# CERTivation

# CERTIFIED IN FRACTURE MECHANICS: CS032F

To be awarded the Certified in Fracture Mechanics designation, a candidate must pass a comprehensive examination consisting of forty-(40)multiple-choice questions. The relative order of importance of the KSAs determines the percentage of the total exam questions.

Please note that questions from the various content areas will be mixed throughout the examination. The questions will NOT be presented in content area order on the examination. All questions are only offered in English.

## Knowledge of:

1. Quantitative and qualitative toughness and interpreting fracture toughness (Kmat) from Charpy and toughness data, using standard correlations. Fracture toughness testing.**(12.5%)**

2. Identify primary and secondary stresses, toughness, and other inputs to a fracture analysis. **(12.5%)**

3. Stress fields at crack tips, and elastic-plastic fracture using K, J, or CTOD. Relationship between K, J and CTOD. **(12.5%)**

4. FADs for fracture and collapse. Choice of FAD, inclusion of residual stress, effects of pressure testing and PWHT on inputs. **(10%)**

5. Can carry out fatigue analyses by S-N or fracture mechanics methods, including environmental effects and cycle counting of data. **(12.5%)**

6. Assessment codes – BS 7910, API 579 – and other approaches (e.g., CorLAS, PAFFC, LEFM). Use of commercial ECA software packages for routine analyses. **(12.5%)**

7. Assessment of environmental cracking.**(12.5%)**

8. Can interpret pipeline data such as design and service records, pipe stress analysis **(15%).**

## Preparing for the Exam

Individuals need some technical knowledge before commencing this certification program, particularly if an individual is new to, or inexperienced in, pipeline integrity. Each certification scheme contains a list of recommended awareness level competencies (knowledge and skills) which cover basic terminologies, principles, and practices in pipeline integrity competencies.

This list of awareness level competencies can assist in understanding the foundation level competency prior to assessment. These competencies are only a recommendation but are **NOT** required.

### CS020A: Pipeline Defect Assessment
*Knowledge of*
1. Material properties (strength, ductility, hardness, and toughness).
2. Fracture mechanics: history, key parameters, methods, and published good
3. practices.
4. Stress analysis (internal pressure and external loading).
5. Pipeline failure causes (with a focus on external interference, corrosion, materials defects, fatigue, ground movement, theft).
6. Types of failure (including ductile, brittle, overload, and fatigue).
7. Case studies in major pipeline failures
8. Corrosion assessment, crack assessment, mechanical damage assessment.
9. Crack management in pipelines.

## CS030A: Stress Analysis

*Knowledge of*

1. Loads, forces, moments.
2. Pressure, stress.
3. Stresses in pipelines caused by internal pressure and external loadings.
4. Stress versus strain.
5. Mechanical properties (strength, deformation, fracture).
6. Stressing guidelines in pipeline standards, including allowable stresses and design factors.
7. Effect of subsea environment, and stresses in risers.
8. Effect of ground movement on pipelines.

## CS032A: Fracture Mechanics

*Knowledge of*

1. History of fracture mechanics. Material properties, including ductile and brittle fracture, and transition curves. Strength, toughness, and ductility.
2. Structural mechanics, stress, strain, strength. Effect of notches and cracks on structures.
3. Linear elastic fracture mechanics, and the stress intensity factor.
4. Fatigue predictions using S-N curves and fracture mechanics crack growth.
5. Effects of environment on fracture and fatigue.

## CS033A: Failure Analysis

*Knowledge of*

1. Material properties (strength, ductility, hardness, and toughness).
2. The ductile to brittle transition of steel.
3. Pipeline failure causes (with a focus on external interference, corrosion, materials defects, fatigue, ground movement, theft).
4. Modes (e.g., buckling) and mechanisms of failure (including corrosion, and fatigue).
5. Failure mechanisms and their causes (including cracking, corrosion growth, and erosion).
6. Chain of custody.
7. Human factors in failures (e.g., CSA's EXP248-2015.)
8. Failure site investigations and protecting evidence.
9. Site safety following a failure.

## CS042A: Failure Modes and Mechanisms

*Knowledge of*

1. Why failures occur.
2. Loading types (tension, torsion, compression, etc.)
3. Brittle and ductile failures.
4. Failure modes (collapse, buckling), and failure modes from pressure loading (leak, etc.).
5. Failure mechanisms (including corrosion and fatigue)
6. Modes of failure (including ductile, brittle, overload, and fatigue).
7. Failure mechanisms and their causes (including cracking, corrosion growth, and erosion), modes, and final failure.

## CS048A: Pipeline Defects

*Knowledge of*

1. Line pipe welds (longitudinal, and spiral), welding processes, inspection methods, and defects (e.g. lack of fusion, laminations, hook cracks, porosity).
2. Pipeline welds (circumferential): standards, inspection methods, and defects (including geometric defects such as misalignment).
3. Common pipeline construction related defects (e.g., misalignment) and their causes.
4. Common types of internal and external corrosion (e.g., pitting, general) and their causes.
5. In-service defects (e.g., mechanical damage, stress corrosion cracking and fatigue cracking

# CERTivation

# Certification Application

## Contact Information

Mr.            Miss            Mrs.            Ms.

First Name                    Middle Name                    Last Name

Street Address or PO Box

City                    State            Country                    Zip Code/Mail Code

Contact Number            Email Address

## Applying for

First-Time Applicant

Previous Applicant

## Certification Area

Pipeline Engineering Principles CS001F

Pipeline Inspection and Surveillance CS005F

Pipeline Integrity Management CS014F

Pipeline Defect Assessment CS020F

Inline Inspection Technologies and Procedures CS022F

Inline Inspection Data and Reporting CS026F

Stress Analysis CS030F

Fracture Mechanics CS032F

## Special Testing Accommodations

The purpose of test accommodations is to provide all candidates with full access to the test. However,test accommodations are not a guarantee of improved performance or test completion.
CERTIVATION GmbH will provide reasonable and appropriate test accommodations to individuals with documented disabilities who demonstrate a need for test accommodations.

I will be applying for special testing accommodations and I understand that my application will **NOT** be approved until I submit the required documentation.

I will not be applying for special testing accommodations.

## Certificate / Certificants Registry

Enter your name exactly as it should appear on your certificate. This does not have to match your government issued ID.

The Certification Registry is an up-to-date record of individuals who have earned a certification and those who have chosen to keep it active. The registry is an opportunity for employers and recruiters to verify your certification. Certificants can opt out of the having their name published in the online registry during the application process. However, we are obligated to give this information on request on the basis of ISO/IEC 17024 the certification registry, your information will not be included. You will not be notified if a request is made about the status of your certification. You can opt out of the listing in the registry at any time.

The certification registry will only include the following information:

- Certificants Name
- Personnel Certification Number
- Personnel Certification Expiration Date
- Personnel Certification Type
- Country Of Residence

No personal contact information, such as email, physical address, or phone number, will be included in the registry. Inclusion in the registry is voluntary. If you have an active certification and choose not to be listed

I want my name to be included in the certification registry.

I **DO NOT** want my name to be included in the certification registry.

## Evidence of Eligibility

Applicants are required to submit evidence of eligibility.  (see candidate handbook for more details).

By initialing, I understand that my application will **NOT** be approved until I submit the required documentation.

Initial Here

## Fees & Payment Information

Application fees are the non-refundable fees paid for the processing, review, and data management for each certification application. This is paid when the application is submitted. The application fee must be paid every time an applicant applies to any of the certifications available except for applicants applying for the Certified Pipeline Integrity Engineer certification.

Applicants, whose applications is incomplete and not corrected within thirty-(30) days of notification will forfeit their application fee and will be required to repay the application once if they restart the application process.

Examination Sitting Fees are the non-refundable fees paid to take the knowledge examinations. Candidates must pay the exam-sitting fee within thirty-(30) days of acceptance into the program and must schedule their exam within the one-(1) year of paying the exam-sitting fee. Failure to do so, the candidate will forfeit all fees paid.

All payments must be made by either a Visa or MasterCard credit card. We do **NOT** accept American Express. Payments can be made through the CERTIVATION website.

## Refund Policy

1. Fees are subject to change, and it is the applicant / candidate's responsibility to submit the current fee for any aspect of the certification. A description of all fees are published in the candidate's handbook.

2. Application fees are non-refundable, which is why candidates are encouraged to review the eligibility requirements prior to applying.

3. Applicants whose applications are incomplete and fail to correct any and all discrepancies within thirty-(30) days of notification, forfeits their application fee.

4. Candidates arriving thirty-(30) minutes after the scheduled start exam time will be considered absent and will forfeit their exam fee.

5. Candidates who are a no show, forfeits their exam fee.

6. Candidates who fail to take their exam within the one-(1) year timeframe, which begins at the time of payment for the exam, forfeits all fees paid.

7. Refunds are not granted to candidates who forfeit or fail the examination; this includes candidates who cannot produce the required identification for exam admittance. Under these circumstances candidates will be considered absent, will forfeit the full examination fee, and will be required to repay the examination fee.

8. Refunds and partial refunds for examination fees are granted at the discretion of the CERTIVIATION GmbH certification management for extenuating circumstances only.

By signing below, I am acknowledging that I read and understand the refund policy.


Signature of Applicant                                                                                      Date


## Code of Conduct

The Code of Conduct establishes the basic ethical standards for the professional behavior of certificants. Although a Code of Conduct cannot include rules for every imaginable situation, it is designed to provide both appropriate ethical practice guidelines and enforceable standards.

As a condition of earning and maintaining certification, I agree to uphold and abide by the following tenets:

1. Exercise a reasonable industry standard of care in the performance of professional duties.

2. Perform professional duties with trust, integrity, and verity.

3. Respect human rights

4. Hold paramount the health and safety of the public in the performance of professional duties.

5. Work in a manner consistent with all applicable laws and regulations; demonstrate integrity, honesty, and fairness in all activities; and strive for excellence in all matters of ethical conduct.

6. Act with integrity in any relationship that involves an employer or client and disclose fully to an affected employer or client any conflicts-of-interest resulting from business affiliations or personal interests. Voluntarily and immediately report any felony convictions or other legal dispositions that would constitute violations of this Code of Conduct that have not already been disclosed, regardless of when they occurred, and report any conditions that prohibit fulfillment of duties as set forth in the competence requirements.

By signing below, I agree to abide by the code of conduct.


Signature of Applicant                                                                                      Date


## Candidate Agreement Acknowledgement

1. The candidate for the award or certification of a competency agrees and acknowledges, by signing below, to the following provisions:

2. the competence assessment and all related materials sent to the candidate are copyrighted and strictly confidential, and shall not be shared with any third party;

3. the candidate has seen and understands the relevant Competence Standard(s), contents, requirements, and criteria, and believes he/she meets these;

4. the candidate agrees to notify CERTIVATION in a timely manner of changes concerning the information they have provided, including my current address and telephone number;

5. the candidate agrees to notify CERTIVATION without delay, of any matter that affects the individual's ability to continue to fulfil the Personnel Certification requirements once Personnel Certification is granted;

6. the candidate accepts and agrees with the assessment and its criterion (subject to item 10);

7. the candidate will act in a truthful and honest manner at all times and declares that all information and documentation he/she submits is correct and an honest record of his/her education, qualifications and experience;

8. the candidate will not participate in fraudulent test taking practices;

9.  the candidate will submit all required information and documentation prior to any award or certification, and that all materials submitted become the property of CERTIVATION GmbH, and are not required to return the materials; information related to the participation in this assessment may be used in an anonymous manner for research purposes only;

10. the candidate is aware of the grievance and appeal process, and will accept the final outcome of such process;

11. the candidate will comply with all applicable provisions of this assessment and any resulting certification scheme;

12. the applicant/candidate will immediately cease the use of all claims to the assessment or certification that contain any reference to the Assessment, CERTIVATION GmbH or any award by such CERTIVATION GmbH upon suspension or withdrawal of such certification, and to return all certificates issued by the CERTIVATION GmbH;

13. the candidate will only make claims regarding this assessment only with respect to the scope for which the certification has been granted;

14. the candidate hereby releases, discharges and indemnifies CERTIVATION GmbH, QPPI Certification Board, ROSEN Swiss AG, all related ROSEN entities, its directors, officers, members, examiners, employees, attorneys, representatives and agents from any actions, suits, damages, claims or obligations arising out of or in connection with this application and the awarded competency or qualification. The candidate further agrees and understands that all decisions regarding competency or qualification award rest solely in the discretion of Body;

15. the candidate agrees not to use the use the certification in such a manner as to bring the certification body into disrepute, and not to make any statement regarding the certification which the certification board considers misleading or unauthorized;

16. the candidate agrees not to use the certificate in a misleading manner;

17. Information about applicants / candidates / certificants and their application status and examination results are considered confidential. Personal information submitted by the applicants /candidates / certificants with an application is considered confidential. Confidential information will not be released unless a signed release is provided or is required by law. When required by law, the applicants / candidates / certificants will be notify to the extent permitted by law.

18. The applicant/candidate understands the certification exam is proctored by an invigilator and will be monitored via a webcam.

19. The applicant/candidate understands during the validation process, they will be required to pan their monitor / camera around the room to get a 360° view.

Any violation of the above provisions may result in the immediate suspension or withdrawal of the assessment or certification. The candidate can appeal the suspension or withdrawal in accordance with the discipline policy. If the candidate does not appeal or the suspension / withdrawal is upheld, then the

assessment and/or certification will be immediately rescinded.

The candidate has read this Candidate Agreement and Statement of Acknowledgment in its entirety, understands it and agrees with it. By signing below, the candidate agrees to comply with all the above provisions.


Signature of Applicant                                                                                          Date

# Experience Verification Affidavit

*Return the completed form with your application.*

## Applicant Information

Name                                                                 Total Hours Claimed

*Enter the number of hours you have spent working in each knowledge area and a brief description on how you applied this knowledge. This will count toward the total hours of experience needed to fulfill the eligibility requirement.*

1. Quantitative and qualitative toughness, and interpreting fracture toughness (Kmat) from Charpy and toughness data, using standard correlations. Fracture toughness testing.

2. Identify primary and secondary stresses, toughness, and other inputs to a fracture analysis.

3. Stress fields at crack tips, and elastic-plastic fracture using K, J, or CTOD. Relationship between K, J and CTOD.

4. FADs for fracture and collapse. Choice of FAD, inclusion of residual stress, effects of pressure testing, and PWHT on inputs.

5. Can carry out fatigue analyses by S-N or fracture mechanics methods, including environmental effects and cycle counting of data.

6. Assessment codes – BS 7910, API 579 - and other approaches (e.g., CorLAS, PAFFC, LEFM). Use of commercial ECA software packages for routine analyses

7. Assessment of environmental cracking.

8. Can interpret pipeline data such as design and service records, pipe stress analysis output, SCADA data, and derive inputs for fracture and fatigue analyses.

By signing below, I certify all facts on this experience verification affidavit is correct. I understand any false statements made in connection with my application is sufficient cause for my application to the Pipeline Integrity Engineer Certification Program to be denied.

**APPLICANT SIGNATURE**                                                                 **DATE**

## Organization Information

Organization

Street Address

City                                                     State                           Country

Person Completing this Form                                                  Title

Email Address                                                         Contact Number

I hereby verify that the information provided below is true and correct, and I release this form to CERTIVATION GmbH for verification. I am aware that all applicants are subject to audit by CERTIVICATION GmbH and that I may be contacted by the CERTIVATION GmbH if further details are needed.

**REPRESENTATIVE SIGNATURE**                                                         **DATE**

# Mentoring Verification Affidavit

*Return the completed form with your application.*

## Applicant Information

Name                                                                Total Hours Claimed

The person named above is applying to the Pipeline Integrity Engineer Certification Program and is required to provide evidence he/she has received 36 hours of mentoring or guided learning. Mentoring is not managing. Mentoring focuses on the development of an individual through the sharing of experiences and knowledge from a more experienced and/or knowledgeable person.

Mentor Name                                                          Title

Organization

Address                          City                               State                    Country

Email Address                                          Contact Number

Relationship to the applicant                          From                    To

Please give the number of mentoring hours / topic:

1. Quantitative and qualitative toughness, and interpreting fracture toughness (Kmat) from Charpy and toughness data, using standard correlations. Fracture toughness testing.

2. Identify primary and secondary stresses, toughness, and other inputs to a fracture analysis.

3. Stress fields at crack tips, and elastic-plastic fracture using K, J, or CTOD. Relationship between K, J and CTOD.

4. FADs for fracture and collapse. Choice of FAD, inclusion of residual stress, effects of pressure testing, and PWHT on inputs.

5. Can carry out fatigue analyses by S-N or fracture mechanics methods, including environmental effects and cycle counting of data.

6. Assessment codes – BS 7910, API 579 - and other approaches (e.g., CorLAS, PAFFC, LEFM). Use of commercial ECA software packages for routine analyses.

7. Assessment of environmental cracking.

8. Can interpret pipeline data such as design and service records, pipe stress analysis output, SCADA data, and derive inputs for fracture and fatigue analyses.

By signing below, I certify all facts on this experience verification affidavit is correct. I understand any false statements made in connection with my application is sufficient cause for my application to the Pipeline Integrity Engineer Certification Program to be denied.

**APPLICANT SIGNATUREDATE**

I hereby verify that the information provided below is true and correct, and I release this form to CERTIVATION GmbH for verification. I am aware that all applicants are subject to audit by CERTIVICATION GmbH and that I may be contacted by the CERTIVATION GmbH if further details are needed.

**REPRESENTATIVE SIGNATURE**                                                          **DATE**

# CERTivation

# Experience In Lieu Of Degree Verification Affidavit

Return the completed form with your application.

## Applicant Information

Mr.        Miss        Mrs.        Ms.

First Name        Middle Name        Last Name

Contact Number        Email Address

## Organization Information

Organization        Applicant's Position / Title

Street Address

City        State        Country

From        To

Person Completing this Form        Title

Email Address        Contact Number

The person named above is applying to the Pipeline Integrity Engineer Certification Program. Applicants may substitute 4 years of relevant work experience within the pipeline integrity field in lieu of a degree from an accredited/recognized university. This form is for his/her supervisor or human resource management department to verify that he/she has met the necessary experience requirements.

I hereby verify that the information provided below is true and correct, and I release this form to CERTIVATION GmbH for verification. I am aware that all applicants are subject to audit by CERTIVICATION GmbH and that I may be contacted by the CERTIVATION GmbH if further details are needed.

**REPRESENTATIVE SIGNATURE**        **DATE**