BETHLEHEM AREA VOCATIONAL-TECHNICAL SCHOOL
3300 CHESTER AVENUE BETHLEHEM PA 18020

Welding
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WELDING

COURSE DESCRIPTION:

The purpose of this class is to give students the necessary tools to navigate a future in the continuously growing and changing world of welding. Due to a steady growth in the demand for goods, fabricated by welding, new welders are needed in every area of welding, such as small shops, specialty fabrication shops, large industries, and construction. The first thing the students will be responsible for learning is how to work safe. Safety will be of the utmost importance to me. After learning to work safe the students will need to learn certain important professional skills. Such as working well with hand tools and equipment. It is a high priority that no matter the skill level the student acts as a professional at all times so they are prepared to enter the workforce and be a valuable member to whichever team they decide to join. Basic math, skills, using effective written and verbal skills, and working well with others will also be important. Learning how to interpret welding drawings and sketches will be another skill that will have to be learned. There are going to be many other skills taught in this class like knowing theory and application of various welding process. Those processes include shielded metal arc welding, gas metal arc welding, flux core arc welding, and gas tungsten arc welding.

Average pay: According to payscale.com the average salary in the Lehigh Valley for a welder is dependent on what type of welding is done. A welder fitter can start at $43,630. A structural iron and steel worker is $60,100. A welding soldering and brazing machine setters, operators, tender can average $35,740. A union welder that welds on high pressure vessels can make considerably more than a non union welder. Depending what weld tests you can pass will truly determine where and how much you work and make.

Two-Year Degree: Associates degrees can be obtained through post graduation trade schools

In Demand Careers: Boilermakers, Pipe Fitters, Pipe Welders are in extreme demand in the growing field of natural gas. There is always a need for fabricators and welders locally.

Reference Material: Welding Principles and Applications 8th edition by Larry Jeffus. Published by Cengage Learning with accompanying Lab Manual

Classroom Tools: Miller XMT welding machine, Miller Multimatic 255 multi process welding machine, Miller syncrowave, Hydraulic Ironworker 75 ton, JET drill press, horizontal bandsaw, plasma arc machine, oxyfuel cutting torches, carbon arc cutting equipment, Pedestal grinders, DRYROD Electrode Stabilizing Oven. We also have hand tools that include chipping hammers, wire brushes, combination squares, speed squares, framing squares, 2 foot and 6 foot levels, pipe wraps, various types of vise grips, C-clamps, Table Vice, 4 inch grinders, 6 inch grinders, 9 inch grinders, ball peen hammers, and other various hand tools.

Course Syllabus Level 1

First Semester (First Marking Period)

Develop good safety habits in the welding shop, identify a welding circuit and start basic welding skills

Intro to Safety in welding (textbook chapter 2)

Safety Test

Weld Circuit Test

Electrode in Use

Ruler Test

Projects

Oxyfuel Cutting on Carbon Steel

Pad weld carbon steel with 7018

Duty and Tasks Covered:

100 Occupational Orientation and Safety

102 Perform housekeeping duties daily

105 Inspect Personal Protective Equipment

500 Shielded Metal Arc Welding

503 Setup and Operate SMAW equipment

First Semester (Second Marking Period)

Safety, Housekeeping, Flame Cutting, and Shielded Metal Arc Welding

Chapter 3- Shielded Metal Arc Equipment, Setup, and Operation

Chapter 4- Shielded Metal Arc Welding of Plate

Chapter 7- Flame Cutting

Projects

E6010 or 6011 Shielded Metal Arc Welding Fillets

Flat padding (E6010 or 6011 1/8)

1F Lap joint

1F Practice Block Single Pass

1F Practice Block Multi Pass

1F Break Test Single Pass, pass or fail test

1F Break Test Multi Pass, pass or fail test

E7018 Shielded Metal Arc Welding Fillets

Flat padding (7018 1/8)

Flat padding (7018 3/32)

1F Lap joint

1F Practice Block Single Pass

1F Practice Block Multi Pass

1F Break Test Single Pass

1F Break Test Multi Pass

Oxyfuel cut straight lines on thick steel (1/2”or >)

Oxyfuel cut holes on thick steel (½ or >)

Oxyfuel bevel cuts on thick steel (½ or >)

Duty and Tasks Covered

100 Occupational Orientation and Safety

101 Complete time or job sheet, reports, or records

103 Follow verbal instructions to complete work assignments

104 Follow written instructions to complete work assignments and rules

106 Maintain proper organization and operation of work area

107Demonstrate proper use of ventilation equipment

111 Inspect welding and thermal cutting equipment for safe operations

113 Identify oxyfuel safety procedures

114 Identify arc welding/cutting safety procedures

115 Follow emergency action plan

200 Principles of Welding

201 Identify major types of metals (ferrous and nonferrous)

205 Identify various joint designs and joint geometry

206 Clean and prepare materials for welding and or cutting

207 Demonstrate proper use of hand tools

209 Demonstrate proper use of power equipment

500 Shielded Metal Arc Welding (SMAW)

501 Perform safety inspections of SMAW equipment and accessories

502 Make minor external repairs to SMAW equipment and accessories

900 Manual Oxyfuel Gas Cutting

905 Perform straight cutting operation on steel

Second Semester (Third Marking Period)

Safety, Principles of Welding, Visual Examination, Inspection, and Testing, Shielded Metal Arc Welding, Manual Oxyfuel Gas Cutting

Chapter 22- Joint Design and Welding Symbol

Chapter 22 Lab Manual

Practice 22-1 Reading Welding Symbols

Projects

E6010 or E6011 Shielded Metal Arc Welding Fillets

Horizontal padding E6010 or E6011

2F Lap Joint E6010 or 6011

2F Practice Block E6010 or 6011 Single Pass

2F Practice Block E6010 or 6011 Multi Pass

2F Break Test single pass E6010 or 6011

2F Break Test multi pass E6010 or 6011

E7018 Shielded Metal Arc Welding Fillets

Horizontal padding E7018

2F Lap Joint E7018

2F Practice Block single pass E7018

2F Practice Block multi pass E7018

2F Break Test single pass E7018

2F Break Test multi pass E7018

2G V-groove with backing strip

E6010 or E6011 Shielded Metal Arc Welding Fillets

3F Lap Joint E6010 or 6011

3F practice block single pass E6010 or E6011

3F practice block multi pass E6010 or E6011

3F Break Test single pass E6010 or E6011

3F Break Test multi pass E6010 or E6011

E7018 Shielded Metal Arc Welding Fillets

3F Lap Joint E7018

3F practice block single pass E7018

3F practice block multi pass E7018

3F Break Test single pass E7018

3F Break Test multi pass E7018

3G V-groove with backing strip

Duty and Tasks Covered

100 Occupational Orientation and Safety

108 Discuss proper Hot Work operation

109 Demonstrate knowledge of proper work actions for working in confined spaces

110 Identify Safety Data Sheets (SDS) and precautionary labeling

112 Display familiarity with industrial OSHA safety standards

200 Principles of Welding

202 Describe the basic principles of heat, expansion, and contraction as it relates to metals.

203 Select appropriate welding technique , equipment, and supplies for a given metal or process

204 Describe the Industry accepted welding codes, standards, and procedures

208 Demonstrate proper use of standard measuring layout tools

500 Shielded Metal Arc Welding

504 Make fillet welds in all positions

505 Make groove welds in all positions

506 pass performance test in all positions

507 perform qualification test

900 Manual Oxyfuel Gas Cutting

901 Perform safety inspections of OFC equipment and accessories

902 Make minor external repairs to OFC equipment and accessories

903 Set up manual equipment and accessories

904 Operate manual OFC equipment

Second Semester (Fourth Marking Period)

Visual Examination, Inspection, and Testing. Manual Oxyfuel Gas Cutting, Shop Math and Weld Cost

Chapter 20- Shop Math and Weld Cost

Chapter 20- Lab Manual

Projects

20-1 Calculate the Area Using a Calculator

20-2 Calculate the Volume Using a Calculator

20-3 Finding Weld Groove Volume

20-4 Finding Weld Weight of Filler Metal

20-5 Create a Bill Of Materials

E6010 or E6011 Shielded Metal Arc Welding Fillets

4F Lap Joint E6010 or 6011

4F Practice Block single pass E6010 or E6011

4F Practice Block multi pass E6010 or E6011

4F Break Test single pass E6010 or E6011

4F Break Test multi pass E6010 or E6011

E7018 Shielded Metal Arc Welding Fillets

4F Lap Joint E7018

4F Practice Blocks single pass E7018

4F Practice Blocks multi pass E7018

4F Break Test single pass E7018

4F Break Test multi pass E7018

4G V-groove with backing strip

Duty and Tasks Covered

400 Visual Examination, Inspection, and Testing

403 Perform visual inspection, destructive and non destructive testing

900 Manual Oxyfuel Gas Cutting

906 Perform shape cutting operations on steel

907 Perform Bevel cutting operations on steel

908 Perform piercing operations on steel

Course Syllabus Level 2

First Semester (First Marking Period)

Welding, Drawing, and Weld Symbol Interpretation. Gas Metal Arc Welding

Chapter 21- Reading Technical Drawings

Chapter 10- Gas Metal Arc Welding, Equipment, Setup, and Operation

Chapter 21 Lab Manual

Chapter 10 Lab Manual

Projects

21-1 Reading Mechanical Drawings

21-2 Sketching Straight Lies

21-3 Sketchig Circles and Arcs

21-4 Sketching a Block

21-5 Sketch a Candlestick Holder

21-6 Sketching the Parts of a Workmanship Qualification Test

21-7 Sketching Curves and Irregular Shapes

Duty and Tasks Covered

300 Welding, Drawing, and Weld Symbol Interpretation

301 Interpret basic elements of a drawing or sketch

302 Fabricate parts from a drawing or sketch

600 Gas Metal Arc Welding (GMAW)

601 Perform safety inspections of GMAW equipment and accessories

602 Make minor repairs to GMAW equipment and accessories

603 Set up and operate GMAW equipment

First Semester (Second Marking Period)

Welding, Drawing, and Weld Symbol Interpretation. Gas Metal Arc Welding (GMAW)

Chapter 11- Gas Metal Arc Welding

Chapter 11- Lab Manual

Chapter 23- Fabricating Techniques and Practices

Chapter 23- Lab Manual

Projects

11-3 Stringer Beads Using the Short Circuiting Metal Transfer Method in the Flat Position

11-4 Flat Position Butt Joint, Lap Joint, and Tee Joint

11-5 Flat Position Butt Joint with 100% Penetration

11-6 String Bead at 45 Vertical Up Angle

11-7 Stringer Bead in the Vertical Up Position

11-8 Butt Joint, Lap Joint, and Tee Joint in the Vertical Up Position at a 45

11-9 Butt Joint in the Vertical Up Position with 100% Penetration

11-10 String Bead at a 45 Vertical Down

11-11 String Bead in the Vertical Down Position

11-12 Butt Joint, Lap Joint and Tee Joint in the Vertical Down Position

11-13 Butt Joint in hte Vertical Down Position with 100% Penetration

11-14 Horizontal Stringer Bead at a 45

11-15 Stringer Bead in the Horizontal Position

11-16 Butt Joint, Lap Joint, and Tee Joint in the Horizontal Position

11-17 Butt Joint in the Horizontal Position with 100% Penetration

11-18 Stringer Bead Overhead Position

11-19 Butt Joint, Lap Joint, and Tee Joint in the Overhead Position

11-20 Butt Joint in the Overhead Postion with 100% Penetration

11-21 Stringer Bead

11-22 Butt Joint

11-23 Butt Joint with 100% Penetration

11-24 Tee Joint and Lap Joint in the 1F Position

11-25 Tee Joint and Lap Joint in the 2F Position

11-26 String Bead 1G Position

11-27 Butt Joint, Lap Joint, and Tee Joint Using Axial Spray Method

11-28 Butt and Tee Joint

23-1 Laying Out Square, Rectangular and Triangular Parts

23-2 Laying Out Circles, Arcs, and Curves

23-3 Nesting Layout

23-4 Bill of Materials

23-5 Allowing Space for Kerf

Duty and Tasks Covered

300 Welding, Drawing, and Weld Symbol Interpretation.

302 Interpret welding symbol information

600 Gas Metal Arc Welding

604 Make Fillet Welds in all positions

605 Make groove welds in all positions

606 Pass performance test

Second Semester (Third Marking Period)

Flux Core Arc Welding, Mechanized Oxyfuel Gas Cutting

Chapter 12- Flux Cored Arc Welding Equipment, Setup, and Operation

Chapter 13- Flux Cored Arc Welding

Chapter 13 Lab Manual

Projects

13-1 FCAW Equipment Setup

13-2 Threading FCAW Wire

13-3 String Beads Flat Position

13-4 Square Butt Joint

13-5 V-groove Butt Joint 1G

13-6 Lap Joint and Tee Joint 1F

13-7 Butt Joint at 45 Vertical Up Angle

13-8 Square Groove Butt Joint 3G

13-9 V-Groove Butt Joint 3G

13-10 Fillet Weld Joint at a 45 Vertical Up Angle

13-11 Lap Joint and Tee Joint 3F

13-12 Lap Joint and Tee Joint 2F

13-13 Lap and Tee Joint 2F

13-14 String Bead at a 45 Horizontal Angle

13-15 Bevel Butt Joint

13-16 V-Groove Butt Joint 2G

13-17 Square Butt Joint 4G

13-18 V-Groove Butt Joint 4G

13-19 Lap Joint and Tee Joint 4F

13-20 Butt Joint 1G

13-21 Lap Joint and Tee Joint 1F

13-22 Butt Joint 3G

13-23 Lap Joint and Tee Joint 3F

13-24 Lap Joint and Tee Joint 2F

13-25 Butt Joint 2G

13-26 Butt Joint4G

13-27 Lap Joint and Tee Joint 4F

13-28 Plug Weld

Duty and Tasks Covered

700 Flux Cored Arc Welding (FCAW)

701 Perform safety inspections of FCAW equipment and accessories

702 Make minor external repairs to FCAW equipment and accessories

703 Setup and Operate FCAW equipment

1000 Mechanized Oxyfuel Gas Cutting

1001 Perform safety inspections of mechanized OFC equipment and accessories

1002 Make minor external repairs to mechanized OFC equipment and accessories

1003 Setup and Operate OFC equipment on steel

Second Semester (Fourth Marking Period)

Flux Core Arc Welding, Mechanized Gas Cutting, Visual Examination, Inspection, and Testing

Chapter 15- Gas Metal Arc and Flux Cored Arc Welding AWS SENSE Certification

Chapter 15- Lab Manual

Chapter 25- Testing and Inspection

Chapter 26- Welding Metallurgy

Chapter 26- Lab Manual

Projects

15-1 All positions Butt Joint, Tee Joint, and Lap Joint

15-2 AWS SENSE Gas Metal Arc Welding-Short Circuit Metal Transfer Workmanship Sample

15-3 V Groove Butt Joint 1G

15-4 Fillet Weld Tee Joint 1F

15-5 AWS SENSE Gas Metal Arc Welding Spray Transfer Workmanship Sample

15-6 AWS SENSE Gas Metal Arc Welding Spray Transfer Workmanship Sample

15-7 V-Groove Butt Joint 1G and 3G positions

15-8 Bevel Groove Butt Joint 2G

15-9 Bevel Groove Butt Joint 4G

15-10 All Positions Fillet Welds on Lap Joint and Tee Joint

26-1 Latent and Sensible Heat

26-2 Temper Colors

26-3 Crystal Formation

26-4 Effect of Quenching and Tempering on Metal Properties

Duty and Tasks Covered

400 Visual Examination, Inspection, and Testing

401 Evaluate cut surfaces and edges of prepared base metals for testing

402 Identify and evaluate weld discontinuities as per accept/reject criteria

1000 Mechanized Oxyfuel Gas Cutting

1004 Perform straight cutting operations on steel

1005 Perform bevel cutting operations on steel

Course Syllabus Level 3

First Semester (Fifth Marking Period)

Gas Tungsten Arc Welding, Codes and Standards

Chapter 16- Gas Tungsten Arc Welding Equipment, Setup, Operation, and Filler Metals

Chapter 16- Lab Manual

Chapter 24- Codes and Standards

Chapter 24- Lab Manual

Projects

16-1 Hand Grinding the Tungsten to the Desired Shape

16-2 Removing a Contaminated Tungsten end by breaking

16-3 Melting the Tungsten End Shape

16-4 Setting up a GTA Welder

16-5 Striking an Arc

24-1 Writing a Welding Procedure Specification (WPS)

24-2 Procedure Qualification Record (PQR)

Duty and Tasks Covered

800 Gas Tungsten Arc Welding (GTAW)

801 Perform Safety inspections of GTAW equipment and accessories

802 Make minor external repairs to GTAW equipment and accessories

803 Set up and operate GTAW equipment

First Semester (Second Marking Period)

Gas Tungsten Arc Welding, Manual Plasma Arc Cutting

Chapter 8- Plasma Arc Cutting

Chapter 8- Lab Manual

Chapter 17- Gas Tungsten Arc Welding of Plate

Chapter 17 Lab Manual

Projects

8-1 Flat, Straight Cuts in Thin Plate

8-2 Flat, Straight Cuts in Thick Plate

8-3 Flat Cutting Holes

8-4 Beveling of a Plate

8-5 U-Grooving of a plate

8-6 Cutting Round Stock

8-7 Beveling Pipe

17-1 Stringer Beads, Flat Position, on Mild Steel

17-2 Stringer Beads, Flat Position on Stainless Steel

17-3 Stringer Beads, Flat Position on Aluminum

17-4 Flat Position, Using Mild Steel, Stainless Steel, Aluminum

17-5 Outside Corner Joint 1G Position, Using Mild Steel, Stainless Steel, and Aluminum

17-6 Butt Joint, 1G Position, Using Mild Steel, Stainless Steel, and Aluminum

17-7 Butt Joint, 1G Position with Minimum Distortion, Using MIld Steel, Stainless Steel, and Aluminum

17-8 Lap Joint, 1F Position, Using MIld Steel, Stainless Steel, and Aluminum

17-9 Tee Joint, 1F Position, Using Mild Steel, Stainless Steel, and Aluminum

17-10 String Bead at a 45 Vertical Angle Using MS, SS, and Aluminum

17-11 String Bead, 3G, Using MS, SS, and Aluminum

17-12 Butt Joint at 45 Vertical Angle, Using MS, SS, and Aluminum

17-13 Butt Joint, 3G, Using MS, SS, and Aluminum

17-14 Lap Joint at a 45 Vertical Angle, using MS, SS, and Aluminum

17-15 Lap Joint, 3F, Using MS, SS, and Aluminum

17-16 Tee Joint at 45 Vertical Angle, Using MS, SS, and Aluminum

17-17 Tee Joint 3F Position, Using MS, SS, and Aluminum

17-18 String Bead at a 45 Reclining Angle, Using MS, SS, and Aluminum

17-19 String Bead, 2G, Using MS, SS, and Aluminum

17-20 Butt Joint, 2G, Using MS, SS, and Aluminum

17-21 Lap Joint, 2F, Using MS, SS, and Aluminum

17-22 Tee Joint, 2F, Using MS, SS, and Aluminum

17-23 String Bead, 4G, Using MS, SS, and Aluminum

17-24 Butt Joint, 4G Position, Using MS, SS, and Aluminum

17-25 Lap Joint 4F, Using MS, SS, and Aluminum

17-26 Tee Joint, 4F, Using MS, SS, and Aluminum

Duty and Tasks Covered

800 Gas Tungsten Arc Welding

804 Make Fillet Welds in all Positions on ferrous materials

805 Pass Performance test on ferrous materials

1100 Manual Plasma Arc Cutting

1101 Perform Safety inspections of PAC equipment and accessories

1102 Make minor external repair to PAC equipment and accessories

1103 Set up and operate manual PAC operations on ferrous and nonferrous materials.

Second Semester (3rd Marking Period)

Gas Tungsten Arc Welding, Carbon Arc Gauging, Manual Plasma Cutting

Chapter 9- Related Cutting Processes

Chapter 9- Lab Manual

Chapter18- Gas Tungsten Arc Welding of Pipe

Chapter 18 Lab Manual

Projects

9-1 Air Carbon Arc Straight U-Groove in the Flat Position

9-2 Air Carbon Arc Edge J-Groove in the Flat Position

9-3 Air Carbon Arc Back Gouging in the Flat Position

9-4 Air Carbon Arc Weld Removal in the Flat Position

18-1 Tack Welding Pipe

18-2 Root Pass, Horizontal Rolled Position

18-3 String Bead, Horizontal Rolled Position

18-4 Weave and Lace Beads, Horizontal Rolled Position

18-5 Filler Pass

18-6 Cover Pass

18-7 Stringer Bead, Horizontal Fixed Position

18-8 String Bead, Vertical Fixed Position

18-9 String Bead on a fixed pipe at a 45

Duty and Tasks Covered

800 Gas Tungsten Arc Welding

806 Set up and operate GTAW on non ferrous materials

807 Make fillet welds on nonferrous materials

808 Pass performance test on nonferrous materials

1100 Manual Plasma Arc Cutting

1104 Perform shape cutting operations on ferrous and non ferrous materials

1105 Perform gauging and scarfing operations to remove base and weld metal on steel

1200 Manual Air Carbon Arc Cutting (CAC-A)

1201 Perform safety inspections of CAC-A equipment

1202 Make minor external repairs to CAC-A equipment

1203 Setup and operate manual CAC-A gouging and cutting operations on steel

Second Semester (4th Marking Period)

Gas Tungsten Arc Welding, NOCTI preparation

Chapter 19 Gas Tungsten Arc Welding Plate and PIpe AWS SENSE certifacation

Chapter 19 Lab Manual

Projects

19-1 Butt Joint, All positions using Mild Steel with 100% Joint Penetration to be tested

19-2 Lap and Tee Joints, All Positions Using Mild Steel with 100% Root Penetration

19-3 Butt Joint, All Positions Using Austenitic Stainless Steel with 100% Joint Penetration

19-4 Lap and Tee Joints, All Positions Using Stainless Steel with 100% Root Penetration

19-5 Butt Joint, All Positions Using Aluminum with 100% Root Penetration

19-6 Lap and Tee Joints, All Positions Using Aluminum with 100% Root Penetration

19-7 AWS SENSE GTAW on plain carbon steel workmanship sample

19-8 AWS SENSE GTAW on stainless steel workmanship sample

19-9 AWS SENSE GTAW on Aluminum workmanship sample

19-10 AWS SENSE 2G and 5G Pipe Welds on MIld Steel Tubing

19-11 AWS SENSE 2G and 5G Pipe Welds on Stainless Tubing with and without a backing

19-12 AWS SENSE 2G and 5G Pipe Welds on Aluminum with and without backing

19-13 Single V-Groove Pipe Weld, 1G position

19-14 Single V Butt Joint 5G 100% root penetration

19-15 Single V Butt Joint 2G 100% root penetration

19-16 Single V Butt Joint 6G 100% root penetration

Supplemental Learning Activities

Students who participate in this program will also have the opportunities to participate in the following programs and school sponsored activities:

SkillsUSA: Two students participate in the Welding competition at the SkillsUSA Regional Competition. One student competes as an individual and the other will compete with three students from other trades in teamwork competition.

Cooperative Education: Students who have attended six quarters in their career and technical programs are eligible to participate in a paid work experience during the PM session of BAVTS. Positions must be available and the students must be recommended by the CTE teacher to be eligible.

Job Shadowing: Students are eligible to visit business and industry partners for one or more days to view the day to day operations of this career area.

Field Trips: Students in this program will on occasion attend field trips that expose them to educational experiences with the career field.

American Welding Society: The AWS has a local chapter in the Lehigh Valley that students are encouraged to join. There is a local competition that takes place during the school year between schools.

OSHA: There is an OSHA 10 course available to students that allows them to be further ready to join the workforce.