



2025 GUAM WEATHERIZATION FIELD GUIDE



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This field guide is aligned with the U.S. Department of Energy's Standard Work Specifications (SWS) for home energy upgrades and adopted from the State and Community Energy Programs Island Grantee Job Aid, DOE/GO-102023-6134, June 2024.

Table of Contents

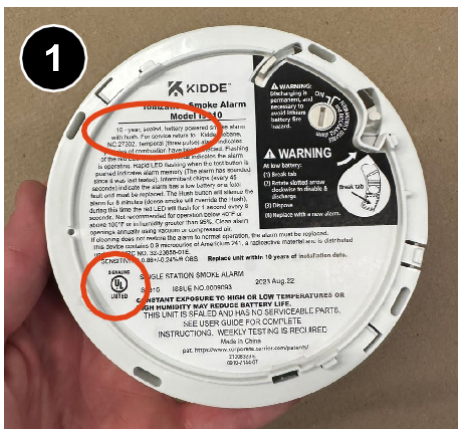
Section 1: Install Smoke Alarms	1
Section 2: Install Carbon Monoxide (CO) Alarms	3
Section 3: Install a Low-Flow Showerhead	5
Section 4: Install a Low-Flow Faucet Aerator	9
Section 5: Install LED Bulbs	12
Section 6: Install Advanced Power Strips	16
Section 7: Install a Refrigerator	19
Section 8: Install an AC (Mini-Split)	23
Section 9: Install AC (Window)	29
Section 10: Install AC (Through Wall)	33
Section 11: Install a Water Heater (Heat Pump)	37
Section 12: Install a Solar Water Heater	42
Appendix – Smoke Alarm & Carbon Monoxide Detectors	



Install Smoke Alarms

Island Grantee Job Aid

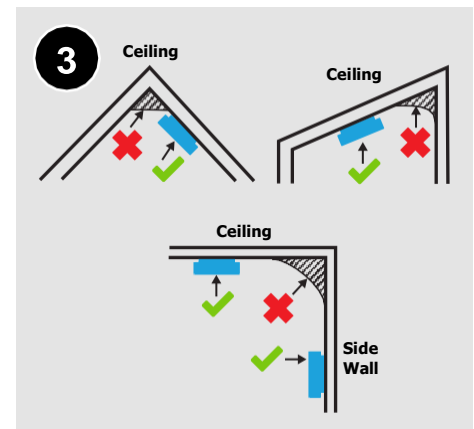
Aligns With Standard Work Specification 2.0101.2



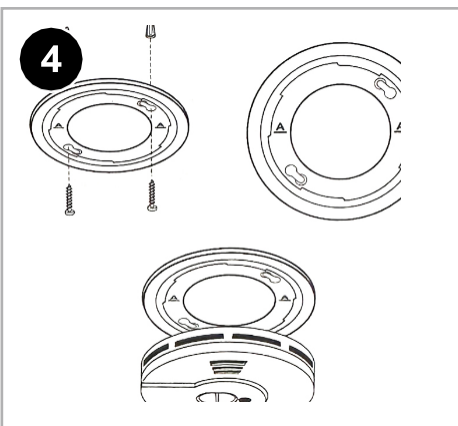
Select battery-operated smoke alarms that are listed and labeled in accordance with UL 217 and have sealed, non-replaceable, 10-year batteries. **2.0101.2a.**



Install smoke alarms in locations required by the Authority Having Jurisdiction (AHJ) (i.e. bedroom, hallway, living room, kitchen). **2.0101.2b.**



Avoid installing in locations with dead air space, or locations with excessive fresh air inlet (i.e., frequently used doors and windows).



Install the smoke alarm in accordance with manufacturer instructions. **2.0101.2c.**



Provide occupants with the manufacturer written instructions. **2.0101.2d.**



Checklist

Install Smoke Alarms

DESIRED OUTCOME

Properly selected and installed battery-operated smoke

- ☐ Verify UL 217 label.
- ☐ Verify appropriate location according to AHJ.

ACKNOWLEDGEMENTS

Developed for the U.S. Department of Energy by Simonson Management Services (SMS) under contract #89243422FEE400259, with input from Weatherization trainers and providers throughout the country and the generous assistance of Catkins Solutions, Guam Energy Office, National Renewable Energy Laboratory, Richard Heath & Associates, and WxTV.





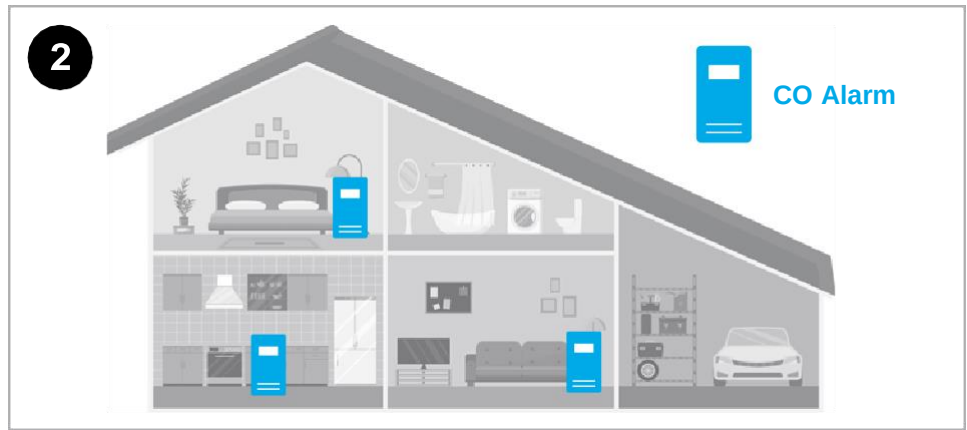
Install Carbon Monoxide (CO) Alarms

Island Grantee Job Aid

Aligns With Standard Work Specification 2.0102.1



Select battery-operated CO alarms that are listed and labeled in accordance with UL 2034 or approved by the **Authority Having Jurisdiction (AHJ)** and minimally have sealed, non-replaceable batteries and a 10-year manufacturer's warranty. [2.0102.1a.](#)



Install CO alarms in all homes where not present or inoperable in compliance with [ASHRAE 62.2-2016](#) (which references [NFPA 72](#)). Locations are to be determined by the AHJ. [2.0102.1b.](#)

Avoid installation near vents, windows, exterior doors, in dead air spaces, or closer to combustion equipment than manufacturer recommendations.



Install the CO alarm in accordance with manufacturer instructions. [2.0102.1c.](#)



Provide occupants with the manufacturer written instructions. [2.0102.1d.](#)



Checklist

Install Carbon Monoxide (CO)

DESIRED OUTCOME

Properly selected and installed CO alarms.

- ☐ Verify UL 2034 label.
- ☐ Verify appropriate location according to NFPA 72 and WAP requirements.

ACKNOWLEDGEMENTS

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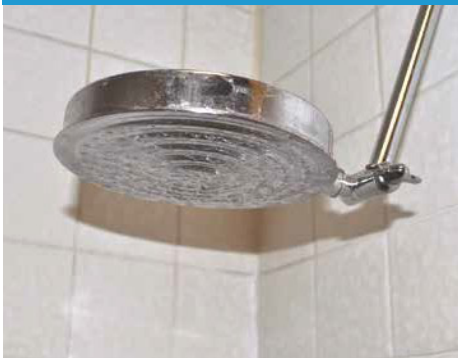


Install a Low-Flow Showerhead

Island Grantee Job Aid

Aligns With Standard Work Specification 7.0201.1

BEFORE



Higher flow showerheads wastewater and use energy to heat water that could be saved by installing a low-flow showerhead.



Verify current plumbing infrastructure is sufficient to support the installation(s) and water is free of visible debris that may clog the equipment. [7.0201.1a](#).



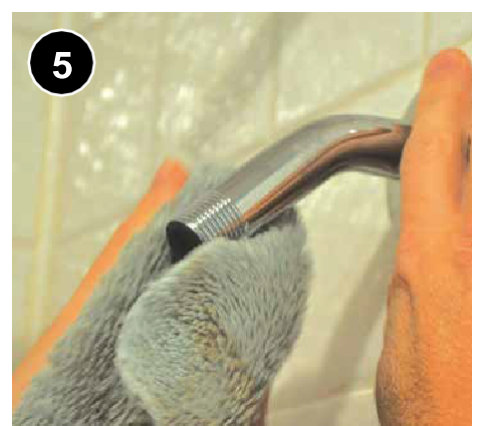
Carefully remove old showerhead with adjustable wrench, taking care not to loosen shower arm.



If old showerhead does not have flat sides at connection, wrap with buffer material, such as a piece of rubber.



Then use pipe wrench or channel locks to loosen connection at shower arm.



Clean threads of shower arm well to remove old residue.

Install a Low-Flow Showerhead



Wrap new thread tape around threads. [7.0201.1c](#)



Install new showerhead according to occupant needs, such as handheld, shut-off, or swivel.



Ensure that connections will not leak while preventing damage by using buffer material.



Use thread tape at all connections.



Verify proper water flow and that there are no leaks.



Permanently remove equipment from job site and recycle or dispose of removed equipment and refrigerant in accordance with local and federal law (e.g., EPA Section 608 of Clean Air Act of 1990). [7.0201.1d](#)

Install a Low-Flow Showerhead

AFTER



Low-flow showerheads must have flow rates of 2.5 gallons per minute or less, to reduce heating load and water use. [7.0201.1b](#).



Checklist

Install a Low-Flow Showerhead

DESIRED OUTCOME

Energy and water use reduced while occupant needs for water flow maintained.

- ☐ Equipment is installed in accordance with manufacturer instructions and applicable building codes.
- ☐ Rated flows of new fixtures will be no more than 2.5 gallons per minute.
- ☐ Showerhead is installed so that:
 - ☐ There is no water leakage upon completion.
 - ☐ Fixtures are undamaged.
 - ☐ Fixtures are fully functional (verify by testing).

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Install a Low-Flow Faucet Aerator

Island Grantee Job Aid

Aligns With Standard Work Specification 7.0201.1

BEFORE



Faucets without aerators produce excess flow and old aerators can impinge flow or cause leakage.



1. Verify current plumbing infrastructure is sufficient to support the installation(s) and water is free of visible debris that may clog the equipment. [7.0201.1a](#).



2. Using adjustable wrench or aerator wrench, gently remove old aerator, taking care not to damage faucet.



3. Once loose, continue removal by hand.

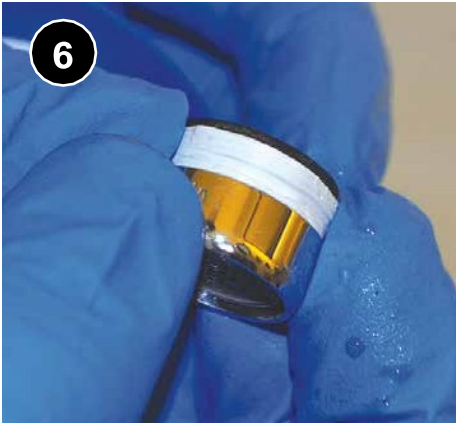


4. Clean threads of the faucet with a soft rag to remove any debris.



5. Verify which size and type of aerator will work with faucet. [7.0201.1b](#).

Install a Low-Flow Faucet Aerator



Wrap thread tape around new aerator if male, or faucet threads if it takes a female aerator. [7.0201.1c.](#)



Carefully install new aerator without over tightening. Ensure rubber washers are in place and take care not to cross-thread.



Run water through new aerator to verify it is not cross-threaded and no water is leaking around sides.



Remove old aerator from property and dispose of it. [7.0201.1d.](#)



Low-flow faucet aerators limit flow to 2.2 gallons per minute or less and reduce water heating load by reducing water usage. [7.0201.1b.](#)



Checklist

Install a Low-Flow Faucet Aerator

DESIRED OUTCOME

Energy and water use reduced while occupant needs for water flow maintained.

- ☐ Equipment is installed in accordance with manufacturer instructions and applicable building codes.
- ☐ Rated flows of new fixtures will be no more than 2.2 gallons per minute.
- ☐ Faucet aerator is installed so that:
 - ☐ There is no water leakage upon completion.
 - ☐ Fixtures are undamaged.
 - ☐ Fixtures are fully functional (verify by testing).

ACKNOWLEDGEMENTS

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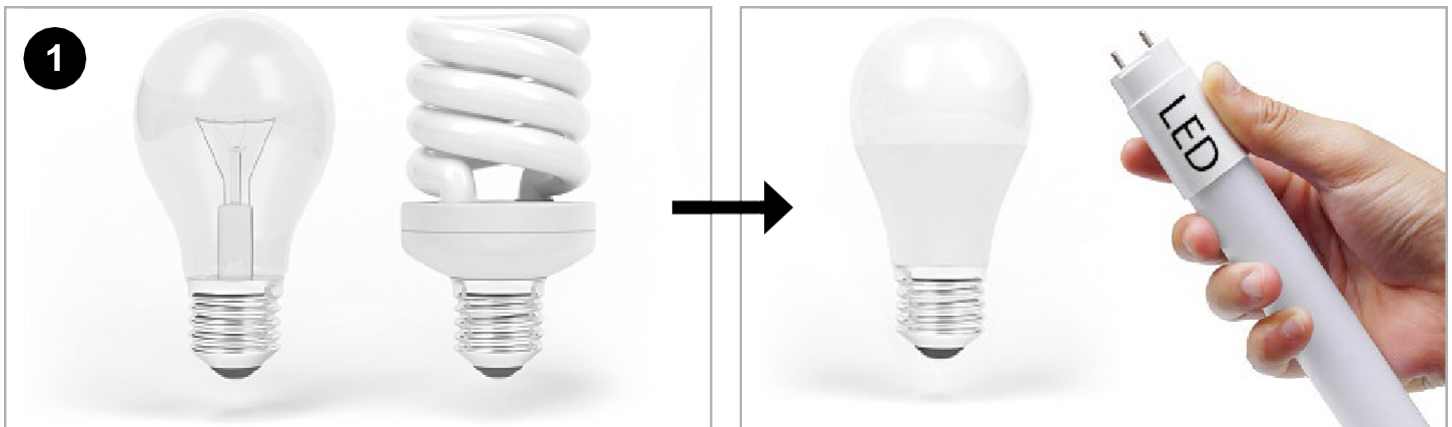
Install LED Bulbs

Island Grantee Job Aid

Aligns With Standard Work Specification 7.0103.1

Priority List Required:

Light Emitting Diode (LED) lighting replacement of all existing screw-based incandescent, halogen, compact fluorescent lighting, or pin-based fluorescent tube lighting used for a minimum of one hour per day.

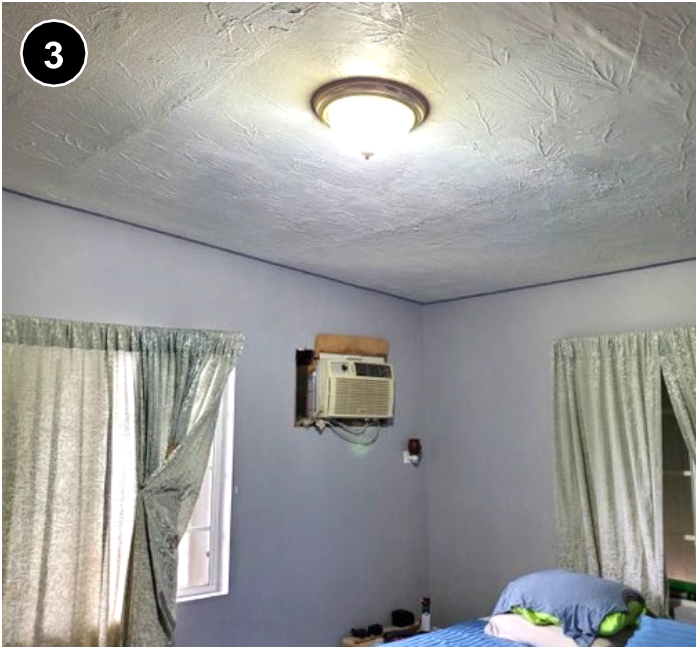


If used for a minimum of one hour per day, replace existing screw-based incandescent, halogen, or compact fluorescent or pin-based fluorescent lighting with ENERGY STAR® qualified or equivalent LED lighting.



New LED bulbs must be selected that are appropriate for the location (e.g., ok for damp locations, appliance-specific bulbs, dimmable if necessary) and provide lighting level quality (lumens and color temperature) required for the application. Double check the base or end connection pins to ensure the replacement bulb is a direct fit for the fixture. Ensure any bulbs are rated for no more than the rated wattage of the fixture. **7.0103.1a.**

Install LED Bulbs



Bedrooms and living areas will have 10-20 lumens per square foot and color temperatures between 2,200 and 3,000 K.



Bathrooms and kitchens will require 75-80 lumens per square foot and color temperatures between 2,700 and 5,000 K.

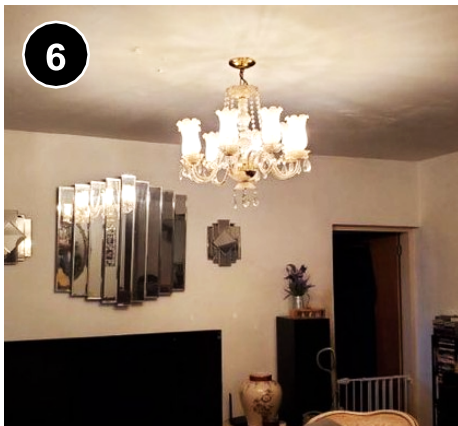


Turn off the light fixture and double check there are no safety issues such as frayed wiring or an improperly mounted fixture base. If necessary, use an appropriate ladder to safely reach the bulbs.



If necessary, clean the lens and reflector before installing a new bulb. [7.0103.1b.](#)

Install LED Bulbs



Turn the light on to ensure it works as intended.



Permanently remove the bulbs from the job site and recycle or dispose of in accordance with local and federal law. [7.0103.1d](#).



Provide the occupant/owner with the user's manual for the system, warranty information, installation instructions, and installer contact information. [7.0103.1e](#).



Checklist

Install LED Bulbs

DESIRED OUTCOME

Improved lighting efficacy without performance loss.

- ☐ Verify appropriate bulbs were used for the fixtures (wattage, dimmable, wet environment, lumens, color temperature).
- ☐ Verify number and type of bulbs match client file.

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Install Advanced Power Strips

Island Grantee Job Aid

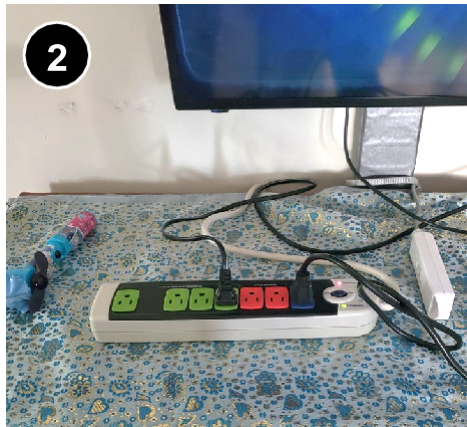
Aligns With Standard Work Specification 7.0102.1

Priority List Optional:

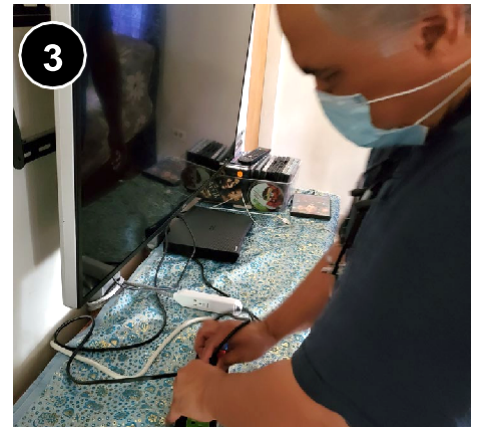
Advanced Power Strip (APS) devices are primarily designed to address both passive and active standby power targeted for home entertainment and PC (personal computer) environments. Devices must cost no more than \$75.00 to purchase and install.



Verify the electrical receptacle meets the requirements of **NFPA 70 Article 422** (Maximum breaker size for the circuit matches the breaker marking on the devices being plugged into the power strip). **7.0102.1a.**



Select up to 2 APS devices per home that consume less than 1W each, have a one-year warranty, provide warranty for connected devices, provide surge protection to 740 joules, be **UL 1449** and **1362** listed, be rated for 15 amps, and have a resettable circuit breaker. **7.0102.1b.**



Install equipment according to manufacturer specifications and applicable code. Enable all energy-saving features unless specifically directed otherwise by the occupant. **7.0102.1c.**

Install Advanced Power Strips



Master/peripheral load-sensing strips must have at least 3 connected device outlets and include adjustable sensitivity. These strips work by automatically turning off peripheral accessories when a primary device is turned off by the user. Direct-installed strips (those on timers or motion controls) must disconnect power to at least 2 controlled devices.



Turn on device(s) and ensure proper operation.



Provide occupants/owners with user's manual, warranty information, installation instructions, and installer contact information. [7.0102.1f](#).



Checklist

Install Advanced Power Strips

DESIRED OUTCOME

Decreased electricity consumption without reducing performance.

- ☐ Verify number and type of Advanced Power Strip (APS) devices meet WAP requirements.
- ☐ Verify APS is using an appropriate outlet (faceplate intact, maximum breaker for the circuit matches the breaker marking on the associated appliances).
- ☐ Verify function of APS.

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Install a Refrigerator

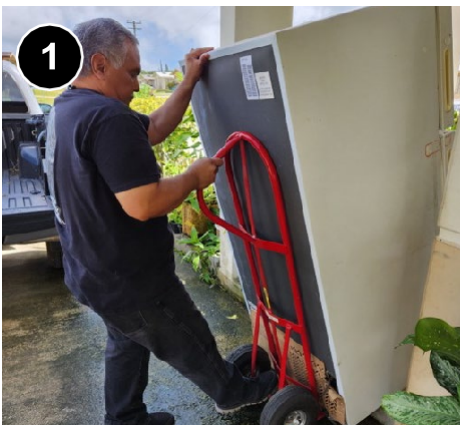
Island Grantee Job Aid

Aligns With Standard Work Specification 7.0101.1

Priority List Required:

Replace up to one refrigerator per home, with a label rating of less than 450kWh/yr and maximum installed cost of \$2,000 per unit when the existing refrigerator:

- Was manufactured before 2001, OR
- Uses >800 kWh/yr based upon energy use metering or industry accepted resource.



Unplug and remove the old refrigerator from the home, taking care to avoid damaging walls, floors, doorways, etc. Verify the electrical receptacle meets the requirements of **NFPA 70 Article 422** (Maximum breaker size for the circuit matches the breaker marking on the appliance).



The old appliance must be permanently removed from the job site and recycled or disposed of in accordance with local and federal law. Remove doors if necessary. **7.0101.1e.**



Double check the new refrigerator to ensure the following: it is **ENERGY STAR®** qualified, equivalent, or better, and it has a minimum one-year warranty that provides a replacement appliance if repeated issues relating to health, safety, or performance occur. The new appliance should roughly be the same volume as the appliance being replaced. **7.0101.1b.**

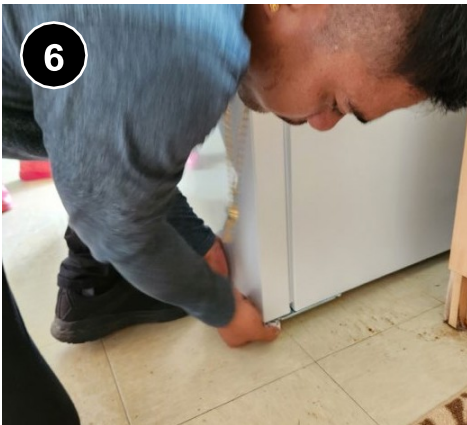
Install a Refrigerator



Clean the floor area where the new refrigerator will be placed. Measure to ensure the refrigerator will not block access to light switches, cabinets, etc., and will fit through the smallest opening between the outside and the installation location. **7.0101.1b.**



Move the new refrigerator into place and install appliance according to manufacturer specifications and applicable code. If a water line is present, connect the line to the new refrigerator being careful not to damage the line or fittings. Turn the water on and check for leaks. At this time, you may also need to install handles and shelving per manufacturer instructions. **7.0101.1c.**



Use a level to check for level left to right. It's best to use the frame of the refrigerator itself. Adjust the refrigerator feet if necessary. Ensure the appliance does not reduce required maneuvering clearances in the kitchen to less than those permitted by local, state, or federal guidelines. **7.0101.1d.**



Now check for level front to back, again using the frame of the refrigerator. You will want the unit to lean slightly to the rear, so the door gently closes on its own. Adjust the feet if necessary.



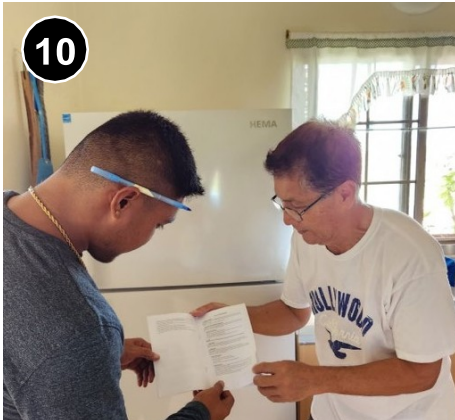
Install a Refrigerator



If the refrigerator was transported upright, wait 1 hour before plugging it in and turning it on. If the refrigerator was transported in an orientation other than upright, most manufacturers will recommend you let the oil in the compressor settle in its upright position for 4 hours before plugging it in and turning the unit on.



Plug the refrigerator in. Set the temperature controls to the manufacturer's recommended starting setting for safe food storage and energy efficiency to ensure proper operation.



Provide the occupant/owner with the user's manual for the system, warranty information, installation instructions, and installer contact information. [70101.1f](#).



Checklist

Install a Refrigerator

DESIRED OUTCOME

Safe, efficient, compliant, and accessible appliance

- ☐ Verify appliance meets ENERGY STAR or equivalent (name plate).
- ☐ Verify 1-year warranty in client file.
- ☐ Verify appliance is using an appropriate outlet (faceplate intact, maximum breaker for the circuit matches the breaker marking on the appliance).
- ☐ Verify appliance is level without rocking and operating correctly without leaks.
- ☐ Verify doors open appropriately and no part of the unit blocks light switches, cabinets, etc.

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Install an AC (Mini-Split)

Island Grantee Job Aid

Aligns With Standard Work Specification 5.0108.3

Priority List Optional:

Path 1: Replace existing window/room air conditioners larger than 12,000 btu and manufactured before 2014, or with an EER of 9.7 or lower with a new ductless mini-split rated for a minimum SEER of 19 of the same or lesser capacity.

Path 2: Replace existing ductless air conditioners (i.e., room air conditioners or mini-splits) manufactured before 2014, or with an EER or 10.1 (11.5 SEER) or lower with a new ductless mini-split rated for a minimum SEER of 19 of the same or lesser capacity.



Disconnect the old unit and permanently remove it from the site, disposing of it properly per federal and local regulations.



Double check the specifications of the new unit to be installed. Prior to installation, ensure refrigerant line total length will not exceed manufacturer specifications. Refer to Standard Work Specification [5.0108.3](#).



Install an AC (Mini-Split)



Locate the indoor unit in an area that allows effective airflow to the desired location, maintaining clearances in accordance with manufacturer specifications. A best practice is to locate the unit approximately 6-7' off the ground and with reasonable room from the ceiling, free from obstructions in front of it and on the return side. [5.0108.3f](#).



Securely fasten the mounting bracket to the wall, level, using appropriate anchors. The bracket must be installed following manufacturer specifications and in accordance with applicable building codes. [5.0108.3g](#).



Drill hole(s) for control wires and the condensate and refrigerant lines (preferably one, but multiple if necessary).



Securely mount the indoor unit according to manufacturer specifications, pushing lines through the hole you drilled, ensuring the condensate drainage is properly sloped. [5.0108.3h](#).

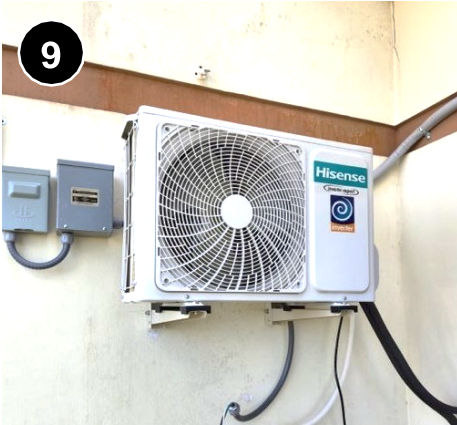


If used, install wall mounted thermostats that are not within the direct airflow of the indoor unit. [5.0108.3n](#).

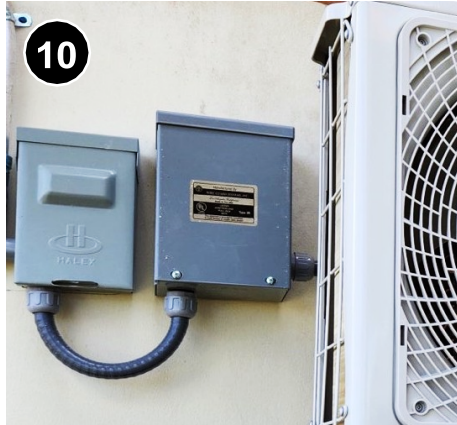


Locate the outdoor unit with manufacturer recommended clearance on all sides and to allow service access according to applicable code. [5.0108.3c](#). Also take care to ensure the total length of refrigerant piping will not exceed system manufacturer specifications. [5.0108.3n](#).

Install an AC (Mini-Split)



Situate the outdoor unit on a non-wicking equipment pad or stand, ensuring it is level, plumb, stable, and elevated above any potential flooding or drainage level. [5.0108.3d.](#)



Connect wiring on the inside and outside units according to manufacturer specifications. Wires from the system must run to an electrical disconnect within sight of the outdoor unit. Best practice includes installing a surge protection device at the disconnect. All high voltage wiring must be within protective conduit and approved junction boxes. No wiring connections (high or low voltage) will occur outside of an appropriate junction box. [5.0108.3j.](#)

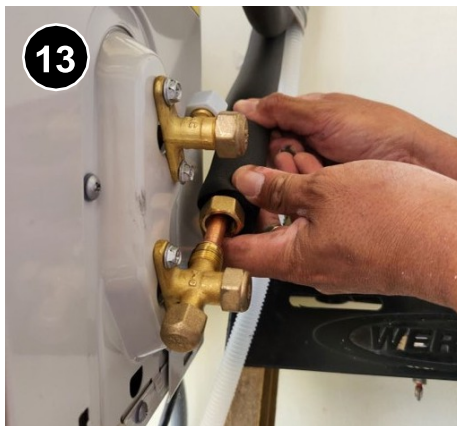


Install refrigerant lines ensuring there are no kinks, crimps, or excessive bends. Join all lines using manufacturer-approved methods. [5.0103.1c.](#)

NOTE: Install P-traps on suction line risers that are greater than 10' in height.



Ensure outdoor unit is installed according to manufacturer specifications and applicable building code [5.0108.3e.](#)



Insulate all suction lines to a minimum of R-4 with a Class II or better vapor-retarding insulation. Seal all insulation seams and joints with compatible material. All exterior insulation must be rated against UV degradation or protected from UV with another material. [5.0103.1d.](#)



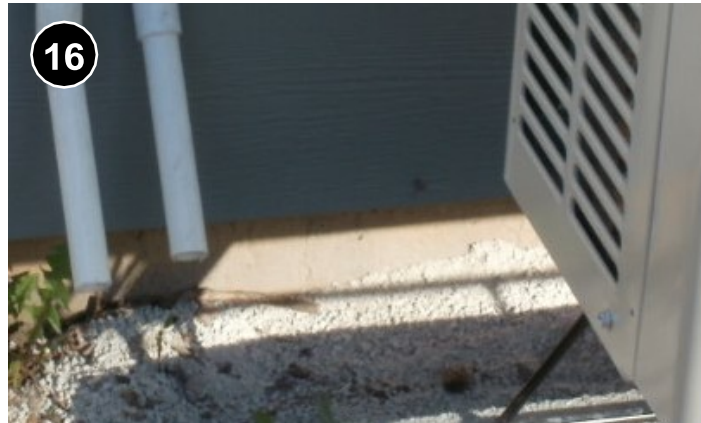
Secure and support refrigerant lines according to applicable code and in a manner that protects the lines from damage by workers or occupants. [5.0103.1e.](#)

If lines are installed where they may be damaged, install a rigid sleeve or pipe duct over them to provide adequate impact protection. [5.0103.1f.](#)

Install an AC (Mini-Split)



Repair all holes and damage caused by refrigerant and condensate lines passing through the building. Use appropriate materials from Appendix A that are both durable and aesthetically similar to the client's home.



Ensure condensate can flow from the cooling unit to the exterior of the building. [5.0102.1a.](#)

The condensate line termination must be directed downwards and away from the foundation of the building [5.0102.1i.](#)



At this point, an electrician will need to make the final electrical connections and a trained technician will purge the system with nitrogen to check for leaks, remove nitrogen and moisture from the system and open the outdoor valves to release refrigerant into the system.



Install locking caps on all refrigerant access ports. [5.0103.1g.](#)

Install an AC (Mini-Split)



Test the system to ensure proper operation.



Provide the occupant/owner with the user's manual for the system, warranty information, installation instructions, and installer contact information. [50108.3q](#).



Checklist

Install an AC (Mini-Split)

DESIRED OUTCOME

Safe, compliant, efficient, and effective system installation in which sequence of operation is correct.

- ☐ Verify a SEER of 19 or higher on the name plate.
- ☐ Verify indoor unit is securely mounted with appropriate fasteners in an appropriate location, level, and all supply/exhaust vents are unobstructed.
- ☐ Verify thermostat (if present) is not within direct airflow of the unit.
- ☐ Verify outdoor unit is securely mounted, plumb and stable, elevated above flood potential, and has clearance on all sides for maintenance.
- ☐ Verify refrigerant lines have no visible kinks, crimps, or other damage.
- ☐ Verify the presence and operability of a dedicated electrical disconnect within sight of the outdoor unit.
- ☐ Verify all suction lines are insulated with a minimum of R-4 insulation and joints/seams all sealed with independent means.
- ☐ Verify presence of P-traps on suction lines over 10' in height.
- ☐ Verify the presence of rigid protection around pipes in any areas where damage from humans or vehicles may occur.
- ☐ Verify the presence of locking caps on refrigerant access ports.

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Install AC (Window)

Island Grantee Job Aid

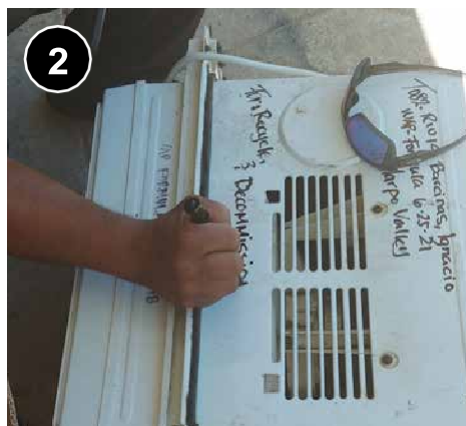
Aligns With Standard Work Specification 5.0301.1

Priority List Optional:

Replace existing window air conditioners manufactured before 2014, or with an EER of 9.7 or lower, with a minimum of 12 CEER or higher unit of the same or lesser capacity.

1	ENERGY STAR CERTIFIED Room Air Conditioners
Midea : 1010451315	
Specifications	
ENERGY STAR Unique ID:	2740429
Brand Name:	Midea
Model Number:	1010451315
Type:	Window
Casement Window:	None
Annual Energy Use (kWh/yr):	636.0
Combined Energy Efficiency Ratio (CEER):	16.0
Percent Less Energy Use than US Federal Standard:	47
Cooling Capacity (Btu/hr):	8000
Voltage (volts):	115
Product Class:	3. Without reverse cycle, with louvered side

Double check the name plate of the new AC unit to ensure the new unit meets the requirements of the program. The new unit must match existing voltage and have a CEER of 12 or higher of the same or lesser capacity (when compared to the unit it is replacing). **5.0301.1b.**

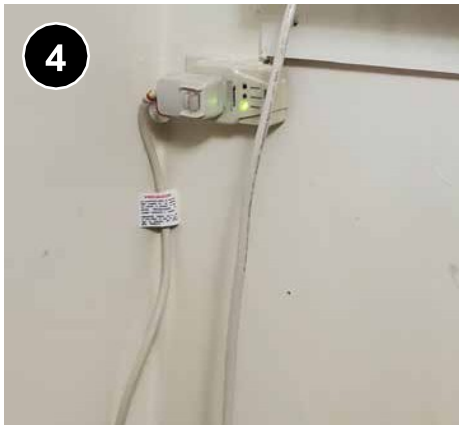


Permanently remove the old unit from the job site, taking care not to damage the wall, window, or other parts of the home. Recycle or dispose of the unit and refrigerant in accordance with local and federal law. Permanently decommission old equipment. **5.0301.1f.**



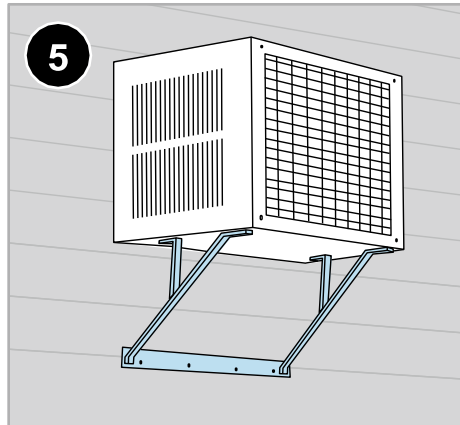
Remove the new AC until from its packaging and ensure the physical size will fit in the window. **50301.1a.**

Install AC (Window)



Ensure the supplied electrical cord is of sufficient length to reach the nearest outlet that meets the requirements of **NFPA 70 Article 422** (Maximum breaker size for the circuit matches the breaker marking on the appliance). If the cord does not reach, proceed with one of the following options, based on the recommendation of the auditor and available funds:

- a. Relocate the AC unit so the cord can reach the nearest outlet.
 - b. Install a new outlet that meets the requirements of the appliance within reach of the cord.
- Note: This action will require H&S, IRM or other braided funds.*



Install the mounting bracket or frame and dry-fit the unit with the help of another individual. Ensure that once the unit is mounted (according to manufacturer's instructions) it will be stable, secure, and not pose a risk to occupant safety. **5.0301.1d.**

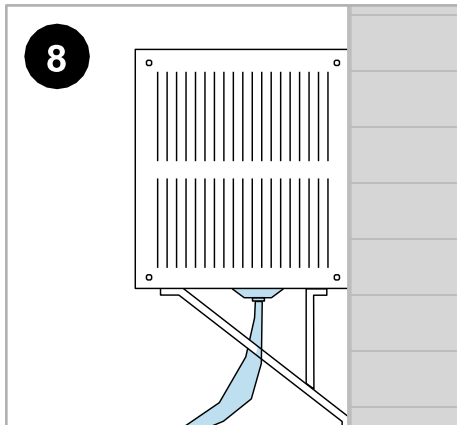


Mount the unit, leveling from left to right, keeping the unit's mounting surface flush with the inner surface of the mounting bracket, frame, or window as per manufacturer instructions. Ensure the unit's condensate drain is at the lowest possible point, sloped away from the unit and the building.

Install AC (Window)



Use manufacturer-supplied side extensions and/or suitable materials to seal around the top, bottom and sides of the unit. [5.0301.1e.](#)



Attach the drain hose (if supplied) to the outside of the air conditioner. Ensure condensate drains away from the building and any other items that may be damaged.



Plug the new unit in and ensure it operates properly.



Provide the occupant/owner with the user's manual for the system, warranty information, installation instructions, and installer contact information. [5.0301.1g.](#)



Checklist

Install AC (Window)

DESIRED OUTCOME

Efficient, safe, and compliant room conditioning.

- ☐ Verify unit is 12 CEER or higher on name plate and of equal or lesser capacity to old unit.
- ☐ Verify unit is stable/safe, level left to right, and tilted slightly to the outside.
- ☐ Verify unit is sealed around its perimeter with appropriate materials.
- ☐ Verify unit vents are not blocked.
- ☐ Verify supplied cord reaches the nearest outlet without an extension cord.
- ☐ Verify unit operates appropriately (cycle through options).
- ☐ Verify condensate drips outside the home as intended.

ACKNOWLEDGEMENTS

Developed for the U.S. Department of Energy by Simonson Management Services (SMS) under contract #89243422FEE400259, with input from Weatherization trainers and providers throughout the country and the generous assistance of Catkins Solutions, Guam Energy Office, National Renewable Energy Laboratory, Richard Heath & Associates, and WxTV.





Install an AC (Through Wall)

Island Grantee Job Aid

Aligns With Standard Work Specification 5.0301.1

Priority List Optional:

Replace existing through wall air conditioners manufactured before 2014, or with an EER of 9.7 or lower, with a minimum of 12 CEER or higher unit of the same or lesser capacity.

1

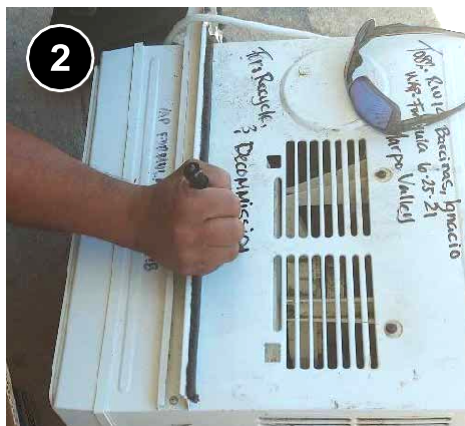
ENERGY STAR CERTIFIED
Room Air Conditioners

Midea : 1010451315

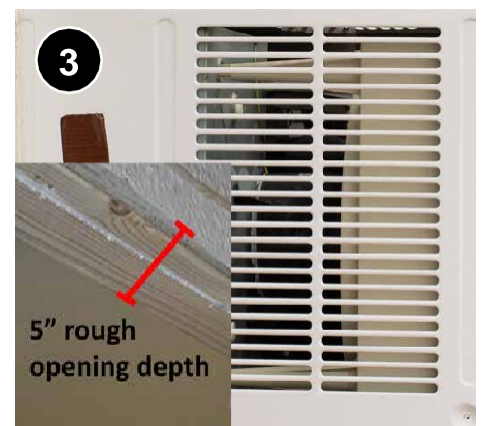
Specifications

ENERGY STAR Unique ID:	2740429
Brand Name:	Midea
Model Number:	1010451315
Type:	Window
Casement Window:	None
Annual Energy Use (kWh/yr):	935.0
Combined Energy Efficiency Ratio (CEER):	18.0
Percent Less Energy Use than US Federal Standard:	47
Cooling Capacity (Btu/hr):	8000
Voltage (volts):	115
Product Class:	3. Without reverse cycle, with louvered side

Double check the name plate of the new unit to ensure the new unit meets the requirements of the program. The new unit must match existing voltage and have a CEER of 12 or higher of the same or lesser capacity (when compared to the unit it is replacing). **5.0301.1b.**



Permanently remove the old unit from the job site, taking care not to damage the wall, window, or other parts of the home. Recycle or dispose of the unit and refrigerant in accordance with local and federal law. Permanently decommission old equipment. **5.0301.1f.**



Measure the thickness from inside wall surface to the outside covering of the home. The wall thickness must not exceed the non-vented portion of the AC unit mounting assembly or unit itself (i.e., when installed, AC vents must not be blocked in any way).

Install an AC (Through Wall)

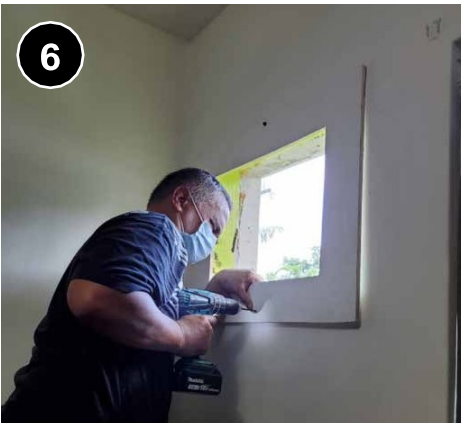


Remove the new AC unit from its packaging and ensure the physical size will fit in the current hole without blocking vents. **5.0301.1a.**



Ensure the supplied electrical cord is of sufficient length to reach the nearest outlet that meets the requirements of **NFPA 70 Article 422** (Maximum breaker size for the circuit matches or exceeds the breaker marking on the appliance). It is not allowable to plug the unit into an extension cord. Therefore, if the cord does not reach, proceed with one of the following options, based on the recommendation of the auditor and available funds:

- a. Relocate the AC unit so the cord can reach the nearest outlet.
- b. Install a new outlet that meets the requirements of the appliance within reach of the cord. *Note: This action will require H&S, IRM or other braided funds.*



Install the mounting bracket or frame and dry-fit the unit with the help of another individual. Ensure that once the unit is mounted (according to manufacturer's instructions) it will be stable, secure, and not pose a risk to occupant safety. **5.0301.1d.**

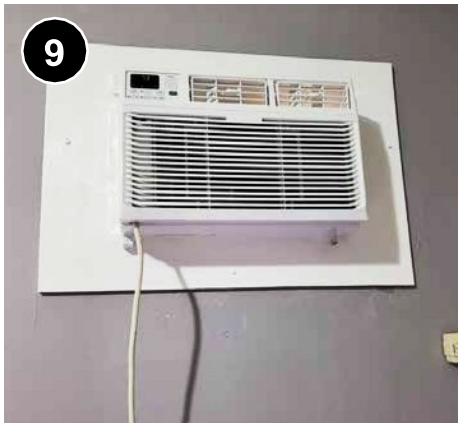


Before installing through-wall unit, seal all adjacent framing and provide a sealed and sleeved opening. After installation, seal the perimeter with suitable materials. **5.0301.1e.**

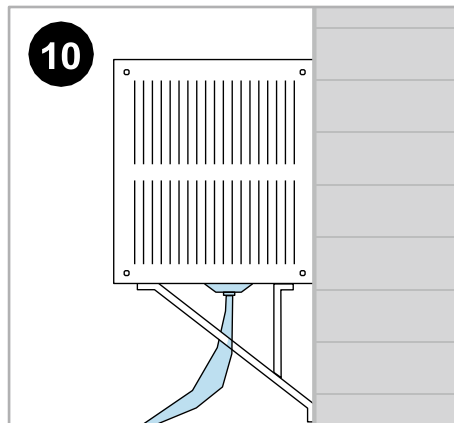


Mount the unit, leveling from left to right, keeping the unit's mounting surface flush with the inner surface of the mounting bracket, frame, or wall surface as per manufacturer instructions. Ensure the unit's condensate drain is at the lowest possible point, sloped away from the unit and the building.

Install an AC (Through Wall)



Seal the perimeter with suitable materials. Repair any excess holes in the wall opening with appropriate materials so it is aesthetically pleasing and sealed. [5.0301.1e](#).



Attach the drain hose (if supplied) to the outside of the air conditioner. Ensure condensate drains away from the building and any other items that may be damaged.



Plug the new unit in and ensure it operates properly.



Provide the occupant/owner with the user's manual for the system, warranty information, installation instructions, and installer contact information. [5.0301.1g](#).



Checklist

Install an AC (Through Wall)

DESIRED OUTCOME

Efficient, safe, and compliant room conditioning.

- ☐ Verify unit is 12 CEER or higher on name plate and of equal or lesser capacity to old unit.
- ☐ Verify unit is stable/safe, level left to right, and tilted slightly to the outside.
- ☐ Verify unit is sealed around its perimeter with appropriate materials.
- ☐ Verify unit vents are not blocked.
- ☐ Verify supplied cord reaches the nearest outlet without an extension cord.
- ☐ Verify unit operates appropriately.
- ☐ Verify condensate drips outside the home as intended.

ACKNOWLEDGEMENTS

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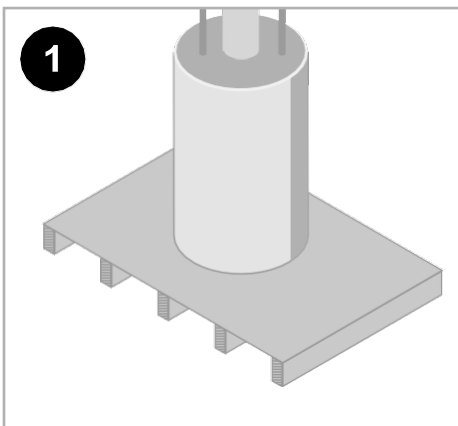
Install a Water Heater (Heat Pump)

Island Grantee Job Aid

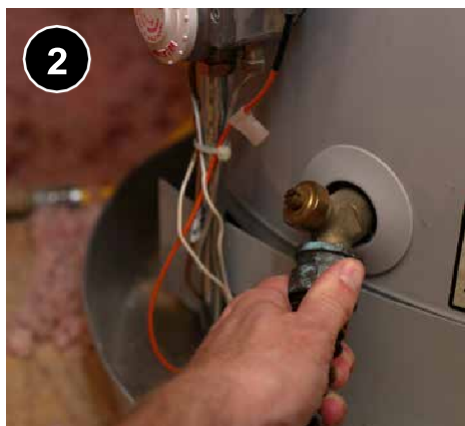
Aligns With Standard Work Specification 7.0302.3

Priority List Optional:

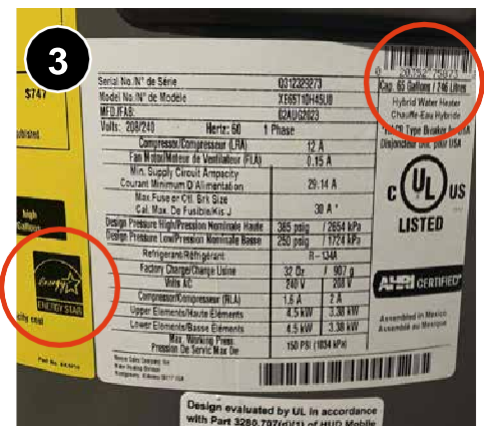
Use the DOE-approved Water Heater Savings Calculator (i.e., *Guam's Domestic Water Heater Decision Tool*) to determine allowable cost and Savings to Investment Ratio (SIR) for replacing the existing system with either a hybrid heat pump water heater (HPWH) or solar water heater. The replacement system showing the highest SIR must be installed.



Ensure the floor can support the additional weight of the HPWH and that plumbing is adequate and leak-free. [7.0302.3a.](#)



Turn off water to the old unit, drain, and permanently remove it from the job site and recycle or dispose of it in accordance with local and federal law. [7.0302.3m.](#)



Select a new HPWH that is ENERGY STAR® certified, equivalent, or better and fits in the installation space with appropriate clearances and provides sufficient hot water for the home and occupants. [7.0302.3b.](#)

Install a Water Heater (Heat Pump)



Ensure the room meets requirements for the unit. Is there enough volume and clearance for airflow around the unit? Are the ceilings high enough? Is there adequate space to allow maintenance of the heat pump components, including removal and cleaning of the air filter? Ensure the unit will not blow directly on an indoor thermostat or occupants. [7.0302.3c.](#)



If the HPWH will be installed in or above conditioned space or in a location where water damage could occur, install a drain pan according to IRC requirements. Drain the pan to the exterior of the building. [7.0302.3g.](#)



Install the HPWH in compliance with applicable code and manufacturer specifications. If conflict exists between code and manufacturer specifications, apply the more restrictive requirement (e.g., seismic straps may be required in some areas). [7.0302.3d.](#)



Double check clearance in front of the unit's control side to allow at least 30" x 30" to allow for inspection, maintenance, and replacement of components. [7.0302.3e.](#)



Install a Temperature and Pressure (T&P) relief valve per IRC and manufacturer specifications. Pipe the valve to within 6" of the floor or drain pan, or directly to the outdoors in an observable location. Piping material must meet IRC requirements. [7.0302.3f.](#)



If not already present, install separate water cut-off valves for both hot- and cold-water lines. [7.0302.3h.](#)

Install a Water Heater (Heat Pump)



If the cold water supplying the HPWH passes through a check valve, **pressure reducing valve (PRV)**, or backflow preventer, install an expansion tank on the cold- water supply line at a point that is downstream of all those valves. Size the expansion tank in accordance with manufacturer specifications and applicable code. [7.0302.3i.](#)

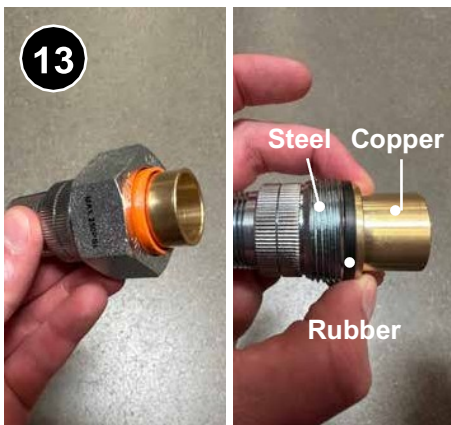


Support the expansion tank so that it does not move or sag using rigid support material that is able to support twice its weight when filled with water. [7.0303.5d.](#)



Image from RHA Job Aids for the Retrofit Installation of Heat Pump Water Heaters (10/23 California version)

Set the pressure in the expansion tank to match incoming water pressure. [7.0303.5e.](#)



Install dielectric unions when connecting copper to galvanized steel piping in accordance with IRC and manufacturer specifications. [7.0302.3j.](#)



If not provided by the manufacturer, install heat traps on the inlet and outlet piping. [7.0302.3k.](#)



Set the discharge temperature to 120°F. [7.0302.3l.](#)

Install a Water Heater (Heat Pump)



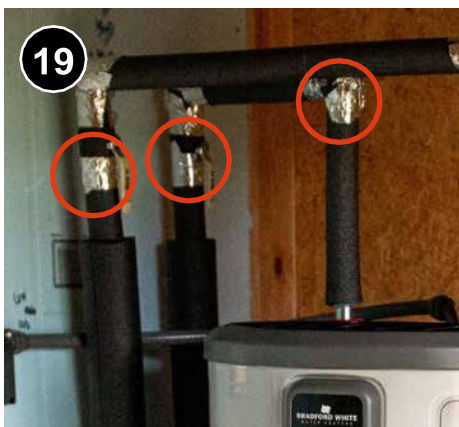
If the HPWH is hardwired, a certified electrician will need to make the final electrical connections.



Turn water back on and ensure there are no leaks.



On all accessible pipes carrying hot water, install pipe insulation of R-3 or better that is a vapor retarder and sized for the correct diameter of the pipes. [7.0301.1b.](#)



Seal all insulation seams, joints, and connections with tape, tie straps, or other independent means. [7.0301.1c.](#)

Turn the unit on and ensure proper operation.



Provide the occupant/owner with the user's manual for the system, warranty information, installation instructions, and installer contact information. [7.0302.3n.](#)



Checklist

Install a Water Heater (Heat Pump)

DESIRED OUTCOME

Adequate hot water supplied by a leak-free, safe, durable, efficient, and accessible water heater.

- ☐ Verify room requirements (ceiling height, volume, appropriate support for unit).
- ☐ Verify drain pan if present (if in area where water damage may occur) and plumbed to the outside of the building.
- ☐ Verify shut-offs on hot and cold water.
- ☐ Verify presence of T&P valve.
- ☐ Verify appropriate installation of expansion tank (if required).
- ☐ Verify a minimum of 30" x 30" maintenance area in front of unit.
- ☐ Verify presence of heat traps on inlet and outlet piping.
- ☐ Verify all hot-water pipes are insulated to a minimum of R-3 and seams/joints sealed with independent means.
- ☐ Verify temp set at 120°F.

ACKNOWLEDGEMENTS

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Install a Solar Water Heater

Island Grantee Job Aid

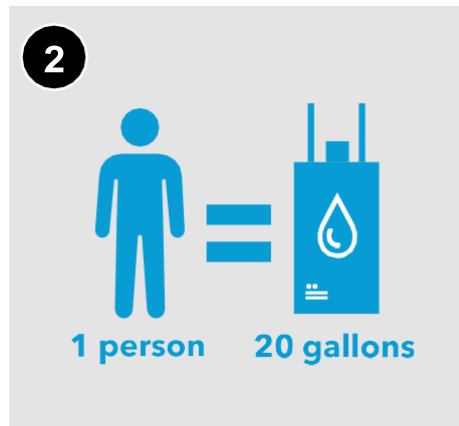
Aligns With Standard Work Specification 7.0302.6

Priority List Optional:

Use the DOE-approved Water Heater Savings Calculator (i.e., *Guam's Domestic Water Heater Decision Tool*) to determine allowable cost and SIRs for replacing the existing system with either a hybrid heat pump water heater or solar water heater. The replacement system showing the highest SIR must be installed.



Verify the plumbing infrastructure is leak-free and sufficient to support a solar hot water installation. If mounting the solar collector on the roof, verify the roof will adequately support the installation (dead load and wind load) and that the roof has more than 10 years of useful life remaining. Consider using **Weatherization Readiness Funds (WRF)** if this is not the case. [7.0302.6a.](#)



Installations must be sized according to the US DOE approved "*Guam Domestic Water Heater Decision Tool*," which uses a 20 gal/ person standard.



Locate solar collectors to minimize shading and maximize solar gain without interfering with other appliance operations (e.g., chimneys, vents, and exhaust terminations). [7.0302.6c.](#)

Install a Solar Water Heater



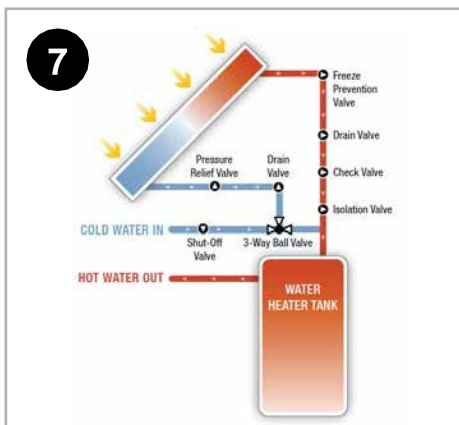
Install the solar collector in compliance with applicable code and manufacturer specifications. If conflict exists between code and manufacturer specifications, apply the more restrictive requirement. [7.0302.6d](#).



Select a storage tank/backup water heater that is ENERGY STAR® certified, equivalent, or better; fits in the installation space with required clearances; provides sufficient hot water for the home and occupants; and is insulated to R-12.5 or greater. [7.0302.6b](#).



If the storage tank will be installed in or above conditioned space or in a location where water damage could occur, install a drain pan according to IRC requirements. Drain the pan to the exterior of the building. [7.0302.6g](#).



Install the storage tank in compliance with applicable code and manufacturer specifications. If conflict exists between code and manufacturer specifications, apply the more restrictive requirement (e.g., seismic straps may be required in some areas). [7.0302.6d](#).



Double check clearance in front of the storage tank to allow for inspection, maintenance, and replacement of components (including replacement of the anode rod). [7.0302.6e](#).



Install a Temperature and Pressure (T&P) relief valve per IRC and manufacturer specifications. Pipe the valve to within 6" of the floor or drain pan, or directly to the outdoors in an observable location. Piping material must meet IRC requirements. [7.0302.6h](#).

Install a Solar Water Heater



If not already present, install a separate water cut-off valve for each incoming water line at the storage tank, and between each additional component of the system (e.g., mixing valves, solar collector, additional storage tank). [7.0302.6k.](#)



If the cold-water supply passes through a check valve, pressure reducing valve (PRV), or backflow preventer, install an expansion tank on the cold-water supply line at a point that is downstream of all those valves. Size the expansion tank in accordance with manufacturer specifications and applicable code. [7.0302.6l.](#)

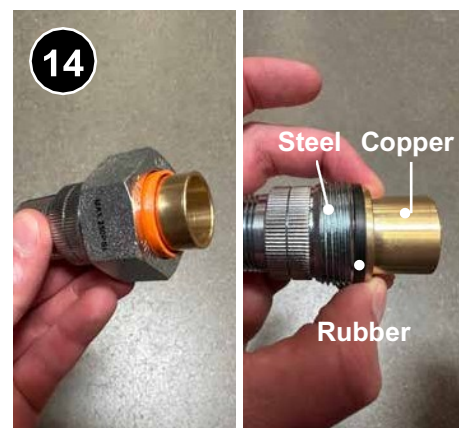


Support the expansion tank so that it does not move or sag using rigid support material that is able to support twice its weight when filled with water. [7.0303.5d.](#)



Image from RHA Job Aids for the Retrofit Installation of Heat Pump Water Heaters (10/23 California version)

Set the pressure in the expansion tank to match incoming water pressure. [7.0303.5e.](#)



Install dielectric unions when connecting copper to galvanized steel piping in accordance with IRC and manufacturer specifications. [7.0302.6i.](#)



If not provided by the manufacturer, install heat traps on the inlet and outlet piping. [7.0302.6j.](#)

Install a Solar Water Heater



Set the discharge temperature to 120°F. Install temperature-indicating device at the discharge outlet of the thermostatic mixing valve. [7.0302.6n](#).



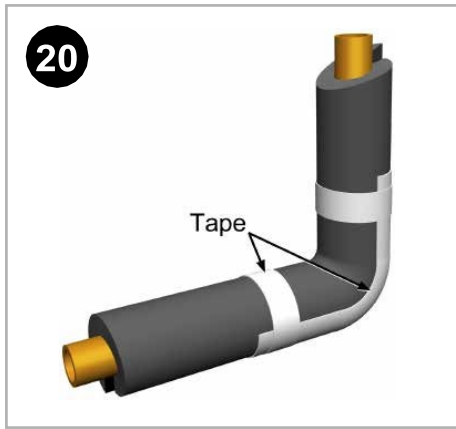
If the storage tank and/or other electrical devices are hardwired, a certified electrician will need to make the final electrical connections.



Turn water back on and ensure there are no leaks.



On all accessible pipes carrying hot water, install pipe insulation of R-3 or better that is a vapor retarder and sized for the correct diameter of the pipes. [7.0302.6m](#).



Seal all insulation seams, joints, and connections with tape, tie straps, or other independent means. [7.0301.1c](#).

Turn the system on and ensure proper operation.



Provide the occupant/owner with the user's manual for the system, warranty information, installation instructions, and installer contact information. [7.0302.6q](#).



Checklist

Install a Solar Water Heater

DESIRED OUTCOME

Adequate hot water supplied by a leak-free, safe, durable, efficient, and accessible water heater.

- ☐ Verify solar unit is leak-free and mounted solidly based on local code.
- ☐ Verify unit is sized to 20 gal/person.
- ☐ Verify drain pan if present for interior storage (if in area where water damage may occur) and plumbed to the outside of the building.
- ☐ Verify shut-offs on hot and cold water.
- ☐ Verify presence of T&P valve.
- ☐ Verify appropriate installation of expansion tank (if required).
- ☐ Verify adequate maintenance clearance surrounding all interior and exterior units.
- ☐ Verify presence of heat traps on inlet and outlet piping.
- ☐ Verify all hot-water pipes are insulated to a minimum of R-3 and seams/joints sealed with independent means.
- ☐ Verify temp set at 120°F.

ACKNOWLEDGEMENTS

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APPENDIX

SMOKE ALARM & CARBON MONOXIDE DETECTORS

How We Test Smoke and Carbon Monoxide Detectors

Each smoke and carbon monoxide detector that enters Consumer Reports' labs is rigorously tested to make sure these devices keep you and your family safe. For smoke detectors, we test their response time to both flaming fires and smoldering, smokey fires. We've found that not all detectors can adequately detect both fire types.

For carbon monoxide detectors, we test them against low CO levels (at 100 parts per million) and high CO levels (at 400 ppm). We also test the accuracy of their carbon monoxide measurements if they offer readings through a digital display or audio announcements.

Combination detectors go through both sets of tests, while smart detectors receive additional testing for their wireless connectivity and smartphone alerts. All of these test results are then folded into our comprehensive [smoke and carbon monoxide detector ratings](#).

Types of Smoke and Carbon Monoxide Detectors

You can find standalone smoke detectors and carbon monoxide detectors, as well as combination smoke and carbon monoxide detectors in smart and non-internet-connected forms. All three detector types offer standalone and interconnected varieties. Consumer Reports has yet to test a combination detector that is effective at detecting carbon monoxide, smoldering fires, and flaming fires, which is why we recommend consumers use a combination of detectors in their homes for complete protection.



Smoke Detectors

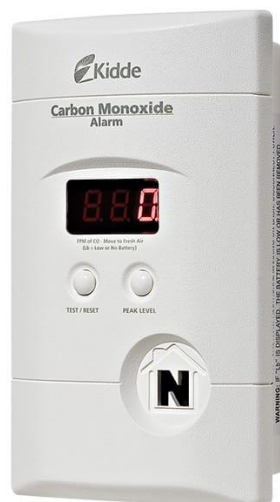
Fires burn differently: Some flare, some smolder. You'll find three types of smoke detectors on the market, but only one is effective against both types of fire.

Ionization Smoke Detectors are best at detecting the small particles typical of fast, flaming fires. But in our tests, all tested poorly for detecting smoky, smoldering fires. Ionization units are prone to false alarms from burnt food and steam, so don't mount them near a kitchen or bathroom.

Photoelectric Smoke Detectors are best at detecting the large particles typical of smoky, smoldering fires but poor at detecting fast, flaming fires. Photoelectric units are less prone to false alarms from burnt food, so they may be a better fit in kitchen areas.

Dual-Sensor Smoke Detectors combine ionization and photoelectric technology to detect both flaming and smoldering fires, offering you the best protection and saving you the hassle of installing two separate smoke detectors. But you may still need to install carbon monoxide detectors, if appropriate for your home.

[Smoke Detectors Ratings](#)



Carbon Monoxide Detectors

Carbon monoxide detectors use sensors to detect the presence of CO in your home. Some models include digital displays to show the level of CO they detect, and some can read out the CO level via audio messages. Remember, carbon monoxide detectors do not detect smoke or explosive gases, such as natural gas, propane, and methane.

Carbon Monoxide Detectors Ratings



Combination Smoke and Carbon Monoxide Detectors

Combination detectors incorporate ionization or photoelectric technologies and carbon monoxide detection to protect against both smoke and CO. Both conventional (not internet-connected) and "smart" models are available.

Smart detectors offer additional features through a companion smartphone app. Features include smartphone alerts about smoke/CO (even when you're not home) and low batteries, as well as the ability to hush alarms from your phone. Some models connect to the internet via WiFi, while others require an additional bridge or hub, which are standalone devices that connect smart home devices to the internet.

Consumer Reports has yet to test a combination detector with both ionization and photoelectric sensors that can capably detect CO, flaming fires, and smoldering fires. We tested one smart model that claims to have all three sensors, but it still failed our flaming fire test, which ionization sensors are designed to detect.

Our challenge to manufacturers: Produce a single device that successfully senses both kinds of fire as well as CO.

Where to Place Them Throughout Your Home

Smoke detectors are a must in all homes, and carbon monoxide detectors are needed for any home with fuel-burning appliances such as a furnace, water heater, range, cooktop, or grill. Even those living in all-electric homes should install carbon monoxide detectors, because CO can seep into the house from an attached garage or if a backup generator is used too close to your living quarters during a power outage.

You'll need smoke detectors that detect flaming and smoldering fires for each bedroom, with at least one detector installed on each floor, including in a finished attic and in the basement. You should also have a carbon monoxide detector on each living level, in the basement, and near (not inside) an attached garage.

Use the illustration below as a guide to where you need detectors and tally up the number of smoke and carbon monoxide detectors you need to buy. Keep in mind that your home might need more or fewer detectors depending on its size and number of rooms.

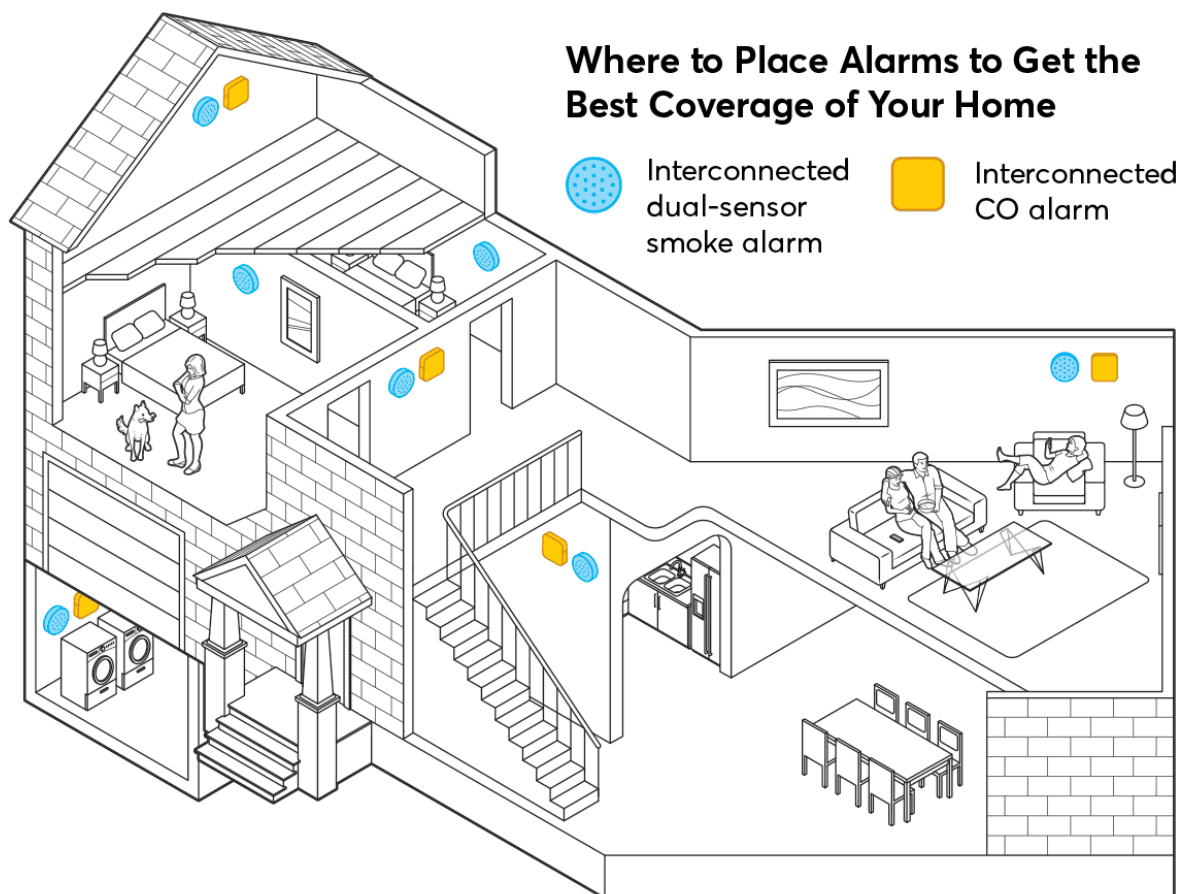


Illustration: Chris Philpot

[Smoke & Carbon Monoxide Detector Ratings](#)

How to Shop for Detectors

1. Check Local Regulations

Before you shop, check regulations in your area. Your town or state might have specific requirements (such as when you sell your home) about what you need, including types of detectors

and their placement. Also, some insurance companies offer a discount for homes with smoke detectors.

2. Pick a Power Source

Hard-wired smoke and carbon monoxide detectors tie into your home's wiring, which requires professional installation, and usually have backup batteries. Battery-only detectors are the simplest to install, and they work during a power failure. Some models use removable batteries that require annual replacement, while others use sealed lithium batteries that last the life of the detector. Plug-in detectors are also available, but electric outlets are typically located low on the wall, while the optimal placement for the detector is on or near the ceiling.

3. Smart or Not

Smart smoke and carbon monoxide detectors give you the advantage of knowing if something's wrong when you're not home, but they also come with a big price tag. We also haven't found a smart smoke and CO detector that successfully does it all. But if you do decide to outfit your home with them, we recommend also installing additional dual sensor smoke detectors. Smart detectors, whether hard-wired or battery-powered, will also interconnect with other detectors of the same model.

Another option is the [Roost Smart Battery](#), which replaces the nine-volt battery in smoke and CO detectors that use them. It adds WiFi, smartphone alerts, and in-app hushing (for battery-powered models only) to existing detectors. A third option is a smart listening device like the [Leeo Smart Alert](#) or [Kidde RemoteLync Smart Home Monitor](#), which listen for existing detectors' alarms and send you alerts when they go off.

4. Look for the UL Stamp

Check the detector packaging to make sure it meets the Underwriters Laboratories Standard—look for the UL label. You should also look for the date of manufacture printed on the back of the detectors. Devices lose their sensitivity over time, so the fresher, the better. As a rule of thumb, replace carbon monoxide detectors every five years and smoke detectors every 10 years.

UL has [also announced](#) updates to its standards, which will require all manufacturers to make smoke detectors that can distinguish between smoldering fires and cooking smoke by May 2020. And as part of UL's updated standard, it is expected that manufacturers will not be able to make "traditional, single sensor" (photoelectric or ionization) smoke detectors after May 2020.

5. The Truth About Interconnected Detectors

You can interconnect some smoke and carbon monoxide detectors so that all units in the house sound an alarm when any single one is triggered. Some newer homes may have wiring already in place to link the detectors. In a home without such wiring, you can buy detectors that interconnect

wirelessly. These interconnected smoke and carbon monoxide detectors are an important safety feature in a home with multiple levels, although standalone detectors may be adequate for a small, single-level home.

While interconnected alarms can make your home safer, they do have some limitations. In many cases interconnected alarms can only interconnect with models made by the same brand. In fact, the National Fire Protection Association's Senior Electrical Specialist Richard Roux told CR that you should always check with the manufacturer to see which specific models are compatible, even within the same brand, as some brands could change their interconnect system over time.

Despite the limitations, we still recommend using interconnected detectors. They can make your home much safer by alerting you to danger before the fire or CO spreads throughout your home. Roux adds that interconnected alarms (whether hardwired or wireless) are also becoming a requirement in many states when you try to sell your home.

6. Consider Voice Alerts

Children tend to sleep more deeply than adults and may not awaken to a conventional alarm. Some smoke and combination smoke and carbon monoxide detectors use a voice command, but it's not confirmed whether that's the most effective way to wake children. According to one study, a greater percentage of children ages 6 through 12 awoke to the sound of their mother's prerecorded voice than to a tone alarm.

7. Consider Your Security System

You can incorporate some smoke and carbon monoxide detectors into a system that sounds an alarm outside and inside the house. Such systems may also have a monitoring service that can notify the police or fire department, or even call your cell phone.

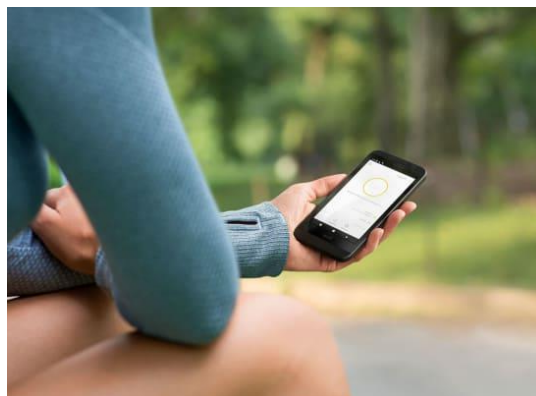
Features You'll Find

The latest smoke and carbon monoxide detectors have added features to better protect you and your family. Here's what to consider when tailoring the safest combination of detector options to your household's needs.



Battery Backup

A backup battery for hardwired smoke and carbon monoxide detectors offers security in case of a power failure. All battery-powered smoke and carbon monoxide detectors warn you when the battery is low. Some provide warning chirps, a low battery voice message, or a visual display.



Smartphone Alerts from Smart Detectors

Smart smoke and carbon monoxide detectors connect to smartphone apps that can alert you when detectors go off, even if you're not home. They will also let you know when batteries are running low so you can avoid pesky chirping.



Digital Carbon Monoxide Display

This feature displays carbon monoxide concentrations in parts per million, even when the concentrations are below the level that triggers the detector. Carbon monoxide detectors certified by UL must go off at no less than 70 ppm, but lower amounts may harm heart patients. The display can alert you if the carbon monoxide level is inching up or is higher than usual. Some also show the peak level since they were reset, warning you of any spikes that occurred while you were away. Expect to pay a little extra for this feature: \$5 or \$10 for standalone detectors, slightly more for smart detectors.



Hush Button

To silence a nuisance smoke detector, pressing a hush button is more convenient than disabling the unit, and it avoids the possibility of forgetting to turn it back on. All the smoke detectors we tested had this feature. Some carbon monoxide and combination CO/smoke detectors can work with a remote control to silence a nuisance alarm.



Safety and Strobe Lights

Some smoke detectors provide path illumination, a potential life-saver in the dark. There are also alarms with strobe lights, which are the best warning for the hearing impaired. Some smoke detectors have an integrated strobe light, and some accept add-on strobes.

Installation and Maintenance

Smoke and carbon monoxide detectors are only protective when installed correctly and if their batteries are replaced annually. Smoke rises, so mount smoke detectors on the ceiling or high on the wall. Test smoke and carbon monoxide detectors weekly and vacuum them monthly. Follow the manufacturer's recommendations regarding battery replacement. Replace carbon monoxide detectors every five years and smoke detectors every 10 years.

Brands

FIRST ALERT

First Alert owns the BRK branded units, and the ONELINK line of wireless, talking units. Products include plug-in, battery, hardwired, and hardwired with battery-backup units. First Alert also makes units that detect carbon monoxide and smoke as well as dual sensor units, which combine ionization and photoelectric technologies.

KIDDE

Kidde owns FireX branded units and offers the Nighthawk and Silhouette lines. Nighthawk comes in plug-in and battery operated units. The Silhouette line comes in hardwired units and features a sealed, self-charging lithium battery that lasts for the life of the unit. Kidde offers combo units, which have a smoke detector feature in addition to the carbon monoxide detector. Kidde also makes dual sensor units that use ionization and photoelectric technologies.

OTHER BRANDS

The main manufacturers of smoke detectors and CO alarms are First Alert and Kidde, representing three-quarters of the market. Other manufacturers include: Nest, Swann, Gentex, Firex, Code One, Honeywell, Universal S