

### 7.5.4.2 Limits of rangeability

The term rangeability was, for a long time, not clearly defined so that it was interpreted in various ways. Even today „rangeability“ is often confused with the term „turn-down ratio“ which means the ratio of maximum to minimum flow through a control valve without regarding any tolerances of the inherent flow characteristic, but usually considering flow repeatability. Using this definition and assuming the application of a control valve positioner which guarantees a travel repeatability of 0.5 %, a turn-down ratio of 100:1 and higher can be achieved, while the rangeability, as defined in standard IEC 60534 is not much greater than 15:1. With most trim types, the plug immerses into the seat ring, which requires a minimum gap width, in order to avoid sticking caused by thermal influences or even seizing of seat ring and plug. As a result, an unintentional flow occurs through the gap. This determines the minimum controllable flow and sets natural rangeability limits for any control valve (Figure 7.5.4.2.-1).

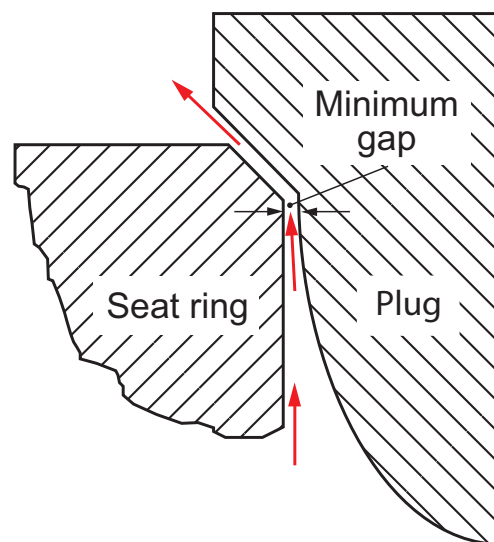


Figure 7.5.4.2.-1: Gap flow within a control valve with contoured plug

This effect occurs more with tapered face angles, and with greater ratios of gap flow to the total flow. On condition that a good valve travel repeatability exists, a flat plate plug without any seating face behaves best under these circumstances. Table 7-3 indicates the maximum achievable rangeability of different trim types.

Trim type or shape	Rangeability
Flat ON-OFF plug without any seating face	> 100:1
Contoured, parabolic plug (linear or equal-percentage characteristic)	about 50:1
V-port or multi-hole plug	about 50:1
Cage trim with cylindrical plug	about 30:1
All low flow trims according to Figure 7.5.1.-1	about 25:1

Table 7.5.4.2.-2: Maximum rangeability of different trim types