



U.S. Department  
of Transportation

**Federal Railroad  
Administration**

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## **Information Guide on Positive Train Control in 49 CFR Part 236, Subpart I**

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### **Information Disclaimer**

This guide is intended to provide information regarding existing requirements in FRA's regulations governing positive train control (PTC) systems, Title 49 Code of Federal Regulations (CFR) part 236, subpart I. FRA is issuing this information guide pursuant to its general authority to prescribe regulations and issue orders for every area of railroad safety under Title 49 United States Code (U.S.C.) §§ 103(g) and 20103(a). FRA issued the requirements in part 236, subpart I pursuant to a statutory mandate under 49 U.S.C. § 20157. Except when referencing laws, regulations, policies, or orders, the contents of this information guide do not have the force and effect of law and are not meant to bind the public in any way.

### **Background**

PTC systems are designed to prevent train-to-train collisions, over-speed derailments, incursions into established work zones, and movements of trains through switches left in the wrong position. PTC systems use communication-based and processor-based train control technology to reliably and functionally perform these functions.

In October 2008, Congress passed, and the President signed, the Rail Safety Improvement Act of 2008 requiring PTC systems to be fully implemented by December 31, 2015, on Class I railroads' main lines that transport poison- or toxic-by-inhalation hazardous materials and any main lines with regularly scheduled intercity or commuter rail passenger service. In October 2015, Congress and the President extended the deadline for full implementation by at least three years to December 31, 2018, and required FRA to approve any railroad's request for an "alternative schedule and sequence" with a final deadline not later than December 31, 2020, if a railroad demonstrated it met certain statutory criteria by December 31, 2018.

On December 29, 2020, FRA announced that PTC technology was in operation on all 57,536 required freight and passenger railroad route miles, prior to the December 31, 2020, statutory deadline. Furthermore, as of that date railroads reported that interoperability had been achieved between each applicable host and tenant railroad that operating on PTC-governed main lines. In addition, as required, FRA certified that each host railroad's PTC system complies with the technical requirements for PTC systems. This accomplishment was the culmination of over a decade of sustained and direct engagement and collaboration among FRA and the now 42 railroads subject to the statutory mandate, which includes 7 Class I railroads, Amtrak, 28 commuter railroads, and 6 other freight railroads that host regularly scheduled intercity or

commuter rail passenger service, as well as key railroad industry associations, material suppliers, and service providers.

## **Frequently Asked Questions**

### **1) Why was PTC mandated in 2008, and where is it required to be operational?**

PTC was mandated by Congress through the Rail Safety Improvement Act of 2008 (RSIA) prompted by the 2008 Chatsworth train collision between a Union Pacific Railroad freight train and a Metrolink commuter train, resulting in 25 deaths.

PTC is currently implemented and operational on 57,536 route miles of the nearly 140,000 route miles that make up the U.S. rail network, just over 41%. These 57,536 route miles include Class I railroads' main lines over which five million or more gross tons of annual traffic and certain hazardous materials are transported, and main lines over which intercity or commuter rail passenger transportation is regularly provided.

### **2) When were FRA's PTC regulations put in place?**

FRA's PTC regulations were initially published on January 15, 2010, after approximately a year of public consultation following the passage of RSIA. FRA's PTC regulations are performance-based, requiring the system to slow or stop a train prior to four specific unsafe conditions.

### **3) What does a "performance-based regulation" mean?**

A performance-based regulation requires a system to perform a function or action but does not prescribe the exact design of the system. In the case of FRA's PTC regulations, PTC must be designed to prevent train-to-train collisions, over-speed derailments, incursions into established work zones, and movements of trains through switches left in the wrong position. How and with what technology a railroad reliably implements a PTC system is left for the railroad to decide.

It should be noted that the PTC statute also requires PTC systems to be interoperable, where interoperability means the ability to control locomotives of the host railroad and tenant railroad to communicate with and respond to the PTC system, including uninterrupted movements over property boundaries. Hence, although a host railroad may select the PTC technology it will use, the host railroad must also ensure that the PTC technology it implements is interoperable for all tenant railroads operating on the host's infrastructure, and the onboard component of any railroad's PTC system must be interoperable when operating as a tenant on other railroads' infrastructure.

### **4) What does "reliably and functionally prevent" mean?**

The statutory mandate directed FRA to issue regulations "specifying in appropriate technical detail the essential functionalities of positive train control systems." Under 49 CFR § 236.1005, FRA outlines how a PTC system must be configured to be considered to reliably and

functionally prevent train-to-train collisions, over-speed derailments, incursions into established work zones, and movements of trains through switches left in the wrong position.

In general, FRA regulations require the following actions to reliably and functionally execute the four required performance requirements of PTC:

- *Train-to-Train Collisions*: To prevent collisions, PTC enforces a positive stop in many cases, and it enforces restricted speed in other cases. There are varying requirements associated with interlocking arrangements where one or more PTC routes intersect with one or more non-PTC routes. *See* 49 CFR § 236.1005(a)(1)(i), (f).
- *Overspeed Derailments*: To prevent derailments caused by excessive speed, PTC is required to enforce civil speed limits, slow orders, and reduce excessive speeds over switches and through turnouts. *See* 49 CFR § 236.1005(a)(1)(ii).
- *Incursions into Established Work Zone Limits*: PTC enforces a positive stop prior to a train entering an established work zone without first receiving appropriate authority and verification from the dispatcher or roadway worker. *See* 49 CFR § 236.1005(a)(1)(iii).
- *Movement of a Train through a Switch in the Improper Position*: PTC is required to enforce restricted speed when a main line switch position is unknown or improperly aligned for a train's route in advance of the train's movement, if there is a wayside or cab signal system. PTC is required to enforce a positive stop before any main line switch and any switch on certain sidings, when the switch position is unknown or improperly aligned for a train's route in advance of the train's movement, but only if the movement over the switch is made without the benefit of the indication of a wayside or cab signal system, or in a condition with unacceptable risk. *See* 49 CFR § 236.1005(a)(1)(iv), (e).

As each type of PTC system is designed differently, it may perform or execute the mandated functions in different manners, which FRA reviews and approves in the associated PTC Safety Plans to help ensure compliance. In addition, there are four certification classifications under 49 CFR § 236.1015(e)—*i.e.*, a non-vital overlay system, a vital overlay system, a stand-alone system, and a mixed system. For example, a non-vital overlay PTC system is one that reliably executes the above functions and also is shown to obtain at least an 80% reduction of the risk associated with PTC-preventable accidents.

##### **5) Does PTC prevent all of the four accident types where PTC is installed?**

PTC systems are designed (and implemented) to reliably and functionally prevent train-to-train collisions, over-speed derailments, incursions into established work zones, and movements of trains through switches left in the wrong position. However, there are some events where PTC, as designed, is not able to prevent an accident:

- *Train-to-train collisions at or below restricted speed*: PTC enforces a positive stop prior to a train moving through a red signal. But there are operating rules that in some cases, allow a train to pass a red signal, with approval, at restricted speed. PTC will enforce

the upper limit of restricted speed, which is 20 miles per hour (mph) or 15 mph, per the railroad's operating rules. There have been some instances where a rear-end collision has occurred when a train is operating at or below restricted speed, when there was limited visibility, and the train operator did not operate the train ready to stop within one-half the range of vision.

- *Overspeed derailments at or below restricted speed:* PTC is required to enforce civil speed limits, slow orders, and excessive speeds over switches and through turnouts. As noted above, PTC enforces the upper limit of restricted speed. However, PTC will not necessarily prevent an overspeed movement through a turnout within a restricted speed area if the maximum speed of the turnout is below the maximum restricted speed threshold.
- *IncurSION into an established work zone:* PTC enforces a positive stop prior to entering an established work zone. There have been several near-misses between a train and maintenance of way (MOW) workers when the MOW workers inadvertently located themselves outside the established work zone or, alternatively, did not properly establish a work zone.
- *Movement through a switch in the wrong position:* PTC is required to enforce restricted speed when a main line switch position is unknown or improperly aligned for a train's route in advance of the train's movement, if there is a wayside or cab signal system. As noted above, PTC enforces the upper limit of restricted speed. There have been some instances where a train has derailed due to the movement through a misaligned switch, noting that depending on visibility and terrain, the train operator must operate the train ready to stop within one-half the range of vision.

FRA reminds the industry that *Restricted speed* means a speed that will permit a train or other equipment to stop within one-half the range of vision of the person operating the train or other equipment, but not exceeding 20 mph, unless further restricted by the operating rules of the railroad. 49 CFR §§ 236.812, 236.1003.

## **6) What types of accidents are not prevented by PTC?**

Most PTC systems are an overlay to the underlying signaling system and rely upon the signal system for train detection, interlocking control, and train routing. In the event of a failure of the signal system, PTC may not be able to continue to reliably perform. For example, in the event of a loss of shunt, specifically failure of track circuit train detection, the signal behind this failure may show proceed and a train in PTC could be at risk of a rear-end collision.

Further, PTC will protect only a correctly established work zone. FRA has seen incidents where a work zone was put into place incorrectly by the roadway worker in a split control point. FRA has also seen a situation where a roadway worker requested a work zone on the wrong main track. PTC will enforce only the work zone put in place by the dispatcher. If the work zone is requested in the wrong location, PTC will enforce the established work zone, not the "intended" work zone. FRA reminds the industry that following established procedures and being

knowledgeable of the track layout and any unique locations, such as split control points, when requesting a work zone is paramount to PTC protecting the work zone.

## 7) How many PTC systems are currently in operation?

Please see below for a brief description of the five FRA-certified PTC systems that are currently in operation.

### **Interoperable Electronic Train Management System (I-ETMS)**

- GPS- and radio-based system
- Used by Class I railroads, Amtrak (off the Northeast Corridor (NEC)), and most commuter railroads not operating on the NEC and short line railroads

### **Advanced Civil Speed Enforcement System II (ACSES II) and the Advanced Speed Enforcement System II (ASES II)**

- Transponder and radio-based system overlaying a cab signal system and/or automatic train control (ATC) in most locations
- Used by most railroads on the NEC

### **Enhanced Automatic Train Control (E-ATC)**

- Track circuit-based ATC system with additional functionality to comply with PTC requirements
- Used by several railroads with limited interoperability needs and pre-existing ATC systems in place

### **Incremental Train Control System (ITCS)**

- Radio- and transponder-based system
- Used by Amtrak in Michigan

### **Communication Based Train Control (CBTC)**

- Track circuit and transponder-based system
- Used by PATH

## 8) How is a PTC system approved?

The process outlined in FRA's regulations for PTC approval includes multiple phases:

- A PTC Development Plan (PTCDP) is prepared by at least one railroad to outline the high-level design and operating concept of the PTC system to be developed to meet the PTC regulations. The PTCDP is the core document that enables FRA to determine whether the proposed PTC system could, if implemented, meet the statutory and regulatory requirements. If FRA approves a PTCDP for a particular system, FRA may issue that system a Type Approval, which other railroads using the same system may rely on.
- A PTC Implementation Plan (PTCIP) is prepared by each host railroad subject to the PTC regulations that documents, among other things, where a PTC system must be

installed, the sequence of installation, and how each applicable tenant railroad will achieve PTC system interoperability.

- A PTC Safety Plan (PTCSP) is prepared by each host railroad to reflect the as-built PTC system and document the design, the system hazards and risks, and the system safety analysis, as well as a range of other information such as the railroad's approach to testing, verification and validation, configuration management, training, and records management.

## 9) When is it allowable to operate with PTC disabled:

In general, any railroad that operates on a PTC-mandated track segment must ensure its controlling locomotives are equipped with a fully operative and functioning PTC system. 49 CFR § 236.1006(a). However, FRA's PTC regulations and the statutory mandate recognize that PTC technology may sometimes experience failures and be disabled.

### *Is the train crew or other craft of railroad employee able to "turn off" PTC?*

Disabling a PTC system without permission or circumventing a PTC enforcement is subject to civil penalty or disqualification for the responsible locomotive engineer or conductor. When PTC is disabled, the PTC system is unable to initiate the brakes to prevent a train-to-train collision, over-speed derailment, incursion into an established work zone, or the movement of a train through a switch left in the wrong position.

### *Can a train operate in PTC territory with PTC "turned off"?*

The law and FRA's regulations have provided certain operational flexibilities, the last of which are in effect until December 31, 2022, knowing that railroads may still be resolving initial reliability issues in their PTC systems:

- In 2021, a railroad could operate a train on PTC-mandated territory if its PTC system had failed to initialize and if the PTC system had failed *en route*, with no operating restrictions.
- In 2022, a railroad can operate a train on PTC-mandated territory if its PTC system had failed to initialize and if the PTC system has failed *en route*, with operating restrictions.

In 2023 and beyond, the only time a railroad may lawfully operate on PTC-mandated territory without a functioning PTC system is if the PTC system has failed *en route*, including malfunctions and other cut outs. In the instance of a PTC failure *en route*, the train may operate, with speed limitations, no farther than the next forward designed location for the repair or exchange of onboard PTC apparatuses. The operating restrictions relating to speed are required under 49 CFR §§ 236.567 and/or 236.1029.

In general, if any safety-critical PTC system component fails to perform its intended function, the cause must be determined and the faulty component adjusted, repaired, or replaced without

undue delay. Until repair of such essential components is completed, a railroad shall take appropriate action as specified in its PTCSP. 49 CFR § 236.1029(a).

### **10) What must a railroad do when PTC fails?**

In 2023 and beyond, if a train fails to initialize as a result of an on-board PTC failure, a failure of the PTC wayside infrastructure or failure of the PTC back-office, a train shall not operate, as any railroad that operates on a PTC-mandated track segment must ensure its controlling locomotives are equipped with a fully operative and functioning PTC system. 49 CFR § 236.1006(a). Hence, the train without a fully operational PTC system must not operate.

Currently and in 2023 and beyond, if a train's PTC system fails *en route*, including failures caused by an on-board PTC failure, a failure of the PTC wayside infrastructure or failure of the PTC back-office, the train may operate, with speed limitations, no farther than the next forward designed location for the repair or exchange of onboard PTC apparatuses. The operating restrictions relating to speed are required under 49 CFR §§ 236.567 and/or 1029.

In general, if any safety-critical PTC system component fails to perform its intended function, the cause must be determined and the faulty component adjusted, repaired, or replaced without undue delay. Until repair of such essential components is completed, a railroad shall take appropriate action as specified in its PTCSP. 49 CFR § 236.1029(a).

### **11) Are PTC failures reported to FRA, and if so, how are they investigated?**

Throughout railroads' testing and implementation of PTC technology, FRA has collected data about the performance and reliability of railroads' PTC systems. Such data supported railroads' PTCSPs and FRA's certification of each host railroad's PTC system.

FRA continues to oversee the performance and reliability of PTC technology by reviewing, for example, failure-related notifications that railroads, vendors, and suppliers submit under 49 CFR § 236.1023, *Errors and malfunctions*. Of particular note is the requirement to notify FRA, within 15 days of discovery of a failure, malfunction or defective condition that decreased or eliminated the safety functionality. This notification must, in general, provide specific details regarding the failure, malfunction or defective condition, the status of measures to rectify, and any counter measures to mitigate the condition. FRA tracks these reports, performs inspections to validate rectification of the conditions and performs audits of railroads' compliance with its processes and procedures to monitor, report and rectify PTC failures, malfunctions, and defective conditions.

Notably, railroads must also submit Quarterly Reports of PTC System Performance (Form FRA F 6180.152, OMB Control No. 2130-0553)—pursuant to FRA's PTC regulations and 49 U.S.C. § 20157(m). Railroads' Reports of PTC System Performance provide key information about each host railroad's and its applicable tenant railroads' PTC system initialization failures, cut outs, and malfunctions during the reporting period. In addition, these reports include information about PTC technology's positive impact on rail safety, including the number of accidents and/or incidents prevented by a PTC system. FRA began requiring railroads to submit

Form FRA F 6180.152 in 2021, to enable FRA to effectively oversee the rate at which PTC system failures occur and to evaluate improvements over time.

In addition, FRA utilizes railroads' performance-related reporting to help prioritize FRA's general audits and targeted audits of railroads' operation of their PTC systems.

**12) If a railroad needs or wants to modify a PTC system, is a further FRA approval needed?**

In general, 49 U.S.C. § 20157(h) requires FRA to certify that a host railroad's PTC system complies with FRA's PTC regulations, before the technology may be operated in revenue service. Before a railroad can make certain changes to an FRA-certified PTC system or the associated FRA-approved PTCSP, a host railroad must submit, and obtain FRA's approval of, a request for amendment (RFA) to its PTCSP under 49 CFR § 236.1021.

FRA's regulations at 49 CFR § 236.1021(h) identify the types of proposed changes that trigger the filing of an RFA to a railroad's PTC system and PTCSP. Specifically, a railroad is required to submit this type of RFA, for FRA's review and approval, if the railroad seeks to:

- Modify a safety-critical element of its PTC system; or
- Modify its PTC system in a way that would affect the safety-critical functionality of any other PTC system with which it interoperates.

FRA's regulations provide, under 49 CFR § 236.1021(e), that FRA will publish a notice in the *Federal Register* and invite public comment on these RFAs. As such, the public has an opportunity to review a railroad's incoming RFA and submit comments to FRA during the timeframe specified in the *Federal Register* notice. FRA reviews any submitted comments during its review-and-decision process.

FRA is required by regulation to approve, approve with conditions, or deny a railroad's RFA to its PTCSP within 45 days of the date on which the RFA was filed under 49 CFR § 236.1021(m). A railroad's incoming RFA and FRA's decision letters are available to the public in the respective railroad's PTC docket on [regulations.gov](https://www.regulations.gov). Hyperlinks to railroads' PTC dockets are available at <https://railroads.dot.gov/train-control/ptc/ptc-annual-and-quarterly-reports>.

In addition, railroads are required to submit RFAs to their PTCIPs, subject to FRA's review and approval, for certain types of proposed changes, including if a railroad seeks to:

- Initiate a new category of service (e.g., passenger or freight);
- Add, subtract, or otherwise materially modify one or more lines of railroad which implementation of a PTC system is required; or
- Decrease the PTC system's limits (e.g., by excluding or removing a PTC system from a track segment).



**13) If there are only five (5) approved PTC systems, why does each railroad need to submit a PTC Safety Plan for approval?**

As noted above, the statutory mandate requires FRA to certify that *each host railroad's* PTC system complies with FRA's PTC regulations before the technology may be operated in revenue service. In its own PTCSP, each host railroad must provide a complete description of the "as built" PTC system with its associated safety case, as each host railroad's operating environment, design choices, and ongoing operation and maintenance procedures may vary.

Following notice-and-comment, FRA modified its PTC regulations in July 2021, among other reasons, to permit host railroads utilizing the same type of PTC system, with the same certification classification, to submit *joint* RFAs to their PTCSPs and PTC Development Plans. Appreciating that changes to safety-critical elements, including software or system architecture, of a certain PTC system will likely impact multiple, if not most, railroads operating that same type of PTC system, 49 CFR § 236.1021(l) and (m) outline specific instructions for such host railroads to submit joint RFAs. FRA recognizes that modifying and simplifying the process for host railroads to submit RFAs to PTCSPs for FRA-certified PTC systems is necessary to facilitate required maintenance and upgrades to PTC technology and encourage railroads to enhance their PTC systems to continue to improve rail safety.

**14) If I want more information about a PTC system and how it works, who should I ask?**

To learn more about PTC technology, please visit FRA's websites at <https://railroads.dot.gov/train-control/ptc/positive-train-control-ptc> and <https://railroads.dot.gov/train-control/ptc/positive-train-control-ptc-information-rd>.

For convenience, all active PTC dockets are hyperlinked on FRA's website at <https://railroads.dot.gov/train-control/ptc/ptc-annual-and-quarterly-reports>. If you have any questions, please contact FRA's subject matter experts by sending an e-mail to [PTC.correspondence@dot.gov](mailto:PTC.correspondence@dot.gov).