Although the Multileaf Collimator (MLC) is an extremely sophisticated electrical/mechanical device, two facts help simplify Acceptance Testing, Commissioning, and QA of this equipment. First, the past five years of clinical experience have demonstrated a remarkable reliability for this new technology, resulting in only a minor increase in treatment unit downtime when an MLC is attached. Second, a large number of studies have been conducted to characterize the various collimator systems, and in many cases spot checking of the information available in these reports is sufficient to show that an MLC system is performing adequately. This does not mean that performance of a particular MLC is guaranteed, and this talk describes measurements and checks that should be used to determine that the system can be accepted from the manufacturer, and is ready for initial and continued clinical use. The measurements and checks are divided into two parts: those recommended for utilization of an MLC for simple block replacement and the additional measurements needed to use the system for Intensity Modulated Radiation Therapy (IMRT). For block replacement, it is convenient to compare to the type, tolerance levels and frequency of checks that are typically used (and recommended in the AAPM Task Group 40 report) for the QA of alloy block. An analogy can be drawn between the accuracy and testing of block fabrication equipment and demonstrating that the MLC can faithfully reproduce standard shapes. Block placement tolerance limits, typically stated as 2.0 mm, can be applied to MLC systems. This talk will include consideration of the possibility of tightening the alloy block tolerance limits to take advantage of the superb mechanical accuracy of modern MLC systems, and to better meet the needs of Conformal Radiation Therapy (CRT). The analogy with alloy blocks can be taken further if one considers between-leaf leakage as equivalent to voids caused by air pockets within alloy blocks, and the handling of MLC files as the equivalent of labeling of blocking trays. The use of MLC for IMRT presents a different set of problems that will also be discussed. The issues for IMRT are most severe when this treatment is to be delivered dynamically. For example, if a sliding window of approximately 1.0 cm is used for IMRT dose delivery, the 2.0 mm placement accuracy taken from the alloy block analogy represents 20% of the window width and will not be acceptable. Much of the testing and routine QA for MLC relies on film dosimetry. This talk will include discussion of the problem of accurately representing the rapid dose gradient that occurs at an MLC defined field edge, or the very sharp peaks representing between-leaf leakage.

EDUCATIONAL OBJECTIVES:

1) To present a comprehensive Acceptance Test procedure for MLC systems.
2) To develop a set of Commissioning measurements for MLC.
3) To furnish a list of Quality Assurance checks and measurements, and corresponding tolerance limits.