

MINUTES

IADC Geothermal Committee meeting,

2 October 2025

Present at the meeting were:

Alex Heger, ÖMV; Alexis Garcia, NOV; Andreas Karkossa, H&P; Gregg Walz, Clear Round Technology; Drummond Lawson, Altiss Technology; Bruce Gatherer, Iceland Drilling; Alexa Gonzalez, Blade Energy; Arun Karle, Askara (IADC); Andrew Barry, Wild Well Control; Dennis Breg, HP Wellscreen;; Floyd Estay, BOP Products; Gabriel Hounq, Beyond MPD; Mitch Dzienkowski, Altiss Technology; Idris Ben-Fayed, Blade Energy; Lars Nydahl Jørgensen, IADC (minutes); Marcus Oesterberg, Ignis Energy; Max Wyndham, 3TGlobal; Oliver Tausch, RED Drilling;; Paul Dodd, BetaTec; Peter Kazar, ENOWA; Scott Farmer (Committee Chair), Helmerich & Payne;; Toney Deer, Well Control School; Kevin Gray, Black Reiver; Martin Brown, BP; Brett Dalgety, BP.

In total 25

1. New Members

New members were introduced. Please refer to the list of members in the Sharepoint repository.

2. Committee Meetings 2025

The current meeting was the fourth quarter meeting in 2025. However, the committee agreed that it would be useful to have a meeting in December 2025, and then have the two following meetings late March and May-June respectively. The latter would enable an update ahead of the World Geothermal Congress in Calgary June 2026.

3. External Presentations – planned and requested

1) The presentation that was planned to be given by Scott at the **European Geothermal Congress** in Zürich in the coming week, will now instead be given by Florian Mercier of H&P.

2) The Geothermal Committee and companies represented in the Geothermal Committee have been requested by the **“India Energy Week”** to participate in a geothermal session to take place in the course of the week, specifically 29th January 2026.

In September 2025, the Government of India announced a new National Policy on Geothermal Energy with the aim of leveraging this untapped resource to drive its energy transition towards Net Zero 2070. A framework to incentivise geothermal exploration, pilot initiatives, resource development and joint ventures has been created.

IADC enjoys a close collaboration with the Federation of Indian Petroleum Industry (FIPI), and IADC encourages committee members to consider participating in the Geothermal Session during India Energy Week. If you were to plan to give a presentation during this session, please contact Arun Karle, Askara Group (arun_karle@askaragroup.com). Arun was one of the founders of IADC's South Central Asia chapter and is now pushing the growth of geothermal energy in India.

3) **IADC Drilling Caspian and Black Sea**, 4th-5th February 2026 in Baku. Despite the name, this conference also covers onshore activities. We had been requested by the conference committee to give a presentation on the status of our work. Drummond Lawson of Altiss Technologies kindly offered to give this presentation.

4) **AADE Innovative and Emerging Technology Study Group**, Houston, 19th March 2026. The invitation has been accepted.

5) **Montanuniversität Leoben**. The student body at this university have requested a presentation on Geothermal energy within 2025-2026. Alexander Heger of OMV kindly took on this challenge.

6) **World Geothermal Congress 2026**, Calgary 8th-12th June 2026. IADC's participation has been confirmed.

7) **IADC Geothermal Drilling Conference**, Copenhagen, 17-18 November 2026. The conference committee settled on Copenhagen. Invitation to submit "Challenges" (in lieu of abstracts) will come out early 2026.

IADC's Houston conference team has asked whether it would not be a good idea to hold the conference after the Copenhagen conference in North America. Members of the Geothermal Committee were asked consider what might be a good location and a good theme for this conference, if it were to be held in North America.

4. Guidelines and API standards

Gregg Walz of Clear Round Technology gave an overview of the dialogue between API and IADC on this matter. We have earlier had discussions with API with the purpose of ensuring that we do not get new API standards before our work on the "IADC Well Construction Guideline" has been completed. API agree that we need to coordinate activities. We have found it prudent to emphasise this need and consider putting our plans in writing.

5. IADC Well Construction Guideline - Work Group Updates

Please refer also to the power point presentation appended at the end of this document.

1) Classification

The first part of this, the Definitions, had been blished mid February. Scott Farmer went through the following steps, the next one being, the "Complexity Calculator – Risk Index". Scott invited volunteers to participate in the work group for the purpose of Risk Calulations. Kevin Gray of Black Reiver volunteered.

2) Well Control

Toney Deer went through the status of the work carried out (please refer to

presentation below). The work group has been very active and the work is very far progressed, so much so that a draft document is expected to be available within four weeks. The work group was commended for this great result.

3) Well Design

Alex Heger gave a presentation. He noted that the chapters of the Well Design part of the Guideline were now reasonably well defined. He further explained how the group had spent quite some time discussing barrier philosophies. He discussed a number of specific cases and reflected among others on how the differences between Low – and High Enthalpy wells would be reflected in casing design

4) Rig & Equipment

Bruce Gatherer explained the status of work, which had not progressed as much as the work group had been expecting. They therefore reached out to the committee during the meeting for new members. Kevin Gray volunteered to join the group.

5) Drilling Technology

Alex Vetsak gave a summary of the work to date. The list of chapters have been agreed. The group had discussed how this aligns with the overall strategic framework. A “strawman” had been produced earlier and had been sent out to members of the Committee. Scott encouraged everybody to consult this strawman.

Alex sought expertise to join the group. The group ideally needs one new member with expertise in each of the following areas:

- geothermal completions,
- real time distributed sensing and AI, and
- hybrid geothermal applications.

Please approach Alex, if you or one of your colleagues can provide this expertise (alex.vetsak@eavor.com).

There was a discussion about the further progress of the work in all the groups. We have budget allocated to pay for a technical writer, the same writer who helped with the “Definitions” chapter. This is a great help as it goes a long way to ensure consistency. When the document has been collated, the technical writer will go through it all.

6. AOB

Drummond Lawson of Altiss Technologies gave a presentation of comprehensive testing (tension, thermal conductivity and corrosion of titanium, nickel and hastelloy).

There being no further business, the meeting was adjourned.



Geothermal Committee
Quarterly Meeting – Q4 2025 – 02/10/25

Agenda

- New Members
- Committee Meetings – 2025
- Presentations and Abstracts
- Guidelines and API Standards
- Work Group Updates
 - Classification – Scott Farmer
 - Well Control – Toney Deer
 - Well Design – Alex Heger
 - Rig & Equipment – Bruce Gatherer & Andreas Karkossa
 - Drilling Technology – Alex Vetsak
- AOB

New Members

- ...

85 members
54 companies

Proposed Planning – 2025

- Quarterly Committee Meetings, but more frequent work group meetings
 - 2 x in-person and 2 x virtual with longer format
 - Work Group leaders can dictate the frequency of WG meetings
- Committee Meetings for 2025:
 - Q1 – 23rd of January 2025 – Virtual
 - Q2 – 27th of March 2025 – In-person (hybrid) – Vienna
 - Q3 – 26th of June 2025 – Virtual
 - Q4 – 2nd of October – In-person (hybrid) – Reykjavk following IADC ART Conference
 - Year End – Virtual Meeting in December?

Presentations & Abstracts

- Presentations:

- 20th of February 2025, Offenburg – GeoTHERM 2025 – **DONE**
- 28th of February 2025, Webinar – Thinkgeoenergy – **DONE**
- 10 – 11th of June 2025, Amsterdam – IADC World Drilling 2025 – **DONE**
- 30th of September – 1st of October 2025, Reykjavik – IADC Advanced Rig Technology 2025 – **DONE**
- 6 – 10th of October 2025, Zurich – European Geothermal Congress 2025 – **CONFIRMED**
- **GRC??**
- 19th of March 2026, Houston – AADE, Innovative and Emerging Technology Study Group – **INVITE ACCEPTED**

- Session Proposal:

- 8 – 12th of June 2026, Calgary – WGC 2026 – Have Your Say: The IADC Geothermal Well Drilling Guideline – **CONFIRMED**
- 4 – 5th of February 2026, Baku – IADC Drilling Caspian & Black Sea – **SPEAKER REQUESTED**
- Montanuniversität Leoben – **SPEAKER REQUESTED**
- 29th of January 2026, India Energy Week – **SPEAKER REQUESTED**

 Save

IADC GEOTHERMAL DRILLING

Conference & Exhibition

17-18 NOVEMBER 2026
RADISSON BLU SCANDINAVIA HOTEL COPENHAGEN, COPENHAGEN, DENMARK

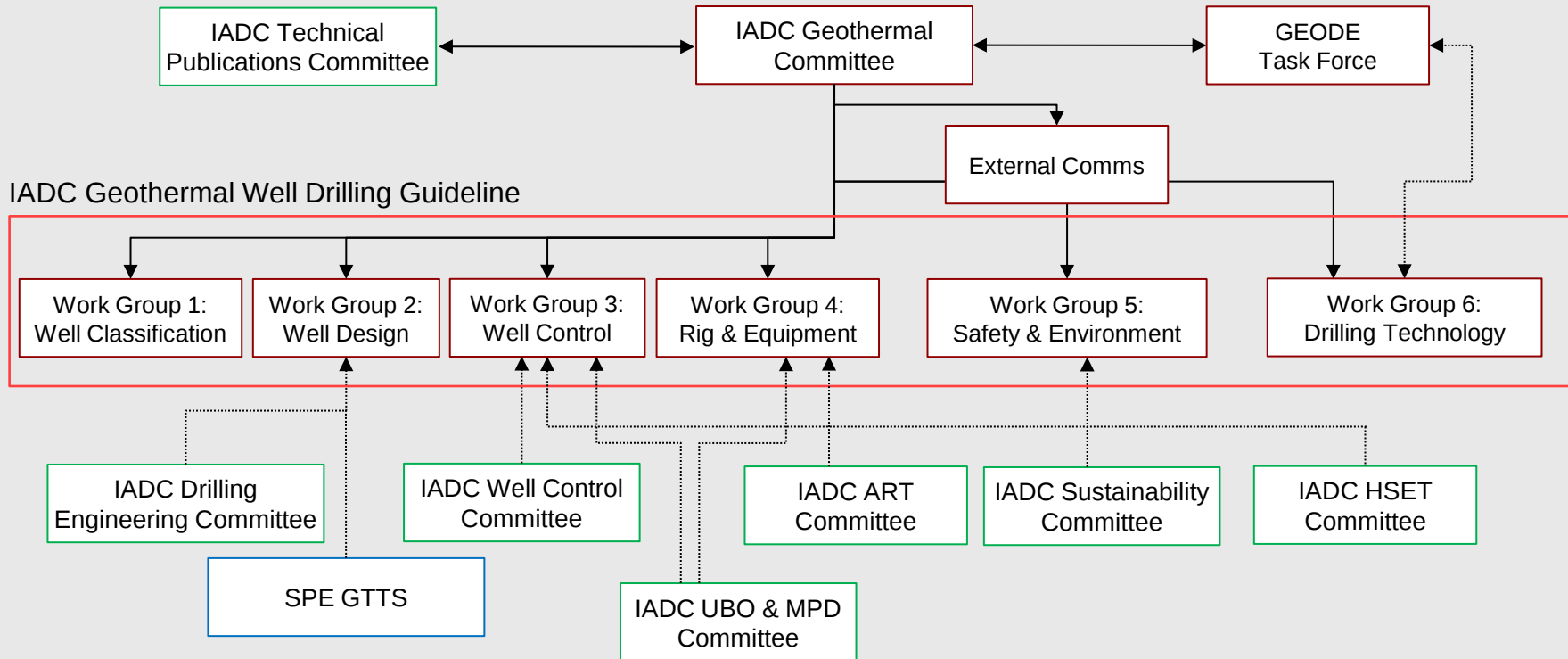


IADC[®]

Guidelines and API

- Gregg Walz

Work Groups



Work Group Update – Classification

- Part 1 – Definitions was published in mid-February
 - Available on the website
- Part 2 – Complexity Calculator → Risk Index (BETA release)
- Part 3 – Worked Examples
- Questionnaire to gather wells information to refine weightings and logic
- Dedicated online application and database

Work Group Update – Well Control

- Tony Deer

All well lifecycle phases: Drilling, Completion, Servicing, Stimulation, and Abandonment

To cover well control in every phase of the well lifecycle, including; barrier philosophy, drilling, completion, stimulation, workover, well servicing, well intervention and permanent abandonment. This document excludes non-standard well control operations.

- Distinguishing the difference in well control hazards
- Well Classifications for context
- Risk Management and Operational Hazards
- Barriers
- CCS, MPD and Auxiliary Equipment
- BOP equipment (Drilling, MPD, CT, Wireline, Cementing, Casing)
- Well Control Recommended Practices Drilling
- Geothermal Well Kill Methods
- **Managing Hazardous Gasses**
- Well Control Recommended Practices Well Intervention
- Well Control Recommended Practices Plug and Abandonment
- Personnel Training and Competency
- Definitions and Acronyms

This document also builds upon the foundational work of several industry standards organizations. We acknowledge the vital role of the following standards, which were referenced throughout these guidelines:

- i. **API** (American Petroleum Institute), specifically standards and recommended practices including API Standard 53, API Recommended Practice 59, API Recommended Practice 64, API Recommended Practice 92M, API Specification 6A, API Specification 16C, and API 16ST.
- ii. **IADC** (International Association of Drilling Contractors).
- iii. **NACE International / ISO** (International Organization for Standardization), specifically NACE MR0175 / ISO 15156.
- iv. **NORSOK**, specifically standard D-010.
- v. **NZS 2403** (New Zealand Standard).

Work Group Update – Well Design

- Alex Heger

Work Group Update – Well Design

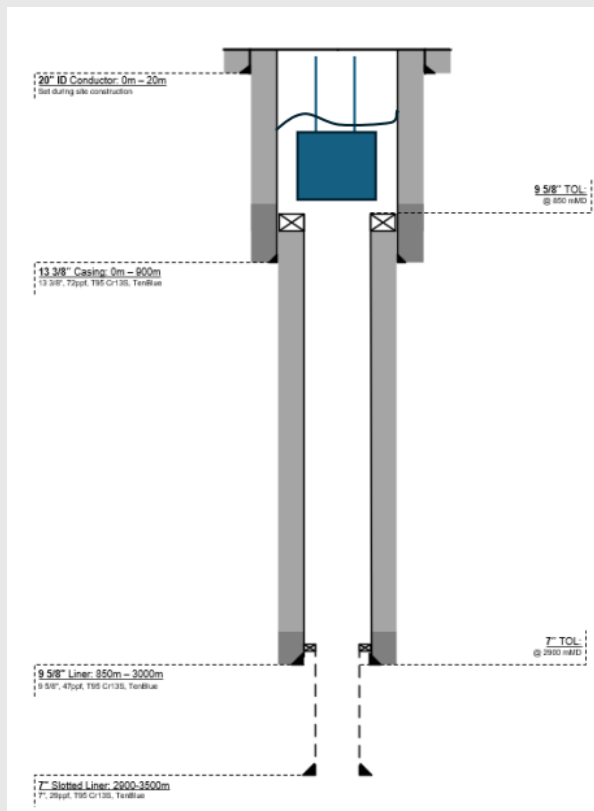


Table of Contents

Introduction	3
Objectives	4
Guideline to Standards	5
Well Design Inputs and Outputs	6
1. Well type	6
2. Pore pressure	6
3. Fracture pressure	6
4. Temperature profile	6
5. Lithology	6
6. Fluid type and chemistry (PH values ...)	6
7. Material selection	6
8. Load cases	6
9. Casing connections	6
10. Cement design	6
11. Drilling fluid design?	6
Geological settings	10
Reservoirs	11
Completion Design Considerations	14
Standards to consider	15
Re	16

Work Group Update – Well Design

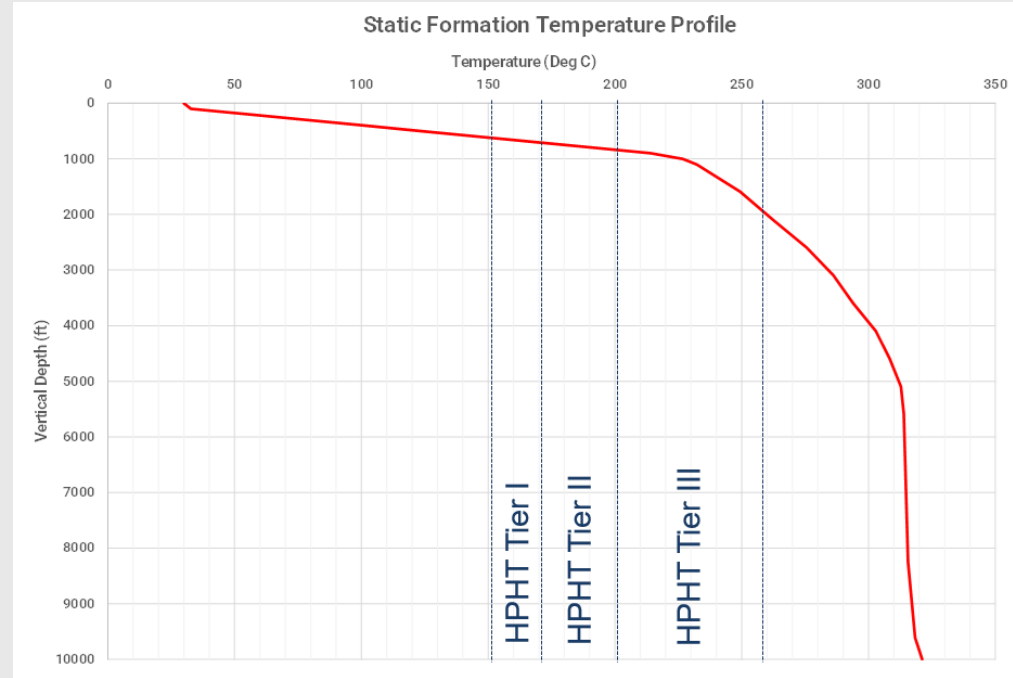
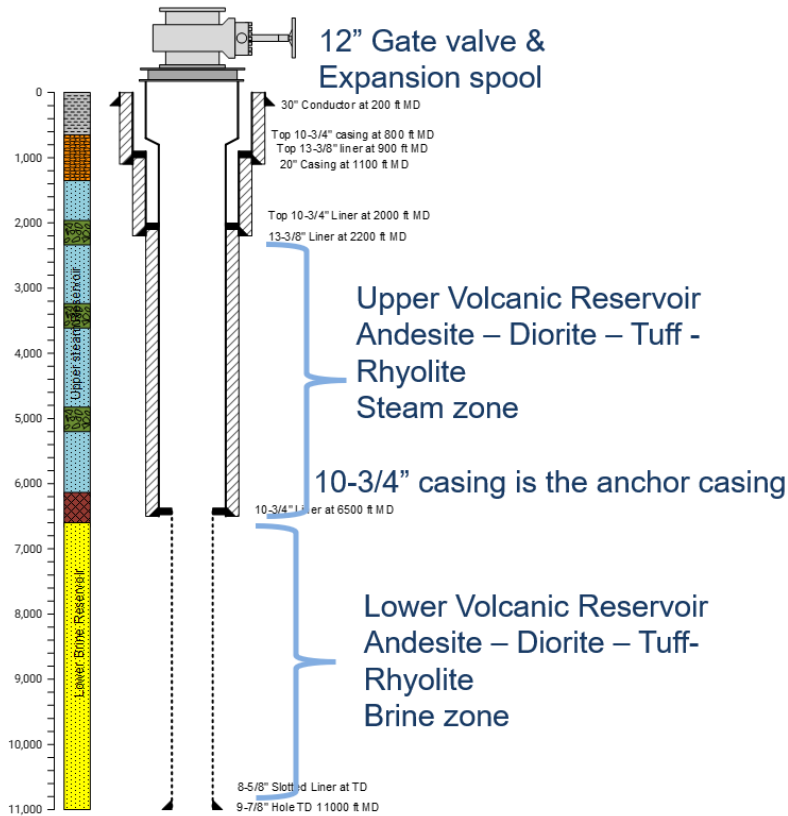
Low Enthalpy Wells



	Pipe	Load	Internal Profile	External Profile	Design Factor
1.4	Surface, Intermediate and Production Casing	Burst while Drilling	Maximum expected wellhead pressure during circulating out a kick tolerance volume kick with gas at surface Gas gradient: 0.28 SG	seawater gradient at the wellhead (subsea); atmospheric pressure above cellar ground (onshore); initial mud gradient above TOC; pore pressure gradient below TOC if cement is opposite formation; mix water gradient if cement is inside another casing;	1.1
	Production Casing	Burst during production	Most severe of tubing leak near surface plus well-kill or stimulation injection pressure;	mud base fluid density; cement mix water gradient below TOC;	1.1
2.4	Surface & Intermediate Casing	Collapse while Drilling	Mud level drops to the depth where mud pressure balances the pore pressure;	seawater gradient at the wellhead (subsea); initial mud gradient above TOC; pore pressure gradient below TOC if cement is opposite formation; mix water gradient if cement is inside another casing; max. load during cementing operation;	1.1
	Production Casing	Collapse	Complete evacuation;	initial mud gradient above TOC; pore pressure gradient below TOC if cement is opposite formation; mix water gradient if cement is inside another casing;	1.1
	Surface, Intermediate & Production Casing	Tension while drilling	-Calculate casing string weight in air -Calculate casing string weight in mud -Add additional loads: bumping the plug, setting loads including wellhead and BOP weight which are transferred & Required Margin-of-Over pull (MOP)		1.5

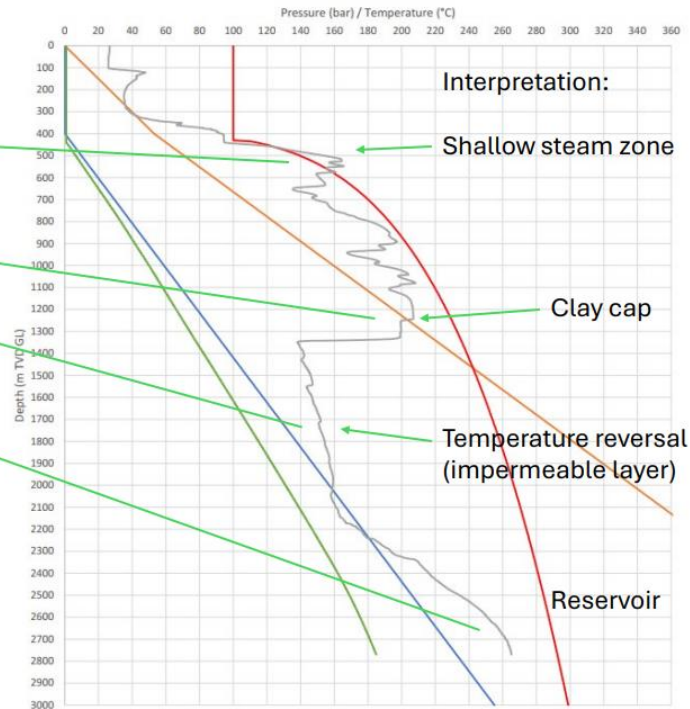
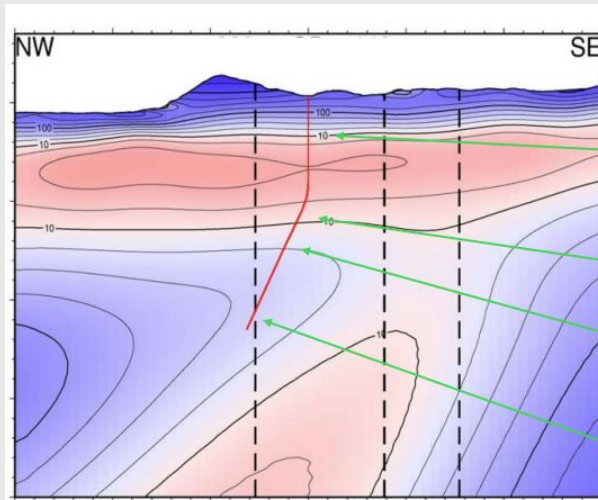
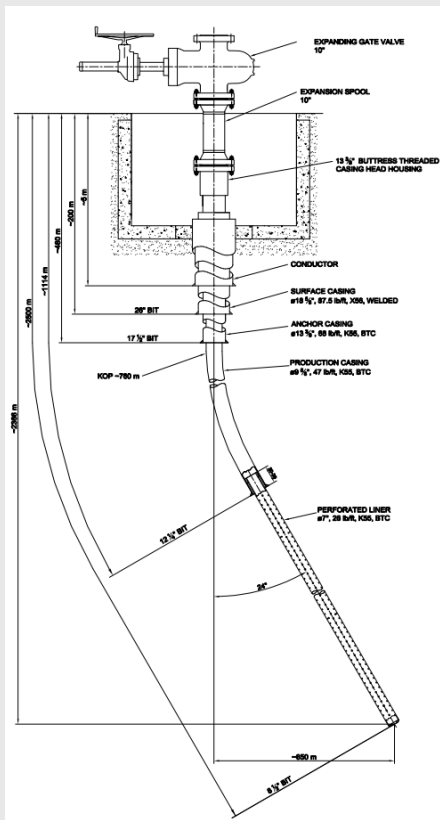
Work Group Update – Well Design

High Enthalpy Wells 1



Work Group Update – Well Design

High Enthalpy Wells 2



Work Group Update - Rig and Equipment

- Bruce Gatherer

Work Group Update – Drilling Technology

- Alex Vetsak

AOB

- ...

ALTISS Technologies Geothermal

Update

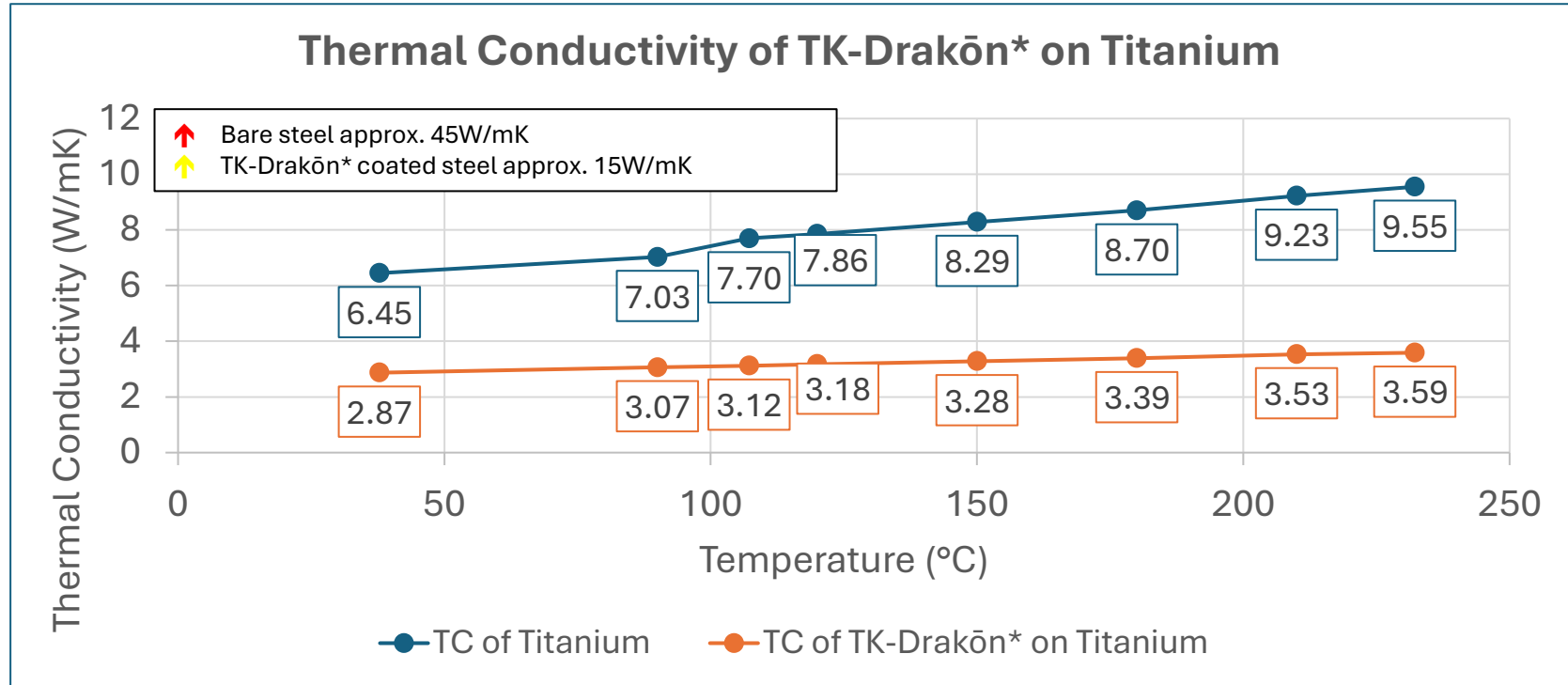
6-5/8" Titanium Torque Testing



Torque – 130K Ft-Lbs. | Tension – 3MM lbf. plus

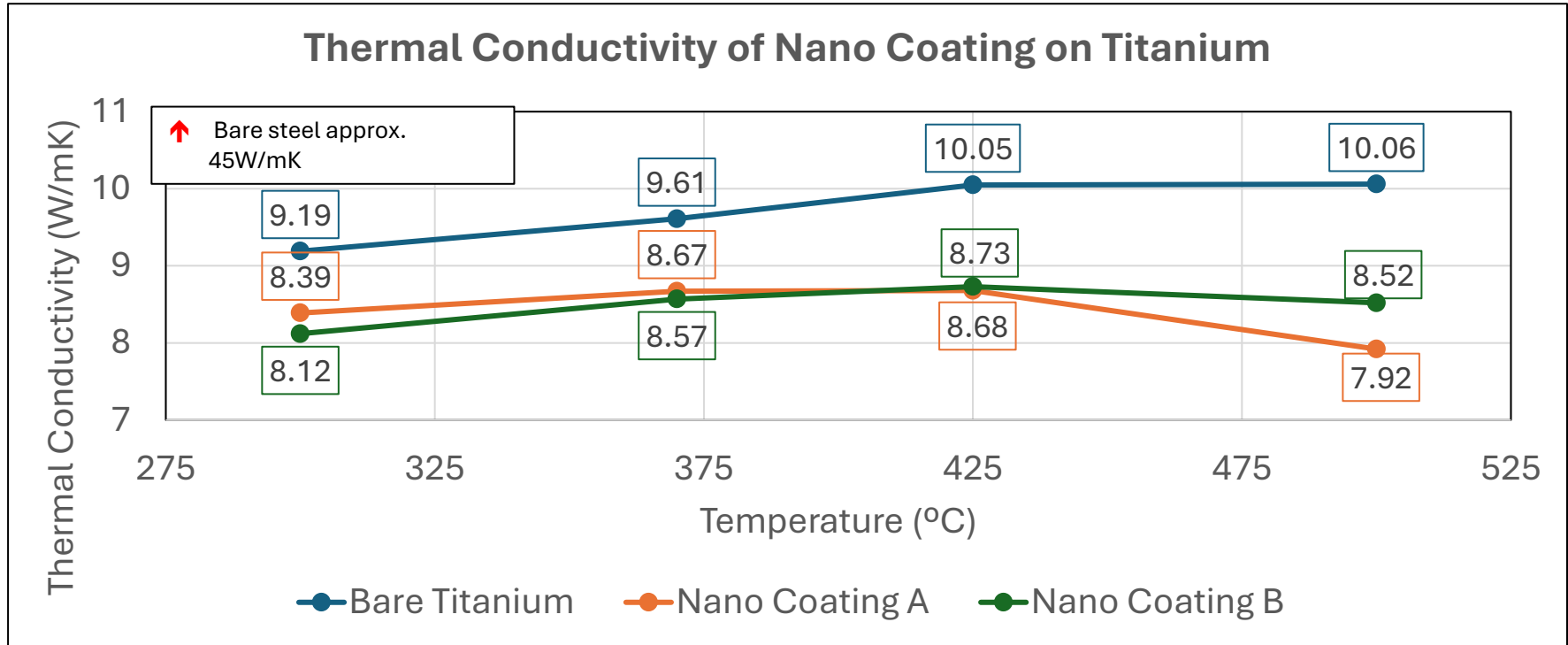
PATENTED

Titanium Thermal Conductivity Up To 232°C



* TK-Drakōn: © 2025 NOV Inc. All rights reserved

Super Hot Titanium Thermal Conductivity Up to 500°C



High-temperature (454°C) Corrosion Analysis for Geothermal Applications Simulating Deep or Volcanic Conditions

- ***Joshua Jackson, PhD¹, Mitchell Dziekonski², Einar Strand², Torfinn Havn³***
 - 1) US Corrosion Services LLC, Houston, USA
 - 2) ALTISS Technologies AS, Oslo, Norway
 - 3) Ztrong Partner AS, Stavanger, Norway



Testing Summary

- **Materials:**

- Nickel 718
- Titanium Grade 12
- Hastelloy C276
- Titanium 6-2-4-6

- **Time: 7 Days**

- 100,000 ppm of chlorides

- 454°C Temperature

- **Pressure:**

- 212 bar CO₂
- 5.62 bar N₂
- 1.5 bar O₂
- H₂O

- Stacked in Ceramic Boats for Galvanic Isolation



Summary of Hot Rock Corrosion Analysis

Testing Duration 7 Days

- Corrosion loss: Least on Titanium Grade 12
- Pitting: Only on Nickel 718 with corrosion loss
- Highest Corrosion Loss: Hastelloy C276



Nickel 718

Titanium Grade 12 shows overall best performance

- Contact: drummond.lawson@AltissTech.com