CAMT Training:
Appliance Maintenance and Repair Course

Clothes Washers | Clothes Dryers | Cooktops | Ovens | Dishwashers | Refrigerators

INSTRUCTOR RESOURCE GUIDE

National Apartment Association Education Institute

CAMT Certificate for Apartment Maintenance Technicians (ANSI)

Presented by: Lowe's ProServices

CAMT Online Training

Don't Forget…Take the Online Training for this CAMT Course!

To continue your education, you can also complete a brief online course on Appliance Maintenance and Repair.

This course will take approximately 30 minutes. You can access the course on your home computer, a computer in a public place such as a library, or a computer at work.

1. Go to the following web site: http://www.naahq.org/cps
2. Type the username and password you received.
3. Once you are logged in, you should see your **Dashboard**.
4. Your classes are listed under **Required Training**. You should be able to click on each learning track to access the modules.
5. Go through each learning track, and click on **Launch** to review each module within them. If the course does not open after clicking Launch, please make sure your pop up blocker is turned off.
6. After you complete each course, you are able to see it listed as **Complete** in the Learning track, as well as in Your Transcript.
7. If you have any issues, please contact education@naahq.org.

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NAA National Apartment Association | Education Institute

CAMT Training:
Appliance Repair and Maintenance Course

The National Apartment Association thanks you for your time, talent, and technical expertise in training and developing the next generation of Certificate for Apartment Maintenance Technicians.

Whether you're a subject matter expert or lay person…a seasoned instructor or a new teacher…this guide will help you become an even more engaging and effective trainer.

In this course on appliances, you'll help maintenance technicians:

- Understand their role in appliance repair and maintenance.
- Improve their appliance knowledge, skills, and abilities.
- Perform appliance repairs with greater ability and confidence.
- Become an even more valuable members of the apartment community.
- Pursue the Certificate for Apartment Maintenance Technicians (CAMT) designation.

Although this course is targeted at technicians with one year of on-the-job experience, it can also be used to teach those with more or less experience who would like to learn more about appliance maintenance and repair.

Guide Contents

Fast Facts: The Appliance Maintenance and Repair Course

Course Type

- Instructor-led classroom training
- Uses short presentations, photos, videos, demonstrations, participant discussions, hands-on activities, and question and answer sessions to teach course material

Course Materials

- This *Instructor Guide*
- The *Appliance Participant Resource Guide* (also for use as an on-the-job reference)
- CAMT USB flash drive

Course Length

Approximately 15 hours

Best Way to Schedule

- Two full-day sessions (include two 15 minute breaks and 30 minutes for lunch)

OR

- Four four-hour sessions (include a 15-minute break in each session)

Course Location

Because this is a course with demonstrations and hands-on activities, the best place to teach it is in an apartment community. Use a vacant apartment and a meeting room (if available) as your primary classrooms. In an actual apartment unit, participants will be able to see and experience many of the appliance maintenance and repair tasks you will teach. Use your training center if you have one.

Course Content

Because there is no one single standard for many types of appliance repair, poll participants at the beginning of each training section to see what they need to be successful on the job. Perhaps you don't need to teach participants about gas cooktop repairs if all have electric cooktops in the communities they serve.

Spend time teaching topics that are relevant to your participants, things they can immediately apply back on the job to make their communities better.

Subject Matter Experts

Invite a subject matter expert—a current or retired appliance repair professional, a trade school instructor—to volunteer her/his time to participate in the instruction. Experts are especially helpful for answering participants' questions, giving real-world tips and tricks, and talking about industry trends. (Check with your affiliate if the expert requires compensation for helping with the course.)

Fast Facts:
The Appliance Maintenance and Repair Course
(continued)

Demonstrations and Hands-on Practice

Many of the topics in this course also include a brief demonstration or a suggested hands-on activity to let participants actually see or do the repair task.

If you can include these elements in your training, it will elevate and enrich the participants' experience. Hands-on practice is especially valuable; because participants will get a chance to try out the skills they've learned in a safe environment, where mistakes do not have potentially serious consequences.

However, both demonstrations and hands-on practice require more planning and preparation on your part—and most likely, support from your NAA affiliate.

Training Kit

If you choose to conduct demonstration and hands-on practice, which is highly recommended, work with your NAA affiliate to put together a training kit of tools and materials you can use in the course. This kit will not be expensive, but it will take planning and time to complete.

See "Suggested Training Kit for this Course" in the appendix.

Online Training Scenarios

Participants will also get a chance to reinforce what they've learned in the classroom by completing 30 to 60 minutes of online training, either at home or back on the job. In this training, participants will complete three scenarios in which they'll troubleshoot common (but challenging) appliance repair problems.

For more details on this training—and how to present it to participants—please see page 95 of this guide.

Preparing to Teach the Course

To give course participants a first-rate learning experience, plan to spend several hours preparing to teach this class.

When to Prepare

Depending on your experience with this course, begin preparing two to three weeks before the scheduled course date. That's enough time to absorb the material without feeling rushed.

How to Prepare

- ***Read the instructor guide carefully.*** Get familiar with the organization and flow of the course, as well as the content and the leader's instructions.
- ***Look for ways to personalize the instruction.*** Add your own stories, examples, and insights. Make the material come alive for the participants.
- ***Mark up this guide.*** Write notes throughout. Highlight passages you want to emphasize. Add prompts for your examples and explanations.
- ***Practice.*** Do a dry run of the material (or at least some of it) in front of willing colleagues or family members. Get their feedback. Find out: What are you doing well? What's one thing you could improve?

When It's Time to Teach the Course

- ***Use this instructor guide.*** Refer to it often to keep the class on track. Using notes will make you look natural, relaxed, and yes, even confident.
- ***Approach the course as a conversation, not as a presentation.*** Keep things open and easygoing. Pick yourself up if you make a "mistake." Answer the questions you can. Most important, avoid the temptation to be the expert—simply share what you've learned.
- ***Keep participants actively involved.*** Allow participants to ask questions, share ideas with one another, and get as much hands-on experience as possible. Remember: telling isn't training.
- ***Be yourself.*** Participants appreciate (and learn more from) instructors who are not only knowledgeable, but also approachable, personable, and dedicated.

Preparing the Classroom

To complete your final preparations, arrive at the training site at least one hour before class begins.

Find the Location of these Public Facilities or Services

- Restrooms
- Kitchen facilities or vending machines
- Emergency exits

Prepare Materials

- *Appliance Participant Resource Guide* for each participant
- *Appliance Instructor Guide* (with all your preparation notes in it)
- CAMT USB flash drive
- Training Kit (make sure you have the right tools, parts, and demonstration equipment for this class)
- Sign-in form (to be turned in to the affiliate office after class)

Prepare and Test Equipment

- Computer with projector
- Flipchart with stand or whiteboard
- Markers
- Microphone or sound system (if needed)

Prepare a Learning-Friendly Classroom

- Arrange the tables and chairs in the room so that participants will be able to easily see and hear the videos, take notes, and talk with one another.
- Make sure the room isn't too hot or cold.
- Ensure that there's adequate lighting.
- Write the day's training agenda on the flipchart or whiteboard.

Course Schedule-at-a Glance

The total classroom training time for the Appliance Maintenance and Repair course is approximately 15 hours, typically delivered over two full-day sessions. Here's how it breaks out.

Day 1	Time Needed	Topic
	30 minutes	Welcome and Introduction
	30 minutes	Appliances: You Are Here
	25 minutes	Diagnosing Appliance Problems
	30 minutes	Appliance Safety
	30 minutes	Key Appliance Repair and Maintenance Tools
	3 hours	Clothes Dryer Maintenance and Repair
	3 hours, 30 minutes	Clothes Washer Maintenance and Repair
Day 2	**Time Needed**	**Topic**
	1 hour, 15 minutes	Oven and Cooktop Maintenance and Repair
	1 hour, 10 minutes	Dishwasher Maintenance and Repair
	3 hours	Refrigerator Maintenance and Repair
	30 minutes	Key Takeaways, Action Plan, and Wrap-Up

The course may be delivered in a different manner (for example, four four-hour sessions) to accommodate instructor and subject matter expert schedules, location availability, and other local factors.

Instructor Script:
Welcome and Introduction (30 minutes)

 **Slide 1**

In this brief opening section, you'll welcome participants, introduce yourself, and set the stage for the "Appliance Repair and Maintenance" course.

Leader's Instructions:

Welcome participants to the course. Introduce yourself to the class, and then proceed with the script below.

Dive in…you're going to do just fine!

Welcome. My name is _____, and I'll be your instructor for this CAMT course on appliance repair and maintenance.

Residents depend on the appliances in their apartment and/or those available within the apartment community to complete routine tasks each day. And since washing clothes and cleaning up the dishes aren't always high on the list of favorite activities for folks, when appliances do not work properly, it can make an unpleasant task even more frustrating. You have probably noticed already, but when an appliance is not working – the resident wants it fixed fast.

Appliance maintenance and repair ranges from cosmetic touch-ups (i.e., fixing paint scratches, changing light bulbs) to complex part replacements (i.e., clothes dryer heating element, refrigerator thermostat). The repairs between these extremes are vast and require you to increase your skills in determining the root cause of a problem.

Repairing appliances can be time-consuming and expensive. The good news is that you can make a difference in the number service requests generated in the future by your ongoing actions. Carefully checking the operation of appliances during make-ready inspections and performing routine maintenance (i.e., clearing lint from the outside dryer vent, removing build-up from the refrigerator coils) minimizes the frustration caused by appliances that are not functioning properly or stop working completely.

During this course, you will be able to practice the skills you previously learned in the CAMT and courses since appliances generally use electricity, water or both. In fact, you'll likely tackle a combination of electrical, gas, plumbing, and mechanical systems within an appliance. However, the appliance repairs you will face are specific to the appliance's make and model. Where electrical and plumbing work follow basic scientific or design principles, appliance repair varies greatly by the manufacturer and model of the unit. Parts are located in different places; new technology replaces older methods; the list goes on.

In this class, we will cover standard appliance operation information and view specific repair examples. You will need to develop your skills as a diagnostician in order to quickly assess problems and complete repairs. Communities tend to use the same appliances in each apartment, so hopefully you won't need to learn about several additional models right away.

This course focuses on the maintenance and repair of the most common apartment community appliances: clothes washer, clothes dryer, dishwasher, oven, cooktop, and refrigerators.

With that brief introduction, we've set the stage for the course. Now, I'd like to get to know a little more about you.

Participant Introductions

Leader's Instructions:

It's time to go around the room and do those beginning-of-the-course introductions. This activity has three parts:

1. Ask participants to share their name, the name and location of their employer, and their experience with appliance repair during their time as a technician. This gives you a sense of the depth and breadth of knowledge in the room.
2. Introduce any subject matter experts who may be participating in the class. Have the experts share a few words about themselves.
3. And finally, tell participants more about yourself. Talk about your experience in the apartment industry, with training, or with the maintenance or appliance business. And talk a little about your life away from work, too.

Thanks for doing that. It's nice to get to know all of you better.

Instructor Script: Welcome and Introduction (continued)

 **Slides 2 - 3**

A Closer Look at the Training

Now, let's take a few minutes to look more closely at this appliance training.

Turn to page Welcome i in your *Resource Guide*, so we can take a look how this entire course lays out and see what's on tap for today.

Leader's Instructions:

1. Cover the course schedule, which you'll find on page Welcome vi of this guide.
2. Go over the day's agenda, which you will have written on the flipchart or whiteboard.
3. Let participants know about the scheduled breaks and lunches for the day—and how you'd like participants to handle any "unscheduled" breaks, such as the need to make a phone call.
4. Ask for any questions.

Throughout the course, we'll be doing a variety of things to help you learn and absorb the material:

- Using the *Resource Guide*
- Watching in-class demonstrations and videos
- Having group discussions
- And doing hands-on activities

All I ask is that you participate fully. That means stay with us, both mentally and physically. Ask questions. Share your tricks and tips, as well as your own experiences. Tell us about the things that have worked well on the job, and the things that haven't.

You'll only get out of this class what you put into it, so give everything you can.

Housekeeping Items

We're almost ready to dive into today's activities, but before we can do that, I need to cover a few housekeeping items, just to answer any logistical questions that may be lingering in your mind.

Leader's Instructions:

Cover any other remaining housekeeping items, such as the location of the rest rooms, emergency exits, and kitchen or vending machine facilities—as well as any registration or sign-in activities. Ask for any questions before moving on.

You Are Here: Appliance Maintenance and Repair (30 minutes)

Slide 4

In this part of the training, you'll tie it all together for the aspiring CAMTs by talking about their roles and responsibilities as they relate to appliance maintenance and repair.

Leader's Instructions:

Instead of just lecturing participants on their appliance repair and maintenance responsibilities, ask them to give you the answers. By allowing participants to talk, they use (and show off) their experience—and you actively involve them in the course. That's important, because involvement is key to an engaging and enriching classroom experience.

By the way, this ask-a-question approach is easier for you, too. Rather than having to convey all sorts of information, you only need to fill in what the participants missed. But have a little patience—it may take participants a while to formulate their answers after you've asked your questions.

Just follow the script below, and you'll be great!

Let's set the stage for everything you'll be learning in this course by relating it back to what you do on the job. In other words, let's talk about a maintenance technician's roles and responsibilities as they relate to appliance maintenance and repair.

I'm going start things off by talking about one important responsibility: working safely. Appliance repair, especially when it involves electricity, can be a dangerous thing, and that's why you must always follow the safety procedures you'll be learning in this course, as well as any that your company may have instituted, too.

No matter how busy you may be, you can never take shortcuts. Your personal safety depends on it. Your residents' safety depends on it. And keeping the building in excellent shape depends on it, too.

So safety is one of your key roles and responsibilities when you're completing appliance repairs. Now, it's time for you to tell me about your other appliance repair responsibilities, by sharing your experiences with us.

Turn to page 1 in your *Resource Guide*, and take notes as the discussion unfolds.

You Are Here: Appliance Maintenance and Repair (continued)

Leader's Instructions:

1. Ask participants: "Besides working safely, what are your other key roles and responsibilities as they relate to appliance repair?"
2. Accept all reasonable answers, but make sure participants touch on these:
   - Successfully completing the *CAMT Electrical Maintenance and Repair* and *Plumbing Maintenance and Repair* courses before taking the *Appliance Maintenance and Repair* course or before making appliance repairs. This course assumes the participant is able to make basic electrical and plumbing repairs.
   - Doing requested and permitted repairs (e.g., replacing parts, etc.)
   - Completing preventive maintenance tasks
   - Completing "make-ready" maintenance when an apartment turns
   - Performing unscheduled or emergency maintenance
   - Educating residents on appliance repair issues as needed; answering their questions
   - Complying with state and local regulations/building codes relating to electrical and plumbing installation and maintenance
   - Following your company's policies and procedures as they relate to handling and documenting service requests, keeping maintenance records, and working with outside contractors like electricians, plumbers, and appliance repair specialists
3. When the responses are no longer forthcoming, fill in any answers you may need to.

Thanks for helping me build such a complete and accurate list of your appliance repair roles and responsibilities.

When to Call an Electrician, Plumber, or Appliance Repair Specialist

Now, let's tackle a related question: when to call an electrician, plumber, or appliance repair specialist. Follow along on page 2 of your *Resource Guide*.

You'll need to call an electrician, plumber, or appliance repair specialist when:

- State or local regulations require it.
- You don't know how to do the task or feel uncomfortable doing it.
- Your workload is too heavy, or when you can't do the repair in a reasonable timeframe to satisfy the boss or a resident. Consider the time/cost benefit.
- The physical size or nature of the job is too big.
- When the broken item is still under a warranty.

If a professional comes on site to do a repair or replacement, watch what they're doing and ask questions—you might be able to do some or all of the work if it happens again.

That concludes our discussion on appliance repair roles and responsibilities. Can I answer any questions for you before we move on?

You Are Here: Appliance Maintenance and Repair (continued)

What Brand?

This section of the Certificate for Apartment Maintenance Technician curriculum is based upon the most common appliances generally found in the apartment industry. It would be impossible to attempt to include specific information for every brand and model available. To meet the challenge of providing useful information to make repairs on appliances, this book will cover basic standards that can be applied to this most common of equipment.

It is possible that to complete a service request on an appliance will require more detailed information than this book can provide. In that instance, it is recommended that information be obtained from the specific manufacturer. Sources for further information could include:

- The manufacturer's website
- Manufacturer technical manuals
- Installation manuals
- Schematics and diagrams that are included with the appliance

Always follow all safety rules and instructional guidelines as given by the manufacturer.

Diagnosing Appliance Problems
(25 minutes)

Slides 5 - 13

Determining the root cause of appliance problems is equal parts technical knowledge, communications savvy, and perseverance.

Leader's Instructions:

1. Ask participants to turn to page 4 in their *Resource Guide*.
2. Allow 10 minutes for them to order the steps they would use to diagnose an appliance repair problem – simplest to most complex.
3. After the review time has passed, ask for volunteers to share just one of the steps. Next, ask for another to share a step AND it's placement relative to the first example. Continue until there are no more answers volunteered. Encourage debate of placement of steps in the process. Spend about 15 minutes building the list.
4. Add your own insights.
5. Ask participants to record the final list in their *Resource Guide*. It will likely include many of the following:
   - ***Listen.*** Although you likely have a service request stating the issue, ask the resident to describe the problem to you, if possible. Use follow-up questions to seek additional information.
   - ***Observe.*** Look for possible simple solutions (i.e., electrical cord unplugged, refrigerator door left open) before taking anything apart.
   - ***Categorize.*** Start by reviewing the most common problems for the appliance in distress that can be fixed without taking apart the unit. For example, if the problem is with the clothes dryer, 80% of the time the culprit is lint, either in the unit or the vent.
   - ***Locate.*** If possible, find the specific appliance owner's manual. Some appliances have technical data sheets provided underneath the control panel.
   - ***Test.*** Try to recreate the problem the resident is having with the appliance so you can see where the process breaks down.
   - ***Repair/Replace.*** Use the resources and tools available to fix the problem. Begin by assuming the easiest solution and work toward the most difficult remedy.
   - ***Call.*** Contact an electrician, plumber, or appliance repair specialist to repair the appliance, if necessary.

Appliance Safety (20 minutes)

Slide 14

In this part of the training, you'll review important safety information that you have previously learned about electrical and plumbing maintenance and repairs.

Introduction

To keep participants involved in the learning—and again, to take advantage of their experience, consider teaching this information by asking participants about it.

Have them close their *Resource Guide*s, and then ask them: "When you're working on appliance repairs, what sort of safety precautions do you take?"

Let participants tell you what they do, and fill in any gaps, using the safety information that follows. This should be a review for your participants.

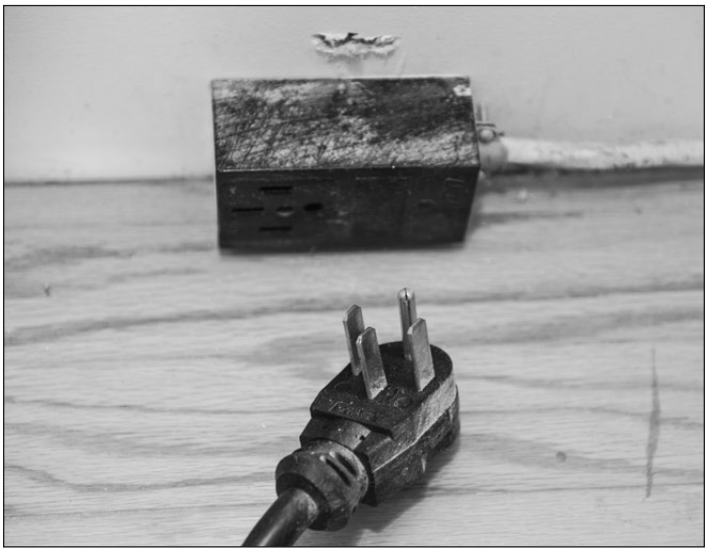
Introduction

When working with appliances, you need to be well-versed in electrical, gas and plumbing safety precautions. You need to be aware of these hazards and protect yourself from them.

Safety Rule #1: If Working with Electricity, Turn the Power Off

Slide 15

Whether you're repairing an electric clothes washer, dishwasher, refrigerator or a dryer, always turn off the power to the appliance. Then use a circuit tester (or multimeter) to **make sure the power is off.** Never take chances. Verify everything.



Appliance Safety (continued)

Safety Rule #2: Wear Personal Protective Equipment (PPE)

Slide 16

When working with appliances, wear the proper personal protective equipment to protect you from bacteria and germs, cuts and scrapes, and electrical sparks.

This equipment includes:

- Gloves
- Eye shields or goggles
- Sturdy shoes with a protective toe box and a non-slip sole, so you won't slip, trip, or fall in wet areas
- Masks to cover your nose and mouth

In addition, when working with electricity, do not:

- Have nylon or elastic in clothing when working with anything above 200 amps.
- Wear jewelry or watches when doing electrical work.
- Touch metal pipes, faucets, or fixtures while working with electricity. The metal may provide a grounding path, allowing electrical current to flow through your body.

Appliance Safety (continued)

Safety Rule #3: Follow Lockout/Tagout Procedures

Slide 17

Lockout/tagout is a safety procedure to make sure that power and energy sources, such as water or electricity, are shut off properly and secured.

You'll use lockout/tagout procedures when doing appliance maintenance and repairs, particularly when you're shutting off a key water supply line, like for a clothes washer, or working on an electrical appliance like a refrigerator.

Lockout Devices and Tags

Typical lockout devices that you'll use include:

- Padlocks
- Gate and ball valve lockouts
- Circuit breaker lockouts
- Chains
- Cable

Lockout tags usually are brightly colored so you can immediately see and identify them.

Your company may have lockout/tagout kits they want you to use. Check with your supervisor.

Where to Place Lockout Devices and Tags

Lockout devices and tags are typically applied to shut-off valves, electrical cords, or main service panels.

How to Lock and Tag Out

Your employer is required to train you on the complete lockout and tagout process. But here's a high-level look at how it's done:

1. Shut off the source of the water or electrical power.
2. Attach a lockout device to this source, then lock and tag it.
3. Release or drain any energy left in the plumbing or electrical lines or equipment.
4. Test to be sure the energy is turned off and removed from the pipes, circuits, or equipment.

Once these lockout//tagout steps are complete, you can go ahead with the appliance repair.

Appliance Safety (continued)

Safety Rule #4: Know Your Chemicals

Slide 18

Be familiar with chemicals like adhesives, paint and cleaning solutions you may use while performing appliance repairs and maintenance. Use Safety Data Sheets (SDS) to learn about the chemical properties, health hazards, and required personal protective equipment (PPE) you will need.

In addition, avoid exposure to contaminated water by wearing gloves, washing your hands, and decontaminating your equipment after use.

Safety Rule #5: Keep Tools and Equipment in Good Working Order

Slide 19

You'll use a variety of hand tools and power tools to maintain and repair the appliances in your apartment community. Therefore, keep your tools and equipment, and their safety features, in good working order. For example, keep power tools charged so they will work when needed.

How does the shop look at your community?

Leader's Instructions:

Slide 20

Note that this course cannot be brand-specific, as there are many brands and models of each appliance available. As a class we need to discuss each appliance with generalities. All references need to be generalized to normal operation. In other words, while each appliance will perform the same job; each manufacturer may do it with a little different thought process or procedure.

Group Discussion on Appliance Safety

(10 minutes)

Now that you've covered the baseline information on appliance safety, take full advantage of one of the key benefits of classroom learning—the chance for people to interact—to enrich participants' knowledge on the topic.

Leader's Instructions:

Hold a 10-minute open discussion on appliance safety. You can do this in a variety of ways, such as:

- Presenting additional material on appliance safety. (Or having an invited subject matter expert do it.) *For example, the U.S. Consumer Products Safety Commission estimates that clothes dryers are associated with more than 15,000 fires each year that result in property damage, injury and in the worst cases, death. Dryers rank third among appliances that start fires, with only stoves and fixed heating systems ranking higher.*
- Asking participants to share their stories and experiences.
- Holding a question and answer session.
- Asking participants to share their best "tips and tricks" related to appliance safety.

Let participants know the how the discussion will work, and encourage them to take notes on page 9 of their *Resource Guide.*

Key Tools for Appliance Repairs (30 minutes)

The aspiring CAMT needs to be well and safely equipped to perform appliance maintenance and repairs. In this part of the training, you'll explain the key repair and testing tools every technician needs.

Introduction

You'll need several tools to repair and maintain the appliances in your apartment community.

The good news is that you can do many appliance repairs with the hand tools you already have. And if you add just a few specialty tools to your workbench, you'll be well-equipped for almost any appliance repair event that may come your way.

The Basic Hand Tools

- **Slotted and Phillips insulated screwdrivers** can help you with many appliance repair tasks.

- An **adjustable wrench** has a movable jaw that lets you fit the wrench to many sizes of nuts and bolts.

- A **ratchet wrench** has interchangeable sockets to fit various sizes of nuts and bolts. You use it to tighten and loosen these nuts and bolts.

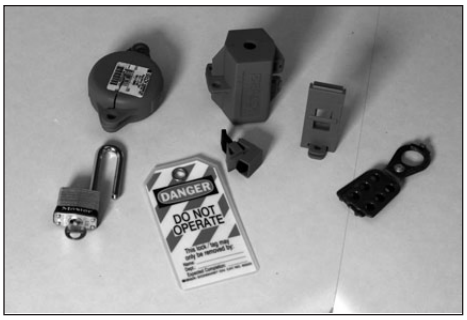
- A **tongue and groove pliers** has a movable handle that lets you adjust the jaws for maximum gripping strength.

- An **insulated needlenose pliers** has thin jaws for grabbing small things.

- A **putty knife** will help you open the front panel on a dryer.

Key Tools for Appliance Repairs (continued)

- A **utility knife** has a sharp single-edge razor that can be used to cut a variety of materials.



- **Lockout/tagout kits** should be used to identify that a power source, such as a main shut-off valve or circuit breaker, is shut off and secured.

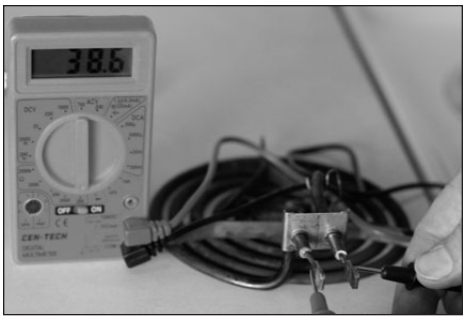
Leader's Instructions:

Ask participants: "What other tools would you recommend for appliance repairs?"

Add your own recommendations, too.

Key Tools for Appliance Repairs (continued)

Additional Appliance Repair Tools



- A **multimeter** is a "must-have" battery-operated tool used to measure electrical voltage, test for continuity, and test resistance in devices like heating elements.

- An **insulated combination tool** is used to cut cables and wires, measure wire gauges, and strip wires.

- A **wet vacuum** is sometimes needed to remove standing water from inside an appliance.

- An **electric blower** is used to blow the dryer vent from inside the building to remove built up lint and other debris. (A gas blower is prohibited.)

- A **digital thermometer** is used to take the internal temperature of appliances, such as ovens and refrigerators, during operation.

Leader's Instructions:

Ask participants: "Are any of you unfamiliar with any of these tools?"

Be sure to show participants how to use key tools, like the digital thermometer or multimeter if they have not previously used them.

Clothes Dryer Maintenance and Repair

Slides 21 - 23

(2 hours 30 minutes)

How long would it take for a 12 oz. glass of water to fully evaporate if you set it on a table? How long for a wadded up beach towel thrown into the hamper? Dryers serve one purpose – they speed up evaporation time.

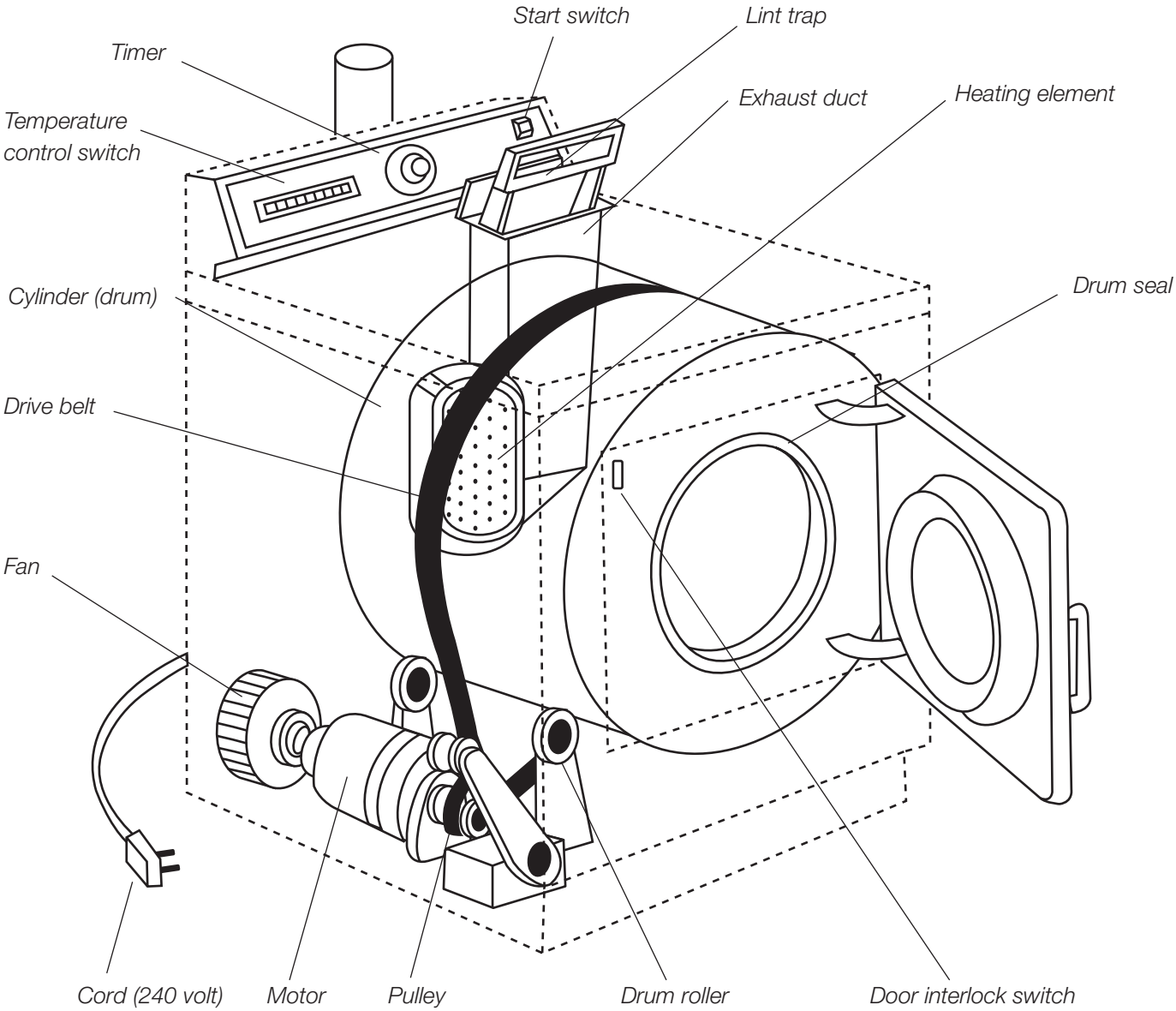
Introduction

Turn to page 13 in your guide.

A clothes dryer uses air, heat and motion to dry clothes, bedding, towels and other fabrics. It uses a motor to turn a drive belt, which spins the cylinder or drum with the wet laundry. A blower pushes heated air into the spinning cylinder to convert liquid water into water vapor. This process is called evaporation. This mechanical system is the same for both gas and electric dryers.

Dryer controls are used to adjust the drying time and temperature. Some dryers use mechanical controls and some controls are electronic.

Anatomy of a Clothes Dryer



Key Parts of a Clothes Dryer (10 minutes)

 **Slides 24 - 30**

To better understand how a clothes dryer functions, let's look closer at its key parts.

The Drum

The drum is a cylinder that holds the wet fabrics and spins to remove excess moisture.

The Motor

The motor turns the pulleys, which control the drive belt.

The Drive Belt

The drive belt is a rubber belt that spins the drum. There are two very clear signs that the belt is malfunctioning: You can easily spin the drum by hand when the dryer is turned off, or you hear a thumping sound coming from the drum when the dryer is running.

The Exhaust Duct

The moisture removed from fabrics exits through an exhaust duct or vent. If the exhaust duct is blocked or restricted, the same wet air is circulated in the dryer, greatly increasing drying time.

The Thermostats

Thermostats, the dryer temperature control switches, are controlled by the temperature inside the dryer or by the heat of the motor. One or more thermostats on the panel can be adjusted to control the temperature in the dryer. The operating thermostats sometimes stick, causing control problems. These thermostats are usually positioned near the exhaust duct bulkhead or the fan housing of the dryer; so you'll remove the back panel of the dryer to get at them.

The Heating Element

Heating elements provide the catalyst for warming the air. They differ in gas and electric dryers.

- In a gas dryer, heat is provided by a gas heater that is controlled by an air shutter. The gas heater is generally the source of no-heat or drying problems. You can often correct such problems by adjusting the air shutter on the gas burner, which is located along the bottom of the dryer. Gas dryers use an electric ignition device rather than a pilot light to light the gas heater. Electric ignition systems are always sealed; you can't adjust or repair them. If an electric ignition device fails, call a professional service person for replacement.
- Electric heating elements, found in electric dryers, are self-contained units located in the back of the dryer. A defective heating element is frequently the source of no-heat or drying problems. Remove the back service panel to gain access to the elements.The heating elements are located inside the heater ducts.

The Control Panel

The control panel houses the start switch and timer. Start switches rarely fail, but you may need to occasionally replace a timer.

The Lint Screen

Lint, which is removed during the drying process, is captured on a lint screen inside the dryer. It also escapes into the exhaust duct. It is very important to keep the vent clear of this lint or the dryer's ability to convert water to vapor is diminished.

Take a Clothes Dryer Tour (45 minutes)

Slides 31 - 34

A dryer is simply a large drum into which wet laundry is loaded. A motor with pulleys and belts turns the drum. Air heated by a gas heater or electric heating element is blown through the drum to dry the laundry.

Leader's Instructions:

If you're holding the training in an apartment community—or a building where you can easily access a clothes dryer—this is wonderful opportunity to get out of the classroom and show people what you're talking about. If you're unable to use the dryer in an apartment community, we highly recommend that you work with your local affiliate to obtain a clothes dryer to support this instruction. You can also work with various suppliers, who may be willing to donate new, used, or ready-to-recycle clothes dryers.

Spend about 45 minutes showing participants the inner workings of the dryer and compare the diagram in the *Resource Guide* to the dryer on hand to determine similarities and differences. Most repairs involve electrical work. Once the faulty part is identified, it's a matter of testing and replacing the old part with a new one.

We strongly recommend doing this tour to bring the topic alive--and to let participants move around a bit.

If you are in an apartment community, make sure the dryer is owned by the community before you touch anything! With some coin-operated machines, the vendor assumes full responsibility for the maintenance and repairs of the dryer (and washer) since they own them.

When you're finished, return to the classroom.

Common Clothes Dryer Problems and Solutions (30 minutes)

Slides 35 - 38

Statistics show that nearly 80% of all clothes dryer repair problems can be traced to a single culprit – lint!

Clothes Dryers and Lint

Lint is the arch enemy of every dryer. Before we look specifically at the havoc it raises, watch the following video.

Leader's Instructions:

Now, play the video "Dryer Airflow Troubleshooting."

After the video, invite discussion about the participants' experiences with dryer repair and specifically the damage caused by lint. Ask them for feedback on what was discussed in the video. Do they agree? What would they add?

Now, play the video "Dryer Lint Screen."

Clothes Dryers and Lint Discussion Notes

Common Clothes Dryer Problems and Solutions (continued)

Problem	Solution(s)
Dryer does not turn on	1. There is a tripped circuit breaker or blown fuse. Check the main service panel to reset. 2. The electrical cord is faulty. Inspect the cord for frayed wire or broken insulation. Test the power to the cord. 3. The door switch may be broken or damaged; see page 19. 4. The start switch may be faulty; see page 20. 5. On rare occasions, the thermal fuse may need to be replaced. See page 21 for directions.
Clothes are not dry or take too long to dry	1. The appliance is not being used properly. No one likes to be overworked. Drying too many clothes at a time can slow drying time significantly. 2. There is a lint build up or an obstruction in the dryer housing, vent, exhaust duct, or outside flap/baffle. This can be fixed by removing the lint or obstruction (i.e., bird's nest, leaves) or un-kinking the exhaust duct and vent. 3. The motor runs, but the dryer doesn't heat. In this case, the dryer timer may need to be tested and replaced. If that is not the problem, the heating element may need to be tested and replaced, see page 22.
Dryer runs too hot	1. There is a lint build up or an obstruction in the dryer housing, vent, exhaust duct, or outside flap/baffle. This can be fixed by removing the lint or obstruction (i.e., bird's nest, leaves) or un-kinking the exhaust duct and vent. 2. Next, check the thermostats; they may be faulty. To test and replace the thermostats, see page 23. 3. If that is not the problem, the heating element may need to be tested and replaced, see page 22.

Common Clothes Dryer Problems and Solutions (continued)

Problem	Solution(s)
The dryer is squeaky/noisy	1. There is a lint build up or an obstruction in the dryer housing, vent, exhaust duct, or outside flap/baffle. This can be fixed by removing the lint or obstruction (i.e., bird's nest, leaves) or un-kinking the exhaust duct and vent. 2. The dryer may not be level. Adjust the leveling feet in the front. The rear feet should adjust automatically. 3. A worn drive belt can be noisy. Depending on model, it is located either inside or on the bottom of the unit. See page 24 for replacement instructions.
Drum does not spin	1. Replace a broken or worn drive belt; see page 24 for directions.

These are some common problems you may encounter in your role as a maintenance technician. It is not an all-inclusive list.

Leader's Instructions:

It's important to stress with your students that the instructions provided here are general, not specific to a certain model and likely do not perfectly align with the style of dryer you are using as an example in class or the dryers in their apartment community.

When possible, a great way to learn more about the specifics of the appliances in their communities is to accompany another technician or a supervisor on a few repair calls.

This will be true of each appliance category as we move through the rest of the material.

Testing and Replacing a Clothes Dryer Door Switch

Leader's Instructions:

Unfortunately, there isn't enough time to show every possible clothes dryer repair. Demonstrate this one for the class, and then you'll use another method to cover more repairs.

1. Introduce the topic.
2. Cover the how-to information below. (This information is also on page 18 of the participants' *Resource Guide*.)
3. Ask for questions.
4. Have participants and invited subject matter experts share their best tips and tricks.
5. Invite the participants to review the additional common repair instructions provided in their *resource guide*.

Safety

Make sure the power to the dryer is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical parts.

Tools and Materials Needed

- Lockout/tagout plug cover
- Screwdriver
- Insulated combination tool
- Multimeter
- Door switch

How-to Steps

First, check the metal prong that triggers the switch. Replace if broken or damaged. Then test dryer again to see if this fixed the problem.

If the prong is in good condition:

1. Unplug dryer or turn off electricity to dryer at main electrical panel.
2. Lockout/tagout the cord or panel.
3. Remove the switch and disconnect the wires.
4. Use multimeter on RX1 setting to test:
   - Touch one probe to one terminal and the other probe to the other terminal.
   - Turn switch on.
   - The display should show zero. If not, replace switch.
5. Reconnect switch.
6. Turn on electricity to dryer.
7. Turn on dryer and check operation.

Testing and Replacing a Dryer Start Switch

Safety

Make sure the power to the dryer is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical parts.

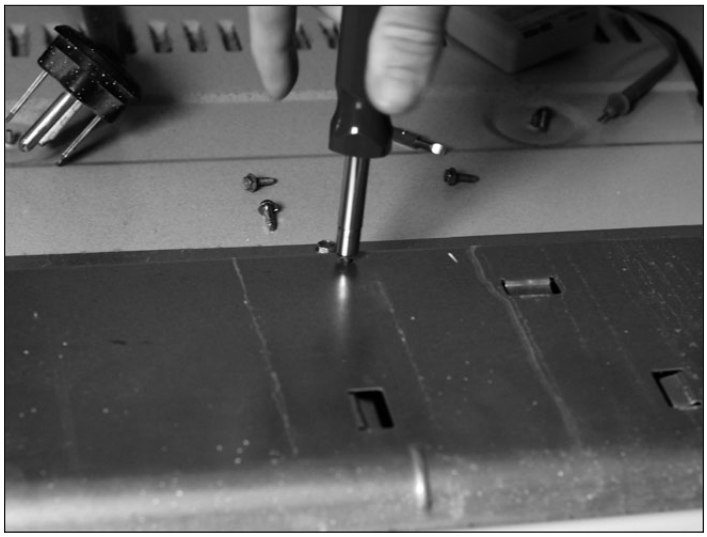
Tools and Materials Needed

- Lockout/tagout plug cover
- Screwdriver
- Insulated combination tool
- Multimeter
- Start switch

How-to Steps

The start switch rarely malfunctions, but if you suspect it is faulty:

1. Unplug dryer or turn off electricity to dryer at main electrical panel.
2. Lockout/tagout the cord or panel.
3. Remove the control panel cover.
4. Disconnect the wires.
5. Use multimeter on RX1 setting to test:
   - Touch one probe to one terminal and the other probe to the other terminal.
   - Turn switch on.
   - The display should show zero. If not, replace switch.
6. Reconnect switch.
7. Turn on electricity to dryer.
8. Turn on dryer and check operation.



Testing and Replacing a Dryer Thermal Fuse

Safety

Make sure the power to the dryer is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical parts.

Tools and Materials Needed

- Lockout/tagout plug cover
- Screwdriver
- Insulated combination tool
- Multimeter
- Putty knife
- Thermal fuse

How-to Steps

The thermal fuse is a heat-sensitive fuse on the exhaust duct that “blows” if the dryer overheats. To test the thermal fuse:

1. Allow dryer to cool to room temperature.
2. Unplug dryer or turn off electricity to dryer at main electrical panel.
3. Lockout/tagout the cord or panel.
4. Open the dryer’s cabinet; use the putty knife to pop it free, if necessary. (Different on most models.)
5. Locate the thermal fuse.
6. Pull the wire connectors to disconnect the wires.
7. Use multimeter on RX1 setting to test:
   - Touch one probe to one terminal and the other probe to the other terminal.
   - The display should show zero (at room temperature). If not, replace fuse.
8. Install fuse.
9. Turn on electricity to dryer.
10. Turn on dryer and check operation.

Testing and Replacing a Dryer Heating Element

Safety

Make sure the power to the dryer is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical parts.

Tools and Materials Needed

- Lockout/tagout plug cover
- Screwdriver
- Insulated combination tool
- Multimeter
- Putty knife
- Heating element

How-to Steps

The heating element produces the heat to dry the clothes. To replace the heating element:

1. Allow dryer to cool to room temperature.
2. Unplug dryer or turn off electricity to dryer at main electrical panel.
3. Lockout/tagout the cord or panel.
4. Open dryer housing to expose heating element. Use the putty knife to gently pry it free, if necessary.
5. Locate the dryer heating element.
6. Use multimeter on RX1 setting to test:
   - Touch one probe to one terminal and the other probe to the other terminal.
   - The display should show zero (at room temperature). If not, replace heating element.
7. Unscrew heating element.
8. Install heating element.
9. Replace dryer housing.
10. Turn on electricity to dryer.
11. Turn on dryer and check operation.

Testing and Replacing Dryer Thermostats

Safety

Make sure the power to the dryer is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical parts.

Tools and Materials Needed

- Lockout/tagout plug cover
- Screwdriver
- Insulated combination tool
- Multimeter
- Putty knife
- Thermostats

How-to Steps

Dryers use several thermostats to control the various drying temperatures. The thermostats are usually located just past the exhaust from the cylinder. They are elliptical in shape and under two inches long.

1. Allow dryer to cool to room temperature.
2. Unplug dryer or turn off electricity to dryer at main electrical panel.
3. Lockout/tagout the cord or panel.
4. Open dryer housing. Use the putty knife to gently pry it free, if necessary.
5. Locate the dryer thermostat.
6. Pull the wire connectors to disconnect the wires.
7. Use multimeter on RX1 setting to test:
   - Touch one probe to one terminal and the other probe to the other terminal.
   - The display should show zero (at room temperature). If not, replace thermostat.
8. Install thermostat.
9. Turn on electricity to dryer.
10. Turn on dryer and check operation.

Replacing a Dryer Drive Belt

Safety

Make sure the power to the dryer is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical parts.

Tools and Materials Needed

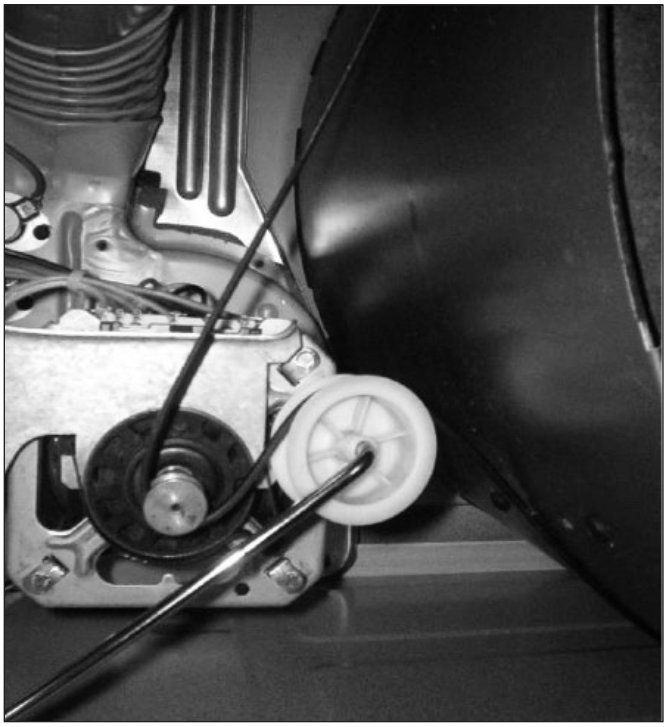
- Lockout/tagout plug cover
- Screwdriver
- Multimeter
- Putty knife
- Drive belt

How-to Steps

The drive belt spins the cylinder or drum. To replace a worn or broken drive belt:

1. Unplug dryer or turn off electricity to dryer at main electrical panel.
2. Lockout/tagout the cord or panel.
3. Open dryer housing to expose cylinder. Use the putty knife to gently pry it free, if necessary.
4. Push pulley arm to remove belt.
5. Install new belt.
6. Replace dryer housing.
7. Turn on electricity to dryer.
8. Turn on dryer and check operation.

In some models, you will be able to replace the drive belt on the bottom of the unit.



Practicing Clothes Dryer Repairs (75 minutes)

Clothes dryer repairs are fairly straightforward. Remember what you learned about electrical repairs – you're going to use that knowledge here!

Leader's Instructions:

1. Get your Training Kit and remove the dryer repair parts and tools. If you do not have one, be sure to secure the parts and tools needed for this exercise.
2. Get the participants up and moving! If you have access to a clothes dryer (strongly recommended), you will use it for this section. If you do not have access to a working dryer, you'll need to have a control panel with all of the parts connected to the back to use instead.
3. Ask participants to divide into groups of two or three.
4. Assign each group a test and replace repair (i.e., test and replace a dryer start switch or test and replace a dryer heating element). Assign as many different tasks as possible.
5. Then, give participants the parts and tools they will need to complete the job. Give them 15 minutes to discuss the repair. Walk around and answer questions as necessary.
6. Ask each group to perform the test and replacement process as the rest of the participants watch (and learn). This should be informal, with tips, guidance, and encouragement from the rest of the participants.
7. Debrief the activity. Ask questions such as:
   - "What did you think about this practice?"
   - "What was easy?"
   - "What was more challenging?"
8. Have participants and any invited subject matter experts share their best ideas and advice.

Group Discussion on Dryer Repair and Maintenance (15 minutes)

 **Slide 39**

Once again, use discussion to extend and enrich participants' knowledge on dryer repair and maintenance.

Leader's Instructions:

Hold a 15-minute discussion on dryer repair and maintenance. Again, you can do this in a variety of ways, such as:

- Presenting additional material on dryer repairs. (Or having an invited subject matter expert do it.)
- Asking participants to share their stories and experiences.
- Holding a question and answer session.
- Asking participants to share their best "tips and tricks" related to dryer repair.
- Be sure to take this opportunity to talk about fixing the little stuff like paint scratches or adjusting the door.

Let participants know the how the discussion will work, and encourage them to take notes on page 26 of their *Resource Guide*.

Clothes Washer Maintenance and Repair
(3 hours)

Slides 40 - 42

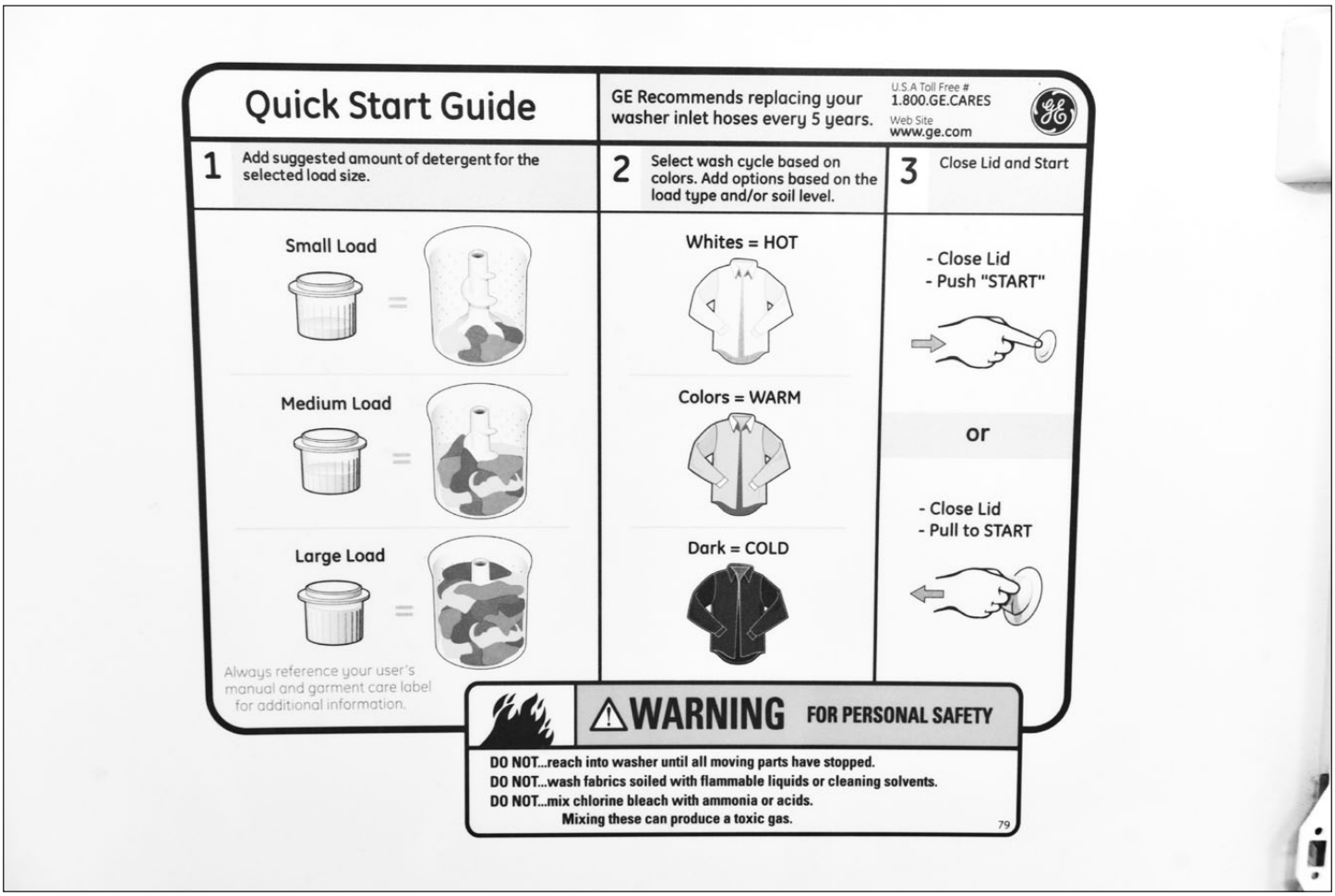
Next, we're going to explore clothes washer repairs. Another level of difficulty is added since the electrical and mechanical systems are joined by a plumbing system.

Introduction

A washer uses water, detergent and motion to clean laundry. It has four basic functions - fill, agitate, drain, and spin. At the start of the wash cycle, the tub fills with hot, cold or warm water. In a top-loading washer, the agitator moves back and forth or up and down. In the spin cycle, water is removed from the clothes and dirty water is drained.

In newer front-loading washers, the agitator is eliminated and the cylinder spins the laundry clean.

Turn to page 28 in your *Resource Guide*, and we'll take a closer look.



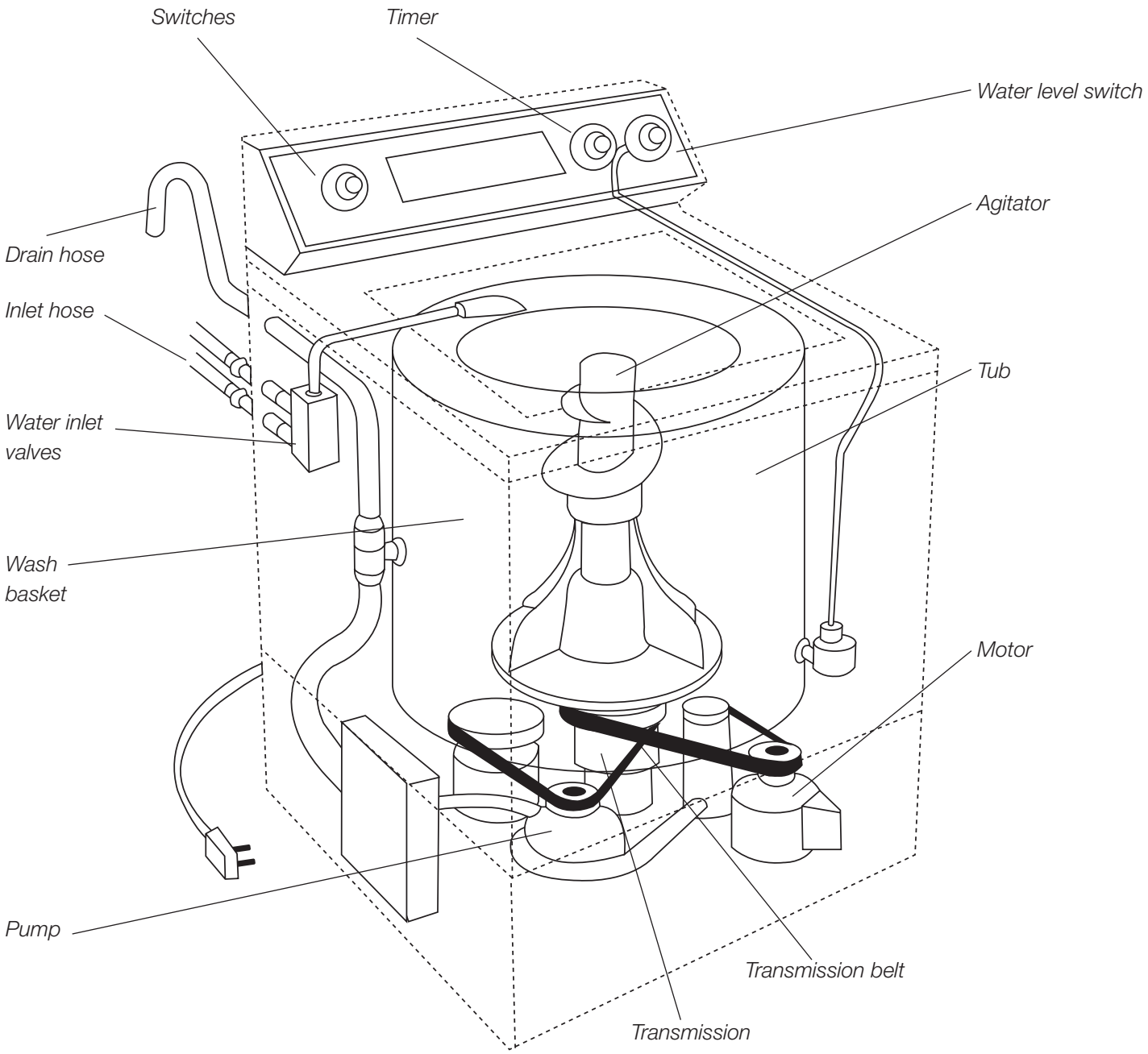
Clothes Washer Maintenance and Repair (continued)

Leader's Instructions:

Slide 43

Now, play the video "Washing Machine Overview."

Anatomy of a Clothes Washer



Key Parts of a Clothes Washer (10 minutes)

 **Slides 44 - 57**

Here is a closer look at the key parts of a clothes washer. Because washing machines do so many things, it is often more difficult to diagnose the problem than it is to correct it.

Agitator

An agitator is the finned apparatus in the center of upright washing machines that moves back and forth or up and down to clean laundry.

Inlet Hose

The inlet hose fills the clothes washer with hot, cold, or warm clean water.

Drain Hose

The drain hose removes the dirty water from the washer prior to the spin cycle.

The Motor and Transmission

There are two types of machines: A direct-drive clothes washer uses gears on the motor to turn the agitator and spin the drum. A belt-drive washer transfers power from the motor to the agitator and drum using a belt-and-pulley system. The inner workings of the motor are best left to a professional to repair.

The Pump

Of all washing machine parts, the water pump probably takes the most punishment, because it is constantly in use. When the pump is faulty, you can hear or see the trouble: a loud rumbling inside the machine, or a failure of the water to drain out of the tub.

Switches and Timers

Unlike a toaster, which performs the exact same function over and over, washing machines run through elaborate cycles with multiple settings. The devices that control these cycles can occasionally fail. There is a lid switch, temperature selector switch, water level control switch, and a timer.

Tub

The tub is a large cylinder that holds the wash basket.

The Wash Basket

The wash basket is a cylinder that holds the laundry.

Take a Clothes Washer Tour (1 hour)

Diagnosing washing machine problems is difficult – but it is possible. All it takes is common sense, patience, and some practice.

Leader's Instructions:

If you're holding the training in an apartment community—or a building where you can easily access a clothes washer—again, get out of the classroom and into the work environment.

Spend about 1 hour reviewing the washer's electrical, mechanical and plumbing systems. Compare the diagram in the *Resource Guide* to the washer on hand to determine similarities and differences. Review the safety procedures to follow when working with electrical and plumbing systems.

We strongly recommend doing this tour to bring the topic alive—and to let participants move around a bit.

If you are in an apartment community, make sure the washer is owned by the community before you touch anything! With some coin-operated machines, the vendor assumes full responsibility for the maintenance and repairs of the washer (and dryer) since they own them.

When you are finished, return to the classroom.

Clothes Washer Tour Notes

Common Clothes Washer Problems and Solutions

(30 minutes)

It is very important to remember the steps for diagnosing appliance repair problems we covered earlier today. Begin with the simplest possible solutions and work your way to the most difficult.

Problem	Solution(s)
The washer does not turn on, or there is a humming sound	1. Tripped circuit breaker or blown fuse. Check electrical service panel for a tripped switch or blown fuse. 2. Faulty electrical cord. Test the electrical cord. 3. There is a faulty water level switch. Test and possibly replace the water level switch; see page 35. 4. The lid switch is broken. Test and possibly replace the lid switch; see page 36. 5. The timer is broken. Test and possibly replace the timer; see page 37.
There is no hot or cold water, or the washer does not fill with water	1. The hoses are clogged or kinked. Make sure hoses are free of debris and do not have creases preventing water from flowing. 2. There is a faulty water level switch. Test and possibly replace the water level switch; see page 35. 3. The water inlet valve is faulty. Test and replace the water inlet valve; see page 38. 4. The timer is broken. Test and possibly replace the timer; see page 37. 5. Water to the apartment is turned off.
The washer fills very slowly	A clogged water inlet valve screen causes the washer to fill slowly. Clean the inlet screens to remedy the situation.

Common Clothes Washer Problems and Solutions (continued)

Problem	Solution(s)
The agitator does not work	1. The agitator is faulty. Replace the agitator using the instructions on page 39. 2. The motor and transmission may not be working properly. You can test to see if the motor is faulty using your multimeter, but repairs to the motor itself are best left to a professional.
The washer will not drain	1. Drain hose set too high or kinked. Make sure hose is placed properly and is free of debris and do not have any creases preventing water from flowing. 2. The pump may be blocked. Dissasemble pump from housing to determine if there is a blockage inside the pump. See page 34 for instructions and a video clip. 3. The timer is broken. Test and possibly replace the timer if necessary. See page 37 for instructions.
The washer is overflowing or leaking	1. The hoses are clogged or kinked. Make sure hoses are free of debris and do not have creases preventing water from flowing. Replace worn or leaking hoses. 2. The pump may be blocked. Dissemble pump from housing to determine if there is a blockage inside the pump. See page 34 for instructions and a video clip.
The machine shakes or “dances” out of balance	1. The washer may have been overfilled by the resident. Check capacity vs. load size – did the resident put 40 lbs. of laundry in a 20 lb. machine? Be sure to educate the resident, if possible, to prevent future incidents. 2. The machine is not level. The rear legs should automatically level themselves, but occasionally the front legs need to be adjusted. 3. A clogged water inlet valve screen can cause the washer to shake. Clean the inlet screens to remedy the situation.

Common Clothes Washer Problems and Solutions (continued)

Problem	Solution(s)
Clothes are still soaking wet after the spin cycle	1. The water level switch may be faulty. Test and possibly replace the water level switch; see page 35. 2. The motor and transmission may not be working properly. You can test to see if the motor is faulty using your multimeter, but repairs to the motor itself are best left to a professional. 3. The pump may be blocked. Disassemble the pump from hosing to determine if there is a blockage inside the pump. See page 34 for instructions and a video clip.

These are some common problems you may encounter in your role as a maintenance technician. It is not an all-inclusive list.

Leader's Instructions:

It's important to stress with your students that the instructions provided here are general, not specific to a certain model and likely do not perfectly align with the style of washer you are using as an example in class or the washers in their apartment community.

When possible, a great way to learn more about the specifics of the appliances in their communities is to accompany another technician or a supervisor on a few repair calls.

Checking a Washer's Pump for Blockage

Slide 58

(15 minutes)

If water doesn't drain from a washer or clothes are excessively wet when the cycle is complete, there may be a blockage in the water pump.

Leader's Instructions:

For this topic, you'll watch a video of the procedure and follow it up by asking one of the participants to perform the task on a washer available to you. This reinforces that there is more than one way to complete the task and gives the students an opportunity to learn about performing the job from multiple viewpoints.

1. Introduce the topic.
2. Cover the how-to information below. (This information is also on page 34 of the participants' *Resource Guide*.)
3. Play the "Clogged Water Pump" video clip.
4. Ask for questions.
5. Ask for a volunteer to perform the task using the demo machine or unit available in an apartment community. If you don't get volunteers right away, encourage them to participate since you will all be completing the task together.
6. After that, ask participants and invited subject matter experts to share their best tips and tricks.

Safety

Make sure the power to the washer is off.

Use lockout/tagout procedures.

Wear hand protection when cleaning out hoses.

Wear eye protection when working with electrical systems.

Tools and Materials Needed

- Screwdriver
- Needlenose pliers
- Lockout/tagout device

How-to Steps

The washing machine pump is a hard-working part, but yes, it can eat a sock. In order to determine if it has become blocked:

1. Unplug washer or turn off electricity to washer at main electrical panel.
2. Lockout/tagout the cord or panel.
3. Remove housing to access the pump.
4. Loosen hose clamps and remove from pump inlet and outlet.
5. Label hoses.
6. Remove clips holding pump to motor.
7. Remove pump and inspect for blockage or damage.
8. Clean or replace as needed.

Testing and Replacing a Water Level Switch

Slides 59 - 62

Safety

Make sure the power to the washer is off.

Use lockout/tagout procedures.

Wear hand protection when cleaning out hoses.

Wear eye protection when working with electrical systems.

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Utility knife
- Multimeter
- Water level switch

How-to Steps

1. Unplug washer or turn off electricity to washer at main electrical panel.
2. Lockout/tagout the plug or the panel.
3. Remove control panel housing.
4. Flag, label and disconnect wires from switch.
5. Disconnect air hose. (If hose connection is loose, cut off 1/2-inch from hose end.)
6. Blow lightly into air hose to trigger switch into full position.
7. Use multimeter on RX1 setting to test switch:
   - Touch one probe to one terminal and the other probe to the other terminal.
   - Blow lightly into hose.
   - The display should show continuity. If not, replace water level switch.
8. Attach new switch.
9. Replace control panel housing.
10. Turn on electricity to washer.
11. Turn on washer and check operation.

Testing and Replacing a Lid Switch

Safety

Make sure the power to the washer is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Rags or towels
- Multimeter
- Lid switch

How-to Steps

If the washer will not start, one of the first things to check is the lid switch. It's actually a safety device for the machine.

1. Unplug washer or turn off electricity to washer at main electrical panel.
2. Logout/tagout the plug or panel.
3. Clean the area around lid switch removing built up detergent and lint.
4. Remove cabinet housing.
5. Remove switch.
6. Use multimeter on RX1 setting to test switch:
   - Touch one probe to one terminal and the other probe to the other terminal.
   - Close washer lid.
   - The display should show zero. If not, replace lid switch.
7. Attach a new lid switch.
8. Replace cabinet housing.
9. Turn on electricity to washer.
10. Turn on washer and check operation.

Testing and Replacing a Timer

Safety

Make sure the power to the washer is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Multimeter
- Timer

How-to Steps

When the timer goes, several things will stop working properly. To test and replace a clothes washer timer:

1. Unplug washer or turn off electricity to washer at main electrical panel.
2. Lockout/tagout the plug or the panel.
3. Remove control panel housing.
4. Flag, label and disconnect wires to timer.
5. Remove timer.
6. Use multimeter on RX100 setting to test timer:
   - Touch one probe to one terminal and the other probe to the other terminal.
   - The display should show readings from 1,000 to 3,000 ohms. If not, replace timer.
7. Attach a new timer.
8. Replace control panel housing.
9. Turn on electricity to washer.
10. Turn on washer and check operation.

Testing and Replacing a Water Inlet Valve

Safety

Make sure the power to the washer is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

Wear hand protection when cleaning out hoses.

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Multimeter
- Water inlet valve

How-to Steps

If the washer won't fill or fills very slowly, if it overfills, or if the water is the wrong temperature, the water inlet valve could be faulty.

1. Unplug washer or turn off electricity to washer at main electrical panel.
2. Lockout/tagout the plug or the panel.
3. Turn off water supply to washer.
4. Disconnect both hot and cold water hoses that go into the inlet valve.
5. Remove and clean water inlet valve screens.
6. Replace screens, if necessary.
7. Identify the two coils on the water valve. (These coils tell the valve when to open and let water in and close to shut off the water.)
8. Flag, label and disconnect the two wires from each coil.
9. Use multimeter on RX1 setting to test each coil:
   - Touch one probe to one terminal and the other probe to the other terminal.
   - If the display shows infinity, the coil is bad and needs to be replaced.
10. Remove the water inlet valve.
11. Attach a new water inlet valve.
12. Connect both hot and cold water hoses.
13. Turn on water supply to washer.
14. Turn on electricity to washer.
15. Turn on washer and check operation.

Replace the Agitator

Tools and Materials Needed

- Screwdriver

How-to Steps

The agitator can tear laundry if the fins are cracked or broken. You may be able to solve the problem temporarily by pinching off the splinters with pliers and lightly filing the plastic smooth, but this is just a stopgap measure; the agitator should be replaced.

1. Remove cap from agitator. Unscrew bolt or screw, if necessary.
2. Pull up agitator. If stubborn, fill tub halfway with warm water and rock side to side.
3. Replace agitator.

Practicing Clothes Washer Repairs (75 minutes)

There are a multitude of choices when it comes to diagnosing washer problems. Use this time to practice some of the most common repairs.

Leader's Instructions:

1. Get your Training Kit and remove the washer repair parts and tools. If you do not have one, be sure to secure the parts and tools needed for this exercise.
2. Get the participants up and moving! If you have access to a clothes washer (strongly recommended), you will use it for this section. If you do not have access to a working washer, you'll need to have a non-working demo unit to make this activity come to life.
3. Break the participants into six groups.
4. Assign each group a test and replace repair: 1) remove and check the pump; 2) test and replace the water level switch; 3) test and replace the lid switch; 4) test and replace the timer; 5) test and replace the water inlet valve; and 6) replace the agitator. USE GOOD JUDGEMENT! Some tasks as easier to complete than others. Give the more difficult jobs to the more seasoned technicians or skip them altogether. Add additional tasks if you are willing to share the process steps.
5. These tasks do not require complex tools. They will replace the part with the one they removed. Give them 15 minutes to discuss the repair. Walk around and answer questions as necessary.
6. Ask each group to perform their assigned repair as the rest of the participants watch (and learn). This should be informal, with tips, guidance, and encouragement from the rest of the participants.
7. Debrief the activity. Ask questions such as:
   - "What did you think about this practice?"
   - "What was easy?"
   - "What was more challenging?"
8. Have participants and any invited subject matter experts share their best ideas and advice.

Group Discussion on Washer Repair and Maintenance (15 minutes)


Slide 63

Use discussion to extend and enrich participants' knowledge on washer repair and maintenance.

Leader's Instructions:

Hold a 15-minute discussion on washer repair and maintenance. Again, you can do this in a variety of ways, such as:

- Presenting additional material on washer repairs. (Or having an invited subject matter expert do it.) For example, reinforce that clothes washers, unlike dryers, have a great deal of variation among manufacturers. Differences are found in type of agitator, where the door is located, how much power and water they consume, and many other variables.
- Asking participants to share their stories and experiences.
- Holding a question and answer session.
- Asking participants to share their best "tips and tricks" related to clothes washer repair.
- Be sure to take this opportunity to talk about fixing the little stuff like paint scratches and leveling feet.

Let participants know the how the discussion will work, and encourage them to take notes on pages 40 and 41 of their *Resource Guide*.

Cooktop and Oven Maintenance and Repair (2 hours)

 **Slides 64 - 66**

Ever wonder which is "greener?" Because gas burners provide instant heat, and cooks have greater control over the temperatures, they're generally more energy efficient than their electric competitors.

Introduction

Turn to page 41 in your guide.

Electric cooktops use electricity to warm heating elements. Switches regulate the electric current to the heating elements to increase or decrease the temperature. Electric cooktops use both 240-volt and 120-volt circuits. The 240-volt circuit powers the heating element and the 120-volt circuit powers the light, clock and other features.

Electric ovens use 240-volt electric current to cook food at a consistent temperature in a contained space. A thermostat monitors and controls the temperature of the oven. Electric ovens usually have two heating elements: a bottom element for most cooking tasks and a top element for broiling. A separate 120-volt electric current is used to power lights, clock and other features.

Gas cooktops use natural gas and flames to cook food. Controls regulate the amount of gas to the burner to increase or decrease the temperature. Gas cooktops also use a 120-volt circuit to power the light, clock and other features.

Gas ovens use natural gas and flames to cook food at a consistent temperature in a contained space. Some gas ovens use a pilot light to light the burners, while others have ceramic igniters or glow plugs to light burners. As with an electric oven, a thermostat monitors and controls the temperature of the oven. Gas ovens use a 120-volt circuit to power the controls, light, clock and other features.

Both electric and gas cooktops are often part of a stove, or range, which includes the oven.

Leader's Instructions:

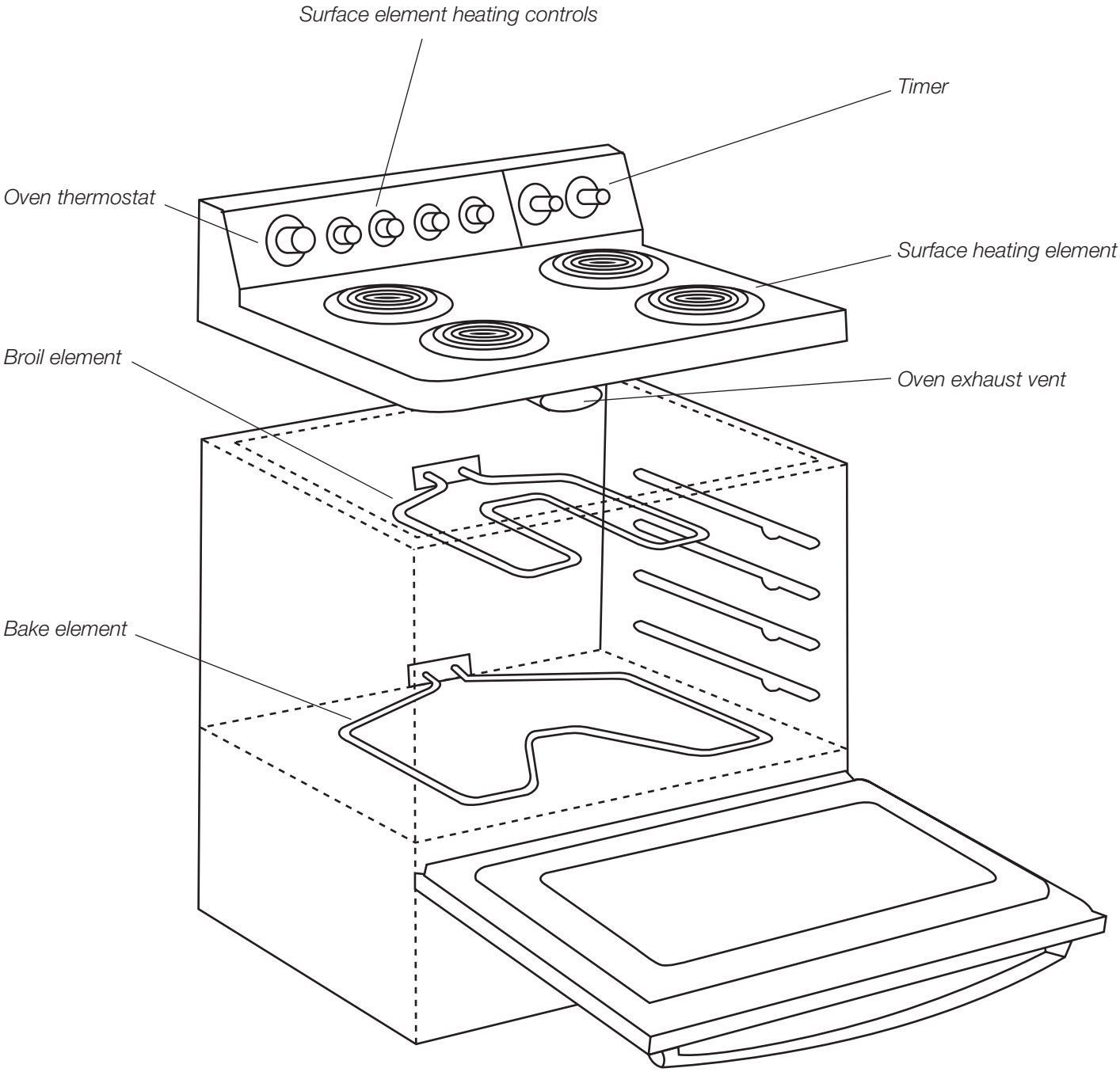
 **Slide 67**

Now play the video "Stove Tip Check."

Cooktop and Oven Maintenance and Repair (continued)

Slide 68

Anatomy of an Electric Range



Key Parts of an Electric Range (10 minutes)

Electric ranges and ovens are generally easy to repair, because there's not much to go wrong and there's not much you can do.

Leader's Instructions:

Slide 69

Now play the video "Electric Stove and Oven Overview."

Range Control Panel

The control panel houses the oven thermostat, burner controls, clock, light, and other features.

Cooktop Heating Element

The burner coils that heat up when you turn the electricity on.

Cooktop Receptacle Source

The receptacle provides electricity to the cooktop heating element while allowing for easy disconnect of the cooktop heating element.

Infinite Switch

This switch is found behind the control knob on the cooktop. Its name comes from the ability to have an "infinite" number of settings. The switch operates by having a small heating element inside next to a bimetal strip that opens and closes the 240v circuit providing power to the surface element (6"or 8").

The switch operates by opening and closing the circuit at differing intervals based upon the setting. If the "HI" setting is selected, the circuit is always closed and the element receives constant 240v. If the "LOW" setting is selected, the circuit will open and close with 240v being present rarely. On the "Med" setting, the circuit will be open as long as it is closed.

Key Parts of an Electric Range (continued)

Oven Baking Element

This element is found at the bottom of the oven. It provides heat to the walls, racks, ceiling and door of the oven so that the food may be cooked by 360˚ of constant heat.

Oven Broiling Element

The heating element coil located on the top of the oven chamber. The Broil function can be viewed as an upside down grill as heat is provided to one side of the food being cooked.

Oven Temperature Sensor

Often found in the back or side of the oven box, this sensor will be part of the switch that controls the temperature inside the oven. There are two types of this sensor:

- Capillary: This type is a bulb that is attached directly to the Oven Temperature Control by a very thin tube. Inside the bulb is a substance that reacts in a measured way to changes in temperature. As the temperature in the oven changes, the pressure inside of the bulb and tube increases or decreases which in turn opens or closes a switch found in the Temperature control.
- Resistance: This type is generally shorter and smaller than the capillary. It is connected to the Oven Temperature control by way of a wire. As the temperature in the oven changes, the resistance of the sensor changes due to the dissimilar metals that are contained in the sensor. The circuit opens and closes based upon this change in Ohms.

Oven Temperature Control

This adjusts the temperature in the internal chamber when activated by the temperature sensor.

Oven Gasket

The gasket is a form-fitting piece that provides a seal around the oven door.

Oven Thermostat

Set behind the temperature selector knob, this gauge can be calibrated by adjusting the back of the knob, if the oven actual temperature is over or under the selected temperature.

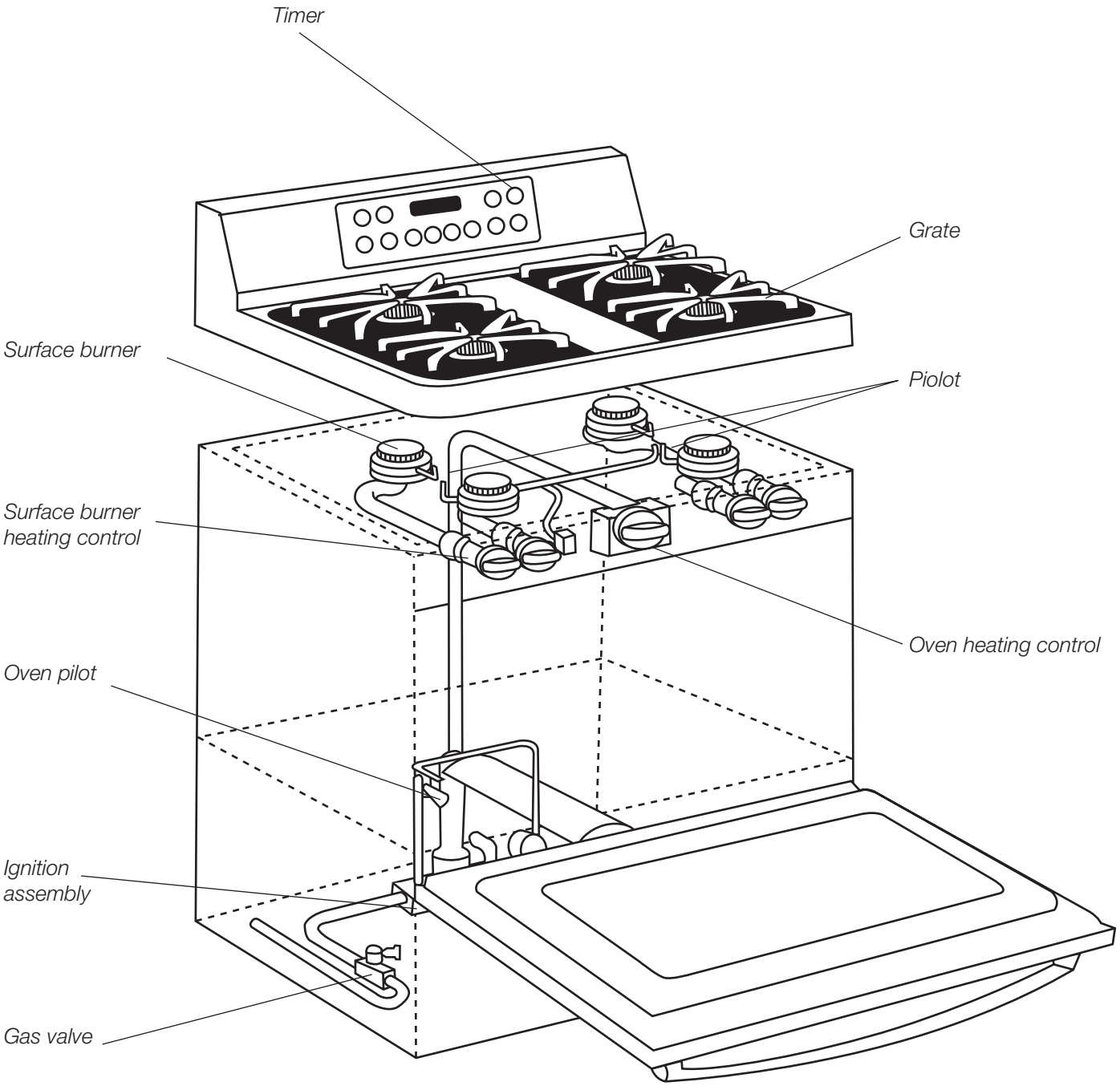
Cooktop and Oven Maintenance and Repair (continued)

Slides 70 - 82

Leader's Instructions:

Now play the following videos: "Gas Range Overview," "Gas Oven Overview," and "Gas Stovetop and Burner."

Anatomy of a Gas Range



Key Parts of a Gas Range (10 minutes)

Most of the malfunctions that affect gas ranges involve the supply and ignition of gas in the burners and the oven.

Range Control Panel

The control panel houses the oven thermostat, burner controls, clock, light and other features.

Igniter

Most modern gas ranges use an electronic spark igniter (glow bar or glow plug) to start the pilot. The gas is ignited by an electric ignition system. An element becomes hot and glows like the filament in a light bulb when an electric current passes through it. The heat from the filament lights the gas. These ignition systems are sealed and cannot be repaired or adjusted. When an electric ignition device fails, don't try to fix it. Call a professional service person for replacement.

Cooktop Pilot Light

A correctly adjusted pilot flame is steady and blue, between 1/4 and 1/2 inch high. If the flame goes out repeatedly, or if it's yellow at the tip, it's getting too little air. If there's a space between the flame and the pilot feed tube, it's getting too much air.

Oven Ignition Module

Produces the high voltage spark necessary to start the pilot.

Oven Gasket

The gasket is a form-fitting piece that provides a seal around the oven door.

Oven Thermostat

Set behind the temperature selector knob, this gauge can be calibrated by adjusting the back of the knob, if the oven actual temperature is over or under the selected temperature.

Gas Range Safety Tip

If you smell gas, leave the apartment immediately. Do not try to turn off the gas from inside the apartment, or turn any lights on or off. Go to a telephone or use your cell phone OUTSIDE THE APARTMENT to call the gas company or the fire department immediately to report a leak. Do not re-enter the apartment.

Caution: Before doing any work on a gas range or oven, make sure it's unplugged, or turn off the electric power to the unit at the main service panel. If there is a grounding wire to the range, disconnect it. Also close the gas supply valve to shut off the unit's gas supply.

Leader's Instructions:

 **Slide 83**

Now play the video "Oven Door Removal."

Common Electric Cooktop Problems and Solutions
(45 minutes)

Electric cooktops often have problems with bad burner elements. It is important to become skilled at recognizing cooktop problems to limit the amount of time you spend testing and solving the problems.

Leader's Instructions:

Ask participants if the communities they serve have gas or electric appliances. You may be able to focus your attention on one type rather than both.

1. Introduce each topic.
2. Cover the how-to information below. (This information is also on page 48 of the participants' *Resource Guide*.)
3. Provide a demonstration if you have access to a gas or electric cooktop or stove.
4. Ask for questions.
5. After that, ask participants and invited subject matter experts to share their best tips and tricks.

Problem	Solution(s)
Electric cooktop: Burner does not heat or gets too hot	1. The heating element may be faulty. You may need to replace the heating element; see page 49. 2. The burner receptacle may have stopped working. You may need to replace the burner receptacle. See page 51 for directions. 3. Defective infinite switch. Check switch with multi-meter and replace if necessary.

Are there are other problems you have frequently fixed?

Replace a Cooktop Heating Element

Slide 84

Safety

Make sure power to the cooktop is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Multimeter
- Cooktop heating element

How-to Steps

If an electric cooktop has power and yet a heating element does not heat or gets too hot, the likely problem is a faulty heating element. To replace a broken heating element:

1. Turn off electricity to cooktop at main electrical panel.
2. Lockout/tagout the panel.
3. Remove the heating element from the receptacle.
4. Check the element for damage.
5. Clean corroded terminals of heating element with fine steel wool.
6. Use an Ohm meter to check the element for continuity from one terminal through the other. If there is no continuity, the element is bad. Replace it. If there is continuity, continue with the next step.
7. Plug element into working receptacle to test.
8. Turn on electricity to cooktop. If element does not heat, replace it.
9. Turn off electricity to cooktop.
10. Install new heating element.
11 Turn on electricity.
12. Turn on power to heating element and check operation.

Troubleshooting an Infinite Switch

Slides 85 - 86

Often, a surface indicator light will stay on after all of the switches are turned off on the cooktop. This indicates that one of the infinite switches is malfunctioning. Here's how to determine which switch is the culprit.

Safety

Make sure power to the cooktop is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

How-to Steps

1. Turn off power and perform Lockout/Tagout procedures

2. Gain access to the terminals on the back of the infinite switch. This may require pulling out the stove and removing the access cover behind the control panel.

3. Inspect the terminals for damage. It is possible that a short has happened in the switch and you will detect a "burnt electronics" smell.

4. Note the location of the wiring connections and then remove the leads attached to the back of the infinite switch.

5. Turn the infinite switch to "HI"

6. With the terminals exposed, test for continuity between the terminals as follows. (You should show continuity between them.) If continuity does not occur in between these terminals, replace the switch.

- L1 and P
- L1 and H1
- L2 and H2

7. Test for continuity between the any terminal labeled 1 and any terminal labeled 2 (example: L1 and L2). There should not be continuity. If there is, replace the switch.

Replace a Heating Element Receptacle

Safety

Make sure power to the cooktop is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Multimeter
- Cooktop heating element receptacle

How-to Steps

1. Turn off electricity to cooktop at main electrical panel.
2. Lockout/tagout the panel.
3. Remove heating element from receptacle.
4. Unscrew receptacle.
5. Identify wires running from receptacle to switch.
6. Use multimeter on RX1 setting to test:
   - Touch one probe to one of the corresponding terminals on the switch and the other probe to each receptacle terminal. The display should show continuity.
   - Repeat with the other terminal switch. The display should show continuity. If not, the receptacle is bad and needs to be replaced.
7. To replace receptacle, cut the wires to the receptacle.
8. Splice leads of new receptacle to wires using porcelain wire cap.
9. Attach receptacle.
10. Attach heating element.
11. Turn on electricity.
12. Turn on power to heating element and check operation.

Common Gas Cooktop Problems and Solutions

Because there are no moving parts to speak of, a gas cooktop is nearly trouble free.

Problem	Solution(s)
Gas cooktop: Pilot light is out or needs adjustment	1. The pilot light is out so you will need to relight it. See page 53. 2. Pilot light height needs adjustment. Page 54 contains instructions.
Gas cooktop: Burner will not light	1. The burner ports may be clogged. Clear them with a paper clip, pin, or sewing needle. 2. The igniter may be faulty. To replace the igniter, see the directions on page 55.

Relighting a Pilot Light

Safety

Wear eye protection.

Tools and Materials Needed

- Match

How-to Steps

Pilot lights occasionally go out. To relight a pilot light:

1. Turn cooktop controls to OFF.
2. Prop cooktop open.
3. Light match and place near pilot light opening (between the two burners).
4. Lower cooktop.
5. Turn on burner and check operation.

Adjust the Height of a Pilot Light

Safety

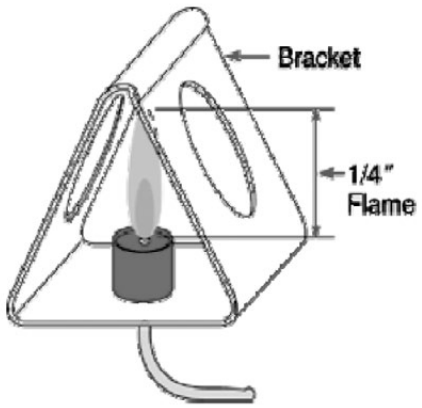
Wear eye protection.

Tools and Materials Needed

- Screwdriver

How-to Steps

1. Turn cooktop controls to OFF.
2. Prop cooktop open.
3. Turn pilot adjustment screw counterclockwise to increase size of pilot light. (Screw may be on side of pilot, on pilot gas line, or behind burner control knob.)
4. Adjust flame to 1/4 to 3/8 inches high.
5. Lower cooktop.
6. Turn on burner and check operation.



Replace Cooktop Igniter

Safety

Wear eye protection.

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Igniter

How-to Steps

Faulty igniters may sometimes keep burners from lighting. To replace an igniter:

1. Turn on other burner that uses the same igniter.
   - If igniter sparks, first burner control is bad. Clean tip and retest.
2. Follow igniter cable to the terminal on the ignition control module. (This on the back of the cooktop.)
3. Remove the cover.
4. Disconnect the igniter cable.
5. Replace the igniter.

Common Electric Oven Problems and Solutions

 **Slides 87 - 91**

Ovens haven't changed much over the years, except that the controls are more sophisticated. You now can set controls to start and stop cooking at various times, even check and regulate temperatures, so that dinner is ready when you are – if it works correctly. If not, here's how you can fix it.

Problem	Possible Cause(s)
Electric oven: Inconsistent temperature	1. The temperature control may be faulty. To test and replace the temperature control, see page 58. 2. The oven thermostat may need to be recalibrated; see page 57.
Electric oven: Takes too long to heat the oven	The oven elements are broken or weak. Test and replace the oven heating elements. Directions are on page 59.
Electric oven: Self-cleaning and/or broiler features do not work	1. The heating elements may be broken or weak. Test and replace the oven heating elements. Directions are on page 59. 2. The temperature control may be faulty; see page 58. 3. The oven selector switch may be broken. Instructions for repair are on page 60.

Leader's Instructions:

Before you serve up into the specific repairs for electric ovens, you'll watch a video of showing the calibration of an oven thermostat. This is one of the more routine tasks technicians will be required to perform on the job.

1. Introduce the topic of oven calibration.
2. Cover the how-to information below. (This information is also on page 56 of the participants' *Resource Guide*.)
3. Play the "Reset the Oven Temperature" video clip.
4. Ask for questions.
5. After that, ask participants and invited subject matter experts to share their best tips and tricks.

Recalibrating the Oven Temperature

Slide 92

If oven temperatures are off, the thermometer may need to be recalibrated.

Tools and Materials Needed

- Screwdriver
- Oven thermometer

How-to Steps: Checking the Oven Temperature

1. Place digital thermometer in the oven.
2. Turn the oven to a specific temperature (300º is good).
3. Allow oven to cycle (heat up).
4. When the element cycles off, note the temperature.
5. Allow the temperature to drop in the oven.
6. When the element cycles back on, note the temperature.
7. Repeat steps 3-6 twice more.
8. Add the six temperature measurements up and divide by six.
9. Match this average to the temperature selected.
10. If temperature is off by more than 5º follow instructions to recalibrate the oven temperature.
11. If temperature is off by more than 20º replace control.

How-to Steps: Recalibrating the Oven Temperature

(Note: If the stove has touch pad controls, follow manufacturer instructions to reprogram)

1. Take off oven control knob.
2. On knobs with a ring:
   - Loosen screws.
   - Turn knob to adjust ring appropriately to either raise or lower the temperature.
   - Tighten screws.
3. On knobs without a ring:
   - Penetrate seal with screwdriver.
   - Turn inside screw about 1/8-turn.
4. Replace the knob on the control panel.

Test and Replace Oven Temperature Control

Safety

Make sure power to the oven is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

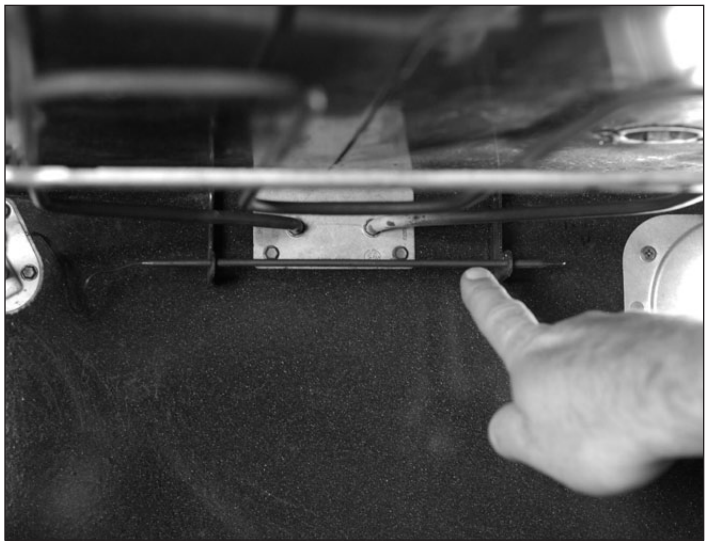
Wear rubber safety gloves.

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Multimeter
- Oven temperature control

How-to Steps

A faulty temperature control can result in inconsistent temperatures in the oven. To replace the temperature control:



1. Turn off electricity to oven at main electrical panel.
2. Lockout/tagout the panel.
3. Open the oven control panel.
4. Locate the temperature control. If terminals are discolored or burned, replace.
5. Use multimeter on RX1 setting to test:
   - If temperature control has more than two terminals, check manual to identify terminals to check.
   - Disconnect wire from one terminal.
   - Touch one probe to one terminal and the other probe to the other terminal.
   - Turn oven temperature control to 300˚F.
   - If display doesn't indicate continuity, replace temperature control.
6. To replace, unseat capillary tube and remove through back of oven. (Caution: Use rubber safety gloves and goggles when handling capillary tube.)
7. Unscrew the two temperature control screws.
8. Flag, label and disconnect wires from temperature control.
9. Replace any burned wire connectors.
10. Attach wires to new control and screw control into place.
11. Push capillary tube through back and into oven. (Caution: Use rubber safety gloves and goggles when handling capillary tube.)
12. Reseat capillary tube.
13. Close oven control panel.
14. Turn on electricity.
15. Turn on power to oven and check operation.

Test and Replace an Element in an Electric Oven

Safety

Make sure power to the oven is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Multimeter
- Electric oven element

How-to Steps

When the oven element is broken or damaged, the oven may take a long time to heat up. To replace the element:

1. Turn off electricity to oven at main electrical panel.
2. Lockout/tagout the panel.
3. Remove fasteners that secure element to back of oven.
4. Unscrew support brackets inside oven, if there are any.
5. Pull out element to show wires.
6. Disconnect wires from element terminals.
7. Remove element from oven. Replace if terminals are damaged or worn.
8. Use multimeter on RX1 setting to test:
   - Touch one probe to one terminal and the other probe to the other terminal.
   - If the display doesn't indicate continuity, replace element.
   - Clip one probe to terminal and one to element to test for ground.
   - If display shows activity, replace element.
9. Connect wires to element.
10. Attach element to support brackets, if applicable.
11. Secure element to back of oven.
12. Turn on electricity.
13. Turn on power to oven and check operation.

Test and Replace an Oven Selector Switch

Safety

Make sure power to the oven is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Multimeter
- Electric oven selector switch

How-to Steps

A faulty oven selector switch may disable the self-cleaning function of an electric oven. To replace an oven selector switch:

1. Turn off electricity to oven at main electrical panel.
2. Lockout/tagout the panel.
3. Open control panel.
4. Locate the oven selector switch.
5. Use multimeter on RX1 setting to test:
   - Disconnect one wire from each pair of terminals and check for continuity.
   - If the display doesn't show continuity, replace.
6. Remove switch and pull out through the back of the oven.
7. Label and disconnect wires from switch.
8. Connect wires to new switch.
9. Reattach switch.
10. Close oven control panel.
11. Turn on electricity.
12. Turn on power to oven and check operation.

Common Gas Oven Problems and Solutions

Gas ovens are relatively simple in operation and require little maintenance. That's good news because it means you probably won't have many service requests for gas oven repairs.

Problem	Solution(s)
Gas oven: The oven does not get hot	1. The pilot light is out. See instructions for relighting the pilot light on page 61. 2. The igniter or glow bar may be faulty; call a service professional.
Gas oven: The temperature is inconsistent	Oven temperature needs to be recalibrated. See page 57 for resetting the thermostat.

Are there are other common issues you have seen?

Relight a Pilot Light

Safety

Wear eye protection when working with gas appliances.

Tools and Materials Needed

- Match

How-to Steps

Oven pilot lights occasionally go out. To relight a pilot light:

1. Turn all controls off, open the doors, and allow gas to dissipate.
2. Hold a lighted match near the tip of the pilot on the burner assembly. If a burner does not light within two minutes, adjust the pilot, step 3.
3. Turn the pilot adjustment screw (located near the pilot or the thermostat) in small increments and retest until the pilot has a blue flame.

Group Discussion on Electric and Gas Ranges (10 minutes)

 **Slides 93 - 94**

Bring the instruction on ovens and cooktops full circle by discussing both.

Leader's Instructions:

Hold a 10-minute group discussion on gas and electric ranges to enrich participants' knowledge.
Again, you can do this in a variety of ways, such as:

- Presenting additional material on ranges. (Or having an invited subject matter expert do it.)
- Asking participants to share their stories and experiences.
- Asking for a volunteers to describe their most interesting range repairs.
- Holding a question and answer session.
- Asking participants to share their best "tips and tricks" related to electric and gas ranges.
- Be sure to cove the little things that arise like fixing paint scratches, replacing oven lights, etc.

Let participants know the how the discussion will work, and encourage them to take notes on page 63 of their *Resource Guide*.

Dishwasher Maintenance and Repair
(1 hour 45 minutes)

Next to the television and the microwave, the dishwasher is probably the most used modern appliance there is. Hey – who wants to wash and dry dishes by hand?

Leader's Instructions:

It is much easier to learn about the inner workings of a dishwasher when it is not installed in someone's kitchen. This is because many of the internal parts are at the floor level when the unit is installed. We highly recommend that you work with your local affiliate to obtain a dishwasher to support this instruction. You can work with various suppliers, who may be willing to donate new, used, or ready-to-recycle dishwashers.

Use the diagram provided and the sample dishwasher to familiarize participants with the appliance.

Introduction

Turn to page 64 in your guide.

A dishwasher is very self-sufficient. It fills itself with water, automatically opens the detergent dispenser at the right time, shoots the water through jets to get the dishes clean, drains the dirty water, sprays more water on the dishes to rinse them, drains itself again, and heats the air to dry the dishes off (if the user has selected that setting). Power is supplied through a 120-volt plug.

The only thing it doesn't do is rinse and load the dishes!

Because the dishwasher is connected to both the plumbing system and the electrical system, you must consider both systems when working on this appliance. Before doing any work on the dishwasher, make sure the unit is unplugged or the power to the unit is turned off. Shut off the water supply to the dishwasher at the water valve under the kitchen sink or at the main apartment shutoff.

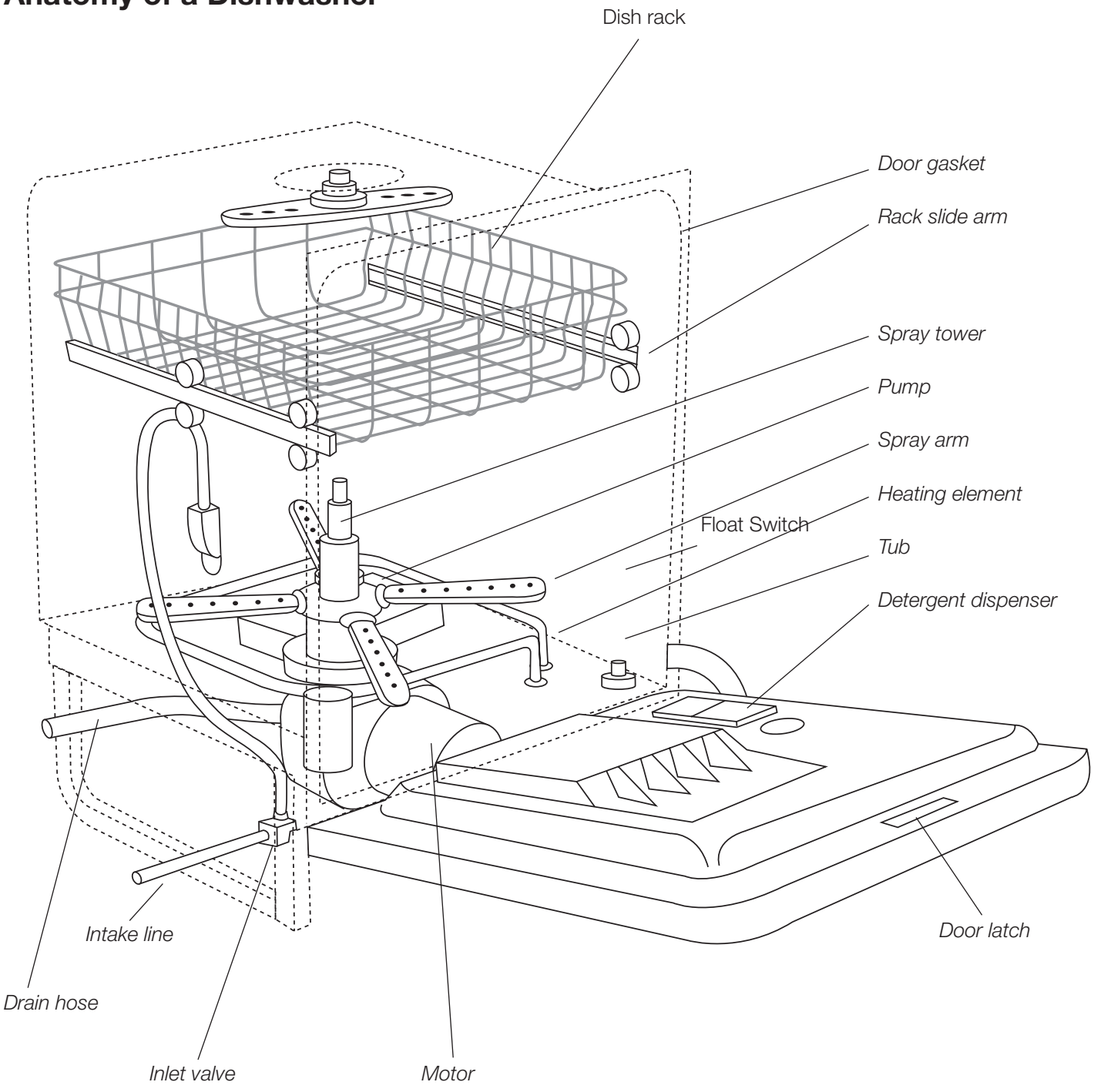
Dishwasher Maintenance and Repair (Continued)

Slides 96 - 97

Leader's Instructions:

Now play the video "Dishwasher Overview."

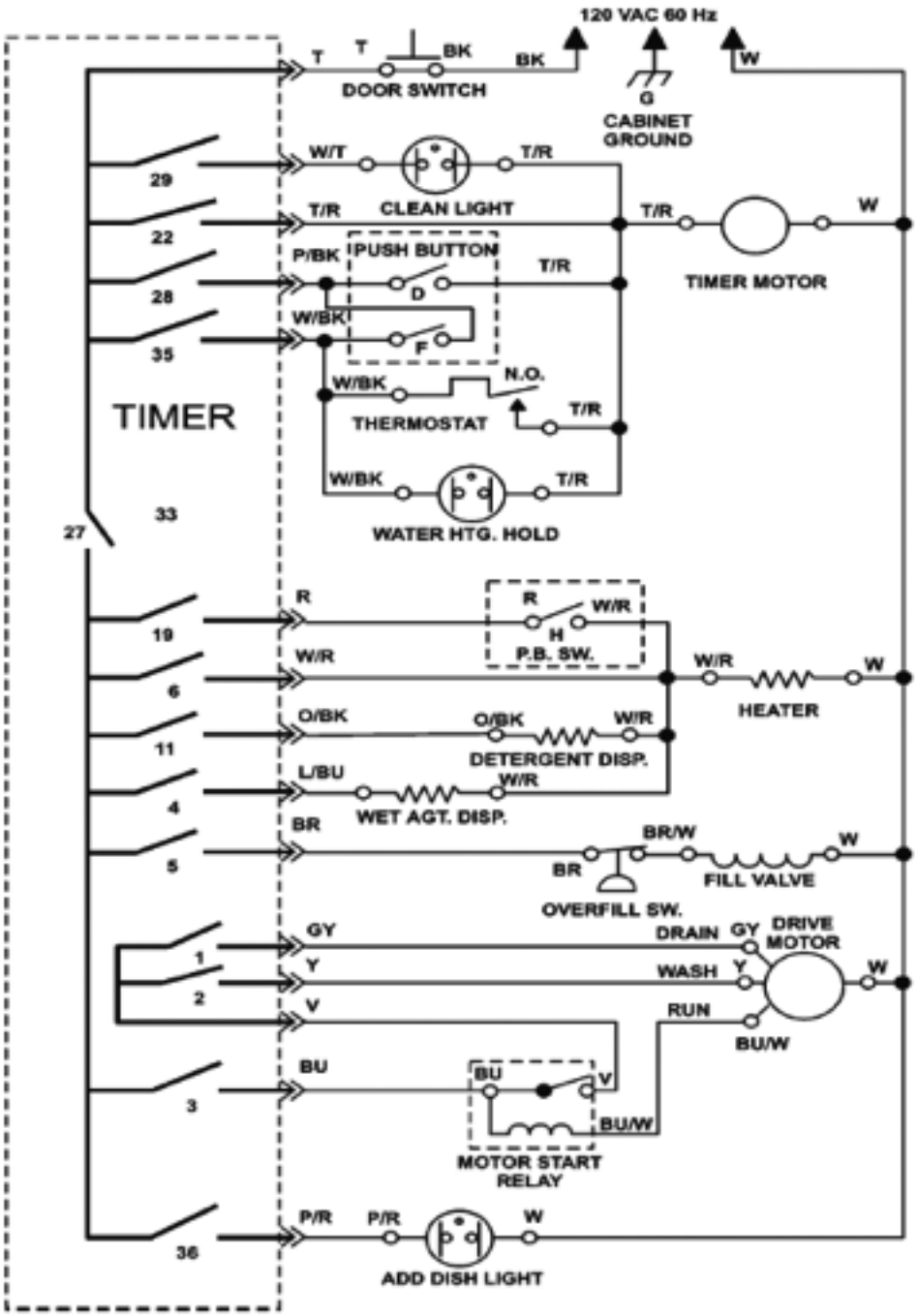
Anatomy of a Dishwasher



Dishwasher Maintenance and Repair
(continued)

Slide 98

Dishwasher Timer Schematic



Key Parts of a Dishwasher (10 minutes)

 **Slides 99 - 110**

Although dishwashers are watertight, they don't actually fill with water. Just a small basin at the bottom fills up.

Control mechanism

The control mechanism is located inside the door behind the control panel. Many units use a simple electro-mechanical system: a timer determines how long each part of the cycle lasts and activates the proper function at the proper time. Most units also have a door latch that must be closed for the unit to run. Some also have child safety locks.

Intake valve

This is where water from the home's water supply enters the dishwasher. The unit's pump doesn't pump the water into the basin – when the intake valve opens, water pressure drives the water into the unit.

Pump

An electric motor powers the pump. During the pump cycle, the pump forces water up into the spray arms. During the drain cycle, the pump directs the water into the drain hose. The motor-pump assembly is mounted beneath the basin, in the center of the dishwasher. There are reversible and direct-drive pumps.

Detergent Dispenser

The dispenser releases the detergent into the dishwasher at the appropriate time during the wash cycle.

Spray Arm

Water is pumped up into the arm or arms through the tower during the wash cycle. The arm rotates, spraying water throughout the appliance.

Door Gasket

This material seals the door to create a watertight environment.

Corner Seal

This is found in the bottom front corners of the unit and helps to keep the appliance watertight. If there is water running down the outside of the dishwasher, the corner seal is the likely culprit.

Common Dishwasher Problems and Solutions

(45 minutes)

Permanent dishwashers are installed underneath the countertops and bolted into place. Hoses underneath the kitchen sink connect directly to the hot water line and the drain line, and the unit usually plugs in under the sink. The installation requires a 120-volt grounded line.

Leader's Instructions:

Ask participants if any of them have previously worked on dishwasher repair. You can then gauge the topics to focus on and the level of detail needed.

1. Introduce each topic.
2. Cover the how-to information below. (This information is also on page 68 of the participants' *Resource Guide*.)
3. Provide a demonstration if you have access to a dishwasher. After you have performed the task, invite a participant to demonstrate it if time permits.
4. Ask for questions.
5. After that, ask participants and invited subject matter experts to share their best tips and tricks.

Problem	Solution(s)
Water runs down the outside of the door	1. The resident may be using sink dish soap instead of dishwasher soap. 2. There is a faulty corner seal. See page 70. 3. The door gasket is cracked or broken. See page 71 for directions to replace.
There is water under the unit	1. You may need to clean the clogged drain hose. See page 72. 2. Water line leaking. Check water line and repair or replace as necessary. 3. Dishwasher motor leaking. Check motor and motor gasket and repair or replace as necessary. Follow instructions provided. 4. Dishwasher tub cracked or rusted. Replace the dishwasher and follow the instructions provided.

Common Dishwasher Problems and Solutions (continued)

Problem	Solution(s)
There is water standing inside the bottom of the unit	1. You may need to remove the blockage from a plugged strainer or garbage disposer. 2. You may need to clean the clogged drain hose. See page 72. 3. Clogged pump impellor. Check pump impellor inside the dishwasher and remove food and debris from impellor as necessary.
The water is not hot enough	1. Test and replace a faulty heating element. 2. Verify that the water heater is working properly. 3. In older units, resident needs to verify that kitchen sink water is hot before starting dishwasher.
The soap dispenser does not open	Repair or replace a broken or corroded dispenser. See page 75.
The dishes are not clean after the cycle is complete	1. Dishes must be properly rinsed before they are placed in the dishwasher. Be sure the resident understands this. 2. Remove a plugged strainer and rinse it in the sink. 3. Clean a dirty spray arm. See page 73. 4. Test the motor and switches to make sure they are working correctly. See page 76.
The dishes are not dry	1. Test and replace a broken heating element. 2. Heating element switch defective. Check switch with multi-meter and replace if necessary.
There are spots on the dishes	1. The dishwasher may have been loaded incorrectly. Be sure the resident understands the proper way to load the appliance. In addition, check to be sure they are using the right soap. Using regular dish soap is a common mistake. 2. Clean a dirty or blocked strainer. 3. Hard water problem – you may not be able to correct this issue if it requires the installation of a water softener.
The door does not latch shut	1. The resident may have a child who sits on dishwasher door when it is open or they may use it as a platform to hold heavy things like full grocery bags. Be sure the resident understands the results of such activities. 2. The door latch or door latch switch may need adjustment. See page 77 for directions.

Replace a Dishwasher Corner Seal

Slide 111

Leader's Instructions:

Before you dive into the specific repairs for dishwashers, you'll watch a video of showing the replacement of a corner seal. This is a common repair and the typical reason water runs down the outside door.

1. Introduce the topic of replacing a dishwasher corner seal.
2. Cover the how-to information below. (This information is also on page 70 of the participants' *Resource Guide*.)
3. Play the "Replace a Dishwasher Corner Seal" video clip.
4. Ask for questions.
5. After that, ask participants and invited subject matter experts to share their best tips and tricks.
6. Continue reviewing the other common dishwasher service requests. Demonstrate as many as you can in the time provided. Remember to allow 15 minutes for group discussion at the end of the session.

Safety

Wear eye protection when working with electrical systems.

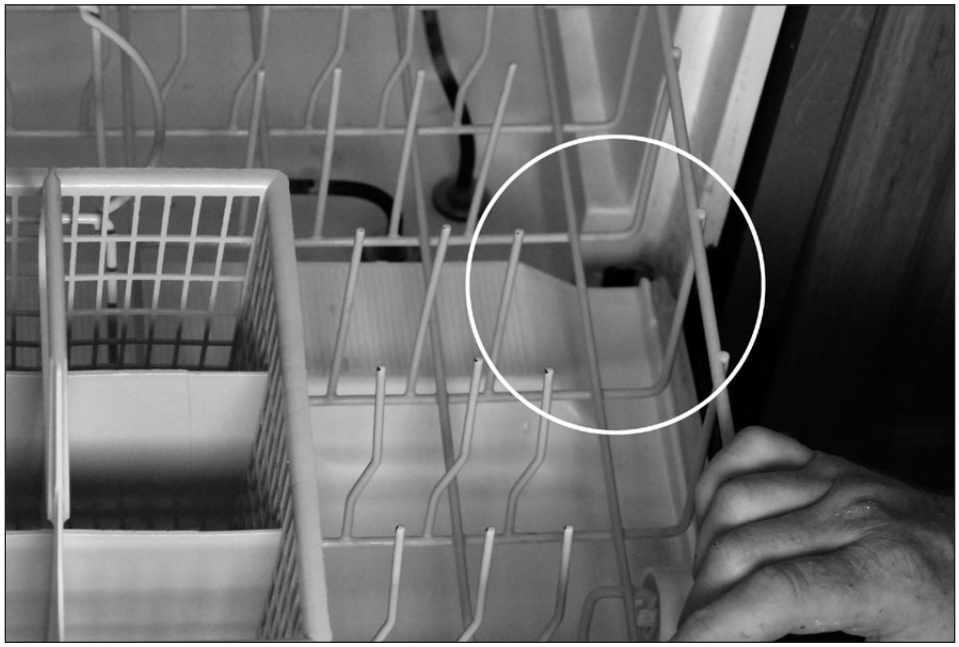
Tools and Materials Needed

- Screwdriver
- Corner seal

How-to Steps

The corner seal is an easy part to replace. When water is running out of the door and pooling on the floor – check the corner seal first.

1. Remove the bottom dish rack.
2. There is a corner seal in the bottom front corner on both sides. Use a screwdriver to remove the old corner seal on the side that is leaking.
3. Replace with a new corner seal.
4. Test to be sure the problem has been corrected.



Replace a Dishwasher Door Gasket

Safety

Make sure the power to the dishwasher is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

Tools and Materials Needed

- Screwdriver
- Lockout/tagout device
- Warm, soapy water
- Door gasket

How-to Steps

If water runs down the door of the dishwasher, the problem may be a bad door gasket. To replace a door gasket:

1. Unplug dishwasher or turn off electricity to dishwasher at main electrical panel.
2. Lockout/tagout the panel.
3. Remove the bottom dish rack.
4. Use a screwdriver to remove the old door gasket.
5. Soak the new gasket in warm, soapy water so it is easier to work with.
6. Working from the center of the door to the ends, press or slide the new gasket into its track.
7. If gasket has screws or clips, refasten.
8. Replace bottom dish rack.
9. Turn on electricity to dishwasher.
10. Turn on dishwasher and check operation.

Clean the Dishwasher Drain Hose

Safety

Make sure the power to the dishwasher is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

Wear hand protection when cleaning out hoses and working with chemical solutions.

Tools and Materials Needed

- Screwdriver
- Lockout/tagout device
- Pan to collect the water
- Water and bleach solution
- Rags or towels

How-to Steps

If water pools under the dishwasher, the problem may be a clogged drain hose. To unclog the drain hose:

1. Unplug dishwasher or turn off electricity to dishwasher at main electrical panel.
2. Lockout/tagout at the panel.
3. Turn off the water supply to the dishwasher.
4. Remove the lower panel of the dishwasher.
5. Put a pan or bowl under the pump to collect excess water.
6. Loosen the drain hose clamp.
7. Disconnect the hose from the pump.
8. Disconnect the other end of the hose from the drain or garbage disposer under the sink.
9. Clean hose with water and bleach. If worn, replace.
10. Reattach hose to drain/garbage disposer and pump.
11. Remove pan or bowl. Wipe up excess water on floor.
12. Attach lower panel of dishwasher.
13. Turn on water supply.
14. Turn on electricity to dishwasher.
15. Turn on dishwasher and check operation.

Clean and Replace the Dishwasher Spray Arm

Safety

Make sure the power to the dishwasher is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

Wear hand protection when working with chemical solutions.

Tools and Materials Needed

- Lockout/tagout device
- Soft bristle brush
- Water and vinegar solution
- Spray arm, if needed

How-to Steps

If water pools under the dishwasher, the problem could be a dirty spray arm. To clean the spray arm:

1. Unplug dishwasher or turn off electricity to dishwasher at main electrical panel.
2. Lockout/tagout the panel.
3. Remove bottom dish rack.
4. Unscrew the spray tower by hand.
5. Remove (turn clockwise) the spray arms.
6. Use soft bristle brush to clean holes in spray arm. Soak in water and vinegar solution. If spray arm is worn, corroded or broken, replace.
7. Reattach spray arms.
8. Reattach (turn counterclockwise) the spray tower.
9. Rotate spray arms to make sure they move freely. If not, tighten.
10. Lift spray tower to make sure it moves freely. If not, tighten.
11. Replace bottom dish rack.
12. Turn on electricity to dishwasher.
13. Turn on dishwasher and check operation.

Testing and Replacing a Dishwasher Water Inlet Valve

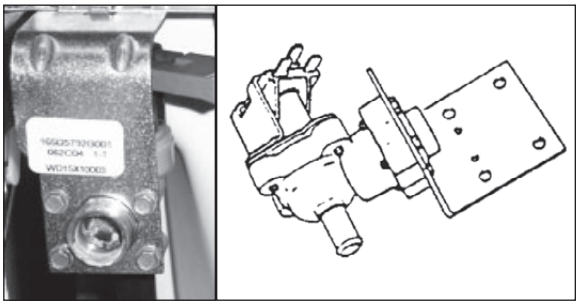
Safety

Make sure the power to the dishwasher is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

How-to Steps



1. Unplug dishwasher or turn off electricity to dishwasher at main electrical panel.
2. Lockout/tagout the panel.
3. Turn off water supply to dishwasher.
4. Remove lower front panel on dishwasher.
5. Check water inlet valve connections—hose to tub and incoming water line. These are typically on the left bottom.
6. Label, and disconnect wires to inlet valve.
7. Use multimeter on RX1 setting to test water inlet valve:
   - Touch one probe to one terminal and the other probe to the other terminal.
   - If the display shows infinity, the valve is bad and needs to be replaced.
8. If a new valve is needed, remove the old valve and connect the hose and incoming water line to the new water inlet valve.
9. Attach wires to the inlet valve.
10. Replace lower front panel.
11. Turn on water supply.
12. Turn on electricity to dishwasher.
13. Turn on dishwasher and check operation.

Replacing a Soap Dispenser

Safety

Make sure the power to the dishwasher is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

Wear hand protection when working with corroded material.

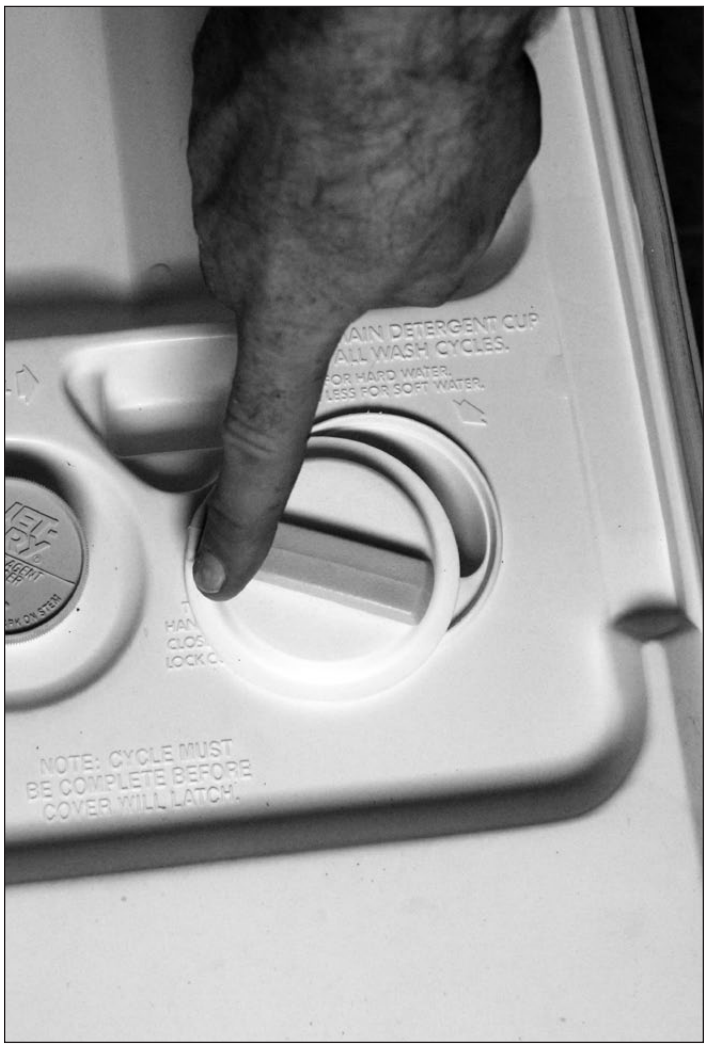
Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Multimeter
- Soap and/or rinse agent dispenser

How-to Steps

Soap dispensers may become corroded or even break. To replace a soap dispenser:

1. Unplug dishwasher or turn off electricity to dishwasher at main electrical panel.
2. Lockout/tagout the panel.
3. Remove caked-on soap on and around the dispenser.
4. Look for a worn or damaged gasket. Replace, if necessary.
5. Take off inside door panel.
6. If the dispenser is electrically operated:
   - Use multimeter on RX1 setting to test soap dispenser.
   - Touch one probe to one terminal and the other probe to the other terminal.
   - If the display shows infinite, the dispenser is bad and needs to be replaced.
7. If the dispenser is not electrically operated:
   - Take off the soap and rinse agent dispensers.
   - Look for worn, corroded, stuck or broken parts. Replace, if necessary.
   - Reattach the new soap and rinse agent dispensers.
8. Attach inside door panel.
9. Turn on electricity to dishwasher.
10. Turn on dishwasher and check operation.



Testing the Dishwasher Motor

Safety

Make sure the power to the dishwasher is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Multimeter

How-to Steps

If dishes are not clean after the completion of the cycle, the motor could be faulty. If you identify that it is bad, it will either need to be replaced by a professional or the entire unit will need to be replaced – whichever is more cost-effective. To check the dishwasher motor:

1. Unplug dishwasher or turn off electricity to dishwasher at main electrical panel.
2. Lockout/tagout the panel.
3. Turn off water supply to dishwasher.
4. Remove lower front panel on dishwasher.
5. Turn motor fan blades. (If they do not move freely, look for obstructions.)
6. Label and disconnect wires to motor.
7. Use multimeter on RX1 setting to test motor:
   - Touch one probe to one terminal and the other probe to the other terminal. The motor should show little resistance.
   - Check the ground connection by placing one probe on the motor's bare metal housing and the other probe on each terminal in turn. There should be no reading. If the motor fails either test, replace motor following provided instructions and ask for assistance if necessary.
8. Attach wires to motor.
9. Replace lower front panel.
10. Turn on water supply.
11. Turn on electricity to dishwasher.
12. Turn on dishwasher and check operation, if appropriate.

Adjusting the Door Latch and Testing the Door Latch Switch

Safety

Make sure the power to the dishwasher is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Multimeter
- Door latch switch

How-to Steps

A dishwasher door that does not properly latch may simply need adjustment. Or the door latch switch may need to be replaced. To service the door latch:

1. Unplug dishwasher or turn off electricity to dishwasher at main electrical panel.
2. Lockout/tagout the panel.
3. Loosen the latch bolts, align latch and tighten bolts. Check operation.
4. Use multimeter on RX1 setting to test the latch:
   - Touch one probe to one terminal and the other probe to the other terminal.
   - The meter should indicate continuity with the switch button pushed in; and an open circuit when it's out. Replace the switch if your test results are different.
5. To replace switch, remove switch bolts and install a new latch. Check alignment.
6. Turn on electricity to dishwasher.
7. Turn on dishwasher and check operation.

Group Discussion on Dishwashers
(15 minutes)

 **Slide 112**

Here's a tip for residents: don't mix steel and silver items in the dishwasher. Putting two different types of metal in contact in a humid environment is a perfect recipe for corrosion.

Leader's Instructions:

Hold a 15-minute group discussion on dishwashers to enrich participants' knowledge. Again, you can do this in a variety of ways, such as:

- Presenting additional material on dishwashers – perhaps other "what to do and what not to do" suggestions regarding use and repair. (Or having an invited subject matter expert do it.)
- Asking participants to share their stories and experiences.
- Holding a question and answer session.
- Asking participants to share their best "tips and tricks" related to dishwashers.

Let participants know the how the discussion will work, and encourage them to take notes on page 78 of their *Resource Guide.*

Refrigerator Maintenance and Repair
(3 hours 30 minutes)

 **Slide 113**

The refrigerator is one of those miracles of modern living that completely changes life. Prior to refrigeration, the only way to preserve meat was to salt it, and iced beverages in the summer were a real luxury.

The basic idea behind refrigeration is simple: It uses the evaporation of a liquid to absorb heat. We'll spend a hefty chunk of time exploring refrigeration concepts and learning about the most common service requests you'll receive for this spectacular invention.

Introduction

Turn to page 79 in your guide.

Leader's Instructions:

As you talk through the science of refrigeration, it's a good idea to tap into your experts. If you have one available, and you are less comfortable with this content, it may be a good idea to ask him/her to cover this section.

Be sure to spend ample time covering the material. It is important for participants to understand how and why the appliance works the way it does before beginning to diagnose problems with the system.

The basic idea behind a refrigerator is to use the evaporation of liquid to absorb heat. Cold air isn't created; instead, heat is removed from the inside of the unit and transferred outside the unit.

Think about when you put water on your skin; it makes you feel cool. As the water evaporates, it absorbs heat, creating the cool feeling. After physical exertion, your body sweats to cool down. The sweat on your skin evaporates into the air. Rubbing alcohol on your skin feels even cooler. Why? It evaporates at a lower temperature.

The liquid, or refrigerant, used in a refrigerator evaporates at an extremely low temperature, so it can create freezing temperatures inside the refrigerator. If you placed a refrigerator's refrigerant on your skin (**DO NOT DO THIS**), it would freeze your skin as it evaporated.

Refrigerator Basics (1 hour 30 minutes)

Leader's Instructions:

Hint: It may be helpful for your participants if you draw this out on the whiteboard or flipchart so that they can follow along with the methodology.

Participants can take notes on page 80 in their guide.

To understand what is happening inside your refrigerator, it is helpful to understand refrigerants a little better. Even though we are not going to conduct this experiment today, talking through it can help you understand the concepts.

Imagine that you have filled an oven-safe glass bowl with water. You put a thermometer that can measure up to at least 450° F in the bowl, put the container in the oven, and turn up the temperature to 400° F.

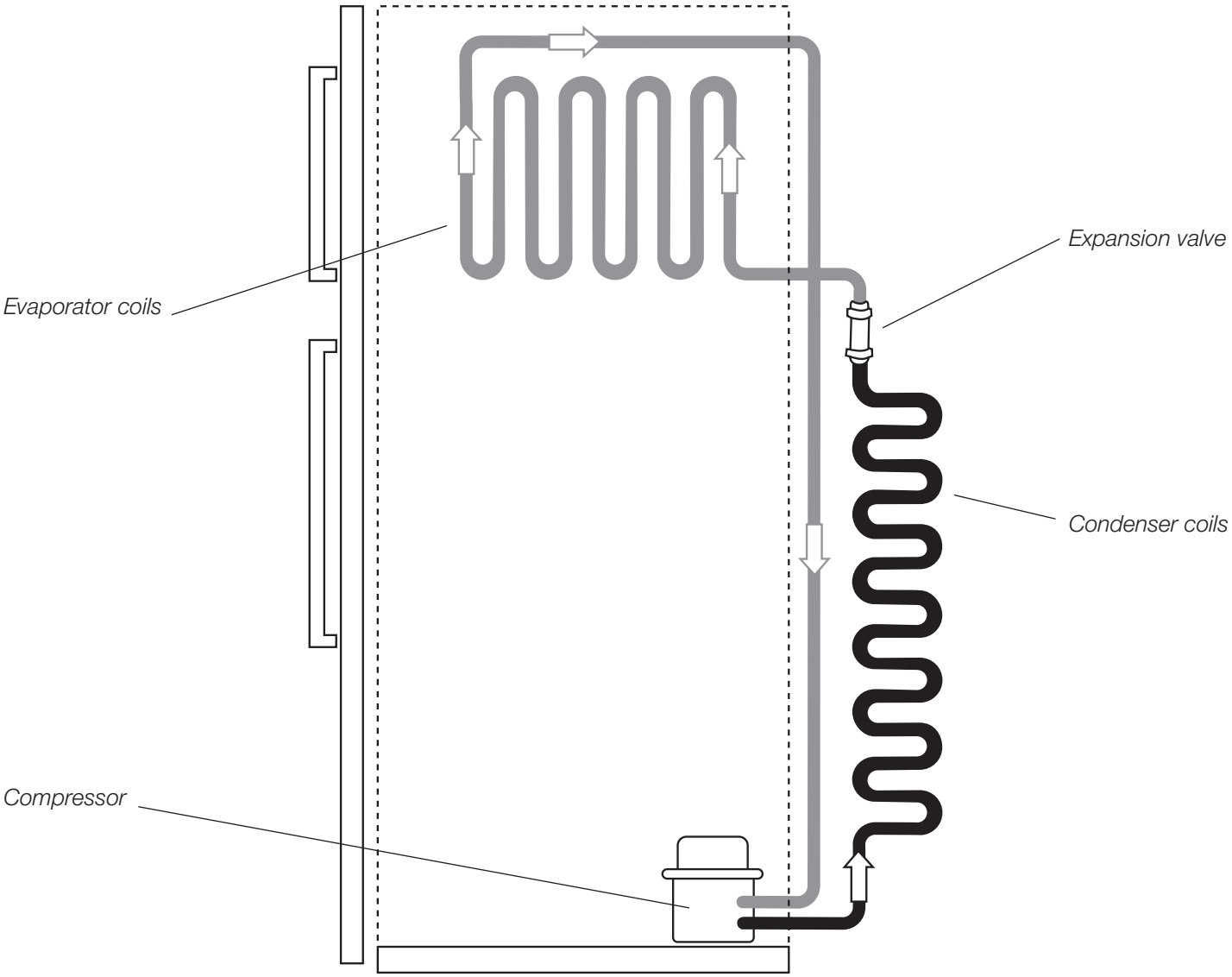
As the oven heats up, the temperature of the water will rise until it hits 212° F, and then starts boiling. The water's temperature will stay at 212° F even though it is completely surrounded by an environment that is at 400° F. If you let all the water boil away, as soon as the water is gone the temperature of the thermometer will shoot up to 400° F.

This experiment is interesting if you think about it this way: Imagine some creature that is able to live happily in an oven at 400° F. This creature thinks 400° F is great -- the perfect temperature (just like most humans think that 70° F is terrific). If the creature is living in an oven at 400° F, and there is a cup of water in the oven boiling away at 212° F, how will the creature feel about that water? It is going to think that the boiling water is VERY cold. After all, the boiling water is 188 degrees colder than the 400° F that this creature thinks is comfortable. That's a huge temperature difference!

This is exactly what is happening when we humans interact with liquid nitrogen. We generally feel comfortable at 70° F. Liquid nitrogen boils at -320° F. So if you had a pot of liquid nitrogen sitting on the kitchen table, its temperature would be -320° F, and it would be boiling away, but to you, it would feel incredibly cold.

Refrigerator Basics (continued)

Slide 114



There are five basic parts to a refrigerator:

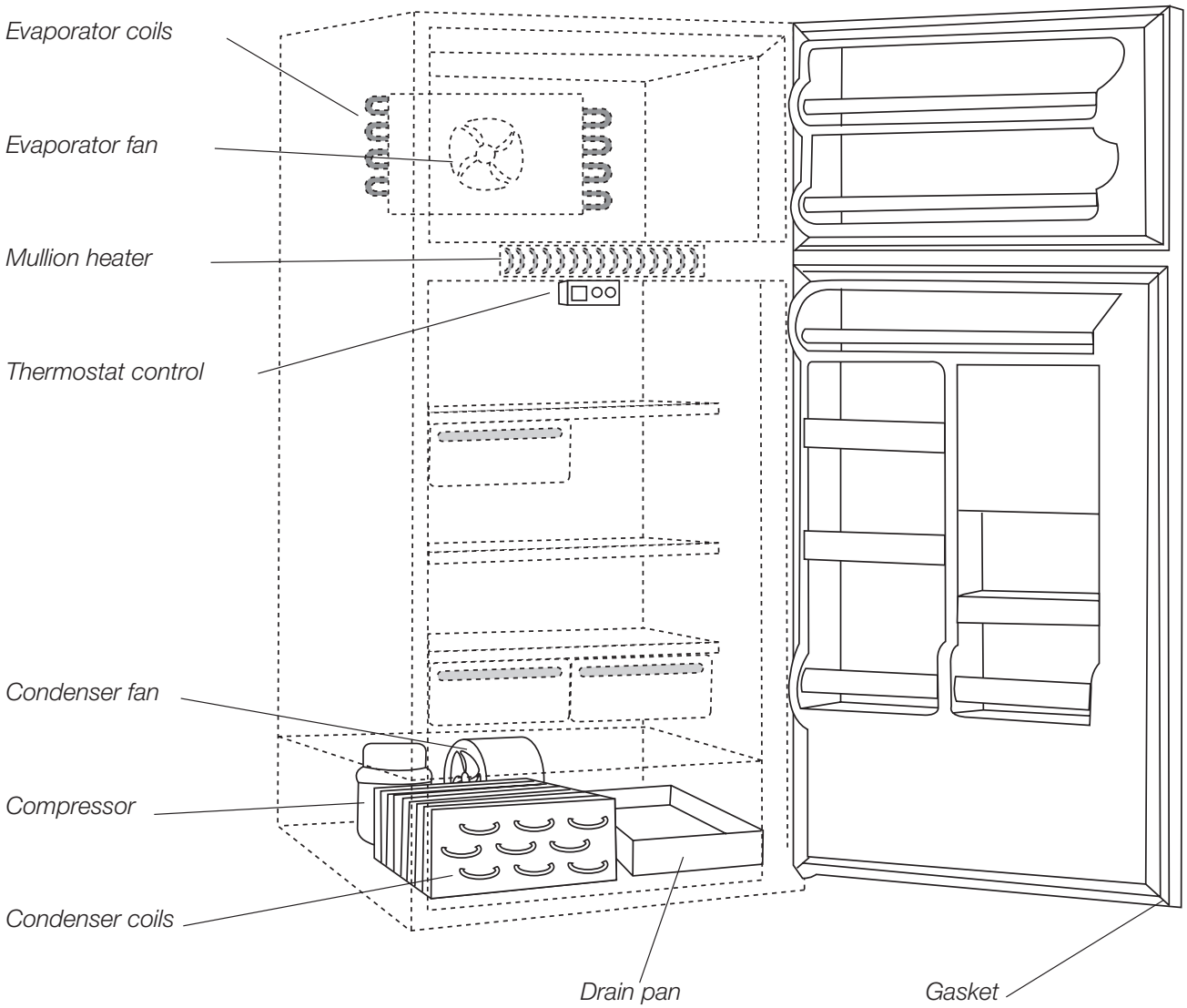
- **Compressor** – The compressor compresses the refrigerant gas and forces it through metal coils. This process raises the refrigerant's pressure and temperature
- **Condenser coils** – The coils located outside, on the back of the refrigerator, let the hot refrigerant gas dissipate its heat.
- **Expansion valve** - As it cools, the refrigerant condenses into liquid form and flows through the expansion valve. When it flows through the expansion valve, the liquid refrigerant is allowed to move from a high-pressure zone to a low-pressure zone, so it boils and vaporizes. In evaporating, it absorbs heat, making it cold.
- **Evaporator coils** – The coils set inside the unit allow the refrigerant to absorb heat, making the inside of the refrigerator cold.
- **Refrigerant** – liquid that evaporates inside the refrigerator to create the cold temperatures. The first refrigerant was ammonia, which boils at -27° F. However ammonia is highly toxic to people, so chlorofluorocarbons (CFCs) were developed in the 1930s. In the 1970s, it was discovered that the CFCs in use were harmful to the ozone layer. As of the 1990s, all new refrigerators use refrigerants that are less harmful to the ozone layer. Modern refrigerators use a regenerating cycle that reuses the same refrigerant over and over again.
- The cold gas is sucked up by the **compressor**, and the cycle repeats itself.

Refrigerator Basics (continued)

Slides 115 - 119

You've learned about the internal systems; now let's take a look at the rest of the refrigerator.

Anatomy of a Refrigerator



Leader's Instructions:

Ask the participants if they have any questions about how refrigeration or a refrigerator works. Be sure to answer their questions before moving on to the activity.

If you're holding the training in an apartment community—or a building where you can easily access a refrigerator, get out of the classroom and into the work environment.

Spend about 1 hour reviewing the refrigerator's electrical, mechanical and plumbing systems. Compare the diagram in the *Resource Guide* to the refrigerator on hand to determine similarities and differences. Review the safety procedures to follow when working with refrigeration, electrical and plumbing systems.

We strongly recommend doing this tour to bring the topic alive--and to let participants move around a bit.

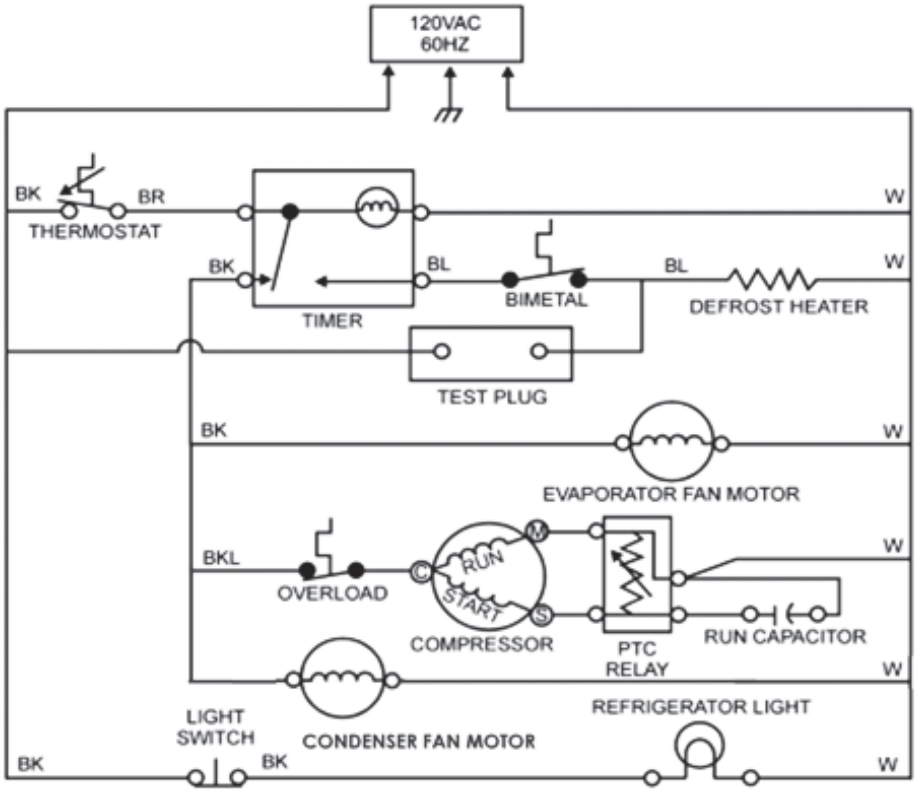
When you are finished, return to the classroom.

Now play the videos "Refrigerator Controls" and "Refrigerator Cold Control."

Refrigerator Basics (continued)

Slides 120 - 135

Refrigerator Schematic



Common Refrigerator Problems and Solutions (1 hour 15 minutes)

 **Slide 136**

Lint and dust clogging the condenser coils is one of the most common refrigerator problems. Now where have we heard that before…?

Leader's Instructions:

1. Introduce each topic.
2. Cover the how-to information below. (This information is also on page 84 of the participants' *Resource Guide*.)
3. Provide a demonstration if you have access to a refrigerator. Invite a participant or two to complete the task after you've shown it while the other participants look on. Be sure they describe what they are doing as they perform the steps.
4. Ask for questions.
5. After that, ask participants and invited subject matter experts share their best tips and tricks.

Problem	Solution(s)
Door sweats	1. The gasket may be broken. See page 87 for instructions on replacing it. 2. The defrost timer may be broken; see page 89. 3. The mullion heater may be faulty. This is an "anti-sweat" device that provides heat in the area around the door seals to reduce condensation. Replace the mullion heater following the instructions provided and ask for help if necessary.

Common Refrigerator Problems and Solutions (continued)

Problem	Solution(s)
Food is not cold enough	1. Airflow across condenser coils may be blocked. Vacuum the condenser coils. 2. The defrost timer may be broken; see page 89. 3. The thermostat control may be faulty. To replace the thermostat control, see page 88. 4. The compressor may have stopped working properly. However, the compressor and motor are mounted inside a sealed container. Replacing either is a job for an appliance professional. Generally the cost of replacing a failed compressor far exceeds the value of the refrigerator. 5. The condenser may be faulty. The condenser is the coil on the outside of the refrigerator and it is sealed. Replacing it is a job for an appliance professional.
Standing water in the bottom of the refrigerator	1. The door may have been left open. Ask the resident if the door might have been inadvertently left open for a period of time before completing unnecessary work. 2. The drain may be plugged. Clean out the ports to the drain pan with warm water or flexible tubing. 3. The door gasket may be weak or broken. See page 87 for instructions on replacing it. 4. The defrost timer may be broken; see page 89. 5. If you suspect the refrigerator is low on refrigerant, it's time to replace it or call an appliance specialist.
Ice-maker not working	1. The buildup of lint under the unit can really impact the refrigerator's performance. Clean the lint with a special brush designed for the job. 2. Check to be sure the water supply is turned on to the refrigerator. 3. Check for kinks or blockage in water line and remove them. 4. Check the freezer temperature. It should be between 0 – 8°F. If it is above 10 – 12°F, the ice maker may not work. 5. The fill valve may be faulty. See page 90 for instructions on replacing it.

Common Refrigerator Problems and Solutions (continued)

Problem	Solution(s)
Frost buildup	1. Check with the resident to see if a hot item was recently placed in unit. This can cause frost build-up. 2. The thermostat control may be faulty. To replace the thermostat control, see page 88. 3. There may be a bad defrost heater; see page 91 for directions on replacing this part. 4. Defrost timer broken. Replace defrost timer. See page 89 for instructions.
Refrigerator is noisy	1. Sometimes a refrigerator is noisy because it is not level. This is a real problem because to operate efficiently, a refrigerator must be level. To level a refrigerator, place a bubble-type level on the top of the unit and use a wrench to lengthen or shorten the front feet of the refrigerator. You may need to remove the front panel to access the feet. 2. The condenser fan motor may be dirty. Clean it and see if that solves the problem. 3. A noisy refrigerator can be low on refrigerant. Call a professional or replace the unit.
Ice cream isn't hard	1. Real ice cream has high milk fat content and is naturally soft. You may need to explain this to a resident since the ice cream will never get very hard unless it has very low fat content. 2. The defrost timer may be broken; see page 89. 3. Freezer door gasket defective. Check door gasket and replace if necessary. See page 87 for instructions.

Replacing a Door Gasket

Safety

Make sure the power to the refrigerator is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

Tools and Materials Needed

- Screwdriver
- New Gasket

How-to Steps

The door gasket provides a seal to keep the cold inside the refrigerator and the heat outside the refrigerator. To replace a door gasket:

1. Find an exact replacement for the door gasket.
2. Soak the gasket in hot water.
3. Loosen (do not remove) the screws that hold the old gasket in place.
4. Pull out old gasket.
5. Push new gasket under the metal retainer and tighten the screws.
6. Close door and check for gaps. Adjust as necessary.

Note: Newer models have a kerf style door gasket. Simply grasp and remove in the corner and press the gasket into place.

Replacing a Thermostat Control

Leader's Instructions:

Before you review the specific repairs for refrigerators, you'll watch a video of showing the replacement of a thermostat. This is a common repair and the typical reason water runs down the outside door.

1. Introduce the topic of replacing a refrigerator thermostat control.
2. Cover the how-to information below. (This information is also on page 88 of the participants' *Resource Guide*.)
3. Play the "Replace a Refrigerator Thermostat" video clip.
4. Ask for questions.
5. After that, ask participants and invited subject matter experts to share their best tips and tricks.
6. Continue reviewing the other common refrigerator service requests. Demonstrate as many as you can in the time provided. Remember to allow 15 minutes for group discussion at the end of the session.

Safety

Make sure the power to the refrigerator is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

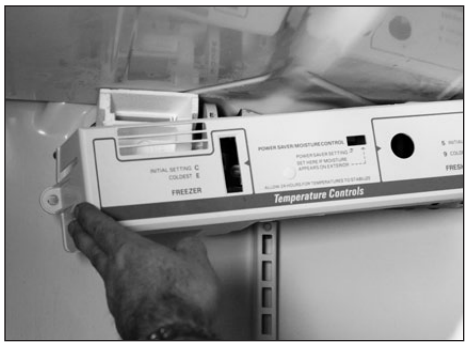
Tools and Materials Needed

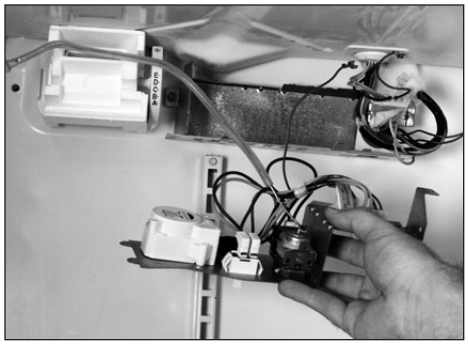
- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Multimeter
- Electrical tape
- Thermostat

How-to Steps

The thermostat control regulates the temperature inside the refrigerator. If the refrigerator runs but food is not staying cold the problem could be a bad thermostat control. To replace a thermostat control:

1. Unplug refrigerator or turn off electricity to refrigerator at main electrical panel.
2. Lockout/tagout the plug or panel.
3. Remove the thermostat knob.
4. Remove screw(s) holding cover into place and take off the housing cover.
5. Remove the wires, connections, and grounding wire.
6. Remove the mounting screws for the panel.
7. Carefully bend the capillary tube to remove it from its holder.
8. Remove the entire assembly.
9. Take off the capillary guard.
10. Remove the 1/4-inch screws holding the old thermostat to the panel. Remove the terminals.
11. Install the terminals of the new thermostat and place in the assembly. Screw into place with the 1/4-inch screws.
12. Install the capillary guard. Bend the capillary tube to reinsert it into the proper place.
13. Reinstall the assembly. Be careful not to kink, bend, or break any wires or the capillary tube.
14. Install the mounting plate screw and secure it to the back of the refrigerator.
15. Reattach the grounding wire, connections, and other wires.
16. Replace the cover and thermostat knob.





The thermostat in this refrigerator is mounted on a metal support behind the plastic cover.

Replacing the Refrigerator Defrost Timer

Safety

Make sure the power to the refrigerator is off.

Use lockout/tagout procedures.

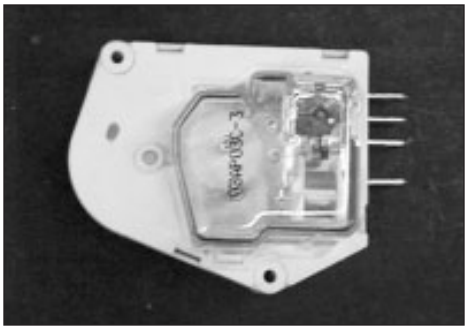
Wear eye protection when working with electrical systems.

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Multimeter
- Defrost timer

How-to Steps

1. Unplug refrigerator or turn off electricity to refrigerator at main electrical panel.
2. Lockout/tagout the plug or the panel.
3. Locate the defrost timer. (Look behind front grill, behind the cover in refrigerator or freezer, or in the temperature control console in back by the compressor.)
4. Remove screws.
5. Gently pull out timer part way.
6. Disconnect from wiring connector.
7. Replace timer.
8. Turn on electricity to refrigerator.
9. Turn on refrigerator and check operation.



Replacing a Refrigerator Fill Valve

Safety

Make sure the power to the refrigerator is off.

Use lockout/tagout procedures.

Wear eye protection when working with electrical systems.

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Multimeter
- Fill valve

How-to Steps

1. Unplug refrigerator or turn off electricity to refrigerator at main electrical panel.
2. Lockout/tagout the plug or panel.
3. Locate the ice maker fill valve.
4. Detach the fill valve.
5. Label, and disconnect wires to fill valve.
6. Remove feed lines.
7. Attach feed lines to new fill valve.
8. Connect wires.
9. Attach fill valve.
10. Turn on electricity to refrigerator.

Replacing a Refrigerator Defrost Heater

Safety

Make sure the power to the refrigerator is off.

Use lockout/tagout procedures.

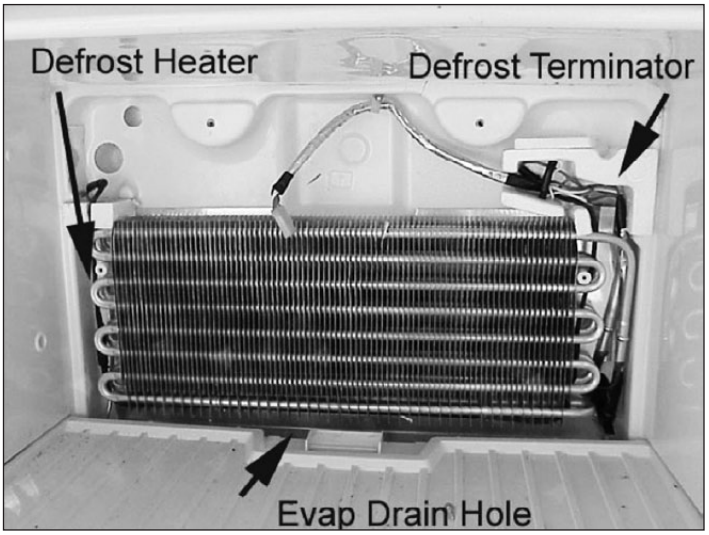
Wear eye protection when working with electrical systems.

Tools and Materials Needed

- Screwdriver
- Insulated combination tool
- Lockout/tagout device
- Multimeter
- Defrost heater

How-to Steps

The defrost heater is the heating element on the evaporator coil. It melts the frost. If there is a problem with frost build-up it could be a faulty defrost heater. To replace the defrost heater:



1. Unplug refrigerator or turn off electricity to refrigerator at main electrical panel.
2. Lockout/tagout the plug or panel.
3. Remove the panel inside the refrigerator.
4. Locate the defrost heater.
5. Label and disconnect the wires to the defrost heater.
6. Use multimeter on RX1 setting to test:
   - Touch one probe to one terminal the and other probe to the other terminal.
   - The display should read between 5 and 20 ohms.
     If not, replace the defrost heater.
7. Connect wires to new defrost heater.
8. Attach panel.
9. Turn on electricity to refrigerator.
10. Turn on refrigerator and check operation.

Group Discussion on Refrigerators
(15 minutes)

 **Slide 137**

This is the final group discussion of the course. Spend a few minutes covering any additional refrigerator topics.

Leader's Instructions:

Hold a 15-minute group discussion on refrigerators to enrich participants' knowledge.

Again, you can do this in a variety of ways, such as:

- Presenting additional material on refrigerators. (Or having an invited subject matter expert do it.) For example, remind them that the top maintenance items for refrigerators are keeping the condenser coils clean, making sure the door gaskets are in good shape, making sure the refrigerator is level, and making sure the drain pan is empty and clean.
- Asking participants to share their stories and experiences.
- Holding a question and answer session.
- Asking participants to share their best "tips and tricks" related to refrigerator maintenance and repair.

Let participants know the how the discussion will work, and encourage them to take notes on page 91 of their *Resource Guide*.

Key Takeaways, Action Plan, and Wrap-up (30 minutes)

Participants have just learned about appliance maintenance and repair. It's time for them to make the most of their newfound knowledge by taking action on what they have learned.

In this part of the training, participants will briefly review the key takeaways for this course, write a brief "Start/Stop/Continue" action plan, and then be introduced to the supplemental online training for this course.

Well, you've come a long way. We've covered all of these appliance maintenance and repair topics:

- Your roles and responsibilities
- Appliance basics and terms
- Appliance safety
- Tools and equipment for appliance repairs

Now, to cross the finish line for this course, there are just three things remaining:

1. Taking a look at the key takeaways for this course
2. Having you write a simple action plan
3. And introducing you to the supplemental online training for this course

Let's start with the key takeaways. Turn to page 90 in your *Resource Guide*.

Key Takeaways, Action Plan, and Wrap-up (continued)

Key Takeaways

It's not easy to sum up a course that has covered as much ground as this one has. But we've tried, by identifying several key takeaways you can use once you get back on the job:

Appliance Safety Takeaways

- Follow the correct safety procedures whenever you work with plumbing, electricity or appliance mechanical systems. Do not cut corners or take risks.
- When repairing an electrical appliance such as a clothes washer, turn off power to the circuit. Use a circuit tester or multimeter to make sure power is off.
- Follow lockout/tagout procedures.
- Wear the correct personal protective equipment—in most cases, eye protection—and wear non-slip soled shoes.
- Call a plumber, an electrician or an appliance repair specialist to do work for which you are not qualified.

Appliance Repair and Maintenance Takeaways

- Use the repair techniques you've learned today to improve the speed and quality of your work.
- Do your best to keep up with the latest advances in tools, technology, and techniques as they relate to appliance maintenance and repair.
- Feel free to use this *Resource Guide* when you're back on the job.

Leader's Instructions:

Ask participants if they would like to add any key takeaways. Write any on the flipchart or whiteboard, and invite participants to write them in their *Resource Guide*.

With these takeaways in mind, let's now move on to having you write an action plan. Turn to the next page in your *Resource Guide*.

Key Takeaways, Action Plan, and Wrap-up (continued)

 **Slide 138**

"Start/Stop/Continue" Action Plan

The point of an action plan is simple. It gets you thinking about what you've learned in this course, and then asks you to write down a few things you'll do differently back on the job.

You'll be doing a simple and realistic action plan today called "Start/Stop/Continue." All you need to do is reflect on the things you've learned in this course, and based on that, write at least one thing you want to start doing, stop doing, and continue doing when you return to your apartment community.

Then, if you can work on these things for the next month, you'll most likely improve your on-the-job skills, feel more confident, and just enjoy your time as a maintenance technician even more.

I'm going to give you ten minutes now to work on your "Start/Stop/Continue" plan, and remember, this plan is for you and you alone. You don't need to share it with anyone, unless you'd like to.

Leader's Instructions:

Give participants ten minutes to work on their "Start/Stop/Continue" action plans, and answer any questions along the way.

Thank you for taking the time to work on your plan. I wish you all the best as you work on it over the next month.

Supplemental Online Training

Before we bring this course to its official close, I want to tell you about another way you can build on—and reinforce—what you've learned today.

As part of this course, you can also complete a brief online training course on Appliance Maintenance and Repair. The course will take approximately 30 minutes, and it will cost you nothing extra. You can access and take the course on your home computer, a computer in a public place like a library, or a computer at work, as long as your have your supervisor's permission to do so.

In this online course, you'll get to complete three practice scenarios, in which you'll play the role you know best, that of a maintenance technician.

These realistic scenarios will let you prioritize, diagnose, and repair appliance problems, just as you would on the job. You'll also be able to ask questions and get feedback as you go along.

You can find the instructions for accessing the course on the inside front cover of your *Resource Guide*.

Key Takeaways, Action Plan, and Wrap-up (continued)

Closing

Thank you for being a part of the Appliance Maintenance and Repair course.

I wish you the best of luck as you pursue your CAMT designation, and all the best back on the job, too. It's been my pleasure to be your instructor.

Leader's Instructions:

If there are no further questions or comments, dismiss the participants.

On behalf of the NAA and your local affiliate, thank you for teaching the "Appliance Maintenance and Repair" course.

Appendix: Suggested Training Kit for this Course

If you choose to conduct demonstration and hands-on practice, which is highly recommended, work with your NAA affiliate to put together a training kit of tools and materials you can use in the course. This kit will not be expensive, but it will take a little planning and time to complete.

Safety Equipment

Lockout/tagout kits

Pairs of goggles

Pairs of gloves

Masks

Tools

Screwdrivers

Tongue and groove pliers

Needlenose pliers

Adjustable wrenches

Ratchet wrenches

Utility knives

Putty knives

Tubing cutters

Emery cloths

Small wire brushes

Neon circuit testers

Inexpensive digital multimeters

Digital thermometers

Materials

Ideally, you will have access to a working clothes dryer, clothes washer, electric and/or gas range (cooktop and oven), dishwasher, and refrigerator. Learning in the actual context of the work environment is a very powerful method.

If that isn't possible, the next best solution from a training perspective is access to these appliances in a classroom setting (not connected to electricity or plumbing). (As discussed earlier in the guide, try to get old appliances from apartment communities, appliance dealers, or other sources.)

If neither of these situations is possible, the following parts will be useful during these lessons:

Dryer lint screen

Dryer vent

Dryer door switch

Dryer start switch

Dryer thermal fuse

Dryer heating element

Dryer thermostat

Dryer drive belt

Washer pump

Washer water level switch

Washer lid switch

Washer timer

Washer water inlet valve

Washer agitator

Range control panel

Electric cooktop heating element

Oven thermostat

Oven selector switch

Dishwasher corner seal

Dishwasher door gasket

Dishwasher tower/spray arm

Dishwasher heating element

Refrigerator door gasket

Refrigerator thermostat

Refrigerator defrost timer

Refrigerator defrost heater

Refrigerator fill valve

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