

## Camera Tests

Each time a cinematographer embarks on a production, there are a multitude of tests that need to be conducted. Many are designed to address specific questions about achieving the aesthetic objectives of the project. Some are designed to help build a common vocabulary between the cinematographer and director. The most basic tests are designed to determine the proper working order of the equipment to be used on the production.

Often, the creative tests a cinematographer designs are specific to the requirements of the production at hand, and so are customized to address unique visual concepts. In the professional arena, cinematographers conceive, design and execute the tests they need to answer the specific questions that arise in pre-production. But it usually falls to the camera assistant to properly test the equipment as part of his/her regular equipment check out. In the world of student film making, it is usually the cinematographer who conducts his/her own equipment tests.

Before any tests are shot, the first step in ensuring that your equipment is complete and in good working order is the camera equipment check out. When picking up your camera, be sure to completely assemble your camera system. Check to make sure that everything you asked for has been included in your order. By assembling your camera system, you will quickly discover if you are missing anything that you should have ordered, but inadvertently forgot.

### **Equipment check out:**

1. Check the equipment against the inventory to make sure every piece is there.
2. Check to make sure every piece is in working order.
3. Assemble equipment to make sure nothing is missing from your package.
4. Test the fluid or gear head you are using. Does it lock securely? Does it pan and tilt smoothly? Is it secure on your tripod? Are the legs solid?

Once you have confirmed that your camera order is complete and your visual inspection and assembly of the camera package indicates that everything appears to be working properly it is time to conduct more specific detailed tests of the equipment. Remember, these tests are to ensure that the equipment is indeed working properly. If you discover that there are problems with your equipment, then you must remedy the problems before proceeding with your production.

The most basic tests are:

1. scratch
2. registration
3. viewing system
4. light leak
5. shutter sync
6. lens tests (focus and aperture)

1. The **scratch test** is designed to test your camera's film path and magazines for any extreme wear or dirt, which might scratch either the emulsion or base of your film as it runs through the camera under normal operating conditions.

Conduct a scratch test for each magazine as part of your regular camera checkout procedure.

Use a dummy load (film that has been light struck). There is no need to use fresh film for this. Clean the magazine using a soft cloth or brush and compressed air. Load the film in the camera, use a sharpie (permanent marker) to draw a mark on the film in the gate, and run a few feet of film through the camera.

Remove the magazine and inspect the film from the take up reel in the light (hard back light is best for this). Look for scratches in the emulsion and on the base. If there are scratches, notice if they occur on both sides of the drawn mark or only after the mark. This will help you identify where in the camera the scratching is taking place. Carefully inspect the film path to see if there is something that could cause the scratches—maybe some dirt.

Carefully remove the dirt and using a new length of film, one that is not scratched, run a second test. After inspection, if you are confident that the problem has been solved, you can load the magazine with fresh unexposed negative.

During production, when you check the gate, to look for hair or dirt, also be sure to look to see if there are scratches on the film. Additionally, you will check for scratching each time you reload a magazine and as part of your typical gate check between each camera setup.

If you are shooting under extreme conditions such as in high winds, in the desert or at the beach, you will want to execute more thorough scratch tests during the course of production, always be sure to reload in a sheltered environment such as a vehicle.

2. The **registration test** is designed to indicate whether your film is being held firmly in place in the gate each time a frame is exposed. In order for this test to work, you need to secure your camera firmly on the tripod. Compose and shoot a full frame shot of a registration chart (usually a black lined grid on a white background). Then in a light proof environment, wind your film back and slightly adjust your frame. Then shoot the registration chart again.

The resulting image will be a double exposure of the registration chart. You may notice some weave in the projected image. This will present as the entire image moving lightly on the screen. But you are looking to see whether the two images of the registration chart move or weave independently of one another. If they do, you have a potential registration problem. If they move together, your movement is likely in the projector.

3. The **viewing system** of your camera may be slightly out of alignment with your gate. It is important to test this prior to shooting any of your principle photography, so you can have confidence that the images you compose will be the images that appear in your final film.

To test for this, set your camera on a tripod and aim it at a wall. The camera needs to be perpendicular to this wall for your test to be accurate. Use thin black paper tape (1/8") to mark the outside frame lines. Also use the tape to indicate the markings on your ground glass. Once you are satisfied that your tape markings exactly correspond to the image area and markings on your ground glass, expose 10-20 seconds of film.

When you screen this footage, you will be able to tell if the image that is centered in your viewfinder is centered on the screen. If it is not, you might want to look at the test on a different projector or look at the film directly on a light table with a magnifying loop, in order to rule out the possibility of a problem with the gate in the first projector. If there is a problem with the alignment of the viewfinder in relation to the gate in the camera, you should talk to your camera technician to find the best solution.

4. Testing for **light leaks** is about as basic as testing gets. Simply load some film into your camera, and without taping the magazines, expose 10 - 20 seconds of film.

By projecting either the processed negative or the print from the processed negative, you should be able to determine if there is a light leak. A leak will present as fogging or light streaking across the film.

Just as you should scratch test every magazine, you should test every magazine for a light leak.

Once you determine that your camera and magazines do not leak light, you should continue the practice of taping your magazines after loading them. Be careful not to catch tape in the door of the magazine which can cause a light leak and damage to the equipment.

This is a good professional practice in that it helps to ensure that you will not have a future light leak, it helps to keep dirt out of your magazine; and, using colored tape to indicate which emulsion is loaded is a fast and easy way to prevent errors on set.

5. **Shutter sync** tests are becoming more common. As you know, motion picture cameras are designed to expose film when the shutter opens and advance the film to the next unexposed frame when the shutter is closed. If the film is moving when the shutter is open, then the resulting image will be blurred and have streaking due to the film's movement in the gate while being exposed.

There are two simple tests you can conduct to determine if your shutter is in sync. First and most basic, take a short piece of film, and using a sharpie, draw a squiggly line down the emulsion side. Then thread the film into the film path, so that it will advance when manually controlled.

Without a lens on the camera, look through the lens port on the front of the camera body at the film in the gate. Turn the inching knob to advance the film forward along the film path. If the shutter is in sync, you should see the film, then the mirror comes into view, then another frame of film. If the shutter is out of sync, you will actually see the film move before the shutter is closed and the mirror is in place. If you see the film move, you will need to have the camera serviced.

A second test, which helps to test with the camera running at normal speed, is to create a high contrast situation, perhaps a bare light bulb against a black background. Compose your shot so the bulb is no more than 5% - 10% of the area of the frame, do not make it too large.

From your camera's position looking forward to the light bulb, if the shutter is rotating on its center so that the pivot point is on the right side of the gate, compose your shot so the bare bulb is on the same side of the frame. (as the image passes through the lens it is recorded on film upside down and backwards – on the other side of the frame where the shutter movement is most pronounced) This positioning will ensure that the bare bulb has the greatest chance of blurring due to an out of sync shutter.

Expose 10-20 seconds of film. When you screen this footage, if you see light streaking from the bulb usually in a downward direction, you are likely have a problem with your shutter sync.

6. There are many **lens tests** you can conduct. The most basic are for iris and focus. You want to make sure that your lenses are working properly before you embark on principle photography.

Begin with a visual inspection of each lens. Check the lens barrel and the witness marks to make sure that everything looks satisfactory. Next check the front and rear glass elements to make sure they are not scratched, cracked or dirty. If they are dirty, you can try blowing dust off them with an air syringe or a can of compressed air. If there are fingerprints, which there should not be, you can try a little lens cleaning solution on a lens cleaning tissue. Wipe gently in a circular motion. Then blow with air to remove any hairs or fibers.

Assuming that the exterior of your lenses check out, look through each lens at a bright background. Then turn the aperture ring to see the iris close and open. You want to be sure that the iris moves smoothly, and opens all the way.

Once you know that the mechanics of the lens are in order, test each lens carefully and methodically.

Lenses typically do not function as well when they are at either aperture extreme as they do when they are two stops from either end of their range. A lens that has a range of T1.3 to T16, will perform better at apertures between T2.8 and T8 than it will nearer its limits.

I recommend testing your lenses with their apertures set wide open if possible, so you can see the worst case scenario when viewing your focus tests.

### **Testing prime lenses for focus:**

Each test should be accurately and legibly slated for your convenience when viewing. As with all tests, you should try to avoid changing more than one variable from shot to shot, so you can know with certainty that the change you see is the result of one change you made. (Don't forget to focus your diopter first) (I would use a c-stand to position your slate clearly in each frame so you can refer to it easily as you view your tests.)

First, make sure your camera is secure in a fixed position that will not change for the duration of your tests.

Turn the focus ring on the lens once it is mounted on your camera. It should turn smoothly and evenly.

Set your aperture.

Focus on a focusing chart or registration chart. You can hold the chart in place with a c-stand.

Position the chart 30 feet from the camera. Light the chart to the appropriate level for your pre-selected aperture. Focus by eye (make sure your slate indicates this is an eye focus). Expose 10 feet of film. Adjust your lens to match the witness marks with the actual distance, and expose another 10 feet of film. (Make note on your slate). Move the chart to 20 feet, check the light and shoot the same two versions. (focusing by eye first, then by witness marks) Again at 10 feet. Again at 5 feet. Again at 3 feet. Again at 2 feet. Again at the minimum close focus distance for the particular lens. (each time you are checking eye focus against witness marks, re-lighting and re-slating)

Some wide angle lenses do not have witness marks at appropriate intervals. If you have a lens that jumps from 6 feet to infinity. You will want to create some of your own marks. You can do this with a piece of thin white paper tape and a fine line sharpie. Create marks for what you think will be 8 feet, 10ft, 15ft, 20ft, and 30ft. Then using a sharp pencil create a faint mark on either side of each of your markings. Then set your focusing chart the appropriate distance from the rear focal

plane and shoot three exposures for each distance setting, one on the near mark, one on your sharpie mark, and one on the far mark. When you view the tests, make note of which mark is most accurate for that distance. Carefully using another piece of thin paper tape, transfer the witness marks to your lens.

**Testing zoom (or variable focal length) lenses for focus:**

Each test should be accurately and legibly slated for your convenience when viewing. As with all tests, you should try to avoid changing more than one variable from shot to shot, so you can know with certainty that the change you see is the result of one change you made. (Don't forget to focus your diopter first) (I would use a c-stand to position your slate clearly in each frame so you can refer to it easily as you view your tests.)

Turn the focus ring on the lens once it is mounted on your camera. It should turn smoothly and evenly. Test adjusting the focal length, this adjustment should also move smoothly and evenly.

Before you shoot anything with a zoom lens, check the tracking. Looking through the camera, zoom in on an easily identifiable point and center your cross hairs on that point. Lock your camera in position. Now zoom out. The point selected should still be very close to the center of your composition. If it is not, your lens has either been adjusted for a different film format (ie. Super 16 or Super 35) or the tracking is simply off. If it is off, see your lens technician to remedy this situation.

Next, make sure your camera is secure in a fixed position that will not change for the duration of your tests.

Select your focal length. (you will want to test your lens at several focal lengths) Set your aperture.

Focus on a focusing chart or registration chart. You can hold the chart in place with a c-stand.

With your lens at its widest focal length, position the chart 30 feet from the camera. Light the chart to the appropriate level for your pre-selected aperture. Focus by eye (make sure your slate indicates this is an eye focus). Expose 10 feet of film. Adjust your lens to match the witness marks with the actual distance, and expose another 10 feet of film. (Make note on your slate). Move the chart to 20 feet, check the light and shoot the same two versions. Again at 10 feet. Again at 7 feet. Again at the minimum close focus distance for the particular lens. (each time you are checking eye focus against witness marks, re-lighting and re-slating)

Assuming you are using a Zeiss 10-100mm T2 zoom, test your lens at T2 for various focal lengths at the above prescribe distances. Recommended focal lengths for testing are: 10mm, 12mm, 16mm, 25mm, 50mm and 100mm.

**Testing your iris for consistent aperture:**

Earlier when visually inspecting your lenses you checked to see that the iris appeared to be working smoothly and properly. Before you begin principle photography, you should confirm this through a series of simple lens exposure tests.

In a controlled environment, light your test subject to a level consistent with a normal exposure for your film stock at your lenses widest aperture. Your subject should include a person, a white card, a black card and a gray card as well as a slate to identify the pertinent data.

If you are using prime lenses, expose 10 seconds of film with each lens, move the camera as necessary to maintain approximately the same image size (if possible). You should then re-light your subject to a level consistent with the aperture you think you are most likely to use throughout your film and shoot the same shot with each lens at the same aperture, again maintaining the same image size.

If you are using a zoom (variable focal length) lens, light your subject to a level consistent with a normal exposure for your film stock at your lenses widest aperture. Then beginning with the widest angle of view your lens allows, expose 10 seconds of film, then do the same for each of the following focal lengths: 12mm, 16mm, 25mm, 50mm, 100mm. (move the camera as necessary to maintain approximately the same image size)

You should then re-light your subject to a level consistent with the aperture you think you are most likely to use throughout your film and shoot the same shot with each focal length at the same aperture, again moving the camera to maintain the same image size.

This test should tell you whether your aperture settings are accurate and consistent from lens to lens or from focal length to focal length within the range of your variable focal length lens. (\*note: often zoom lenses “loose speed” as they zoom in to the longer end of the lens)

\*Once production is underway, if you are planning to add equipment on an as needed basis, you should plan to receive the equipment early enough so that you can test and view the results before using the equipment for your production.

**Checking your flange focal depth:**

Depth of focus is the range behind the lens that the imaging medium can be and still receive a sharp image. If the flange depth is not set properly, then the resulting images will be out of focus. In video applications, this is the same as the backfocus.

Depth of focus decreases with wider lenses and increases with longer lenses – the opposite of depth of field. With a zoom lens, zoom in all the way to your subject and focus the lens. Shoot 10 seconds of film, then with the camera rolling, zoom out all

the way. If the image stays sharp, your flange depth is accurate, if not, it may need to be checked by a technician. This is not an adjustment you can do on your own.

With prime lenses, measure the distance from the rear focal plane to your subject, then using the witness marks on your lens, set the focus ring for the appropriate distance. Shoot first with a long lens, and then with a short lens. If you notice that the shorter lens is soft, it may be the flange focal depth. Of course, it might also be the lens. In either instance, have the camera and lens checked.

If you notice that the image is not sharp across the plane, but rather seems to be sharp in one place and consistently soft in another (across the same plane) then your flange may be misaligned and will need to be checked.

Once you have determined that your camera package is functioning properly, you can then test your film stocks. It is likely that you will want to determine the film stock(s) that will give you the results you and the director are looking for within the requirements of your production.