to-learn involves thoughtful, reflective mental processing of information so that it can be recalled and used long after it is read. Reading-to-learn generates "working knowledge"; it involves long-term memory. Reading-to-do work involves following written instructions and finding information for immediate use. In reading-to-do tasks, information is remembered no longer than a few minutes, so short-term memory skills are essential.

The purpose of the reading task differentiates reading-to-learn from reading-to-do. Comprehension on the job and in training involves the same skills: interpreting expository prose and graphics, relating printed information to existing equipment and materials, and interpreting technical vocabulary. Differences lie in the extent to which learning and memory are essential. On the job, learning through reading is seldom required. In fact, memorization is often discouraged by employers who stress the use of handbooks and checklists to improve accuracy in job performance.

Characteristics of Occupational Reading Materials

Regardless of the work or training environment in which they are found, occupational reading materials require competency in dealing with special visual and organizational factors. One important characteristic of occupational reading materials is the high frequency with which graphic aids (figures, diagrams, charts, tables, and pictures) appear. The use of tables to convey important information in a clear and economical way is extensive. Graphics occur in conjunction with and independent of textual information.

Second, written or printed instructions or directions to workers and students frequently appear in on-the-job and training program settings.

Third, work and training program tasks frequently call for workers or students to interpret handwritten or printed materials which refer to some object or tool with which they are working.

Fourth, each occupation presents a specialized vocabulary which workers/students must recognize and understand.

Finally, occupational reading materials employ expository styles of organizing information. Although written and printed materials range from tersely worded memoranda to highly complex technical documents, they are heavily laden with references to important technical operations, concepts, and relationships.

Educators at prevocational, vocational, adult basic, and on-the-job levels can account for each of the mentioned factors in their dealings with students and workers. The balance of this section focuses on methods of
preparing students and workers for mastering reading related occupational competencies.

Reading-to-Do

Many of the reading skills relevant to this section are necessary in both reading to perform work and in reading to learn information. Skills which pertain to the characteristics of occupational reading materials in general are discussed first. The final part of this section deals with expository patterns of organization and the development of reading-to-learn competencies.

Graphic aids to comprehension which are typical of occupational reading materials include figures, diagrams, charts, graphs, pictures, and tables. Their purpose is to enhance reader comprehension of expository text. Since most readers ignore graphic aids when reading (which may reflect teacher admonitions in beginning reading experiences to “look at the words not the pictures”), formal instruction in how to interpret graphics seems necessary.

Methods of preparing readers to interpret effectively and use graphic aids in various school subjects are described by Sheperd (1978), Robinson (1978), and Singer and Donlan (1980). The recommendations which follow are applicable to occupational reading materials. References and examples from occupational settings are used as illustrations of how skills instruction can be applied to relevant materials.

Figures and diagrams are similar in that they usually take the form of drawings which illustrate textual information. Sticht (1980) notes that figures and diagrams often contain words which identify some aspect of the illustrated item. According to Robinson (1978), figures and diagrams are integral parts of explanations presented in accompanying written text. As such, they must be read in conjunction with the text through a series of back and forth referrals. A sound strategy for teaching learners to make good use of figures and diagrams is to train them to focus their attention on such graphic aids before examining the text itself. Learners should be encouraged to use a figure or diagram as a basis for preparing to read the accompanying text by setting purposes for reading. Just as readers can use headings and other print related cues as guides to more efficient reading, they can use figures, diagrams, and other graphic aids as cues for questions to be answered through careful reading.

The illustrations which follow show arrangements of textual information in conjunction with figures and diagrams. The examples are taken from occupationally related materials, but similar patterns are commonly found in classroom mathematics and science textbooks.
Example 1
TEXT WITH FIGURES
Fixing a Leaking Faucet

Compression faucet. At the end of the stem of a compression faucet, is a washer held in place by a screw. When the faucet is turned off, the stem is screwed all the way down, and the washer fits snugly into the valve seat, stopping the flow of water. If the faucet is dripping from the end of the spigot, it is possible that either a washer or a valve seat has deteriorated.

Charts show relationships between various components of an organization or process. Used frequently in the electronics and computer science industries, charts contribute clarifying concreteness by expressing complex information in visually simple formats. As with other forms of
graphic aids, learners may not fully use charts unless they are taught to attend to and interpret them.

Instruction in the use of charts should be based on the understanding that these graphic aids are provided by writers because they summarize detailed information from the printed text. Learners should be instructed to recognize the purpose of the chart and then determine the organization of the chart, identify the meaning of the symbols used, and relate the chart to the accompanying text. Examples (see Example 2) might be employed to develop skill in using charts to full advantage in occupationally relevant reading tasks.

**Example 2**

**TEXT WITH CHART**

A. Amplifies the 3.58 MHz “burst” signal transmitted by the TV station. This signal is used as a reference for the demodulators to determine the beam intensity. The beam intensity, in turn, determines the proper amount of each color.

B. Compares the output frequency of the 3.58 MHz reference signal oscillator with the burst frequency, and generates a correction voltage.

C. Changes capacity as the correction voltage changes. This corrects the 3.58 MHz oscillator, making it the same frequency as the burst signal.

D. Creates a 3.58 MHz reference voltage; provides the reference to the demodulators to obtain correct color signals.

E. Amplifies the 3.58 MHz reference voltage for demodulators.
Graphs, like charts, summarize information which is presented in written or tabular form elsewhere. Three types of graphs predominate: bar (used to show differences in amount); line (used to show increases or decreases); and circle or pie (used to show proportional distributions of variables).

Guidelines for users of graphs should focus attention on the meaning of headings and labels, the comparison of information represented in the graph with textual information, and the evaluation of the relative importance of aspects of the graphically presented information.

Example 3 illustrates graphs found in occupational settings. In each case, the relevance of the information in the graph is determined by the text which accompanies it.

Example 3
TEXT WITH GRAPH

Color, Automatic Color Control, and Color Killer Amplifiers

The video signal is coupled from the output of the IF circuit board through resistor R817 to pin 11 on the chroma circuit board. Coupling capacitor C353, coil L351, resistor R359, and capacitor C354 form a wave-shaping network at the 3.58 MHz, color signal frequencies. The wave-shaping network passes the higher frequencies (color information) and limits the lower frequencies of the luminance signal.

Complete Television Signal for Channel 2

![Graph showing video and color carriers and signal frequencies](image-url)
Pictures are widely used in occupational settings and in occupational training. They often relate directly to a specific task, material, tool, or machine and are sometimes enhanced by arrows or circles which guide the user's attention. Because they establish a visual context which includes many environmental cues, pictures are useful and important aids to comprehension. Therefore, skill in the use of pictorial information is essential in occupational and training program settings.

Readers should learn to examine pictures as a prelude to reading for detail. The strategy of previewing and setting purposes before carefully reading the text should always include thoughtful examination of supplementary pictures. Example 4 shows combinations of pictures and accompanying text.

Example 4
Text and Picture*

Current truck radiator installation design (left) requires flat front. Air resistance can be reduced by a streamlined design (right) where ducts bring sufficient cooling air to the radiator.

* Through design improvement, over-the-road trucks can function with radiator openings one-third as large as those used currently. Sealing of ducts is necessary so that all cooling air is directed to the radiator. Applications of such truck designs have existed in the aircraft industry for many decades. Automotive engineers should examine aeronautical engineering practices in their quest for aerodynamic efficiency.
Tables often accompany graphs and are used to summarize numerical or statistical information. In interpreting tables, as in interpreting graphs, the user must attend to the general heading of the table as well as to the headings of its rows and columns of numbers. Tabular information must then be compared and interpreted in light of the textual information it accompanies. In Example 5, the reader must associate the information in the table with the task at hand and with the information provided in text.

**Example 5**

**TEXT AND TABLE**

Low Hydrogen Electrodes

Hydrogen has harmful effects on alloy steels, causing intergranular cracks called hydrogen embrittlement thus lowering fatigue resistance and strength.

<table>
<thead>
<tr>
<th>RIGHT HAND DIGIT</th>
<th>COVERING COMPOSITIONS</th>
<th>APPLICATION (USE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Low hydrogen sodium type.</td>
<td>This is a low hydrogen electrode for welding low carbon, alloy steels. Power shovels and other earth moving machinery require this rod. The weld machines or files easily. Use DC, RP only.</td>
</tr>
<tr>
<td>6</td>
<td>Same as 5 but with potassium salts used for arc stabilizing.</td>
<td>It has the same general application as 5 above except it can be used on either DC, RP, or AC. For low carbon alloy steels, use DC or AC.</td>
</tr>
<tr>
<td>E-7015</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-7016</td>
<td>High iron oxide (Low Hydrogen). Flat and horizontal joint weld position.</td>
<td>For low carbon alloy steels, use DC or AC.</td>
</tr>
<tr>
<td>E-7027</td>
<td>Iron powder (Low Hydrogen). Flat position only.</td>
<td>Similar to 5 and 6, DC, RP, or AC. Heavy covering allows the use of high speed drag welding. AC or DC RP may be used.</td>
</tr>
<tr>
<td>E-7028</td>
<td>Iron powder plus low hydrogen sodium covering.</td>
<td></td>
</tr>
<tr>
<td>E-8018</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Low hydrogen electrode covering Compositions and Applications. These coverings will withstand a high temperature and therefore high currents (amperages) may be used.

Following instructions involves the ability to read and carry out written or printed instructions. It is an essential skill which requires methodical reading and intense concentration. When teaching learners how to follow written instructions, it is best to emphasize that such reading is hard work and requires a slow, careful approach.
The process of reading and following instructions parallels the reflective process of the Directed Reading-Thinking Activity (DRTA, described under reading-to-learn) and similar approaches to reading for learning and studying purposes. In reading to follow instructions and reading-to-learn, readers are required to be aware of their purposes, to demonstrate their comprehension, and to evaluate their interpretation of what they have read. The essential difference lies in the application of skills. In most situations, DRTA and similar methods are applied to chapter length segments of text; following instructions usually involves brief passages. Unlike reading to follow instructions, reading-to-learn from text seldom requires an immediate physical response from readers.

Instruction in reading and following instructions should include cautionary statements about the need for care and concentration. Also, practice should be required in applying a systematic, self-directed approach to samples of written instructions. Specific rules might be stated in this way:

1. Develop a mental set for what is to be done by reading the instructions once completely.
2. Read the first step carefully and do as it directs.
3. Reread the step and check your work.
4. Read, do, and reread each of the remaining steps until all are accomplished.
5. Reread and check your work for the whole set of instructions.

In most classrooms, a variety of materials is available for use in teaching learners to carry out instructions. Written instructions for daily assignments can provide frequent practice when used to full advantage by teachers. Such instructions, however, require careful attention from teachers. Poorly prepared instructions may cause frustration and discourage independent action by learners. The effect of carefully prepared instructions can be subverted by teachers who consistently repeat or restate classroom instructions since attention to instructions is unnecessary when repetitions are readily available.

A method of stressing attention to instructions is to provide written instructions, for which no supplemental help is available, for at least one activity per day. As learners develop skill with written instructions, the number of daily assignments can be increased.

The use of sets of instructions closely related to those encountered in the workplace is an important teaching consideration. Laboratory activities from biological, physical, and social science curricula are good sources of instructions. Mathematics textbooks may include many well-prepared problems which require careful reading. Educational games, model build-
ing kits, recipes, and instructions for household appliances are also good sources of material for extending practice of an important skill into the “real world.”

Occupational and training tasks often require readers to interpret and integrate printed, graphic, and physical information to materials, tools, and equipment.

As in the case of instructions involving written language alone, it is important that learners understand the importance of slow, methodical reading and complete concentration when following instructions. This is especially true in tasks which combine written, graphic, and physical information. Given this understanding, rules can be taught for reading instructions which involve existing materials.

A set of guidelines, derived from a student self-evaluation checklist for science laboratory reading (Thomas & Robinson, 1977), is relevant to the many tasks which require reading to guide the manipulation of materials, tools, and equipment.

1. Skim the instructions to establish a mind set. Note titles, headings, and graphic aids, and read the introduction and study questions.

2. Familiarize yourself with any materials or equipment involved in the task.

3. Read the entire procedure.

4. Verify the meanings of words and symbols of which you are unsure.

5. Read and do each step with great concentration, paying special attention to difficult or unclear steps. These should be reread and thoughtfully interpreted.

6. Read numeric information with exactness.

7. Pay special attention to cautionary words such as danger, caution, note, and attention.

8. Make use of graphic aids by consciously relating them to both the text and equipment at hand.

9. Be alert to the order/sequence in which steps are to be done.

10. Reflect on what you are doing while you are working.

11. After completing the procedures, carefully evaluate what you have done in light of the instructions. Using a written or mental checklist, check off each completed step in sequence.

Learners should be made aware that concentrated effort is necessary to gain an understanding of the function or operation of materials, tools, and equipment.
Guidelines for such tasks should require that learners take active roles in planning controlled reading. First, headings, pictures, graphs, introductions, and summaries are surveyed to establish a mental set for subsequent careful reading. Next, purposes are set for reading small sections of the text. Careful reading follows with purposes in mind. Frequent back and forth references between print, graphics, and physical media are made to verify understanding. Then, in their own words, readers attempt to develop a brief explanation of what has been read. If only poor explanations can be stated, readers must reread to find the causes of the gaps in understanding. This procedure is similar to several procedures for effective reading and study, including the Directed Reading-Thinking Activity (Stauffer, 1980), which is described in the reading-to-learn section.

**Reading-to-Assess**

Students should work with reading materials and tasks directly related to those actually found in occupational settings. Wherever possible, reading materials should be used in worklike activities (Sticht, 1982). Reading-to-do tasks, involving finding and using information, should be addressed as essential occupational skills.

Analysis of whether, when, and how to use reading materials is a crucial occupational reading skill. Like skills in finding and using information, reading-to-assess skills can be practiced through teacher developed work simulations (Mikulecky & Winchester, 1983).

A work simulation might involve correctly setting an electronic wristwatch. At a classroom center, learners would be required to select the appropriate reference from among technical textbooks, electrical handbooks, and sets of instructions for several electrical appliances.

**Reading-to-Learn**

The reading skills discussed in the previous section are as important in tasks requiring learning through reading as they are in tasks which require the accomplishment of work. With respect to learning, however, there are key aspects of reading which are more important than in reading-to-do tasks. These include the systematic approach to reading for study purposes and skill in interpreting information which is presented in the various organizational patterns used by writers of expository prose.

An orientation to the reading-to-learn process is acquired indirectly through most developmental reading programs. Such programs systemati-
tally prepare readers to make mental connections between their existing knowledge and the information they read. Approaches such as the DRTA are typical of developmental reading programs and involve the following steps or stages:

1. Previewing the material to establish a mind set for reading.
2. Setting purposes for reading by using headings, subheadings, and graphic aids as sources of questions to be answered.
3. Careful reading with purposes in mind.
4. Recitation—formulation of answers to questions or relating key information to prior knowledge. (These are always personalized responses in the reader's own words.)
5. Rereading as necessary to find answers to questions formulated in step 2 or to clarify relationships between the new information and prior knowledge.

Directed reading activities are effective tools in reading-to-learn because, through the process of rewording key information, learners are required to associate important ideas, concepts, and relationships with their prior knowledge. The recitation component usually involves the association of new information with prior knowledge through personally meaningful examples. Further, recitation serves as a method of self-monitoring comprehension; key points cannot be restated if they have not been recognized and understood.

Most approaches to developmental reading emphasize strategies necessary in reading-to-learn. Teachers can stress the relevance of such strategies in the world of work by planning lessons which highlight work related applications of reading. Frequent use of exercises involving occupationally relevant materials could enhance the practical value of preoccupational and occupational courses.

Essential organizational differences exist between narrative and expository prose. Narrative prose is typically organized according to a plot, or story grammar. Readers become familiar with narrative patterns through listening and reading experiences. Expository prose can be organized in one of several patterns which, because of their infrequent use in literature, require formal instructional attention.

The skills required for reading expository materials may be taught through early and frequent experiences with written materials which impart factual or technical information. Prevocational level social studies, science, mathematics, and developmental reading textbooks are good sources of such material. Tradebook authors such as Roy Gallant and Isaac Asimov have published many short, readable books explaining subjects of interest to upper elementary and secondary school readers. Such books can
be useful in developing skill in reading expository prose in its various organ-
izational forms.

Social studies materials are written in styles also common in occupa-
tional reading materials. Patterns such as contextual definitions, enumera-
tion of examples, classification of information, sequences of steps and
stages, comparison and contrast, and cause and effect frequently appear in
both social studies and work related contexts. Robinson (1978) presents
detailed descriptions of these organizational patterns and their implications
for instruction. Although his discussion focuses on social studies, it is
quite relevant reading for those whose instructional concerns are related to
other technical subjects. It is possible and appropriate for expository read-
ing skills to be introduced in elementary school social studies and applied
and practiced at each grade level through formal occupational training.

Prevocational classroom science and mathematics programs also em-
ploy patterns of organization which occur frequently in work related writ-
ten materials. Common patterns include enumeration, sequence, com-
parison and contrast, cause and effect, and if/then relationships. In-
struction in reading such patterns may begin in the early grades and con-
tinue for the duration of formal education.

Early and repeated experiences with materials written in expository
style will enable learners and workers to focus their attention on key infor-
mation without becoming confused by unfamiliar writing styles. Also, the
importance of listening to expository prose being read correctly should be
emphasized. For example, oral reading of difficult or unfamiliar material
by an instructor who understands how punctuation affects phrasing pro-
vides learners with models to apply in independent reading. Teachers
should encourage learners to read complex or difficult materials aloud as a
means of aiding comprehension.

General recommendations concerning learning through reading in-
clude the use of an approach such as the DRTA in planned sessions involving
short periods of intensive study interspersed with brief intervals of unre-
lated activity. Authorities recommend twenty minute periods of study in
college level skills development. Long periods of cramming have little ef-
fect on long term retention of information and should be avoided. Learning
through reading is much more effective when knowledge is gradually ac-
quired and periodically reviewed.

In higher level prevocational courses and vocational education, stu-
dents should focus on their long range goal, the acquisition of working
knowledge, rather than on short term goals of merely “passing the test.”
Such a focus makes it more likely that learners will carefully plan study
time and use appropriate techniques of reading and study.
Writing

A review of the third chapter shows that writing in skilled and semi-skilled occupations does not require a high level of sophistication. With the exception of the secretarial occupation, standard usage is less important than clarity of communication. Handwriting styles vary considerably, even in the drafting occupation. Hence clarity, as exemplified by legibility, is again the critical factor but a wide range of legible styles is accepted.

Clarity of written expression and handwriting seems to be of greater importance than standard usage in occupational communication. Thus, instruction in job related writing skills should focus on clear communication of information. A telegraphic style of writing, clear and concise, might be used to develop initial skills:

Smith,
Attach return hydraulic hose to frontloader. See me.

Jones

Messages such as this also could be used as a basis for instruction in standard forms of English usage. Exercises might require the combining of telegraphic phrases and sentences into more complex, fluent sentences.

Oral Language

Listening effectively is a crucial competency in work and training program environments. As in the case of reading, listening is used both to facilitate the accomplishment of work tasks and to enable the learning of information for later use. The purpose of the listening task determines the relative importance of short and long term memory. In either application of listening, similar skills are required.

The key skill in effective listening is actively focused attention. No matter what the situation, if the listener fails to focus on the message given by the speaker, no information is comprehended. Teachers need to demonstrate ways for learners to improve the ability to pay close attention during listening activities. One approach is to demonstrate the consequences of inattentive listening. Safety films, speakers from local businesses, and classroom activities which require learners to follow aural instructions or to relate personal experiences in which poor listening caused problems are methods of focusing on the need for improvement.

There are several causes of poor listening; most involve inattention. Comprehension of information is reduced when listeners allow their minds
to wander, allow themselves to respond emotionally to the speaker, are distracted by environmental factors, are distracted by annoying characteristics of the speaker, listen for detail rather than for central ideas, or are reluctant to work at listening.

In both listening-to-do work and listening-to-learn, the following guidelines can lead to more efficient processing information.

1. Use what you already know about the speaker's subject to help you listen and learn.
2. Try to anticipate what the speaker will say next.
3. Listen for main ideas and relationships between them.
4. Make frequent summaries of main ideas and relationships in your own words.
5. Monitor your comprehension of what is being said and think about it.
6. Ask questions when you are not sure that you understand.

In addition to these general guidelines, awareness of certain aspects of occupational settings might be stressed. In most job related situations, there are environmental factors which can be used to enhance listening. Speakers frequently refer to objects close at hand. Sketches are often employed to clarify the meaning of what is said. Rarely are instructions given outside a specific and familiar context. Thus, if listeners alert themselves to the available clues in the occupational settings, they will be better able to cope with the listening demands of those settings. Newcomers to a job or training program should be particularly attentive to available clues to listening. As they become familiar with people and equipment in their new surroundings, attention to relevant clues will become second nature.

**Speaking**

Clarity of communication is essential in occupational settings; however, leeway in levels of grammar and usage is granted in most situations. A short, clear, grammatically imperfect message is much preferred to a misleading, grammatically perfect one.

Perhaps the best advice to speakers in occupationally related settings is to focus on making sure the message is clearly understood by the listener. Several precautions can be taken to assure clear communication.

1. Prepare your listeners by helping them associate what you are going to say with what they already know. Tell them how the instructions you are giving are related to what you asked them to do yesterday. Establish a context for your information.
2. Use environmental clues to aid your listeners in attending and understanding. Equipment, pictures, and diagrams enhance listening and understanding.

3. Be attentive to nonverbal and verbal signs of inattention and/or confusion on the part of your listeners. Listener responses such as "uh-huh" or "yes" are not evidence of attention or understanding, especially when accompanied by vacant or puzzled facial expressions.

4. When your listeners seem inattentive and confused, restate your message in different terms.

5. Observe yourself as you give information or instructions. Be alert to actions or mannerisms which might be distracting or misleading.

6. Be clear in your use of context and environmental cues. Fortunately for speakers, oral language allows for reinforcement of information so that miscommunication need not occur. The trick is to focus on making sure the message is clear and that listeners are receiving it.

Summary

This chapter has reviewed the nature of reading, writing, and oral language requirements in occupational settings and described some instructional approaches to provide learners with occupational literacy and related competencies.

Mikulecky's research (1982) shows that workers consistently read more diverse materials, in greater depth, for more times per day, and with greater importance than do secondary students. Workers also view reading as more important than do students. These findings have important implications for teachers at all levels. Instructional attention must be given to reading-to-do skills, to finding and applying information which is presented in graphic form, and to following written instructions.

The required competencies are much less complex in writing and oral language than in reading. The focus of successful performance in these occupational literacy related areas is on clarity of communication. Learners in school settings should strive for mastery of standard English usage, but they should also become familiar with the telegraphic, nonstandard styles in which much occupational communication occurs.

In all instructional matters, a healthy concept for teachers to bear in mind is that knowledge and skills need application if effective learning is to
take place. By applying skills to occupational examples, two purposes may be simultaneously met: 1) Enhanced retention of knowledge and skills through realistic practice, and 2) genuine appreciation of the value of such knowledge and skills. It seems worth the effort to connect the school to the workplace.

References


Teachers must focus on the essential knowledge and skills of their subjects. Reading and literacy related skills, critical to comprehension and learning, are part of the essential content of every subject. Yet it is doubtful that many teachers devote much time to direct instruction in such skills.

Mikulecky's research (1982) suggests the importance of increasing teacher awareness of subject related reading competencies. He found differences in the quality and quantity of reading in school compared to reading on the job, and observed that the reading demands placed on workers exceed those experienced by high school students. For example: 1) on-the-job reading requires more time per day than in-school reading; 2) workers read a wider variety of materials for more specific purposes than do high school students; 3) compared to technical school students, workers see reading as more important to success; and 4) workers do significantly more applications oriented reading.

If, as this evidence suggests, reading and related skills merit instructional attention before and during occupational training, a logical place to start is with the teaching of essential vocabulary. Each occupation has its particular set of requirements which include literacy and language competencies. Each has a specialized vocabulary essential to understanding, learning, and communication. The words which make up the technical vocabulary of a subject or occupation fit two categories: 1) True technical words, which seldom occur in normal usage (i.e., suprarenal, syndrome, hypotenuse, and heliarc), and 2) multiple meaning words, everyday words with special meanings (i.e., field, root, leg, branch, strike, plug, and tape).
In light of the strong relationship between word knowledge and comprehension (Davis, 1944, 1968; Spearitt, 1972) and learning (Anderson & Freebody, 1979), the need is clear for systematic instruction which emphasizes meaningful application of knowledge and skills. Such instruction should enable learners to independently determine the meanings of unfamiliar words.

**Awareness of Words**

A comprehensive program of vocabulary development should create a general awareness of words and their relationships as a prerequisite to instruction in specific vocabulary skills. Such an awareness can be fostered through methods described by Johnson and Pearson (1984) and Johnson (1984). Their instructional recommendations stress the need for connecting words to the various contexts in which they might occur. Several related methods are appropriate for accomplishing such instruction.

A method of showing connections between words and contexts, known as semantic webbing or mapping, seems particular valuable in specialized and occupational studies. The basic procedure for constructing a semantic map involves 1) selecting a key word, 2) brainstorming as many related words as possible, 3) categorizing the related words, 4) preparing a diagram which shows word relationships, and 5) optionally selecting a word from the map to serve as the core of a new map.

Example 1 shows a possible semantic map of the word *pressure*. Maps such as this are useful because they graphically illustrate the relationships between words and the differing shades of meaning which they take on in different settings.

Semantic mapping can be modified to emphasize the value of learning word parts—prefixes, suffixes, and roots. Example 2 presents a map of the Latin prefix *trans* (across).

Maps of word parts illustrate the relationships between similar words. Also, maps graphically present the power of mastery over word parts; knowing the meaning of *trans* unlocks virtually scores of words for the reader.

Semantic feature analysis is a second method of orienting learners toward words and word relationships. Like semantic mapping, this method requires learners to use their knowledge and experience to expand their vocabulary. Use of semantic feature analysis requires these basic steps: 1) selecting a category or topic, 2) identifying terms to list beneath the category, 3) listing features in a row beside the category, and 4) marking correspondences between words and features.

Example 3 shows a semantic feature chart for the category, *tools*. 
Example 1
SEMANTIC MAP — KEY WORD

Pressure

- Tire
- Radiator
- Cylinder

- Automobiles
- Trucks
- Aircraft

- Blood
- Sinus
- Emotional

- Worker
- Student
- Parent

- Air
- Water
- Oil

- Tests
- Bills
- Deadlines

- School
- Work
- Home

Example 2
SEMANTIC MAP — WORD PART

TRANS-(across)

- Translate
- Transcribe
- Transmission

- Transit
- Transamerican
- Transport

- Translation
- Transcription
- Transaxle

- Transitory
- Transoceanic
- Transact
After awareness of words and word relationships has been developed through the foregoing methods, independent vocabulary skills can be taught. Training in specific vocabulary skills can be based on the recommendations of Deighton (1959), who described the importance of context clues, word analysis, dictionary and glossary use, and other text based aids.

**Context Clues**

Learners and workers should be made aware that context clues are efficient and powerful tools for determining the meanings of unfamiliar words. In most situations, readers can apply their knowledge of the context surrounding an unfamiliar word to determine its meaning. Teachers and learners should be aware, however, that context clues are not foolproof. Context at best reveals only a single meaning and frequently provides only partial meaning. Context contributes to vocabulary growth in proportion to the amount of reading done. In general, reliance on context alone yields very gradual vocabulary growth.

Context clues may be more effective in specialized subjects and occupational settings in which expository materials are prevalent. Writers of technically oriented textbooks and reference materials commonly employ devices which increase the value of context in determining word meaning. *Definition, example, and restatement* are three frequently used literary devices which clarify the meanings of key words in technical writing. In fact, Deighton (1959) recommended these devices to writers as means of enhancing the value of context as a tool for vocabulary development.
An instance of the use of *definition* follows:

*Flashing* is then installed. Flashing is sheet metal installed around the base of the chimney so that water is prevented from running under the roofing material.

Here, the writer has deliberately provided a clear definition of the term immediately after its introduction.

*Example* is very often used in technical writing to clarify new words. Orienting skills, especially map reading and compass use, are essential to the wilderness hiker.

In this case, the writer has used the word *especially* to signal the reader that a clarifying example is about to be presented. Other words which signal examples include *such as*, *for example*, and *for instance*.

*Restatement* may not be as clearly connected to the unfamiliar word as definition or example, but awareness of this device can be an asset to readers of technical materials. In the following sentence, the writer has presented the meaning of the new word without using a separate sentence or a signal word.

The technician sometimes makes a *hypothesis*, an educated guess, about the cause of a malfunction.

The term *hypothesis* has been restated in more familiar words.

**Word Analysis**

A second major component of a program of technical vocabulary development is word analysis. Its use requires knowledge of word parts and their meanings—prefixes, suffixes, and word roots. There is some disagreement about the amount of emphasis the study of word parts should receive, but in specialized fields such study seems appropriate. High frequency word parts with consistent meanings should be considered part of the content of specialized and occupational studies.

Lists of word parts which have utility in general education can be found in Thomas and Robinson (1977), Sheperd (1978), and Deighton (1959). Examination of the vocabulary of work, presented in the appendices, suggests that the following prefixes and suffices should be taught in occupationally oriented programs.
Prefixes

a, ab (away from)
ad (to, toward)
com, con (with)
de (from)
dis (apart, not)
en (in)
ex (out)
im, in (in, into)
non (not)
ob (against)
pre, pro (before)
re (back)
sub (under)
trans (across)
un (not)

Number prefixes

uni, mono (one)
du, bi (two)
tri (three)
quad, tetra (four)
quin, pent (five)
sex, hex (six)
sept (seven)
oct (eight)
de (ten)
cent, hect (hundred)
mill, kilo (hundred)
semi, demi, hemi (half)
mega (million)

Suffixes

able, ible
age
al
ance
ant
ate
ble
ent
er, or
ing
ity
ly
or
sion
ship
tion

Roots derived from Latin and Greek which have occupational applications

acqu, hydra (water)
mis, mit (send)
aud (hear)
mov, mot (move)
auto (self)
par (get ready)
bio (life)
pli (fold)
duct (lead)
part (carry)
equ (equal)
sta, stat (stand)
fract, rupt (break)
spect, spic (see)
equ (equal)
string, strict (tighten)
fract, rupt (break)
threat, strict (tighten)
geo (earth)
tract (drag)
mag, magni (great)
man, manu (hand)
vid, vis (see)
meter (measure)
Graphic aids

In addition to context and word analysis, another text related factor—graphic aids—contributes to vocabulary development. A previous chapter presented procedures for teaching learners how to take advantage of graphs, tables, figures, and pictures to aid comprehension. Example 4 illustrates the value of graphics in defining key words.

Context clues, word analysis, and graphic aids, used alone or in concert, enable readers to determine word meanings effectively and efficiently. In work and training settings, it is sometimes necessary to know complete and precise definitions of key words. Thus, skill in using glossaries and dictionaries is important to both workers and students.

Glossaries are included in many textbooks and reference materials found in occupational settings. Although glossaries provide the precise meaning intended by the writer, they are frequently overlooked by the readers. Readers should recognize that while most glossaries appear as appendices to entire books, writers frequently place glossaries in chapters or in page margins near the first occurrences of key words. Margin glosses are shown in Example 5. Note the proximity of the glosses to the words they define.

Dictionaries are often the last resort in the search for word meaning because, like glossaries, their use requires interruption of the reading act. Nevertheless, the ability to use dictionaries is important because they may be the only sources of knowledge about word pronunciation and precise meaning. Dictionaries also reinforce the importance of context; they require readers to choose from several definitions the one which best fits the context in which the unfamiliar word has occurred.

To Elementary Educators

Thus far, this chapter has dealt with recommendations to instructors of specialized and occupationally related subjects. There is much that can be done at earlier stages of the educational process to inspire interest in and awareness of words. The intensity of focus will vary according to the grade level of the learners, but teachers should be sensitive to opportunities to connect words, word parts, and vocabulary skills with the world of work.

The strategy of connecting vocabulary with occupational applications can be employed early in the educational experience. Many words which have special meanings in work settings are introduced in elementary school
Example 4

GRAPHIC DEFINITION

TOOLS

SCREWDRIVERS

Square blade shank can take wrench

Standard blade and tip for general use

Stubby screwdriver for tight spots

WRENCHES

Adjustable wrench

Double-end open-end wrench fits two sizes
The cursor shows where something will happen next

In Apple Writer words automatically wrap around to the next line. Word wraparound means automatic carriage return.

Example 5
MARGIN GLOSSES

Typing Text
The display should be blank, except for the blinking cursor and a row of letters and numbers across the top called the Data Line. The Data Line is important to many of Apple Writer's commands and capabilities, as you will see later. Before we learn about the Data Line, though, let's learn the basics. You bought Apple Writer because you wanted to type documents, so let's type.

Did you notice the display when the cursor moved to the end of the line? When there wasn't enough room for a word at the end of the line, the cursor took the word and automatically moved it down to the beginning of the next line. It's an automatic carriage return, commonly referred to as word wraparound.

Keep typing (type anything you want) until you feel comfortable with the idea of not pressing return at the end of each line.

From AppleWriter II for IIe only. Permission granted by Apple Computer, Inc.

subjects. Teachers should routinely remark about the work meanings of such words.

Many of the prefixes, suffixes, and roots listed occur in primary grade reading materials. Words in which these parts appear can be readily associated with words from technical fields.

Field trips to school laboratories, shops, kitchens, nurses' offices, and administrative offices can help promote vocabulary awareness and growth when materials and equipment are labeled. Similarly, key words can be taught prior to and reviewed after class outings.

The recommendations of this chapter are not exhaustive. Teachers who wish to strengthen their vocabulary development programs should read the references cited. Works by Dale, O'Rourke, and Bamman (1971) and Johnson and Pearson (1984) should be of particular value at the elementary school level.

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Occupational Literacy Education
Summary

This chapter, suggesting that few teachers deal effectively with technical vocabulary, has presented methods and information for vocabulary development. In any situation in which reading and word knowledge are important to human performance, formal instruction in vocabulary development is necessary and relatively easy to provide. Instructional methods from several sources have been recommended. Especially useful are those described by Johnson and Pearson because such methods as semantic mapping and semantic feature analysis are both excellent and appropriate for those who teach children or adults.

Instructional techniques have been described, but methods and materials are only part of vocabulary development. Teacher awareness of the close relationship between word knowledge and comprehension may be the essential element in bringing technical vocabulary instruction into every classroom.

References

Anderson, R.C., and Freebody, P. Vocabulary Knowledge and learning. Reading Education Report No 11, University of Illinois at Urbana-Champaign, 1979.


Davis, F.B. Fundamental factors of comprehension in reading. Psychometrika, 1944, 9, 185-197.


Appendix A
Highest Frequency Words for Ten Occupations

The following list shows the 100 words most frequently used by adults in a study of ten skilled and semiskilled occupations and related training programs. The list is based on combined samples of written and oral language from all job and training program sites. The words comprise 45 percent of all language sampled.

Total Words = 180,000
Unique Words = 9,000

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<th>Word</th>
<th>Frequency</th>
</tr>
</thead>
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<tr>
<td>will</td>
<td>7,176</td>
</tr>
<tr>
<td>of</td>
<td>7,105</td>
</tr>
<tr>
<td>one</td>
<td>7,088</td>
</tr>
<tr>
<td>to</td>
<td>7,087</td>
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<tr>
<td>in</td>
<td>7,062</td>
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<tr>
<td>it</td>
<td>7,060</td>
</tr>
<tr>
<td>for</td>
<td>7,058</td>
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<td>that</td>
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<td>you</td>
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<td>on</td>
<td>7,046</td>
</tr>
<tr>
<td>are</td>
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<td>I</td>
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<tr>
<td>this</td>
<td>7,040</td>
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<td>with</td>
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<td>as</td>
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<td>by</td>
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<td>at</td>
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<td>was</td>
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<td>got</td>
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<td>know</td>
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<td>them</td>
<td>7,004</td>
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<td>air</td>
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<td>that's</td>
<td>6,994</td>
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<td>but</td>
<td>6,992</td>
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<td>6,986</td>
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<td>them</td>
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<td>time</td>
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<td>about</td>
<td>6,956</td>
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<td>been</td>
<td>6,954</td>
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<td>some</td>
<td>6,952</td>
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<td>business</td>
<td>6,950</td>
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<td>how</td>
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<td>its</td>
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<td>over</td>
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<td>work</td>
<td>6,940</td>
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<tr>
<td>would</td>
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<td>temperature</td>
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<td>same</td>
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<td>also</td>
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<td>where</td>
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<tr>
<td>now</td>
<td>6,928</td>
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<tr>
<td>only</td>
<td>6,926</td>
</tr>
<tr>
<td>like</td>
<td>6,924</td>
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</tbody>
</table>
Appendix B
Technical Vocabulary Lists

This section contains two vocabulary lists derived from written and oral language samples from each of ten occupations. For each occupation, a brief list of high frequency technical words precedes a complete technical vocabulary.

Common words from everyday adult language (found in the most frequent 1,000 words of the Kucera-Francis list, *Computational analysis of present day American English*, Brown University Press, 1967) have been deleted from the technical vocabulary lists. Also removed are numerals; labels; names of people, places, products, and companies; contractions and possessives; and colloquialisms.

Some of the words in the lists are uncommon words which may not be technical in nature. The lists should, therefore, be treated as sources rather than standards. In each technical vocabulary list, the most frequent words are marked with asterisks.

The following table shows the total number of words and the number of unique words contained in the original language sample for each occupation.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Total Sample Words</th>
<th>Unique Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account Clerk</td>
<td>20,055</td>
<td>2,981</td>
</tr>
<tr>
<td>Auto Mechanic</td>
<td>20,900</td>
<td>3,034</td>
</tr>
<tr>
<td>Draftsman</td>
<td>27,874</td>
<td>3,414</td>
</tr>
<tr>
<td>Electrician</td>
<td>20,492</td>
<td>3,126</td>
</tr>
<tr>
<td>Heating/Air Conditioning Mechanic</td>
<td>19,937</td>
<td>2,841</td>
</tr>
<tr>
<td>Industrial Maintenance Mechanic</td>
<td>21,000</td>
<td>3,164</td>
</tr>
<tr>
<td>Licensed Practical Nurse</td>
<td>24,964</td>
<td>3,955</td>
</tr>
<tr>
<td>Machine Tool Operator</td>
<td>15,200</td>
<td>2,473</td>
</tr>
<tr>
<td>Secretary</td>
<td>15,259</td>
<td>2,492</td>
</tr>
<tr>
<td>Welder</td>
<td>13,687</td>
<td>2,375</td>
</tr>
</tbody>
</table>
HIGH FREQUENCY WORDS
ACCOUNT CLERK

accountant, accounting, accounts, actual, add, annual, application, appropriate, assets, balance, bank, businesses, capital, cash, check(s), computes, contract, corporate, corporation, credit, date, debts, depreciating, depreciation, dollars, eight, employees, exempt(ion), expense(s), fees, fifty, file, fund(s), gross, inventory, investment, item, joint, legal, liability, liable, maintains, monthly, net, nine, offer, organization, owners, partially, partner(s), partnership, payment(s), payroll, percent(age), prepares, principal, profit, proprietor, purchase(d), purposes, quarterly, reasonable, receipts, receives, related, reports, request(s), revenue(s), sale, sell(ing), separate, shares, sheet, sold, statements, stockholders, taxable, taxes, thirty, twenty, wages
ability
abrogate
absence
academic
accept(s)
   (ed) (ance) ('ing)
accident(s)
accommodate
accommodating
accomplish
accord(ance)
accountant*
accounting*
accounts*
accrual
accrued
accumulate
accurately
achieve(ment)
acknowledge
acquired
acquisition
act(ed)
   (s)
actions
actual*
ad
ad.*('ing)
   (s)
addends
adequate
adjust(ed)
administer
admission
adopted
advance(s)
advantage(s)
advantageous
advertising
advisable
affect(ing)
affiliated
affirmative
afford
afraid
agencies
agency
agent
agreement
   (s)
aids
aliens
allegation
allocate
allocation
allow(ed)
   (s) (able) (ance)
alternative
amended
amendment(s)
amortized
amounts
ample
analyze
analyzing
annual*(ly)
annuity
answers
apparent
appearing
applicable
application*
applies
apply
appointment
appreciable
appropriate*
approval
approved
arbitrary
arguments
arise
arising
arithmetic
arrangement
arrive
arriving
article(s)
artificial
asking
assembly
assessed
asset(s*)
assign(ed)
   (ment) (s)
assistance
assistant
assisting
assists
associate(d)
assume(s)
assuming
attach(ed)
   (ment)
attempted
attorneys
attributable
audit(ing)
   (or) (s)
authority
authorized
auxiliary
avoid(s)
aware
background
backing
balance*(s)
bank*(s)
bargain(ing)
   (s)
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beats
becomes
beg
begin
behalf
beneficiary
benefit(ed)
   (ing) (s)
bias
biggest
bilateral
bill(ed)
   (ing) (s)
binary
binding
bit
biweekly
bonds
books
border
borrow(ed)
   (er) (ing)
bought
bound
boundaries
brackets
breach
briefly
bringing
broad
broken
budget(ed)
busiest
businesses*
businessman
buy(er)
   (ing)
bylaws
calculate(d)
calculating
calculator
calendar
calling
canceled
cancellation
capacities
capacity
capital*
carefully
carload
carry(ing)
cash*
catalog
causals
centralize
cents
certificate
ACCOUNT CLERK (continued)

challenge
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changing
chapter(s)
characteristic
charge(able)
(d) (s)
charitable
charter
check*(ing)
(s*)
circular(s)
cited
citizen(s)
civic
civil
claim(ed)
(s)
clarification
classification
classified
clause
clean(ing)
clear(ed)
(ing) (s)
clerk
closing
code(d)
(s)
coding
coin(s)
collect(able)
(ed) (ion)
column(s)
combination
combined
combining
commerce
commercial
commission
commodities
commonly
communicate
companies
comparable
comparative
compared
comparison
compensation
completed
compliance
complies
comply
compounded
comprehension
comptroller
computation
compute(d)
(s*)
computer(s)
computing
combination
concentrate
concept(s)
concern(ing)
conclusion
conclusive
condition
conduct(ed)
confidential
confined
conflict
conform
consent
considerable
considerate
consider(ing)
(s)
consist(ent)
(s)
consolidate
constitution
construed
consume(d)
(r)
contact(s)
contained
contains
contemplate
continues
continuity
continuous
contract*(or)
(s) (ual)
contribute
contribution
control(led)
(ing) (s)
convention
convert(s)
conveyed
copies
copy
corporate*
corporation*
correct(ion)
(s)
correspond
council
counsel
count(er)
(s)
courses
courts
cover(s)
coworkers
create(d)
(s)
creating
creation
credit*(ed)
(ing)
creditor(s)
criteria
criticism
crucial
cumulative
currency
custom(ary)
customer(s)
damage(s)
date*(s)
debit(ed)
debt(or)
(s*)
decimal
decisions
decrease(d)
(s)
deduct(ed) (ible)
(ing) (ion) (ions)
dedemed
defect ive
(s)
defined
definite
definition
delay(ed)
(s)
delegation
delinquent
deliver(y)
demand(ed)
denomination
denominator
deny
depend(ent)
(ing) (s)
deposit(ed)
(or) (s)
depreciating*
depreciation*
deprive(d)
describes
description
designated
desk
desperate
detail(s)
determine(d)
(mination)
(mines)
determining
devoted
diamond
dictate
differential
difficulty
digits
diligence
dire
ACCOUNT CLERK (continued)

directed
directors
disabilities
disability
disagreement
disbursement
disclaim
discount
discovered
discriminate
discuss(ed)
   (ing) (ion)
disposal
disposing
dissolution
dissolve(d)
   (s)
dissolving
distinct
distinguish
distribute
distributing
divest
divide(d)
dividends
dividing
divisor
document(s)
dollar(s*)
double
dozen
draft
draw(s)
drawings
drawn
draws
dues
duplicate
duration
duties
duty
earn(ing)
   (ings)
educational
effecting
efficiently
eight*
eighteen
eighty
electric(ion)
electronic
eleven
eligible
eliminate
emerge
employed
employee(s*)
employers
employs
enable
enact
encumbered
encumbrance
ended
ending
ends
enforce(able)
engage(d)
engaging
enhanced
enjoyed
enriched
enrolled
enter(ed)
   (ing) (s)
enterprise
entertain
entirely
entities
entitle(d)
entity
entries
entry
equal(ly) (s)
equity
errors
essential(ly)
establish(ing)
   (ment)
estate
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estimates
etc.
evenly
event(s)
everybody
evidenced
evident
examination
examine
examples
exceed(ed)
   (s)
exception(s)
excess
exchange
excluding
exclusively
excusable
excuse
executed
execution
executives
executory
exemplified
exempt*(ion*)
   (ions)
exercise
exhibit
exist(ing)
   (s)
expanded
expecting
expects
expenditure
expense*(s*)
explain(ed)
exploded
express(ed)
extended
extends
extension
extra
facilitate
facilities
factions
factor
factory
facts
fails
failure
fair
falls
false
familiar
families
fault
favorable
feature(s)
fee(s*)
fifteen
fifty*
figuring
file*(d)
   (s)
filing
filled
finance
financial
finding
finds
finish
firms
fit
fix(ed)
flexibility
flight
flow
follow(s)
forced
forcefully
forever
forget
forgot
formal
formation
formed
formerly
ACCOUNT CLERK (continued)

| forming | holder | insolvency | juror(s) |
| formula | holding | inspect(ion) | jury |
| formulation | hospitals | installment | keeping |
| forth | hotels | instance(s) | key(punched) |
| forty | hourly | institution | kinds |
| forwarded | housecleaning | instruction | label |
| foundation | housing | instructor | lag |
| fourteen | hundreds | instrument | laid |
| fractions | hundredths | insufficient | lately |
| freely | identical | insurance | latent |
| freight | illegal | insured | lawful |
| frequency | illustrate | intangible | laws |
| frequently | inspection | intended | lawsuit |
| Friday | immediately | intent | lawyer |
| fully | immunities | intercede | laying |
| functions | impartial | interesting | layovers |
| fund*(*s*) | implied | internal | leagues |
| furnish(ing) | implies | interpret | learns |
| gain(ed) | importantly | interstate | leased |
| gentleman | imposed | intramural | leases |
| gifts | impossible | intrastate | leaves |
| giving | impression | introduce(d) | leaving |
| glue | improper | inventories | ledger |
| goes | incapacity | inventory* | legal*(ly) |
| goodbye | incidence | invert | legibly |
| goodness | included | invest(ed) | legislation |
| goods | includes | invisible | legislative |
| gotten | incomes | invitation | legitimate |
| governing | incorporate | invite(d) | lender |
| granted | increases | invoice(s) | lending |
| grants | incurred | involve(s) | lessee |
| grocer(y) | incurring | involving | lesson(s) |
| gross*(es) | indicate(s) | irrevocable | levied |
| grown | indirectly | issued | liabilities |
| guarantee(s) | indispensible | issues | liability* |
| guard | inefficient | issuing | liable* |
| guess | inevitably | item*(s) | license(d) |
| guilty | influenced | jobs | lifetime |
| handle | inherent | join(t*) | limit |
| happens | inherit | journal | liquid(ation) |
| hearing | initial | judgment | listed |
| heirs | initiative | July | listen(ing) |
| hence | injuries | June | listing |
| highest | injury | juries | lists |
| hint | inquiring | | literally |
ACCOUNT CLERK (continued)

literary
litigation
loan(ed)
(ing)
located
location
lodging
log
logically
lose
loss(es)
lowest
lucky
lumber
machine
mail
maintain(ed)
(ing) (s*)
majority
managed
management
managerial
managers
manifests
manual(ly)
manufacture
mark(ed)
markdown(s)
marketing
markup(s)
match(es)
(ing)
materials
meant
meetings
membership
memo
memorial
mental
mentality
mentioned
merchandise
merchants
mere
mergers
mess(ed)
minds
minimum(s)
minute
misconduct
misleading
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misrepresent
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missing
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modification
modified
monthly*
motive
mounting
multiple
multiplication
multiplied
multiples
multiply(ing)
mutual
named
names
necessarily
necessitate
necessity
negative
negligence
neighborhood
net*
nickel
nine*
nineteen
ninety
ninth
noise
non
nonexempt
nonexistence
nonprofit
noon
normally
notation(s)
noted
notes
notice(s)
notifies
notify
null
numbering
numerator(s)
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obligated
obligation
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occasional
occupation
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officer(s)
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official(s)
 omission
omits
operate(d)
(s)
operating
operational
operations
operators
opposing
opposite
option
oral
orders
ordinarily
ordinary
ordinates
organize(d)
organization*
original
ostensible
otherwise
ounce
outcome
outlined
outstanding
overdraw
overhead
tovertime
owe(d)
owned
owner(s*)
(ship)
owning
owns
o’clock
package
packaging
packing
page
paint
papers
paragraph
pardon
parent
partial(ly*)
participant
participate
parties
partner*(s*)
(ship*)
passbook
patrons
payable
payer
paying
payment*(s*)
payroll*(s*)
pays
pending
pension(s)
percent*(age*)
perform(ed)
(s) (er) (ing)
periodic(al)
periods
 permanence
permanent
permission
permits
permitted
ACCOUNT CLERK (continued)

require(ment) require(s)
requiring requisition
resale rescinded
resell reserve
residence resident
resolving resources
respective responsible
restrict(ed) (ion) (s) restricting
resulting retail ers)
(ing) (s) retained
retains retention
retired returning revealing
revenue*(s*) reversals
reverse(d) reversing review(ed)
(ion) revolv(ing)
rid rights
ring risk(s)
role(s) rolls
rooms round
rule(s) rulings
rush safe
salaried saliaries salary
sale* satisfy
Saturday save(d) (r)
saving(s) schedule
scientific scope scrapped
secret securities security sees
seized seldom select(ed)
sell*(er) (ing*) (s)
semimonthly send(s)
separate*(ly) seriously serves
settlement seventy share(d) (s)
shareholder sharing
sheet*(s) shelves
shift shipments shipped
shipping shop(s)
showing shows sign(ed)
(ing) signals signature
significant similarly simplest sit
similarly situations sixteen sixty
skill(fully) skipping slow
sold* sole solution solve
somebody somehow someone sometime
sorry sought sounds sources speaking
specialize specifically specified
speed spell(s) spent
stable s*ck
standards stand
stare starts stated
statement(s*) stating status
stands statutes stipulate(d)
stipulation stockholder* stocks
store(s) strictly strip
stronger structure(s) stub
stuff style
subchapter subjects
submits subscription subsidiary
substantial subtotal subtract(ed)
(ion) success(ful) sue(d)
suffered sufficient
suitable sum(s)
summoned Sunday sundries supermarket
supervision supervisor supplier
supply(ing) supported suppose(d)
supreme surfaced survey
sweater swimming switch
tabs takes
talent(s) talked
talking
ACCOUNT CLERK (continued)

tangible
tape
tasks
taxability
taxable*
taxation
taxed
taxes*
taxpayer
teach
technically
technique
telephone
teller
tells
temporary
tenancy
tenant
tend(ed)
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tentative
term(ed
termina:ed)
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thank(s)
thereafter
thereof
thereon
thinks
thirteen
thirthie
thirty*
 thorough
thousand(s)
throw
throw
Thursday
tie
tuning
tomorrow
tonight
tons
tool
totally
touch	
tourist
traded
trade in
trailer
transact(ion)
transfer(ed)
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transposing
travel
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truly
trust(ee)
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tryout
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tuition
turning
twelve	
twenty*
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unanimous
unanticipated
unattracting
unchanged
unco:stitutional
underlying
understand
undertake
undesirable
unemployment
unenforceable
unfilled
uniform
unilateral
unions
unique
units
unknowingly
unknown
unless
unlike
unnecessary
unpaid
unrelated
unused
update
useful
uses
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valid
valuable
valuation
valued
variation
varies
variety
vary
verbal
verdicts
vertical
vested
vinyl
violating
violation
virtually
void
voluntarily
voting
voucher(s)
wages*
wait
waived
waking
walk
wants
warranty
watch
wealth
wear
Wednesday
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weekly
weight
weird
whenever
whereas
wherever
whichever
wholly
widely
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willing
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worth(while)
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discussing
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dispatcher
dispense
dispensing* display
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disposed
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distributor
divide(d)
dividing
document
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double
downs
downward
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1 Vocabulary Lists
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couplings
courses
cousin
cover(age)
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(ing) (ings) (s)
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debris
deceleration
decent
decimal(ly)
deck
decoration
defects
define(s)
defied
defining
definitely
definition
deflection

dimension*(ed)

dinner
directed
directions
director
discharge
discuss(ed)
disposal
disposed
distances
distinguish
disturbing
diver
divide(d)
dividing
divisions
document
dollars
domestic
doorknob
dot(ted)
double
doubts
downstairs
downtown
downward
draft(ing)
draftsman
drain(age)

draw*(ing*)

dress
drilled

drinks
drippings
DRAFTSMAN (continued)

driven

driver

drives

driveways

driving

drop(ped)

(s)
drove

dry

duct(s)
ductwork
dug
dumbwaiter
durable
dusting
dwelling
dynamic(s)
easier
eating
eaves
eccentric
economical
economy
edge
editions
effectively
efficiency
effluent
eight*
eighteen
eighty
elaborate
elbow(s)
electrical
electronic
elevation*(s)
eleven
eliminate(s)
elipse
elliptical
elongation
embedded
emphasis
emphasized
employed

employees
emptied
empty
enclose(d)
enclosure(s)
encountered
ending
ends
energy
engineer(ing)
enjoyed
ensure
entail(s)
entering
enters
enthusiasm
entirely
entrance
environment
equal*(ly)
(s)
equation(s)
equilibrium
equipped
equivalent
erase
erect(ing)
(ion)
erosion
escalator(s)
esential
establish(ing)
estimate(s)
etc.
evenly
event(ually)
(s)
evolved
exact(ing)
(ly) (ness)
exam(ination)
(ined)
examples
excavation
exceed(ing) (s)

exception(s)
exchange
excluded
excuse
exempted
exercise(s)
exert(s)
exhaustive
exist
exit(s)
expanded
expans
expansion
expensive
explain(ed)
(s)
explanatory
exposed
expressed
expressing
extend
(ing)
extension
exterior*
external
extinguish
extra
extreme
eyelets
fabricated
fabrication
facing
factor
failure
fairly
falling
falls
false
familiar
fan(ned)
fancy
fantastic
farmer
fasten(ed)
(ing)

favor(ites)
feasible
feature*(s*)
February
feeder
fewer
fiber
fields
fifteen(th)
fifth(s)
fifty*
fig.*
fights
figured
figuring
file(d)
(s)
fiiled
fillet
finding
fingers
finish(ed)
(ing)
firebrick
fireplace
firmly
fit(s)
fitting(s)
fixed
fixtures
flame
flammability
flange(d)
(s)
flashing
flat
flight
flooring
floors
flow
flue
flush
flux
fly
foam
folder
galvanized
games
gap
gas(eous)
(gas(es) (es) (sed)
headers
gauge(s)
heads*
heat*(ed)
(heat* (es) (ing)
heaviest
heal
height
hereof
hereunder
hidden
highly
holdage
holders
holding
hole(s)
homes
homework
hook
hopefully
horizontal
horizontal*
houses
housing
hub(s)
hungry
hurt
hydraulic
hypotenuse
identical
identification
identified
identify(ing)
illustrate
illustration
impact
impending
implies
implies
implying
impossible
impractical
impression
improve
inaccurate
inches
inclined
included
inclusive
incomplete
inconsistent
incorrectly
increases
increasing
increment
incurred
indentation
independent
indicate(s)
indicating
indication
indicated
indirectly
inertia
inherent
initial
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inspection
inspector
installation
installed
instances
institute
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instruction
instructor
instrument
insulating
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interval(s)
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isolation
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jams
jobs
join(ed)
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joint*(ed)
(s*)
joist(s)
judging
jumper
jumps
justification
keeping
keeps
key
kg
kilograms
kit
kitchen
knocking
knows
labeled
laboratories
laborers
lacking
laid
landed
landing
lands
lap(ped)
(s)
largely
lath
laundry
layer
laying
layout*(s)
lb.
leading
leads
leaked
leaking
lease
leaves
leaving
ledger
ledges
leg(s)
lengths
lesser
leveled
levels
liability
librarian
libraries
library
lieu
lift(ing)
lights
liked
limit(ing) (s)
linear
lin(ed)
liner(s)
lining(s)
lip
liquid
listed
listen(ing)
lists
lives
load(ed)
(ing) (s)
loadd bearing
locate(d)
locating
location*(s)
lock(ing)
logical
longitudinal
looks
loosened
looseness
lose
losing
losses
lowest
lucky
lumber
lunch
lyrics
machine(d)
(ry) (s)
magnetic
magnifies
magnitude
magnolia
mail
mainly
maintain(ed)
(s)
manhole
manhours
manpower
manufacture*
mark(ing)
masonry
master
matching
materials
math
matting
matrix
maximum
meanings
measure(d)
(ment) (s)
measuring
mechanical
mechanism
medium
meets
mental(ly)
merits
mesh
message
metal*
meter(ing)
(s)
metric
mile
millimeter
mineral
miniaturize
minimize
minimum
minus
minute
miter(s)
mm
modification
modular
module
moisture
moldings
molds
moments
Monday
monetary
moon
moreover
mornings
mortar
motion
motivated
mountains
mounted
mounts
movable
mph
mud
multiple
multiplied
DRAFTSMAN (continued)

multiply(ing)
mutual
nail(ed)
  (ing) (s)
naturally
nearby
nearest
neat(ly)
necessarily
necessitate
necessity
neck(s)
negative
neglecting
negligible
net
newtons
nice
nine
nineteen
nobody
noise
nominal
noncombustible
noncomplex
noncorrosive
normally
notch(ed)
noted
notes
notice(able)
nozzle(s)
numbered
numerical
object*(s)
objectionable
obstruction
obtain
obvious
occasion
occupancies
occupancy
occupant(s)
unoccupied
occupy
occurrence
occurrence
occurrence
occupied
occurrences
occurrences
occurrences
occur
octagon
offering
offices
official
offset(s)
(ting)
ogee
oil
ok
omitted
onto
opening(s*)
opens
operable
operate
operations
operator
opposed
opposes
opposing
opposite
ordered
organized
original
otherwise
ought
outer
outlet(s)
outline(d)
output
overall
overhang(s)
overhead
overlap(ping)
overlapped
overwork
owner
pack(age)
page(s)
pan
painted
panel*(ing)
(lized) (s*)
papers
parachute
paragraph(s)
parallel*
pardon
partially
particle
parties
partition(s)
partly
pass(es)
(ting)
patched
path(s)
patio
patterns
penalties
penetrate
penetration
penthouses
percent(age)
perforated
performed
performing
perform
perimeter
permanent
permise
permit(s)
(ted)
perpendicular
personnel
perspective
pertaining
physically
p
pick(ed)
(ting)
picket
pictorial
pieces
pier(s)
pigtail
pinned
pins
pipe*(s)
piping
pit
places
placing
plain
planer(s)
planes
planned
plaster
plastic(s)
plate*(d)
(s)
platforms
plated
playing
plot(ted)
(ting)
plug(ged)
plumb(ed)
(ing)
plus
plywood
printing
policies
popular
porcelain
porch
port(able)
portion(s)
posed
positional
positioned
positions
positive
possibility
possibly
postal
potential
pounds
poured
practical
practice(s)
presedence
precipitate
precisely
precision
DRAFTSMAN (continued)

predetermine  prove(d)  reduce(d)  respects
  predrilled  (n)  provides  reduction  restricted
  preferably  providing  redwood  restrooms
  preferred  provision(s)  refastened  rests
  preheating  psi  refer(red)  resulting
  preliminary  pull(ed)  (ring)  retaining
  preparation  pulse  regardless  retardant
  prepared  punched  registered  reveal(ing)
  preparing  purchase  registrars  reverse
  preplan  purposes  regular  review
  pre. cribed  pursued  reinforced  rewards
  present day  pushed  reinforcement  rig
  presents  putting  refer(red)  right
  pressing  quadrant(s)  retaining  ring(s)
  pressures  quantities  retardant  ripped
  prevailing  quantity  reverse  rise
  prevent(s)  quarter(s)  rocks  roads
  previous  quick(er)  rod  rolled
  prices  quick(ier)  (s)  rolled
  primarily  radius  (s)  round(ed)
  principles  raised  safe(ty)
  printed  rails  repairs  rule(s)
  printing  raised  represented  runs
  prints  ramp  requiring  safe(ty)
  prior  rampset  represented  runs
  procedures  random  representing  scale
  proceed  rapid  requesting  salvaged
  processes  rates  requirement  sample
  processing  random  requiring  satellite
  produce(d)  (s)  reasonable  satisfactory
  produce(d)  (s)  reasons  satisfied
  product  raw  requisition  Saturday
  proficient  reactions  resembling  scale
  profile(s)  realistic  reserved  scaling
  progresses  realize  resembles  schedule(d)
  prohibit  reasonable  reserved  schematics
  project(ed)  reasonable  reserve(s)  scissors
  (ing) (ion)  reasons  residence(s)  scratch
  promised  reefound  residential  screen
  proof  rapid  recommended  screws
  properly  rates  recorded  scribed
  proportion  rating  recorded  scried
  propose  raw  rectangular  scissored
  prospective  reactions  record(s)  screw(s)
  protect(ed)  readable  recorded  screws
  (ion)  readable  rectangular  scissored
DRAFTSMAN (continued)

script  
sealed  
sealer  
seam  
searching  
seated  
seating  
secondary  
seconds  
sectional(s)  
sections  
secured  
securely  
securing  
seep(age)  
seldom  
selected  
selecting  
selection  
self  
selling  
semicircle  
semidiameter  
send  
separate(d)  
separation  
septic  
septic  
septic  
sewage  
seller  
shade  
shadow(s)  
shaft(s)  
shakes  
shape(d)  
(s)  
sheet*(ing)  
(s)  
shell(ed)  
(s)  
shield  
shift(s)  
shingles  
ship(ment)  
shoot  
shop  
shorted  
shortest  
should  
showcases  
showing  
shows  
shrink  
sides  
sidewalk(s)  
siding  
signal(s)  
significant  
signify  
sill(s)  
similarly  
simplest  
simplification  
simultaneous  
singing  
singular  
sitting  
site  
situations  
sixteen(th)  
sixth  
sized  
sizes  
sizing  
sketch(ed)  
(sk) (ing)  
skids  
skilled  
sky  
skylights  
slab(s)  
slanted  
sledge  
sleeper  
sleeping  
slide(rs)  
slightly  
slipped  
slope(s)  
slots  
slow  
slug  
smaller  
smoke(y)  
smooth(ly)  
snap(ped)  
socket  
sold  
solder  
solid  
solution  
solve(d)  
solving  
sooner  
source(s)  
spaced  
spaces  
spacing  
span  
spandrels  
spec  
specialize  
specifically  
specification*  
specified*  
specify(ing)  
specimen(s)  
spell  
spend  
spherical  
spiral  
square(s)  
square(s)  
struck  
structural  
structure(s)  
studies  
stuff  

staggered  
stainless  
stairways  
stamped  
standards  
standing  
standpoint  
starter(s)  
starting  
starts  
stated  
static(s)  
stating  
stationery  
statistics  
stays  
steam  
steel*  
steep  
stenograph  
stepping  
stick(ing)  
stiffen  
stocked  
stone  
stopper  
stops  
storage  
store(s)  
storm  
strap(s)  
streets  
strengths  
stresses  
stretch  
strike  
striking  
strings  
strip(ped)  
(s)  

104  
95
DRAFTSMAN (continued)

style
sub
subcontract
subdivision
subgrade
subjected
subjects
subparagraph
subsection
subsequent
substances
substantial
substitute
substituting
successful
sufficient
suggest(ion)
suitable
sum:
supervisor
supper
supplement
suppliers
supply
supported
suppose(d)
surfaces
surprised
surrounding
surveying
suspended
switch
symbol(s)
symmetrical
symmetry
tables
tabs
tack welding
tag
tail
takeoff
takes
talked
talking
tally
tamped
tangent	tank(s)
tape(d)
taper(ed)
ing(s)
target
task	team
techniques
tee(s)
telephone
temporarily
temporary
tenant
tend(s)
tensile
tension*
tentative
tenth
term
terminal(s)
terminate(s)
termination
testing
tests
text(s)
textural
texture(s)
theorem
theoretical
thereby
therein
thereof
thereo
thereo
thick(er)

(ness*)

thinner
thirteen
thirty
thorough(ly)
thousand
thread(ed)
throat
	hrow(s)

thorough
thumbnail
Thursday
tie(d)
s
tighten
tightly
tightness
tile
till
timber
tiny
tip(ping)
title
toe
toilet
tolerance*(s)
tomorrow
tons
tool(ed)
totaled
touchup
trace(d)

track(s)

trades

traditional

traffic

trailer(s)

trained

transfer

transition

transportation

transverse

trapezoid

traveling
treated
treatments	
trench(es)
trend	

triangle(s)

triangulate

trim(mers)

truck(s)

truss(es)
tube(s)
tubing
tune
twelve*
twenty*
twice
twisted
twisting
typical
ultrasonic
unacceptable
unacquainted
unbalanced
unbearable
uncle

uncontrolled
undercarriage
undermining
underneath
undimensioned
unenclosed
uneven
unfired
unforseeable
unified
uniform(ly)
unilateral
unit(s)
unknown(s)
unless
unloading
unnecessary
unproductive
unprotected
unstayed
unsupported
unusual(ly)
unwieldy
upper
upset
upward
usable
useful
usual
vacation
valley
vanish(es)
(ing)
vaporizer
variables
variation(s)
variety
vary(ing)
vault(s)
vector(s)
velocity
veneer(s)
vents
verge
verify
vertical*(ly)
vessel*(s*)
 violation
virtual
vitreous
vitrified
void
volts
volumes
wainscoting
wait
wales
walk
wallboard
walls*
wants
warrant
waster
wasted
wastes
wedge
weekend
weighed
weighs
weight(s)
weld*(ed*)
(er) (ing)
(s*)
wheeler
wheeling
whereas
wherever
whoever
widely
wider
width(s)
win
wind
windlift
windows
windstorm
winter
wire*(s*)
wiring*
withstand
won
wonder
wood*
wool
worker
(s)
workmanship
worksheet
worry
worse
wrap(per)
wrecked
wrench
yards
yell
yellow
yesterday
zero
zone
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<tr>
<th>HIGH FREQUENCY WORDS</th>
<th>ELECTRICIAN</th>
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<td>(ages) (s)</td>
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<td>wire</td>
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<td>wiring</td>
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</table>
### TECHNICAL VOCABULARY
#### ELECTRICIAN

| abilities | ability | abnormal | absence | acceptable | accepting | access(ible) | accident(s) | accompanying | accomplish | accordance* | accumulating | accuracy | accurate(ly) | achieving(ment) | activated | actual | actuate | additions | adequacy | adequate | adhesive | adjacent | adjusted | adjusting | adjustment | admired | adult(s) | advanced | advice | affect(ed)(s) | affixed | afterward | agency | aggregate | air conditioning | alarm(s) | algebraic | allow(ing)(s) | alloys | alnico |
|-----------|---------|----------|---------|------------|-----------|-------------|-------------|--------------|------------|-------------|-------------|----------|-------------|----------------|-----------|--------|---------|-----------|----------|----------|----------|---------|---------|----------|---------|---------|---------|--------|----------------|--------|----------|--------|---------|----------------|--------|---------|---------|--------|--------|
| carriers | clean(ed) | condition(ing) | correlation |
| cast | (ing) | conduct(ion) | correspond |
| catalog | cleared | conductive | corrosion |
| catatonic | climates | conduit*(s) | costly |
| category | climb | confidence | counting |
| caused | closely | conflict | coupling |
| causes | closer | conform | courses |
| causing | closures | confused | cover(s) |
| ceiling(s) | clothed | crises | crescent |
| Celcius | cobalt | crisis* | crisscross |
| cemented | code*(s) | considerable | critical |
| centers | coefficient | considerate | cross |
| chair | coil*(ed) | considering | crowd(ed) |
| chalk | (s) | considers | crystal |
| chances | collector | consist(ent) | curie |
| changed | collision | constitute | currently |
| changing | column(s) | construct(ing) | currents |
| chapter(s) | comb | consumes | curve |
| characteristic | combination | contact(s) | customer |
| charged | combined | constitute | cuts |
| charges* | combustible | consumes | cutting |
| charging | comfort(able) | continuous | cycle |
| chart | commercial | contentment | damage(d) |
| chases | companies | continuous | (s) |
| chassis | comparable | contract*(or*) | dangerous |
| chatter | compare(d) | (s) | dangers |
| -check(ed) | complaining | contribute | date(s) |
| (ing) (s) | completed | controlled | dc |
| chewed | completion | controller | dealing |
| choose | complex | controls | decimal |
| choosing | compliance | convenient | de-energize |
| chosen | comply | conveyors | defined |
| chromium | component(s) | cooling | defining |
| circuit*(s*) | composition | cools | definition |
| circulate(s) | compressed | cooperate | deflection |
| cited | compression | coordinate | degrees |
| claim | compressor | coordination | delay |
| clamping | computation | coordinate | delivered |
| classified | computed | coordination | delivery |
| classes | computer | cope | demagnetize |
| classification | concentrate | copper | demand |
| classified | concept(s) | copy | demolition |
| concise | concrete | core* | demonstrate |
denominator
density
depend(ency) (ent) (ing) (s)
deposits
depth
derived
description
designating
designation
desired
detail
detector
deteriorate
determinant
determining
develop(ing) (s)
device(s)
diagram(matc) (ings) (n)
die
dielectric
differently
differing
dimensional
dip
directed
dirt
disagreement
dissociation
discharge
disconnect
discourage
discovered
discussed
discusses
discussing
disease
disintegrate
dislike(s)
disorder
display
disputable
distinct
distinction
distinguish
distorts
distributing
diversity
dives
divided
divider(s)
documents
dodge
dollar(s)
dominated
doors
doses
dotted
double
drag
draglines
drain
draw(ing)
(ings) (n)
driddles
dressed
dribble
dried
drift
drills
drops
drives
driving
drop(ped) (s)
drove
drum(s)
dry
dual
duct(s)
dug
dull
dumped
dust
dynamic
easier
economy
edition
effectively
effectiveness
eight
elect
electric*(al*)
(eian) (ity)
electrode(s)
electromotive
electron(ic) (s)
element
elevator
eliminate(d)
elsewhere
embarrassment
embedded
emergency
emt
emotional(ly)
emphasis
employed
empty
enclosed
enclosure(s)
encountered
energized(d)
energy
engages
engineering
engineers
engraved
erchances
enter
entrance
envelope
environment
equal(s)
equation*(s*)
equipment
equivalent
erratic
errors
escape
essential(ly)
estimate
etc.*
evaluates
evaluation
event(ually)
evident
exact(ly)
emam(ine)
(plies)
excavato
exceed(ing)
exception
excess(ive)
excluding
exclusive
excuse
execution
executive
exhaust(ing)
exist(ed)
expands
expense
experiencing
experiment
explain(ed)
explanations
exposed
expressing
expression
expressly
extended
extensive
external
extra
extremes
facilities
factor
failure
false
familiar
families
fan
fascinating
fast
fastened
fastened
fault
favor(able)
fears
feature
fed
feedback
feeder*(s)
ferromagnet
fiberglass
fields
fifteen
fifth
fig.
figured
filing
fill
filtered
financial
finding
finds
finish(ed)
(es)
fireplace
fires
fit(ting)
(tings)
fixture*(s)
flammable
flattened
flexible*
floatless
floors
flow(s)
fluids
flush
flux
focus
follow
fool
foot(ing)
forced
foregoing
formula
forth
forty
fourth
fraction(al)
(frame
freezing
frequency
frequently
friday
frozen
frustrating
frustration
fullscale
fully
fume
functional
functioning
functions
fundamental
furnishes
furnishing
furthermore
fuse(s)
gate
gallons
galvanized
games
gases
gasoline
gauge
gear
generate(d)
generating
generation
generator(s)
gets
giving
glad
glandular
glass
go
gold
govern(ing)
grade
gradual
graph*(s)
grass


grease
grids
grinned
grounded*
grouting*
grout
grow(s)
guarantee
guard(ed)
guess
guide(lines)
guns
gutter(s)
habits
hallway
handbook
handicap
handle
handout
handy
hanger
hanging
happening
happens
happiness
harm
hazardous
heat(er)
heat-reacting
height
hence
herein
hertz
high(er)
(est)
highpower
hill
hoists
holder
holds
hole(s)
hoods
hook
horizontal
horsepower
hostile
hp
humidity
hundredth
hypotenuse
identify(ing)
identity
illustrate
imbalance
immeasurable
immediately
impedance
impression
improper
inaccessible
inadequate
incessantly
inch(es)
incental
included
includes
inconvenient
increases
increasing
incurred
independent
indicate
indication
indoor
induction
inductive
inductor
inexpensive
influenced
influences
informal
informed
initial
inoperative
input
inquiry
insert
inspection
inspector
installation*
ELECTRICIAN (continued)

installed
instance(s)
instant
instinct(ive)
instruction
instrument
insulated
insulating
insulation
insulator
integers
integral
intellectual
intense
intent
interact(ion)
interchange
interference
interior
interlocks
internal
interrupting
intersection
intervals
interwoven
intolerable
introduce(d)
introducing
introduction
inverted
investigate
invisible
involved
involve(ment)
(s)
involving
iron*
irritability
isolated
item(s)
jacket(ed)
jerkered
joint(s)
judgment
jumper*

junction
keen
keeping
kicked
kiddin(g)
killed
kilo(gram)
kinds
knock(out)
(outs)(s)
kw
lab
label(ed)
(ling)
laboratories
laboratory
lag(s)
iaminated
lamp(s)
lampholder
largest
lash
lately
latest
lattice
laws
layout(s)
lays
lcd
lead in
leading
leads
leakage
leaking
leaves
legs
lessen
lesser
liability
lifetime
lighting
lights
liked
likes
limitation
limiting
linear
lingering
lining
link
liquefied
liquid*(s)
listed
listing
literal
lives
load*(s)
located
location(s*)
lock(ed)
logical
longest
looped
loosely
loosen
loses
losing
loss
low
lug(s)
machine(d)
magazines
magnet(ic*)
(ism)
(ized)
(izing)
magnitude
mainly
maintain(ed)
(ing)
(s)
majority
manage
mandrel
manganese
manual
manufacture
mark(ed)
marrage
materials*
| motion | motivated | motivation | motives | motor*(s) | mounted | movable | ms | multimotor | multiple | multiplication | multiplied | multiply(ing) | mv | named | nameplate | nationally | nearest | necessarily | necessary | negative | negligence | neoprene | net(work) | neutral | nickel | nights | nine | nineteen | ninety | noisy | noncombustible | nonhazardous | nonmagnetic | nonmetallic | normally | noted | notice | numerous | nurseries | objection | obtain | occupation | occupy | occur(s) | offensive | officials | offset | ohm(meter) (s*) | oil | older | opening(s) | operate(d) | operating | operations | opposite | orators | ordered | ordering | orders | ordinance | ordinarily | orientation | original | oscillator | otherwise | ought | outdoor | outgrow | outlet*(s) | outlined | outline | output | oven | overcome | overcurrent | overhead | overlapping | overload | owner | oxygen | oz | pace | page | pain | paint | pair(s) | panel(s) | panelboard | papers | parallel(ed) | paralysis | paesis | park | partially | pass(ing) | pasted | patching | path | peak | pendant | penetration | perceivable | perceive | percent | perception | perceptual | perform(s) | periodic(al) | permanent | permeability | permissible | permit(s) | (ted*) | perceivable | particular | personality | personally | phase(s) | pick | pictorial | pin | pipe(s) | piping | places | plain | planned | plastic | plate(s) | platinum | played | playing | pleasant | plug(ged) | plus | pointed | polarities | polarity | pole | polynomial | popular | porches | portable | porton(s) | pose | positioned | positive | possibility | post | potential | pour(ed) | powerful | powers | practical(ly) | practice | preapplied | preceded | preceeding | precise | precision | precoated | predict | preliminary | premounted | prepaid | prepare(d) | prescribed | presence | presented | presupposed | prevent(s) | previous | primarily | primary | principles | printed | prints | prior | probability |
ELECTRICIAN (continued)

- probe(s)
- procedure
- proceed
- processes
- produce(d)
- (s)
- producing
- product
- profound
- prohibited
- project
- proper(ly)
- properties
- protect(ed)
- (ion)
- prove
- provides
- provision(s)
- publicity
- published
- pull
- pullboxes
- pulse(s)
- pump(s)
- pure
- purple
- purposes
- putting
- quadratic
- quantities
- quantity
- quarter
- quickly
- quit(s)
- raceway(s)
- radial
- rags
- rails
- raised
- ranges
- rapidly
- rare
- rated
- rating*(s)
- ratio
- reaches
- react(ance)
- readings
- reality
- realize
- rearranged
- reasonable
- reasons
- receive(r)
- (rs)
- receptacle
- recessed
- recessing
- reciprocal
- recognize(d)
- (s)
- recognizing
- reconnected
- reconnecting
- recording
- recovered
- rectangular
- rectified
- rectifier
- reduce(d)
- reduction
- reevaluating
- refer(red)
- (s)
- refrigerate
- regard(less)
- regular
- regulate
- regulation
- rejection
- relate(d)
- (s)
- relative(ly)
- relay*(s)
- release
- relieved
- relocate
- relocation
- remain(s)
- remedied
- removal
- remove(d)
- rename
- repaired
- repairs
- repeat(ed)
- repelling
- repetition
- replace(d)
- represent(ative)
- (ing) (s)
- requested
- require(ment)
- reserved
- reserves
- reset
- residual
- resist(ance*)
- (ant) (or*) (ors)
- resolve(d)
- resolving
- resonance
- resonant
- resources
- respective
- respects
- respond(s)
- responses
- responsible
- resultant
- resulting
- reused
- revenge
- reversal
- reverse(s)
- rigid
- rise(r)
- rocks
- rolled
- rolling
- roofed
- rooms
- root(s)
- rotated
- rotates
- rotating
- rotation
- rough(ing)
- round
- routed
- row
- rubber
- rule(s)
- runs
- ruptured
- safety
- salesman
- salvaged
- samples
- sap
- satisfaction
- satisfactory
- satisfied
- satisfy
- saturated
- Saturday
- scale(d)
- scare(d)
- (s)
- scheduled
- schematics
- scientists
- scratch
- screen
- screw(ed)
- (s)
- seal(ed)
- secondary
- seconds
- sections
- secure(d)
- security
- seek(ing)
- segments
- seldom
- select(ion)
- self
- self-concept
- semiconductor
- send(ing) (s)
ELECTRICIAN (continued)

- senses
- sensing
- sensitivity
- separate(d)
- separating
- separation
- sets
- setting
- settle(d)
- setup
- seventy
- severe
- shafts
- shakes
- shaped
- sharp
- sheaths
- shed
- sheet
- shipment
- shock
- shop
- shortcircuit
- shortest
- shots
- shovels
- showing
- shows
- shunt
- shut(s)(ting)
- sign(s)
- signal
- significant
- silver(s)
- silverplate
- similarly
- simplex
- simplified
- simplify
- simulates
- simulating
- simultaneous
- site
- sixteen(th)
  (ths)
- sized
- sizes*
- sketch(es)
- slide
- slight(ly)
- slot
- smaller
- smallest
- smash
- smell
- smoke
- snap(s)
- sockets
- soft
- solenoid
- solid
- solution*(s)
- solve(d)
- solving
- sounding
- sounds
- source(s)
- southwest
- spacers
- spaces
- specifically
- specification*
- specified*
- spend
- splice(s)
- split
- spot
- square
- stability
- stable
- stages
- stainless
- standards
- standstill
- starter
- starts
- stated
- statements
- staying
- stays
- steel
- stick(y)
- stimuli
- stimulus
- stopping
- stops
- storage
- store
- storeroom
- stranded
- stray
- strengths
- stressed
- strictly
- strips
- strongly
- structural
- structure
- stuck
- studied
- studies
- stuff
- subjected
- submit
- substance
- subsection
- substitute
- subtract(ed)
- (ion)
- sufficient
- suggestion
- suitable
- suites
- sum
- super
- superintendent
- supplement
- supplied
- supplies
- supply(ing)
- supported
- supports
- surge
- surgical
- survival
- suspended
- switch
- switchboard
- symbol
- symmetrical
- symmetry
- synonymous
- systematic
- tags
- takes
- tall(er)
- tank
- tap(ped)
  (s)
- task(s)
- teams
- technician
- tedious
- telephone
- television
- telling
- tells
- temporary
- tend(s)
- tent
- term
- terminal*(s*)
- terminated(d)
- terminating
- termination
- tested
- testing
- tests
- text(books)
- theories
- therein
- thermal
- thermometer
- thickness
- thirteen
- thirty
- thoughtless
- thousand*(th)
- threats
- throw(n) (s)
ELECTRICIAN (continued)

tile
unbroken
utility

uncoated
utilization

unconscious
utilize

underground
valve(s)

ununderstood
vapors

unsecond
variable(s)

ununderwriter
variation(s)

uneven
variety

unfinished
vary(ing)

uninsulated
vast

utilization
ventilating

utilize
verify

(utility)
vessels

unconscious
verified

underground
verify

ununderstood
versus

unsecond
vertical(ly)

no third
vessels

utilization
viewed

utilize
viscous

(utility)
visible

utilize
visually

unconscious
volatile

uncoated
volt*(age*)

underground
volt*(age*)

ununderstood
(s*)

no third
voltmeter(s)

utilization
walls

utilize
wants

(utility)
warehouses

utilize
waste

(utility)
watch*(ing)

ununderstood
waterproof

unsecond
waterproof

underground
weather

ununderstood
wet

no second
wherever

unsecond
wherein

uncoated
wider

unsecond
width

unsecond
winding(s)

unsecond
windows

unsecond
wire*(d)

underground
(s)

underground
wiring*

underground
wise

underground
withdrawal

unsecond
wonder

unsecond
workable

no third
workmanlike

no third
workmen

unsecond
worse

underground
wound

unsecond
wrapped

unsecond
wreck

underground
yard

unsecond
zero

unsecond
zinc

Technical Vocabulary Lists

al Vocabulary Lists 116 107
# HIGH FREQUENCY WORDS

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HEATING/AIR CONDITIONING MECHANIC (continued)

...impossible

...invent(s)

...items

...jackets

...jar

...jobs

...joint*(s)

...kinetic

...kit(s)

...latent

...lavatory

...layoff

...layout

...leader

...leading

...leak(age)

...leaving

...length(en)ing

...lengths

...levels

...lever

...library

...lift(ed)

...lightweight

...limit(ing)

...lineal

...lined

...liniting

...liquid*(s)

...liquified

...listed

...listing

...lists

...lit

...lites

...liver

...lives

...load(ing)

...locate(d)

...locating

...location*(s)

...logical

...louvers

...lowered

...lowering

...lubricated

...machine(d)

...magnetic

...mains

...maintain(s)

...manhole(s)

...manifold

...manufacture*

...marble

...margin

...mark(ing)

...marketplace

...match(ing)

...materials

...maximum

...measure(d)

...measure(s)

...measuring

...mechanic(al)

...medium

...melt(ed)

...merchandise

...metal*(s)

...meter(ed)

...metric

...midair

...milder

...millivolts

...minimum

...minus

...minute

...missed

...mistake

...mixed

...model(s*)

...modification

...modulate

...modulating

...moisture

...met

...mold

...molecules

...monitoring

...monitors

...mortar*

...motion

...motor(s)

...mount(ed)

...ing)

...multi

...multiple

...multiplication

...multiply(ing)

...multispeed

...needle

...negative

...nema

...neutral

...nipple

...nominal

...non

...nonadjustable

...nonpolluting

...nonposition

...normally

...northeastern

...object(s)

...observed

...obstruction

...obtain(ing)

...occasional

...occupant

...occur(red)

...s

...offset(s)

...ohms

...oil*(s)

...oneway

...opening

...operate(d)

...operating*

...operators
opposite
optional
ordered
orifice
original
originate
OSHA
outdoors
outer
outlet(s)
outlined
output
overall
overcharge
overcome
overflow(s)
overhead
overload(s)
 overtime
oxide
oxidized
panel(s)
parallel
parcels
partial(ly)
partition(ed)
passing
patented
path(s)
pension
percentage
performance
performs
perimeter
periodic
periods
permanent
permit(s)
  (ted) (ting)
pertinent
petroleum
phase
physics
pieces
pilot

pipe*(s*)
progressive
promptly
propane
proper*(ly)
properties
proportion
proposed
proprietor
protect(ed)
  (ing) (ion) (ors)
provides
providing
provision
psc
psi
psig
ptc
published
puffing
pulley
pump*(ed)
  (ing) (s)
purchased
quadrant
quantities
quantity
quarter
ranging
rap.d(ly)
rated
rating
reads
reasonable
recall
receiver
receives
receptacle
recirculate
recommended
record(ed)
  (ing) (s)
reduce(d)
  (r) (s)
reducing
reduction
reefs
refer(red)
refreezing
refrigerant*
refrigerate*
regained
region
register(ed)
  (s)
regular
regulates
regulating
regulation
regulator
reinforced
related
relations
relative(ly)
relay*(s)
release(d)
remain(s)
remodel
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remove(d)
removing
repair
repeated
repel
replacement
represent(ed)
  (ing) (s)
require(ment)
  (s)
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reset
residence(s)
residential
resistance*
resistant
resisting
resists
respective
responds
responsible

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HEATING/AIR CONDITIONING MECHANIC (continued)

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retainers
retains
retarded
returning
returns
reversed
reversing
review
ring(s)
rod(s)
roll(ed)
(s)
roof
rooms
root
rose
rotor
rough
round
rubbing
rugged
rule(r)
(s)
rumble
rumbling
runner
saddle
safety*
sanitary
satisfactory
satisfied
saturated
saturation
scaled
scope
seal(ed)
(er)
seam
seasons
sections
securely
sedimentation
select(ed)
(ion) (or)
sensation
sensiole
sensing
sensitive
separately
separation
servicing
settings
settle
shaft
shape(d)
sharp
sheet
shelf
shell
shielded
shipped
shipping
shortage
shortening
shows
shunts
shut
shutoff
shutters
sign
significant
silencer
sr .plify
sit
site
sizeable
sized
sizes
sizing
slab
slanting
stick
slide
slightly
slings
slope(d)
slowing
smaller
smell
soil
solar
solder(ed)
solenoid
solid(ly)
solution
solving
soot
source(s)
spaces
specification
specified
speed
spigot
spoilage
spot
spout
squeaking
squeaky
stable
stack(s)
standing
standpoint
start(e) (s)
starting*
startup
stated
static
stationary
steam
steamfitted
steel*
stick(s)
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stocking
storage*
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storeroom
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strains
straps
stream
structure(s)

style(s)
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submerged
substance(s)
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success
suction*
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suitable
summarize
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testation
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sustains
switch*(ing)
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INDUSTRIAL MAINTENANCE MECHANIC (continued)

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- bushings
- butane
- button
- bypass
- cabinet
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- cage
- calcium
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- calculating
- calculation
- calibrated
- calls
- cam
- canvas
- cap*
- capacities
- capacitive
- capacitor
- capacity
- carbon
- carefully
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- carry(ing)
- casing
- cast(ing)
- catalyst
- catch
- caused
- causes*
- causing
- caution
- cavities
- cemented
- centerline
- centrifugal*
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partial(ly)
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pin(s)
pinion
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piping
piston*(s)
pit(ting)
pitches
placer
plants
plaster
plate(s)
platinum
plug(ged)
plumb
plus
pneumatic
pocket
INDUSTRIAL MAINTENANCE MECHANIC (continued)

<p>| Pointed | Procedures | Procedures | Prove(d)(s) | Rated | Rare | Rating(s) | Ratio | Reaches | Reactance | Readily | Readjust | Reads | Replaced | Reassured | Receive(r) | Reciprocate | Recognize(d) | Recommend | Reciprocate | Rectangular | Reduce(d) | Reduction | Reeds | Refer(red) | Reftined | Refineries | Refreezing | Refrigeration* | Regained | Regardless | Region | Regular | Regulates | Regulation | Regulator | Relationship | Relative(ly) | Relay*(s) | Release(d) | (s) | Reliability | Relief* | Relieve | Remain(s) | Remedied | Remote(ly) | Removal | Remove(d) | Removing | Repair | Repeat(ed) | Repel(ing) | Repetition | Replace(d) | (ment) | Replacing | Reporting | Reposition | Represent(s) | Reproduced | Reproduction | Require(ment) | (s) | Reservoir | Reset | Resin | Resistance* | Resistant | Resisting | Resistor*(s) | Resonance | Resor.ant | Respective | Responds | Restore | Restraining | Restricted | Resultant | Resulting | Retains | Retard(ed) | Retraction |
| Polarity | Polishing | Polyeurathane | Pop(s) | Port* | Portion | Position(ed) | (ing) (s) | Positive | Possibly | Post | Potential | Pound(s) | Pour | Powered | Powers | Practical(ly) | Practice(s) | Precise | Precision | Predetermined | Predominant | Preheat | Premature | Premium | Presents | Preservation | Preserves | Pressure | Pressurize | Prevent*(active) | (ing) | Previous(ly) | Prices | Primary | Prime(r) | Principally | Principles | Printed | Printing | Prior |</p>
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INDUSTRIAL MAINTENANCE MECHANIC (continued)

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straighten  symmetry  through  underside
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(s)  tables  tighten(ing)
stray  tags  till
stream  takes  timed
stressed  tangent  tolerances
string  tank*  tool(s)
strips  tanned  tooth
troke*  tape  torque
stronger  taper(ing)  touch
strongly  taperheaded  toward
strontium  task  trained
structural  technically  transfer(red)
structure  technician  transform(ed)
tap  technically  (ing)
taps  tension  (s)
task  temporary  taper(ing)
technically  temporary  syphon(ing)
technical  tend(ency)
technique  tension  tanged
technical  tenth  tape
nee  temp.  taper(ing)
teeth*  temporary  tapered
temp.  tension  tapped
temporary  tenth  tapetooth
tend(ency)  term  tapped

tenth  terminal(s)  taps
term  terminated  task
terminal(s)  technically  task
terminated  tension  tapped
text  temporarily  tapped
textile  temporary  tanged
textile  tend(ency)  tan
textile  terminal(s)  task
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thereby  temporary  tanged
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thermistor  temporary  tanged
thermodynamic  temporary  tanged
thermometer  temporary  tanged
thermostat  temporary  tanged
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thin  temporary  tanged
though(ly)  temporary  tanged
thousand*(th)  temporary  tanged
thread(ed)  temporary  tanged
(s)  temporary  tanged

underwrite  unequal
unkindness  unethical
uniform  unequal
unit(s)  unequal
(y)
universal  unequal
unknown  unequal
unless  unequal
unload(ed)  unequal
unmodified  unequal
unsymmetrical  unequal
unwanted  unequal
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upright  unequal
upside  unequal
usage  unequal
useful  unequal
user  unequal
usual  unequal
utilized  unequal
vacuum  unequal
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vane(s)  unequal
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(izes) (izing) (s)
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variation(s)  unequal
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vent(s)  unequal
vertical(ly)  unequal
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viewing  unequal
violet  unequal
viscosity  unequal
visually  unequal
volatile  unequal

al Vocabulary Lists

134  125
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acquire
acted
actions
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acts
actual
acute
add(ing) (itive)
(additives) (s)
adenoid
adequate(ly)
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adhesive
adjacent
adjoining
adjust(ment)
LICENSED PRACTICAL NURSE (continued)

axis
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bacteriostasis
balance(d)
band
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bar(s)
bare(s)
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bedmaking
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belly
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benefit
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besides
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birth
bit*
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circulator
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Technical Vocabulary Lists
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129
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gonorrea
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gram
grandparent
grapefruit
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gravity
greatest
greatly
greenish
grounds
groupings
grow(n)
guard
guide
guideline(s)
gurgling
habits
halter
hammer
LICENSED PRACTICAL NURSE (continued)

posted

posterior(ly)

posture

potions

pounded

pour(ed)

(ing)

practical

practice(d)

(s)

practicum

precaution

preceded

precedes

precipitation

precision

predispose

prefer(able)

(s)

prefix

pregnancy

preigniting

premium

preoperation

preparation

prepare(d)

(s)

prepping

prescribed

preserve

preset

pressed

pressures

preven(tative) (ed)

(ing) (ion) (s)

previous(ly)

primary

prior

privacy

probe

procedure*(s)

proceed

processed

processes

produce(s)

producing

profuse

project

prolonged

promptly

prone

proper(ly)

proportion

protect(ed)

(ive) (s)

protein(s)

proven

provides

psyche

psychiatric

psychological

psychosis

psychosocial

psychosurgical

pubic

publicized

pulmonary

pulsation

pulse

pump(ed)

(s)

punch(ed)

puncture

pupil(s)

purge

purulent

pus

push(ed)

(ing)

pushbutton

qualification

qualities

quantities

quantity

rack

radial

radiation

radical

radiopaque

raise

ranks

rapid(ly)

rash

rattle

ray(s)

reaching

reactions

reacts

readily

readings

readjustment

realize

rear

reasonable

reasons

reassemble(d)

recall

receptacle

receptors

recognition

recommendation

recommended

recorded

recorder

recordings

records

recovering

recognition

rectal

rectum

recumbent

recurrence

reduce(d)

reestablish

refer(ence)

(ref) (ring)

refill

reflect

reflex

refrigerate

refusal

refuse

regarded

regarding

regardless

regimen

region

registered

registration

regular(ly)

regulated

regulates

regulating

regulation

rehabilitate

rejected

related

relation

relationship

relative(ly)

relax

release(d)

releasing

reliable

relieve(d)

religions

remain(s)

remedies

remote

removable

removal

remove(d)

removing

render

renewing

rented

repaired

repeat

replace(d)

replacing

replenish

reports

represent

reprocessed

reproduction

request(ed)

(ing)

require(ment)

(s)
stands
stapes
staphylococcal
statistics
status
stays
steady
stenosis
stenotic
sterile
sterility
sterilized
stethoscope
stimulate(d)
stimulating
stimulation
stoma
stomach*
stool(s)
(ing)
stopper
storage
stored
storeroom
stove
straighten
strain(ing)
(s)
strands
strata
streptococcus
stretch(er)
(ers) (es)
strikes
strip
strives
stroke
structors
structure*(s)
studies
stunted
stupor
subclavian
subjective
subsequent
subside
substance(s)
suffer
sufficient
suffix
suggestion
suitable
suited
suites
sum
summary
super
superior
superstition
supervision
supervisor
supine
supplied
supplies
supply
supported
supporting
supports
suprarenal
supreme
surgeon
surgeries
surgery*
surgical
surround(ing)
susceptible
suspected
swab
swallow(ing)
(s)
swelling
symptomatic
symptoms
synchronize
syndrome
Syntex
synthesize
syringe
systematic
systole
tablets
tape(d)
task
taut
technician
technique(s)
technology
techs
temp
temporal
tempting
tends
tens
tension
term
terrestrial
termination
terribly
tertiary
testing
tests
thalamus
therapies
therapy
thermostat
thermostatic
thickened
thicker
thigh
thin
thoroughly
thousand(s)
threading
threadlike
threat
thrive
throat
thyroid
tilt
tissue*(s)
title
toe(s)
toenails
tongs
tongue
tooth
towel(s)
toxic
toxins
trachea
tract(ion*)
transfer(red)
transfusion
transient
transmission
transmitted
transport(ation)
transverse
trapped
trauma
traveled
travels
tray
treating
treatments
treelike
triglycerin
trillionth
trimester
trip
trochanter
troughlike
trunk(s)
tube*
tubing
tumor
turning
tympanic
typical
ulcer
ulnar
unauthorized
uncomfortable
uncommunicable
unconstitute
underlies
undernourish
undertaken
undressing
undue
unequivocal
unethical  unethical
unfastened  unethical
unfastens  unethical
unique  unethical
unit*(s)  unethical
unlock  unethical
unnecessary  unethical
unnoticed  unethical
unpleasant  unethical
unplugged  unethical
unprotected  unethical
unreasonable  unethical
untold  unethical
untreated  unethical
upright  unethical
upset(ting)  unethical
urge  unethical
urinal  unethical
urinary  unethical
urine  unethical
uterine  unethical
uterus  unethical
utility  unethical
vaccine  unethical
vacolter  unethical
vacutainer  unethical
vagina  unethical
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valid  unethical
valuable  unethical
(s)  unethical
valve  unethical
variations  unethical
variety  unethical
vary  unethical
vein  unethical
venereal  unethical
ventricles(s)  unethical
ventricular  unethical
verify  unethical
vermicular  unethical
vertebrae  unethical
vertically  unethical
vessel(s)  unethical
via  unethical
vibrating  unethical
vibrations  unethical
victory  unethical
vigorously  unethical
violating  unethical
visible  unethical
vision  unethical
visitation  unethical
visiting  unethical
visitors  unethical
vital  unethical
vitamin  unethical
vocal  unethical
voltage  unethical
voluntary  unethical
volunteers  unethical
vomit  unethical
(ing)  unethical
voxiderm  unethical
wards  unethical
warning  unethical
wash*  unethical
waste  unethical
watched  unethical
watery  unethical
weakening  unethical
weakness  unethical
wear  unethical
weaving  unethical
weekly  unethical
weight  unethical
(s)  unethical
wheelchair  unethical
wheels  unethical
whereas  unethical
whitish  unethical
widespread  unethical
withdraw  unethical
wither  unethical
witnessed  unethical
witnessing  unethical
wondering  unethical
worm(s)  unethical
worn  unethical
worried  unethical
worry  unethical
worth  unethical
wound  unethical
HIGH FREQUENCY WORDS
MACHINE TOOL OPERATOR

ac
bas e
 cable
caliber
capacitor
check
circuit
clamp
coil
connected
crisis
degrees
depth
develop
diameter
draw
(ing)
eight
elevation
equal
fig.
fixture
gauge
(s)
generator
holes
inch(es)
machine
measure
measuring
metal
meter
micrometer
miter
motor
patterns
pick
pieces
pipe
plug
remove
rod
round
scale
screw
sheet
shows
shunt
steel
success
switch
taper
tool
(s)
vertical
voltage
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<th>Technical Vocabulary</th>
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MACHINE TOOL OPERATOR (continued)

- guy
- habits
- hammer
- handle(d)
- handling
- handout
- happen(s)
- hardened
- harm
- hazard
- heads
- heat(ed)
- (ing)
- heel
- height
- hide
- highest
- highly
- holds
- hole(s*)
- homes
- horizontal
- horsepower
- household
- humor
- identified
- identity(ing)
- illustrate
- illustrate(ing)
- imbalance
- immeasurable
- immediately
- improperly
- improved
- inability
- inaccurate
- incessantly
- inch*(es*)
- included
- includes
- increases
- increasing
- independent
- index
- indicates
- induce
- inductor
- influence(s)
- inner
- inquiry
- inserted
- inspecting
- inspection
- installation
- instance(s)
- instant
- instructor
- instrument
- insulation
- insulator
- insurance
- intense
- intensity
- interact(ion)
- interchange
- intermediate
- internal
- interrupted
- intersect(ed)
- (ion)
- interwoven
- invention
- involve(ment)
- (s)
- irregular
- jacket
- jarred
- jarring
- join(t)
- judging
- keeper
- knurled
- lapped
- lathe(s)
- leakage
- leg(s)
- legal
- lengths
- lessen
- lesser
- leverage
- levers
- lifetime
- limit(s)
- linear
- liquid
- load(ed)
- (ing) (s)
- locate(d)
- locating
- location(s)
- locator
- lock(ed)
- (· .g)
- logical
- loss(es)
- lowest
- machine*(s)
- machining
- machinist(s)
- magnetic
- (s)
- magnetism
- magnetized
- maintain(ed)
- manager
- manufacture
- mark(ed)
- materials
- math
- maximum
- measure*(d)
- (ment) (ing*)
- mechanical
- mechanism
- medium
- mental*(ly)
- mercury
- message
- metal*
- meter*(s)
- metric
- microampere
- microtometer*
- microphone
- mill(ing) (s)
- milliampere
- mini
- minor
- minute
- mishandled
- misused
- miter*(s)
- model
- modify
- moldings
- molecules
- momentary
- momentum
- motor*(s)
- mounted
- multiple
- nearby
- necessarily
- negative
- neutral
- nine(ty)
- numbered
- numerators
- numerous
- obtain(ing)
- occupation
- occurs
- octagon
- offers
- officials
- offset(ting)
- oil
- older
- opening(s)
- operate
- operations
- operator
- opposite
- ordinary
- original
- outer
- outlet(s)
- outline
- output
- overhear
overlapping
oxygen
pace
panel
papers
parallel
patterns*
perception
permit(s)
perpendicular
phase(s)
physically
physiological
pick*(ed)
pieces*
pilots
pipe*(s)
pivots
planers
planes
plate(s)
plug*(s)
pole(s)
porcelain
portable
portion
positive
potential
pound(s)
practice
preceded
precision
predict
preferred
preheat(s)
preliminary
prepare
presented
prevent
previous
primarily
principles
printed
probability
proceed
processes
produced
profile(s)
project(ing)
(project)
proper(ly)
protect(ion)
(proper)
provides
quarter
quick(ly)
radius
raised
rapid(ly)
rated
react
readily
readings
ream
rebuilt
receive
recess
(recess)
recognize(s)
recording
recorder
rectangular
reduce
reduction
reevaluation
refer(s)
refrigerate
regardless
registered
regrind
regular
regulate
regulating
regulator
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relation(ship)
relatively
release
relying
remedied
remodeling
remove*
repelling
repetition
replaced
represent
(repetition)
(ation)
(ed)
require(ment)
(s)
resetting
resistance
resolve
resolving
resources
respective
respond(s)
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reverse(d)
reversing
review
revolving
ridiculous
ring(s)
rod*(s)
rolled
rotation
rough
round*
row
rpm
rule
runs
safety
sample
satisfied
satisfies
satisfy
savings
scale*
scientists
scoop(s)
screen
screw*(ed)
(s)
scribed
script
sealed
seam
secondary
sections
secure
security
seek(ing)
seethe
segments
seizing
seldom
semicircle
semidiameter
semiprofile
senses
sensory
separate
separating
separation
separators
seventy
severe
shape(s)
sharp
shield
shipping
shock(ed)
shop
shoulder
showing
shows*
shunt*(s)
signal
signed
significant
sill
similarly
simultaneous
sixteenth(s)
sixty
sized
MACHINE TOOL OPERATOR (continued)

sizes
skid
skilled
skim
slick
slides
slight(ly)
sling
sloppy
slots
slotted
socket(s)
soft
solid
solution
solve(d)
solving
sounding
source
spaces
spare
speaking
specifically
speed(s)
spend
spin
spindle(s)
spline(d)
(s)
split
squared
stages
stamped
standards
starter(s)
starting
starts
steel*

stick
stimulus
stimulated
stimulating
stops
stored
storing
strengths
strictly
striking
strip
struggling
strung
stud
substance
substitute
success*(ful)
surge
suspended
switch*(es)
symmetrical
synchronous
synonymous
tables

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upper
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valve
variation
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varies
variety
vary(ing)
vernier
versus
vertical*
viewed
volt(age*)

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waste
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weakened
wear(ing)
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wheel(s)
whereas
width
wind
wire
wiring
wise
withdrawal
workable
worker
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wrapper
wrapper

Technical Vocabulary Lists

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proposed*  referring  schedule(d)  speaking  specialist
protection  referred  scholar  specialize  specialities
prove  reform  sciences  specifically  specified
provides  refrigerate  script  spelled  spelling
providing  refund  sealed  spending  sponsored
provisions  regarding  search  sponsors  spouse(s)
publication  region(al)  seats  staffed  stamps
punctuation  registered  secondary  standards  standpoint
pupil(s*)  registers  secretarial  stapler  static
purchase  registrant  referred  status  stimulate
purchasing  registration  regulating  storing  stress(ed)
purposes  regular*(ly)  regulation  strips  strips
purposive  regulated  regulator  studies  styles
qualification  regulation  reimbursement  subjects  subcontract
qualified  requires  require(d)  subdivided  subdivision
qualify  new  residing  subjects  submission
quantities  regulated  residents  submitted  subscribe
quarter  regulation*  reimbursement  subjects  submit
quick  regulation*  reimbursement  subjects  subject(s)
quotation  reimbursement  reimbursement  subjects  subjected
quoted  reimbursement  reimbursement  subjects  subject(s)
radial  reimbursement  reimbursement  subjects  subject(s)
radius  reimbursement  reimbursement  subjects  subject(s)
rapidly  reimbursement  reimbursement  subjects  subject(s)
rarely  reimbursement  reimbursement  subjects  subject(s)
rates  reimbursement  reimbursement  subjects  subject(s)
reaches  reimbursement  reimbursement  subjects  subject(s)
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recommendation  reimbursement  reimbursement  subjects  subject(s)
(ed)  reimbursement  reimbursement  subjects  subject(s)
recordings  reimburse(ed)  reimbursement  subjects  subject(s)
records*  reimbursement  reimbursement  subjects  subject(s)
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reduce(d)  reimbursement  reimbursement  subjects  subject(s)
reducing  reimbursement  reimbursement  subjects  subject(s)
reduction  reimbursement  reimbursement  subjects  subject(s)
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referencing  reimbursement  reimbursement  subjects  subject(s)
referral(s)  reimbursement  reimbursement  subjects  subject(s)
referred  reimbursement  reimbursement  subjects  subject(s)
schedule(d)  speaking  specialist  specialize  specialities  specifically  specified  spelled  spelling  spending  sponsored  sponsors  spouse(s)  staffed  stamps  standards  standpoint  stapler  static  status  stimulating  storage*  store(d)  storing  stress(ed)  strips  strips  studies  styles  subjects  subcontract  subdivided  subdivision  subjects  submission  submitted  subscribe  subsequent  substitute  substitution  subsystem(s)  succeeding  success  sufficient  suggested
HIGH FREQUENCY WORDS
WELDER

| ac | acetylene | angle | arc | argon | base | bead | burn | cable | carbon | circuit | coil | connected | copper | correct | cutting | dc | degrees | electric | electrode(s) | flame | flat | flow | fusion | gas | gauges | generator(s) | heat | horizontal | hose | inch | iron | joint(s) | lamp | load | magnet(ic) | metal | meter | motor | natural | oxygen | pass | penetration | phone | pipe | plate(s) | polarity | pole | produce(d) | properties | puddle | resistance | reverse | rod(s) | root | shock | shows | shunt | speed | starting | steel | switch(es) | tape | tip(s) | torch | travel | unit | valve | voltage | weld(ed) | (ing) | wire |

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flux(es)  handle(d)  increases  laboratory
forex  hang  indicate(s)  lamp*(s)
forged  hardening  indicating  lap
formation  harm  indication  largely
formed  haul  induce  latent
formulate  hazard  inductor  layer
fourfold  hearing  inherent  laying
fours  hearth  initial  leak(age)
fourway  heat*(ed)  (ing)  inner
fractional  heat*  indicating  (ing) (s)
fracture  heavier  innovation  leaves
frequency  helium  input  leaving
frequently  helper  inspect(ed)  lecture
friction(al)  helpful  (ion)  leg(s)
fuel  hibond  intensity  lenses
fumes  highcarbon  instant  lesser
furnace  highpressure  instructor  lever(age)
fuse(s)  highest  insulation  lightweight
fusion*  highspeed  insulator  limit(s)
gage  highstrength  liquifying  litre
galvanized  hissing  load*(er)  located
gap  Hobart(s)  intensity  locations
gas*  highspeed  locations  machinable
gasfed  highpressure  intercom  machine(d)
gauge(s*)  highstrength  magnet*(s)
generated  holding  magnesium
generator*(s*)  horsepower  maintained
glare  horizontal*  maintenance
hose*(s)  horsepower  manganese
generated  household  manually
Hobart(s)  hydrogen  manufacture
holder(s)  identical  materials
holds  identification  max
hopper  ignites  maximum
horizontal*  invented  measure(d)
horseshoe  involves  (ment) (ing)
hose*  iron*  mechanical
gas fed  household  mechanism
gauge(s)  invented  medium
grade(s)  ionizes  manganese
horsepower  iron*  materials
hose*  iron*  max
 household  involved  max
inaccurate  involve  maximum
impurities  ionize  measure
incorrect  items  measure
inclusions  jarred  mechanical
incoming  jarred  mechanism
handier  jarred  medium
hand(d)  joint*(s*)  medium
handle(d)  jarred  mechanical
handle(d)  joint*(s*)  mechanism
WELDER (continued)

melt(ed)
(ing) (s)
mercury
metal*(s)
meter*(s)
metre
metric
microampere
microwire
mild
millimeter
milking
 mishandled
mistake
model
moderately
modernized
modify
molecules
motion
motor*(s)
mounted
movable
multiple
narrow
naturally
nearby
negative
neutral*
nipple(s)
nonburnable
nondestruct
nonferrous
nonpressure
noisec
nozzle
nut
obtain
occupation
occur(s)
odorless
offers
oil*(y)
openings
operate(d)
operating
operations
operator
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ordinarily
ordinary
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orifice
original
otherwise
outlet(s)
output
outstripped
oval
overall
overhead
overheat(in)g
overma .
overseas
oxidation
oxides
oxidiz.*
 oxyacetylene
oxygen*
panel
parallel
partially
partner
pass*(es)
(ing)
patch
path
peculiar
penetrate
penetration*
percent
perform(ed)
permanent
permit(s)
phase(s)
phone*
physically
pick(er)
(up)
pictures
pieces
pig
pin
pinpoint
pipe*(s)
pitched
 pivots
plate*(s*)
plug(s)
plus
pocket(ed)
(s)
poisonous
 polari ty*
pole*
porcelain
porosity
portable
positioned
positions
positive
pot
potential
practice
preceding
preferable
preference
preferred
preheat(in)g
(s)
preionizes
preparation
prepared
presents
pressures
prevent(ed)
(s)
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primary
principal
procedure
proceed
processes
prod
produce*(d*) (s)
progressive
projection
prone
proper(ly)
properties*
proportion
protect(ed)
(ion) (ive)
provides
publication
puddle*
pull(ed)
pumps
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purify
purity
qualified
ranging
rapid(ly)
radiation
rated
readily
realize
rebuilt
receive
recommended
recorder(s)
recovering
rectangular
reduce(d)
reels
refer(s)
reference
refrigerate
registration
regular
regulator(s)
reinforcement
related
relationship
relatively
relight(ing)
relying
removable

Technical Vocabulary Lists

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Vocabulary Lists

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WELDER (continued)

remove(d) repair(ed) repelling require(ment) (s) reset resin resistance* resists respiration respirator resulting reverse*(d) reversible reversing review rich ricochet rivet rod*(s) root* rotating rotation route rpm rugged ruin sampling saturated scale scattered scrap scratched screw(ed) seamless seat secured security select semester semiautomate separate separation setting settle settling severe sewing shape(s) sharp sheet shield(ed) (ing) shipping shipyard shock*(ed) shows* shrill shrinkage shunt*(s) shut signed silicon sill sink situations sizes slag(ging) slight(ly) slip socket(s) soldering solid(s) soot sorter source spacing sparks spatter specifically specification specified specify specs speech speed*(s) splice(d) (r) (s) spontaneous stability stabilization stable stainless stall stamped stamps standing starter(s) starting* steel(s) storage store(d) (s) storing straighten strengths striking string(er) strip(s) strongest strongly structural struggling strung subjected submerged submerging substitute suitable supplier(s) supplies supply surf-ces surfacing surge suspended switch*(es*) symbol(s) synchronous tack(ing) tank(s) tape* taps taut technically technique tee tensile tension terminal(s) terminated testing thermal thicker thickness(es) thirds thorough threads tinning tip* torch*(es) track transfer(red) transmit(ted) transport travel* trigger trimmer tube(s) tubing tungsten twisted twists typically unbroken unconstitute undercutting underneath unit*(s) unstable upright utility valve*(s) varied varies variety varying vectors vee ventilation
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