



## **Level One**

### **MODULE 32101 – ELECTRICAL SAFETY**

- Overhead projector and screen
- Whiteboard/chalkboard
- Appropriate Personal Protective Equipment
- Copy of the latest edition of the National Electrical Code®
- OSHA Electrical Safety Guidelines (pocket guide)
- Trainee Task Module
- Transparencies
- Markers/chalk
- Lockout/tagout devices and labels
- Module Examinations
- Performance Profile Sheets

## **MODULE 32102 – HAND BENDING**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Tape measure  
Hickey  
Hand bender  
Copy of the latest edition of the National Electrical Code®  
Calculator  
Hacksaw  
Pipe vise  
Pipe cutter  
Reamer  
Hand-operated threader  
Sandbox or drip pan  
Trainee Task Module  
Transparencies  
Markers/chalk  
Pencils/scratch paper  
Various pieces of conduit  
One piece of EMT per trainee  
PVC pieces  
PVC cement  
Cutting oil  
Shop towels  
Module Examinations  
Performance Profile Sheets

## MODULE 32103 – FASTENERS AND ANCHORS

Overhead projector and screen

Whiteboard/chalkboard

Appropriate Personal Protective Equipment

Mechanic's tool box with an assortment of wrenches, screwdrivers, etc.

Torque wrenches

Drills/drivers and assorted drill bits

Trainee Task Module

Transparencies

Markers/chalk

Assorted threaded fasteners, including:

- Bolts

- Cap screws

- Studs

- Machine screws

- Nuts

- Washers

Assorted non-threaded fasteners, including:

- Retainers

- Keys

- Pins

- Blind (pop) rivets and rivet tool

- Tie wraps

Assorted special threaded fasteners, including:

- Eye bolts

- Anchor bolts

- J-bolts

Assorted screws, including:

- Wood screws

- Lag screws and shields

- Concrete/masonry screws

- Thread-forming (sheet metal) and thread-cutting screws

- Deck screws

- Drywall screws

Hammer-driven tools and related pin and stud fasteners

Powder-actuated tool, powder charges, and related pin and stud fasteners

Assorted mechanical anchors and associated anchor setting tool(s), including:

- Wedge

- Stud

- Sleeve

- One-piece

- Hammer-driven

- Drop-in

- Expansion shields

- Lead (caulk-in)

## **MODULE 32103 – FASTENERS AND ANCHORS (Continued)**

Screw (fiber, lead, and plastic)

Self-drilling

Toggle bolts

Sleeve-type

Wallboard

Metal drive-in

Concrete, masonry, wood

Module Examinations

Performance Profile Sheets

## **MODULE 32104 – ELECTRICAL THEORY ONE**

Overhead projector and screen

Whiteboard/chalkboard

Appropriate Personal Protective Equipment

Volt-ohm-milliammeter (VOM)

Copy of the latest edition of the National Electrical Code®

Trainee Task Module

Transparencies

Markers/chalk

Module Examinations

Performance Profile Sheets

## **MODULE 32105 – ELECTRICAL THEORY TWO**

Overhead projector and screen

Whiteboard/chalkboard

Appropriate Personal Protective Equipment

Copy of the latest edition of the National Electrical Code®

Trainee Task Module

Transparencies

Markers/chalk

Module Examinations

Performance Profile Sheets

## **MODULE 32106 – ELECTRICAL TEST EQUIPMENT**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Ammeter  
Voltmeter  
Ohmmeter  
Volt-ohm-milliammeters (both analog and digital)  
Wattmeter  
Megohmmeter  
Frequency meter  
Power factor meter  
Continuity tester  
Recording instruments  
Voltage tester  
Cable-length meter  
Copy of the latest edition of the National Electrical Code®  
Trainee Task Module  
Transparencies  
Markers/chalk  
Calculator  
Pencils and scratch paper  
Module Examinations  
Performance Profile Sheets

## **MODULE 32107 – INTRODUCTION TO THE NEC**

Overhead projector and screen  
Whiteboard/chalkboard  
Copy of the latest edition of the National Electrical Code®  
Trainee Task Module  
Transparencies  
Markers/chalk  
Module Examinations  
Performance Profile Sheets

## MODULE 32108 - CONDUCTORS

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Copy of the latest edition of the National Electrical Code®  
Standard wire gauge  
Fish tape  
Basket grip  
Wire grip  
Manual wire puller  
Power puller  
Reel cart  
Tugger puller  
Pulling rope  
Electrician's hand tools  
Trainee Task Module  
Transparencies  
Markers/chalk  
Variety of solid wire conductors  
Samples of stranded conductors  
Samples of cable, including:  
Type NM  
Type NMC  
Type NMS  
Type FCC  
Type TC  
Type USE  
Type UF  
Type MV  
Channel wire components and accessories  
Conduit run  
Module Examinations  
Performance Profile Sheets

## **MODULE 32109 – INTRODUCTION TO ELECTRICAL BLUEPRINTS**

Overhead projector and screen  
Whiteboard/chalkboard  
Copy of the latest edition of the National Electrical Code®  
Architect's scale  
Engineer's scale  
Set of electrical blueprints and written specifications  
Bench vise  
Golf ball  
Hacksaw  
Trainee Task Module  
Transparencies  
Markers/chalk  
Module Examinations  
Performance Profile Sheets

## **MODULE 32110 – OXYFUEL CUTTING**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Leather gauntlet-type gloves  
Oxyfuel cutting equipment  
Tip cleaners  
Cutting goggles  
Chipping hammer  
Pliers  
Tape measure  
Soapstone  
Friction lighter  
Framing squares  
Combination squares with protractor  
Various sizes of cutting tips for 14-gauge to 1-inch plate  
Washing tips  
Gouging tips  
10-inch crescent wrench  
Trainee Task Module  
Markers/chalk  
Transparencies  
Steel plate:

- Thin (16 to 10 gauge)
- Thick (1/4 to 1 inch)

Module Examination  
Performance Profile Sheets

# Level Two

## MODULE 32201 – WIRING: COMMERCIAL AND INDUSTRIAL

Overhead projector and screen  
Whiteboard/chalkboard  
Copy of the latest edition of the National Electrical Code®  
Screwdrivers  
Wire strippers  
Assortment of switches, including:  
Single-pole, single-throw  
Double-pole, single-throw  
Single-pole, double-throw  
Double-pole, double-throw  
Four-way  
Dimmer  
Assorted safety/disconnect switches housed in Type 1 through Type 13 NEMA enclosures  
Explosion-proof enclosure used with toggle switches  
Assortment of duplex and other receptacles  
Ground fault circuit interrupter (GFCI) receptacles  
Relays  
Limit switches  
Trainee Task Module  
Transparencies  
Markers/chalk  
Pencils/scratch paper  
Wire (No. 14 or No. 12 AWG)  
Assorted solderless connectors  
Assorted crimp-on wire lugs  
Module Examinations  
Performance Profile Sheets

## MODULE 32202 – ALTERNATING CURRENT

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Scientific calculator or trigonometric tables  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
Module Examinations  
Performance Profile Sheets

## **MODULE 32203 – MOTORS: THEORY AND APPLICATION**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Megger  
Various types of motors, including:  
Three-phase wye/star  
Three-phase delta  
Two-phase double-voltage  
Low-voltage  
High-voltage  
Scientific calculator or trigonometric tables  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
Module Examinations  
Performance Profile Sheets

## **MODULE 32204 - GROUNDING**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Earth ground resistance tester  
Wire strippers  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
OSHA Electrical Safety Guidelines (pocket guide)  
Transparencies  
Markers/chalk  
No. 4 AWG bare copper grounding wire  
Small main panelboard  
Switch boxes  
Grounding clips  
Grounding screws  
Galvanized water pipe  
Ground clamp  
Various lengths of Type NM cable  
Module Examinations  
Performance Profile Sheets

## MODULE 32205 – BOXES AND FITTINGS

Overhead projector and screen

Whiteboard/chalkboard

Appropriate Personal Protective Equipment

Trainee Task Module

Copy of the latest edition of the National Electrical Code®

Transparencies

Markers and chalk

Examples of different types of metallic and nonmetallic boxes, device covers, and extension rings

Examples of pull and junction boxes

Example of FS and FD boxes

Examples of different types of conduit bodies, pulling elbows, and entrance ells

Examples of different types of boxes used in hazardous locations

Seal-off fittings

Examples of fittings, including:

EMT

Rigid

Aluminum

IMC

Locknuts and bushings

Module Examinations

Performance Profile Sheets

## MODULE 32206 – CABLE TRAY

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Hacksaw with blades  
Protractor  
Conventional square  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
Cable tray samples:  
Metal ladder tray  
Metal trough tray  
Solid bottom tray  
Tray covers  
Nonmetallic tray  
Dropout plates  
H-bar  
Eight vertical adjustment splice plates  
Cable tray supports, including:  
Beam clamps  
Anchor clips  
All-thread rods  
Nuts, bolts, washers, and other hangers  
Cable tray sections for cutting an offset  
Felt-tip markers  
Module Examinations  
Performance Profile Sheets

## **MODULE 32207 – CONDUCTOR TERMINATIONS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protection Equipment  
Wire strippers  
Power cable strippers  
Hand crimping tools and dies  
Hydraulic crimping tools and dies  
Torque wrenches  
Heat gun for shrink insulators  
Ratchet cable bender  
Hydraulic cable bender  
Propane torch  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
Assorted sizes and types of crimp connectors  
Heat-shrink insulators  
Assorted sizes and types of mechanical compression connectors  
Assorted sizes and types of wire nuts  
Assorted sizes of wire/cables and connectors  
Heat-shrink and roll-on insulating cap motor connection kits  
Assortment of electrical insulating tapes  
Metal-clad (MC) cable  
Type MC cable connectors  
Module Examinations  
Performance Profile Sheets

## **MODULE 32208 – INSTALLATION OF ELECTRIC SERVICES**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
Samples of floor plans and specifications  
Service head  
4/0 aluminum conductor  
Single-pole and two-pole circuit breakers and panelboard  
Module Examinations  
Performance Profile Sheets

## **MODULE 32209 – CIRCUIT BREAKERS AND FUSES**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
Module Examinations  
Performance Profile Sheets  
Samples of circuit breakers, including:  
Single-pole  
Two-pole  
Three-pole  
Various types of GFCIs  
Samples of fuses, including:  
    Edison-base fuses  
    Type S fuses and adapters  
    Nonrenewable cartridge fuses  
    Renewable cartridge fuses  
    Several blown renewable cartridge fuses with renewable links

## **MODULE 32210 – CONTACTORS AND RELAYS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Electrician's tool set  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
120V lighting contactors  
Pushbutton stations  
Lampholders and lamps  
Cable for connecting contactors  
Module Examinations  
Performance Profile Sheets

## **MODULE 32211 - LUBRICATION**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Bucket pump  
Filler pump  
Gear lube dispenser  
Lever guns  
One-shot lubricator  
Power-operated lubrication gun  
Transfer pumps  
Trainee Task Module  
Transparencies  
Markers/chalk  
Module Examination  
Performance Profile Sheets  
Copies of OSHA standard 29 CFR part 1910.1200  
Copies of EPA standard 40 CFR parts 260 through 271 and 300 through 302  
Lubrication equipment  
Sample lubrication charts  
Sample MSDSs  
Note pads and pencils

## **MODULE 32212 – INTRODUCTION TO BEARINGS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Trainee Task Module  
Transparencies  
Markers/chalk  
Module Examination  
Performance Profile Sheets  
Plain bearings  
Ball bearings  
Roller bearings  
Thrust bearings  
Guide bearings  
Flanged bearings  
Pillow block bearings  
Takeup bearings

## MODULE 32213 – COPPER AND PLASTIC PIPING PRACTICES

Overhead projector and screen

Whiteboard/chalkboard

12" rules

Selection of copper and plastic fittings:

Elbows

Tees

Unions

Nipples

Transitions

Selection of pipe hangers and supports:

Clevis hanger

Ring hanger

Pipe roll

Anchor chair

Riser clamps

Beam clamp

C-clamp

Straps

Hook

Sections of copper tubing in various sizes

Pre-charged tubing set

Sections of plastic pipe

Tubing cutter

Hacksaw and sawing fixture

Flaring tools

Flare fittings

Compression fittings

Spring tube bender

Lever tube bender

Swaging tools

Plastic pipe cement

Appropriate Personal Protective Equipment

Trainee Task Module

Module Examination

Transparencies

Markers/chalk

Performance Profile Sheets

## **MODULE 32214 – FERROUS METAL PIPING PRACTICES**

Overhead projector and screen  
Whiteboard/chalkboard  
Pipe cutters  
Reamers  
Yoke and chain vises  
Pipe wrenches  
Chain wrenches  
Strap wrenches  
Measuring tapes  
Stocks and dies  
Power threading machine  
Appropriate Personal Protective Equipment  
Trainee Task Module  
Module Examinations  
Markers/chalk  
Transparencies  
Several pieces of black iron and galvanized pipe of different sizes and weights  
Threaded sections of pipe  
Examples of tees, elbows, unions, couplings, nipples, crosses, plugs, caps and bushings  
Examples of grooved pipe and typical fittings  
Short sections of pipe for cutting, reaming and threading  
Pipe dope/Teflon<sup>®</sup> tape  
Rags  
Cutting oil  
Performance Profile Sheets

## **MODULE 32215 – PIPING SYSTEMS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Trainee Task Module  
Transparencies  
Markers/chalk  
Module Examination  
Performance Profile Sheets

## **MODULE 32216 – SMAW - EQUIPMENT AND SETUP**

Appropriate Personal Protective Equipment

Overhead projector and screen

Whiteboard/chalkboard

Leathers

Welding gloves

Safety glasses and goggles

Welding shield

Respirator

Hot work permit

Welding cable

Lugs and quick disconnect

Workpiece clamp

Electrode holder

Chipping hammer

Wire brush

Pliers

Pneumatic weld flux chipper

Trainee Task Module

Transparencies

Markers/chalk

Module Examination

# Level Three

## MODULE 32301 – OVERCURRENT PROTECTION

- Overhead projector and screen
- Whiteboard/chalkboard
- Appropriate Personal Protective Equipment
- Trainee Task Module
- Copy of the latest edition of the National Electrical Code®
- Transparencies
- Markers/chalk
- Various types of circuit breakers
- Various types of fuses, including electronic fuses
- Sample fuse blocks and holders with nonrejection bases
- Sample fuse blocks and holders with rejection clips that accept only Class R fuses
- Module Examinations
- Performance Profile Sheets

## MODULE 32302 – DISTRIBUTION EQUIPMENT

- Overhead projector and screen
- Whiteboard/chalkboard
- Appropriate Personal Protective Equipment
- Trainee Task Module
- Copy of the latest edition of the National Electrical Code®
- Markers/chalk
- Transparencies
- Manufacturer's literature for various types of distribution equipment
- Module Examinations
- Performance Profile Sheets

## **MODULE 32303 – MOTOR CONTROLS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
Manual starter  
Several types of magnetic motor starters  
Armature assemblies  
Motor overload relays  
FHP, 120V motor starter  
Small 120V motor  
Pushbutton stations  
Magnetic motor controller  
No. 12 AWG THHN conductors  
240V motor  
Tools necessary for making wiring connections  
Module Examination  
Performance Profile Sheets

## **MODULE 32304 – MOTOR MAINTENANCE, PART ONE**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Motor end bells with lubrication filler and drain plugs  
Grease gun  
Various types of motor bearings  
Sample motors for disassembly  
Defective motors for troubleshooting  
Small compass  
Motor testing instruments  
Untagged motor without nameplate  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
Bearing grease  
Module Examinations  
Performance Profile Sheets

## **MODULE 32305 – MOTOR MAINTENANCE, PART TWO**

Overhead projector and screen

Appropriate Personal Protective Equipment

Whiteboard/chalkboard

Ohmmeter

Megger

Trainee Task Module

Copy of the latest edition of the National Electrical Code®

Transparencies

Markers/chalk

Several different types of motors (good and defective) for testing

Module Examinations

Performance Profile Sheets

## MODULE 32306 – INSTALLING COUPLINGS

Overhead projector and screen

Whiteboard/chalkboard

Appropriate Personal Protective Equipment

Trainee Task Module

Transparencies

Markers/chalk

Rigid couplings:

- Flanged
- Sleeved
- Ribbed

Mechanical flexible couplings:

- Slider
- Gear
- Chain
- Grid

Material flexible couplings:

- Spider
- Spring
- Rubber tire
- Flexible disc
- Pin and bushing
- Pin and disc
- Spacer
- Universal joint

Soft-start couplings:

- Fluid
- Shot
- Clutch-style

Press-fit couplings

Shafts to install couplings on

Split couplings to install

Interference-fit couplings to install

Fabricated stop to position interference-fit couplings

Heat-resistant gloves

Couplings to remove with mechanical pullers

Couplings for hydraulic removal

Manual mechanical pullers

Fittings for hydraulic coupling removal

Hydraulic mechanical pullers

Hydraulic pump

Hydraulic press

Micrometers

Torque wrench

Bearing heater

Module Examination

Performance Profile Sheets

## **MODULE 32307 – INSTALLING MECHANICAL SEALS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Mechanical seals that show various types of damage  
Mechanical seals to install and remove  
Pumps to install seals on  
Trainee Task Module  
Markers/chalk  
Transparencies  
Module Examination  
Performance Profile Sheets

## **MODULE 32308 – INSTALLING BELT AND CHAIN DRIVES**

Overhead projector/screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Equipment to install belts on  
Chain drives to install  
Equipment to install chain drives on  
Trainee Task Module  
Markers/chalk  
Transparencies  
V-belts:

- FHP
- Standard multiple
- Wedge
- Double-angle
- Joined
- Notched

Synchronous belts:

- Single-sided
- Dual-sided

Roller chains:

- Single-strand
- Multiple-strand

Silent chains  
Module Examination  
Performance Profile Sheets

## MODULE 32309 – INSTALLING BEARINGS

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Angular-contact ball bearings  
Bearing heater  
Bearing heating ring  
Bearing pullers  
Bearings to remove  
Cutting torch and accessories  
Equipment to remove and install bearings on  
Feeler gages  
Files  
Hydraulic nut with pump  
Hydraulic press and/or arbor press  
Micrometers  
Overhead projector  
Pillow block bearings  
Spherical roller bearings  
Tapered roller bearings  
Thrust bearings  
Trainee Task Module  
Markers/chalk  
Emery cloth  
Manufacturer's installation instructions for each type of bearing  
Module Examinations  
Performance Profile Sheets

## **MODULE 32310 – GASKETS AND PACKING**

Overhead projector and screen  
Whiteboard/chalkboard  
Dividers  
Protractor  
Gasket cutter  
Hole punch  
Hammer  
Flange  
Tin snips  
Graphite  
Appropriate Personal Protective Equipment  
Trainee Task Module  
Markers/chalk  
Transparencies  
Various types of gaskets  
Various types of packing  
Various types of O-rings  
Pieces of hardwood  
SAE standards and specifications for gaskets and packing  
Specification sheets for gaskets and packing  
ANSI standards and specifications for gaskets and packing  
ASTM standards and specifications for gaskets and packing  
Vendor manuals for gaskets and packing  
Module Examination  
Performance Profile Sheets

## **MODULE 32311 – INSTALLING SEALS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Removal and installation tools  
Various applications for seals  
Trainee Task Module  
Transparencies  
Markers/chalk  
Module Examination  
Performance Profile Sheets  
Oil or other lubricant  
Various types of seals

## **MODULE 32312 - PUMPS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Sample pumps  
Pump setups  
Assorted screwdrivers  
Ball-peen hammer  
Needle-nose pliers  
Allen wrenches  
Trainee Task Module  
Transparencies  
Markers/chalk  
Module Examination  
Performance Profile Sheets

## **MODULE 32313 – BASIC HYDRAULIC SYSTEMS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Trainee Task Module  
Transparencies  
Markers/chalk  
Module Examination  
Performance Profile Sheets

## **MODULE 32314 – BASIC PNEUMATIC SYSTEMS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Compressed-air treatment devices  
Pneumatic system actuators  
Pneumatic system mufflers  
Pneumatic system valves  
Trainee Task Module  
Transparencies  
Markers/chalk  
Module Examination  
Performance Profile Sheets  
Lock, tag, and try procedure  
Pneumatic symbols

## **MODULE 32315 – BASIC ELECTRONIC THEORY**

Overhead projector and screen  
Appropriate Personal Protective equipment  
Whiteboard/chalkboard  
24V transformer with plug and power cord  
Filter capacitor  
Oscilloscope  
DC load resistance  
Selection of diodes, transistors, and SCRs  
Multimeter  
Integrated circuit chips  
Grounding strap  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
Selection of schematic and logic diagrams  
Module Examinations  
Performance Profile Sheets

# Level Four

## MODULE 32401 – PRACTICAL APPLICATIONS OF LIGHTING

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Assortment of incandescent, halogen, fluorescent, and HID lighting fixtures, including:  
    Surface-mounted  
    Recessed  
    Suspended  
    Track-mounted  
Assortment of incandescent, fluorescent, and HID dimming controls, ballasts, etc.  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
Examples of lighting fixture manufacturers' catalogs  
Module Examinations  
Performance Profile Sheets

## MODULE 32402 – STANDBY AND EMERGENCY SYSTEMS

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Hygrometer  
Digital low-resistance ohmmeter  
Battery load test unit  
AC generator and/or disassembled AC generator parts  
Examples of AC generator set service manuals  
Examples of automatic and nonautomatic transfer switches  
Assortment of lead acid and nickel cadmium batteries  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
Module Examinations  
Performance Profile Sheets

## **MODULE 32403 – ADVANCED CONTROLS**

Overhead projector and screen

Appropriate Personal Protective Equipment

Whiteboard/chalkboard

Test board for demonstrating control devices such as limit switches, solenoids, etc.

Tools required for making connections to test board

Trainee Task Module

Copy of the latest edition of the National Electrical Code®

Transparencies

Markers/chalk

Manual drum controller

Miscellaneous control devices

Module Examinations

Performance Profile Sheets

## MODULE 32404 – COMMERCIAL AND INDUSTRIAL REFRIGERATION

Appropriate Personal Protective Equipment  
Overhead projector and screen  
Whiteboard/chalkboard  
Operational refrigeration systems and equipment  
Cold storage plant and/or warehouse  
Walk-in coolers  
Reach-in coolers  
Open-type, refrigerated display cases  
System(s) with single, multiple, and satellite compressors  
Systems with multiple condensers  
Systems with multiple evaporators  
Operational ammonia refrigeration system  
Filters and filter-driers  
Sightglass/moisture-liquid indicators  
Suction line accumulator  
Crankcase heater  
Oil separator  
Receiver  
Manual shutoff and service valves  
Relief valves and fusible plugs  
Check valves  
Compressor muffler  
Vibration isolators  
Crankcase pressure regulating valves  
Evaporator pressure regulating valves  
Condenser pressure regulator  
High-to-low-side bypass valve  
Bypass control valve  
Compressors equipped with unloaders  
Trainee Task Module  
Module Examination  
Transparencies  
Markers/chalk  
Performance Profile Sheets  
Manufacturer's operation and service literature for demonstration equipment  
Ammonia-sensitive wet indicating paper, such as phenolphthalein

## **MODULE 32405 – ELECTRICITY IN HVAC SYSTEMS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
Thermostats, including:  
    Electric bimetal thermostat  
    Single-pole, line voltage thermostat  
500W, 120V electric baseboard heater  
Cord and plug assembly  
Module Examinations  
Performance Profile Sheets

## **MODULE 32406 – HVAC CONTROLS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Programmable electronic thermostat  
24V mercury bulb thermostat  
Line-voltage thermostat  
Selection of 24V thermostats:  
    Heating-only  
    Cooling-only  
    Heating-cooling  
Heat pump  
Level  
Wire strippers  
Clamp-on ammeter  
Gas furnace  
Allen wrenches  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
Thermostat wire  
Length of wire with alligator clips  
Module Examinations  
Performance Profile Sheets

## **MODULE 32407 – CONVENTIONAL ALIGNMENT**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Alignment simulator  
Dial indicators and bases  
Feeler gauges  
Straightedges  
Levels  
Soft-faced hammers  
Dial calipers  
Trainee Task Module  
Transparencies  
Markers/chalk  
Module Examination  
Performance Profile Sheets

## MODULE 32408 – MAINTAINING VALVES

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Assorted screwdrivers  
Channel-lock pliers  
Combination wrenches  
Drift pins  
Hacksaws  
Levels  
Pipe cutters  
Pipe threaders  
Pipe vises  
Pipe wrenches  
Putty knives  
Sharp knives  
Soapstones  
Tape measures  
Torque wrenches  
Tri squares  
Valve O-rings  
Valve packing removal tools  
Trainee Task Module  
Transparencies  
Markers/chalk  
Pencils  
Antiseize compound  
Bonnet gaskets  
Carbon steel pipe to match valve sizes  
Flange gaskets  
Flanged valves in a small system  
Pipe joint compound  
Thread cutting oil  
Threaded pipe unions  
Threaded valves in a small system  
Valve packing  
Valves that contain bonnet gaskets  
Valves that contain O-rings  
Module Examination  
Performance Profile Sheets

## **MODULE 32409 – IDENTIFYING AND INSTALLING VALVES**

- Angle valves
- Ball check valves
- Ball valves
- Butterfly check valves
- Butterfly valves
- Chain operators
- Control valves
- Diaphragm valves
- Drift pins
- Electric motor-driven actuators
- Flanged valves
- Foot valves
- Framing levels
- Framing squares
- Bolts
- Carbon steel pipe
- Cleaning solvent
- Flanged piping
- Gaskets
- Nuts
- Pipe joint compound
- Soapstones
- Teflon® tape
- Thread cutting oil

## **MODULE 32410 – STEAM TRAPS**

- Overhead projector and screen
- Whiteboard/chalkboard
- Appropriate Personal Protective Equipment
- Sample steam traps
- Trainee Task Module
- Transparencies
- Markers/chalk
- Module Examinations
- Performance Profile Sheets

## MODULE 32411 – STEAM SYSTEMS

Appropriate Personal Protective Equipment  
Overhead projector and screen  
Whiteboard/chalkboard  
Steam heating system(s)  
Assorted boiler components:  
Cast iron and steel boiler parts  
Electric boiler heating elements and other parts  
Pressure gauges  
Water gauge glass set/water columns  
Low-water cutoff controls  
Water feeder controls  
High-pressure limit controls  
Pressure relief valves  
Assorted gate, globe, and check valves  
Thermostatic valves  
Pressure-reducing valves  
Shell and tube and plate heat exchangers  
Fan coil units  
Unit ventilators  
Steam heating coils  
Steam traps (both good and defective), including:  
Inverted bucket traps  
Liquid expansion thermostatic traps  
Balanced pressure thermostatic traps  
Bimetallic thermostatic traps  
Float and thermostatic (F&T) traps  
Thermodynamic disc traps  
Strainers:  
Screwed strainers  
Basket strainers  
Flanged Y strainers  
Condensate pumps  
Receiver tanks  
Vacuum pumps  
Steam piping system components and fittings  
Steam system maintenance tools and equipment  
Trainee Task Module  
Module Examination  
Markers/chalk  
Transparencies  
Performance Profile Sheets

## **MODULE 32412 – PROGRAMMABLE LOGIC CONTROLLERS**

Overhead projector and screen  
Whiteboard/chalkboard  
PLC  
Programming device  
Trainee Task Module  
Transparencies  
Markers/chalk  
Module Examination  
Performance Profile Sheets  
Ladder logic printout

## **MODULE 32413 – HIGH-VOLTAGE TERMINATIONS/SPLICES**

Overhead projector and screen  
Appropriate Personal Protective Equipment  
Whiteboard/chalkboard  
Hi-pot tester  
Cable splicers  
Trainee Task Module  
Copy of the latest edition of the National Electrical Code®  
Transparencies  
Markers/chalk  
High-voltage cable  
Tape or rubber for insulation  
Splicing compound  
Insulation cutter  
Connectors  
Vinyl tape  
Inline splicing kits  
Ribbon shielding cable  
Module Examinations  
Performance Profile Sheets

## **MODULE 32414 – VIBRATION ANALYSIS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Vibration test equipment  
Trainee Task Module  
Transparencies  
Markers/chalk  
Module Examination

## MODULE 32415 – COMMERCIAL HEATING AND COOLING SYSTEMS

Appropriate Personal Protective Equipment

Overhead projector and screen

Whiteboard/chalkboard

Hot water heating system(s) and/or assorted system components, including:

- Cast iron and steel boiler parts

- Electric boiler heating elements and other parts

- Pressure relief valves

- Low-water fuel cutoff controls

- Combination low-water cutoff/feeder controls

- Aquastats

- Electronic-type water level controls

- Expansion/compression tanks

- Air control devices

- Circulating pumps

- Pressure reducing valves

- Backflow preventer valves

- Zone control valves

- Multi-purpose valves

- Balancing and flow control valves

- Two-way and three-way valves

- Assorted hot water terminals, including:

  - Convectors

  - Baseboard and finned-tube

  - Radiators

  - Unit heaters

  - Heating coils

  - Shell and tube and plate heat exchangers

  - Tankless water heaters

Chilled water system(s) and/or assorted system components, including:

- Reciprocal, centrifugal, and screw chiller parts

- Cooling tower and/or evaporative condenser parts

- Assorted chilled water and dual-temperature terminals, including:

  - Fan coil units

  - Unit ventilators

  - Air-water induction units

Water piping system components and fittings

Trainee Task Module

Module Examination

Markers/chalk

Transparencies

Performance Profile Sheets

# Level Five

## **MODULE 32501 – PREVENTIVE AND PREDICTIVE MAINTENANCE**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Trainee Task Module  
Markers/chalk  
Transparencies  
Module Examination

## **MODULE 32502 – PERFORMING REVERSE ALIGNMENT**

Overhead projector and screen  
Whiteboard/chalkboard  
Alignment demonstration rig  
Reverse dial indicator jigs  
Appropriate Personal Protective Equipment  
Trainee Task Module  
Markers/chalk  
Transparencies  
Alignment records  
Graph paper  
Graphical alignment charts  
Calculator  
Straightedges  
Feeler gauges  
Dial indicators  
Dial indicator bases  
Pencils  
Reverse dial indicator plotting guides  
Module Examination  
Performance Profile Sheets

## **MODULE 32503 – PERFORMING LASER ALIGNMENT**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Alignment demonstration rig  
Optalign laser alignment system  
Trainee Task Module  
Markers/chalk  
Transparencies  
Graph paper  
Pencils  
Module Examination  
Performance Profile Sheets

## **MODULE 32504 - TROUBLESHOOTING AND REPAIRING PNEUMATIC EQUIPMENT**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Pneumatic system to inspect  
Pneumatic system components to repair/overhaul  
Set of flare nut wrenches  
Assorted screwdrivers  
Emery cloths and hones  
Needle-nose pliers  
Set of Allen wrenches  
Trainee Task Module  
Markers/chalk  
Transparencies  
Manufacturers' maintenance and repair manuals  
Sample troubleshooting charts  
Module Examination  
Performance Profile Sheets

## MODULE 32505 – TROUBLESHOOTING AND REPAIRING PUMPS

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Allen wrenches  
Arbor press or length of pipe to install bearings  
Assorted screwdrivers  
Ball-peen hammers  
Bearing puller  
Combination wrench sets  
Dial indicators  
Emery cloths and hones  
Feeler gauges  
Flare nut wrenches  
Grease gun  
Needle-nose pliers  
Portable crane/rigging device  
Shaft key wrenches  
Sling and hardware for rigging  
Snap-ring pliers  
Socket sets  
Torque wrenches  
Various types of pumps  
Trainee Task Module  
Markers/chalk  
Transparencies  
600-grit sandpaper  
Appropriate machine oil  
Silicone lubricant  
Manufacturers' maintenance and repair manuals  
Module Examination  
Performance Profile Sheets

## **MODULE 32506 – TROUBLESHOOTING AND REPAIRING HYDRAULIC EQUIPMENT**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Hydraulic actuator  
Hydraulic control valves  
Hydraulic gauge  
Hydraulic hoses with couplings  
Hydraulic pump  
Trainee Task Module  
Transparencies  
Markers/chalk  
Module Examination  
Performance Profile Sheets  
Schematic diagrams

## **MODULE 32507 – TROUBLESHOOTING AND REPAIRING GEARBOXES**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Dead-blow hammer  
Dial indicator  
Feeler gauge  
Gear pullers  
Heating torch  
Hydraulic press  
Lifting devices  
Bearing heater  
Safety equipment  
Sample gears and gearboxes  
Trainee Task Module  
Transparencies  
Markers/chalk  
Module Examination  
Performance Profile Sheets

## **MODULE 32508 – PROGRAMMABLE LOGIC CONTROLLERS**

Overhead projector and screen  
Whiteboard/chalkboard  
Trainee Task Module  
Transparencies  
Markers/chalk  
Scratch paper/pencils  
Module Examinations  
Performance Profile Sheets

## **MODULE 32509 – INSTRUMENT DRAWINGS AND DOCUMENTS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Trainee Task Module  
Transparencies  
Markers/chalk  
ISA Standard S5.1, Instrument Symbols  
and Identification  
Samples of Piping and Instrument  
Drawings (P&IDs)  
Samples of Loop Drawings  
Samples of Installation Detail Drawings  
Samples of Location Drawings  
Samples of Piping Drawings  
Samples of Instrument Specification Sheets  
Samples of Instrument Indexes  
Samples of General Instrument Specifications  
Module Examination  
Performance Profile Sheets

## MODULE 32510 – FLOW, PRESSURE, LEVEL, AND TEMPERATURE

Overhead projector and screen  
Whireboard/chalkboard  
U-tube manometer  
Well manometer  
Inclined manometer  
Bellows  
Bourdon tube pressure gauge  
Spiral Bourdon tube  
C-shaped Bourdon tube  
Helix Bourdon tube  
Diaphragm  
Concentric orifice plate  
Eccentric orifice plate  
Segmental orifice plate  
Flow nozzle  
Venturi tube  
Pitot tube  
Target flowmeter  
Magnetic flowmeter  
Turbine flowmeter  
Vortex flowmeter  
Rotameter  
Fluid thermometer  
Bimetallic thermometer  
Thermocouple  
Thermowell  
Resistance temperature detector (RTD)  
Dip stick  
Sight glass  
Float-cable level arrangement  
Displacer  
Magnetic-type float device  
Appropriate Personal Protective Equipment  
Trainee Task Module  
Markers/chalk  
Transparencies  
Mockup of U-tube manometer system  
Mockup of well manometer system  
Module Examination  
Performance Profile Sheets  
Mockup of Inclined Manometer System

## **MODULE 35211 – PROCESS CONTROL THEORY**

Overhead projector and screen

Whiteboard/chalkboard

Appropriate Personal Protective Equipment

Trainee Task Module

Transparencies

Markers/chalk

Module Examination

Performance Profile Sheets

Sample set of P&IDs for control loops (copy for each trainee)

Sample set of Instrument Data Sheets or vendor technical bulletins/manuals for the detectors/sensors in the sample set of P&IDs (copy for each trainee)

## MODULE 32512 – PRECISION MEASURING TOOLS

Overhead projector/screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Master levels  
No. 98 mechanic's levels  
Optical levels  
Electronic levels  
Tubing water levels  
Inside calipers  
Outside calipers  
Steel rules  
Vernier calipers  
Dial calipers  
Outside micrometers  
Inside micrometers  
Depth micrometers  
Height gauges  
Snap gauges  
Small hole gauges  
Dial indicators  
Protractors  
Bevel protractors  
Universal bevel protractors  
Parallels  
Adjustable parallels  
Gauge blocks  
Magnifying glasses / optical flats  
Trammels  
Precision straightedges  
Tachometers  
Stroboscopes  
Feeler gauges  
Pyrometers  
Various work pieces to be measured  
Trainee Task Module  
Markers/Chalk  
Transparencies  
String  
Chamois or lint-free cloth  
Cleaning fluid  
High-grade instrument oil  
Module Examination  
Performance Profile Sheets

## **MODULE 32513 - FORKLIFTS**

Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate Personal Protective Equipment  
Forklift  
Pallets  
Blocking  
Sheeting  
Posts, constructed from 2 × 4s or other suitable material  
Trainee Task Module  
Markers/chalk  
Transparencies  
Forklift operator's manual  
Capacity chart  
Forklift brochures  
Module Examination  
Performance Profile Sheets

## **MODULE 32514 – FIBER OPTICS**

Appropriate Personal Protective Equipment  
Overhead projector and screen  
Whiteboard/chalkboard  
Copy of the latest edition of the National Electrical Code®  
Trainee Task Module  
Transparencies  
Markers/chalk  
Scratch paper/pencils  
Module Examinations