

**Technical Innovations
7851 Cessna Ave.
Gaithersburg, MD 20879**

Dome Rotation Problem Diagnosis

Introduction

This note is a detailed guide to diagnosing rotation problems in our products. Rotation problems are quite unusual but do occur. They may occur immediately after construction, or may show up later. The problems may be apparent in hand operation or in motor operation or in both. When faced with a problem, many users will apply lubricants or take other steps to fix the symptom. In general, this is not a good idea as it simply confuses the issues. Likewise, tweaking or tuning motor adjustments and the like should not be necessary: spring tensions or other adjustments are not critical.

We have found that the best thing to do is a step by step evaluation of the problem so that the cause(s) can be identified and fixed. This helps avoid jumping to conclusions, or fixing symptoms when it is more important to fix the cause. We strongly recommend that the evaluation be done using hand rotation –not motors-so that you can identify more accurately exactly what is going on.

Finally, please let us help you. Give us a call or send email so we can help you make your dome operate the way it should.

Initial Operation

After the initial construction, you might find that the dome does not turn easily, i.e., it turns easily at some points of the circle, and not at others, or it may turn in one direction and not the other. A systematic look will generally locate the problem.

First, check that all the blocks are removed, and that there is no foreign material (tape, wood scraps, etc.) between the DSR and the base ring. A bolt or nut under the DSR can make horrible noises at particular rotation points, and also resist rotation. Check that the DSR lip screws have been removed (or are not touching the base ring). Check that the rollers are all clean. Check that nothing is catching on a sharp edge (this will normally show up as a sudden stoppage of the rotation). If this is the case, find the offending spot and bevel or modify it. If you think the problem is under the DSR (e.g. a lost bolt), use the DSR Swingout to inspect the area (see below).

Later Operation — Problem Diagnosis

When faced with a rotation problem that occurs after you have used the dome for a while, you should try several different steps to identify the characteristics of the problem. In general, we recommend that you perform all the following tests, and that you keep notes of your findings (things can get very confused). After you have done all the tests, you will be in a good position to decide whether you have just one or a combination of problems, and what the proper solution(s) should be.

All the following tests assume that you have no motors, or that the motors are not engaged, and that the dome is being turned by hand. Although this is the best way to test rotation, one possible confusion can arise. With the motors down, in some domes there is then a large span between support rollers. In this case, the DSR may sag down and rub the top of a side roller bolt (which would not occur when the motor is pressing upwards). If this causes a major diagnostic problem, you may want to install temporary support rollers in the motor slots (off center is fine). We can supply additional rollers if you wish.

Outer DSR Clearance: Walk around the stationary dome on the outside, and slide your fingers up under the DSR. Or you may use a 1/8-inch thick piece of plastic or wood. You will probably find that at some areas, there is a lot of space between the DSR and the base ring (you can slide in your whole hand), while in other areas you can get your finger tips only a few inches up (space available is under 1/2 in.). You should always have at least 1/8 in. of clearance all the way up (except when you are at the side rollers, where you will hit the roller as it touches the inside of the DSR). Draw a simple map and show the relative spacing around the dome. Now turn the dome 90 degrees one way and repeat the measurement. If you turned the dome 90 to the right (from the outside), the dome should have shifted slightly off center to the right, thus creating more space to the right, and less to the left.

You will normally find that the dome is relatively tight over 90 — 120 degrees of arc, that is, the DSR is snug against the side rollers. If too tight (less than 1/8 inch), or if the side rollers do not project enough to hold the DSR away from the base ring, then the DSR will rub (you will find the scratches and dust as discussed below). The remainder of the dome (270 — 240 degrees) should have spare space.

If it is tight all the way around, your base ring is too big or the DSR is too small: at least one of these will have to be changed. This may require some dome disassembly. However, you can often make a patch by enlarging the DSR by moving DSR sections outward. You would remove the bolts in one DSR section, move it outward (cut caulk if necessary), re-drill and re-bolt. Then go on to the next DSR section. You may find that you do not need to do all four.

If the DSR is tight on opposite sides, the dome and/or base is out of round. You can tell which is which by successive 90-degree rotation of the dome, keeping track of the relative spacings. Again, if the problem is severe, you may need to rebuild your dome and base ring. However, as in the above case, you may be able to patch the problem by enlarging the DSR as in the above case.

Hand Rotation Test. Now go **INSIDE** the dome. Turn the dome by hand from the inside, walking all the way around in one direction, then in the other. Then repeat the test, but now pushing on the dome at a point opposite from your first test. This type of hand test is very stringent, as the hand force will tend to move the dome off center. Inside the dome, you can more easily listen to any noises that may help you diagnose the problem. Now answer the following questions

- Was the dome easy to turn? A six-foot dome should turn with two fingers, a ten-foot with an outstretched hand (not leaning into the motion, about 10lb), and a fifteen-foot dome with a strong hand (leaning into the motion, about 40lb to start, 30 to turn).
- Is the dome easy or hard to turn all the way around?
- When it is hard to turn, does it stop suddenly (i.e., something is hitting). Does it stop at exactly the same place each time? Or does it simply get harder to turn, then get easier after say, 90 degrees more rotation? When hard to turn, is there rubbing noise? Grinding noise?

Roller Freedom: As the dome turns, different rollers will pick up and carry the weight of the dome as it turns. In most installations, about 50-70% of the rollers will be in contact at any given position. To check that rollers are not binding, rotate the dome. Verify that at some point in the rotation every roller does turn. When each roller is engaged (i.e., carrying weight), slide paper or cardboard up behind the roller to verify that the "back" of the roller is not rubbing against the inner base ring wall. Keep track of your results. Of course, a few rollers might have been installed too low and will never engage (this usually causes no problems). If you find a roller that is binding against the inner wall of the base ring, you may find that its axle bolt simply needs to be tightened. If it still rubs, remove the roller and install a fender washer or other shim material behind the roller.

DSR Swing-out/Splice Plate. The dome will normally have a DSR Swingout or splice plate. If the dome is turned to some point and the Swingout is opened, you will be able to inspect the side roller, support roller, and condition of the parts under the DSR. Do not wipe off dust and dirt until you have evaluated the problem—dust can be a diagnostic tool! NEVER rotate the dome unless you have closed the Swingout, as the slot opening can expand and the dome will fall around the base.

You can use the Swingout to inspect a particular problem area (e.g., a suspected interference). You can also rotate the dome stepwise, opening the Swingout at each stop so as to inspect the entire circumference of the base ring. You would look for several things:

- Is the support roller clear, or is it close to rubbing the side of its hole? (enlarge the hole with a file)
- Is the support roller bolt tight? (tighten)
- Is the support roller likely rubbing against the inner base ring wall? (install a fender washer or other shim to move it inward and away from the wall)
- Is the side roller turning easily? If the side roller bolt is loose and cannot be properly adjusted, you may want to put a 1/4-20 nut underneath as a jam nut to prevent the bolt from turning.
- Does the side roller show substantial wear, i.e., its outer edge totally chewed up?
- Is there fiberglass dust on the side roller bolt head or is it scratched, indicating that the DSR may be scraping the bolt head? (support rollers nearby may be low, or you may want to grind the bolt, or you may want to remove that side roller)
- Are there blue scratches (from the inside of the DSR) on the upper edge of the base ring, indicating rubbing of the DSR on the base ring? (may want to move nearby side rollers outward 1/8 in to force DSR away from base ring)
- You will see grit from the underside of the DSR. This is walnut grit for traction, and some of it falls to the base ring. Although a bother, this causes very few rotation problems. Any grit at all remaining is sufficient for the motors, if used. Do not remove the loose grit until you are satisfied that you have obtained all your diagnostic information in the above steps.

Motor Operation

If the dome rotates properly using hand rotation, there is almost never a motor rotation problem. This is because hand rotation causes the dome to move off center, thus "testing" the side rollers and support system. When the motors are used, they apply symmetric rotation forces, thus making the dome easier for the motors to turn. The motors supplied have way more than sufficient force to turn the dome: if they fail to do so, something is definitely wrong. In general, the motors are very conservatively used. For example, the ten-foot will turn with only one motor

(two supplied), while the fifteen foot dome will turn with two or three (four supplied). If you have motor rotation problems, FIRST thoroughly check the operation by hand as described above.

We assume that the dome turns fine in both directions by hand, without binding. If the motors fail to turn the dome, check the following

- Does the motor easily slide up and down on its pivot bearing? If not, the pivot bearing bolt may be loose, the pivot itself may be too tight in the motor plate; the large washer holding the plate in place may be binding or too tight against the plate.
- Is there sufficient spring tension (if not, the motor will slip)? The motor must press upward hard against the DSR. The spring supplied can be used under full tension, if needed, on larger domes.
- Is there too much tension? On the six-foot dome, the motor spring may be sufficient to lift the DSR up against the underside of the reverse flange (especially when the open shutter passes over the motor). If this is the case, reduce the spring tension.
- Remove the motor drive from the wall of the dome for test. Being very careful of loose clothing and fingers, run the motor in each direction. Carefully load down the motor by gripping the driven rollers—it should be very hard to slow down. Check that the motor drive sprocket is clear and not pressing on the drive plate.
- You may suspect that DSR traction material (grit) has fallen off causing lack of traction. However, most domes will turn fine with NO traction material at all. Adding traction material without taking the dome apart is very difficult.