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D2.1
Preliminary Operational Procedures

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1 Executive Summary

This document constitutes Deliverable 2.1 Preliminary Operational Procedures of ER JU Flagship Area 5 project FP5-TRANS4M-R. The document reports results from task 2.1 **Target operational procedure** description. The project aims to boost innovation for the European rail freight sector, concretely by developing, validating and demonstrating FP5-TRANS4M-R technical enablers.

The objective of this document is to provide the first agreed throughout Europe target operational procedures for rail freight. The procedures will define the basis for the development of the innovations for WP3-WP12. It describes the **target of full automation of the freight sector**, as well as a subset based on the agreed technical enablers in FP5-TRANS4M-R.

The section Methodology explains how WP2 intensively aligned the various version of the target operational procedures within the project, as well as within the sector. Sections General Assumptions and Premises as well as Definitions lay the foundation to understand the framework under which the processes must be read.

At the centre of this document are the Target Operational Procedures, describing unified processes how to **operate the Full Digital Freight Train in Europe**. The detailed processes are accompanied by detailed process-descriptions.

These are followed by a special version of the target procedures focussing on the to be delivered technical enablers in FP5-TRANS4M-R.

Keywords: Operational Procedures; Full Automation; Technical Enabler

2 Abbreviatons & Acronyms

Abbreviation / Acronym	Description
ABT	Automated brake test
ASO	Automated Shunting Operations
ATO	Automatic Train Operation
BMDV	Federal Ministry of Digital Affairs and Transport
CBA	Cost Benefit Analysis
CCS	Control-Command and Signalling
CCU	Central Control Unit
DAC	Digital Automatic Coupler
DAC4	DAC level 4
DAC4EU	Digital Automatic Coupling for Europe
Demo	Demonstrator
DPS	Distributed Power System
EDDP	European DAC Delivery Programme
EIM	European Rail Infrastructure Manager
EP	ER JU Process
ER JU	Europe's Rail Joint Undertaking
ETCS	European Control System Unit
FA	Flagship Area
FDFT	Full Digital Freight Train
FDFTO	Full Digital Freight Train Operations
FP	Flagship Project
FPSE	Flagship Project System Engineers
GCU	General Contract of Use for Consist
HMI	Human Machine Interface
IM	Infrastructure Manager
MAWP	Multiannual Work Plan
OPE	Operational Procedures
RU	Railway Undertaking
SG	Subgroup
SPE	Single pair ethernet
TIS	Technical Innovation Circle for Rail Freight Transport
TP	Target Process
TRL	Technology readiness level
TSI	Technical Specifications for Interoperability
UIC	International Union of Railways
WP	Working package

Table 1: Abbreviation & Acronyms

3 Background

The present document constitutes the Deliverable D2.1 “Preliminary Operational Procedures” in the framework of the Flagship Project FP5-TRANS4M-R as described in the EU-RAIL MAWP.

The project aims to boost innovation for the European rail freight sector, concretely by developing, validating and demonstrating FP5-TRANS4M-R technical enablers. The work to reach this level of TRL is complex and thus divided into several work packages highly dependent on each other. See WP structure in Figure 1 below

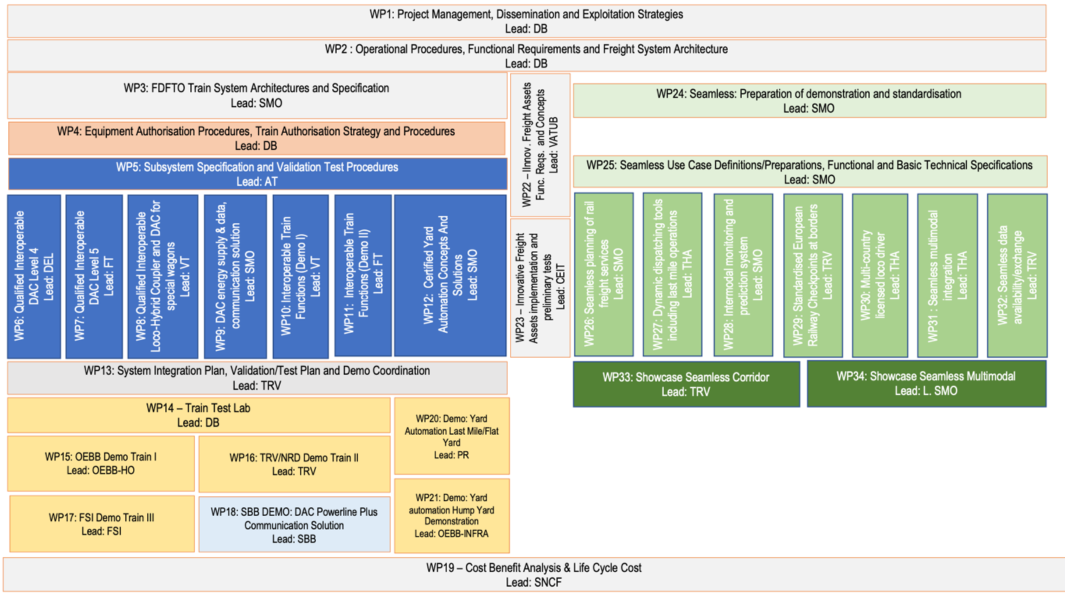


Figure 1: WP-structure in FP5-TRANS4M-R.

WP2 is leading, coordinating and developing the operational procedures within FP5-TRANS4M-R, not only for the FDFTO, which is the focus, but also including the work of the other innovation workstreams (yard automation, innovative freight assets and seamless).

3.1 EDDP WP1 SG4

In European DAC Delivery Program EDDP Working Package 1 “DAC Technology, Operations and Standardisation” 120 participants from 59 companies from 13 European countries have contributed to the development of specifications for the DAC, the electrical energy and communication system for freight trains as well as to the development of future processes for DAC operations in rail freight. The analysis of today’s operational processes and setting-up of future processes for rail freight with DAC has been worked out by WP1 sub-group 4 with altogether 47 participants.

In a first step the operational processes with respect to coupling and uncoupling procedures in rail freight transportation have been analysed in different infrastructural conditions like e.g. shunting in marshalling yards with hump operations, shunting in customer sidings and intermodal terminals as well as shunting in workshops and shunting of damaged Consist. For analysing the current processes and defining the future processes with a DAC five railway undertakings which have contributed to EDDP WP1 have developed case studies for real transports. In these case studies at first today’s process for train preparation and shunting with screw coupler has been analysed. In a second step it has been investigated which how train preparation and shunting processes would look like with DAC and further technical enablers like e.g. automated brake test.

In a second step the impacts of operational processes on the DAC functional requirements have been analysed. Here, several options for DAC operations have been taken into consideration, like e.g.

- Functional level of the DAC (DAC4 with manual uncoupling, DAC4.5 with automated uncoupling by pushing a push-button and DAC5 with remote controlled uncoupling from the cabin of the locomotive or a control tower).
- Position of a manual uncoupling mechanism.
- Availability of a prevent-coupling position in the DAC.

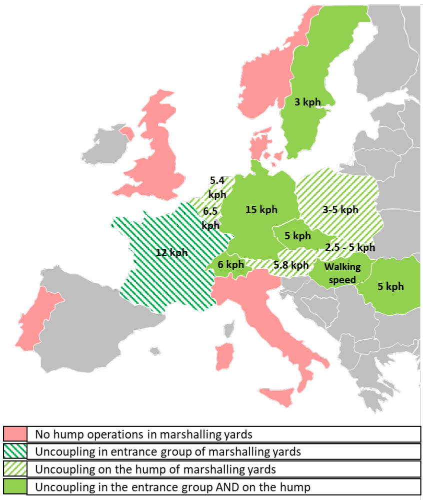
Finally, the future operational DAC-processes have been defined in a draft version. The results of EDDP WP1 sub-group 4 on future DAC processes have been documented in *DACcelerate* report D3.2 “Technical Specifications and Operational Rule” (see also chapter 3.2). The results of EDDP WP1 sub-group 4 have been handed-over to FP5-TRANS4M-R in July 2022 and serve as a basis for further development of future FDFTO operational processes.

3.2 Assessment of DAC affected operational processes (DACcelerate)

For defining future operational processes with a DAC, it is necessary to analyse in which situations freight trains are being coupled and uncoupled. Thus, together with EDDP WP1 SG4 *DACcelerate* analysed different shunting situations like in marshalling yards, in customer sidings and intermodal terminals, in Consist workshops and in case of shunting of damaged Consist. For each of these situations case studies have been developed, showing the current processes and defining how the process would work with a DAC (REF_1).

During the discussions with RU and IM it became obvious that there is no typical European operational process for shunting in marshalling yards or for operations in customer sidings and terminals. This is especially true due to different infrastructural conditions e.g. in marshalling yards which require different operational processes.

In a survey carried out by European Rail Infrastructure Managers EIM in December 2021 on request by EDDP WP1 SG4 it has been analysed in which European countries hump operations in marshalling yards are common practice and if yes, where the Consist are uncoupled before going over the hump and being sorted into the classification tracks. Additionally, it has been analysed at which speeds the Consist are being shunted over the hump and whether a so-called push-off operations, where the locomotive pushes Consist away in order to sort them into a track is allowed and applied or not. Figure 2 shows the results of this survey of EIM.



AT	• Uncoupling on the hump • Push-off operations allowed and common practice	Max. hump speed 5.8 kph
BE	• Uncoupling on the hump – only at 2 yards in Antwerps • Push-off operations allowed - only at 2 yards in Antwerps	Max. hump speed 6.5 kph
CZ	• Uncoupling in entrance group and on the hump • Push-off operations allowed and common practice	Max. hump speed 5 kph
FR	• Uncoupling in entrance group • Push-off operations not allowed	Max. hump speed 12 kph
DE	• Uncoupling in entrance group and on the hump • Push-off operations allowed and common practice	Max. hump speed 15 kph
HU	• GYSEV: no hump operations / MAV: uncoupling on the hump • Push-off operations allowed	Max. hump speed Walking speed
NL	• Uncoupling on the hump • Push-off operations not allowed	Max. hump speed 5.4 kph
PL	• Uncoupling only on the hump • Push-off operations allowed, but only used in smaller stations	Max. hump speed 3 - 5 kph
RO	• Yes, humps are existent; use decreases • Push-off operations allowed, but only used in major marshalling yards	Max. hump speed 5 kph
SK	• Uncoupling on the hump • Push-off operations allowed and common practice	Max. hump speed 2.5 - 5 kph
SE	• Uncoupling dep. on RU rules, generally in entrance group. & on hump • Push-off operations allowed and used in marshalling yards	Max. hump speed 3 kph
CH	• Uncoupling in entrance group and on the hump • Push-off operations practiced by SBB Infra.but not by SBB Cargo	Max. hump speed 6 kph
DK, IT, NO, PT, UK	• No hump operations in marshalling yards	

Figure 2: Different operational Processes in marshalling yards

Source: EDDP WP1 SG4 DAC operations / EIM (January 2022)

In countries like e.g. Norway, UK, Portugal or Italy humps are not used in marshalling yards for sorting of the Consist. In France hump operations are executed. Here, the Consist are being uncoupled only in the entrance group before being pushed onto the hump with speeds up to 12kph. In other countries like e.g. Poland, Slovakia or Austria it is just the opposite way, that Consist are uncoupled on the hump at walking speeds so that operational staff is capable of manual uncoupling of the Consist. In other countries like e.g. Czech Republic, Germany, Hungary, Romania or Sweden both ways are practiced: uncoupling of Consist in the entrance group as well as uncoupling on the hump.

The same differences exist in European rail freight operations when talking about push-off-operations. In some countries push-off operations is allowed and common practice, in other countries push-off operations is forbidden.

3.3 Additional Initiatives

Previous to FP5-TRANS4M-R and in addition to the already mentioned initiatives EDDP and DACcelerate, there already have been multiple (national) initiatives preparing the development of DAC and the FDFT. Various output has been taken into account while designing this deliverable. Exemplary, some of the major initiatives of the Core-Team members are stated.

The following initiatives present results based on the respective project state of knowledge and may therefore deviate from the contents now valid and developed in ER JU FP5-TRANS4M-R WP2. With ongoing projects, FP5-TRANS4M-R is in a constant alignment, results of already closed projects are superseded with the presented results in the document.

3.3.1 DAC4EU

DAC4EU is a BMDV pilot project to accelerate the DAC migration process for the demonstration, testing and approval of DAC was awarded to the DAC4EU consortium (Digital Automatic Coupling for Europe) on 22 June 2020 (REF_2).

This project involves various manufacturers' coupling prototypes being tested in order to determine the basic principles for the selection of a standard DAC for Europe. After completion of the test series in Phase I, a demonstrator train with the DAC type selected by the EDDP was constructed and then tested under real operational conditions in Phase II. The project is being conducted on behalf of the Federal Ministry of Digital Affairs and Transport (BMDV) from June 2020 to December 2022 and is funded with approximately 13 million euros. In October 2022, the contract was awarded for an extension of the project until June 30, 2024, with additional financing of around 7 million euros. This is to ensure that the necessary further developments of the coupling systems are accompanied.

The objective of phase I was to compare the performance of various coupling systems by carrying out selective individual tests under controlled ambient conditions.

In phase II, the DAC4EU demonstrator train will be gradually extended to 24 Consist with the chosen coupling design. Operational sequences and processes which are affected by using a DAC when forming, breaking up and operating trains are to be tested with the DAC prototypes.

The exchange with the DAC4EU project was very relevant, especially with regard to phase II, as the test results and experience reports had a direct influence on the development of the process. In this way, the process steps could be adapted to the real conditions and needs. Processes that have benefited a lot from this are, for example, "uncoupling" or "hump yard shunting"

3.3.2 TARO

TARO (Towards Automated Railway Operation) is research project, funded by the "Austrian Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK)" and "The Austrian Research Promotion Agency (FFG)", with the aim of supporting automation and digitalisation in rail traffic. The project was launched in June 2020 and will end in December 2023 (REF_3).

Work Package 5 focusses on topics related to the DAC type 4. In addition to topics such as fleet analyses, analysis of testing, simulation of migration scenarios and consideration of functional requirements, process analyses were also carried out. The current steps of the operational process were identified and compared to the target process steps with a DAC type 4. In a further step, a national target process with additional automation components was developed and synergies and advantages were identified. These results were introduced into the EDDP (Europe DAC Delivery Programme) and later ER JU in order to be able to design a harmonised target process together with other European railways.

3.3.3 Automation Programme (Switzerland)

SBB Cargo launched the Automation programme in 2015 with the aim of making SBBC technologically fit for future market requirements, strengthening its core business with intelligent transport solutions, leveraging the necessary efficiency gains in production and, last but not least, not missing contact with road transport, which is also working intensively on automation processes. Automation offers by far the greatest leverage for future efficiency measures in production. In addition, there is pressure to act due to the demographic development of the area staff and as a result of changed customer demands.

In the automation programme, solutions were developed together with various technology partners, some of which are already being used in trial or pilot operations.

- The automatic coupler (AKU2) (Scharfenberg type 2, Cargoflex from Voith) has been in use in the operational traffic of SBB Cargo's inland CT network since May 2019.
- The digital test logic has been in test use since 2018, whereby in addition to way side cameras, the associated software is also installed and continuously developed.
- The automatic brake test has been implemented and thoroughly tested on all Consist equipped with an automatic coupler.
- The final steps are currently being taken to obtain the operating licence so that the system can be used operationally from around autumn 2023.
- The installation of cameras and radar technology planned for the shunting locomotives to monitor the track in one person shunting operations had to be suspended due to technological requirements (data transmission, ergonomics). However, SBB Cargo is currently involved in the further development of the "Driver Assistant System" (DAS) together with SBB Infrastructure and SBB Passenger Traffic.

The individual programmes are funded by the Federal Office of Transport with support contributions.

3.3.4 TRUST5

TRUST5 project financed by European Commission was a one-year project from May 2021 to May 2022 aiming at assessing the feasibility of a DAC Type5. The TRUST5 consortium was composed of fret SNCF, Wabtec, Captrain Italia and Trafikverket. (REF_4)

TRUST5 objectives and methodology

Modal shift needs a breakthrough in rail freight performance. That breakthrough will be driven by a high level of automation of Railway Undertakings operations. In that way, the TRUST5 consortium wanted to overcome the half automatic coupler DAC4 (without automated uncoupling). The TRUST5 project, completing EDDP studies, proposes an assessment of the **full automatic coupler DAC5.**

DAC5 Benefits

Hump yard:

Studies have been realized on the main French Marshalling Yard Woippy. The operational process can be deeply reviewed and streamlined with DAC5.

Efficiency gains (number of Consist dealt with per shunter) would be around 30% without combination with digital brake test (40% with brake test) compared to the current situation with the same volume. And the throughput of the marshalling yard would be improved which is especially interesting during peak times. DAC5 would improve the efficiency and speed of the Push Off (shunting maneuvers outside of a hump yard whilst pushing unbraked Consist use case too.

Customer siding:

The use of DAC5 allows to speed up the process. However, the analysis must be done on all tasks and not only coupling and uncoupling that represent less than 20% of shunter tasks according to Tergnier analysis. The potential gains are important on a “single staff” mode that is to say in combination with others automation components (digital brake test, rear camera, technical visit automation, etc.).

Global Transformation :

The use of DAC5 opens the way to a 24/7 pace of our operations. It allows a huge improvement of the service level (transit time, frequency, reliability), key factor of the rail freight attractiveness and modal shift.

Feasibility

Wabtec and Trafikverket tested a DAC5 coupler in Sweden, it has been possible to remotely uncouple couplers between two Consists. We notice that other suppliers are already working on DAC5 prototypes.

DAC4EU consortium added several components to the DAC4, to build a DAC4.5. It includes an activator, a side Button, a remote control of the side button. Therefore, the DAC4.5 needs more components than the DAC5. If we consider that the DAC4 is reachable, then the DAC5 is reachable.

The only specific component of the DAC5 is the remote application (Driver-Machine Interface) and associated software. Those can be developed and validated before 2025.

A study has been performed on automated Immobilization function. Several technological solutions are identified. Different paths can be followed, from adapting and enhancing already existing technologies in other Railway applications (Passenger) to developing a new technological sub-system integrated in an overall new system architecture and especially new brake system architecture.

Safety

Regarding Staff Safety, DAC5 eliminates arduous postures, and staff doesn't need to stay close to the dangerous zone (where Consist are moving).

About Railway Safety, DAC5 allows a positive result, because it becomes possible to introduce controls (right location, right speed, right Consist…) between the command of an uncoupling on an interface and its execution between 2 couplers. The major risk identified is unwanted uncoupling both during train run or whilst the train is standing inducing roll away risk of uncoupled Consist. However, this risk can be addressed with solutions that allows to deactivate the uncoupling command when uncoupling is forbidden.

The Cyber Security study of TRUST5 has assessed the threats with state-of-the-art methodology (STRIDE, I EC62443). Its conclusion is that standard solutions are able to cope with these threats.

In addition to the described topics migration and DAC5 cost estimation were also carried out.

3.3.5 Automated Brake Test via TIS

In 2021, the TIS WG ABT was established in the Technical Innovation Group Rail Freight (TIS) to harmonise the requirements for an Automatic Brake Test (ABT). In this TIS Working Group ABT, railway undertakings, Consist keepers, Consist manufacturers, system suppliers etc. are working together at European level on the development of an automatic brake test system that can be used intermodally. The following subgroups were formed to work on the different topics:

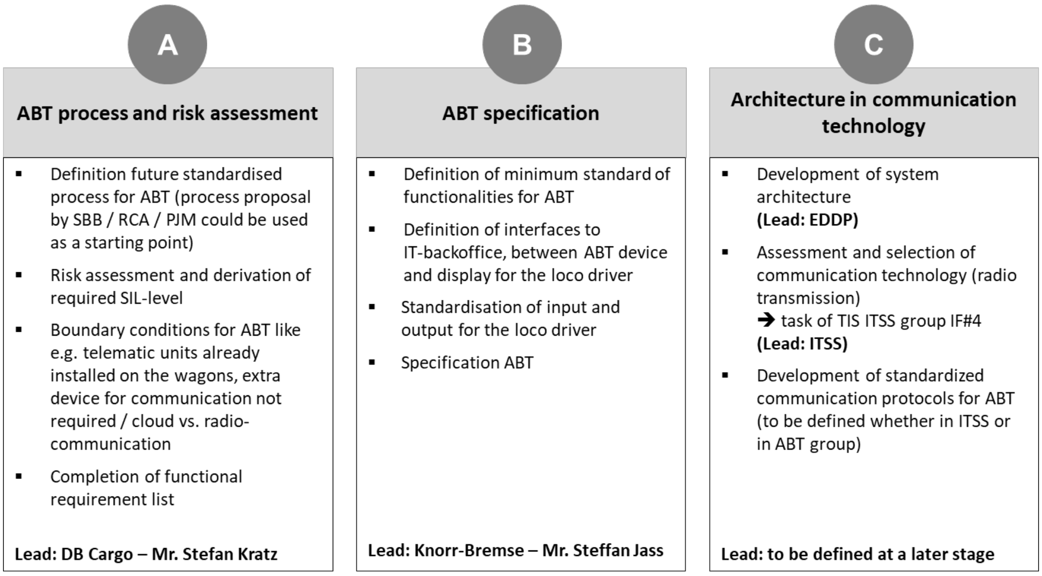


Figure 3: ABT in TIS

At the same time, DB Cargo AG, in cooperation with the Technical University of Berlin, launched the R&D project "Establishment of a test field for the automation of the brake test in the rail freight transport" in December 2020, which is funded by the Federal Ministry of Digital Affairs and Transport. The aim of this project is to evaluate the operational suitability of various solutions from three providers on the market in pilot tests and to define the requirements of the industry as a whole. The result is a set of specifications for the automated brake test that is accepted throughout the industry and Europe, and which describes an approvable, interoperable and at the same time economical solution. With a successful project conclusion, the introduction of the automated brake test in the German and European rail freight transport market could be initiated.

4 Objective/Aim

The objective of this document is to provide the first agreed throughout Europe target operational procedures for rail freight. The procedures will define the basis for the development of the innovations for WP3-WP12. It describes the target of full automation of the freight sector, as well as a subset based on the agreed technical enablers in FP5-TRANS4M-R.

4.1 Task description

Task 2.1 started in month one and the outputs of these tasks are included in this document. The following table gives the direct match of the task definition from the proposal with the output and a link to the section where more details can be found.

	Task definition from proposal (Task 2.1)	Output of WP2
Task 2.1	A State-of-Art documentation by ADIF, RENFE, DB, OEBB-RCA OEBB-INFRA, PR, SNCF, TRV, of existing operational processes and their risk & safety related aspects, EDDP outcomes and a thorough set of available operational information and data, will be consolidated in a document, serving as a foundation for defining the future FDFT operational procedures.	Background Methodology Operational Procedures
Task 2.1	The task will describe the personas (users) directly involved in the process, their roles and the necessary human-machine interaction.	Definitions and Explanations Operational Procedures (incl. detailed process descriptions)
Task 2.1	The partners will identify critical differences between members States/Regions (EU-25, CH/NO/UK and South-Eastern countries) in the existing processes, again in relation to the EDDP and elaborate additional relevant use cases: for all types of infrastructural sites like customer sidings, marshalling yards, terminals etc.	EDDP WP1 SG4 Assessment of DAC affected operational processes (DACcelerate) Operational Procedures

	Task definition from proposal (Task 2.1)	Output of WP2
Task 2.1	In-depth description of the procedures from user perspective at least for: i) train preparation, ii) shunting, iii) train run, iv) Consist monitoring (telematics), v) goods monitoring, vi) loading & unloading and maintenance, shall serve as input for functional requirements derivation of the of the interoperable FDFTO components.	Operational Procedures 1. TP03 - Train Preparation 2. TP01 - Shunting Preparation 3. TP04 - Train Run 4. TP30 - Switch to FDFT mode Shunting & TP31 – Switch to FDFT mode Train Run 5. TP30 - Switch to FDFT mode Shunting & TP31 – Switch to FDFT mode Train Run 6. Flat shunting & TP07 - Flat Shunting Drop Off, TP08 - Flat Shunting Pick Up 7. Flat shunting & TP07 - Flat Shunting Drop Off, TP08 - Flat Shunting Pick Up
Task 2.1	The supplier industry will be responsible to gather, and elaborate on the technical feasibility, identify constraints, and assess the reliability of the new technologies related to the destination 5 technical enablers (addressed in the WP6 to WP12)	Methodology ER JU Processes

Table 2: Task description matched with output in deliverable

4.2 Outline of deliverable 2.1

The outline of this deliverable is the following:

Section 1-4: Summary, Abbreviations, Background & Objective

Section 5: Methodology

Section 6: Definitions and Explanations

Section 7: General Assumptions and Premises

Section 8: Operational Procedures

Section 9: Conclusions

Section 10: References

The section Methodology explains how WP2 intensively aligned the various version of the target operational procedures within the project, as well as within the sector. Sections General Assumptions and Premises as well as Definitions and Explanations lay the foundation to understand the framework under which the processes must be read.

At the centre of this document are the Target Operational Procedures, describing unified processes how to operate the Full Digital Freight Train in Europe. The detailed processes are accompanied by detailed process-descriptions.

These are followed by a special version of the target procedures focussing on the to be delivered technical enablers in FP5-TRANS4M-R.

5 Methodology

This chapter outlines the methodology used for designing the processes and which personnel was involved to formulate them.

5.1 Team composition

The work to design new processes for DAC and Full Digital Freight Train already started during the EDDP (see chapter 3.1) and was now continued in ER JU WP2. The task was to develop uniform, European processes with the aim of future standardisation and European harmonisation of operational processes. These were to be made leaner and more efficient by increasing the degree of automation. The main focus is to develop an Intelligent Freight Train and to achieve a complete digitalisation of rail freight transport.

The WP2 is led by DB Cargo AG. The WP2 team is composed of European operational and project experts from several companies. It was important to consider the previous operational DAC experiences of the individual railway companies and the industry and to develop these further. The formal project work took place in regular work sequences and workshops and consisted of theoretical and practical parts.

The overall synchronisation of the individual WP's and the communication between EDDP and ER JU proved to be challenging.

In addition, WP2 manages, coordinates and develops the operations within FP5-TRANS4M-R, not only for the FDFTO, which is the focus, but also the work of the other innovation workstreams (yard automation, innovative freight facilities and seamless).

5.2 CoreTeam

The practical core work was done within the international Core Team. The focus of the work was on the fundamental evaluation of the country-specific actual processes and a conceptual design of new target processes. The main stakeholders (operational experts with sometimes decades of experience in daily operations today) came from SBB, RCA, SNCF and DB Cargo AG. The interim results were presented in regular national and international rounds of the RUs and the feedback was continuously taken into account first in the drafts and finally in the valid version. The timely involvement of various stakeholders, such as industry or testing institutes, proved to be an advantage. Other European committees and projects were involved as needed to clarify specific technical questions, but also to obtain clear decisions regarding the technical parameters of the DAC, further Consist specifications and migration.

The formation of expert groups, in particular EG3 (train functions), EG5 (brakes), EG6 (occupational safety) and EG7 (hazardous goods), proved to be a valuable addition to the Core Team. This provided important, practical input into the aspects of work and operational safety. This also resulted in some gaps that served to specify the technical requirements more clearly and to implement these in the further DAC development. An ongoing challenge was the issue of active participation of the individual railway companies and the industry.

5.3 Alignment within FP5-TRANS4M-R

At certain milestones of the process development the content was shared by the core team with all participants from WP2, feedback was obtained and integrated. All operators of WP2 agreed that the target process is also suitable for operation in their organisations.

It was also important to involve partners from other WP, especially industry. At an earlier stage of process development, feedback from manufacturers was mainly provided via written documentation (Excel), which gave the opportunity to incorporate feedback and explanations via this format. At a point where the process diagram and process description had a high degree of readiness, there were several workshops and meetings with the CoreTeam and industry partners to ensure a quality they could continue to work with. This synchronisation was particularly valuable because different views and issues to be clarified came up and a common way of handling them was defined.

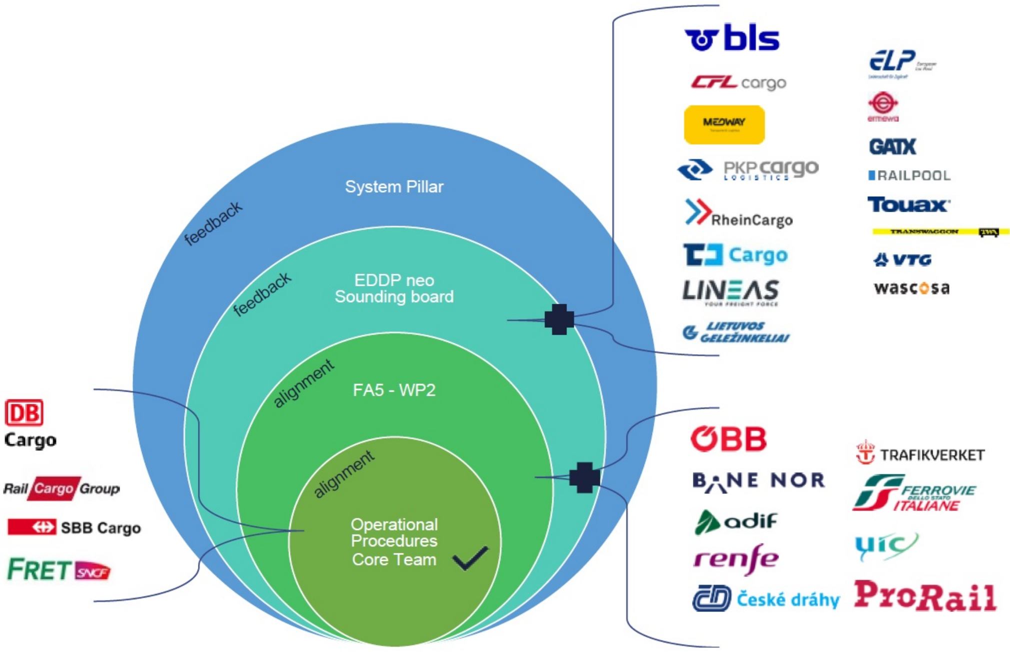


Figure 4: Alignment process

5.4 Feedback via EDDP (neo)

In addition to the agreement of the affected partners from ER JU FP5-TRANS4M-R, agreement is also required with stakeholders outside the project. This is important in order to obtain as much feedback as possible from other operators on the one hand and to increase the sector's acceptance of the target processes on the other.

The processes were therefore presented to all interested stakeholders at certain milestones in the process development after internal coordination in ER JU FP5 within the framework of the EDDP Sounding Board Operations. The EDDP Sounding Board presented versions 1.2, 1.3 and 1.5 to the participants. Feedback was requested at each sounding board, which was collected in the form of an Excel list, processed and answered by the Core Team and then made available to the EDDP participants.

After the sounding boards, the participants were asked about their acceptance of the status of the target process. The participation was not as numerous as hoped, but the participants reported a good level of acceptance. The following chart (Figure 5) shows the feedback from the participants.

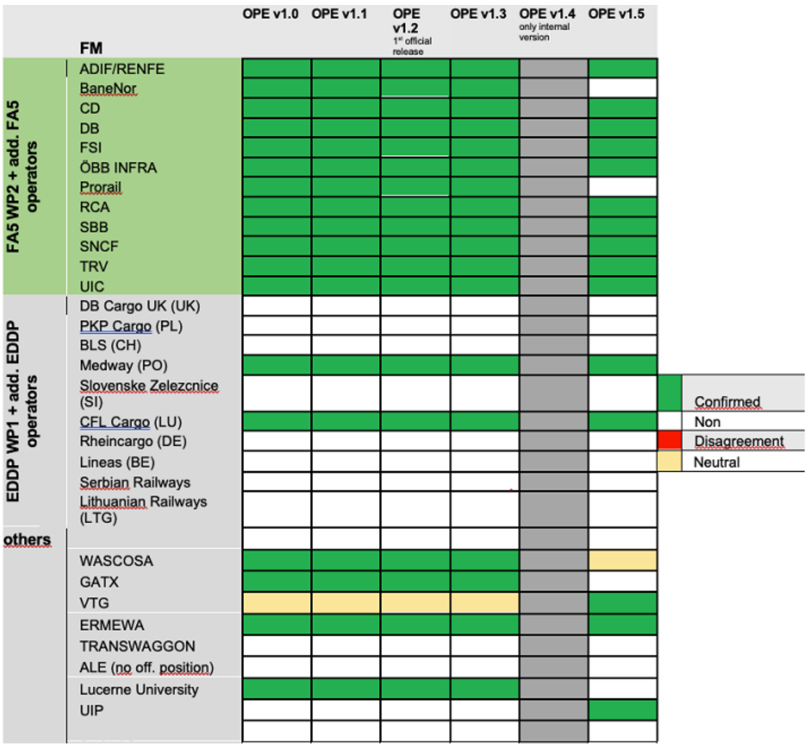


Figure 5: EDDP Feedback status

5.5 Feedback via System Pillar – Task 4

Based on the work done in FP5-TRANS4M-R, the target operational procedures, will be also reviewed again within the System Pillar Task4 WP2 “Target Operational Procedures”, by further distributing it in the (freight) sector, to gain even more feedback from the sector and include it into a later version of the document. Based on this document a series of webinars is already planned for July and September 2023. The target is to gain an as complete sector alignment as possible within FP5-TRANS4M-R.

In addition, the System Pillar will foster the European standardisation work, to include the Target Operational Procedures into the upcoming TSI updates, combined with the change demands of the other Flagship Projects, making them a mandatory operational basis in Europe.

A full overview of the different work packages of System Pillar Task 4 can be found in the Table in Figure 6.

WP	TITLE	WP LEAD	STATUS	Major Results in first 6 months	Milestones	Deliverables
WP 1	**Review of Ops Concepts + Sector Alignment**	HENON - TIONE		FP5-WP2 & T4 experts iterations organized with mirror groups EU Rail Community Webinars under preparation	Q3 - 2023	Report
WP 2	**Target Operational Procedures**	HENON TIONE		Target operational procedures established and widely discussed in FP5 (C3 industry, EDDP). Risks and Safety considerations (PRAMSS interface) Connection with STIP for AMOCs/Standards registration	Q4 - 2024	Rule Book
WP 3	**Operations Architecture related to FDFTO interfaces**	GROZEA – TIONE HALLER – TIONE MASCIS - TIONE		3.1 FDFTO/ERTMS L3 Interaction, interfaces, safety analysis regarding Train Integrity and Train Length 3.2 FA5 Use Cases review, and missing Use Cases identification involving interactions between FDFTO and ERTMS L3 3.3 FDFTO architecture towards ASO/ATO, shunting on supervised tracks. Exploration of future interaction ERTMS / Yards	Q2 2023 Q2 2023 Q2 2023	Reports
WP 4	**Proposal for a central instance for managing data access and processes for SW update**	HENON - TIONE		Proposal for a central instance for managing data access and processes for SW update As is analysis of existing IT systems", managing data access and processes for SW updates (bug fixing and system upgrades), taking into account existing responsibilities and legal obligations of different stakeholders	Q2 - 2023	Report
WP 5	**Production of standardisation and TSI input Plan (STIP) + Authorization Strategy**	HENON - TIONE		Iteratons with ERA, CEN, ISO, Eurospec, RID, NSA network, NB network for elaboration of standardization needs (TSI, CEN, etc.) and support DAC authorization strategy STIP collaboration + FP5 + FP3 + FP2	Q1 – 2023 Continuous	First Draft + Continuous
WP 6	**Consistency with Migration Roadmap**	HENON - TIONE		Ensure consistency of DAC/FDFTO migration roadmap with SP roadmap, based on input from EDDP on migration and deployment, (no high priority during the first 12 months)	Q4 - 2023	Report
WP 7	**Consistency CBA with CBO's**	HENON - TIONE		Checking CBA provided by EDDP and FP5 for consistency with CBOs : closely follow activities of FP5 and EDDP (no high priority during the first 12 months)	Q3 - 2023	Report

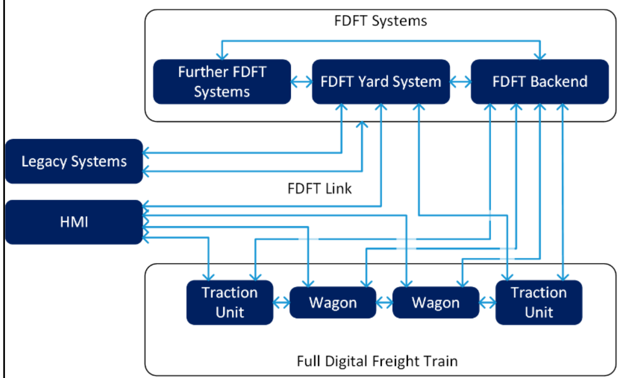
Figure 6: WP overview System Pillar Task 4

6 Definitions and Explanations

The following three tables provide definitions for terms used throughout the process descriptions and diagrams.Table 3 describes commonly used terms, Table 4 describes actors of process diagrams and Table 5 lists data and information transmitted by components.

6.1 Terms

Term	Description
Brake: Automated Parking Brake	An automated parking brake secured Consist or Consist Composition against rolling away. Activation of applying and releasing is done via the FDFT link.
Brake Calculation	Calculation of brake power according to national regulations.
Brake: Controllable Brake	The Controllable Brake can be one or more systems covering the following functions: 1. Secured Consist or Consist Composition against rolling away. This function can be realised on the one hand by the Automated Parking Brake (especially longer parking periods) or by the service brake (shorter parking periods, depending on national regulations). 2. Targeted braking of the Consist to a certain speed or standstill, which takes place after the Consist (Composition) has separated from the Traction Unit (e.g. braking of the Consist after hump shunting/fly shunting). The status of the brake can be determined.
Brake: Legacy braking means to secure Consist against rolling away	Today existing braking means like drag shoe, hand brake, track brake, etc.
Brake: Service Brake	The service brake is the braking system used today on freight trains (compressed air brake), which slows down the vehicles by lowering the air in the main brake pipe or, depending on national regulations, secure vehicles against rolling away for short periods of parking.
CCU	CCU is a system on each Consist, which executes Consist components (e.g., DAC coupler heads, Consist wide power control system, battery management system, brake system, sensors). It can communicate via FDFT Link (network) e.g. with the Traction Unit, FDFT Backend (if available), landside systems, with personnel by using a Mobile HMI
Consist composition	Consists coupled with DACs.
Coupling Point of Shunting Composition/Consist Composition	Identifies the future connection between two DAC coupler heads planned for coupling.
FDFT Function	Function that does not exist today and need to be developed to achieve the target state. Note: Example for a "FDFT Function" could be "FDFT function prevent coupling" or "train integrity monitoring"

Term	Description
FDFT function Prevent Coupling	While the FDFT function Prevent Coupling is activated, the DAC coupler head must not allow coupling. This function must be activated on both coupler heads. In case of electrical activation/deactivation, this function can only be activated in FDFT mode Shunting. Note: The required activation on both coupler heads results from current statements regarding the technical feasibility of the manufactures. Note: This function is required at all levels of DAC, even if the technical solution may be different.
FDFT Link	Enables communication between FDFT Systems, mainly FDFT Backend, Legacy System, Traction Unit and Consist with CCU. This connection can be physical (data connection between Traction Unit, Stationary Device and Consist via DAC coupler head) or wireless. Multiple FDFT Links can form a network so that FDFT Systems can communicate with each other using an intermediate FDFT System, e.g., FDFT Backend uses wireless FDFT Link to Traction Unit to communicate with CCU via a physical FDFT Link.  *Figure 7: FDFT Links* Note: The figure only shows possible connection combinations of FDFT Links, the real development can deviate from the representation depending on the time of development (fully or semi-automated state)
FDFT mode Shunting (note: not ETCS Shunting Mode)	Allows electrical uncoupling of DAC coupler heads, electrical activation of function prevent coupling and activation of Automated Parking Brake. When uncoupled, no harmful electrical power on DAC coupler head is present, especially on electrical contacts. When uncoupling, electrical connections of DAC coupler head must be free of harmful electrical power or current prior to mechanical uncoupling. When coupling, harmful electrical power and current is only applied after successful mechanical coupling of both DAC coupler heads including electrical coupler. This mode is required for all consists (Consist and traction nit). All consists of one composition are in the same mode.

Term	Description
FDFT mode Train Run	Coupled DAC coupler heads of Train cannot be commanded to uncouple. First and last DAC coupler heads of Train must have FDFT function Prevent Coupling deactivated and this function cannot be activated. Power supply over DAC coupler heads can be enabled by Traction Unit. Automated Parking Brake cannot be activated. This mode is required for all consists (Consist and Traction Unit). All consists of one composition are in the same mode. An operational train run is carried out in FDFT mode Train Run. This mode is not to be confused with train integrity monitoring.
FDFT System	Systems that do not exist today and need to be developed to achieve the target state. Note: Example for a “FDFT System” could be "FDFT Backend” or “FDFT Yard System”
Legacy process	Fallback to already in use processes without requiring (all) FDFT System components.
Legacy System	Today’s technical systems in use by operators, Consist keepers, ...
Mobile HMI	(Locally) (remote) device for personnel to interact with FDFT Systems. Connection to FDFT Systems can be wireless and physical, even to CCU. For example, personnel can connect the Mobile HMI to a Consist in a Consist Composition and retrieve Consist Status Data and Consist Composition Data of the entire Consist Composition.
Semi-automated State	During Semi-automated State the automated operations are not yet fully possible. Manual intervention on site will take place on a regular basis.
Shunting Composition	Traction Unit(s) coupled by DAC to a Consist (Composition). Consist and TU are in FDFT mode Shunting. This composition has no uniquely identifiable attribute, which is only assigned when all conditions for train preparation have to be fulfilled (see Processes).
Target State	The future of rail freight transport depends on fully automated operations in all processes for Consist handling from shunting preparation through Consist processing and train preparation until train run. Manual intervention on site will only take place in the event of deviations or malfunctions.
Train	Uniquely identifiable composition of Traction Unit(s) and optionally a Consist (Composition).
Train Run	The Train Run starts and ends regularly in yards (including sidings) and stations. Operational definition of Train moving or parked. Before the Train Run starts all conditions for train preparation must be fulfilled (see Processes).
Uncoupling Point of Shunting Composition/Consist Composition	Identifies the connection between two DAC coupler heads planned for uncoupling.

Table 3: Terms

6.2 Actors

Actor / Swimlane	Description
Brake Test Operator (BO)	On site personnel performing the brake test.
Consist (A) (B)	A consist is the smallest railway rolling stock entity for operation (e.g. Consist, Traction Unit, …), containing one CCU representing one node on DAC network. It can be a Traction Unit or a single Consist as a fixed set of single vehicles (segments) which are not disconnected while in operation. A Consist owns a unique vehicle identification number.
Consist/Consist Composition (CCC)	Consist: Single physical freight Consist equipped with DAC coupler head at each end. Consist permanently coupled (just one UIC Number) together should behave like a single Consist and cannot be uncoupled. Consist Composition: Consist coupled together by DAC coupler heads.
FDFT Backend (BE)	Collection of new FDFT functions on land side. Receives, supplies, and stores Consist Data (e.g. Consist Target Track Data, Traction Unit Status Data, Consist Composition Data and Additional Consist Data). FDFT Backend provides and receives data to and from other systems (FDFT Yard, Traction Unit, etc.) FDFT Backend initiates different functions, e.g., coupling and uncoupling processes, in Target State.
FDFT Yard (FY)	FDFT Yard is infrastructure based and controls all infrastructure elements in its area. FDFT Yard provides current state of infrastructure to FDFT Backend if available. The interfaces between FDFT Backend and FDFT Yard will be defined in a later step.
Operator TU (O)	Personnel (remotely) controlling Traction Unit(s).
Personnel (P)	Only for subprocesses. Refers to the originating swim lane actor in the main process. E.g. if subprocess activity was on the *Yard Manager* swim lane, Personnel refers to *Yard Manager* in the subprocess context.
Signaller (S)	Performer in charge of the route setting of trains/shunting movements and of issuing instructions to Operator of Traction Unit (see TSI OPE).

Stationary Device (SD)	Infrastructure-sided device that provides air for (automated) brake test and measurement data (e.g. air pressure). For target processes: Power and data are also supplied and connected. Over this device, a connection between Consist to FDFT Backend or Legacy Systems is possible.
Traction Unit (TU)	• A Traction Unit with DAC coupler heads that supplies traction power and moves itself and coupled vehicles. This also includes multiple Traction Units moving together. • The DAC coupler heads can also be hybrid couplers. • A Traction Unit can also have Distributed Power System functionalities. • ATO and ASO systems can be applied. • A Traction Unit can be equipped with FDFT functionalities, e.g. allows retrieving Consist Status Data or Consist Composition Data and can initiate CCU's functions, like secure against rolling away, bleeding, etc. • An unpowered Traction Unit is considered and behaves like a Consist with CCU. • Traction Units can be main line locomotives, shunting locomotives, shunting devices, two-way vehicles, etc. • The Traction Unit (TU) supplies the electrical energy for all the Consist in a train, if technical available. • User Interface is available.
Wagon Inspector (WI)	On site personnel performing technical inspection of Consist.
Yard Legacy System (YL)	Today's technical systems used in yard operations.
Yard Manager (YM)	Personnel responsible for operation of shunting yards.
Yard Personnel (YP)	On site personnel needed for manual shunting operations, e.g. for uncoupling / coupling rolling stock, for securing rolling stock and any other activities that require human intervention in shunting operation.

Table 4: Actor/swimlane definitions

6.3 Data

Data/information type	Description
Additional Consist Data	Additional Consist Data consists of static (e.g., Consist length, empty Consist weight, master data) and dynamic (e.g., type of load, restrictions, total weight) data. The Consist is not capable of deriving these data by itself, e.g., by use of sensors.
Consist Status Data	Includes Consist Status Data and Traction Unit Status Data.
Cut List Information	Information about the planned Uncoupling Points for a given Consist Composition. Based on this information, documents like cut lists can be created.
Traction Unit Status Data	Compiled data about the status of a Traction Unit (e.g. state of DAC coupler heads, state of hybrid coupler, state of brake system). If FDFT Backend is available and the Traction Unit can communicate with FDFT Backend, all changes in Traction Unit Status Data will be automatically sent from Traction Unit to FDFT Backend. If other actors need this information, it is actively pulled from Traction Unit.
Consist Composition Data	Information derived by Consist Status Data to reflect orientation and order of each Consist in a Consist Composition.
Consist Status Data	Compiled data about the status of a Consist and CCU can derive this data by itself (e.g. state of DAC coupler heads, state of brake system). If FDFT Backend is available and CCU can communicate with FDFT Backend, all changes in Consist Status Data will be automatically sent from CCU to FDFT Backend. If other actors need this information, it is actively pulled from CCU.
Consist Target Track Data	Information sufficient to determine the target track of each Consist in a shunting process (e.g. Hump Shunting).

Table 5: Data/information type definitions

6.4 Types of shunting

This document describes the following types of shunting:

- Flat shunting
- Fly shunting
- Hump shunting

6.4.1 Flat shunting

Flat shunting is the separation of Consist in a shunting yard by continuous forward and backward Traction Unit movements. The Traction Unit is always in control of the movement of the Consist means that the Consist are not moving independently at any time.

Shunting at workshop (maintenance):

The processes before the maintenance activities correspond to the delivery to the workshop and can be found in "TP07 - Flat Shunting Drop Off".

After maintenance has been carried out, the vehicles are transported out of the workshop in accordance with the "TP08 - Flat Shunting Pick Up".

Shunting in the frame within the workshop also corresponds to processes P07 and P08, whereby it can be assumed that only semi-automation will be implemented in the workshop and thus manual processes will be carried out in the same way as today.

Shunting at loading/unloading points:

Loading and unloading is carried out by shippers or the customers themselves. The processes before loading/unloading can be found in "TP07 - Flat Shunting Drop Off". After this process, loading and unloading takes place. After this has been completed, the Consist are picked up again and the process "TP08 - Flat Shunting Pick Up" follows.

In the context of the loading process, further innovations can be considered, such as weighing sensors, measurement of load distribution or sensors for monitoring closure mechanisms.

6.4.2 Fly shunting

When fly shunting, the Traction Unit accelerates the shunting composition. The Consist are uncoupled from the Traction Unit and, after the Traction Unit decelerates, continue to run into the target track.

Today, the Consist are braked in the destination track by e.g. brake shoes.

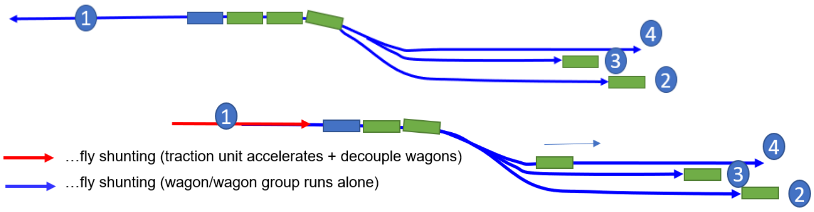


Figure 8: Fly Shunting

6.4.3 Hump shunting

The Traction Unit pushes the Consist over the top of a so-called shunting hump, an artificially created hill. After uncoupling they roll down the slope on their own and are directed via the switch area to one of the directional tracks.

Depending on the infrastructure and national requirements, the Consist are currently either uncoupled in the entrance group at standstill (e.g. France, ...) or on the hump at walking speed (e.g. Austria).

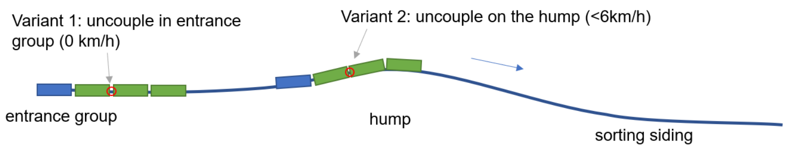


Figure 9: Hump shunting

6.5 Technical Wagon Inspection

Each RU shall handle the Consist with care and, in particular, carry out safety-related checks in accordance with Annex 9 GCU. According to this, Consist must be inspected for operational safety and roadworthiness, any recognisable defects or indications thereof must be identified in accordance with GCU, Annex 9, Appendix 1 (catalogue of defects) and the necessary measures must be taken.

At certain points in the processes described, the successful completion of the technical Wagon inspection is checked. For a positive result, relevant data must be available and stored that allow the conclusion to be drawn that the Consist can be used properly (or with restrictions) or that necessary measures can be initiated. In the future, this data can be collected continuously by the FDFT system as well as enriched by manual test steps. Ideally, this testing should be fully automated in the future. Annex 9 of the GCU forms the basis of the scope.

The implementation by the railway undertaking enables optimisation in terms of automatic control of the Consist.

7 General Assumptions and Premises

The present design of the Preliminary Operational Procedures reflects the current status of the discussion on operational procedures within the sector and specifically within FP5-TRANS4M-R.

7.1 Design premises

These Operational Procedures are designed as processes for universal usage in Europe, so by definition generic. It is not target of these processes, to define the detailed individual processes of each RU, Consist keepers, but it should serve as a foundation for the individual adaptions on locations and/or local rules, to be done by each and every company.

7.2 Delimination

The present design of the Preliminary Operational Procedures reflects the current status of the discussion on operational procedures within the sector and specifically within FP5-TRANS4M-R.

The following has been excluded from this study:

- Disruption/error process

Disruptive processes often introduce a high level of intricacy, involving multiple variables and uncertainties that can complicate the analysis and interpretation of results. Due to the inherent complexity, there are no disruption processes considered in this document.

- Migration

The document does not cover any migration scenarios. These scenarios are subject of other initiatives. However, the document could be a base for the development of migration scenarios.

- Border traffic/handover between countries and/or infrastructures

Handover between RUs or at border stations are not directly considered, as these processes are the responsibility of the RUs. However, the individual process steps should be included in the processes, whereas the order of the steps may vary.

- Existing operational processes (Signaller, ETCS, …)

Existing processes without impact of Full Digital Freight Train are not part of the document.

- IT interfaces only in a generic view

Not known at this time, this topic is partially addressed in other working packages within ER JU.

- Maintenance processes

Only the operative shunting processes in the workshop are taken into account (supply/discharge). The maintenance/repair processes of the vehicle or components are not considered.

- Consist functions

Train functions may be accompanied by consist functions, which are not described in this document.

7.3 Definition of DAC hardware level and FDFT Functions

The general and DAC level specific definitions of the hardware and the functions which are being developed in ER JU FP5-TRANS4M-R project listed below. The general assumption is that DAC 4 is upgradeable to DAC 5.

Note: Migration impact not yet included

Note: Alignment process for allocation for functions to DAC level is still ongoing; updated version will be available in D3.1 System Requirement Specification FDFT.

FDFT Hardware General	FDFT Hardware DAC Level specific
• mechanical coupler • electrical coupler • power and data lines, battery, CCU, emergency release • Hardware of Functions (e.g. sensors, …)	DAC 4: • lever on Consist side DAC 4.5: • electrical actuator • push button on Consist side DAC 5: • electrical actuator

Table 6: FDFT Hardware

FDFT Functions General
• coupling • uncoupling • prevent coupling • train composition detection • train integrity monitoring • train length determination • automated brake test • automated parking brake • ep-brake • distributed power system • air management

Table 7: FDFT Functions

Train Functions are needed to automize and accelerate the train operation especially in shunting mode. The so-called train functions are functions which are provided by the technical FDFT System in each consist of a train in order to ensure an automation of today's manual processes.

Train functions are controlled or monitored by the leading consist of the composition or an FDFT System. These functions shall be available to the user independent of a given train number with departure and arrival station and time. The majority of the functions shall be used while shunting and train preparation. The user shall select the operation mode "train run" or "shunting" in order to enable the corresponding set of train functions.

Train function users can be:

- a locomotive driver
- Personnel
- an ATO system (Automatic Train Operation) or
- a train protection system

of the leading consist or an FDFT System.

For all train functions a validated train composition is needed as precondition to execute train functions in a safe and correct manner.

The deliverable D 5.1 – Train function specification will specify the train functions in detail and will represent the leading specification for the train functions and the resulting interface specification on consist level.

The following train functions shall be provided in the frame of the FP5-TRANS4M-R project:

Train composition detection function, train length determination

- The train composition detection detects in maximum 100 Consist and up to 4 locomotives in one train in order to ensure the proper execution of further train functions
- The Train composition detection shall be executed automatically, when one or more consists will be coupled and confirmed by driver or later by an automation system. When one or more consists will be uncoupled, the automatic execution of train composition detection shall be possible to inhibit.

Note: Uncoupling of a consist in “train run mode” must result in a train integrity violation.

- Train length determination will be done in the leading consist by summarizing all consist data, transmitted by the train composition detection.

Train integrity monitoring

- As soon as the consist composition is validated an information regarding the train integrity that is sufficient for the function must be transmitted. It must be monitored that the last coupler is not coupled.
- The train integrity monitoring information can be used to interface the onboard train protection system in the train run mode if required.

Remote uncoupling

In the shunting mode the user shall be able to uncouple a consist or a set of consists. The user takes care about the unintended movement of the uncouple vehicles in beforehand and in accordance with local specifics and regulations.

Automated brake test

In the shunting mode the user shall be able to perform an automated brake test.

Parking brake control

The parking brake control provides three train functions which can be executed by the user on the locomotive as leading consist always when the train is not in train run mode.

1. Status monitoring of parking brake
2. Apply parking brake
3. Release parking brake

Beside the described train functions a local parking brake status monitoring possibility as well as means to apply and release the parking brake without electrical energy shall be available at each consist equipped with a parking brake.

Network based ep-brake control

The network-based electro pneumatic brake shall enable the use of a simultaneous braking along the train in order to minimize the longitudinal forces.

Distributed Power

The distributed power function shall enable the use of up to four locomotives in a train.

7.4 Differences between Processes

As part of the politically intended mobility turnaround, there will be a significant increase in transport volumes in European rail freight transport.

The sector must provide the corresponding transport capacities for this. However, it will hardly be possible to build new routes or stations, so a significant part of the future transport volume will have to be handled by the existing infrastructure.

In order to provide significantly increased capacities, train lengths, loads and speeds on the line must be increased and the process times in the stations and operating points must be significantly decreased. All in all, this leads to accelerated cycle transfers, reduced resource consumption and faster transport times.

The future of rail freight transport depends on fully automated operations. Manual intervention on site will only take place in the event of deviations or malfunctions.

7.4.1 Differences between Target Process and Semi-Automated Process

The **target process** represents **fully automated operation**.

Processes that are only **partially automated**, are called **semi-automated processes**.

Possible reasons:

- the technical development is not yet ready
- certain areas (e.g. customer siding) are not (yet) fully equipped

Therefore, a differentiation is made between the “Target State”, which represents the fully automated operations (Target Processes) and the “Semi-Automated State” (Semi-automated processes).

7.4.2 Differences between Target Process and ER JU Process

Within the framework of ER JU FP5-TRANS4M-R, not all developments that can represent the target state are carried out. For this reason, semi-automated processes, called "ER JU Process", are defined in this document, which represents the status that can be achieved after developments in ER JU FP5-TRANS4M-R have been completed (Technical Enabler).

7.5 Current status of technical development

Air system: The current air system remains in place. However, efforts are being made to achieve rollability without the need for bleeding or at least to ensure rollability and other operations required due to bleeding automatically. This development aims to improve efficiency in processes.

ER JU FP5-TRANS4M-R WP11 deals with the topic of ep brakes, which are to be used in the current air system and would result in faster braking and possibly releasing the air brakes.

Power/Data system: The power system operates on 400V, providing a continuous supply of power. Individual vehicles receive power for battery charging, which can be sourced from the locomotive or infrastructure. A data bus is implemented to transfer all data to the locomotive for optimal forwarding to diverse landside and RU systems, ensuring reliable communication.

DAC: The presence of electronic equipment, including the CCU and electrical coupler, serves as the foundation for enabling train functions. These components facilitate the operation and coordination of various functions, contributing to the overall efficiency and safety of the system.

8 Operational Procedures

8.1 Process description

The operational procedures for the Full Digital Freight Train are described as flow charts with additional specific information in this document. The overall procedures are split in main *processes* and *subprocesses* for better understanding. Subprocesses describe a set of activities and can be reused in different parts of the main processes.

Figure 10 is giving an overview of the elements used in the flow charts of a process or subprocess.

At the top of each flow chart the different *actor* swim lanes – running from top to bottom – are indicated. An actor is the responsible person or system to carry out a specific *activity*. Only the actors needed for the process are listed.

The start of the activity is marked by a grey circle. From this starting point the activity flow (order of execution) is given by blue arrows. The path along green activities is describing the Target State.

Each activity is identified by a consecutive number in the centre (unique only for each process diagram) and an actor-activity-identifier in the lower half. The actor-activity-identifier is prefixed by the swim lane's actor abbreviation and followed by the Process-ID, a point and then the number. Transformational State activities follow the same pattern and are drawn in yellow. The consecutive number is prefixed by the character "T".

Activities with a red border marking are considered activities with an operational necessity (e.g. process traceability, safety relevant checks according to regulations). If a deviation is detected during this activity, error handling must start. Only when this has been successfully completed and this state allows for process continuation, the process can be continued.

Activities with a white flag in the top right corner refer to subprocesses. If a subprocess is drawn on a Transformational State actors swim lane, like *Yard Manager*, the swim lane called *Personnel* refers to the originating actor – *Yard Manager*. For other relevant actors inside a subprocess, see the subprocesses description.

Along the activity flow, decisions are marked as blue diamond shape. From there activity flow is branched depending on the evaluation of the decision. Only one path can be followed after evaluation of a decision. Each decision is identified by a number prefixed by the character "D". After branching, decisions end with a smaller blue diamond shape.

Sequence-independent activity paths are shown by a horizontal thick line with at least two originating paths. Activities along these paths are executed in order but are executed independently to the other paths. Sequence-independent paths are joined by a horizontal thick line. Execution after the join is only possible after all paths are carried out completely.

If the path along the Target State activity flow is not possible, the alternative path using Transformational State activities is marked by a dotted yellow line. The return to the originating Target State path is also indicated by a dotted yellow line.

In some cases, information flow is explicitly shown by orange arrows. The swim lane of the sender or receiver without an activity uses a small blue rectangle as a symbol for the information interface.

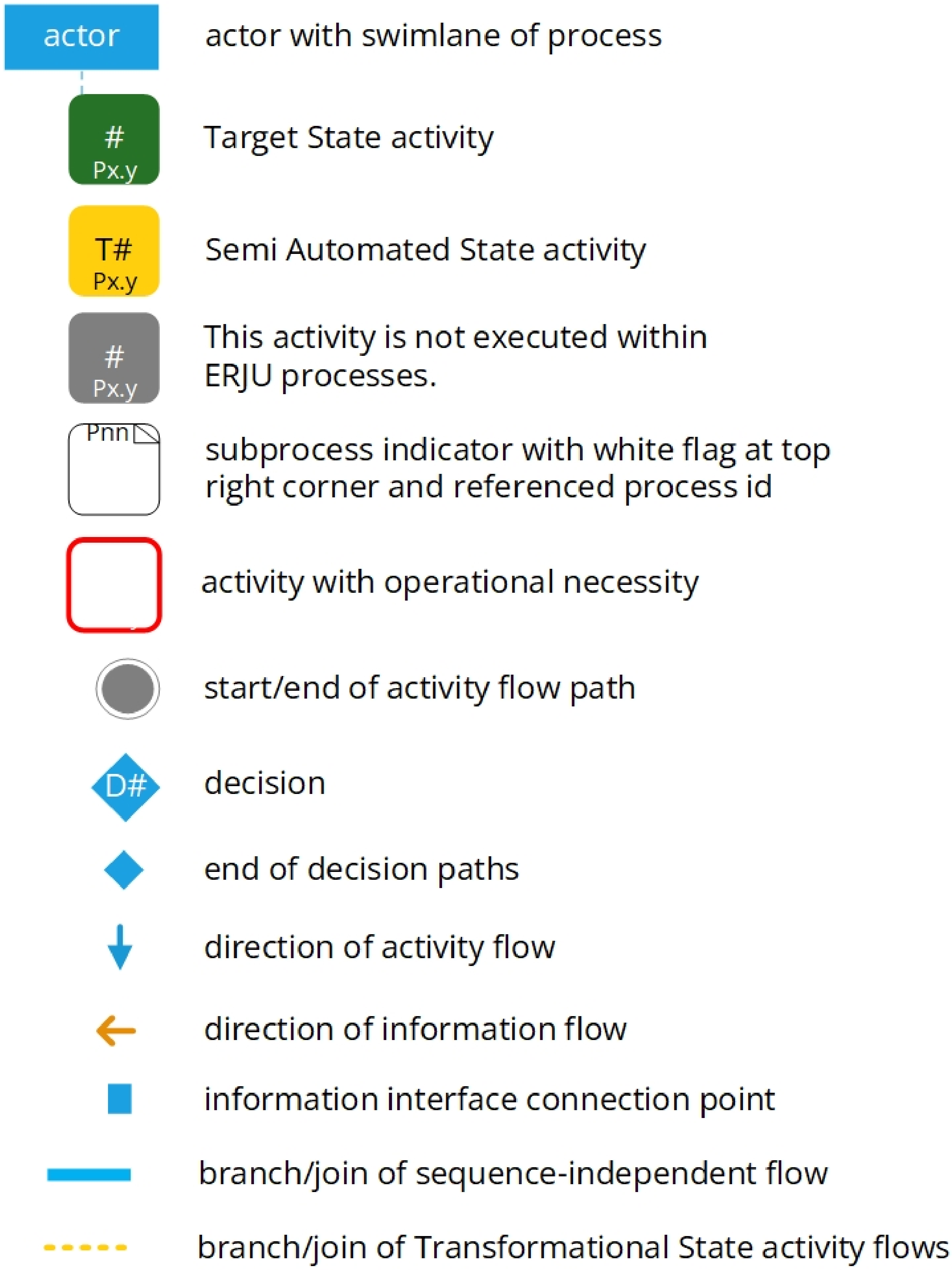


Figure *10*: Process description symbols

8.2 Activity description

The following template table (Table 8) describes an activity in detail. An activity and its content are identified by the actor-activity-identifier: IDx.y. The *ID* is replaced with the swim lanes abbreviation (e.g. S for *Signaller*), *x* is the process id and *y* the consecutive number identifier. The colouring matches for Target State and Transformational State activities.

For each activity found in a process diagram, a corresponding table can be found in this document. Transformational activities are indicated by a yellow background in the top left corner of the table.

IDx.y	
Activity	*Short description of containing task(s)*
Precondition	• *conditions that must be fulfilled to begin the overall process*
Conditions	• *conditions that must be fulfilled to start the activity without degradation. If not, a reference to an alternative degraded activity is given here or is indicated by a dotted yellow line in the process diagram*
Tasks	• *description of tasks to be done in activity*
Remarks	• *additional information to understand the context of the tasks*
Rationale	• *additional reason for activity in process context*
Postcondition	• *states or information that must be reached/fulfilled/sent/received after finishing the scenario or activity*

Table 8: Template of activity description table

8.3 Decision description

The following template table (Table 9) describes a decision in detail. A decision and its content are identified by the decision identifier ID. The identifier is found in the process diagram.

For each decision found in a process diagram, a corresponding table can be found in this document.

ID	
Decision	*Short description of decision*
Branch 1	• *First option of branching according to decision*
Branch 2	• *Second option of branching according to decision*
…	• *Further options if necessary*
Remarks	• *additional information to understand the context of the decision*
Rationale	• *additional reason for condition in process context*

Table 9: Template of condition description table

8.4 Target Operational Procedures

The Target Operational Procedures follow the main idea of a train arriving at a local yard, which then is prepared for shunting operations, the Consist are sorted and finally the newly composed train is prepared for departure.

Figure 11 shows the four main processes: Shunting Preparation (TP01, see 8.4.2), Consist Processing (TP02, see 8.4.3), Train Preparation (TP03, see 8.4.4) and Train Run (TP04, see 8.4.5). For the processes Train Run and Consist Processing important subprocesses are also shown. Additional subprocesses are not shown here but shown in the detailed process description.

For an overview of all processes and subprocesses see Figure 12.

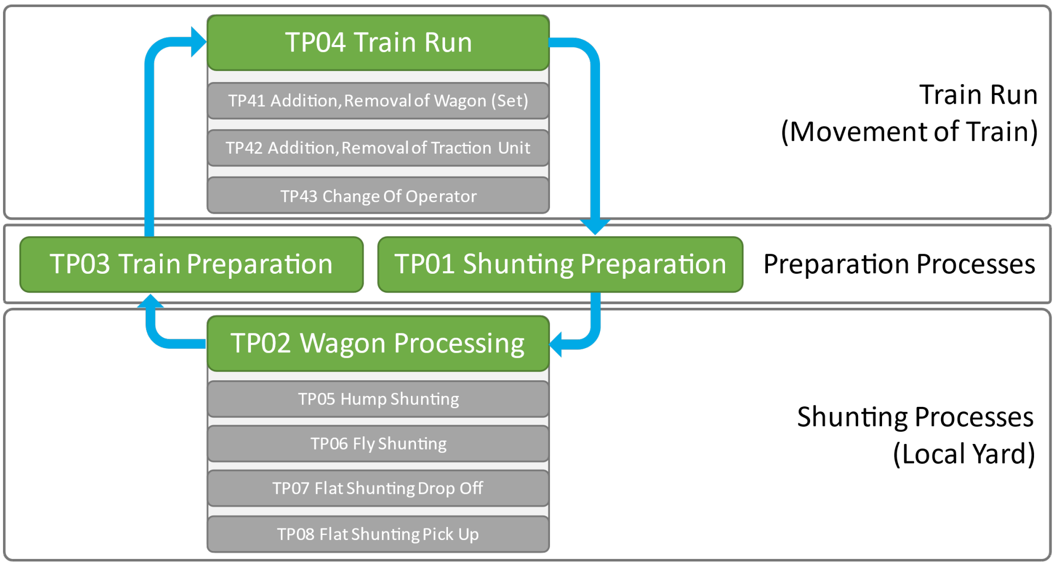


Figure *11*: Process overview with four main processes

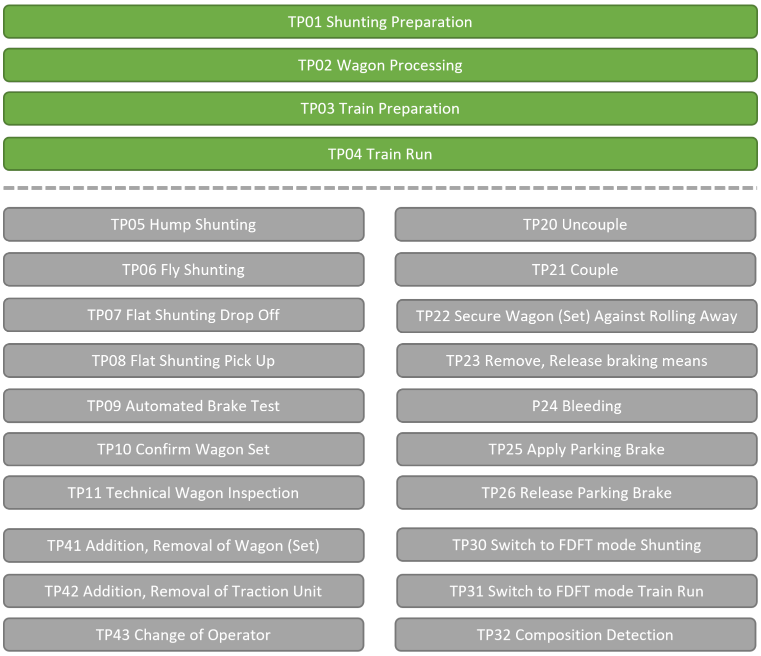


Figure *12*: Process overview

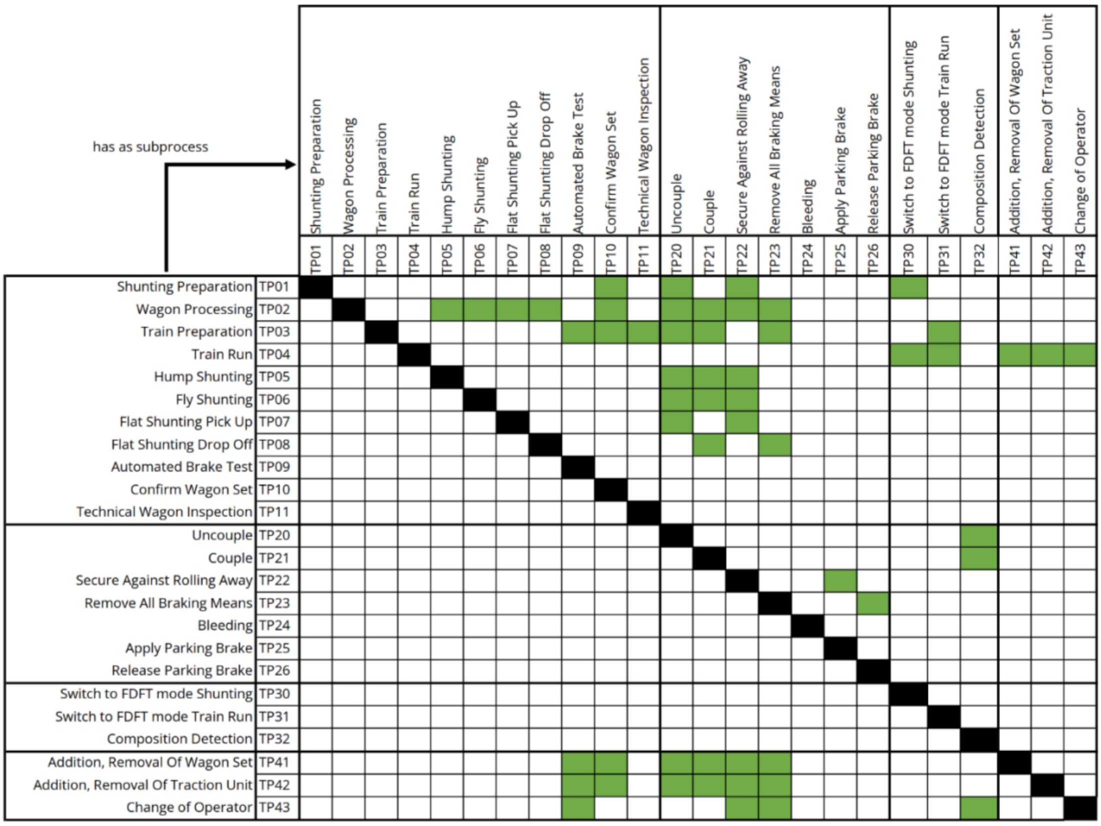


Figure *13*: Process matrix

8.4.1 Process enumeration

Within the following table a complete list of processes and subprocesses and their versions are given.

ID	Description	Version
1	Shunting Preparation	Ed. 02P08 13.06.2023
2	Consist Processing	Ed. 02P12 21.06.2023
3	Train Preparation	Ed. 02P10 19.06.2023
4	Train Run	Ed. 02P09 13.06.2023
5	Hump Shunting	Ed. 02P10 19.06.2023
6	Fly Shunting	Ed. 02P09 14.06.2023
7	Flat Shunting Drop Off	Ed. 02P08 13.06.2023
8	Flat Shunting Pick Up	Ed. 02P08 13.06.2023
9	Automated Brake Test	Ed. 02P09 13.06.2023
10	Confirm Consist Set	Ed. 02P07 14.06.2023
11	Technical Wagon Inspection	Ed. 02P07 13.06.2023
20	Subprocess: Uncouple	Ed. 02P09 13.06.2023
21	Subprocess: Couple	Ed. 02P07 13.06.2023
22	Subprocess: Secure Against Rolling Away	Ed. 02P11 21.06.2023
23	Subprocess: Remove All Braking Means	Ed. 02P07 13.06.2023
24	Subprocess: Bleeding	Ed. 02P06 13.06.2023
25	Subprocess: Apply Parking Brake	Ed. 01P06 26.06.2023
26	Subprocess: Release Parking Brake	Ed. 01P05 26.06.2023
30	Subprocess: Switch to FDFT mode Shunting	Ed. 02P09 14.06.2023
31	Subprocess: Switch to FDFT mode Train Run	Ed. 02P07 14.06.2023
32	Subprocess: Composition Detection	Ed. 02P06 13.06.2023
41	Subprocess: Addition, Removal Of Consist (Set)	Ed. 02P10 14.06.2023
42	Subprocess: Addition, Removal Of Traction Unit	Ed. 02P08 14.06.2023
43	Subprocess: Change Of Operator	Ed. 02P04 13.06.2023

Table 10 Process enumeration

8.4.2 TP01 - Shunting Preparation

TP01 - Shunting Preparation

8.4.2.1 Target Process

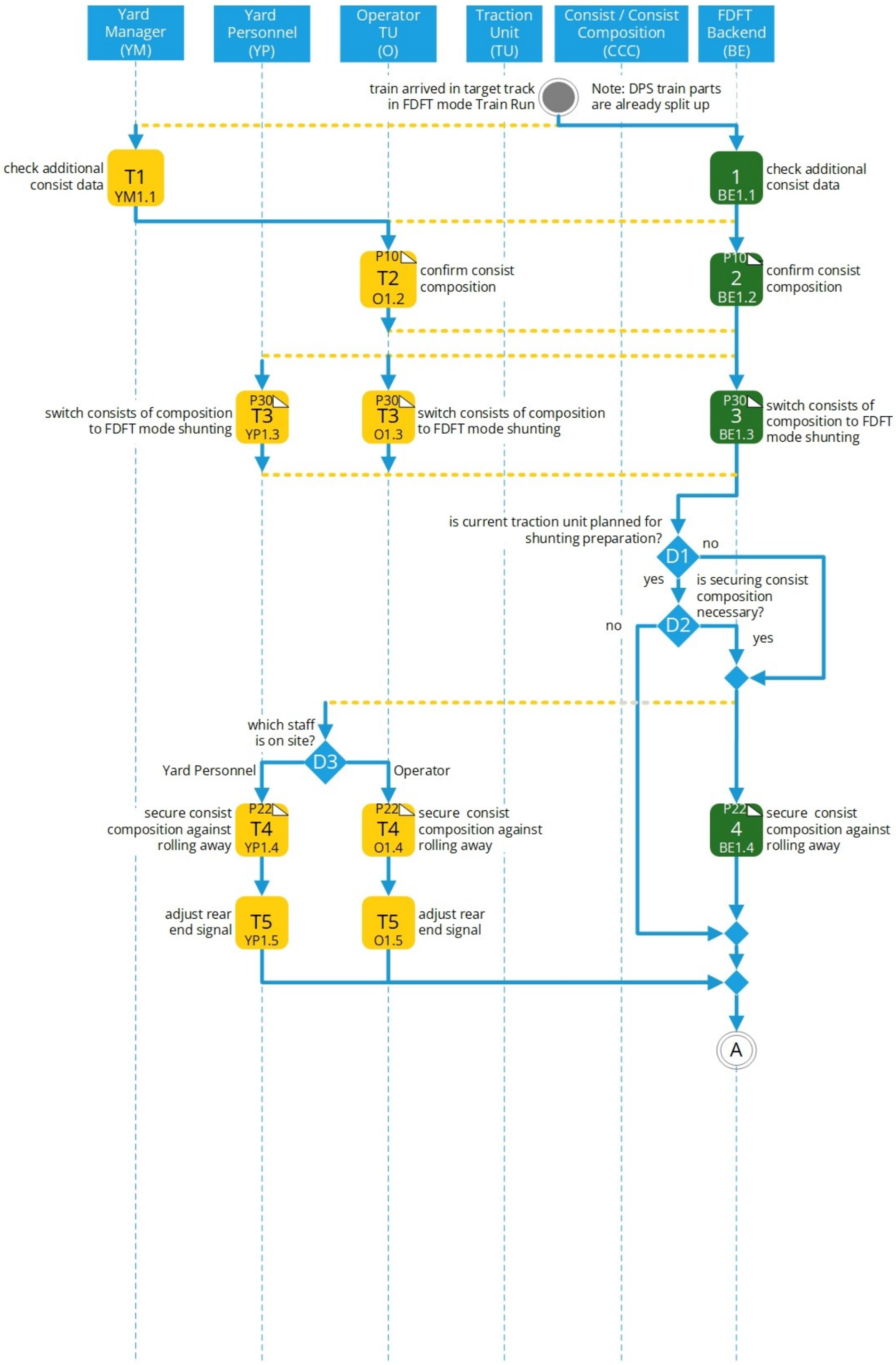


Figure *14*: TP01 Shunting Preparation - 1 of 2

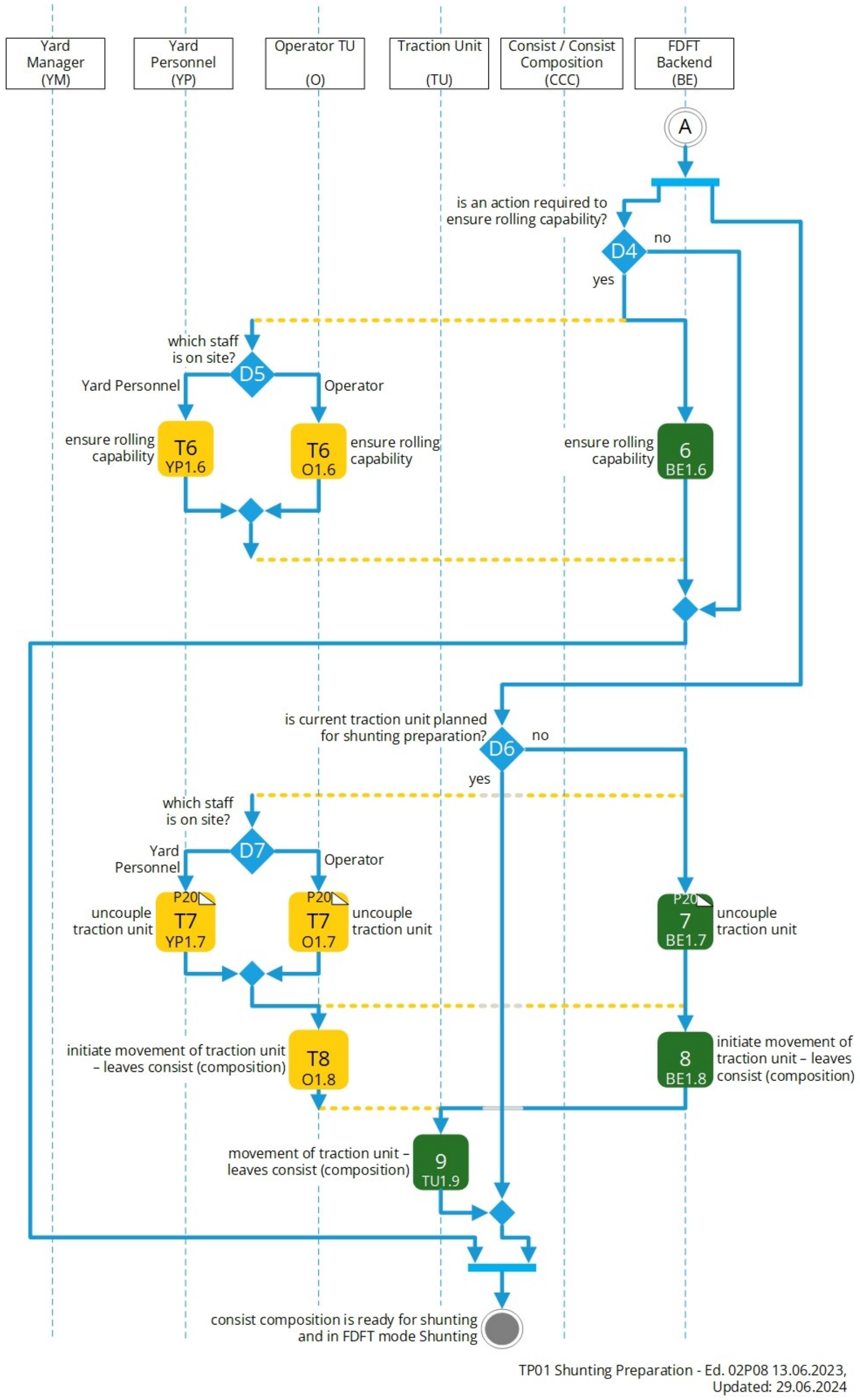


Figure *15*: TP01 Shunting Preparation - 2 of 2

8.4.2.2 Process-Description

BE1.1 Check additional Consist Data

Precondition	▪ DPS Train Parts are already split up.
Conditions	▪ FDFT Backend is available and communication between FDFT Backend and CCU is possible.
Tasks	▪ The FDFT Backend ensures that its set of additional Consist Data is current.
Remarks	▪ All data that can be provided by other systems (e.g. CCU, landsided systems, legacy systems...) should be checked in order to know the current status of the shunting composition and to ensure optimisation of the process at an early stage if necessary (e.g. damaged Consist processing).
Activity Rationale	▪ -
Postcondition	▪ -

YM1.1 Check additional Consist Data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard manager inputs train and additional Data into to FDFT Backend if available. ▪ If FDFT Backend is not available, use legacy processes.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE1.2 Subprocess: Confirm Consist Composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can confirm Consist Composition.
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ Information can be used to identify possibly malfunctioning (automation) components.
Postcondition	▪ FDFT Backend knows arrived train composition and has access to an updated version of Consist Status Data.

O1.2 Subprocess: Confirm Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D1 Is current Traction Unit planned for shunting preparation?

Decision	**Yes:** ▪ Arrived Traction Unit is used for following shunting activities. ▪ All needed requirements regarding the Traction Unit and its use in following processes are met before by planning.
Note Actor/s	▪ -
Additional Information	**Rationale:** ▪ Future Tractions Units allow for more flexibility (no difference between shunting loco or line loco). Then a Traction Unit change can be omitted.

D2 Is securing Consist Composition necessary?

Decision	**Yes:** ▪ Dependent on local environment and entity.
Note Actor/s	▪ -
Additional Information	**Remarks:** ▪ Depending on train weight, infrastructure requirements and duration of stillstand securing of Consist may be necessary. ▪ This can be achieved by using the arriving Traction Unit.

BE1.3 Subprocess: Secure Consist Composition against rolling away

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can secure Consist (Composition) against rolling away. ▪ Every Consist in Composition can secure itself against rolling away by remote command.
Tasks	▪ See subprocess description 8.4.10.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D3 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

YP1.3 Subprocess: Secure Consist Composition against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.15.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP1.4 Adjust rear end signal

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Personnel adjusts rear end signals.
Remarks	▪ This step can be skipped if not necessary according to regulations. ▪ E.g., train integrity monitoring makes rear end signal obsolete.
Activity Rationale	▪ -
Postcondition	▪ -

O1.3 Subprocess: Secure Consist Composition against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.15.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O1.4 Adjust rear end signal

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator adjusts rear end signals.
Remarks	▪ This step can be skipped if not necessary according to regulations. ▪ E.g., train integrity monitoring makes rear end signal obsolete.
Activity Rationale	▪ -
Postcondition	▪ -

BE1.5 Subprocess: Switch Consist(s) of Composition to FDFT mode Shunting

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can switch Consist(s) to FDFT mode Shunting.
Tasks	▪ See subprocess description 8.4.19.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP1.5 Subprocess: Switch Consist(s) of Composition to FDFT mode Shunting

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.19.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O1.5 Subprocess: Switch Consist(s) of Composition to FDFT mode Shunting

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.19.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D4 Is an action required to ensure rolling capability?

Decision	**No:** ▪ No unintentional loss of air in system with negative influence on the rolling capability e.g., in the shunting processes.
Note Actor/s	▪ -
Additional Information	**Remarks:** ▪ The rolling capacity of the Consist must be ensured, especially in the processes of fly and hump shunting. ▪ Today bleeding is use to achieve rolling capability (for Bleeding Process see P24 – Bleeding). Generally bleeding should not be required. **Rationale:** ▪ More efficient process if bleeding can be avoided.

BE1.6 Ensure rolling capability

Precondition	▪ In Case of Bleeding: Air supply of Traction Unit is shut off or disconnected.
Conditions	▪ FDFT Backend is available and can ensure rolling capability.
Tasks	▪ Make sure the rolling capability of the Consist is given.
Remarks	▪ Consist Composition is still secured. ▪ Today bleeding is used to archieve rolling capability (for Bleeding Process see P24 – Bleeding).
Activity Rationale	▪ If the rolling capability is not ensured, there would be the risk of an unintentional stop of the Consist. This would lead to additional effort within shunting or possibly a collision of Consist.
Postcondition	▪ -

D5 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	**Rationale:** ▪ Future Traction Units allow for more flexibility (no difference between shunting loco or line loco). Then a Traction Unit change can be omitted.

O1.6 Ensure rolling capability

Precondition	▪ In Case of Bleeding: Air supply of Traction Unit is shut off or disconnected.
Conditions	▪ -
Tasks	▪ Make sure the rolling capability of the Consist is given.
Remarks	▪ Consist Composition is still secured. ▪ Today bleeding is used to archieve rolling capability (for Bleeding Process see P24 – Bleeding).
Activity Rationale	▪ If the rolling capability is not ensured, there would be the risk of an unintentional stop of the Consist. This would lead to additional effort within shunting or possibly a collision of Consist.
Postcondition	▪ -

YP1.6 Ensure rolling capability

Precondition	▪ In Case of Bleeding: Air supply of Traction Unit is shut off or disconnected.
Conditions	▪ -
Tasks	▪ Make sure the rolling capability of the Consist is given.
Remarks	▪ Consist Composition is still secured. ▪ Today bleeding is used to archieve rolling capability (for Bleeding Process see P24 – Bleeding).
Activity Rationale	▪ If the rolling capability is not ensured, there would be the risk of an unintentional stop of the Consist. This would lead to additional effort within shunting or possibly a collision of Consist.
Postcondition	▪ -

D6 Is current Traction Unit planned for shunting preparation?

Decision	**Yes:** ▪ Shunting planning requires a Traction Unit change.
Note Actor/s	▪ -
Additional Information	▪ -

BE1.7 Subprocess: Uncouple Traction Unit

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can command CCU to uncouple.
Tasks	▪ See subprocess description 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE1.8 Initiate movement of Traction Unit - leaves Consist (Composition)

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ FDFT Backend is available and can initiate movement of Traction Unit.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D7 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O1.7 Subprocess: Uncouple Traction Unit

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP1.7 Subprocess: Uncouple Traction Unit

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O1.8 Initiate movement of Traction Unit - leaves Consist (Composition)

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU1.9 Movement of Traction Unit – leaves Consist (Composition)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Uncoupled Traction Unit moves away from the Consist (Composition) to an assigned destination.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.3 TP02 - Consist Processing

TP02 - Consist Processing

8.4.3.1 Target Process

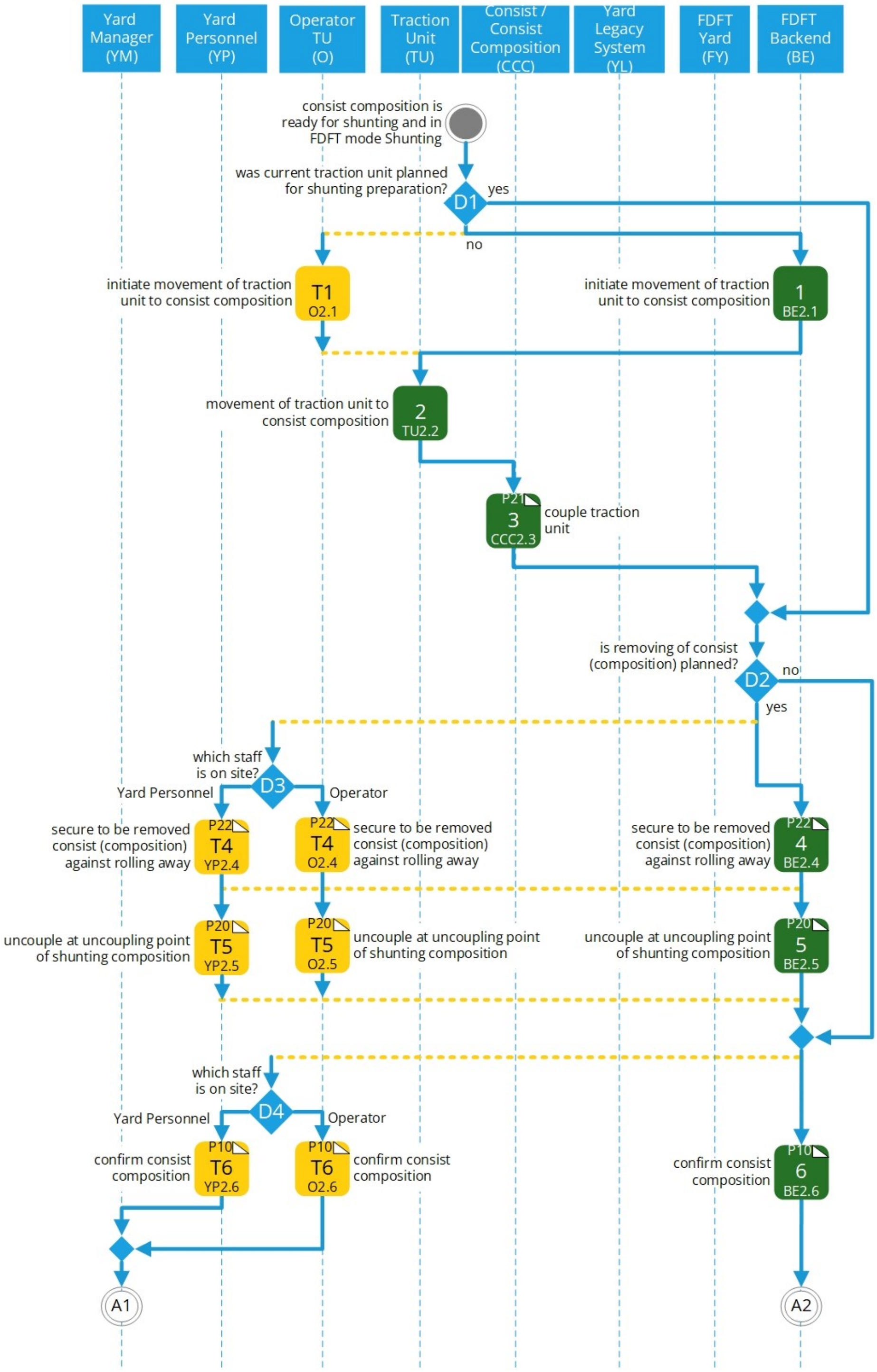


Figure *16*: TP02 Consist Processing - 1 of 4

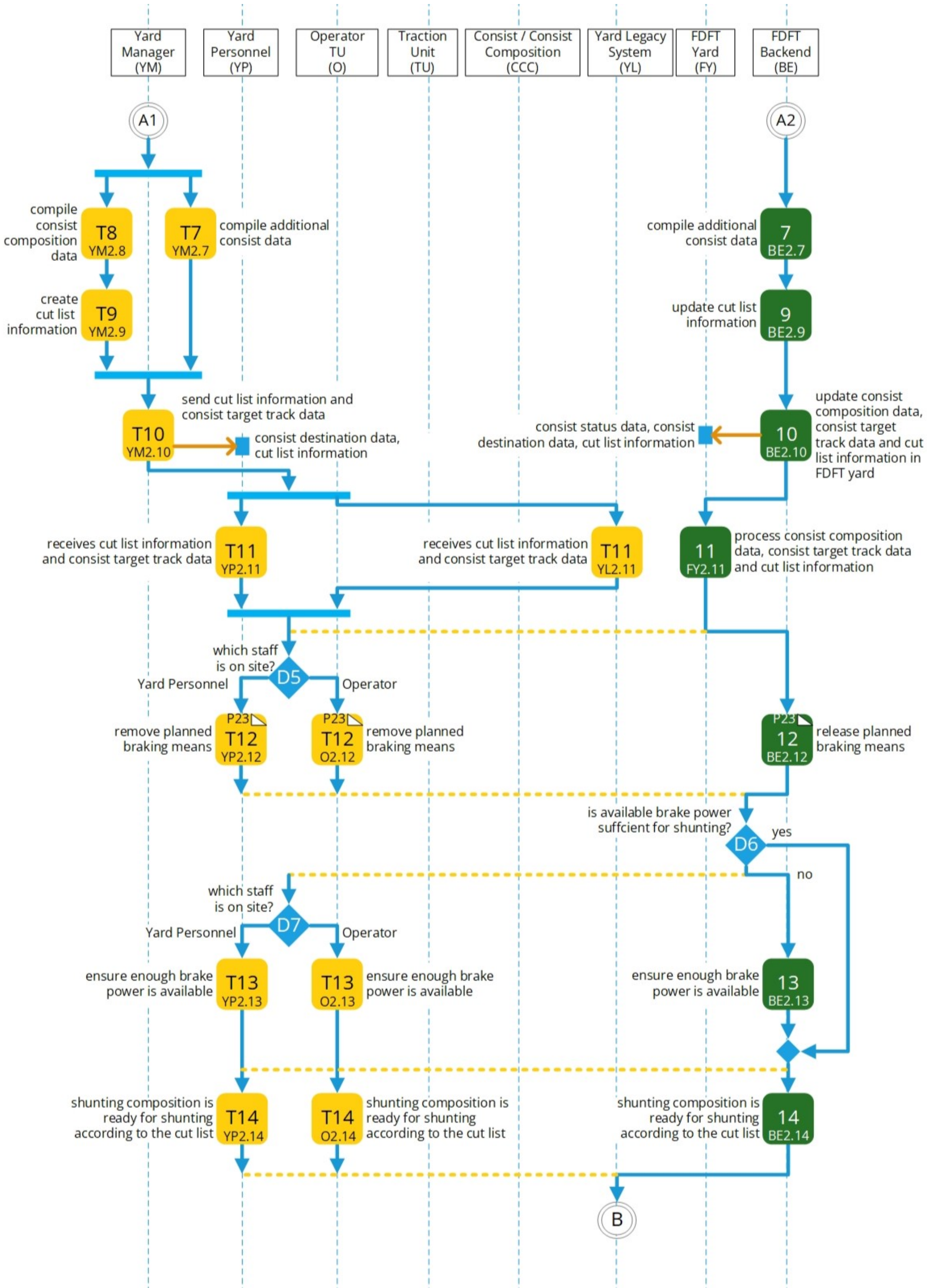


Figure *17*: TP02 Consist Processing - 2 of 4

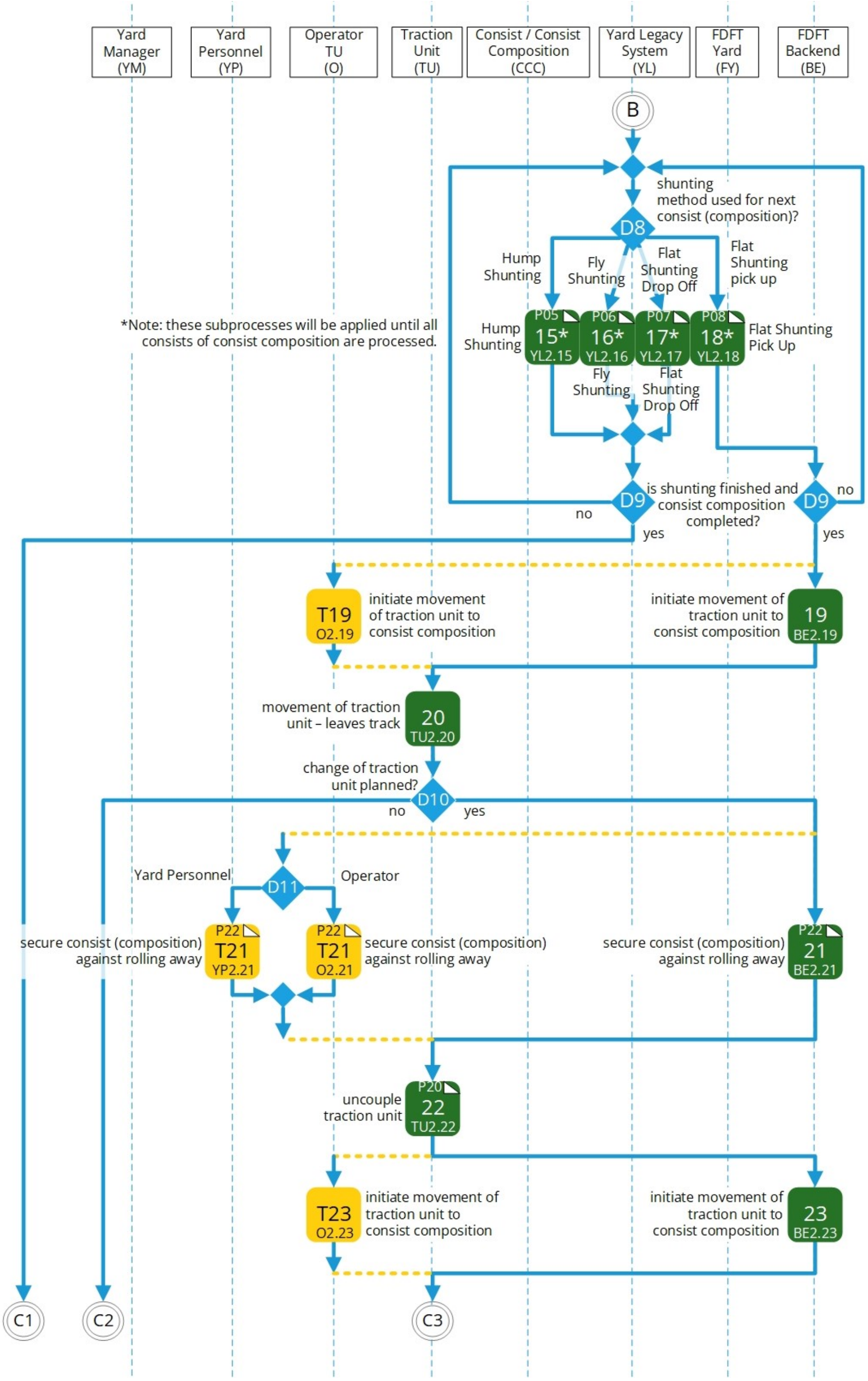


Figure *18*: TP02 Consist Processing - 3 of 4

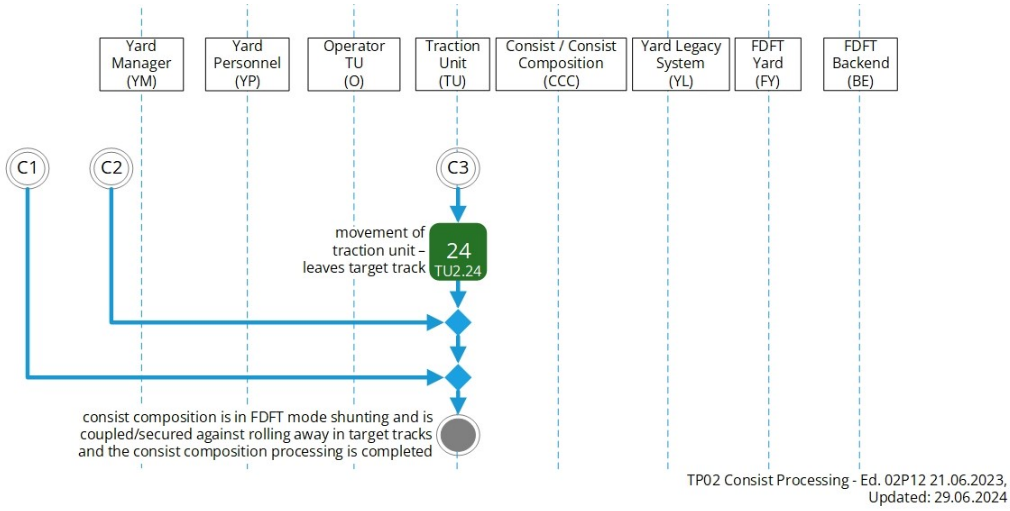


Figure *19*: TP02 Consist Processing - 4 of 4

8.4.3.2 Process-Description

D1 Was Traction Unit change planned?

Decision	**Yes:** ▪ In previous process, a Traction Unit change was planned and done. **No:** ▪ In previous process, a Traction Unit change was not planned and done.
Note Actor/s	▪ -
Additional Information	▪ -

BE2.1 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Traction is allowed and possible.
Conditions	▪ FDFT Backend is available and can initiate movement of Traction Unit.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O2.1 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU2.2 Movement of Traction Unit to Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit is moved to Consist Composition (without Traction Unit).
Remarks	▪ This Traction Unit is used for following shunting movements.
Activity Rationale	▪ -
Postcondition	▪ -

CCC2.3 Couple Traction Unit

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.14.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D2 Is removing of Consist (Composition) planned?

Decision	**Yes:** ▪ Part of Consist Composition is planned to be removed. **No:** ▪ Consist Composition is ready for further processing.
Note Actor/s	▪ -
Additional Information	▪ -

BE2.4 Subprocess: secure to be removed Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate securing against rolling away.
Tasks	▪ See subprocess description 8.4.15.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE2.5 Subprocess: uncouple at uncoupling point of shunting composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate uncoupling.
Tasks	▪ See subprocess description 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D3 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O2.4 Subprocess: secure to be removed Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.15.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP2.4 Subprocess: secure to be removed Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.15.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O2.5 Subprocess: uncouple at uncoupling point of shunting composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP2.5 Subprocess: uncouple at uncoupling point of shunting compostion

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE2.6 Subprocess: Confirm Consist Composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with CCU on each Consist in Composition. ▪ Through mentioned communication, each FDFT Backend can determine the order and orientation of each Consist in Composition.
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ FDFT Backend knows train composition: order and orientation of each Consist in Composition.

BE2.7 Compile additional Consist Data

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ FDFT Backend compiles Additional Consist Data, e.g. load type, weight, operational shunting restrictions, special handling restriction.
Remarks	▪ This information is used for cut list information.
Activity Rationale	▪ -
Postcondition	▪ -

BE2.9 Update Cut List Information

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ With current Consist Composition Data and Destination and Additional Consist Data, the Cut List Information may be updated if actual state differs from planned state.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE2.10 Update Consist Composition Data, Consist Target Track Data and Cut List Information in FDFT Yard

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ FDFT Backend sends Consist Composition Data, Consist Target Track Data and Cut List Information to FDFT Yard.
Remarks	This step is used to update FDFT Yard about possible Consist order and orientation or load changes which are not to plan.
Activity Rationale	▪ -
Postcondition	▪ -

FY2.11 Process Consist Composition Data, Consist Target Track Data and Cut List Information

Precondition	▪ -
Conditions	▪ -
Tasks	▪ FDFT Yard receives Consist Composition Data, Consist Target Track Data and Cut List Information from FDFT Backend and updates planned shunting processes if necessary.
Remarks	▪ FDFT Yard uses this information to plan, manages and executes following shunting processes. ▪ See also subprocesses hump 8.4.6, fly 8.4.7 and flat shunting 8.4.8/8.4.9.
Activity Rationale	▪ -
Postcondition	▪ -

BE2.12 Subprocess: Release planned braking means

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate release braking means. ▪ Traction Unit is coupled to Consist Composition.
Tasks	▪ See subprocess description 8.4.16.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D4 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O2.6 Subprocess: Confirm Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP2.6 Subprocess: Confirm Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YM2.7 Compile additional Consist Data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Manager compiles Consist Target Track Data and Additional Consist Data for each Consist in set.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YM2.8 Compile Consist Composition Data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Manager compiles Consist Composition Data (order and orientation).
Remarks	▪ This data can be provided by Yard Personnel or an existing legacy system.
Activity Rationale	▪ -
Postcondition	▪ -

YM2.9 Create Cut List Information

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Manager derives Cut List Information from Consist Set Data, Consist Target Track Data and Additional Consist Data.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YM2.10 Send Cut List Information and Consist Target Track Data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Manager sends Cut List Information and Consist Target Track Data to personnel on site or legacy system.
Remarks	▪ This information can be used by Yard Personnel or trigger a (automatic) legacy process.
Activity Rationale	▪ -
Postcondition	▪ -

YL2.11 Receives Cut List Information and Consist Target Track Data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Legacy System receives Cut List Information and Consist Target Track Data and starts legacy processes for shunting.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP2.11 Receives Cut List Information and Consist Target Track Data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Legacy System receives Cut List Information and Consist Target Track Data and starts legacy processes for shunting.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D5 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O2.12 Subprocess: Remove planned braking means

Precondition	▪ -
Conditions	▪ Traction Unit is coupled to Consist Composition.
Tasks	▪ See subprocess description 8.4.16. ▪ Operator removes planned braking means at Consist in Composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP2.12 Subprocess: Remove planned braking means

Precondition	▪ -
Conditions	▪ Traction Unit is coupled to Consist Composition.
Tasks	▪ Yard personnel removes planned braking means at Consist in Composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D6 Is available brake power sufficient for shunting?

Decision	**Yes:** ▪ FDFT Backend calculates necessary brake power by using stored Consist Data, Traction Unit Data, topology, and operational requirements. ▪ If FDFT Backend is not available, necessary brake power is calculated by legacy processes.
Note Actor/s	▪ -
Additional Information	**Remarks:** ▪ It should be considered that Traction Unit can solely provide necessary brake power. ▪ Some Consist in Composition may have their brake system in service to provide necessary brake power.

BE2.13 Ensure enough brake power is available

Precondition	▪ -
Conditions	▪ Additional brake power can be utilised without the need for manual intervention at each Consist. FDFT Backend is available.
Tasks	▪ FDFT Backend uses Traction Unit and some Consist CCU's to provide brake power.
Remarks	▪ In preceding process all Consist of Composition may have been bled. ▪ Today, necessary brake power is achieved by using some Consist in front of the Traction Unit (air brake). In future, different solutions can be implemented. ▪ If additional Consist are used as brake power (air brake), these Consist must be bled before shunting.
Activity Rationale	▪ -
Postcondition	▪ -

BE2.14 Shunting composition is ready for shunting according to the cut list

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with Yard Legacy System and/or FDFT Yard.
Tasks	▪ FDFT Backend sends information “shunting composition ready to shunt” to Yard Legacy System and/or FDFT Yard depending on availability.
Remarks	▪ This information is used to trigger following shunting processes in surrounding systems.
Activity Rationale	▪ -
Postcondition	▪ -

D7 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O2.13 Ensure enough brake power is available

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator ensures that enough brake power is available through legacy process or by using CCU as additional brake power. ▪ Communication to CCU can be provided by Traction Unit or Mobile Device.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O2.14 Shunting composition is ready for shunting according to the cut list

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator sends information “shunting composition ready to shunt” to Yard Legacy System and/or FDFT Yard depending on availability.
Remarks	▪ This information is used to trigger following shunting processes.
Activity Rationale	▪ -
Postcondition	▪ -

YP2.13 Ensure enough brake power is available

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Personnel ensures that enough brake power is available through legacy process or by using CCU as additional brake power. ▪ Communication to CCU can be provided by Traction Unit or Mobile Device.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP2.14 Shunting composition is ready for shunting according to the cut list

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard personnel sends information “shunting composition ready to shunt” to Yard Legacy System and/or FDFT Yard depending on availability.
Remarks	▪ This information is used to trigger following shunting processes.
Activity Rationale	▪ -
Postcondition	▪ -

D8 Shunting method used for next Consist (Composition)?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ Flat shunting pick up planned for next Consist. ▪ Flat shunting drop off planned for next Consist. ▪ Fly shunting planned for next Consist. ▪ Hump shunting planned for next Consist. **Remarks:** ▪ Planned shunting method depends on available infrastructure and national operational regulations. ▪ This decision in conjunction with the four following shunting methods are run repeatedly until all Consist of set are processed. ▪ This process does not differentiate between Consist and tractions units. Unpowered Traction Units are considered as a Consist and shunted accordingly.

YL2.15 Subprocess: Hump Shunting

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess definition 8.4.6.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YL2.16 Subprocess: Fly Shunting

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess definition 8.4.7.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YL2.17 Subprocess: Flat Shunting Drop Off

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess definition 8.4.8.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YL2.18 Subprocess: Flat Shunting Pick Up

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess definition 8.4.9.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D9 Is shunting finished and Consist Composition completed?

Decision	**Yes:** ▪ Is shunting process finished and Consist Composition is completed according to the plan.
Note Actor/s	▪ -
Additional Information	▪ -

BE2.19 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ FDFT Backend is available.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O2.19 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU2.20 Movement of Traction Unit – leaves track

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Uncoupled Traction Unit moves away from the Consist (Composition) to an assigned destination.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D10 Change of Traction Unit planned?

Decision	**Yes:** ▪ Change of Traction Unit is planned.
Note Actor/s	▪ -
Additional Information	▪ -

BE2.21 Subprocess: Secure Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate securing against rolling away.
Tasks	▪ Secure those Consist (Composition) against rolling away, which is currently connected to the Traction Unit. ▪ See subprocess description 8.4.15.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D11 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

YP2.21 Subprocess: Secure Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Secure those Consist (Composition) against rolling away, which is currently connected to the Traction Unit. ▪ See subprocess description 8.4.15.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O2.21 Subprocess: Secure Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Secure those Consist (Composition) against rolling away, which is currently connected to the Traction Unit. ▪ See subprocess description 8.4.15.
Remarks	
Activity Rationale	
Postcondition	

TU2.22 Subprocess: uncouple Traction Unit

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE2.23 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ FDFT Backend is available.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O2.23 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU2.24 Movement of Traction Unit – leaves target track

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Uncoupled Traction Unit moves away from the Consist (Composition) to an assigned destination.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.4 TP03 - Train Preparation

TP03 - Train Preparation

8.4.4.1 Target Process

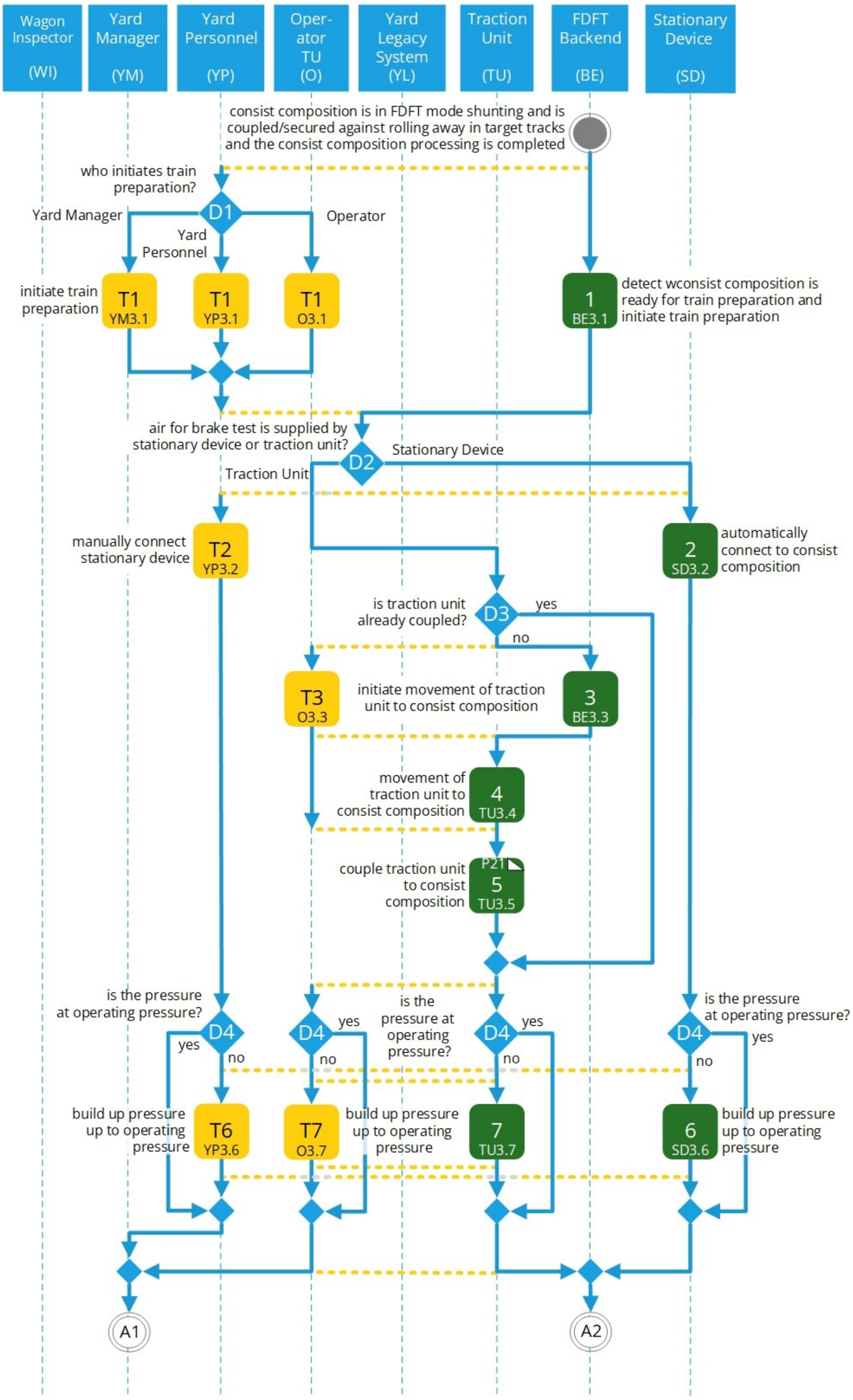


Figure *20*: TP03 Train Preparation - 1 of 4

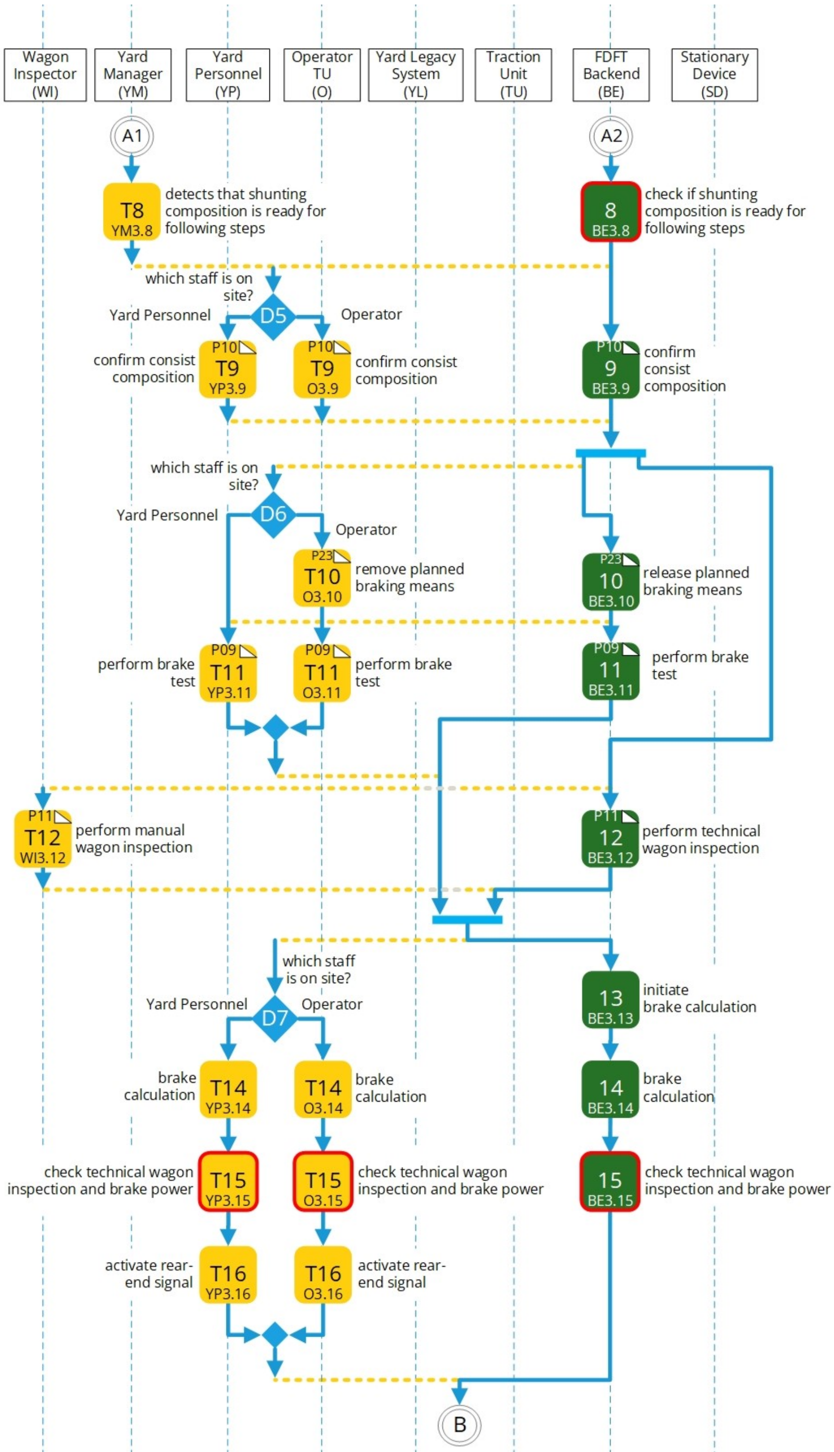


Figure *21*: TP03 Train Preparation - 2 of 4

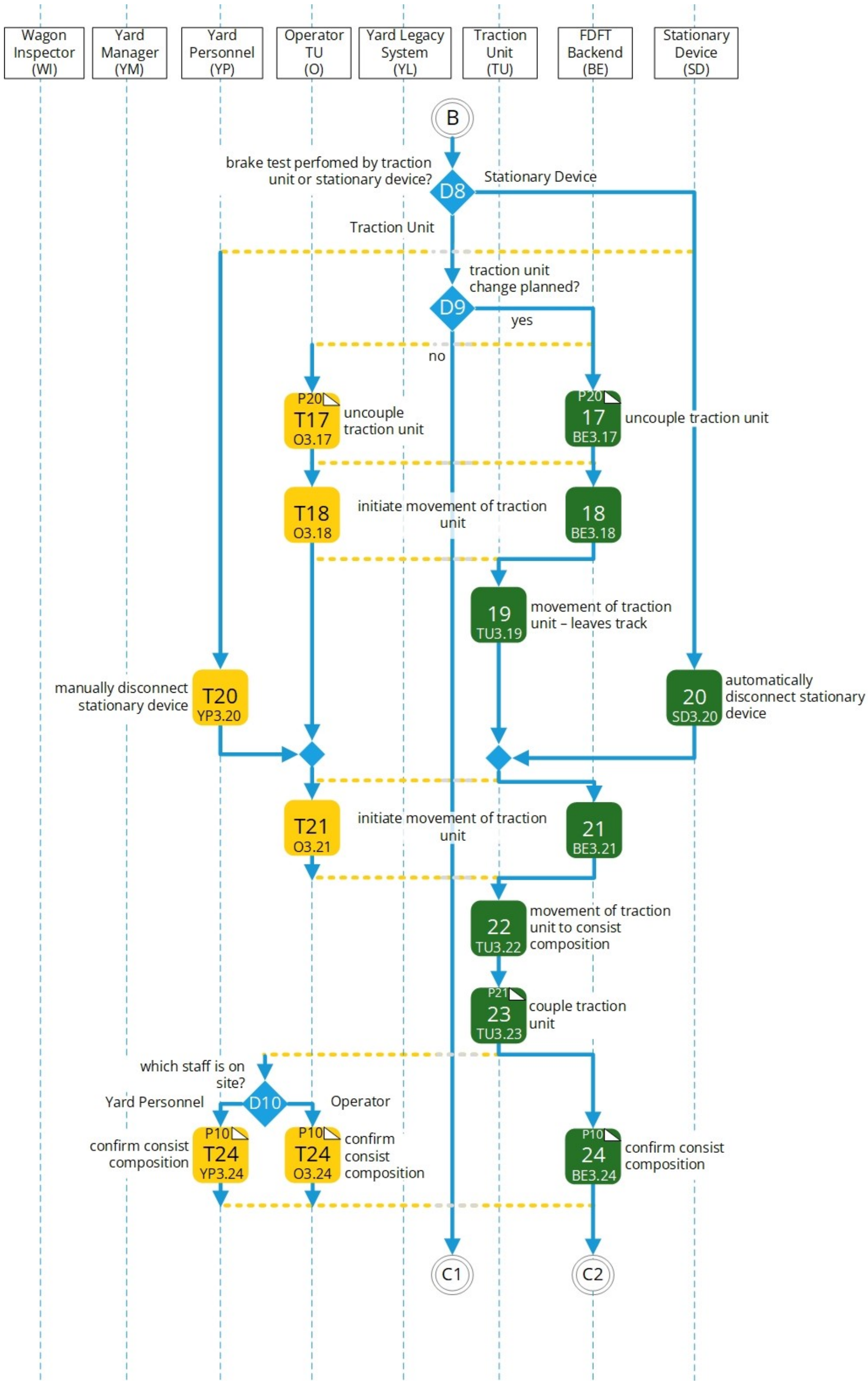


Figure 22: TP03 Train Preparation - 3 of 4

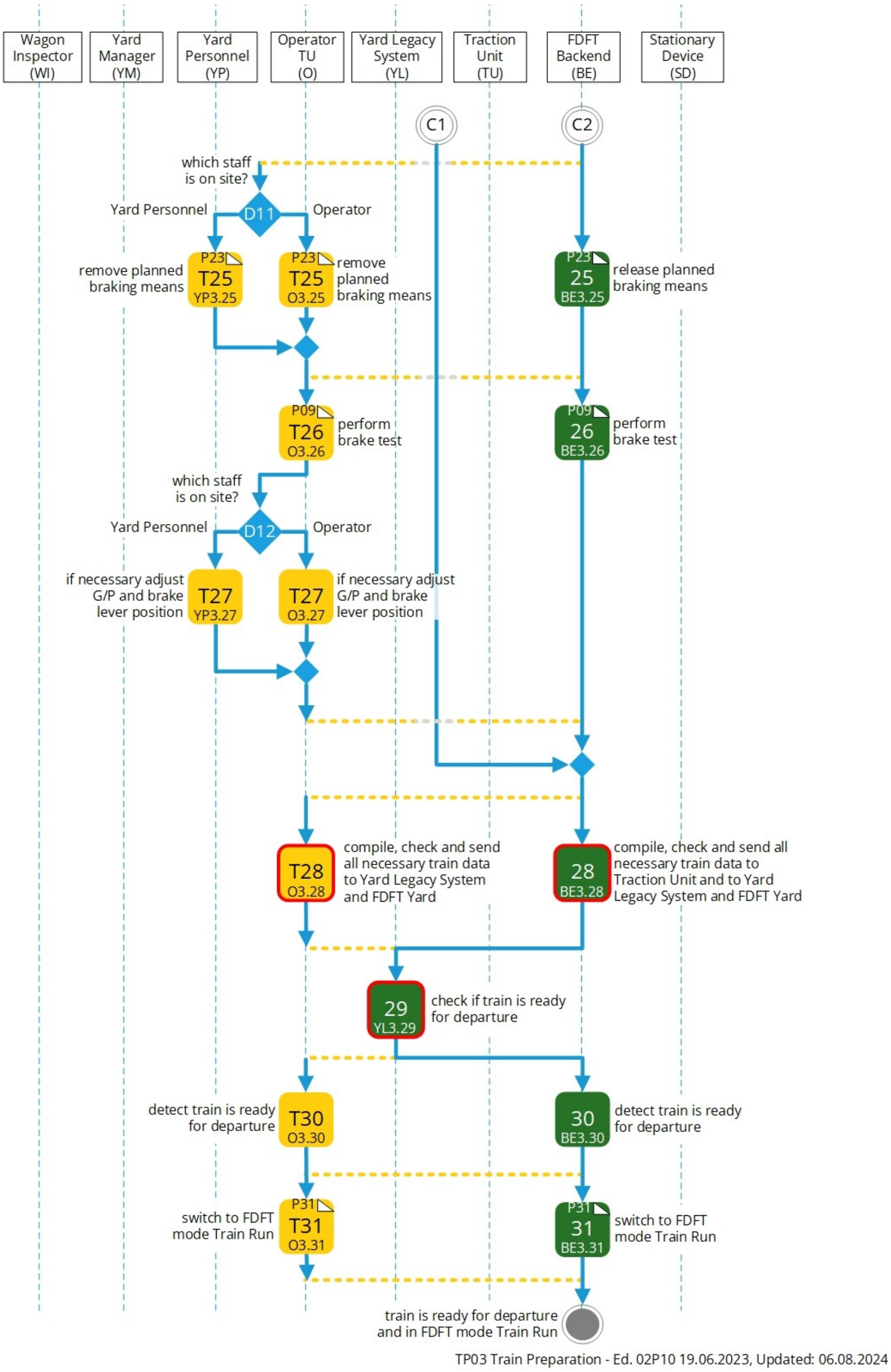


Figure 23: TP03 Train Preparation - 4 of 4

8.4.4.2 Process-Description

BE3.1 Detect Consist Composition is ready for train preparation

Precondition	▪ Consist Composition is secured against rolling away in target track and the Consist processing is completed.
Conditions	▪ FDFT Backend is available and can automatically detect that Consist Composition is ready for train preparation.
Tasks	▪ FDFT Backend automatically detects that Consist Composition is ready for train preparation and initiates following processes.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D1 Who initiates train preparation?

Decision	▪ -
Note Actor/s	▪ Yard Manager initiates train preparation. ▪ Yard Personnel initiates train preparation. ▪ Operator initiates train preparation.
Additional Information	▪ -

O3.1 Initiate train preparation

Precondition	▪ -
Conditions	▪ -
Tasks	▪ If FDFT Backend is available, inform FDFT Backend that Consist Composition is ready for train preparation. ▪ If FDFT Backend is not available, start legacy train preparation processes.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP3.1 Initiate train preparation

Precondition	▪ -
Conditions	▪ -
Tasks	▪ If FDFT Backend is available, inform FDFT Backend that Consist Composition is ready for train preparation. ▪ IF FDFT Backend is not available, start legacy train preparation processes.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YM3.1 Initiate train preparation

Precondition	▪ -
Conditions	▪ -
Tasks	▪ If FDFT Backend is available, inform FDFT Backend that Consist Composition is ready for train preparation. ▪ IF FDFT Backend is not available, start legacy train preparation processes.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D2 Air for brake test is supplied by Stationary Device or Traction Unit?

Decision	▪ -
Note Actor/s	▪ Air for brake test is supplied by Stationary Device. ▪ Air for brake test is supplied by Traction Unit.
Additional Information	**Rationale:** ▪ Stationary Devices can be used to accelerate overall process as wating for Traction Unit is not needed. ▪ The usage of Stationary Devices does not bind Traction Units for preparation activities.

SD3.2 Automatically connect to Consist Composition

Precondition	▪ -
Conditions	▪ Stationary Device can automatically connect to Consist Composition.
Tasks	▪ Stationary Device automatically moves to coupling position and connects air, and - if available - power and data at one of the outermost Consist.
Remarks	▪ Some of these activities may change depending on the automation of Stationary Device. e.g. the Consist Composition can be moved to the Stationary Device. ▪ Depending on the technical development it is possible that the Stationary Device connects to the Consist group at an earlier point in the process. ▪ Today a blow out of the main brake pipe of the SD is performed from some RUs. Whether this will be necessary in the future must be checked.
Activity Rationale	▪ -
Postcondition	▪ -

D3 Is Traction Unit already coupled?

Decision	**Yes:** ▪ Traction Unit is already coupled to Consist Composition. **No:** ▪ Traction Unit is not coupled to Consist Composition.
Note Actor/s	▪ -
Additional Information	**Rationale:** ▪ Traction Unit could be coupled from process Flat Shunting Provide.

BE3.3 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ FDFT Backend is available and can initiate movement of Traction Unit.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O3.3 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU3.4 Movement of Traction Unit to Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit leaves track.
Remarks	▪ Uncoupled Traction Unit moves away from the Consist (Composition) to an assigned destination.
Activity Rationale	▪ -
Postcondition	▪ -

TU3.5 Subprocess: Couple Traction Unit to Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.14.
Remarks	▪ Today a blow out of the main brake pipe of the Traction Unit is performed from some RUs. Whether this will be necessary in the future must be checked.
Activity Rationale	▪ -
Postcondition	▪ -

YP3.2 Manually connect Stationary Device

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Personnel manually connects Stationary Device and connects air, and - if available - power and data at one of the outermost Consist.
Remarks	▪ Some of these activities may change depending on the automation of Stationary Device. E.g. the Consist Composition can be moved to the Stationary Device. ▪ Today a blow out of the main brake pipe of the Stationary Device is performed from some RUs. Whether this will be necessary in the future must be checked.
Activity Rationale	▪ -
Postcondition	▪ -

D4 Is the pressure at operating pressure?

Decision	**Yes:** ▪ Pressure in main brake pipe is at operating pressure. **No:** ▪ Pressure in main brake pipe is not at operating pressure.
Note Actor/s	▪ -
Additional Information	**Conditions:** ▪ An Operator is available at the Traction Unit and Traction Unit is able to activate “build up pressure in main pipe to operating pressure”.

SD3.6 Build up pressure up to operating pressure

Precondition	▪ -
Conditions	▪ Stationary Device is able to activate "build up pressure in main pipe to operating pressure".
Tasks	▪ Stationary Device builds up pressure in main brake pipe to operating pressure.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU3.7 Build up pressure up to operating pressure

Precondition	▪ -
Conditions	▪ Traction Unit is able to activate "build up pressure in main pipe to operating pressure".
Tasks	▪ Traction Unit builds up pressure in main brake pipe to operating pressure automatically.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP3.6 Build up pressure up to operating pressure

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Personnel activates "build up pressure in main brake pipe to operating pressure" at Stationary Device.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O3.7 Build up pressure up to operating pressure

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator activates “build up pressure in main brake pipe to operating pressure” at Traction Unit.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE3.8 Check if shunting composition is ready for following steps

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ FDFT Backend checks if either Stationary Device or Traction Unit is connected to Consist Composition and main brake pipe is at operational pressure. FDFT Backend initiates following processes.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YM3.8 Detect that shunting composition is ready for following steps

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Manager checks if either Stationary Device or Traction Unit is connected to Consist Composition and main brake pipe is at operational pressure. Yard Manager then initiates following processes.
Remarks	▪ The Yard Manager notifies FDFT Backend on the current status of shunting composition if FDFT Backend cannot automatically detect or determine this.
Activity Rationale	▪ -
Postcondition	▪ -

BE3.9 Subprocess: Confirm Consist Composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate confirm Consist Composition.
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D5 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

YP3.9 Subprocess: Confirm Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O3.9 Subprocess: Confirm Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE3.10 Subprocess: Release planned braking means

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate release planned braking means.
Tasks	▪ See subprocess description 8.4.16. ▪ Only as many brakes may be released so that the shunting composition is sufficiently (planned) secured.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE3.11 Subprocess: Perform brake test

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate the Automatic Brake Test.
Tasks	▪ See subprocess description 8.4.10.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D6 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O3.10 Subprocess: remove planned braking means

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.16.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O3.11 Subprocess: perform brake test

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.10.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP3.11 Subprocess: perform brake test

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.10.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE3.12 Subprocess: perform technical Wagon inspection

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate the technical Wagon inspection.
Tasks	▪ See subprocess description 8.4.12.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

WI3.12 Subprocess: perform manual Wagon inspection

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.12.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE3.13 Initiate brake calculation

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate the brake calculation.
Tasks	▪ Compile all information needed to calculate brake power. This may include getting data from other systems (not part of FDFT System Environment).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE3.14 Brake calculation

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ FDFT Backend uses compiled data on Consist of Composition and load and calculates available brake power.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE3.15 Check technical Wagon inspection and brake power

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ FDFT Backend checks that available brake power is sufficient for planned track. ▪ FDFT Backend checks technical Wagon inspection data. ▪ FDFT Backend checks restrictions due to national requirements. E.g. Consist clearance, exceptional consignments.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D7 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O3.14 Brake calculation

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Legacy process for calculation of available brake power.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O3.15 Check technical Wagon inspection and brake power

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator checks that available brake power is sufficient for planned track. ▪ Operator checks technical Wagon inspection data. ▪ Operator checks restrictions due to requirements. E.g. Consist clearance, exceptional consignments, ...
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O3.16 Activate rear-end signal

Precondition	▪ -
Conditions	▪ -
Tasks	▪ If trailing Consist has automatic rear-end signal capabilities, activate rearend signal on Consist. ▪ This can also be achieved by using the Mobile HMI. ▪ If not, use legacy process.
Remarks	▪ If rear-end signal is not necessary according to changes in regulations, this step can be skipped.
Activity Rationale	▪ -
Postcondition	▪ -

YP3.14 Brake Calculation

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Legacy process for calculation of available brake power.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP3.15 Check technical Wagon inspection and brake power

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard personnel checks that available brake power is sufficient for planned track. ▪ Yard personnel checks technical Wagon inspection data. ▪ Yard personnel checks restrictions due to requirements. E.g. Consist clearance, exceptional consignments, ...
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP3.16 Activate rear-end signal

Precondition	▪ -
Conditions	▪ -
Tasks	▪ If trailing Consist has automatic rear-end signal capabilities, activate rearend signal on Consist. ▪ This can also be achieved by using the Mobile HMI. ▪ If not, use legacy process.
Remarks	▪ If rear-end signal is not necessary according to changes in regulations, this step can be skipped.
Activity Rationale	▪ -
Postcondition	▪ -

D8 Brake test performed by Traction Unit or Stationary Device?

Decision	▪ -
Note Actor/s	▪ Brake test was performed by Stationary Device. ▪ Brake test was performed by Traction Unit.
Additional Information	▪ -

SD3.20 Automatically disconnect Stationary Device

Precondition	▪ -
Conditions	▪ Stationary Device disconnects automatically.
Tasks	▪ Automatically disconnect Stationary Device.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP3.20 Manually disconnect Stationary Device

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Manually disconnect Stationary Device. ▪ This can either be achieved by manual interaction with Stationary Device or automatically triggered by Mobile HMI. In each case, manual work must be done to physically remove Stationary Device.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D9 Traction Unit change planned

Decision	**Yes:** ▪ Traction Unit change is planned. **No:** ▪ Traction Unit change is not planned.
Note Actor/s	▪ -
Additional Information	▪ -

BE3.17 Subprocess: uncouple Traction Unit

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate uncoupling of Traction Unit.
Tasks	▪ See subprocess description 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O3.17 Subprocess: Uncouple Traction Unit

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE3.18 Initiate movement of Traction Unit

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate movement of Traction Unit.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O3.18 Initiate movement of Traction Unit

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU3.19 Movement of Traction Unit – leaves track

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit leaves track.
Remarks	▪ Uncoupled Traction Unit moves away from the Consist (Composition) to an assigned destination.
Activity Rationale	▪ -
Postcondition	▪ -

BE3.21 Initiate movement of Traction Unit

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate movement of Traction Unit.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O3.21 Initiate movement of Traction Unit

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU3.22 Movement of Traction Unit to Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit moves to track with Consist Composition.
Remarks	▪ Traction Unit is moved to Consist Composition.
Activity Rationale	▪ -
Postcondition	▪ -

TU3.23 Subprocess: Couple Traction Unit

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.14.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE3.24 Subprocess: Confirm Consist Composition

Precondition	▪ -
Conditions	▪ Backend is available, can communicate with CCU and can initiate confirm Consist Composition.
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D10 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O3.24 Subprocess: Confirm Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP3.24 Confirm Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE3.25 Subprocess: Release planned braking means

Precondition	▪ -
Conditions	▪ Backend is available, can communicate with CCU and can initiate release braking means.
Tasks	▪ See subprocess description 8.4.16.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D11 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O3.25 Subprocess: Remove planned braking means

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.16.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP3.25 Activity Subprocess: Remove planned braking means

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.16.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE3.26 Subprocess: perform brake test

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate brake test.
Tasks	▪ See subprocess description 8.4.10.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O3.26 Subprocess: Perform brake test

Precondition	▪ It is ensured that main brake pipe is continuous from first to last Consist.
Conditions	▪ -
Tasks	▪ Perform legacy brake test according to regulations.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D12 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O3.27 If necessary, adjust brake lever position

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Personnel adjusts brake lever position if necessary.
Remarks	▪ This step can be skipped if Consist is equipped with a brake system not needing manual lever changes.
Activity Rationale	▪ -
Postcondition	▪ -

YP3.27 If necessary, adjust brake lever position

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator adjusts brake lever position if necessary.
Remarks	▪ This step can be skipped if Consist is equipped with a brake system not needing manual lever changes.
Activity Rationale	▪ -
Postcondition	▪ -

BE3.28 Compile, check and send all necessary train data to Traction Unit and to Yard Legacy System and FDFT Yard

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ FDFT Backend compiles all necessary train data in preparation of train run. ▪ FDFT Backend performs checks according to national regulations. ▪ FDFT Backend sends train data to Traction Unit. ▪ FDFT Backend sends train data to Yard Legacy System and FDFT Yard if available.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O3.28 Compile, check and send all necessary train data to Yard Legacy System and FDFT Yard

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator compiles all necessary train data in preparation of train run. ▪ Operator performs checks according to national regulations. ▪ Operator enters data into Traction Unit. ▪ Operator sends train data to Yard Legacy System and FDFT Yard if available.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YL3.29 Check if train is ready for departure

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Legacy receives train data and initiates legacy processes, e.g. set route.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE3.30 Detect train is ready for departure

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can automatically detect that train is ready for departure.
Tasks	▪ FDFT Backend automatically detects that train is ready for departure and triggers following processes, e.g. train is allowed to start train run by infrastructure.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O3.30 Detect train is ready for departure

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator detects that train is ready for departure and informs FDFT Backend, if available. This can be achieved by using the Mobile HMI. E.g. train is allowed to start train run by infrastructure.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE3.31 Subprocess: Switch to FDFT mode Train Run

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate switch to FDFT mode Train Run.
Tasks	▪ See subprocess description 8.4.20.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O3.31 Subprocess: Switch to FDFT mode Train Run

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.20.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.5 TP04 - Train Run

TP04 - Train Run

8.4.5.1 Target Process

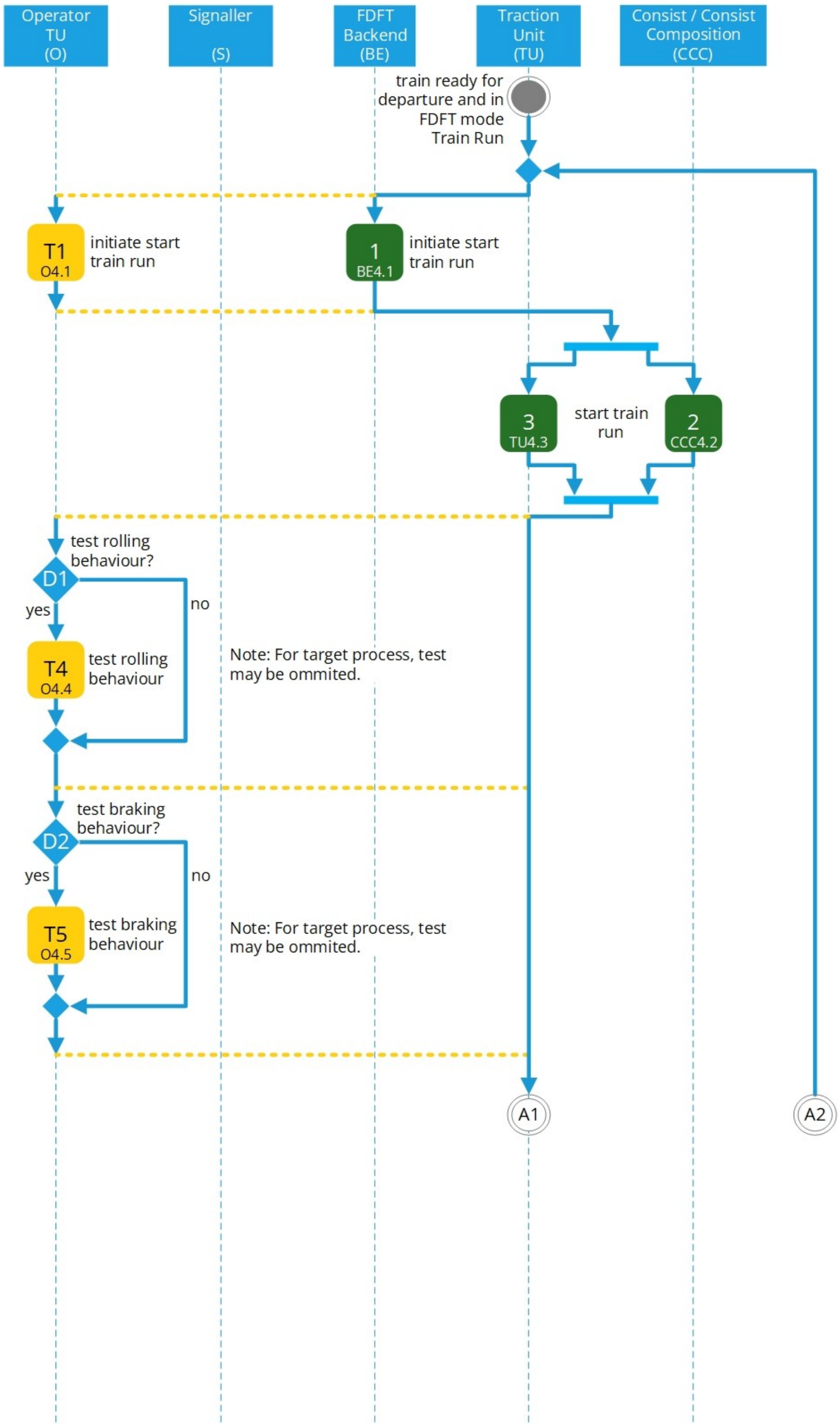


Figure *24*: TP04 Train Run - 1 of 2

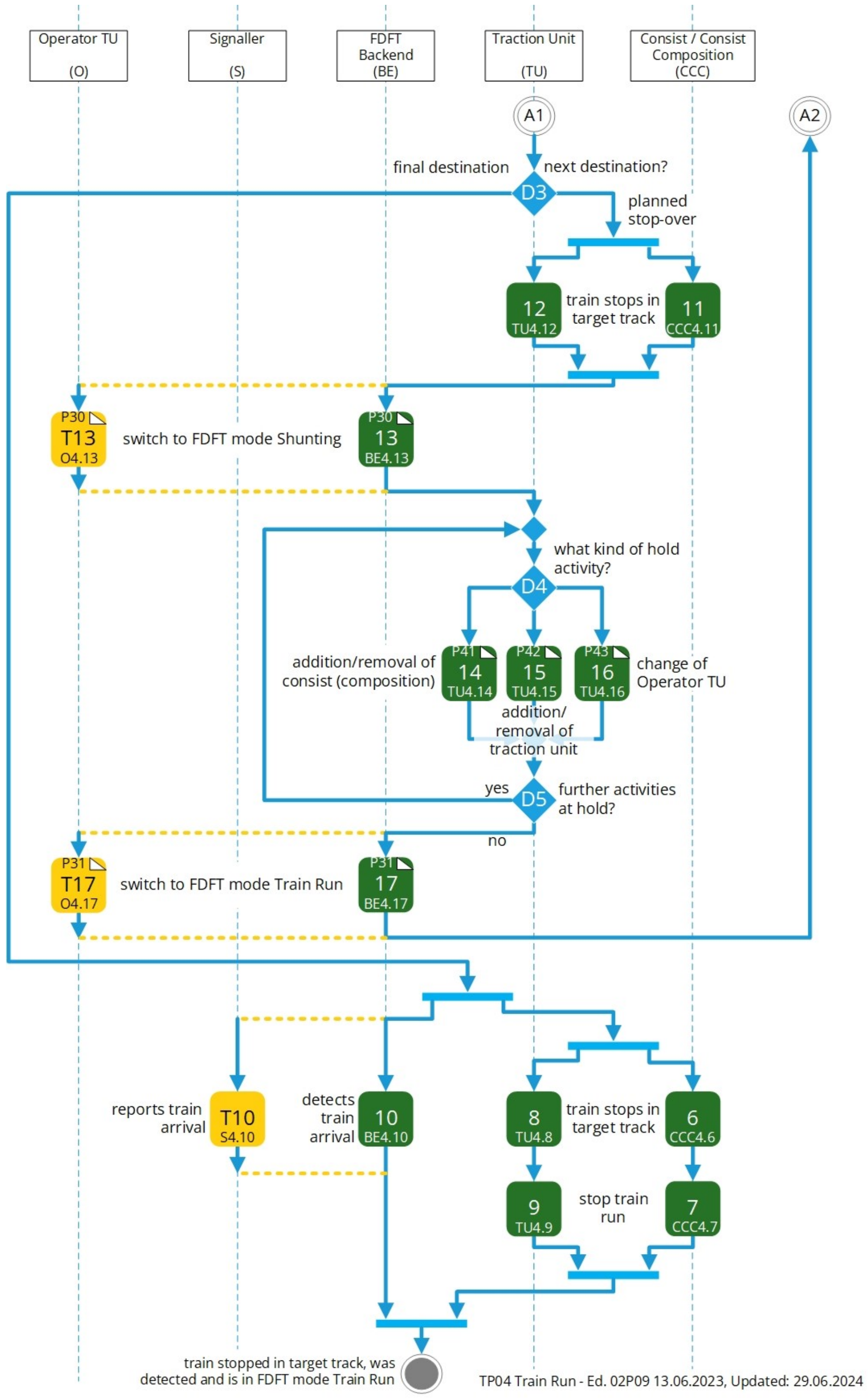


Figure 25: TP04 Train Run - 2 of 2

8.4.5.2 Process-Description

BE4.1 Initiate start train run

Precondition	▪ Train is ready for departure and operator reports readiness to departure.
Conditions	▪ FDFT Backend is available and can initiate train run.
Tasks	▪ FDFT Backend triggers the operational start of train run (e.g. ensures that uniquely identifiable composition of Traction Unit and Consist (Composition) is given) and initiates train movement.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O4.1 Initiate start train run

Precondition	▪ Train is ready for departure and operator reports readiness to departure.
Conditions	▪ -
Tasks	▪ Operator triggers the operational start of train run (e.g. ensures that uniquely identifiable composition of Traction Unit and Consist (Composition) is given) and initiates train movement.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU4.3 Start train run

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Train starts moving.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC4.2 Start train run

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Train starts moving.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D1 Test rolling behaviour?

Decision	**Yes:** ▪ Rolling behaviour should be tested. **No:** ▪ Rolling behaviour should not be tested.
Note Actor/s	▪ -
Additional Information	**Conditions:** ▪ Do regulations require testing of the rolling behaviour?

O4.4 Test rolling behaviour

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator tests rolling behaviour according to regulations and no unintentional braking means are applied.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D2 Test braking behaviour?

Decision	**Yes:** ▪ Braking behaviour should be tested. **No:** ▪ Braking behaviour should not be tested.
Note Actor/s	▪ -
Additional Information	**Conditions:** ▪ Do regulations require testing of the braking behaviour?

O4.5 Test braking behaviour

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator tests braking behaviour according to regulations.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D3 Next destination?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ Next destination is the final stop of train run. ▪ Next destination is a planned stop-over of train run. **Remarks:** ▪ Unplanned stops (e.g. malfunctions) are not considered in this process.

CCC4.6 Train stops in target track

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Train comes to a halt in target track.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC4.7 Stop train run

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Train arrives in target track and the operational train run stops (e.g. resolves the uniquely identifiable train number, which means that the composition is a Shunting Composition).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU4.8 Train stops in target track

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Train comes to a halt in target track.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU4.9 Stop train run

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Train arrives in target track and the operational train run stops (e.g. resolves the uniquely identifiable train number, which means that the composition is a Shunting Composition).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE4.10 Detects train arrival

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can automatically detect train arrival.
Tasks	▪ FDFT Backend detects train arrival.
Remarks	▪ This information can be used to trigger following processes.
Activity Rationale	▪ -
Postcondition	▪ -

S4.10 Activity Reports train arrival

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator detects and reports train arrival.
Remarks	▪ This information can be used to trigger following processes.
Activity Rationale	▪ -
Postcondition	▪ -

TU4.12 Train stops in target track

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Train comes to a halt in target track.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC4.11 Train stops in target track

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Train comes to a halt in target track.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE4.13 Subprocess: Switch to FDFT mode Shunting

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate switch to FDFT mode Shunting.
Tasks	▪ See subprocess description 8.4.19.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O4.13 Subprocess: Switch to FDFT mode Shunting

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.19.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D4 What kind of hold activity?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

TU4.14 Subprocess: Addition, Removal of Consist (Composition)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.22.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU4.15 Subprocess: Addition, Removal of Traction Unit

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.23.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU4.16 Subprocess: Change of Operator

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.24.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D5 Further activities at hold?

Decision	**Yes:** ▪ Further activities at hold are planned. **No:** ▪ All activities at hold are completed.
Note Actor/s	▪ -
Additional Information	▪ -

BE4.17 Subprocess: Switch to FDFT mode train run

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate switch to FDFT mode Train Run.
Tasks	▪ See subprocess description 8.4.20.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O4.17 Subprocess: Switch to FDFT mode train run

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.20.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.6 TP05 - Hump Shunting

TP05 - Hump Shunting

8.4.6.1 Target Process

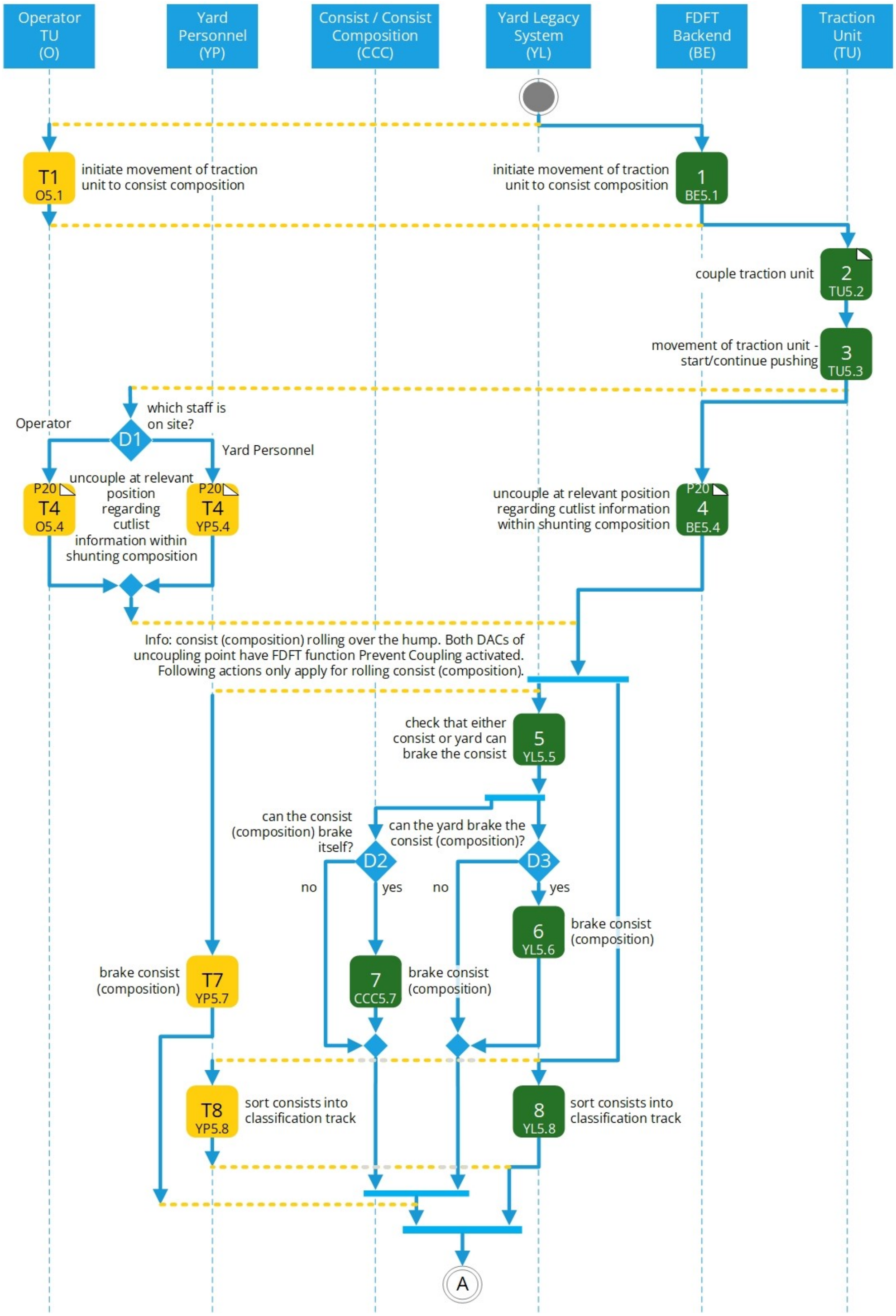


Figure *26*: TP05 Hump Shunting - 1 of 2

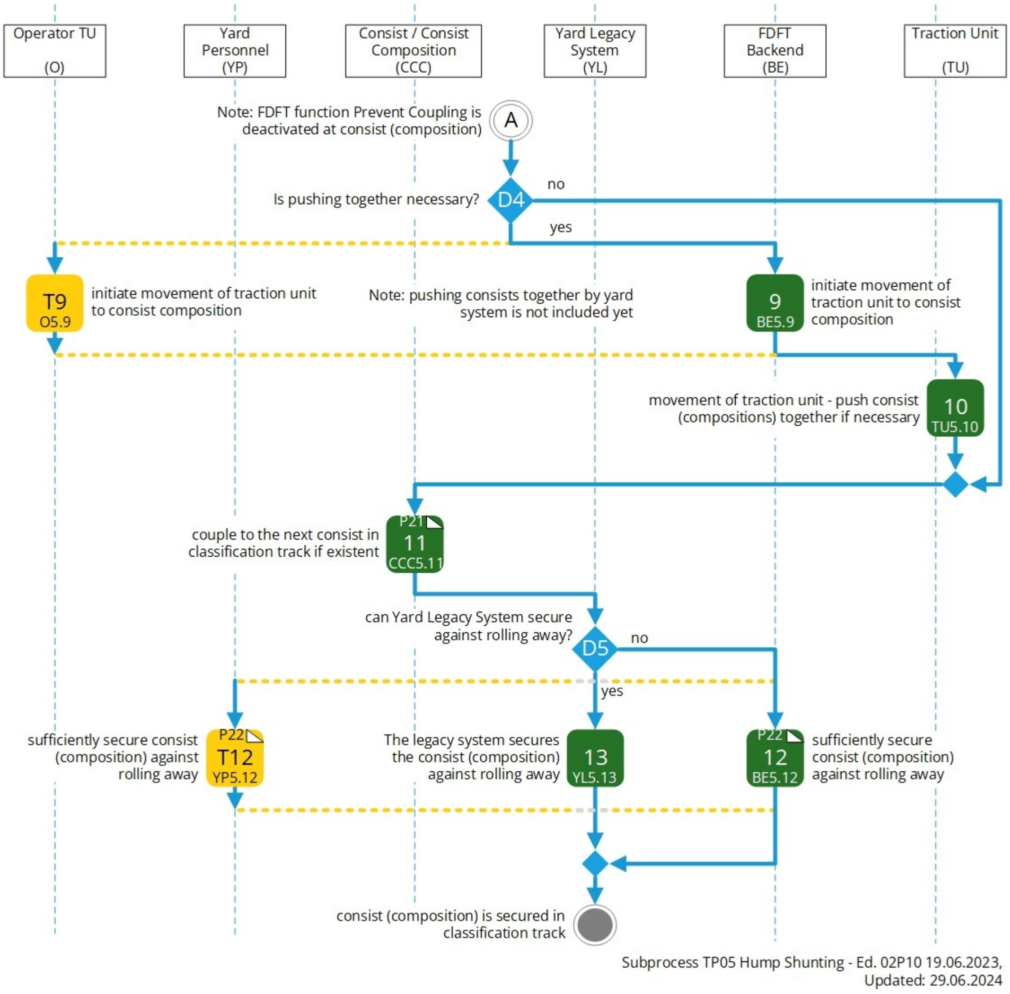


Figure 27: TP05 Hump Shunting - 2 of 2

8.4.6.2 Process-Description

BE5.1 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ FDFT Backend is available and can initiate movement of Consist Composition.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O5.1 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU5.2 Couple Traction Unit

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU5.3 Activity Start/continue pushing

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit pushes the Consist Composition up over the hump according to local regulations. ▪ Traction Unit is controlled by FDFT Backend or Yard Legacy System.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE5.4 Subprocess: Uncouple at relevant position regarding cutlist information within shunting composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with the FDFT Consist Base System and can initiate uncoupling.
Tasks	▪ See subprocess Uncouple 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D1 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

YP5.4 Subprocess: Uncouple at relevant position regarding cutlist information within shunting composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess Uncouple 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O5.4 Subprocess: Uncouple at relevant position regarding cutlist information within shunting composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess Uncouple 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YL5.5 Check that either Consist or yard can brake the Consist

Precondition	▪ -
Conditions	▪ The Consist has a Controllable Brake or/and the Yard has a brake system, which brakes the Consist (Composition).
Tasks	▪ Check, if the Consist itself or/and the Yard brake system can brake the Consist (Composition) after the hump.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D2 Can the Consist (Composition) brake itself?

Decision	**Yes:** ▪ The Consist has a Controllable Brake, which brakes the Consist (Composition).
Note Actor/s	▪ -
Additional Information	▪ -

D3 Can the Yard brake the Consist (Composition)?

Decision	**Yes:** ▪ The Yard has a brake system, which brakes the Consist (Composition).
Note Actor/s	▪ -
Additional Information	▪ -

YL5.6 Brake the Consist (Composition)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ The infrastructure-side system brakes the Consist (Composition) so that it either comes to a standstill at a certain point in the track or hits the front Consist at a certain speed.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC5.7 Brake the Consist (Composition)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ The infrastructure-side system brakes the Consist (Composition) so that it either comes to a standstill at a certain point in the track or hits the front Consist at a certain speed.
Remarks	▪ The brake is controlled via the FDFT Link by the FDFT Backend or Personnel.
Activity Rationale	▪ -
Postcondition	▪ -

YP5.7 Brake the Consist (Composition)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Personnel brakes the Consist (Composition) according to legacy processes.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YL5.8 Sort Consist (Composition) into classification track

Precondition	▪ -
Conditions	▪ There is a system available that can control the switch stand.
Tasks	▪ The Yard Legacy System ensures that the switches are set so that the Consist (Composition) run into the planned track.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP5.8 Sort Consist (Composition) into classification track

Precondition	▪ -
Conditions	▪ -
Tasks	▪ The Yard Personnel ensures that the switches are set so that the Consist (Composition) run into the planned track.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D4 Is pushing together necessary

Decision	**Yes:** ▪ It is necessary.
Note Actor/s	▪ -
Additional Information	**Remarks:** ▪ This process step is only required before the train preparation of this consist composition starts.

BE5.9 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ FDFT Backend is available and can initiate movement of Traction Unit.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O5.9 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU5.10 Push Consist (Composition) together if necessary

Precondition	▪ -
Conditions	▪ -
Tasks	▪ If necessary, a Traction Unit push the Consist Composition together so that Consist (Composition) can couple.
Remarks	▪ Performed only when a planned coupling between Consist has not occurred.
Activity Rationale	▪ -
Postcondition	▪ -

CCC5.11 Activity Subprocess: Couple to the next Consist in classification track if existent

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess Couple 8.4.14. ▪ Couple to the next Consist in classification group if existent. ▪ Multiple coupling processes can be checked in total at a later step.
Remarks	▪ This step is not necessary if this is the first Consist for the new Consist Composition to be formed.
Activity Rationale	▪ -
Postcondition	▪ -

D5 Can Yard Legacy System secure against rolling away?

Decision	**Yes:** ▪ Yard Legacy System can secure the Consist (Composition) against rolling away?
Note Actor/s	▪ -
Additional Information	▪ -

BE5.13 Subprocess: sufficiently secure Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate secure Consist (Composition) against rolling away.
Tasks	▪ See subprocess 8.4.15. ▪ Sufficiently secure Consist against rolling away.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP5.12 Activity Subprocess: sufficiently secure Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess 8.4.15 ▪ Sufficiently secure Consist against rolling away.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YL5.13 Activity Sufficiently secure Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ The infrastructure has a system that secures the Consist from rolling away. ▪ Yard legacy system initiates securing the Consist (Composition) against rolling away. ▪ The infrastructure sided system secures the Consist (Composition) against rolling away and checks, if the Consist (Composition) is secured. ▪ If available the Yard legacy system sends the securing data to FDFT Backend.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.7 TP06 – Fly Shunting

TP06 - Fly Shunting

8.4.7.1 Target Process

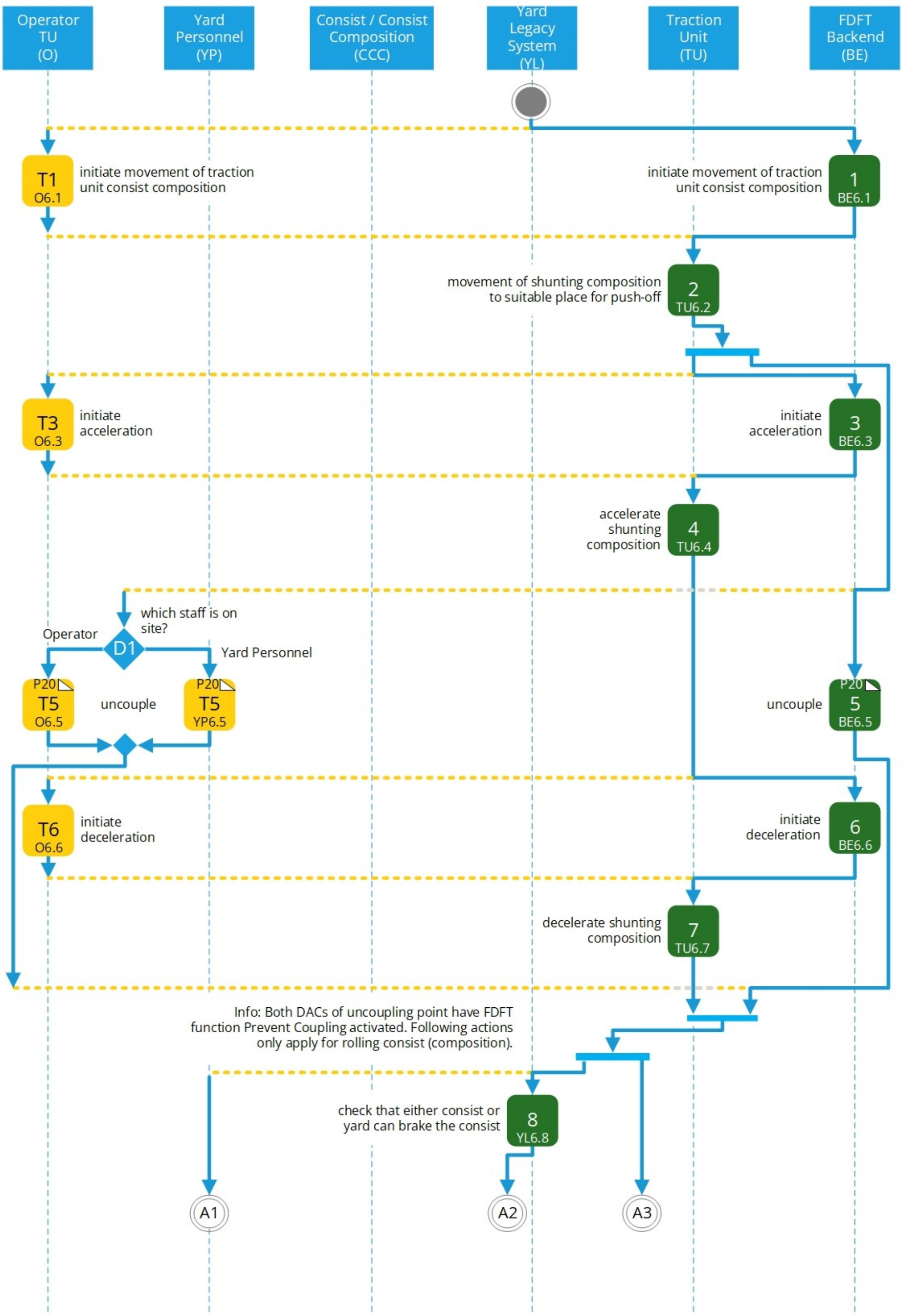


Figure *28*: TP06 Fly Shunting - 1 of 2

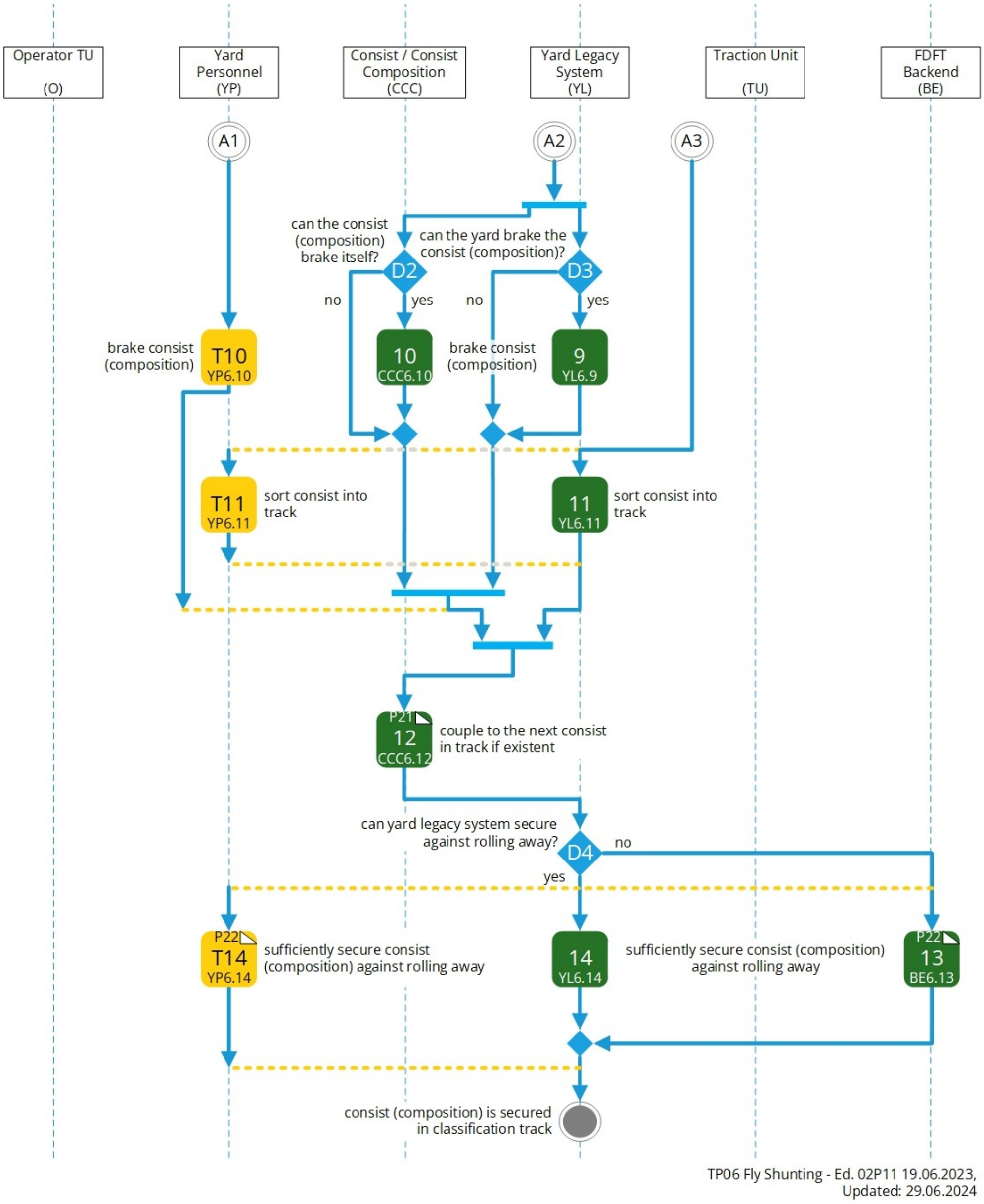


Figure *29*: TP06 Fly Shunting - 2 of 2

8.4.7.2 Process-Description

BE6.1 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ FDFT Backend is available and can initiate movement of Traction Unit.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O6.1 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU6.2 Move shunting composition to suitable place for push-off

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Movement of Traction Unit to suitable place for push off.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE6.3 Initiate acceleration

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ FDFT Backend is available and can initiate acceleration.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O6.3 Activity Initiate acceleration

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU6.4 Activity Accelerate shunting composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Shunting composition accelerates to fly shunting speed.
Remarks	▪ The fly shunting speed depends on the characteristics of the Consist Composition, the infrastructure, and the point at which the Consist are to stop in the track.
Activity Rationale	▪ -
Postcondition	▪ -

BE6.5 Subprocess: Uncouple

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate uncouple.
Tasks	▪ See subprocess Uncouple 8.4.13. ▪ Uncouple at uncoupling point.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE6.6 Initiate deceleration

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate deceleration.
Tasks	▪ Apply brake force to Shunting composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O6.6 Activity Initiate deceleration

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Apply brake force to Shunting composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU6.7 Activity Decelerate shunting composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Shunting composition decelerates as planned.
Remarks	▪ If there are no Consist left, it could be that only the Traction Unit decelerates.
Activity Rationale	▪ -
Postcondition	▪ -

D1 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O6.5 Activity Subprocess: Uncouple

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess uncouple 8.4.13. ▪ Uncouple at uncoupling point.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP6.5 Activity Subprocess: Uncouple

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess uncouple 8.4.13. ▪ Uncouple at uncoupling point.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YL6.8 Check that either Consist or yard can brake the Consist

Precondition	▪ -
Conditions	▪ The Consist has a Controllable Brake or/and the Yard has a brake system, which brakes the Consist (Composition).
Tasks	▪ Check, if the Consist itself or/and the Yard brake system can brake the Consist (Composition).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D2 Can the Consist (Composition) brake itself?

Decision	**Yes:** ▪ The Consist has a Controllable Brake, which brakes the Consist (Composition).
Note Actor/s	▪ -
Additional Information	▪ -

CCC6.10 Brake Consist (Composition)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ The Controllable Brake brakes the Consist (Composition) so that it either comes to a standstill at a certain point in the track or hits the front Consist at a certain speed.
Remarks	▪ The brake is controlled via the FDFT Link by the FDFT Backend or Personnel.
Activity Rationale	▪ -
Postcondition	▪ -

D3 Can the Yard brake the Consist (Composition)?

Decision	**Yes:** ▪ The Yard has a brake system, which brakes the Consist (Composition).
Note Actor/s	▪ -
Additional Information	▪ -

YL6.9 Brake Consist (Composition)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ The infrastructure-side system brakes the Consist (Composition) so that it either comes to a standstill at a certain point in the track or hits the front Consist at a certain speed.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP6.10 Brake Consist (Composition)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Personnel brakes the Consist (Composition) according to legacy processes.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YL6.11 Sort Consist into track

Precondition	▪ -
Conditions	▪ There is a system available that can control the switch stand.
Tasks	▪ The Yard Legacy System ensures that the switches are set so that the Consist run off into the planned track.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP6.11 Sort Consist into track

Precondition	▪ -
Conditions	▪ -
Tasks	▪ The Yard Personnel ensures that the switches are set so that the Consist run into the planned track.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC6.12 Subprocess: Couple to the next Consist in track if existent

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess Couple 8.4.14. ▪ Couple to the next Consist in track if existent. ▪ Multiple coupling processes can be checked in total at a later step.
Remarks	▪ This step is not necessary if this is the first Consist for the new Consist Composition to be formed.
Activity Rationale	▪ -
Postcondition	▪ -

D4 Can Yard Legacy System secure against rolling away?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	**Remarks:** ▪ If Yard Legacy System is able to secure consists against rolling away.

BE6.13 Subprocess: sufficiently secure Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate secure Consist (Composition) against rolling away.
Tasks	▪ See subprocess Secure Consist Composition against rolling away 8.4.15. ▪ Sufficiently secure Consist against rolling away.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YL6.14 Sufficiently secure Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ The infrastructure has a system that secures the Consist from rolling away. ▪ Yard legacy system initiates securing the Consist (Composition) against rolling away. ▪ The infrastructure sided system secures the Consist (Composition) against rolling away and checks, if the Consist (Composition) is secured. ▪ If available, the Yard legacy system sends the securing data to FDFT Backend.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP6.14 Subprocess: sufficiently secure Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess Secure Consist Composition against rolling away 8.4.15. ▪ Sufficiently secure Consist against rolling away.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.8 TP07 - Flat Shunting Drop Off

TP07 - Flat Shunting Drop Off

8.4.8.1 Target Process

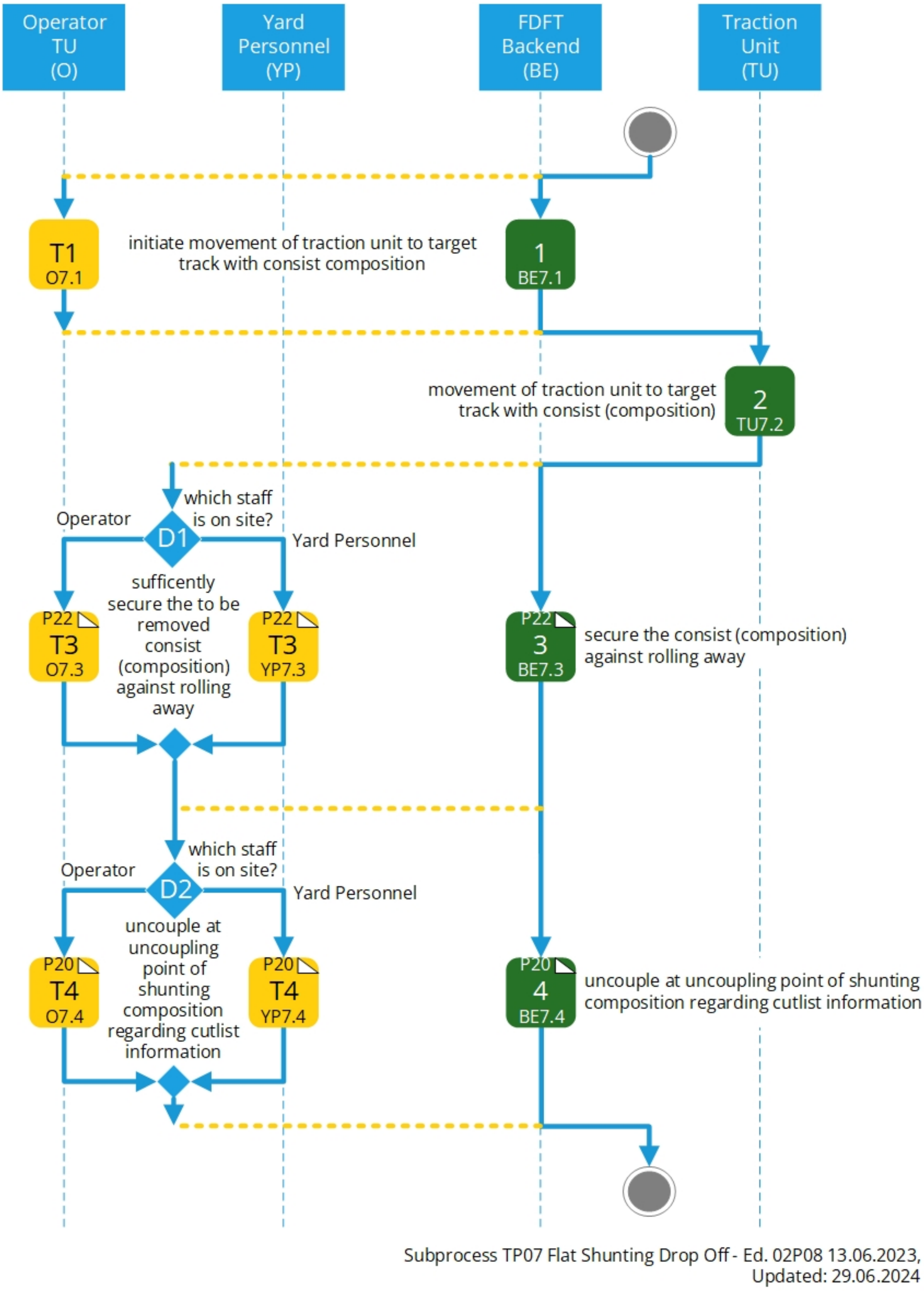


Figure *30*: TP07 Flat Shunting Drop Off - 1-1

8.4.8.2 Process-Description

BE7.1 Initiate movement of Traction Unit to target track with Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ FDFT Backend available and can initiate movement of Traction Unit.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O7.1 Initiate movement of Traction Unit to target track with Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU7.2 Movement to target track with Consist (Composition)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit moves to target track.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE7.3 Subprocess: Secure the Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ FDFT Backend is available. Controllable brake is available and can initiate securing the Consist. FDFT backend is available and can communicate with the CCU.
Tasks	▪ See subprocess description 8.4.15. ▪ The Consist Composition to be removed has to be secured.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE7.4 Subprocess: Uncouple at uncoupling point of shunting composition regarding cutlist information

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate uncoupling.
Tasks	▪ See subprocess description 8.4.13. ▪ Uncouple at uncoupling point of shunting composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D1 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O7.3 Subprocess: sufficiently secure the to be removed Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.15. ▪ Secure the Consist (Composition) to be removed against rolling away.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP7.3 Subprocess: sufficiently secure the to be removed Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.15. ▪ Secure the Consist (Composition) to be removed against rolling away.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D2 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O7.4 Subprocess: Uncouple at uncoupling point of shunting composition regarding cutlist information

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.13. ▪ Uncouple at uncoupling point of shunting composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP7.4 Subprocess: Uncouple at uncoupling point of shunting composition regarding cutlist information

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.13. ▪ Uncouple at uncoupling point of shunting composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.9 TP08 - Flat Shunting Pick Up

TP08 - Flat Shunting Pick Up

8.4.9.1 Target Process

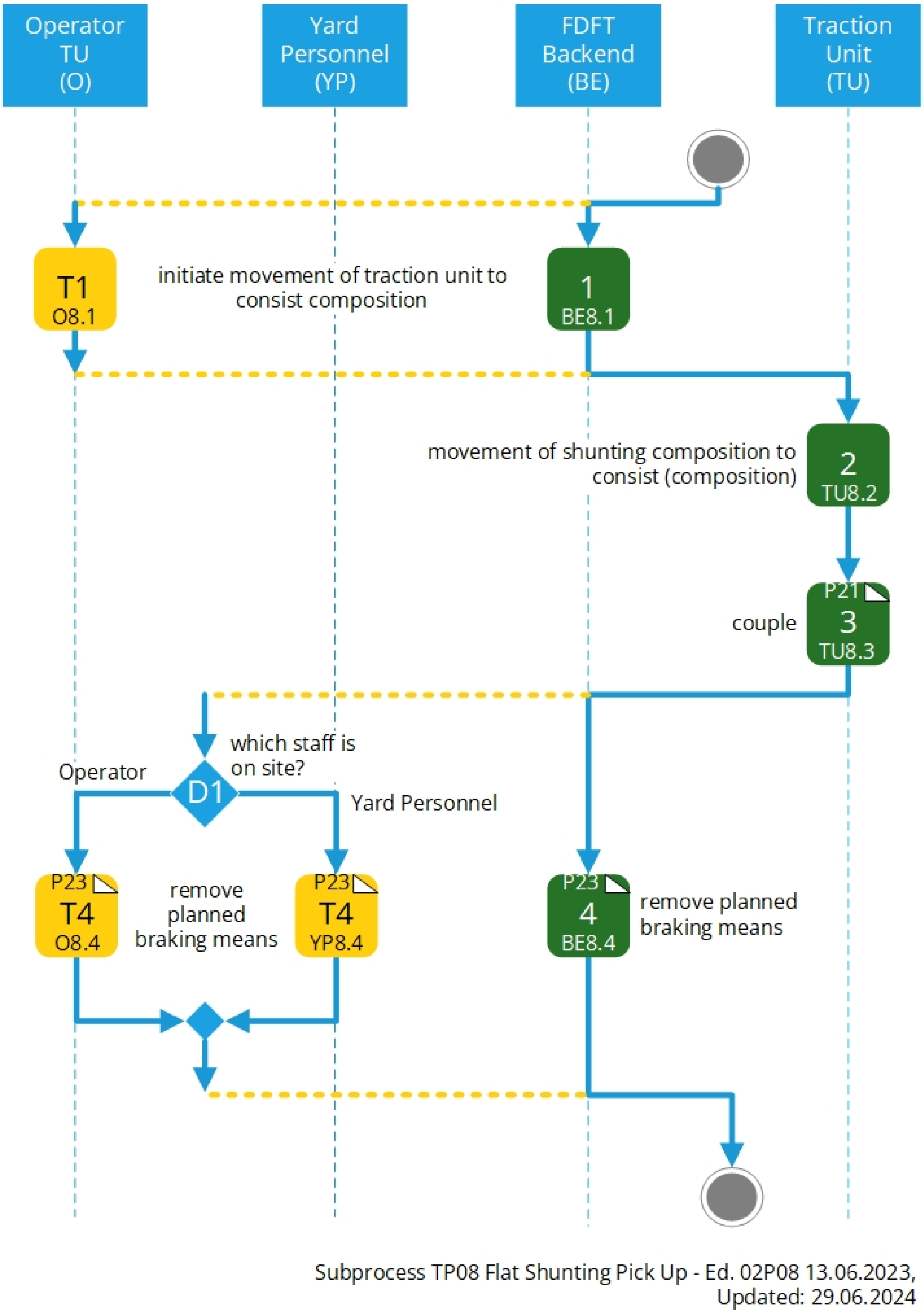


Figure *31*: TP08 Flat Shunting Pick Up - 1 of 1

8.4.9.2 Process-Description

BE8.1 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ FDFT Backend is available and can initiate movement of Traction Unit.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O8.1 Initiate movement of Traction Unit to Consist Composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU8.2 Movement of shunting composition to Consist (Composition)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Movement of shunting composition to Consist (Composition) which will be picked up.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU8.3 Subprocess: Couple

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.14. ▪ Couple shunting composition or Traction Unit to Consist (Composition).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE8.4 Subprocess: Remove planned braking means

Precondition	▪ -
Conditions	▪ Controllable brake is available and can initiate securing the Consist. FDFT Backend is available and can communicate with the CCU.
Tasks	▪ See subprocess description 8.4.16.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D1 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O8.4 Subprocess: Remove planned braking means

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.16.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP8.4 Subprocess: Remove planned braking means

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.16.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.10 TP09 - Automated Brake Test

TP09 - Automated Brake Test

8.4.10.1 Target Process

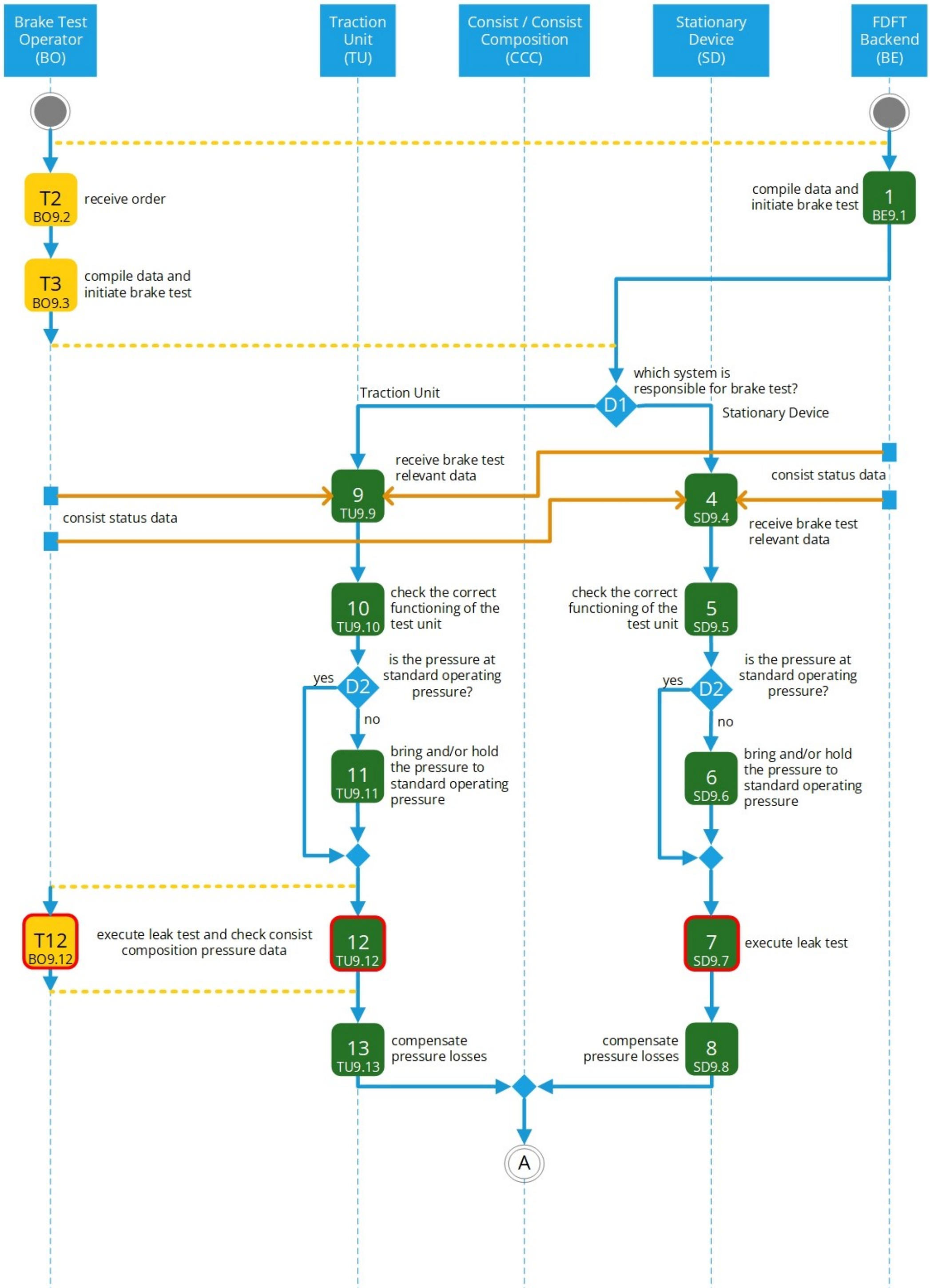


Figure 32: TP09 Automated Brake Test - 1 of 3

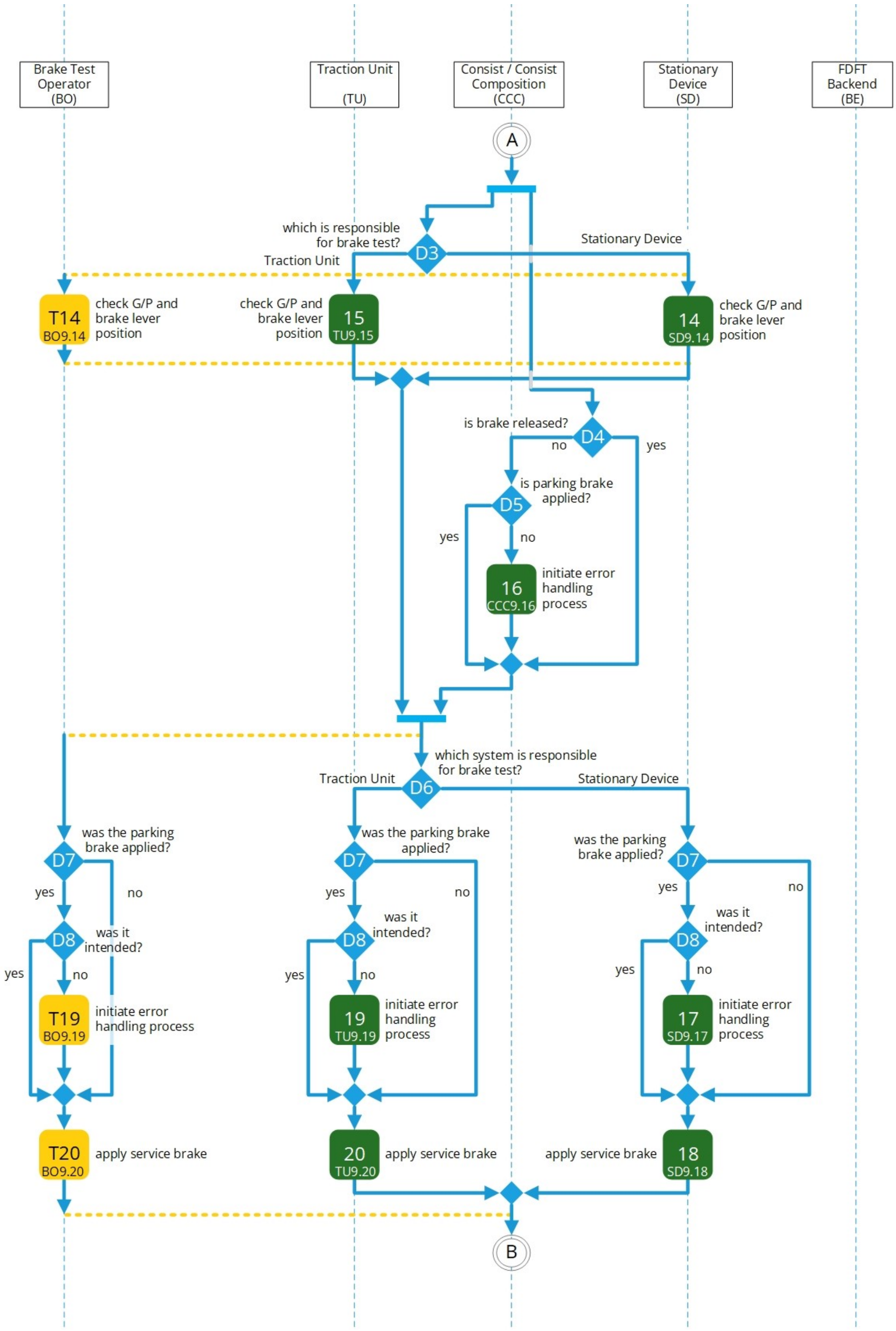


Figure 33: TP09 Automated Brake Test - 2 of 3

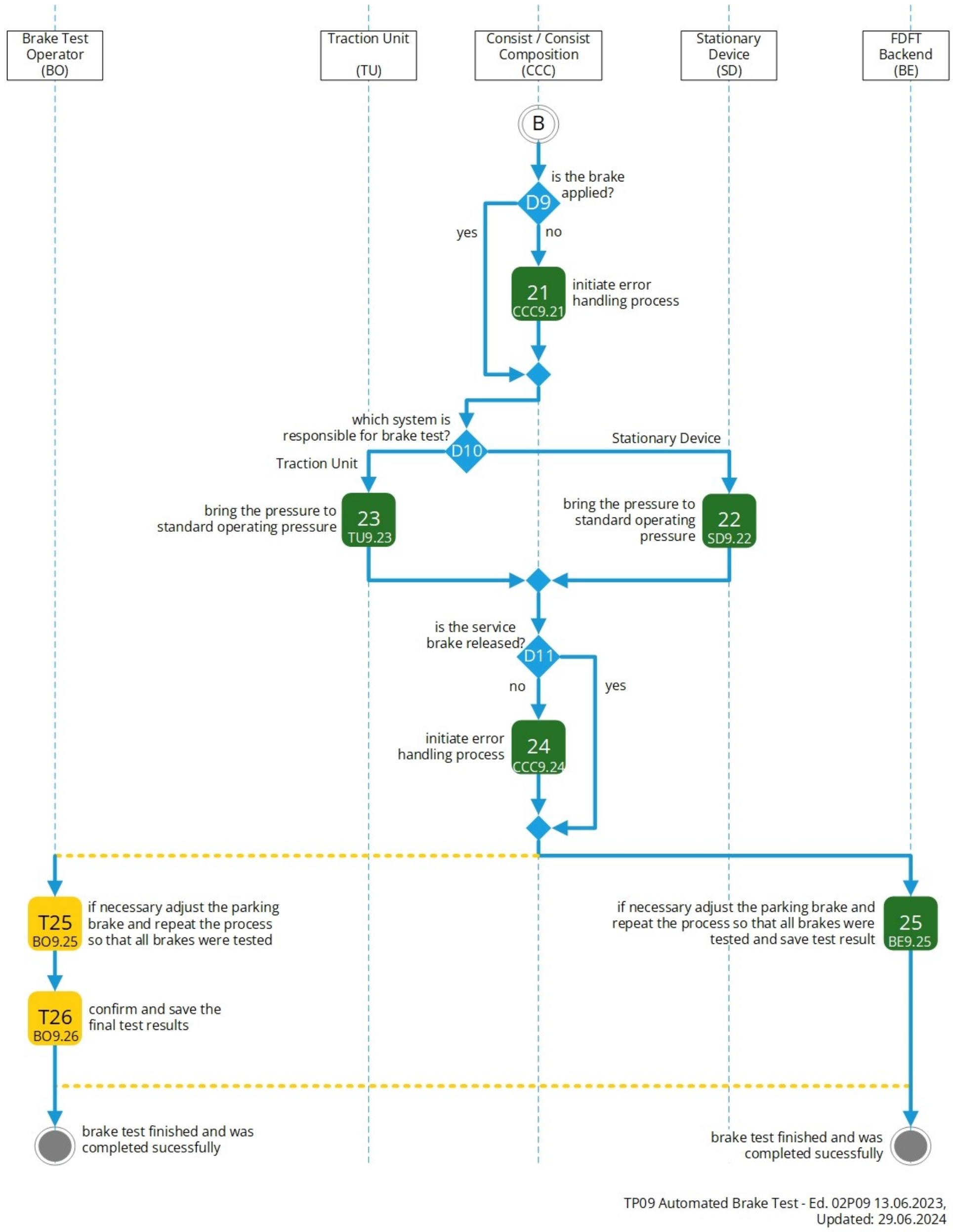


Figure *34*: TP09 Automated Brake Test - 3 of 3

8.4.10.2 Process-Description

BE9.1 Compile data and initiate brake test

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate brake test.
Tasks	▪ FDFT Backend compiles all necessary data and initiates brake test.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BO9.2 Receive order

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Brake Test Operator receives order to perform brake test on Consist Composition using legacy processes.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BO9.3 Compile data and initiate brake test

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Brake Test Operator compiles brake test relevant data and initiates brake test.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D1 Which is responsible for brake test?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

SD9.4 Receive brake test relevant data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Stationary Device receives brake test relevant data.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

SD9.5 Check the correct functioning of the test unit

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Correct functioning of test unit on Stationary Device is checked.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D2 Is the pressure at standard operating pressure?

Decision	**Yes:** ▪ The pressure is at standard operating pressure.
Note Actor/s	▪ -
Additional Information	▪ -

SD9.6 Bring and/or hold the pressure to standard operating pressure

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Stationary Device brings pressure in main brake pipe to standard operating pressure.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

SD9.7 Activity Execute leak test

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Stationary Device executes leak test.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

SD9.8 Compensate pressure losses

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Stationary Device compensates pressure losses.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU9.9 Activity Receive brake test relevant data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit receives brake test relevant data.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU9.10 Check the correct functioning of the test unit

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Correct functioning of test unit on Traction Unit is checked.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D2 Is the pressure at standard operating pressure?

Decision	**Yes:** ▪ The pressure is at standard operating pressure.
Note Actor/s	▪ -
Additional Information	▪ -

TU9.11 Bring and/or hold the pressure to standard operating pressure

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit brings pressure in main brake pipe to standard operating pressure.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU9.12 Execute leak test and check Consist Composition pressure data

Precondition	▪ -
Conditions	▪ Traction Unit can receive pressure data for each Consist.
Tasks	▪ Traction Unit executes leak test and checks pressure data for each Consist Composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BO9.12 Execute leak test and check Consist Composition pressure data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Brake Test Operator receives Consist pressure data via the Mobile HMI.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU9.13 Compensate pressure losses

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit compensates pressure losses.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D3 Which system is responsible for brake test?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	**Remarks:** ▪ The outcome of this decision needs to be the same as in D1.

SD9.14 Check G/P and brake lever position

Precondition	▪ -
Conditions	▪ The Stationary Device can check the brake lever position.
Tasks	▪ Check planned G/P and Brake lever position.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BO9.14 Check G/P and brake lever position

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Brake Test operator checks planned G/P and Brake lever position.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU9.15 Check brake lever position

Precondition	▪ -
Conditions	▪ The Traction Unit can check the brake lever position.
Tasks	▪ Check planned G/P and Brake lever position.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D4 Is brake released?

Decision	**Yes:** ▪ Brake(s) are released.
Note Actor/s	▪ -
Additional Information	▪ -

D5 Is the parking brake applied?

Decision	**Yes:** ▪ Parking brake is applied.
Note Actor/s	▪ -
Additional Information	▪ -

CCC9.16 Initiate error handling process

Precondition	▪ -
Conditions	▪ -
Tasks	▪ CCU reports failure in automated brake test. ▪ This information can be used to trigger an error handling process.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D6 Which is responsible for brake test?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	**Conditions:** ▪ This System used for the brake test can check if the service brake was applied. **Remarks:** ▪ if neither the TU nor the system is responsible, the yellow path (partially automated) need to be followed.

D7 Was the parking brake applied?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

D8 Was it intended?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

SD9.17 Initiate error handling process

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Stationary Device reports failure in automated brake test. ▪ This information can be used to trigger an error handling process.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

SD9.18 Apply service brake

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Stationary Device applies service brake.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU9.19 Initiate error handling process

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit reports failure in automated brake test. ▪ This information can be used to trigger an error handling process.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU9.20 Apply service brake

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit applies service brake.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BO9.19 Initiate error handling process

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Brake Test Operator reports failure in automated brake test. ▪ This information can be used to trigger an error handling process.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BO9.20 Apply service brake

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Brake Test Operator applies service brake.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D9 Is the brake applied?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

CCC9.21 Initiate error handling process

Precondition	▪ -
Conditions	▪ -
Tasks	▪ CCU reports failure in automated brake test. ▪ This information can be used to trigger an error handling process.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D10 Which is responsible for brake test?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

SD9.22 Bring the pressure to standard operating pressure

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Stationary Device brings pressure in main brake pipe to standard operating pressure.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU9.23 Bring the pressure to standard operating pressure

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit brings pressure in main brake pipe to standard operating pressure.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D11 Is the service brake released?

Decision	**Yes:** ▪ The service brake is released.
Note Actor/s	▪ -
Additional Information	▪ -

CCC9.24 Initiate error handling process

Precondition	▪ -
Conditions	▪ -
Tasks	▪ CCU reports failure in automated brake test. ▪ This information can be used to trigger an error handling process.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE9.25 If necessary, adjust the parking brake and repeat the process so that all brakes were tested

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate the brake test.
Tasks	▪ If a parking brake was required to secure the shunting composition, the functionality of the brake(s) that have not yet been tested must be implemented. For this purpose, the brake test operator adapts the security in such a way that the untested brake is released but the shunting composition is sufficiently secured against rolling away at all times. ▪ For checking the unbraked brake(s), the process must be started at (A).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BO9.25 If necessary, adjust the parking brake and repeat the process so that all brakes were tested

Precondition	▪ -
Conditions	▪ -
Tasks	▪ If a parking brake was required to secure the shunting composition, the functionality of the brake(s) that have not yet been tested must be implemented. For this purpose, the brake test operator adapts the security in such a way that the untested brake is released but the shunting composition is sufficiently secured against rolling away at all times. ▪ For checking the unbraked brake(s), the process must be started at (A).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BO9.26 Confirm the final results

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Brake test operator confirms the results of brake test to FDFT Backend. ▪ This can also be achieved by using the Mobile HMI.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.11 TP10 - Confirm Consist Composition

TP10 - Confirm Consist Composition

8.4.11.1 Target Process

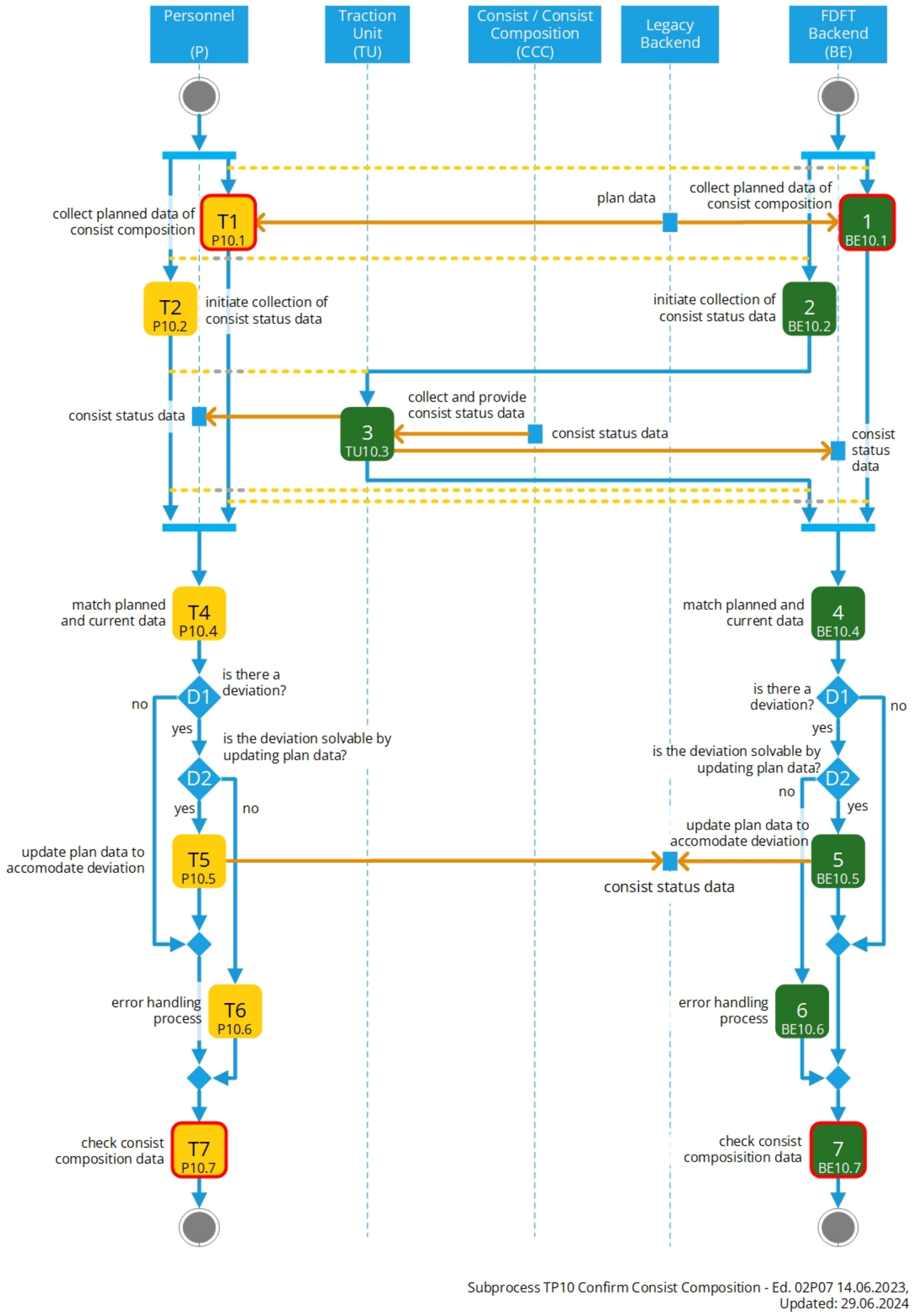


Figure *35*: TP10 Confirm Consist Composition - 1 of 1

8.4.11.2 Process-Description

BE10.1 Collect planned data of Consist Composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with CCU.
Tasks	▪ FDFT Backend collects data on Consist Composition to be processed. ▪ Information is retrieved from planning systems (e.g. operator specific planning systems).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE10.2 Initiate collection of Consist status data

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with CCU.
Tasks	▪ FDFT Backend triggers train composition detection function.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU10.3 Collect and provide Consist status data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ FDFT System of Traction Unit collects all composition relevant data of the consist composition, e.g. consist unique id, sequence number, consist orientation, consist length, further static properties of the consists and indicates all data to the Operator.
Remarks	▪ TU20.3
Activity Rationale	▪ -
Postcondition	▪ -

P10.1 Collect planned data of Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel collects planned data of Consist Composition via legacy system.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P10.2 Initiate collection of Consist Status Data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel triggers train composition detection function.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE10.4 Match planned and current data

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can match planned and current data.
Tasks	▪ FDFT Backend compares planned and current data to identify possible deviations and stores these deviations.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D1 Is there a deviation?

Decision	**Yes:** ▪ Deviation between plan data and current data was found.
Note Actor/s	▪ -
Additional Information	▪ -

D2 Is the deviation solvable by updating plan data?

Decision	**Yes:** ▪ A change of plan data is sufficient to correct the deviations.
Note Actor/s	▪ -
Additional Information	▪ -

BE10.5 Update plan data to accommodate deviations

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ FDFT Backend changes plan data to reflect found deviations. ▪ The new plan state equals the current state.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE10.6 Error handling process

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ FDFT Backend initiates operator specific error handling process to deal with found critical deviations. ▪ The process continues as soon as the error handling process finishes. The result plan state does not deviate to current state.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE10.7 Check Consist Composition Data

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ FDFT Backend checks that current Consist Composition Data matches planned data.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P10.4 Match planned and current data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel compares planned and current data to identify possible deviations.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P10.5 Update plan data to accommodate deviations

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel changes plan data to reflect found deviations. ▪ The new plan state equals the current state.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P10.6 Error handling process

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel initiates operator specific error handling process to deal with found critical deviations. ▪ The process continues as soon as the error handling process finishes. The result plan state does not deviate to current state.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P10.7 Check Consist Composition Data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel checks that current Consist Composition Data matches planned data.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.12 TP11 - Technical Wagon Inspection

TP11 - Technical Wagon Inspection

8.4.12.1 Target Process

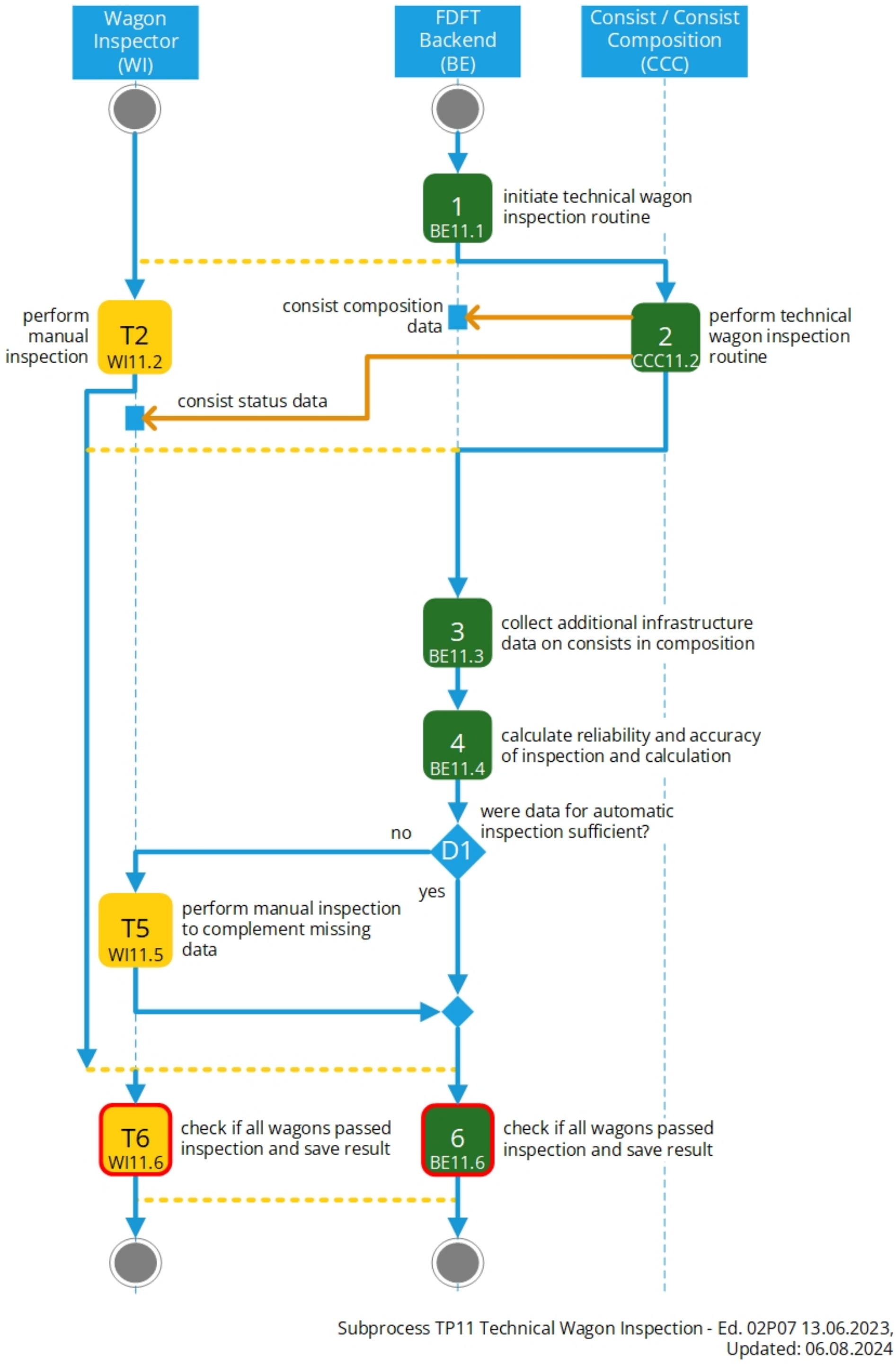


Figure *36*: TP11 Technical Wagon Inspection - 1 of 1

8.4.12.2 Process-Description

BE11.1 Initiate technical Wagon inspection routine

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ FDFT Backend initiates Wagon inspection routine in FDFT Consist Base Set for all Consist in set.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC11.2 Perform technical Wagon inspection routine

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with all Consist in Composition.
Tasks	▪ CCU receives command to perform Wagon inspection routine and starts the routine. ▪ CCU send results of inspection to FDFT Backend.
Remarks	▪ Inspection is supported by the usage of Sensors and other available Consist Data.
Activity Rationale	▪ -
Postcondition	▪ -

WI11.2 Perform manual Wagon inspection routine

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Wagon Inspector performs Wagon inspection including report using legacy processes. ▪ Wagon Inspector inputs results to FDFT Backend if available.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE11.3 Collect additional infrastructure data on Consist in Composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ FDFT Backend collects additional data from infrastructure systems (e.g. video gate, hot box detector) on each Consist if available.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE11.4 Calculate reliability and accuracy of inspection and calculation

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ FDFT Backend uses all available data on each Consist to calculate the reliability and accuracy of data as basis for further checks.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D1 Were data for automatic inspection sufficient?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

WI11.5 Perform manual inspection to complement missing data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Wagon Inspector performs additional manual inspections on Consist where available data is not sufficient. ▪ Wagon Inspector reports results to FDFT Backend.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE11.6 Check if all Wagon(s) passed inspection and save results

Precondition	▪ -
Conditions	▪ FDFT Backend is available and has sufficient current data for technical Wagon inspection check.
Tasks	▪ FDFT Backend uses Consist Status Data (sensors on Consist), Consist Data provided by infrastructure (e.g. video gate) to verify that Consist are operationally safe for planned subsequent movement. ▪ FDFT Backend stores the results of the technical Wagon inspection (according to regulations) in a tamper safe way and provides this data to other systems. ▪ FDFT Backend initiates a separate process for deviations (damaged Consist prohibiting subsequent movement).
Remarks	▪ See regulations: General Contract of Use for Consist (GCU), Appendix 9.
Activity Rationale	▪ -
Postcondition	▪ -

WI11.6 Check if all Wagon(s) passed inspection and save results

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Use legacy processes for technical Wagon inspection check.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.13 TP20 – Uncouple

TP20 - Uncouple

8.4.13.1 Target Process

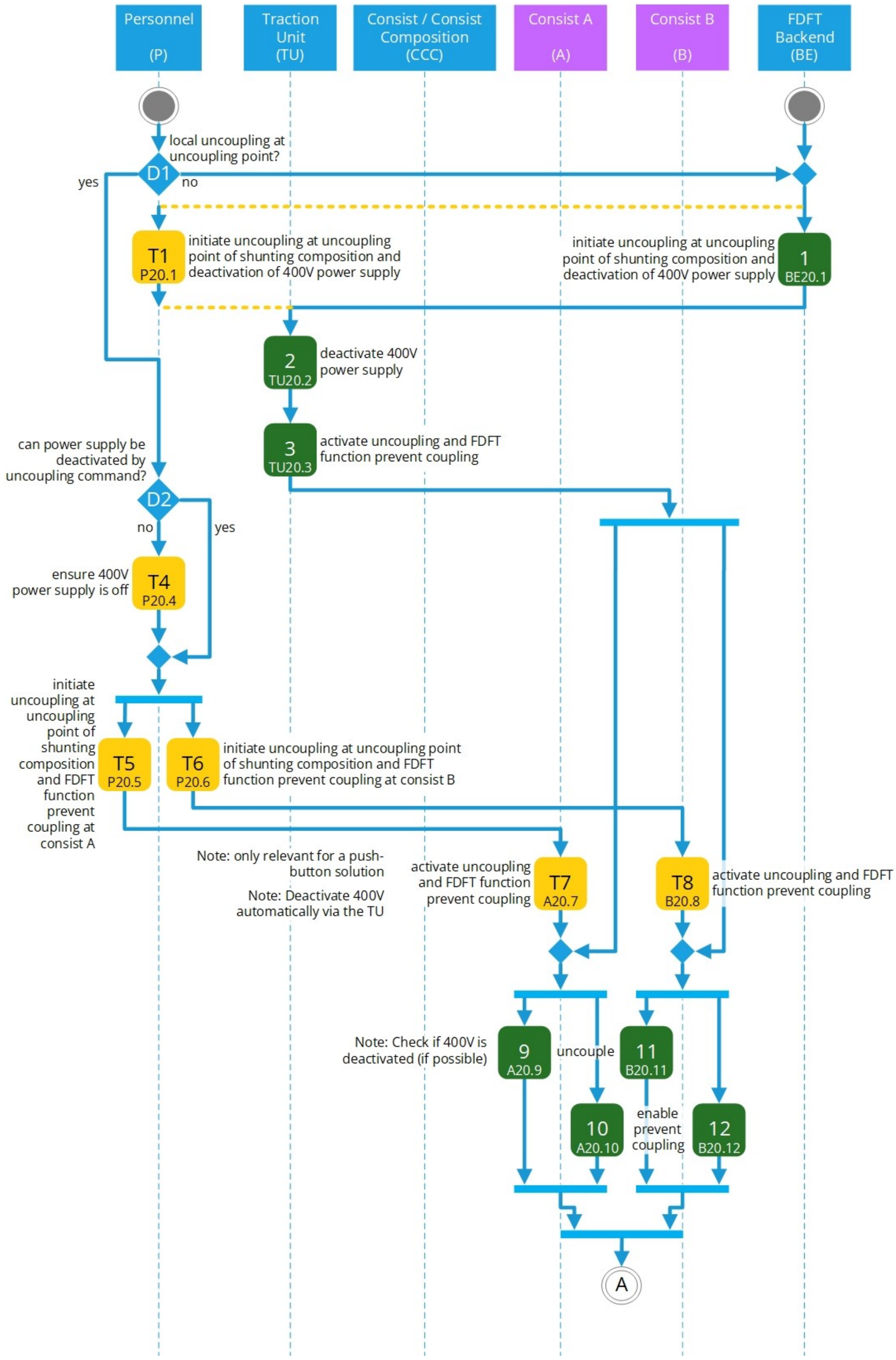


Figure 37: TP20 Uncouple - 1 of 2

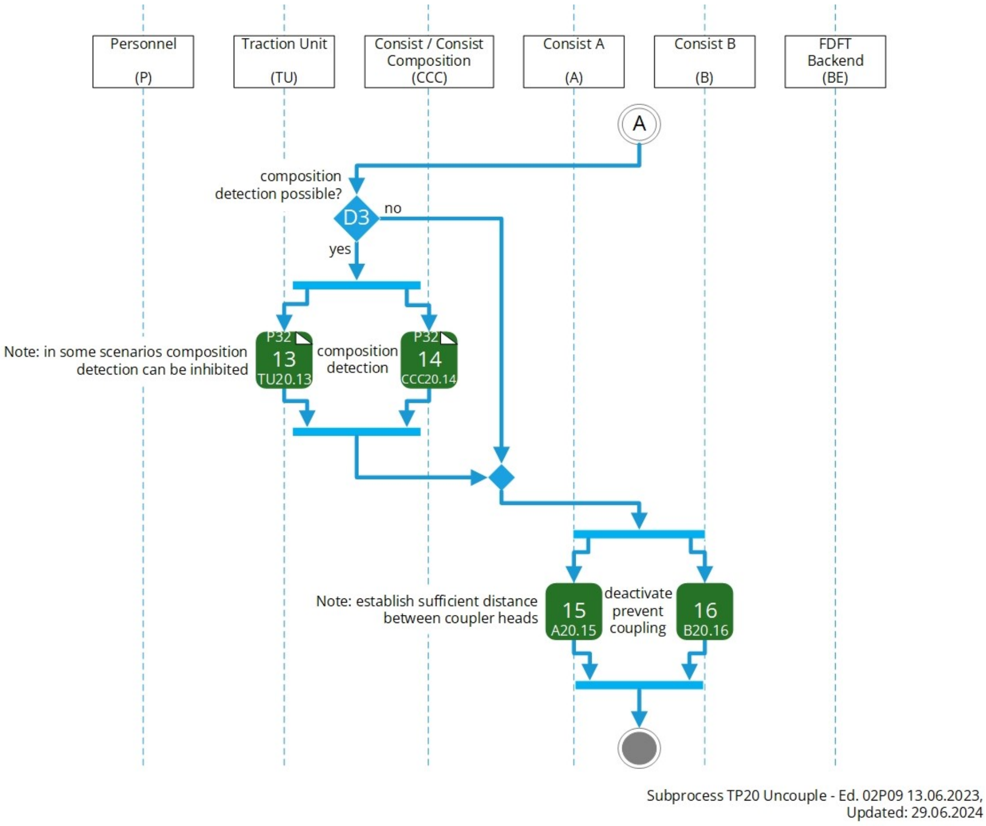


Figure *38*: TP20 Uncouple - 2 of 2

8.4.13.2 Process-Description

D1 Local uncoupling at uncoupling point?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

BE20.1 Initiate uncoupling at uncoupling point of shunting composition and deactivation of 400V power supply

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate uncoupling incl. deactivation power supply.
Tasks	▪ FDFT Backend initiates uncoupling at Uncoupling Point at relevant CCU and deactivation of 400V power supply.
Remarks	▪ Data from FDFT Backend to CCU is transferred through FDFT Link(s).
Activity Rationale	▪ -
Postcondition	▪ -

P20.1 Initiate uncoupling at uncoupling point of shunting composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel initiates uncoupling by using Traction Unit or Mobile HMI.
Remarks	▪ Manual emergency lever is not considered as feasible means for uncoupling.
Activity Rationale	▪ -
Postcondition	▪ -

TU20.2 Deactivate 400V power supply

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit deactivates 400V power supply.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU20.3 Activate uncoupling and FDFT function prevent coupling

Precondition	▪ -
Conditions	▪ -
Tasks	▪ FDFT System activates consist A coupler and consist B coupler prevent coupling function until it will be deactivated.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D2 Can power supply be deactivated by uncoupling command?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

P20.4 Activity Ensure 400V power supply is off

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel makes sure that the 400V power supply is turned off.
Remarks	▪ -
Activity Rationale	▪ If uncoupled with power supply on, this could result in harmful electric arc.
Postcondition	▪ -

P20.5 Initiate uncoupling at uncoupling point of shunting composition and FDFT function prevent coupling at consist A

Precondition	▪ -
Conditions	▪ -
Tasks	▪ User triggers uncoupling at uncoupling point of shunting composition at consist A.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

A20.7 Activate uncoupling and FDFT function prevent coupling

Precondition	▪ -
Conditions	▪ -
Tasks	▪ FDFT System activates consist A coupler uncoupling function until it will be deactivated.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P20.6 Initiate uncoupling at uncoupling point of shunting composition and FDFT function prevent coupling at consist B

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel triggers uncoupling at uncoupling point of shunting composition at consist B.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

B20.8 Activate uncoupling and FDFT function prevent coupling

Precondition	▪ -
Conditions	▪ -
Tasks	▪ FDFT System activates consist B coupler uncoupling function until it will be deactivated.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

B20.11 Uncouple

Precondition	▪ No or sufficiently low tensile forces.
Conditions	▪ -
Tasks	▪ Activate function uncouple on selected coupler.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

B20.12 Enable prevent coupling

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Activate function prevent coupling.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

A20.9 Uncouple

Precondition	▪ No or sufficiently low tensile forces.
Conditions	▪ -
Tasks	▪ Activate function uncouple on selected coupler.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

A20.10 Enable prevent coupling

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Activate function prevent coupling.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D3 Composition detection possible?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

TU20.13 Subprocess Composition Detection

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.21.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC20.14 Subprocess Composition Detection

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.21.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

A20.15 Deactivate prevent coupling

Precondition	▪ -
Conditions	▪ -
Tasks	▪ The function prevent coupling is deactivated.
Remarks	If this function will not be deactivated by the coupler itself (e.g. actuator), then it must be ensured on the infrastructure side with a device e.g. in case of hump shunting.
Activity Rationale	▪ -
Postcondition	▪ Coupler are in ready to couple position.

B20.16 Deactivate prevent coupling

Precondition	▪ -
Conditions	▪ -
Tasks	▪ The function prevent coupling is deactivated.
Remarks	If this function will not be deactivated by the coupler itself (e.g. actuator), then it must be ensured on the infrastructure side with a device e.g. in case of hump shunting.
Activity Rationale	▪ -
Postcondition	▪ Coupler are in ready to couple position.

8.4.14 TP21 - Couple

TP21 - Couple

8.4.14.1 Target Process

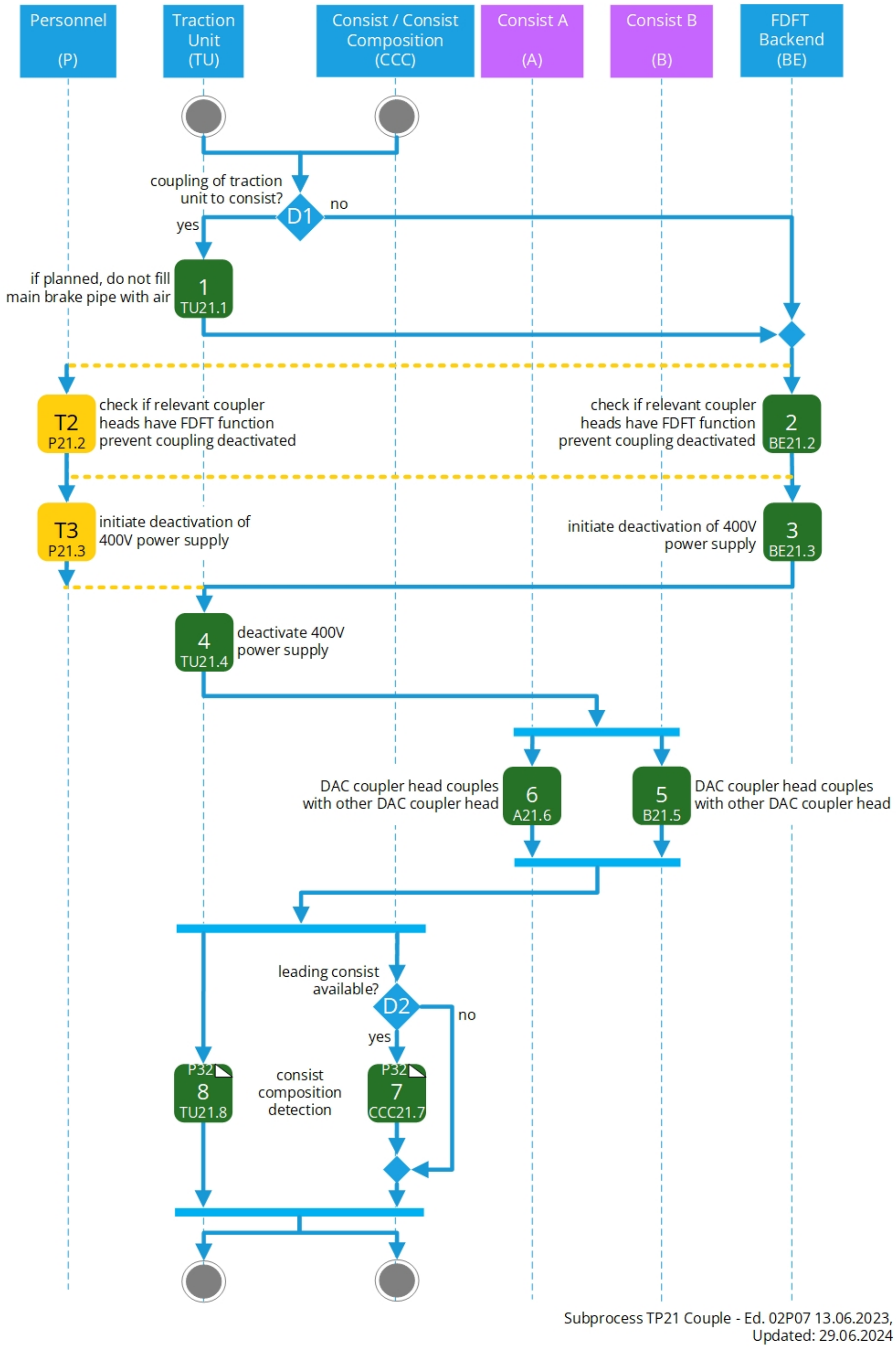


Figure 39: TP21 Couple - 1 of 1

8.4.14.2 Process-Description

This subprocess describes the coupling of two DAC coupler heads mounted on Consist thus requiring an CCU. The coupling of Stationary Device or other DAC coupler head compatible devices is out of scope of this process.

D1 Coupling of Traction Unit to Consist?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

TU21.1 If planned do not fill air pipe with air

Precondition	▪ -
Conditions	▪ -
Tasks	▪ If planned ensure that the main brake pipe does not fill with air.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE21.2 Check if relevant coupling points have FDFT function Prevent Coupling deactivated

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with relevant CCU.
Tasks	▪ FDFT Backend checks that the two relevant DAC coupler heads have FDFT function Prevent Coupling deactivated.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P21.2 Check if relevant coupling points have FDFT function Prevent Coupling deactivated

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator checks that the two relevant DAC coupler heads have FDFT function Prevent Coupling deactivated. ▪ This can also be achieved by using the Mobile HMI.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE21.3 Initiate deactivation of 400V power supply

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate power supply.
Tasks	▪ FDFT Backend triggers deactivation of the power supply.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P21.3 Initiate deactivation of 400V power supply

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel triggers deactivation of the power supply.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU21.4 Deactivate 400V power supply

Precondition	▪ -
Conditions	▪ -
Tasks	▪ 400V power supply will be deactivated in the Traction Unit.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

B21.5 DAC coupler head couples with other DAC coupler head

Precondition	▪ -
Conditions	▪ -
Tasks	▪ DAC coupler head couples with other DAC coupler head.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

A21.6 DAC coupler head couples with other DAC coupler head

Precondition	▪ -
Conditions	▪ -
Tasks	▪ DAC coupler head couples with other DAC coupler head
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D2 Leading consist available?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

CCC21.7 Subprocess Consist composition detection

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.21.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU21.8 Subprocess Consist composition detection

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.21.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.15 TP22 - Secure Consist (Composition) Against Rolling Away

TP22 - Secure Consist (Composition) Against Rolling Away

8.4.15.1 Target Process

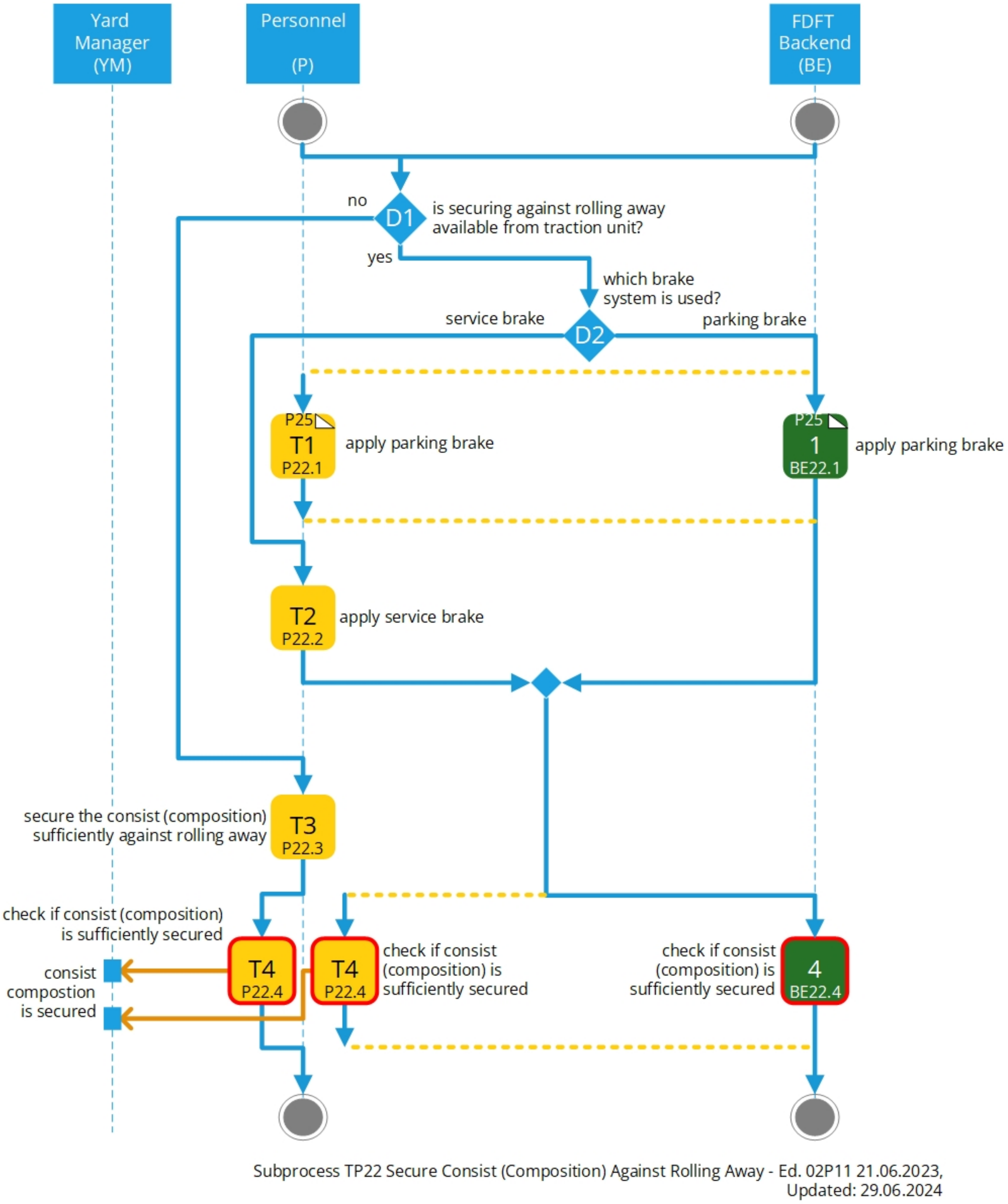


Figure *40*: TP22 Secure Consist (Composition) Against Rolling Away - 1 of 1

8.4.15.2 Process-Description

D1 Is securing against rolling away available from Traction Unit?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

D2 Which brake system is used?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

BE22.1 Subprocess: Apply parking brake(s)

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate parking brake(s).
Tasks	▪ See subprocess description 8.4.17.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P22.1 Subprocess: Apply parking brake(s)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.17.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P22.2 Apply service brake(s)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ -
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE22.4 Check if Consist (Composition) is sufficiently secured

Precondition	▪ -
Conditions	▪ FDFT Backend is available and communicate with CCU.
Tasks	▪ FDFT backend checks if the brake(s) are activated as planned. ▪ The Consist Status Data for each Consist is stored tamper safe.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P22.3 Secure Consist (Composition) sufficient against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Secure Consist (Composition) against rolling away as legacy process.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P22.4 Check if Consist (Composition) is sufficiently secured

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel checks the braking status and sends data to Yard Manager.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.16 TP23 – Remove, Release Braking Means

TP23 - Remove, Release Braking Means

8.4.16.1 Target Process

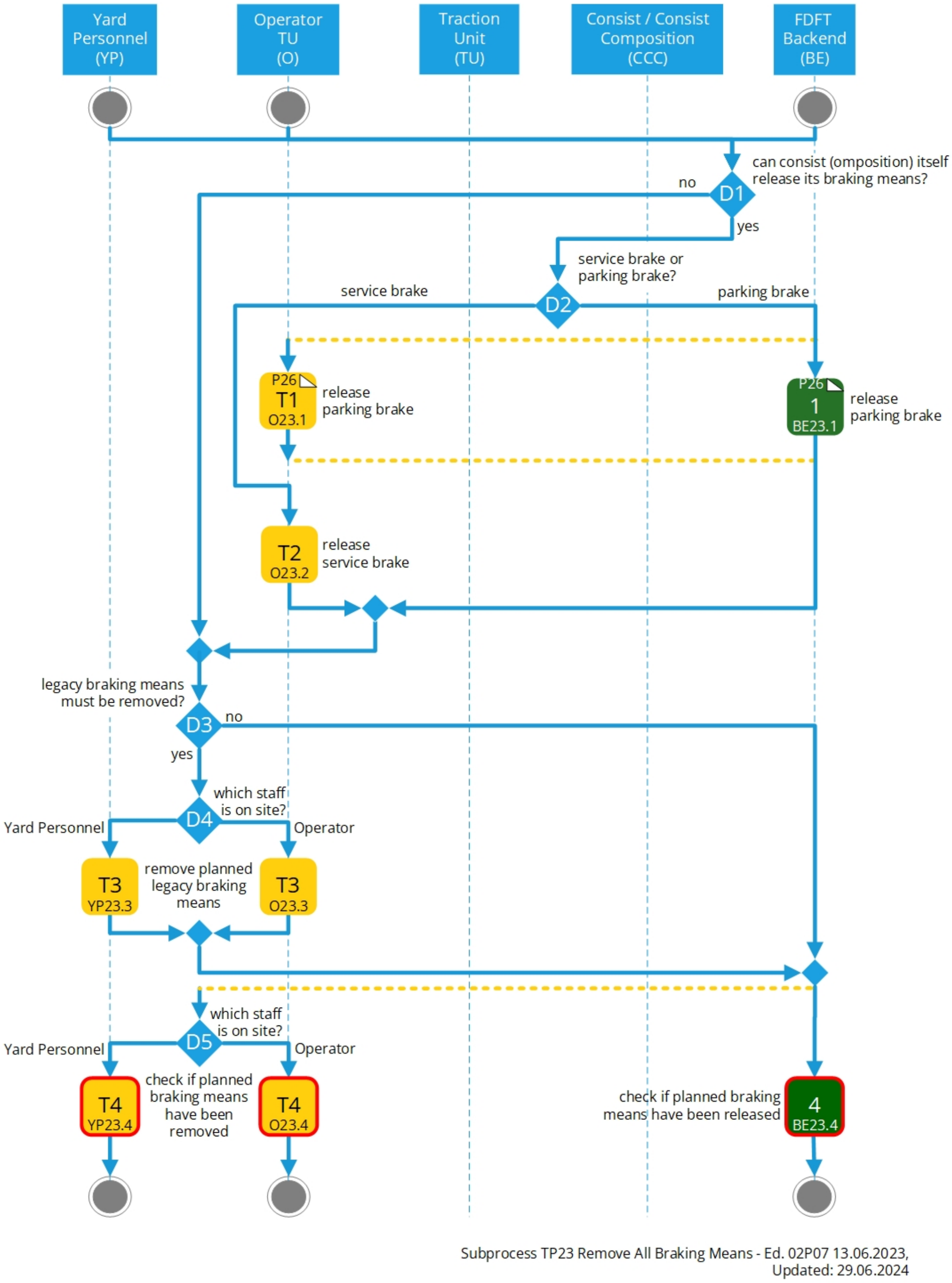


Figure *41*: TP23 Remove, Release Braking Means - 1 of 1

8.4.16.2 Process-Description

D1 Consist (Composition) itself can release braking means?

Decision	**Yes:** ▪ CCU can execute all its braking means.
Note Actor/s	▪ -
Additional Information	▪ -

D2 Service brake or parking brake?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

BE23.1 Subprocess: Release parking brake

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with FDFT Base System and can initiate parking brake.
Tasks	▪ See subprocess description 8.4.18.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O23.1 Subprocess: Release parking brake

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.18.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O23.2 Release service brake

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator releases service brake.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D3 Legacy braking means must be removed?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

D4 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O23.3 Remove planned legacy braking means

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator removes or releases planned legacy braking means. ▪ Report that planned braking means have been removed or released to FDFT Backend if available.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP23.3 Remove planned legacy braking means

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Personnel removes or releases planned legacy braking means. ▪ Report that planned braking means have been removed or released to FDFT Backend if available.
Remarks	
Activity Rationale	
Postcondition	

BE23.4 Check if planned braking means have been released

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with CCU.
Tasks	▪ FDFT backend checks if the brakes are deactivated as planned. ▪ The Consist Status Data for each Consist is stored tamper safe.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D5 Which staff is on site?

Decision	▪ -
Note Actor/s	▪ Yard Personnel is on site. ▪ Operator is on site.
Additional Information	▪ -

O23.4 Check if planned braking means have been removed

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator checks that planned braking means have been removed. ▪ Operator reports that planned braking means have been removed (Legacy process). ▪ Operator reports that planned braking means have been removed to. FDFT Backend if available.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

YP23.4 Check if planned braking means have been removed

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Personnel checks that planned braking means have been removed. ▪ Yard Personnel reports that planned braking means have been removed (Legacy process). ▪ Yard Personnel reports that planned braking means have been removed to FDFT Backend if available.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.17 TP25 – Apply Parking Brake

TP25 - Apply Parking Brake

8.4.17.1 Target Process

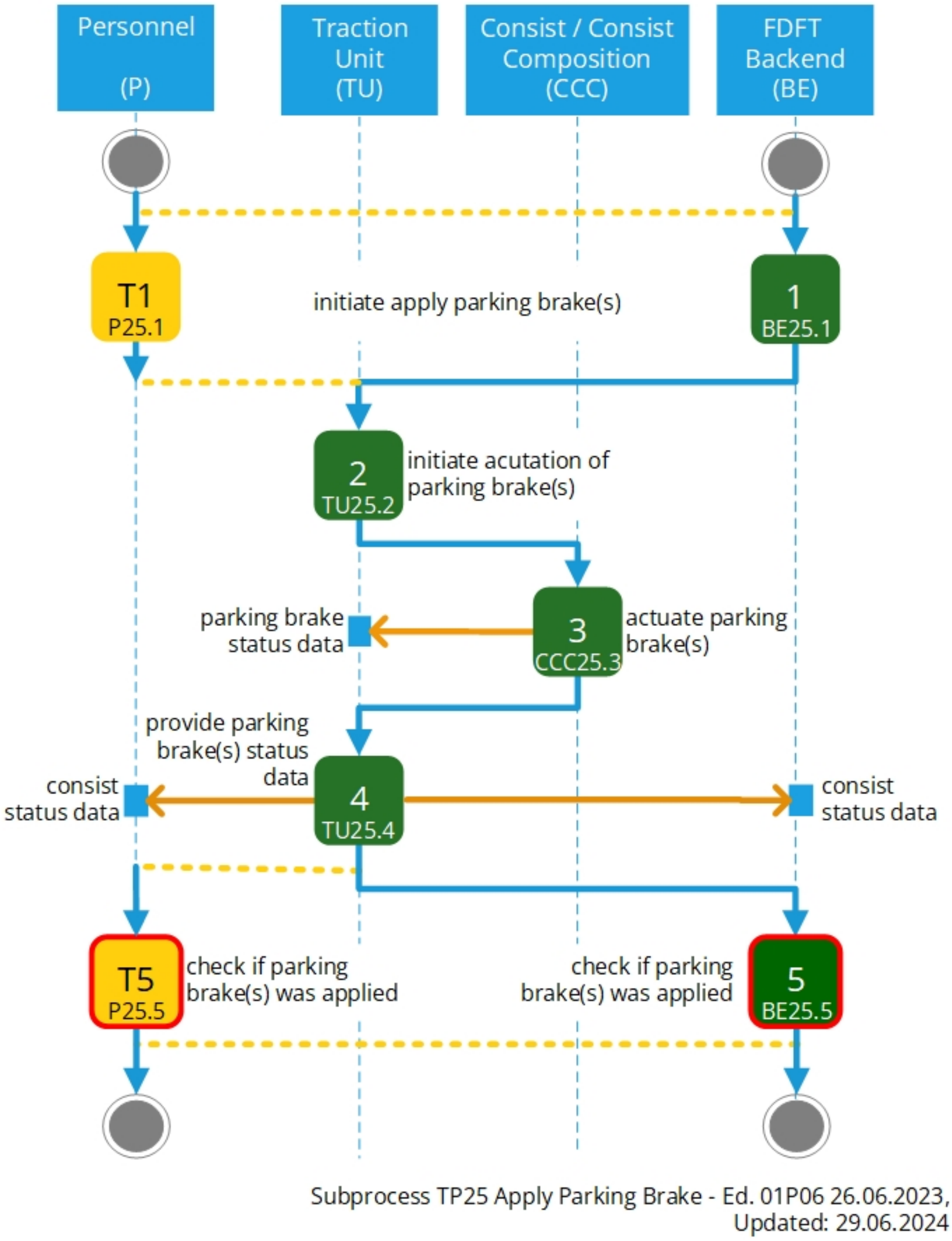


Figure *42*: TP25 Apply Parking Brake - 1 of 1

8.4.17.2 Process Description

BE25.1 Initiate apply parking brake(s)

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate parking brake(s).
Tasks	▪ FDFT Backend selects the parking brake(s) to be applied in a consist composition and triggers the application.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P25.1 Initiate apply parking brake(s)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel selects the parking brake(s) to be applied in a consist composition and triggers the application.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU25.2 Initiate actuation of parking brake(s)

Precondition	▪ Train composition is valid.
Conditions	▪ -
Tasks	▪ FDFT System commands each selected parking brake(s) to be applied, if available.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC25.3 Actuate parking brake(s)

Precondition	▪ It must be ensured that the Consist cannot roll away unintentionally. This can be done e.g. by the brake(s) of the locomotive.
Conditions	▪ -
Tasks	▪ Each consist receiving the apply parking brake(s) command will actuate the parking brake(s) application locally.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU25.4 Provide parking brake(s) status data

Precondition	▪ Train composition is valid.
Conditions	▪ -
Tasks	▪ FDFT System collects the status of all parking brake(s) in the Consist and indicates it to Personnel.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE25.5 Check if parking brake(s) was applied

Precondition	▪ -
Conditions	▪ FDFT Backend is available. FDFT Base System is available and can communicate with FDFT Base System.
Tasks	▪ FDFT Backend checks the status of all parking brake(s).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P25.5 Check if parking brake(s) was applied

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel shall check the status of all parking brake(s).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.18 TP26 – Release Parking Brake

TP26 - Release Parking Brake

8.4.18.1 Target Process

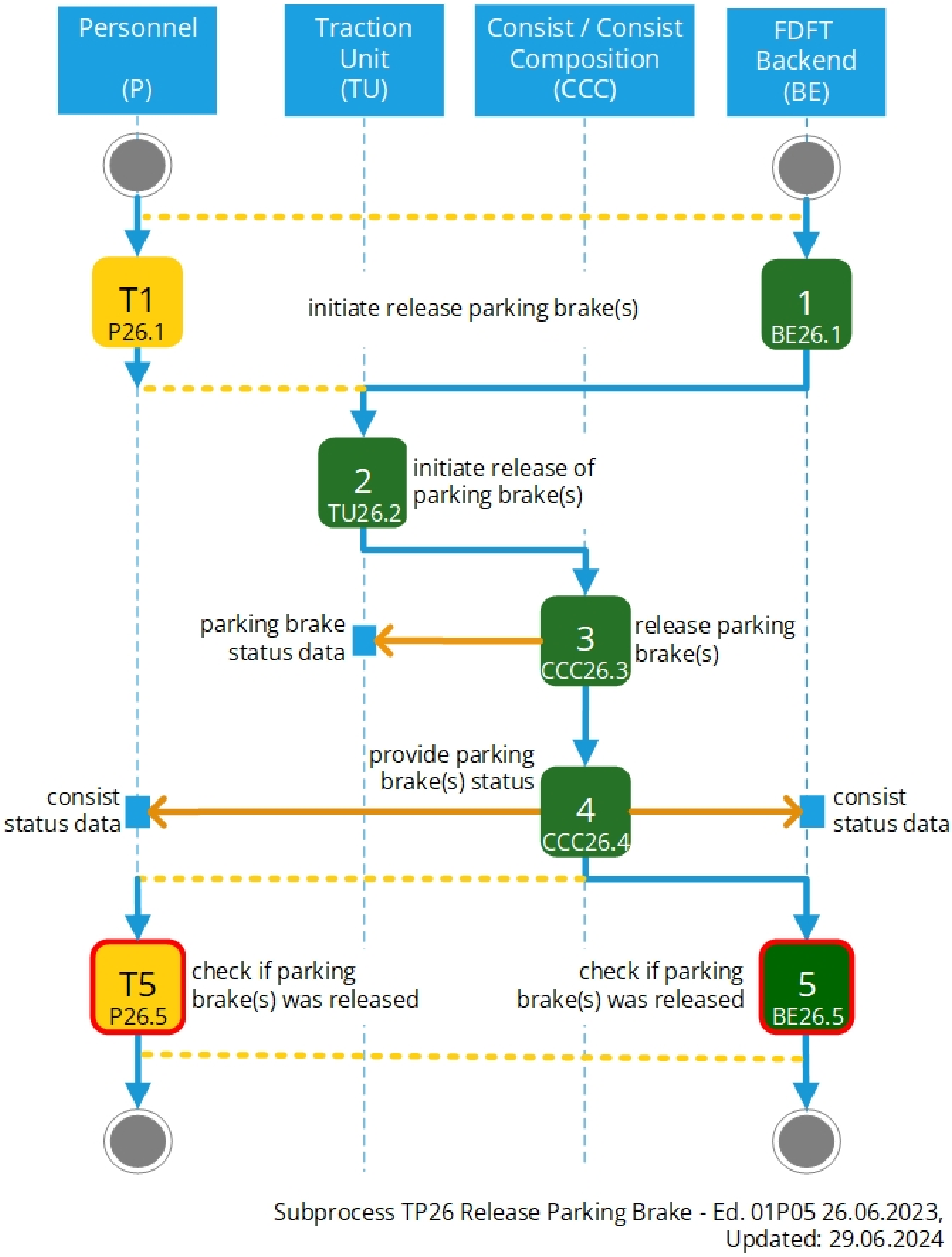


Figure *43*: TP26 Release Parking Brake - 1 of 1

8.4.18.2 Process Description

BE26.1 Initiate release parking brake

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate parking brake.
Tasks	▪ FDFT Backend selects the parking brake(s) to be released in a consist composition and triggers the release.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P26.1 Initiate release parking brake

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel selects the parking brake(s) to be released in a consist composition and triggers the release.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU26.2 Initiate release of parking brake(s)

Precondition	▪ Train composition is valid.
Conditions	▪ -
Tasks	▪ FDFT System commands each selected parking brake to be released, if available.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC26.3 Release parking brake(s)

Precondition	▪ Service brake is active.
Conditions	▪ -
Tasks	▪ Each consist receiving the release parking brake command will actuate the parking brake release locally.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU26.4 Provide parking brake(s) status data

Precondition	▪ Train composition is valid.
Conditions	▪ -
Tasks	▪ FDFT System collects the status of all parking brakes of the Consist and indicates it to Personnel.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE26.5 Check if parking brake(s) was released

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with CCU.
Tasks	▪ FDFT Backend checks the status of all parking brakes.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P26.5 Check if parking brake(s) was released

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel shall check the status of all parking brakes.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.19 TP30 - Switch to FDFT mode Shunting

TP30 - Switch to FDFT mode Shunting

8.4.19.1 Target Process

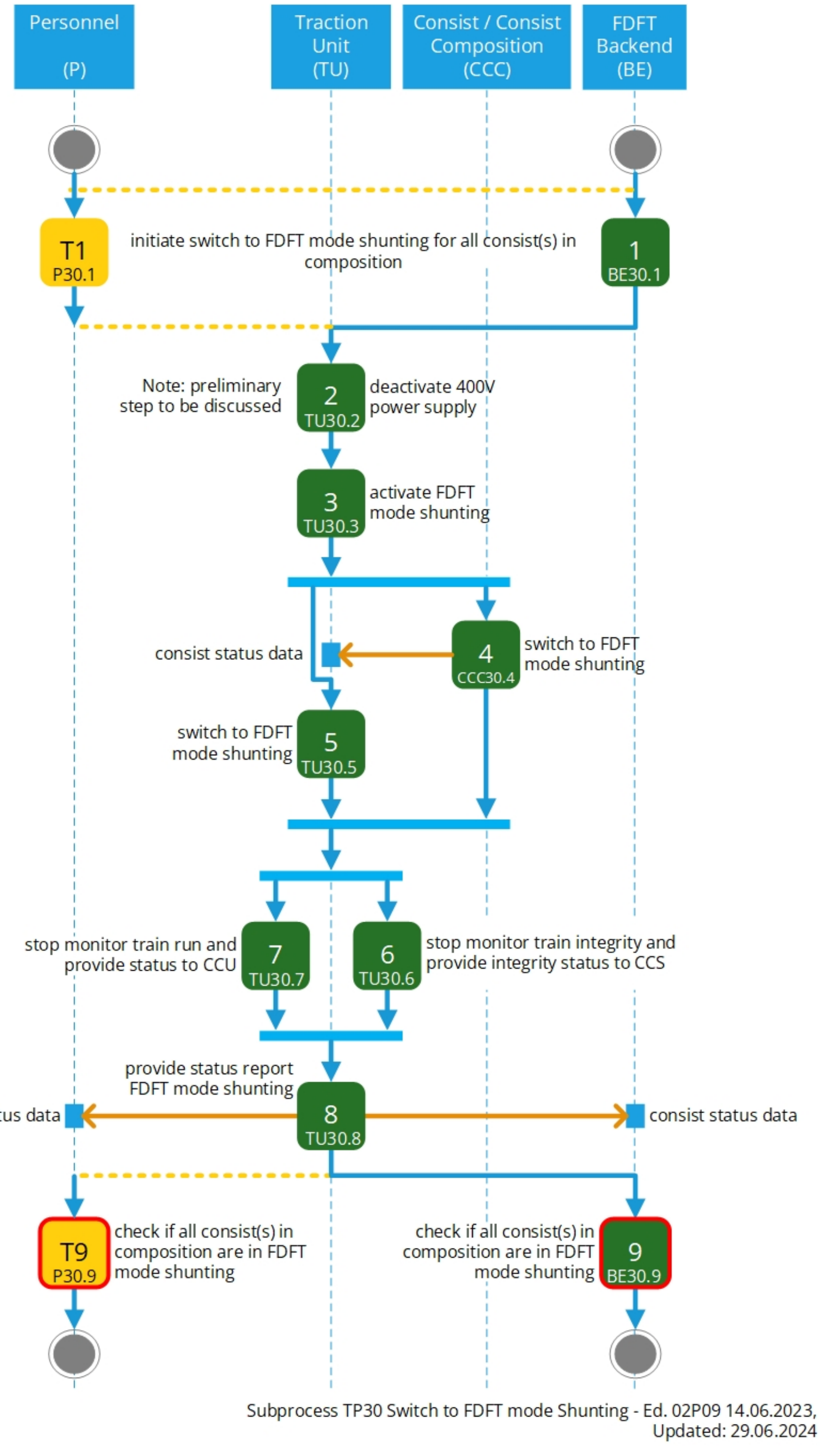


Figure *44*: TP30 Switch Consist of Composition to FDFT mode Shunting - 1 of 1

8.4.19.2 Process-Description

BE30.1 Initiate switch to FDFT mode Shunting for all Consist in set

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU for each Consist in Composition and can initiate Switch to FDTF mode shunting.
Tasks	▪ FDFT Backend initiates activation of FDFT mode Shunting for all Consist in set and Traction Unit.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P30.1 Initiate switch to FDFT mode Shunting for all Consist in Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel initiates the activation of the FDFT mode Shunting for all Consist in Composition and Traction Unit. ▪ This can also be achieved by using the Mobile HMI.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU30.2 Deactivate 400V power supply

Precondition	▪ -
Conditions	▪ -
Tasks	▪ FDFT System deactivates the 400V power supply.
Remarks	▪ This activity is included preliminarily.
Activity Rationale	
Postcondition	

TU30.3 Activate FDFT mode Shunting

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit commands activation of FDFT Shunting mode to all consist in the consist composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC30.4 Switch to FDFT mode Shunting

Precondition	▪ -
Conditions	▪ -
Tasks	▪ CCU switches to FDFT mode Shunting. ▪ If FDFT Backend is available, the CCU sends Consist Status Data to FDFT Backend.
Remarks	▪ E.g. after switch to FDFT mode Shunting, uncoupling and activation of FDFT function Prevent Coupling is allowed.
Activity Rationale	▪ -
Postcondition	▪ -

TU30.5 Switch to FDFT mode Shunting

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit switches to FDFT mode Shunting. ▪ If FDFT Backend is available, the Traction Unit sends Consist Status Data to FDFT Backend.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU30.6 Stop monitor train integrity and provide integrity status to CCS

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Monitoring of train integrity will be deactivated and provide integrity status.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU30.7 Stop monitor train run and provide status to CCU

Precondition	▪ -
Conditions	▪ -
Tasks	▪ The last valid status of the train must be saved.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU30.8 Provide status report FDFT mode Shunting

Precondition	▪ -
Conditions	▪ -
Tasks	▪ FDFT System of the Traction Unit detects FDFT mode of all Consists in Consist Composition and indicates it to Personnel.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE30.9 Check if all Consist in Composition are in FDFT mode Shunting

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with the CCU.
Tasks	▪ FDFT Backend checks if every Consist in Composition and Traction Unit is in FDFT mode Shunting.
Remarks	
Activity Rationale	
Postcondition	

P30.9 Check if all Consist in Composition are in FDFT mode Shunting

Precondition	▪ -
Conditions	▪ Personnel must be able to see the status of all Consist on a HMI.
Tasks	▪ Personnel checks if every Consist in Composition and Traction Unit is in FDFT mode Shunting. ▪ This can also be achieved by using the Mobile HMI.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.20 TP31 – Switch to FDFT mode Train Run

TP31 - Switch to FDFT mode Train Run

8.4.20.1 Target Process

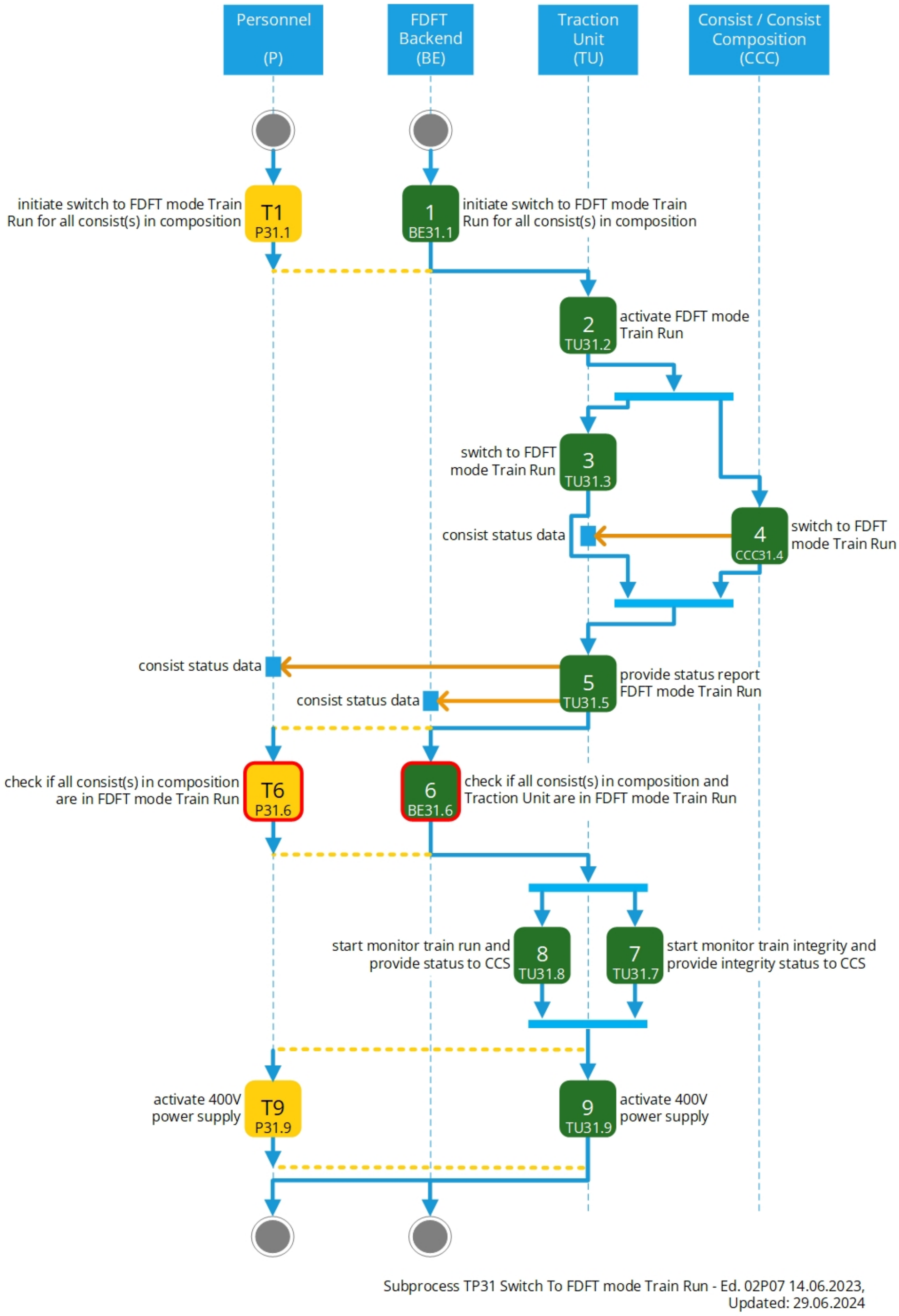


Figure *45*: TP31 Switch to FDFT mode Train Run - 1 of 1

8.4.20.2 Process-Description

BE31.1 Initiate switch to FDFT mode Train Run for all Consist in Composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU for each Consist in Composition and can initiate switch to FDFT mode Train Run.
Tasks	▪ FDFT Backend initiates switch to FDFT mode Train Run for all Consist in Composition and Traction Unit.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P31.1 Initiate switch to FDFT mode Train Run for all Consist in Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel initiates the activation of the FDFT mode Train Run for all Consist in Composition and Traction Unit. ▪ This can also be achieved by using the Mobile HMI.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU31.2 Activate FDFT mode Train Run

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit commands activation of FDFT mode Train Run to all consist in the consist composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU31.3 Switch to FDFT mode Train Run

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit switches to FDFT mode Train Run.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC31.4 Switch to FDFT mode Train Run

Precondition	▪ -
Conditions	▪ -
Tasks	▪ CCU switches to FDFT mode Train Run. ▪ If FDFT Backend is available, the CCU sends Consist Status Data to FDFT Backend.
Remarks	▪ E.g. after switch to FDFT mode Train Run, Uncoupling and activation of FDFT function Prevent Coupling is not allowed.
Activity Rationale	
Postcondition	

TU31.5 Provide status report FDFT mode Train Run

Precondition	▪ -
Conditions	▪ -
Tasks	▪ FDFT System of the Traction Unit detects FDFT mode of all consists in consist composition and indicates it to Personnel.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE31.6 Check if all Consist in Composition and Traction Unit are in FDFT mode Train Run

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with CCU.
Tasks	▪ FDFT Backend checks if every Consist in Composition and Traction Unit is in FDFT mode Train Run.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P31.6 Check if all Consist in Composition and Traction Unit are in FDFT mode Train Run

Precondition	▪ -
Conditions	▪ Personnel must be able to see the status of all Consist on a HMI.
Tasks	▪ Personnel checks if every Consist in Composition and Traction Unit is in FDFT mode Train Run.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU31.7 Start monitor train integrity and provide integrity status to CCS

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Monitoring of train integrity will be activated.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU31.8 Start monitor train run and provide status to CCS

Precondition	▪ -
Conditions	▪ -
Tasks	▪ -
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU31.9 Activate 400V power supply

Precondition	▪ Train composition is valid.
Conditions	▪ -
Tasks	▪ FDFT System activates the 400V power supply.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P31.9 Activate 400V power supply

Precondition	▪ Train composition is valid.
Conditions	▪ -
Tasks	▪ FDFT System activates the 400V power supply.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.21 TP32 – Composition Detection

TP32 - Composition Detection

8.4.21.1 Target Process

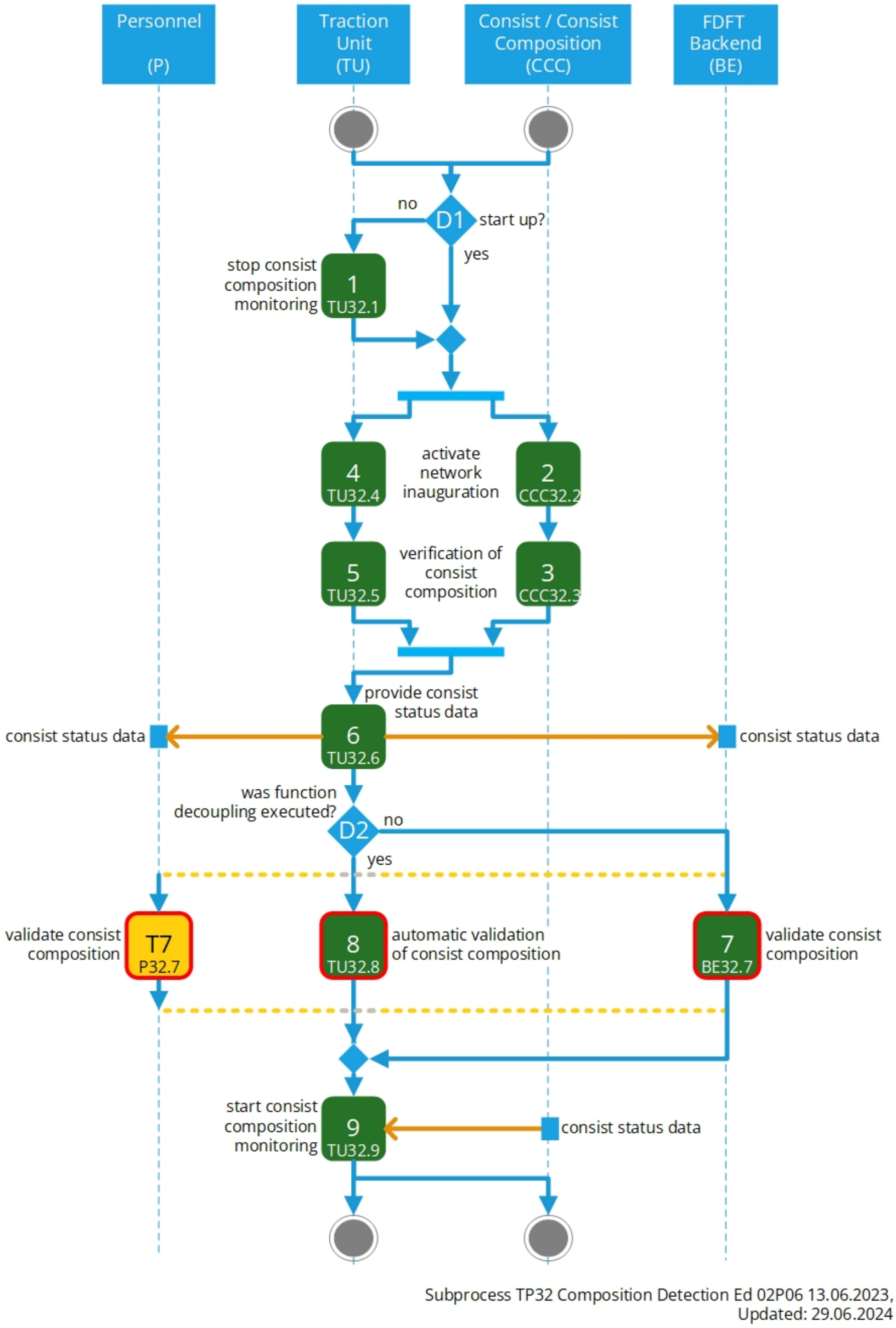


Figure *46*: TP32 Composition Detection - 1 of 1

8.4.21.2 Process Description

D1 Start up?

Decision	**Yes:** ▪ FDFT System powers up from power off status.
Note Actor/s	▪ -
Additional Information	▪ -

TU32.1 Stop consist composition monitoring

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit stops monitoring of the current consist composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC32.2 Activate network inauguration

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Network inauguration is executed by FDFT System in all Consists to compile a network node list.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC32.3 Verification of consist composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ FDFT System verifies the network node list detects further consist which are either unpowered or which leaking a network node and build a composition list (consist status data).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU32.4 Activate network inauguration

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Network inauguration is executed by FDFT System in all consists to compile a network node list.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU32.5 Verification of consist composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ FDFT System verifies the network node list detects further consist which are either unpowered or which leaking a network node and build a composition list (consist status data).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU32.6 Provide consist composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ FDFT System indicates the detected composition list to Personnel or FDFT Backend.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D2 Was function uncoupling executed?

Decision	**Yes:** ▪ If FDFT System detects based on the detected composition only a shortening of the last valid composition, a validation by Personnel or FDFT Backend is not necessary.
Note Actor/s	▪ -
Additional Information	**Remarks:** ▪ In case of uncoupling without the train function being activated by Personnel/Backend, the train driver/backend system should receive a status message.

BE32.7 Validate consist composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ Validate consist composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

P32.7 Validate consist composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel shall validate the indicated consist composition - indicated consist composition shall fit to the real consist composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU32.8 Automatic validation of consist composition

Precondition	▪ Uncoupling is activated.
Conditions	▪ -
Tasks	▪ Consist composition is set to automatically validify if it fits to the last valid composition minus uncoupled consists.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU32.9 Start consist composition monitoring

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit starts monitoring of the current consist composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.22 TP41 – Addition, Removal of Consist (Composition)

TP41 - Addition, Removal of Consist (Composition)

8.4.22.1 Target Process

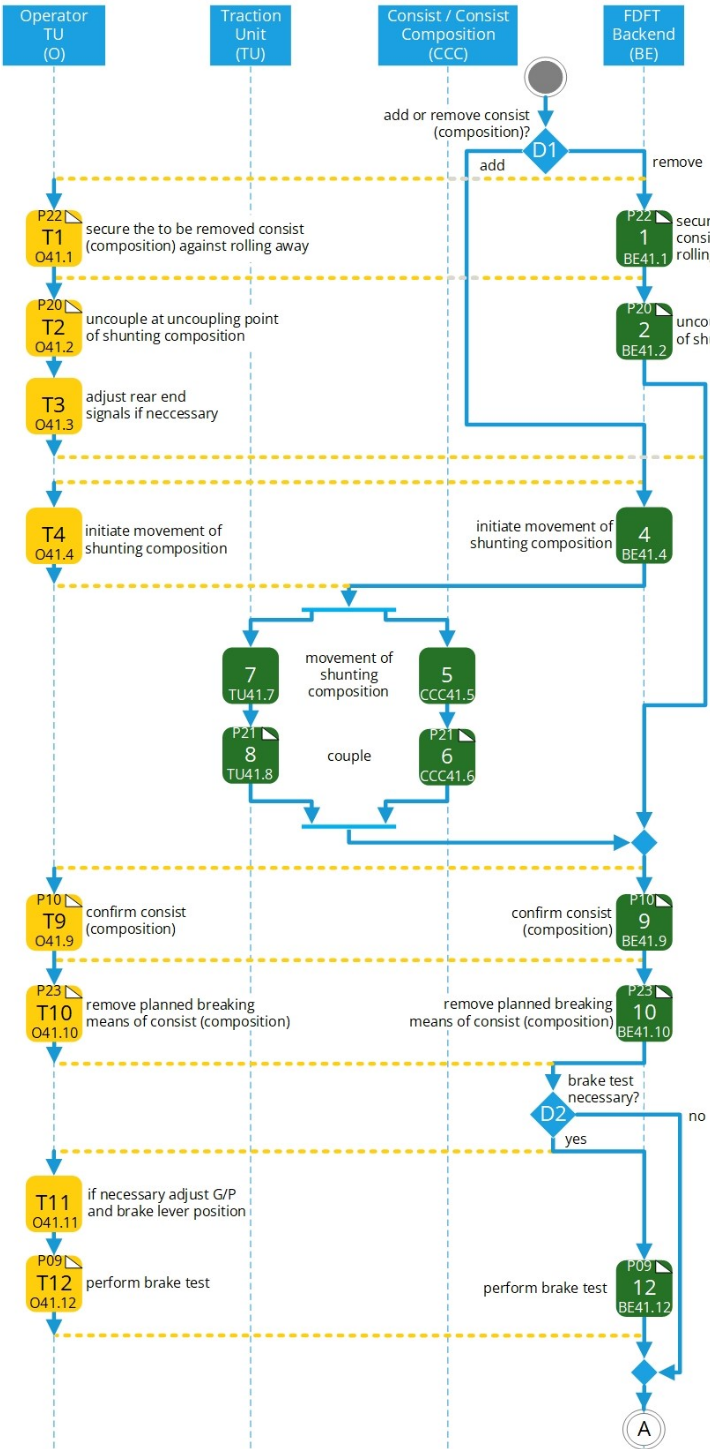


Figure *47*: TP41 Addition, Removal of Consist (Composition) - 1 of 2

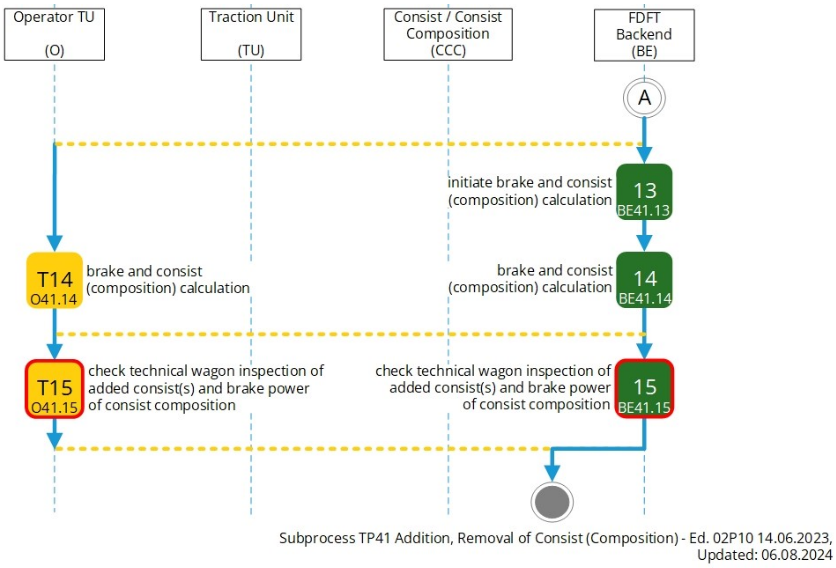


Figure *48*: TP41 Addition, Removal of Consist (Composition) - 2 of 2

8.4.22.2 Process-Description

D1 Add or remove Consist (Composition)?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

BE41.1 Subprocess: Secure to be removed Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ FDFT Backend is available and, can communicate with FDFT Base System and can initiate secure against rolling away.
Tasks	▪ See subprocess description 8.4.15.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE41.2 Subprocess: uncouple at uncoupling point of shunting composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available and, can communicate with FDFT Base System and can initiate uncouple.
Tasks	▪ See subprocess description 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O41.1 Subprocess: Secure to be removed Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.15.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O41.2 Subprocess: uncouple at uncoupling point of shunting composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O41.3 Adjust rear end signals if necessary

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator adjusts rear end signals.
Remarks	▪ This step can be skipped if not necessary according to regulations. ▪ E.g. train integrity monitoring makes rear end signal obsolete.
Activity Rationale	
Postcondition	

BE41.4 Initiate movement of shunting composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ FDFT Backend is available.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O41.4 Initiate movement of shunting composition

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU41.7 Movement of shunting composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Movement of shunting composition to Consist (Composition).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU41.8 Subprocess: Couple

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.14.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC41.5 Movement of shunting composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Movement of shunting composition to Consist (Composition).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC41.6 Subprocess: Couple

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.14.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE41.9 Subprocess: Confirm Consist Composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with CCU.
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O41.9 Subprocess: Confirm Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE41.10 Subprocess: Remove planned braking means of Consist Composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate remove braking means.
Tasks	▪ See subprocess description 8.4.16.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O41.10 Subprocess: Remove braking means of Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.16.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D2 Brake test necessary?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	**Remarks:** ▪ For example, a brake test has to be made when a Consist will be added.

BE41.12 Subprocess: Perform brake test

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate brake test.
Tasks	▪ See subprocess description 8.4.10.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O41.11 If necessary, adjust brake lever position

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator adjusts brake lever position if necessary.
Remarks	▪ This step can be skipped if Consist is equipped with a brake system not needing manual lever changes.
Activity Rationale	▪ -
Postcondition	▪ -

O41.12 Subprocess: Perform brake test

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.10.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE41.13 Initiate brake and Consist (Composition) calculation

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with CCU and can initiate brake calculation.
Tasks	▪ Compile all information needed to calculate brake power. ▪ This may include getting date from other systems (not part of FDFT System environment).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE41.14 Brake and Consist (Composition) calculation

Precondition	▪ -
Conditions	▪ -
Tasks	▪ FDFT Backend uses compiled data on Consist of Composition and load and calculates available brake power.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O41.14 Brake and Consist (Composition) calculation

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ Legacy processes for calculation of available brake power.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE41.15 Check technical Wagon inspection of added Consist and brake power of Consist Composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ FDFT Backend checks that added Consist passed technical Wagon inspection and stores that information tamper safe. ▪ FDFT Backend checks that brake power is sufficient.
Remarks	▪ Technical Wagon inspection for added Wagon(s) is done beforehand and not part of this process.
Activity Rationale	▪ -
Postcondition	▪ -

O41.15 Check technical Wagon inspection of added Consist and brake power of Consist Composition

Precondition	▪ -
Conditions	▪ Operator checks that available brake power is sufficient for planned track. ▪ Operator checks technical Wagon inspection data. ▪ Operator checks restrictions due to requirements. E.g. Consist clearance, exceptional consignments.
Tasks	
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.4.23 TP42 – Addition, Removal Of Traction Unit

TP42 - Addition, Removal of Traction Unit

This process can also be used to change the direction of travel. First the leading Traction Unit uncouples, then couples on the other end. The change of brake lever must be accounted for.

In case of extended standing time, additional steps like technical Wagon inspection may be necessary.

8.4.23.1 Target Process

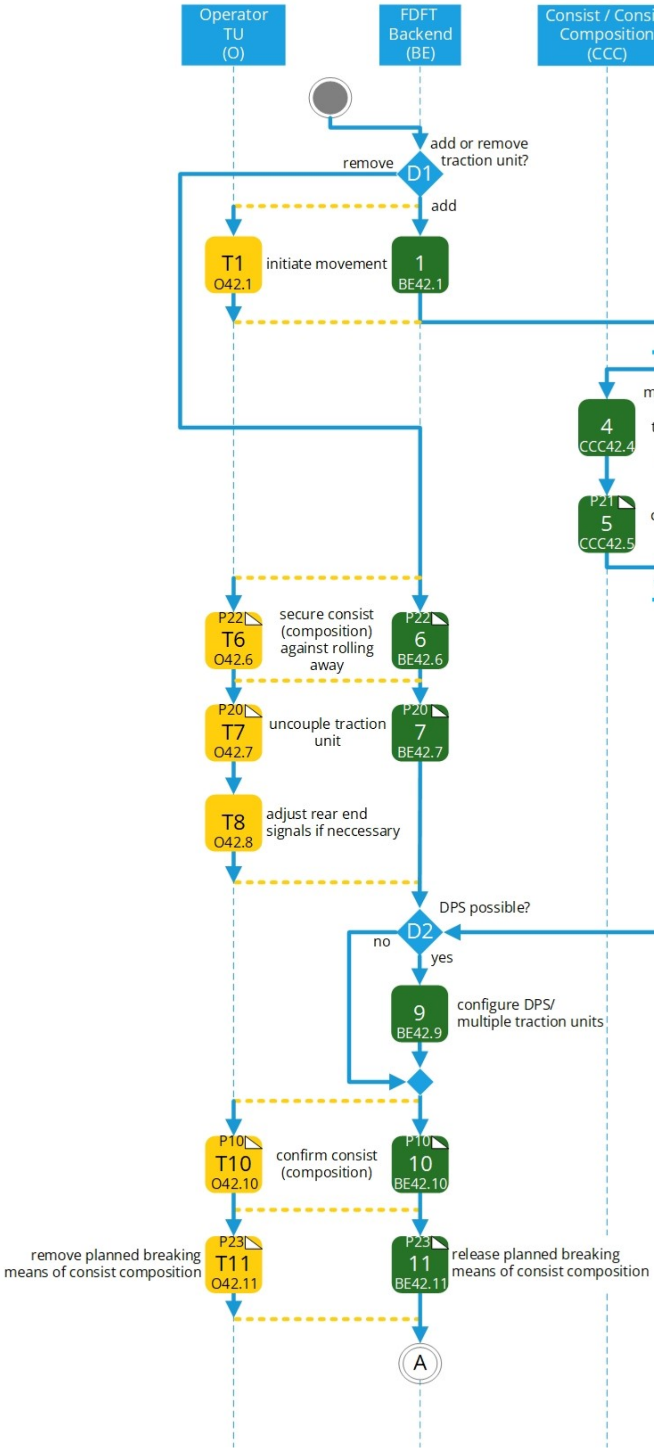


Figure *49*: TP42 Addition, Removal of Traction Unit - 1 of 2

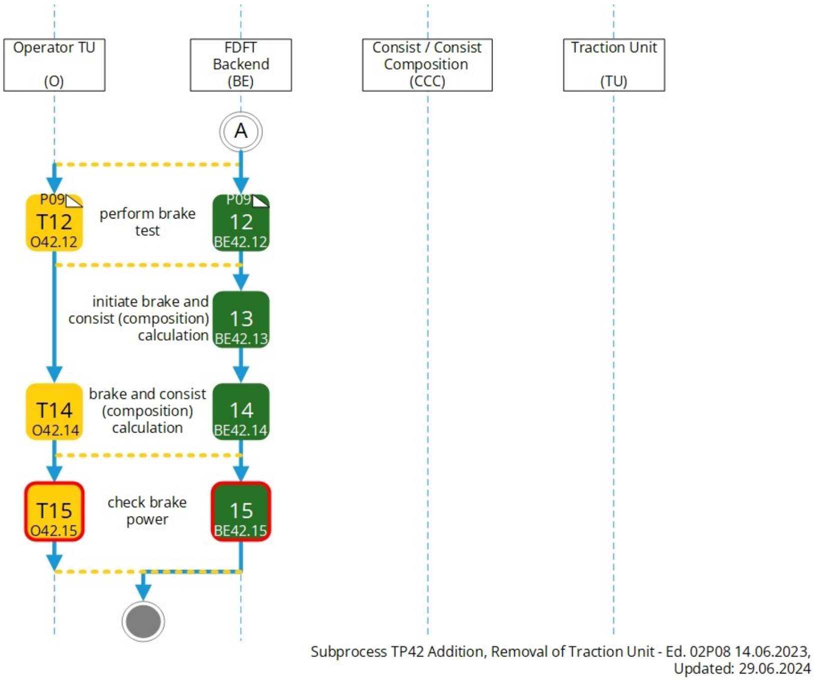


Figure *50*: TP42 Addition Removal of Traction Unit - 2 of 2

8.4.23.2 Process-Description

D1 Add or remove Traction Unit?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

BE42.1 Initiate movement

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ FDFT Backend is available and can initiate movement of Traction Unit.
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O42.1 Initiate movement

Precondition	▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.
Conditions	▪ -
Tasks	▪ Increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU42.2 Movement of the to be added Traction Unit to shunting composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit moves to the shunting composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU42.3 Subprocess: Couple Traction Unit

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description Couple 8.4.14.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC42.4 Movement of the to be added Traction Unit to shunting composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit moves to the shunting composition.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

CCC42.5 Subprocess: Couple Traction Unit

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description Couple 8.4.14.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE42.6 Subprocess: Secure Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with the CCU and can initiate securing against rolling away.
Tasks	▪ See subprocess description 8.4.15.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE42.7 Subprocess: Uncouple Traction Unit

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with the CCU and can initiate uncoupling of Traction Unit.
Tasks	▪ See subprocess description 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O42.6 Subprocess: Secure the Consist (Composition) against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.15.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O42.7 Subprocess: Uncouple Traction Unit

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.13.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O42.8 Adjust rear end signals if necessary

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator adjusts rear end signals.
Remarks	▪ This step can be skipped if not necessary according to regulations. ▪ E.g. train integrity monitoring makes rear end signal obsolete.
Activity Rationale	▪ -
Postcondition	▪ -

D2 DPS possible?

Decision	▪ -
Note Actor/s	▪ -
Additional Information	▪ -

BE42.9 Configure DPS/multiple Traction Units

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ This step is a placeholder for processes needed to reflect the changed train configuration.
Remarks	▪ E.g. assign new master Traction Unit.
Activity Rationale	▪ -
Postcondition	▪ -

BE42.10 Subprocess: Confirm Consist Composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with CCU.
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O42.10 Subprocess: Confirm Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE42.11 Subprocess: Release planned braking means of Consist Composition

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with the FDFT Base System and can initiate releasing of braking means.
Tasks	▪ See subprocess description 8.4.16.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O42.11 Subprocess: Remove planned braking means of Consist Composition

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.16.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE42.12 Subprocess: Perform brake test

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with the FDFT Base System and can initiate brake test.
Tasks	▪ See subprocess description 8.4.10.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O42.12 Subprocess: Perform brake test

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.10.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE42.13 Initiate brake and Consist (Composition) calculation

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate brake calculation.
Tasks	▪ FDFT Backend triggers calculation of brake and Consist (Composition) values.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE42.14 Brake and Consist (Composition) calculation

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ FDFT Backend calculates brake and Consist (Composition) values.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O42.14 Brake and Consist (Composition) calculation

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Carry out brake and Consist Composition calculation.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE42.15 Check brake power

Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ Calculated brake power is compared to the required main line minimum brake power at the given speed.
Remarks	▪ If brake power is insufficient for intended speed, then select appropriate lower speed for that mainline track.
Activity Rationale	▪ -
Postcondition	▪ -

O42.15 Check brake power

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Calculated brake power is compared to the required main line minimum brake power at the given speed.
Remarks	▪ If brake power is insufficient for intended speed, then select appropriate lower speed for that mainline track.
Activity Rationale	▪ -
Postcondition	▪ -

8.4.24 TP43 - Change Of Operator

TP43 - Change of Operator

8.4.24.1 Target Process

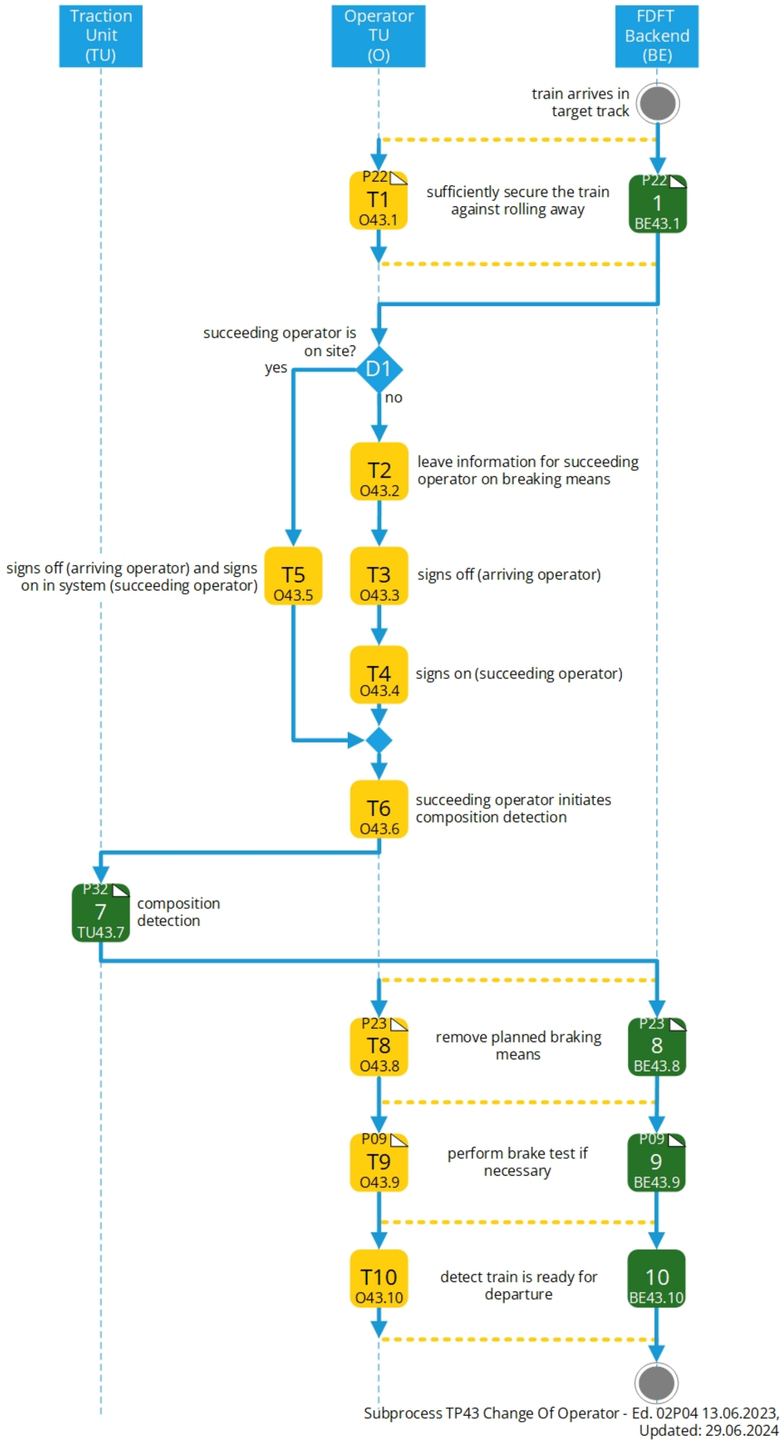


Figure *51*: TP43 Change of Operator - 1 of 1

8.4.24.2 Process-Description

BE43.1 Subprocess: Sufficiently secure the train against rolling away

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with relevant CCU's and can initiate secure Consist against rolling away.
Tasks	▪ See subprocess description 8.4.15.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O43.1 Subprocess: Sufficiently secure the train against rolling away

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.15.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

D1 Succeeding operator is on site?

Decision	**Yes:** ▪ Operators can change directly.
Note Actor/s	▪ -
Additional Information	▪ -

O43.2 Leave information for succeeding Operator on braking means

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator leaves information how the securing was done for the succeeding Operator (legacy process). ▪ If FDFT Backend is available, the information can be retrieved from FDFT Backend.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O43.3 Signs off (arriving Operator)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Arriving Operator signs off on Traction Unit (legacy process).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O43.4 Signs on (succeeding Operator)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Succeeding Operator signs on and takes further steps according to Legacy process.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O43.5 Signs off (arriving Operator) and signs on in System (succeeding Operator)

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Arriving Operator signs off (legacy process). ▪ Succeeding Operator signs on (legacy process).
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O43.6 Succeeding operator initiates composition detection

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Trigger composition detection on HMI.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

TU43.7 Subprocess: Composition detection

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.21.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE43.8 Subprocess: Release planned braking means

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with the CCU and can initiate release braking means.
Tasks	▪ See subprocess description 8.4.16.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O43.8 Subprocess: Remove planned braking means

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.16.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE43.9 Subprocess: perform brake test if necessary

Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with the CCU and can initiate brake test.
Tasks	▪ See subprocess description 8.4.10.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O43.9 Subprocess: perform brake test if necessary

Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.10.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

BE43.10 Detect train is ready for departure

Precondition	▪ -
Conditions	▪ FDFT Backend is available and can automatically detect that train is ready for departure.
Tasks	▪ FDFT Backend automatically detects that train is ready for departure and triggers following processes.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

O43.10 Detect train is ready for departure

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator detects that train is ready for departure and triggers following processes.
Remarks	▪ -
Activity Rationale	▪ -
Postcondition	▪ -

8.5 ER JU Processes

The following chapter describes the semi-automated processes "ER JU Processes" as described in chapter 7.4.

8.5.1 EP01 - Shunting Preparation

EP01 - Shunting Preparation

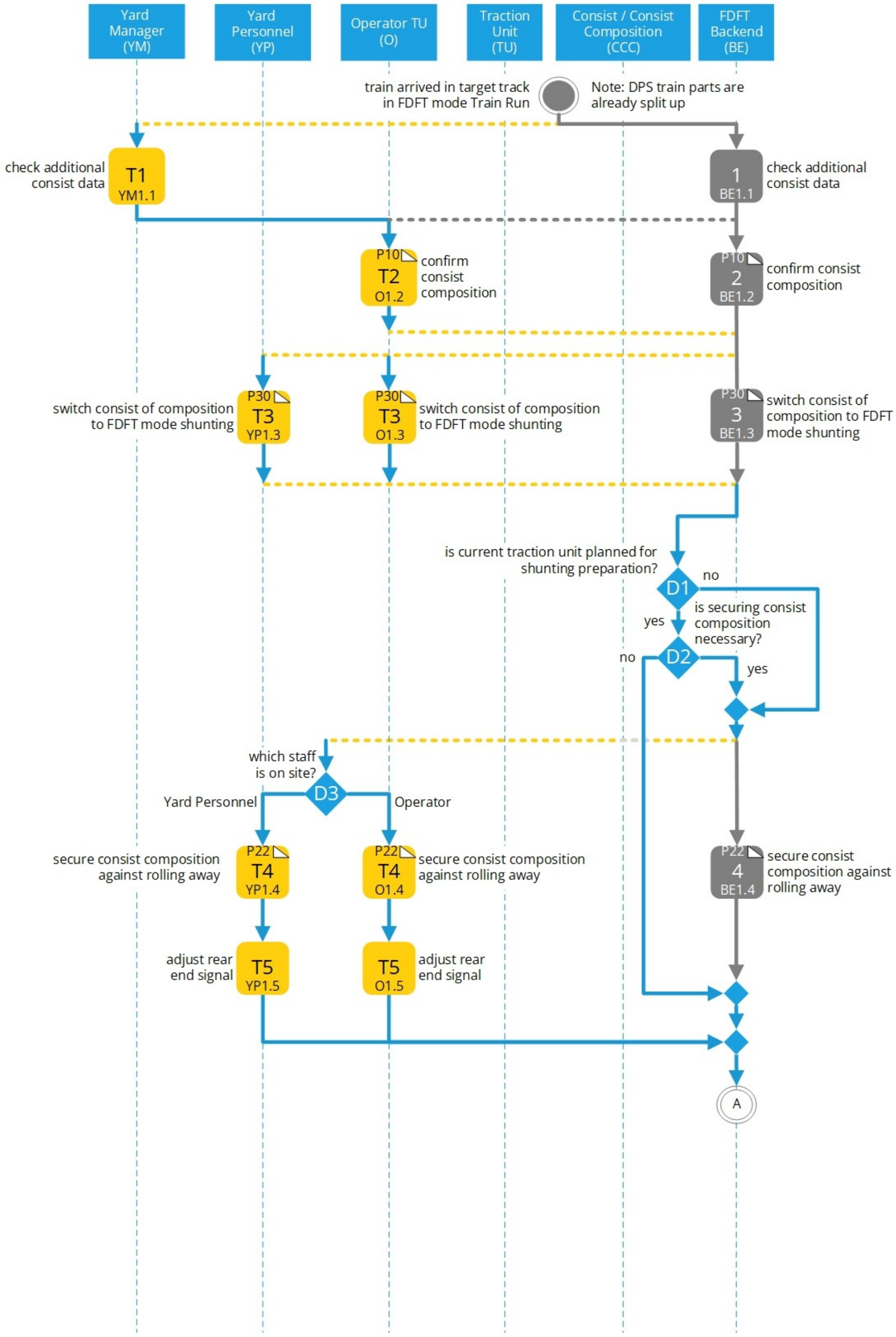


Figure *52*: EP01 Shunting Preparation - 1 of 2

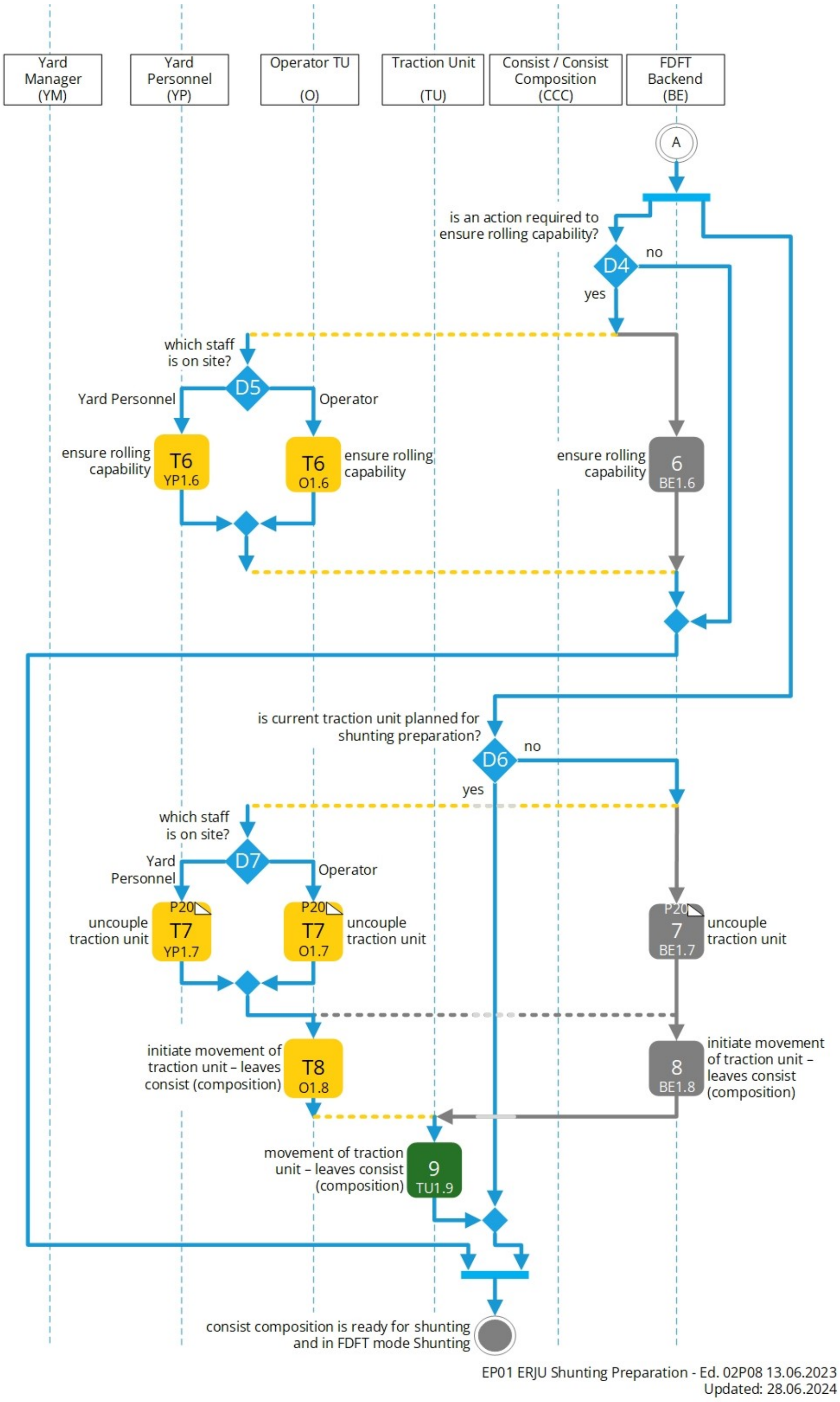


Figure *53*: EP01 Shunting Preparation - 2 of 2

8.5.2 EP02 - Consist Processing

EP02 - Consist Processing

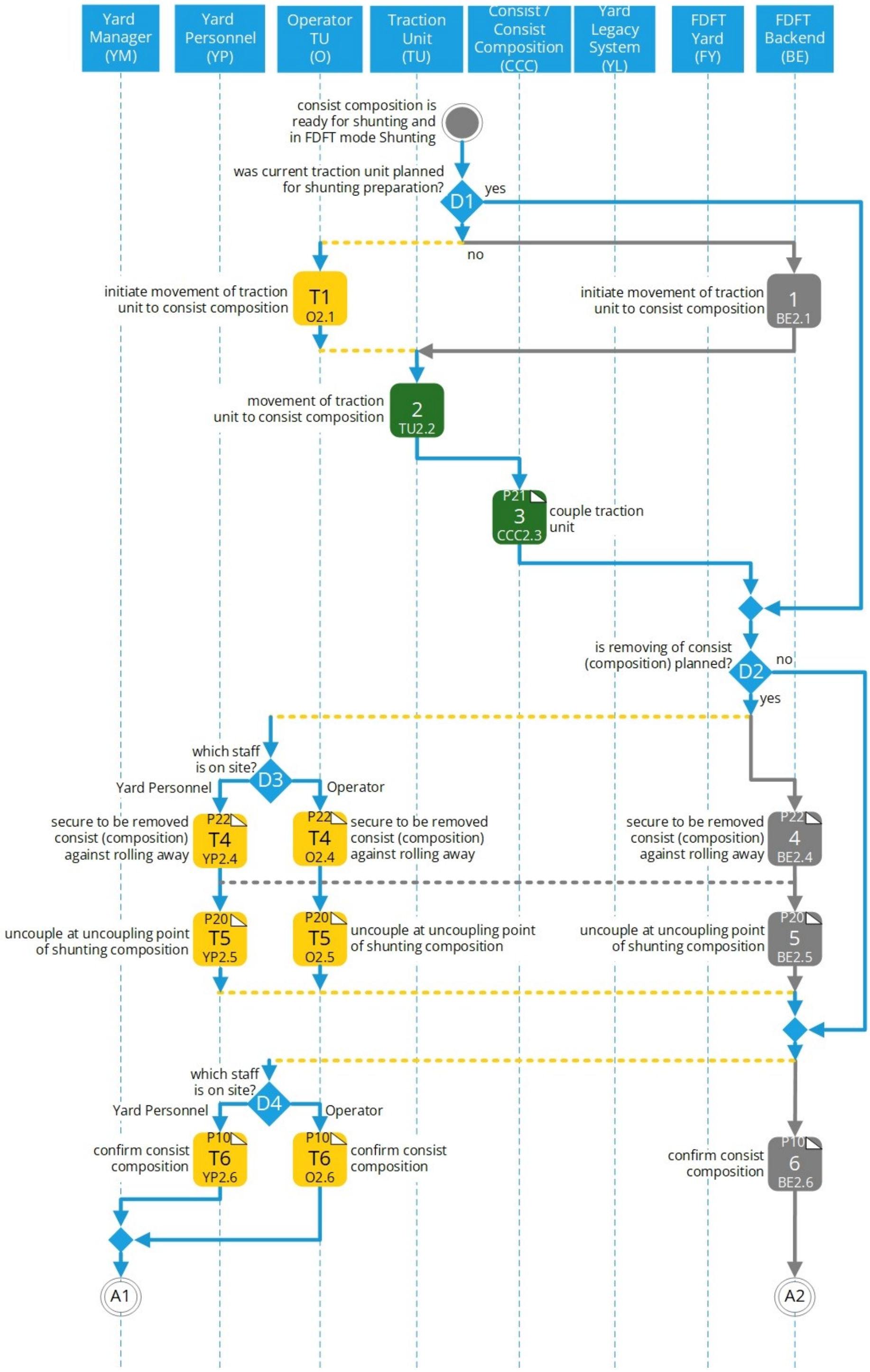


Figure *54*: EP02 Consist Processing - 1 of 4

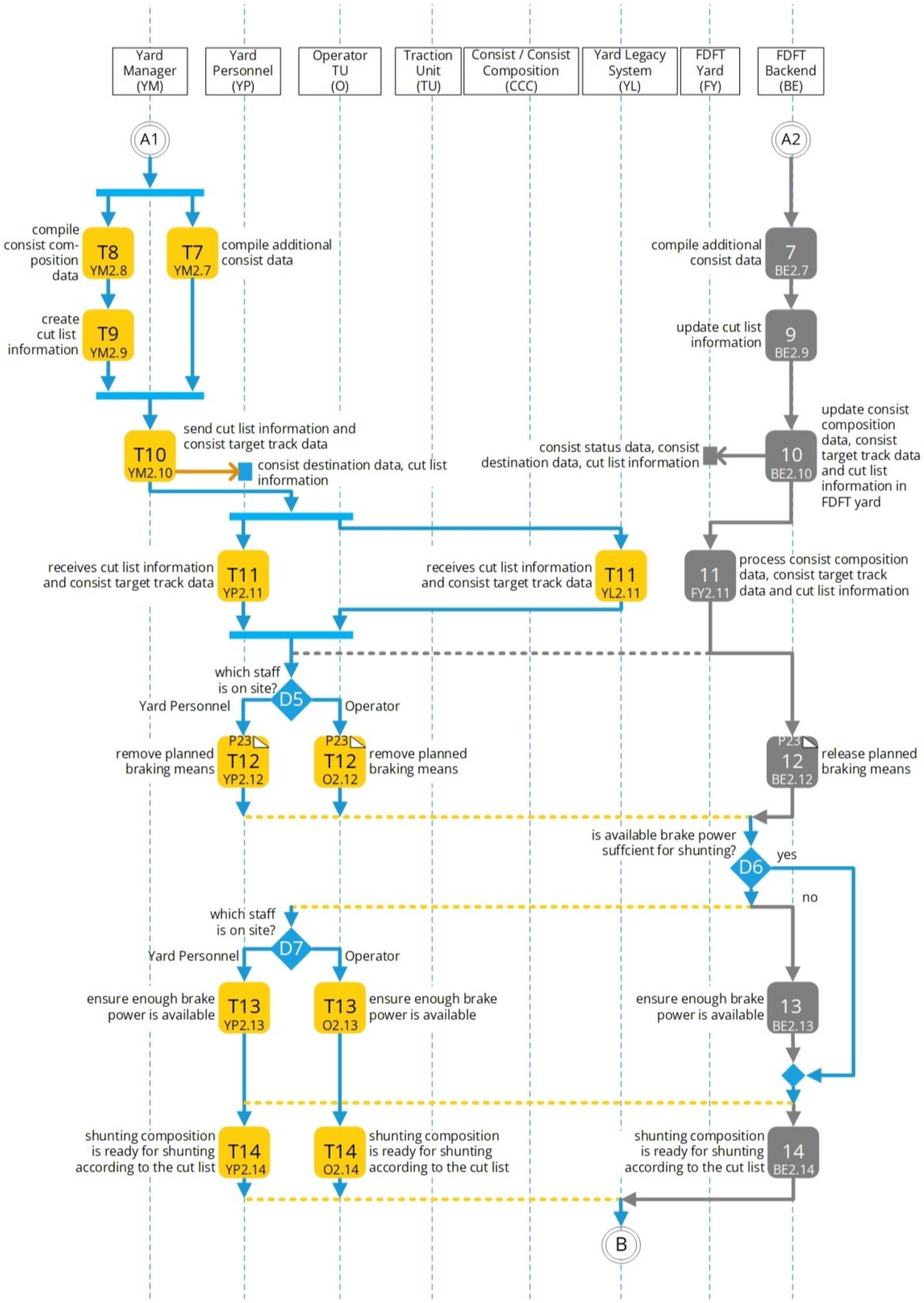


Figure *55*: EP02 Consist Processing - 2 of 4

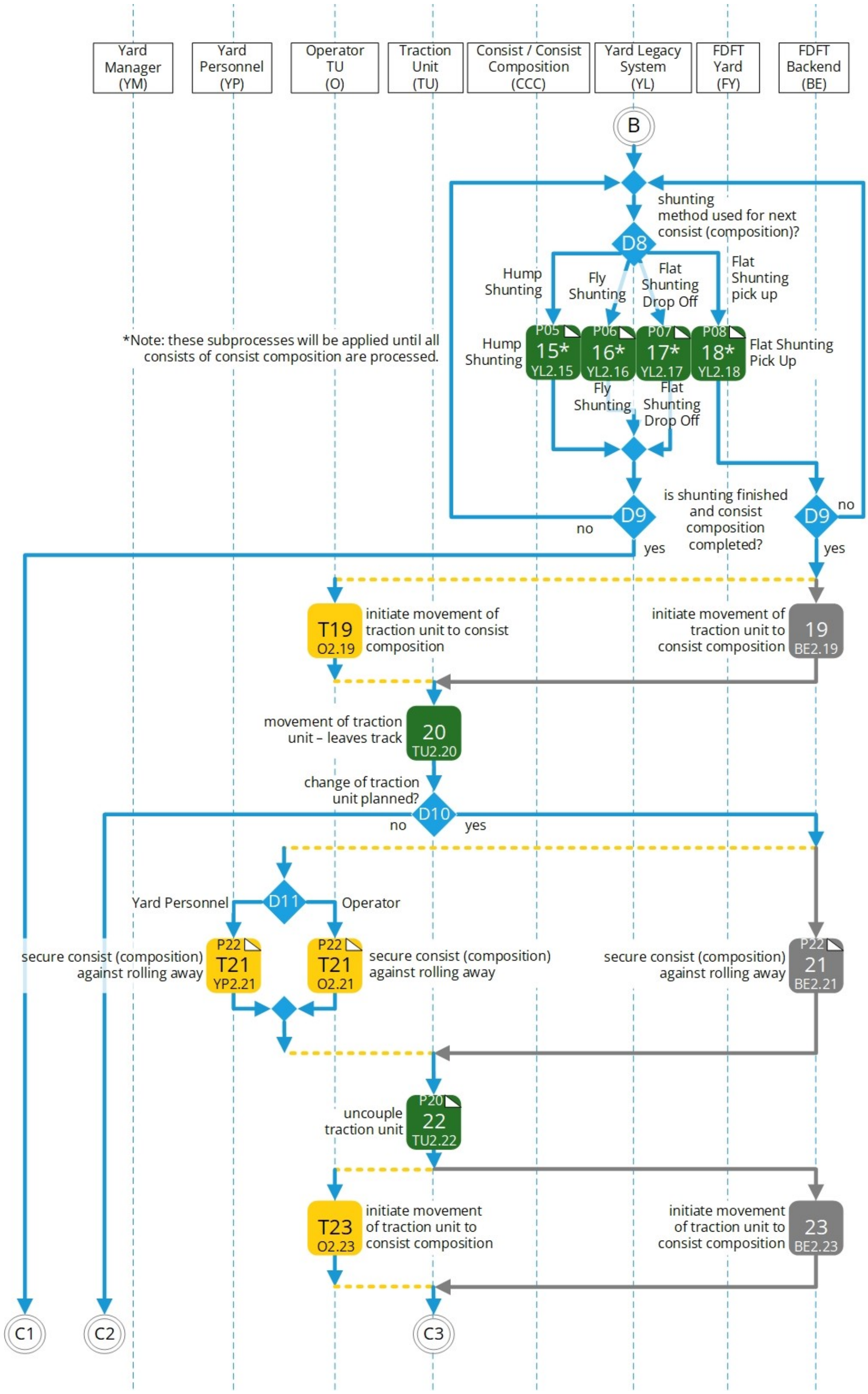


Figure *56*: EP02 Consist Processing - 3 of 4

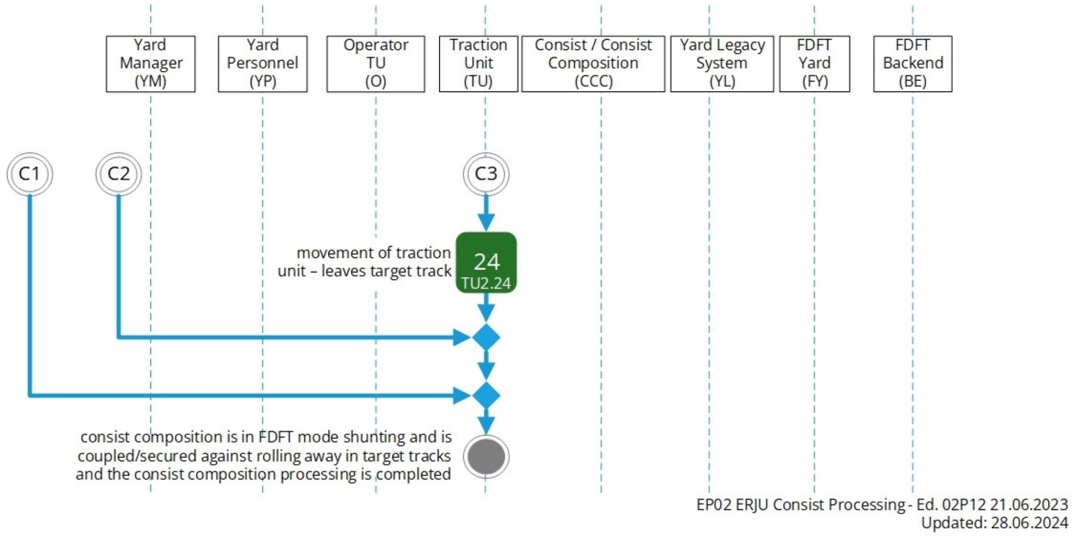


Figure *57*: EP02 Consist Processing - 4 of 4

8.5.3 EP03 - Train Preparation

EP03 - Train Preparation

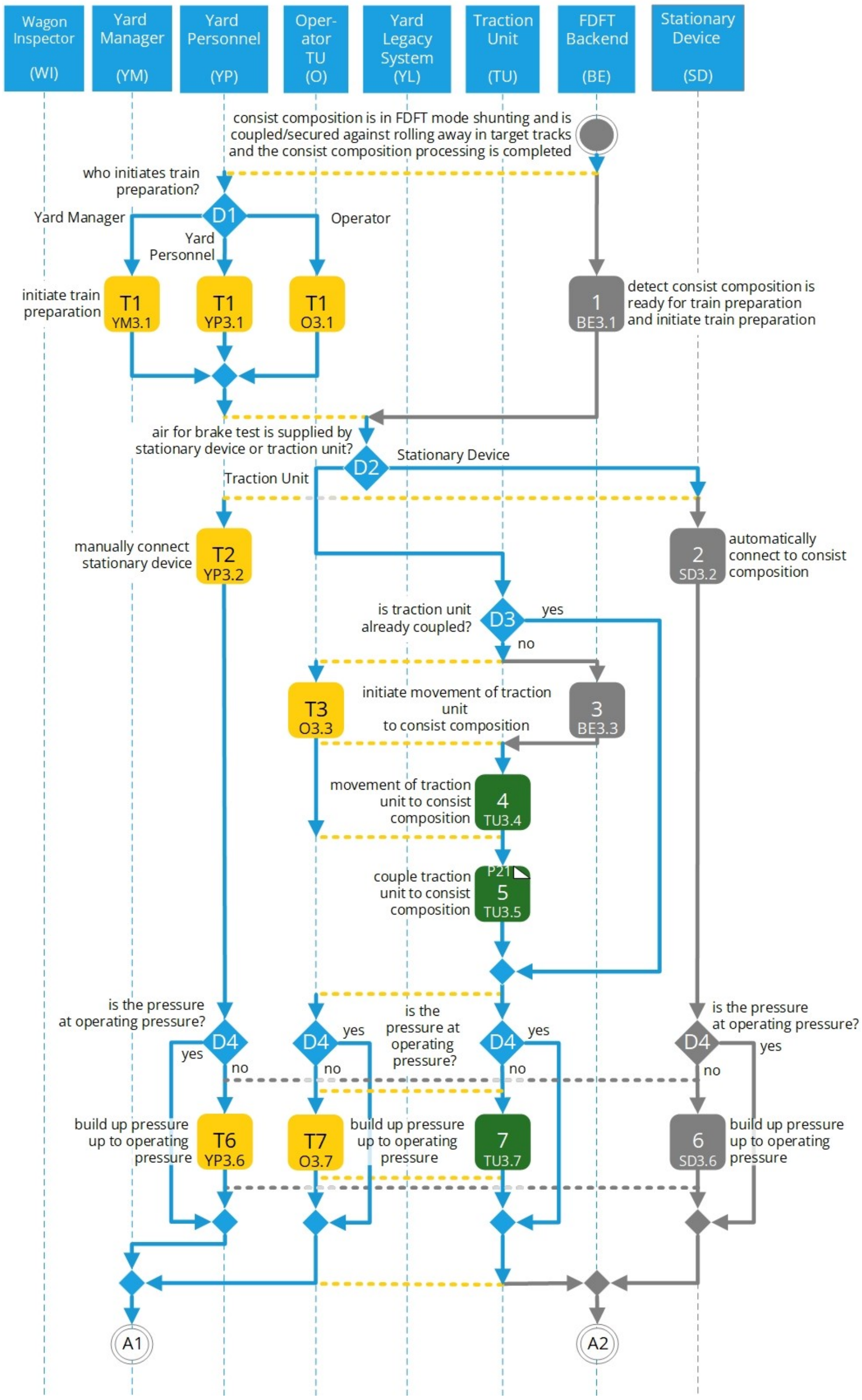


Figure *58*: EP03 Train Preparation - 1 of 4

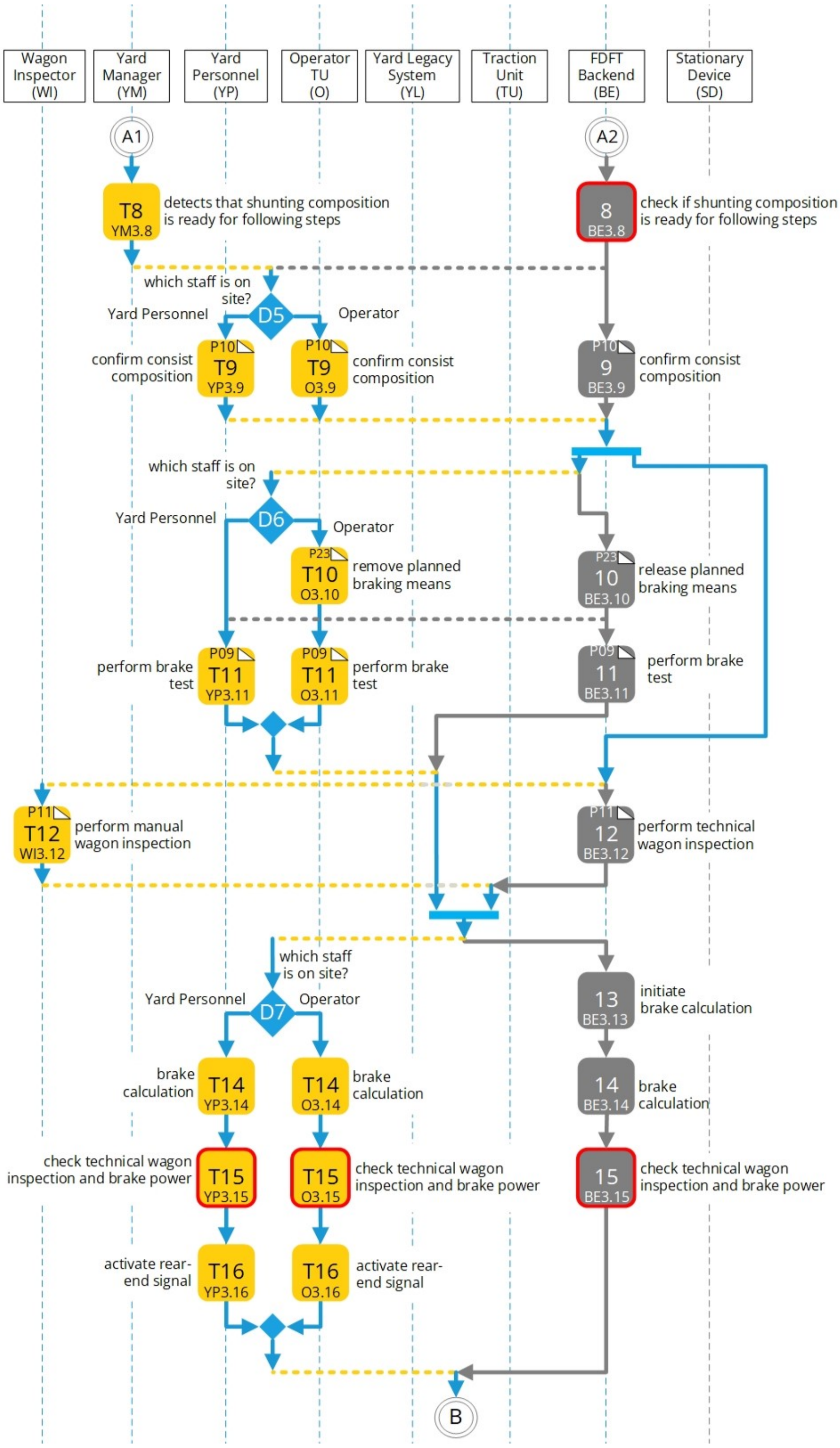


Figure *59*: EP03 Train Preparation - 2 of 4

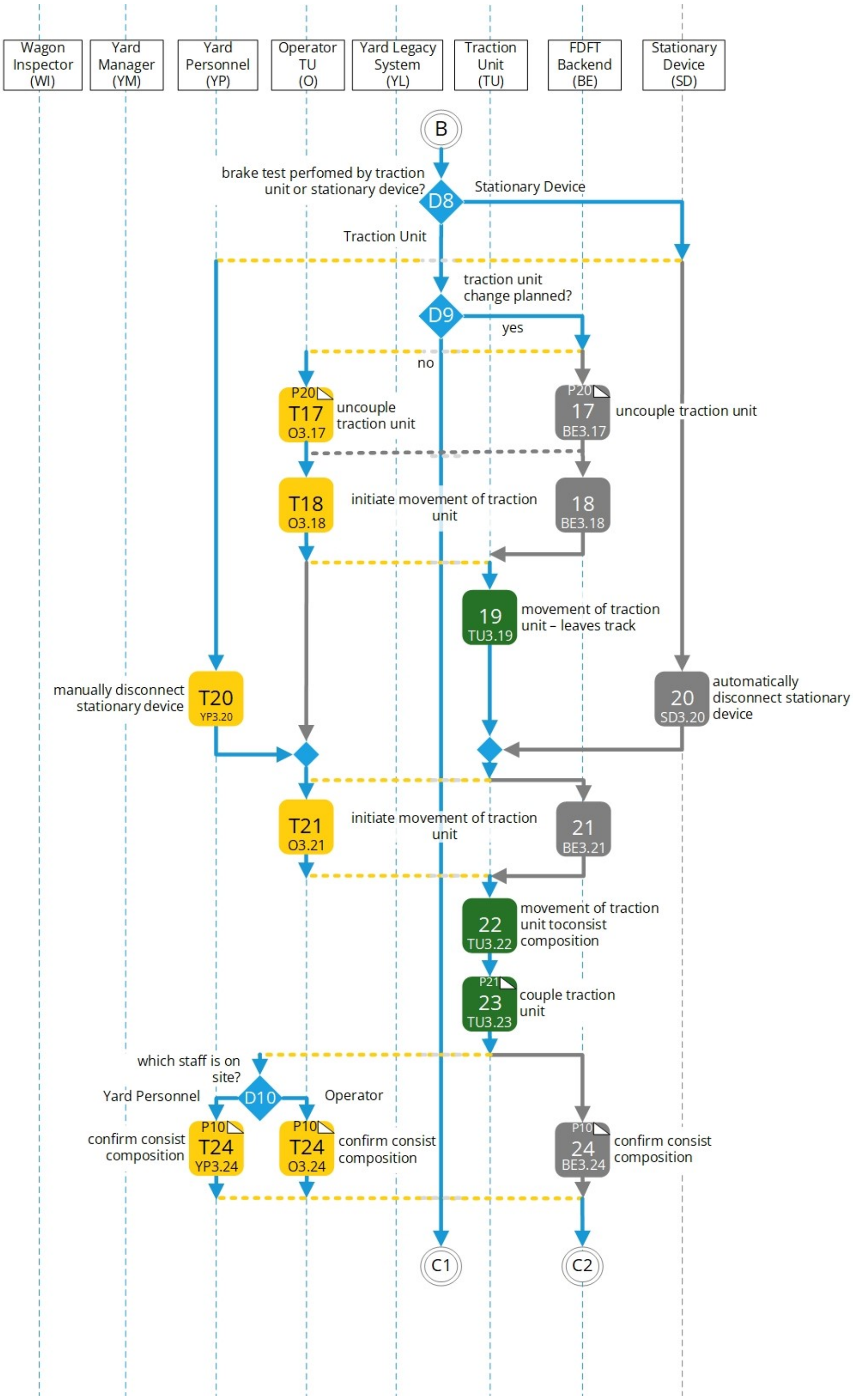


Figure *60*: EP03 Train Preparation - 3 of 4

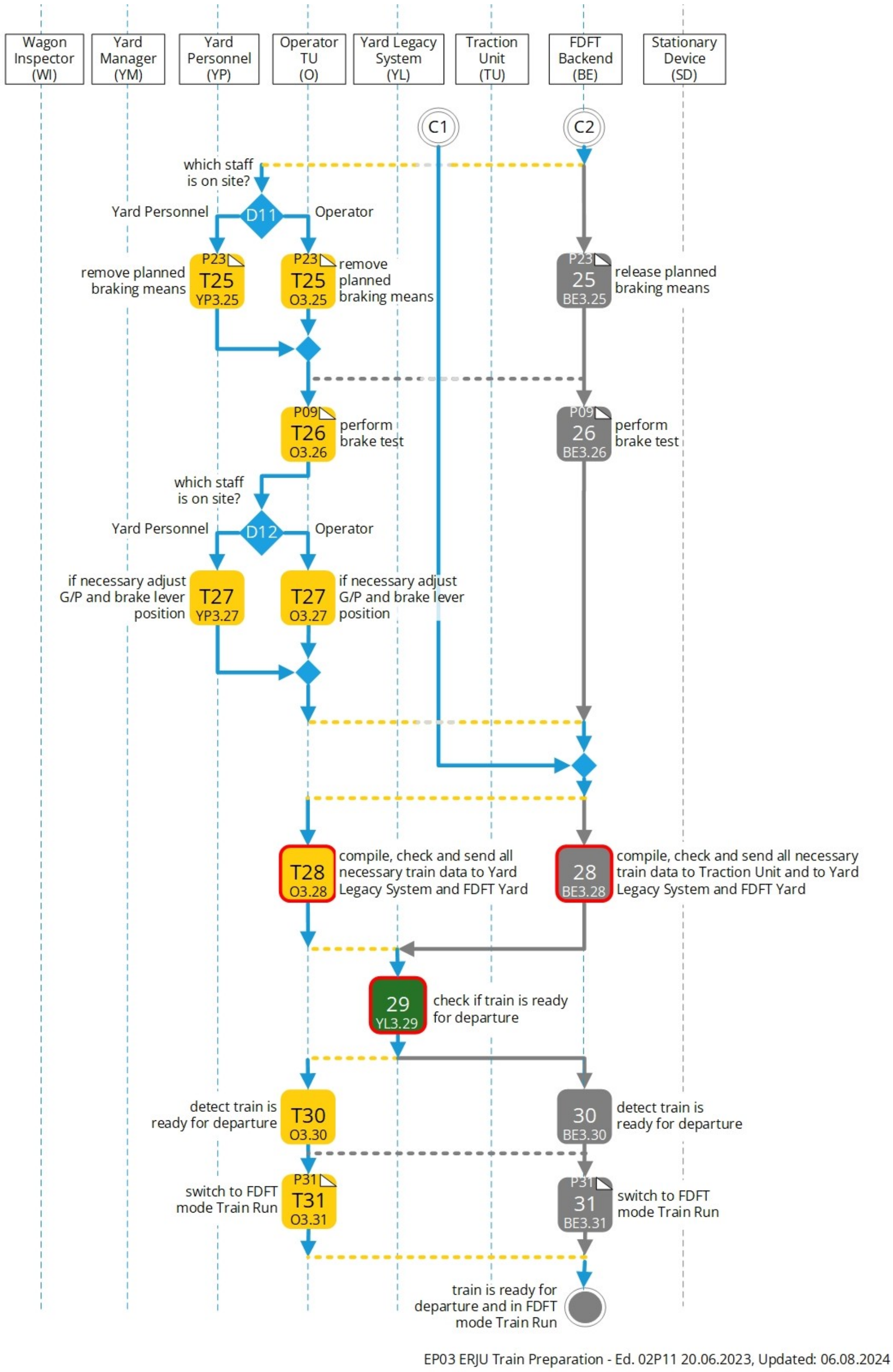


Figure *61*: EP03 Train Preparation - 4 of 4

8.5.4 EP04 - Train Run

EP04 - Train Run

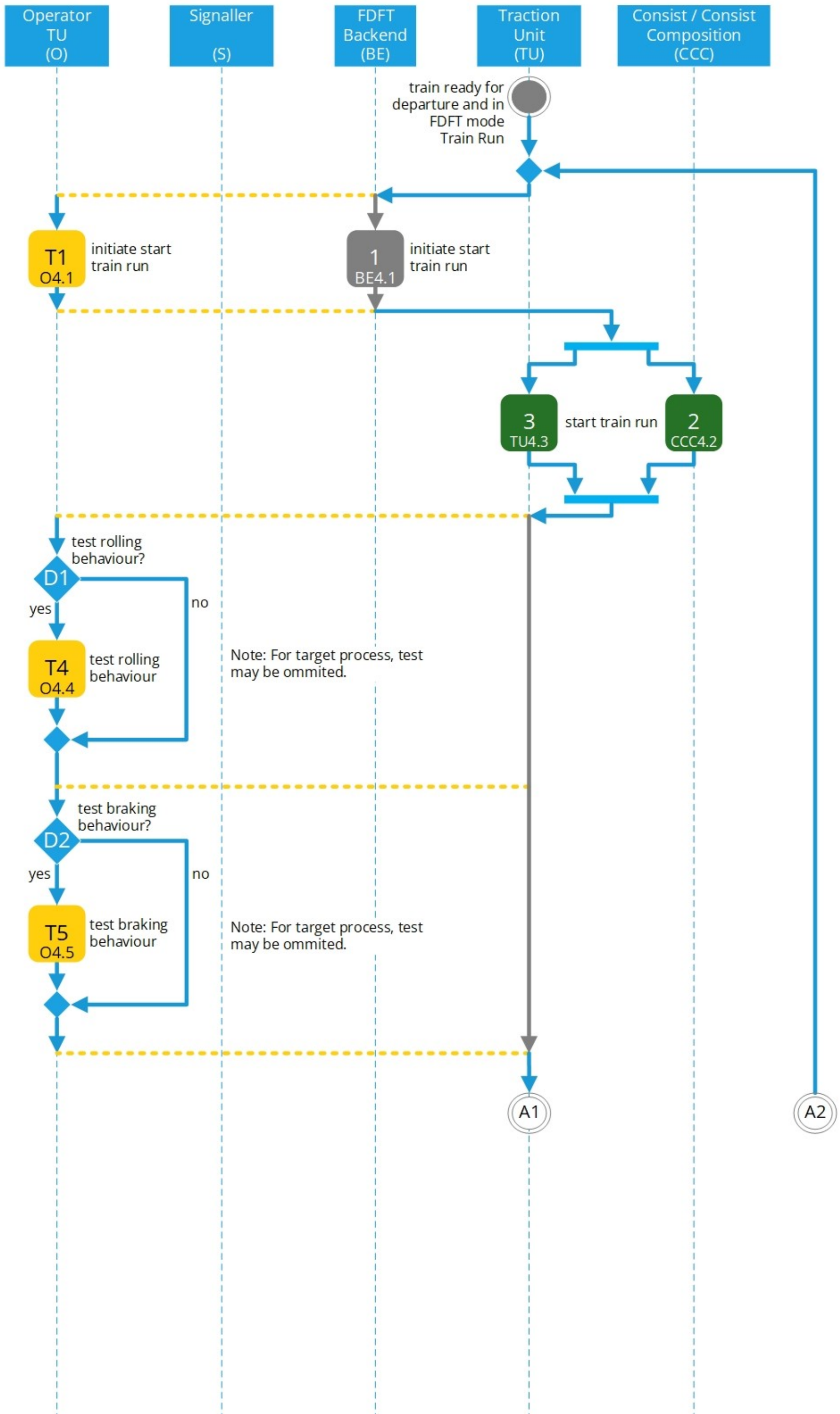


Figure 62: EP04 Train Run - 1 of 2

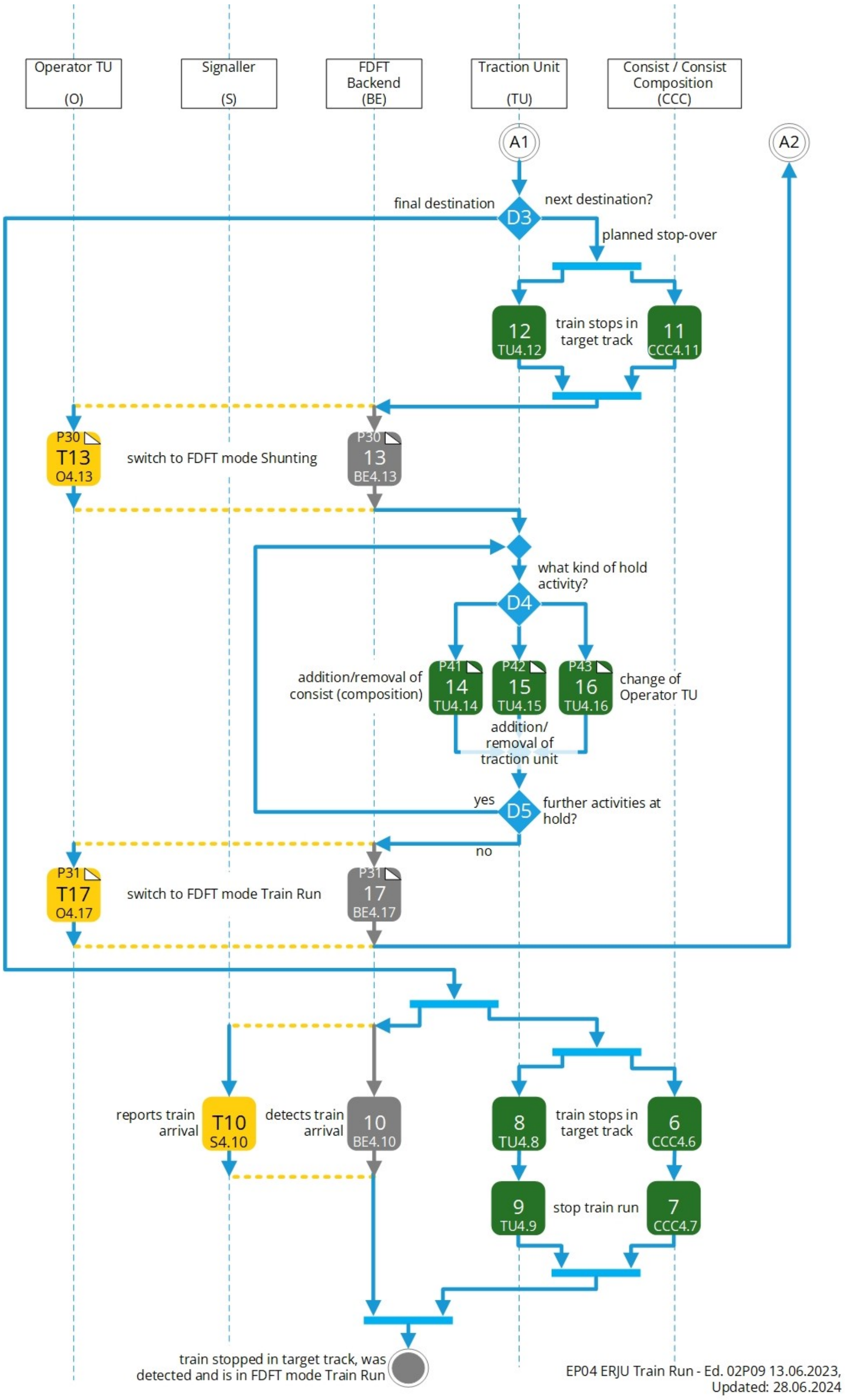


Figure 63: EP04 Train Run - 2 of 2

8.5.5 EP05 - Hump Shunting

EP05 - Hump Shunting

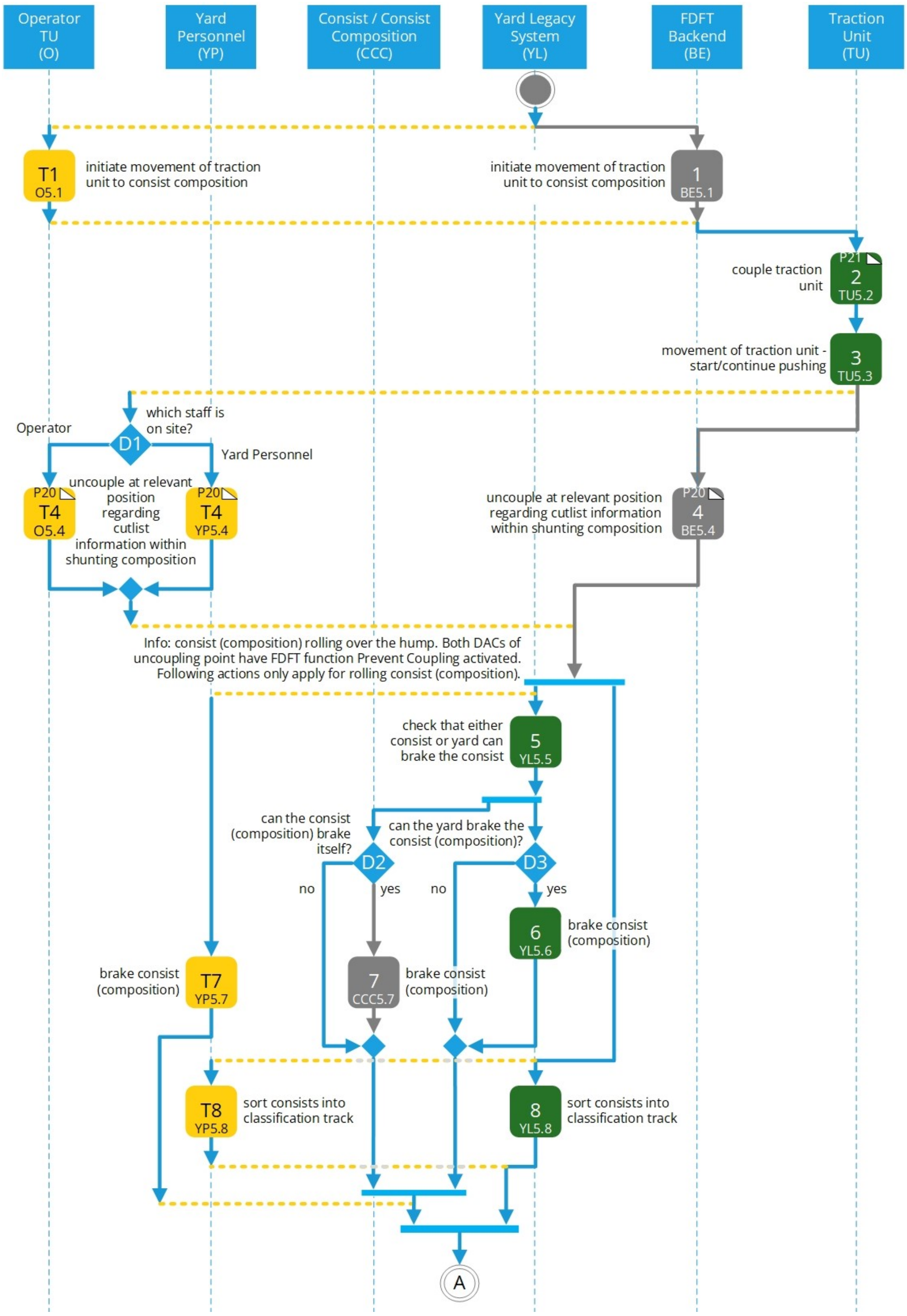


Figure *64*: EP05 Hump Shunting - 1 of 2

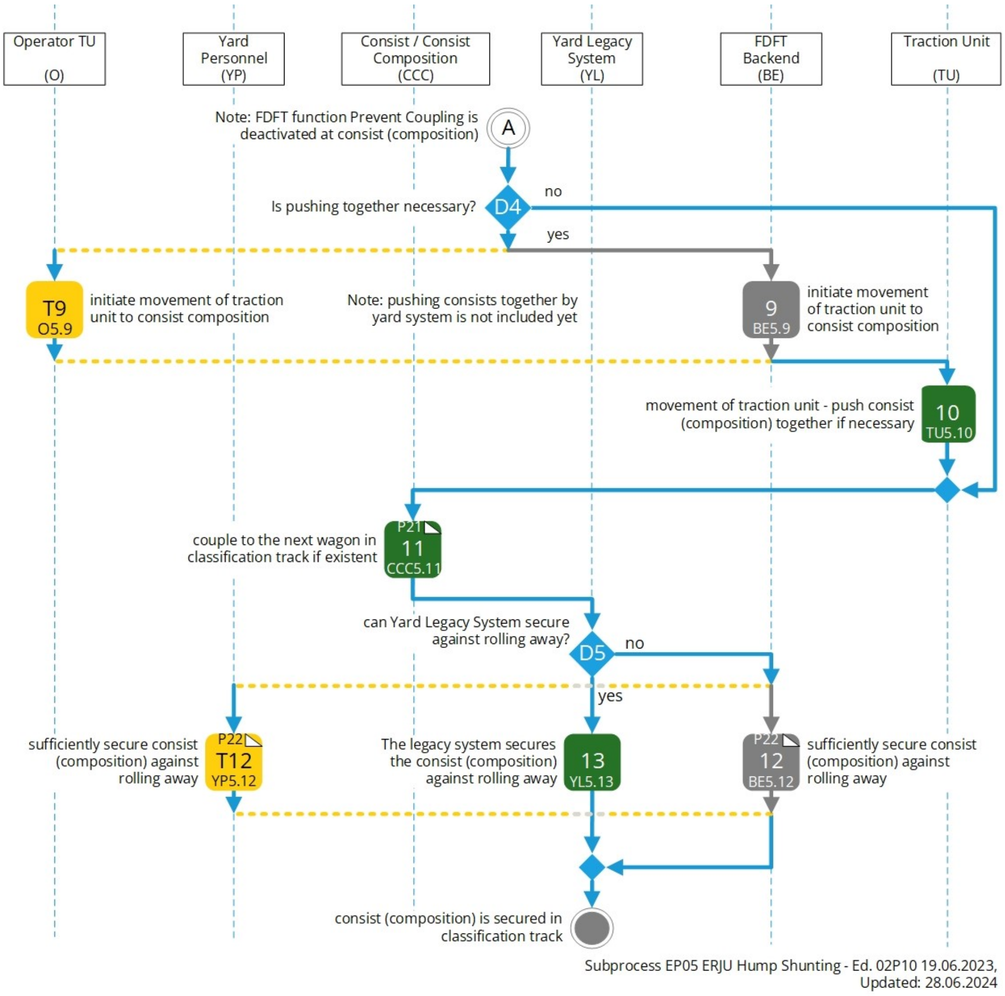


Figure *65*: EP05 Hump Shunting - 2 of 2

8.5.6 EP06 - Fly Shunting

EP06 - Fly Shunting

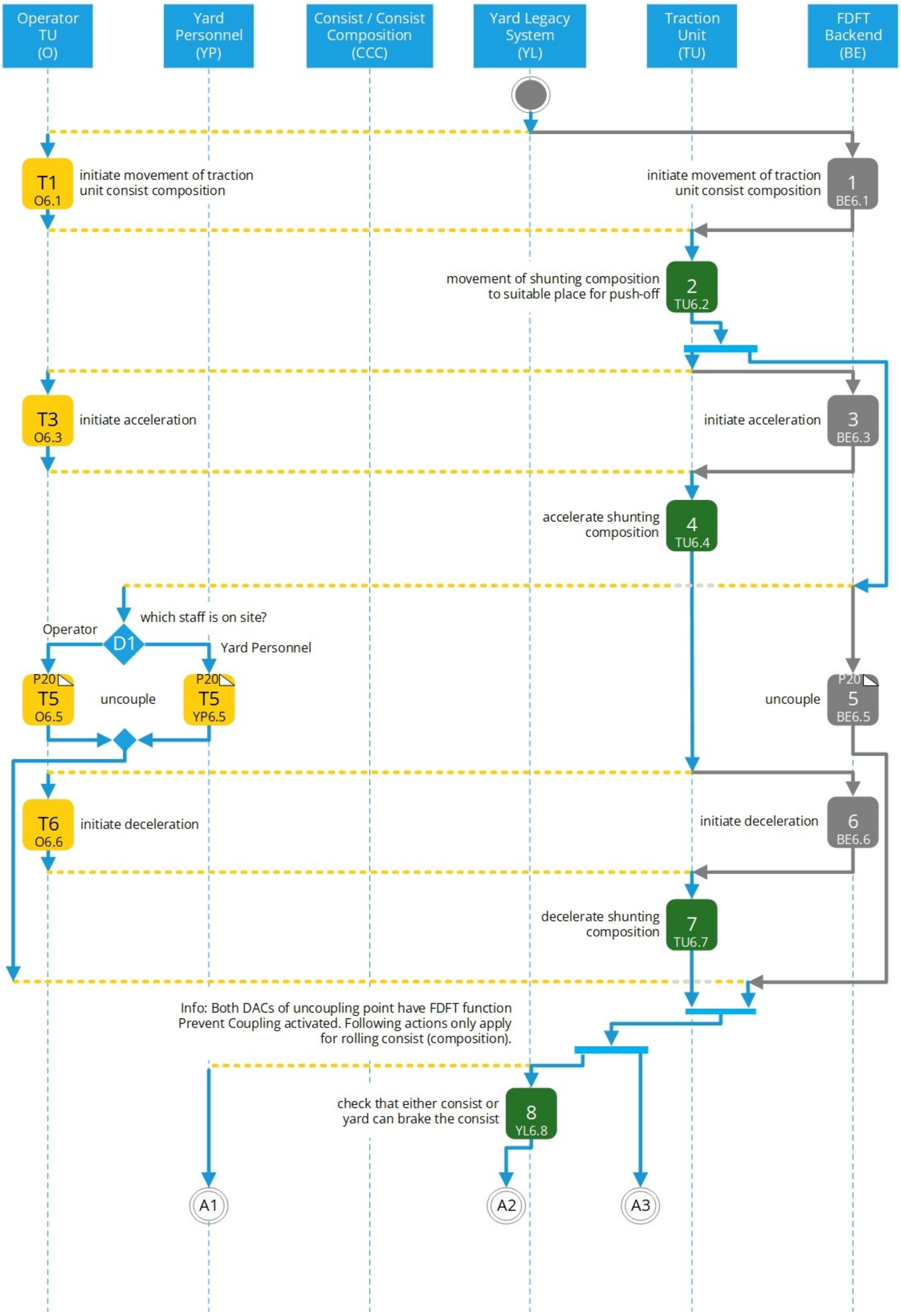


Figure *66*: EP06 Fly Shunting - 1 of 2

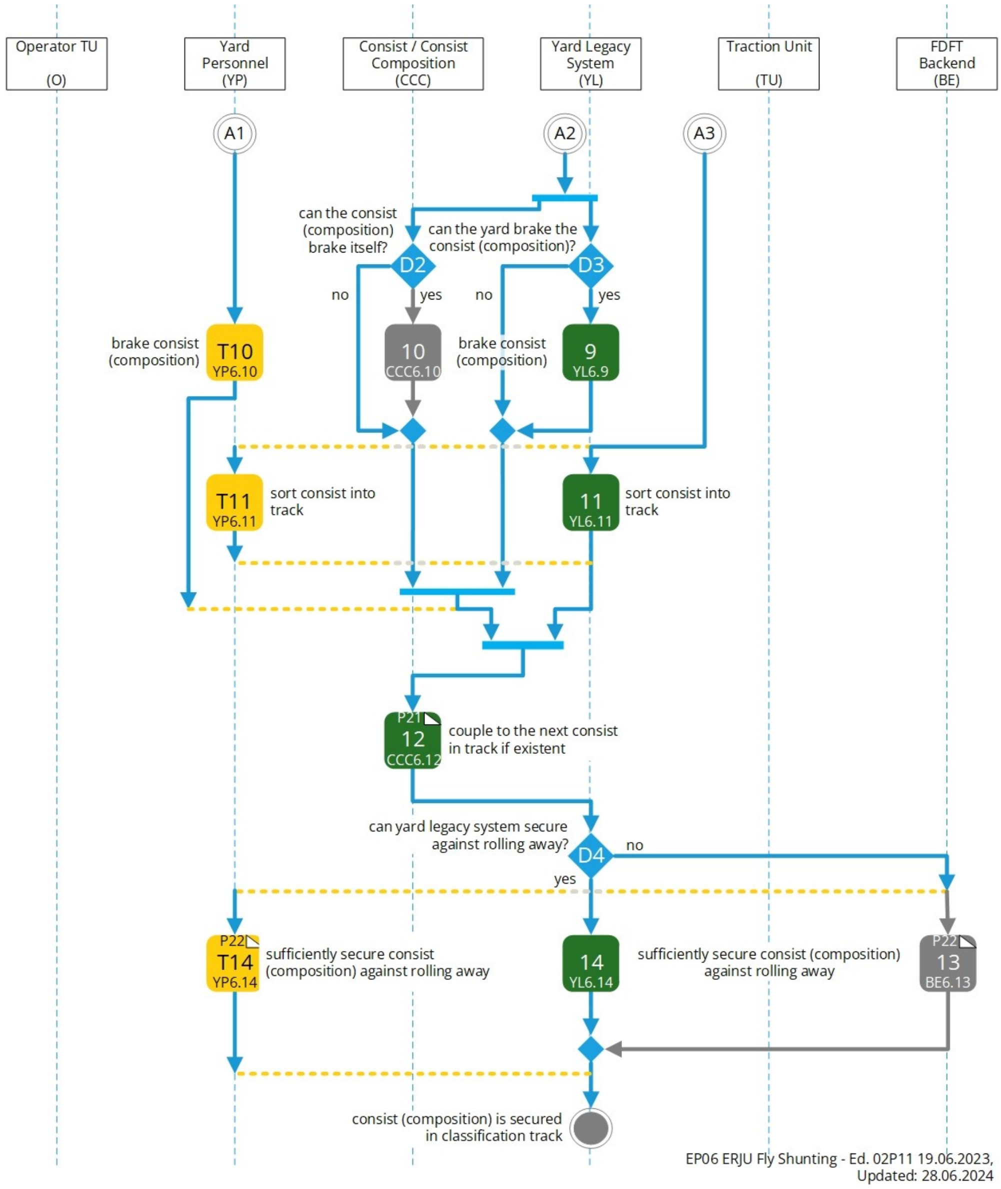


Figure 67: EP06 Fly Shunting - 2 of 2

8.5.7 EP07 - Flat Shunting Drop Off

EP07 - Flat Shunting Drop Off

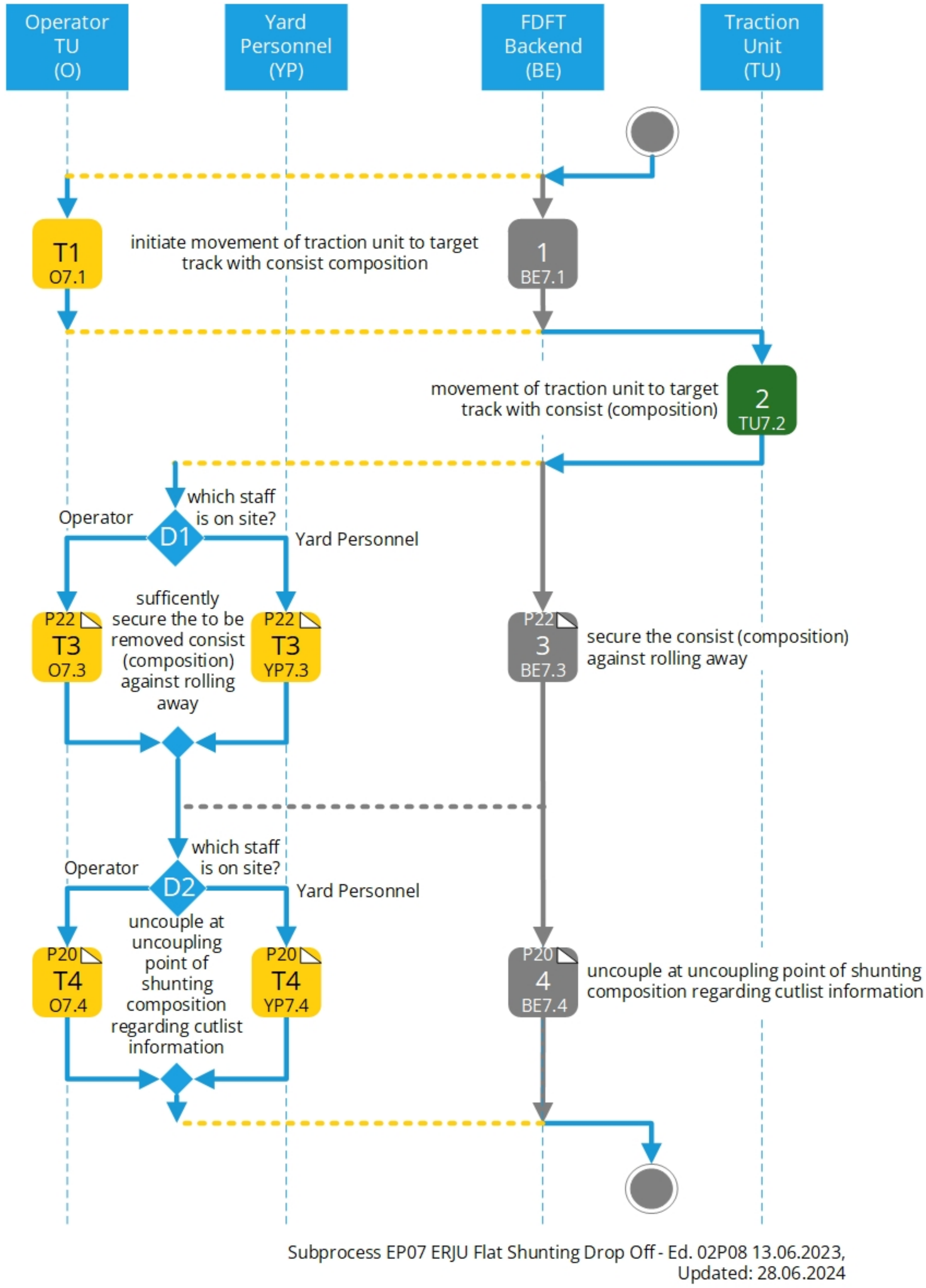


Figure *68*: EP07 Flat Shunting Drop Off - 1 of 1

8.5.8 EP08 - Flat Shunting Pick Up

EP08 - Flat Shunting Pick Up

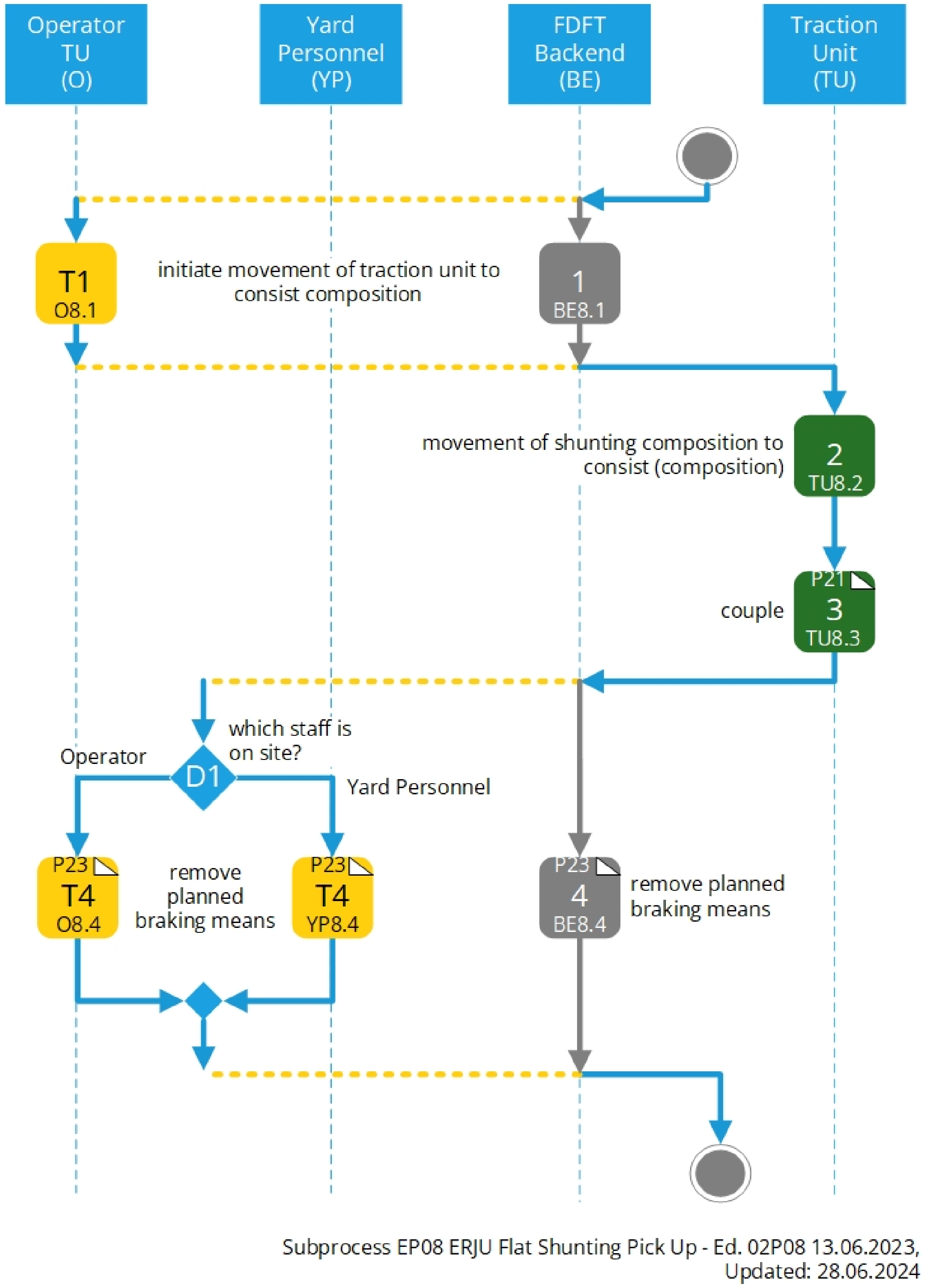


Figure 69: EP08 Flat Shunting Pick Up - 1 of 1

8.5.9 EP09 - Automated Brake Test

EP09 - Automated Brake Test

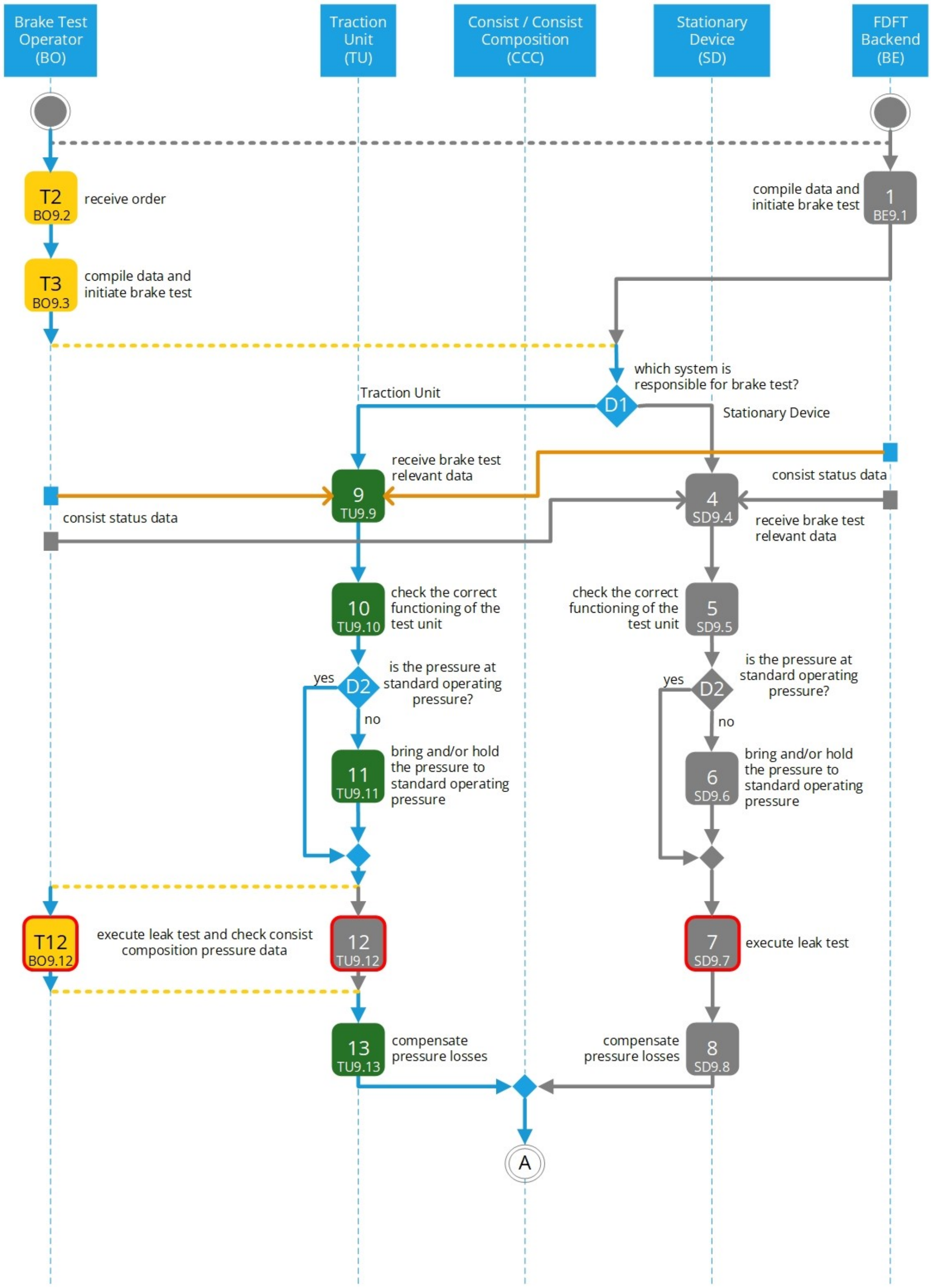


Figure *70*: EP09 Automated Brake Test - 1 of 3

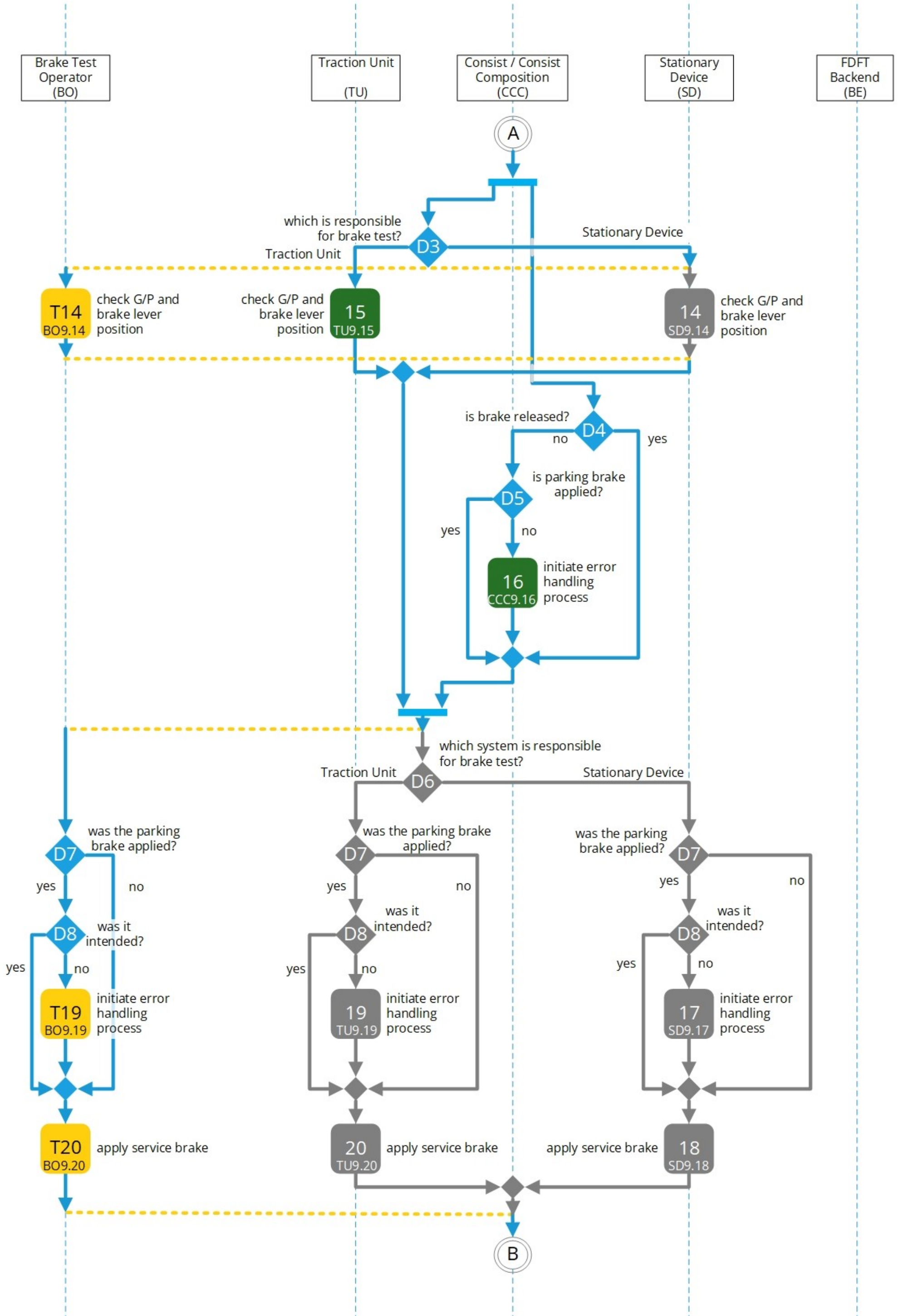


Figure 71: EP09 Automated Brake Test - 2 of 3

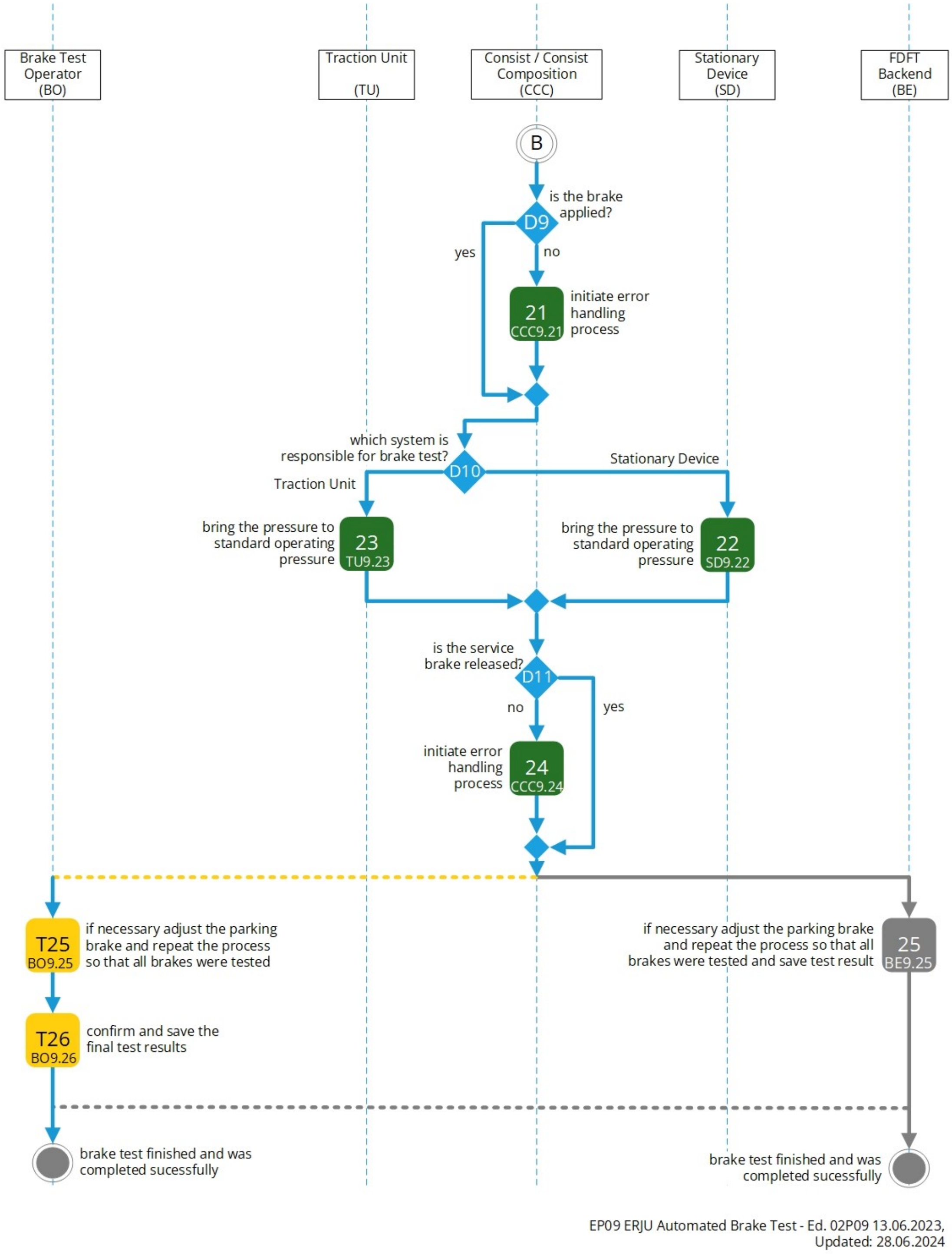


Figure 72: EP09 Automated Brake Test - 3 of 3

8.5.10 EP10 - Confirm Consist Composition

EP10 - Confirm Consist Composition

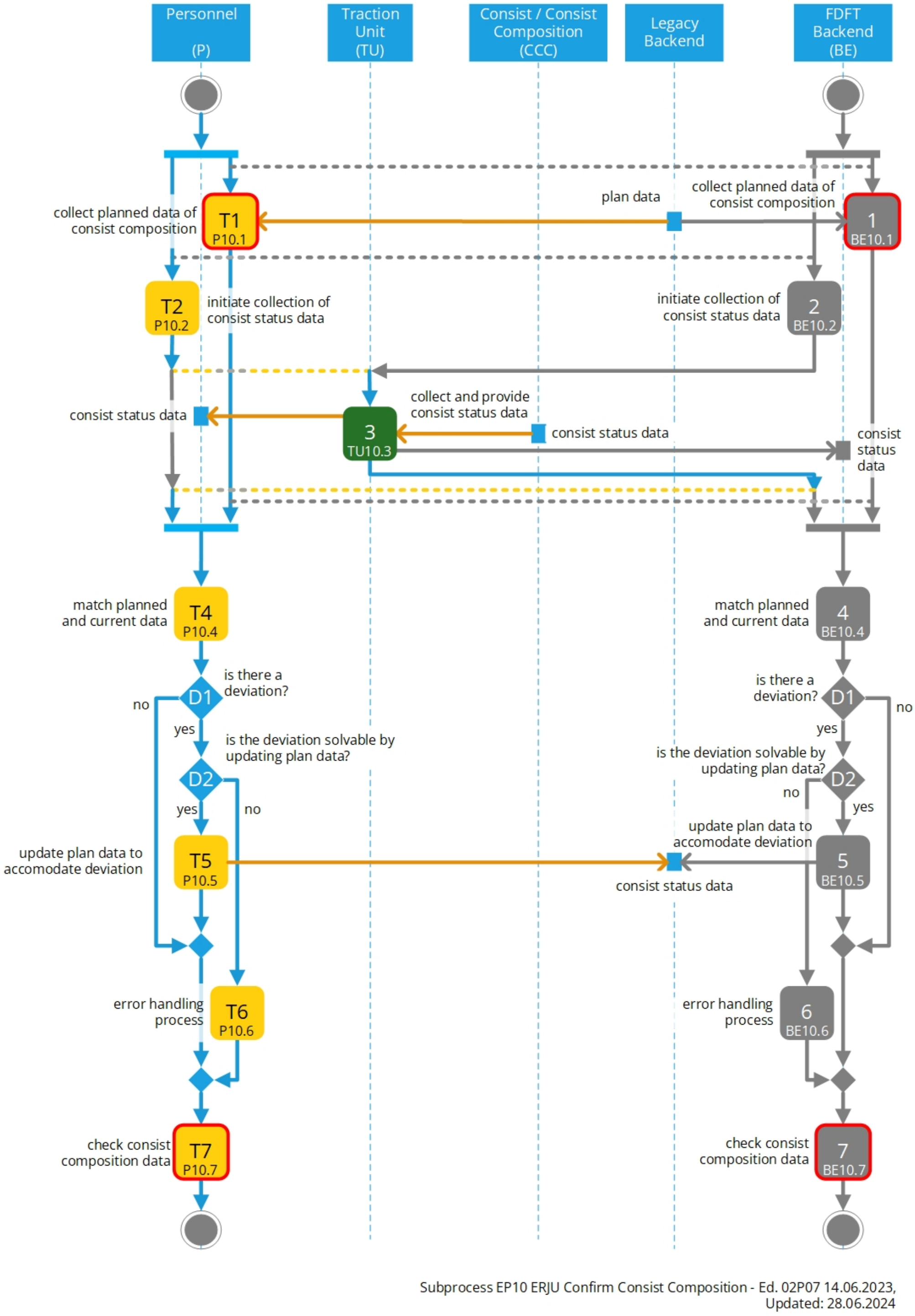


Figure 73: EP10 Confirm Consist Composition - 1 of 1

8.5.11 EP11 - Technical Wagon Inspection

EP11 - Technical Wagon Inspection

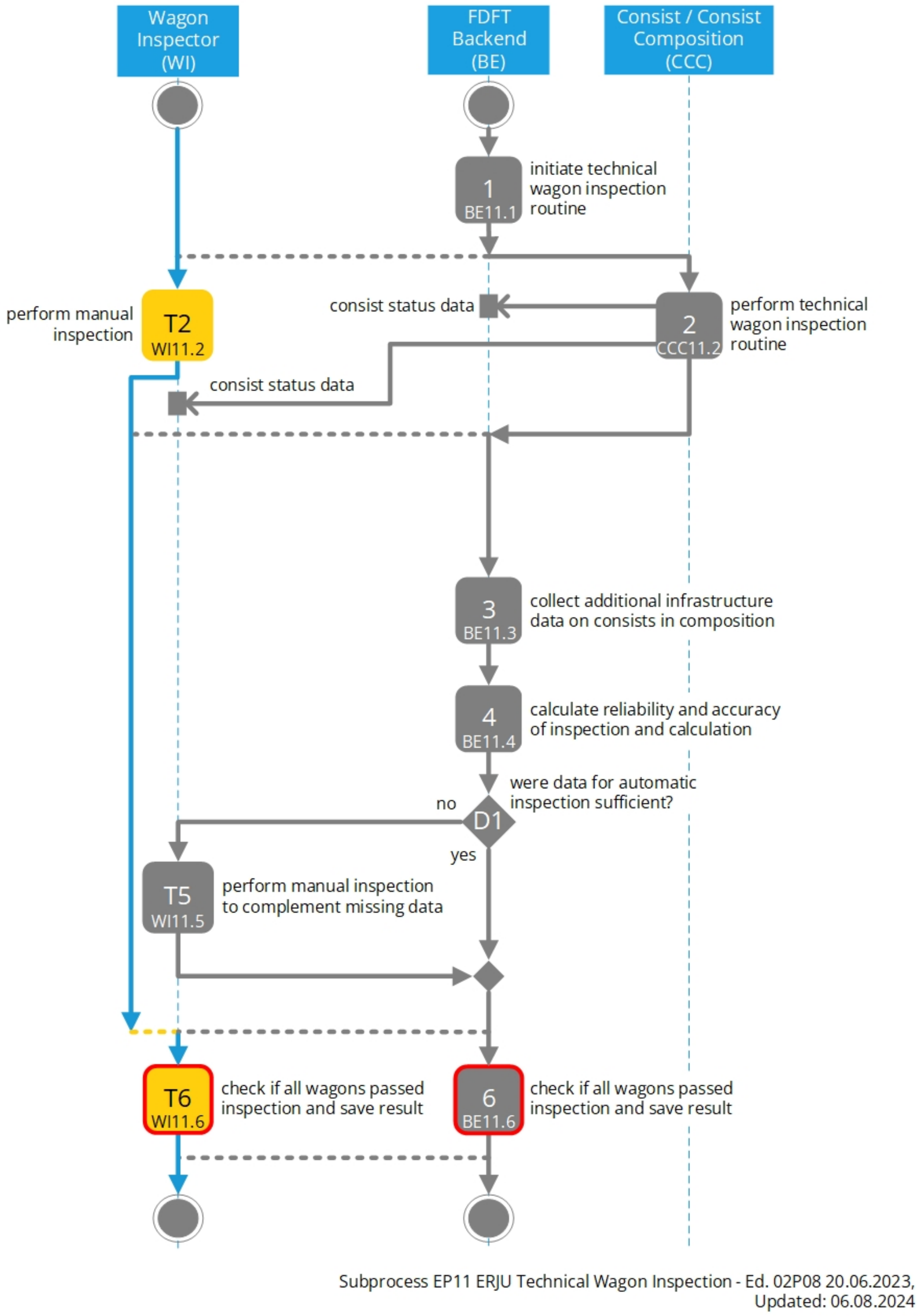


Figure *74*: EP11 Technical Wagon Inspection - 1 of 1

8.5.12 EP20 – Uncouple

EP20 - Uncouple

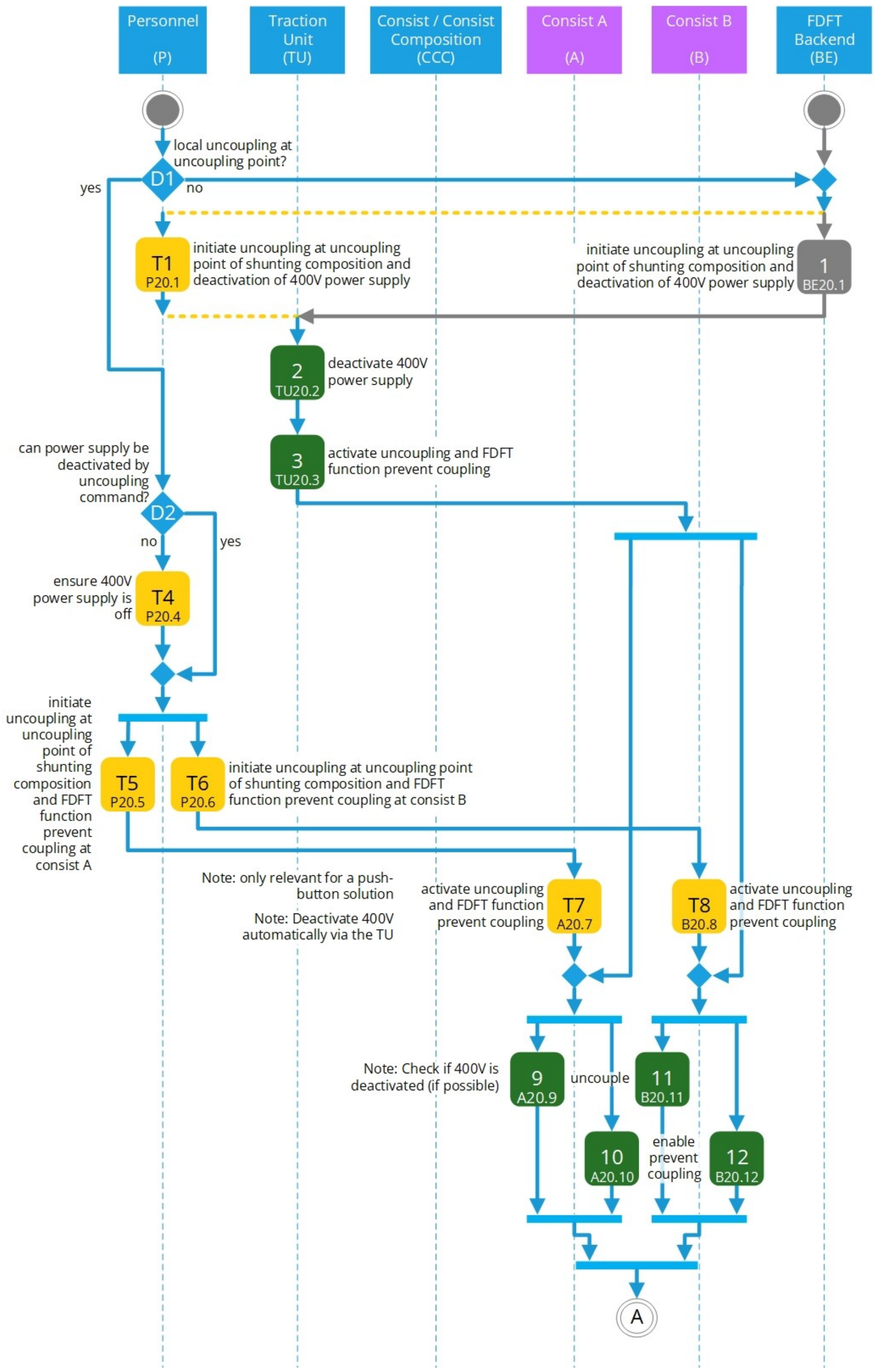


Figure *75*: EP20 Uncouple - 1 of 2

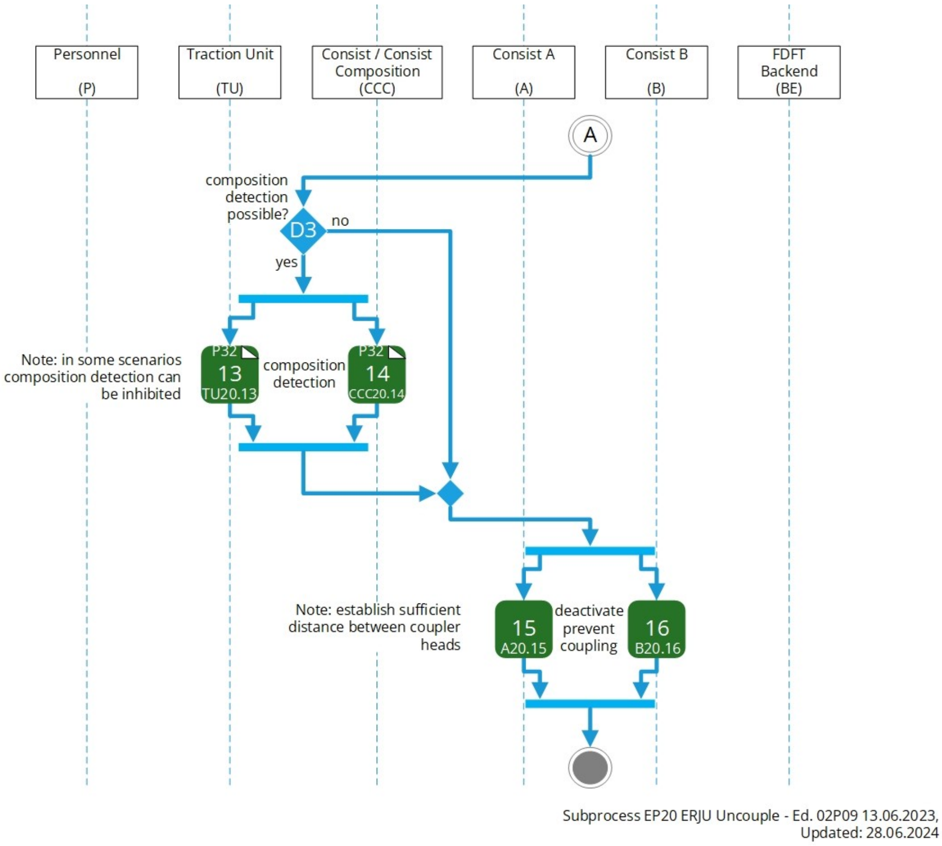


Figure *76*: EP20 Uncouple - 2 of 2

8.5.13 EP21 - Couple

EP21 - Couple

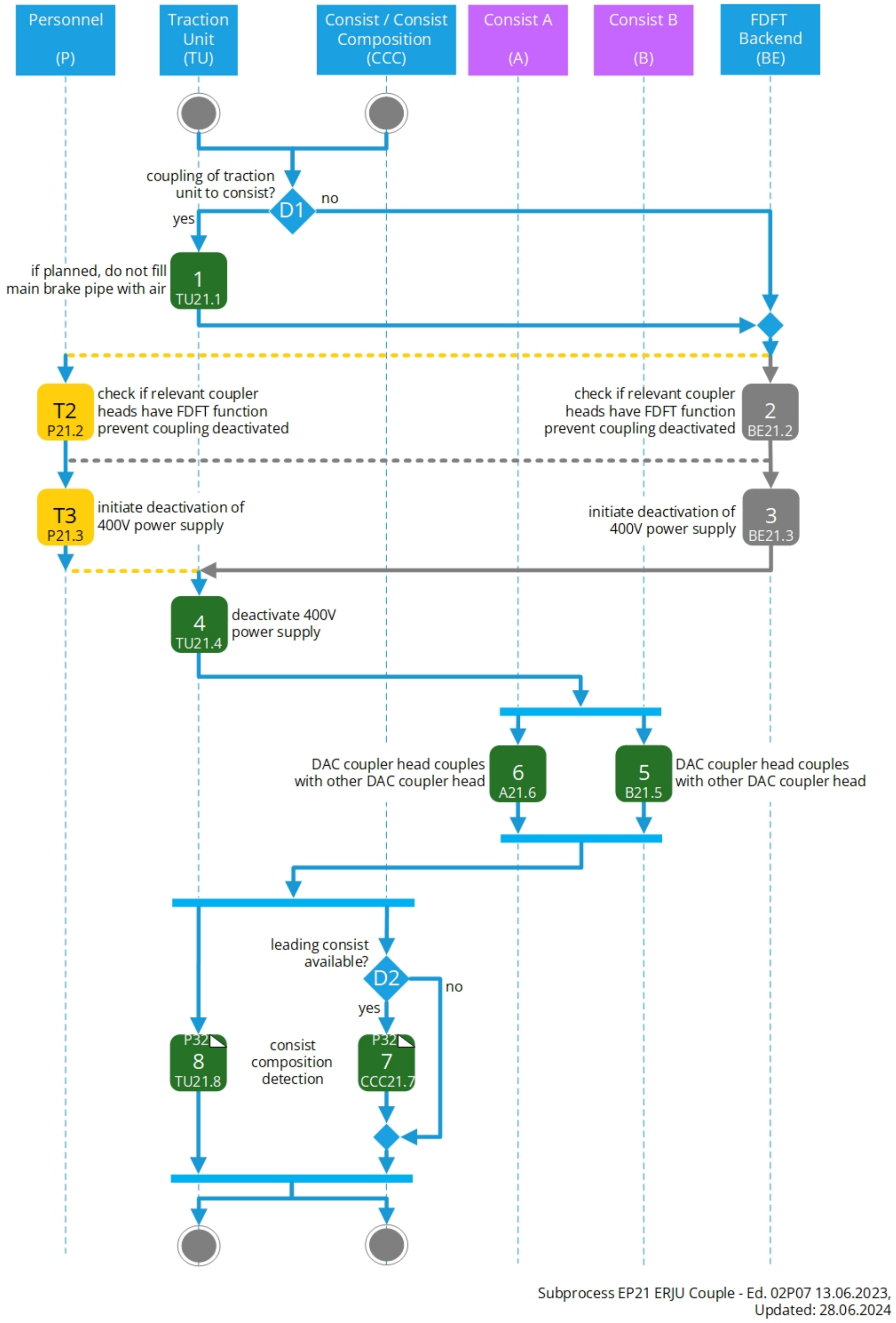


Figure #: EP21 Couple - 1 of 1

8.5.14 EP22 - Secure Consist (Composition) Against Rolling Away

EP22 - Secure Consist (Composition) Against Rolling Away

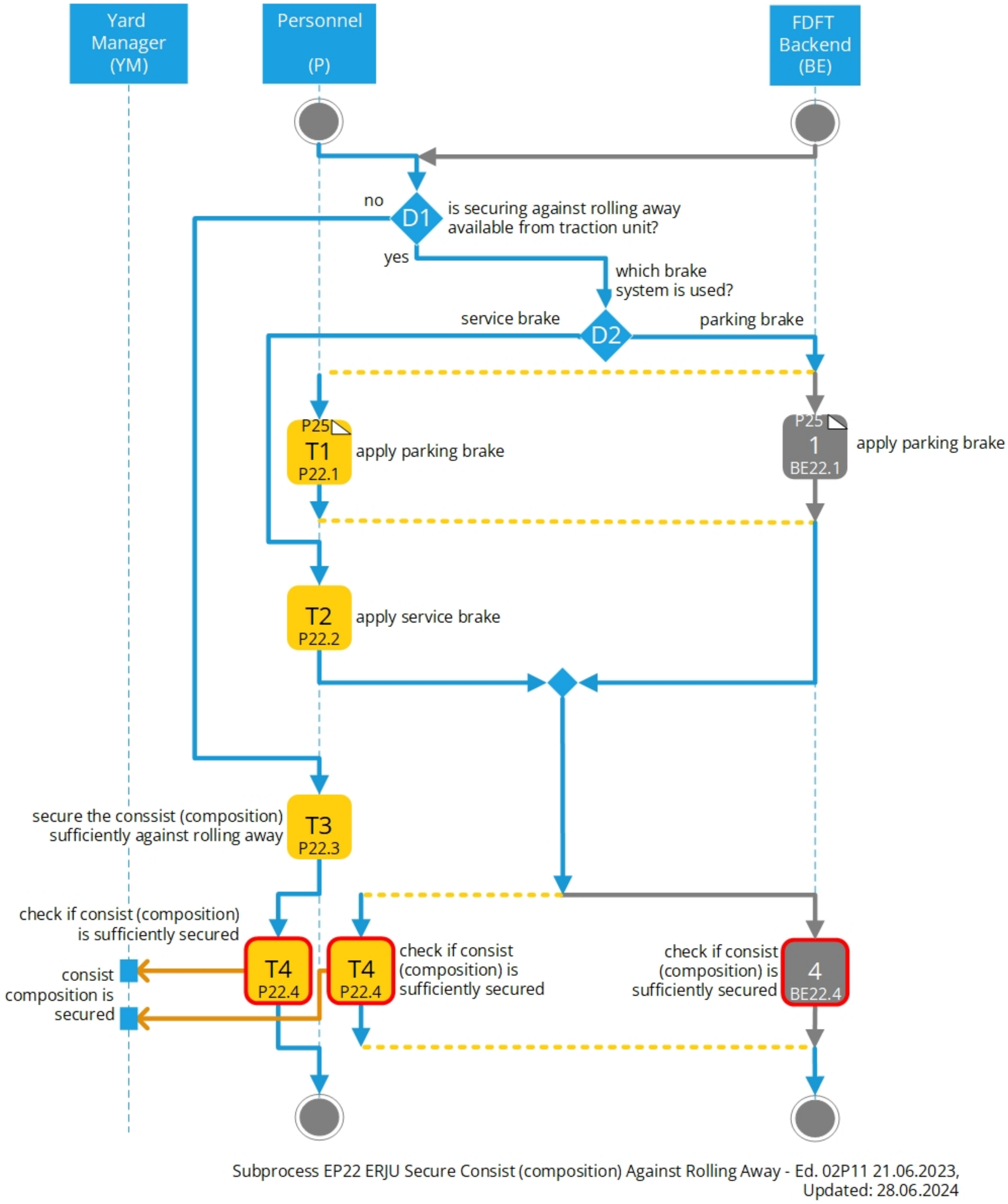


Figure 77: EP22 Secure Consist (Composition) Against Rolling Away - 1 of 1

8.5.15 EP23 – Remove, Release Braking Means

EP23 - Remove, Release Brake Means

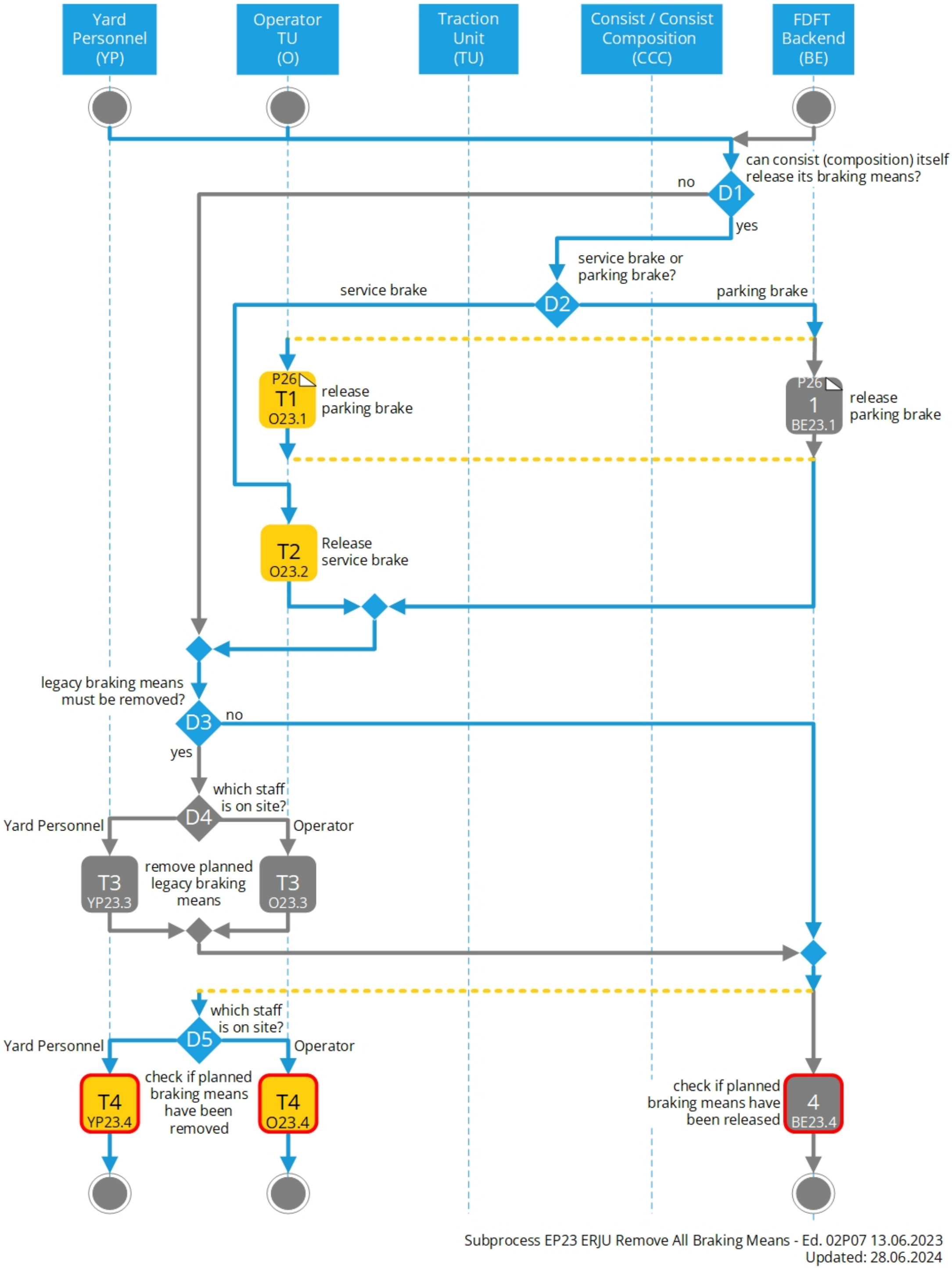


Figure *78*: EP23 Remove, Release Braking Means - 1 of 1

8.5.16 EP25 – Apply Parking Brake

EP25 - Apply Parking Brake

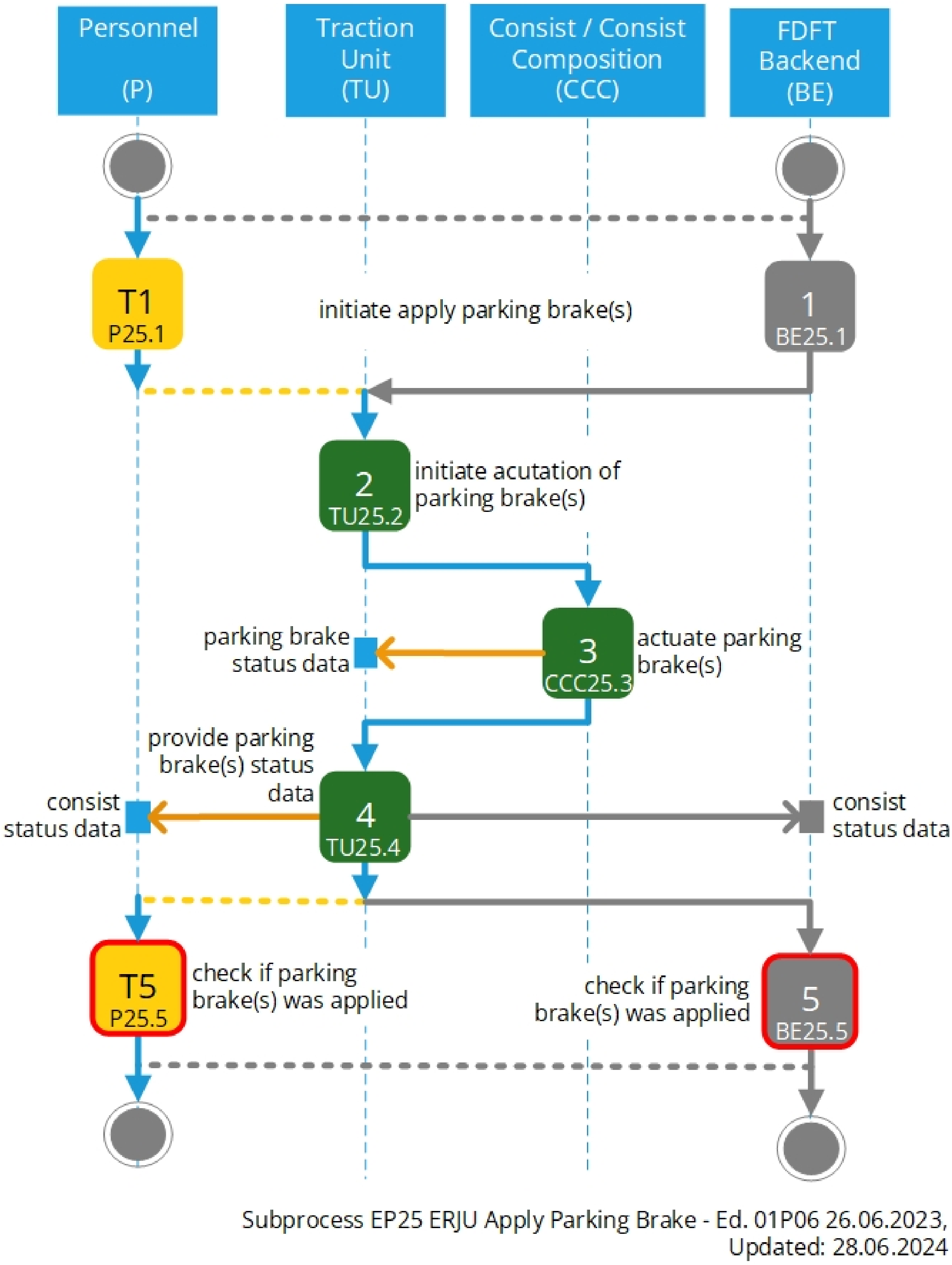


Figure 79: EP25 Apply Parking Brake- 1 of 1

8.5.17 EP26 – Release Parking Brake

EP26 - Release Parking Brake

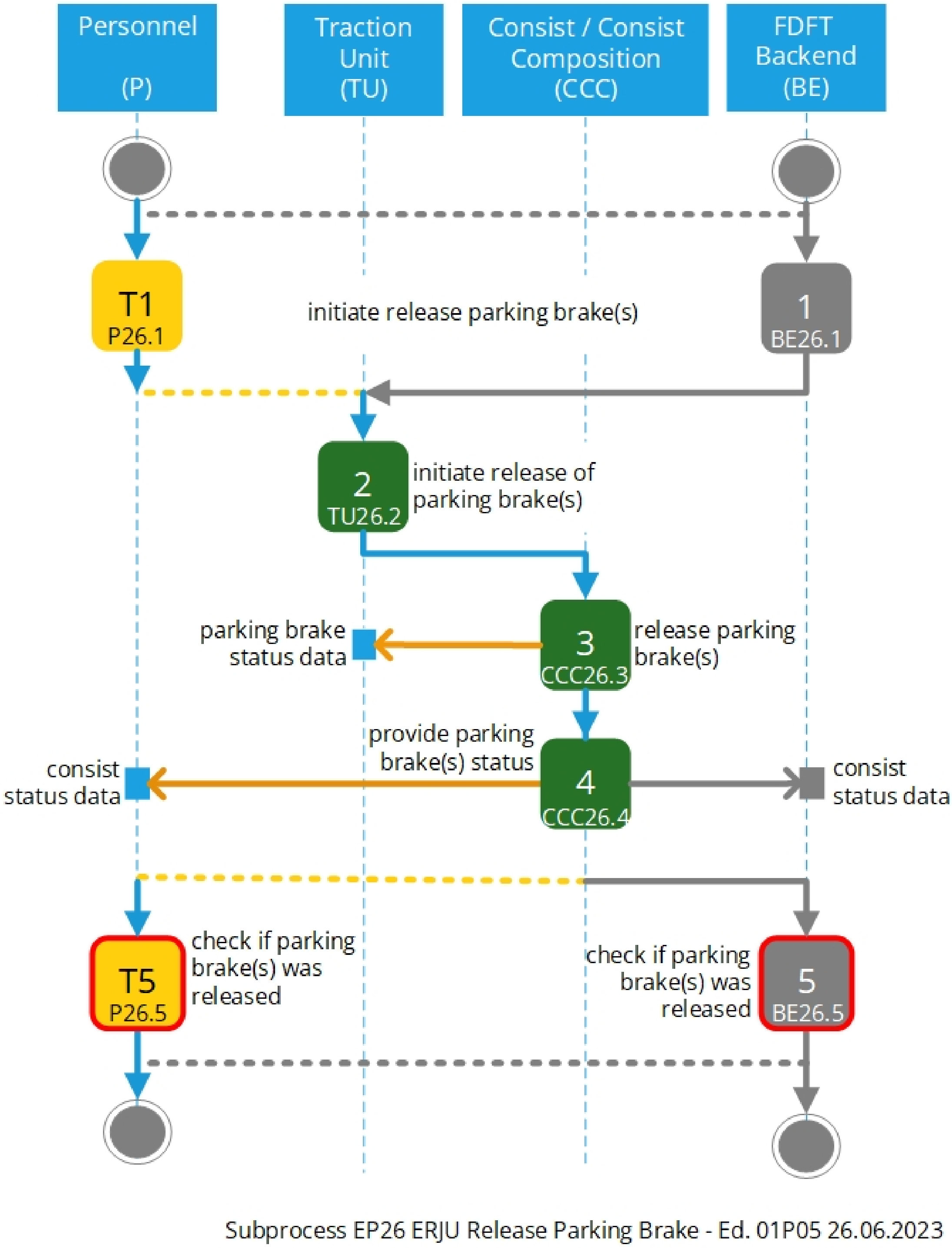


Figure *80*: EP26 Release Braking Means - 1 of 1

8.5.18 EP30 - Switch Consist of Composition to FDFT mode Shunting

EP30 - Switch Consist of Composition to FDFT mode Shunting

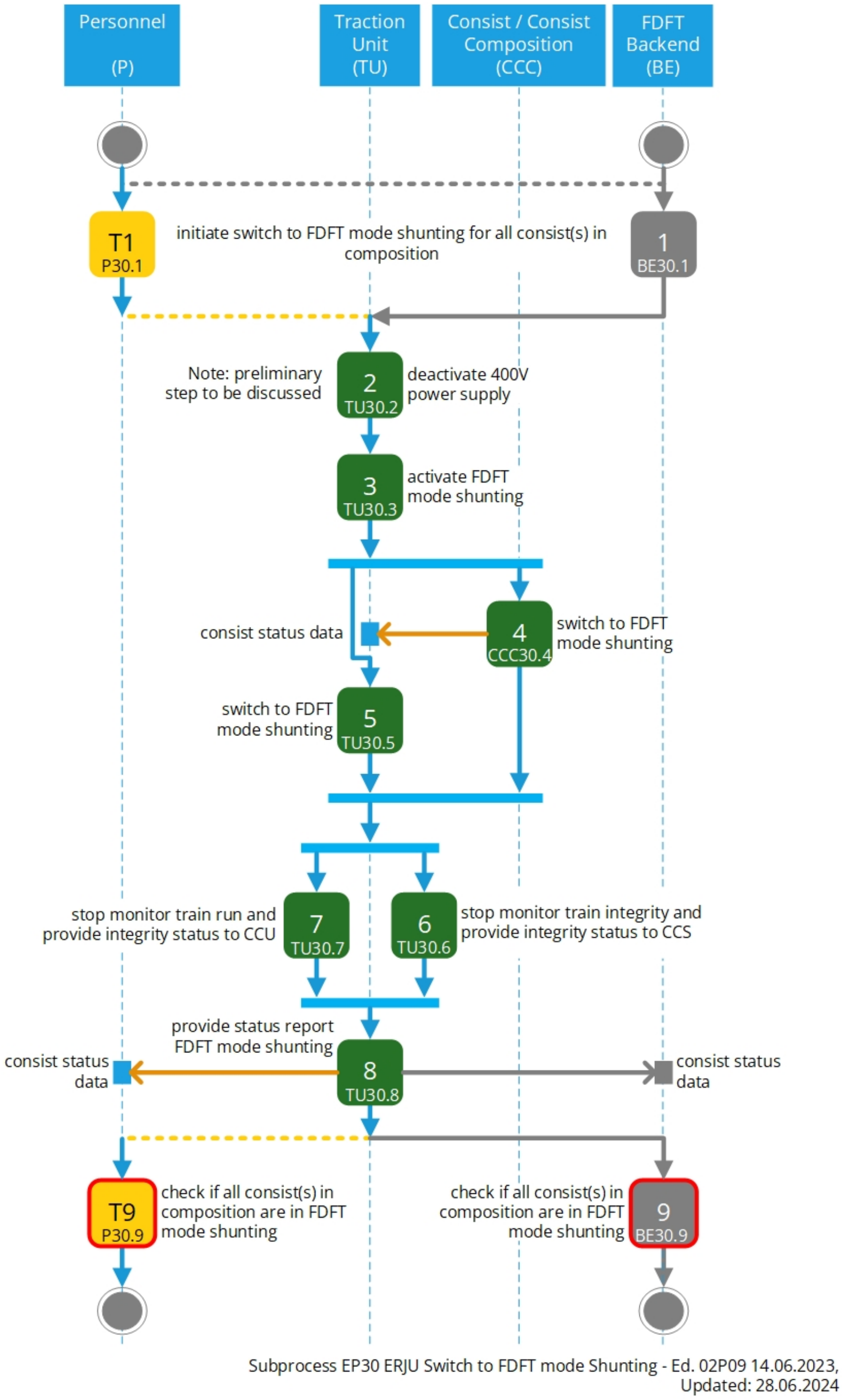


Figure *81*: EP30 Switch Consist of Composition to FDFT Mode Shunting - 1 of 1

8.5.19 EP31 – Switch to FDFT mode Train Run

EP31 - Switch to FDFT mode Train Run

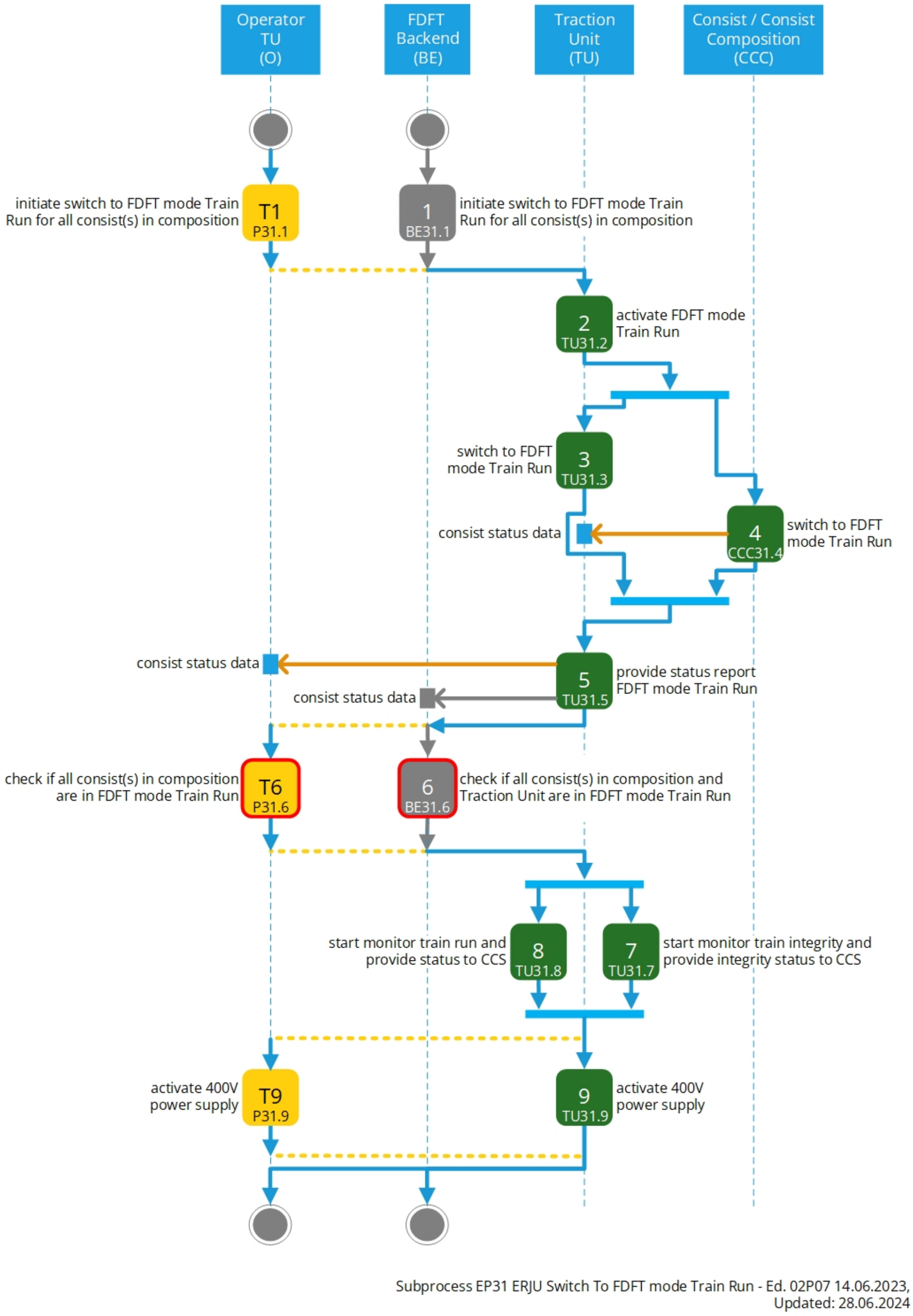


Figure *82*: EP31 Switch To FDFT Mode Train Run - 1 of 1

8.5.20 EP32 –Subprocess Composition Detection

EP32 - Subprocess Composition Detection

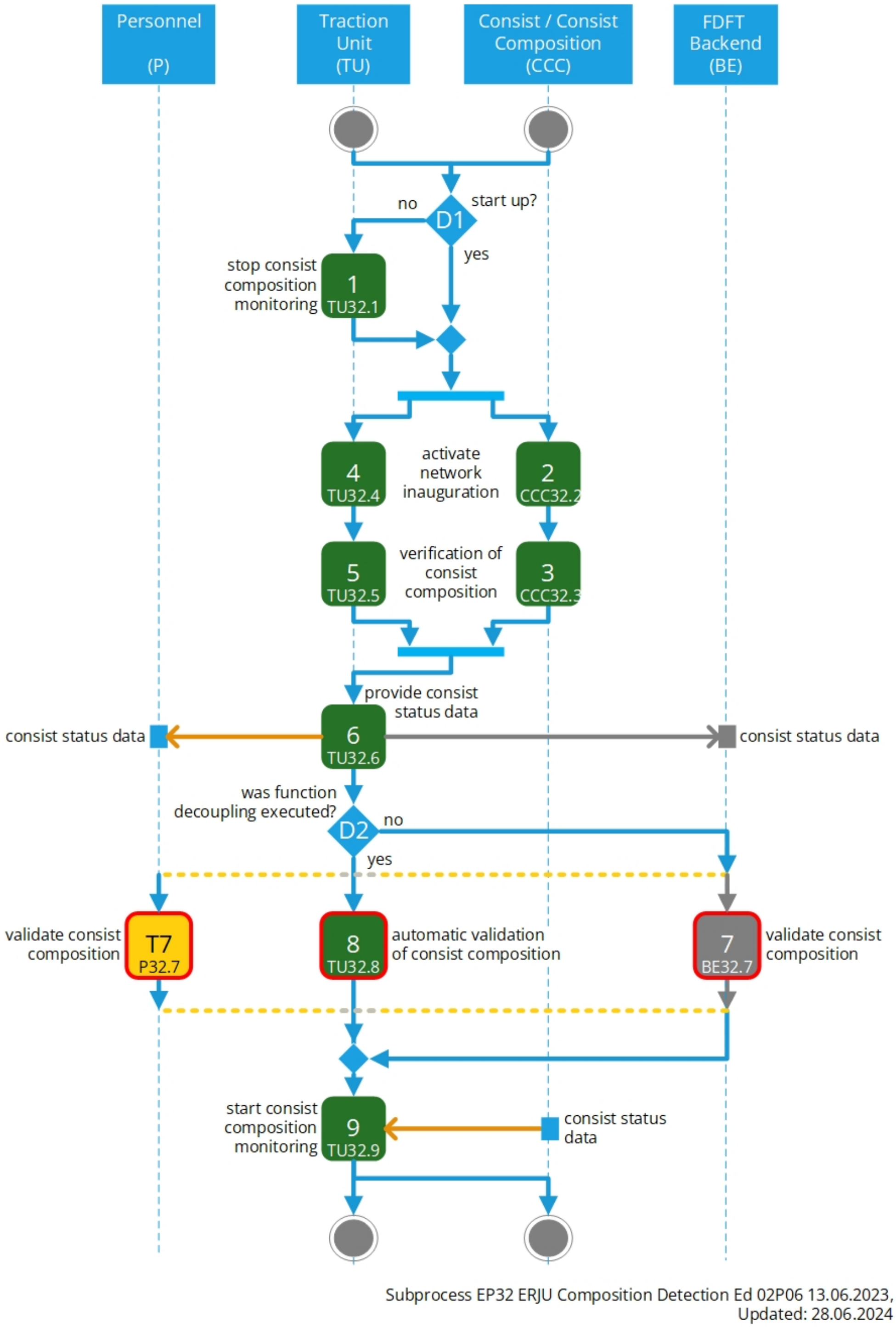


Figure *83*: EP32 Composition Detection - 1 of 1

8.5.21 EP41 – Addition, Removal of Consist (Composition)

EP41 - Addition, Removal of Consist (Composition)

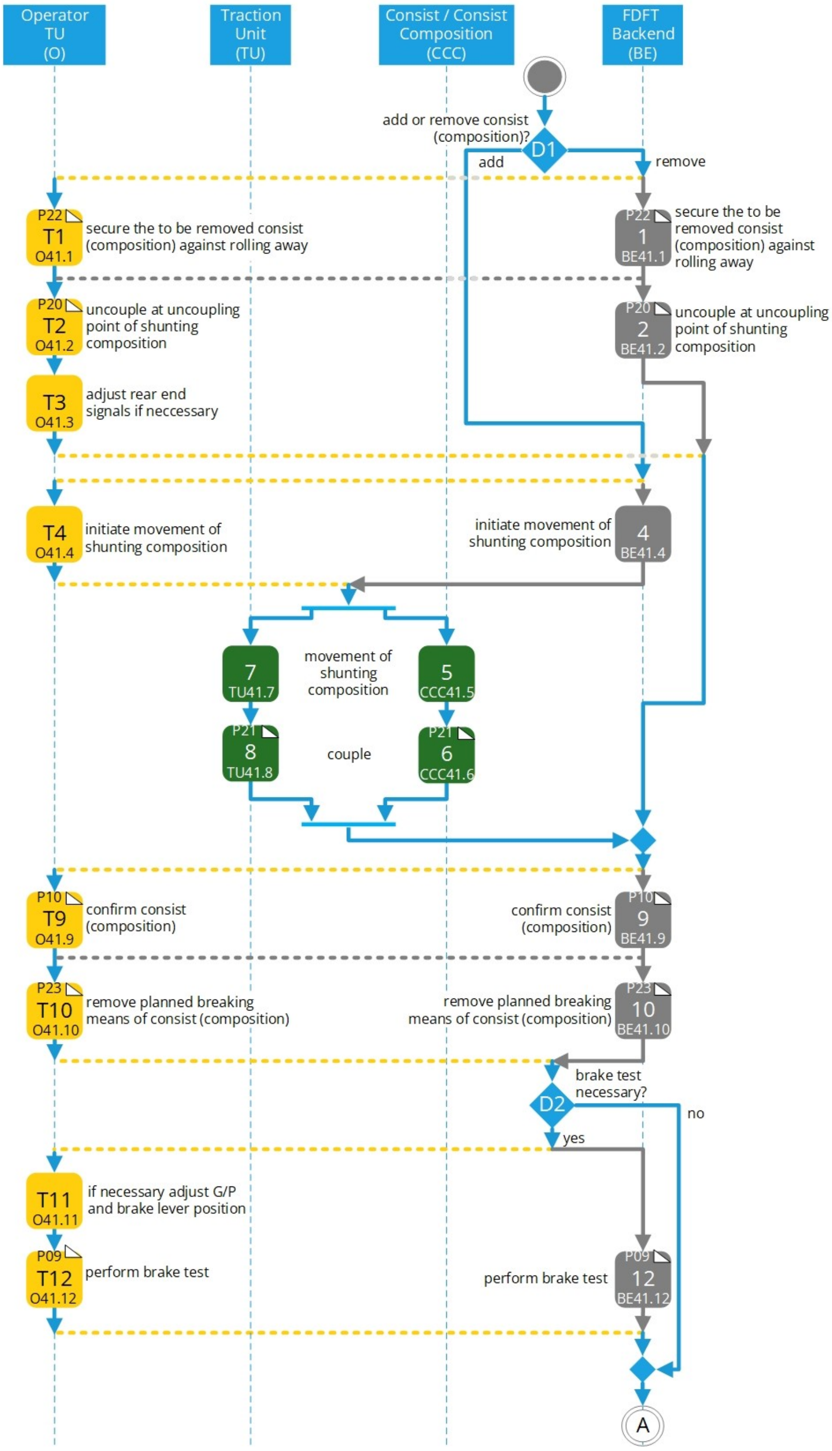


Figure *84*: EP41 Addition, Removal Of Consist (Composition) - 1 of 2

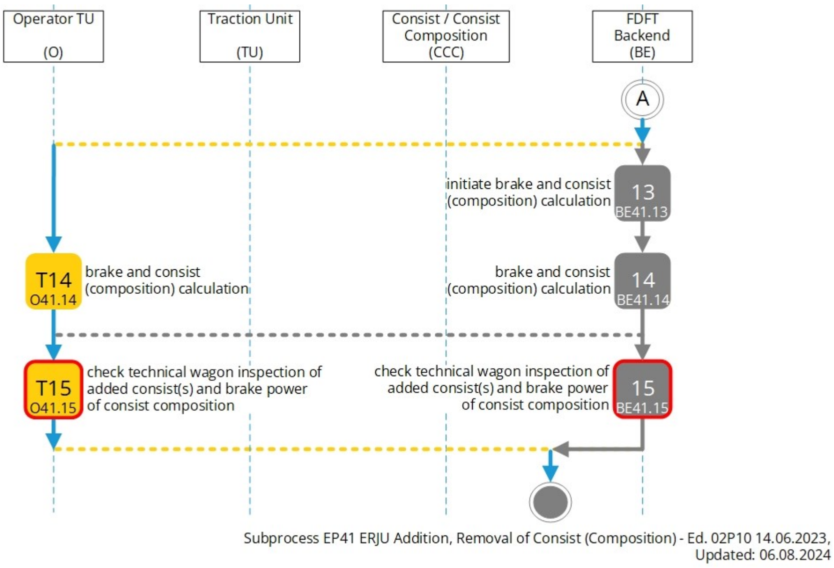


Figure *85*: EP41 Addition, Removal Of Consist (Composition) - 2 of 2

8.5.22 EP42 – Addition, Removal Of Traction Unit

EP42 - Addition, Removal of Traction Unit

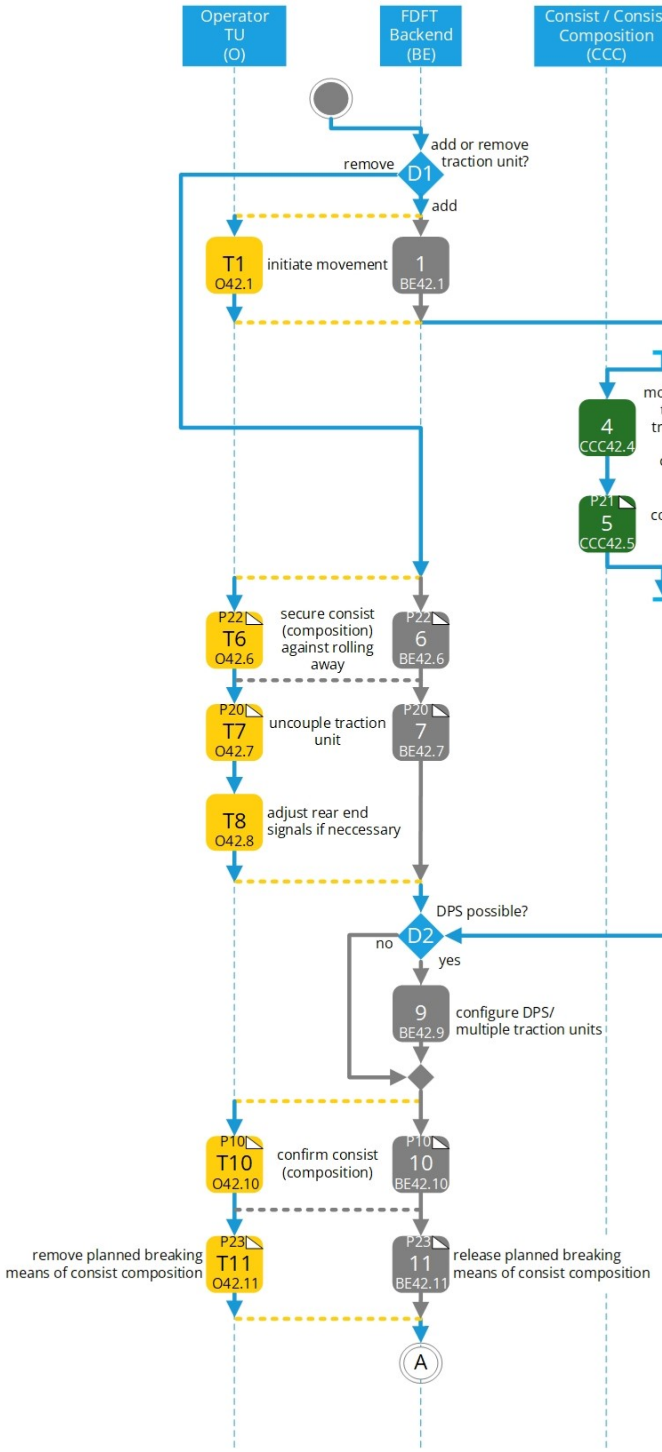


Figure *86*: EP42 Addition, Removal Of Traction Unit - 1 of 2

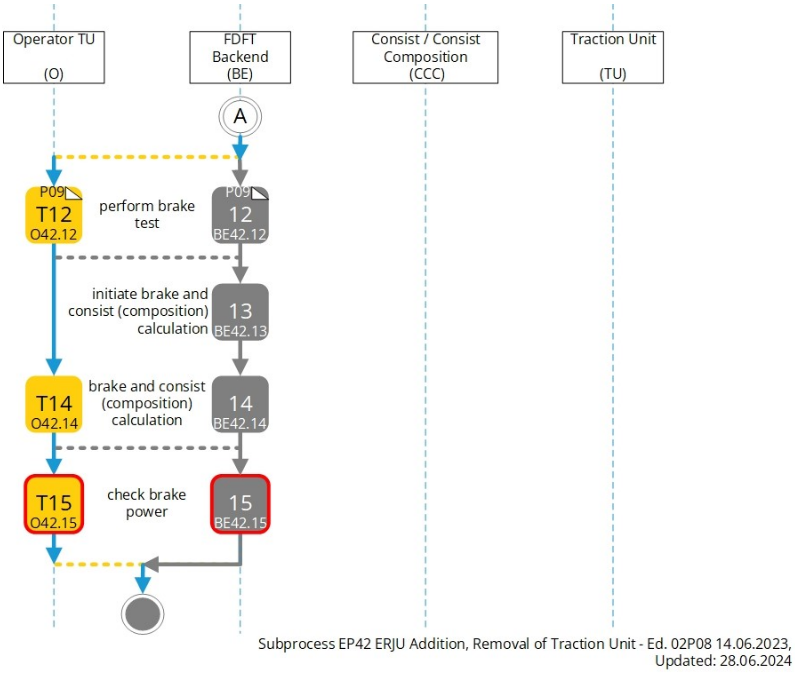


Figure *87*: EP42 Addition, Removal Of Traction Unit - 2 of 2

8.5.23 EP43 - Change Of Operator

EP43 - Change of Operator

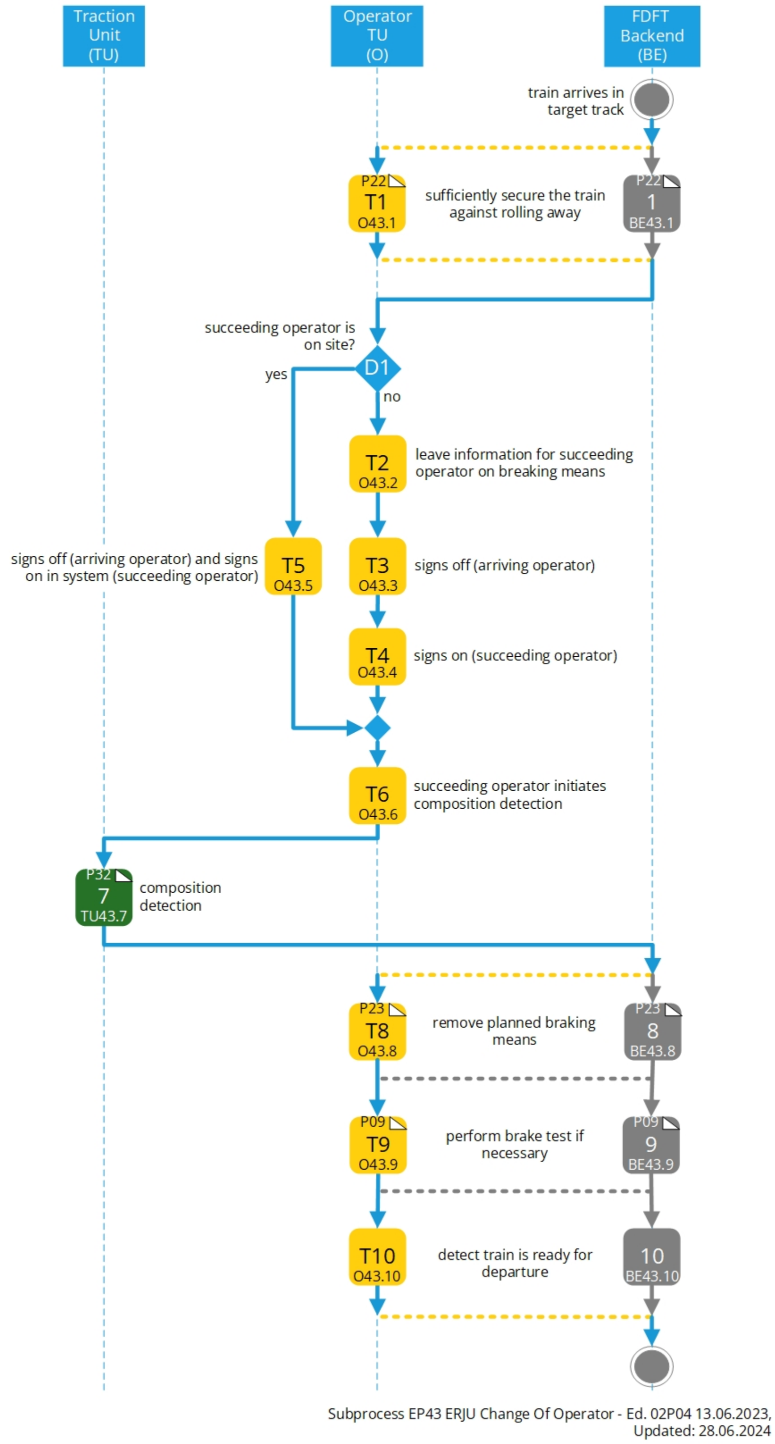


Figure *88*: EP43 Change Of Operator - 1 of 1

9 Conclusions

This document constitutes Deliverable 2.1 Preliminary Operational Procedures of ER JU Flagship Area 5 project FP5-TRANS4M-R. The project aims to boost innovation for the European rail freight sector, concretely by developing, validating and demonstrating FP5-TRANS4M-R technical enablers.

The objective of this document is to provide the first agreed throughout Europe target operational procedures for rail freight. The procedures will define the basis for the development of the innovations for WP3-WP12. It describes the target of full automation of the freight sector, as well as a subset based on the agreed technical enablers in FP5-TRANS4M-R.

The section Methodology explains how WP2 intensively aligned the various version of the target operational procedures within the project, as well as within the sector.

With this work a major step towards common processes in Europe has been made. But a further alignment within the sector and more involved parties is necessary to reach a common level of alignment needed for the envisioned admission into the TSI OPE via the ER JU System Pillar.

While designing the processes, gaps between the target processes and the current ER JU processes have been identified. So not everything mentioned within the Target Processes is covered in the contract of ER JU Call1. These gaps have to be discussed for the upcoming Call2 of ER JU, since some of the gaps are crucial for operational usage, as well as for Digitisation.

With this document the groundwork has been done for a common development of the FDFT. All other WPs can use this document as their foundation.

As stated also in chapter 7.2, there are some delimitations in the document. The most important one, is migration. Since there is no official known migration concept available at the moment, due to ongoing work of EDDP neo, this very important issue is not yet addressed in the document. Changes on the operational procedures are more then likely, once the concept is available.

Based on the continuous development in FP5-TRANS4M-R, the feedback from the freight sector, new concepts, this document will be updated and updated versions will be published.

10 References

Reference	Title
[REF_1]	DACcelerate; DELIVERABLE D 3.2 Technical Specifications and operational rules; 2022-12-31; V1.0
[REF_2]	DAC4EU; https://www.dac4.eu/en/
[REF_3]	TARO; https://konzern.oebb.at/en/taro/
[REF_4]	TRUST5; https://projektdatabas.vti.se/bib/4017

11 Annexes

11.1 P24 – Bleeding

11.1.1 Target Process

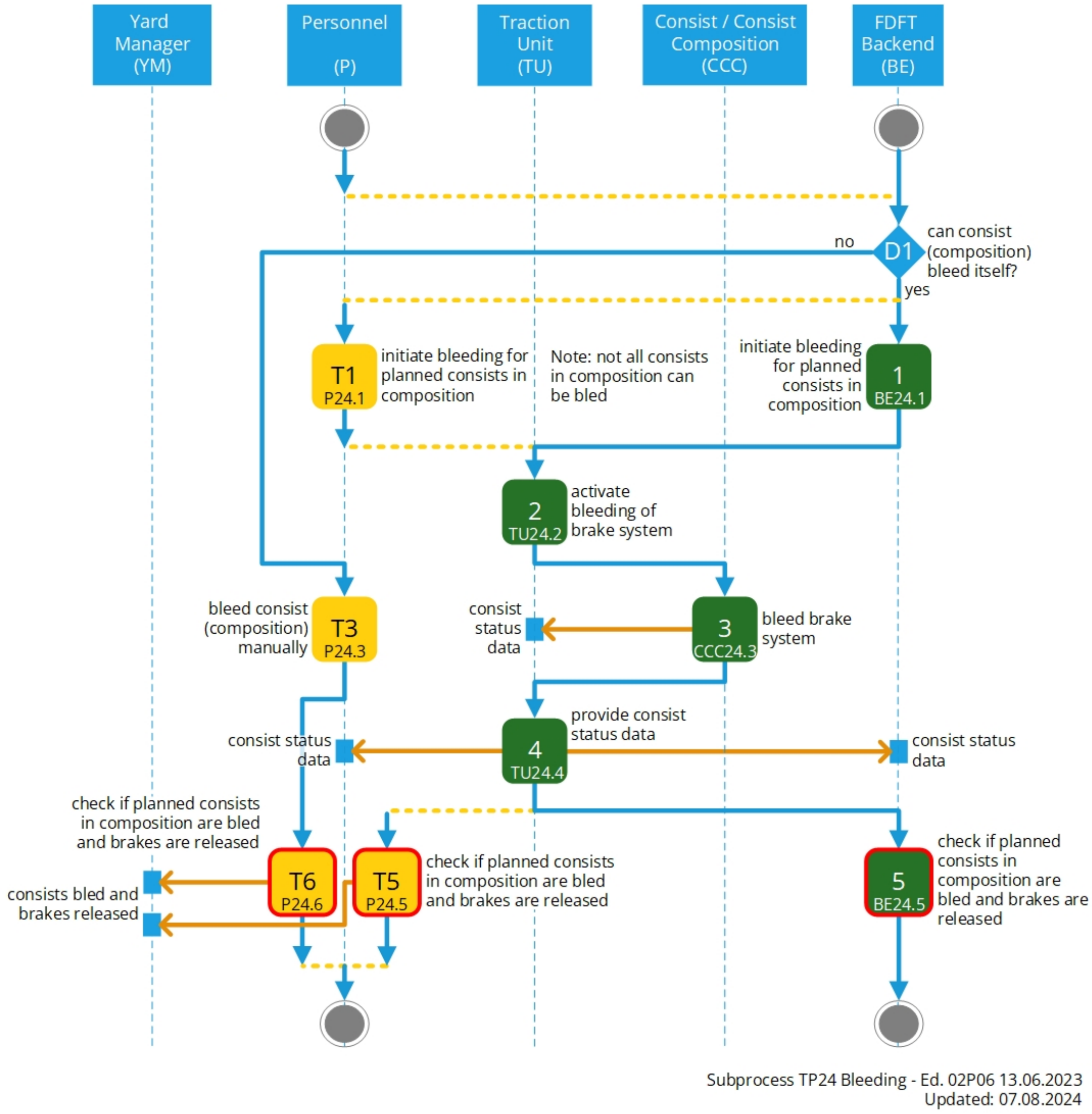


Figure *89*: P24 Bleeding - 1 of 1

11.1.2 Process-Description

D1	
Decision	Can Consist in Composition bleed itself?
Yes	• Function automated bleeding is available.
Remarks	• -
Rationale	• -

BE24.1	
Activity	Initiate bleeding for planned Consist in Composition
Precondition	• -
Conditions	• FDFT Backend is available and can communicate with FDFT Wagen Base System and FDFT Backend can command bleeding of each Consist.
Tasks	• FDFT Backend initiates bleeding for each Consist in Composition.
Remarks	• It can be required that not all Consist should be bled.
Rationale	• -
Postcondition	• -

P24.1	
Activity	Initiate bleeding for planned Consist in Composition
Precondition	• -
Conditions	• -
Tasks	• Personnel initiates bleeding for each Consist in Composition. • This can also be achieved by using the Mobile HMI.
Remarks	• -
Rationale	• -
Postcondition	• -

TU24.2

Activity	Activate bleeding of brake system
Precondition	• -
Conditions	• -
Tasks	• The Function bleeding is activated.
Remarks	• -
Rationale	• -
Postcondition	• -

CCC24.3

Activity	Bleed brake system
Precondition	• -
Conditions	• -
Tasks	• CCU bleeds auxiliary tank and releases brake(s). • CCU sends Consist Status Data to FDFT Backend if available.
Remarks	• It must be possible, that single Consist can be individually bled.
Rationale	• -
Postcondition	• -

TU24.4

Activity	Provide Consist Status Data
Precondition	• -
Conditions	• -
Tasks	• The Consist Status Data is provided.
Remarks	• -
Rationale	• -
Postcondition	• -

BE24.5

Activity	Check if planned Consist in Composition are bled and brakes are released
Precondition	• -
Conditions	• FDFT Backend is available and can communicate with each CCU.
Tasks	• Check if all brakes of Consist are released as planned.
Remarks	• -
Rationale	• -
Postcondition	• -

P24.3

Activity	Bleed Consist (Composition) manually
Precondition	• -
Conditions	• -
Tasks	• Personnel bleeds each Consist in Composition manually as planned.
Remarks	• -
Rationale	• -
Postcondition	• -

P24.5

Activity	Check if planned Consist in Composition are bled and brakes are released
Precondition	• -
Conditions	• -
Tasks	• Personnel checks if each Consist in Composition is bled and brakes are released as planned.
Remarks	• -
Rationale	• -
Postcondition	• -

P24.6

Activity	Check if planned Consist in Composition are bled and brakes are released
Precondition	• -
Conditions	• -
Tasks	• Personnel checks if each Consist in Composition is bled and brakes are released as planned.
Remarks	• -
Rationale	• -
Postcondition	• -

11.1.3 ER JU Process

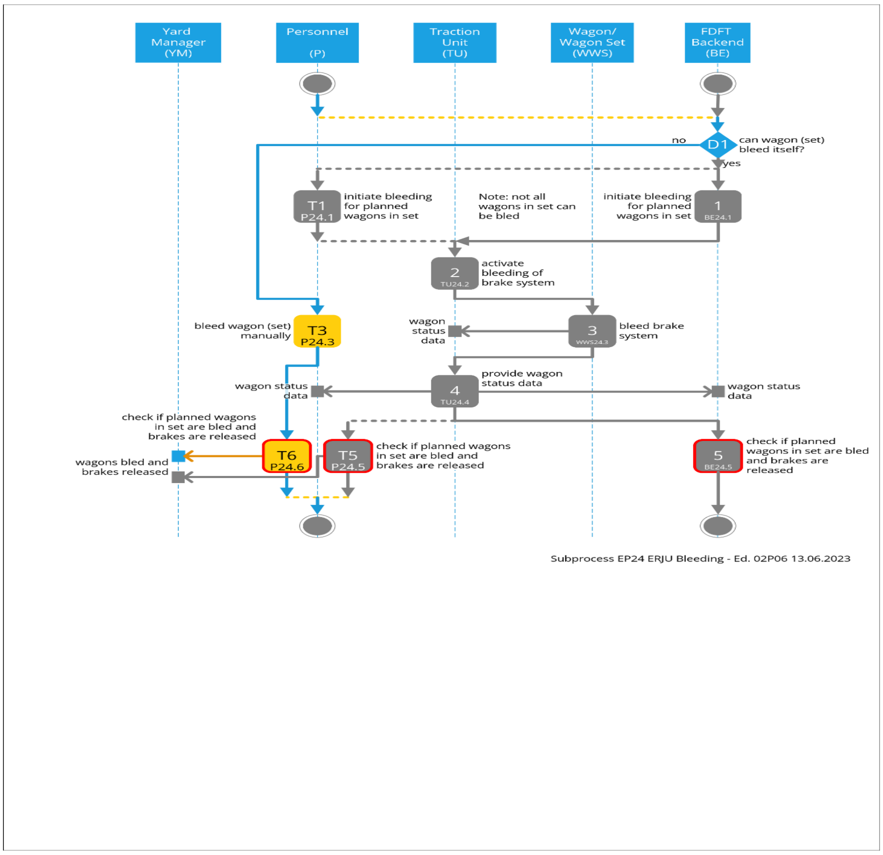


Figure *90*: ER JU P24 Bleeding - 1 of 1