

PRACTICAL GUIDE · 2026 EDITION

Strength Calculation for EAC The Handbook

A comprehensive handbook for manufacturers,
exporters and product managers



**LOADS · MATERIALS · CALCULATION · APPROVAL
TESTING · DOCUMENTATION · CHECKLISTS**

How to use this handbook

From confirmed inputs to a traceable strength assessment.

This handbook addresses manufacturers, designers, plant builders, quality managers and exporters. Its focus is strength assessment for pressure equipment and integration into EAC certification or declaration. It also covers interfaces with machinery, piping, valves, boilers and specialist sectors. The AC Inorms sector page is connected with official regulatory and standards information. Both editions share the same structure. Templates support project work; the calculation example explains basic principles without designing actual equipment.

Structure and use

Pages 4-9 cover obligation review, regulations, standards, nuclear cases and existing international evidence. Pages 10-12 address roles, workflow and inputs. Pages 13-27 discuss data, loads and components. Pages 28-36 cover methods, FEA, testing, reports and changes. Pages 37-40 provide templates and an annotated calculation example. Pages 41-47 contain four cases, errors, costs and worksheets; sources and contact close the guide.

Edition 1.0 · As of 14 October 2026

Check standards status, TR-list eligibility and technical applicability separately. GOST R 52857.4-2007 was withdrawn in Russia in 2018; GOST 34233.4-2017 is its successor reference there.

Contents

Linked chapters and printable working aids.

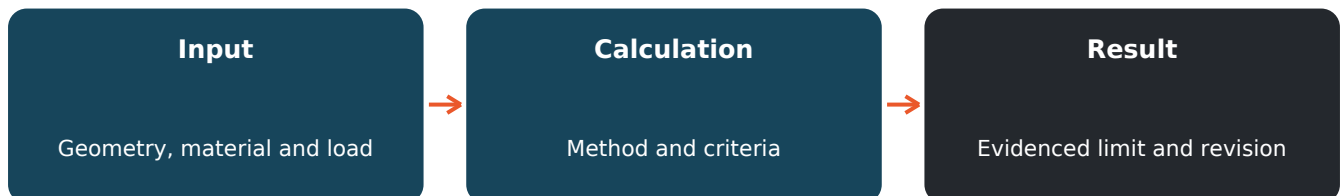
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Roles, workflow and inputs	10-12
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Suggested starting point

Start with product boundaries and regulatory allocation. Confirm geometry, material, pressure, temperature and load cases. Then select the method and assess its coverage.

What a strength assessment establishes

Justify protection against relevant failure modes.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Strength	Compare demand with suitable allowable criteria.
Stability	Assess instability, buckling and collapse where relevant.
Service life	Cycles, temperature, corrosion and time-dependent effects.
Leak-tightness	Consider joints and sealing systems separately.
Result	Confirmed limits, evidence and limitations.

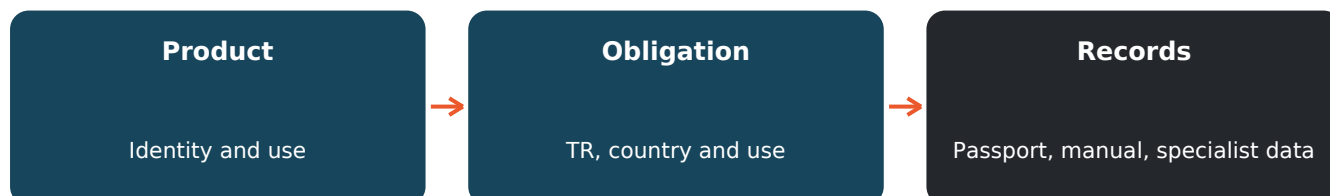
Strength assessment means more than stating that a component does not break. Failure modes, load cases and limits matter. Low stress cannot compensate for absent stability or fatigue assessment. Connect drawing, material properties, loading model and acceptance criteria. Results apply only to the recorded configuration. Keep inputs, assumptions and excluded scenarios visible. The website describes software and simulated conditions; a suitable analytical method may suffice for a particular task. A software output alone is not a technically approved assessment.

In practice

Every conclusion needs a load case and a suitable criterion.

TR 032: calculation duties and product scope

Pressure alone does not fully settle applicability.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Product	Vessel, boiler, piping, valve or component.
Inputs	Pressure, volume/DN, substance and function.
Scope	Assess TR thresholds and exclusions by product.
Dossier	Allocate strength and necessary capacity evidence.
Other duties	Review other TRs and national operating rules.

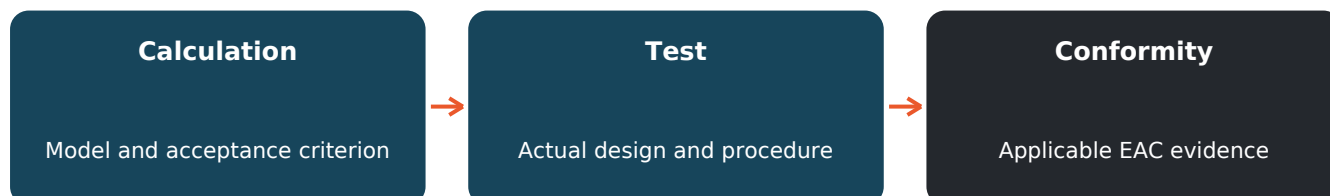
TR CU 032/2013 requires applicable calculation results and other technical records in the conformity dossier. Clarify classification before commissioning calculations. A claim that calculations are compulsory for every export is too broad: scope and exclusions matter. An assembly may contain differently classified items. Not every pressurised machine body is an independent vessel. Exclusion from TR 032 does not remove engineering safety responsibilities. Record the reasoned scope decision with actual supply boundaries.

In practice

Answer regulatory applicability and engineering necessity separately.

Calculation, testing and EAC evidence

Three levels with different meanings.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Calculation	Model-based assessment of confirmed geometry and loads.
Testing	Examination of actual configuration under a procedure.
Conformity	Certificate or declaration under applicable regulations.
Reconciliation	Drawing, report, material and product revision.
Limit	A successful individual item is not universal approval.

Calculation and testing can complement each other without being interchangeable. Pressure testing does not automatically assess cyclic service life. FEA stress alone does not establish sealing or manufacturing quality. Conformity evidence uses the necessary dossier and serves a distinct legal function. Software analysis is not automatically accredited laboratory testing. Strength calculation is not metrological calibration. State agreed scope clearly. Carry results consistently into safety justification, passport and instructions. A strength report alone does not authorise EAC marking; that follows the applicable successful conformity procedure.

In practice

Quotations and reports should distinguish calculation, testing and certification.

Standards plan: current GOST references

Selection for vessels and apparatus; not a universal standards list.

Reference	Project linkage
GOST R 52857.4-2007	Withdrawn in Russia from 1 August 2018.
GOST 34233.4-2017	Successor reference for flange strength and sealing.
GOST 34233.1-2017	General vessel-calculation foundations.
GOST 34233.2-2017	Shells, heads and covers by actual geometry.
GOST 34233.3-2017	Openings and external nozzle loads.
GOST 34233.5-2017	Support loads on shells and heads.
GOST 34233.6-2017	Low-cycle loading.
GOST 34233.7-2017 / .8-2017	Heat exchangers or jacketed equipment.
GOST 34233.12-2017	Presentation of computer-based strength assessments.

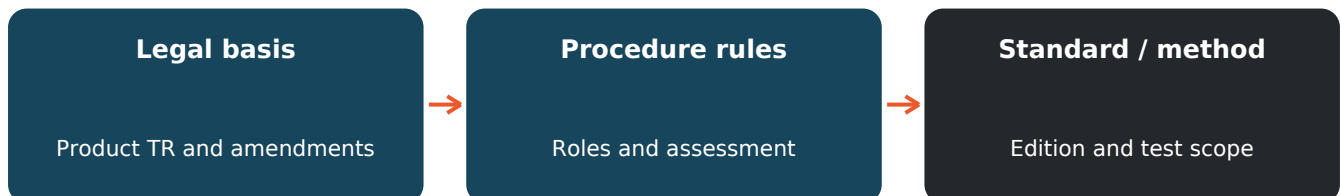
Check complete editions, relevant corrections and TR lists. National succession does not automatically amend every contract or list reference in all states. Select other parts and product rules by construction and failure modes.

Documentation

Record standard, edition, applicability, load case and acceptance criterion together.

Nuclear and other specialist applications

Derive specialist rules from actual use.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
PNAE G-7-002-86	Calculation rules for nuclear equipment and piping.
NP-068-05	Specialist requirements for nuclear plant valves.
TR 032	Nuclear-specific equipment and radioactive media excluded.
Oil / gas	Review assembly, transmission piping and station equipment separately.
Energy / construction	Function and actual product duty determine scope.

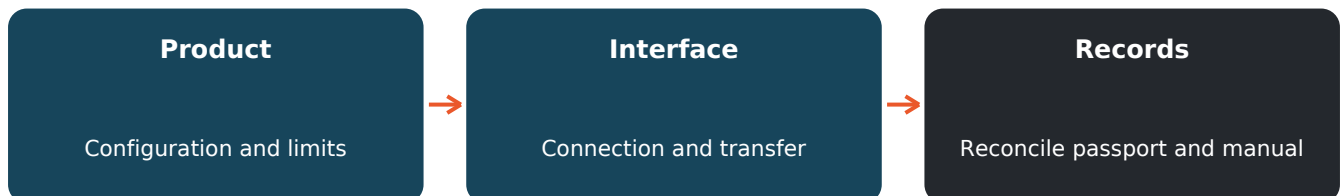
The sector page lists nuclear rules alongside industrial standards. This does not universally require ordinary vessels to follow PNAE or NP. Assess those documents within their specialist scope. A power-plant location alone does not establish nuclear-specific equipment. Oil and gas also have important scope boundaries. Excluded areas may have their own national rules and operator duties. Identify purpose, substance, function and installation in the brief. Plan specialist expertise and authority procedures where actually required.

In practice

Do not mix industrial and nuclear bases without technical justification.

Existing PED, EN and ASME evidence

Reuse technical quality and review differences clearly.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Product	Matching drawing, material and manufacturing revision.
Basis	Compare editions, criteria and applicability limits.
Loads	Reconcile pressure, temperature, forces and combinations.
Material	Confirm properties and actual supply evidence.
Gap	Agree additions and eligibility in the EAEU procedure.

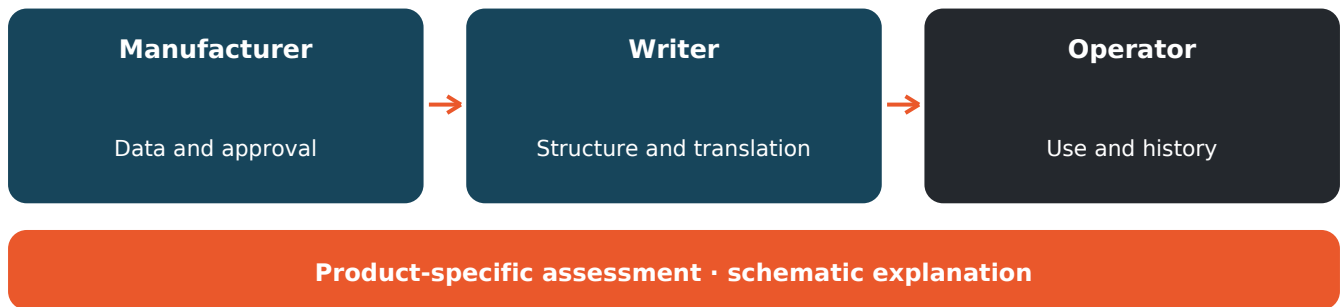
A reliable international report is valuable input. Translation alone does not make it complete EAC evidence. Compare assumptions, allowables, materials and load models. Editions and supplied configuration must match. Mixing favourable values from different rules can undermine a consistent safety basis. Record necessary supplementary assessment. The applicable procedure determines eligible evidence; a CE mark alone does not provide a strength argument. Justify technical applicability in writing.

In practice

Use a consistent calculation basis instead of selecting favourable individual factors.

Roles, input approval and technical review

Allocate ownership of inputs and results clearly.



Assessment area	Project implementation
Manufacturer	Confirm configuration, purpose and limits.
Design	Geometry, material, tolerances and load assumptions.
Analyst	Method, model, criteria and conclusion.
Operator	Process, installation and actual loading inputs.
Reviewer / body	Technical review and procedural alignment.

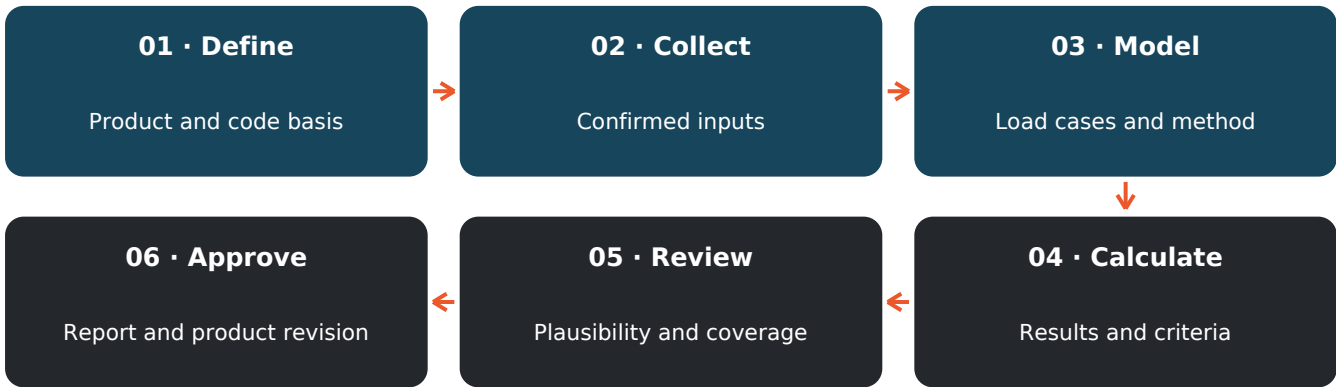
External analysis does not remove manufacturer responsibility for confirmed inputs. Decide who supplies absent piping loads or material properties. Analysts must not silently treat unconfirmed numbers as safe limits. Reviewers assess model and technical claims, not only grammar. Allocate interface ownership for assemblies. Software operation alone is not complete technical competence. Record approval with revision, name, role and date. Align responsibilities in quotation, report and EAC procedure.

In practice

Assign each unresolved input an owner, significance and due date.

Workflow: from inputs to approval

A clear sequence connects inputs, analysis and decisions.



Source infographic: five stages	Meaning
Input documents	Provide records and review requirements.
Simulation / software	Analyse the selected calculation method and results.
Report	Document conditions, results and conclusions.
Adjustments	Implement requirements and update records.
Approval	Review and issue the confirmed documentation.

English adaptation of the AC Inorms source infographic. The six-phase working diagram above separates method selection and evidence review; simulation is not compulsory for every case. This infographic provides a general project overview. Engineering additionally establishes scope, calculation basis, load cases and model quality. Simulation is necessary only where required by the selected method. Reassess affected evidence after changes. Keep report, drawing and approved configuration connected.

Completion

Approval follows technical review and closed evidence gaps, not merely a software run.

Preparing complete input records

Apply the sector-page checklist to actual scope.

Source checklist: document	Project input
Material list	Grades, product forms and evidence.
Technical drawings	Geometry, tolerances and revisions.
Operating description	Function, states and limits.
Use location	Environment and installation.
Design duration	Intended design period.
Piping loads	Forces, moments and reference axes.
Design pressure	Basis and load combinations.
Product description	Configuration and component scope.
Design temperature	Material properties and thermal states.
Regulatory records	Existing approvals and procedure basis.
Load types	Static, cyclic and other applicable loads.
Service life	Use assumptions and maintenance.
Assembly structure	Components and interfaces.

English adaptation of the AC Inorms source checklist; actual completeness depends on equipment and calculation scope.

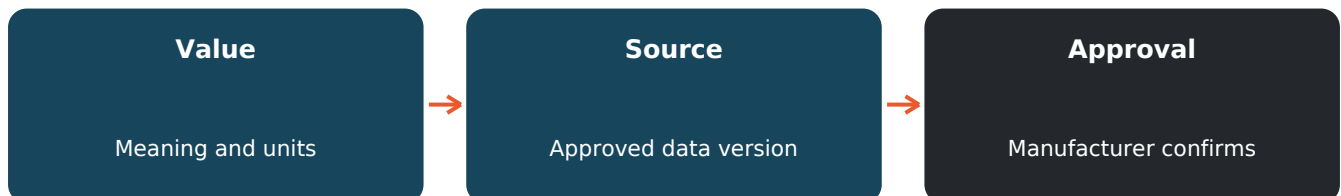
Add revision, input origin and unresolved fields. Drawings and materials lists must agree. Loading inputs need units, reference system and combinations. Existing approvals may help without being universal prerequisites. Connect design duration and service life with actual use and design.

Intake

Distinguish confirmed values, justified assumptions and missing inputs.

Allocating pressure terms and units correctly

Operation, calculation and testing are different states.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Operation	Actual intended process conditions.
Calculation	Pressure basis for the relevant strength assessment.
Allowable limit	Confirmed product limit and associated temperature.
Testing	Pressure under the specified testing procedure.
Unit	1 bar = 0.1 MPa = 100 kPa; state the reference type.

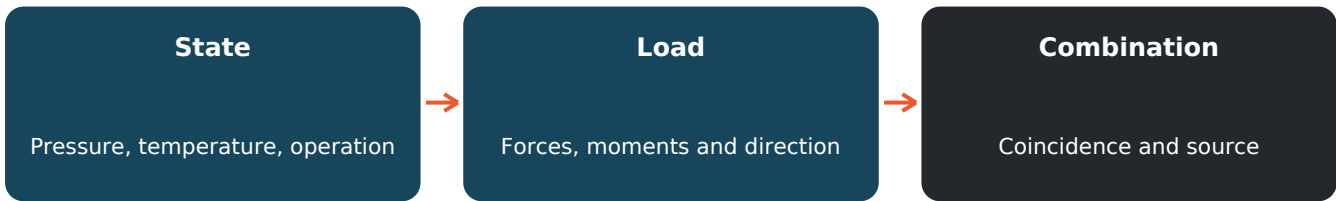
An identical number may mean different things under different references. Distinguish gauge and absolute pressure. Review hydrostatic head and local differences. Testing has its own temperature and loading conditions. Pressure without unit, definition or reference point is incomplete. Use a shared parameter table for report, passport and nameplate. Changes to allowable limits are not merely editorial. The page-40 learning example demonstrates unit checking without replacing code design.

In practice

Record unit and pressure definition beside every input.

Temperature, operating states and design limits

Temperature affects material properties and loading.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Substance	Inlet, process profile and local thermal conditions.
Component	Actual wall and component temperature.
Transient	Start-up, shutdown and gradients.
Material	Properties at the relevant temperature.
Combination	Consider pressure and temperature together by load case.

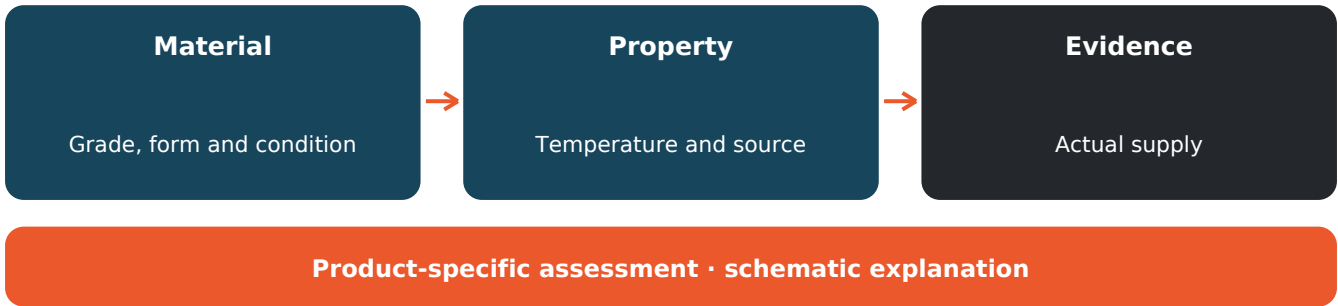
Do not use room-temperature properties for hot operation without review. Ambient, substance and wall temperatures differ. Gradients can produce additional loading. Peak pressure need not coincide with peak temperature, but justify combinations. Other failure mechanisms may govern at low temperature. Derive the thermal model from confirmed process and installation. Keep absent transient inputs open. Record limits and validity of properties.

In practice

Do not adopt a material value without temperature and product-form linkage.

Materials and allowable properties

Connect grade, supply condition and evidence.



Assessment area	Project implementation
Identity	Material standard, grade, product form and batch.
Condition	Heat treatment, thickness and manufacturing effects.
Property	Temperature dependence and applicable criteria.
Compatibility	Substance, corrosion and special environment.
Evidence	Material records and actual supplied configuration.

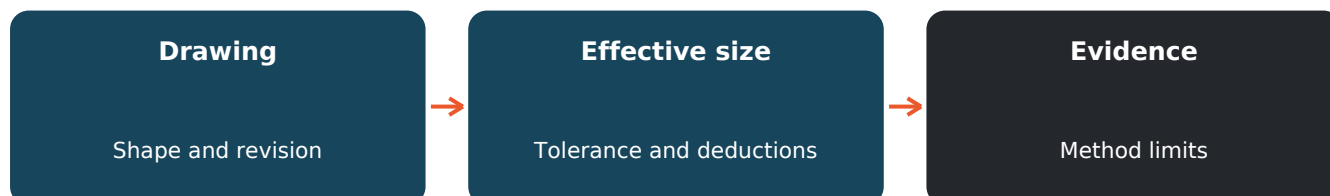
A similar trade name does not prove material equivalence. Review product form and supply condition. Allowables follow the selected consistent calculation basis. Do not combine foreign properties with favourable factors from a different standard. Welding and heat treatment may affect local conclusions. Technically assess alternatives. Record source and revision of software databases. State confirmed inputs and supply evidence still required before manufacture or approval.

In practice

Treat material substitution as an engineering change.

Geometry, tolerances and effective wall thickness

Distinguish nominal and calculation-effective dimensions.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Geometry	Diameter, radii, length and shape.
Thickness	Nominal wall and governing effective thickness.
Deductions	Manufacturing tolerance, corrosion and other relevant allowances.
Manufacture	Forming, local thinning and deviation.
Source	Drawing, measurement and actual revision.

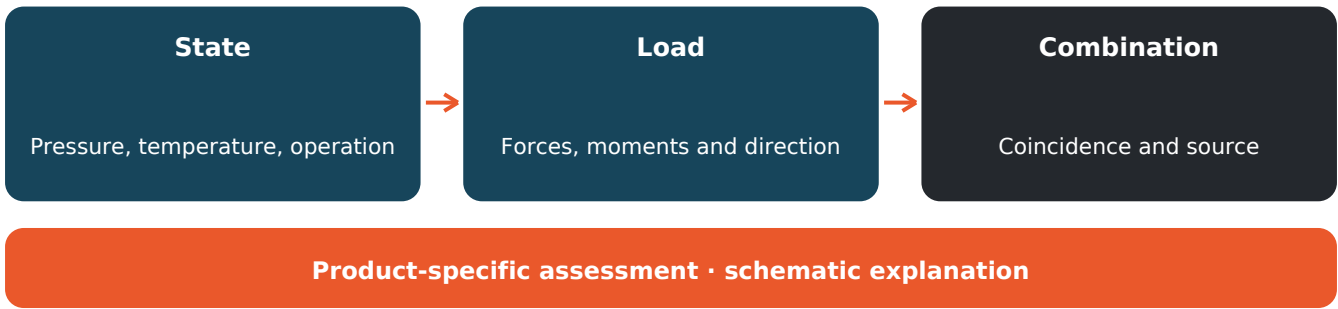
A drawing thickness is not automatically available everywhere. Consider tolerances and deductions under the chosen method. Forming may alter local dimensions. Reconcile manufactured geometry with assumptions. Do not double-count or silently omit allowances. Justify adverse configurations for families. Measurements from another revision are not a reliable basis. The page-40 example deliberately illustrates only the influence of confirmed effective thickness.

In practice

Document thickness with origin, deductions and validity by component.

Determining load cases and combinations

Consider more than normal internal pressure.



Assessment area	Project implementation
Pressure	Internal, external, vacuum and local differences.
Mechanical	Weight, attachments, pipe forces and moments.
Thermal	Expansion, gradients and constrained movement.
Operation	Start, stop, testing and relevant upset states.
Combination	Confirm coincidence, axes and direction.

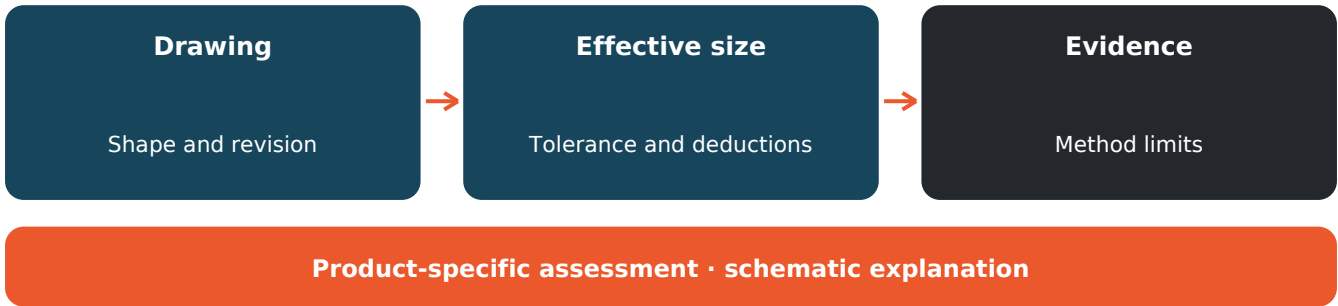
A load list becomes a model when conditions, coincidence and directions are visible. Capture supports, transport and relevant installation. The largest individual load is not automatically the adverse combination. Keep signs and units traceable. Agree nozzle-load limits with integrator and suppliers. Do not approve unassessed conditions implicitly. Explain why selected cases cover intended use. Record missing inputs with significance and owner.

In practice

Every result must belong to a clear load-case ID.

Internal pressure and local loading

Distinguish global structural behaviour and local disturbance.



Assessment area	Project implementation
Basic form	Cylinders, cones and heads with suitable method.
Effect	Hoop and longitudinal loading according to geometry.
Disturbance	Transitions, openings and attachments.
Assessment	Specified loads and allowable criteria.
Limit	Simplifications and additional assessment needs.

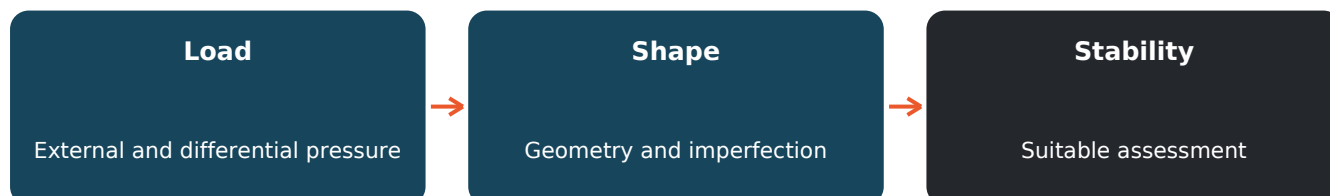
An idealised cylinder illustrates basic effects without fully designing an apparatus. Openings, heads and connections influence local demand. Check formula geometry and load limits. Comparing the highest software value with an arbitrary material number is insufficient. Identify the section and criteria. Add assessment where a method does not cover a connection. The page-40 learning example is an order-of-magnitude check, explicitly not a complete GOST calculation.

In practice

A simple plausibility check supports review without replacing required assessment.

External pressure, vacuum and stability

Low stress does not exclude instability.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Load	External pressure and possible differential pressure.
Shape	Length, diameter, wall and stiffening.
Deviation	Ovality, tolerance and relevant imperfection.
Condition	Vacuum use, draining, cooling and testing.
Method	Suitable stability rule or justified analysis.

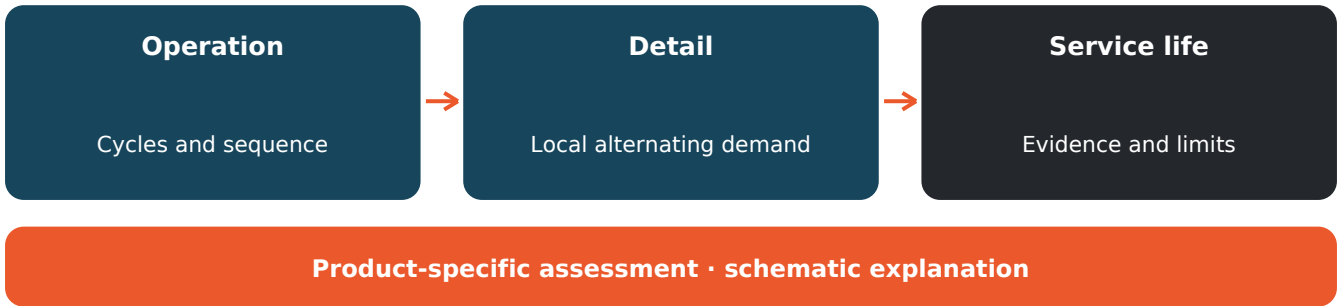
Equipment adequate for internal pressure may be inadequate under external pressure. Review vacuum and possible differential pressure during ordinary procedures too. Stability depends on geometry and deviations. An ideal linear eigenvalue model is not automatically reliable collapse evidence. Include necessary imperfections and assumptions in the method. Reconcile stiffening and supports with actual construction. Results without boundaries cannot be extended meaningfully. State assessed limits and remaining conditions.

In practice

Report stress and stability assessments separately.

Cyclic loading and fatigue

Track cycles and local demand over service life.



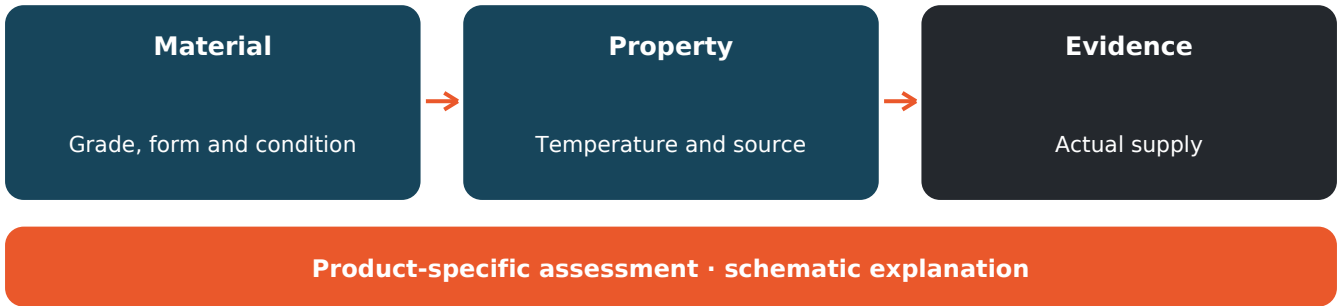
Assessment area	Project implementation
Cycle	Pressure, temperature and mechanical cycles.
History	Count, range and intended sequence.
Detail	Notch, weld and geometric transition.
Method	Suitable curves, criteria and evaluation.
Change	New operation or extended service life.

Static adequacy does not automatically establish fatigue resistance. Capture cycles from actual use. Average load may hide local alternating demand. Weld details and transitions need suitable evaluation. Arbitrary cycle counts do not replace a confirmed spectrum. Justify omission of fatigue analysis through the selected rules. Reassess changed operation. Carry relevant assumptions into instructions and limits, such as intended counts of particular start-up events.

In practice
Keep cycle assumptions as controlled report inputs.

Creep, ageing and corrosion

Time and environment can alter capacity.



Assessment area	Project implementation
Time	Temperature, stress and duration.
Loss	Corrosion, erosion and local thinning.
Material	Time-dependent properties and supply condition.
Condition	Inspection inputs and required minimum limits.
Reassessment	Substance change and extended use.

Service life cannot be derived from one instantaneous stress value. Review time-dependent mechanisms relevant to material and process. A generic corrosion allowance without substance linkage is incomplete. Local loss may differ from uniform thinning. Identify absent operating or inspection inputs explicitly. Do not mix existing-equipment assessment uncritically with new design. Define necessary checks and limits. Extended use needs suitable additional technical assessment.

In practice
Connect corrosion and service life with confirmed substance and use profile.

Flanges, bolts and leak-tightness

Capacity and sealing function need distinct assessment.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Geometry	Flange, bolt pattern and connection.
Gasket	Type, dimensions and necessary properties.
Assembly	Preload, method and variability.
Operation	Pressure, temperature, external force and moment.
Evidence	Assess bolt, flange and sealing consistently.

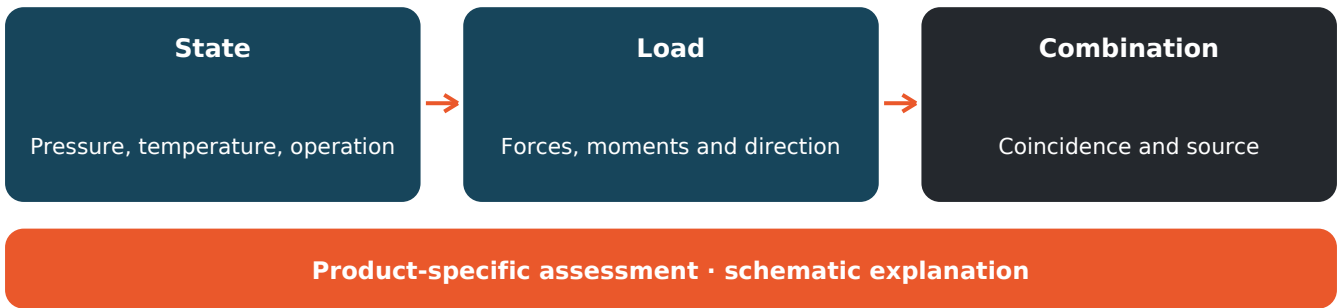
A joint may have adequate strength yet leak. Gasket properties and assembly affect results. Review bolt materials at relevant temperature. External loads may add demand. Equal diameter does not alone approve a different gasket. In Russia, GOST 34233.4-2017 succeeds withdrawn GOST R 52857.4-2007. Select the actual standards plan and state applicability limits. Assembly information follows confirmed design; do not invent universal tightening torque.

In practice

Make strength, preload and sealing separately traceable.

Openings, nozzles and piping loads

Assess local effects at actual connection geometry.



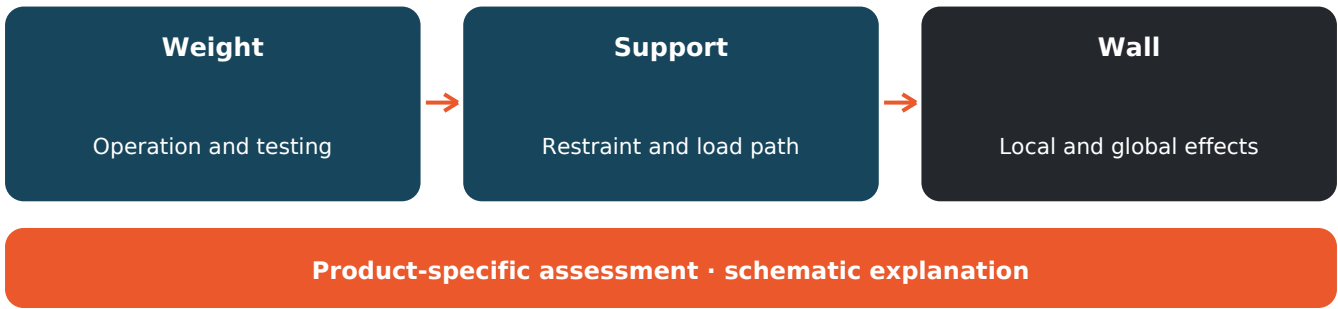
Assessment area	Project implementation
Opening	Location, size, reinforcement and nearby connections.
Piping load	Force, moment, direction and coordinates.
Combination	Pressure, weight and thermal effects.
Detail	Weld, transition and local thickness.
Coverage	Suitable formula limits or additional analysis.

Loads without axes and application point are incomplete. Establish whether inputs are confirmed or provisional. Forces and moments must belong to the same combination. Large openings or close spacing may limit simplified methods. Record geometry and assumptions with drawing references. Do not extend catalogue nozzle limits to another configuration without justification. Align local assessment with overall vessel model and installation. Piping-layout changes may require reconciliation.

In practice
Provide pipe loads with units, signs, application point and combination.

Supports, attachments and external forces

Understand load transfer into the surroundings.



Assessment area	Project implementation
Weight	Distinguish empty, operating and testing states.
Support	Saddle, leg, skirt and actual restraint.
Attachment	Platform, drive, insulation and other parts.
Environment	Wind, seismic and transport where relevant.
Evidence	Local wall demand and overall behaviour.

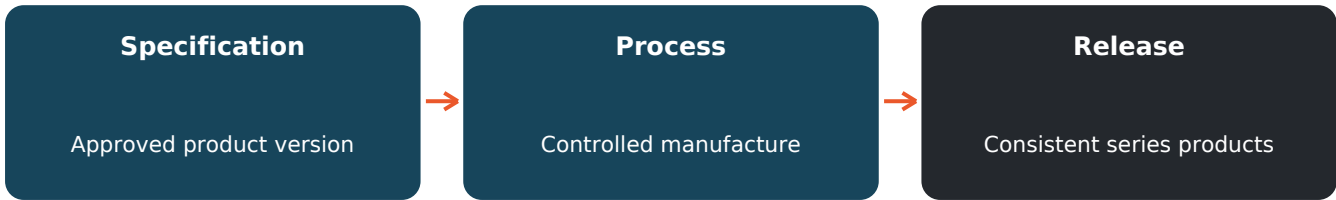
Supports and attachments load vessel walls too. Review fill states. Water testing can weigh more than operation. Restraint affects thermal movement and local forces. Foundations and attachments have their own owners. Confirm relevant site loads rather than applying arbitrary assumptions. Describe allowed degrees of freedom. State assessed parts and external interfaces needing evidence. Review additional attachments before installation.

In practice

Record testing weight and operating weight separately.

Welds and manufacturing quality

Calculation and actual manufacture must agree.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Weld	Type, location, geometry and assumptions.
Material	Base material, filler and heat treatment.
Quality	Examination scope and confirmed characteristics.
Deviation	Misalignment, shape variation and local thickness.
Evidence	Connect manufacture, examination and calculation basis.

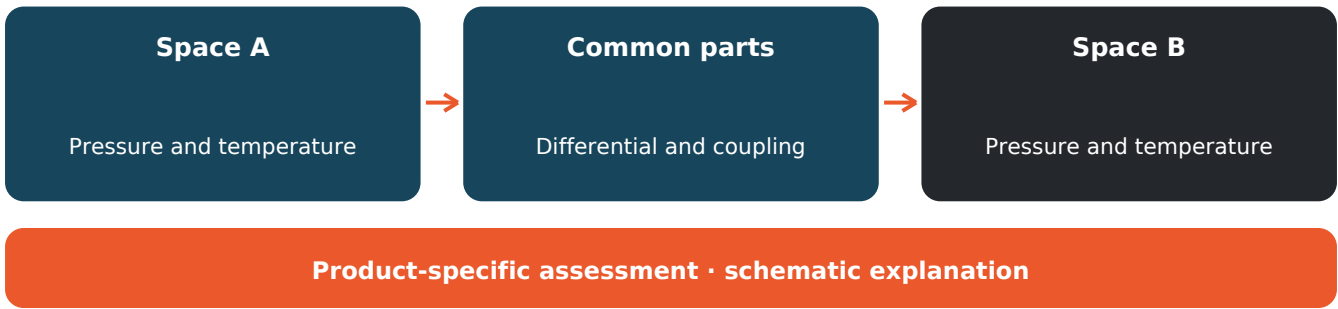
A welding characteristic assumed in analysis must be supportable in manufacture and examination. Welder qualification alone does not establish every actual weld. Define scope, methods and records through the applicable technical plan. Assess deviations before treating drawings as manufactured condition. Weld repairs may require added review. Calculation does not replace production approvals or necessary non-destructive examination. Keep weld, report and component linkage traceable.

In practice

Carry calculation assumptions into controlled drawing characteristics.

Heat exchangers, jackets and multiple pressure spaces

Capture differential pressure and thermal coupling explicitly.



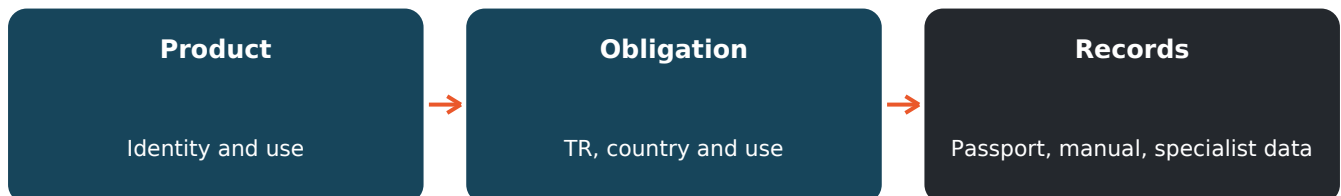
Assessment area	Project implementation
Space	Record each pressure space with substance and limits.
Differential	Possible opposing states and draining.
Thermal	Different temperatures and expansion.
Component	Tubesheet, jacket, connection and restraint.
Evidence	Allocate combinations and variants completely.

Do not assess two spaces independently where common walls or parts interact. An empty space beside a pressurised one may govern. Review sequence and temperature difference. Heat exchangers have design questions a simple cylinder formula does not answer. Record assessed combinations. Instructions must not authorise unassessed switching sequences. Evidence shared components against matching drawing revisions. Reassess coupled demand after substance or thermal-profile changes.

In practice
Keep a matrix of all relevant pressure-space combinations.

Piping, boilers, valves and accessories

Select the assessment basis for actual construction.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Piping	System movement, loads and relevant components.
Boiler	Heating, temperature and specific design rules.
Valve	Body, cover, connection and sealing.
Safety accessory	Distinguish strength and necessary capacity.
Assembly	Interfaces and manufacturer ownership.

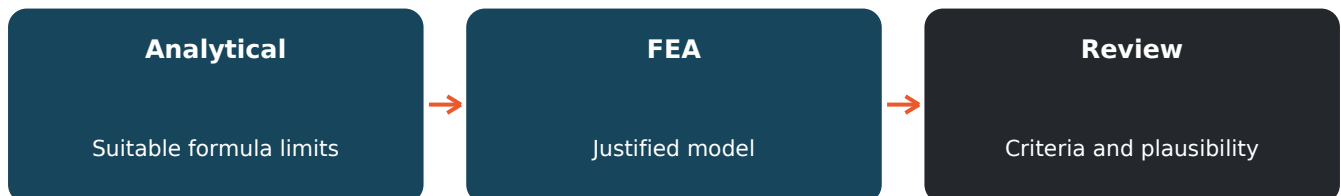
Vessel standards are not automatically universal rules for all accessories. Select by product, loads and failure modes. Safety valves need suitable functional/capacity review alongside pressure integrity. Boilers have specific thermal conditions. Piping may need flexibility and load-transfer assessment. Review actual valve construction. Carry results into the applicable dossier. The website lists many industries; that does not establish identical EAC classification or methods for every item.

In practice

Justify equipment type and calculation method through technical purpose.

Selecting analytical calculation or FEA

The method follows the engineering question.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Analytical	Suitable rules within confirmed limits.
FEA	Model-based analysis of complex geometry and load effects.
Combination	Align basic assessment and local analysis.
Acceptance	Set code criteria and procedures beforehand.
Review	Plausibility, limits and independent checks.

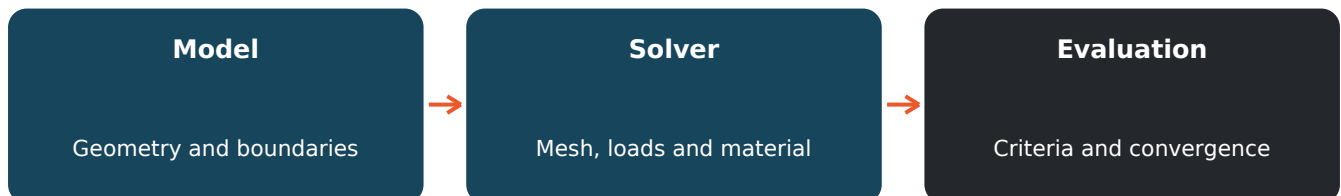
FEA is not automatically more accurate when inputs or boundaries are wrong. A suitable established analytical method can be highly traceable. Complex contact or load paths may need extra numerical work. Justify selection before solving. Do not choose acceptance criteria after finding attractive plots. Reconcile alternative methods explicitly. Strength and stability are different engineering questions. Explain what the model investigates and what needs further evidence.

In practice

Record method selection with limits and necessary assessment depth.

FEA model: geometry and boundary conditions

Model assumptions determine conclusions.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Geometry	Simplifications, symmetry and relevant details.
Material	Elastic/nonlinear and temperature-dependent inputs.
Restraint	Degrees of freedom, contact and actual connections.
Load	Distribution, application, direction and combination.
Check	Review reactions, equilibrium and units.

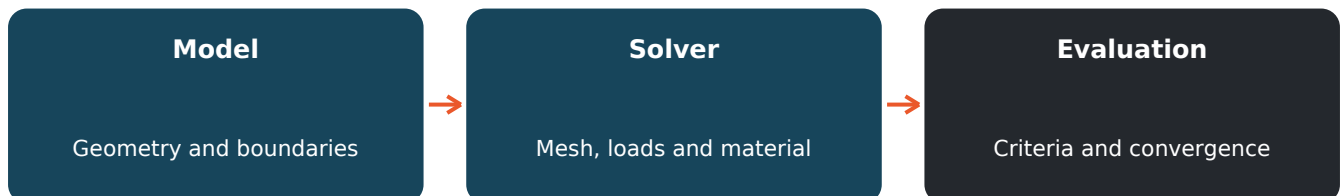
Overly rigid restraint can distort stress and displacement. Symmetry requires matching geometry and loading. Model contact and bolt preload against actual design. Removing a small radius may change the critical local area. Compare model and real construction. State units explicitly. Reaction forces help plausibility checks. Record software version, element choice and key settings. A colourful stress plot without model description cannot be reproduced.

In practice

Choose boundaries through engineering rationale rather than program defaults.

FEA evaluation, mesh and singularities

Distinguish numerical output and engineering evaluation.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Mesh	Resolution and convergence in relevant areas.
Peak	Identify geometric or boundary singularities.
Criterion	Suitable stress evaluation and load case.
Check	Energy, reactions and simple independent calculation.
Report	Show location, method and evaluation limits.

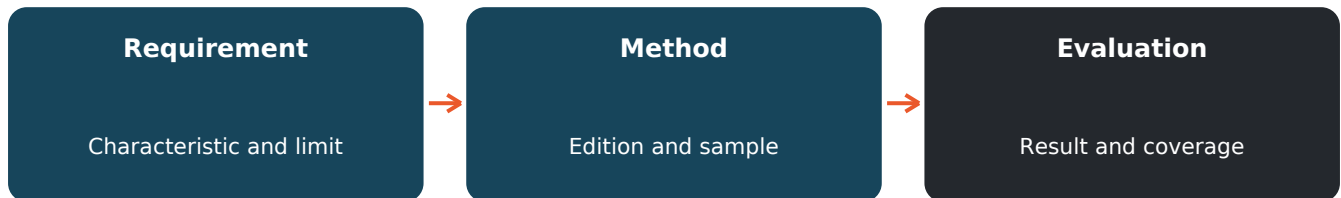
The highest nodal value is not automatically the governing real demand. Review singularities and suitable code evaluation. Refinement may increase a singular value without proving a physical failure. Record mesh studies and evaluation locations. Do not arbitrarily smooth raw results to obtain a pass. Explain differences from simple checks technically. Nonlinear and stability work needs its own evaluation. Reviewers should understand why the chosen result supports the actual assessment.

In practice

Label plots with load case, unit, legend and evaluation method.

Testing and model validation

Connect calculation and actual construction under control.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Purpose	Which claim should testing support?
Sample	Record identity, revision and deviations.
Condition	Pressure, temperature, load and measurement locations.
Result	Criterion, measurements and relevant uncertainty.
Applicability	Justify production and variant coverage.

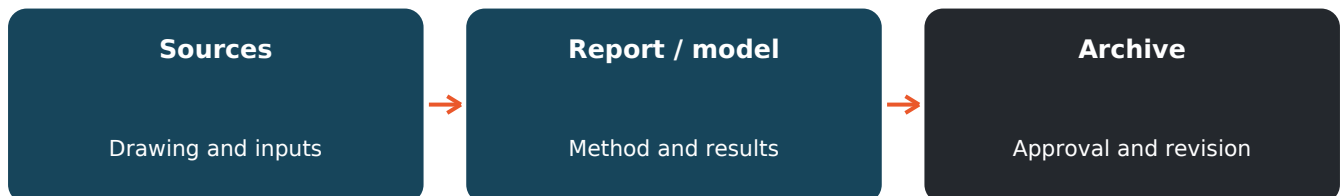
Plan tests with clear purposes. Pressure, leak and strain testing provide different information. Match the sample to calculation revision. Check whether testing represents only part of the product. Investigate differences instead of hiding them through presentation changes. Agree methods and acceptance beforehand. Physical testing belongs in scope only where expressly included. Do not present computed results as actual laboratory reports. Connect both evidence types with their limits.

In practice

Name calculation and test reports separately and reconcile them together.

Structuring a traceable calculation report

Other competent reviewers should reconstruct the argument.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Identity	Product, component, model and drawing revision.
Inputs	Geometry, material, pressure, temperature and loads.
Method	Standards, software, model and assumptions.
Result	Criteria, evaluation, coverage and limits.
Approval	Review, open items, decision and revision.

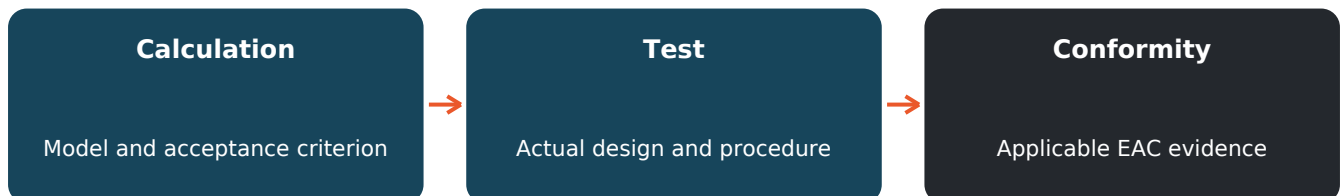
Show more than final values. Link sources and revisions so analysis can be reviewed again. Model images and diagrams explain locations and behaviour. Results without units or cases are incomplete. Identify unassessed parts clearly. Negative results explain clarification or change needs. Recalculate affected results after changes. State actually confirmed limits in conclusions. Technical approval and EAC conformity decisions remain separate steps.

In practice

Software appendices need an understandable engineering conclusion.

Carrying results into passport, instructions and justification

Keep confirmed configuration consistent through supply.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Passport	Identity and confirmed pressure/temperature limits.
Instructions	Operation, load limits, servicing and safe intervention.
Safety justification	Failure scenarios and associated evidence.
Marking	Actual allowable scope and product revision.
Reconciliation	Drawing, report and delivered component.

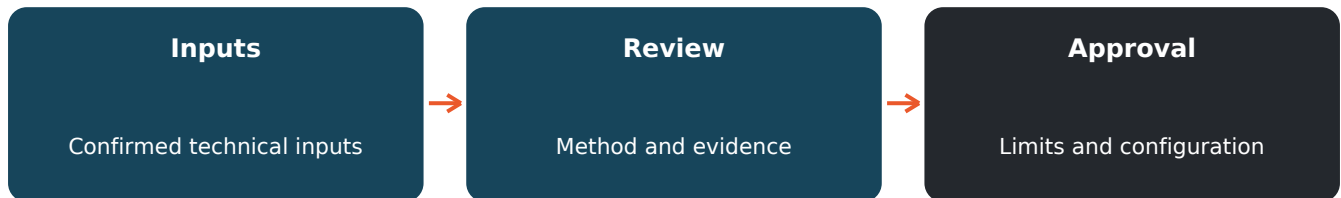
Do not combine a temperature-limited calculation with broader instructions. Carry relevant loading and life assumptions into operating records. Not every detail belongs on a nameplate; check mandatory information against rules. Passport and justification use clear references. Do not approve unassessed variants. Review values, units and terms carefully in translation. Before supply assign someone to confirm matching revision and necessary completeness.

In practice

Calculated limits and promised operating limits must agree.

Technical review and approval

Review model, evidence and conclusion together.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Completeness	Relevant parts, cases and failure modes.
Inputs	Confirmed values and traceable assumptions.
Method	Applicability limits and suitable criteria.
Plausibility	Units, reactions and independent checks.
Decision	Open items, conditions and approval status.

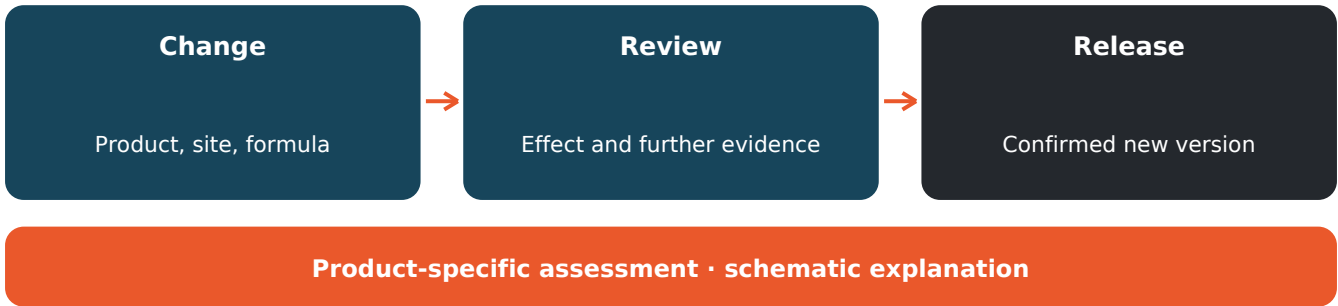
Review technical conclusions and coverage. An attractive file may still contain an incorrect loading model. Use a checklist and track deviations to closure. Plan suitable additional review for complex or critical assessments. Approval states actual revision and conditions where necessary. Deadlines do not replace absent material confirmation. Keep comments traceable; do not hide key changes in filenames alone. Then supply the approved edition to procedure participants.

In practice

Record approval with name, role, date and product revision.

Changes, repair and reassessment

The same model name does not mean the same assessment scope.



Assessment area	Project implementation
Geometry	Wall, opening, nozzle, support and attachment.
Material	Grade, gasket, bolt and heat treatment.
Operation	Pressure, temperature, substance and spectrum.
Repair	Actual condition and possible effects.
Procedure	Review affected records and conformity implications.

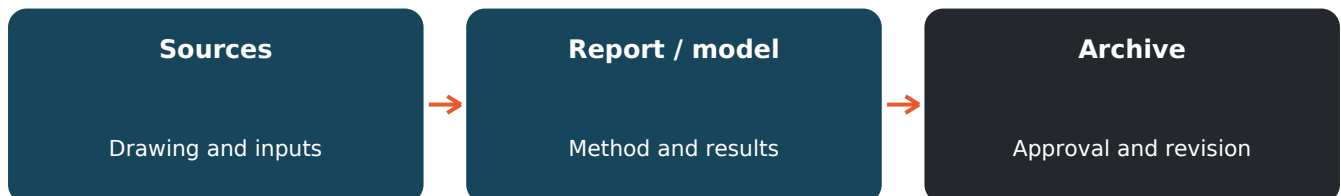
Assess changes before implementation. A new opening may affect local strength; an added drive support loads. Substance changes may affect corrosion and materials. Classify repairs by actual effects. New inspection inputs can trigger review without modification. Link affected cases and results in change control. For certificates involve the issuing body under applicable procedure; review declarations under their rules. Archive previous and new revisions with decisions.

In practice

Resolve change approval and recalculation needs before manufacture.

Versions, archiving and reproducibility

Keep technical decisions traceable over time.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Sources	Approved drawings and inputs.
Model	Software version, model and key settings.
Evidence	Calculations, results and technical review.
Supply	Configuration and approved edition used.
Access	Retention and permissions under actual duties.

A PDF of final values alone may be insufficient for later changes. Plan model and source retention. Applicable rules and agreements govern retention; do not invent a universal period for all products. Control obsolete editions and languages. Link results to actual delivered revision. Keep assumptions visible. Future analysts should know which inputs were confirmed. Record handover to manufacturer, applicant and operator according to their tasks.

In practice

Archive report, model, inputs and approval as one evidence revision.

Template 1: calculation report structure

Annotated structure for traceable engineering results.

Section	Content / linkage
1 · Cover / status	Product, report ID, revision, author and approval.
2 · Brief / boundaries	Assessed parts, variants and excluded areas.
3 · Code basis	TR, standards editions and criteria.
4 · Inputs	Geometry, materials, pressure, temperature and sources.
5 · Load cases	Operation, testing and other relevant states.
6 · Method / model	Analytical work, FEA, simplifications and boundaries.
7 · Assessments	Strength, stability, fatigue and relevant extra issues.
8 · Results	Values, criteria, location and actual coverage.
9 · Plausibility	Independent checks, equilibrium and mesh review.
10 · Conclusion	Confirmed limits, open items and limitations.
11 · Implementation	Drawing, passport, instructions and justification.
12 · Annexes / approval	Sources, model images, review and change log.

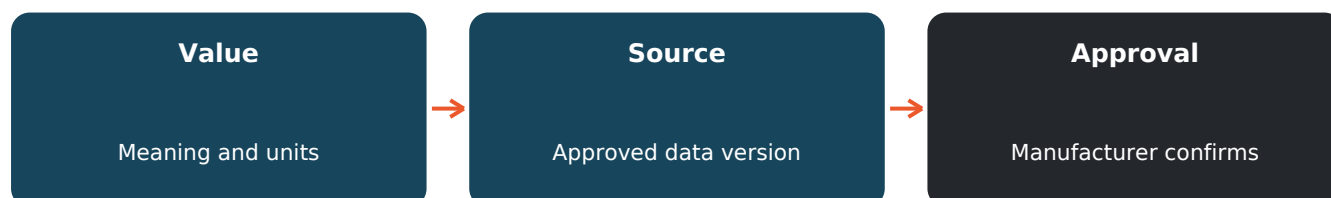
This structure is a working aid adapted to equipment, method and procedure. Not every calculation needs identical chapters. Reasoned boundaries are preferable to empty forms. Reference existing controlled records clearly.

Approval

Mark reports with unresolved technical issues as draft or limited status.

Template 2: calculation input register

Separate confirmed values, assumptions and input gaps.



Product-specific assessment · schematic explanation

Input field	Value / source / status
Product / component / variant	_____
Drawing / revision / geometry	_____
Material / form / supply condition	_____
Pressure type / value / unit	_____
Temperatures by condition	_____
Thickness / tolerance / deductions	_____
Pipe forces / moments / axes	_____
Supports / weight / installation	_____
Cycles / service life / substance	_____
Standards plan / input approval	_____

Give every value a source, unit and approval status. Assumptions need reasoning and result significance. Do not hide gaps with typical values. Reconcile affected cases after input changes.

Template, not evidence

Completed entries need technical review; blank fields are not approvals.

Template 3: load-case and result matrix

Trace each load case to its technical decision.

Field	Entry / technical linkage
Load-case ID	LC-___ / product and model revision ___
State	Operation / testing / start / other confirmed state.
Loads	Pressure, temperature, weight, forces and moments.
Coincidence	Source and justification of combination.
Method / component	Code reference, formula limits or FEA model.
Failure mode	Strength / stability / fatigue / other.
Acceptance	Suitable criterion with technical source.
Result	Value, unit, location and evaluation.
Coverage	Variant, drawing and remaining limit.
Status	Confirmed / open / change needed; reviewer and date.

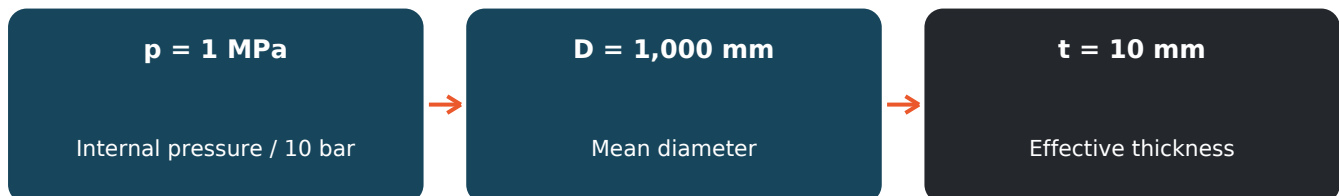
Assess results with their conditions and criteria. Add rows for other failure modes or combinations. A low static value does not replace required fatigue or stability assessment.

Review question

Can a reviewer reconstruct load, model and conclusion from the references?

Calculation example: pressure and thickness

Sanity calculation for an idealised thin-walled cylinder.



Product-specific assessment · schematic explanation

Assume uniform internal pressure $p = 1 \text{ MPa} = 10 \text{ bar}$, mean diameter $D = 1,000 \text{ mm}$ and confirmed effective thickness $t = 10 \text{ mm}$. Idealise a thin cylindrical wall, closed ends and elastic membrane action without local disturbances. Under these learning assumptions:

Hoop stress = $p \times D / (2 \times t) = 50 \text{ MPa}$

Longitudinal stress = $p \times D / (4 \times t) = 25 \text{ MPa}$

Case	p	t	Hoop	Axial
Base	1 MPa	10 mm	50 MPa	25 MPa
Lower effective thickness	1 MPa	8 mm	62.5 MPa	31.25 MPa
Lower pressure	0.8 MPa	10 mm	40 MPa	20 MPa

What this example explains

Under these simplified assumptions, lower thickness increases stress and lower pressure decreases it. MPa and mm yield MPa here. These numbers establish no allowable operating limit. Missing aspects include material criteria, temperature, tolerances, welds, openings, heads, flanges, external loads, fatigue and stability.

Not complete GOST design

Membrane relationships support understanding and review only. They are not universal design formulas or approval of actual pressure equipment.

Case 1: vessel with a flanged cover

Assess wall, cover, joint and supports separately.



Pressure equipment · image: AC Inorms



Product-specific assessment · schematic explanation

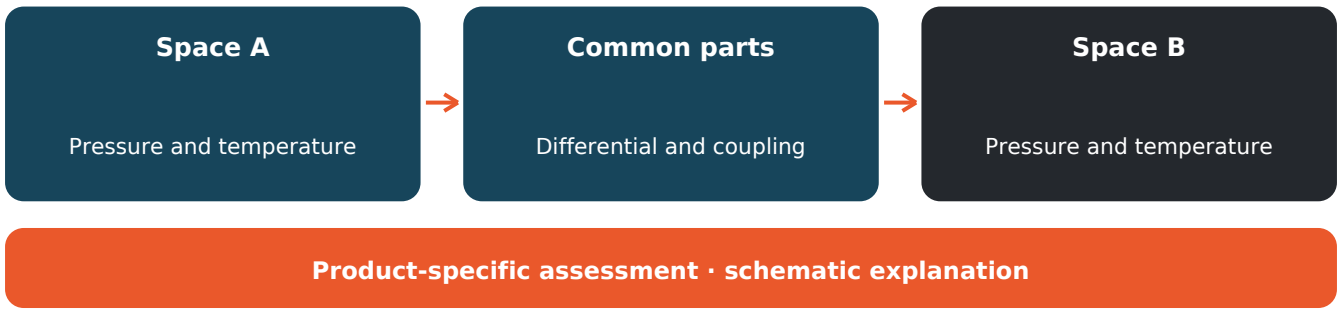
Assessment area	Project implementation
Starting point	Vessel with cover, nozzles and saddles.
Inputs	Geometry, material, pressure, temperature and tolerances.
Loads	Internal/external pressure, weight and nozzle loads.
Assessments	Component strength, sealing and relevant extra checks.
Completion	Align limits with drawing and passport.

Illustrative case without equipment approval: the wall is assessed suitably, but cover-joint records remain incomplete. Do not close the dossier merely because the wall passes. Add flange, bolts and gasket evaluation. Review testing with actual fill weight. Keep provisional nozzle loads open until confirmed. Reassess affected results after changes. State evidenced configuration and limits in conclusions. Supply that edition for subsequent procedural alignment.

In practice
A passed wall assessment is not complete vessel evidence.

Case 2: heat exchanger with two pressure spaces

Differential pressure and thermal sequence may govern.



Assessment area	Project implementation
Starting point	Tube and shell sides with different substances.
Combination	One-sided pressure and different temperatures.
Detail	Tubesheet, connections and thermal movement.
Assessment	Specific design and relevant cycles.
Operation	Confirmed start-up and shutdown limits.

Example: a heat exchanger will use a different start-up sequence. Adequacy of each separate space does not settle coupled demand. Add combinations and assess common parts. Include gradients and cycles. Existing reports remain useful, but justify coverage again. Instructions may permit only confirmed sequences. Review the change before use and record it in a revised report.

In practice

Show common walls and thermal coupling explicitly in the case matrix.

Case 3: industrial pumping and filtration assembly

Distinguish pressure equipment and excluded machine parts correctly.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Starting point	Filter housing, piping, pump and support structure.
Scope	Assess each part by function and actual TR scope.
Load	Pressure, piping forces, weight and operating vibration.
Evidence	Connect analysis with supplier limits.
Change	PVC section, other substance or changed piping layout.

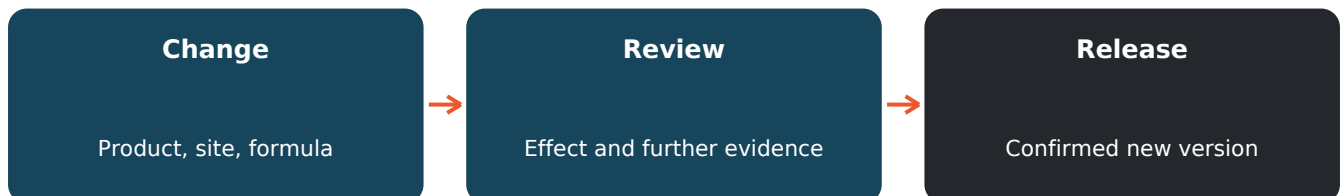
Example: a unit uses different filter and pump suppliers. Pressure alone does not classify the pump body as an independent vessel. Classify the filter separately. Confirm actual piping loads and materials for connections. Do not apply metallic design rules to plastic parts without review. Show manufacturer boundaries and extra evidence in the overview. Reconcile local loads after layout changes. Carry confirmed limits into justification and operating records.

In practice

Assembly safety needs clear ownership at every interface.

Case 4: changed material and larger opening

An unchanged basic shell may need new local evidence.



Product-specific assessment · schematic explanation

Assessment area	Project implementation
Starting point	Confirmed vessel with a planned modification.
Geometry	Larger nozzle and changed reinforcement.
Material	Alternative grade and actual supply condition.
Assessment	Affected local, thermal and cyclic issues.
Approval	Recalculation, drawing and conformity implications.

Example: a similar size will use another material and larger connection. Do not merely rename an old report. Review properties, effective geometry and earlier method limits. Link affected cases and evidence in change control. Review new results against changed drawings. Determine necessary conformity action before supply. Identify approved variants and exclude unassessed configurations. Keep history and supply records consistent.

In practice

Similar dimensions do not establish technical equivalence.

Ten common errors and their correction

Connect inputs, method and conclusion traceably.

Error	Correction
Calculation called compulsory for every export	Review product and applicable regulation.
Nuclear rules used for all industry	Respect specialist scope.
52857.4-2007 treated as current Russian basis	Consider withdrawal and 34233.4-2017.
Nominal wall used without deductions	Use effective thickness under confirmed basis.
Pressure without unit or definition	State reference, unit and case.
Only internal pressure assessed	Include relevant external, thermal and cyclic loads.
Colourful FEA plot treated as complete evidence	Document model, criteria and review.
Peak nodal stress evaluated blindly	Review method and singularities technically.
Pressure test replaces all life assessment	Distinguish evidence types and coverage.
Old file renamed for a new variant	Justify changes and recalculation.

Use corrections as review questions. Common gaps concern unconfirmed inputs and unsupported result extension. A formally complete report can remain technically incomplete.

Core rule

No result without revision, case, method and suitable criterion.

FAQs, costs and realistic schedules

Distinguish website guidance and binding scope.

Website figure	Technical position
About 5 working days	Non-binding; assumes complete inputs and limited scope.
EUR 700-900	Guidance, not a universal assembly or FEA flat fee.

Is simulation always necessary?

No. Method follows component, loads and code basis. Use FEA where it appropriately resolves the engineering question.

Can an existing report be reused?

After reconciling revision, inputs, criteria and actual coverage. Translation alone is insufficient.

What happens after an adverse result?

Review cause, model and design. Implement necessary changes and reassess affected evidence.

A quotation identifies parts, variants, cases, methods, language, reviews and extra testing. The website describes input review, calculation/simulation and reporting; confirm actual coverage for the brief. Agree laboratory work, samples, complex special cases and certification explicitly.

Schedule drivers

Absent piping loads, material inputs or extra variants may affect work more than solver time.

Worksheet: enquiry and technical approval

Printable aid for manufacturers and calculation projects.

Intake	Entry
Manufacturer / contact	_____
Product / components / models	_____
Destination / regulation / date	_____
Drawings / material / revision	_____
Pressure / temperature / substance	_____
Piping loads / cycles / service life	_____

Approval checklist

Review item	Status / owner
Resolved scope and standards plan	_____
Confirmed inputs and effective geometry	_____
Complete cases and combinations	_____
Suitable method limits and criteria	_____
Strength / stability / fatigue assessed	_____
Reviewed results and plausibility	_____
Report / drawing / passport reconciled	_____
Review / open items / revision completed	_____

Completion

Product revision: _____ Date: _____

Technically reviewed and approved by: _____

Sources and legal foundations

Linked foundations for product-specific assessment.

[1] AC Inorms: strength calculation for EAC

[Open original source](#)

[2] AC Inorms: regulations archive

[Open original source](#)

[3] Adilet: TR CU 032/2013, current regulatory text

[Open original source](#)

[4] EEC: TR 032, amendments and standards lists

[Open original source](#)

[5] Rosstandart: TR 032 list, GOST calculation family

[Open original source](#)

[6] Rosstandart: GOST R 52857.4-2007, withdrawal in 2018

[Open original source](#)

[7] Rosstandart: GOST 34233.4-2017, flange joints

[Open original source](#)

[8] Rosstandart: GOST 34233.1-2017, general foundations

[Open original source](#)

[9] Rosstandart: GOST 34233.2-2017, shells and heads

[Open original source](#)

Official regulations, current lists and complete agreed editions are authoritative. Review national status and list eligibility separately. Unnumbered procedures, cases and templates are original editorial recommendations.

Further sources and image credits

Linked foundations for product-specific assessment.

[10] Rosstandart: GOST 34233.12-2017, computer-based reports

[Open original source](#)

[11] YaRB library: PNAE G-7-002-86, nuclear scope

[Open original source](#)

[12] YaRB library: NP-068-05, nuclear valves

[Open original source](#)

[13] Rosstandart: GOST 34233.7-2017, heat exchangers

[Open original source](#)

[14] Rosstandart: GOST 34233.8-2017, jacketed equipment

[Open original source](#)

[15] ISO: 16528-1, boiler and vessel performance requirements

[Open original source](#)

[16] EAEU: Decision 96/2019, official TR 032 lists

[Open original source](#)

[17] EAEU: conformity evidence registry

[Open original source](#)

[18] EAEU: EAC mark, Decision 711/2011

[Open original source](#)

As of 14 October 2026. Cover, workflow infographic, checklist and additional pressure-equipment image: ac-inorms.com. English versions of both infographics were adapted. Diagrams, tables and learning example are original aids, not equipment design. No complete standards texts or specimen certificates.

Your strength assessment with AC Inorms

Connect inputs, traceable analysis and EAC procedures.



Strength calculation · image: AC Inorms

AC Inorms supports manufacturers and exporters in planning technical records and required evidence. Start with scope, drawings, materials, conditions and actual loads. Select standards, methods and necessary reviews for the brief. The report connects inputs, model, results and confirmed limits. Align justification, passport and instructions to the same revision. Identify extra testing and EAC certification/declaration explicitly in scope. Manufacturer technical approval remains a distinct step.

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For the initial enquiry

Send the page-47 worksheet with drawings, materials, limits and complete existing reports.