

# Solar Tracking Structure Design

By  
Hashem Bukhamsin, Angelo Edge,  
Roger Guiel, Dan Verne  
Team 18

## Operations Manual Document

*Submitted towards partial fulfillment of the requirements for  
Mechanical Engineering Design I – Fall 2013*



Department of Mechanical Engineering  
Northern Arizona University  
Flagstaff, AZ 86011

Table of Contents

**SAFETY** ..... 3

**ASSEMBLY**..... 4

**Small Scale**..... 5

**Large Scale** ..... 5

**OPERATION** ..... 6

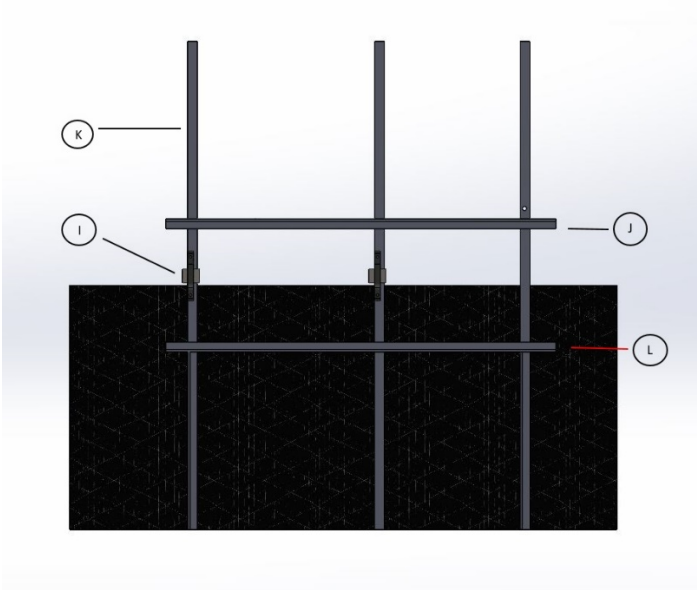
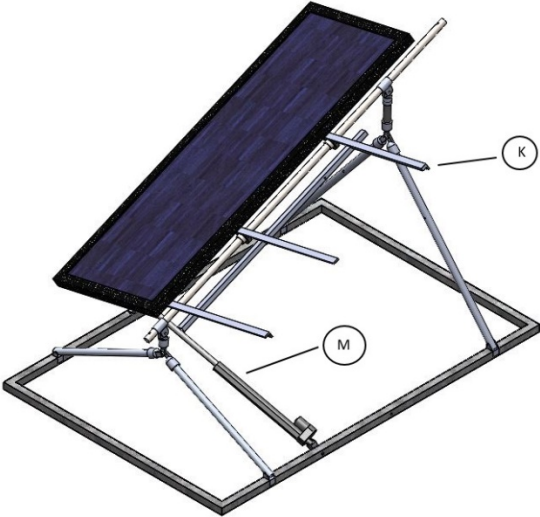
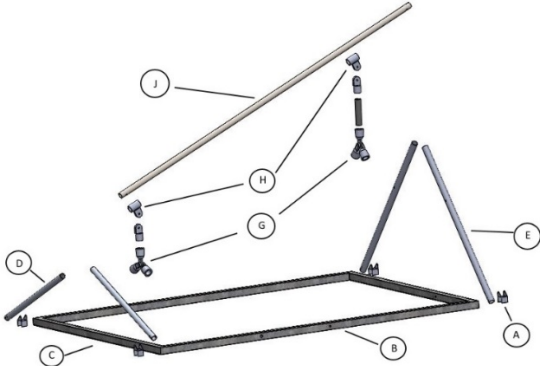
**MAINTENANCE**..... 6

## **SAFETY**

During assembly and maintenance, please be aware of the following:

- It is possible to pinch your fingers when lowering the assembly after swapping a PVC pipe. Use caution while changing the pipes.
- When handling the battery, do not come in contact with exposed leads when the system is operational.
- Sharp edges are located at the ends of the U-channel panel mounts. Use caution when working around them.

**ASSEMBLY**



## Small Scale

The following tools are needed to assemble the solar tracker:

- Allen wrench
  - 7/16 inch combination wrench
  - Socket wrench
1. Assemble the rectangular base as shown. Place one L bracket (Component A) on the end of each square tubing section (Component B) so that the vertical portion of the bracket is facing inward towards the remaining length of the square tube. Place the flat tie bar (Component C) on top of the L brackets, and secure using the 7/16 inch bolts and nuts.
  2. Use the remaining L brackets to secure the front and back support legs (Components D and E, respectively).
  3. Position the electrical box (Component F) by sliding the rings located on the box over the back support legs.
  4. Place the ends of the support legs into the support elbows (Component G). Secure using an allen wrench.
  5. Use the pre-cut PVC piping to connect the elbows to the adjustable T brackets (Component H). The shortest PVC section should be used for the front elbow. Use any of the remaining PVC sections for the back elbow. Fasten using an allen wrench.

Note: Each PVC pipe corresponds with a different North-South tracking angle. In order to maximize the amount of power generated by the panel, it is important to use the appropriate pipe. Pipe 1 is pre-cut for Spring in Flagstaff, Arizona. Pipe 2 is pre-cut for Spring in Las Cruces, New Mexico.

6. Place the pillow bearings (Component I) onto the primary shaft (Component J). Slide the primary shaft into the T brackets. Fasten using an allen wrench.
7. Connect the U-channel panel mounts (Component K) to the pillow bearings.
8. Connect the support shaft (Component L) to the U-channel mounts.
9. Mount the actuator (Component M) onto the square base, then connect the free end of the actuator to the bottom U-channel mount.
10. Mount the panel by aligning the holes on the panel frame with the holes on the U-channel mounts. If the panel does not have the required holes, drill through the frame to make them.

## Large Scale

1. Dig the holes needed to cement the vertical support bars (Component N). The suggested depth of each hole is 1 foot.
2. Place an adjustable T bracket on top of each vertical support bar.
3. Position the pillow bearing onto the primary shaft, then slide the shaft through the adjustable T brackets.
4. Connect the U-channel mounts to the pillow bearings, then connect the support bar to the U-channel mounts.

5. Connect the horizontal extender (Component N) to the rear vertical support bar, then connect the actuator to the extender.
6. Connect the free end of the actuator to the support bar.

## **OPERATION**

Press the “A” button on the electrical box in the morning. Suggested activation time is 7:00 AM. The system will continue to track the sun throughout the day and reset at sunset.

## **MAINTENANCE**

For the Solar Tracking Structure System, maintenance falls into three basic areas:

- In order to maximize the efficiency and power output of the system, the North-South PVC piping must be adjusted periodically. Once per month is suggested.
- Pillow bearing should be oiled at least once per year.
- The linear actuators should be inspected at least once every two years.