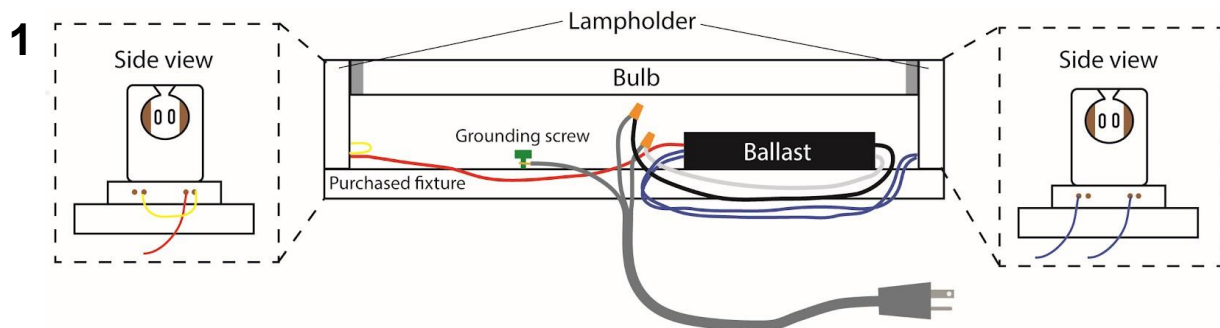


Use existing UVGI bulbs and fit a premade fixture

Rationale: Standard biosafety cabinet (BSC) UV bulbs are most commonly odd numbered lengths, such as 3 ft (91 cm) or 5 ft (152 cm). Standard striplight fixtures available in local hardware stores are even numbered lengths, such as 4 ft (122 cm) or 6 ft (183 cm). This protocol is designed for using existing UV bulbs from a BSC and retrofitting them into a striplight available at most hardware stores around the world. These fixtures can be wired to a Type B 3-prong appliance cord end that works in any standard 15A outlet in the US or as locally appropriate (e.g., Type C/E in France or Type G in UK for 230V and 50Hz supply). In this protocol we provide an easy to follow method to alter a larger sized fixture to fit smaller bulbs (Fig. 1). In the example images for North American systems, we are using 3 ft bulbs, and fit them to a 4 ft fixture (Fig. 1). Remember, this setup can be adapted to locally available strip light fixtures, cords and plugs, wire nuts or terminal blocks, and other components. Wire colors noted here are not the same in all countries. Please follow the advice of local electrical component experts in your region.



Safety Note: UV exposure can cause skin and eye damage. The light assembly should not be turned on unless all occupants have adequate eye protection and there is no exposed skin. We recommend that personnel leave the room during the decontamination cycle. If this is not possible, occupants must always wear personal protective equipment (PPE) including UV safety goggles, UV face shields, tightly woven clothes, and gloves.

Important Factors to Consider Before Decontaminating:

1) Higher UV required for higher humidity levels

- Important when considering condition of the mask—each mask should be allowed to dry so water vapor from breathing is not left on mask at the time of decontamination.
- Decontamination should not be conducted in a particularly humid environment, otherwise mask irradiation should be adjusted accordingly. [1]

2) UVGI is less effective at decontaminating mask straps

- Recommend additional decontamination using a disinfectant wipe on the straps, which is NOT an appropriate option for the filtering part of the mask. [2]

3) UVGI does not penetrate the interior of the mask [2]

- The recommended doses will only provide surface decontamination. This still presents major benefits to HCWs to prevent further spread of the virus between patients, and to themselves, and other HCWs.
- Higher UVGI doses can allow for deeper penetration, but the stability of the mask materials can degrade and the number of decontamination cycles possible will be reduced.

4) US CDC, NIOSH, and FDA currently do not recommend N95 decontamination [3]

- Decontamination during this unprecedented pandemic should be done carefully with the understanding that UVGI has not been firmly tested to rigorous standards, but could help stop the spread of the virus caused from re-donning a contaminated mask.



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Materials needed (Examples of products available in North America):

1. 32-Watt 2-Light White 4 ft. Fluorescent Strip Light (Home Depot, Internet # 305016128, Store SKU # 1003174551, [Fluorescent Strip Light](#))
2. 6 ft. 16/3 SPT-3 Appliance Replacement Cord, Grey (Home Depot, Internet # 100672804, Store SKU # 588547, [Appliance Replacement Cord](#)) *Plug Type varies by country
3. 3/8 in. Flexible Metal Conduit (FMC) Combination Clamp Connector (5-pack) (Home Depot, Internet # 100186543, Store SKU # 604070, [FMC Clamp Connector](#))
4. 14 in. UV cable tie – Black (100-pack) (Home Depot, Internet # 203531913, Store SKU # 295875, [UV Cable Tie](#))
5. Temflex 3/4 in. x 60 ft. 1700 Electrical Tape – Black (Home Depot, Internet # 310698741, Store SKU # 1004658377, [Electrical Tape](#))
6. 73B Orange WIRE-NUT Wire Connectors (100-pack) (Home Depot, Internet # 202894270, Store SKU # 621228, [Wire Nut](#)) *Terminal blocks used in some countries
7. UV Bulb(s) (Bulb obtained from local research institution or online store)
8. Aluminum foil (Any brand will work)
9. Pliers

Protocol:

NOTICE: After construction of the UVGI lamp assembly, UV-C output must be measured with the appropriate UV-C meter (attenuation $\lambda=254\text{nm}$) in order to determine the required decontamination/irradiation times. UV-C output should be measured at essential points in the mask decontamination area. Please refer to our website (<https://gleghornlab.com/uvgi-decontamination>) for specific details. Further questions or feedback can be submitted via query in our webform (<https://forms.gle/qmhKNax5eR15hMuC8>).

Step 1: Remove the fixture from the box and remove the cover (Fig. 2a-2c). In this guide, we are using a 4 ft fixture, but this could be applied to any fluorescent strip light assembly. Once the light assembly has been removed, remove the lampholder assembly (Fig. 3a-3c). This can be started at either end of the fixture as modifications will be made to both lampholder assemblies. Take note that there are hooks on the assembly within a track, these hooks will need to clear the tracks for the lampholder assembly to be removed. There are 4 total metal tabs on the lampholder assembly. One on either side toward the bottom as well as two tabs on the bottom of the lampholder assembly. Using pliers, push these metal tabs down so that they are flush with frame of the lampholder assembly (Fig. 4a-4d). Once the metal tabs are flush with the frame and edges are smooth, replace the lampholder into the fixture. This should be placed approximately 6 inches (15 cm) from the end of the fixture assembly. Repeat these steps for the other lampholder assembly.

Step 2: Once both lampholder assemblies have been modified, locate the round knockout piece in the light fixture that is near the ballast (Fig. 2c). Knockout this piece in the sidewall (Fig. 5a-5b). Remove the washer from the conduit clamp and place the clamp into the knockout hole (Fig. 6a-6e). Make sure that the conduit clamp is placed so that the set screws are on the outside part of the light fixture with the heads of the screws pointing upwards (Fig. 6c). Screw the washer from the conduit clamp back onto the clamp within the light fixture (Fig. 6d) to hold the conduit clamp in place.



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Step 3: In the US, a green grounding screw should be included with the light fixture (Fig. 7). In the center of the light fixture, next to the conduit clamp that was just mounted, there should be a screw hole and the letters GRND (Fig. 6e and 7). Place the green grounding screw into this slot and tighten about halfway through the grounding hole (Fig. 7). Take the appliance replacement cord and feed it through the conduit clamp so that the side with the three wires is inside the light fixture and the 3 prong part of the cable that will be plugged into a wall outlet is on the outside of the light fixture (Fig. 8a-c). The amount of exposed copper on these wires should be sufficient for making contact in this build, but wire cutters or strippers can be used to strip back the plastic sheath to expose more copper if necessary. The grounding wire should be either green or bare wire without plastic shielding, depending on the cord purchased (Fig. 8d). If using the cord listed in the materials, it will be green. Bend this cord so that the copper wire is around the green grounding screw (Fig. 8d). Tighten the green ground screw to secure this ground wire in place (Fig. 8e). **Note: 2-prong plugs would connect to the fixture by terminal blocks rather than a GRND screw. Wire colors in the cord/fixture may be different in your country.**

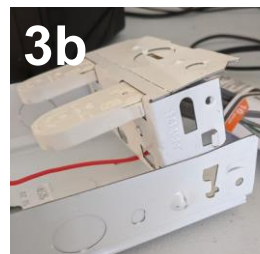
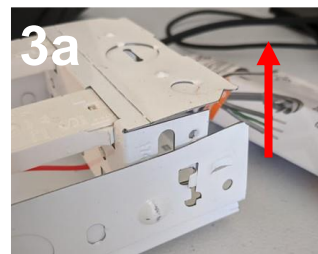
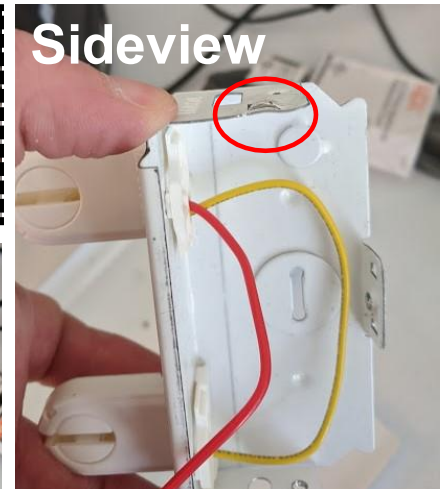
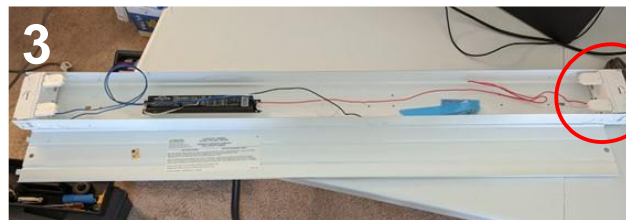
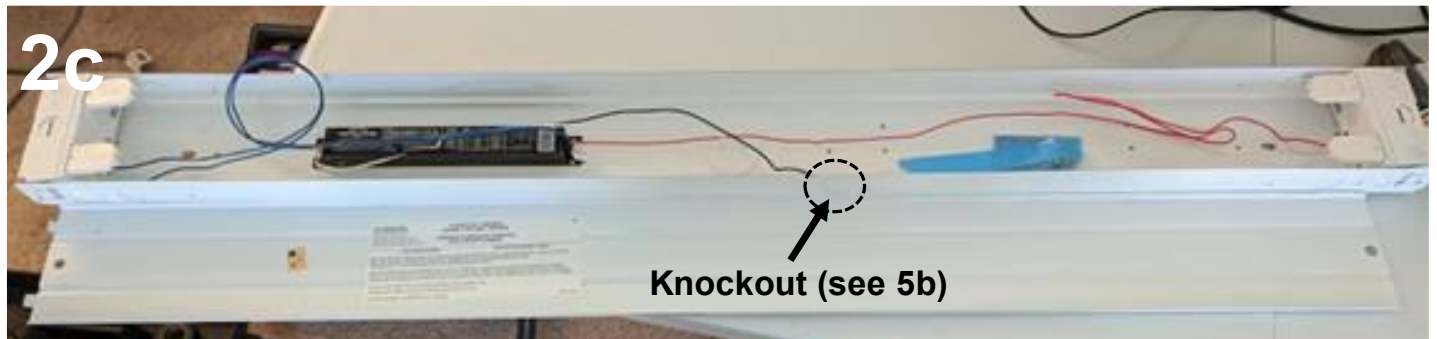
Step 4: Next, the live and neutral wires on the appliance replacement cord will be connected to the ballast. The ballast contains two wires: 1 white and 1 black (Fig. 2c). It does not matter which ballast wire (white or black) is connected to one of the remaining appliance replacement cord wires, as long as there is only one ballast wire connected to one appliance replacement cord wire. Bring one ballast wire and one cord end wire together so that the ends of the wires are pointing in the same direction (Fig. 9a). Twist on a wire nut in a clockwise direction until tight (Fig. 9b-9c). Wrap the base of both wire nuts with electrical tape so that there are no gaps between the wire nut and the exposed wire within it (Fig. 9d). Repeat these steps with the two remaining wires: one from the ballast and one from the replacement cord (Fig. 9e-9g).

Step 5: Grab your UV bulb to place into the light fixture. Each end of the UV bulb has 2 pins, which will slide into the lampholder assembly perpendicular to the fixture (Fig. 10a). Using the UV bulb length as a guide, bring the lampholder assembly pieces together to allow the bulb to be securely placed into each lampholder assembly without putting too much pressure on the bulb that it will break (Fig. 10b). Once this final position is obtained, use the zip ties to secure the lampholder assemblies in their new position (Fig. 10c-10e). Wrap the zip tie around the lampholder assembly and pull the zip tie tight to the light fixture in front of the bulb connector but under the bulb (Fig. 10d). Place a second zip tie behind the lampholder connector and pull that zip tie tight (Fig. 10e). Repeat this same zip tie securing for the other lampholder assembly (Fig. 10f). Once the lampholder assemblies have been secured, the bulb can be fastened into the fixture by rotating the bulb in 90 degrees either direction, locking it in place (Fig. 10g). If fitting two bulbs into this fixture, a second UV bulb can be placed next to this first one.

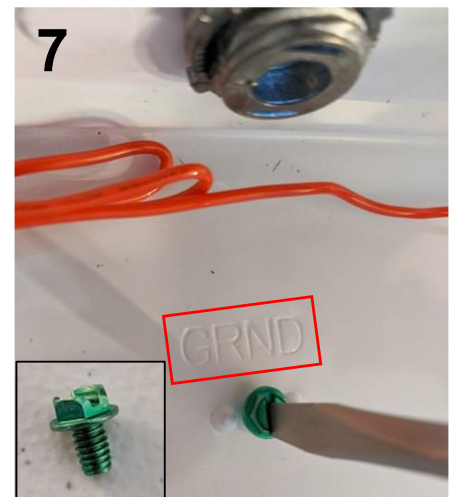
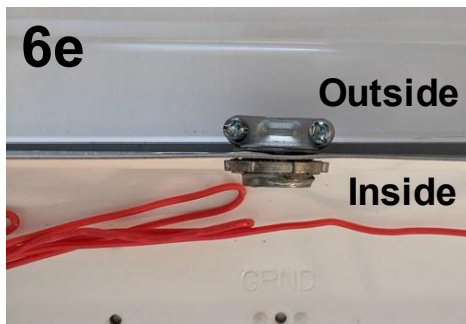
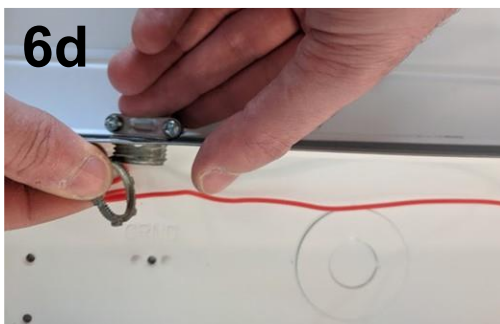
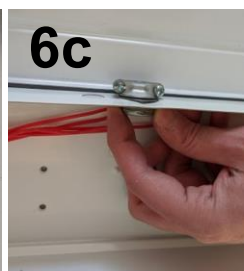
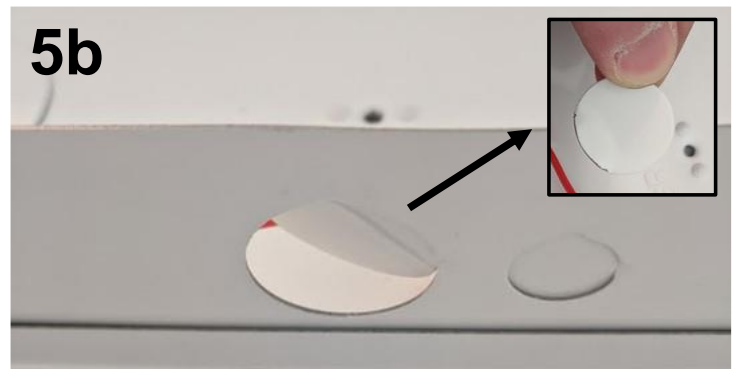
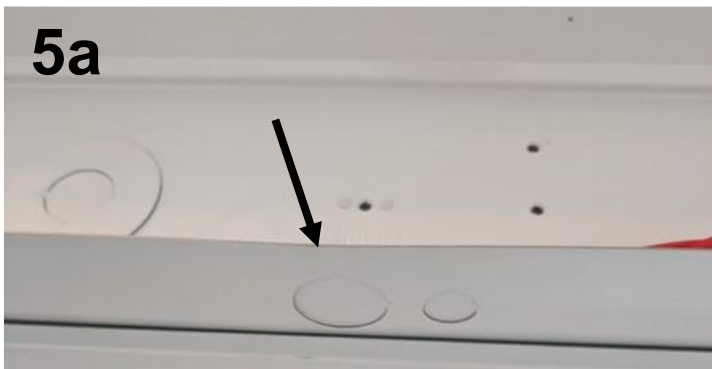
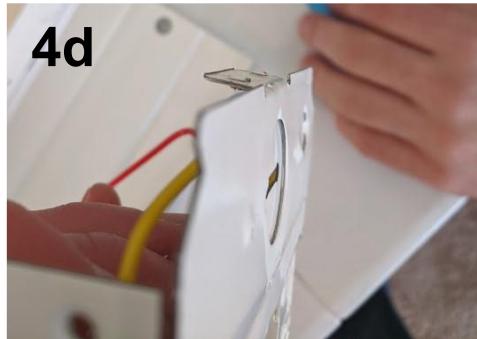
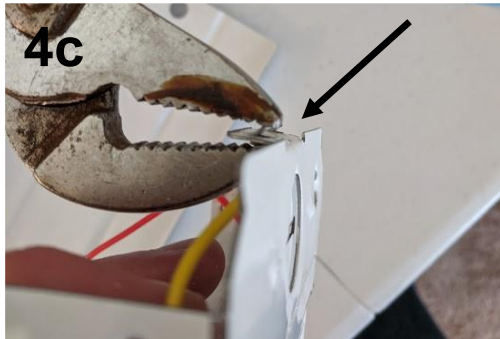
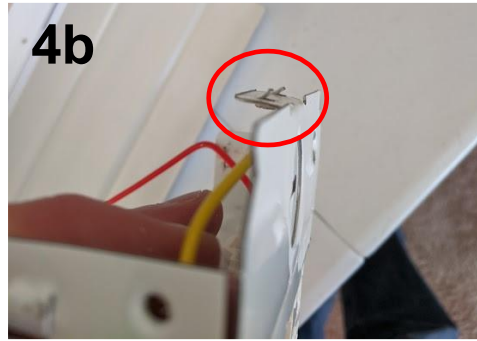
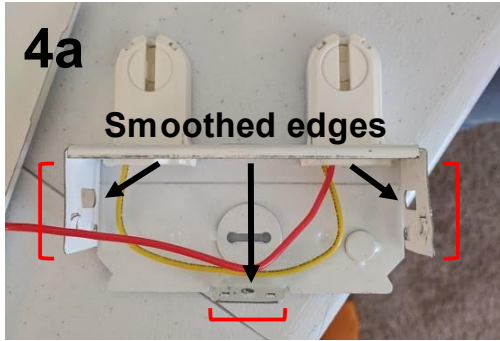
Step 6: Finally, the light fixture should be wrapped in aluminum foil to protect the electrical components from UV exposure while also providing a reflective surface. Tape sheets of aluminum foil so that the shiny side is facing the bulb (Fig. 11a-11b). To secure the appliance cord in the fixture, tighten the screws on the conduit clamp to hold the cord in place (Fig. 11c). Clean the UV bulb with a cloth to ensure it is free of any dust that might affect the UV output. The finished fixture should be placed in the decontamination location and secured as will be most useful for any one individual set-up, such as zip tying to an IV pole or table. The finished product can then be plugged in and tested for UV-C output using a UV-C meter ($\lambda=254\text{nm}$). Be sure to use UV safety while using this assembly to prevent unwanted UV exposure to personnel (Fig. 11d-11e).



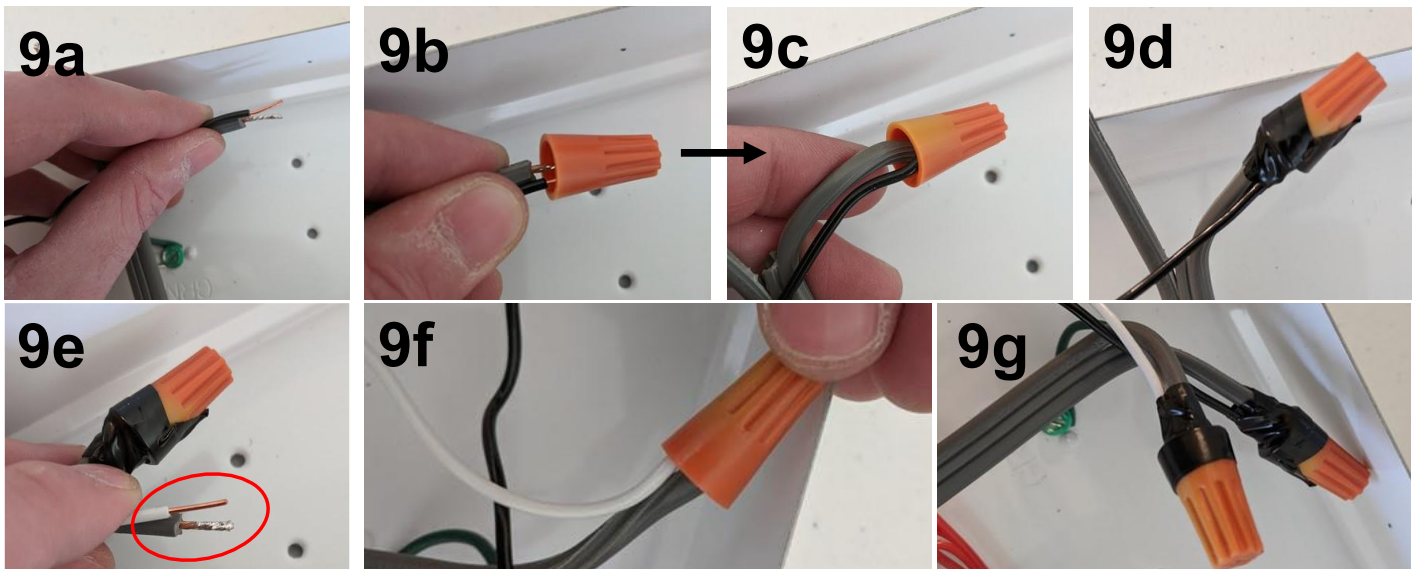
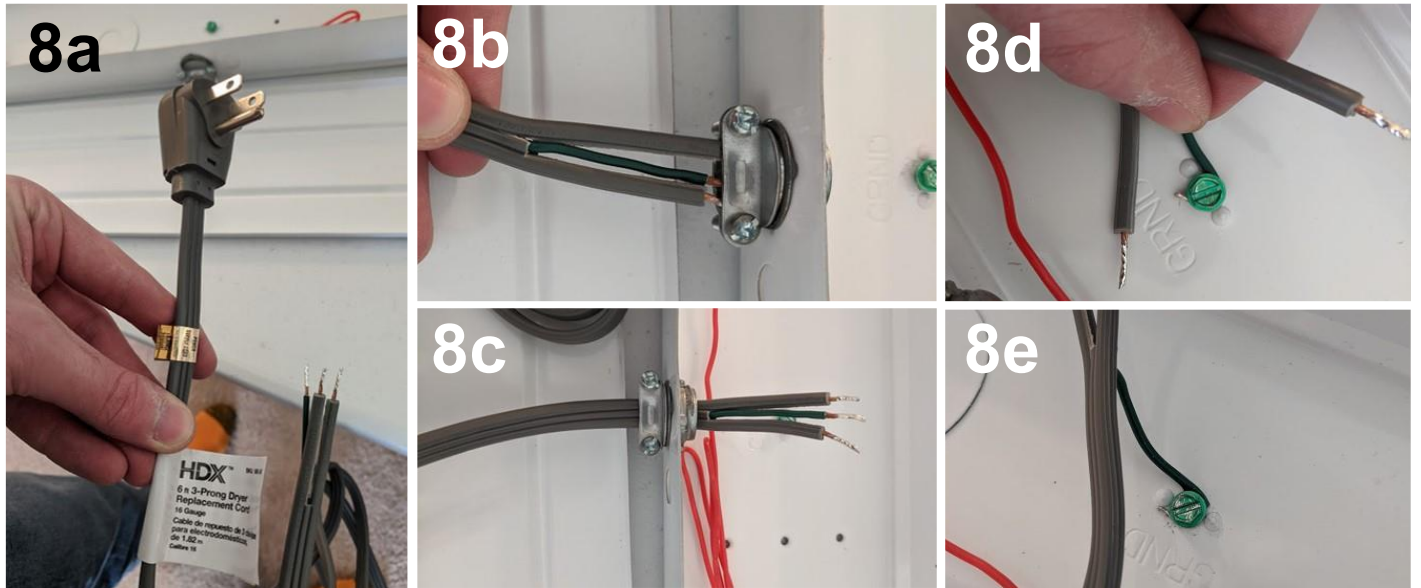
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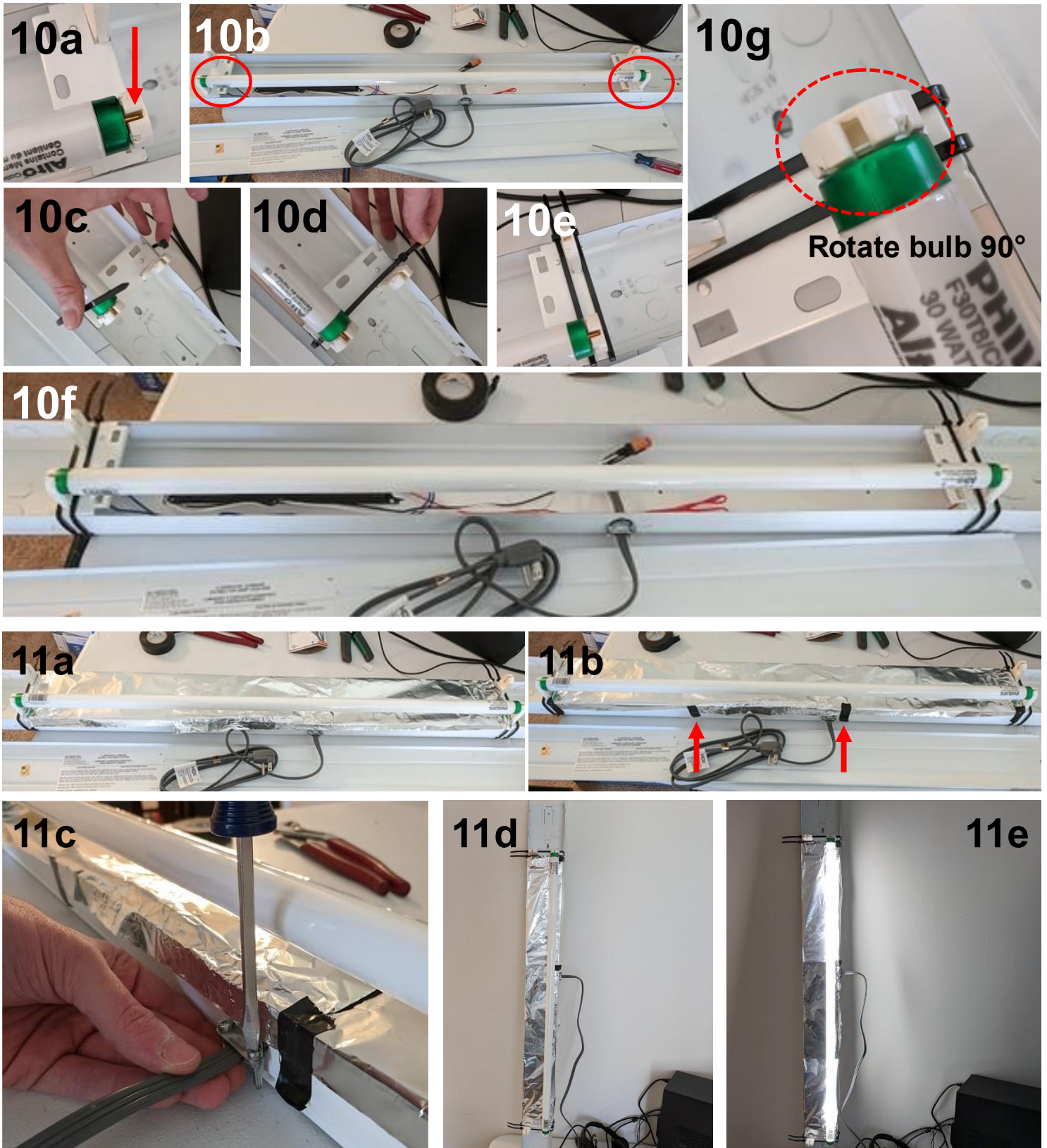
Use existing UVGI bulbs and fit a premade fixture



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**In this example set-up, a non-UV fluorescent bulb was used for demonstration.*