

Report to WG C57.139

Problems and Suggested Remedies

IEEE Transformers Committee
Insulating Fluids Subcommittee
S13 Meeting - Munich, Germany

Jim Dukarm
j.dukarm@ieee.org
2013-03-06

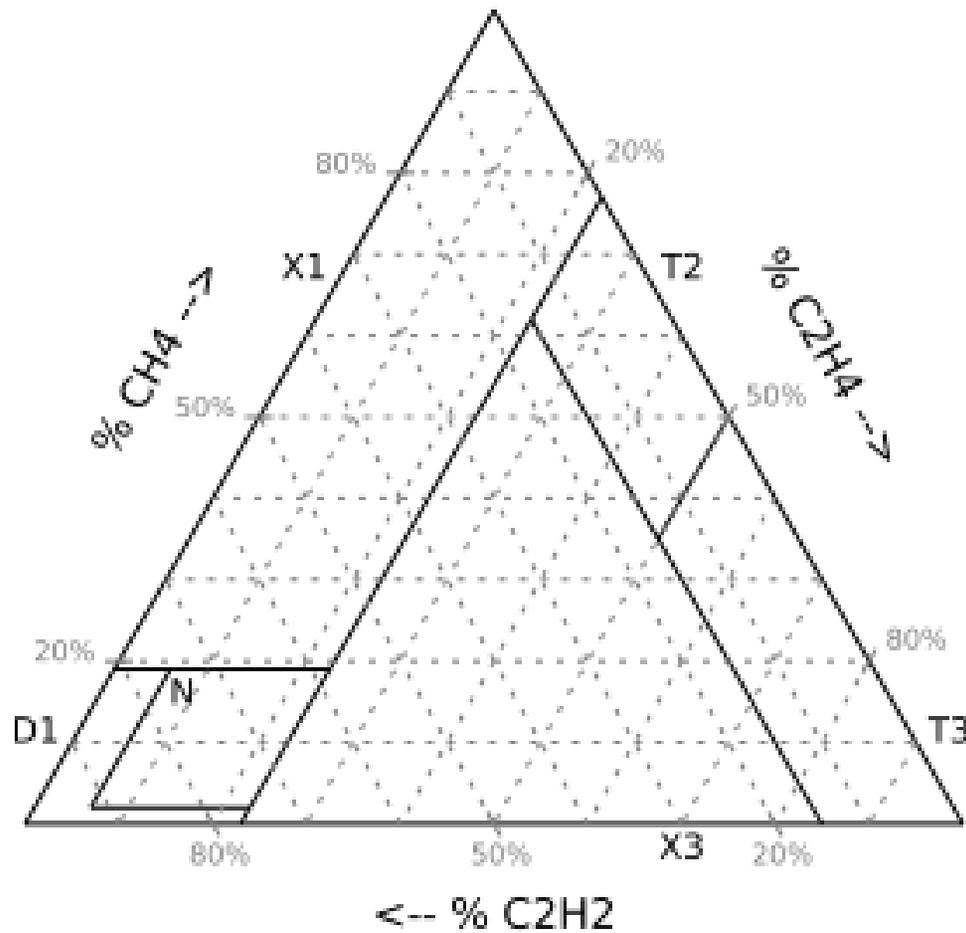
Statistical Method Summarized

- Use DGA data from 50+ similar LTCs with similar operating conditions and maintenance policies.
- Gas concentration and gas ratio limits
- Limits are designed to identify data values that are so **extreme** that they are unlikely to be associated with a trouble-free LTC operating under its usual conditions.

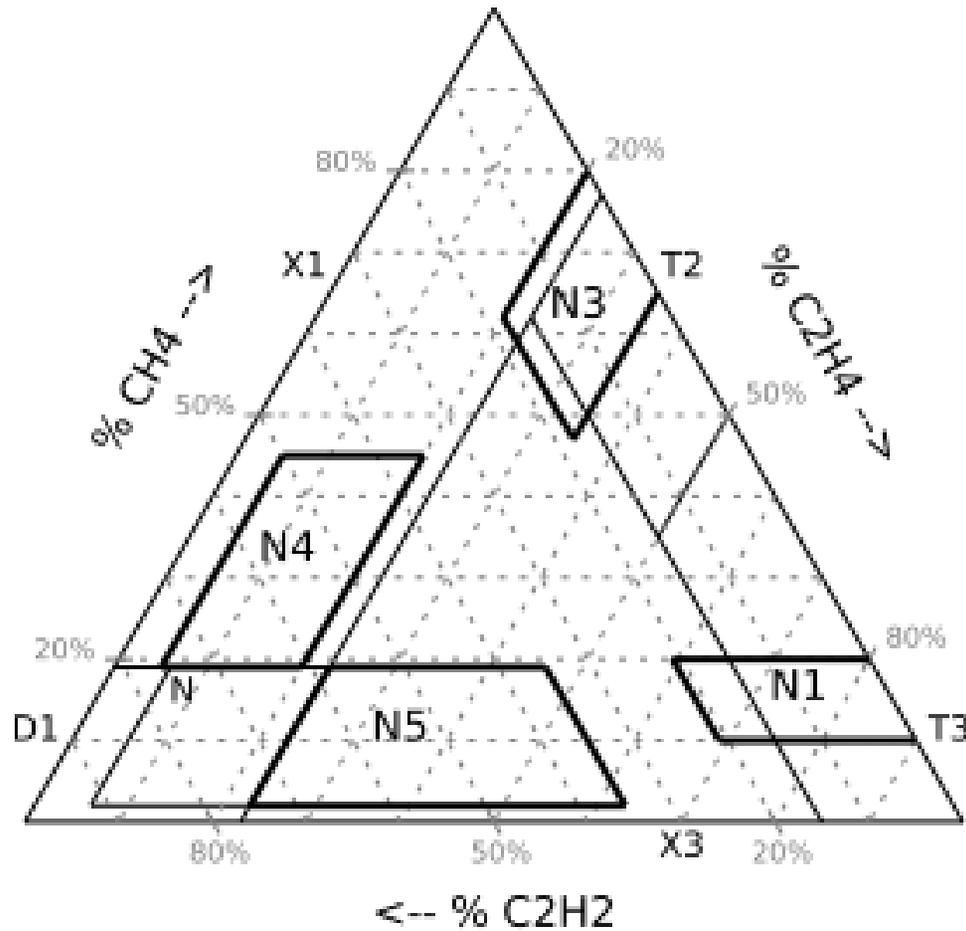
Problems with C57.139-2010 Statistical Method

- Applicable to populations of 50+ LTCs, but many LTC populations are smaller
- Statistical limits for similar LTCs differ greatly between companies. Generic or default limits can't be defined.
- When LTCs are new or very well maintained, the statistical limits are often too low to be fault-related.
- Not clear how to define limits applicable to exceptional resistive type LTCs.

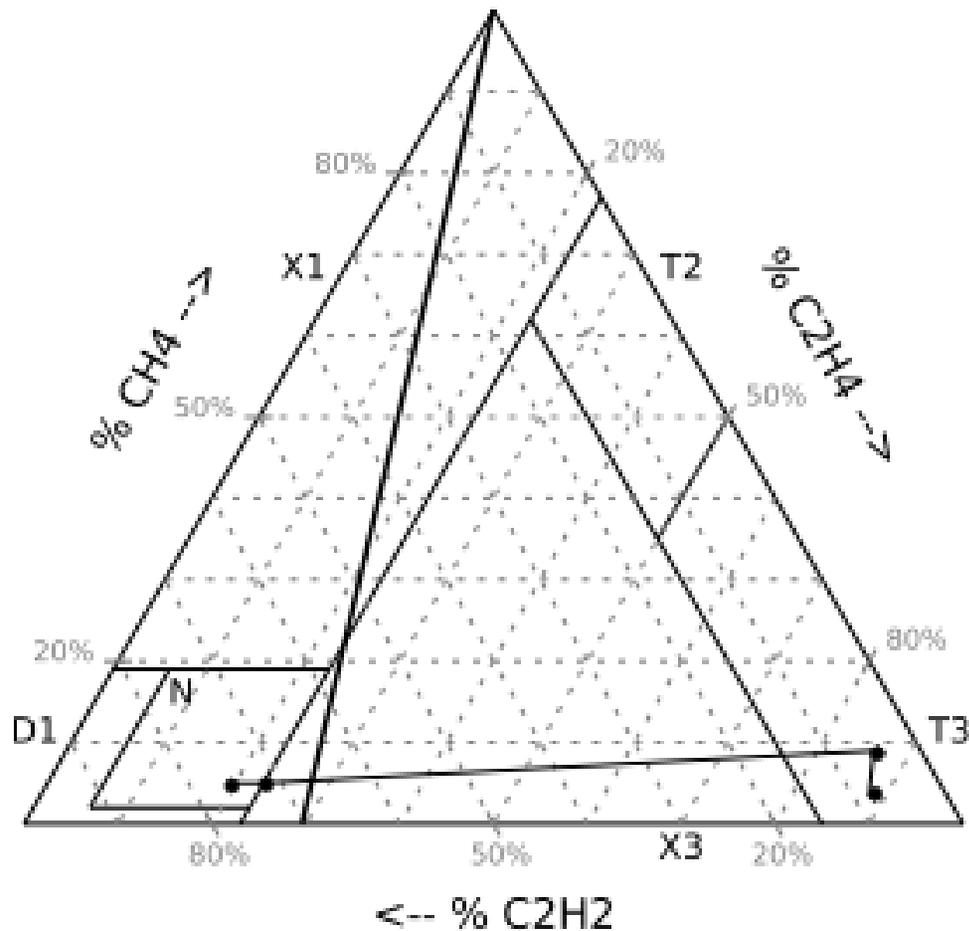
Duval Triangle 2 for LTCs



Extra N Zones for Exceptional Types



Gas Ratio Limits are Straight Lines



A C_2H_4/C_2H_2 ratio limit (in this case, **0.42**) can be represented by a line from the apex to the base.

CH_4/C_2H_4 and C_2H_2/CH_4 (or their inverses) are represented by lines from the other corners to the opposite side.

Example 3 (Burned Reversing Switch) from C57.139-2010 is plotted as 2 points in N followed by 2 points in T3. This line joining them indicates order of occurrence.

Proposed Hybrid Approach

- Statistical procedure for gas concentration limits modified to work for small (5+) and large LTC populations
- Similar modified procedure for gas ratio limits. OR use default limits derived from triangle N zone boundaries.
- Use triangle for classifying DGA results as OK or not-OK. Also for detecting and interpreting trends and identifying nature of fault.
- Superimpose population-specific ratio limits or an extra N zone, if needed. Default ratio limits can be used for small populations.
- Gas concentration limits still needed for some fault types.