NRC FORM 658
(9-1999)

U.S. NUCLEAR REGULATORY COMMISSION

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DATE OF MEETING
08/13/2003

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| | |
|---|---|
| Docket Number(s) | NA |
| Plant/Facility Name | NA |
| TAC Number(s) (if available) | MB4306 |
| Reference Meeting Notice | ML032120114 |
| Purpose of Meeting (copy from meeting notice) | Forthcoming Meeting with ISA - The Instrumentation Systems, and Aut Automation Society 67.04 Committee Members Regarding Application of Options 1, 2, and 3 In Determination of Allowable Val |

| NAME OF PERSON WHO ISSUED MEETING NOTICE | TITLE |
|---|---|
| Hukam Garg | Sr. Electrical Engineer |

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# NRC MEETING WITH ISA 67.04 COMMITTEE

AT NRC HEADQUARTER

AUGUST 13, 2003

# NRC'S PERSPECTIVE ON ALLOWABLE VALUE

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## LIMITING SAFETY SYSTEM SETTING

10CFR50.36(C)(1)(ii)(A) defines limiting safety system setting (LSSS) as setting that must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded.

New Improved TS Bases defines allowable value (AV) to be equivalent to LSSS and defines that a channel is operable if the trip setpoint is found not to exceed the AV during Channel Operational Test (COT).

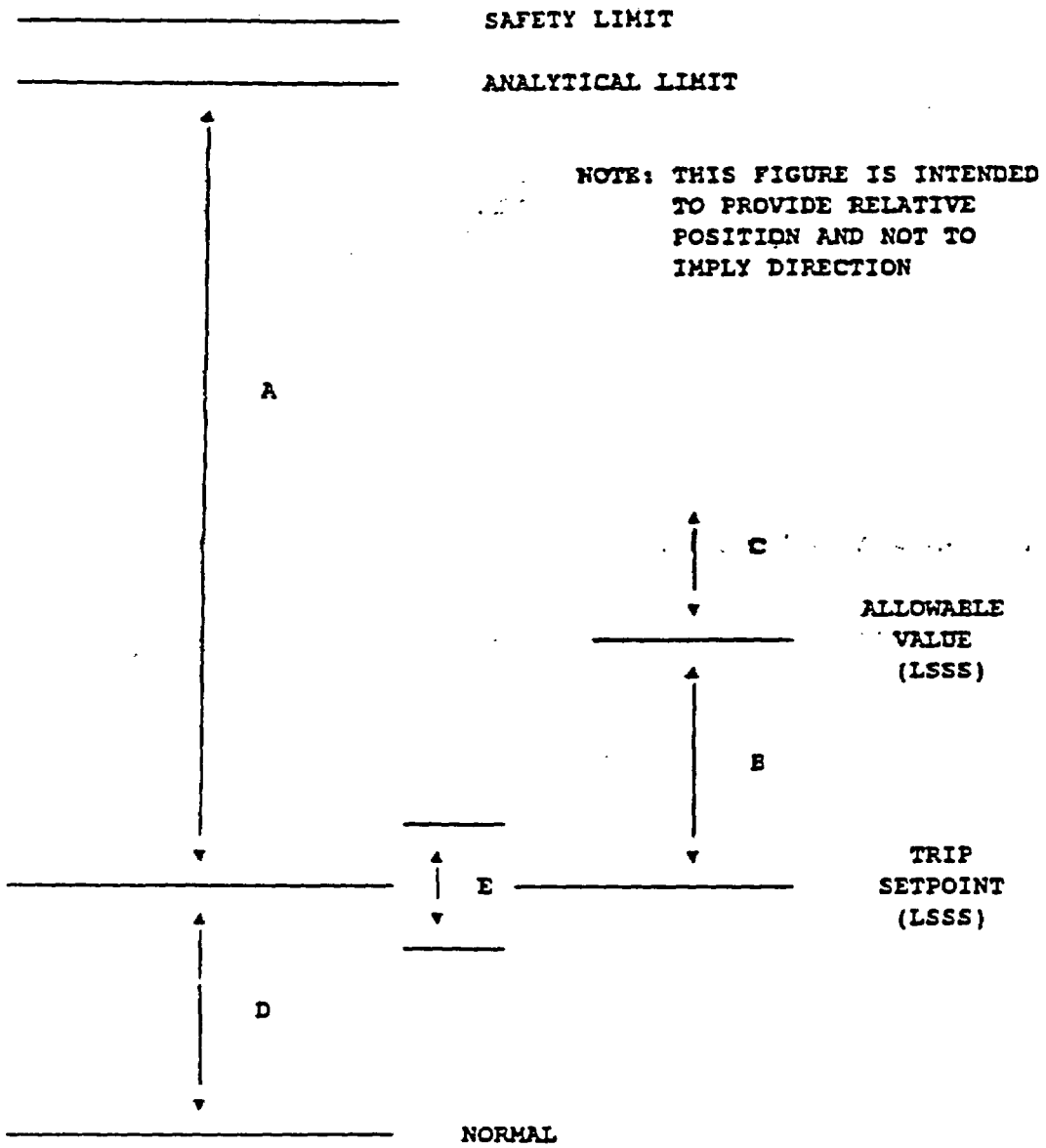
## Allowable Value

Section 3.1 of ISA67.04.01 defines AV as a limiting value that the TSP may have when tested periodically beyond which appropriate action shall be taken.

Section 7.3 of the ISA-RP67.04.02 defines that allowance between AV and trip setpoint (TSP) should account for no more than:

a. Drift
b. Calibration uncertainties for the channel tested; and
c. Instrument uncertainties during normal operation that are measured during testing.

New Improved TS Bases also requires the bistable to be properly adjusted when the "as left" setpoint value is within the band for Channel Calibration uncertainty allowance and thus trip setpoint is considered a nominal value.




A. ALLOWANCE DESCRIBED IN PARAGRAPH 4.3.1
B. ALLOWANCE DESCRIBED IN PARAGRAPH 4.3.2
C. REGION WHERE CHANNEL MAY BE DETERMINED INOPERABLE
D. PLANT OPERATING MARGIN
E. REGION OF CALIBRATION TOLERANCE (ACCEPTABLE AS LEFT CONDITION) DESCRIBED IN PARAGRAPH 4.3.1

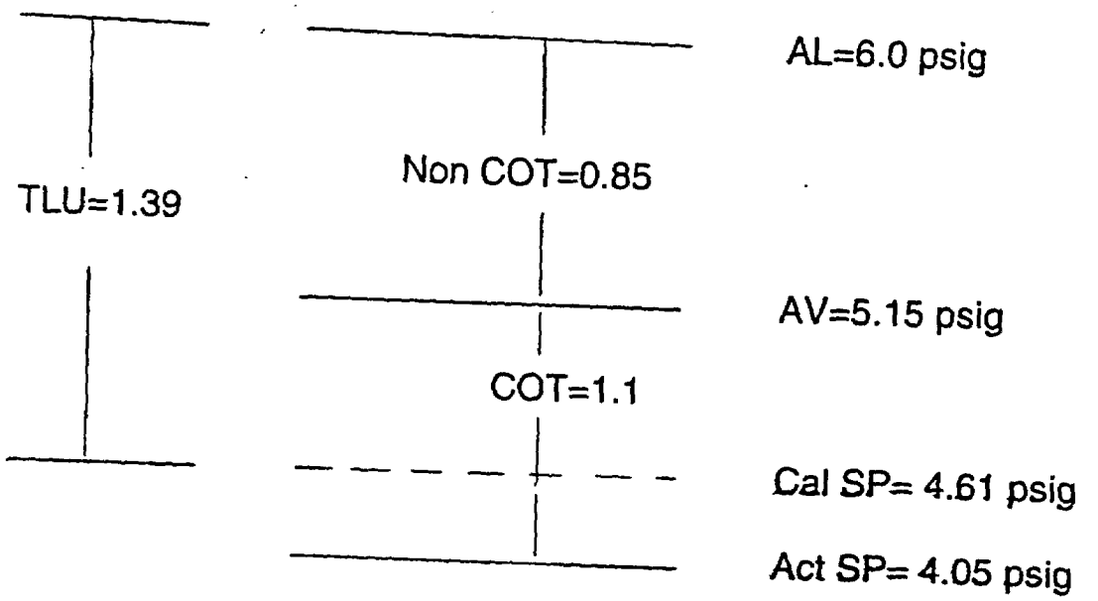
Figure 1 — Nuclear safety-related setpoint relationships

## Application of setpoint methodology option

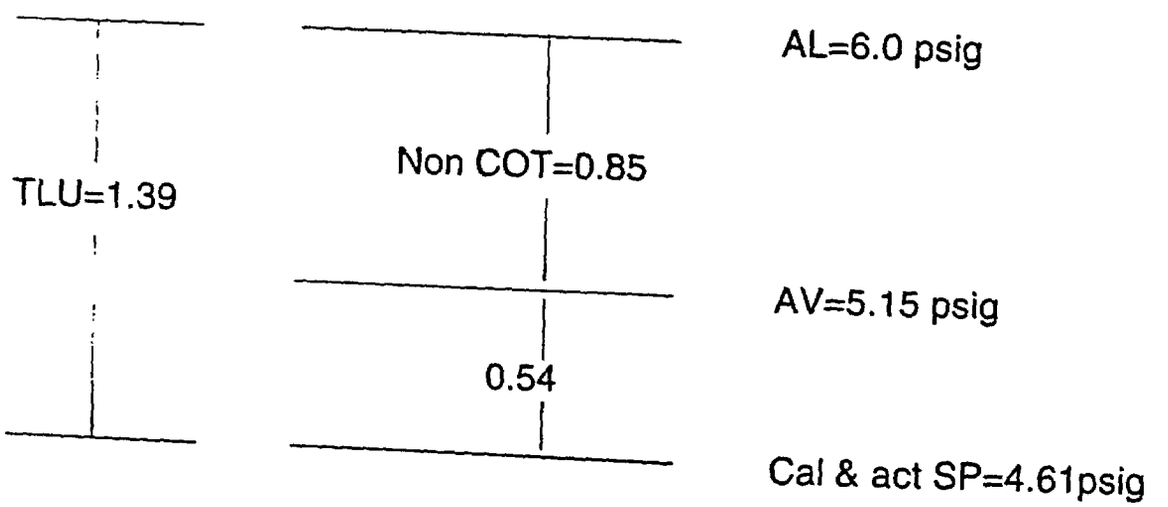
Example:

| | |
|---|---|
| Analytical Limit (AL): | 6.0 psig |
| Calculated Instrument Uncertainties during COT: | 1.1 |
| Calculated Instrument Uncertainties not measured during COT: | 0.85 |
| Total Instrument loop uncertainties | 1.39 |

Method 1:



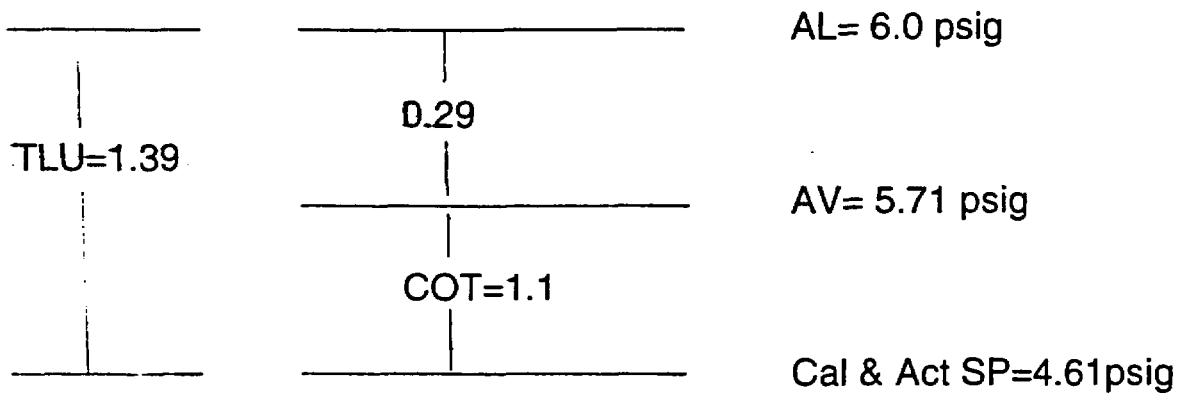

Method 2:



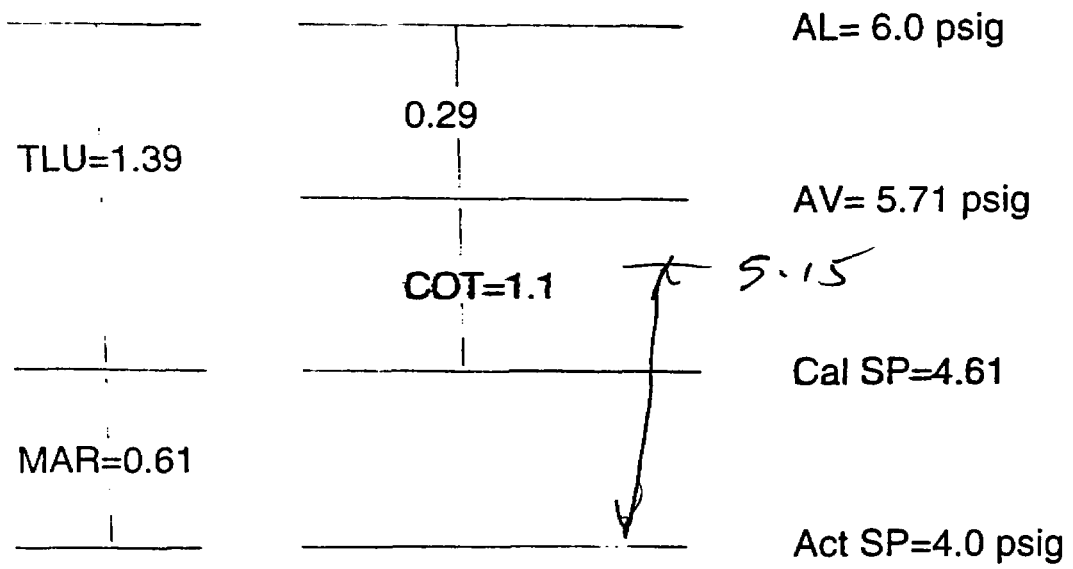
## Check Calculation

Section 7.3 of ISA - RP67.04.02 states that check calculation should provide assurance that the purpose of AV is still satisfied by providing a large enough allowance to account for those uncertainties not measured during the test. However, it also states that this calculation is needed if calculation methods for TSP and AV are different such as, square root of the sum of the squares (SRSS) vs. combination of SRSS and algebriac.

Method 3:




Method 3 with additional margin:



## Conclusion

Method 3, and method 3 with additional margin, as shown in the examples, are not acceptable methods for calculating Allowable Values because the methodology permits the "as found" trip setpoint to be greater than 5.15 psig without declaring the channel inoperable. The staff notes that if non-COT uncertainties were added to the "as found" TSP, the instrument channel would exceed its analytical limit and therefore would not preserve the safety limit. Therefore, the channel will not meet the 10 CFR 50.36 requirements for LSSS. However, if the methodology includes a check calculation to provide assurance that the AV is still satisfied by providing a large enough allowance to account for those uncertainties not measured during the test, then method 3 and method 3 with additional margin would be acceptable.

# ISA S67.04 Methods of Determining Trip Setpoints and Allowable Values

ISA 67.04 Subcommittee on AV

# ISA S67.04 Subcommittee

- Jerry Voss - Chairman
- Tim Hurst
- Ron Jarrett
- Edward Quinn
- John Guider
- Dave Willis
- Charles R. Tuley
- James Snelson
- Mike Eidson
- Robert Fredricksen
- Pete VandeVisse

# Position Statements

- The difference between the Allowable Value (AV) and the Analytical Limit (AL) is not a direct defense of the AL.
- The Trip Set Point (TSP) protects the AL.
- The AV confirms the TSP.

# Background

- 10 CFR 50.36 defines LSSS
- ISA S67.04 establishes methods for determining TSP & AV
- ISA S67.04 is a mature industry consensus standard
- RG 1.105 endorses the standard
- Licensees must justify / document methods used to establish TSP & AV
- Plant TS can include TSP and/or AV

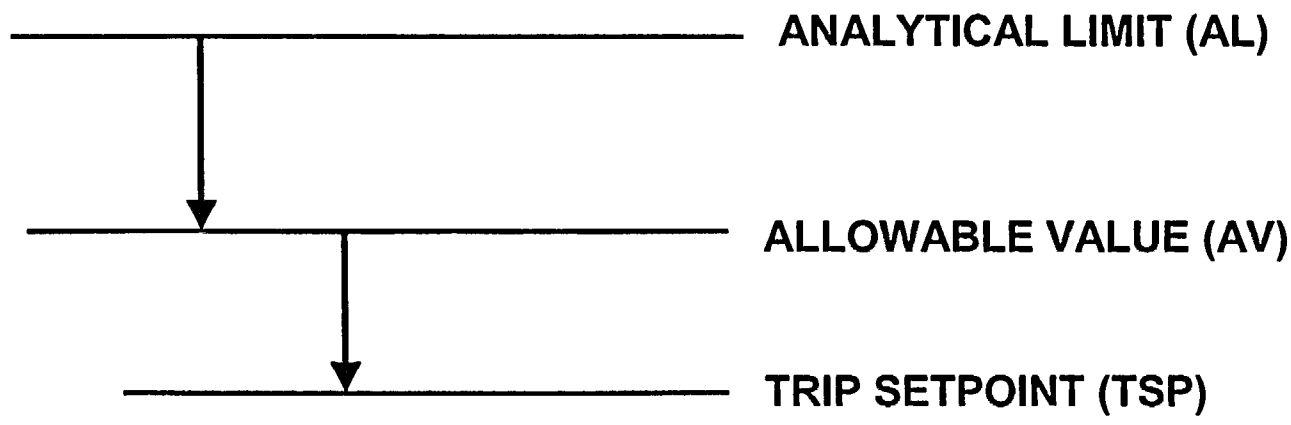
# Development of TSP & AV

ISA RP67.04.02, Recommended Practice, Section 7.3, provides three methods of deriving an AV.

Calculation of AV entails distinguishing between errors measured during surveillance testing and errors not measured during surveillance testing. The statistical combination of the errors results in a Total Loop Uncertainty (TLU).

# ISA RP67.04.02 Method 1

The first method of calculating Allowable Value is to add the error not measured during surveillance testing to the AL. The AL is the limiting value assumed in safety analyses that assures the safety limit is protected. The setpoint is determined by adding the error allowance measured during surveillance testing to the AV. Errors may be combined by algebraic, SRSS, or other statistical methods as appropriate.

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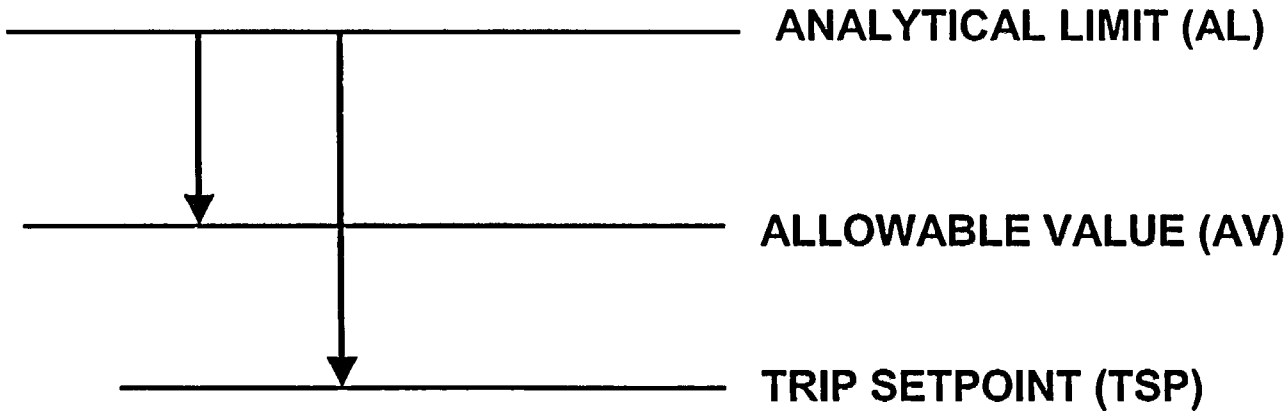
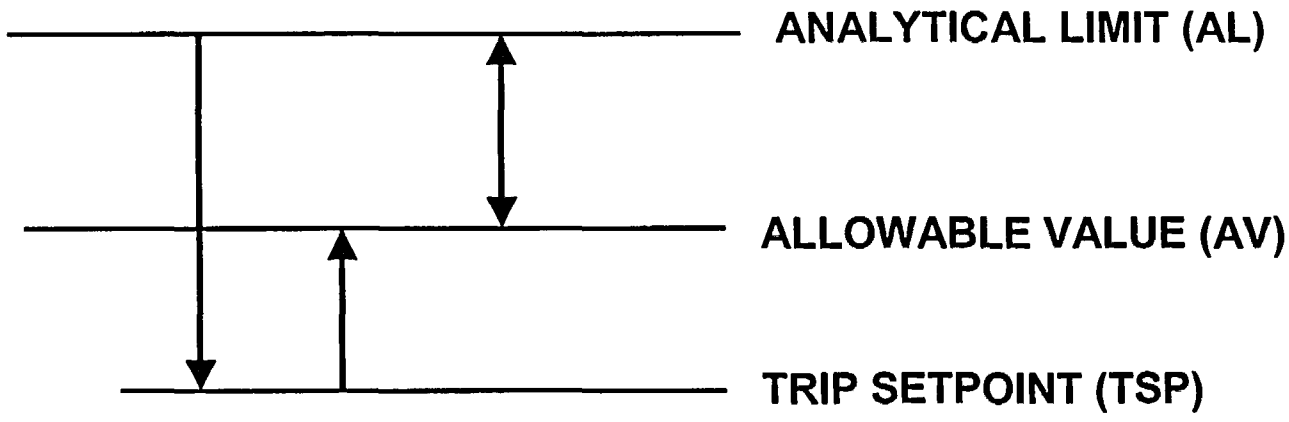
# ISA RP67.04.02 Method 2

The second method of calculating AV is the same as the first method, but the setpoint is calculated by adding the TLU to the AL. TLU is normally calculated using an SRSS methodology.

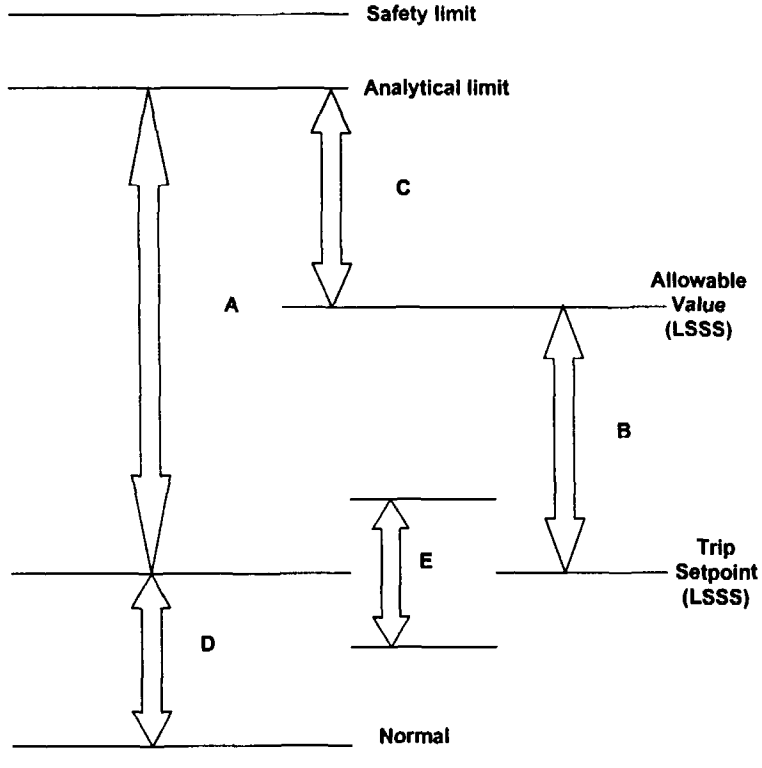


# ISA RP67.04.02 Method 3

The third method of calculating AV is to calculate the setpoint as described in method 2, then add the allowance errors measured during surveillance testing to that value in the direction of the AL. This is the method that is used by a majority of the nuclear plants.



# ISA S67.04.01 Figure 1




A. Allowance described in paragraph 4.3.1
B. Allowance described in paragraph 4.3.2
C. Region where channel may be determined inoperable
D. Plant operating margin
E. Region of calibration tolerance (acceptable as left condition) described in paragraph 4.3.1

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# Development of AV

Note that for method 2 and 3 the TSP is calculated in an identical manner. A TLU, containing all known random and bias terms, is calculated. This TLU is then added or subtracted from (depending upon direction of conservatism) the AL. This TSP is sufficiently conservative to protect the AL if errors have been adequately identified.

# Development of AV

- An example of the values obtained is illustrated using round numbers for simplicity. Assume the AL limit is less than or equal to 20, the errors not measured during surveillance test are 3, and the allowance for errors measured during the surveillance test are 4.
- The TLU is $(3^2 + 4^2)^{1/2} = 5$

The table below shows the results of each method as described above.

| | Method 1 | Method 2 | Method 3 |
|---|---|---|---|
| Analytical Limit (AL) | 20 | 20 | 20 |
| Allowable Value (AV) | 17 | 17 | 19 |
| Setpoint | 13 | 15 | 15 |

# Comparison of Methods

Comparing the actual probabilities of the TSP protecting the AL for each method, assuming a 95% probability input, shows that all methods meet or exceed the probability limits.

| | Method 1 | Method 2 | Method 3 |
|---|---|---|---|
| **Probability of protecting AL** | **99.5%** | **95%** | **95%** |
| | | | |

# Comparison of Methods

Comparing the actual probabilities of satisfying the AV during surveillance testing, assuming a 95% probability input, demonstrates that method 2 has a significantly lower probability as compared to the other methods.

| | Method 1 | Method 2 | Method 3 |
|---|---|---|---|
| Probability of protecting AL | 99.5% | 95% | 95% |
| Probability of meeting AV | 95% | 68% | 95% |

# Purpose of the Calibration and Periodic Surveillance Requirements

- The Channel Calibration ensures the performance of all loop components is consistent with the methodology.
- The Channel Functional Test (CFT) or Channel Operational Test (COT) verifies that the rack portions of the loop are functioning within design parameters consistent with the methodology.
- In each case acceptance criteria are defined by the surveillance procedure.
- An As-Found value less than the AV means the errors contained in the surveillance measurement were less than the error allowance calculated for the surveillance.
- This confirms that the allowance for errors measured during surveillance testing, as defined in the TLU calculation, is satisfied and confirms the acceptability of the TSP.

# Summary

- Reg. Guide 1.105 endorses the calculation of the TSP using statistical methods.
- The AV, based on a portion of the errors, does not invalidate the TSP.
- The TSP protects the AL.
- The AV validates an error contribution assumption via periodic surveillance testing.
- As long as the AV is not exceeded, the channel is OPERABLE.
- During surveillance testing, the AV serves as the LSSS.
- The errors between the AV and the AL are not part of the LSSS as defined by 10 CFR 50.36.

# Conclusion

- The difference between the AV and the AL is not a direct defense of the Analytical Limit.
- The TSP protects the AL.
- The AV confirms the TSP.