**Disclaimer:** This document is a current working document of Phil Scinto of the Lubrizol Corporation as of the date shown. It is expected serve as a great example of precision matrix development considerations, but was not reviewed for consensus among the industry statisticians group. Therefore, the contents may not represent the full range of opinions and recommendations, and may not even reflect the author’s current recommendations as of the date of review of this document.

**Guidelines for Industry Matrix Development**

**DRAFT**

**DRAFT 1 – November 2, 2023**

I. Overview

The Industry Matrix, also known as the Precision Matrix, is a resource investment to establish published test precision for the test procedure, and ASTM Lubricant Test Monitoring System (LTMS) targets. Optionally, data for Base Oil Interchange (BOI) Guidelines, and Viscosity-Grade Read-Across Guidelines (VGRA) may be generated, dependent upon agreement in funding, to use in additional industry matrices such as BOI/VGRA as an example.

To be clear, the Industry Matrix is not intended for test development, discrimination demonstration, or establishment of chemical limits. Also note that the Industry Matrix is a separate matrix from its necessary predecessor, the Prove-Out Matrix.

This document contains a checklist of items that need satisfied before Industry Matrix testing may commence. Any exceptions to these decision criteria must be communicated and documented in writing to all parties of the Memorandum of Agreement (MOA) prior to matrix testing.

Suggestions for the design of the Industry Matrix are also provided in this document.

II. Criteria

1. Test Champion (organization proposing the need for the engine test in the performance category) generates and shares data demonstrating proof of concept for the proposed engine test (be it a new test or an existing test), known as the Prove-Out Matrix, as detailed below.
   1. A minimum of two (2) valid test results on at least two (2) oils in the same test procedure, parts batch, and fuel batch to be used in the Industry Matrix from a single Test Laboratory.
   2. **The oils must be the same viscosity-grade and meet (approximately meet within consensus reason) all physical, analytical, and chemical box limitations of the performance category.**
      1. **At least one of the oils should be as close to performance category capable as possible.**
      2. **It would be of benefit to have field performance data on the oils .**
   3. At least one (1) test result on an oil from II.1.a in the same procedure, parts, and fuel from II.1.a in a Test Laboratory different from the one in II.1.a.
      1. Demonstrate that the test can be run in more than one lab.
2. Prove-Out Matrix test results, of which there will be at least five (5), demonstrate discrimination for all proposed pass/fail parameters to the satisfaction of the appropriate ASTM Surveillance and Classification Panel.
3. The Prove-Out Matrix, results, and analysis must be complete in advance of the signing of the Industry Matrix MOA.
   1. There is no requirement that Prove-Out Matrix oils need inclusion in the Industry Matrix.
4. The laboratory inspection team has made a visit to each Industry Matrix Laboratory and filed a report regarding the Laboratory’s conformance to specification that includes, at a minimum, completed laboratory inspection checklists.
5. Laboratory readiness, as summarized by the lab inspection team reports, is deemed satisfactory by the appropriate ASTM Surveillance and Classification Panels.
6. Each Industry Matrix Laboratory has run at least two (2) operationally valid tests (shakedown runs are eligible) using the latest test procedure on the oils of their choice (although Prove-Out Matrix oils are recommended). The appropriate ASTM Surveillance and Classification Panels must deem these test results operationally satisfactory.
7. The current batch supply of any Baseline Oil (BL), potential Reference Oil (RO), critical test parts and critical test fuel used in the matrix is enough to use in post-matrix testing beyond one reference cycle.
8. Each Industry Matrix, Matrix Oil sponsor is responsible for generating data for evaluation in meeting the following needs.
   1. At least two (2) test results in the test procedure, or a closely related test procedure or engine test, in the DI package, or a closely related DI package.
   2. Chemical, physical, and analytical data consistent with the requirements of the category.
   3. Capability of meeting viscosity needs for all eligible viscosity-grades of the category.
9. A project manager must be identified for the Industry Matrix.
10. The test sponsor, the API Base Oil Interchange / Viscosity Grade Read Across Task Force, and the API Lubricants Committee have reached agreement on a plan on whether (and if so, how) or not to incorporate the Industry Precision Matrix into additional industry matrices.

III. Matrix Design Guidelines

The following guidelines are *strongly endorsed* as contributing toward a ‘plan for success’ Industry Matrix. Every effort should be made to achieve these endorsed guidelines.

* The Matrix test plan has designed at least ten (10) runs, or the equivalent of 10 runs **in terms of precision calculations**, for each reference oil.
* At least one to two Matrix Oils should be planned as reference oils and thus supplied initially in the required volume for TMC inventory.
* The Matrix test plan allows for estimation of critical factors and features such as stand/engine, laboratory, engine aging, carryover, oil, or any other variables in the matrix.
* The Matrix test plan allows for estimation of parts and fuel effects if there are plans for parts and fuel interchangeability in the future for the test.
* Two-way correlations among factors and features should not exceed 0.5.
* Each level of an identified critical factor or feature should be tested at least 4 times in the Matrix.
  1. A test laboratory is a level.
  2. A test stand may be a level.
  3. A test engine may be a level.
  4. An oil is a level.

In addition, each identified critical main effect should aim for a power of at least 0.8 in identifying differences of more than 2 standard deviations, and a p[ower of 0.5 for critical interactions.