

# ASIANLOOP CUSTODY CALCULATOR – USER MANUAL

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## **1. ABOUT THIS CALCULATOR**

The Asianloop Custody Calculator is a supporting engineering tool intended for use in custody transfer, calibration, and training activities involving hydrocarbon liquids. It provides quick calculations for Corrected Volume (Vcorr), Mass, and Energy, enabling engineers, auditors, and technicians to verify, estimate, and validate custody calculations without relying solely on flow computers or certified proving systems.

**Appropriate Usage:** - During design and engineering (FEED and Detailed Design) to estimate flows at standard reference conditions. - During proving activities, as an independent verification of flow computer or prover data. - During audits, to quickly verify custody tickets and system configurations. - In training, to help engineers and operators understand custody principles.

**Not Appropriate For:** - Official contractual reporting (certified systems must be used). - Gas custody transfer (requires compressibility factors AGA3, AGA8). - Multiphase flow or entrained gas/liquid systems.

## **2. HOW TO USE THIS CALCULATOR**

**Step 1: Input Measured Values** - Enter measured volume (V) in m<sup>3</sup>, bbl, L, or US gallons. - Input measured temperature (T) and reference temperature (T<sub>ref</sub>), typically 15 °C. - Select whether to calculate CTL using an approximate coefficient ( $\alpha$ ) or enter manual CTL directly from API tables. - Optionally, input density at reference temperature (kg/m<sup>3</sup>) and higher heating value (HHV in MJ/kg).

**Step 2: Calculation** - The calculator applies the equation  $V_{corr} = V \times CTL$ . - Mass is computed as  $V_{corr} \text{ (m}^3\text{)} \times \rho \text{ (kg/m}^3\text{)}$ . - Energy is computed as  $\text{Mass} \times \text{HHV}$ .

**Step 3: Export & Documentation** - Results may be exported into a spreadsheet file (.xlsx). - Reference documents (API, ISO, OIML) can be accessed directly from within the tool. - Disclaimers and standards are accessible via the popup modal.

### **3. STANDARDS & REFERENCES**

This calculator references the following international standards: - API MPMS Chapter 11.1 - Temperature and Pressure Volume Correction Factors. - API MPMS Chapter 21.2 - Custody Transfer of Crude Oil. - ISO 5167 (2022) - Measurement of fluid flow by means of pressure differential devices. - OIML R117 - Measuring systems for liquids other than water. - AGA Report No. 3 - Orifice metering of natural gas (not covered by this calculator, for awareness).

Users should consult the official publications for precise methods, correction factors, and contractually binding values.

#### **4. WORKED EXAMPLES**

**Example 1: Corrected Volume** - Measured Volume  $V = 1000$  bbl at  $28\text{ }^{\circ}\text{C}$  - Reference Temperature  $T_{\text{ref}} = 15\text{ }^{\circ}\text{C}$  -  $\alpha = 0.0007$  per  $^{\circ}\text{C}$  -  $\text{CTL} \approx \exp[-\alpha \times (T - T_{\text{ref}})] = \exp[-0.0007 \times 13] \approx 0.9909$  - Corrected Volume  $V_{\text{corr}} = 1000 \times 0.9909 \approx 990.9$  bbl

**Example 2: Mass Calculation** - Using Example 1, density at reference  $\rho = 840$   $\text{kg}/\text{m}^3$  -  $V_{\text{corr}} = 990.9$  bbl  $= 990.9 \times 0.158987 \approx 157.5$   $\text{m}^3$  - Mass  $= 157.5 \times 840 \approx 132,300$  kg

**Example 3: Energy Calculation** - Using Example 2, HHV  $= 44$  MJ/kg - Energy  $= 132,300 \times 44 \approx 5,821,200$  MJ

## **5. LIMITATIONS & BEST PRACTICES**

- The calculator provides approximate results unless manual CTL values are used from official API tables. - Always document the source of CTL, density, and HHV when using results. - Do not use outputs as official contractual data. - For training, it is recommended to run the provided examples and compare them against API/ISO tables to validate understanding. - For audits, this tool provides a quick verification method but must be complemented with official system data.

## **6. DISCLAIMER & COPYRIGHT**

This tool is provided as-is for educational, engineering support, and training purposes. Asianloop Sdn Bhd makes no warranty for contractual or legal acceptance of calculations derived from this tool. Official custody transfer measurements must always be performed using certified systems compliant with API, ISO, and OIML standards.

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