WHO WE ARE

E²G | The Equity Engineering Group, Inc. is internationally recognized in the refining and petrochemical industries as a leader in aging infrastructure services and support.

- E²G engineers pioneered the advancement of Fitness-for-Service (FFS) technologies and were the lead investigators of the international standard API 579-1/ASME FFS-1 (API-579).
- The document has rapidly become the FFS standard of choice for other industries including pulp & paper, fossil utility, food processing, and non-commercial nuclear.

API 579 / ASME FFS – FOR THE WEB

The new web-based delivery of API-579 offers a complete set of WebTools for conducting a fitness-for-service assessment. Each Part of API-579 is included as a separate WebTool. The WebTools incorporate the most recent updates to API-579 and offer numerous features:

- Intuitive user interface;
- Clear organization of results;
- Modern graphics;
- Automatically generated reports for easy sharing;
- Ability to save and load assessments;
- Easy access to help, and much more.

WHY THE WEB?

- No installation - No maintenance - Ever
- Runs in any compatible web browser
- Access on phones, tablets, and desktop browsers
- Calculations handled on powerful cloud servers
- Does not consume local CPU resources
- Instant access to updates and improvements
- User friendly and easy to use, despite complex calculations going on under the hood
• **Provide Feedback:** At all steps, users may send feedback, ask questions, provide general comments and recommend enhancements.

• **Intuitive/Concise User-Interface:** Leveraging years of ongoing customer feedback, the user interface is organized in an intuitive concise manner that aligns with the user’s expectations. Each tool maintains a consistent step-based workflow design. The most important and meaningful results are presented first, with additional results available at the click of a button.

• **Pre-Populated Examples:** Each WebTool includes a catalogue of pre-populated examples to demonstrate typical use cases and highlight specific capabilities.

• **Save/Load Cases:** Each assessment can be saved to the user’s local hard drive, and files from previous assessments can be loaded to automatically populate all fields.

• **PDF Reports:** A printable or downloadable PDF report is generated with each assessment that contains all inputs necessary to reproduce the calculation, and all primary and intermediate results.

• **US/SI Units:** Each WebTool is compatible with both imperial (US Customary) unit and metric (SI) systems.

• **Extensive Material Database:** Each WebTool has access to E2G’s extensive material property database with coverage of the most popular construction codes, i.e. ASME Section I, VIII-1, VIII-2, B31.1, B31.3, B31.4, and B31.8.

• **Excel Compatible:** Tabular input data may be entered directly or copy-and-pasted from Excel.

• **Data Validation:** Logic checks are built into the input fields so that users are alerted of out-of-bounds conditions that may lead to misleading results or errors.

• **Information Buttons:** Info buttons direct users to additional information for input fields that warrant a more thorough explanation.

• **Instructional Videos:** While the interface is designed for simplicity, videos are included throughout EEC to provide additional guidance.

• **Verification:** Extensive software verification and quality management per ISO 9001.
PART 3 – BRITTLE FRACTURE

Level 1
- Screening of equipment for susceptibility to brittle fracture
- Point wise screening check of MAT at MAWP

Level 2
- Includes Methods A and B
  - Method A – Determines safe operating MAT envelope
  - Method B – Hydrostatic pressure check

Level 3
- Detailed assessment using fracture mechanics, based on Part 9
- Evaluation of controlling factors: stress, flaw size, and toughness

What Else?
- User defined operating envelope may be input for comparison

PART 4 AND 5 – GENERAL AND LOCAL THINNING

Levels 1 and 2
- Thickness readings input options:
  - Random Point Thickness Readings (PTR)
  - Critical Thickness Profile (CTP)
  - Grid of thickness readings
- No limit to number of thickness readings

What Else?
- Applicable to Type A components per API 579-1/ASME FFS-1
- Acceptability criterion based on MAWP and thickness criteria
- Remaining life from user-specified corrosion rate
- Output includes visuals of thickness readings

PART 6 – PITTING

Level 1
- Screening comparison with standard pitting charts
- Generate custom pit charts

Level 2
- Widespread pitting and localized pitting
- Based on detailed pit-couple interactions

What Else?
- No limits on number of pit-couple interactions
- Applicable to Type A components per API 579-1/ASME FFS-1
- Acceptability criterion based on both MAWP and thickness
PART 7 – HYDROGEN DAMAGE
Level 1
• Screening criteria for hydrogen damage
Level 2
• HIC Strength Assessment evaluating using RSF approach
• HIC Crack-like Flaw Assessment based on Part 9, Level 2
• Hydrogen Blister Assessment evaluated as local metal loss (Part 5)
• Hydrogen Blister Assessment includes check for periphery cracks
What Else?
• Accounts for both hydrogen blisters and HIC

PART 8 – SHELL DISTORTION
Level 1
• Based on construction code fabrication tolerances
Level 2
• Includes fatigue assessment
  • ASME smooth bar or welded joint fatigue curve
What Else?
• Includes misalignment and/or out-of-roundness
• Centerline offset and/or angular misalignment
• Longitudinal and circumferential weld seams
• Global and arbitrary-shape out-of-roundness

PART 9 – CRACK-LIKE FLAWS
Level 1
• Determines limiting flaw length using Level 2 with Level 1 restrictions
• Semi-elliptical surface breaking and through-wall cracks
Level 2
• Evaluates critical crack-front points using the FAD
• Semi-elliptical surface breaking, through-wall, and embedded cracks
• Cracks parallel or normal to longitudinal or circumferential welds
What Else?
• Output includes critical flaw screening curve
• Weld residual stress based on welding parameters
• Material Toughness using Master Curve or ASME Section XI model
PART 10 – CREEP

Level 1
- Screening criteria for creep damage
- Specified target component life and operating temperature
- Provides conservative estimate of creep-governed allowable stress
- Specify multiple historical operating conditions for comparison
  - Duration, pressure, temperature, corrosion rate

Level 2
- Calculates cumulative creep damage based on historical operating conditions
- Estimate of remaining life based on projected future conditions
- Choose between MPC Omega or Larson Miller creep damage procedure

PART 11 – FIRE DAMAGE

Level 1
- Heat Exposure Zones established to determine components that require a Level 2 assessment

Level 2
- Estimate fire damaged tensile and allowable stress
- Predict MAWP, MDMT, and retirement thickness
- Accounts for flame impingement and radiant heat of a fire

What Else?
- Fire damage properties based on hardness test values

PART 12 – DENTS AND GOUGES

Level 1
- Limits maximum dent depth to % of outer diameter
- Part 5 methodology assuming gouge is local metal loss
- Combined dent/gouge
  - Screening criteria based on dent depth to OD and gouge depth to wall thickness

Level 2
- Includes a fatigue assessment for effects of cyclic pressure
- Combined dent/gouge
  - RSF approach
  - Determines MAWP based on dent and gouge depths

What Else?
- Includes dents, gouges, and combined dents-gouges
PART 13 – LAMINATIONS
Levels 1 and 2
- Screening criteria for lamination damage
- Assess laminations parallel to plate surface
Controlling factors include:
- Lamination size
- Orientation relative to the surface
- Spacing of lamination to weld-joints, structural discontinuities, and other laminations

PART 14 – FATIGUE DAMAGE
Level 1
- Screening criteria for fatigue damage
- Customization for in-service components
Level 2
- Smooth bar and welded joint fatigue methods
- Cycle counting and plasticity correction included
Level 3
- Strain-life fatigue damage model
- Multiaxial critical plane cycle count and search for plane of maximum damage
What Else?
- Palmgren-Miner damage accumulation
- No limit to the size of the input loading history
- Primary results are a prediction of cumulative fatigue damage and number of permissible repetitions of the user-specified loading history until failure
- Additional results include cycle data, applicable fatigue curve, and loading history plots