Approve™

ENTERPRISE-LEVEL METER PROVING

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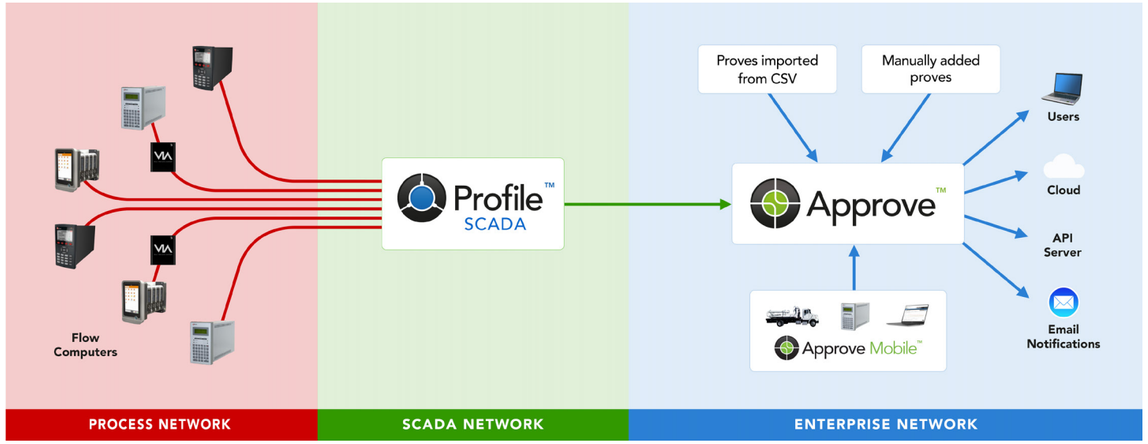
Introduction

All meters need to be proved regularly to ensure that they are operating within specified limits and comply with the Pipeline and Sales Agreements in operation. Flow computers perform rudimentary checks on the K factor / meter factor, but the API Chapter 4.1 (Metering Systems Hierarchy of Proving Systems) calls for more stringent tests than the flow computer alone can provide. Furthermore, the prove data recorded has often been limited in scope, relying either on the basic prove reports generated by the flow computer or the use of non-standard, unvalidated spreadsheets.

Approve™ is designed to manage the prove data generated by flow computers. Prove results from every prove performed are stored in a centralised database, creating a comprehensive and accurate prove history. Prove data and control charts can be shared instantly and securely over a corporate intranet or across the Internet, enabling technicians, auditors, operations and management to monitor the performance of every meter on the system.

Approve™ is fully compliant with the specifications defined in API chapter 13.2 (Statistical Methods of Evaluating Meter Proving Data) for evaluating the performance of turbine or displacement meters in custody transfer and non-custody transfer metering applications.



Meter Factor Verification

Prove results can be manually entered into Approve™, imported from a CSV file, or automatically collected from the flow computer (when used with Profile™). Approve™ runs a series of tests on the data and presents the results with a clear pass or fail indication:

Deviation From the Base Curve - This test determines that the prove is within a set of limits (typically 0.1%) from the meter's base performance curve.

Within the Tolerance Limit - This test passes if the K factor / meter factor is within the tolerance limits of the control charts. The tolerance limits are based on a 99.5% confidence level of the t-distribution table as per API 13.2.

Deviation from the Previous Prove - This test passes if the new K factor / meter factor has not deviated from the previous prove beyond a defined limit (typically 0.1%).

Approve™ can also verify all the prove calculations to ensure the meter factor and K factor have been entered correctly.

Prove Certificates

The prove results are presented on a printable prove certificate that clearly explains the test results and the reason for the pass or fail, as well as providing advice on the next steps should a prove fail its tests. The flow computer generated prove report can also be attached to the prove results, providing full traceability back to the flow computer generated prove data. When used with Profile™, Approve™ will store failed or aborted flow computer proves.

Prove History

Every prove result from every flow meter is stored in the database, providing a complete and auditable prove history that tracks each meter's performance over time.

Base Curve Management

Every meter has a base curve that accounts for the performance of the meter at different flow rates. New proves are stored and tested against this base curve using a normalised meter factor.

Approve™ supports both K factor curves and meter factor curves for single and multiple products.

Control Charts

Approve™ uses the historical data from each prove to generate a series of high quality control charts that clearly illustrate the results of each test and how the meter has been performing over extended periods of time. The control charts make it easy to see the deviation from the base curve or previous prove and check that the K factor / meter factor is within the required tolerance limits, enabling operators to quickly identify potential problems.

Historical Meter Factor Chart

Flowrate Linearisation Chart

Days Between Proves Chart

Meter Recalibration

A new base curve is created whenever a meter is replaced or recalibrated. This will automatically reset the meter's prove history. Historical prove results recorded against previous base curves are retained for full audibility and traceability.

Prove Notifications

A daily email is sent to the measurement team to highlight proving issues caused by problems with the meter, prover or operator error. This email flags proves that have failed their tests, had too many aborted proves, started to drift, or haven't been proved on time, with links back to the relevant prove certificate in Approve™.

Meter Factor Prediction

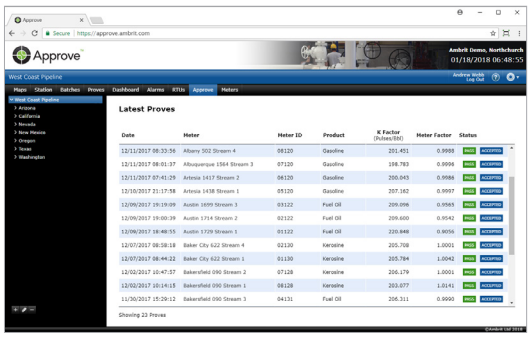
Approve™ uses multi-variable data regression analysis on the historical prove data to predict the meter factor for each prove, which is then compared against the actual meter factor.

Portable Proving

Many meters are proved in the field by portable provers. Approve Mobile™ is an offline version of Approve™ that manages the portable proving operation. It sets up the prover flow computer, manages the prove sequence, obtains the prove results and uploads them back to the Approve™ server.

Approve™

Approve™ is an enterprise-level application designed to manage and verify the meter factors generated by a flow computer. It runs a series of calculations and other tests to ensure the prove complies with the guidelines as set out in API chapter 13.2. Details of every prove from every meter are stored in the Approve™ database to create a centralised prove history for multiple metering stations.



Approve™ helps visualise the performance of the meter by presenting the historical prove data as a series of high-quality control charts that demonstrate the results of each prove. This prove data builds up over time to provide a complete picture of the performance of every meter and can be used to quickly identify meters that need to be recalibrated or replaced.

Approve™ simplifies the process of recording prove data and verifying the prove results. By storing this data centrally and making it easily accessible to those users who need to be able to view it, Approve™ helps ensure all flow meters are measuring accurately and in accordance with industry best practice; whilst demonstrating compliance to auditors and other interested parties.

Approve™ is one of the elements in the Metrology™ suite of products. Profile™ can seamlessly pass the prove data from the flow computer through to Approve™, where the prove tests are automatically performed and the proves are stored against the meter.

Approve Mobile™ has been developed to manage meters proved with portable provers. Approve™ controls the process and ensures that Approve Mobile™ always has the latest meter data available. Proves collected using Approve Mobile™ are uploaded back to the Approve™ server so the prove tests can be performed and the results can be shared with the measurement team.

Approve™ can automatically record prove events directly into the Record™ logbook. These proves are interlaced chronologically with other data in the logbook to build a comprehensive audit trail of the entire process.

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Prove Tracking

- Support for Bi-Directional, Uni-Directional, Compact and Master Meter provers
- Complies with API Chapter 13.2
- Automatic / Manual prove entry
- Flow Computer generated prove reports
- Prove prediction
- Meter Factor regression analysis
- Base curve management and tracking
- Multiple stations
- Multi-product
- Prove history for each meter
- Import / export of prove results
- Prove certificates
- Portable proving with Approve Mobile™

Prove Tests

- Deviation from Base Curve
- Within Tolerance Limit
- Deviation from Previous Prove
- Meter Factor Validation

Control Charts

- K Factor / Meter Factor Linearisation Chart
- Historical Meter Factor Chart
- Deviation from Previous Prove Chart
- Temperature and Pressure Chart
- Meter Factor and Temperature Chart
- Repeatability and Reproducibility Chart
- Drift Chart
- Days Between Proves Chart
- Meter Factor Regression Chart
- Process Line Chart
- Process Scatter Chart

Web Interface

- Multi-user access with individual user access privileges
- Multi-language support
- 256 bit SSL encryption
- Active Directory
- Single Sign-On

Integration

- Link to Profile™, Uncertainty™, Record™

Metrology™

Metrology™ provides a common access point and navigation interface so that system data can be shared seamlessly between Approve™ and the other Metrology products:

Profile™
Data collection and reporting

Calibrate™
Calibration management

Uncertainty™
Uncertainty management

Validate™
Meter data validation

Equate™
Volume and mass balance

Record™
Inventory and event logbook

Inventory™
Equipment and location database

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