

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LIBERTY ENERGY, INC. AND LIBERTY OILFIELD SERVICES LLC
Petitioners,

v.

U.S. WELL SERVICES, LLC
Patent Owner.

Case No. IPR2024-01274
Patent 11,091,992

**PETITIONERS' OPPOSITION TO PATENT OWNER'S NON-
CONTINGENT MOTION TO AMEND**

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PETITIONER’S UPDATED EXHIBIT LIST

Exhibit No.¹	Description
1001	U.S. Patent No. 11,091,992 by Joel Broussard et al. entitled “System for Centralized Monitoring and Control of Electric Powered Hydraulic Fracturing Fleet” (the “992 Patent”)
1002	File History for U.S. Patent No. 11,091,992
1003	Declaration of Dr. Robert Durham
1004	U.S. Patent Publication No. 2012/0255734 by <i>Coli</i> et al., “Mobile, modular, electrically powered system for use in fracturing underground formations,” (“ <i>Coli</i> ”) filed April 6, 2012 and published October 11, 2012.
1005	U.S. Patent No. 5,606,853 to <i>Birch</i> et al., “Gaseous Fuel Compression and Control System for Gas Turbine Engine,” (“ <i>Birch</i> ”) filed April 28, 1995 and issued on March 4, 1997.
1006	U.S. Patent Publication No. 2008/0236818 by Dykstra, “Method and Apparatus for Controlling the Manufacture of Well Treatment Fluid,” (“ <i>Dykstra</i> ”) filed March 27, 2007 and published on October 2, 2008.
1007	U.S. Patent Publication No. 2008/0288115 by <i>Rusnak</i> et al., “Intelligent Pump System,” (“ <i>Rusnak</i> ”) filed May 14, 2007 and published November 20, 2008.
1008	U.S. Patent Publication No. 2010/0038907 by <i>Hunt</i> et al., “Power Generation,” (“ <i>Hunt</i> ”) filed April 30, 2009 and published February 18, 2010.

¹ Citations to patents are made by column and line cite; citations to patent publications are made by paragraph number; citations to Exhibit 1002 are made with reference to the Bates-stamped pagination; citations to other exhibits are made to the page number of the document itself.

Exhibit No. ¹	Description
1009	IEEE100: The Authoritative Dictionary of IEEE Standards Terms, 7th ed. (IEEE Press: 2000), ISBN: 0-7381-2601-2 (<i>“IEEE Standards Dictionary”</i>)
1010	U.S. Patent No. 9,410,410 by Broussard et al., “System for Pumping Hydraulic Fracturing Fluid Using Electric Pumps,” (<i>“Broussard079”</i>), filed Nov. 16, 2012 and published May 22, 2014
1011	U.S. Patent No. 9,970,278
1012	Chart Comparing Claims of the ’992 Patent and the ’278 Parent Patent
1013	Complaint, U.S. Well Services, LLC et al. v. Liberty Energy, Inc. et al., No. 4:24-cv-00839 (S.D. Tex. March 6, 2024)
1014	Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (June 21, 2022)
1015	Federal Court Management Statistics (June 30, 2024), available at < https://www.uscourts.gov/sites/default/files/data_tables/fcms_na_appprofile0630.2024.pdf >
1016	Lionel B. Roe, Practices and Procedures of Industrial Electrical Design (McGraw-Hill: 1972), ISBN: 0-07-053390-3 (<i>“Roe”</i>)
1017	John A. Camara, Electrical Engineering Reference Manual for the Electrical and Computer PE Exam, 6th ed. (Professional Publications, Inc.: 2002), ISBN: 1-888577-56-8 (<i>“EE-Reference”</i>)
1018	U.S. Patent No. 1,743,771 to Hall et al., entitled “System of Electric Distribution” (filed March 25, 1926 and issued January 14, 1930) (<i>“Hall”</i>)
1019	Donald G. Fink, Standard Handbook for Electrical Engineers, 13th ed. (McGraw-Hill, New York: 1993), ISBN: 0-07-020984-7 (<i>“Fink”</i>)
1020	U.S. Patent Publication No. 2011/0241590 to Horikoshi et al., entitled “Motor Driving Apparatus Having Fault Diagnostic

Exhibit No. ¹	Description
	Function” (filed Feb. 11, 2011 and published Oct. 6, 2011) (“ <i>Horikoshi</i> ”)
1021	IEEE Recommended Practice for Electric Power Distribution for Industrial Plants (IEEE Red Book). 1986. ANSI/IEEE Std 141-1986: 1-609. (“ <i>Red Book</i> ”)
1022	Second Declaration of Dr. Robert Durham
1023	Deposition Transcript of Dr. Michael Nikolaou in IPR2024-01274
1024	U.S. Patent Pub. No. 2014/0138079 by Broussard et al., “System for Pumping Hydraulic Fracturing Fluid Using Electric Pumps,” (“ <i>Broussard079</i> ”), filed Nov. 16, 2012, published May 22, 2014
1025	U.S. Patent No. 8,789,601 by Broussard et al., “System for Pumping Hydraulic Fracturing Fluid Using Electric Pumps,” (“ <i>Broussard601</i> ”), filed Feb. 26, 2014, published Jun. 26, 2014, and issued Jul. 29, 2014
1026	U.S. Patent No. 5,790,972 by <i>Kohlenberger</i> , “Method and Apparatus for Cooling the Inlet Air of Gas Turbine and Internal Combustion Engine Prime Movers,” (“ <i>Kohlenberger</i> ”), filed Aug. 24, 1995, and issued Aug. 4, 1998
1027	U.S. Patent No. 8,747,533 by <i>Ekanayake</i> and Scipio, “Systems and Methods to Determine Fouling in a Gas Turbine Filter,” (“ <i>Ekanayake</i> ”), Apr. 30, 2013, and issued June 10, 2014
1028	U.S. Patent No. 8,552,728 by Weiher, “Sluggish Circuit Breaker Detection System and Method,” (“ <i>Weiher</i> ”), filed Nov. 30, 2010, and issued Oct. 8, 2013
1029	European Patent No. 0023879 by <i>Newman</i> , “Engine module life tracking system,” (“ <i>Newman</i> ”), filed August 4, 1980, and published January 30, 1985
1030	Rosemount Model 3051 Transmitter Product Manual, available as of March 22, 2012, at https://web.archive.org/web/20120322124738/http://www2.emersonprocess.com/siteadmincenter/PM%20Rosemount%20Documents/00809-0100-4774.pdf

Exhibit No.¹	Description
1031	Rosemount 848T High Density Temperature Transmitter Reference Manual, available as of January 18, 2012, at https://web.archive.org/web/20120118001644/http://www2.emersonprocess.com/siteadmincenter/PM%20Rosemount%20Documents/00809-0100-4697.pdf
1032	Declaration of Mina Ching, Internet Archive
1033	U.S. Patent App. Pub. No. 2009/0188682 by Gensel <i>et al.</i> , “Fire Extinguishing System for a Casing,” (“ <i>Gensel</i> ”), filed March 31, 2009, and published July 30, 2009
1034	Whitaker, “AC Power System Handbook,” 3 rd Ed., CRC Press (2007)
1035	U.S. Patent No. 1,717,071, by <i>Smith</i> and <i>Smith</i> , “Shutting-down Means for Hydraulic Turbines,” (“ <i>Smith</i> ”), filed May 4, 1925, issued June 11, 1929
1036	U.S. Patent No. 3,605,919, by <i>Bromell</i> and Homanick, “Drilling Rig Control,” (“ <i>Bromell</i> ”), filed May 16, 1969, issued Sept. 20, 1971
1037	U.S. Patent App. Pub. No. 2009/0181582 by Thompson, “Enhanced Cable for Field Data Distribution System,” (“ <i>Thompson</i> ”), filed Jan. 16, 2009, published July 16, 2009
1038	U.S. Patent No. 7,949,483 by Discenzo <i>et al.</i> , “Integration of Intelligent Motor with power Management Device,” (“ <i>Discenzo</i> ”), filed Sept. 30, 2005, issued May 24, 2011
1039	U.S. Patent App. Pub. No. 2013/0142601 by McIver and Cunningham, “Fracture Sand Silo System and Methods of Deployment and Retraction of Same,” (“ <i>McIver</i> ”), filed Oct. 23, 2012, published June 6, 2013
1040	International Publication No. WO2016/019219 by <i>Omont</i> <i>et al.</i> , “Monitoring Health of Additive Systems,” (“ <i>Omont</i> ”), filed July 31, 2015, published February 4, 2016.
1041	Gardner Denver GD-2500 Quintuplex Well Servicing Pump Operating and Service Manual, captured by the Internet Archive on Sept. 17, 2005, available at

Exhibit No. ¹	Description
	< https://web.archive.org/web/20120917102614/http://www.quincieoilfield.com/pdf/3.0%20Gardner%20Denver/2500/GD2500Q%20Op%20&%20Service%20Manual.pdf >
1042	Tutterow, V. and McKane, A. T., “Variable Speed Pumping: A Guide to Successful Applications,” Europump and Hydraulic Institute, 2004.
1043	Mark’s Standard Handbook for Mechanical Engineers, Eleventh Edition, McGraw-Hill Companies, New York, 2007
1044	Langewis, Jr., C. and Gleeson, C. W., “Practical Hydraulics of Positive Displacement Pumps for High-Pressure Waterflood Installations,” Society of Petroleum Engineers, February 1971.
1045	September 3, 2025, Email from the Board RE: IPR2024-01274 – Additional Pages Request
1046	NFPA 79, “Electrical Standard for Industrial Machinery” National Fire Protection Association, Quincy, Mass, 1962-2007.
1047	Pearson, “Proposed HSE guidelines on emergency shutdown systems,” 1989 A First International Conference on the Use of Programmable Electronic Systems in Safety Related Applications Computers and Safety, 1989, pp. 55-58
1048	Gilson, Bill. "Fast Response System for Large-Volume Acid Stimulation." Paper presented at the Offshore Technology Conference, Houston, Texas, May 1996. doi: https://doi.org/10.4043/8096-MS
1049	Rex Burgos; Marc Allcorn; Robin Mallalieu; Jorge Vicens “Eliminating Human Error during Coiled Tubing Operations,” SPE Production & Operations 22 (03) (June 2006): 335–338. DOI: 10.2118/100164-PA
1050	J. J. Sammarco, "Programmable electronic and hardwired emergency shutdown systems: a quantified safety analysis," Fortieth IAS Annual Meeting. Conference Record of the 2005 Industry Applications Conference, 2005., 2005, pp. 210-217 Vol. 1, doi: 10.1109/IAS.2005.1518312

Exhibit No. ¹	Description
1051	Kurz, Rainer, and Robert C. White. "Modeling Emergency Shutdowns of Centrifugal Compressors." Paper presented at the PSIG Annual Meeting, Galveston, Texas, May 2009.

Petitioners note that the Board authorized a 5-page extension to this Opposition, as shown in Exhibit 1045.

I. INTRODUCTION

In its Non-Contingent Motion to Amend (Paper 13, “MTA”), Patent Owner (“PO”) replaces Original Claims (“Or. Claims”) 1-20 with Substitute Claims (“Subst. Claims”) 21-40. Independent Subst. Claims 21, 28, and 37 specify “*maximum continuous torque*” and “*maximum continuous power output*” values of the claimed “*electric pump*,” and other Subst. Claims require monitoring “*operating characteristics*” of various equipment. The Subst. Claims are both indefinite and unpatentable in view of prior art references raised in this Opposition.

II. THE SUBST. CLAIMS ARE UNPATENTABLE

A. Subst. Claims 21-40 are Indefinite

The claims, specification, and prosecution history of the ’992 Patent provide no objective standard for ascertaining the scope of “*continuous*,” a subjective term of degree. EX1022, ¶¶59-61; *see Datamize, LLC v. Plumtree Software, Inc.*, 417 F.3d 1342, 1351 (Fed. Cir. 2005) (“When a word of degree is used the district court must determine whether the patent’s specification provides some standard for measuring that degree.”) (quoting *Seattle Box Co. v. Indus. Crating & Packing, Inc.*, 731 F.2d 818, 826 (Fed. Cir. 1984)). The claims are indefinite because the scope of the term changes based on several other parameters, and the intrinsic record does not “provide objective boundaries for those of skill in the art.” *Interval Licensing LLC v. AOL, Inc.*, 766 F.3d 1364, 1371 (Fed. Cir. 2018).

The independent Subst. Claims recite an electric pump having a particular “maximum continuous torque” and a particular “maximum continuous power output.” While Petitioner argues a maximum torque is different from a maximum “continuous” torque and a maximum power output is different from a maximum “continuous” power output, there is no objective standard for determining how long a torque or power output must be maintained for it to be considered “continuous.” The specification does not provide any “objective baseline” or guideposts to enable a POSITA to differentiate “*continuous*” operation from other types of operation, such “maximum or “instantaneous” operation. “Terms of degree are problematic if their baseline is unclear to those of ordinary skill in the art.” *See Liberty Ammunition, Inc. v. United States*, 835 F.3d 1388, 1395 (Fed. Cir. 2016). Dr. Nikolaou concedes that the “[t]here is no specific number” in the ’992 Patent that indicates some amount of time for which a particular torque would need to be maintained for it to be considered “continuous.” EX1023, 138:11-16. Dr. Nikolaou contends that for a pump’s power output or torque to be considered “*continuous*,” it must be maintained “[f]or the duration of an operation over which this” power output or torque “is used.” EX1023, 125:11-15. But Dr. Nikolaou admits that the length of fracturing operations “can vary somewhat” and “take different lengths of time,” and that he was not aware of any fixed or standardized definition for “*continuous*” operation. *See* EX1023, 128:6-16, 137:1-18, 138:7-10, 140:6-10. Dr. Nikolaou also explained that a pump’s

“*continuous*” operation varies based on a vendor’s definition. *Id.*, 136:16-22 (“And for communication between the vendor and the buyer, *there would be specifications from the vendor as to what they refer to when they say continuous, ...*”), 138:2-6 (“It has to be continuous by *whatever form that continuous can be certified by the vendor in agreement with the buyer.*” (emphasis added)); *see also id.*, 139:20-140:5. Even under Dr. Nikolaou’s interpretation, the “*continuous*” language thus “requires that an artisan make a separate infringement determination for every set of circumstances in which” electric pumps “may be used, and when such determinations are likely to result in differing outcomes (sometimes infringing and sometimes not), that construction is likely to be indefinite.” *See Halliburton Energy Servs., Inc. v. M-I LLC*, 514 F.3d 1244, 1255 (Fed. Cir. 2008). A POSITA has no way of knowing the boundaries of what “*continuous*” operation is intended to represent, and the term renders the claims indefinite. EX1022, ¶¶59-61.

B. The Subst. Claims are Obvious

The Subst. Claims would have been obvious under 35 U.S.C. §103 in view of the following grounds. In the grounds, Petitioners address only the limitations from the Subst. Claims added by PO in the MTA; limitations from the original claims not addressed below are addressed in the Petition.

Ground	Subst. Claims	Prior Art
3A	21, 22, 28, and 29	<i>Coli, Birch, Rusnak, Broussard079, Broussard601</i>
4A	23, 32	<i>Coli, Birch, Rusnak, Hunt, Broussard079, Broussard601, Kohlenberger, Ekanayake, Weiher, Newman</i>
5A	24, 30, 38	<i>Coli, Birch, Rusnak, Hunt, Broussard079, Broussard601, and Gensel</i>
6A	25, 31	<i>Coli, Birch, Rusnak, Hunt, Broussard079, Broussard601, Gensel, Omont</i>
7A	26, 35	<i>Coli, Birch, Rusnak, Broussard079, Broussard601, Smith, Bromell</i>
8A	27, 36	<i>Coli, Birch, Rusnak, Hunt, Broussard079, Broussard601, Smith, Bromell, Thompson</i>
9A	33, 37, 40	<i>Coli, Birch, Rusnak, Hunt, Broussard079, and Broussard601</i>
10A	34	<i>Coli, Birch, Rusnak, Broussard079, Broussard601, and Discenzo</i>
11A	39	<i>Coli, Birch, Rusnak, Hunt, Broussard079, Broussard601, and McIver</i>

PO asserts that the priority date of Substitute Claims 21-40 is October 15, 2015. *See* MTA, 13-23 (purporting that the earliest written description support for the Substitute Claims is in Exhibit 2005, which was filed on October 15, 2015). The following references are prior art to the '992 Patent at least under:

35 U.S.C §102(a)(1): *Broussard079* (published 5/22/2014); *Broussard601*, (filed 2/26/2014, issued 7/29/2014); *Omont* (filed 7/31/2015).

35 U.S.C §§102(a)(1)-(2): *Kohlenberger* (filed 8/24/1995, issued 8/4/1998); *Ekanayake*, (filed 4/30/2013, issued 6/10/2014); *Weiher*, (filed 11/30/2010, issued 10/8/2013); *Newman*, (filed 8/4/1980, published 1/30/1985); *Gensel* (filed

3/31/2009, published 7/30/2009); *Smith* (filed 5/4/1925, issued 6/11/1929); *Bromell* (filed 6/16/1969, issued 9/20/1971); *Thompson* (filed 1/16/2009, published 7/16/2009); *Discenzo* (filed 9/30/2005, issued 5/24/2011); *McIver* (filed 10/23/2012, published 6/6/2013).

Each of the prior art references is in the same field of endeavor (controlling and/or monitoring industrial equipment) and/or is reasonably pertinent to the problem addressed by the '992 Patent (controlling and/or monitoring industrial equipment from a centralized location). EX1022, ¶¶68, 71, 81-87, 110, 121, 135-139, 149, 166, 179.

1. Ground 3A: Subst. Claims 21, 22, 28, and 29 are obvious.

Subst. Claims 21 and 28 add the “*continuous*” limitations in [21e], [21f], [28f], and [28g]. Pet. at 26-35, 40-42 (Or. Claims 1, 8); MTA at A-1, A-4-5. Subst. Claims 22 and 29 add the “*liquefied natural gas*” limitation in [22a] and [29a]. Pet. at 35-39, 42 (Or. Claims 2, 9); MTA, A-2, A-5. [21e], [21f], [22a] are addressed below. [28f], [28g], and [29a] are obvious for the same reasons given for [21e], [21f], and [22a], respectively.

i. [21e] is obvious.

Coli discloses fracturing modules 20 that contain electric motor 21 and fluid pump 22, where the fluid pump 22 “utilize[s] electric power...to pump the fracturing fluid directly to the wellbore.” See Pet. at 27-28. *Broussard079* provides that “some

pumps 10 can have...a maximum continuous torque of about 8750 lb-ft or more.” EX1024, [0020]. *Broussard601* provides that “some pumps 10 can have...a maximum continuous torque of about 8750 ft-lb, 11,485 ft-lb, or more.” EX1024, 4:20-23. A POSITA would have understood that a “*maximum continuous torque of at least 11,488 lb-ft or more*” falls within the ranges of “about 8750 lb-ft or more” (as provided by *Broussard079*) and “about 8750 ft-lb, 11,485 ft-lb, or more” (as provided by *Broussard601*), as these disclosed ranges do not have an upper bound such that “at least 11,488 lb-ft or more” would necessarily fall within the disclosed range. EX1022, ¶74. It would have been obvious to a POSITA to implement *Coli*’s pumps with particular torque values as described by *Broussard079* and *Broussard601* to ensure that *Coli*’s pumps are sufficiently powerful for fracturing operations. *Id.*, ¶72. Doing so would have involved the mere application of a known technique (*i.e.*, fracturing pumps with particular torque figures, as taught by *Broussard079* and *Broussard601*) to a known system (*i.e.*, the *Coli*’s hydraulic fracturing system) ready for improvement. *Id.*

ii. [21f] is obvious.

In addition to their disclosures regarding torque, *Broussard079* and *Broussard601* provide particular power outputs of electric fracturing pumps. *Broussard079* provides that “some pumps 10 can have a maximum continuous power output of about 1500 BHP, 1750 BHP, or more,....” EX1010, [0020]; *see*

also id., [0019] (defining “BHP” as brake horsepower). *Broussard601* provides that “some pumps 10 can have a maximum continuous power output of about 1500 BHP, 1750 BHP, or more...” EX1024, 4:20-23. A POSITA would have been motivated to use pumps with particular output power values in *Coli*’s system, and would have reasonably expected success in doing so, for the same reasons discussed above for [21e]. EX1022, ¶¶72, 75; *supra*, II.B.1.i.

iii. [22a] is obvious.

Coli discloses the use of “[o]ne or more natural gas-powered turbine generators 30” for providing electric power to several fracturing modules, and that the turbine generators can be driven by “liquid fuels.” EX1004, [0010], [0038], [0040]; Pet., 7. *Broussard079* discloses a “natural gas powered generator, which can be a turbine generator,” and that “the generators can be powered by liquefied natural gas.” EX1024, [0009], [0024]. It would have been obvious to use “liquefied natural gas” for powering turbine generators, as taught by *Broussard079*, in view of *Coli*’s disclosure regarding the use of liquid fuels. EX1022, ¶¶73, 76. And using liquefied natural gas to power turbine generators as described by *Broussard079* would have involved the mere application of a known technique (*i.e.*, using liquefied natural gas to power turbine generators, as taught by *Broussard079*) to a known system (*i.e.*, the *Coli*’s natural gas-powered turbine generators) ready for improvement. *Id.*

2. Ground 4A: Subst. Claims 23 and 32 are obvious.

Subst. Claims 23 and 32 add limitations regarding monitoring particular “*operating characteristics*” of a turbine generator in [23b], [23c], [32b], and [32c]. Pet. at 39, 43 (Or. Claims 3, 12); MTA at A-2, A-6. [23b] and [23c] are addressed below. [32b] and [32c] are obvious for the same reasons given for [23b] and [23c], respectively.

i. [23b] is obvious.

For the reasons provided in Section II.B.2.ii regarding [23c], [23b] is obvious.

ii. [23c] is obvious.

Coli discloses a “control center 40” that includes “controls and computer monitoring *for the entire fracturing operation*,” which includes turbine generators. EX1004, [0010], [0072]. It would have been obvious to a POSITA to monitor the “operating characteristics” listed in [23c], in view of *Coli*’s disclosure and because it was known in the art and/or obvious to monitor these operating characteristics, as shown below and as conceded by Dr. Nikolaou. EX1023, 33:18-48:8.

“*fuel system air supply pressure transmitter failure*”: *Kohlenberger* discloses a “motor/turbine control center” that “has sensors (not shown) within the air inlet to insure that the air entering the turbine cabinet 48 is of constant temperature and pressure to optimize the performance of the gas turbine 42.” EX1026, 6:2-6. In combination with *Coli*, it would have been obvious that

Kohlenberger's monitoring pressure at the gas turbine's air inlet (*i.e.*, the “*fuel system air supply pressure*”) would have been incorporated into *Coli's* control system, as such monitoring falls within the control system's general functionality of monitoring all equipment of a hydraulic fracturing site. EX1022, ¶93. And it was known in the art that “pressure transmitters,” such as *Kohlenberger's* air inlet pressure sensors, could further transmit failure codes. *Id.* (citing EX1030, C-4-5, which details the operation of a particular pressure transmitter, and shows that this pressure transmitter can transmit various error codes). Thus, it would have been obvious to a POSITA that *Coli's* control system would have monitored whether a “*fuel system air supply pressure transmitter*” has failed. *Id.*, ¶¶93-94.

“*thermocouple input module thermistor failure*”: *Birch* discloses a “thermocouple 18 for monitoring the discharge (gas) temperature.” EX1005, 3:4-12. It was known in the art that a thermocouple's “*input module thermistor*” could further transmit failure codes. EX1022, ¶95 (citing EX1031, D-5, which details the operation of a particular temperature transmitter, and shows that this temperature transmitter is capable of transmitting various error codes). Accordingly, it would have been obvious to a POSITA that *Coli's* control system would have monitored whether a “*thermocouple input module thermistor*” has failed. *Id.*, ¶¶95-96.

“*start VFD configuration failure*”: *Coli* discloses using “variable frequency drives” (VFDs), which “essentially ‘tell motors what they are allowed to do.’”

EX1004, [0065]; Pet., 25. *Rusnak* discloses an external controller 30 (*i.e.*, centralized control unit) that controls a VFD and can “automatically reset [a] faulted condition” in the VFD. EX1007, [0087]; *see also id.*, [0020]-[0021]; *see also* Pet. at 34. It would have been obvious that one such “faulted condition” of a VFD is that it fails to start. EX1022, ¶97. It would have been obvious that *Rusnak*’s external controller for monitoring faulted conditions of a VFD, including whether the VFD has failed to start, would have been incorporated into *Coli*’s control system. *Id.*

“turbine air inlet filter transmitter failure”: *Ekanayake* discloses a “filter assembly” that filters “air entering a gas turbine for power generation application.” EX1027, 1:24-27. The filter assembly further “includes a fouling detection instrument” for detecting the extent to which the filter assembly has been “fouled” and “a wireless communication module” for “wirelessly communicating the degree of fouling.” *Id.*, 2:19-35. It would have been obvious to a POSITA that *Coli*’s control system would have monitored the status of *Ekanayake*’s filter assembly and associated wireless communication module (*i.e.*, “turbine air inlet filter transmitter”) to ensure that these components have not failed. EX1022, ¶98.

“generator circuit breaker failure to open”: *Weiher* discloses a “circuit breaker electronic trip unit” that “provide[s] an appropriate indication or alarm, and also trip an upstream circuit breaker, if a sluggish operation or a stuck breaker is detected.” EX1028, 3:58-66. *Weiher* teaches that a “‘stuck breaker’ condition, in

which the circuit breaker fails to open,” would be one case in which an alarm would be generated. *Id.*, 3:2-3. In combination with *Coli*, it would have been obvious that *Weiher*’s circuit breaker state monitoring device would have been incorporated into *Coli*’s control system for monitoring whether a generator circuit breaker has failed to open, as this would have been an obvious mechanism for improving the safety of the overall fracturing system. EX1022, ¶100 *see also* EX1023, 40:8-14 (explaining that such monitoring would offer operational and safety benefits).

“gas fuel supply pressure transmitter failure”: *Birch* discloses a “gaseous fuel compression and control system for a turbine engine” that includes “under and over pressure electronic sensors 6a and 6b.” EX1005, 2:30-39, Fig. 1. These sensors monitor pressure of a “mains supply 1,” which supplies natural gas to a compressor associated with a turbine generator. *Id.*, 2:36-39, Fig. 1. And as discussed above, pressure sensors that could transmit failure codes were well-known in the art. EX1022, ¶101. In combination with *Coli*, it would have been obvious that *Birch*’s teaching of monitoring pressure of a mains supply that provides natural gas to a turbine generator’s compressor (*i.e.*, the “gas fuel supply pressure transmitter”) would have been monitored by *Coli*’s control system. *Id.* And it would have been obvious that *Coli*’s control system would have monitored whether such a pressure transmitter has failed, consistent with the well-known functionality of such pressure transmitters and *Coli*’s control system functionality. *Id.*

“gas fuel control pressure transmitter failure”: *Birch* discloses a “a pressure sensor 17 for monitoring the discharge (gas) pressure” of a compressor associated with a turbine generator. EX1005, 3:4-8. *Birch* explains that the pressure measurements generated by pressure sensor 17 control the operation of the compressor, which ultimately dictates how much compressed gas (*i.e.*, “*fuel*”) is provided to the turbine generator. *Id.*, 3:37-4:12. Accordingly, a POSITA would have understood *Birch*’s “pressure sensor 17” to be a “gas fuel control pressure transmitter.” EX1022, ¶102. And as discussed above, pressure sensors that could transmit failure codes were well-known in the art. *Id.* In combination with *Coli*, it would have been obvious that *Birch*’s “pressure sensor 17” for monitoring the discharge pressure of a compressor (*i.e.*, the “*gas fuel control pressure transmitter*”) would have been incorporated into by *Coli*’s control system. *Id.* Further, it would have been obvious that *Coli*’s control system would have monitored whether such a pressure transmitter has failed, consistent with the well-known functionality of such pressure transmitters and *Coli*’s control system functionality. *Id.*

“utility circuit breaker closed”: As discussed in the Petition, the combined *Coli-Birch-Rusnak-Hunt* system includes a switchgear, which comprises circuit breakers, that controls the coupling of a turbine generator bus with a utility bus. Pet., 60-65. A POSITA would have therefore understood the switchgear to teach a “*utility circuit breaker*.” EX1022, ¶103. Further, a POSITA would have understood that

Coli's control system would have monitored the status of the “*utility circuit breaker*,” including whether it is open or closed, consistent with the control system's general functionality of monitoring all equipment of a hydraulic fracturing site. *Id.*

“***generator frequency***”: *Hunt* discloses multifunction control module that “monitor[s] the frequency of the power produced by generator 215.” EX1008, [0040]; *see also id.*, [0054]. In combination with *Coli*, it would have been obvious that *Hunt*'s teachings regarding monitoring generator frequency would have been incorporated into *Coli*'s control system. EX1022, ¶104.

“***and engine serial number***”: *Newman* discloses a “life tracking system (LTS) for automatically identifying and recording in permanent record the configurations of a gas turbine engine by exact module type and serial number.” EX1029, [0003]. It would have been obvious that *Coli*'s system of monitoring various operating characteristics of a turbine generator, as discussed above, would have also monitored an “*engine serial number*” associated with the turbine generator to keep such monitoring organized (*i.e.*, to couple the monitored operating characteristics are with the relevant turbine generator engine) as taught by *Newman*. EX1022, ¶105.

A POSITA would have been motivated to combine the control system taught by *Coli* with the monitoring techniques taught by *Kohlenberger*, *Birch*, *Ekanayake*, *Hunt*, *Weiher*, and *Newman* to further *Coli*'s goal of providing “control and computer monitoring for the entire fracturing operation...at a single central

location.” EX1022, ¶91; EX1004, [0072]. A POSITA would be motivated to turn to references providing more detail regarding such control, such as *Kohlenberger*, *Birch*, *Ekanayake*, *Hunt*, *Weiher*, and *Newman*, which provide highly relevant details regarding the monitoring of various aspects of turbine generators and associated equipment. EX1022, ¶91. Overall, such a combination represents the mere application of known techniques (*i.e.*, monitoring of various aspects of turbine generators and associated equipment, as described above) to a known system (*e.g.*, control system for all equipment in a hydraulic system including turbine generators) ready for improvement (*i.e.*, to monitor gas turbines and associated equipment). *Id.*

3. Ground 5A: Subst. Claims 24, 30, and 38 are obvious.

Subst. Claims 24, 30, and 38 add limitations regarding monitoring particular “*operating characteristics*” of a switchgear in [24c], [24d], [30a], and [30b] and. *See* Pet. at 39, 42, 69 (Or. Claims 4, 10, 18); MTA at A-2-3, A-5, A-9-10. [24b]-[24d] are addressed below. [30a] is obvious for the same reasons given for [24b] and [24c], and [30b] is obvious for the same reasons given for [24d]. [38b] and [38c] are obvious for the same reasons given for [24c] and [24d], respectively.

i. [24b] is obvious.

As discussed in the Petition, the *Coli-Birch-Rusnak-Hunt* combination discloses a system that includes a switchgear. *See* Pet., 58-65 (Or. Claims 6, 7).

ii. [24c] is obvious.

For the reasons provided in Section II.B.3.ii regarding [24d], [23b] is obvious.

iii. [24d] is obvious.

The combined *Coli-Birch-Rusnak-Hunt* system teaches a switchgear that operates as an emergency power off unit. Pet., 58-65. *Gensel* discloses a “fire extinguishing system for casing,” “in particular for casings for electronics, or switchgear cabinets, into which the electronic units may be plugged in or built in.” EX1033, Abstract, [0002]. *Gensel*’s system includes a “fire alarm” and “evaluation electronics” that displays a fire alarm condition. *Id.*, [0063]-[0066]. In combination with *Coli*’s control system, it would have been obvious to incorporate *Gensel*’s switchgear fire alarm monitoring functionality into *Coli*’s control system in view of *Coli*’s teaching that its control system monitors all equipment of a hydraulic fracturing site. EX1022, ¶113. And it was well-known in the art that switchgears (and the rooms housing switchgears) were prone to fires due to the high currents and voltages associated with switchgears. EX1022, ¶113 (citing EX1034, 342). Overall, such a combination represents the mere application of known techniques (*i.e.*, switchgear fire alarm condition monitor, as taught by *Gensel*) to a known system (*e.g.*, a hydraulic fracturing system that includes a switchgear) ready for improvement (*i.e.*, to improve the safety of the overall system). EX1022, ¶113.

4. Ground 6A: Subst. Claims 25 and 31 are obvious.

Subst. Claims 25 and 31 add limitations regarding monitoring particular “*operating characteristics*” of a hydraulic system in [25c] and [25d] and. *See* Pet. at 39 (Original Claim 5), 42-43 (Original Claim 11); MTA at A-3, A-5-6. Claim 31 incorporates the “*liquefied*” limitation in [31a] and [31b]; these elements are obvious for the same reasons provided for [22a]. *Supra*, II.B.1.iii. [25b]-[25d] are addressed below. [31c] and [31d] and are obvious for the same reasons given for [25b]-[25d].

i. [25b] is obvious.

Coli discloses a hydraulic fracturing system for pressurizing fluid for injection into a wellbore, thereby effectuating hydraulic fracturing. EX1004, [0009]. *Coli* therefore discloses “*the system further comprising a hydraulic system.*”

ii. [25c] is obvious.

For the reasons provided in Section II.B.4.iv regarding [25d], [24c] is obvious.

iii. [25d] is obvious.

Coli discloses a “control center 40” that includes “controls and computer monitoring *for the entire fracturing operation.*” EX1004, [0010], [0072]. It would have been obvious to a POSITA to monitor the “*operating characteristics*” listed in [25d], in view of *Coli*’s disclosure, and because it was known in the prior art and/or obvious to monitor these operating characteristics, as shown below and as conceded by Dr. Nikolaou. *See* EX1023, 80:5-82:20.

“system pressure”: *Coli* teaches monitoring pressure at pumps to avoid exceeding a maximum pressure. *See* Pet., 30-32. And as discussed above, the system generally discloses monitoring pressures at different points of the fracturing system, including pressures associated with the turbine generator. *See supra*, II.B.2.ii. Similarly, *Omont* discloses monitoring pressure at the “material transfer device” (e.g., pump). EX1040, [0052]. Accordingly, a POSITA would have understood that the Ground 6A references render obvious this limitation. EX1022, ¶127.

“charge pressure”: “Charge pressure” simply refers to the pressure at an input hydraulic system. *See* EX1023, 58:18-21; EX1022, ¶128. And *Omont* discloses monitoring “suction” pressure, which a POSITA would have understood to mean monitoring “charge pressure.” EX1040, [0133]; EX1022, ¶128. As discussed above, the system taught by the Ground 6A references teaches monitoring pressure at various points of the fracturing system, such that a POSITA would have understood that the system’s “charge pressure” is also monitored, consistent with *Coli*’s teaching that the control system monitors all aspects of the fracturing site and *Omont*’s disclosure. EX1022, ¶128.

“temperature”: *Omont* discloses monitoring temperature of a “material transfer device” (e.g., pump) and a “prime mover” (e.g., a motor). EX1040, [0052].

“hydraulic oil level”: *Omont* discloses monitoring “dates of engine oil, transmission fluid, and other fluid changes” associated with a prime mover (e.g., a

motor), as well as monitoring a “tub level” of the fracturing fluid and the level of materials in a container. EX1040, [0048], [0099], [0120]. A POSITA would have understood that such monitoring would indicate an oil/fluid level (*i.e.*, “*hydraulic oil level*”), particularly when pump uses hydraulic fluid. EX1022, ¶130.

“*filter status*”: *Omont* discloses monitoring “service of filters” associated with a prime mover (*e.g.*, a motor). EX1040, [0120]. A POSITA would have understood that such monitoring would indicate a “*filter status*.” EX1022, ¶131.

A POSITA would have been motivated to combine the system taught by *Coli* monitoring techniques taught by *Omont* to further *Coli*’s goal of providing “control and computer monitoring for the entire fracturing operation...at a single central location.” EX1022, ¶124; EX1004, [0072]. Overall, such a combination represents the mere application of known techniques (*i.e.*, monitoring particular aspects of a hydraulic fracturing system, as taught by *Omont*) to a known system (*e.g.*, *Coli*’s hydraulic fracturing system) ready for improvement (*i.e.*, to improve the breadth of *Coli*’s system monitoring functionality). EX1022, ¶124.

5. Ground 7A: Subst. Claims 26 and 35 are obvious.

Subst. Claims 26 and 35 add limitations regarding the emergency power unit being operated by a switch that sounds an audible alarm in [26c] and [35b]. *See* Pet. at 58-60, 65-66 (Or. Claims 6, 15); MTA at A-3, A-7. [26c] is addressed below. [35b] is obvious for the same reasons given for [26c].

i. [26c] is obvious.

Smith discloses a “means for shutting down large hydraulic turbines and connected generators,” which enables an operator to “shut down a turbine unit in an emergency by simply closing a switch to energize and actuate a movable electrical part, which effects the result sought through the governor mechanism.” EX1035, 1:1-3, 1:24-29. *Bromell* discloses “drilling rig control” that includes the “determination of off-normal operation upon the deviation of one of three variable from individually established levels.” EX1036, 1:33-36. When such “off-normal operation” is detected, *Bromell* discloses “sound[ing] an alarm.” *Id.*, 1:19-21.

It would have been obvious to effectuate the “emergency power-off” functionality of the system taught by the Ground 7A references via *Smith*’s “switch.” EX1022, ¶144. Further, it would have been obvious to sound an alarm when triggering such a switch, as it was well-known in the art to “sound an alarm” to notify a drill site about “off-normal operation,” as taught by *Bromell*, which a POSITA would have understood to include an “emergency power off” scenario. *Id.*

Incorporating *Smith* and *Bromell* into the combined *Coli-Birch-Rusnak-Hunt-Broussard079-Broussard601* system, such that the emergency power off unit may be controlled by a switch (as taught by *Smith*) that triggers an audible alarm (as taught by *Bromell*) represents the mere application of known techniques (*i.e.*, *Smith*’s switch-controlled technique for shutting down an turbine generator and

Bromell's the implementation of an audible alarm) to a known system (e.g., a hydraulic fracturing system) ready for improvement (i.e., to improve the safety of the overall system). EX1022, ¶142; EX1023, 63:9-19.

6. Ground 8A: Subst. Claims 27 and 36 are obvious.

Subst. Claims 27 and 36 add limitations regarding the signal being transmitted “*over armored shielded CAT5E cabling*” in [27c] and [36b]. *See* Pet., 60-66 (Or. Claims 7, 16); MTA, A-3, A-8. [27c] is addressed below. [36b] is obvious for the same reasons given for [27c].

i. [27c] is obvious.

Thompson discloses the use of a “cable assembly for [a] field data distribution system formed by a plurality of twisted conductor pair bundled within a conductive shield and an insulative sheath” which is “configured to comply with Category 5E specifications, often referred to CAT 5E” and has “an outer ‘armor’ layer (not shown) to reduce damage to the cable member 77 from contact with” potentially-harmful objects. EX1037, Abstract, [0015], [0049]. *Thompson* further teaches that the cable is “for carrying computer network signals, such as Ethernet type signals.” *Id.*, [0008]. The combined *Coli-Birch-Rusnak-Hunt* system renders obvious using Ethernet cables for transmitting signals to and from *Coli's* control system. Pet., 33-34. A POSITA implementing system taught by the Ground 8A references would have been motivated to look to additional references that teach particular types of

Ethernet cables, such as *Thompson*. EX1022, ¶151. Overall, such a combination represents the mere application of known techniques (*i.e.*, a shielded CAT5e with an outer “armor” layer, as taught by *Thompson*) to a known system (*e.g.*, *Coli*’s hydraulic fracturing system, which uses Ethernet cables) ready for improvement (*i.e.*, to gain the benefits of armored, shielded CAT5e cabling, such as more resilient communication cables). *Id.*, ¶152.

7. Ground 9A: Subst. Claims 33, 37, and 40 are obvious.

Subst. Claim 33 adds limitations regarding monitoring particular “*operating characteristics*” of a turbine generator in [33c]. Pet., 43 (Or. Claim 13); MTA, A-2, A-6-7. Subst. Claim 37 adds the “*continuous*” limitations in [37f] and [37g]. Pet., 66 (Or. Claim 17); MTA, A-9. Subst. Claim 40 adds the “*liquefied natural gas*” limitation in [40b]. Pet., 70 (Or. Claim 20); MTA, A-10. [33b] and [33c] are addressed below. [37f] and [37g] are obvious for the same reasons given for [21e] and [21f]; [40b] is obvious for the same reasons given for [22a]. *Supra*, II.B.1.i-iii.

i. [33b] is obvious.

For the reasons provided in Section II.B.7.ii regarding [33c], [33b] is obvious.

ii. [33c] is obvious.

Coli discloses a “control center 40” that includes “controls and computer monitoring *for the entire fracturing operation*,” which includes turbine generators. EX1004, [0010], [0072]. It would have been obvious to a POSITA to monitor the

“*operating characteristics*” listed in [33c], in view of *Coli*’s disclosure and because it was known in the prior art and/or obvious to monitor these operating characteristics, as shown below and as conceded by Dr. Nikolaou. *See* EX1023, 80:5-82:20.

“*gas fuel main valve discharge pressure transmitter failure*”: A POSITA would have understood *Birch*’s “under and over pressure electronic sensors 6a and 6b,” discussed above with reference to [23c], to be “*gas fuel main valve discharge pressure transmitter*,” because these sensors monitor pressure of a gas fuel mains supply 1, which includes a solenoid isolating valve 4 just prior to the location of the sensors. EX1005, 2:30-39, Fig. 1; EX1022, ¶160. Thus, a POSITA would have understood that the sensors monitor a “*gas fuel main valve discharge pressure*.” EX1022, ¶160. For the same reasons discussed above with reference to [23c], *Birch* renders obvious this limitation. *See supra*, II.B.2.ii.

“*backup system relay failure*”: *Hunt* discloses a power distribution system wherein utility power may be utilized to power a load (*e.g.*, pumps) should a generator need to be disconnected from the load (*e.g.*, due to temperature overheat or fuel starvation). *See* Pet. at 54-55 (citing EX1008, [0033]-[0035], [0046], [0075]-[0076]. *Hunt* further discloses a “[s]witchgear 221 [that] is coupled to generator power bus 240 and utility power bus 260” and a “[s]witchgear control relay 229 [that] is connected to engage or disengage switchgear 221, thus coupling or

decoupling power buses 240 and 260.” *Id.*, [0046]. A POSITA would understand switchgear control relay 229 to be a “*backup system relay*” because it controls the engagement of utility power bus 260 (*i.e.*, the “*backup system*”). EX1022, ¶161. And it would have been obvious to monitor the status of this relay, including whether this relay has failed, in view of *Coli*’s teaching that its control system monitors all equipment of the fracturing site. *Id.*

8. Ground 10A: Subst. Claim 34 is obvious.

Subst. Claim 34 adds limitations regarding monitoring particular operating characteristics of a variable frequency drive in [34c]. *See* Pet., 43-44 (Or. Claim 14); MTA, A-7. [34b] and [34c] are addressed below.

i. [34b] is obvious.

For the reasons provided in Section II.B.8.ii regarding [34c], [33b] is obvious

ii. [34c] is obvious.

Coli discloses a “control center 40” that includes “controls and computer monitoring *for the entire fracturing operation*,” which includes VFDs. EX1004, [0065]-[0066], [0072]. It would have been obvious to a POSITA to monitor the “operating characteristics” listed in [23c], in view of *Coli*’s disclosure and because it was known in the prior art and/or obvious to monitor these operating characteristics, as shown below and as conceded by Dr. Nikolaou. *See* EX1023, 82:21-87:2.

“motor winding temperatures”: *Discenzo* discloses monitoring various operating conditions of an electric motor, including “load end and fan end bearing temperatures, winding temperature, and vibration.” EX1038, [0044]. This sensor information is used to “determine the condition of the windings, the bearings, the rotor, out of balance condition, torque, or the health of a pump connected to the motor,” or “to predict a motor failure, such as a winding failure, that may occur in the near future.” *Id.*, 8:66-9:1.

“the motor RPM”: *Rusnak* discloses that it “is known in the prior art to use of a VFD and an external processor to control a centrifugal pump. The VFD is used to vary pump speed and provide speed and torque measurements.” EX1007, [0002]. *Rusnak* further provides that “[m]otor speed and torque values from a VFD are supplied to a processor” to further processing. *Id.*, [0003]. Accordingly, a POSITA would have understood that the “speed and torque measurements” taken by the VFD correspond to motor speed and torque. And a POSITA would have understood that a motor’s speed may be measured in revolutions per minute (RPM). EX1022, ¶173.

“the voltage”: *Rusnak* discloses a method for controlling a centrifugal pump that driven by a VFD and associated electric motor, which “comprises internally monitoring automatically output current and voltage of the VFD to the AC motor without the need for an external sensor.” EX1007, [0005].

“the torque”: *Rusnak* discloses providing “[m]otor speed and torque values” of a motor “from a VFD” to a processor further processing. EX1007, [0003].

“and the current (amperage)”: *Rusnak* discloses “internally monitoring automatically output current and voltage of the VFD to the AC motor without the need for an external sensor.” EX1007, [0005].

A POSITA would have been motivated to combine the system taught by *Coli* monitoring techniques taught by *Discenzo* and *Rusnak*, discussed above, to further *Coli*’s goal of providing “control and computer monitoring for the entire fracturing operation...at a single central location.” EX1022, ¶169; EX1004, [0072]. Overall, such a combination represents the mere application of known techniques (*i.e.*, techniques for monitoring electric motors and VFDs, as taught by *Discenzo* and *Rusnak*) to a known system (*e.g.*, *Coli*’s hydraulic fracturing system, which includes electric motors and VFDs that control the electric motors) ready for improvement (to improve the breadth of *Coli*’s system monitoring functionality). EX1022, ¶169.

9. Ground 11A: Subst. Claim 39 is obvious.

Subst. Claim 39 adds limitations regarding monitoring and controlling several pieces of equipment. *See* Pet., 70 (Or. Claim 19); MTA, A-10.

Coli discloses a “control center 40” that includes “controls and computer monitoring for the entire fracturing operation.” EX1004, [0010], [0072]. It would have been obvious to a POSITA to monitor the particular equipment listed in Claim

39 in view of *Coli*'s disclosure and because it was known in the prior art and/or obvious to monitor these operating characteristics, as shown below.

“compression of natural gas,”: See Pet. at 36-39 regarding [2b].

“electric motors,”: *Coli* teaches that the electric motors used in the system can be “controlled by variable frequency drives” that “essentially ‘tell’ the motors what they are allowed to do,” which a POSITA would have understood to disclose controlling electric motors via a VFD. Pet. at 32-33 (citing EX1004, [0011], [0065], EX1003, ¶¶95-99, 162). In addition to controlling the electric motors in this manner, *Coli* discloses monitoring “the entire fracturing operation...at a central location” (*i.e.*, *Coli*'s control system). EX1004, ¶72. A POSITA would have understood that such functionality includes monitoring the electric motors, which are part of the fracturing operation. EX1022, ¶185.

“switchgear,”: The combined *Coli-Birch-Rusnak-Hunt* system comprises a switchgear that operates as an emergency power off unit. See Pet. at 58-65. Because *Coli* teaches a control system that “controls” and “monitor[s]” an “entire fracturing operation,” a POSITA would have understood that the switchgear, which is part of the fracturing operation taught by the combined system, would have been controlled and monitored by *Coli*'s control system. EX1022, ¶186.

“transformers,”: *Coli* discloses that its fracturing system includes “an electrical transformer and drive unit 50 (see FIG. 3) to step down the voltage of the

power from turbine generator 30 to a voltage appropriate for electric motor 21.” EX1004, [0047]. Because *Coli* teaches a control system that “controls” and “monitor[s]” an “entire fracturing operation,” a POSITA would have understood that the transformer, which is part of the fracturing operation taught by *Coli*, would have been controlled and monitored by *Coli*’s control system. EX1022, ¶187.

“mobile turbines,”: *Coli* in view of *Birch* discloses monitoring and controlling gaseous fuel compression for a gas turbine generator. Pet., 36-39. *Broussard079* teaches that turbines generator “can be mounted on vehicles, and can be ported from one well to another.” EX1024, [0008]. When implementing the gas turbine generators of the combined system in the manner taught by *Broussard079* (*i.e.*, such that the turbine generators “can be mounted on vehicles, and can be ported from one well to another”), a POSITA would have understood the turbine generators to be “mobile.” EX1022, ¶188.

“rate and pressure of the overall system,”: *Coli* discloses that “[i]f a rate change is required, the system will increase the rate of the entire system with a single command. This means that if pumps 22 are told to increase rate, then blender module 40 along with the chemical units and even ancillary equipment like sand belts will increase rates to compensate automatically.” EX1004, [0071]. A POSITA would have understood that controlling the rate of pumps 22, blender module 40, and the chemical units and ancillary equipment, *Coli* discloses controlling the rate of the

overall system. EX1022, ¶189. Further, *Coli*'s teaching of a "rate change [being] required" indicates that the system's rate is being monitored, thereby allowing need for a rate change to be detected in the first place. *Id.* *Coli* therefore discloses monitoring and controlling rate of the overall system.

And as discussed in the Petition, *Coli* discloses monitoring and controlling pressure at the pumps to avoid exceeding a maximum pressure value. Pet. at 30-32. And as discussed above, the combined system generally discloses monitoring pressures at different points of the fracturing system, including pressures associated with the turbine generator (*see supra*, II.B.2.ii) and pressures associated with "*the hydraulic system*" (*see supra*, II.B.4.iii). And because *Coli* teaches a control system that "controls" and "monitor[s]" an "entire fracturing operation," a POSITA would have understood that the various pressures throughout the fracturing system that are monitored (as discussed above) would also have been "controlled," consistent with *Coli*'s teachings. EX1022, ¶190.

"vertical sand silos,": *McIver* discloses a system that monitors "the level of sand in each silo" of its configuration, wherein each silo may be positioned to stand vertically. EX1039, [0017], [0056]. *McIver*'s system further controls "the rate at which the sand or other proppant is being removed from the silo." *Id.*, [0056]. Accordingly, the combined system taught by the Ground 11A references renders obvious controlling and monitoring "*vertical sand silos.*" EX1022, ¶191.

“and electrical conveyor belt.”: *McIver* discloses the use of a “dual belt conveyor system” that is used to “move material, such as sand or other solid or semi-solid material used in fracking applications, horizontally.” EX1039, [0044]-[0045], [0054]. *McIver* explains that the dual belt conveyor as a “Variable Frequency Drive” that controls the conveyor’s speed. *Id.*, [0056]. A POSITA would have recognized that this means that the dual belt conveyor system is “electrical,” because a VFD controls the electrical inputs into a load (*e.g.*, the dual belt conveyor system) to control the load’s speed. EX1022, ¶192. Further, a POSITA would have understood that to control the dual belt conveyor’s speed, as taught by *McIver*, the system would need to monitor the speed in the first place. *Id.* When incorporating *McIver*’s dual belt conveyor system into the *combined* system, a POSITA would have understood that *Coli*’s control system would have controlled and monitored *McIver*’s dual belt conveyor system, consistent with *Coli*’s teaching that the control system monitors all equipment of the fracking site. *Id.*

A POSITA would have been motivated to combine the system taught by *Coli*, which discloses the use of “blender units” “to blend fluids with proppant, sand, chemicals, acid, etc. ... prior to delivery to the wellbore,” to include the proppant storage and transport equipment taught by *McIver*, in order to ensure that there is sufficient proppant available and being delivered to facilitate the proppant blending operations as described in *Coli*. EX1022, ¶182; EX1004, [0053]-[0055]. A POSITA

further would have been motivated to incorporate the monitoring functionality taught by *McIver* to further *Coli*'s goal of providing "control and computer monitoring for the entire fracturing operation...at a single central location." EX1022, ¶182; EX1004, [0072]. Overall, such a combination represents the mere application of known techniques (*i.e.*, proppant storage and transport equipment and the monitoring thereof, as taught by *McIver*) to a known system (*e.g.*, *Coli*'s hydraulic fracturing system, which includes a blender unit for mixing proppant for fracturing operation) ready for improvement. EX1022, ¶182.

III. CONCLUSION

The Substitute claims are indefinite and unpatentable over the prior art. PO's MTA should be denied.

Respectfully submitted,

BAKER BOTTS L.L.P.



Date: September 15, 2025

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CERTIFICATE OF SERVICE

The undersigned hereby certifies on this September 15, 2025, that true and correct copies of the foregoing PETITIONERS' OPPOSITION TO PATENT OWNER'S NON-CONTINGENT MOTION TO AMEND, Exhibits 1022-1051, and related documents were served in their entirety on Patent Owner via electronic mail at the following addresses:

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