adjustment is required to optimize lens/camera performance when a camera body/lens combination do not precisely match each other.

Flange Back

Television zoom lenses are manufactured with an adjustable mechanism called the flange back. The sole function of the flange back is to compensate for differences in the distance between the image plane and the rear-most element of the lens. The flange back has a variable operating range of ± 0.5 mm to ± 1 mm. This increment is deliberately small to prevent contacting the prism block assembly with the rear element of the lens. Two points should be noted: 1) that the flange back does not permit independent adjustment of any of the tubes, as the flange back moves the whole lens assembly; 2) the flange back is only a compensatory adjustment and doesn't preclude proper tracking adjustment of each independent tube. As a point of information for those working in the field when lens malfunction may necessitate a lens change, the flange back adjustment can be used as a stop-gap measure. Since this adjustment alters the normal tube position, it can be used as a means of last resort when there is no time to make the proper adjustments.

Lens Flange Back Adjustment

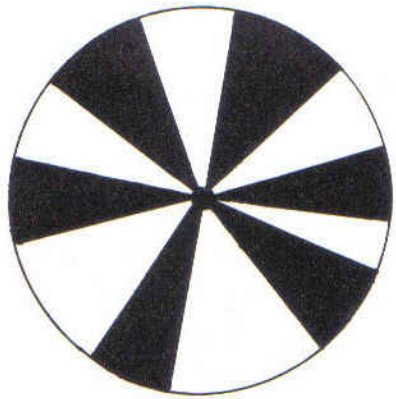
The step-by-step procedure is to 1) adjust the flange back mechanism to 0 (zero); 2) zoom to the telephoto end of the lens; 3) focus; 4) zoom to the wide end of the lens; 5) loosen the flange back lock and adjust it to bring the green channel into sharp focus; 6) repeat steps 2 and 3 to bring the image into focus at both ends of the lens; 7) zoom out to the wide end of the lens to check the focus on the red and blue channels. If either channel is out of focus, you must turn the flange back mechanism to zero and re-initiate the tracking procedure.

Tracking Adjustment

The proper and usual procedure would be to do a tracking alignment.

Tracking Adjustment is defined as the process of precisely aligning the photoconductive layer of the camera pick-up tubes with the image plane of the zoom lens. (*TV OPTICS: The Canon Guidebook of Optics for Television System, page 28.*)

This procedure ensures that each of the camera tube faceplates are on the same image plane as the lens. Without this critical adjustment, the lens, although functioning properly, will appear to mistrack. The result would be loss of focus at numerous points as the lens is zoomed through its range, because the image would not be properly formed on the image plane of all three tubes.



Star Chart used for Tracking Adjustment.

It is imperative to align the red and the blue channels so that they track with the green channel to prevent color degradation caused by blurring. If tracking isn't optimized, the blurring will be most pronounced at the telephoto end of the lens due to longitudinal chromatic aberration. Longitudinal aberration causes differing wavelengths to focus on different planes instead of a single image plane.

The procedure for adjusting tracking is as follows: to begin, you need a star chart (see diagram). Begin by placing the chart at a distance of roughly ten feet for a studio or ENG lens, or 12-21 feet for a field lens. At this distance the chart will fill the frame and the zoom will be in the middle of its range. Adjustments should be made in the mid-range, not at either end of the zoom as this could introduce lens aberrations into the alignment. 1) Set the lens flange back to 0, open the lens to full aperature (the smallest f stop number). 2) Zoom to the telephoto end of the lens. 3) Focus. 4) Zoom to the wide end of the lens. 5) Adjust the green tube, using the appropriate adjustment mechanisms. 6) This procedure is repeated at both ends of the zoom, wide and telephoto, until the image is in focus at either end of the zoom. 7) Adjust the red and blue tubes as per the green tube.

Following these steps should align all of the tubes and ensure precise tracking.

Registration

The next step in the chain of events is registration. Since all radiated wave-