CalcHub

# Fitness-for-Service Assessment Summary

Method reference: API 579-1/ASME FFS-1 Part 9

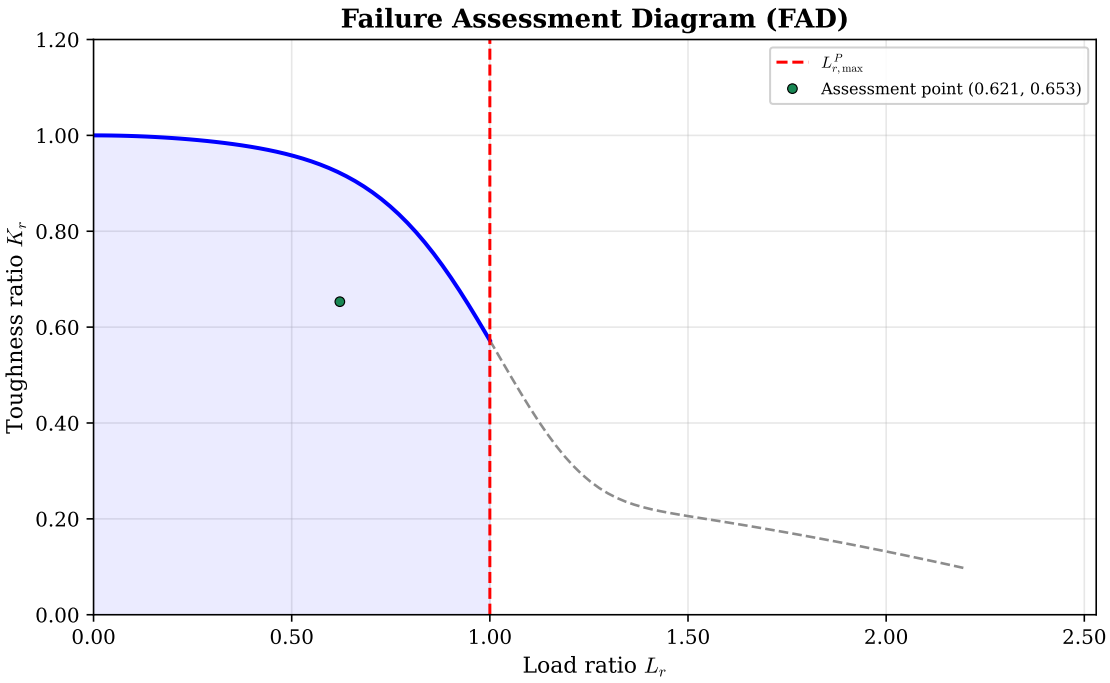
### Title: Cylinder, longitudinal surface crack

| | | | |
|---|---|---|---|
| **Assessment Type:** | Crack-Like Flaw | **Component:** | Cylinder |
| **Level:** | 2 | **Unit System:** | METRIC |
| **Report Date:** | 2026-10-18 16:06 CEST | **Assessment Created:** | 2026-10-18 16:06 CEST |

## ACCEPTABLE

Specified flaw and load case at 24.0 bar(g), -50 °C.

## Failure Assessment Diagram - Assessment Point



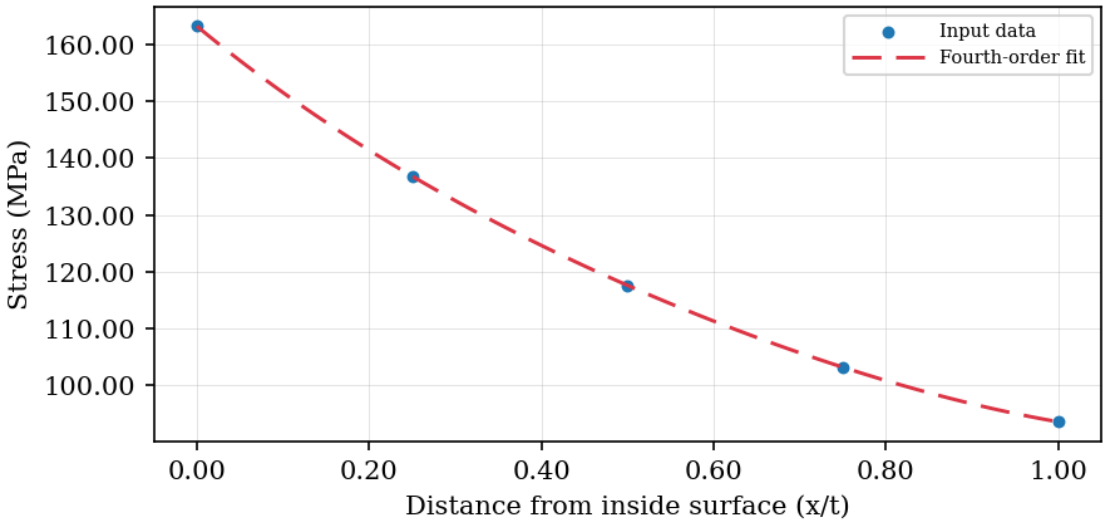

## Level 2 Assessment - 12-Step Summary

### Step 1 - Operating Conditions

| Parameter | Value | Units |
|---|---|---|
| **Internal pressure** | 24.0 | bar(g) |
| **Assessment temperature** | -50 | °C |

### Step 2 - Stress Input

| Parameter | Value | Units |
|---|---|---|
| **Stress input basis** | Direct input | - |
| **Crack-face pressure** | 24 | bar(g) |



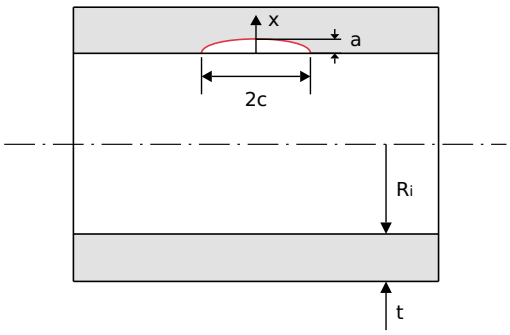

### Step 3 - Material Yield Strength

| Parameter | Value | Units |
|---|---|---|
| **Material yield used for plastic collapse** | 250.00 | MPa |
| **Material yield used for residual stress** | 250.00<br>Basis: Material yield strength | MPa |

### Step 4 - Fracture Toughness

| Parameter | Value | Units |
|---|---|---|
| **Fracture toughness option** | Master Curve Option A - Exemption Curve (Annex 9F.4.3.2) | - |
| **ASME exemption curve** | Curve B | - |
| **Ambient yield strength used for toughness** | 300 | MPa |
| **Sulphur content** | Low sulphur content (S ≤ 0.01 wt.%) | - |
| **Cumulative probability of failure $P_f$** | 0.05 | - |
| **Material fracture toughness $K_{mat}$** | 39.19 | MPa√m |

### Step 5 - Geometry and Flaw




| Input | Value | Units |
|---|---|---|
| **Geometry selection** | Cylinder | - |
| **Crack geometry selection** | Surface, Longitudinal, Semi-Elliptical - Arbitrary Stress | - |
| **Thickness t** | 10 | mm |
| **Inside diameter ID** | 1000 | mm |
| **Inner radius $R_i$** | 500.00 | mm |
| **Flaw depth a** | 5 | mm |
| **Flaw half-length c** | 25 | mm |
| **Flaw surface / location** | Inside surface (ID) | - |
| **Crack-front assessment angle** | 90 | deg |

### Step 6 - Reference Stress

| Parameter | Value | Units |
|---|---|---|
| **Reference-stress solution** | Surface, Longitudinal, Semi-Elliptical - Arbitrary Stress, Annex 9C.5.12 | - |
| **Reference stress** | 155.37 | MPa |
| **Surface correction factor $M_s$** | 1.08 | - |
| **Surface correction basis** | Net-section collapse (the recommended surface correction) | - |

### Step 7 - Load Ratio

| Parameter | Value | Units |
|---|---|---|
| **Load ratio $L_r^P$** | 0.621 | - |

### Step 8 - Primary Stress Intensity

| Parameter | Value | Units |
|---|---|---|
| **Stress profile method** | Fourth order polynomial approximation | - |
| **Stress-intensity solution** | Surface, Longitudinal, Semi-Elliptical - Arbitrary Stress, Annex 9B.5.12 | - |
| **Primary stress intensity factor $K_I^P$** | 25.59 | MPa√m |

### Step 9 - Secondary and Residual Stress Intensity

| Parameter | Value | Units |
|---|---|---|
| **Residual-stress basis** | Base metal (no weld); PWHT: No | - |
| **Reverse residual stress field** | No | - |
| **Secondary / residual stress intensity factor $K_I^{SR}$** | 0.00 | MPa√m |

### Step 10 - Plasticity Interaction

| Parameter | Value | Units |
|---|---|---|
| **Plasticity interaction factor Φ** | 1.00 | - |

### Step 11 - Toughness Ratio

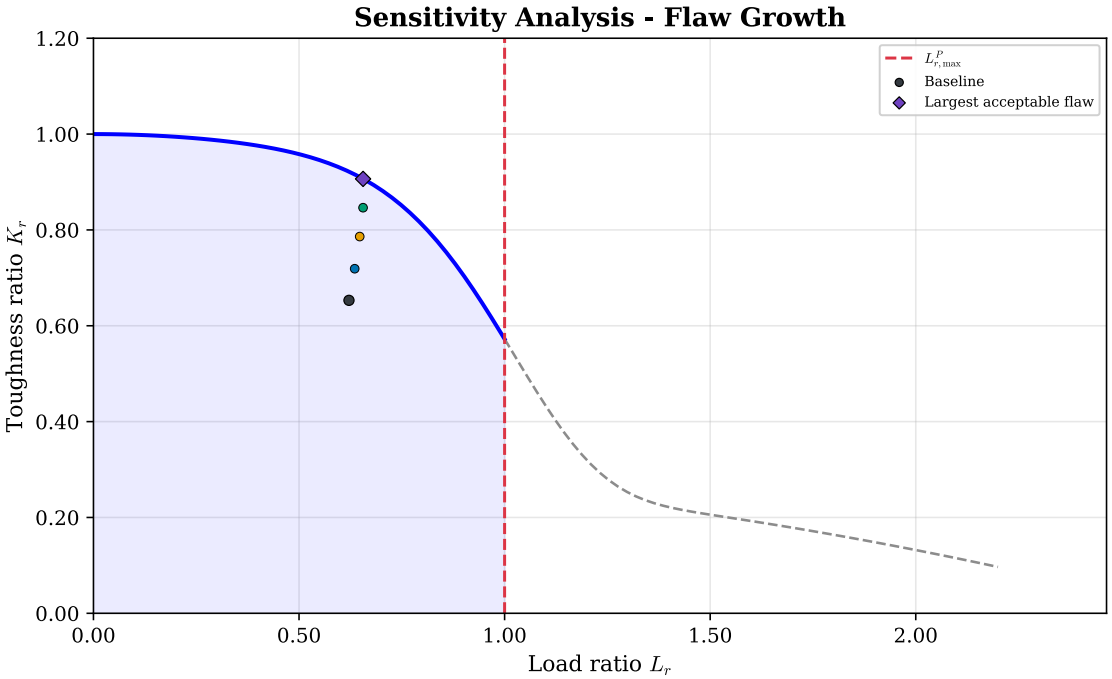
| Parameter | Value | Units |
|---|---|---|
| **Toughness ratio $K_r$** | 0.653 | - |

### Step 12 - FAD Evaluation

| Parameter | Value | Units |
|---|---|---|
| **FAD result** | Acceptable | - |
| **Load factor** | 1.262 | - |
| **FAD cutoff $L_{r,max}^P$** | 1<br>Yield plateau | - |

## Sensitivity Assessment

| Parameter | Value | Units |
|---|---|---|
| **Largest acceptable flaw** | a = 6.99 mm, c = 34.95 mm, growth = 39.92% | - |
| **Failing upper bound** | a ≈ 7.00 mm, c ≈ 35.00 mm, growth = 40.00% | - |
| **Search tolerance** | 0.10% of initial flaw dimensions | - |
| **Fixed inputs** | Loads, material data and other geometry inputs. | - |




| Plot | Point | Crack depth, $a$ (mm) | Crack half-length, $c$ (mm) | $L_r^P$ | $K_r$ | Load factor | Result |
|---|---|---|---|---|---|---|---|
| ● | Baseline | 5.00 | 25.00 | 0.621 | 0.653 | 1.262 | Acceptable |
| ● | 1 | 5.50 | 27.50 | 0.635 | 0.719 | 1.182 | Acceptable |
| ● | 2 | 6.00 | 30.00 | 0.648 | 0.786 | 1.109 | Acceptable |
| ● | 3 | 6.50 | 32.50 | 0.656 | 0.846 | 1.051 | Acceptable |
| ◆ | Maximum | 6.99 | 34.95 | 0.656 | 0.906 | ≈1 (above minimum) | Acceptable |