RADCO

شرکت دانش بنیان مه راد صنعت خلاق (رادکو)

Pipeline Repair Products

High Pressure & High Temperature

Offshore & Onshore Pipeline

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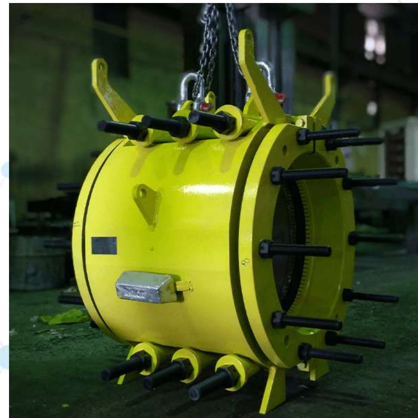
EPRS Brochure



Pipeline Repair Products

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ENGINEERING

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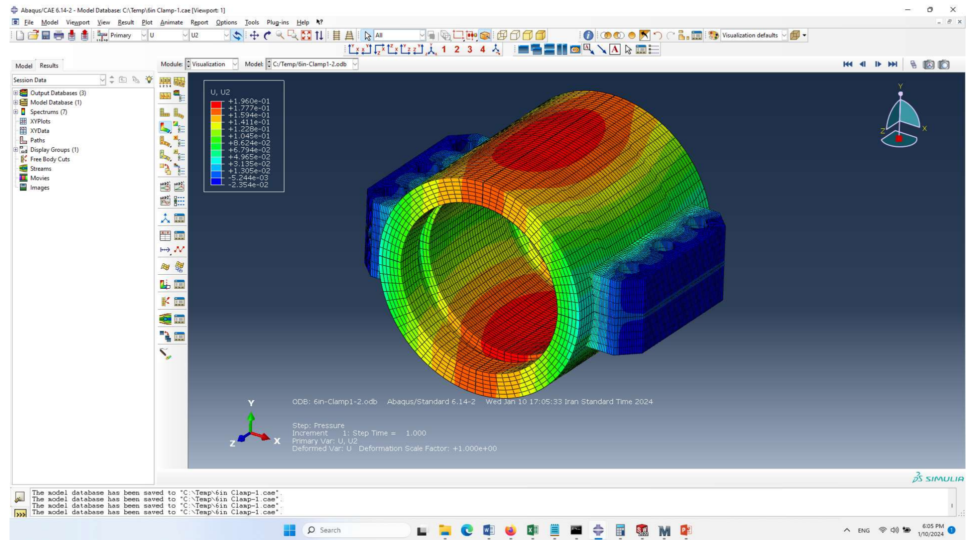
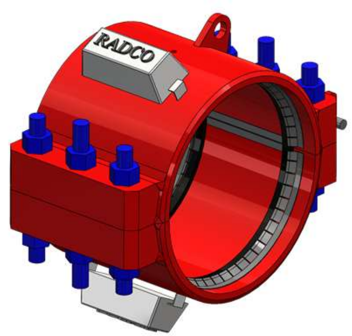
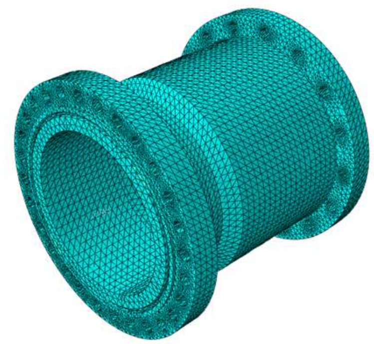
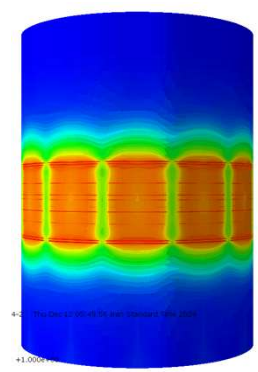
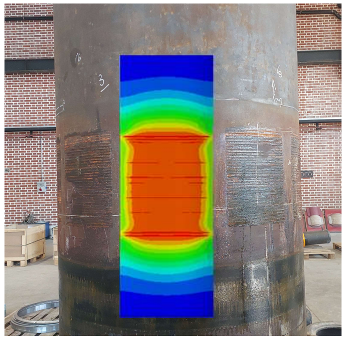
- 3D Modeling (SolidWorks)
- Advanced Computer Aided Design (CAD)
- Nonlinear Finite Element Analysis (Abaqus)
- Hyper Elastic Sealing Analysis
- Load and Resistance Factor Design (LRFD)
- Standard Based Design
- Bolt Tightening Calculation





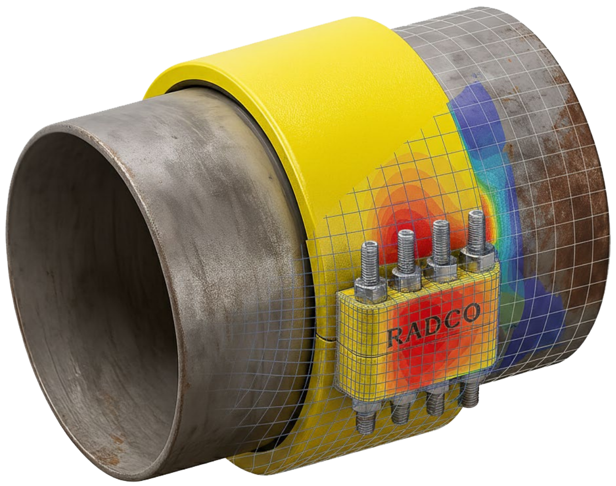






DESIGN REPORT

32 in #300 Split Sleeve Design Report



Items	Description
Nominal pipe size (NPS)	32 Inch
Pipeline Outside Dia.	813mm
ANSI rating	#300
Design Code	API 6 H , ASME PCC 2
Body Material	ASTM 216 Acc. To API 6 H
Inboard seal	HNBR
Protection sheet	SS 304L
Coating	Epoxy
Stud bolts	A 193 B7M

Split Sleeve Clamp – FEA Results Summary

Project: Split Sleeve Leak Repair Clamp

Design Codes: API 6H, ASME B31.4, ASME PCC-2

FEA Software: Abaqus

The table below presents a concise summary of the finite element analysis results for both Design and Hydrotest conditions. It includes calculated values, allowable limits, and the resulting safety factors for engineering assessment.

Parameter	Working condition		Hydrotest condition	
	Calculated value	Allowable value	Calculated value	Allowable value
Tangential (hoop) stress [MPa]	120	167	180	207
Clamp opening [mm]	0.4	NA	0.6	NA
Stud bolt load [KN]	42% Fp	75% Fp	63	75% Fp

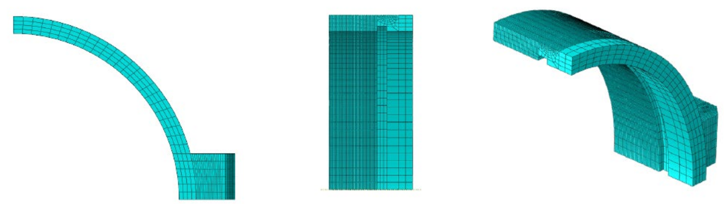
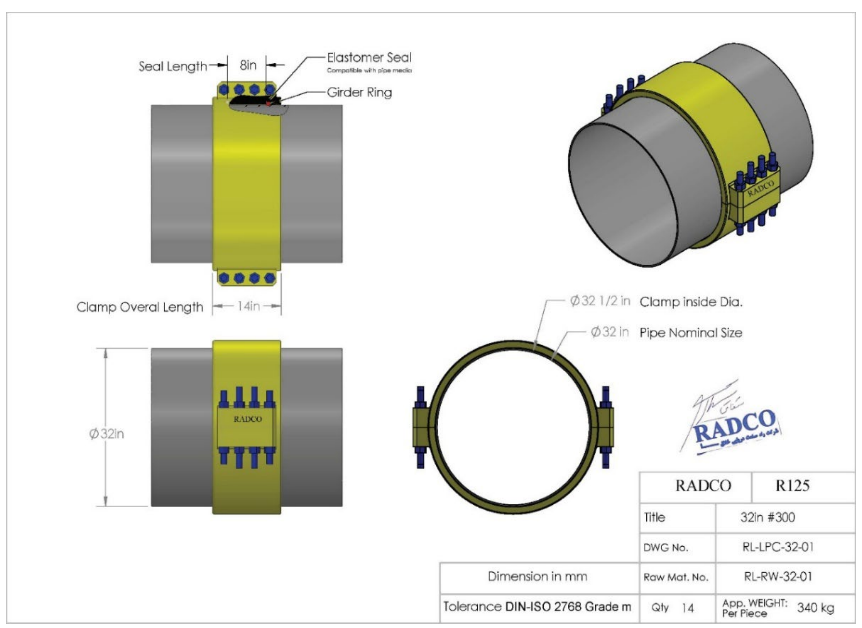


Figure 4: Clamp Mesh Detail



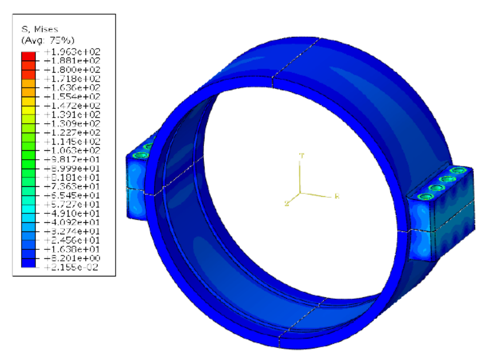


Figure 12: Mises Stress

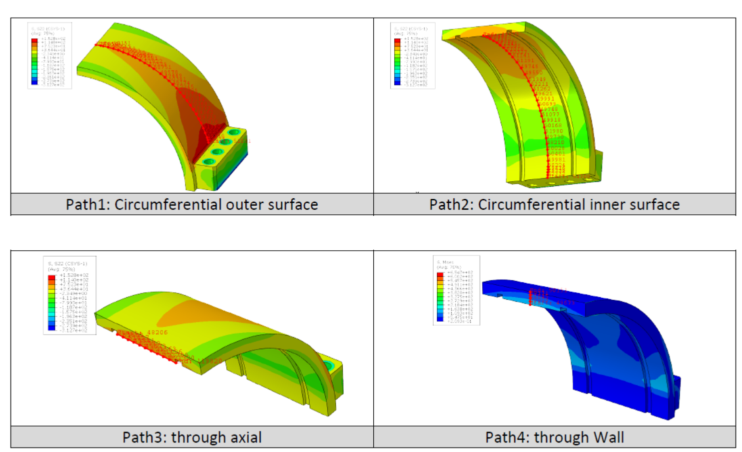
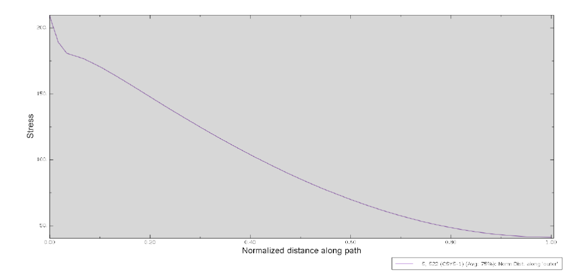


Figure 5: Output Paths for Stress Analysis



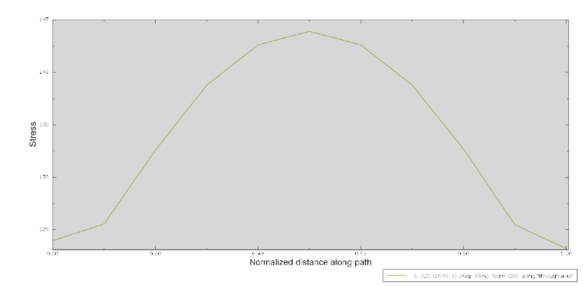
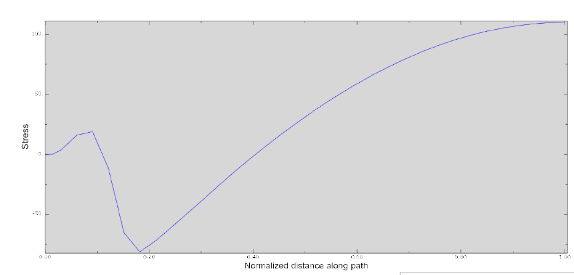
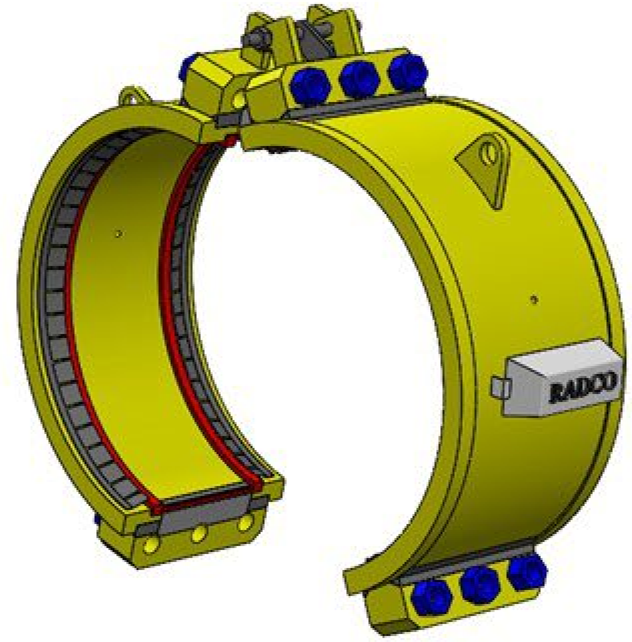


Figure 8: Hoop stress at Path3: through axial

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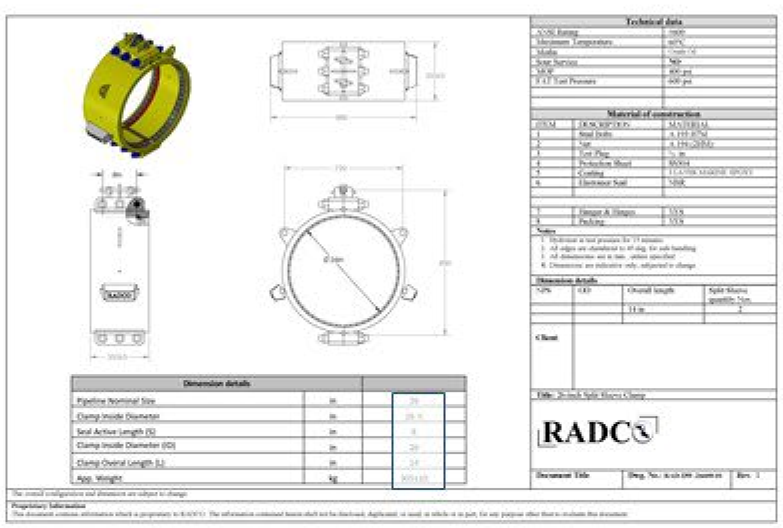
Technical data
Material of construction
Dimension details
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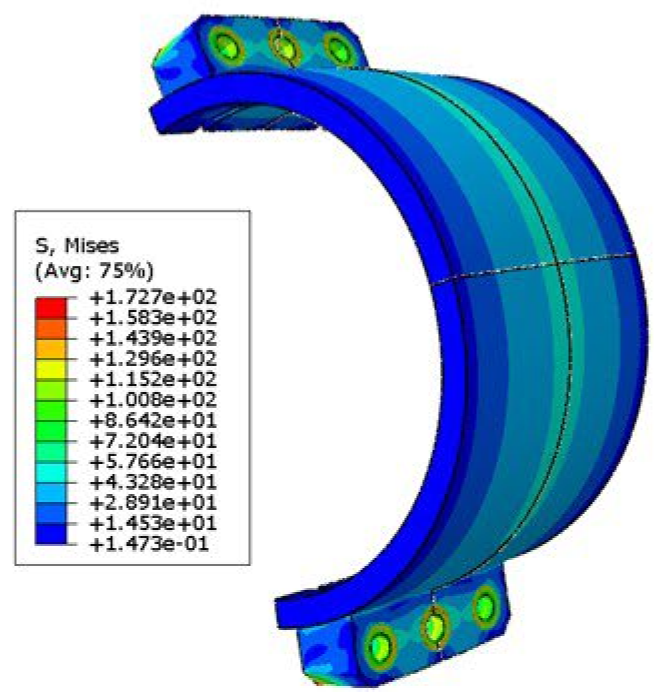
S, Mises
(Avg: 75%)
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+1.583e+02
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+1.008e+02
+8.642e+01
+7.204e+01
+5.766e+01
+4.328e+01
+2.891e+01
+1.453e+01
+1.473e-01


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Drilling

1. Introduction

The design of connectors for subsea pipeline repair requires a multidisciplinary engineering approach, considering structural and operational challenges under extreme environmental and mechanical conditions. One of the main challenges is ensuring sealing performance and mechanical grip under varying pipeline geometries and external pressures.

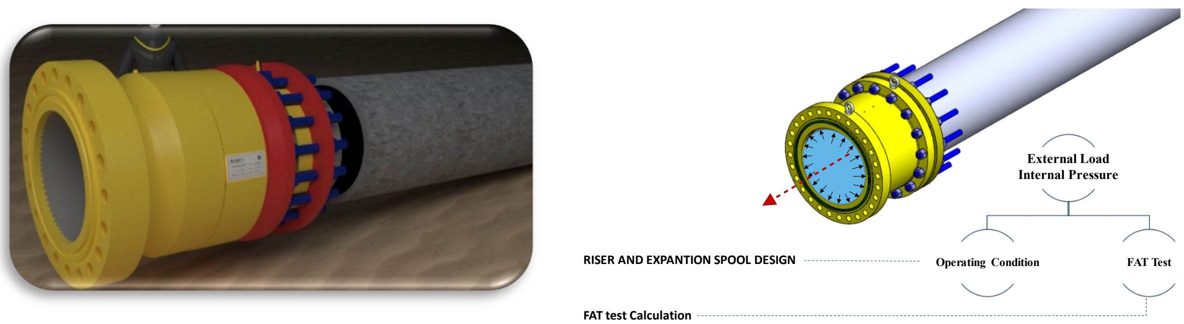

Figure 1: Connector on subsea under different load condition

To address these challenges, a nonlinear finite element analysis (FEA) approach was adopted using the **Abaqus** software. Special emphasis was laid on verifying the sealing performance of elastomeric materials and the grip mechanism of the gripper. The design process was validated through experimental benchmarks and by adhering to established industry standards, particularly the **DNV GL RP F113**. This report elaborates on the methods, modeling details, and tests performed to achieve a robust and validated connector design.

The connector comprises two essential components requiring nonlinear FEA:

1. **Sealing System:** Utilizing elastomeric materials for pipeline sealing.
2. **Grip Mechanism:** Ensuring structural locking under substantial axial, bending, and internal pipeline forces.

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2. Finite Element Modeling Overview

Nonlinear finite element modeling was conducted as part of the design qualification process to evaluate the performance of critical connector components thoroughly. Physical testing and measurement tools were previously built to validate the FEA models and ensure their real-world accuracy.

2.1 Modeling Elastomer Behavior for Sealing

The elastomeric sealing system was designed as per the DNV GL RP F113 standards. Elastomer performance is crucial, as it maintains the sealing of the connector under high external pressures and adverse environmental conditions. The nonlinear behavior of elastomers adds complexity to

Gripper FEA Considerations:

The specific user elements modeled and analyzed for the gripper include:

- Contact interface length and stress propagation across the contact surface.
- Activation force required to engage the gripper teeth with the pipeline surface effectively.
- Mechanical load tolerances under axial, bending, and torsional loads.
- Gripper-induced deformation on the pipeline outer surface.

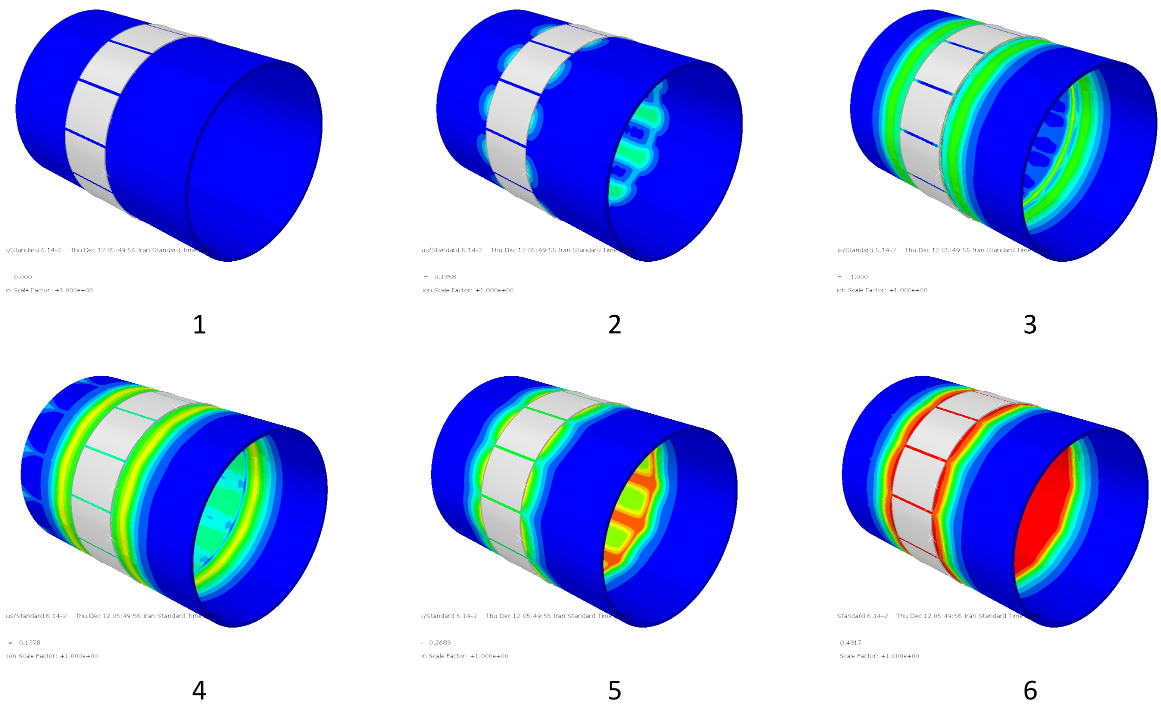

Figure 7 : Sequential Stages of Gripper Penetration on the Pipe

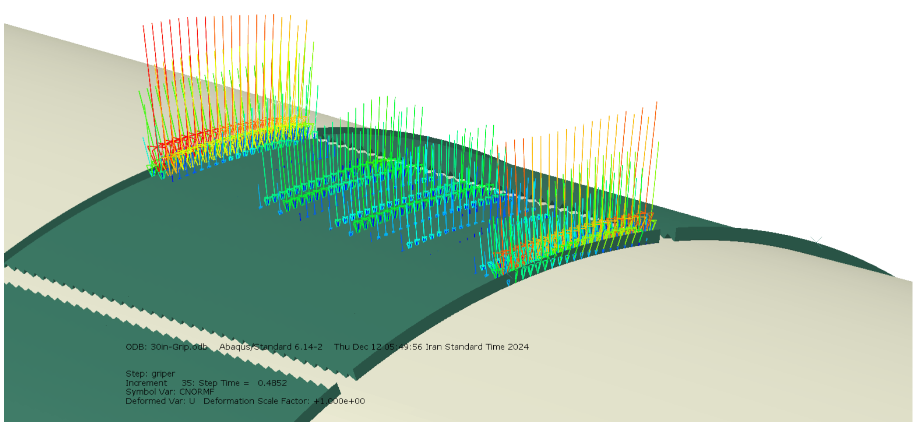

Figure 7: Normal Force distribution on Pipe Due to Gripper Effect

 The images, outputs, and results presented are for illustrative purposes only and are not citable and referable.

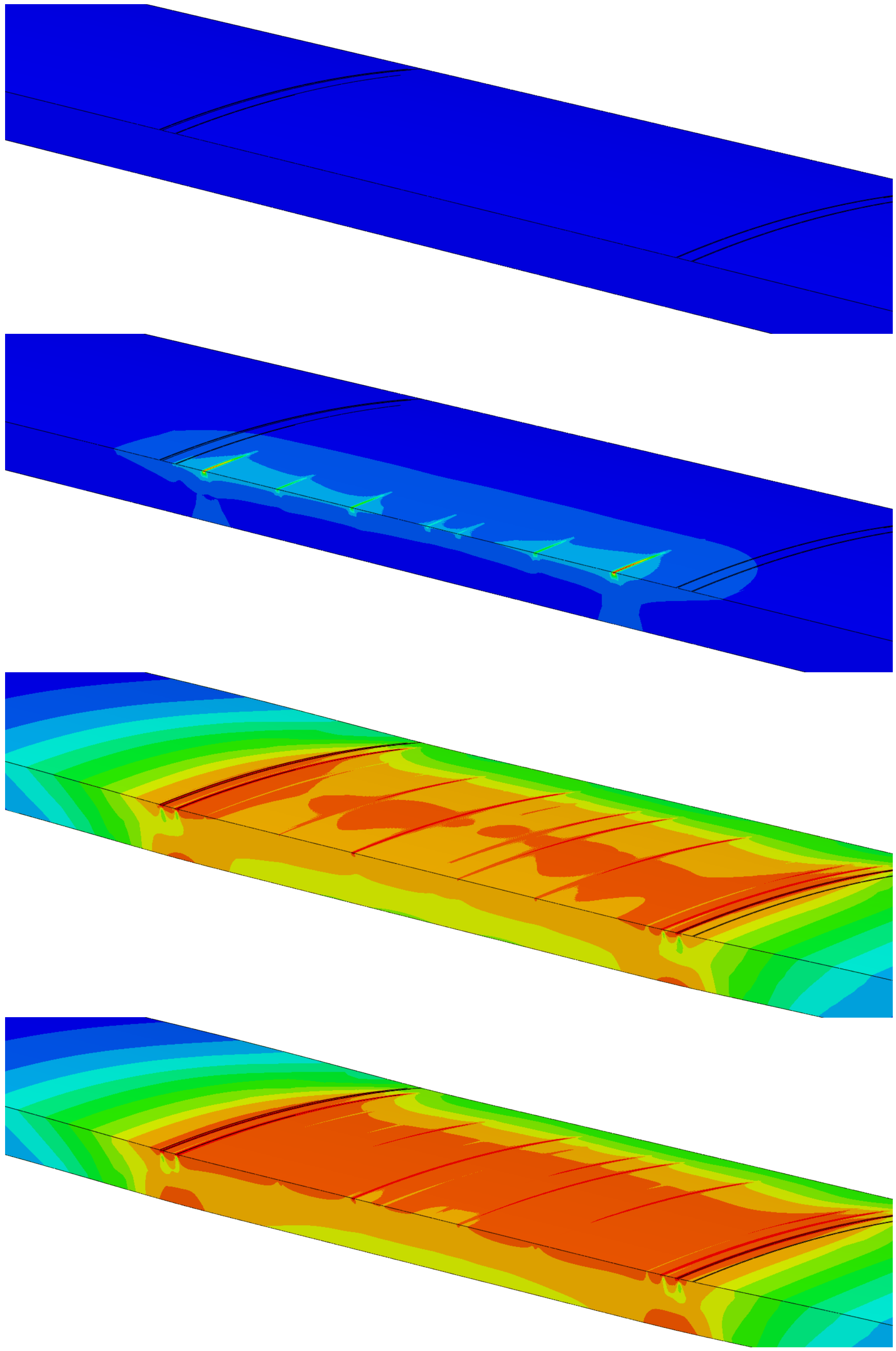

Figure 8: Progressive Penetration of Gripper Teeth on the Pipe

