

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

WEATHERFORD U.S., L.P.,

Petitioner

v.

HALLIBURTON ENERGY SERVICES, INC.

Patent Owner

Case IPR2024-00990

Patent No. 11,333,007

**THIRD DECLARATION OF DR. ROBERT A. DURHAM
IN SUPPORT OF PATENT OWNER'S REVISED CONTINGENT MOTION
TO AMEND**

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I, Robert Durham, declare as follows:

I have been retained on behalf of Halliburton Energy Services, Inc. (“Halliburton”) to provide my opinions regarding Weatherford U.S., L.P.’s Petition for *Inter Partes* Review of Claims 1-23 of U.S. Patent No. 11,333,007 (“the ’007 Patent”) and Opposition to Patent Owner’s Revised Motion to Amend. I submit this declaration based on my personal knowledge and in support of Halliburton’s Revised Contingent Motion to Amend.

I. INTRODUCTION

1. In formulating my opinions, I have relied upon my knowledge, training, and experience in the relevant art. My qualifications are stated more fully in my curriculum vitae, previously submitted as Ex. 2003. My CV also lists publications on which I am a named author and identifies parties on behalf of whom I have previously provided expert testimony within the past four years. Here, I provide a brief summary of my qualifications.

2. I am a consulting engineer with experience in a number of technical areas. I have oil and gas industry expertise from drilling and completion to downstream. As a consultant, I have worked with oil field production companies, refining and chemical plants, equipment manufacturers, and technology development companies for over twenty years. My work relates to the subject matter of the U.S. Pat. No. 11,333,007 (“the ’007 Patent”).

A. Background

3. My relevant qualifications, including my educational background and career history is summarized below. A copy of my curriculum vitae, which includes a more detailed enumeration of my background, experience, patents, and publications, is attached as Ex. 2003.

4. I received my Bachelor of Science in Electrical Engineering and Master of Engineering and Technology Management degrees from the University of Tulsa in 1992 and 1997, respectively. After years of professional work and research, I received my Ph.D. in Engineering Management from Kennedy Western University in 2004.

5. I have also served in leadership positions in the Petroleum and Chemical Industry Committee (PCIC) of the Institute of Electrical and Electronics Engineers (IEEE) for nearly twenty years. IEEE is the world's largest technical professional association. The PCIC is the premier forum for the exchange of electrical applications technology related to the petroleum and chemical industry. From 2005 to 2012, I served as secretary, vice chair, and ultimately chair of the Production Subcommittee of the PCIC. The Production Subcommittee is the primary method for PCIC members to communicate technical papers related to drilling, wellhead, and facilities operations of oil and gas wells. In 2013, I was appointed as Vice-Chair of the Standards Subcommittee of the PCIC, a role which transitioned to Chair in 2014. I served as Chair until 2022. The Standards Subcommittee of the

PCIC is the Sponsor of IEEE standards relating equipment operations in the Oil and Gas Industry. The PCIC Standards Subcommittee sponsors nearly 50 electrical and oil and gas-related standards. In September 2022, I was elected as an Executive Officer of the PCIC. I will serve as an Executive Officer for eight years, serving two-year terms in each position: Secretary, Vice Chair, Chair, and Chair of Advisory and Awards.

6. My peers have recognized my contributions, particularly in the area of electrical equipment in the oil and gas industry. Because of this recognition, in 2019, I was elevated to the grade of Fellow of the IEEE for “contributions to submersible electrical equipment analysis and multi-point ground methods in hazardous petroleum and chemical environments.” The IEEE Fellow grade is limited to the top 0.1% of the IEEE membership worldwide.

7. I have worked directly in the oil and gas fields both as an employee and as a consulting engineer. From 2000 until the end of 2002, I was employed as Manager of Electric Infrastructure for New Dominion, LLC (NDL). In that capacity, I administratively owned and was responsible for all electrical equipment, including overhead power lines, transformers, switchgear, drives, and motors, throughout NDL’s production, exploration, and drilling areas.

8. After a brief stint as Vice President for EDG Power Group, responsible for Engineering and Project Management of generation and co-generation facilities across the U.S., I transitioned to the role of consulting engineer. In that role, I have

served as a consulting engineer in designing, constructing, and analyzing all kinds systems, especially those in the oil and gas industry. This has included the design and selection of equipment and the analysis of equipment failures in the oil and gas field from drilling/completion sites to production facilities, midstream, and downstream (refinery) locations.

9. I am also a principal of PEDOCS, Inc., an oil and gas production company operating over 50 oil and gas production wells in Oklahoma. As such, I am familiar with oil and gas well operations, including well stimulation, completion, hydraulic fracturing, and production.

10. I have been familiar with oil and gas drilling, fracturing (fracking), completion, production, midstream, and downstream operations for over twenty years. I am familiar with sand control technologies, including sand screens and gravel packs. I have specified and used sand control devices in production wells owned by PEDOCS, particularly in loosely consolidated sand formations. Additionally, I was familiar with sand control devices when employed at New Dominion, LLC. I have studied gravel pack technologies in a consulting role, even before this engagement, and have testified regarding such technologies.

11. Additionally, I have specified and used sand control systems in unconsolidated sand formations for multiple wells.¹ I have specified and used both

¹ Unconsolidated is a term of art differentiating those formations that are “consolidated” or have been compacted and cemented to the degree that they become coherent, relatively solid [rock](#). See, for example, Ex 2016, 3 (defining

traditional sand screens and “pre-pack” gravel pack systems as sand control methods. In specifying and using those systems, I performed engineering analysis of the produced sand, including size and shape. In addition, I performed analysis of how much production would be affected by the inclusion of sand control devices in the well, and compared that with the cost of damaged equipment that the operator was experiencing. From those calculations and analysis, I specified, and used, the appropriate sand control systems, including gravel pack systems.

12. I author or co-author over fifty published papers and five books. A list of publications that I have written over the last thirty years is included in my professional CV.²

13. Therefore, based on my education, professional experience of over 30 years, and scholarly books and publications, I am an expert in the relevant field of the '007 Patent and have been an expert in this field since before the '007 Patent was filed with the United States Patent and Trademark Office (“USPTO”). I am familiar with how a person having ordinary skill in the art would have understood and used the terminology found in the '007 Patent at the time of filing.

“consolidated” as “relatively solid or firm rock”); <https://glossary.slb.com/en/terms/c/consolidated>. Any formation that is not cemented and stable, solid rock would be unconsolidated. Ex. 2016, 4 (defining “unconsolidated” as “loose uncemented sediments”). For example, any sand formation that produces sand would be unconsolidated.

² See Ex. 2003.

II. SUMMARY OF CONCLUSIONS

14. In my opinion, the *Bonner* reference does not disclose a “high pressure” screen, but rather discloses a conventional eccentric screen (having a 5,000-psi burst pressure rating and an approximately 3,000-psi operating pressure rating).³

15. In my opinion, the conventional eccentric screen disclosed in *Bonner* was not a suitable substitute for the high-pressure concentric screen disclosed in *Yeh* for use upstream, at the heel of the production interval.⁴

16. In my opinion, the prior art does not disclose, teach, or suggest varying modifying nozzle spacing across packing tubes, as required by Claim 24.⁵

17. In my opinion, the *Yeh*, *Yeh2*, and *Bonner* references do not disclose, teach, or suggest an upstream “packing tube ... interconnected to a” downstream “junction block.”⁶

18. In my opinion, the ’007 Patent specification enabled a POSITA to make and use a gravel pack system with varied packing tube nozzle sizes, locations, and spacing or number, such that downstream packing tube nozzles allowed a larger volume of fluid to flow than upstream packing tube nozzles.⁷

³ See Section VIII.A below.

⁴ See Section VIII.A below.

⁵ See Section VIII.B below.

⁶ See Section VIII.C below.

⁷ See Section VIII.D below.

III. MATERIALS REVIEWED

19. For this declaration, I have been asked to review the Petition for *Inter Partes* Review of Claims 1-23 of the '007 Patent, Patent Owner's Revised Contingent Motion to Amend, and Petitioner's Opposition to the Revised Contingent Motion to Amend, along with the '007 Patent, File History, alleged Prior Art and other associated exhibits and provide my opinions regarding the Substitute Claims in Patent Owner's Revised Contingent Motion to Amend and Petitioner's Opposition to the Revised Contingent Motion to Amend. In forming my opinions, I have reviewed the materials cited in the List of Exhibits and the materials cited throughout my declaration.

IV. LIST OF EXHIBITS

Exhibit No.	Description
1001	U.S. Patent No. 11,333,007 ("'007 Patent")
1002	File History for U.S. Patent No. 11,333,007
1003	Declaration of Michael R. Chambers Sr. ("Chambers Decl.")
1004	CV of Michael R. Chambers Sr.
1005	U.S. Patent No. 9,797,226 ("Yeh")
1006	IPTC 12549 ("Yeh2")
1007	U.S. Patent No. 4,945,991 ("Jones")
1008	U.S. Patent No. 5,113,935 ("Jones2")
1009	L.G. Jones et al., <i>Alternate Path Gravel Packing</i> , Society of Petroleum Engineers, SPE 22796 (Oct. 1991)
1010	U.S. Patent No. 7,661,476
1011	<i>ExxonMobil Awards Alternate Path Technology License to Weatherford</i> , ExxonMobil Press Release (Aug. 27, 2013)

1012	U.S. Patent No. 5,588,487
1013	G. Hurst et al., <i>Alternate Path Completions: A Critical Review and Lessons Learned From Case Histories With Recommended Practices for Deepwater Applications</i> , Society of Petroleum Engineers, SPE 86532 (Feb. 2004) (“Hurst”)
1014	K.W. Lagrone et al., <i>A New Development in Completion Methods The Limited Entry Technique</i> , Society of Petroleum Engineers, SPE 530 (July 1963) (“Lagrone”)
1015	M.T. Hecker et al., <i>Extending Openhole Gravel Packing Capability: Initial Field Installation of Internal Shunt Alternate Path Technology</i> , Society of Petroleum Engineers, SPE 135102 (Sept. 2010) (“Hecker”)
1016	A. Bonner et al., <i>Design and Validation of an Improved Shunt Tube System</i> , Society of Petroleum Engineers, SPE-169440-MS (2014) (“Bonner”)
1017	API Technical Report 5C3, published in December 2008 with an Addendum in October 2015 (excerpts)
1018	ASTM A554-16: Standard Specification for Welded Stainless Steel Mechanical Tubing (2016) (excerpts)
1019	Declaration of Christine Diedrich of the Society of Petroleum Engineers
1020	Complaint for Patent Infringement, <i>Halliburton Energy Servs. v. Weatherford U.S. L.P.</i> , Case No. 24-cv-00090 (W.D. La. Jan. 22, 2024)
1021	U.S. District Courts – Combined Civil and Criminal Federal Court Management Statistics (March 31, 2023), available at https://www.uscourts.gov/statistics-reports/federal-court-management-statistics-march-2023
1022	Shahryar Saebi, <i>The Evolution of Completion Designs Using Alternate Path (Shunt-Tubes) Technology</i> , Society of Petroleum Engineers SPE 155129 (Mar. 2012)
1023	U.S. Patent No. 5,476,143
1024	U.S. Patent No. 7,938,184
1025	Larry G. Myers et al., <i>Case History in Achieving High Rate Producers in Sub Sea Gravel Packed Completions</i> , Society of Petroleum Engineers, SPE 39433 (Feb. 1998)
1026	Raymond Tibbles, et al., <i>Design and Execution of a 3000-ft Horizontal Gravel-Packed Completion (A Kazakhstan Case History)</i> , Society of Petroleum Engineers, SPE 64410 (Oct. 2000)

1027	M.D. Barry et al., <i>Openhole Gravel Packing With Zonal Isolation</i> , Society of Petroleum Engineers, SPE 110460 (Nov. 2007)
1028	U.S. Patent No. 5,890,533
1029	ASTM A500/A500M-13: Standard Specification for Cold- Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes (2013) (excerpts)
1030	U.S. Patent No. 4,629,218
1031	Declaration of Stephen McNamee
1032	Fischer Stainless Steel Tubing - Part Number List
1033	L.G. Jones et al., <i>Gravel Packing Horizontal Wellbores with Leak-Off Using Shunts</i> , Society of Petroleum Engineers, SPE 38640 (Oct. 1997)
1034	D.W. Bryant & L.G. Jones, <i>Completion and Production Results from Alternate-Path Gravel-Packed Wells</i> , SPE Drilling & Completion, SPE 27359 (Sept. 1995)
1035	U.S. Patent No. 6,588,506
1036	Halliburton Cementing Tables (1979) (excerpts)
1037	Introduction to Otis Multi-Position Gravel Pack System, Otis Engineering Corporation, Technical Manual 2004/88 (excerpts)
1038	Johnson Oil and Gas Well Screens Catalog (1991) (excerpts)
1039	U.S. Patent No. 2,905,245
1040	U.S. Patent No. 8,839,861
1041	U.S. Patent No. 5,842,516
1042	Omitted
1043	Transcript of May 15, 2025 Deposition of Dr. Robert A. Durham
1044	Second Declaration of Michael R. Chambers Sr. (“Second Chambers’ Decl.”)
1045	U.S. Patent App. Pub. No. 2005/0121192 (“Hailey”)
1046	U.S. Patent No. 7,784,532
1047	Baker Oil Tech Facts Engineering Handbook (1994) (excerpts)
1048	Halliburton Cementing Tables (1979) (excerpts) (updated EX1036)
1049	Weatherford Openhole Shunted Screen System (2011), available at https://www.weatherford.com/documents/technical-specification-

	sheet/products-and-services/completions/openhole-shunted-screen-system/
1050	Schumberger OptiPac System specification (2014), available at https://www.slb.com/-/media/files/sand-control/product-sheet/optipac-alternatepath-ps.pdf , and at https://web.archive.org/web/20160803161036/http://www.slb.com/%7E/media/Files/sand_control/product_sheets/optipac_alternatepath_ps.pdf
1051	Y. Cengel & J. Cimbala, <i>Fluid Mechanics, Fundamentals and Applications</i> (McGraw-Hill, 3d ed. 2014) (excerpts)
1052	Third Declaration of Michael R. Chambers Sr. (“Third Chambers Decl.”)
2001	Deposition Transcript of Dr. Michael R. Chambers re: IPR2024-00990 (February 21, 2025)
2002	Declaration of Robert A. Durham
2003	Curriculum Vitae of Robert A. Durham
2004	Second Declaration of Dr. Robert Durham
2005	U.S. Provisional Application No. 62/688,813 (the ’813 Provisional)
2006	Bourgoyne, Adam T., Jr., Keith K. Millheim, Martin E. Chenevert, and F.S. Young, Jr., <i>Applied Drilling Engineering</i> , Society of Petroleum Engineers (1986).
2007	Staff of Royal Dutch / Shell Group of Companies, <i>The Petroleum Handbook</i> , (1983).
2008	Rahman, S. S. and G. V. Chilingarian, <i>Casing design-theory and practice</i> (1995).
2009	IEEE RP 1017, “IEEE Recommended Practice for Field Testing Electric Submersible Pump Cable” (2004).
2010	Conaway, Charles F, <i>The Petroleum Industry: A Nontechnical Guide</i> . Pennwell Books (1999).
2011	Braek, A. M., R. A. Almehaideb, and R. Hughes, <i>Application of Eos to Optimize the Design of an Early Production Scheme of an Onshore Oil Field in Abu Dhabi</i> , Abu Dhabi International Petroleum Exhibition and Conference (1998).
2012	Omitted
2013	Deposition Transcript of Michael R. Chambers re: IPR2024-00990

	(July 2, 2025)
2014	Omitted
2015	Deposition Transcript of Michael R. Chambers re: IPR2024-00990 (September 5, 2025)
2016	“Consolidated” & “Unconsolidated” Definition. Norman J. Hyne, <i>Dictionary of Petroleum, Exploration, Drilling, and Production</i> (1991).

V. UNDERSTANDING OF THE LAW

20. I am not an attorney and offer no legal opinions, but, in my work, I have had experience studying and analyzing patents and patent claims from the perspective of a person skilled in the art (a “POSITA”).

21. For the purposes of this declaration, Patent Owner’s counsel has informed me about certain aspects of the law that are relevant to my opinions, as set forth below. I understand that the patentability of a patent is analyzed on a claim-by-claim basis, from the perspective of a hypothetical person of ordinary skill in the art (“POSITA”).

A. Priority Date and Prior Art

22. I understand that, subject to the next paragraph, the asserted “priority date” of a patent is the earlier of: (a) the date on which a patent application is filed; or (b) the date on which an earlier-filed patent application is filed if the patentee claims the benefit of priority to that earlier-filed patent application.

23. I understand that it is not enough for a patent to merely claim the benefit of an earlier-filed application, but that additional criteria must be met. In particular, the prior application itself must describe the claimed invention, and must do so in

sufficient detail that one skilled in the art can clearly conclude that the inventor invented the claimed invention as of the filing date sought. First, I understand that a priority-date analysis is on a claim-by-claim basis. Second, I understand that, in order for a patent claim to be entitled to the filing date of an earlier patent application, a “Section 112 analysis” must be conducted. I am informed that a “Section 112” analysis encompasses looking to the earlier patent application, and ascertaining whether that earlier patent application meets both the written description and enablement requirements as of the filing date of the earlier application. I understand that it is not enough that the claim would have been obvious from the earlier application, but that application itself must describe the claimed invention.

24. I understand that in order to satisfy the written description requirement the earlier application must reasonably convey to those skilled in the art that the inventors had possession of the subject matter of the patent as of the filing date of the earlier application. I have been informed that it is the disclosures of the earlier patent application that count, and that while the meaning of terms, phrases, or diagrams in the earlier patent application must be interpreted from the vantage point of one skilled in the art, all of the claimed limitations must appear in the specification. Further, I understand that this analysis is not a question of whether one skilled in the art might be able to construct the claimed invention from the teachings of the disclosure. The question is not whether a claimed invention is an

obvious variant of that which is disclosed in the specification; rather, I understand that an earlier application must itself describe each of the claim limitations.

25. I also understand that in order to satisfy the enablement requirement, the earlier application must enable a person of ordinary skill in the art to practice the claimed invention without undue experimentation.

26. I understand that publications and patents, that were published or otherwise publicly available before the date of a claimed invention may qualify as “prior art” to that invention. I further understand that prior art may render one or more claims of a patent invalid for one of two reasons: (a) anticipation and (b) obviousness. However, I understand that a patent or other publication must first qualify as prior art before it can be used to invalidate a patent claim and that all prior art must be viewed from the perspective of a POSITA at the time of the invention.

27. I understand that to qualify as prior art, a reference must contain an enabling disclosure that allows one of ordinary skill to practice the claims without undue experimentation.

B. Anticipation

28. It is my understanding that the claims of a patent are anticipated by a prior art reference if each and every element of the claim is found either explicitly or inherently in a single prior art reference or system. I understand that inherency requires a showing that the missing descriptive matter in the claim is necessarily or implicitly present in the allegedly anticipating reference, and that it would have been

so recognized by a POSITA. In addition, I understand that an enabling disclosure is a disclosure that allows a POSITA to make the invention without undue experimentation.

29. I understand that in this *inter partes* review, Petitioner does not allege that any claims are anticipated.

C. Obviousness

30. I understand that the prior art may render a patent claim “obvious.” I understand that two or more prior art references (e.g., prior art articles, patents, or publications) that each disclose fewer than all elements of a patent claim may be combined to render a patent claim obvious if the combination of the prior art collectively discloses all elements of the claim and one of ordinary skill in the art at the time would have been motivated to combine the prior art in such a way. I understand that this motivation to combine need not be explicit in any of the prior art, but may be inferred from the knowledge of one of ordinary skill in the art at the time the patent was filed. I also understand that one of ordinary skill in the art is not an automaton, but is a person having ordinary creativity. I further understand that one or more prior art references, articles, patents or publications that disclose fewer than all of the elements of a patent claim may render a patent claim obvious if including the missing element would have been obvious to one of skill in the art (e.g., the missing element represents only an insubstantial difference over the prior art or a reconfiguration of a known system).

31. I understand that under the doctrine of obviousness, a claim may be invalid if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a POSITA to which the subject matter pertains.

32. To assess obviousness, I understand that I am to consider the scope and content of the prior art, the differences between the prior art and the claim, the level of ordinary skill in the art, and any secondary considerations to the extent they exist.

33. I understand that any evidence of secondary indicia of non-obviousness should be considered when evaluating whether a claimed invention would have been obvious to one of ordinary skill at the time of invention. These secondary indicia of non-obviousness may include, for example:

- a long felt but unmet need in the prior art that was satisfied by the claimed invention;
- commercial success of processes claimed by the patent;
- unexpected results achieved by the invention;
- praise of the invention by others skilled in the art;
- the taking of licenses under the patent by others; and
- deliberate copying of the invention.

34. I understand that there must be a nexus between any such secondary indicia and the claimed invention.

35. It is also my understanding that there are additional considerations that may be used as further guidance as to when the above factors will result in a finding that a claim is obvious, including the following:

- the claimed subject matter is simply a combination of prior art elements according to known methods to yield predictable results;
- the claimed subject matter is a simple substitution of one known element for another to obtain predictable results;
- the claimed subject matter uses known techniques to improve similar devices or methods in the same way;
- the claimed subject matter applies a known technique to a known device or method that is ready for improvement to yield predictable results;
- the claimed subject matter would have been “obvious to try” choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- there is known work in one field of endeavor that may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to a POSITA;
- there existed at the time of the invention a known problem for which there was an obvious solution encompassed by the patent’s claims; and
- there is some teaching, suggestion, or motivation in the prior art that would have led a POSITA to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed subject matter.

36. Finally, I understand that a claim may be deemed invalid for obviousness in light of a single prior art reference, without the need to combine references, if the elements of the claim that are not found in the reference can be

supplied by the knowledge or common sense of one of ordinary skill in the relevant art.

D. Claim Construction

37. I understand that the first step in determining whether a patent claim would have been anticipated or obvious is to ascertain how a POSITA would have understood the claim terms.

38. I have been instructed by counsel on the law regarding claim construction and patent claims, and I understand that a patent may include two types of claims: independent claims and dependent claims. An independent claim stands alone and includes only the limitations it recites. A dependent claim can depend from an independent claim, or it can further depend from another dependent claim. I understand that a dependent claim includes all the limitations that it recites, in addition to all the limitations recited in the claim(s) from which it depends.

39. It is my understanding that in proceedings before the USPTO, the claims of a patent are to be construed under what is referred to as the “*Phillips* standard.” I understand that this means that claim terms of a patent are given the meaning the terms would have to a POSITA, in view of the description provided in the patent itself and the patent’s file history.

40. I understand that to determine how a person of ordinary skill would understand a claim term, one should look to those sources available that show what a person of skill in the art would have understood the disputed claim language to

mean. I understand that, in construing a claim term, one looks primarily to the intrinsic patent evidence, including the words of the claims themselves, the remainder of the patent, and the patent's prosecution history. I understand that extrinsic evidence, which is evidence external to the patent and the prosecution history, may also be useful in interpreting patent claims when the intrinsic evidence itself is insufficient.

41. I understand that words or terms should be given their ordinary and accepted meaning unless it appears that the inventors were using them to mean something else. In making this determination, the claims, the remainder of the patent, and the prosecution history are of paramount importance. Additionally, the patent and its prosecution history must be consulted to confirm whether the patentee has acted as its own lexicographer (i.e., provided its own special meaning to any disputed terms), or intentionally disclaimed, disavowed, or surrendered any claim scope.

42. In comparing the claims of the '007 Patent to the prior art, I have considered the '007 Patent and its file history in light of the understanding of a person of skill at the time of the alleged invention.

43. It is my opinion that a POSITA would understand all the claim terms to have their plain and ordinary meaning, and I have applied the plain and ordinary meaning, in the context of the '007 Patent, for all claim terms.

VI. LEVEL OF ORDINARY SKILL IN THE ART

44. When interpreting a patent, I understand that it is important to identify the relevant art pertaining to the patent-in-suit as well as the level of ordinary skill in that art at the time of the claimed invention. The “art” is the field of technology to which the patent is related.

45. I have been instructed by counsel that the person of ordinary skill in the art (“**POSITA**”) is a hypothetical person who is presumed to know the relevant prior art. I understand that the actual inventor’s skill is not determinative of the level of ordinary skill. I further understand that the factors that may be considered in determining the level of skill include the types of problems encountered in the art, prior art solutions to those problems, rapidity with which innovations are made, sophistication of the technology, and educational level of active workers in the field. I understand that not all such factors may be present in every case, and one or more of them may predominate.

46. Petitioners assert that a POSITA “would have had a B.S. degree in mechanical or petroleum engineering or a similar technical discipline, with at least five years of experience in oil or gas well drilling, completion, and/or subsurface production operations or in technical support of such operations including at least some experience in unconsolidated formations utilizing sand control methods and means. Also, additional education in a relevant technical discipline could compensate for less experience in the relevant field, and vice versa.” Pet. pp.31-32.

47. I possess not only the education requirements of POSITA's definition but also the field experience. Not only is my education in a similar technical discipline to that of Petitioner's definition, but I also have additional education beyond a bachelor's degree. Further, I have over twenty years of experience in oil and gas drilling, completion and subsurface production operations, including experience in unconsolidated formations using sand control with gravel pack systems.

48. For purposes of this declaration, I have applied the level of skill proposed by Petitioner's expert.⁸

VII. OVERVIEW OF ALLEGED PRIOR ART REFERENCES

A. Yeh (Ex. 1005)

49. *Yeh* is a United States Patent issued to *Charles S. Yeh et al.* granted on October 24, 2017. The title of *Yeh* is "Crossover Joint for Connecting Eccentric Flow Paths to Concentric Flow Paths."

50. As the title of *Yeh* suggests, *Yeh* is directed to a "crossover tool" that couples two wellbore tools (e.g. sand screens, packers) where "radial center of the primary flow path in the first wellbore tool is offset from a radial center of the primary flow path in the second wellbore tool."⁹ *Yeh* describes the primary problem purportedly solved as "a need exists for an improved sand control system utilizing a

⁸ Ex. 1003, §VI,

⁹ Ex. 1005 (*Yeh*) at Abstract.

crossover joint for connecting an eccentric sand screen with a concentric packer, or vice versa.”¹⁰ *Yeh* describes several considerations in designing the crossover joint, which include minimizing curvature, providing mechanical integrity, limiting “outer diameter” of the tool, and “maximizing inner diameter of the primary flow path.”¹¹ *Yeh* teaches the use of the crossover tool primarily in a gravel pack environment where concentric and eccentric sand screens are connected with each other and with concentric and eccentric packers.¹²

51. *Yeh* provides several examples of the use of this crossover tool, with the preferred embodiment being eccentric screen → crossover tool → concentric packer.¹³ This is the embodiment relied on in the Petition. *Yeh* does not purport to improve on existing sand screens, but rather focuses on connecting sand screens together, and connecting sand screens to packers.¹⁴ *Yeh* teaches using more readily available, lower friction and less expensive eccentric screens downstream, instead of more expensive, less available, higher friction, more complex concentric screens, may “reduce the overall cost of completion.”¹⁵

¹⁰ Ex. 1005 (*Yeh*) 4:12 – 14.

¹¹ Ex. 1005 (*Yeh*) 26:57-64, 28:25-30.

¹² See, e.g., Ex. 1005 (*Yeh*) 29:58 – 30:46

¹³ Ex. 1005 (*Yeh*), 30:13-39.

¹⁴ See, e.g., Ex. 1005 (*Yeh*) 3:23 – 24 (“It is known to use rectangular shunt tubes that are eccentrically attached to the outside of a sand screen.”; see also, e.g., 3:24 – 51 describing a known “Alternate Path sand screen having concentric internal shunt tubes.”)

¹⁵ Ex. 1005, 30:20-33.

B. Yeh2 (Ex. 1006)

52. *Yeh2* is a paper presented at the International Petroleum Technology Conference held December 3 – 5, 2005. *Yeh2* was assigned paper number IPTC 12549 and is titled “Unlocking the Limits of Extreme Length in Alternate Path Gravel Packing.”¹⁶ *Yeh2* describes a concentric sand screen for use in a gravel pack application “over much longer production intervals (~5,000 ft)”, longer than the then known lengths “up to 2,800 ft”.¹⁷ *Yeh2* primarily accomplishes this through the use of internal, closed-end shunt tubes in a 6x3 configuration and “shunt manifolds,” which “incorporates a continuous non-ported shunt tube to transport the slurry and a non-continuous, ported packing tube on each joint used to discharge the slurry. *Yeh2* does not describe the shunt tube wall thickness or describe any approach for modifying shunt tube wall thickness throughout the length of the production interval. *Yeh2* instead teaches to rate shunt tubes to withstand the highest burst pressure at the heel.”¹⁸

C. Jones (Ex. 1007)

53. *Jones* is a United States Patent issued to *Lloyd Jones* granted on August 7, 1990. The application that led to *Jones* (Appl. No. 397,217) was filed on August 23, 1989.¹⁹ The title of *Jones* is “Method for Gravel Packing Wells.”

¹⁶ Ex. 1006 (*Yeh2*) pg 1.

¹⁷ Ex. 1006 (*Yeh2*) pg 1.

¹⁸ Ex. 1006 (*Yeh2*) pg 5.

¹⁹ Ex. 1007 (*Jones*) Cover.

54. *Jones* describes an early example of a gravel pack system with “one or more conduits [] positioned coaxially adjacent the exterior of the sand screen with openings to provide fluid communication between the conduit and a substantial portion of the annulus between the borehole casing and the sand screen.”²⁰ In this arrangement, a gravel slurry is pumped into the annulus to create a gravel pack and “[i]f injection of the slurry of gravel forms a gravel bridge in any portion of the annulus being packed thereby plugging the annulus between the casing and the sand screen, the slurry of gravel will continue to flow down the conduit and into the annulus below the gravel bridge thereby completely packing the annulus between the sand screen and the borehole casing.”²¹ *Jones* teaches that it is applicable “to placing gravel packs in an open-hole wellbore adjacent to a substantial portion of an unconsolidated or poorly consolidated subterranean oil or gas reservoir.”²² *Jones* explains that the shunt tubes “may be made of any pressure-resistant material,” such as “stainless steel.”²³

²⁰ Ex. 1007 (*Jones*) at Abstract.

²¹ Ex. 1007 (*Jones*) at Abstract.

²² Ex. 1007 (*Jones*) at Abstract.

²³ Ex. 1007 (*Jones*) 4:11 – 13.

D. Jones2 (Ex. 1008)

55. *Jones2* is a United States Patent issued to *Lloyd Jones* granted on May 19, 1992. The application that led to *Jones* (Appl. No. 694,163) was filed on May 1, 1991.²⁴ The title of *Jones* is “Gravel Packing of Wells.”

56. *Jones2*, like *Jones*, describes an “[a]pparatus for gravel packing a wellbore interval having shunt means (i.e. conduits) on the external surface of a sand screen.”²⁵ However, unlike *Jones*, which only taught 2 round conduits (i.e., shunt tubes) on the outside of the sand screen, *Jones2* describes “a variety of differently configured, perforated conduits and/or arrangements of these conduits.”²⁶

²⁴ Ex. 1008 (*Jones2*) Cover.

²⁵ Ex. 1008 (*Jones2*) at Abstract

²⁶ Ex. 1008 (*Jones2*) at Abstract

VIII. OPINIONS REGARDING THE REVISED CONTINGENT MOTION TO AMEND AND PETITIONER'S OPPOSITION

A. Mr. Chambers mischaracterizes the teachings of *Bonner* regarding the pressure rating.

57. Mr. Chambers' analysis regarding a POSITA's motivation to combine *Bonner* with *Yeh* and *Yeh2* to substitute Bonner's eccentric screens for *Yeh*'s concentric screens fails because *Bonner*'s screens do not come near providing the benefits taught by *Yeh*'s concentric screens. Mr. Chamber's analysis hinges on his reading of *Bonner* that "its shunt tubing assembly was rated to hold 5,000 psi, which is greater than *Yeh*'s conventional eccentric screen, which was limited to 3,000 PSI."²⁷ However, this mischaracterizes the teachings of *Bonner*.

58. The sections of *Bonner* that Mr. Chambers refers to (pgs 11 and 12) describe a "Shunt Tubing Pressure Test" and that the "objective of this test was to determine the burst pressure rating of the shunt system."²⁸ However, a "burst pressure rating" is not the same as an "operating pressure rating". As discussed more fully below, a POSITA would know that there must be a "safety factor" between the burst pressure and the operating pressure. Even *Bonner* teaches such a safety margin as it states "a 1.33 safety factor was judged to be advisable for a working burst pressure for the tube system in order to allow for variations in the manufacturing of

²⁷ Ex. 1044 ¶66.

²⁸ Ex. 1016 (*Bonner*) pg 11.

the tubes.”²⁹ In fact, a variation in manufacturing of the tubes caused at least one of the tested tubes to fail below 5000 psi.³⁰

59. A POSITA would have understood, based on the teachings of *Bonner* that the shunt tubing system would have, at most, an operating pressure of under 3,760 PSI, a far cry from the 5,000 PSI that Mr. Chambers stated. In fact, the “operating pressure” rating of *Bonner’s* assembly would have been even lower. *Bonner* teaches 3,760 PSI as the maximum “working pressure” rating of the assembly, but an additional safety factor would have been apply below the 3760 PSI rating to come up with an actual operating pressure. *Bonner* teaches that the goal of the system was to be “functionally the same” as previous systems, just easier to assemble and with better seals.³¹ Accordingly, it is very likely that *Bonner’s* system had only as high an operating pressure rating as previous systems, just easier and faster to assemble. There is no discussion in *Bonner* of developing a system with a higher pressure rating than that of previous assemblies.³²

60. A POSITA would not have been motivated to replace the 6,500 PSI rated concentric screen of *Yeh* with a 3,760 PSI, or lower, rated eccentric screen of *Bonner*. This would limit the teachings of *Yeh* of using sand screens with lengths of up to 5,000 feet to around 3,800 feet at most. In order to get to a 5,000 foot gravel

²⁹ Ex. 1016 pg 12.

³⁰ Ex. 1016 pg. 12.

³¹ See, e.g., *Bonner* pg 2.

³² See, e.g., *Bonner*.

pack, using Mr. Chambers' logic, a POSITA would need three different assemblies from the toe to the heel: *Yeh's* eccentric screen for 3,000 feet, *Bonner's* eccentric screen for ~800 feet (if it indeed had a higher operating pressure rating than 3,000 PSI), and *Yeh's* concentric screen for the remaining ~1,200 feet. This would not eliminate the crossover joint and resulting friction that Mr. Chambers claims.³³ The art indicates *Bonner's* screen would not be suitable for packing even the interval from 3,000 to 3760 psi. In *Hurst*, the "burst pressure limit" "of the shunt tubes" in 2x2 screens is "5,000 psi."³⁴ *Hurst's* 2x2 screens are the same 2x2 screens limited to about 3,000-psi working pressure, or 3,000 feet.³⁵ This corroborates that *Bonner's* screen is a conventional eccentric screen rated to 3,000-psi working-pressure. *Yeh* uses this screen at the toe, not the heel.³⁶

61. At most, if indeed *Bonner's* system indeed had an operating pressure rating greater than 3,000 PSI, a POSITA would have been motivated to replace *Yeh's* eccentric screen with the potentially higher operating pressure rated screen of *Bonner*. This would gain the same benefits of cost that Mr. Chambers claimed in ¶67 without the added complexity of stocking, and connecting, three different types of sand screen assemblies.

³³ See, e.g., Ex. 1044 ¶¶68 – 69.

³⁴ Ex. 1013 (*Hurst*), 2, 9.

³⁵ E.g., Ex. 1005 (*Yeh*), 30:15-20; Ex. 1015 (*Hecker*), 1 ("[C]urrent eccentric 2x2 APT screens ... may include [m]aximum shunt system working pressure of 3,000 psi which limits the packable length to ~3,200 ft"), 3.

³⁶ Ex. 1005 (*Yeh*), 30:15-25.

62. Mr. Chambers failed to take into account the “1.33 safety factor” for a working burst pressure. However, this is not the only safety factor disclosed in references that Mr. Chambers provided. Ex. 1010, which is U.S. Patent No. 7,661,476 (“’476 *Yeh*”) issued to Yeh, Haeberle, Barry, Hecker, and Long discloses an even larger safety margin. For example, ’476 *Yeh* discloses that its system was pressure tested to 10,000 PSI for a working pressure of 6,500, a safety factor of over 1.5 (~1.54).³⁷ *Barry*, another article provided by Mr. Chambers, (and coauthored by *Yeh*) discloses similar testing and working pressures.³⁸

63. Applying a 1.5 factor between *working pressure* and burst pressure to the disclosure of *Bonner* would result in a working pressure rating of 3,333 PSI, very near the pressure of the eccentric systems disclosed by *Yeh*.

64. Mr. Chambers failure to take into account the basic engineering principle of a “safety factor” led him to believe that *Bonner*’s eccentric screen would have been a reasonable substitute for *Yeh*’s concentric screen. However, taking a safety factor into account, it is clear that it would not have been.

B. Mr. Chambers claims the prior art motivates a POSITA to vary packing tube nozzle size and spacing, but the prior art teaches not to vary nozzle size or spacing.

65. In his second declaration, Mr. Chambers’ performs an analysis regarding a POSITA’s motivation to vary nozzle size and spacing in a packing tube.³⁹

³⁷ Ex. 1010 (’476 *Yeh*) 24:59-25:6.

³⁸ Ex. 1027 (*Barry*) pg. 4.

³⁹ Ex. 1044, ¶¶32-39.

66. Mr. Chambers relies on *Hurst* as motivating a POSITA to vary nozzle size and spacing in a packing tube.⁴⁰ *Hurst* states “friction and thus the pressure applied to each zone can be controlled through ... the nozzle diameter and frequency.”⁴¹ This is an unremarkable statement that changing packing tube features changes the friction pressure drop. *Yeh2* similarly teaches that packing tube friction loss should not be “too high” or “too low.”⁴² In other words, *Hurst* teaches here that nozzle size and spacing affect friction pressure, but that is not a teaching *to vary* nozzle size or spacing along a packing tube or across packing tubes.

67. Although *Hurst* addresses *friction pressure*, Mr. Chambers claims that a POSITA would have been motivated to modify the nozzles in *Yeh2* to optimize declining *slurry flow*.⁴³ But *Yeh2* solves the problem of lesser flow at the packing tube’s downstream end by closing the end, not by changing nozzle size or spacing.⁴⁴

68. Mr. Chambers also cites to *Jones2* as an example of varied nozzle size and spacing.⁴⁵ But he provides no analysis of how this teaching in *Jones2* would be applied in *Yeh2*.⁴⁶ The “perforations” in *Jones2* range from 1/16”-1/8”⁴⁷, as

⁴⁰ Ex. 1044, ¶37.

⁴¹ Ex. 1013 (*Hurst*), 3-4.

⁴² Ex. 1006 (*Yeh*), 4.

⁴³ Ex. 1044, ¶38.

⁴⁴ Ex. 1006 (*Yeh*), 4, Fig. 6, 13.

⁴⁵ Ex. 1044, ¶36.

⁴⁶ Ex. 1044, ¶36.

⁴⁷ Ex. 1008 (*Jones2*), 4:50-65.

compared to 1/4" or 3/8" in *Hurst* and 6 mm (about 1/4") in *Yeh2*.⁴⁸ *Yeh2* further teaches that "larger portholes ... prevent plugging."⁴⁹ Accordingly, it is unclear how a POSITA that had already maximized porthole size in *Hurst* and *Yeh2* would have applied *Jones2*'s teaching to increase the perforation diameter along the packing tube.

69. And in contrast to *Jones2*, *Yeh2* clearly teaches a POSITA to use a uniform 6 foot nozzle spacing and 6 mm nozzle size.⁵⁰ This is because, as *Yeh2* teaches, "shunt packing becomes more challenging when porthole spacing is greater than 8-10 ft."⁵¹ No other disclosure or suggestion of spacing exists.

70. *Hurst* similarly teaches a uniform nozzle size (1/4", 3/8") and spacing.⁵² If *Yeh2* had varied the nozzle size or spacing, the friction pressure drop along the length of the gravel pack would change, as varying amounts of packing fluid would exit the packing tube. This change in friction pressure drop would be seen in a changing slope for the pressure profile in *Yeh* Figure 15 as the friction pressure drop (the slope of the pressure profile) varied along the gravel pack length. But as shown below, *Yeh2* Figure 15 illustrates a relatively linear pressure profile (i.e., a constant slope)⁵³:

⁴⁸ Ex. 1006 (*Yeh*), 4; Ex. 1013 (*Hurst*), Table 1.

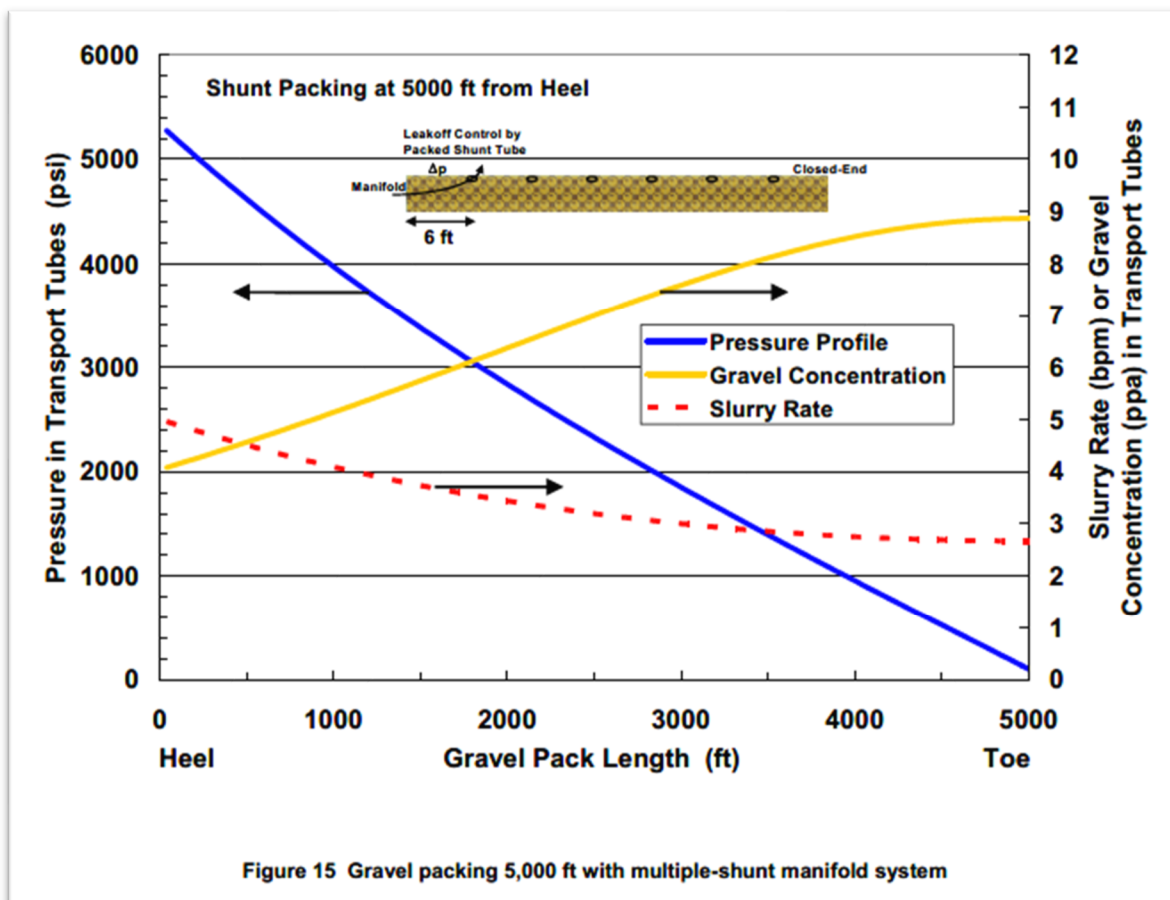
⁴⁹ Ex. 1006 (*Yeh*), 2.

⁵⁰ Ex. 1006 (*Yehs2*) 4, Figs. 6, 9.

⁵¹ Ex. 1006 (*Yeh2*) 3.

⁵² Ex. 1013 (*Hurst*), 2, Table 1.

⁵³ Ex. 1006 (*Yeh2*), Fig. 15.



Yeh2's pressure profile indicates a uniform nozzle size and spacing across the gravel pack length.

71. Mr. Chambers also omits any analysis of how increasing nozzle size or decreasing nozzle spacing (as he states a POSITA would do) would increase friction pressure loss and increase fluid leakoff. Instead he merely notes that a POSITA would have been aware of fluid leakoff, and he states conclusorily that a POSITA would ignore that performance metric.⁵⁴ *Yeh2* and *Hurst*, however, both teach a

⁵⁴ Ex. 1044, ¶39.

POSITA that nozzles above a certain size increase leakoff, and to avoid excessive fluid leakoff by sizing nozzles accordingly.⁵⁵

72. Nor does Mr. Chambers address that Claim 24 relates to nozzles in a “second sand screen assembly”; that is, under Petitioner’s obviousness theory, in a downstream eccentric screen.⁵⁶ *Yeh* teaches to use eccentric screens downstream because they “offer[] lower friction.”⁵⁷ Increasing nozzle size or decreasing nozzle spacing would increase friction pressure drop (as discussed above) and work directly against *Yeh*’s reasons for using eccentric screens.

73. In my opinion, the art does not teach a POSITA to vary nozzle spacing across packing tubes as required by Claim 24. The art contradicts Mr. Chambers’ statements to the contrary.

C. Mr. Chambers misses the teachings of *Yeh* / *Yeh2* and *Bonner* regarding packing tubes and junction blocks.

74. Mr. Chambers attempts to shoehorn the teachings of *Yeh* in view of *Yeh2* into the amended claims that require “the packing tube of the first sand screen assembly is interconnected to a junction block of the second sand screen assembly” (Limitations 27[b], 33[b], 40[b]). While doing so he completely misses the teachings of *Yeh* in view of *Yeh2*. Mr. Chambers states that “*Yeh* disclosed that the fluid (gravel

⁵⁵ Ex. 1006 (*Yeh2*), 2-3 (“[L]arge portholes allow excessive fluid leakoff...”); Ex. 1013 (*Hurst*), 2 (“[I]f the holes are made too large, then leakoff ... becomes excessive, dehydrating the slurry ...”)

⁵⁶ See Ex. 1005 (*Yeh*), 24:54-60, 30:20-25 (using eccentric screen downstream)

⁵⁷ Ex. 1005 (*Yeh*), 24:54-60.

slurry in the sand screen example) flows through the shunt tubes of the first wellbore tool, secondary flow path 1020 of the crossover joint, and shunt tubes of the second wellbore tool,”⁵⁸ which he goes on to argue confirms that the packing tube of the first sand screen assembly is interconnected to the shunt tubes of the second sand screen assembly because “the shunt tubes of the second sand screen assembly would be accessed via a junction block.”⁵⁹ However, *Yeh* does not disclose or suggest such an arrangement, and *Yeh2* teaches directly against it.

75. In referring to Mr. Chambers first declaration regarding limitations 1[c] and 1[d] (which he references in ¶57), I conclude that the section of *Yeh* that Mr. Chambers is referring to is where *Yeh* teaches “injecting the fluid from the wellbore and through the secondary flow paths of the first wellbore tool, the crossover joint, and the secondary flow paths for the second wellbore tool.”⁶⁰ However, Mr. Chambers has to read in a junction block, and specifically an interconnection of the first assembly’s *packing tubes* (not just the “shunt tubes”) interconnected to a junction block of the second assembly. Such a disclosure is simply not there. Accordingly, *Yeh* cannot support Mr. Chambers’ analysis.

76. To “interconnect” an upstream packing tube and a downstream junction block, Mr. Chambers requires the “secondary flow path 1020” of *Yeh*’s crossover

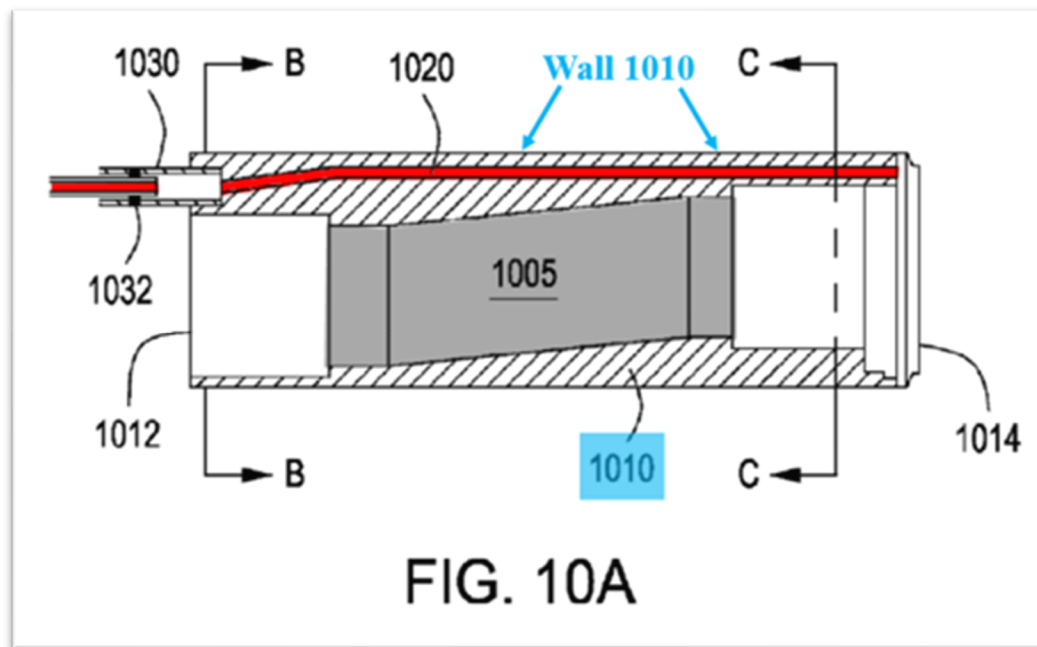
⁵⁸ Ex. 1044 ¶57.

⁵⁹ Ex. 1044 ¶57.

⁶⁰ Ex. 1005 (*Yeh*) at 28:66-29:2.

joint to establish a flow path.⁶¹ But *Yeh*'s "crossover joint" does not contain packing tubes. "Wall 1010" (in blue below) of the crossover joint isolates the primary flow path from the formation, so the interval in the crossover joint is not gravel packed.⁶²

Fig. 10A (annotated) illustrates:



77. *Yeh*'s "secondary flow path 1020" is thus a transport tube and does not contain any packing tubes. Mr. Chambers confirms this in his first declaration.⁶³

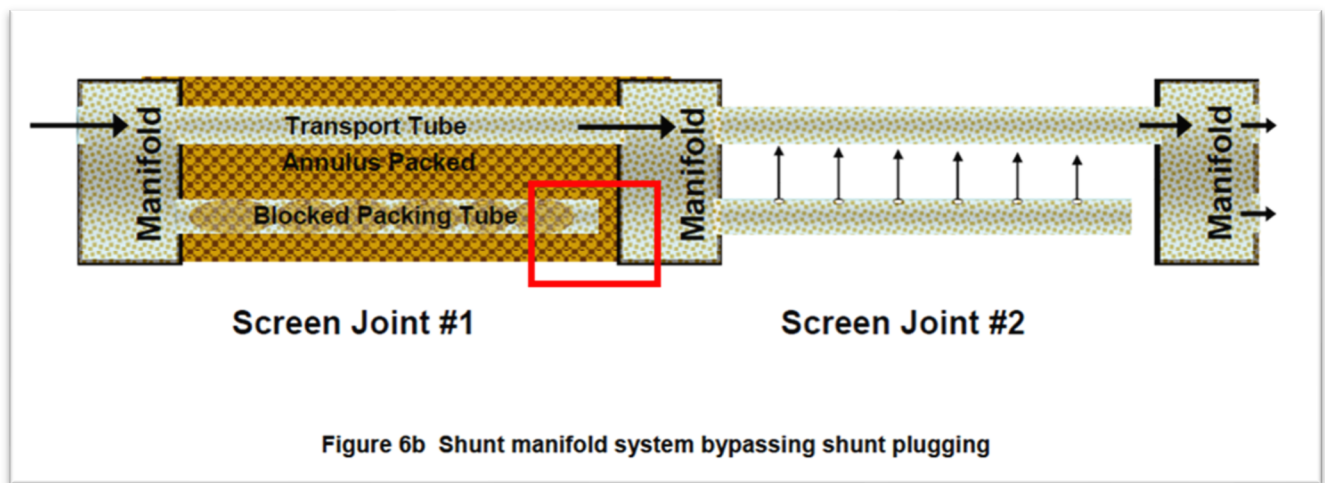
78. There are junction blocks in *Yeh2*. However, *Yeh2* teaches directly against the amended claim. *Yeh2* clearly shows that, while the transport tube is interconnected to the manifold (i.e. junction block) of the second sand screen assembly, the "blocked packing tube" is clearly separated from the junction block

⁶¹ Ex. 1044 ¶57.

⁶² Ex. 1005 (*Yeh*), Fig. 10A

⁶³ Ex. 1003 , ¶287 (describing "secondary flow path" as "transport tubes" that connect the claimed screens).

of the second sand screen assembly, as shown inside the red box annotated onto Yeh2's Figure 6b, below.⁶⁴



79. Yeh2 further explains that the “concept” of the manifold design “was to *differentiate* shunt slurry transport from shunt packing”⁶⁵ and goes on to teach that “[t]he shunt manifold incorporates a *continuous non-ported shunt tube* to transport the slurry and a *non-continuous, ported packing* tube on each joint used to discharge the slurry.”⁶⁶ This makes it clear that while the “shunt tube” is continuous (i.e. connected to the manifold), the packing tube is “non-continuous” (i.e., not connected to the manifold).

80. Further, Yeh2 teaches that “[t]he packing tube has a *closed end* to make the flow from shunt ports more uniform”⁶⁷ Yeh teaches that the closed end causes an “increase in pressure at the closed-end” and thus causes more uniform flow through

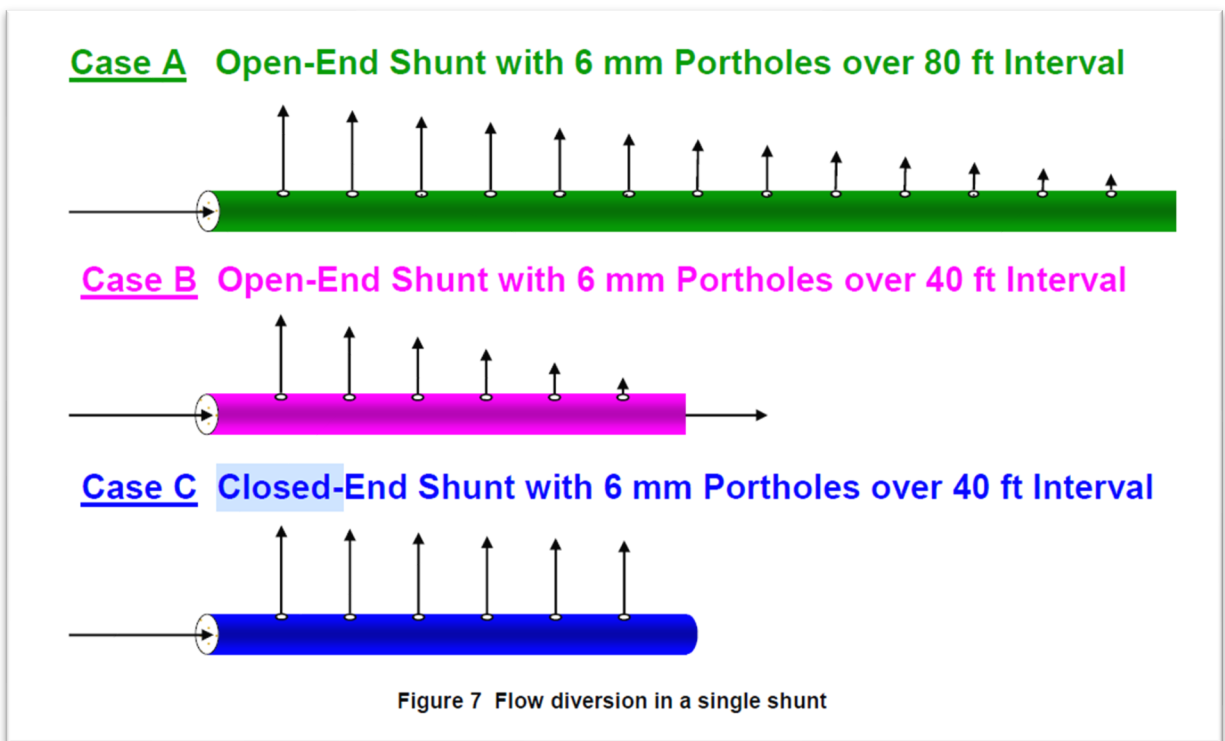
⁶⁴ Ex. 1006 (Yeh2) Figure 6b, see also figures 6a, 9, 13

⁶⁵ Ex. 1006 (Yeh2) pg. 3, emphasis added.

⁶⁶ Ex. 1006 (Yeh2) pg. 3, emphasis added.

⁶⁷ Ex. 1006 pg. 3, emphasis added.

the closed-end packing tube as compared to the open-ended packing tubes of Case A and Case B, shown in *Yeh2*'s Figure 7 below.



81. A “closed-end” packing tube cannot interconnect to the junction block of the second sand screen assembly. Further, if the packing tube were interconnected to the junction block of the second sand screen assembly, it would no longer receive the benefits that *Yeh2* teaches come from the “closed-end” packing tube, i.e. more uniform flow.

82. To the extent that Mr. Chambers is attempting to state that, because both the packing tube and transport tube are connected together *above* the packing tube (i.e. with the junction block of the first sand screen assembly), and that this somehow discloses the claimed “interconnected to a junction block of the second sand screen assembly”, this equally fails. The connection the shunt tube and packing

tubes together in a manifold, such as shown in Figure 6b above, merely show that the packing tube is “interconnected with” the junction block of the first sand screen assembly, it is not “interconnected to” the junction block of the second sand screen assembly.

83. Further “interconnected to” means that there is a flow path “from” the packing tube of the first sand screen assembly “to” the junction block of the second sand screen assembly.⁶⁸ No such flow path exists in the teachings of *Yeh2*. A POSITA would clearly understand that the slurry that flows into the packing tube of the first sand screen assembly would not flow into the junction block (manifold) of the second sand screen assembly.

84. Mr. Chambers apparently applies this same logic to his analysis of *Bonner* regarding limitations 33[b] and 40[b]. Mr. Chambers points to Figures 8 and 9 of *Bonner* (duplicated below) and states that “Bonner disclosed connecting the packing tube to the transport tube of its shunt tube system of its high-pressure eccentric screen with a junction block, which Bonner refers to as a “Box Crossover” or “Box end crossover.”⁶⁹

⁶⁸ Ex. 1001, 10:61-67.

⁶⁹ Ex. 1044 ¶117.

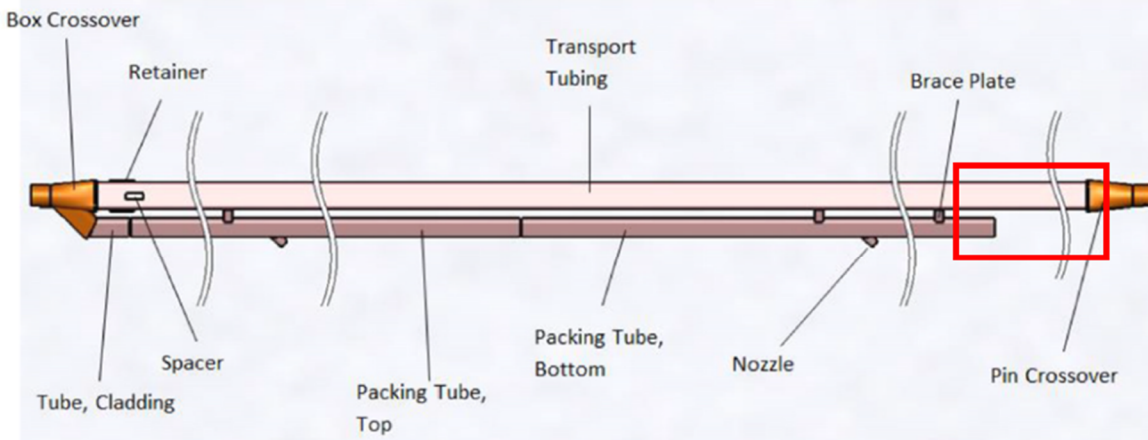
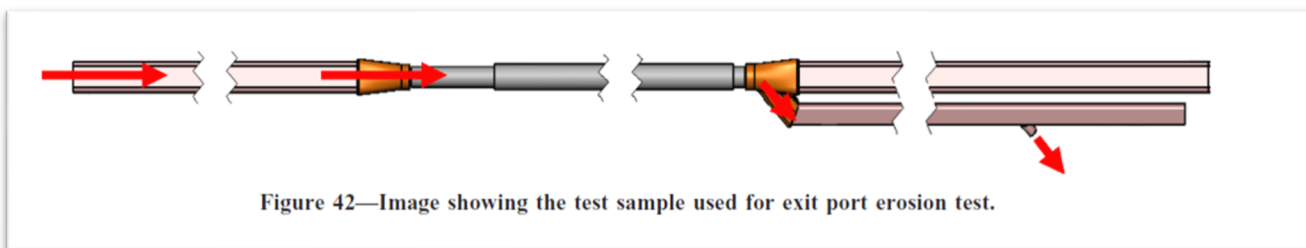


Figure 8—Shunt system tubing weldment with its components



Figure 9—Box end crossover, internally-cladded Packing Tube, and Pin end crossover

85. A POSITA would have understood that the “Box Crossover” would have been at the upper end of the assembly, that the “Pin Crossover” would have been at the lower end of the assembly, particularly as the packing tube nearest the Box crossover is labeled “Top” in Figure 8 the packing tube nearest the Pin crossover is labeled “Bottom”. Further, this is clearly the case, as shown in Figure 42 of *Bonner*, which shows the flow out of the Pin crossover, into the Box crossover, and out of the Box crossover into the packing tube.



86. As clearly shown in Figure 8, (inside the red box annotation) the packing tube stops before the pin crossover and does not connect to anything in the second sand screen assembly. Accordingly, while *Bonner* shows the packing tube “interconnected with” an upstream junction block (e.g., Box end crossover) of the first sand screen assembly, it does not teach or suggest an “interconnection to” the downstream junction block of the second sand screen assembly.

87. Mr. Chambers’ attempts to tie my testimony to his flawed reading of the claim limitations similarly fail. In those sections quoted by Mr. Chambers, I merely agree that the flow arrows in Fig. 2 indicate the direction of flow as I describe above and that the upstream shunt tube system is fluidly connected to a downstream shunt tube system, through the transport tube.⁷⁰ Nowhere do I agree that the packing tube is “interconnected to” a junction block of a second sand screen assembly in assembly in *Bonner* or *Yeh/Yeh2*, as Mr. Chambers seems to suggest.

88. Accordingly, the new limitation “and the packing tube of the first sand screen assembly is interconnected to a junction block of the second sand screen

⁷⁰ Ex. 1044 ¶58. See, e.g., Ex. 1043 (*Durham Transcript*) 111:22-112:7; 114:12-20.

assembly” is not disclosed or suggested in the combination of *Yeh* and *Yeh2*, wither with or without *Bonner*.

D. A POSITA would have known from the '007 Patent how to vary nozzle size to obtain a larger volume of fluid flow through downstream nozzles.

89. Mr. Chambers offers an opinion that Claim 36, which recites that “the low pressure shunt tube system is disposed to allow a larger volume of fluid to flow therethrough than the high pressure shunt tube system is disposed to allow to flow therethrough,” is impossible because it violates the law of conservation of mass.⁷¹

90. To reach this opinion, Mr. Chambers determines that “Flow C” (as used in Mr. Chambers’ declaration, the volume through downstream nozzles) could not be greater than “Flow A” (as used in Mr. Chambers’ declaration, the entire volume of fluid flowing into the gravel pack).⁷² I agree with Mr. Chambers that “Flow C” could not exceed “Flow A” (as those terms are used in his declaration).⁷³

91. In my opinion, a POSITA at the time of the '007 Patent would have understood, from the disclosure of the '007 Patent, how to achieve “a larger volume of fluid” flow through the downstream (“low pressure”) nozzles by varying the nozzle size, location, and spacing (or number). As Mr. Chambers has stated in this proceeding, it was well known that the nozzle size and frequency affected volume

⁷¹ Ex. 1052, 35-39.

⁷² Ex. 1052, 35-39.

⁷³ Ex. 1052, 35-39.

flowing through the nozzles.⁷⁴ The '007 Patent describes the “volume of fluid” in Claim 36 as being determined by the “cross-sectional flow areas, location, and number of nozzles.”⁷⁵ The '007 Patent specification thus informs a POSITA that the claimed “larger volume of fluid” may be achieved by adjusting these nozzle parameters.⁷⁶ The specification then provides specific implementations, varying nozzle size,⁷⁷ nozzle location,⁷⁸ and nozzle spacing or number⁷⁹ between upstream and downstream (or high pressure and low pressure, respectively) shunt tube assemblies in a manner that a POSITA would have understood affected the volume of gravel packed through the packing tube nozzles. The '007 Patent specification also states that these parameters—nozzle size, location, and spacing or number—may be modified in conjunction with one another.⁸⁰

92. The '007 Patent specification teaches a POSITA that these parameters may be modified “to achieve the desired flow regime for a particular shunt tube assembly,” that is, it instructs a POSITA to obtain a desired flow regime by varying nozzle size, locating, and spacing or number.⁸¹ Accordingly, based on the disclosure

⁷⁴ Ex. 1003, ¶303.

⁷⁵ Ex. 1001, 9:36-41.

⁷⁶ Ex. 1001, 9:36-41.

⁷⁷ Ex. 1001, 8:25-33.

⁷⁸ Ex. 1001, 8:38-48.

⁷⁹ Ex. 1001, 8:34-37, 8:49-59, 8:66-9:2.

⁸⁰ Ex. 1001, 15:37-39, 16:13-28.

⁸¹ Ex. 1001, 8:60-64, 9:36-41.

of the '007 specification, a POSITA would have been able to modify nozzle size, locating, and spacing or number, and would have understood that modifying these parameters affected flow through the nozzles. The '007 Patent specification's instruction to use a different nozzle size, locating, and spacing or number for a downstream assembly than in an upstream assembly, moreover, informed a POSITA that the flow regime in the downstream packing tube nozzles may differ from (i.e., enable more flow out of the nozzle) the flow regime in the upstream packing tube nozzles.⁸²

93. A POSITA would thus have been able to obtain a larger volume of fluid through downstream packing tube nozzles relative to upstream packing tube nozzles by increasing the size of nozzles, decreasing the spacing, and changing the distance (i.e., location) of the nozzles from the upstream junction block, as disclosed in the '007 Patent. In my opinion, a POSITA informed by the disclosures of the '007 Patent would have been able to make and use a gravel packing system in which a larger volume of fluid flowed through downstream packing tube nozzles than flowed through upstream packing tube nozzles.

IX. CONCLUSION

94. I reserve the right to supplement the opinions expressed herein and/or offer testimony in support of this Declaration.

⁸² Ex. 1001, 8:25-9:2.

95. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and, further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001.

Executed on September 12, 2025



Robert Durham, Ph.D.