

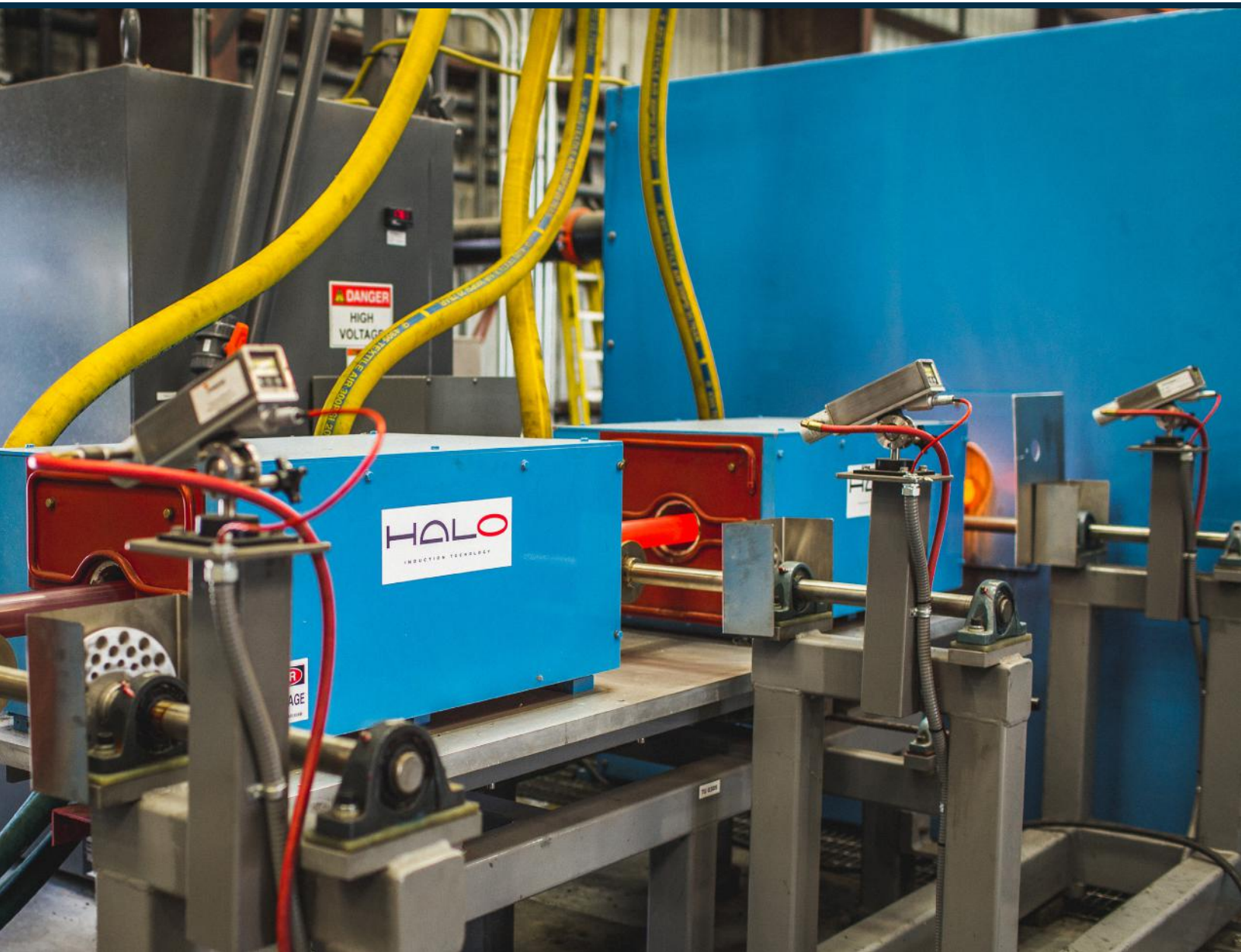
DURACOIL 95

SOOR TESTING

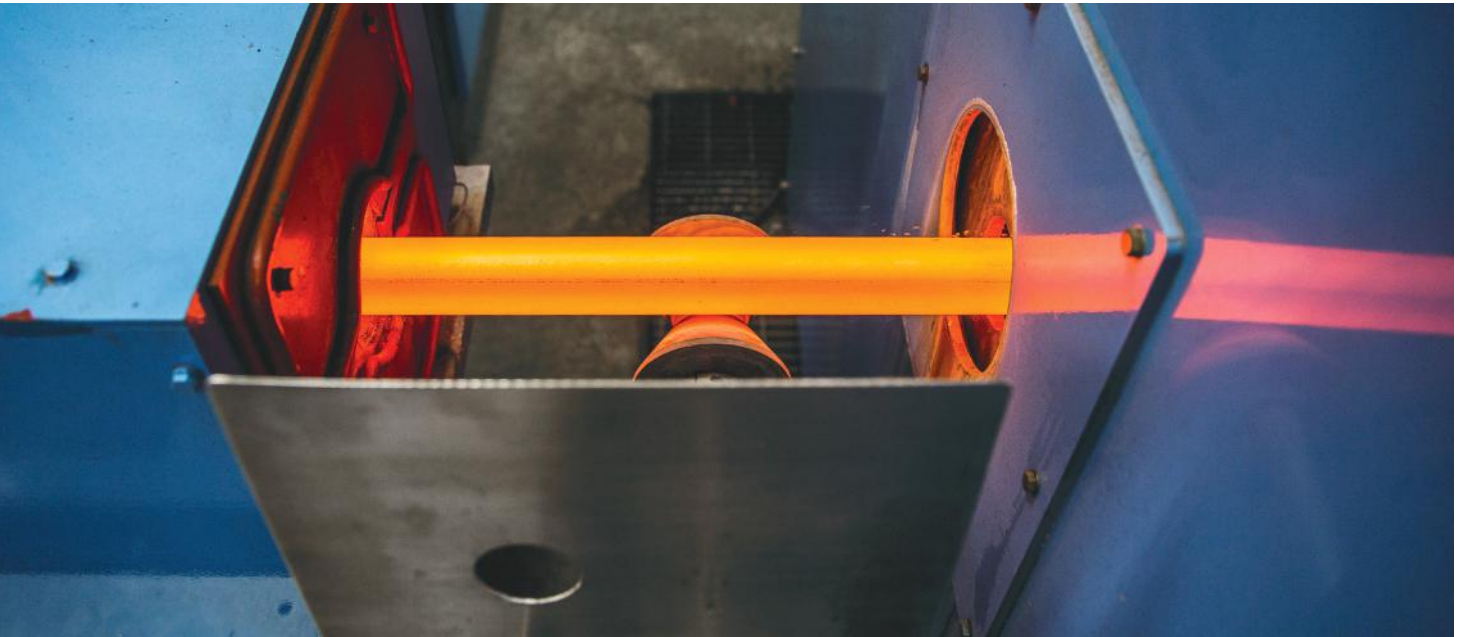
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DURACOIL



TECHNOLOGY

DURACOIL

Global Tubing has developed DURACOIL, its revolutionary coiled tubing product, to improve the reliability, safety and efficiency of coiled tubing operations. DURACOIL addresses the challenges of unconventional wells and provides a reliable technology platform as completions increase in complexity. Bottom line – DURACOIL DELIVERS

DURACOIL OFFERS

- Improved tubing fatigue life and working life predictability
- Greater resistance to abrasion than conventional coiled tubing
- Superior performance in high-pressure environments
- SMARTaper™ and continuous taper sections for advanced, engineered string designs

DURACOIL DELIVERS!

More cost-efficient than traditional coiled tubing, DURACOIL is a safe and low-risk completion technology for service in challenging downhole environments. Simply put, it's predictable, low-risk and economical; making DURACOIL the premier solution for reaching total depth in longer lateral wells.

Utilization of modern quench and temper technology using Global Tubing's patent pending HALO INDUCTION TECHNOLOGY® yields steel microstructure consistency along the entire length of the tubing.

HALO

INDUCTION TECHNOLOGY

HALO INDUCTION TECHNOLOGY®

LEADING THE REVOLUTION IN COILED TUBING TECHNOLOGY.

Global Tubing's HALO INDUCTION TECHNOLOGY® is an innovative process for manufacturing quench and tempered coiled tubing. Designed to meet the reliability and premium offering operators expect from a quench and tempered product, this revolutionary technology represents the most significant leap in coiled tubing technology in the last 30 years.

By combining HALO INDUCTION TECHNOLOGY® with state-of-the-art coiled tubing manufacturing equipment, Global Tubing can provide the most consistent, reliable, premium coiled tubing available.

This continuous process utilizes inline induction heating and precision slot quench technology to produce a microstructure that is 99.9% consistent throughout the entire length of tubing.



DURACOIL

DURACOIL Sour Testing

Quenched & Tempered Innovation for Harsh H₂S Environments

Elevate your sour service operations with the next generation in coiled tubing performance. Designed for resilience, DURACOIL delivers superior safety, durability, and cost-efficiency where it matters most.

WHY UPGRADE TO DURACOIL?

RISK REDUCTION

- Enhanced resistance against Sulfide Stress Cracking (SSC) and Hydrogen Embrittlement
- Uniform microstructure reduces probability of failure at bias welds
- Near zero non-productive time (NPT)

LOWER TOTAL COST OF OWNERSHIP

- **Up to 2x longer string life** under fatigue loading
- **Reduces string changeouts** and related downtime
- **Fewer and less frequent inspections** required

OPERATIONAL ADVANTAGES

- Improved fatigue life in **sour and high-pressure** environments
- Withstands **9,000+ psi** operating conditions after sour exposure¹
- Supports **SMARTaper®** and **hourglass configurations** for extended reach interventions
- Opens doors to **deeper wells, longer laterals**, and higher service intensity

¹ Testing performed with 1.5" x 0.204" coiled tubing after sour exposure.

ESTIMATED CUSTOMER SAVINGS (Illustrative Ranges)

Cost Driver	90 Grade (Current)	DURACOIL 95 (New)	Potential Savings
CT String Replacements/Year	2–3	1	↓ 50–70%
Downtime per Failure Event	1–2 days	Near-zero	↓ \$50K–\$150K/event
Maintenance & Inspection	Bi-monthly	Quarterly	↓ 25–40% annually
Total Annual TCO	100%	60–70%	↓ 30–40% cost reduction

FIELD-TESTED. PROVEN RELIABILITY.

- Survives beyond model retirement thresholds
- Maintains bias weld performance even after sour exposure
- Consistent, predictable service life minimizes operational surprises

EASY INTEGRATION

- No special handling or training required
- Compatible with current Injectors, BOPs, pipe cutters, BHAs
- Same operational flexibility, superior performance

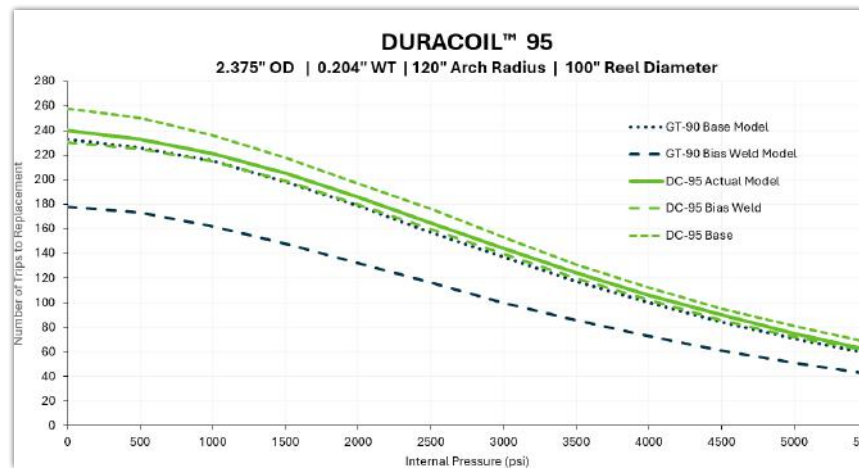
THE FUTURE OF SOUR SERVICE IS HERE

Enhance your capabilities in H₂S. Choose DURACOIL for performance without compromise.

Comparing Fatigue Life at Bias Welds:

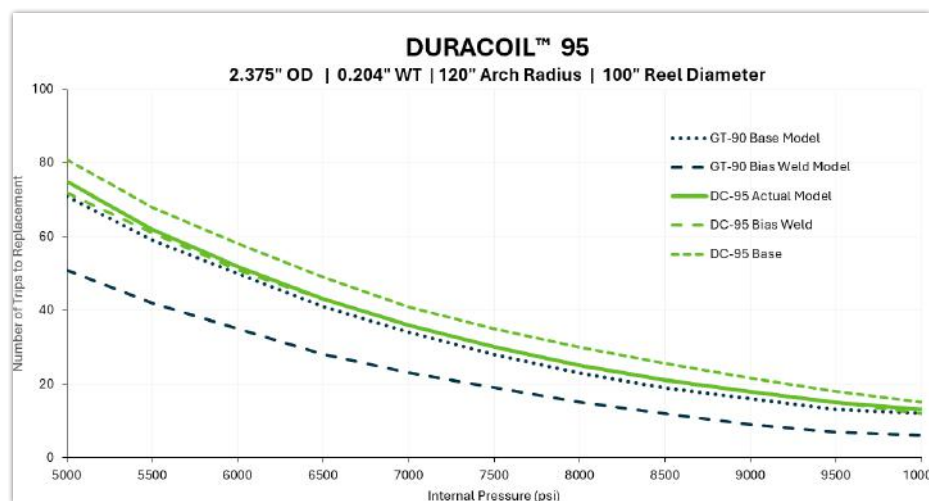
DURACOIL 95 vs. Conventional Coiled Tubing

DURACOIL 95 exhibits significantly enhanced fatigue life at bias welds compared to conventional coiled tubing products. The quench and tempering process optimizes the microstructure of the steel, reducing hardness variations and residual stresses at the bias weld, which are common weak points in conventional tubing.



At lower internal pressures (above), DURACOIL 95 demonstrates significantly enhanced performance compared to conventional 90-grade at the bias welds. It performs equally well or better than the base material of conventional 90-grade tubing throughout the entire string. This eliminates the need to derate fatigue life at bias welds and delivers an immediate improvement in overall string reliability and service life.

At mid-range internal pressures (5000 to 8000 psi, below), DURACOIL 95 still outperforms both the bias welds and base material of conventional 90-grade tubing. This results in superior fatigue resistance, higher operational reliability, and extended string life under demanding conditions.



To understand the effect of H₂S on quenched and tempered Coiled Tubing, Global Tubing DURACOIL 95 was tested in several sour environments.

The effect of H₂S on Coiled Tubing - Sulfide Stress Cracking

Sulfide stress cracking (SSC) is a form of cathodic cracking through hydrogen embrittlement. Susceptible alloys, especially steels, react with hydrogen sulfide (H₂S), forming metal sulfides (MeS) and atomic hydrogen (H⁺) as corrosion byproducts. SSC occurs when atomic hydrogen diffuses into the metal, but the ions can recombine to form hydrogen gas and cause damage to the steel crystal lattice. This reduces the ductility and formability of the metal, which is termed hydrogen embrittlement. Several factors influence SSC: steel composition, heat treatments, microstructure, mechanical properties, pH, H₂S partial pressure, mechanical stresses, temperature, and time. High yield strength steels (ultimate tensile above 100,000 psi or ~700 MPa) are more susceptible to SSC, since their microstructure is particularly sensitive to the effects of H₂S exposure.

Understanding Partial Pressure

Partial pressure of a gas is the pressure exerted by one among the mixture of gases that occupies the same volume. Partial pressure for H₂S is the product of total pressure by the fraction of H₂S present. For example, if the pressure is 10,000 psi at 8 ppm H₂S concentration, the partial pressure is 0.08 psi. The partial pressure of H₂S is used to set production environment limits for carbon steels, low-alloy steels, and corrosion-resistant alloys. The NACE standards relate to an H₂S partial pressure of 0.05 pounds per square inch absolute (psia). Steel used in these environments without inhibition and below 22HRC should be resistant below 0.05psi (0.3kPa), but since these codes are designed for static environments, coiled tubing operations should always use inhibition when sour environments are present.

As a way of illustration, the Ghawar field in Saudi Arabia (the biggest conventional oil field in the world), produces up to 40 mole % H₂S. However, CT interventions are usually restricted to 10 mole % H₂S, with surface pressures averaging 3,000 psi (206.8 bar) in some areas, this equates to 300psi (20.7 bar) of H₂S partial pressure.

Overview of DURACOIL 95 Testing in H₂S Environment

Our testing procedure used NACE solution A for exposure of full tube specimens, which were subsequently bend-fatigue tested to simulate a field application. This process is consistent with the testing outlined in SPE 130279 and has been used for decades.

- Tube ends capped to isolate pipe internals from outside environment (simulating downhole environment)
- External surfaces of inhibited samples were wiped with inhibitor prior to immersion.
- Samples were immersed in Solution A (pH 2.7) and tested at ambient pressure with 100% H₂S in one chamber, and a separate test immersed samples in a high-pressure chamber with 200psi (13.8 bar) H₂S partial pressure, 155psi (10.7 bar) CO₂, and a total pressure of 5000psi. (345 bar) at 25C.
- Samples were tested for 96 hours ~ 4 days.
- Upon completion of the immersion tests, samples were fatigue tested to failure to examine reduction in fatigue life, with and without inhibitors at 4,000 and 9,000 psi fatigue test pressure.

Why our testing methodology is more stringent

In light of the industry needs in the Middle East and around the world we conducted lab testing using the most stringent criteria allowable in a lab environment.

- Testing procedure utilized NACE Solution A with a pH of 2.7 followed by bending fatigue to examine CT performance.
- Higher Partial Pressures used than previously done by other manufacturers for full tube immersion followed by fatigue testing.
- CO₂ was used to accelerate corrosion reaction through oxygen content.
- Fatigue testing done at higher absolute “pumping pressures” than previously done.
- Ratio of sour fluid to exposed tube surface area was maximized by isolating extremities of the samples tested.

Testing Conclusions

Fatigue testing with inhibitors showed retention of fatigue life after 96 hours exposure. Both high and low pressure fatigue showed consistent fatigue results:

- Good fatigue performance (30-40% derating) without inhibition for DURACOIL 95.
- Better fatigue performance with inhibition.
- Always use inhibition in sour environments.

Testing comparison between manufacturers

DURACOIL 95 AMBIENT TESTING PROTOCOL WITH 100% H ₂ S			
SPE Paper	Presenting at ADIPEC 20251	SPE-218332-MS	SPE-184796-MS
Company	FET-Global Tubing	Manufacturer A	Manufacturer B
Failure Mode Tested	SSC/HIC	SSC/HIC	SSC/HIC
NACE Test Solution	NACE Solution A 100% H ₂ S Full Tube Immersion +Fatigue"	NACE Solution A 100% H ₂ S Full Tube Immersion +Fatigue"	NACE Solution A 100% H ₂ S Full Tube Immersion +Fatigue"
Material Grade	DURACOIL 95	Q&T 95	Q&T 95
Material Hardness	<= 26 HRC	<= 26 HRC	20 to 26 HRC
NACE Solution pH	2.7 (Solution A)	2.7 (Solution A)	2.7 (Solution A)
Partial Pressure H ₂ S	Ambient Pressure 14.5 psi (1 bar)	Ambient Pressure 14.5 psi (1 bar)	Ambient Pressure 14.5 psi 1 (1 bar)
Partial Pressure CO ₂	None	None	None
Total Test Pressure	14.7 psi (1 bar)	14.7 psi (1bar)	14.7 psi (1 bar)
Exposure Time	96 hours (4 days)	96 hours (4 days)	96 hours (4 days)
Temperature	75°F ±5	75°F ±5	75°F ±5
Number of Environments Tested	1 environment. Non-inhibited	1 environment. Non-inhibited	1 environment. Non-inhibited
Hoop Stress % of SMYS4 (during fatigue)	Low Pressure 15%	Not Tested	Low Pressure 10%
	High Pressure 35%	High Pressure 42%	High Pressure 30%
Bending Strain (during fatigue)	1.4%	1.4%	2.4% Maximum
Inhibitor Used	None	None	None
Inhibitor concentration	None	None	None
Age of Coupons for Testing	Newly Milled Pipe	Newly Milled Pipe	Newly Milled Pipe
Samples Tested	Base, Bias Weld and Seam Weld	Base, Bias Weld and Seam Weld	Base, Bias Weld and Seam Weld
Remaining Fatigue Life	Low Pressure 61%	Not Tested	Low Pressure 50%
After Sour Exposure	High Pressure 75%	High Pressure 68%	High Pressure 70%

DURACOIL 95 showed better fatigue performance in severe sour environments than conventional GT-90, retaining 70% of its sweet life. Bias Welds require no derating in sour service, consistent with past research.

Competitor A's results aligned with previous studies (SPE-184796-MS), maintaining 68% of sweet life at 42% hoop stress.

Competitor B's tests without inhibition showed 50% fatigue life remaining at lower CT circulating pressures and 70% at higher pressures compared to non-sour life.

Testing comparison between manufacturers

DURACOIL 95 HIGH PRESSURE TESTING PROTOCOL WITH 200 PSI PARTIAL PRESSURE H ₂ S AND 155 PSI PARTIAL PRESSURE CO ₂			
SPE Paper		Presenting at ADIPEC 2025 ¹	Abu Dhabi ICoTA Round Table 2022 ² Canada ICoTA Round Table 2022 ³
Company		FET-Global Tubing	Manufacturer B
Failure Mode Tested		SSC/HIC	SSC/HIC
NACE Test Environment		NACE Solution A 100% H ₂ S Full Tube Immersion + Fatigue	NACE Solution A 100% H ₂ SO Full Tube Immersion + Fatigue
Material Grade		DURACOIL 95	Q&T 95
Material Hardness		<= 26 HRC	<= 26 HRC
NACE Solution pH		2.7 (Solution A)	2.7 (Solution A)
Partial Pressure H ₂ S		High Pressure 4%, 200 psi (13.8 bar)	High Pressure 2 - 4%,126 - 200 psi (8.7 - 13.8 bar)”
Partial Pressure CO ₂		3.1%, 155 psi (10.7 bar)	3.1%, 155 psi (10.7 bar)
Total Test Pressure for Exposure		5,000 psi (344.7 bar)	5,000 psi (344.7 bar)
Exposure Time		96 hours (4 days)	96 hours (4 days)
Temperature		75°F ±5	75°F ±5
Environments Tested		1 environment. Inhibited and non-inhibited	1 environment. Inhibited and non-inhibited
Hoop Stress % of SMYS ⁴ (during fatigue)		Low Pressure 15%	Not Published
		High Pressure 35%	Not Published
Bending Strain (during fatigue)		1.4%	Not Published
Inhibitor Used		Petroleum Distillate	Yes, But Not Published
Inhibitor concentration		Thin layer applied to simulate lubricator	Not Published
Age of Coupons for Testing		Newly Milled Pipe	Newly Milled Pipe
Samples Tested		Base, Bias Weld, and Seam Weld	Base, Bias Weld and Seam Weld
Remaining Fatigue Life After Sour Exposure	Non-inhibited	Low Pressure 60%	Low Pressure 65% ⁵
		High Pressure 70%	High Pressure 90% ⁵
	Inhibited	Low Pressure 123%	Low Pressure 80% ⁵
		High Pressure 112%	High Pressure 90% ⁵

For DURACOIL 95, 100% of fatigue life remains after sour immersion with inhibition, and 60-70% without inhibition compared to sweet life and is consistent with other published data. Competitor B's product shows similar fatigue life after sour immersion, regardless of inhibition.

1. Findings to be presented at the ADIPEC 2025 Exhibition and Conference, 3-6 November, 2025 in Abu Dhabi, UAE

2. Presented at the SPE/ICoTA Workshop: Extreme Well Intervention - Advanced Rigless Strategies and Solutions, held May 24–25, 2022 in Abu Dhabi, UAE

3. Presented at the 2022 ICoTA Canada Roundtable, held November 2, 2022 in Calgary, AB

4. SMYS - Specified Material Yield Strength

5. Results are the average of presented results

Testing comparison between manufacturers

DURACOIL 110 HIGH PRESSURE AND AMBIENT TESTING PROTOCOL WITH H ₂ S			
SPE Paper	SPE-218327	SPE-212878-MS	SPE-184796-MS
Company	FET-Global Tubing	Manufacturer A	Manufacturer B
Failure Mode Tested	SSC/HIC	SSC/HIC	SSC/HIC
NACE Test Solution	NACE Solution A 100% H ₂ S Full Tube Immersion +Fatigue"	NACE Solution A 100% H ₂ S Full Tube Immersion +Fatigue"	NACE Solution A 100% H ₂ S Full Tube Immersion +Fatigue"
Material Grade	DURACOIL 110	Q&T 140	Q&T 95
Material Hardness	<= 30 HRC	<= 39 HRC	20 to 26 HRC
NACE Solution pH	2.7 (Solution A)	2.8 (Solution A)	2.7 (Solution A)
Partial Pressure H₂S	High Pressure 200 psi (13.8 bar)	High Pressure 1,035 psi (71 bar)	Ambient Pressure 14.5 psi (1 bar)
Partial Pressure CO₂	None	None	None
Total Test Pressure	5,000 psi (344.7 bar)	4,500 psi (310.3 bar)	14.7 psi (1 bar)
Exposure Time	96 hours (4 days)	720 hours (30 days)	96 hours (4 days)
Temperature	75°F ±5	75°F ±5	75°F ±5
Number of Environments Tested	1 environment. Inhibited and non-inhibited	1 environment. Inhibited and non-inhibited	1 environment. Non-inhibited
Inhibitor Used	Petroleum Distillate	Not Published	None
Inhibitor concentration	Thin layer simulating lubricator	0.2% weight percent	None
Age of Coupons for Testing	Newly Milled Pipe	Newly Milled Pipe and Fatigued (72 bending radius)	Newly Milled Pipe
Number of Coupons Tested	20	24	Not Published
Testing Results	Nearly 100% of fatigue life remains even after sour immersion with inhibition. Without inhibition, hydrogen cracking is observed and fatigue life is reduced compared to non-sour life.	When testing with inhibition, C Rings Pass with no cracking. Without Inhibition, hydrogen cracking is observed in all coupons.	Sour fatigue test results, performed without any inhibition, indicate that sour fatigue life is reduced by about 50% for lower CT circulating pressures and by about 30% for high circulating pressures relative to its' non-sour life.

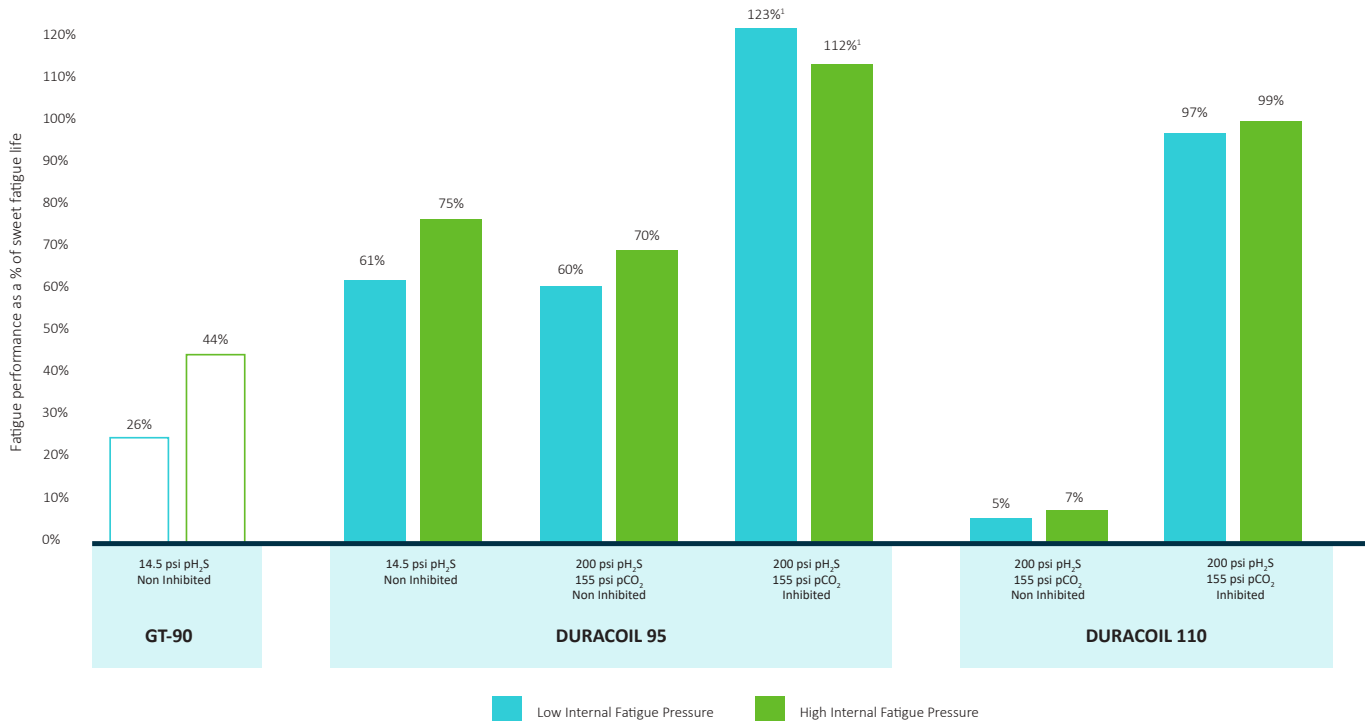
H₂S Testing Comparison Conventional vs DURACOIL

When GT-90 conventional Coiled Tubing is compared to DURACOIL at ambient conditions, DURACOIL shows better performance. Additionally, the remaining fatigue life of DURACOIL 95 after exposure to high partial pressures of H₂S, with and without inhibitors, continues to demonstrate superior results in comparison to GT-90.

SOUR FATIGUE PERFORMANCE TEST RESULTS

BASE & BIAS WELDS (Average)

GT 90 vs. DC 95 vs. DC 110



1. Samples exposed to H₂S have been shown to exceed sweet life fatigue in laboratory testing. Possible causes for this are included in SPE paper 218327 and are part of the current developments in fracture mechanics. In all sour environments, FET-Global Tubing recommends using inhibitors with coiled tubing.



DURACOIL

Revolutionizing Coiled Tubing for Sour Environments

Overview of DURACOIL 95

Global Tubing's DURACOIL 95 is an advanced quench and tempered coiled tubing product designed for superior performance in extreme sour environments, particularly those with high H₂S content, such as in the Middle East. Launched as part of the DURACOIL portfolio, it builds on the revolutionary coiled tubing technology introduced by Global Tubing in 2017, addressing the limitations of earlier products in harsh conditions.

Key Features and Benefits

- **Enhanced Material Properties:** DURACOIL 95 is engineered with a material hardness of ≤ 26 HRC, reducing susceptibility to sulfide stress cracking and hydrogen embrittlement, which are common issues in high-strength conventional coiled tubing. This improves service life predictability and fatigue resistance in sour environments, reducing NPT and string changeouts.
- **Superior Fatigue Life:** Rigorous testing demonstrated that DURACOIL 95 outperforms conventional 90ksi coiled tubing. After exposure to simulated sour conditions of 100% H₂S (NACE Solution A) at ambient pressure, DURACOIL 95 showed more than two times fatigue life at bias welds compared to conventional products in both low and high internal pressure fatigue tests, even without inhibition. With inhibition, it achieved over 100% of sweet life, highlighting the importance of a robust inhibition program.
- **Manufacturing Innovation:** Produced using Global Tubing's patent-pending Halo Induction Technology®, DURACOIL 95 benefits from a one-step, in-line quench and temper process. This ensures a uniform microstructure along the tubing length, minimizing residual stresses and enhancing reliability at bias welds compared to the two-step processes used in conventional tubing. This eliminates the derating typically applied to bias welds, resulting in instant gains in string life.
- **Versatility:** Available in a wide range of outer diameters (1-1/4 in to 2-7/8 in) and wall thicknesses (0.109 in to 0.276 in), and SMARTaper® and hourglass configurations, DURACOIL 95 is suitable for complex well completions, challenging interventions, and extended-reach horizontal wells.

Applications

DURACOIL 95 is optimized for demanding coiled tubing operations, including:

- Well interventions in sour and corrosive environments.
- Advanced horizontal completions requiring extended reach.
- Operations in unconventional wells where reliability and durability are critical.

Market Impact and Reliability

Global Tubing positions DURACOIL 95 as a safe and reliable choice for sour service, minimizing downtime due to pipe failures. Its improved resistance to preferential corrosion and microbial-induced corrosion (MIC) enhances operational efficiency and safety. The product has been showcased at industry events like the ICoTA Coiled Tubing & Well Intervention Conference, where it was recognized for conquering the toughest wells globally.

Availability and Support

Manufactured at Global Tubing's state-of-the-art facility in Dayton, Texas, DURACOIL 95 is supported by the company's Engineered Solutions Team, which offers custom coiled tubing designs to optimize performance.

For more details, visit f-e-t.com/global-tubing.

OUR CORE VALUES

No One Gets Hurt

The safety of our employees and customers is our first priority coupled with a healthy respect for the environment.

Integrity

In everything we do, in every interaction, both internally and externally, we strive to operate with the utmost integrity and mutual respect.

Customer Focused

Our products enhance our customer's performance and we listen to their needs and work with them to solve their challenges.

Good Place To Work

We are committed to creating a workplace that fosters innovation, teamwork and pride. Every team member is integral to our success and is treated equally and fairly.

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