

# APPRENTICESHIP - SHEET METAL

## Program Description

The Sheet Metal trade is unique as it is one of the few crafts that starts with raw material, creates a component and installs and maintains the product. Using a combination of mathematics, layout tools, hammers, drills, plasma and laser beam cutting systems, computers, cutting, forming, seaming or welding machines, workers manipulate the material into the product desired. The maintenance sector includes preventive maintenance, repair, testing, balancing and sometimes certification of the installed systems. Items commonly fabricated and installed include HVAC systems, metal roofs, kitchen hoods, various flashings, gutters, decorative architectural features and many other items made of a variety of metals. It is an interesting and evolving field with exciting growth potential. The apprenticeship is an earn-while-you-learn program involving paid "full time" work and related classes.

Test, Adjust and Balancing (TAB) Technician is a registered apprenticeship program offered in partnership with Sheet Metal Local 104 and Bay Area Training Fund. This 5-year apprenticeship program provides students with 216 hours per year of day or evening class instruction and paid on-the-job training with a sheet metal contractor. This is a "green" construction field that is growing due to the need for indoor air quality and energy efficiency compliance. The type of work performed can range from pressure testing, adjusting and balancing of duct systems for energy efficiency to commissioning and completing documentation of HVAC systems in residential and commercial buildings. The work condition ranges from light physical activity to maneuvering into limited access areas with tools and equipment. Good communication skills are needed to interact with clients. Technicians are held to a code of conduct to assure quality measurements. The program offers a solid career opportunity with livable wages along with retirement and health benefits and provides highly trained and skilled workforce for students/apprentices in the HVAC industry. Per California Code of Regulations, this program is limited to students admitted to the Sheet Metal Local 104 & Bay Area Industry Training Fund's Test, Adjust, and Balancing (TAB) Technician Program.

The Air Conditioning Mechanic program is offered in partnership with Sheet Metal Local 104 and Bay Area Training Fund. This 5-year apprenticeship program provides students with in-class instruction and paid on-the-job training with a sheet metal contractor, in the service sector of the sheet metal and heating, ventilating and air conditioning (HVAC) industry. The students will perform scheduled maintenance and troubleshoot system problems while dealing directly with a variety of customers. The students utilize understanding of refrigerant, electronic and pneumatic controls, filtration and duct systems to maintain safe and efficient system performance. Mechanics use test equipment to verify conditions, research manufacturer's data, and then adjust, repair and replace components as needed. Sheet Metal Air Conditioning Service Mechanics work on residential, light commercial and more often, complex commercial systems. Upgrade training is common in this occupation as more advanced and "greener" equipment is produced. Per California Code of Regulations, this program is limited to students admitted to the Sheet Metal Local 104 & Bay Area Industry Training Fund's Air Conditioning Mechanic Program.

Learn more about the program on the [Apprenticeship website](#).

## Program Learning Outcomes

Students are prepared with the skills and expertise to detail, fabricate and install a variety of sheet metal products in compliance with applicable standards and codes, aiming for optimum environmental and energy efficiency. These highly demanded skills are acquired through on-the-job training and lead to employment in the construction industry. After five years of classroom and work experience students are recognized as journeypersons within the sheet metal industry.

## Career Opportunities

Upon completion of all course requirements and 6500 hours of related work experience, graduates will be recognized as specialist in the Sheet Metal Building Trades field. Depending upon the student's career interest and courses taken, graduates may find employment as a: sheet metal worker, site foreman, superintendent, sheet metal shop fabricator, residential sheet metal journeyperson, sheet metal building inspector, welding inspector, sheet metal apprenticeship instructor, sheet metal detailer, sheet metal contractor, HVAC service technician, sheet metal ship yard worker, air conditioning specialist, or decking and siding.

Upon completion of the Test, Adjust and Balancing (TAB) Technician program, students will be eligible to receive a Certificate of Achievement in Test, Adjust and Balancing (TAB) Technician from Foothill College, an Apprenticeship Completion Certificate from the California Division of Apprenticeship Standards (DAS), and a Test and Balance Certification from International Certification Board (ICB). Career opportunities include, but are not limited to: Test, Adjust and Air Balancing technician; TABB certified supervisor; service technician; Leadership in Energy and Environmental Design (LEED) inspector; sheet metal fabricator; compliance tester; entrepreneur; HVAC educator; business agent; and training coordinator.

Upon completion of the Air Conditioning Mechanic program, students will be eligible to receive a Certificate of Achievement in Air Conditioning Mechanic from Foothill College and an Apprenticeship Completion Certificate from the California Division of Apprenticeship Standards (DAS). The graduates will be employable as HVAC Service Technician/Mechanic; HVAC Service Manager; HVAC Contractor; NATE Certified Air Conditioning Mechanic; Test, Adjust & Balancing Technician; Building Inspector; foreman; estimator/detailer; contractor; instructor; project manager and other related occupations.

## Award Type(s)

- AS = Associate in Science Degree
- CA = Certificate of Achievement
- CCC = Career Certificate [Non-Transcriptable]

## Units Required

- Major: 61-63
- Certificate(s): 6-83

## Associate Degree Requirements

Code	Title	Units
<b>English Proficiency</b>		
Select one of the following:		
ENGL 1A	COMPOSITION & READING	5
ENGL 1AH	HONORS COMPOSITION & READING	5

ENGL 1S & ENGL 1T	INTEGRATED COMPOSITION & READING and INTEGRATED COMPOSITION & READING	8
ESLL 26	ADVANCED COMPOSITION & READING	5

or equivalent

### Mathematics Proficiency

College-level math course at or above the level of Intermediate Algebra

A minimum of 90 units is required<sup>1</sup> to include:

- Completion of one of the following general education patterns: Foothill General Education, CSU General Education Breadth Requirements or the Intersegmental General Education Transfer Curriculum (IGETC)
- Core courses (58 units)
- Support courses (3-5 units)

<sup>1</sup> Additional elective course work may be necessary to meet the 90-unit minimum requirement for the associate degree.

**Note:** All courses pertaining to the major must be taken for a letter grade. In addition, a grade of "C" or better is required for all core and support courses used for the degree or certificates.

## Core and Support Courses

Code	Title	Units
<b>Core Courses</b>		
APSM 101	SMQ-1 TRADE INTRODUCTION	3
APSM 102	SMQ-2 CERTIFIED SAFETY & BEGINNING TRADE MATH	3
APSM 103	SMQ-3 SHEET METAL TOOLS & SHOP	1.5
APSM 104	SMQ-4 SOLDERING & COMMON SEAMS	2
APSM 105	SMQ-5 DRAFTING INTRODUCTION & VIEWS	2.5
APSM 106	SMQ-6 BEGINNING DUCT FITTINGS	1.5
APSM 107	SMQ-7 PARALLEL LINE FITTINGS	1.5
APSM 108	SMQ-8 TRIANGULATION FITTINGS	1.5
APSM 109	SMQ-9 RADIAL LINE LAY OUT & OGEE OFFSETS	1.5
APSM 110	SMQ-10 BASICS OF ARCHITECTURAL SHEET METAL	2
APSM 111	SMQ-11 ARCHITECTURAL SHEET METAL	1.5
APSM 112	SMQ-12 FIELD INSTALLATION	2
APSM 113	SMQ-13 WELDING 1: PROCESS & SAFETY OVERVIEW	1.5
APSM 114	SMQ-14 WELDING 2: GMAW	1.5
APSM 116	SMQ-16 PLANS & SPECIFICATIONS	3
APSM 117	SMQ-17 SUBMITTALS & SHOP DRAWINGS	2.5
APSM 118	SMQ-18 INDUSTRIAL & STAINLESS STEEL INTRODUCTION	1.5
APSM 119	SMQ-19 HVAC AIR SYSTEMS & DUCT DESIGN	3
APSM 122	SMQ-22 CODES & STANDARDS	3
APSM 124	SMQ-24 METAL ROOFING	2
APSM 125	SMQ-25 DETAILING	3
APSM 126	SMQ-26 FOREMAN TRAINING	2.5
APSM 127	SMQ-27 BASIC AUTOCAD	1.5
APSM 128	SMQ-28 HVAC ENERGY CONSERVATION & ENVIRONMENTAL TECHNOLOGY	2.5

APSM 159A	INTRODUCTION TO TESTING ADJUSTING & BALANCING HVAC SYSTEMS	2.5
APSM 175A	TABB TECHNICIAN CERTIFICATION	2
APSM 177A	TITLE 24 MECHANICAL ACCEPTANCE TESTING	2.5

### Support Courses:

Select three courses from the following:		3-5
APSM 120	SMQ-20 MEASURING & SKETCHING	
APSM 121	SMQ-21 FABRICATION & SHORTCUTS	
APSM 130	SMQ-30 ADVANCED WELDING	
APSM 131	SMQ-31 CAD DETAILING	
APSM 132	SMQ-32 INTERMEDIATE CAD DETAILING THIRD PARTY	
APSM 133	SMQ-33 ADVANCED ARCHITECTURAL	
APSM 134	SMQ-34 ADVANCED LAYOUT FABRICATION	
APSM 136	SMQ-36 SERVICE BASICS	

**Total Units**

**61-63**

## Certificate Requirements

### Certificate of Achievement in Sheet Metal Building Trades

- Units: 58

The certificate of achievement is awarded upon completion of the core courses. General education courses are not required.

Currently offered at: Bay Area Sheet Metal JAC.

### Certificate of Achievement in Test, Adjust and Balancing (TAB) Technician

- Units: 70

Code	Title	Units
APSM 155B	AIR DISTRIBUTION & EFFICIENT DUCT DESIGN	2.5
APSM 157B	HVAC ENERGY CODES & STANDARDS	2.5
APSM 158A	INTRODUCTION TO DIRECT DIGITAL HVAC CONTROLS	2
APSM 171A	HVAC TRADE HISTORY & INTRODUCTION TO TESTING, ADJUSTING & BALANCING	3
APSM 171B	BASICS OF AIRFLOW, HEAT ENERGY & HEAT TRANSFER	2.5
APSM 171C	SAFETY TRAINING FOR TAB APPRENTICESHIP	2.5
APSM 172A	BASIC HVAC SYSTEMS, PSYCHROMETRICS, AIR PRESSURES & MEASUREMENTS OF AIR	2.5
APSM 172B	PROPORTIONAL BALANCING	2
APSM 172C	DUCT LEAKAGE TESTING	2
APSM 173A	ELECTRICAL FUNDAMENTALS, ELECTRIC MOTORS & ROTATIONAL MEASUREMENTS	2.5
APSM 173B	TEMPERATURE MEASUREMENTS, DUCT SYSTEMS & BASIC CONTROLS	2.5
APSM 173C	HVAC FANS, FAN LAWS & V-BELT DRIVES	2.5
APSM 174A	HYDRONIC SYSTEMS, PUMPS & HYDRONIC BALANCING	2.5
APSM 174B	BALANCING DOCUMENTATION, COOLING TOWERS & TAB RELATED SKILLS	2
APSM 174C	FIRE LIFE SAFETY LEVEL 1	2.5

APSM 175A	TABB TECHNICIAN CERTIFICATION	2
APSM 175B	DDC CONTROLS & PROGRAMS	2
APSM 175C	FIRE LIFE SAFETY LEVEL 2	2.5
APSM 176A	PLANS & SPECIFICATIONS, CODES & STANDARDS	2.5
APSM 176B	BASIC REFRIGERATION & BRAZING/SOLDERING	2.5
APSM 176C	CLEAN ROOMS & HEPA FILTER TESTING	2
APSM 177A	TITLE 24 MECHANICAL ACCEPTANCE TESTING	2.5
APSM 177B	ADVANCED DDC CONTROLS/COMMISSIONING OF HVAC SYSTEMS	2
APSM 177C	ENERGY AUDITING	2.5
APSM 178A	INDOOR AIR QUALITY	2
APSM 178B	GREEN CONSTRUCTION & LEED CERTIFICATION FOR HVAC	2.5
APSM 178C	FOREMAN TRAINING/PROJECT MANAGEMENT FOR HVAC	2.5
APSM 179A	BUILDING & CASCADING PRESSURES/AIR CHANGE TESTING	2
APSM 179B	SOUND & VIBRATION IN HVAC SYSTEMS	2.5
APSM 179C	BIOLOGICAL SAFETY CABINETS/LABORATORY FUME HOODS	2
<b>Total Units</b>		<b>70</b>

Currently offered at: Bay Area Sheet Metal JAC.

## Certificate of Achievement in Air Conditioning Mechanic

• Units: 83

Code	Title	Units
APSM 122	SMQ-22 CODES & STANDARDS	3
APSM 151A	SERVICE INTRODUCTION & SAFETY	2.5
APSM 151B	ESSENTIAL HVAC SERVICE SKILLS	2.5
APSM 151C	HEAT, MATTER & ENERGY IN HVAC SYSTEMS	2.5
APSM 152A	PIPING, REFRIGERANT EVACUATION & RECOVERY	1.5
APSM 152B	CHARGING REFRIGERANT SYSTEMS	2
APSM 152C	INTRODUCTION TO ELECTRICITY	2.5
APSM 153A	FIELD INSTALLATION FOR THE SERVICE TECHNICIAN	2.5
APSM 153B	ELECTRIC MOTORS & MOTOR CONTROLS IN HVAC SYSTEMS	2.5
APSM 153C	COMPONENTS OF THE REFRIGERANT CYCLE	2.5
APSM 154A	REFRIGERATION IN AIR CONDITIONING	2
APSM 154B	GAS & ELECTRIC HEATING	2
APSM 154C	HYDRONIC HEATING	2
APSM 155A	SHEET METAL FABRICATION	1.5
APSM 155C	MAINTAINING EFFICIENT OPERATION OF ELECTRIC COOLING & HEATING EQUIPMENT	2
APSM 156A	HEAT PUMP EFFICIENT OPERATION & SERVICE	2.5
APSM 156B	COOLING TOWERS, PUMPS & PIPING	2.5
APSM 156C	CHILLED WATER HVAC SYSTEMS & COMPONENTS	2.5
APSM 157A	PLANS & SPECIFICATIONS FOR THE SERVICE TECHNICIAN	2.5
APSM 157B	HVAC ENERGY CODES & STANDARDS	2.5
APSM 157C	INDOOR AIR QUALITY & ENERGY EFFICIENCY	2.5

APSM 158A	INTRODUCTION TO DIRECT DIGITAL HVAC CONTROLS	2
APSM 158B	PNEUMATIC CONTROLS FOR HVAC SYSTEMS	2.5
APSM 158C	INVERTER, VRF & HEAT RECOVERY TECHNOLOGY	2.5
APSM 159B	AIRFLOW & PSYCHROMETRICS FOR TAB	2.5
APSM 159C	TESTING ADJUSTING & BALANCING OF HVAC SYSTEMS	2
APSM 172B	PROPORTIONAL BALANCING	2
APSM 173B	TEMPERATURE MEASUREMENTS, DUCT SYSTEMS & BASIC CONTROLS	2.5
APSM 173C	HVAC FANS, FAN LAWS & V-BELT DRIVES	2.5
APSM 174A	HYDRONIC SYSTEMS, PUMPS & HYDRONIC BALANCING	2.5
APSM 175B	DDC CONTROLS & PROGRAMS	2
APSM 177A	TITLE 24 MECHANICAL ACCEPTANCE TESTING	2.5
APSM 177B	ADVANCED DDC CONTROLS/COMMISSIONING OF HVAC SYSTEMS	2
APSM 177C	ENERGY AUDITING	2.5
APSM 178A	INDOOR AIR QUALITY	2
APSM 178C	FOREMAN TRAINING/PROJECT MANAGEMENT FOR HVAC	2.5
<b>Total Units</b>		<b>83</b>

Currently offered at: Bay Area Sheet Metal JAC.

## Sheet Metal Air Conditioning Specialist Career Certificate

• Units: 6 [Non-Transcriptable]

Code	Title	Units
APPR 188A	ORIENTATION; SAFETY & BEGINNING RESIDENTIAL SHEET METAL INSTALLATION (SPECIALIST 1A)	1.5
APPR 188B	RESIDENTIAL COMPONENTS IDENTIFICATION & INSTALLATION (SPECIALIST 1B)	1.5
APPR 189A	RESIDENTIAL SYSTEMS; DUCT & HVAC SYSTEMS (SPECIALIST 2A)	1.5
APPR 189B	PLANS & ARCHITECTURAL APPLICATIONS FOR RESIDENTIAL SHEET METAL (SPECIALIST 2B)	1.5
<b>Total Units</b>		<b>6</b>

Currently offered at: Bay Area Sheet Metal JAC.