IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

ETHANOL BOOSTING SYSTEMS, LLC, and MASSACHUSETTS INSTITUTE OF TECHNOLOGY Plaintiffs, v. FORD MOTOR COMPANY Defendant.	Civil Action No. 20-cv-706-CFC **JURY TRIAL DEMANDED**

FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT

This is an action for willful patent infringement in which Ethanol Boosting Systems, LLC ("EBS") and the Massachusetts Institute of Technology ("MIT") (collectively, "Plaintiffs") make the following allegations against Ford Motor Company ("Defendant" or "Ford"):

THE PARTIES

1. Plaintiff EBS is a limited liability company duly existing and organized under the laws of the State of Delaware with its principal place of business in Cambridge, Massachusetts.

2. EBS was co-founded by three MIT researchers who work in the field of internal combustion engines: Dr. Leslie Bromberg, Dr. Daniel R. Cohn, and Professor John B. Heywood.

3. During the more than four decades that Dr. Bromberg, Dr. Cohn, and Professor Heywood have been at MIT, they have been widely recognized as leaders in their field, and have published hundreds of articles in academic journals and conference proceedings.

4. For example, Dr. Bromberg is internationally known for his work, including his work in the fields of vehicle engine and pollution reduction technologies, alternative fuels, and plasma-based energy technologies. Dr. Bromberg also has received a number of awards for the

innovative technologies he has invented, and his inventions have resulted in more than 90 granted United States patents.

5. Dr. Cohn also is internationally known for his work on improved engine technologies, alternative transportation fuels, and plasma-based energy and environmental technologies and has received awards for innovation in transportation and environmental technologies. He also is a fellow of the American Physical Society, and his inventions have resulted in more than 80 granted United States patents.

6. Professor Heywood was the Director of the Sloan Automotive Laboratory at MIT and has done research and taught classes at MIT on internal combustion engines for decades. He also literally wrote the book on internal combustion engines. Since first being published in 1988, his textbook—Internal Combustion Engine Fundamentals—has sold more than 130,000 copies and is widely considered a field-defining publication. A revised and updated second edition was published in 2018. Professor Heywood is a member of the National Academy of Engineering, a fellow of the American Academy of Arts and Sciences, and of the Society of Automotive Engineers.

7. Building on its founders' expertise and inventions, EBS has sought to develop innovative internal combustion engines and fuel-management systems that result in cleaner and more efficiently operating internal combustion engines. One of EBS's approaches for accomplishing this improvement is through the use of gasoline internal combustion engines and fuel-management systems that incorporate the MIT/EBS dual port and direct injection technology at issue in this case.

8. Plaintiff MIT is a non-profit private research and educational institution duly incorporated and existing under the laws of the Commonwealth of Massachusetts with its

principal place of business in Cambridge, Massachusetts. MIT's mission is to advance knowledge and educate students in science, technology, and other areas of scholarship that will best serve the nation and the world in the 21st century. MIT commits itself to generating, disseminating, and preserving knowledge, and to working with others to bring this knowledge to bear on the world's great challenges.

9. Defendant Ford is a corporation duly existing and organized under the laws of the State of Delaware that makes, sells, and offers for sale in the United States, or imports into the United States, motor vehicles and related motor vehicles components and accessories, including those products accused of infringement in this matter.

JURISDICTION AND VENUE

10. This Court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a) as this action arises under Title 35 of the United States Code.

11. This Court has personal jurisdiction over Ford because Ford is incorporated in the State of Delaware. This Court also has personal jurisdiction over Ford because Ford regularly transacts business with entities and individuals in the State of Delaware, including one or more of at least four Ford dealerships located in the State of Delaware, and because Ford manufactures and distributes infringing motor vehicles and other infringing products that it purposefully directs into the State of Delaware, including this District, or at least places into the stream of commerce via established distribution channels with the knowledge and expectation that they will be sold in the State of Delaware, including in this District.

12. Venue is proper in this District under 28 U.S.C. § 1400(b) because Ford is incorporated in the State of Delaware.

THE ASSERTED PATENTS

13. This lawsuit concerns Ford's infringement of United States Patent No. 9,708,965 (the "'965 Patent"), United States Patent No. 10,619,580 (the "'580 Patent"), and United States Patent No. 10,781,760 (the "'760 Patent") (collectively, the "Asserted Patents").

14. Each of the above patents continues from and claims priority to U.S. Patent Application No. 11/100,026 (now U.S. Patent No. 7,225,787), which was filed on April 6, 2005, and which was a continuation-in-part of the application that resulted in United States Patent No. 7,314,033, which was filed on November 18, 2004.

15. Each of the Asserted Patents was invented by Dr. Bromberg, Dr. Cohn, and Professor Heywood. Each of the inventions has been assigned to MIT, and since such assignment, MIT has owned and continues to own each of the Asserted Patents. EBS currently is the exclusive licensee of each Asserted Patent, with the right to sue for any infringement of the Asserted Patents and the exclusive right to sublicense any alleged infringer of such patents.

16. Generally speaking, each of the Asserted Patents is directed to fuel management systems for spark-ignition engines that improve over prior art fuel management systems through their incorporation of MIT/EBS's dual injection technology, which involves the use of both port and direct fuel injection. For example, each of the Asserted Patents recites ways in which a spark-ignition engine fuel management system employs both port and direct injection such that, at certain torque values, the engines are fueled by both simultaneously. Further, in some embodiments, the fraction of fueling provided by direct injection increases with increasing torque. Further, in other embodiments, port fueling alone is utilized when torque is below a certain value. Further, in other embodiments, both the port and direct injection systems are configured to introduce gasoline into the engine.

17. Such inventions improve over the prior art by, for example, permitting an increase in engine efficiency and reducing emissions as described in their Common Specification—providing the advantages of port fuel injection, which allows for better fuel/air mixing and combustion stability than direct injection, while also providing the engine knock suppression advantage associated with direct injection.

18. The inventions disclosed in the Asserted Patents have been revolutionary throughout the industry. In fact, the patent family to which each of the Asserted Patents belongs has been cited by over 125 other patents, including dozens of patents filed by Ford and its related entities such as Ford Global Technologies, LLC.

THE PARTIES' PAST RELATIONSHIP AND FORD'S USE OF PLAINTIFFS' TECHNOLOGY

19. Ford incorporated MIT/EBS's patented dual injection technology into its highly profitable vehicles even though (a) EBS told Ford that such technology was patented and (b) Ford indicated to EBS that Ford would not be incorporating the MIT/EBS dual injection technology into its vehicles and thus did not need a license.

20. As described below, Ford's representations were false when made, and Ford has willfully infringed and continues to willfully infringe the Asserted Patents.

21. Ford has had notice since at least October 2014 of a number of MIT and EBS patents and pending applications covering the use of dual port and direct injection.

22. For example, on October 30, 2014, Professor Heywood emailed Dr. Ken Washington (Ford's Vice President of Research and Advanced Engineering) and Mr. Bill Coughlin (Ford's Global Technologies CEO and chief intellectual-property officer) on behalf of EBS—attaching a document titled "Optimized Port + Direct Injection for Cleaner and More Efficient Gasoline Engines."

23. In his email, Professor Heywood explained to Ford that EBS "would like to discuss possible licensing" of an "important technology to Ford" and that "[t]his technology involves optimized combinations of port and direct injection for gasoline engines," which he explained "could provide a relatively simple and low cost way to reduce particulate emissions in direct-injection gasoline engines without the need for a particulate filter" and "could also be employed to increase engine efficiency."

24. Professor Heywood also wrote that "[t]his technology along with the intellectual property is further described in the attachment" and that, given EBS' prior dealings with Ford, EBS "would like to give Ford the first opportunity to discuss a possible license for this intellectual property portfolio." In the referenced attachment, EBS further explained that "EBS has developed a patent portfolio that includes a variety of options related to minimization of direct injection and reduction of particulate emissions in gasoline engines," including "US patents 8,857,410; 8,733,321; 8,302,580; 8,146,568; and 8,069,839" as well as "8 pending applications."

25. Professor Heywood concluded his email by asking Ford to "[p]lease let us know by December 8, 2014, whether Ford would like to pursue this licensing discussion." He also explained that, "while we are excited about the prospect of entering into a licensing agreement with Ford for the technology, we may approach other potential licensees including the possibility of entering into an exclusive license with such licensees," but that "Ford is the first, and only, company we have approached at this time."

26. The next day, Dr. Washington responded on behalf of Ford—stating: "Thank you for your note with the offer for Ford to be the first to discuss a possible license for this

intellectual property portfolio. I suspect that these technologies have a complex business case. I will consult with our technical, legal and business teams and get back with you."

27. More than a month passed without EBS hearing back from Ford.

28. On December 16, 2014, Professor Heywood emailed Dr. Washington again, stating: "We have not yet heard from you and would appreciate knowing where you are in your deliberations and when you could let let [sic] us know if you would like to discuss the possibility of licensing. We believe the technology [i]s important to address the pressing environmental issue of particulate emissions in an affordable way and want to move forward in establishing the path for its utilization. Please let us know if you need any additional information."

29. Dr. Washington replied the following day—telling EBS: "We have not forgotten," and "[s]omeone will get back with you later in the month of January or early February with our thoughts."

30. Another month passed without EBS hearing back from Ford.

31. On January 23, 2015, Professor Heywood emailed Dr. Washington again.. In that email, Professor Heywood told Dr. Washington that EBS had "significantly enhanced our technology and intellectual property portfolio since I contacted you in October and thought it would be useful to pass on an updated description (attached)." In the attachment Professor Heywood provided, EBS again identified several of the patents it was offering to license to Ford, including the '839 Patent, as well as indicating that EBS "also has 4 pending applications," including applications that "include optimized use of port plus direct injection to increase engine efficiency through increased combustion stability and tolerance of EGR at high loads." Professor Heywood then concluded his email by stating: "We look forward to hearing Ford's thoughts about exploration of licensing possibilities of mutual benefit to Ford, MIT and EBS."

32. Yet again, EBS's efforts were met with silence from Ford. On February 13, 2015, Professor Heywood thus wrote Dr. Washington again—telling him "[w]e have not received a response as to whether Ford will meet with us about possible licensing of the MIT spinoff technology on optimized port +direct injection," which Professor Heywood described as "an important part of the solution for the best available technology for direct injection particulate reduction and can also provide other benefits."

33. Professor Heywood concluded his email by telling Ford: "It has been three and half months since I first contacted you and we had expected a response from Ford by now based on your last e-mail. Our only request has been an answer as to whether Ford would meet with us. We have held off in contacting other organizations while awaiting Ford's response. At this point we need to know if Ford will meet with us. If not, we will pursue other pathways for moving forward." He also added: "We believe there are potential arrangements that are fair and mutually beneficial to Ford, MIT and EBS. Please let us know whether or not Ford will meet with us to explore them."

34. Two days later, on February 15, 2015, Ford's chief intellectual property officer, Bill Coughlin, responded. Mr. Coughlin told EBS that he was "cause of the delay" and that "[u]nless advised otherwise by Ken, Ford will meet with you." Mr. Coughlin also added that Ford "should be in a position to advise when we can meet soon." EBS responded—telling Ford: "Thanks for your reply. We would like to set up a meeting date as soon as possible. Would a time in the March 17 to 27th period be feasible?"

35. After further back and forth, Mr. Coughlin agreed to meet with EBS in person at MIT on April 17, 2015. Dr. Cohn and Dr. Bromberg attended that meeting in person; Professor Heywood was traveling but participated via phone.

36. During that meeting, EBS again underscored the existence and importance of the patent family at issue in this case. In response, Mr. Coughlin proposed that—in exchange for EBS agreeing not to assert the patents against Ford—Ford would work with EBS to market other MIT/EBS technology. Mr. Coughlin also told EBS that Ford did not like to work on technology that it was infringing and that, as a result, Ford typically would license such technology, invalidate the patents at issue, or not pursue the technology. Mr. Coughlin also asked Dr. Bromberg, Dr. Cohn, and Professor Heywood whether they were "greedy inventors."

37. In response, EBS suggested that a better way to proceed was for Ford to analyze the patents EBS had disclosed and identify any that Ford believed had weaknesses or were otherwise inapplicable to Ford's products. EBS explained that, once Ford did so, EBS would be happy to discuss with Ford the results of such analysis. In response, Mr. Coughlin asked for more information about Plaintiffs' pending patent applications and told EBS that Ford expected to get back to EBS within around two months.

38. The April 17, 2015 meeting concluded with Dr. Cohn stating that it would be good if Ford and MIT/EBS could find a resolution that was a win-win for all parties involved.

39. After not hearing further from Ford, Professor Heywood and Dr. Cohn reached out to Mr. Coughlin again via email on June 5, 2015. In that email, Professor Heywood reiterated that EBS wanted to license to Ford but also told Ford "that the value of the MIT/EBS patent portfolio is much higher than the value represented by Ford's proposal"—i.e., Ford's offer to work with EBS to market other MIT/EBS technology in exchange for EBS agreeing not to assert the patents for the MIT/EBS dual injection technology at issue in this matter. Professor Heywood suggested that "a good next step to make further progress is to have an in-person meeting to discuss the structure of a possible transaction and appropriate valuation / fees" and also

suggested "setting-up a meeting around the end of June, consistent with the timeframe you suggested for reconnecting during our meeting on April 17t[h]." Professor Heywood also proposed that—during that meeting—the parties could have "a more detailed discussion of the patent portfolio and related inventions, and how they may be helpful to Ford."

40. Ford did not respond to Professor Heywood's June 5, 2015 email.

41. On July 6, 2015, Professor Heywood thus reached out to Mr. Coughlin again—stating: "We have not received a response to our June 5 e-mail and would like to keep moving forward in discussions with Ford." He also expressed that EBS "would appreciate a reply as to whether you would like to have a meeting in Dearborn and, if so, a sense of the time frame in which you think it could occur." EBS also attempted to reach Mr. Coughlin by phone on July 20, 2015.

42. Having heard nothing back from Mr. Coughlin, Professor Heywood emailed Dr. Washington on July 29, 2015—noting that Mr. Coughlin had not replied to EBS's June 5 email, July 6 email, or attempted July 20 phone call. Professor Heywood requested a "meeting in Dearborn to discuss the MIT/EBS technology and how we might thoroughly explore possible solutions that would be fair and beneficial to all parties"—explaining, "[t]his meeting could include anyone at Ford that you would like to include, including technical staff and others at Ford as well as the IP professionals." Professor Heywood concluded his email by asking Ford to "[k]indly acknowledge receipt of this e-mail promptly and let us know by August 31 if Ford wishes to meet with us; and if so, please propose dates that work for Ford. If we have not heard from you by then, we will assume that Ford is no longer interested in continuing discussions regarding use of our optimized port + direct injection gasoline engine technology."

43. Mr. Greg Brown, who at the time was Global Engine Intellectual Property Counsel at Ford Global Technologies, LLC, replied the following week—writing in an August 3, 2015 email that "Bill Coughlin has asked [him] to step in for him on this matter" and that he stood "ready to discuss" Ford's pitch to help EBS license other MIT/EBS technology to third parties in exchange for a "covenant not to sue" on the MIT/EBS dual injection technology at issue in this matter.

44. EBS subsequently had a number of phone calls with Mr. Brown. As part of these discussions, Dr. Cohn emailed Mr. Brown a "list of MIT/EBS patents and patent applications" on October 12, 2015.

45. Mr. Brown responded the same day—stating: "I think it is likely critical that we (Ford) are in a position to review all of the applications in the portfolio" and that "[i]t might be difficult to progress our discussion until that time."

46. EBS's final licensing conversation with Ford occurred in November 2015. Mr. Brown told EBS that Ford was not interested in licensing the offered technology and patents. In response to a question about whether Ford might be interested in the MIT/EBS dual injection technology for future vehicles, Mr. Brown indicated that Ford had no plans that he knew of to use that technology in its vehicles. Mr. Brown also declined EBS's request to involve Ford engineers in their discussions.

47. Contrary to what Mr. Brown had indicated to EBS, however, Ford did have imminent plans to use EBS's patented technology, incorporating infringing dual port and direct injection systems in a number of Ford's EcoBoost engines, as well as some of its V8 engines. Indeed, not only did Ford have plans to incorporate EBS's patented technology into its engines and fuel management systems, but Ford ***already*** was incorporating that technology into its

engines and fuel management systems at the very same time Ford was telling EBS that Ford had no plans to use the technology.

48. For example, just six months after Ford's last discussion with EBS, Forbes Magazine published a May 3, 2016, article detailing how several of Ford's new engines featured "dual fuel systems with both direct and port injectors for each cylinder." Such engines included Ford's 3.5L EcoBoost engine, which Ford rolled out in its most popular product: the Ford F-150.

49. The article states that Ford "completely redesigned [this engine] from the sump up"—with the "single most significant change to the engine" being its "new dual fuel system that now includes both port and direct injection." The article further explained that the 3.5L EcoBoost engine previously had used only direct injection and quoted Al Cockerill (a Ford engine systems supervisor for the 3.5L EcoBoost engine) as explaining how Ford's switch to a dual port and direct injection system was what enabled the "engine to meet Tier III emissions standards without resorting to a particulate filter of the type that is required on modern diesel engines."

50. Similar reports soon followed. On July 11, 2016, for example, Motor Trend Magazine published an article describing Ford's "all-new, ground-up redesign" of the Ford "EcoBoost V-6 we've become accustomed to since 2010." In particular, the article described how Ford had "reveal[ed]" that the 3.5L EcoBoost engine would incorporate Ford's "first use of direct and port fuel injection" and that the use of this (infringing) technology had allowed Ford to increase the engine's horsepower and "all-important torque."

51. Less than a year later, on June 16, 2017, Ford issued a press release explaining that it was incorporating this new (infringing) dual port and direct injection technology not just in its 3.5L EcoBoost engines, but a number of other engine options utilized in the Ford F-150, Ford Expedition, and other Ford models—stating:

> For 2018, F-150 introduces an even smaller, more efficient 3.3-liter V6 that adds dual port and direct-injection technology to deliver more power and torque than the previous 3.5-liter V6, plus improved projected EPA-estimated gas mileage – a win-win for customers.
>
> Aiding in light-weighting, the standard 3.3-liter V6 in the 2018 F-150 is projected to offer a 5 percent power-to-weight ratio improvement versus the steel-bodied 2014 F-150 equipped with 3.7-liter V6 – with better anticipated fuel efficiency and performance.
>
> With advanced dual port and direct-injection technology, the all-new second-generation 2.7-liter EcoBoost® engine delivers a 25 lb.-ft. increase in torque, and at lower engine speeds compared to a traditional V8. Like the second-generation 3.5-liter EcoBoost that debuted last model year, the 2.7-liter will be paired to a segment-exclusive 10-speed automatic transmission for 2018.
>
> The 5.0-liter V8 also is enhanced for 2018. This naturally aspirated engine brings significant upgrades including advanced dual port and direct-injection technology for 10 more horsepower and 13 ft.-lb. of torque.

52. It also has been reported that Ford has incorporated its (infringing) second-generation 3.5L EcoBoost engine in Ford's luxury SUV: the Lincoln Navigator. For example, a July 2018 article in Car and Driver Magazine reported that the 2018 Lincoln Navigator packs the same "port and direct fuel injection" equipped "450-hp, twin-turbocharged 3.5-liter EcoBoost V-6" as the Ford F-150 Raptor.

FORD HAS TOUTED THE BENEFITS OF THE INFRINGING TECHNOLOGY

53. Ford itself has touted the improvements realized by the incorporation of such innovative dual port and direct fuel injection technology. For example, in a June 16, 2017 press release, Ford stated that its new (infringing) EcoBoost engines "add[] dual port and direct-injection technology to deliver more power and torque than [Ford's] previous 3.5-liter V6, plus improved projected EPA-estimated gas mileage—a win-win for customers."

54. Further, according to Hua Thai-Tang, Ford's Executive Vice President of Product Development and Purchasing, incorporation of this (infringing) dual port and direct injection technology is what allows Ford to meet its customers' "unique needs" by "deliver[ing] even

more of the capability and efficiency they are looking for." Ford also has touted how its "innovative V6 engines" allow Ford's customers to "take care of their growing families and businesses, all with fewer stops for fuel along the way."

55. Ford similarly has touted its other dual port and direct injection engines, including its 5.0L V8 engine, which Ford said it recently "enhanced" with "significant upgrades including advanced dual port and direct-injection technology."

56. Ford's marketing brochures for its vehicles similarly emphasize that its vehicles and engines use (infringing) dual port and direct-injection technology.

57. For example, Ford's 2017 brochure for its F-150 trucks emphasized that its "all-new, 2nd-generation 3.5L EcoBoost engine" included a "new dual injection system" that "features both direct injection and port fuel injection. Two injectors per cylinder—one mounted in the intake port where air enters and another positioned inside the cylinder—work together to improve power output and efficiency."

58. Moreover, Ford's 2018 brochure for the Ford F-150 listed at least three additional engines incorporating and using this same "dual-injection system." According to Ford's marketing materials, these engines included Ford's "All-New 3.3L Ti-VCT V6," Ford's "Enhanced 2.7 EcoBoost," and Ford's "Enhanced 5.0L Ti-VCT V8."

59. Similarly, Ford marketed a "port- and direct-fuel-injected 3.5L EcoBoost engine" in Ford's 2018 brochure for the Ford Expedition.

60. Further, Ford's 2018 brochures for its Mustang sports car touted a "more powerful, higher-revving 5.0L V8" engine in the Mustang GT "[t]hanks to a new dual-injection system featuring low-pressure port fuel injection and high-pressure direct injection." That

brochure also promoted that this "New Dual-Injection System" would "improve power output and efficiency over a wide variety of engine loads."

61. Ford has realized substantial revenues and profits from its sale of such infringing products. For example, in June 2018 it was reported that "the F-Series pickup truck franchise [was expected] to produce $42 billion in revenues this year, to generate earnings before interest, taxes and other items of more than $10 billion, and to produce net income of about $6.5 billion." The vast majority of those F-150s included engines and fuel management systems that incorporate EBS's patented technology.

62. It also has been reported that, "[i]n terms of profitability," sales of the F-Series alone would place Ford "well inside the top 50 companies in the U.S."—generating "more profit than giants such as McDonald's Corp. (MCD), 3M Co. (MMM), and United Technologies Corp. (UTX)." For example, it has been reported that industry estimates "of Ford F-Series net profit would place the business at a rank of around #38 on the 2018 Fortune 500 list."

63. Further, in its January 3, 2019 Form 8-K report to the Securities and Exchange Commission, Ford disclosed that its F-Series "finished 2018 with a record 10 straight months above 70,000 pickups sold" and "had record transaction prices in 2018."

64. Further, in its fourth quarter sales report for 2019, Ford stated that "The F-Series was again America's bestselling truck for the 43rd straight year and for the 38th straight year America's bestselling vehicle. With the addition of Ranger, Ford pickups produced their best sales results since 2005, with a total of 986,097 pickups sold."

FORD KNEW OF THE ASSERTED PATENTS AND THEIR CLAIMS

65. On January 30, 2019, EBS and MIT brought suit against Ford in the United States District Court for the District of Delaware (the "First Action") for infringing four patents—

United States Patent Nos. 8,069,839; 9,255,519; 9,810,166; and 10,138,826—each of which was a continuation of the original November 18, 2004 application that matured into United States Patent No. 7,314,033. *See Ethanol Boosting Systems et al. v. Ford Motor Company*, No. 19-cv-00196-CFC (D. Del.). The '965,'580, and '760 Patents are continuations in part from the original November 18, 2004 Application.

66. Throughout the First Action, Ford demonstrated its knowledge and awareness of at least the '965 Patent and its underlying application by identifying and seeking information about the family of patents and patent applications that continued from U.S. Patent Application No. 11/100,026 (the '026 Application)—the parent application of both of the Asserted Patents in this action.

67. For example, on April 30, 2019, Ford served discovery requests on EBS and MIT in which Ford specifically sought information on patents and patent applications "related" to the patents asserted in the First Action, including all "patents and patent applications related to U.S. Patent Application No. 11/100,026."

68. Further, on August 30, 2019, Ford again demonstrated its knowledge and awareness of the '026 Application and the patent into which it matured, U.S. Patent No. 7,225,787, in its initial invalidity contentions in the First Action. Specifically, Ford asserted that the '787 Patent anticipated one or more claims of each patent asserted in the First Action. Ford also stated that the specification of the '787 Patent—which is the same as the specification of the Asserted Patents—"discloses that gasoline is port injected into the cylinder of the engine" and "also discloses that gasoline can also be used for direct injection." Ford also stated that the '787 Patent specification "specifically discloses directly injecting gasoline for a cooling effect."

69. Further, on October 16, 2019, Ford relied on the '026 Application (and related '787 Patent) in each of four petitions for *inter partes* review challenging all four patents EBS and MIT asserted in the First Action. *See* Case Nos. IPR2020-00010; IPR2020-00011; IPR2020-00012; IPR2020-00013 (collectively, the "*Inter Partes* Review Proceedings").

70. In the *Inter Partes* Review Proceedings, Ford noted that the '026 Application and the '787 Patent were disclosed to the United States Patent and Trademark Office Examiner during the prosecution of all four patents asserted in the First Action. Ford noted that the '026 Application was "filed on April 6, 2005" and issued as the '787 Patent on June 5, 2007. Ford further noted that during prosecution of the patents asserted in the First Action, EBS "cited in an Information Disclosure Statement an Office Action from Application No. 11/100,026 (the application that eventually issued as Bromberg) and an international search report for a different application that identified Bromberg." Ford also noted that, during prosecution, the "Examiner also cited a [separate] family member" of the '026 Application, namely, "U.S. Patent App. Pub. No. 2008/0168966." Ford was thus aware of the family of patents and patent applications that continued from the '026 Application.

71. Additionally, pursuant to Ford's discovery requests, on November 4, 2019 EBS produced to Ford a copy of the published patent application that matured into the '965 Patent (U.S. Pub. No. 2015-0369117), a copy of the claims of the '965 Patent, and numerous other documents, including patent file histories of EBS and MIT patents, assignment documents, and information disclosure statements, that identify the '965 Patent and/or its underlying application (U.S. Patent App. No. 14/807,125).

72. Further, on January 21, 2020, and as related to Ford's petitions for *inter partes* review, Plaintiffs served on Ford a Mandatory Notice Pursuant to 37 C.F.R. § 42.8 that disclosed

to Ford the full list of patents and patent applications that continued from the ’026 Application, including the ’965 Patent and U.S. Patent Application No. 16/662,429, which eventually issued as the ’580 Patent.

73. Further, on February 21, 2020, Plaintiffs served on Ford another Mandatory Notice Pursuant to 37 C.F.R. § 42.8 that again disclosed both the ’965 Patent and U.S. Patent Application No. 16/662,429 , which was published one day earlier on February 20, 2020.

74. Further, on March 31, 2020, Plaintiffs served on Ford another Mandatory Notice Pursuant to 37 C.F.R. § 42.8 that again disclosed the ’965 Patent and stated that “U.S. Patent Application Ser. No. 16/662,429 filed on October 24, 2019 . . . will issue on April 14, 2020 as U.S. Patent No. 10,619,580.” The March 31, 2020 Mandatory notice also disclosed “U.S. Patent Application Ser. No. 16/831,044 filed on March 26, 2020” as a patent application that continued from, and claimed priority to, U.S. Patent Application Ser. No. 10/991,774, filed November 18, 2004. The ’044 Application eventually issued as the ’760 Patent.

75. On June 14, 2020, Plaintiffs served on Ford another Mandatory Notice Pursuant to 37 C.F.R. § 42.8 that again disclosed the ’044 Application.

76. On September 21, 2020, Plaintiffs served on Ford another Mandatory Notice Pursuant to 37 C.F.R. § 42.8 stating that “U.S. Patent Application Ser. No. 16/831,044 filed on March 26, 2020 . . . will issue on September 22, 2020 as U.S. Patent No. 10,781,760.”

77. On September 29, 2020, Plaintiffs informed Ford that they intended to amend its complaint to add U.S. Patent No. 10,781,760.

THE ASSERTED PATENTS DISCLOSE SINGLE-FUEL EMBODIMENTS THAT USE ONLY GASOLINE

78. The shared specification of the ’965, ’580, and ’760 Patents recites embodiments in which the same fuel is port injected and direct injected into a spark-ignition gasoline engine. It also discloses embodiments in which that fuel is gasoline alone.

79. For example, the specification states that “Gasoline vaporizes easier than ethanol, and conventional operation with port-fuel or direct injected gasoline would result in easier engine start up.” ’965 Patent, column 10, lines 11-13.

80. The specification also discloses embodiments in which “directly injected ethanol can be mixed with gasoline.” ’965 Patent, column 1, line 67 – column 2, line 1. Later, it elaborates on the benefit of that embodiment, disclosing that “[e]thanol consumption can be minimized if the gasoline is also directly injected.” ’965 Patent, column 11, lines 30-31. It explains that, “[i]n this case, the heat of vaporization of gasoline is also useful in decreasing the temperature of the charge in the cylinder.” ’965 Patent, column 11, lines 32-34.

81. The specification also describes the benefits of using gasoline alone for both port and direct injection. It explains:

> [I]n some cases a means of operating the vehicle at higher loads would be desired. ***This could be accomplished by using gasoline in the ethanol system with gasoline direct injection (GDI), while at the same time port-fuel injecting a fraction of the gasoline***. Under these conditions the engine will operate at higher loads and higher torques, but still far below what ethanol could achieve. Only the cooling effect of the direct injection fuel is obtained, since ***the directly injected fuel has the same octane number as the port-injection fuel (gasoline in both cases)***.

’965 Patent, column 12, lines 24-34.

82. Additionally, claims 12, 14, 21, and 31 of the ’580 Patent all disclose and claim embodiments in which gasoline is injected into the engine using port injection and is also injected into the engine using direct injection.

83. For example, claim 12 of the ’580 Patent recites a “fuel management system of claim 1, wherein the first fueling system is configured to introduce gasoline into the engine and the second fueling system is configured to introduce gasoline into the engine.”

FORD HAS ADMITTED THAT THE ASSERTED PATENTS DISCLOSE SINGLE-FUEL EMBODIMENTS THAT USE GASOLINE

84. In the *Inter Partes* Review Proceedings relating to the four patents asserted in the First Action, Ford described the invention and embodiments disclosed in the shared specification common to the ’965,’580, and ’760 Patents (the “Common Specification”), explaining that it disclosed embodiments in which the same fuel is both port injected and directly injected into the engine.

85. For example, Ford stated that the Common Specification “discloses a fuel management system” in which “an anti-knock agent ***or gasoline can be directly injected*** into the engine. . . . [and] that ***gasoline can be port injected*** into the engine.”

86. Ford further explained that the Common Specification discloses how “port injection is used alone in a torque range and together with the directly injected fuel (e.g., anti-knock agent ***or gasoline***) in another torque range.”

87. Ford later confirmed that the Common Specification “disclose[s] that ***gasoline can also be directly injected*** using the same control approach when ethanol is not employed in fueling the engine.”

COUNT 1
INFRINGEMENT OF U.S. PATENT NO. 9,708,965

88. Plaintiffs repeat and incorporate by reference each preceding paragraph as if fully set forth herein and further state:

89. The ’965 Patent was duly and legally issued on July 18, 2017. A true and correct copy is attached as **Exhibit A**. Collectively, Plaintiffs hold all rights and title to such patent, including the sole and exclusive right to bring a claim for its infringement.

90. To the extent applicable, Plaintiffs have complied with 35 U.S.C. § 287(a) with respect to the ’965 Patent.

91. As described below, Ford has directly infringed the ’965 Patent in violation of 35 U.S.C. § 271(a) by making, using, selling, and/or offering for sale in the United States, and/or importing into the United States, without authorization, products that practice claims of the ’965 Patent.

92. At a minimum, such infringing products include what Ford calls its “second generation” “EcoBoost” engines and fuel management systems, including Ford’s 2.7L EcoBoost engine and fuel management system, 3.5L EcoBoost engine and fuel management system, and High Output 3.5L EcoBoost engine and fuel management system. Such infringing products also include Ford’s 3.3L Ti-VCT and 5.0L Ti-VCT V8 engines and fuel management systems, and other Ford engines that utilize dual port and direct fuel injection. Such infringing products also include those vehicles that include such dual port and direct injection engines and/or fuel management systems.

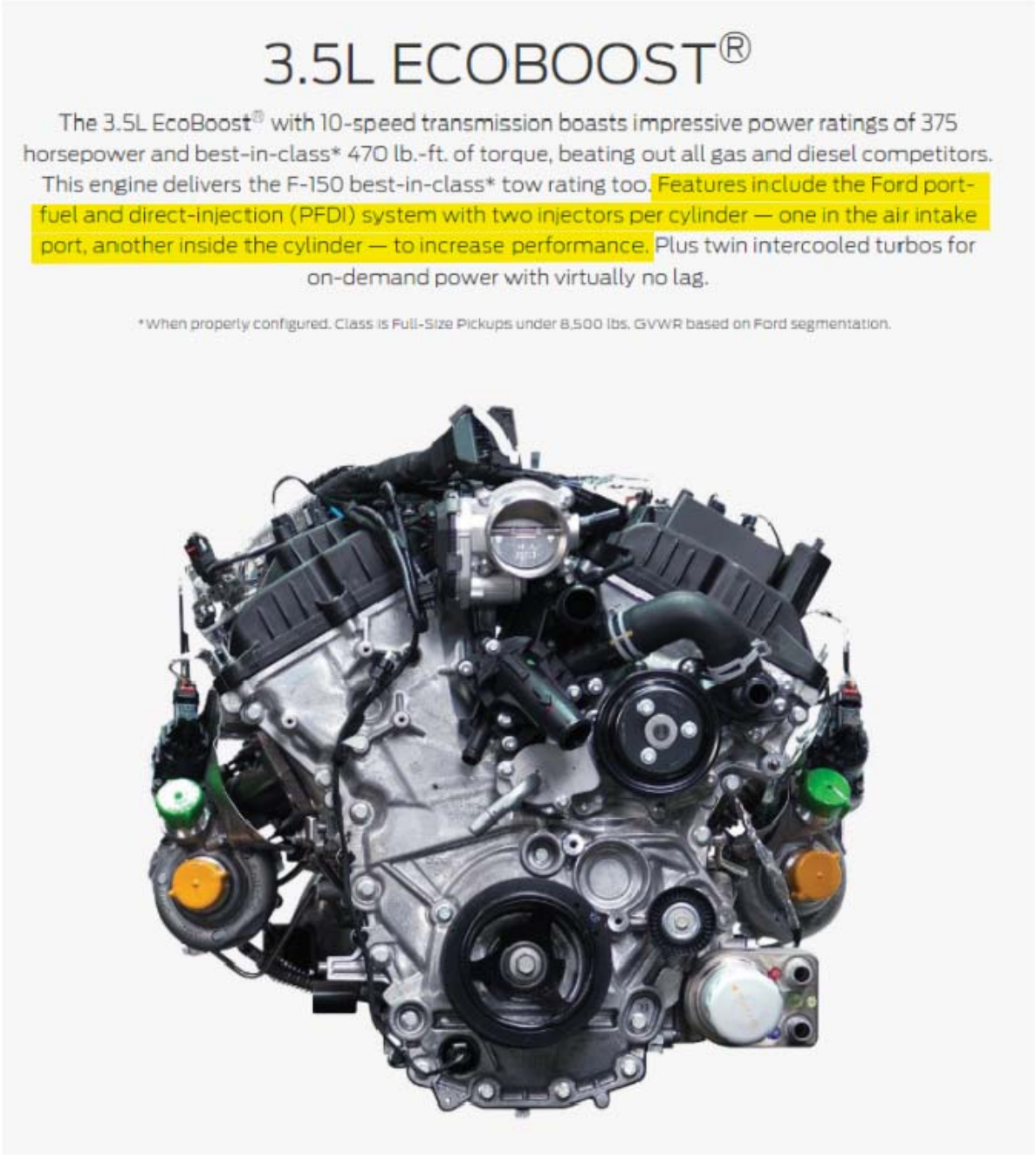
93. For example, Claim 1 is illustrative of the claims of the ’965 Patent. Claim 1 recites: “A fuel management system for spark ignition engine where the fuel management system controls fueling from a first fueling system that directly injects fuel into at least one cylinder as a

liquid and increases knock suppression by evaporative cooling and from a second fueling system that injects fuel into a region outside of the cylinder; and where there is a range of torque where both fueling systems are used at the same value of manifold pressure; and where a fraction of fuel in the cylinder that is introduced by the first fueling system increases with increasing manifold pressure so as to prevent knock by providing increased knock resistance; and where the fuel management system controls the change in the fraction of fuel introduced by the first fueling system using closed loop control that utilizes a sensor that detects knock and where open loop control is also used; and where the open loop control uses an engine map lookup table; and where open loop control is used during transients in engine load."

94. Ford's 3.5L EcoBoost engine, including its fuel management system, meets every element of these claims.[1]

[1] This description of infringement is illustrative and not intended to be an exhaustive or limiting explanation of every manner in which Ford's products infringe.

95. As the below Ford image reflects, the "Ford port-fuel and direct-injection (PFDI) system" is a fuel management system for spark ignition engine where the fuel management system controls fueling from a first fueling system that directly injects fuel into at least one cylinder as a liquid and from a second fueling system that injects fuel into a region outside of the cylinder:



https://www.ford.com/trucks/f150/features/power/. The direct injection of fuel has the effect of increasing knock suppression by evaporative cooling.

96. Further, as demonstrated by the below figure from a July 2018 report issued by the National Highway Traffic Safety Administration, Ford's 3.5L EcoBoost engine, including its fuel management system, utilizes such port and direct fuel injection such that, there is a range of torque where both fueling systems are used at the same value of manifold pressure:

5.4.3.4. Engine boost strategy

Figure 31 shows the engine boost map. Note that the engine intake pressures on the UDDS and highway cycles do not require the turbocharger to provide boost. On the US06 cycle the power-train achieves required power by taking full advantage of the boost from the turbocharger rather than increasing engine speed.

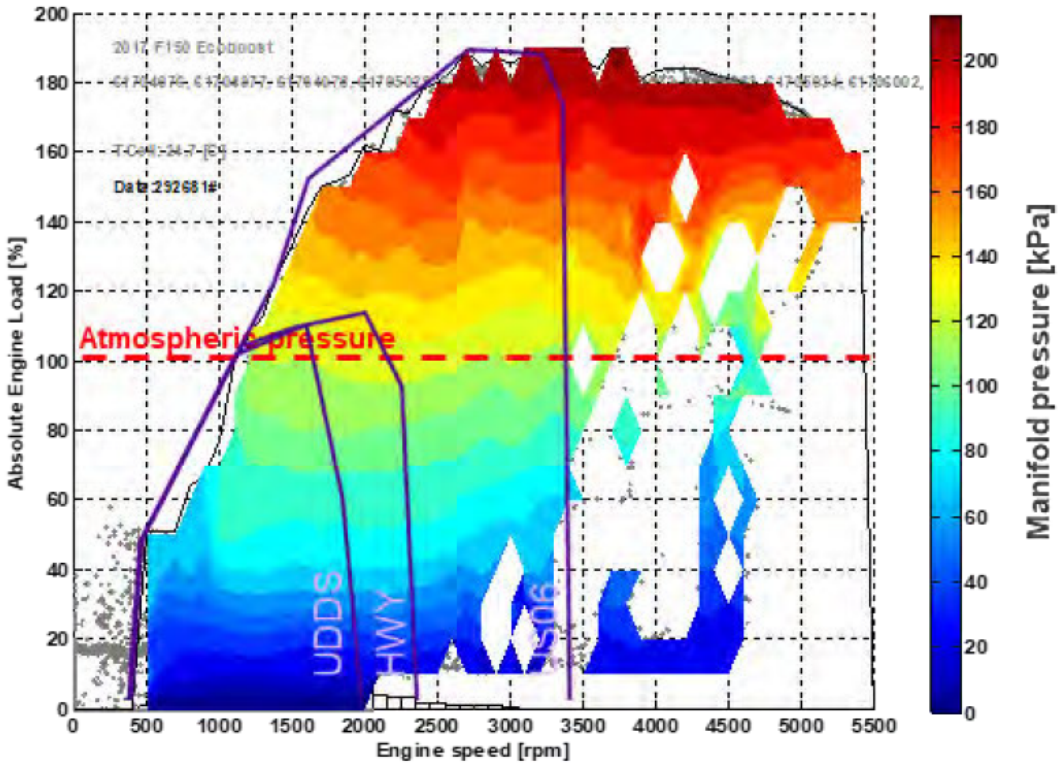


Figure 31: Manifold pressure and boost map as a function of the engine speed and load

The range of torque where both fueling systems are used at the same value of manifold pressure is further shown by the above figure as well as the below figure from the July 2018 National

Highway Traffic Safety Administration report:

5.4.3.2.DI vs PFI

The fuel can be fed to the engine through the PFI system or the DI system. Figure 29 shows the map of the PFI and DI strategy. The PFI system provides the fuel to the engine when the absolute engine load is below 40 percent. The DI system is quickly blended in above 40 percent absolute engine load. Between 60 percent to 140 percent absolute load, 80 percent to 70 percent of the fuel is delivered through the DI system. At absolute engine loads above 140 percent the PFI system provides an increase proportion of the fuel up to 40 percent. At the maximum absolute load above 2,000 rpm 60 percent of the fuel is provided by the DI system and 40 percent by the PFI system that corresponds to the values shown in the maximum acceleration test in Figure 24.

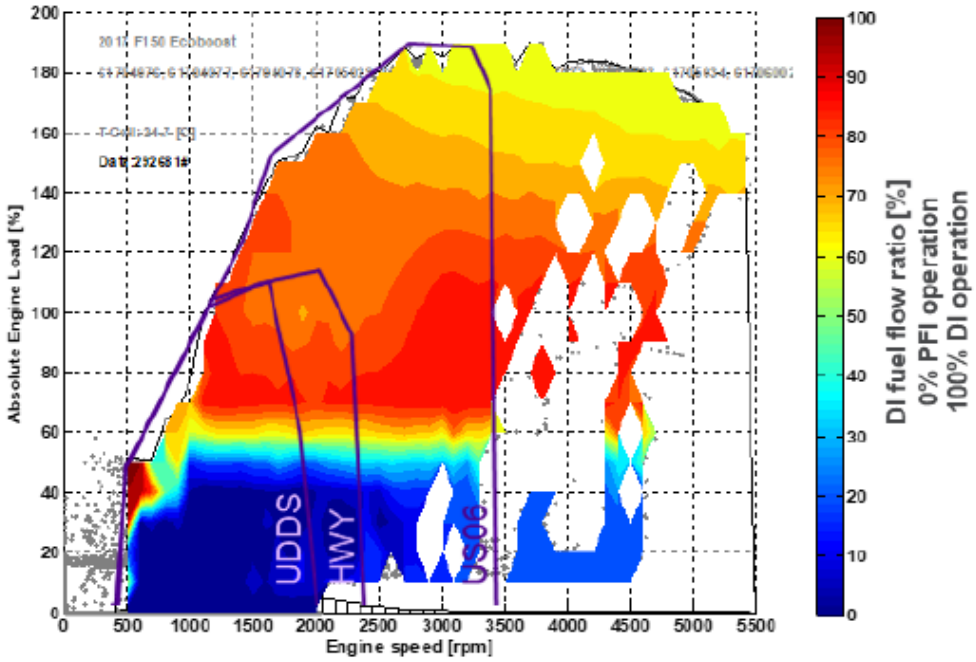


Figure 29: DI and PFI usage map as a function of the engine speed and load

The island of 100 percent DI operation at 575 rpm and 40 percent absolute load corresponds to the engine starting on the DI system before switching to the PFI system as described in the previous section.

The range of torque where both fueling systems are used at the same value of manifold pressure is further shown in the July 23, 2019 Raptor Tuning Guide for the Ford F-150 EcoBoost-equipped Raptor, which states that the Ford EcoBoost engine control unit, or "ECU", "can adjust the proportion of desired fuel mass injected between the direct injectors and the port injectors. At idle, 100% of the fuel mass injected comes from the port injectors. At light load cruise, nearly

all of the fuel mass injected comes from the direct injectors. At [wide open throttle], the factory calibration approaches a near even split between the two, but slightly favors direct injection."

97. Further, as also demonstrated by the above figures as well as the below figure from the July 2018 National Highway Traffic Safety Administration report, Ford's 3.5L EcoBoost engine, including its fuel management system, utilizes such port and direct fuel injection such that the fraction of fuel in the cylinder that is introduced by the first fueling system increases with increasing manifold pressure so as to prevent knock by providing increased knock resistance.

5.4.3.2.DI vs PFI

The fuel can be fed to the engine through the PFI system or the DI system. Figure 29 shows the map of the PFI and DI strategy. The PFI system provides the fuel to the engine when the absolute engine load is below 40 percent. The DI system is quickly blended in above 40 percent absolute engine load. Between 60 percent to 140 percent absolute load, 80 percent to 70 percent of the fuel is delivered through the DI system. At absolute engine loads above 140 percent the PFI system provides an increase proportion of the fuel up to 40 percent. At the maximum absolute load above 2,000 rpm 60 percent of the fuel is provided by the DI system and 40 percent by the PFI system that corresponds to the values shown in the maximum acceleration test in Figure 24.

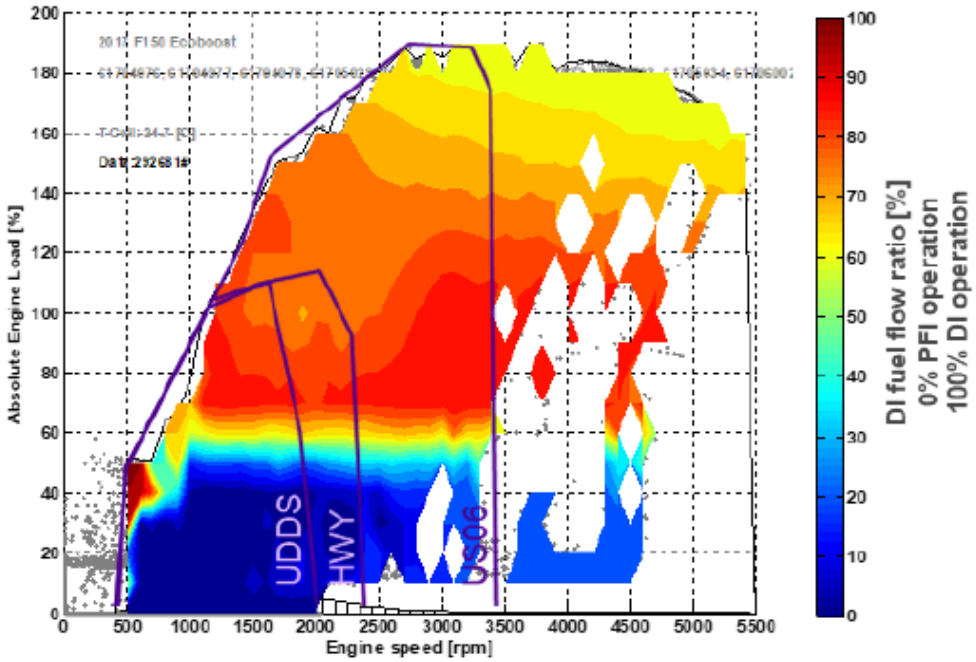


Figure 29: DI and PFI usage map as a function of the engine speed and load

The island of 100 percent DI operation at 575 rpm and 40 percent absolute load corresponds to the engine starting on the DI system before switching to the PFI system as described in the previous section.

98. Further, the fuel management system controls the change in the fraction of fuel introduced by direct injection using closed loop control that utilizes a sensor that detects knock. Such functionality also is demonstrated by the below figure from the July 2018 National Highway Traffic Safety Administration report, which reflects that spark advance decreases with increasing load and—when comparing with the previous figure—shows the fraction of the fuel provided by the first system decreasing with decreasing spark advance (increasing spark retard):

5.4.3.3.Ignition timing

Figure 30 shows the spark ignition timing map for the engine. The most advance is observed at 20-40 percent load (low load cruise) and from 1,000-2,750 rpm.

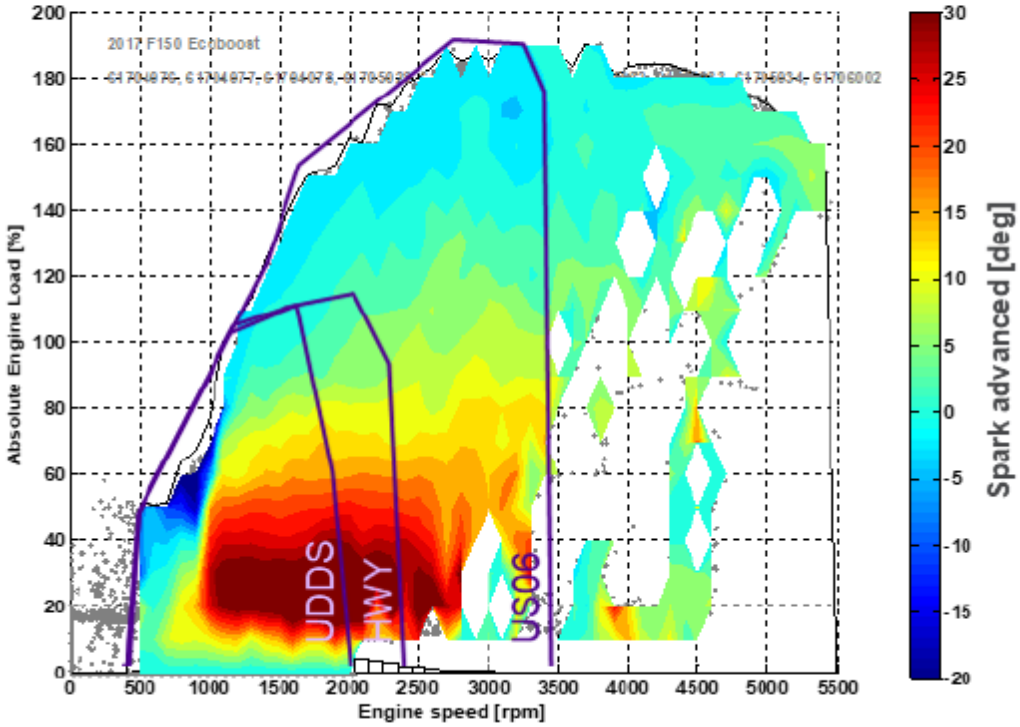


Figure 30: Spark advance map as a function of the engine speed and load

99. Further, open loop control is also used at least during transients in engine load, including use of an engine map lookup table. Such functionality also is demonstrated by the below figure from the July 2018 National Highway Traffic Safety Administration report, which reflects that an engine map lookup table is employed to control a fraction of directly injected versus port-injected fuel based on at least the engine's then-current engine speed (in RPM) and absolute engine load:

5.4.3.2.DI vs PFI

The fuel can be fed to the engine through the PFI system or the DI system. Figure 29 shows the map of the PFI and DI strategy. The PFI system provides the fuel to the engine when the absolute engine load is below 40 percent. The DI system is quickly blended in above 40 percent absolute engine load. Between 60 percent to 140 percent absolute load, 80 percent to 70 percent of the fuel is delivered through the DI system. At absolute engine loads above 140 percent the PFI system provides an increase proportion of the fuel up to 40 percent. At the maximum absolute load above 2,000 rpm 60 percent of the fuel is provided by the DI system and 40 percent by the PFI system that corresponds to the values shown in the maximum acceleration test in Figure 24.

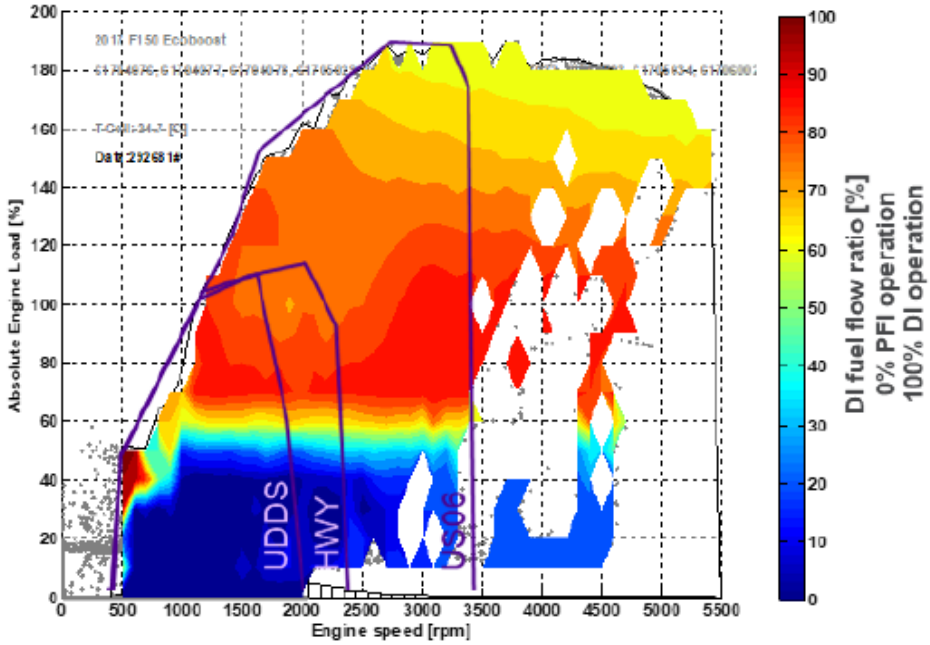


Figure 29: DI and PFI usage map as a function of the engine speed and load

The island of 100 percent DI operation at 575 rpm and 40 percent absolute load corresponds to the engine starting on the DI system before switching to the PFI system as described in the previous section.

100. Ford's acts of infringement have damaged Plaintiffs, and Plaintiffs are entitled to recover from Ford for those damages in an amount to be proven at trial.

COUNT 2
INFRINGEMENT OF U.S. PATENT NO. 10,619,580

101. Plaintiffs repeat and incorporate by reference each preceding paragraph as if fully set forth herein and further state:

102. The ’580 Patent was duly and legally issued on April 14, 2020. A true and correct copy is attached as **Exhibit B**. Collectively, Plaintiffs hold all rights and title to such patent, including the sole and exclusive right to bring a claim for its infringement.

103. To the extent applicable, Plaintiffs have complied with 35 U.S.C. § 287(a) with respect to the ’580 Patent.

104. As described below, Ford has directly infringed the ’580 Patent in violation of 35 U.S.C. § 271(a) by making, using, selling, and/or offering for sale in the United States, and/or importing into the United States, without authorization, products that practice claims of the ’580 Patent.

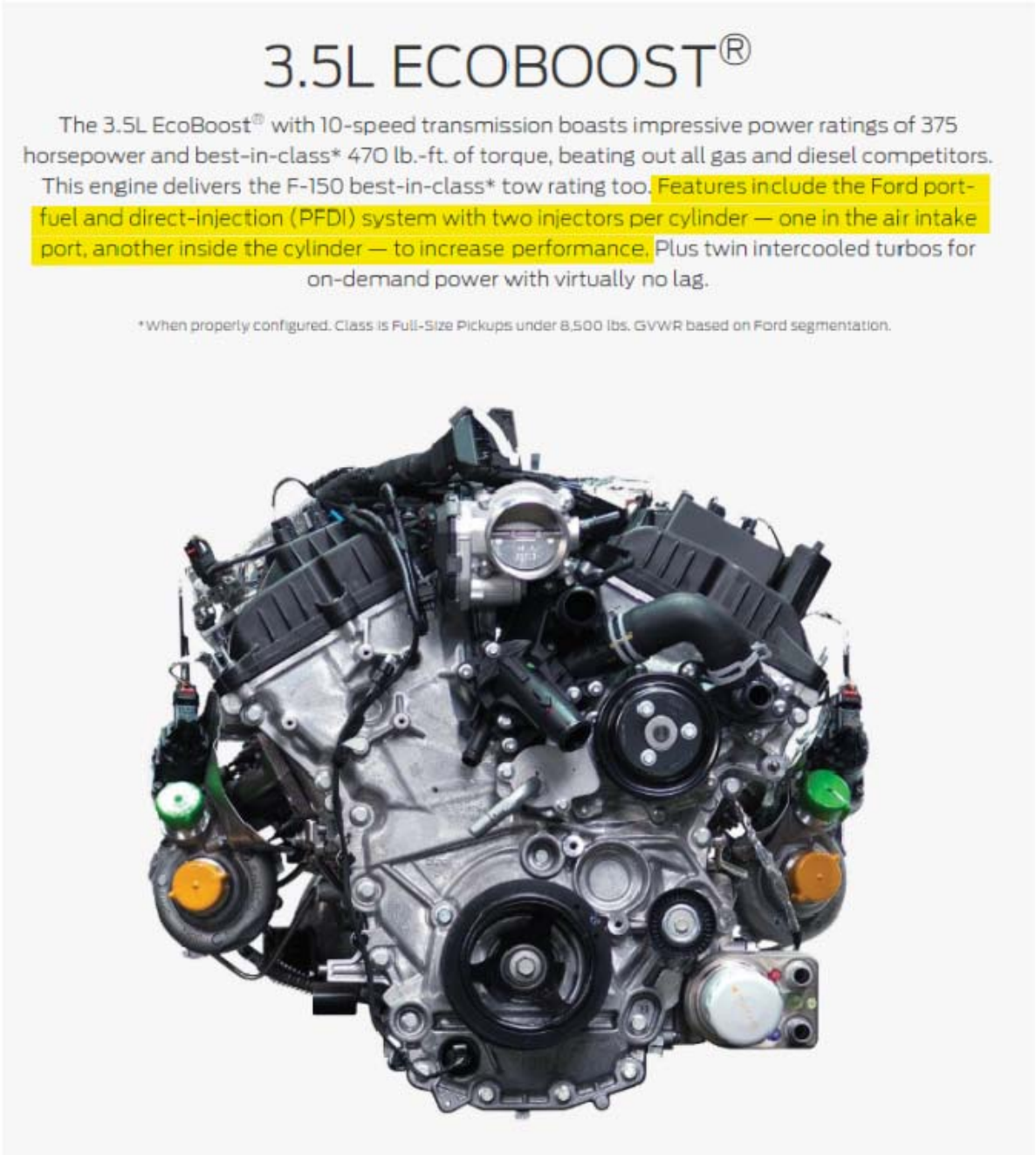
105. At a minimum, such infringing products include what Ford calls its “second generation” “EcoBoost” engines and fuel management systems, including Ford’s 2.7L EcoBoost engine and fuel management system, 3.5L EcoBoost engine and fuel management system, High Output 3.5L EcoBoost engine and fuel management system, and other Ford engines that utilize dual port and direct fuel injection. Such infringing products also include those vehicles that include such dual port and direct injection engines and/or fuel management systems.

106. For example, Claim 1 is illustrative of the claims of the ’580 Patent. It recites “[a] fuel management system for a spark ignition engine, comprising: a first fueling system that uses direct injection; a second fueling system that uses port fuel injection; and a three-way catalyst configured to reduce emissions from the spark ignition engine, wherein the fuel management system is configured to provide fueling in a first torque range, the first torque range being a first range of torque values at which both the first fueling system and the second fueling system are operable throughout the first range of torque values, wherein the fuel management system is further configured such that a fraction of fueling provided by the first fueling system is higher at

a highest value of torque in the first torque range than in a lowest value of torque in the first torque range, wherein the fuel management system is further configured to provide fueling in a second torque range, the second torque range being a second range of torque values at which the second fueling system is operable throughout the second range of torque values and the first fueling system is not operable throughout the second range of torque values, wherein the fuel management system is further configured such that when the system provides fueling at a torque value that exceeds the second range of torque values, the spark ignition engine is operated in the first torque range, and wherein the spark ignition engine is configured to operate at a stoichiometric air/fuel ratio in at least part of the first torque range and in at least part of the second torque range." Ford's 3.5L EcoBoost engine, including its fuel management system, meets every element of these claims.[2]

[2] This description of infringement is illustrative and not intended to be an exhaustive or limiting explanation of every manner in which Ford's products infringe.

107. As the below Ford image reflects, Ford's 3.5L EcoBoost engine comprises a turbocharged spark ignition engine that is fueled using a "port-fuel and direct-injection (PFDI)" fuel management "system":



https://www.ford.com/trucks/f150/features/power/.

108. Further, the Ford F-150 is equipped with what is known as a "three way" catalytic converter which are configured to ensure that the to 3.5L EcoBoost engine, including its fuel management system, operates at a substantially stoichiometric fuel/air ratio and reduces engine emissions.

109. Further, as demonstrated by the below figure from a July 2018 report issued by the National Highway Traffic Safety Administration, Ford's 3.5L EcoBoost engine, including its fuel management system, utilizes port and direct fuel injection such that there is a first torque range (e.g., a range of torque values above approximately 40% absolute engine load) where both fueling systems are operable throughout the range:

5.4.3.2.DI vs PFI

The fuel can be fed to the engine through the PFI system or the DI system. Figure 29 shows the map of the PFI and DI strategy. The PFI system provides the fuel to the engine when the absolute engine load is below 40 percent. The DI system is quickly blended in above 40 percent absolute engine load. Between 60 percent to 140 percent absolute load, 80 percent to 70 percent of the fuel is delivered through the DI system. At absolute engine loads above 140 percent the PFI system provides an increase proportion of the fuel up to 40 percent. At the maximum absolute load above 2,000 rpm 60 percent of the fuel is provided by the DI system and 40 percent by the PFI system that corresponds to the values shown in the maximum acceleration test in Figure 24.

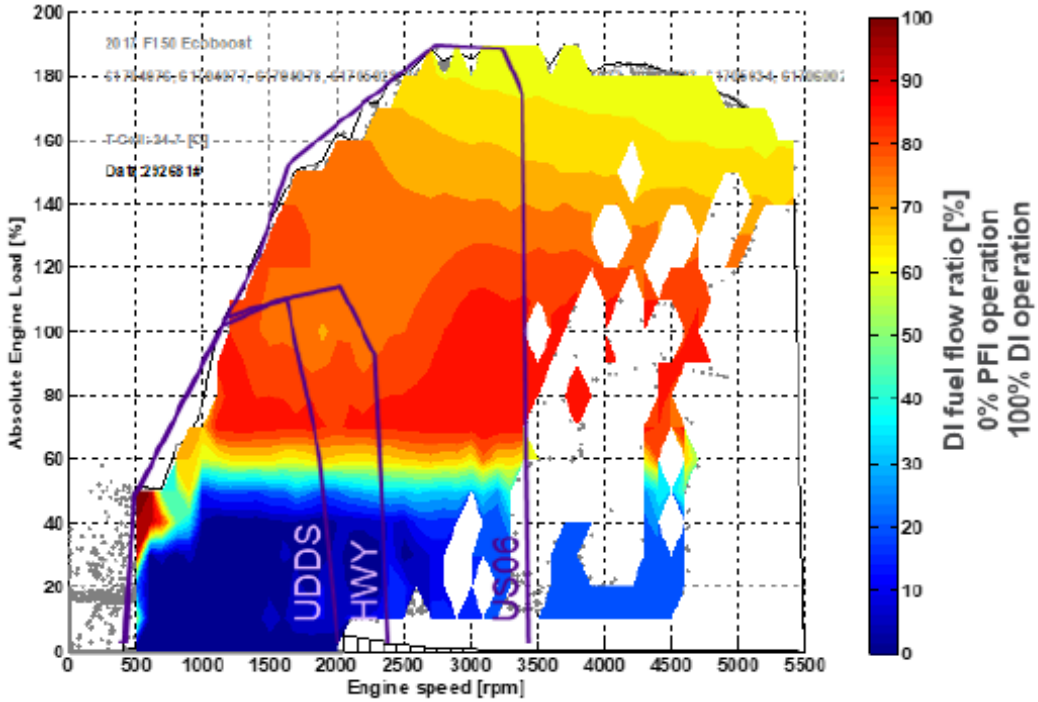


Figure 29: DI and PFI usage map as a function of the engine speed and load

The island of 100 percent DI operation at 575 rpm and 40 percent absolute load corresponds to the engine starting on the DI system before switching to the PFI system as described in the previous section.

The use of port and direct fuel injection such that there is a first torque range where both fueling systems are operable throughout the range is further shown in the July 23, 2019 Raptor Tuning Guide for the Ford F-150 EcoBoost-equipped Raptor, which states that the Ford EcoBoost engine control unit, or "ECU", "can adjust the proportion of desired fuel mass injected between the direct injectors and the port injectors. At idle, 100% of the fuel mass injected comes from the

port injectors. At light load cruise, nearly all of the fuel mass injected comes from the direct injectors. At [wide open throttle], the factory calibration approaches a near even split between the two, but slightly favors direct injection."

110. Further, Ford's 3.5L EcoBoost engine, including its fuel management system, is configured such that the fraction of fueling provided by direct injection is higher at a highest value of torque in the first torque range than in a lowest value of torque in that range. For example, as demonstrated by the above figure from the July 2018 National Highway Traffic Safety Administration report, the fraction of fuel that is directly injected by the Ford's 3.5L EcoBoost engine fuel management system increases from a low of 0% at or around 40% absolute engine load to 70% or 80% direct injection between approximately 60% to 140% absolute engine load.

111. Further, Ford's 3.5L EcoBoost engine, including its fuel management system, is further configured to provide fueling in a second torque range (e.g., each torque value below approximately 40% absolute engine load) where only port-fuel injection is used. In addition, in such engines, the fuel management system is also configured such that when the system fuels the engine at a torque value exceeding the second range (e.g., each torque value at or above approximately 40% absolute engine load) the spark ignition engine is operated in the first torque range.

112. Further, the Ford F-150 is equipped with what is known as a "three way" catalytic converter which is configured to ensure that the 3.5L EcoBoost engine, including its fuel management system, operates at a substantially stoichiometric fuel/air ratio. On information and belief, Ford's 3.5L EcoBoost engine, including its fuel management system, operates at a

stoichiometric air/fuel ratio in at least part of the first torque range and in at least part of the second torque range.

113. Claim 12 is also illustrative of the claims of the ’580 Patent. It recites: “[t]he fuel management system of claim 1, wherein the first fueling system is configured to introduce gasoline into the engine and the second fueling system is configured to introduce gasoline into the engine.”

114. As described above, Ford’s 3.5L EcoBoost engine, including its fuel management system, meets every element of Claim 1, and further meets every element of Claim 12 because Ford’s 3.5L EcoBoost engine is configured such that gasoline is introduced into the engine by both direct injection and port fuel injection.

115. Ford’s acts of infringement have damaged Plaintiffs, and Plaintiffs are entitled to recover from Ford for those damages in an amount to be proven at trial.

COUNT 3
INFRINGEMENT OF U.S. PATENT NO. 10,781,760

116. Plaintiffs repeat and incorporate by reference each preceding paragraph as if fully set forth herein and further state:

117. The ’760 Patent was duly and legally issued on September 22, 2020. A true and correct copy is attached as **Exhibit C**. Collectively, Plaintiffs hold all rights and title to such patent, including the sole and exclusive right to bring a claim for its infringement.

118. To the extent applicable, Plaintiffs have complied with 35 U.S.C. § 287(a) with respect to the ’760 Patent.

119. As described below, Ford has directly infringed the ’760 Patent in violation of 35 U.S.C. § 271(a) by making, using, selling, and/or offering for sale in the United States, and/or

importing into the United States, without authorization, products that practice claims of the ’760 Patent.

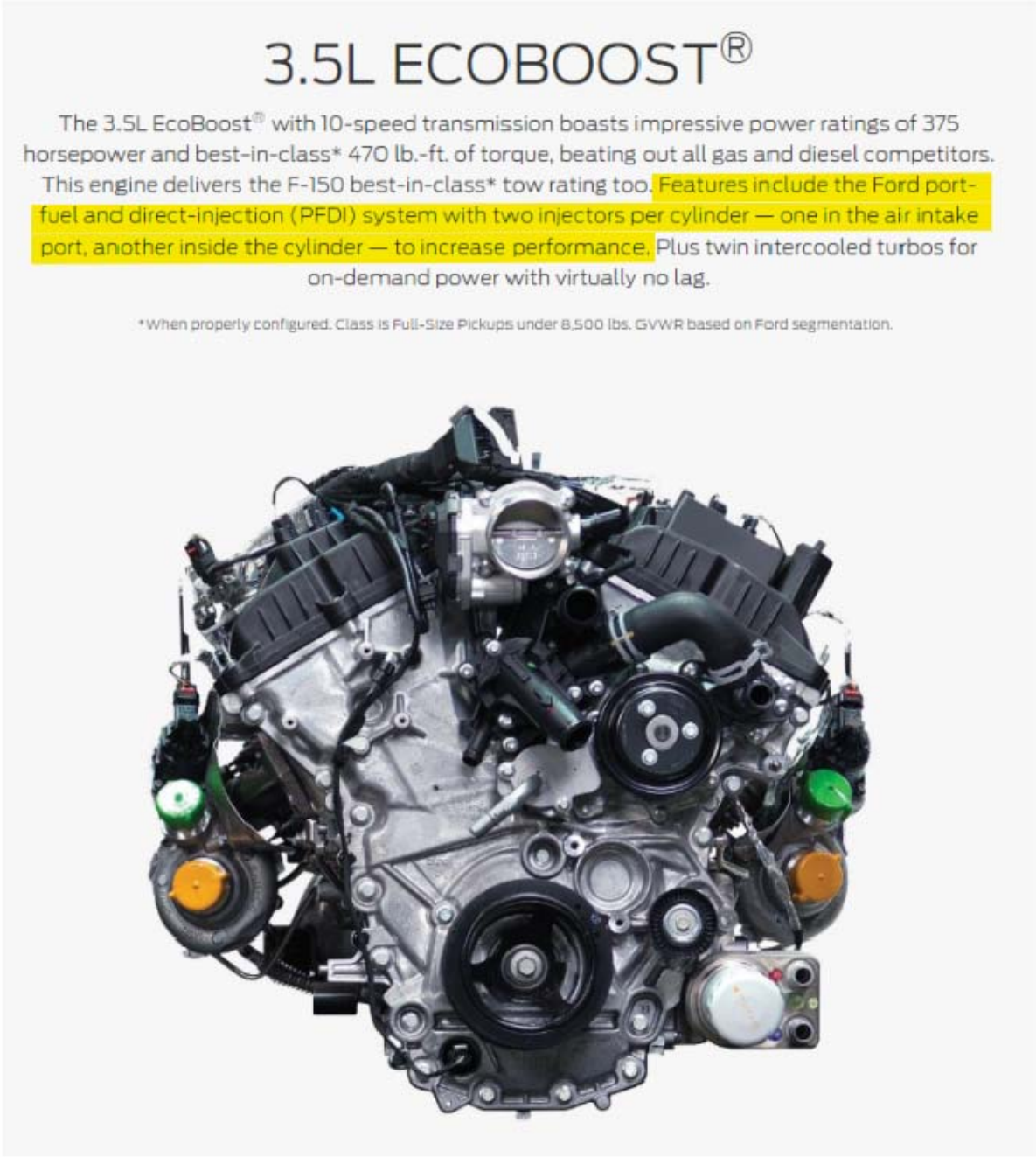
120. At a minimum, such infringing products include what Ford calls its “second generation” “EcoBoost” engines and fuel management systems, including Ford’s 2.7L EcoBoost engine and fuel management system, 3.5L EcoBoost engine and fuel management system, High Output 3.5L EcoBoost engine and fuel management system, and other Ford engines that utilize dual port and direct fuel injection. Such infringing products also include those vehicles that include such dual port and direct injection engines and/or fuel management systems.

121. For example, Claim 1 is illustrative of the claims of the ’760 Patent. It recites “[a] fuel management system for a spark ignition engine, comprising: a first fueling system that uses direct injection; a second fueling system that uses port fuel injection; and a three-way catalyst configured to reduce emissions from the spark ignition engine, wherein the fuel management system is configured to provide fueling in a first torque range, the first torque range being a first range of torque values at which both the first fueling system and the second fueling system are operable throughout the first range of torque values, wherein the fuel management system is further configured such that a fraction of fueling provided by the first fueling system is higher at a highest value of torque in the first torque range than in a lowest value of torque in the first torque range, wherein the fuel management system is further configured to provide fueling in a second torque range, the second torque range being a second range of torque values at which the second fueling system is operable throughout the second range of torque values and the first fueling system is not operable throughout the second range of torque values, wherein the fuel management system is further configured such that when the system provides fueling at a torque value that exceeds the second range of torque values, the spark ignition engine is operated in the

first torque range, wherein the fuel management system is further configured to increase the fraction of fueling provided by the first fueling system in the first torque range as torque increases in at least a part of the first torque range, and wherein the spark ignition engine is configured to operate at a stoichiometric air/fuel ratio in at least part of the first torque range and in at least part of the second torque range." Ford's 3.5L EcoBoost engine, including its fuel management system, meets every element of these claims.[3]

[3] This description of infringement is illustrative and not intended to be an exhaustive or limiting explanation of every manner in which Ford's products infringe.

122. As the below Ford image reflects, Ford's 3.5L EcoBoost engine comprises a turbocharged spark ignition engine that is fueled using a "port-fuel and direct-injection (PFDI)" fuel management "system," which comprises at least "a first fueling system that uses direct injection; [and] a second fueling system that uses port fuel injection":



https://www.ford.com/trucks/f150/features/power/.

123. Further, the Ford F-150 is equipped with what is known as a "three way" catalytic converter which are configured to ensure that the to 3.5L EcoBoost engine, including its fuel management system, operates at a substantially stoichiometric fuel/air ratio and reduces engine emissions.

124. Further, as demonstrated by the below figure from a July 2018 report issued by the National Highway Traffic Safety Administration, Ford's 3.5L EcoBoost engine, including its fuel management system, utilizes port and direct fuel injection such that there is a first torque range (e.g., a range of torque values above approximately 40% absolute engine load) where both fueling systems are operable throughout the range:

5.4.3.2.DI vs PFI

The fuel can be fed to the engine through the PFI system or the DI system. Figure 29 shows the map of the PFI and DI strategy. The PFI system provides the fuel to the engine when the absolute engine load is below 40 percent. The DI system is quickly blended in above 40 percent absolute engine load. Between 60 percent to 140 percent absolute load, 80 percent to 70 percent of the fuel is delivered through the DI system. At absolute engine loads above 140 percent the PFI system provides an increase proportion of the fuel up to 40 percent. At the maximum absolute load above 2,000 rpm 60 percent of the fuel is provided by the DI system and 40 percent by the PFI system that corresponds to the values shown in the maximum acceleration test in Figure 24.

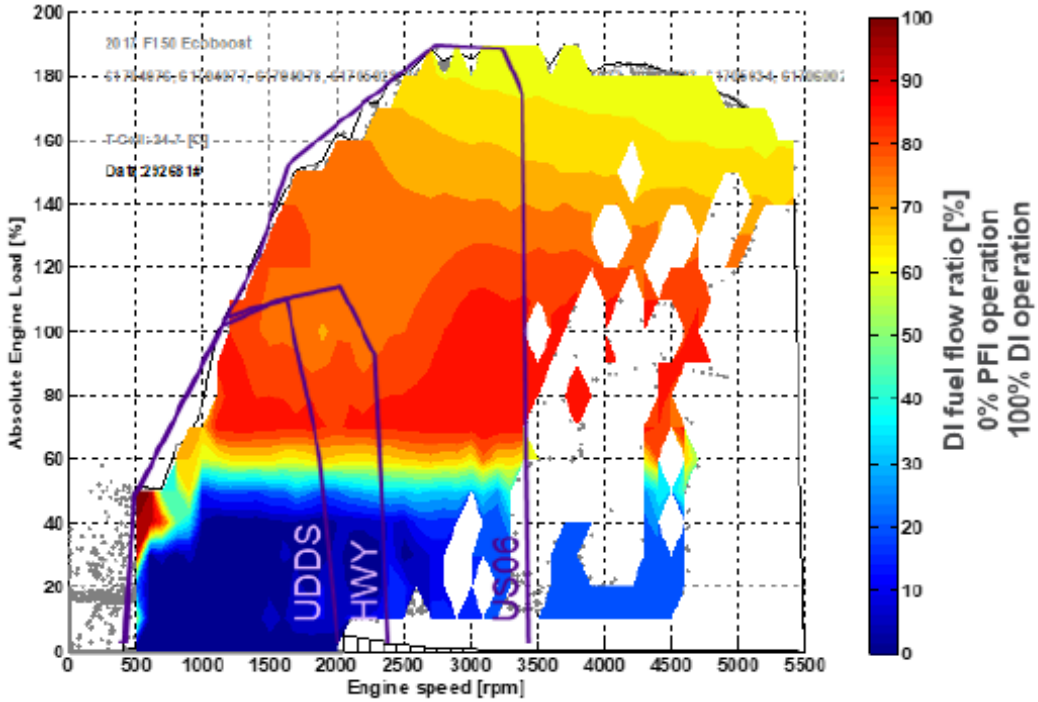


Figure 29: DI and PFI usage map as a function of the engine speed and load

The island of 100 percent DI operation at 575 rpm and 40 percent absolute load corresponds to the engine starting on the DI system before switching to the PFI system as described in the previous section.

The use of port and direct fuel injection such that there is a first torque range where both fueling systems are operable throughout the range is further shown in the July 23, 2019 Raptor Tuning Guide for the Ford F-150 EcoBoost-equipped Raptor, which states that the Ford EcoBoost engine control unit, or "ECU", "can adjust the proportion of desired fuel mass injected between the direct injectors and the port injectors. At idle, 100% of the fuel mass injected comes from the

port injectors. At light load cruise, nearly all of the fuel mass injected comes from the direct injectors. At [wide open throttle], the factory calibration approaches a near even split between the two, but slightly favors direct injection."

125. Further, Ford's 3.5L EcoBoost engine, including its fuel management system, is configured such that the fraction of fueling provided by direct injection (i.e., the first fueling system) is higher at a highest value of torque in the first torque range than in a lowest value of torque in that range. For example, as demonstrated by the above figure from the July 2018 National Highway Traffic Safety Administration report, the fraction of fuel that is directly injected by the Ford's 3.5L EcoBoost engine fuel management system increases from a low of 0% at or around 40% absolute engine load to 70% or 80% direct injection between approximately 60% to 140% absolute engine load.

126. Further, Ford's 3.5L EcoBoost engine, including its fuel management system, is further configured to provide fueling in a second torque range (e.g., each torque value below approximately 40% absolute engine load) where only port-fuel injection is used and the first fueling system is thus not operable.

127. In addition, in such engines, the fuel management system is also configured such that when the system fuels the engine at a torque value exceeding the second range (e.g., each torque value at or above approximately 40% absolute engine load) the spark ignition engine is operated in the first torque range.

128. Further, Ford's 3.5L EcoBoost engine, including its fuel management system, is further configured such that the fraction of fueling provided by direct injection increases with increasing torque in at least part of the first torque range, as indicated in the July 2018 report issued by the National Highway Traffic Safety Administration

129. Further, the Ford F-150 is equipped with what is known as a "three way" catalytic converter which is configured to ensure that the 3.5L EcoBoost engine, including its fuel management system, operates at a substantially stoichiometric fuel/air ratio. On information and belief, Ford's 3.5L EcoBoost engine, including its fuel management system, operates at a stoichiometric air/fuel ratio in at least part of the first torque range and in at least part of the second torque range.

130. Claim 11 is also illustrative of the claims of the '760 Patent. It recites: "[t]he fuel management system of claim 1, wherein the first fueling system is configured to introduce gasoline into the spark ignition engine and the second fueling system is configured to introduce gasoline into the spark ignition engine, and wherein the gasoline introduced by the first fueling system has a higher knock resistance due to vaporization cooling than the gasoline introduced by the second fueling system."

131. As described above, Ford's 3.5L EcoBoost engine, including its fuel management system, meets every element of Claim 1, and further meets every element of Claim 11 because Ford's 3.5L EcoBoost engine is configured such that gasoline is introduced into the engine by both direct injection and port fuel injection, and the gasoline introduced by the first fueling system has a higher knock due to vaporization cooling resulting from the direct injection of gasoline.

132. Ford's acts of infringement have damaged Plaintiffs, and Plaintiffs are entitled to recover from Ford for those damages in an amount to be proven at trial.

COUNT 4
WILLFUL INFRINGEMENT

133. Plaintiffs repeat and incorporate by reference each preceding paragraph as if fully set forth herein and further state:

134. Ford's infringement of at least the '965 Patent and '580 Patent was and continues to be willful.

135. For one non-exhaustive example, and as stated above, on April 17, 2015 Ford's chief intellectual property officer, Mr. Coughlin, indicated that Ford had studied Plaintiffs' intellectual property related to their dual injection technology and identified perceived weaknesses in Plaintiffs' patents—which included pending patent applications such as U.S. Patent App. No. 14/807,125, which matured into the '965 Patent. Dr. Cohn responded that a "rational way to proceed" on negotiations over a licensing agreement was for Ford to analyze the patents issued to Plaintiffs and "specifically identify where [Ford] thought the patents had weaknesses." In addition, at the same meeting, Mr. Coughlin asked for information about Plaintiffs' pending patent applications.

136. Further, when asked when Ford could get back to EBS on this issue, Mr. Coughlin responded "around two months." At the end of that two-month period, Ford identified no perceived weakness in any of Plaintiffs' patents.

137. Ford also told EBS on October 12, 2015 that it was "likely critical that we (Ford) are in a position to review all of the applications in the portfolio." On information and belief, Ford did review Plaintiffs' patents and pending patent applications, and yet Ford never identified to EBS any perceived weakness in any applications, including the application that ultimately resulted in the ''965 Patent. Instead, Ford told EBS in November 2015 that Ford had no plans to utilize the MIT/EBS dual port and direct fuel injection technology in Ford's products.

138. As demonstrated by the above, including by the announcement in Forbes Magazine's May 3, 2016 article that several of Ford's new engines featured "dual fuel systems with both direct and port injectors for each cylinder" and Ford's June 16, 2017 announcement that several of its new engines added "dual port and direct-injection technology to deliver more power and torque" than its previous engines, such representation was false when made.

139. Further, since making that statement, Ford has continued to willfully infringe at least the '965 Patent without identifying any perceived weakness in the patent or offering any explanation as to why Ford's identified products do not infringe such patent.

140. Ford received additional notice of the '965 Patent at least by November 4, 2019, when the '965 Patent Claims and the Published Patent Application underlying the '965 Patent were produced to Ford.

141. Further, Ford demonstrated its knowledge and awareness of at least the '965 Patent by serving discovery requests on April 30, 2019 that sought information on all patents and patent applications relating to U.S. Patent Application No. 11/100,026, which included the '965 Patent.

142. Further, Ford's statements to EBS in its August 30, 2019 invalidity contentions in the First Action, as well as each of Ford's four October 16, 2019 petitions filed in the *Inter Partes* Review Proceedings, illustrate Ford's awareness of and acknowledgement that the Asserted Patents involves the use of both port and direct fuel injection, and recite engines and fuel management systems in which the same fuel is introduced into the engine by both port-injection and direct-injection fueling systems.

143. Ford received additional and further notice of the '965,'580 Patents, and '760 Patents and underlying patent applications on January 21, 2020, February 21, 2020, March 31,

2020, June 14, 2020, and September 21, 2020 when Plaintiffs served on Ford Mandatory Notices Pursuant to 37 C.F.R. § 42.8 in the *Inter Partes* Review Proceedings.

144. In addition, the filing of the original complaint on May 27, 2020 provided Ford with further notice of the ’965 and ’580 Patents of the Asserted Patents such that any continued infringement by Ford after the filing date the original complaint constitutes willful infringement. Further, Plaintiffs’ September 29, 2020 email and their filing of the instant first amended complaint provided Ford with further notice of each of the Asserted Patents, including the ’760 Patent, such that any continued infringement by Ford constitutes willful infringement.

COUNT 5
VIOLATION OF PROVISIONAL RIGHTS UNDER 35 U.S.C. § 154(d)

145. Plaintiffs repeat and incorporate by reference each preceding paragraph as if fully set forth herein and further state:

146. On information and belief, Ford had actual notice of the Published Patent Application for U.S. Patent Application No. 14/807,125 (the “Published ’125 Application”) on or about December 24, 2015, the date the application was published. The ’125 Application eventually issued as the ’965 Patent.

147. The ’125 Application was published on or about the same time that the parties were discussing Ford’s potential licensing of EBS patents. At that time, Ford had actual knowledge of EBS and MIT’s portfolio of patents and patent applications, including all patents and patent applications relating to U.S. Patent Application No. 11/100,026, the original continuation-in-part application from which the ’965 Patent continued.

148. Further, Ford’s actual knowledge of Published ’125 Application was illustrated by Ford’s seeking discovery from EBS in the First Action, when Ford specifically requested from

EBS information on all patents and patent applications relating to U.S. Patent Application No. 11/100,026, the original continuation-in-part application from which the ’965 Patent continued.

149. At least one claim of the Published ’125 Application is substantially identical to at least one claim of the issued ’965 Patent.

150. Ford also received actual notice of the Published Patent Application for U.S. Patent Application No. 16/662,429 (the “Published ’429 Application”) on or about February 20, 2020, the date the application was published, when Plaintiffs served on Ford a Mandatory Notice Pursuant to 37 C.F.R. § 42.8 that disclosed to Ford the full list of patents and patent applications that continued from the ’026 Application, including the ’965 Patent and U.S. Patent Application No. 16/662,429, which eventually issued as the ’580 Patent.

151. Ford received further actual knowledge of the Published ’429 Application on March 31, 2020, when Plaintiffs served on Ford another Mandatory Notice Pursuant to 37 C.F.R. § 42.8 stating that “U.S. Patent Application Ser. No. 16/662,429 filed on October 24, 2019 . . . will issue on April 14, 2020 as U.S. Patent No. 10,619,580.”

152. At least one claim of the Published ’429 Application is substantially identical to at least one claim of the issued ’580 Patent.

153. On information and belief, Ford had actual notice of the Published Patent Application for U.S. Patent Application No. 16/831,044 (the “Published ’044 Application”) on or about July 16, 2020, the date the application was published. The ’044 Application eventually issued as the ’965 Patent.

154. The ’044 Application was published after the original Complaint in this case was filed May 27, 2020, alleging infringement by Ford of the ’965 and ’580 Patents. At that time, Ford had actual knowledge of EBS and MIT’s portfolio of patents and patent applications,

including all patents and patent applications relating to U.S. Patent Application No. 11/100,026, the original continuation-in-part application from which the '965, '580, and '760 Patents continued.

155. Ford received actual notice of the '044 Application on or about March 31, 2020, when Plaintiffs served on Ford another Mandatory Notice Pursuant to 37 C.F.R. § 42.8 disclosing "U.S. Patent Application Ser. No. 16/831,044 filed on March 26, 2020" as a patent application that continued from, and claimed priority to, U.S. Patent Application Ser. No. 10/991,774, filed November 18, 2004. Ford received a similar notice disclosing the '044 Application on June 14, 2020. And on September 21, 2020, Ford received further notice that "U.S. Patent Application Ser. No. 16/831,044 filed on March 26, 2020 . . . will issue on September 22, 2020 as U.S. Patent No. 10,781,760."

156. At least one claim of the Published '044 Application is substantially identical to at least one claim of the issued '760 Patent.

157. Ford has violated Plaintiffs' provisional rights pursuant to 35 U.S.C. § 154(d) by making, using, offering for sale, selling and importing infringing products, including Ford's "second generation" "EcoBoost" engines and fuel management systems, such as Ford's 2.7L EcoBoost engine and fuel management system, 3.5L EcoBoost engine and fuel management system, and High Output 3.5L EcoBoost engine and fuel management system, as well as Ford's 3.3L Ti-VCT and 5.0L Ti-VCT V8 engines and fuel management systems, and other Ford engines that utilize dual port and direct fuel injection.

158. Ford's violations of Plaintiffs' provisional rights under 35 U.S.C. § 154(d) have damaged Plaintiffs, and Plaintiffs are entitled to recover from Ford for those damages in an amount to be proven at trial.

DEMAND FOR JURY TRIAL

159. Plaintiffs hereby demand a jury trial on all issues so triable.

PRAYER FOR RELIEF

WHEREFORE, PLAINTIFFS ETHANOL BOOSTING SYSTEMS, LLC and the MASSACHUSETTS INSTITUTE OF TECHNOLOGY request entry of judgment in their favor and against DEFENDANT FORD MOTOR COMPANY as follows:

A. Declaring that Ford has infringed each of the Asserted Patents;

B. Declaring that Ford's infringement has been willful;

C. Declaring that Ford violated Plaintiffs' provisional rights pursuant to 35 U.S.C. § 154(d);

D. Awarding damages equal to those damages Plaintiffs have suffered as a result of Ford's infringement, including no less than a reasonable royalty pursuant to 35 U.S.C. § 154(d) and 35 U.S.C. § 284, enhanced damages pursuant to 35 U.S.C. § 284, costs, and prejudgment and post-judgment interest;

E. Awarding supplemental damages, with interest, to Plaintiffs with an accounting, as needed;

F. Permanently enjoining Ford and its parents, subsidiaries, affiliates, officers, directors, agents, servants, employees, successors and assigns, and all others in active concert or participation with any of the foregoing from any further acts of infringement of the Asserted Patents or, in the alternative, an award of a reasonable ongoing royalty for future infringement of the Asserted Patents by Ford;

G. Awarding of attorneys' fees pursuant to 35 U.S.C. § 285 or as otherwise permitted by law; and

H. Awarding such other costs and further relief as the Court may deem just and proper.

Dated: October 16, 2020

Respectfully submitted,

FARNAN LLP

/s/ Brian E. Farnan

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