FINAL REPORT

OF

CURRICULUM DEVELOPMENT PROJECT: PLASMA ARC CUTTING AND WELDING

1984 - 85

DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION
GRADUATE SCHOOL OF EDUCATION
RUTGERS - THE STATE UNIVERSITY
NEW BRUNSWICK, NEW JERSEY 08903

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PROJECT TITLE: Curriculum Development Project: Plasma Arc Cutting and Welding

LEGAL NAME OF APPLICANT DISTRICT, INSTITUTION OR AGENCY: Rutgers - the State University

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ABSTRACT

DESCRIPTION OF PROJECT

(Use this sheet and no more than one other to type in single-spaced form a statement of project objectives, procedures that were followed, state and local priorities emphasized and the expected contribution of the project to vocational education.)

This project developed a module on plasma arc cutting and welding. The DACUM process for task analysis was used and a high degree of input from the advisory committee was solicited to ensure the technical accuracy, relevance, and usefulness of the product.

Previously developed task lists, guides, texts, pamphlets, and articles on the subject were sought. A number of pamphlets and articles, as well as sections from textbooks, were used as resources wherever possible. The search for curriculum materials, however, confirmed that this will be the first self-contained curriculum guide on this process.

The module was written by an experienced welding instructor who has also had many years of experience in the welding trade.

A field review is currently underway and will be completed in late July. The module has also been reviewed by the advisory committee members. The manuscript will be revised based upon the input of the field review instructors and the advisory committee.

Publication and dissemination will be handled by the curriculum sales unit of NJVERC.

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This project reported herein was conducted pursuant to a contract from the New Jersey Department of Education, Division of Vocational Education and Career Preparation. It was funded under Section 133 of Public Law 94-482.

Project Duration:

July 1, 1984
Beginning Date

June 30, 1985
Ending Date

CONTENTS

INTRODUCTION

Problem/Description

In an age of rapidly changing technology involving large numbers of occupations, it is essential for the curriculum in use in the classroom to be up-to-date and yet flexible enough to permit additions and deletions of competencies when dictated by advances in the field.

There has been no shortage of guides for welding as evidenced by the results of a search for recently-developed (since 1977) guides. However, the traditional practice in curriculum development has been to develop a guide for each course and each program. Little consideration has been given to the transferability of skills across occupational areas. This has not only been wasteful of financial resources but has also failed to give to students the information about the application of their skills to occupations other than the one for which they have been specifically trained. In many cases, creative classroom teachers have presented this information but there have been few systematic means for doing this.

Curriculum development is a very expensive process. According to figures used by the National Network for Curriculum Coordination in Vocational-Technical Education (NNCCVTE), the development of a curriculum guide, from inception through field-testing, costs approximately $30,000. To produce such a document, only to have it become outdated within a year or two because of changes in the technology, is wasteful and impractical. This project developed a guide on plasma arc cutting and welding in the form of a module which can be added to existing welding curriculum guides.

Currently used by industry for cutting, plating or coating, weld surfacing, and welding, the plasma arc process is steadily proving its many advantages - particularly its suitability as a process for tough-to-weld metals such as stainless steel, titanium, and zirconium. Despite its increasing use as an industrial process, little material is available for training secondary and postsecondary students in this valuable, employable skill. The availability of this publication fills that gap by providing a self-contained module that can be added to an instructor's existing welding curriculum.

Written in a competency-based format, the module includes the competencies to be attained; teacher and student activities; resource and equipment lists; information handouts, job and assignment sheets, transparency masters, and evaluation criteria. The cutting and welding units include a number of projects that help students achieve both entry-level and more advanced competencies in the plasma process. A special section in the introductory unit focuses on applications of the process to a number of occupational areas.

Objectives

The development of this module was guided by the following objectives:

- To establish, with the input of the Division of Vocational Education, county vocational districts, local education agencies, trade associations, unions and employers, an advisory committee to ensure the technical accuracy and usefulness of the end product
- To conduct a DACUM workshop to establish a validated task list as the basis for the content of the module

- To develop, with input from the advisory committee, a module on plasma arc cutting and welding
- To field-test the module
- To revise and edit the module as a result of recommendations from the field-test sites
- To publish and disseminate the completed product

Related Research

Through the services of the Northeast Network for Curriculum Coordination, searches of the ERIC, VECM, and NTIS databases were conducted. Other resources consulted were catalogs of performance objectives from the Vocational-Technical Education Consortium of the States (V-TECS), the East-Central Network's catalog of available task lists, and a variety of welding textbooks, pamphlets from the American Welding Society and Union Carbide, and journal articles.

The searches of the various databases, task lists, and welding curriculum guides confirmed a lack of curriculum materials for this process. Information on the process does exist in rather small sections of textbooks, in journal articles, and in commercial and American Welding Society (AWS) pamphlets. A bibliography of the references used in developing the module appears at the end of this report.

PROCEDURES AND FINDINGS

General Design

The project was directed by the Information Specialist-Curriculum at NJVERC. A Project Coordinator supervised the day-to-day operations of the development process.

The project proposal stated plans to contract two curriculum writers to prepare the actual module. Only one of the recommended writers was available for contract. The writer contracted was Alfred Oman, a welding instructor at Deptford Township High School, Deptford, New Jersey. Editing for the field-review edition was the responsibility of the project coordinator. Necessary revisions, to be identified upon completion of the field review, will be made by the writer under the direction of the project director and coordinator. Arrangements for the publication and dissemination of the document were handled by the project director.

The remainder of this section of the report is centered around the six original project objectives:

- To establish an advisory committee
- To conduct a DACUM workshop
- To develop a module
- To field test the module
- To revise and edit the module
- To publish and disseminate the module

The discussion of each of these objectives will focus on the procedures used to carry out the objective, findings (a comparison of the plans contained in the proposal and actual results), and the interpretation of the findings.

Establishment of the Advisory Committee

Procedures

With the input of the Division of Vocational Education, county vocational districts, local education agencies, trade associations, employers and unions, names of advisory committee candidates were solicited. Each candidate was contacted by phone and invited to participate. Those who agreed to serve on the committee were invited to attend a DACUM workshop at NJVERC.

Findings

The advisory committee is made up of representatives from the welding trade and vocational education. Eight candidates agreed to serve on the committee:

Bill Dallas, Sales Manager, Thermal Dynamics

Michael Gaughan, Sales Department, Thermal Dynamics

Robert P. Gibson, General Manager, Middlesex Welding Sales Co., Inc.

Kenneth Jordan, Instructor, Union County Vocational Technical School

Jack N. Keller, Instructor, Somerset County Adult Education

Robert C. Newman, Ed.D., Assistant Superintendent, Ocean County Vocational School

Bob Urbanski, Union Carbide*

Stuart Struck, Pennsylvania Welding Supply

Interpretation the Findings

The makeup of the advisory committee strikes a balance between the viewpoints of the welding trade representatives and the classroom instructors.

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*The plasma arc process was developed by the Linde Division of Union Carbide in 1955.

The advisors are experienced in the trade and will therefore ensure the technical accuracy and relevance of the module.

The DACUM Workshop

Procedures

The eight member advisory committee participated in a DACUM workshop held on 1 November 1984 at NJVERC.

The workshop was conducted by Robert Newman, Ed.D., Assistant Superintendent, Ocean County Vocational School. The purpose of the meeting was to establish a task list that would serve as the basis for the content of the module.

In addition to the task list developed at the meeting, nine welding task lists were acquired.

Findings

A task list on the plasma arc process was compiled by the advisors at the DACUM chart from the results of the committee's work and the completed chart was approved by the advisors. (A copy of the DACUM chart is included in the Appendices to this report).

Interpretation of the Findings

A search of available welding task lists further confirmed a lack of curriculum material on the plasma process. The task list developed by the advisory committee would therefore form the core of the module's units. The module would include eleven units titled after the duties listed on the DACUM chart: Safety; Blueprint Reading; The Welding Procedure Document; A Review of Performance Testing; Preparing the Base Metal; Selecting Fixtures; Set Up; Plasma Arc Cutting; Plasma Arc Welding; Clean Up and Inspection. The approval of the DACUM chart by the advisors ensured the accuracy of the task listing.

Development of the Module

Procedure

Nine task lists on welding were acquired and searches of databases were conducted. The databases used were ERIC, VECM, and NTIS.

Using sample competency-based curriculum guides as references, an appropriate format was identified and adopted. The writer received a detailed information packet on the required format and content. (Copies of the "General Information" sheet and "Curriculum Module Contents" are included in the Appendices to this report.)

The writer was required to submit an outline of the units before beginning work on the draft module. After approval of his outline, the writer, under the direction of the project coordinator, prepared the manuscript.

The completed draft of the module is now being reviewed by the advisory committee. Revisions will be made according to the findings of the advisors.

The completed draft (or field-test edition) was duplicated and sent to the field review sites (see the following section).

Findings

Although nine welding task lists were acquired, very few of the tasks included pertained to the plasma process. The databases searched did not yield any curricula. Six texts, several technical articles and reports, and commercial pamphlets were identified and used as references. (A complete bibliography is included in the Appendices to this report).

The writer's original target deadline for submitting the completed manuscript was March 1985. The writer unfortunately had difficulty in understanding the format required. As a result, he needed a great deal of supervision and aid from the project coordinator. Each unit of the module needed extensive rewrite work as well as editing. The completion date of the draft was therefore delayed.

Due to the delay in receiving an acceptable draft from the writer, the advisory review and the field review could not be completed as originally scheduled. Both reviews should be completed by the end of July/early August.

Interpretation of the Findings

Although a number of helpful references were identified, the lack of actual curriculum products indicates that this is the only available curriculum guide to offer training to secondary and postsecondary students in the plasma arc process.

The competency-based format used in preparing the module will ensure a training program that offers students thoroughly practical and employable skills. The format has been styled to facilitate use by instructors and students. Each unit contains everything needed for easy-to-follow instruction, performance of the competencies, and evaluation. (See the "Curriculum Module Contents" sheet included in the Appendices section for a description of all instructional elements.)

Problems encountered in working with the contracted writer raise the following suggestions. Although he demonstrated knowledge of and competency in the welding trade in general and the plasma process in particular, the writer had difficulty implementing the format required and completing his tasks in a timely matter. A possible future solution to this problem might

be to contract experienced technical writers - professional writers experienced in adapting materials to a specified format to prepare curriculum materials. Another possibility would be to contract teacher/technical writer teams to complete curriculum assignments: the writer would have the experience necessary to prepare the materials according to the proper format and to do any preliminary editing; the teacher's experience would ensure that the finished product would be practical for classroom use.

The Field Test/Review

Procedure

Eight sites were invited to participate in the field test. Of those invited, four sites agreed to participate: Deptford Township H.S.; Bismarck Junior College, Bismarck, North Dakota; Ocean County Vocational-Technical School; Mercer County Vocational School, Assunpink Center.

Each participating site received the draft module and copies of the Field Test Questionnaire. The instructors were asked to complete a questionnaire for each unit received and to return the questionnaire to the Project Coordinator. (A sample of the questionnaire is included in the Appendices.)

The advisory committee members have also received the draft module and a survey form to complete on each unit. (A sample of the advisor survey also appears in the Appendices section.)

Findings

The difficulty in finding field test sites was due to the relatively small number of school districts that have plasma equipment already functioning in their welding shops. Most of the declining districts did report, however, that they expected to receive plasma equipment during the 1985-86 school year. All have expressed interest in the published module.

Due to the delays in schedule mentioned previously, the field-test edition was not available until early June. As a result, the participating instructors will not be able to test the module with their students. Instructors were asked to review the module and to respond to the survey questions as completely as possible.

Interpretation of the Findings

Although the participating instructors will not be able to test the module with their students, they should, as experienced welding instructors, be able to determine whether or not the activities and techniques used in the module would be practical and effective in the school shop setting. The advisory committee members will be able to ensure the technical accuracy of the text. They will also help determine the applicability of the competencies developed to on-the-job conditions and employment opportunities.

Revision of the Module

The field review of the draft manuscript should be completed by the end of July. At that time, the module will be revised by the writer and the project coordinator according to the recommendations of the field review instructors and the advisors. The writer will be closely supervised to ensure the timely completion of all revisions.

One field test instructor has returned his completed questionnaire. His response to the module was very positive and he recommended only a few minor changes. A copy of his cover letter is included in the Appendices.

Publication and Dissemination of the Module

Procedure

Publicity for the module has already begun. A one page flier was produced to answer inquiries about the product. A press release was developed and sent to the newsletter mailing lists and an article was written for Open Entries. An informational brochure has been drafted and will be printed when a final price has been set. The brochure will include an order form.

The module will be printed by the Duplicating and Mailing office of Rutgers University. The length of the complete module is estimated at 180 pages.

The Curriculum Sales unit of NJVERC will disseminate the published module. (See the following section for other dissemination plans.)

Results

The early responses to publicity efforts promise positive results. Eleven requests for additional information have been received as a result of the article in Open Entries (May 1985). These clients have been added to the mailing list for the informational brochure. Eight school districts have also expressed interest in adopting the module. They will receive the brochure and ordering information. The brochure will also be sent to welding associations and a variety of mailing lists.

Interpretation of the Results

Early requests for information seem to confirm that there is a need for a curriculum guide for plasma arc cutting and welding. Publicity materials will stress the fact that this module is the only one of its kind. Also promising positive sales results are the indications that a number of school districts are beginning to purchase plasma equipment.

DISSEMINATION ACTIVITIES

Publication of the module is scheduled for the end of August. The printed module will be disseminated by the Curriculum Sales unit of NJVERC. This unit has been producing and disseminating vocational-technical curriculum products for over 30 years and has a well-organized, efficient system in place.

Efforts to publicize the availability of the module are under way. A description of the product has been included in NJVERC's Curriculum Materials Catalog. A press release was developed and sent to the newsletter mailing lists. Articles on the project appeared in the NJVERC Information Connection and Open Entries. A number of requests for information were received as a result of the Open Entries article. These contacts have been added to the mailing list for the publicity brochure. The brochure has been drafted and will be printed and disseminated (as soon as a price has been set) to secondary district superintendents, county vocational district superintendents, county colleges and technical institutes, center clients, and other selected mailing lists. In addition to the above publicity materials, a one-page flier was prepared to answer preliminary requests for information.

The module will be entered into the NNCCVTE's curriculum materials database, VECM, and disseminated to the regional centers and State Liaison Representatives. Presentations on the product will be developed and delivered at appropriate workshops, conferences, and meetings of vocational educators. Workshops to introduce and to assist vocational educators in implementing the module will be offered at NJVERC during the 1985-86 school year.

STRATEGIES EMPLOYED TO ELIMINATE SEX BIAS AND SEX ROLE STEREOTYPING

The writer was informed of the requirement for sex-fair language and has demonstrated compliance throughout. Special attention has been paid to the language and tone of the modules during the editing process.

SUMMARY

Conclusions

The background research and the response from educators in the field indicate a receptive market for this publication. As industries continue to adopt the plasma process because of its many advantages, job opportunities will expand for welders with competency in this area.

The DACUM method was adopted in developing this guide because it firmly establishes a viable task list. The task list, compiled by experts in the welding trade, thoroughly covers all of the duties to be performed by a plasma arc cutter/welder on the job. In turn, these duties and tasks form the competencies around which the module units were written. The result is a very practical training tool that emphasizes employable skills.

The format and styling of the module were developed with consideration to usability and readibility by instructors and students. Because it is self-contained — all of the instructional and evaluative materials are provided - the module will be easily inserted into an instructor's existing welding curriculum.

Recommendations

Two major problems were encountered during the development of this module: the delays resulting from the writer's difficulty in grasping the required format; the difficulty in scheduling a field test during the module development year.

The writer is an experienced welder and welding instructor. Visits to his school shop by the project coordinator provided evidence that he is a highly innovative, articulate, and effective instructor. Unfortunately, he

had difficulty in grasping the format established for the module. This was most probably due to that fact that he is not an experienced technical writer. For this reason, it is recommended that any subsequent curriculum modules be written by experienced technical writers. Ideally, a writing team should be contracted, with a technical writer working closely with an instructor in the subject area. This would ensure technical accuracy, classroom feasibility, proper educational methods, proper format, and timely performance.

It is further recommended that field tests for future projects be scheduled for the school year following the module development year. The preparation of this module began during the fall semester of the 1984-85 school year. The field-test was scheduled to occur in April of the same school year. This allows very little flexibility in the production schedule - particularly dangerous if problems arise in the writing schedule as in this instance. An additional consequence is that the advisors are reviewing the manuscript at the exact same time it is being field-tested. Ideally, the technical advisors should be given the opportunity to review the entire module before field-testing occurs. This would permit the correction of any technical errors before students come into contact with the material. The instructors and students would then be using the most accurate, refined product possible, permitting a truer test of the curriculum's effectiveness.

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APPENDICES

These Appendices consist of the following supportive documents:

- The DACUM chart developed from the task list compiled by the advisors at the DACUM workshop
- The "General Information" sheet, "Module Contents" Sheet, and "Curriculum Module Checklist" included in the orientation packet given to the writer
- The Field Test Evaluation Questionnaire
- The Advisor Questionnaire
- Field test response letter from Kenneth Paulus, Bismarck Junior College, Bismarck, North Dakota

FIELD TEST EVALUATION QUESTIONNAIRE: PLASMA ARC CUTTING & WELDING

Name _____ Total # of classroom hours: _____

School _____

Unit Title _____

Date Unit Was Started _____

Date Unit Was Completed _____

1. Do all the elements of this unit (information sheets, tests, etc.) work as designed? If not, specify the element and why it does not work.

2. Is the unit practical for classroom instruction? Can it be implemented in the classroom setting? Specify any problems.

3. Can the unit be implemented using normally available resources?

4. Are all instructions clear? Specify any problems.

5. Is the reading level appropriate for the students?

6. Was student reaction to the unit content and instructional methods/materials positive? Specify any problems.

7. Are the instructional methods/materials motivating? Specify any problems.

8. Is the content adequate to meet the stated competencies? Specify any problems.

DACUM Chart: Plasma Arc Cutting and Welding

CARRY OUT SAFETY MEASURES	Dress safely (EL)	Protect from noise (EL)	Protect eyes (EL)	Protect from smoke (EL)	Wear protective clothing (EL)	Check for electrical safety (EL)	Practice fire prevention (EL)
READ BLUEPRINTS	Identify process	Identify material (Base)	Identify weld location	Identify filler material	Identify size and type of weld	Identify welding procedures	Identify cut location (cutting)
READ WELDING PROCEDURES	Select equipment (EL)	Select filler material (EL)	Identify base metal preparation procedures (EL)				
CARRY OUT PERFORMANCE TESTING	Prepare test materials (EL)	Make test joint (EL)	Test weld joint (EL)				
PREPARE BASE METAL	Grind (EL)	Machine (EL)	Shear (EL)	Plasma cut (EL)			
SELECT FIXTURES	Set up rollers (EL)	Set up seamers (EL)	Set up positioners (EL)	Set up clamps (EL)	Set up tables (cutting) (EL)	Use NC or photocell controlled cutting equipment (cutting)	
SET UP WELDING EQUIPMENT	Examine equipment; e.g. check hose connections, examine torch parts (EL)	Turn on machine (EL)	Select gases (EL)	Set pressure-gas and water (EL)	Set flow rate (EL)	Purge the system (EL)	Connect ground (EL)
WELD	Follow welding procedures (EL)						
CUT	Follow cutting procedures (EL)						
CLEAN UP (WELD & CUT CLEAN UP)	Grind (EL)	Wire brush (EL)	Do chemical cleaning (EL)	Repair if necessary (EL)			
PERFORM VISUAL INSPECTION	Look for defects (EL)	Perform dye penetrant test (EL)					

ment. Counts parts and examines them for scratches or other surface defects. Lubricates parts and machines, using oilcan and grease gun. Cleans parts and equipment, using solvent, brush, and rags. Feeds stamping machine that numbers and marks parts. Paints identification stripes on tubing and conduits. Loads and unloads dollies, racks, and skids. Wraps and unwraps parts, tools, and equipment.

809.687-018 INSPECTOR AND TESTER (struct. & ornam. metalwork)

Inspects metal sashes, window screens, windows, and doors for appearance and accuracy of fabrication and assembly: Feels sides of workpiece for burs, ravelled screening, or defective packing of screening, glass, or splines. Slides panels up and down to insure specified alinement. Verifies dimensions, using fixed gage, rule, or square. Returns defective workpiece for repair or performs such minor repairs as tightening screws, adjusting balance, and rolling or hammering out small dents, using handtools. May apply gummed tape around frame, screen, or glass, pack pieces according to size, and insert screens and glass panels into frames to prepare pieces for shipping.

809.687-022 LABORER, SHIPYARD (ship & boat bldg. & rep.)

Performs following tasks in shipyards: Loads vehicles, using handtruck or dolly. Washes trucks and other vehicles. Cleans ships, piers, drydocks, and other working areas, using broom and water hose. Opens shipping crates, using hammer and pinchbar. Sorts lumber, metals, and other scrap materials. Collects and burns trash. Mixes and pours cement on inner bottoms of ships and around joints on decks to prepare surfaces for tile or to make joints watertight. Removes paint and scale from ships' metal surfaces, using hand or powered wire brushes. Conveys materials and tools to worksite.

809.687-026 MOLD PREPARER (ship & boat bldg. & rep.) mold finisher.

Cleans and waxes fiberglass boat molds preparatory to molding: Washes molds, using sponge. Waxes and polishes interior of mold, using cloth, or electric buffer. Brushes parting agent on mold to facilitate removal of cast after molding.

81 WELDERS, CUTTERS, AND RELATED OCCUPATIONS

This division includes occupations primarily concerned with joining, surfacing, or otherwise fabricating or repairing structures or parts of metal or other weldable material, such as plastic or glass, applying the following welding or cutting processes: arc; gas; resistance; solid state (friction, ultrasonic, cold, explosion, diffusion); and other processes, such as electroslag, electron beam, induction, thermit, and laser beam. Welders in this division are distinguished from workers using welding equipment in other divisions by their knowledge of and experience in welding technology and in being primarily concerned with the equipment and technology of welding. Workers classified in other divisions may use welding equipment, but their knowledge and experience are primarily in assembly or repair techniques. For example, welders who work on storage batteries can be found in Group 727.

810 ARC WELDERS AND CUTTERS

This group includes occupations concerned with welding processes in which joining is produced by heating with an arc or arcs, with or without the application of pressure and with or without the use of filler metal.

810.382-010 WELDING-MACHINE OPERATOR, ARC (welding)

Sets up and operates arc welding machine that welds together parts of fabricated metal products, as specified by blueprints, layouts, welding procedures, and operating charts: Welds flat, cylindrical, or irregular parts that may be clamped, tack-welded, or otherwise positioned. May position weld line parallel to carriage. Turns cranks or pushes buttons to aline electrode on welding head over weld joint to weld linear joints, or adjust length of radial arm to position electrode over weld joint when welding radial joints. Clamps cylindrical workpieces onto turning rolls under stationary head to weld circular joints. Threads specified electrode wire from reel through feed rolls and welding head. Turns welding head to set specified angle of electrode. May fill hopper with specified flux and direct nozzle or gravity feed over weld line, or adjust shielding gas or gas mixture flow rate. Turns knobs to set current, voltage, and slope, and synchronize feed of wire and flux with speed of welding action. May set limit switch which automatically stops machine at end of weld. Starts machine and observes meters and gages, or observes welding action for compliance with procedures. Visually examines welds for adherence to specifications. May grind welded surfaces for penetrant test. Adjusts machine setup to vary size, location, and penetration of bead. May install track template to weld irregularly-shaped seams. May make trial run before welding and record setup and operating data. May layout, fit, and tack workpieces together. May preheat workpiece, using hand torch or heating furnace. May reweld defective joints, using hand welding equipment. May remove surplus slag, flux, and spatter, using brush, portable grinder, and hand scraper. May operate machine equipped with two or more heads. May be designated according to type of welding machine operated as WELDING-MACHINE OPERATOR, ELECTRO-GAS (welding); WELDING-MACHINE OPERATOR, GAS-METAL ARC (welding); WELDING-MACHINE OPERATOR, GAS-TUNGSTEN ARC (welding); WELDING-MACHINE OPERATOR, PLASMA ARC (welding); WELDING-MACHINE OPERATOR, SUBMERGED ARC (welding).

810.384-010 WELDER APPRENTICE, ARC (welding)

Performs duties as described under APPRENTICE (any ind.).

810.384-014 WELDER, ARC (welding)

Welds together metal components of such products as pipelines, automobiles, boilers, ships, aircraft, and mobile homes, as specified by layout, blueprints, diagram, work order, welding procedures, or oral instructions, using electric arc-welding equipment: Obtains specified electrode and inserts into portable holder or threads consumable electrode wire through portable welding gun. Connects cables from welding unit to obtain amperage, voltage, slope, and pulse, as specified by WELDING ENGINEER (profess. & kin.) or WELDING TECHNICIAN (profess. & kin.). Starts power supply to produce electric current. Strikes (forms) arc which generates heat to melt and deposit metal from electrode to workpiece and join edges of workpiece. Manually guides electrode or gun along weld line, maintaining length of arc and speed of movement to form specified depth of fusion and bead, as judged from color of metal, sound of weld, and size of molten puddle. Welds in flat, horizontal, vertical, or overhead positions. Examines weld for bead size and other specifications. May manually apply filler rod to supply weld metal. May clean or degrease weld joint or workpiece, using wire brush, portable grinder, or chemical bath. May repair broken or cracked parts and fill holes. May prepare broken parts for welding by grooving or scarfing surfaces. May chip off excess weld, slag, spatter, using hand scraper or power chipper. May preheat workpiece, using hand torch or heating furnace. May position and clamp workpieces together or assemble them in *jig* or *fixture*. May tack assemblies together. May cut metal plates or structural shapes [ARC CUTTER (welding)]. May be designated according to type of equipment used as WELDER, CARBON ARC (welding); WELDER, FLUX-CORED ARC (welding); WELDER, GAS-METAL ARC (welding); WELDER, GAS-TUNGSTEN ARC (welding); WELDER, HAND, SUBMERGED ARC (welding); WELDER, PLASMA ARC (welding); WELDER, SHIELDED-METAL ARC (welding). May be designated according to product welded as WELDER, BOILERMAKER (boilermaking). Important variations include types of metals welded, subprocesses used, trade name of equipment used, worksite (inplant, job shop, construction, shipyard), method of application (manual, semiautomatic), high production or custom, level of ambidexterity required, type of joint welded (seam, spot, butt). May be required to pass employer performance tests or standard tests to meet certification standards of governmental agencies or professional and technical associations.

810.664-010 WELDER, GUN (welding)

Welds or tack-welds overlapping edges of prepositioned components to fabricate sheet metal assemblies, such as panels, refrigerator shells, and automobile bodies, using portable spot-welding gun: Positions and clamps electrode under overlapping edges of workpiece. Presses electrode against workpiece at specified weld points to complete circuit between electrodes and heat metal to joining temperature. Releases electrode after specified period of time. May adjust equipment for automatic timing of current. May position and clamp workpieces together.

810.684-010 WELDER, TACK (welding) tacker.

Welds short beads at points specified by layout, welding diagram, or by FITTER (any ind.) I, along overlapping edges of metal parts to hold parts in place for final welding. Performs tasks of FITTER HELPER (any ind.). May tack-weld, using hand, submerged, or gas-shielded arc welding equipment. May tack-weld, using portable spotwelding gun [WELDER, GUN (welding)].

811 GAS WELDERS

This group includes occupations concerned with welding in which joining is produced by heating with a gas flame or flames, with or without the application of pressure, and with or without the use of filler metal.

GENERAL INFORMATION

L.

1. Please keep in mind that this is to be a free-standing module that can be added to a teacher's existing welding curriculum. The time allowance for the module would be approximately 4-6 weeks; 4 weeks would be the minimum, but you can go beyond 6 weeks if you feel the extra time is needed.

2. Also keep in mind that the module is to be relevant only to arc plasma cutting and welding and that the units must follow the DACUM Chart. Please see the Curriculum Module Contents sheet for a list of what needs to be included in each unit.

3. Each unit must allow for both entry-level and more advanced competency development so that students who master competencies at a faster rate will be able to increase his or her skill level by working on the more advanced competencies.

4. If at all possible, please submit your manuscript typed, double-spaced, on standard-size bond. This will allow space for clear editing and comments by our advisory committee.

5. Please follow the format used in the sample unit.

6. For each unit, please fill out the Curriculum Module Checklist. This should be sent along with each unit submitted to me.

7. **Deadlines:**

   General outline of your units to me by December 7. The entire module manuscript must be completed by the first week of March '85, but please submit each unit as soon as it is written so that we will have time to submit each to our advisors and do any necessary revisions. We will set specific deadlines for each unit as we go along. Please let me know immediately if you feel you might have any trouble meeting a deadline.

Cathy Liapes,
Project Coordinator
NJVERC
200 Old Matawan Rd.,
Old Bridge, NJ 08857
(201)390-1191 - office, Tues/Thurs
(201)390-3077 - home

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CURRICULUM MODULE CONTENTS

Table of Contents	To be written by NJVERC
Foreword	" " " "
Acknowledgments	" " " "
"Use of this publication"	" " " "
Feedback form	" " " "

Unit I: An introductory unit on Plasma Arc Welding and Cutting. Include definitions of the processes and the application of these skills to a number of occupational areas.

The other unit titles are to follow the Duties listed on the Dacum Chart.

Each unit should include:

1. **Competencies** ("objectives"):
   a. state a terminal competency for the unit
   b. state specific competencies

2. **Suggested Activities**: for instructors and students

3. List of **Instructional Materials:**

   a. Everything provided in the unit from competencies to the end of the unit. For example, the titles of all transparencies.

   b. List of **Resources and References**

4. List of **Equipment and Supplies** needed for the unit

5. **Information Sheets**

6. **Transparency Masters** as needed

7. **Job Sheets** (Be sure to include a list of tools and materials needed on each job sheet)

8. **Assignment Sheets:**
   a. paper and pencil activities
   b. answer sheets for these

9. **Tests and other evaluation criteria:**

   Include any written and performance tests needed.

   * Include progress and record keeping sheets necessary for students and teachers to record performance of skills as outlined in job sheets.

10. **Test answer sheets**

11. Any other record keeping forms needed by the instructor or students.

(Please see the xeroxed "Use of this Publication" for more detailed descriptions of each of the above.)

CURRICULUM MODULE CHECKLIST

(to be submitted to NJVERC with each unit)

*Please specify NA if you feel any item is "not applicable" to this unit.

Unit Number _____ **Unit Title** _____

Check off	# included	Item
a. _____ b. _____	a. _____ b. _____	Competencies a. Terminal Competency b. Specific Competencies
a. _____ b. _____	a. _____ b. _____	Suggested Activities a. Instructor b. Student
a. _____ b. _____	a. _____ b. _____	Instructional Materials a. Provided in unit b. Resources and References
		Equipment and Supplies
		Information Sheets
		Transparency Masters
		Job Sheets (double-check for lists of materials included on each)
		Assignment Sheets
		Answers for assignment sheets
		Tests and other evaluation criteria
		Progress/Recordkeeping Sheets for Tests/Evaluation
		Test Answer Sheets
		Other Recordkeeping Forms

Specify what you included in this unit to allow for more advanced competency development:

9. Are the instructional methods suitable for the competencies sought? Specify any problems.

10. Do the students demonstrate successful achievement of the stated competencies?

11. Do the written and/or performance tests provided in this unit effectively evaluate student achievement of the stated competencies? Specify any problems.

12. Does this unit effectively encourage and provide materials for more advanced competency development?

13. Did you need to modify unit contents, materials, or methods in any way in order to achieve the stated competencies? If so, what did you need to change and how did you do so?

14. Please add any other comments, observations, suggestions for improvement, and recommendations on alternative presentations.

PLASMA ARC CUTTING AND WELDING: ADVISOR QUESTIONNAIRE

Name/Title: _____

Unit Title: _____

Date: _____

1. Please refer to the competency lists at the beginning of this unit. Do the stated competencies describe skills actually needed by the plasma arc cutter/welder?

2. Does this unit provide the knowledge the student will need to perform this task in industry?

3. Are there any inaccuracies in the information or instructions presented in this unit?

4. Please offer any suggestions, changes, or additions you feel are needed.

BISMARCK JUNIOR COLLEGE

July 3, 1985

Catherine R. Liapes
Project Coordinator/Editor
New Jersey Vocational Education
Resource Center
200 Old Matawan Road
Old Bridge, New Jersey 08857

Catherine Liapes:

You were right, it is too late to use the program on students. But I have read it and filled out the evaluations. I do plan on using it this fall and will be glad to do a follow-up if you need. All in all, I'm impressed with it. I have done learning laps for our State Board, so I appreciate the work you have done. Thanks again, if you need anything else, feel free to write or call.

Sincerely,

Ken Paulus

Ken Paulus
Department Chairperson
Welding Department
Bismarck Junior College

jh

BISMARCK, NORTH DAKOTA 58501