



## Setting Tolerances

In most optical designs a lot of time and energy is put into aberration reduction. Somewhat less time goes into designing the mounting for the system. Whatever time is left (usually because of deadlines, not very much) is given over to tolerancing. And let's face it, tolerancing bears little of the attraction that the search for the optimum merit function has. It is much like filling out the paperwork after an exciting archeological dig.

And yet...we can't do without it. The problem is: what is a reasonable tolerance for all the dimensions in a system? It is a problem not easily given over to a computer to solve. At least I know of no programs that can determine the critical and noncritical dimensions of a system and set the tolerances appropriately, while estimating the incremental cost to specify a particular tolerance. It just ain't easy.

But if tolerancing is difficult in optics, assigning tolerance limits in real life is even harder. How much harassment should a woman in the workplace have to tolerate? How large can the pay difference be between a man and a woman or persons of different ethnic backgrounds and races? How much bullying should teachers or playground monitors tolerate before they step in and protect someone? These are difficult issues to decide, but there is an approach, called zero tolerance, that is simple, straightforward, and wrong-headed!

Fortunately, in the field of optical design, there is no such thing as zero tolerances, because the precision with which a piece can be fabricated is finite, as is the budget that must be expended to produce it. Even if we could produce such pieces, the assembly, adjustment, and operation of the device would be hard, if not impossible. The parts would bind and wear and create heat.

In everyday life, however, this is exactly what zero tolerancing does. The establishment of tolerance guidelines means that someone will have to interpret and apply them in actual situations. They have to judge whether this behavior or amount of forbidden material (knives, drugs, skin, etc.) is subject to the rules that have been laid down. Invoking zero tolerance solves these problems. It substitutes a rule that requires no thought for rational judgment and analysis. The rationale behind this is that it relieves

the legislators of having to provide guidance for the public and administrators from taking responsibility for the training and actions of their employees. It makes lawsuits disappear ("Hey, we treat everyone this way...") and in the end makes life miserable for everyone. The only tolerance left is ours.

Has our life been made better by zero tolerancing? Not that I can tell. The papers report a constant series of episodes of violations of zero tolerancing. A student is suspended from school because he left a sickle in his car that he had been using to help someone clear brush before school. Another student is suspended because a plastic sword used to spear cocktail olives was found in her purse. Little old ladies are patted down and their luggage searched a second time at the departure gate in an airline terminal.

In these and many other cases, rules are substituted for judgment and common sense. My wife tells me that at a meeting of a hospital nursing administration, a committee was formed to lay out specific steps for various procedures that are performed by the nursing staff. When my wife protested that they were not needed, because the evaluation of such situations was what her faculty taught their students in the Nursing School, she was told that they didn't want the staff to think.

I don't know whether to attribute zero tolerancing to laziness on the part of the rule makers or to the effect of maintaining political correctness for all judgments made by one human being on another. But whatever the case, the only certain defense is sufficient giggling in the most ludicrous cases to embarrass the powers-that-be into fudging the sentence and reinstating the offender. Will it ever get better? Probably. But not with the repeal of any zero tolerance rules. Humans are adaptable critters and eventually the people have to put a zero and some numbers after the decimal point. With time, those who might have blown the whistle will have to consider the consequences of their judgments—like the giggles.

But for now, it would appear, we will have to just tolerate it.

**Donald C. O'Shea**  
Editor