

# FP5 TRANS4M-R

Transforming  
Europe's Rail Freight

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## D2.1

# Preliminary Operational Procedures

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# I. Table of Contents

- I. Table of Contents..... 3
- II. List of Figures ..... 7
- III. List of Tables..... 10
- 1 Executive Summary ..... 11
- 2 Abbreviations & Acronyms ..... 12
- 3 Background..... 13
  - 3.1 EDDP WP1 SG4 ..... 14
  - 3.2 Assessment of DAC affected operational processes (*DACcelerate*) ..... 15
  - 3.3 Additional Initiatives..... 17
    - 3.3.1 DAC4EU..... 17
    - 3.3.2 TARO ..... 18
    - 3.3.3 Automation Programme (Switzerland)..... 19
    - 3.3.4 TRUST5 ..... 20
    - 3.3.5 Automated Brake Test via TIS ..... 22
- 4 Objective/Aim..... 23
  - 4.1 Task description ..... 23
  - 4.2 Outline of deliverable 2.1 ..... 25
- 5 Methodology..... 26
  - 5.1 Team composition..... 26
  - 5.2 CoreTeam..... 26
  - 5.3 Alignment within FP5-TRANS4M-R..... 27
  - 5.4 Feedback via EDDP (neo) ..... 28
  - 5.5 Feedback via System Pillar – Task 4 ..... 29
- 6 Definitions and Explanations..... 30
  - 6.1 Terms..... 30
  - 6.2 Actors ..... 34
  - 6.3 Data ..... 36
  - 6.4 Types of shunting ..... 37
    - 6.4.1 Flat shunting..... 37

6.4.2	Fly shunting .....	38
6.4.3	Hump shunting .....	38
6.5	Technical Wagon Inspection.....	39
7	General Assumptions and Premises.....	40
7.1	Design premises .....	40
7.2	Delimitation .....	40
7.3	Definition of DAC hardware level and FDFT Functions .....	41
7.4	Differences between Processes .....	45
7.4.1	Differences between Target Process and Semi-Automated Process .....	45
7.4.2	Differences between Target Process and ER JU Process .....	45
7.5	Current status of technical development.....	46
8	Operational Procedures.....	47
8.1	Process description .....	47
8.2	Activity description .....	49
8.3	Decision description.....	50
8.4	Target Operational Procedures.....	51
8.4.1	Process enumeration.....	54
8.4.2	TP01 - Shunting Preparation .....	55
8.4.3	TP02 - Wagon Processing .....	67
8.4.4	TP03 - Train Preparation .....	92
8.4.5	TP04 - Train Run .....	123
8.4.6	TP05 - Hump Shunting.....	134
8.4.7	TP06 – Fly Shunting .....	145
8.4.8	TP07 - Flat Shunting Drop Off .....	156
8.4.9	TP08 - Flat Shunting Pick Up .....	162
8.4.10	TP09 - Automated Brake Test .....	166
8.4.11	TP10 - Confirm Wagon Set .....	184
8.4.12	TP11 - Technical Wagon Inspection.....	191
8.4.13	TP20 – Uncouple .....	196
8.4.14	TP21 - Couple .....	205
8.4.15	TP22 - Secure Wagon (Set) Against Rolling Away .....	211
8.4.16	TP23 – Remove, Release Braking Means.....	215

8.4.17	TP25 – Apply Parking Brake.....	221
8.4.18	TP26 – Release Parking Brake .....	225
8.4.19	TP30 - Switch to FDFT mode Shunting .....	229
8.4.20	TP31 – Switch to FDFT mode Train Run.....	234
8.4.21	TP32 – Composition Detection.....	239
8.4.22	TP41 – Addition, Removal of Wagon (Set).....	244
8.4.23	TP42 – Addition, Removal Of Traction Unit.....	255
8.4.24	TP43 - Change Of Operator .....	265
8.5	ERJU Processes .....	271
8.5.1	EP01 - Shunting Preparation.....	272
8.5.2	EP02 - Wagon Processing .....	274
8.5.3	EP03 - Train Preparation .....	278
8.5.4	EP04 - Train Run .....	282
8.5.5	EP05 - Hump Shunting.....	284
8.5.6	EP06 - Fly Shunting.....	286
8.5.7	EP07 - Flat Shunting Drop Off .....	288
8.5.8	EP08 - Flat Shunting Pick Up .....	289
8.5.9	EP09 - Automated Brake Test .....	290
8.5.10	EP10 - Confirm Wagon Set .....	293
8.5.11	EP11 - Technical Wagon Inspection.....	294
8.5.12	EP20 – Uncouple .....	295
8.5.13	EP21 - Couple .....	297
8.5.14	EP22 - Secure Wagon (Set) Against Rolling Away .....	298
8.5.15	EP23 – Remove, Release Braking Means.....	299
8.5.16	EP25 – Apply Parking Brake.....	299
8.5.17	EP26 – Release Parking Brake .....	301
8.5.18	EP30 - Switch wagon(s) of set to FDFT mode Shunting.....	302
8.5.19	EP31 – Switch to FDFT mode Train Run.....	303
8.5.20	EP32 –Subprocess Composition Detection.....	304
8.5.21	EP41 – Addition, Removal of Wagon (Set).....	305
8.5.22	EP42 – Addition, Removal Of Traction Unit.....	307
8.5.23	EP43 - Change Of Operator.....	309

9	Conclusions .....	310
10	References .....	311
11	Annexes .....	312
11.1	P24 – Bleeding .....	312
11.1.1	Target Process .....	312
11.1.2	Process-Description .....	313
11.1.3	ER JU Process .....	317

## II. List of Figures

Figure 1: WP-structure in TRANS4M-R.....	13
Figure 2: Different operational Processes in marshalling yards .....	15
Figure 3: ABT in TIS .....	22
Figure 4: Alignment process.....	27
Figure 5: EDDP Feedback status .....	28
Figure 6: WP overview System Pillar Task 4 .....	29
Figure 7: FDFT Links .....	31
Figure 8: Fly Shunting .....	38
Figure 9: Hump shunting.....	38
Figure 10: Process description symbols.....	48
Figure 11: Process overview with four main processes.....	51
Figure 12: Process overview.....	52
Figure 13: Process matrix .....	53
Figure 14: TP01 Shunting Preparation - 1 of 2.....	55
Figure 15: TP01 Shunting Preparation - 2 of 2.....	56
Figure 16: TP02 Wagon Processing - 1 of 4.....	67
Figure 17: TP02 Wagon Processing - 2 of 4.....	68
Figure 18: TP02 Wagon Processing - 3 of 4.....	69
Figure 19: TP02 Wagon Processing - 4 of 4.....	70
Figure 20: TP03 Train Preparation - 1 of 4 .....	92
Figure 21: TP03 Train Preparation - 2 of 4 .....	93
Figure 22: TP03 Train Preparation - 3 of 4 .....	94
Figure 23: TP03 Train Preparation - 4 of 4 .....	95
Figure 24: TP04 Train Run - 1 of 2.....	123
Figure 25: TP04 Train Run - 2 of 2.....	124
Figure 26: TP05 Hump Shunting - 1 of 2 .....	134
Figure 27: TP05 Hump Shunting - 2 of 2 .....	135
Figure 28: TP06 Fly Shunting - 1 of 2 .....	145
Figure 29: TP06 Fly Shunting - 2 of 2 .....	146
Figure 30: TP07 Flat Shunting Drop Off - 1-1 .....	156
Figure 31: TP08 Flat Shunting Pick Up - 1 of 1 .....	162
Figure 32: TP09 Automated Brake Test - 1 of 3 .....	166
Figure 33: TP09 Automated Brake Test - 2 of 3 .....	167
Figure 34: TP09 Automated Brake Test - 3 of 3 .....	168
Figure 35: TP10 Confirm Wagon Set - 1 of 1 .....	184
Figure 36: TP11 Technical Wagon Inspection - 1 of 1.....	191
Figure 37: TP20 Uncouple - 1 of 2.....	196
Figure 38: TP20 Uncouple - 2 of 2.....	197

Figure 39: TP21 Couple - 1 of 1 .....	205
Figure 40: TP22 Secure Wagon (Set) Against Rolling Away - 1 of 1 .....	211
Figure 41: TP23 Remove, Release Braking Means - 1 of 1 .....	215
Figure 42: TP25 Apply Parking Brake - 1 of 1 .....	221
Figure 43: TP26 Release Parking Brake - 1 of 1 .....	225
Figure 44: TP30 Switch wagon(s) of set to FDFT mode Shunting - 1 of 1 .....	229
Figure 45: TP31 Switch to FDFT mode Train Run - 1 of 1 .....	234
Figure 46: TP32 Composition Detection - 1 of 1 .....	239
Figure 47: TP41 Addition, Removal of Wagon (Set) - 1 of 2 .....	244
Figure 48: TP41 Addition, Removal of Wagon (Set) - 2 of 2 .....	245
Figure 49: TP42 Addition, Removal of Traction Unit - 1 of 2.....	255
Figure 50: TP42 Addition Removal of Traction Unit - 2 of 2.....	256
Figure 51: TP43 Change of Operator - 1 of 1 .....	265
Figure 52: EP01 Shunting Preparation - 1 of 2.....	272
Figure 53: EP01 Shunting Preparation - 2 of 2.....	273
Figure 54: EP02 Wagon Processing - 1 of 4.....	274
Figure 55: EP02 Wagon Processing - 2 of 4.....	275
Figure 56: EP02 Wagon Processing - 3 of 4.....	276
Figure 57: EP02 Wagon Processing - 4 of 4.....	277
Figure 58: EP03 Train Preparation - 1 of 4.....	278
Figure 59: EP03 Train Preparation - 2 of 4.....	279
Figure 60: EP03 Train Preparation - 3 of 4.....	280
Figure 61: EP03 Train Preparation - 4 of 4.....	281
Figure 62: EP04 Train Run - 1 of 2.....	282
Figure 63: EP04 Train Run - 2 of 2.....	283
Figure 64: EP05 Hump Shunting - 1 of 2 .....	284
Figure 65: EP05 Hump Shunting - 2 of 2 .....	285
Figure 66: EP06 Fly Shunting - 1 of 2 .....	286
Figure 67: EP06 Fly Shunting - 2 of 2 .....	287
Figure 68: EP07 Flat Shunting Drop Off - 1 of 1 .....	288
Figure 69: EP08 Flat Shunting Pick Up - 1 of 1 .....	289
Figure 70: EP09 Automated Brake Test - 1 of 3 .....	290
Figure 71: EP09 Automated Brake Test - 2 of 3 .....	291
Figure 72: EP09 Automated Brake Test - 3 of 3 .....	292
Figure 73: EP10 Confirm Wagon Set - 1 of 1 .....	293
Figure 74: EP11 Technical Wagon Inspection - 1 of 1.....	294
Figure 75: EP20 Uncouple - 1 of 2.....	295
Figure 76: EP20 Uncouple - 2 of 2.....	296
Figure 77: EP21 Couple - 1 of 1 .....	297
Figure 78: EP22 Secure Wagon (Set) Against Rolling Away - 1 of 1 .....	298
Figure 79: EP23 Remove, Release Braking Means - 1 of 1 .....	299



Figure 80: EP25 Apply Parking Brake- 1 of 1 .....	300
Figure 81: EP26 Release Braking Means - 1 of 1 .....	301
Figure 82: EP30 Switch Wagon(s) Of Set To FDFT Mode Shunting - 1 of 1 .....	302
Figure 83: EP31 Switch To FDFT Mode Train Run - 1 of 1 .....	303
Figure 84: EP32 Composition Detection - 1 of 1 .....	304
Figure 85: EP41 Addition, Removal Of Wagon (Set) - 1 of 2.....	305
Figure 86: EP41 Addition, Removal Of Wagon (Set) - 2 of 2.....	306
Figure 87: EP42 Addition, Removal Of Traction Unit - 1 of 2 .....	307
Figure 88: EP42 Addition, Removal Of Traction Unit - 2 of 2 .....	308
Figure 89: EP43 Change Of Operator - 1 of 1.....	309
Figure 90: P24 Bleeding - 1 of 1 .....	312
Figure 91: ERJU P24 Bleeding - 1 of 1.....	317

### III. List of Tables

Table 1: Abbreviation & Acronyms .....	12
Table 2: Task description matched with output in deliverable .....	24
Table 3: Terms .....	33
Table 4: Actor/swimlane definitions .....	35
Table 5: Data/information type definitions.....	36
Table 6: FDFT Hardware .....	41
Table 7: FDFT Functions.....	42
Table 8: Template of activity description table.....	49
Table 9: Template of condition description table.....	50
Table 10: Process enumeration .....	54

# 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 Abbreviations & 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 Wagon(s)
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

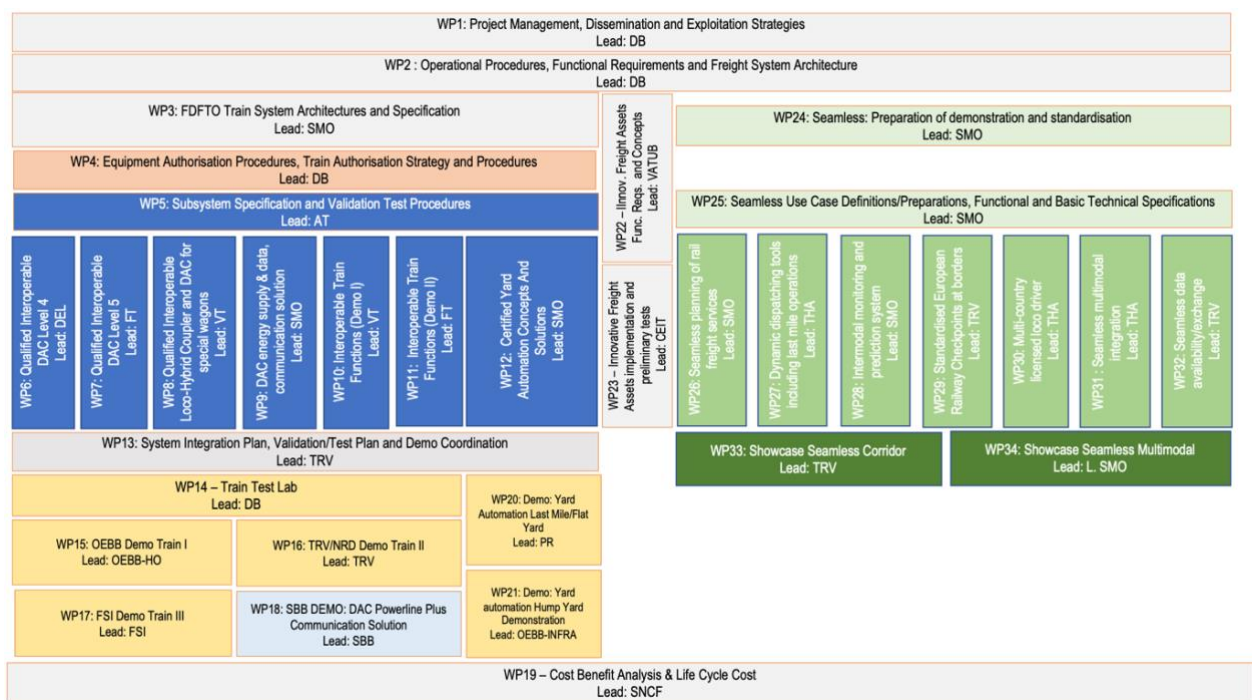


Figure 1: WP-structure in FP5-TRANS4M-R.

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 wagon(s). 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 DFETO 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 wagon workshops and in case of shunting of damaged wagon(s). 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 wagon(s) are uncoupled before going over the hump and being sorted into the classification tracks. Additionally, it has been analysed at which speeds the wagon(s) are being shunted over the hump and whether a so-called push-off operations, where the locomotive pushes wagon(s) 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.

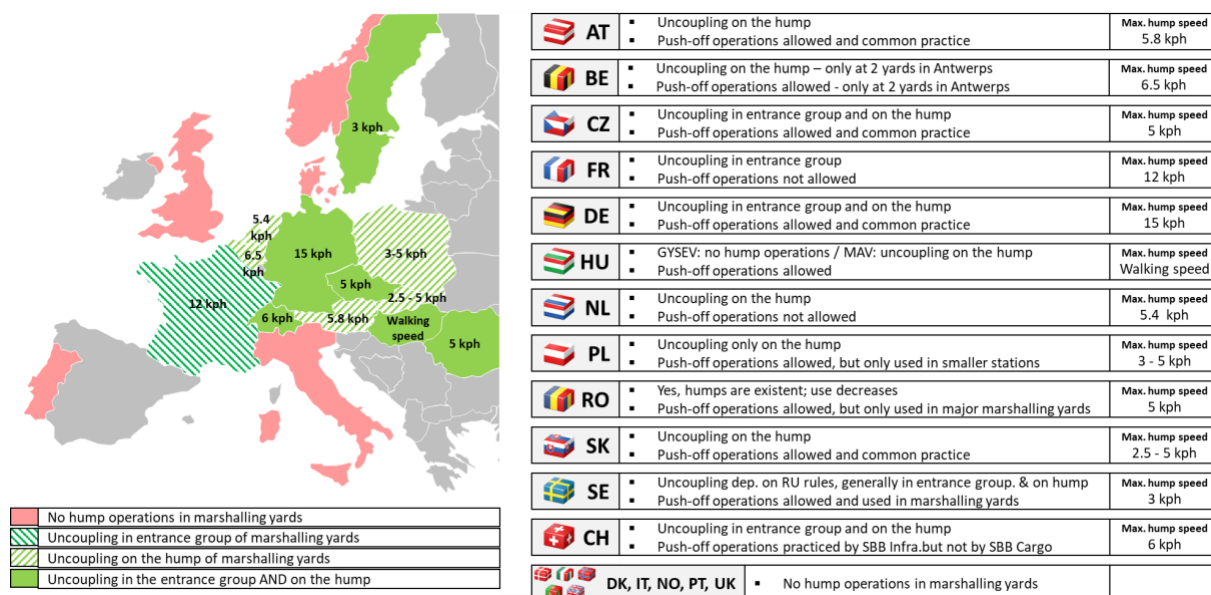


Figure 2: Different operational Processes in marshalling yards

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 wagon(s). In France hump operations are executed. Here, the wagon(s) 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 wagon(s) are uncoupled on the hump at walking speeds so that operational staff is capable of manual uncoupling of the wagon(s). In other countries like e.g. Czech Republic, Germany, Hungary, Romania or Sweden both ways are practiced: uncoupling of wagon(s) 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 wagon(s) 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 wagon(s) 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 wagons 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 wagons) 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 uncouple remotely couplers between 2 wagons. 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 wagons are moving).

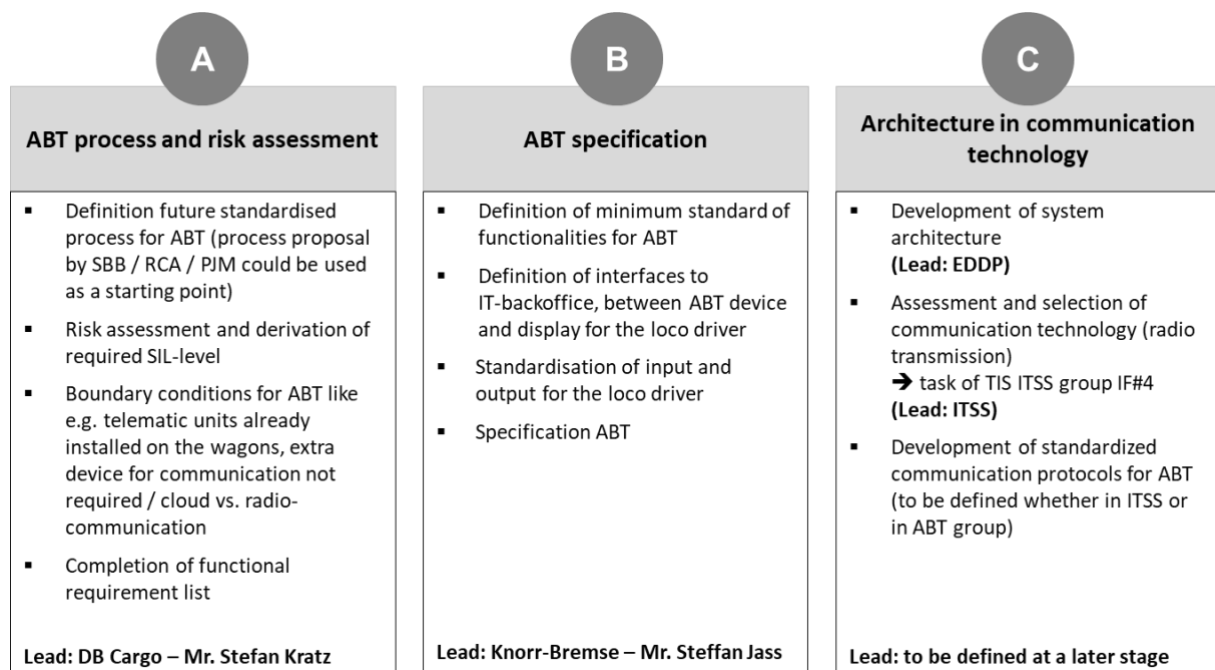
About Railway Safety, DAC5 allows a positive result, because it becomes possible to introduce controls (right location, right speed, right wagon...) between the command of an uncoupling on an interface and its execution between 2 couplers. The major risk identified is unwanted uncoupling both during train run or whilst the train is standing inducing roll away risk of uncoupled wagons. 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, IEC62443). 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, wagon keepers, wagon 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) wagon 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 <ul style="list-style-type: none"> <li>i) TP03 - Train Preparation</li> <li>ii) TP01 - Shunting Preparation</li> <li>iii) TP04 - Train Run</li> <li>iv) TP30 - Switch to FDFT mode Shunting &amp; TP31 - Switch to FDFT mode Train Run</li> <li>v) TP30 - Switch to FDFT mode Shunting &amp; TP31 - Switch to FDFT mode Train Run</li> <li>vi) Flat shunting &amp; TP07 - Flat Shunting Drop Off, TP08 - Flat Shunting Pick Up</li> <li>vii) Flat shunting &amp; TP07 - Flat Shunting Drop Off, TP08 - Flat Shunting Pick Up</li> </ul>
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 wagon 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.

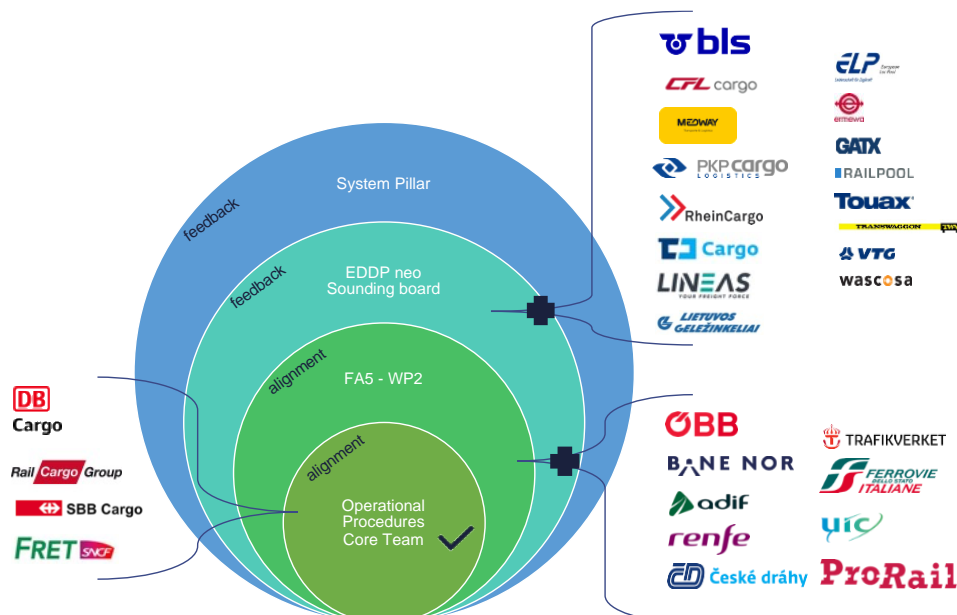


Figure 4: Alignment process

## 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.

		OPE v1.0	OPE v1.1	OPE v1.2 1 <sup>st</sup> official release	OPE v1.3	OPE v1.4 only internal version	OPE v1.5	
<b>FM</b>	ADIF/RENFE							
	BaneNor							
	CD							
	DB							
	FSI							
	ÖBB INFRA							
	Prorail							
	RCA							
	SBB							
	SNCF							
	TRV							
UIC								
<b>FA5 WP2 + add. FA5 operators</b>	DB Cargo UK (UK)							
	PKP Cargo (PL)							
	BLS (CH)							
	Medway (PO)							
	Slovenske Zeleznice (SI)							Confirmed
	CFL Cargo (LU)							Non
	Rheincargo (DE)							Disagreement
	Lineas (BE)							Neutral
	Serbian Railways							
	Lithuanian Railways (LTG)							
<b>others</b>	WASCOSA							
	GATX							
	VTG							
	ERMEWA							
	TRANSWAGGON							
	ALE (no off. position)							
	Lucerne University							
	UIP							

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		Iterations 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 CBO's : closely follow activities of FP5 and EDDP (no high priority during the first 12 months)	Q3 - 2023	Report

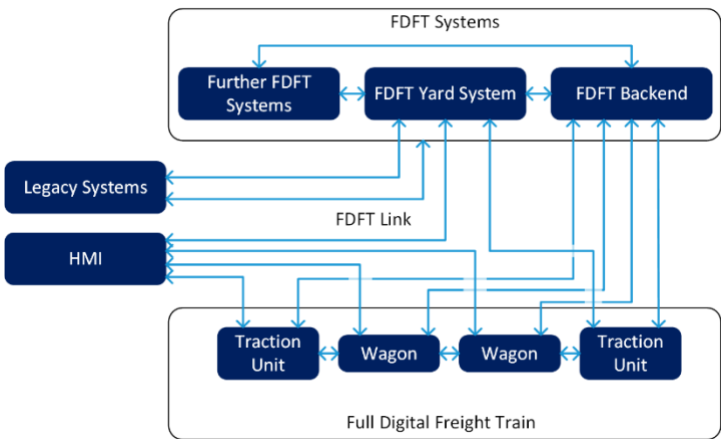
Figure 6: WP overview System Pillar Task 4

## 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 secures the wagon(s) 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	<p>The Controllable Brake can be one or more systems covering the following functions:</p> <ol style="list-style-type: none"> <li>1) Securing the wagon(s) 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).</li> <li>2) Targeted braking of the wagon(s) to a certain speed or standstill, which takes place after the wagon (set) has separated from the traction unit (e.g. braking of the wagon(s) after hump shunting/fly shunting).</li> </ol> <p>The status of the brake can be determined.</p>
Brake: Legacy braking means to secure wagon(s) 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.
Consist composition	Consists coupled with DACs.
Coupling Point of Shunting Composition/Wagon Set	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.

Term	Description
FDFT function Prevent Coupling	<p>Note: Example for a “FDFT Function” could be “FDFT function prevent coupling” or “train integrity monitoring”</p> <p>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.</p> <p>Note: The required activation on both coupler heads results from current statements regarding the technical feasibility of the manufactures.</p> <p>Note: This function is required at all levels of DAC, even if the technical solution may be different.</p>
FDFT Link	<p>Enables communication between FDFT Systems, mainly FDFT Backend, Legacy System, Traction Unit and Wagon with FDFT Wagon Base System.</p> <p>This connection can be physical (data connection between Traction Unit, Stationary Device and Wagon(s) via DAC coupler head) or wireless.</p> <p>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 FDFT Wagon Base System via a physical FDFT Link.</p> <div data-bbox="619 1339 1342 1776" data-label="Diagram">  <p>The diagram illustrates the network of FDFT Links. At the top, a box labeled 'FDFT Systems' contains three interconnected components: 'Further FDFT Systems', 'FDFT Yard System', and 'FDFT Backend'. Below this, 'Legacy Systems' and 'HMI' are shown as external entities. At the bottom, a box labeled 'Full Digital Freight Train' contains 'Traction Unit', 'Wagon', 'Wagon', and 'Traction Unit'. Blue arrows labeled 'FDFT Link' indicate bidirectional communication paths between the FDFT Systems and the Full Digital Freight Train components, as well as between Legacy Systems and HMI.</p> </div> <p><b>Figure 7: FDFT Links</b></p> <p>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).</p>

Term	Description
FDFT mode Shunting (note: <u>not</u> ETCS Shunting Mode)	<p>Allows electrical uncoupling of DAC coupler heads, electrical activation of function prevent coupling and activation of Automated Parking Brake.</p> <p>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.</p> <p>When coupling, harmful electrical power and current is only applied after successful mechanical coupling of both DAC coupler heads including electrical coupler.</p> <p>This mode is required for all consists (wagon and traction unit). All consists of one composition are in the same mode.</p>
FDFT mode Train Run	<p>Coupled DAC coupler heads of Train cannot be commanded to uncouple.</p> <p>First and last DAC coupler heads of Train must have FDFT function Prevent Coupling deactivated and this function cannot be activated.</p> <p>Power supply over DAC coupler heads can be enabled by Traction Unit.</p> <p>Automated Parking Brake cannot be activated (current state of discussion).</p> <p>This mode is required for all consists (wagon and traction unit). All consists of one composition are in the same mode.</p> <p>An operational train run is carried out in FDFT mode Train Run.</p> <p>This mode is not to be confused with train integrity monitoring.</p>
FDFT System	<p>Systems that do not exist today and need to be developed to achieve the target state.</p> <p>Note: Example for a "FDFT System" could be "FDFT Backend" or "FDFT Yard System"</p>
FDFT Wagon Base System (WB)	<p>FDFT Wagon Base System is a system on each wagon, which controls wagon components (e.g., DAC coupler heads, wagon wide power control system, battery management system, brake system, sensors).</p> <p>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</p>



Term	Description
Legacy process	Fallback to already in use processes without requiring (all) FDFT System components.
Legacy System	Today's technical systems in use by operators, wagon keepers, ...
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 wagon (set). Wagon(s) 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 wagon handling from shunting preparation through wagon 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 Wagon (Set).
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/Wagon Set	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)	<p>A consist is the smallest railway rolling stock entity for operation (e.g. wagon, traction unit,...), containing one CCU representing one node on DAC network.</p> <p>It can be a traction unit, single wagon as a fixed set of single vehicles (segments) which are not disconnected while operation.</p> <p>A consist own a unique vehicle identification number.</p>
FDFT Backend (BE)	<p>Collection of new FDFT functions on land side.</p> <p>Receives, supplies, and stores Consist Data (e.g. Wagon Target Track Data, Traction Unit Status Data, Wagon Set Data and Additional Wagon Data).</p> <p>FDFT Backend provides and receives data to and from other systems (FDFT Yard, Traction Unit, etc.)</p> <p>FDFT Backend initiates different functions, e.g., coupling and uncoupling processes, in Target State.</p>
FDFT Yard (FY)	<p>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.</p> <p>The interfaces between FDFT Backend and FDFT Yard will be defined in a later step.</p>
Mobile HMI (HM)	<p>(Locally) (remote) device for personnel to interact with FDFT Systems.</p> <p>Connection to FDFT Systems can be wireless and physical, even to FDFT Wagon Base System.</p> <p>For example, personnel can connect the Mobile HMI to a wagon in a wagon set and retrieve Wagon Status Data and Wagon Set Data of the entire Wagon Set.</p>
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 <i>Yard Manager</i> swim lane, Personnel refers to <i>Yard Manager</i> 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).

Actor / Swimlane	Description
	<p>For target processes: Power and data are also supplied and connected. Over this device, a connection between Wagon(s) to FDFT Backend or Legacy Systems is possible.</p>
Traction Unit (TU)	<ul style="list-style-type: none"> <li>• 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.</li> <li>• The DAC coupler heads can also be hybrid couplers.</li> <li>• A Traction Unit can also have Distributed Power System functionalities.</li> <li>• ATO and ASO systems can be applied.</li> <li>• A Traction Unit can be equipped with FDFT functionalities, e.g. allows retrieving Wagon Status Data or Wagon Set Data and can initiate FDFT Wagon Base System's functions, like secure against rolling away, bleeding, etc.</li> <li>• An unpowered Traction Unit is considered and behaves like a wagon with FDFT Wagon Base System.</li> <li>• Traction Units can be main line locomotives, shunting locomotives, shunting devices, two-way vehicles, etc.</li> <li>• The traction unit (TU) supplies the electrical energy for all the wagons in a train, if technical available.</li> <li>• User Interface is available</li> </ul>
Wagon Inspector (WI)	On site personnel performing technical inspection of wagon(s).
Wagon/Wagon Set (WWS)	<p><u>Wagon:</u> Single physical freight Wagon equipped with DAC coupler head at each end. Wagon(s) permanently coupled (just one UIC Number) together should behave like a single wagon and cannot be uncoupled.</p> <p><u>Wagon Set:</u> Wagon(s) coupled together by DAC coupler heads.</p>
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**  
D2.1 | PU | V1.0 | Final Draft

### 6.3 Data

Data/information type	Description
Additional Wagon Data	Additional Wagon Data consists of static (e.g., wagon length, empty wagon 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	Consists out of Wagon Status Data and Traction Unit Status Data.
Cut List Information	Information about the planned Uncoupling Points for a given Wagon Set. Based on this information, documents like cut lists can be created.
Traction Unit Status Data	<p>Compiled data about the status of a Traction Unit (e.g. state of DAC coupler heads, state of hybrid coupler, state of brake system).</p> <p>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.</p>
Wagon Set Data	Information derived by Wagon Status Data to reflect orientation and order of each wagon in a wagon set.
Wagon Status Data	<p>Compiled data about the status of a wagon and FDFT Wagon Base System can derive this data by itself (e.g. state of DAC coupler heads, state of brake system).</p> <p>If FDFT Backend is available and FDFT Wagon Base System can communicate with FDFT Backend, all changes in Wagon Status Data will be automatically sent from FDFT Wagon Base System to FDFT Backend. If other actors need this information, it is actively pulled from FDFT Wagon Base System.</p>
Wagon Target Track Data	Information sufficient to determine the target track of each wagon 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 wagons in a shunting yard by continuous forward and backward traction unit movements. The traction unit is always in control of the movement of the wagon(s) means that the wagon(s) 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 wagon(s) 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 wagon(s) are uncoupled from the traction unit and, after the traction unit decelerates, continue to run into the target track.

Today, the wagon(s) are braked in the destination track by e.g. brake shoes.

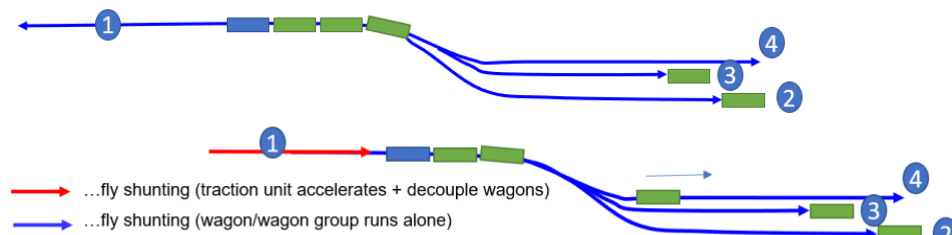


Figure 8: Fly Shunting

### 6.4.3 Hump shunting

The traction unit pushes the wagon(s) 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 wagon(s) are currently either uncoupled in the entrance group at standstill (e.g. France, ...) or on the hump at walking speed (e.g. Austria).

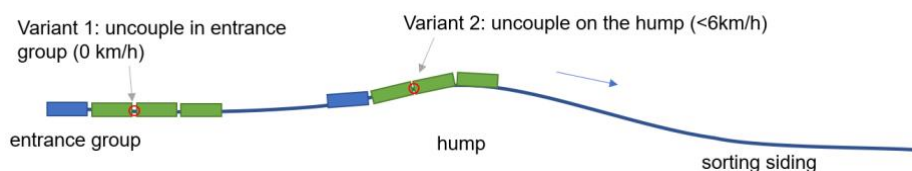


Figure 9: Hump shunting

## **6.5 Technical Wagon Inspection**

Each RU shall handle the wagon(s) with care and, in particular, carry out safety-related checks in accordance with Annex 9 GCU. According to this, wagon(s) 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 wagon 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 wagon(s).

## 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, Wagon keepers, but it should serve as a foundation for the individual adaptations on locations and/or local rules, to be done by each and every company.

### 7.2 Delimitation

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
<ul style="list-style-type: none"> <li>• mechanical coupler</li> <li>• electrical coupler</li> <li>• power and data lines, battery, CCU, emergency release</li> <li>• Hardware of Functions (e.g. sensors, ...)</li> </ul>	DAC 4: <ul style="list-style-type: none"> <li>• lever on wagon side</li> </ul> DAC 4.5: <ul style="list-style-type: none"> <li>• electrical actuator</li> <li>• push button on wagon side</li> </ul> DAC 5: <ul style="list-style-type: none"> <li>• electrical actuator</li> </ul>

**Table 6: FDFT Hardware**

FDFT Functions General
<ul style="list-style-type: none"><li>• coupling</li><li>• uncoupling</li><li>• prevent coupling</li><li>• train composition detection</li><li>• train integrity monitoring</li><li>• train length determination</li><li>• automated brake test</li><li>• automated parking brake</li><li>• ep-brake</li><li>• distributed power system</li><li>• air management</li></ul>

**Table 7: FDFT Functions**

Train Functions are needed to automatize 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 wagon(s) 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.

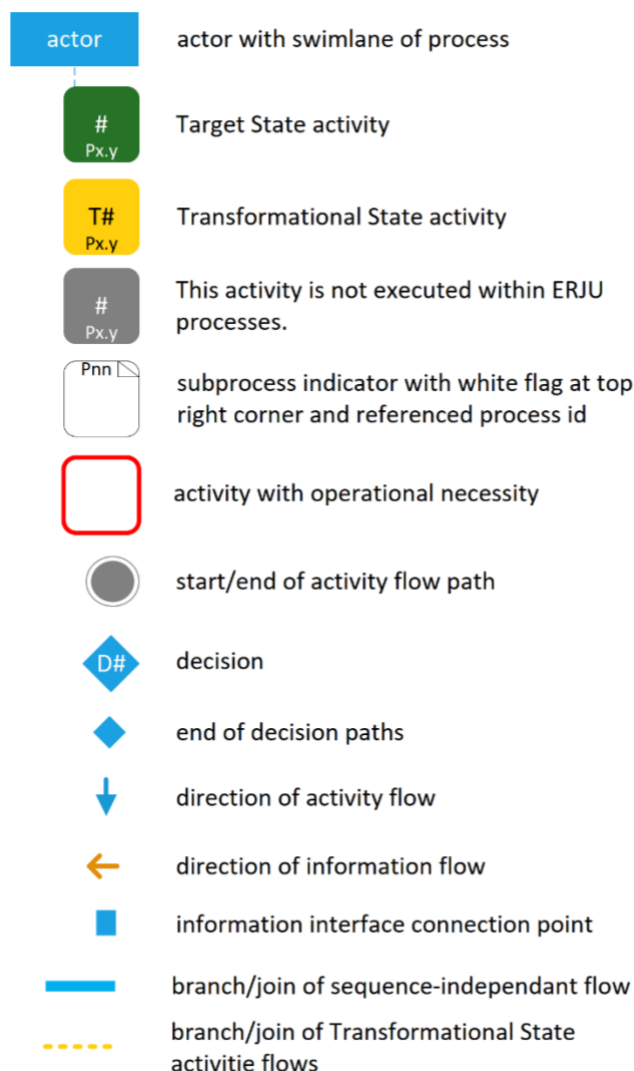


Figure 10: Process description symbols



## 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	<ul style="list-style-type: none"> <li>conditions that must be fulfilled to begin the overall process</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>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</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>description of tasks to be done in activity</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>additional information to understand the context of the tasks</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>additional reason for activity in process context</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>states or information that must be reached/fulfilled/sent/received after finishing the scenario or activity</li> </ul>

**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	<i>Short description of decision</i>
<i>Branch 1</i>	▪ <i>First option of branching according to decision</i>
<i>Branch 2</i>	▪ <i>Second option of branching according to decision</i>
...	▪ <i>Further options if necessary</i>
Remarks	▪ <i>additional information to understand the context of the decision</i>
Rationale	▪ <i>additional reason for condition in process context</i>

**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 wagon(s) 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), Wagon 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 Wagon 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.

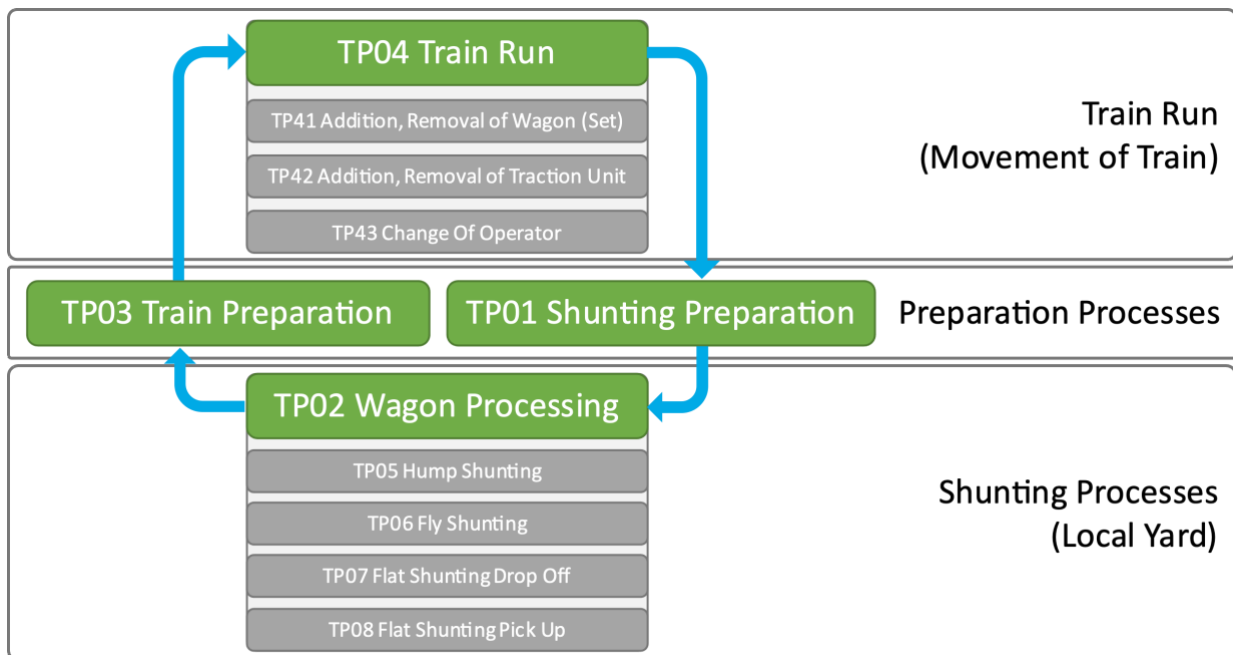
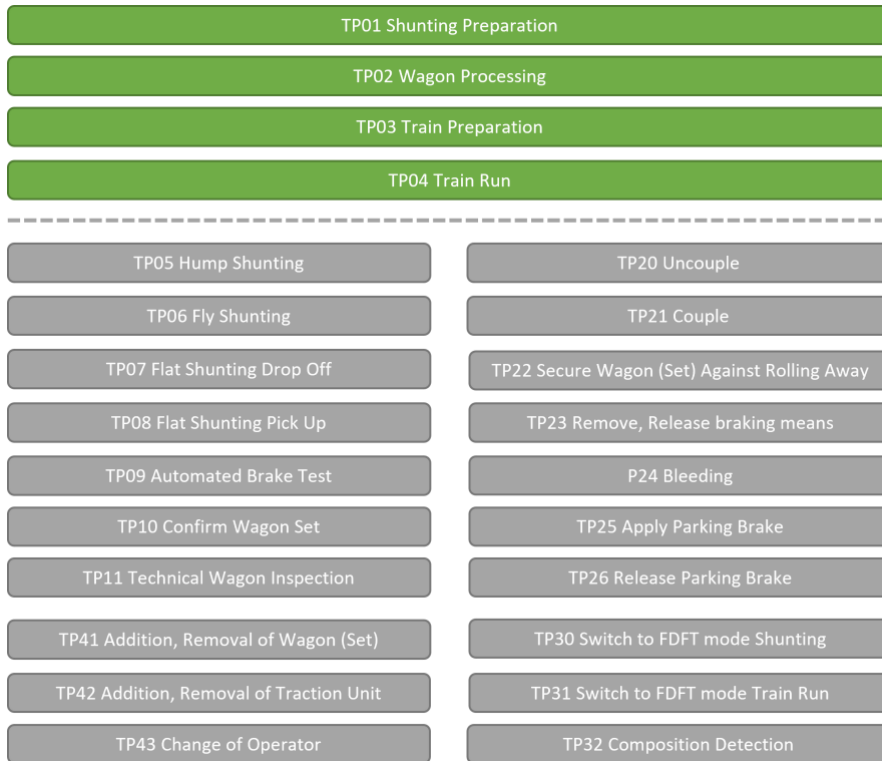


Figure 11: Process overview with four main processes



**Figure 12: Process overview**

has as subprocess

	Shunting Preparation	Wagon Processing	Train Preparation	Train Run	Hump Shunting	Fly Shunting	Flat Shunting Pick Up	Flat Shunting Drop Off	Automated Brake Test	Confirm Wagon Set	Technical Wagon Inspection	Uncouple	Couple	Secure Against Rolling Away	Remove All Braking Means	Bleeding	Apply Parking Brake	Release Parking Brake	Switch to FDFT mode Shunting	Switch to FDFT mode Train Run	Composition Detection	Addition, Removal Of Wagon Set	Addition, Removal Of Traction Unit	Change of Operator
	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08	TP09	TP10	TP11	TP20	TP21	TP22	TP23	TP24	TP25	TP26	TP30	TP31	TP32	TP41	TP42	TP43
Shunting Preparation	TP01																							
Wagon Processing		TP02																						
Train Preparation			TP03																					
Train Run				TP04																				
Hump Shunting					TP05																			
Fly Shunting						TP06																		
Flat Shunting Pick Up							TP07																	
Flat Shunting Drop Off								TP08																
Automated Brake Test									TP09															
Confirm Wagon Set										TP10														
Technical Wagon Inspection											TP11													
Uncouple												TP20												
Couple													TP21											
Secure Against Rolling Away														TP22										
Remove All Braking Means															TP23									
Bleeding																TP24								
Apply Parking Brake																	TP25							
Release Parking Brake																		TP26						
Switch to FDFT mode Shunting																			TP30					
Switch to FDFT mode Train Run																				TP31				
Composition Detection																					TP32			
Addition, Removal Of Wagon Set																						TP41		
Addition, Removal Of Traction Unit																							TP42	
Change of Operator																								TP43

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	Wagon 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 Wagon 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 Wagon (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

### 8.4.2.1 Target Process

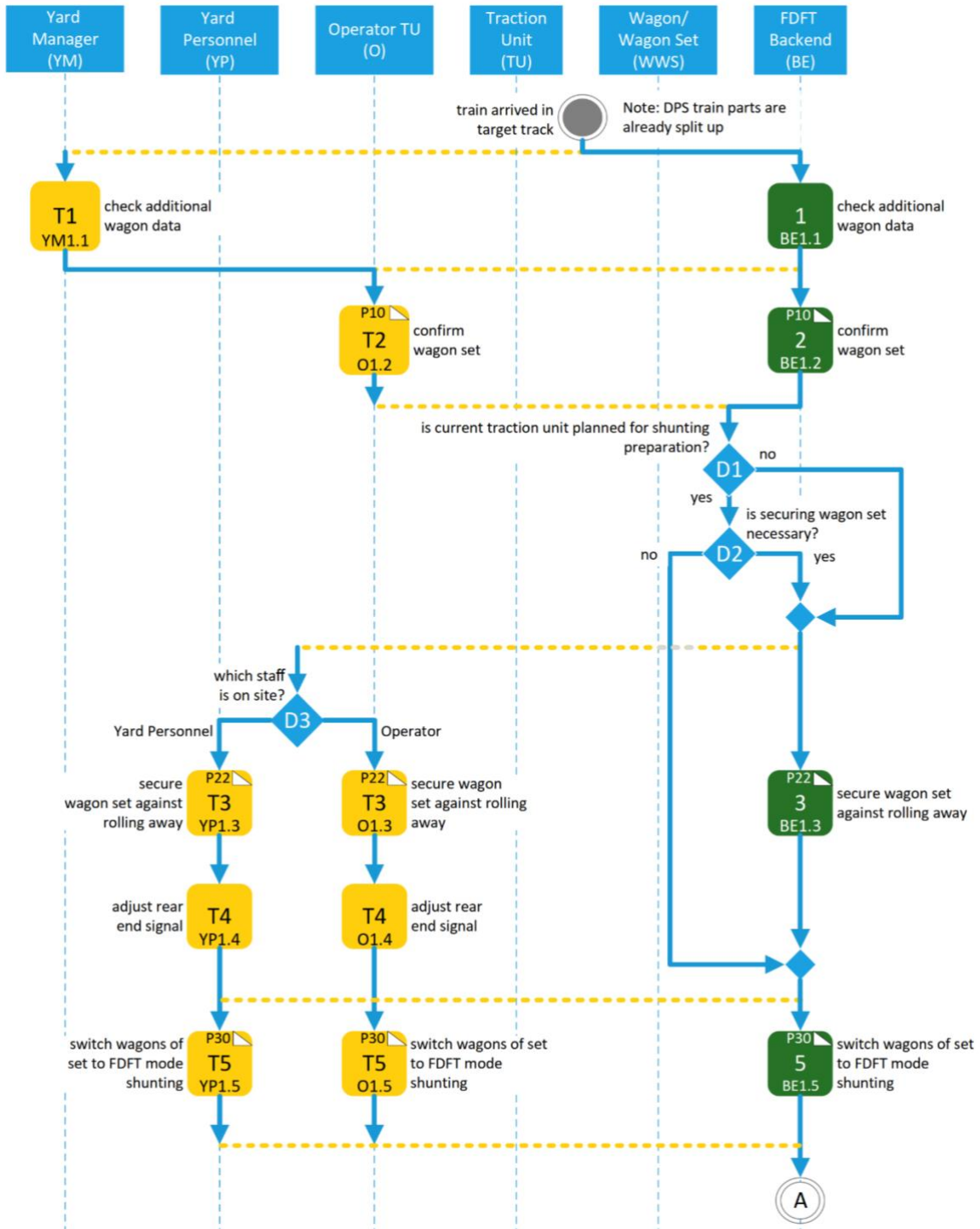
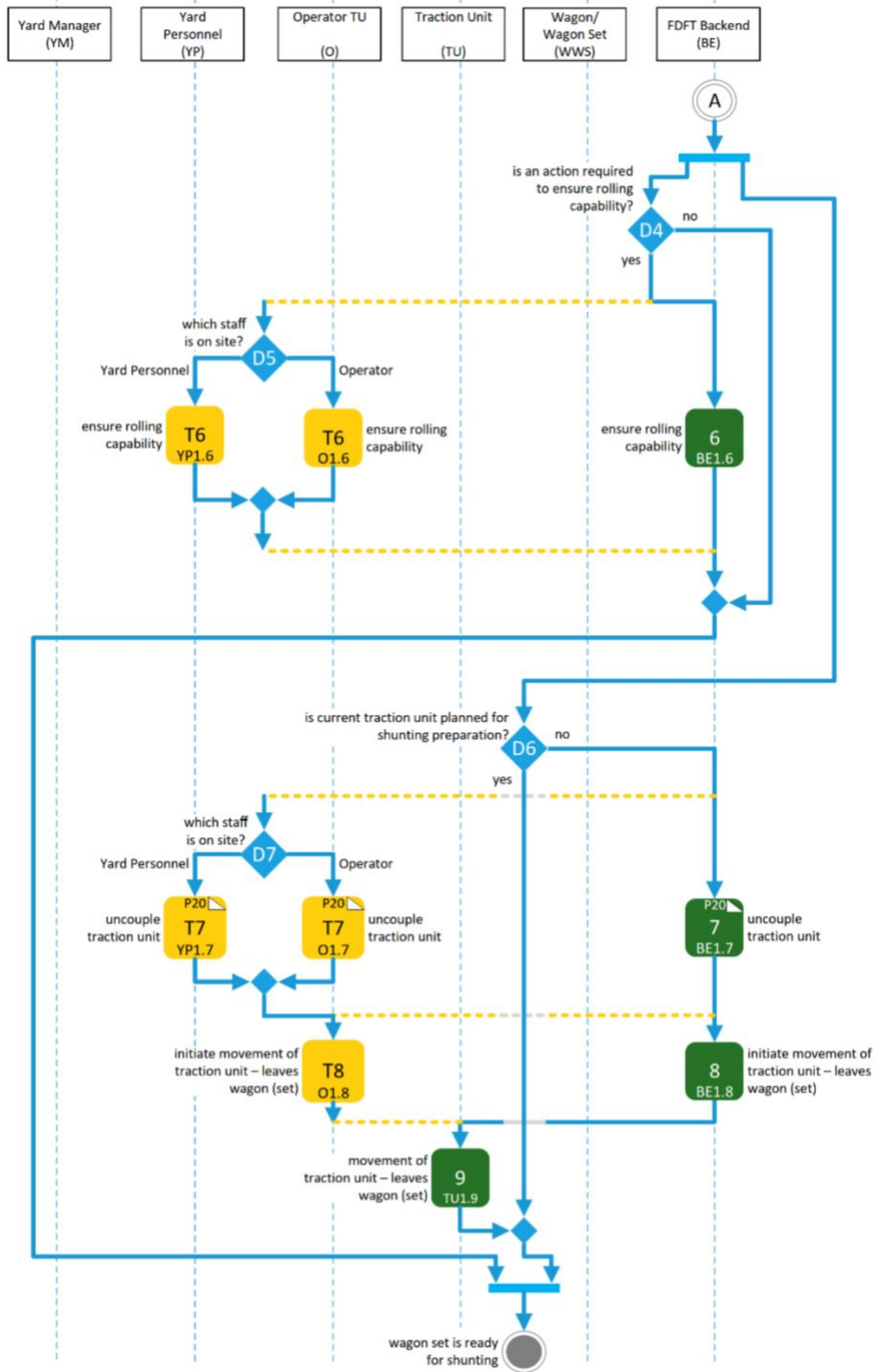


Figure 14: TP01 Shunting Preparation - 1 of 2



TP01 Shunting Preparation - Ed. 02P08 13.06.2023

Figure 15: TP01 Shunting Preparation - 2 of 2



### 8.4.2.2 Process-Description

#### BE1.1

Activity	Check additional wagon data
Precondition	<ul style="list-style-type: none"> <li>DPS Train Parts are already split up.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available and communication between FDFT Backend and FDFT Wagon Base System is possible.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>The FDFT Backend ensures that its set of additional Wagon Data is current.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>All data that can be provided by other systems (e.g. FDFT Wagon Base System, 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 wagon processing).</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

#### YM1.1

Activity	Check additional wagon data
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Yard manager inputs train and additional data into to FDFT Backend if available.</li> <li>If FDFT Backend is not available, use legacy processes.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### BE1.2

Activity	Subprocess: Confirm wagon set
Precondition	▪ -
Conditions	▪ FDFT Backend is available and can confirm wagon set.
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
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 wagon status data.

### O1.2

Activity	Subprocess: Confirm wagon set
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D1

Decision	Is current traction unit planned for shunting preparation?
Yes	<ul style="list-style-type: none"> <li>▪ Arrived traction unit is used for following shunting activities.</li> <li>▪ All needed requirements regarding the traction unit and its use in following processes are met before by planning.</li> </ul>
Remarks	▪ -
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

Decision Is securing wagon set necessary?

Yes
 

- Dependent on local environment and entity.

Remarks
 

- Depending on train weight, infrastructure requirements and duration of stillstand securing of wagon(s) may be necessary.
- This can be achieved by using the arriving traction unit.

Rationale
 

- -

## BE1.3

Activity Subprocess: Secure wagon set against rolling away

Precondition
 

- -

Conditions
 

- FDFT Backend is available and can secure wagon (set) against rolling away.
- Every wagon in set can secure itself against rolling away by remote command.

Tasks
 

- See subprocess description 8.4.10.

Remarks
 

- -

Rationale
 

- -

Postcondition
 

- -

## D3

Decision Which staff is on site?

Yard Personnel
 

- Yard Personnel is on site.

Operator
 

- Operator is on site.

Remarks
 

- -

Rationale
 

- -

### YP1.3

Activity Subprocess: Secure wagon set against rolling away

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

### YP1.4

Activity 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.
- Rationale ▪ -
- Postcondition ▪ -

### O1.3

Activity Subprocess: Secure wagon set against rolling away

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

### O1.4

Activity	Adjust rear end signal
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Operator adjusts rear end signals.
Remarks	<ul style="list-style-type: none"> <li>▪ This step can be skipped if not necessary according to regulations.</li> <li>▪ E.g., train integrity monitoring makes rear end signal obsolete.</li> </ul>
Rationale	▪ -
Postcondition	▪ -

### BE1.5

Activity	Subprocess: Switch wagon(s) of set to FDFT mode Shunting
Precondition	▪ -
Conditions	▪ FDFT Backend is available and can switch wagon(s) to FDFT mode shunting.
Tasks	▪ See subprocess description 8.4.19.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YP1.5

Activity	Subprocess: Switch wagon(s) of set to FDFT mode shunting
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.19.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### O1.5

Activity	Subprocess: Switch wagon(s) of set to FDFT mode shunting
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.19.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D4

Decision	Is an action required to ensure rolling capability?
No	▪ No unintentional loss of air in system with negative influence on the rolling capability e.g., in the shunting processes.
Remarks	<ul style="list-style-type: none"> <li>▪ The rolling capacity of the wagon(s) must be ensured, especially in the processes of fly and hump shunting.</li> <li>▪ Today bleeding is use to achieve rolling capability (for Bleeding Process see P24 – Bleeding) Generally bleeding should not be required.</li> </ul>
Rationale	▪ More efficient process if bleeding can be avoided.

### BE1.6

Activity	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 wagon(s) is given.
Remarks	<ul style="list-style-type: none"> <li>▪ Wagon Set is still secured.</li> <li>▪ Today bleeding is used to archive rolling capability (for Bleeding Process see P24 – Bleeding).</li> </ul>
Rationale	▪ If the rolling capability is not ensured, there would be the risk of an unintentional stop of the wagon. This would lead to additional effort within shunting or possibly a collision of wagon(s).
Postcondition	▪ -

**D5**

Decision Which staff is on site?

Yard Personnel     ▪ Yard Personnel is on site.

Operator            ▪ Operator is on site.

Remarks            ▪ -

Rationale           ▪ -

**O1.6**

Activity             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 wagon(s) is given.

Remarks            ▪ Wagon Set is still secured. Today bleeding is used to archive rolling capability (for Bleeding Process see P24 – Bleeding).

Rationale            ▪ If the rolling capability is not ensured, there would be the risk of an unintentional stop of the wagon. This would lead to additional effort within shunting or possibly a collision of wagon(s).

Postcondition       ▪ -

**YP1.6**

Activity             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 wagon(s) is given.

Remarks            ▪ Wagon Set is still secured. Today bleeding is used to archive rolling capability (for Bleeding Process see P24 – Bleeding).

Rationale            ▪ If the rolling capability is not ensured, there would be the risk of an unintentional stop of the wagon. This would lead to additional effort within shunting or possibly a collision of wagon(s).

Postcondition       ▪ -

### D6

Decision	Is current traction unit planned for shunting preparation?
Yes	<ul style="list-style-type: none"> <li>▪ Shunting planning requires a traction unit change.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>▪ Future tractions units allow for more flexibility (no difference between shunting loco or line loco). Then a traction unit change can be omitted.</li> </ul>

### BE1.7

Activity	Subprocess: Uncouple Traction Unit
Precondition	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>▪ FDFT Backend is available, can command FDFT Wagon Base System to uncouple.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>▪ See subprocess description 8.4.13.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>▪ -</li> </ul>

### BE1.8

Activity	Initiate movement of Traction Unit – leaves wagon (set)
Precondition	<ul style="list-style-type: none"> <li>▪ Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>▪ FDFT Backend is available and can initiate movement of Traction Unit.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>▪ Increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>▪ -</li> </ul>



**D7**

Decision	Which staff is on site?
Yard Personnel	<ul style="list-style-type: none"> <li>Yard Personnel is on site.</li> </ul>
Operator	<ul style="list-style-type: none"> <li>Operator is on site.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>

**O1.7**

Activity	Subprocess: Uncouple Traction Unit
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>See subprocess description 8.4.13.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

**YP1.7**

Activity	Subprocess: Uncouple Traction Unit
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>See subprocess description 8.4.13</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### O1.8

Activity	Initiate movement of traction unit – leaves wagon (set)
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU1.9

Activity	Movement of Traction Unit – leaves wagon (set)
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Uncoupled Traction Unit moves away from the wagon (set) to an assigned destination.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### 8.4.3 TP02 - Wagon Processing

#### 8.4.3.1 Target Process

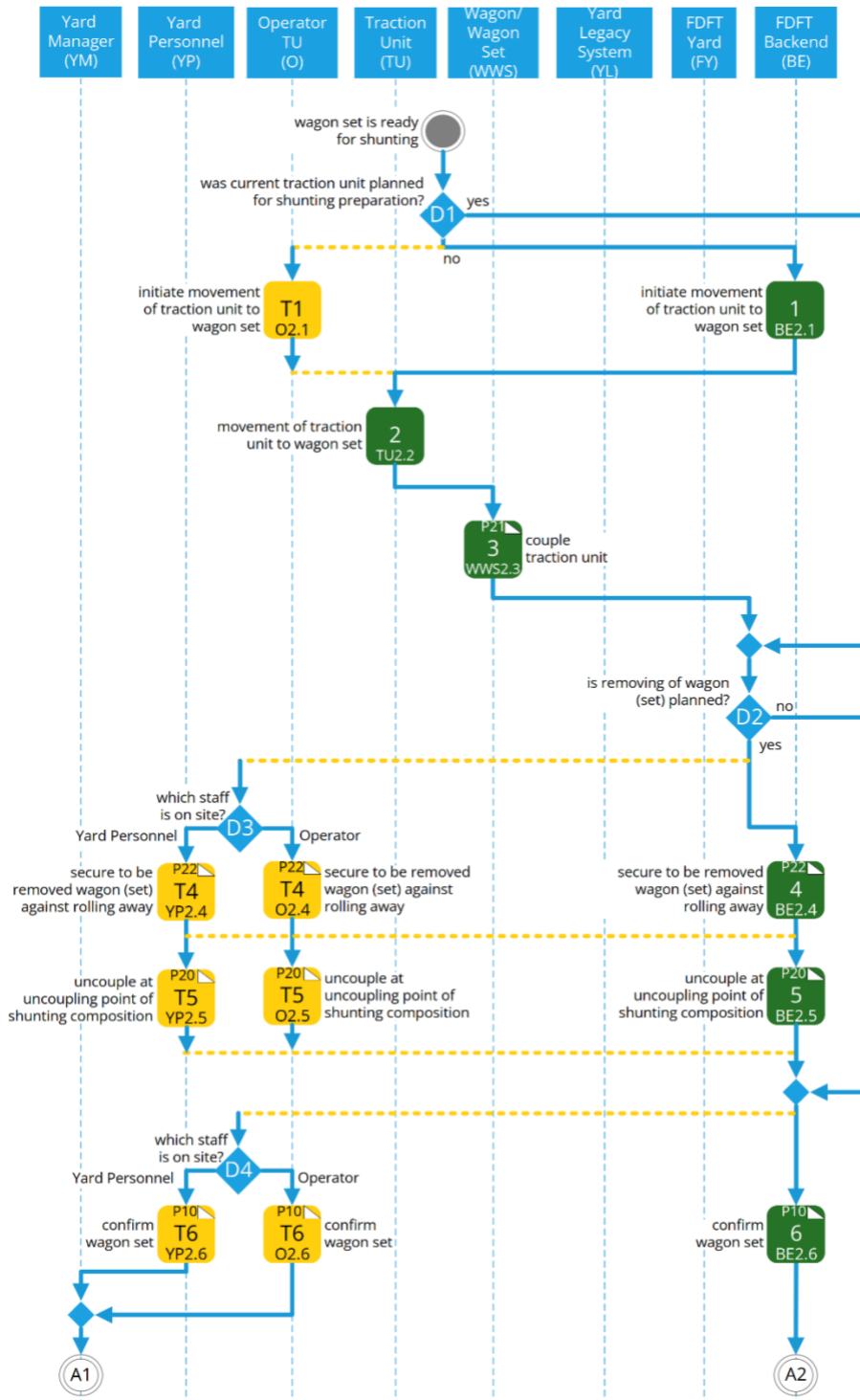


Figure 16: TP02 Wagon Processing - 1 of 4

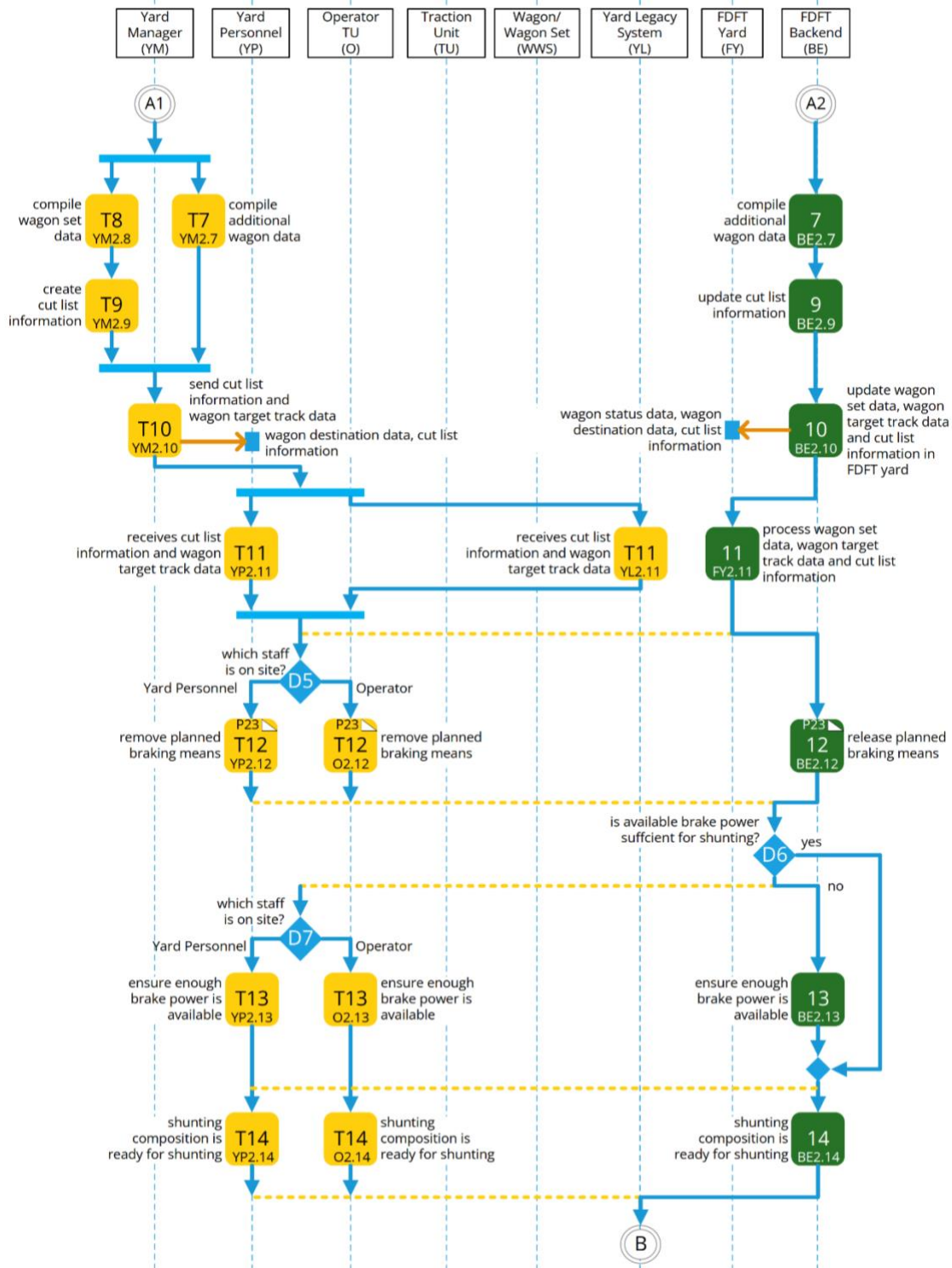


Figure 17: TP02 Wagon Processing - 2 of 4

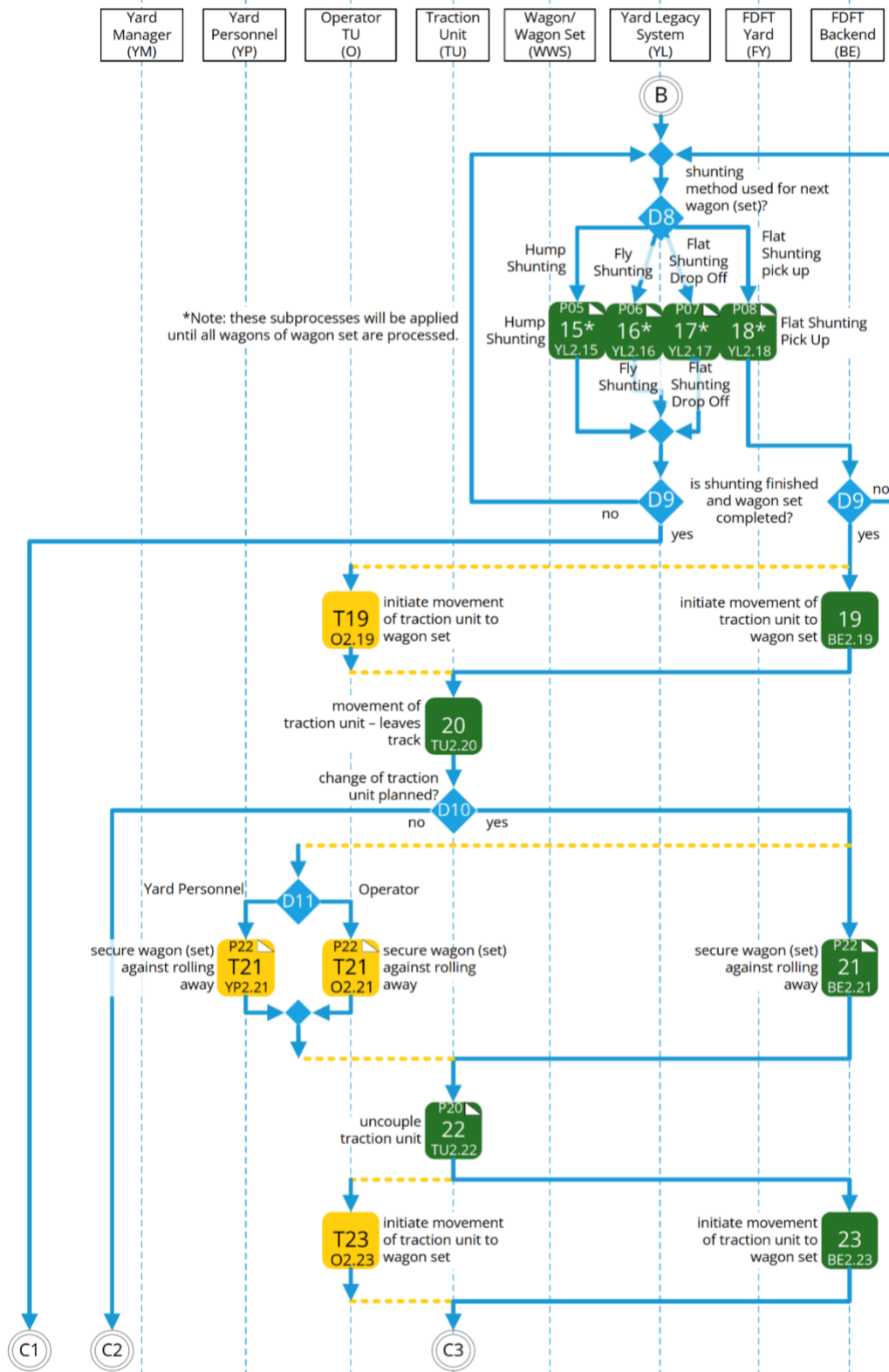


Figure 18: TP02 Wagon Processing - 3 of 4

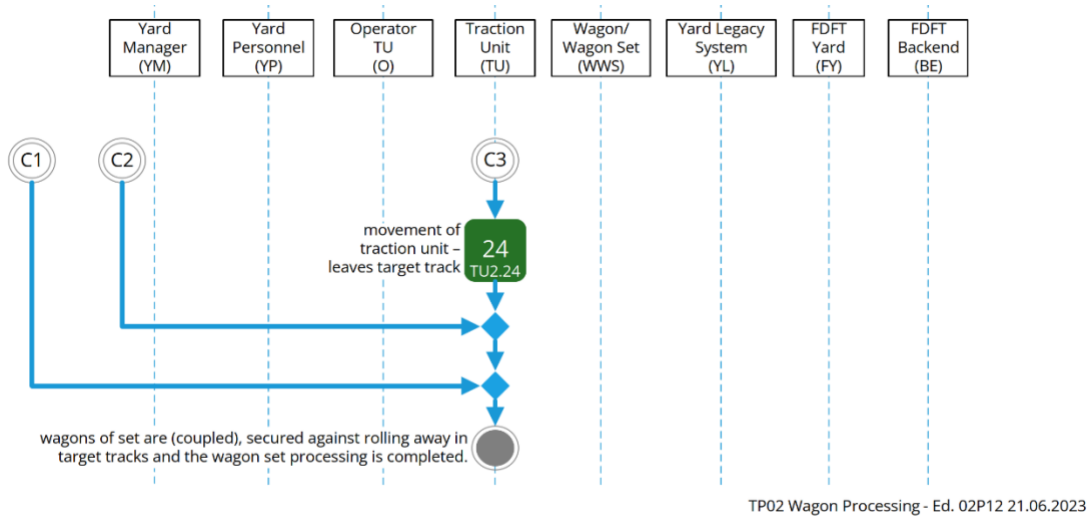


Figure 19: TP02 Wagon Processing - 4 of 4

### 8.4.3.2 Process-Description

#### D1

Decision	Was Traction Unit change planned?
Yes	<ul style="list-style-type: none"> <li>In previous process, a traction unit change was planned and done.</li> </ul>
No	<ul style="list-style-type: none"> <li>In previous process, a traction unit change was not planned and done.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>

#### BE2.1

Activity	Initiate movement of traction unit to wagon set
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available and can initiate movement of Traction Unit.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

#### O2.1

Activity	Initiate movement of traction unit to wagon set
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU2.2

Activity	Movement of Traction Unit to wagon set
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit is moved to Wagon Set (without Traction Unit).
Remarks	▪ This Traction Unit is used for following shunting movements.
Rationale	▪ -
Postcondition	▪ -

### WWS2.3

Activity	Subprocess: Couple Traction Unit
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.14
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D2

Decision	Is removing of wagon (set) planned?
Yes	▪ Part of Wagon Set is planned to be removed.
No	▪ Wagon Set is ready for further processing.
Remarks	▪ -
Rationale	▪ -



### BE2.4

Activity	Subprocess: secure to be removed wagon (set) Against Rolling Away
Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate securing against rolling away.
Tasks	▪ See subprocess description 8.4.15
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE2.5

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### D3

Decision	Which staff is on site?
Yard Personnel	▪ Yard Personnel is on site.
Operator	▪ Operator is on site.
Remarks	▪ -
Rationale	▪ -

## O2.4

Activity	Subprocess: secure to be removed wagon (set) against rolling away
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.15
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

## YP2.4

Activity	Subprocess: secure to be removed wagon (set) against rolling away
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.15
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### O2.5

Activity Subprocess: uncouple at uncoupling point of shunting composition

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

### YP2.5

Activity Subprocess: uncouple at uncoupling point of shunting composition

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

### BE2.6

Activity Subprocess: Confirm Wagon Set

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

### BE2.7

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

### BE2.9

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

### BE2.10

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

### FY2.11

**Activity** Process Wagon Set Data, Wagon Target Track Data and Cut List Information

- Precondition ▪ -
- Conditions ▪ -
- Tasks ▪ FDFT Yard receives Wagon Set Data, Wagon 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.
- Rationale ▪ -
- Postcondition ▪ -

### BE2.12

**Activity** Subprocess: Release planned braking means

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

### D4

**Decision** Which staff is on site?

- Yard Personnel ▪ Yard Personnel is on site.
- Operator ▪ Operator is on site.
- Remarks ▪ -
- Rationale ▪ -

## O2.6

Activity Subprocess: Confirm Wagon Set

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

## YP2.6

Activity Subprocess: Confirm Wagon Set

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

## YM2.7

Activity Compile additional wagon data

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

### YM2.8

#### Activity      Compile Wagon Set Data

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

### YM2.9

#### Activity      Create Cut List Information

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

### YM2.10

#### Activity      Send Cut List Information and Wagon Target Track Data

Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Manager sends Cut List Information and Wagon 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.
Rationale	▪ -
Postcondition	▪ -

### YL2.11

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

### YP2.11

Activity	Receive Cut List Information and Wagon Target Track Data
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Cut List Information and Wagon Target Track Data are available through legacy processes (e.g. legacy mobile device) or the Mobile HMI.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D5

Decision	Which staff is on site?
Yard Personnel	▪ Yard Personnel is on site.
Operator	▪ Operator is on site.
Remarks	▪ -
Rationale	▪ -



### O2.12

Activity	Subprocess: Remove planned braking means
Precondition	▪ -
Conditions	▪ Traction Unit is coupled to Wagon Set.
Tasks	<ul style="list-style-type: none"> <li>▪ See subprocess description 8.4.16</li> <li>▪ Operator removes planned braking means at wagon(s) in set.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YP2.12

Activity	Subprocess: Remove planned braking means
Precondition	▪ -
Conditions	▪ Traction Unit is coupled to Wagon Set.
Tasks	<ul style="list-style-type: none"> <li>▪ See subprocess description 8.4.16</li> <li>▪ Yard personnel removes planned braking means at wagon(s) in set.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D6

Decision	Is available brake power sufficient for shunting?
Yes	<ul style="list-style-type: none"> <li>▪ FDFT Backend calculates necessary brake power by using stored wagon data, traction unit data, topology, and operational requirements.</li> <li>▪ If FDFT Backend is not available, necessary brake power is calculated by legacy processes.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ It should be considered that Traction Unit can solely provide necessary brake power.</li> <li>▪ Some Wagon(s) in Set may have their brake system in service to provide necessary brake power.</li> </ul>
Rationale	▪ -

### BE2.13

Activity	Ensure enough brake power is available
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>Additional brake power can be utilised without the need for manual intervention at each wagon. FDFT Backend is available.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>FDFT Backend uses Traction Unit and some Wagon(s) FDFT Wagon Base Systems to provide brake power.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>In preceding process all wagon(s) of set may have been bled.</li> <li>Today, necessary brake power is achieved by using some wagon(s) in front of the traction unit (air brake). In future, different solutions can be implemented.</li> <li>If additional wagon(s) are used as brake power (air brake), these wagon(s) must be bled before shunting.</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### BE2.14

Activity	Shunting composition is ready for shunting
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available and can communicate with Yard Legacy System and/or FDFT Yard.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>FDFT Backend sends information "shunting composition ready to shunt" to Yard Legacy System and/or FDFT Yard depending on availability.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>This information is used to trigger following shunting processes in surrounding systems.</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### D7

Decision	Which staff is on site?
Yard Personnel	<ul style="list-style-type: none"> <li>Yard Personnel is on site.</li> </ul>
Operator	<ul style="list-style-type: none"> <li>Operator is on site.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>

### O2.13

Activity	Ensure enough brake power is available
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Operator ensures that enough brake power is available through legacy process or by using FDFT Wagon Base Systems as additional brake power.</li> <li>▪ Communication to FDFT Wagon Base Systems can be provided by Traction Unit or Mobile Device.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### O2.14

Activity	Shunting composition is ready for shunting
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Operator sends information "shunting composition ready to shunt" to Yard Legacy System and/or FDFT Yard depending on availability.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ This information is used to trigger following shunting processes.</li> </ul>
Rationale	▪ -
Postcondition	▪ -

### YP2.13

Activity	Ensure enough brake power is available
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Yard Personnel ensures that enough brake power is available through legacy process or by using FDFT Wagon Base Systems as additional brake power.</li> <li>▪ Communication to FDFT Wagon Base Systems can be provided by Traction Unit or Mobile Device.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YP2.14

Activity	Shunting composition is ready for shunting
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Yard personnel sends information “shunting composition ready to shunt” to Yard Legacy System and/or FDFT Yard depending on availability.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ This information is used to trigger following shunting processes.</li> </ul>
Rationale	▪ -
Postcondition	▪ -

**D8**

Decision	Shunting method used for next wagon (set)?
Flat shunting Pick Up	▪ Flat shunting pick up planned for next wagon(s).
Flat shunting Drop Off	▪ Flat shunting drop off planned for next wagon(s).
Fly shunting	▪ Fly shunting planned for next wagon(s).
Hump shunting	▪ Hump shunting planned for next wagon(s).
Remarks	<ul style="list-style-type: none"> <li>▪ Planned shunting method depends on available infrastructure and national operational regulations.</li> <li>▪ This decision in conjunction with the four following shunting methods are run repeatedly until all wagon(s) of set are processed.</li> <li>▪ This process does not differentiate between wagon and tractions units. Unpowered Traction Units are considered as a wagon and shunted accordingly.</li> </ul>
Rationale	▪ -

**YL2.15**

Activity	Subprocess: Hump Shunting
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess definition 8.4.6
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YL2.16

Activity Subprocess: Fly Shunting

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

### YL2.17

Activity Subprocess: Flat Shunting Drop Off

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

### YL2.18

Activity Subprocess: Flat Shunting Pick Up

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

**D9**

Decision	Is shunting finished and wagon set completed?
yes	<ul style="list-style-type: none"> <li>Is shunting process finished and wagon set is completed according to the plan.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>

**BE2.19**

Activity	Initiate movement of traction unit to wagon set
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

**O2.19**

Activity	Initiate movement of traction unit to wagon set
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU2.20

Activity	Movement of traction unit – leaves track
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Uncoupled Traction Unit moves away from the wagon (set) to an assigned destination.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D10

Decision	Change of traction unit planned?
yes	▪ Change of Traction Unit is planned.
Remarks	▪ -
Rationale	▪ -

### BE2.21

Activity	Subprocess: Secure wagon (set) against rolling away
Precondition	▪ -
Conditions	▪ FDFT Backend is available and can initiate securing against rolling away.
Tasks	<ul style="list-style-type: none"> <li>▪ Secure those wagon (set) against rolling away, which is currently connected to the traction unit</li> <li>▪ See subprocess description 8.4.15</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -



### D11

Decision Which staff is on site?

Yard Personnel ▪ Yard Personnel is on site.

Operator ▪ Operator is on site.

Remarks ▪ -

Rationale ▪ -

### YP2.21

Activity Subprocess: Secure wagon (set) against rolling away

Precondition ▪ -

Conditions ▪ -

Tasks ▪ Secure those wagon (set) against rolling away, which is currently connected to the traction unit.  
▪ See subprocess description 8.4.15

Remarks ▪ -

Rationale ▪ -

Postcondition ▪ -

### O2.21

Activity Subprocess: Secure wagon (set) against rolling away

Precondition ▪ -

Conditions ▪ -

Tasks ▪ Secure wagon (set) against rolling away, which is currently connected to the traction unit.  
▪ See subprocess description 8.4.15

Remarks ▪ -

Rationale ▪ -

Postcondition ▪ -

### TU2.22

Activity Subprocess: uncouple Traction Unit

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

### BE2.23

Activity Initiate movement of traction unit to wagon set

- 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 ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### O2.23

Activity Initiate movement of traction unit to wagon set

- 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 ▪ -
- Rationale ▪ -
- Postcondition ▪ -

## TU2.24

Activity	Movement of Traction Unit – leaves target track
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Uncoupled Traction Unit moves away from the wagon (set) to an assigned destination.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

## 8.4.4 TP03 - Train Preparation

### 8.4.4.1 Target Process

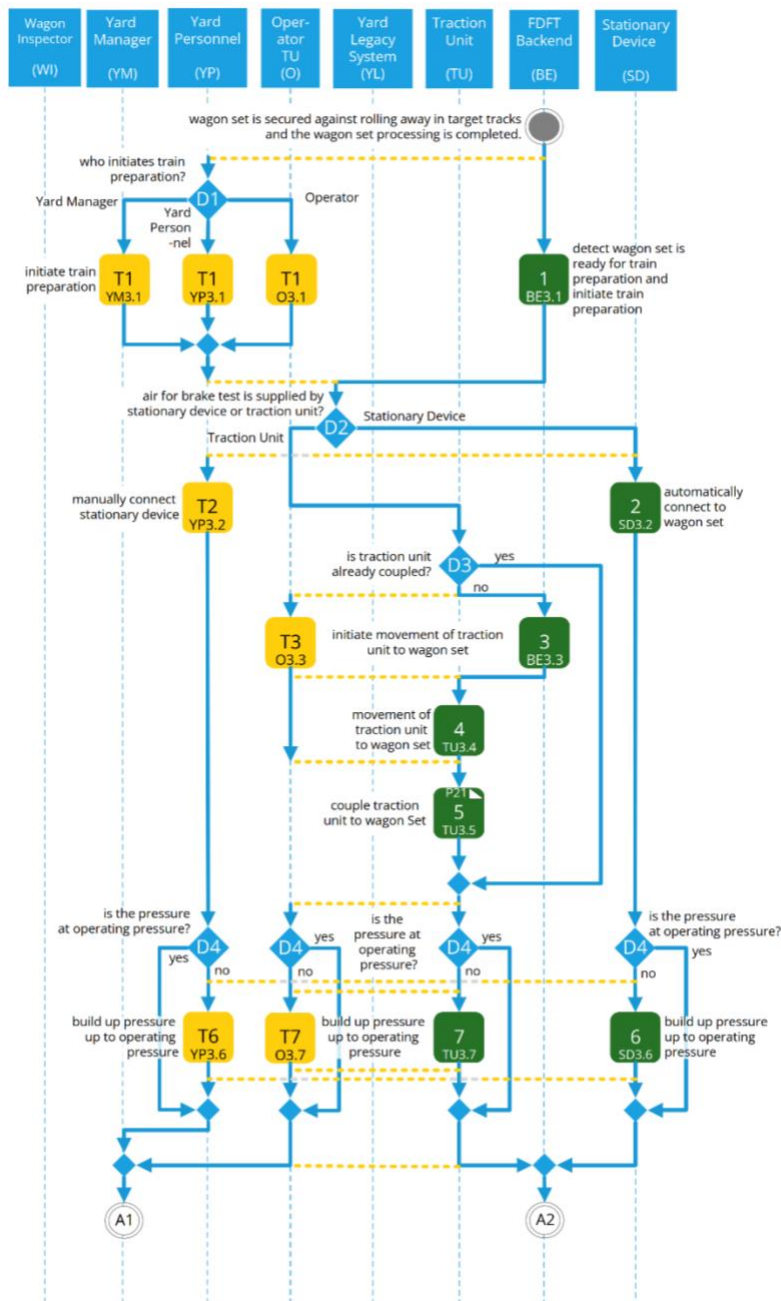
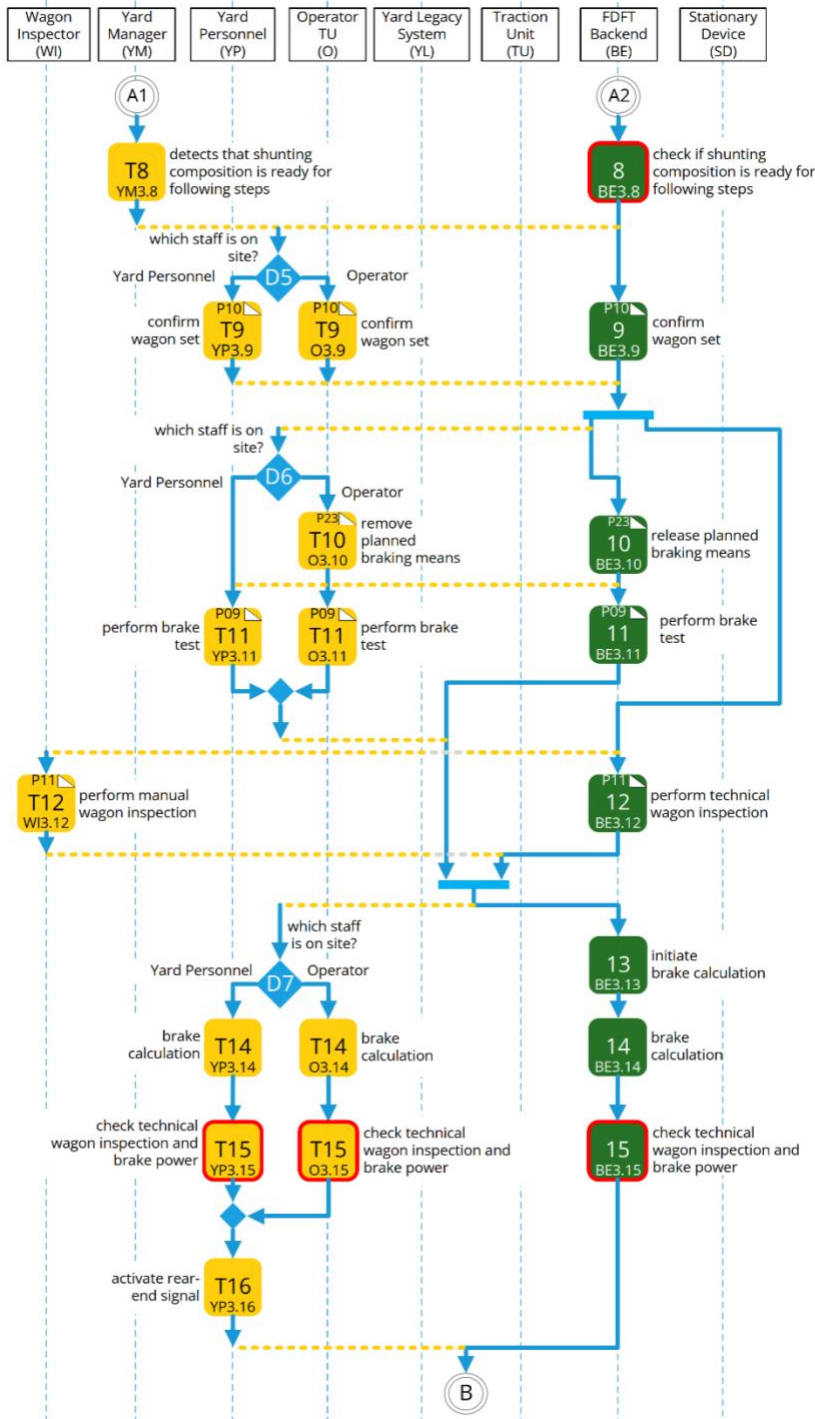


Figure 20: TP03 Train Preparation - 1 of 4



ä

Figure 21: TP03 Train Preparation - 2 of 4

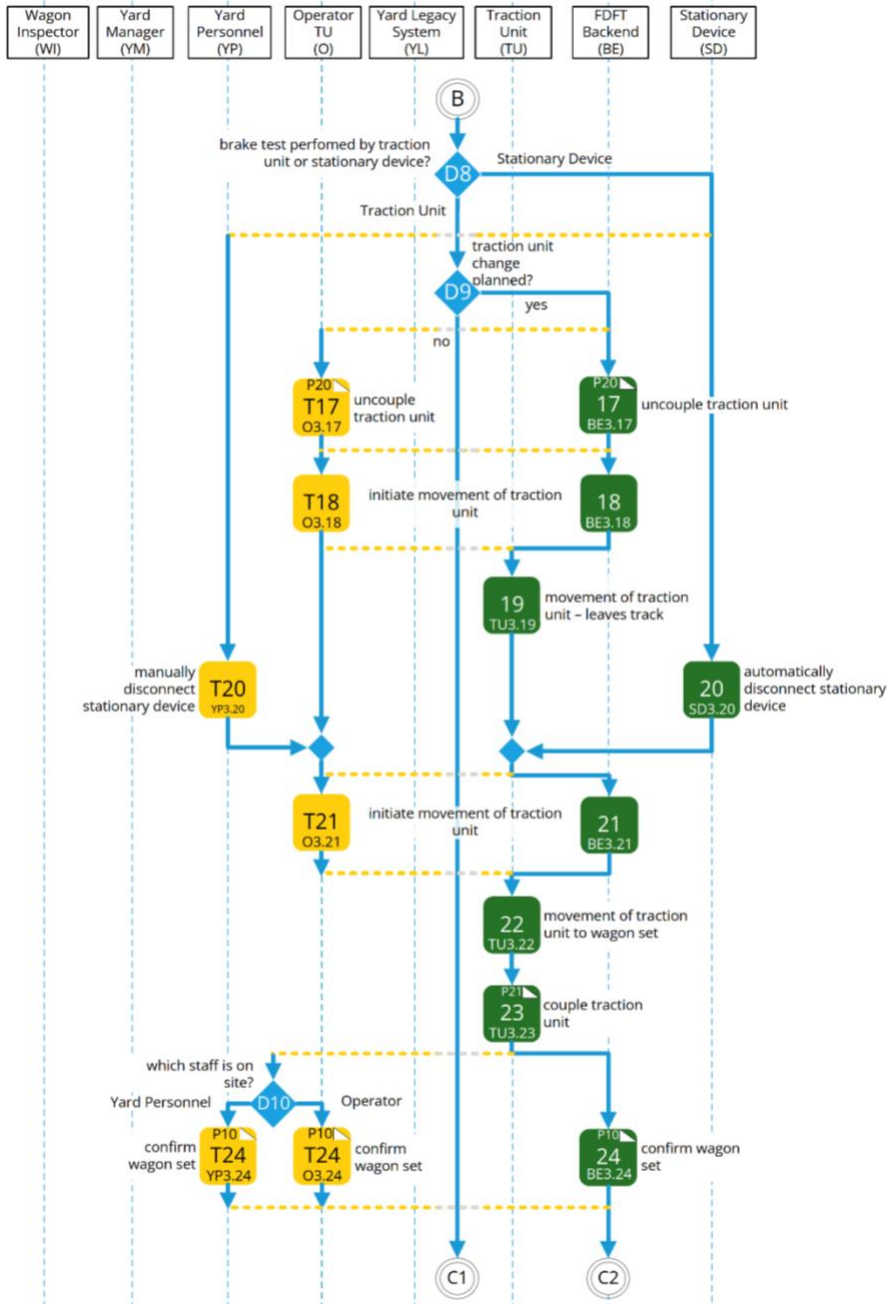
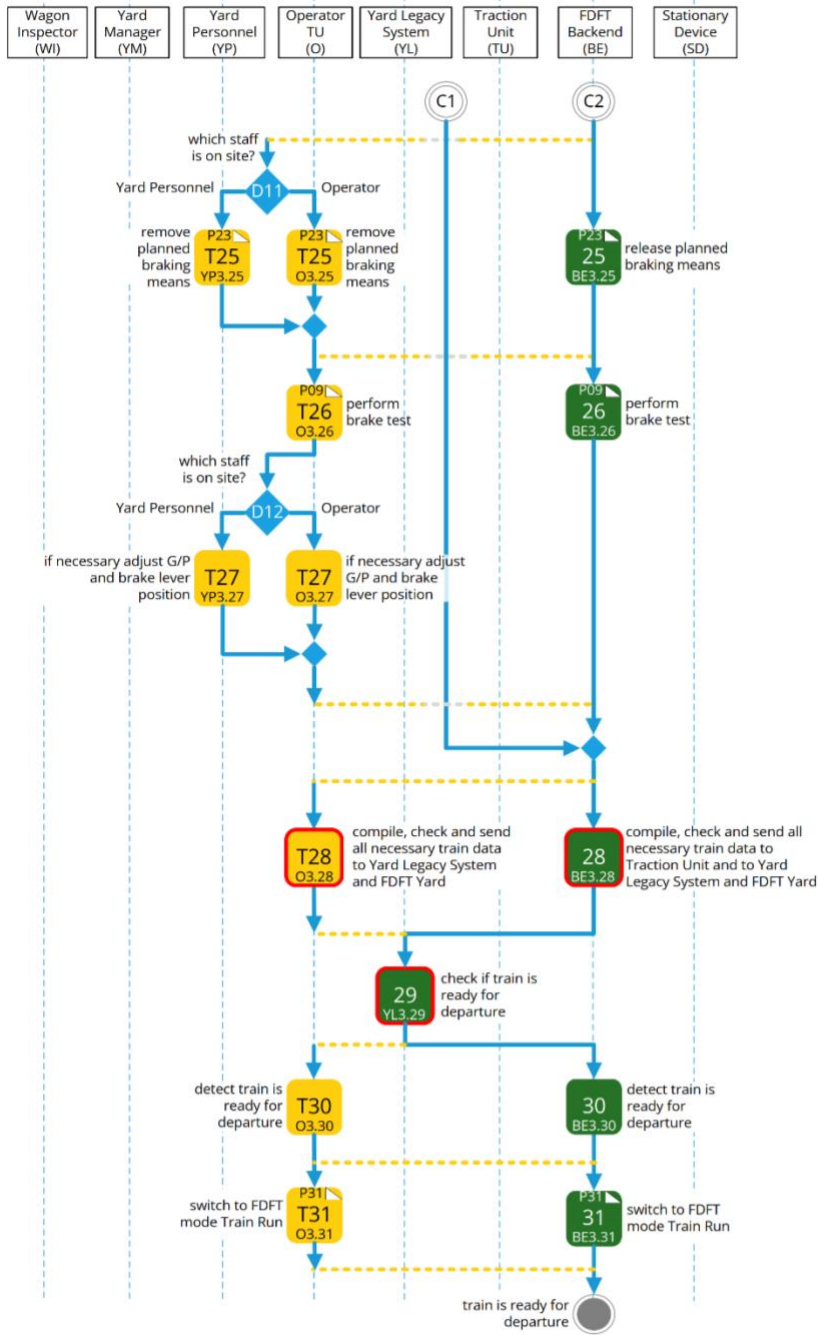


Figure 22: TP03 Train Preparation - 3 of 4



TP03 Train Preparation - Ed. 02P10 19.06.2023

Figure 23: TP03 Train Preparation - 4 of 4

#### 8.4.4.2 Process-Description

##### BE3.1

Activity	Detect wagon set is ready for train preparation
Precondition	<ul style="list-style-type: none"> <li>Wagon Set is secured against rolling away in target track and the wagon processing is completed.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available and can automatically detect that wagon set is ready for train preparation.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>FDFT Backend automatically detects that wagon set is ready for train preparation and initiates following processes.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

##### D1

Decision	Who initiates train preparation?
Yard Manager	<ul style="list-style-type: none"> <li>Yard Manager initiates train preparation.</li> </ul>
Yard Personnel	<ul style="list-style-type: none"> <li>Yard Personnel initiates train preparation.</li> </ul>
Operator	<ul style="list-style-type: none"> <li>Operator initiates train preparation.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>

##### O3.1

Activity	Initiate train preparation
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>If FDFT Backend is available, inform FDFT Backend that wagon set is ready for train preparation.</li> <li>If FDFT Backend is not available, start legacy train preparation processes.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>



### YP3.1

Activity	Initiate train preparation
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ If FDFT Backend is available, inform FDFT Backend that wagon set is ready for train preparation.</li> <li>▪ IF FDFT Backend is not available, start legacy train preparation processes.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YM3.1

Activity	Initiate train preparation
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ If FDFT Backend is available, inform FDFT Backend that wagon set is ready for train preparation.</li> <li>▪ IF FDFT Backend is not available, start legacy train preparation processes.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D2

Decision	Air for brake test is supplied by Stationary Device or Traction Unit?
Stationary Device	▪ Air for brake test is supplied by Stationary Device.
Traction Unit	▪ Air for brake test is supplied by Traction Unit.
Remarks	▪ -
Rationale	<ul style="list-style-type: none"> <li>▪ Stationary Devices can be used to accelerate overall process as waiting for traction unit is not needed.</li> <li>▪ The usage of Stationary Devices does not bind traction units for preparation activities.</li> </ul>

### SD3.2

Activity	Automatically connect to Wagon Set
Precondition	▪ -
Conditions	▪ Stationary Device can automatically connect to wagon set.
Tasks	▪ Stationary Device automatically moves to coupling position and connects air, and - if available - power and data at one of the outermost wagon(s).
Remarks	<ul style="list-style-type: none"> <li>▪ Some of these activities may change depending on the automation of Stationary Device. e.g. the wagon set can be moved to the Stationary Device.</li> <li>▪ Depending on the technical development it is possible that the Stationary Device connects to the wagon group at an earlier point in the process.</li> <li>▪ 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.</li> </ul>
Rationale	▪ -
Postcondition	▪ -

### D3

Decision	Is Traction Unit already coupled?
Yes	▪ Traction Unit is already coupled to Wagon Set.
No	▪ Traction Unit is not coupled to Wagon Set.
Remarks	▪ -
Rationale	▪ Traction Unit could be coupled from process Flat Shunting Provide.

### BE3.3

Activity	Initiate movement of Traction Unit to wagon set
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	▪ -
Rationale	▪ -
Postcondition	▪ -

### O3.3

Activity	Initiate movement of traction unit to wagon set
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU3.4

Activity	Movement of traction unit to wagon set
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Traction Unit leaves track.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>Uncoupled Traction Unit moves away from the wagon (set) to an assigned destination.</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU3.5

Activity	Subprocess: Couple Traction Unit to Wagon Set
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>See subprocess description 8.4.14</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>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.</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### YP3.2

Activity	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 wagon(s).
Remarks	▪ Some of these activities may change depending on the automation of Stationary Device. E.g. the wagon set 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.
Rationale	▪ -
Postcondition	▪ -

### D4

Decision	Is the pressure at operating pressure?
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".
Yes	▪ Pressure in main brake pipe is at operating pressure.
No	▪ Pressure in main brake pipe is not at operating pressure.
Remarks	▪ -
Rationale	▪ -

### SD3.6

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### TU3.7

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### YP3.6

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### O3.7

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE3.8

Activity	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 Wagon Set and main brake pipe is at operational pressure. FDFT Backend initiates following processes.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YM3.8

Activity	Detects that shunting composition is ready for following steps
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Yard Manager checks if either Stationary Device or Traction Unit is connected to Wagon Set 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.
Rationale	▪ -
Postcondition	▪ -

### BE3.9

Activity	Subprocess: Confirm wagon set
Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with FDFT Wagon Base System and can initiate confirm wagon set.
Tasks	▪ See subprocess description 8.4.11
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D5

Decision	Which staff is on site?
Yard Personnel	▪ Yard Personnel is on site.
Operator	▪ Operator is on site.
Remarks	▪ -
Rationale	▪ -

### YP3.9

Activity	Subprocess: confirm wagon set
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### O3.9

Activity	Subprocess: confirm wagon set
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE3.10

Activity	Subprocess: Release planned braking means
Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with FDFT Wagon Base System and can initiate release planned braking means.
Tasks	<ul style="list-style-type: none"> <li>▪ See subprocess description 8.4.16</li> <li>▪ Only as many brakes may be released so that the shunting composition is sufficiently (planned) secured.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -



### BE3.11

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

### D6

Decision	Which staff is on site?
Yard Personnel	▪ Yard Personnel is on site.
Operator	▪ Operator is on site.
Remarks	▪ -
Rationale	▪ -

### O3.10

Activity	Subprocess: remove planned braking means
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.16
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### O3.11

Activity	Subprocess: perform brake test
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.10
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YP3.11

Activity	Subprocess: Perform brake test
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.10
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE3.12

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

### WI3.12

Activity Subprocess: perform manual wagon inspection

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

### BE3.13

Activity Initiate brake calculation

- Precondition ▪ -
- Conditions ▪ FDFT Backend is available, can communicate with FDFT Wagon Base System 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 ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### BE3.14

Activity Brake calculation

- Precondition ▪ -
- Conditions ▪ FDFT Backend is available.
- Tasks ▪ FDFT Backend uses compiled data on wagon(s) of set and load and calculates available brake power.
- Remarks ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### BE3.15

Activity	Check technical wagon inspection and brake power
Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	<ul style="list-style-type: none"> <li>▪ FDFT Backend checks that available brake power is sufficient for planned track.</li> <li>▪ FDFT Backend checks technical wagon inspection data.</li> <li>▪ FDFT Backend checks restrictions due to national requirements. E.g. wagon clearance, exceptional consignments.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D7

Decision	Which staff is on site?
Yard Personnel	▪ Yard Personnel is on site.
Operator	▪ Operator is on site.
Remark	▪ -
Rationale	▪ -

### O3.14

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

### O3.15

Activity	Check technical wagon inspection and brake power
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Operator checks that available brake power is sufficient for planned track.</li> <li>▪ Operator checks technical wagon inspection data.</li> <li>▪ Operator checks restrictions due to requirements. E.g. wagon clearance, exceptional consignments, ...</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YP3.14

Activity	Brake Calculation
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Legacy process for calculation of available brake power.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YP3.15

Activity	Check technical wagon inspection and brake power
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Yard personnel checks that available brake power is sufficient for planned track.</li> <li>▪ Yard personnel checks technical wagon inspection data.</li> <li>▪ Yard personnel checks restrictions due to requirements. E.g. wagon clearance, exceptional consignments, ...</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YP3.16

Activity	Activate rear-end signal
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ If trailing wagon has automatic rear-end signal capabilities, activate rear-end signal on wagon.</li> <li>▪ This can also be achieved by using the mobile HMI.</li> <li>▪ If not, use legacy process.</li> </ul>
Remarks	▪ If rear-end signal is not necessary according to changes in regulations, this step can be skipped.
Rationale	▪ -
Postcondition	▪ -

### D8

Decision	Brake test performed by traction unit or stationary device?
Stationary Device	▪ Brake test was performed by Stationary Device.
Traction Unit	▪ Brake test was performed by Traction Unit.
Remark	▪ -
Rationale	▪ -

### SD3.20

Activity Automatically disconnect stationary device

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

### YP3.20

Activity 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 ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### D9

Decision Traction unit change planned

- yes ▪ Traction Unit change is planned.
- no ▪ Traction Unit change is not planned.
- Remarks ▪ -
- Rationale ▪ -

### BE3.17

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

### O3.17

Activity	Subprocess: Uncouple Traction Unit
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.13
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE3.18

Activity	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 FDFT Wagon Base System and can initiate movement of Traction Unit.
Tasks	▪ increase traction force and gain speed up to shunting yard regulatory maximum.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -



### O3.18

Activity	Initiate movement of traction Unit
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU3.19

Activity	Movement of traction unit – leaves track
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Traction Unit leaves track.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>Uncoupled Traction Unit moves away from the wagon (set) to an assigned destination.</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU3.21

Activity	Initiate movement of traction Unit
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available, can communicate with FDFT Wagon Base System and can initiate movement of Traction Unit.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### O3.21

Activity	Initiate movement of traction Unit
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU3.22

Activity	Movement of Traction Unit to wagon set
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Traction Unit moves to track with wagon set.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>Traction Unit is moved to Wagon Set.</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU3.23

Activity	Subprocess: Couple traction unit
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>See subprocess description 8.4.14</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### BE3.24

Activity	Subprocess: Confirm wagon set
Precondition	▪ -
Conditions	▪ Backend is available, can communicate with FDFT Wagon Base System and can initiate confirm wagon set.
Tasks	▪ See subprocess description 8.4.11
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D10

Decision	Which staff is on site?
Yard Personnel	▪ Yard Personnel is on site.
Operator	▪ Operator is on site.
Remark	▪ -
Rationale	▪ -

### O3.24

Activity	Subprocess: Confirm wagon set
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YP3.24

Activity Confirm wagon set

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

### BE3.25

Activity Subprocess: Release planned braking means

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

### D11

Decision Which staff is on site?

- Yard Personnel ▪ Yard Personnel is on site.
- Operator ▪ Operator is on site.
- Remark ▪ -
- Rationale ▪ -

### O3.25

Activity Subprocess: Remove planned braking means

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

### YP3.25

Activity Subprocess: Remove planned braking means

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

### BE3.26

Activity Subprocess: perform brake test

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

### O3.26

Activity	Subprocess: Perform brake test
Precondition	<ul style="list-style-type: none"> <li>It is ensured that main brake pipe is continuous from first to last wagon.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Perform legacy brake test according to regulations.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### D12

Decision	Which staff is on site?
Yard Personnel	<ul style="list-style-type: none"> <li>Yard Personnel is on site.</li> </ul>
Operator	<ul style="list-style-type: none"> <li>Operator is on site.</li> </ul>
Remark	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>

### O3.27

Activity	If necessary, adjust brake lever position
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Operator adjusts brake lever position if necessary.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>This step can be skipped if wagon is equipped with a brake system not needing manual lever changes.</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

**YP3.27**

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

**BE3.28**

Activity	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	<ul style="list-style-type: none"> <li>▪ FDFT Backend compiles all necessary train data in preparation of train run.</li> <li>▪ FDFT Backend performs checks according to national regulations.</li> <li>▪ FDFT Backend sends train data to traction unit.</li> <li>▪ FDFT Backend sends train data to Yard Legacy System and FDFT Yard if available.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

**O3.28**

Activity	Compile, check and send all necessary train data to Yard Legacy System and FDFT Yard
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Operator compiles all necessary train data in preparation of train run.</li> <li>▪ Operator performs checks according to national regulations.</li> <li>▪ Operator enters data into traction unit.</li> <li>▪ Operator sends train data to Yard Legacy System and FDFT Yard if available.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

**YL3.29**

Activity	Check if train is ready for departure
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Yard Legacy receives train data and initiates legacy processes, e.g. set route.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -



### BE3.30

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### O3.30

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE3.31

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

**03.31**

Activity Subprocess: Switch to FDFT mode Train Run

Precondition ▪ -

Conditions ▪ -

Tasks ▪ See subprocess description 8.4.20

Remarks ▪ -

Rationale ▪ -

Postcondition ▪ -

### 8.4.5 TP04 - Train Run

#### 8.4.5.1 Target Process

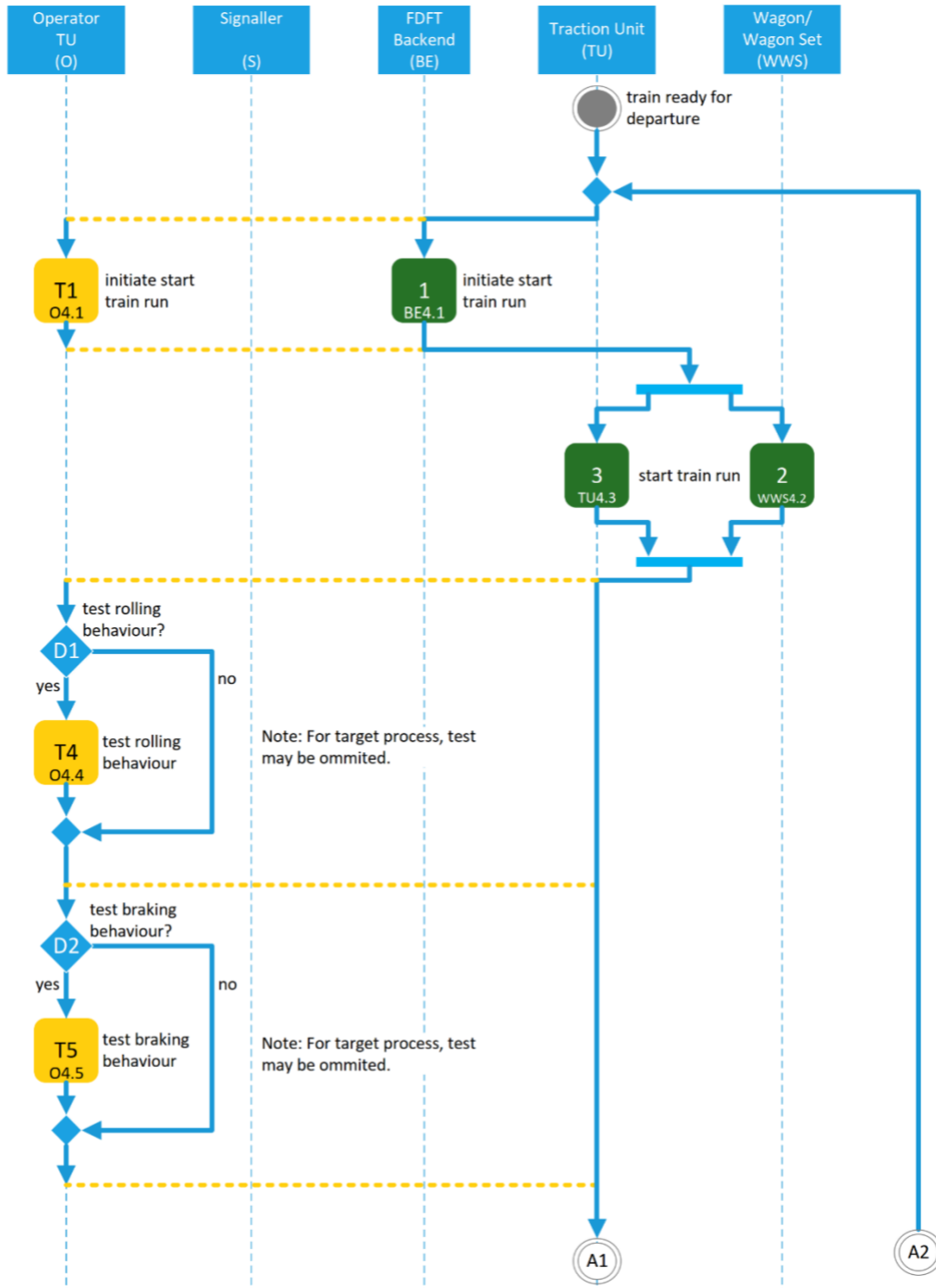


Figure 24: TP04 Train Run - 1 of 2

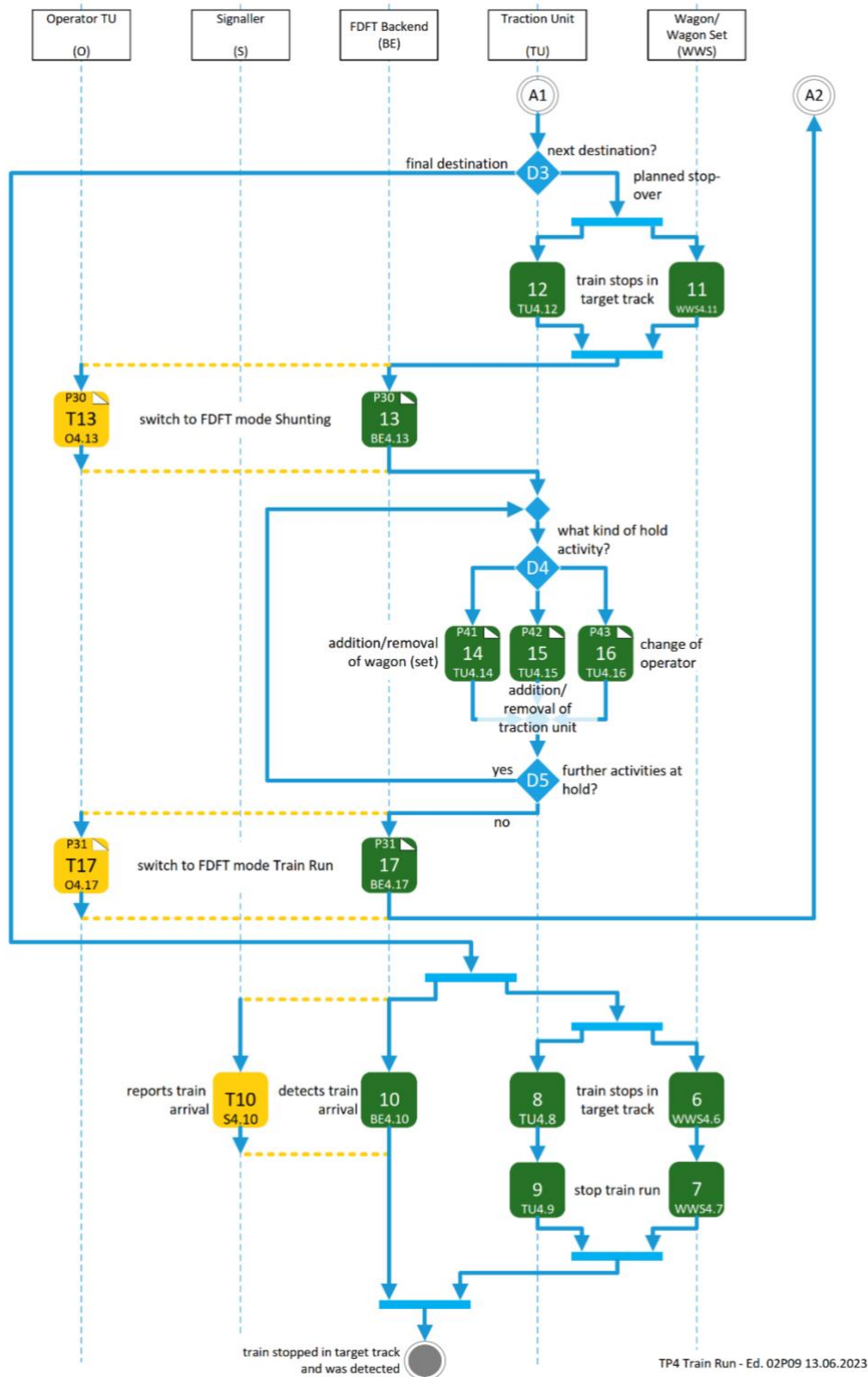


Figure 25: TP04 Train Run - 2 of 2

## 8.4.5.2 Process-Description

### BE4.1

Activity	Initiate start train run
Precondition	<ul style="list-style-type: none"> <li>Train is ready to departure and operator reports readiness to departure</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available and can initiate train run.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>FDFT Backend triggers the operational start of train run (e.g. ensures that uniquely identifiable composition of Traction Unit and Wagon (set) is given) and initiates train movement.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### O4.1

Activity	Initiate start train run
Precondition	<ul style="list-style-type: none"> <li>Train is ready to departure and operator reports readiness to departure</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Operator triggers the operational start of train run (e.g. ensures that uniquely identifiable composition of Traction Unit and Wagon (set) is given) and initiates train movement.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU4.3

Activity Start train run

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

### WWS4.2

Activity Start train run

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

### D1

Decision Test rolling behaviour?

- Conditions ▪ Do regulations require testing of the rolling behaviour?
- Yes ▪ Rolling behaviour should be tested.
- No ▪ Rolling behaviour should not be tested.
- Remarks ▪ -
- Rationale ▪ -

#### O4.4

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

#### D2

Decision	Test braking behaviour?
Conditions	▪ Do regulations require testing of the braking behaviour?
Yes	▪ Braking behaviour should be tested.
No	▪ Braking behaviour should not be tested.
Remarks	▪ -
Rationale	▪ -

#### O4.5

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

### D3

#### Decision      Next destination?

- |                   |   |
|-------------------|---|
| Final Destination | ▪ Next destination is the final stop of train run.                        |
| Planned Stop-Over | ▪ Next destination is a planned stop-over of train run.                   |
| Remarks           | ▪ Unplanned stops (e.g. malfunctions) are not considered in this process. |
| Rationale         | ▪ -   |

### WWS4.6

#### Activity      Train stops in target track

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

### WWS4.7

#### Activity      Stop train run

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



#### TU4.8

Activity Train stops in target track

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

#### TU4.9

Activity Stop train run

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

#### BE4.10

Activity 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.
- 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.
Rationale	▪ -
Postcondition	▪ -

#### TU4.12

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

#### WWS4.11

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

### BE4.13

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### O4.13

Activity	Subprocess: Switch to FDFT mode Shunting
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.19
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D4

Decision	What kind of hold activity?
Addition, removal of Wagon	▪ -
Addition, removal of Traction Unit	▪ -
Change Of Operator	▪ -
Remark	▪ -
Rationale	▪ -

#### TU4.14

Activity Subprocess: Addition, Removal of Wagon (Set)

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

#### TU4.15

Activity Subprocess: Addition, Removal of Traction Unit

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

#### TU4.16

Activity Subprocess: Change of Operator

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

#### D5

Decision	Further activities at hold?
yes	<ul style="list-style-type: none"> <li>Further activities at hold are planned.</li> </ul>
no	<ul style="list-style-type: none"> <li>All activities at hold are completed.</li> </ul>
Remark	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>

#### BE4.17

Activity	Subprocess: Switch to FDFT mode train run
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available and can initiate switch to FDFT mode Train Run.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>See subprocess description 8.4.20</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

#### O4.17

Activity	Subprocess: Switch to FDFT mode train run
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>See subprocess description 8.4.20</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### 8.4.6 TP05 - Hump Shunting

#### 8.4.6.1 Target Process

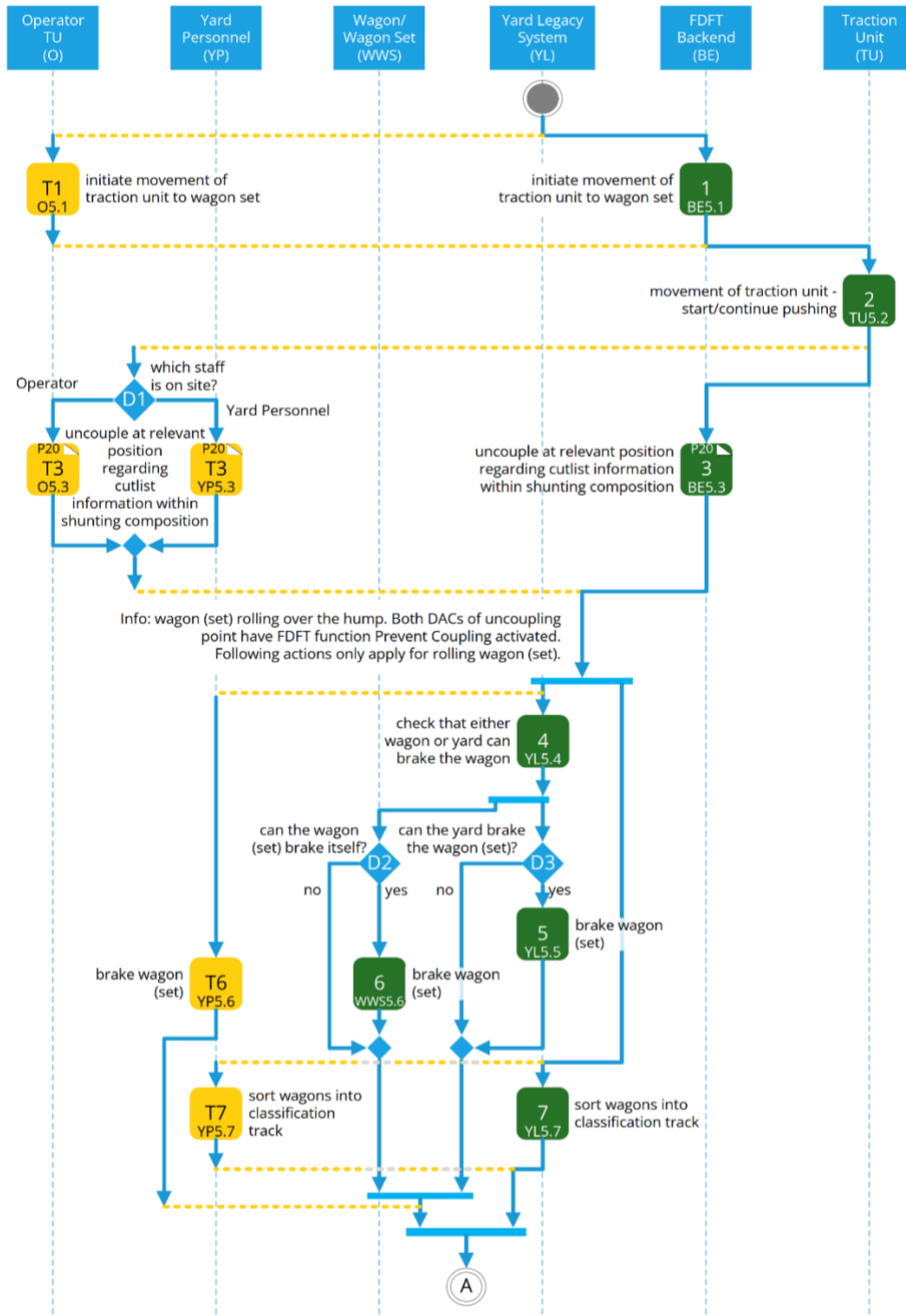


Figure 26: TP05 Hump Shunting - 1 of 2

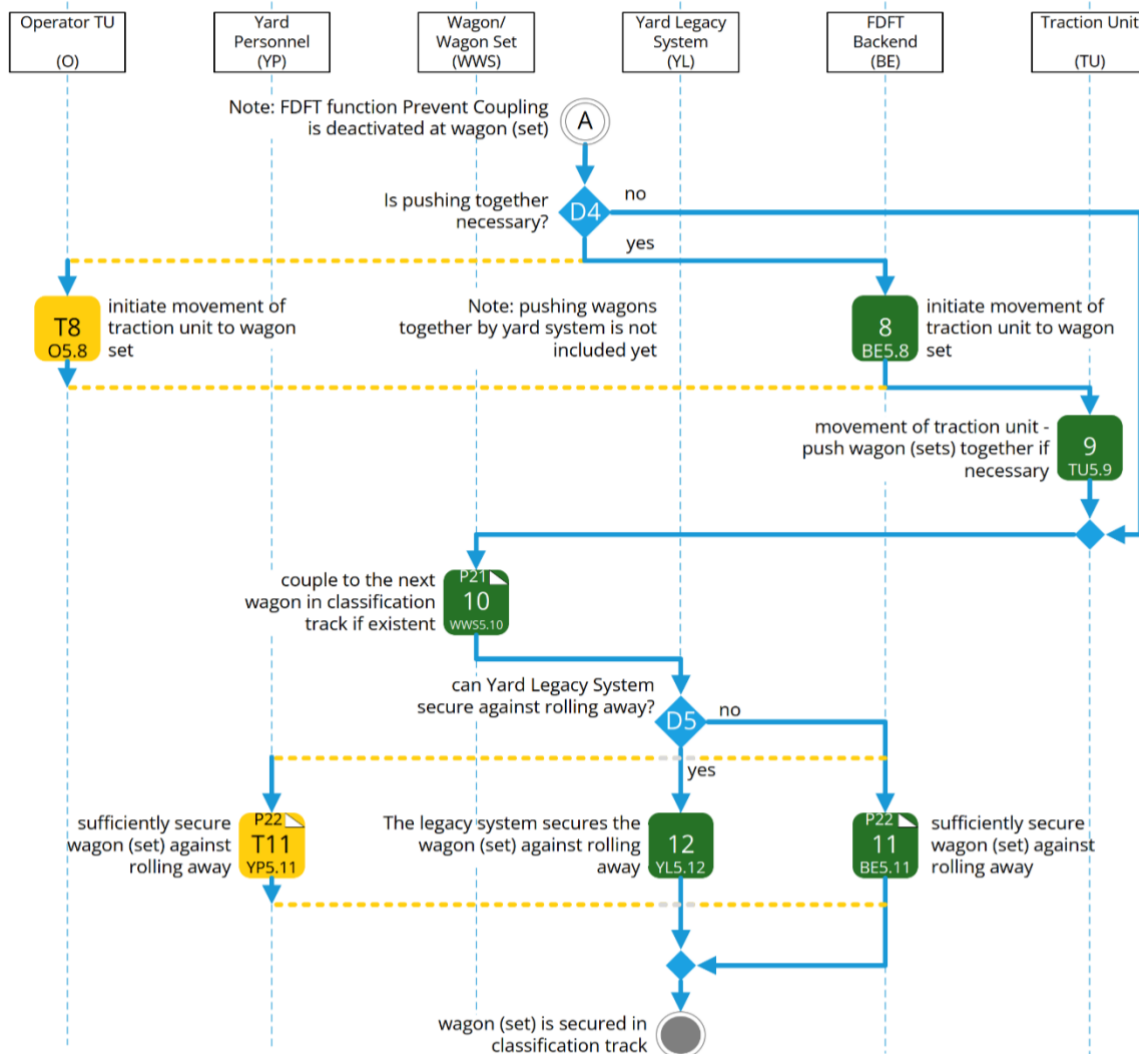


Figure 27: TP05 Hump Shunting - 2 of 2

## 8.4.6.2 Process-Description

### BE5.1

Activity	Initiate movement of traction unit to wagon set
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available and can initiate movement of wagon set.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### O5.1

Activity	Initiate movement of traction unit to wagon set
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU5.2

Activity	Start/continue pushing
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Traction Unit pushes the wagon set up over the hump according to local regulations.</li> <li>Traction Unit is controlled by FDFT Backend or Yard Legacy System.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>



### BE5.3

Activity	Subprocess: Uncouple at relevant position regarding cutlist information within shunting composition
Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with the FDFT Wagen Base System and can initiate uncoupling.
Tasks	▪ See subprocess Uncouple 8.4.13.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D1

Decision	Which staff is on site?
Operator	▪ Operator is on site.
Yard Personnel	▪ Yard Personnel is on site.
Remarks	▪ -
Rationale	▪ -

### YP5.3

Activity Subprocess: Uncouple at relevant position regarding cutlist information within shunting composition

- Precondition      ▪ -
- Conditions        ▪ -
- Tasks             ▪ See Subprocess Uncouple 8.4.13
- Remarks         ▪ -
- Rationale         ▪ -
- Postcondition    ▪ -

### O5.3

Activity Subprocess: Uncouple at relevant position regarding cutlist information within shunting composition

- Precondition      ▪ -
- Conditions        ▪ -
- Tasks             ▪ See Subprocess Uncouple 8.4.13
- Remarks         ▪ -
- Rationale         ▪ -
- Postcondition    ▪ -

### YL5.4

Activity Check that either wagon or yard can brake the wagon

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

## D2

Decision Can the wagon (set) brake itself?

yes 

- The wagon has a Controllable Brake, which brakes the wagon (set).

no 

- -

Remarks 

- -

Rationale 

- -

## D3

Decision Can the Yard brake the wagon (set)?

yes 

- The Yard has a brake system, which brakes the wagon (set).

no 

- -

Remarks 

- -

Rationale 

- -

## YL5.5

Activity Brake the wagon (set)

Precondition 

- -

Conditions 

- -

Tasks 

- The infrastructure-side system brakes the wagon (set) so that it either comes to a standstill at a certain point in the track or hits the front wagon at a certain speed.

Remarks 

- -

Rationale 

- -

Postcondition 

- -

### WWS5.6

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

### YP5.6

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

### YL5.7

Activity	Sort wagon(s) 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 wagon(s) run into the planned track.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YP5.7

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

### D4

Decision	Is pushing together necessary
yes	▪ It is necessary
Remarks	▪ -
Rationale	▪ -

### BE5.8

Activity	Initiate movement of traction unit to wagon set
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	▪ -
Rationale	▪ -
Postcondition	▪ -

### O5.8

Activity	Initiate movement of traction unit to wagon set
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU5.9

Activity	Push wagon (sets) together if necessary
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>If necessary, a traction unit push the wagon set together so that wagon (set) can couple.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>Performed only when a planned coupling between wagon(s) has not occurred.</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### WWS5.10

Activity	Subprocess: Couple to the next wagon in classification track if existent
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>See subprocess Couple 8.4.14</li> <li>Couple to the next wagon in classification group if existent.</li> <li>Multiple coupling processes can be checked in total at a later step.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>This step is not necessary if this is the first wagon for the new wagon set to be formed.</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

**D5**

Decision Can Yard Legacy System secure against rolling away?

Yes
 

- Yard Legacy System can secure the wagon (set) against rolling away?

Remarks
 

- -

Rationale
 

- -

**BE5.11**

Activity Subprocess: sufficiently secure Wagon (Set) against rolling away

Precondition
 

- -

Conditions
 

- FDFT Backend is available and can initiate secure wagon (set) against rolling away.

Tasks
 

- See Subprocess 8.4.15
- Sufficiently secure wagon against rolling away.

Remarks
 

- -

Rationale
 

- -

Postcondition
 

- -

**YP5.11**

Activity Subprocess: sufficiently secure Wagon (Set) against rolling away

Precondition
 

- -

Conditions
 

- -

Tasks
 

- See Subprocess 8.4.15
- Sufficiently secure wagon against rolling away.

Remarks
 

- -

Rationale
 

- -

Postcondition
 

- -

**YL5.12**

Activity	Sufficiently secure Wagon (Set) against rolling away
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ The infrastructure has a system that secures the wagon(s) from rolling away.</li> <li>▪ Yard legacy system initiates securing the wagon (set) against rolling away.</li> <li>▪ The infrastructure sided system secures the wagon (set) against rolling away and checks, if the wagon (set) is secured.</li> <li>▪ If available the Yard legacy system sends the securing data to FDFT Backend.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -



### 8.4.7 TP06 – Fly Shunting

#### 8.4.7.1 Target Process

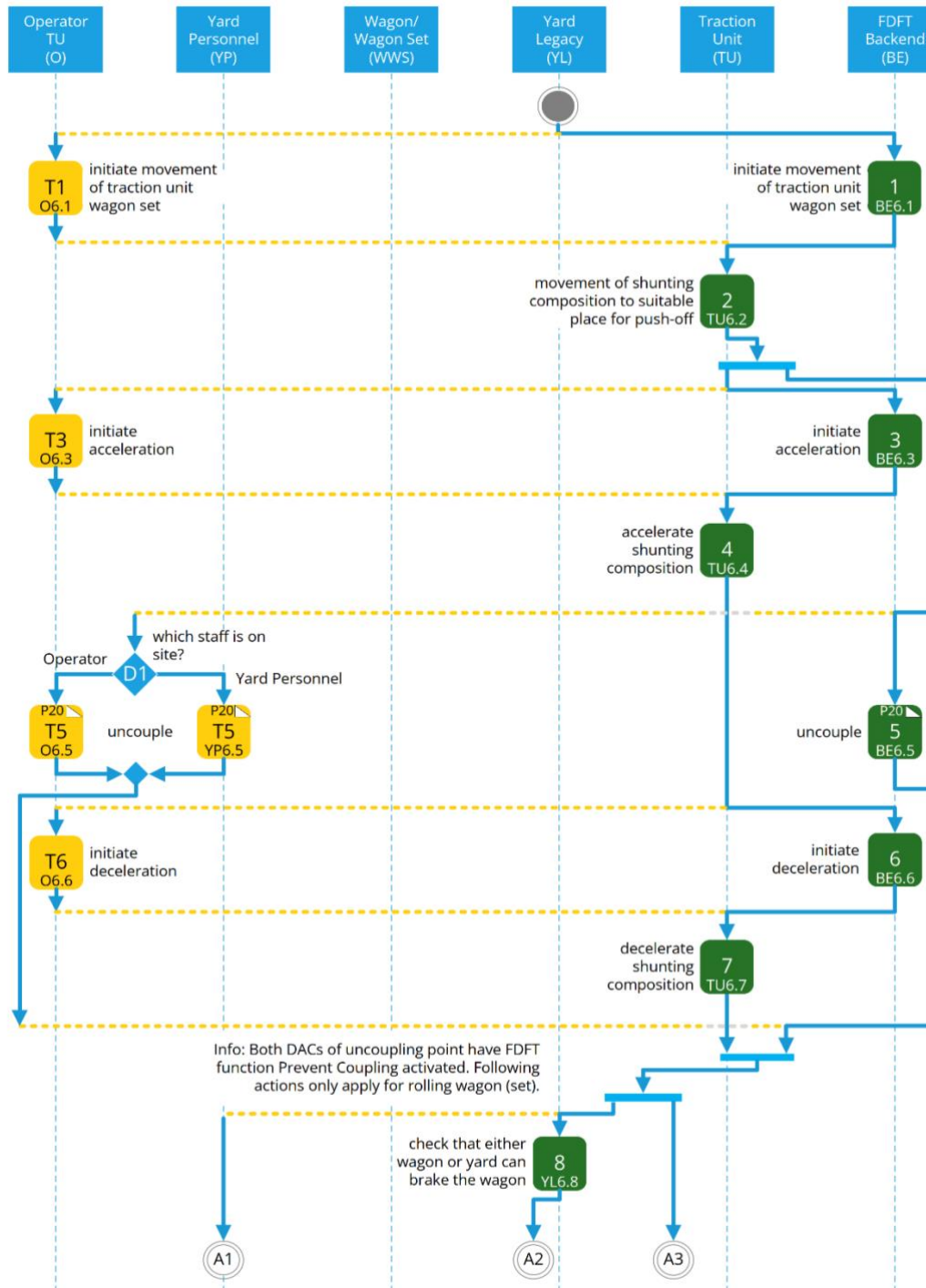
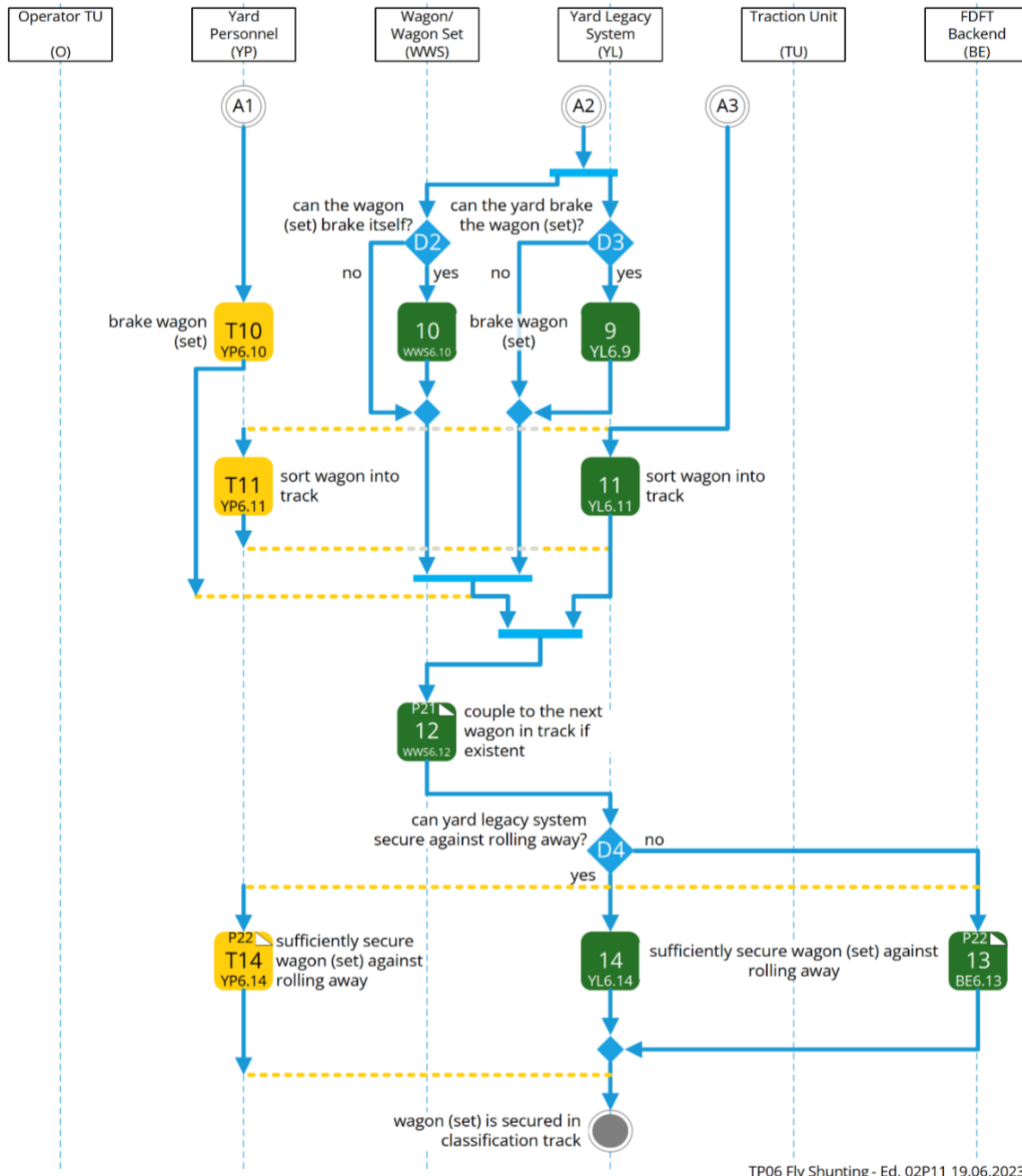


Figure 28: TP06 Fly Shunting - 1 of 2



TP06 Fly Shunting - Ed. 02P11 19.06.2023

Figure 29: TP06 Fly Shunting - 2 of 2

### 8.4.7.2 Process-Description

#### BE6.1

Activity	Initiate movement of traction unit to wagon set
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available and can initiate movement of Traction Unit.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

#### O6.1

Activity	Initiate movement of traction unit to wagon set
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

#### TU6.2

Activity	Move shunting composition to suitable place for push-off
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Movement of Traction Unit to suitable place for push off.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### BE6.3

Activity	Initiate acceleration
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available and can initiate acceleration.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### O6.3

Activity	Initiate acceleration
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU6.4

Activity	Accelerate shunting composition
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Shunting composition accelerates to fly shunting speed.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>The fly shunting speed depends on the characteristics of the wagon set, the infrastructure, and the point at which the wagon(s) are to stop in the track.</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### BE6.5

Activity Subprocess: Uncouple

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

### BE6.6

Activity Initiate deceleration

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

### O6.6

Activity Initiate deceleration

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

### TU6.7

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

### D1

Decision	Which staff is on site?
Operator	▪ Operator is on site.
Yard Personnel	▪ Yard Personnel is on site.
Remarks	▪ -
Rationale	▪ -

### O6.5

Activity	Subprocess: Uncouple
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See Subprocess Uncouple 8.4.13 ▪ Uncouple at uncoupling point
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YP6.5

Activity Subprocess: Uncouple

- Precondition ▪ -
- Conditions ▪ -
- Tasks
  - See Subprocess Uncouple 8.4.13
  - Uncouple at uncoupling point.
- Remarks ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### YL6.8

Activity Check that either wagon or yard can brake the wagon

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

### D2

Decision Can the wagon (set) brake itself?

- yes
  - The wagon has a Controllable Brake, which brakes the wagon (set).
- no
  - -
- Remarks ▪ -
- Rationale ▪ -

### WWS6.10

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

### D3

Decision	Can the Yard brake the wagon (set)?
yes	▪ The Yard has a brake system, which brakes the wagon (set).
no	▪ -
Remarks	▪ -
Rationale	▪ -

### YL6.9

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



### YP6.10

Activity	Brake wagon (set)
Precondition	-
Conditions	-
Tasks	Yard Personnel brakes the wagon (set) according to legacy processes.
Remarks	-
Rationale	-
Postcondition	-

### YL6.11

Activity	Sort wagon(s) 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 wagon(s) run off into the planned track.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YP6.11

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

### WWS6.12

Activity	Subprocess: Couple to the next wagon in track if existent
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ See subprocess Couple 8.4.14</li> <li>▪ Couple to the next wagon in track if existent.</li> <li>▪ Multiple coupling processes can be checked in total at a later step.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ This step is not necessary if this is the first wagon for the new wagon set to be formed.</li> </ul>
Rationale	▪ -
Postcondition	▪ -

### D4

Decision	Can Yard Legacy System secure against rolling away?
Yes	▪ -
Remarks	<ul style="list-style-type: none"> <li>▪ If Yard Legacy System</li> </ul>
Rationale	▪ -

### BE6.13

Activity	Subprocess: sufficiently secure Wagon (Set) against rolling away
Precondition	▪ -
Conditions	<ul style="list-style-type: none"> <li>▪ FDFT Backend is available and can initiate secure wagon (set) against rolling away.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>▪ See Subprocess Secure wagon set against rolling away 8.4.15</li> <li>▪ Sufficiently secure wagon against rolling away.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YL6.14

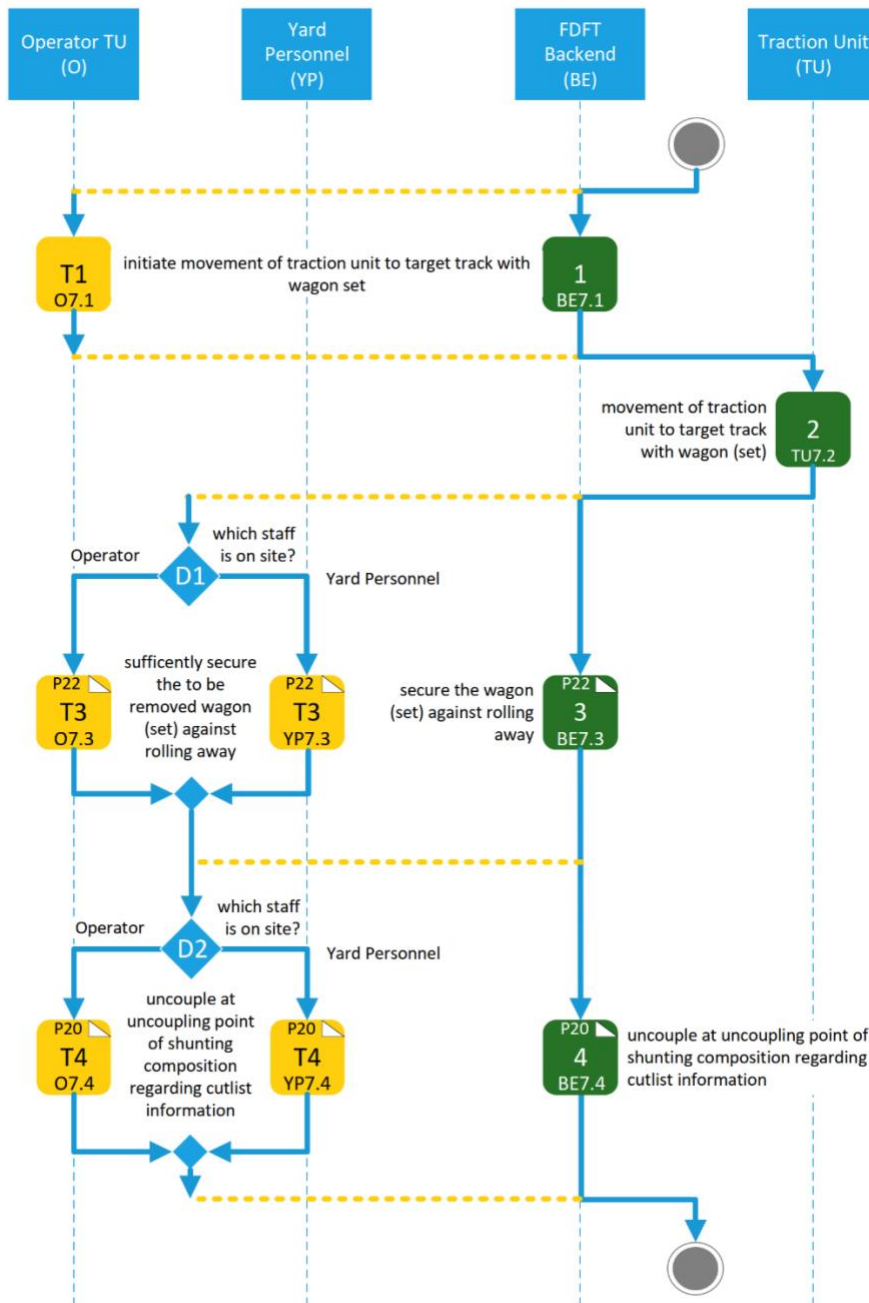
Activity	Sufficiently secure Wagon (Set) against rolling away
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ The infrastructure has a system that secures the wagon(s) from rolling away.</li> <li>▪ Yard legacy system initiates securing the wagon (set) against rolling away.</li> <li>▪ The infrastructure sided system secures the wagon (set) against rolling away and checks, if the wagon (set) is secured.</li> <li>▪ If available, the Yard legacy system sends the securing data to FDFT Backend.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### YP6.14

Activity	Subprocess: sufficiently secure Wagon (Set) against rolling away
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ See Subprocess Secure wagon set against rolling away 8.4.15</li> <li>▪ Sufficiently secure wagon against rolling away.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### 8.4.8 TP07 - Flat Shunting Drop Off

#### 8.4.8.1 Target Process



Subprocess TP07 Flat Shunting Drop Off - Ed. 02P08 13.06.2023

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

### 8.4.8.2 Process-Description

#### BE7.1

Activity	Initiate movement of traction unit to target track with wagon set
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend available and can initiate movement of Traction Unit.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

#### O7.1

Activity	Initiate movement of traction unit to target track with wagon set
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU7.2

Activity Movement to target track with wagon (set)

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

### BE7.3

Activity Subprocess: Secure the wagon (set) against rolling away

- Precondition ▪ -
- Conditions ▪ FDFT Backend is available. Controllable brake is available and can initiate securing the wagon. FDFT backend is available and can communicate with the FDFT Wagon Base system.
- Tasks ▪ See subprocess description 8.4.15  
▪ The wagon set to be removed has to be secured.
- Remarks ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### BE7.4

Activity Subprocess: Uncouple at uncoupling point of shunting composition regarding cutlist information

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

### D1

Decision Which staff is on site?

Operator ▪ Operator is on site.

Yard Personnel ▪ Yard Personnel is on site.

Remarks ▪ -

Rationale ▪ -

### O7.3

Activity Subprocess: sufficiently secure the to be removed wagon (set) against rolling away

Precondition ▪ -

Conditions ▪ -

Tasks ▪ See subprocess description 8.4.15  
▪ Secure the wagon (set) to be removed against rolling away.

Remarks ▪ -

Rationale ▪ -

Postcondition ▪ -

### YP7.3

Activity Subprocess: sufficiently secure the to be removed wagon (set) against rolling away

Precondition ▪ -

Conditions ▪ -

Tasks ▪ See subprocess description 8.4.15  
▪ Secure the wagon (set) to be removed against rolling away.

Remarks ▪ -

Rationale ▪ -

Postcondition ▪ -

## D2

Decision Which staff is on site?

Operator ▪ Operator is on site.

Yard Personnel ▪ Yard Personnel is on site.

Remarks ▪ -

Rationale ▪ -

## O7.4

Activity 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 ▪ -

Rationale ▪ -

Postcondition ▪ -



#### YP7.4

Activity 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

- -

Rationale

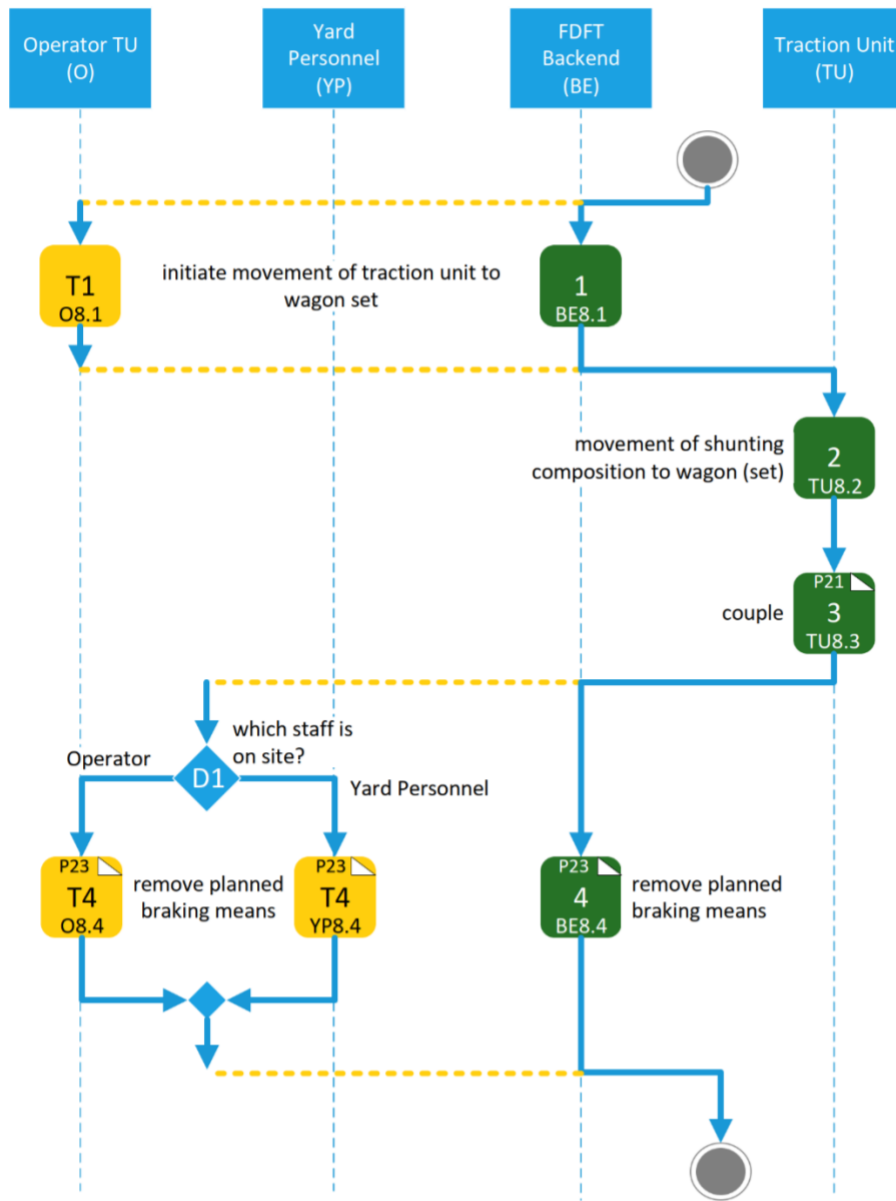
- -

Postcondition

- -

### 8.4.9 TP08 - Flat Shunting Pick Up

#### 8.4.9.1 Target Process



Subprocess TP08 Flat Shunting Pick Up - Ed. 02P08 13.06.2023

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

### 8.4.9.2 Process-Description

#### BE8.1

Activity	Initiate movement of traction unit to wagon set
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available and can initiate movement of Traction Unit.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

#### O8.1

Activity	Initiate movement of traction unit to wagon set
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

#### TU8.2

Activity	Movement of shunting composition to wagon (set)
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Movement of shunting composition to wagon (set) which will be picked up.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU8.3

Activity Subprocess: Couple

- Precondition ▪ -
- Conditions ▪ -
- Tasks ▪ See subprocess description 8.4.14  
▪ Couple shunting composition or traction unit to wagon (set).
- Remarks ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### BE8.4

Activity Subprocess: Remove planned braking means

- Precondition ▪ -
- Conditions ▪ Controllable brake is available and can initiate securing the wagon. FDFT Backend is available and can communicate with the FDFT Wagon Base system.
- Tasks ▪ See subprocess description 8.4.16
- Remarks ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### D1

Decision Which staff is on site?

- Operator ▪ Operator is on site.
- Yard Personnel ▪ Yard Personnel is on site.
- Remarks ▪ -
- Rationale ▪ -

#### O8.4

Activity Subprocess: Remove planned braking means

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

#### YP8.4

Activity Subprocess: Remove planned braking means

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

### 8.4.10 TP09 - Automated Brake Test

#### 8.4.10.1 Target Process

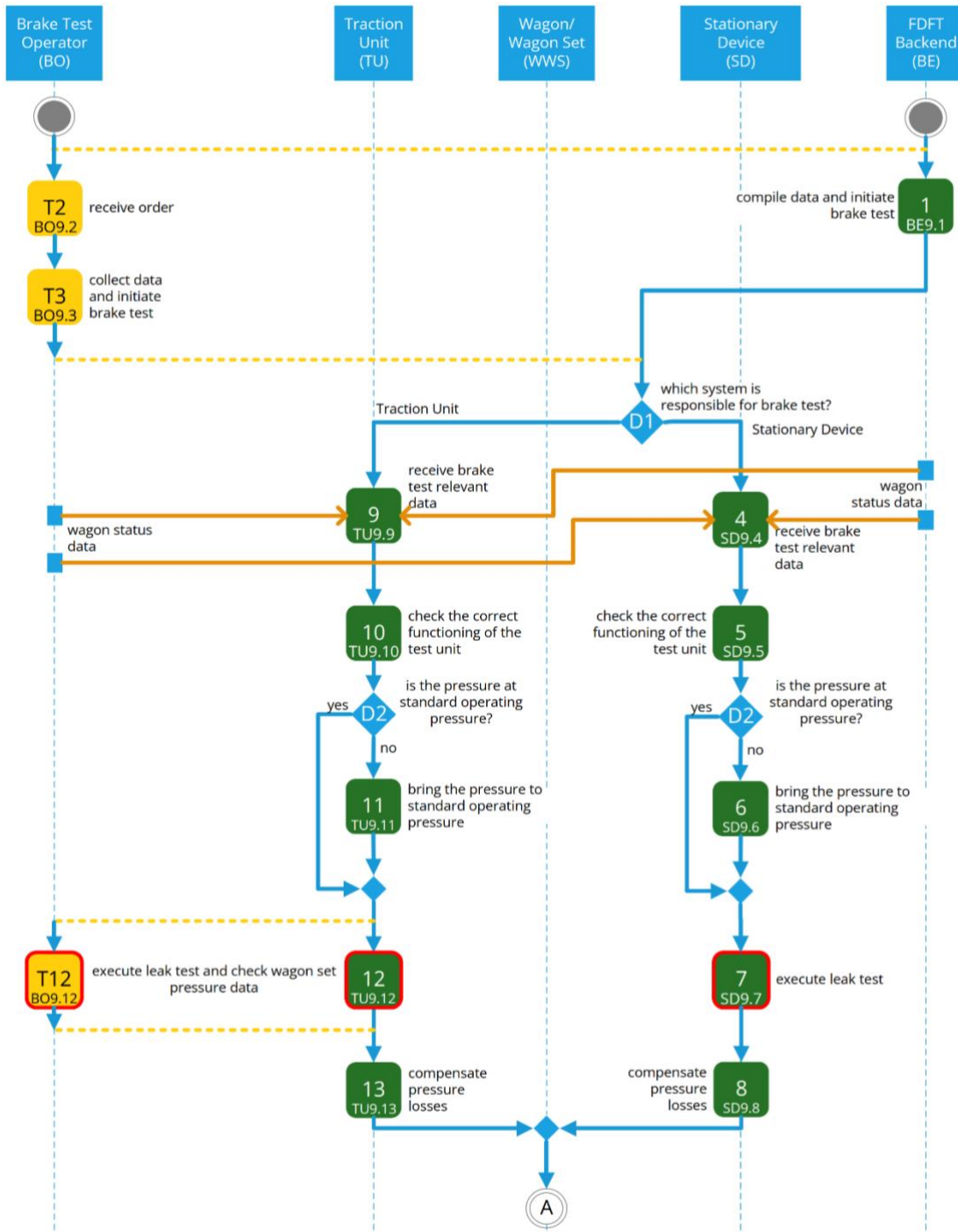


Figure 32: TP09 Automated Brake Test - 1 of 3

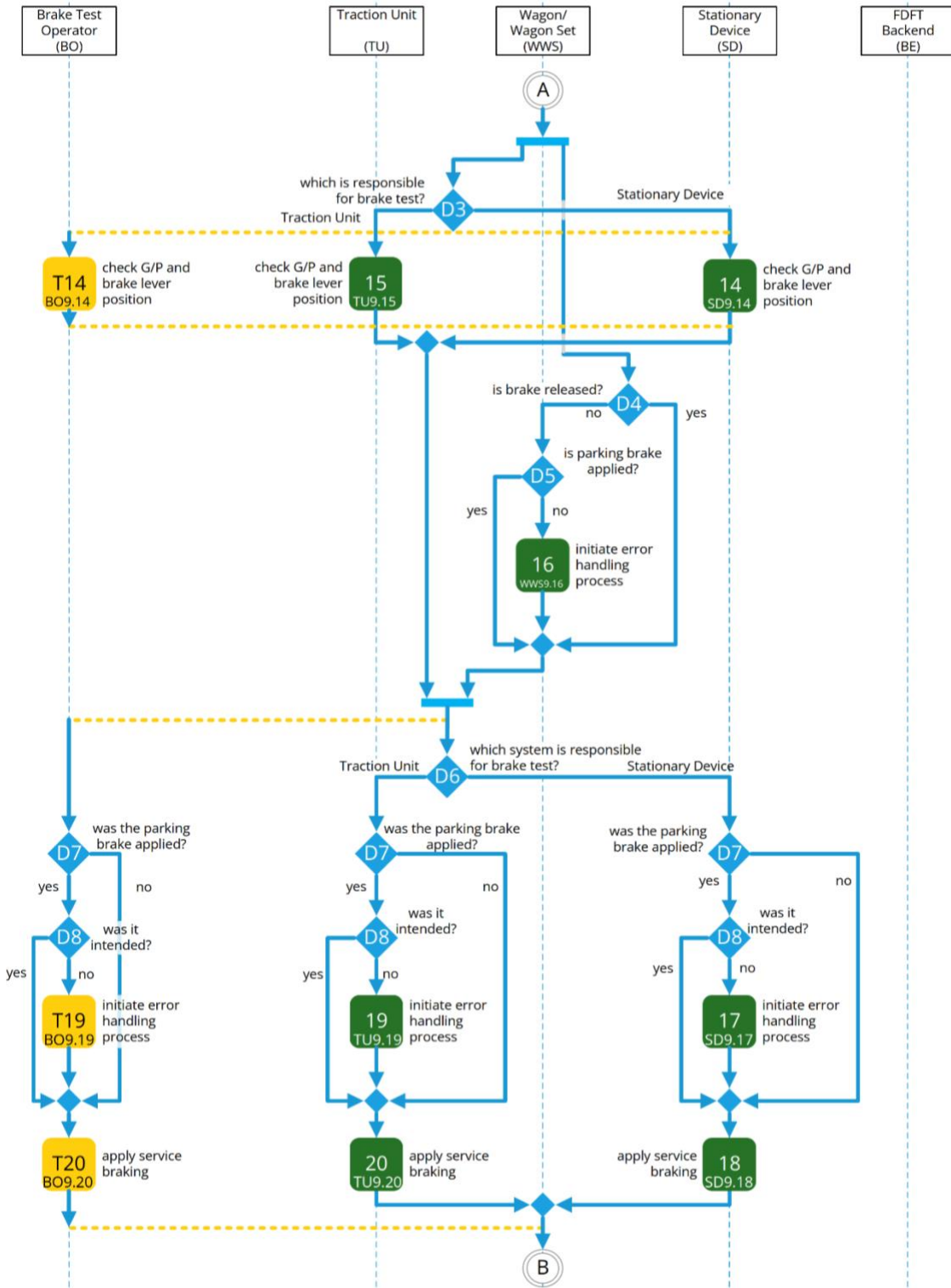
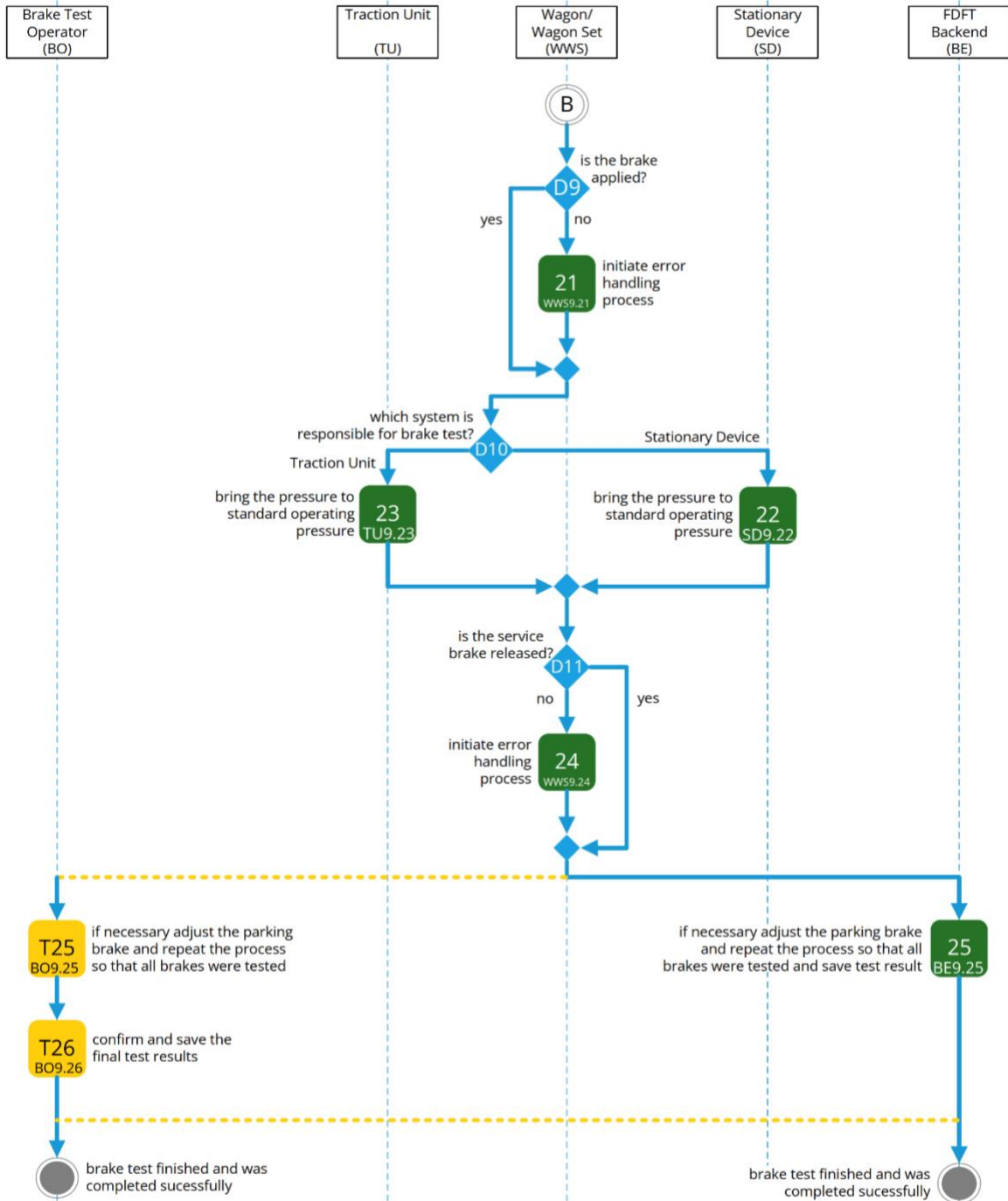


Figure 33: TP09 Automated Brake Test - 2 of 3



TP09 Automated Brake Test - Ed. 02P09 13.06.2023

Figure 34: TP09 Automated Brake Test - 3 of 3



### 8.4.10.2 Process-Description

#### BE9.1

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

#### BO9.2

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

#### BO9.3

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

### D1

Decision Which is responsible for brake test?

Traction Unit     ▪ -

Stationary Device     ▪ -

Remarks     ▪ -

Rationale     ▪ -

### SD9.4

Activity Receive brake test relevant data

Precondition     ▪ -

Conditions     ▪ -

Tasks     ▪ Stationary Device receives brake test relevant data.

Remarks     ▪ -

Rationale     ▪ -

Postcondition     ▪ -

### SD9.5

Activity Check the correct functioning of the test unit

Precondition     ▪ -

Conditions     ▪ -

Tasks     ▪ Correct functioning of test unit on Stationary Device is checked.

Remarks     ▪ -

Rationale     ▪ -

Postcondition     ▪ -

## D2

Decision Is the pressure at standard operating pressure?

Yes
 

- The pressure is at standard operating pressure.

Remarks
 

- -

Rationale
 

- -

## SD9.6

Activity Bring the pressure to standard operating pressure

Precondition
 

- -

Conditions
 

- -

Tasks
 

- Stationary Device brings pressure in air pipe to standard operating pressure.

Remarks
 

- -

Rationale
 

- -

Postcondition
 

- -

## SD9.7

Activity Execute leak test

Precondition
 

- -

Conditions
 

- -

Tasks
 

- Stationary Device executes leak test.

Remarks
 

- -

Rationale
 

- -

Postcondition
 

- -

### SD9.8

Activity                      Compensate pressure losses

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

### TU9.9

Activity                      Receive brake test relevant data

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

### TU9.10

Activity                      Check the correct functioning of the test unit

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

## D2

Decision Is the pressure at standard operating pressure?

Yes ▪ The pressure is at standard operating pressure.

Remarks ▪ -

Rationale ▪ -

## TU9.11

Activity Bring the pressure to standard operating pressure

Precondition ▪ -

Conditions ▪ -

Tasks ▪ Traction Unit brings pressure in air pipe to standard operating pressure.

Remarks ▪ -

Rationale ▪ -

Postcondition ▪ -

## TU9.12

Activity Execute leak test and check wagon set pressure data

Precondition ▪ -

Conditions ▪ Traction Unit can receive pressure data for each wagon.

Tasks ▪ Traction Unit executes leak test and checks pressure data for each wagon in set.

Remarks ▪ -

Rationale ▪ -

Postcondition ▪ -

### BO9.12

Activity	Execute leak test and check wagon set pressure data
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Brake Test Operator receives wagon pressure data via the mobile HMI.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### TU9.13

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

### D3

Decision	Which is responsible for brake test?
FDFT Backend	▪ -
Stationary Device	▪ -
Remarks	▪ -
Rationale	▪ -

### SD9.14

Activity Check G/P and brake lever position

Precondition ▪ -

Conditions ▪ The Stationary Device can check the brake lever position.

Tasks ▪ Check planned G/P Brake and lever position.

Remarks ▪ -

Rationale ▪ -

Postcondition ▪ -

### BO9.14

Activity Check G/P and brake lever position

Precondition ▪ -

Conditions ▪ -

Tasks ▪ Break Test operator checks planned G/P Brake and lever position.

Remarks ▪ -

Rationale ▪ -

Postcondition ▪ -

### TU9.15

Activity Check brake lever position

Precondition ▪ -

Conditions ▪ The Traction Unit can check the brake lever position.

Tasks ▪ Check planned G/P Brake and lever position.

Remarks ▪ -

Rationale ▪ -

Postcondition ▪ -

#### D4

Decision Is brake released?

Yes ▪ Brake(s) are released.

Remarks ▪ -

Rationale ▪ -

#### D5

Decision Is the parking brake applied?

yes ▪ Parking brake is applied.

Remarks ▪ -

Rationale ▪ -

#### WWS9.16

Activity Initiate error handling process

Precondition ▪ -

Conditions ▪ -

Tasks ▪ FDFT Wagon Base System reports failure in automated brake test.  
▪ This information can be used to trigger an error handling process.

Remarks ▪ -

Rationale ▪ -

Postcondition ▪ -



### D6

Decision	Which is responsible for brake test?
Conditions	<ul style="list-style-type: none"> <li>▪ This System used for the brake test can check if the service brake was applied.</li> </ul>
FDFT Backend	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Stationary Device	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ if neither the TU nor the system is responsible, the yellow path (partially automated) need to be followed.</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>▪ -</li> </ul>

### D7

Decision	Was the parking brake applied?
Yes	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>▪ -</li> </ul>

### D8

Decision	Was it intended?
Yes	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>▪ -</li> </ul>

### SD9.17

Activity	Initiate error handling process
Precondition	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>▪ Stationary Device reports failure in automated brake test.</li> <li>▪ This information can be used to trigger an error handling process.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>▪ -</li> </ul>

### SD9.18

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

### TU9.19

Activity	Initiate error handling process
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Traction Unit reports failure in automated brake test.</li> <li>▪ This information can be used to trigger an error handling process.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### TU9.20

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

**BO9.19**

Activity	Initiate error handling process
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Brake Test Operator reports failure in automated brake test.</li> <li>▪ This information can be used to trigger an error handling process.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

**BO9.20**

Activity	Apply service braking
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Brake Test Operator applies service braking.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

**D9**

Decision	Is the brake applied?
Yes	▪ -
Remarks	▪ -
Rationale	▪ -

### WWS9.21

Activity	Initiate error handling process
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ FDFT Wagon Base System reports failure in automated brake test.</li> <li>▪ This information can be used to trigger an error handling process.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D10

Decision	Which is responsible for brake test?
FDFT Backend	▪ -
Stationary Device	▪ -
Remarks	▪ -
Rationale	▪ -

### SD9.22

Activity	Bring the pressure to standard operating pressure
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Stationary Device brings pressure in air pipe to standard operating pressure.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### TU9.23

Activity	Bring the pressure to standard operating pressure
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Traction Unit brings pressure in air pipe to standard operating pressure.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D11

Decision	Is the service brake released?
Yes	▪ The service brake is released
Remarks	▪ -
Rationale	▪ -

### WWS9.24

Activity	Initiate error handling process
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ FDFT Wagon Base System reports failure in automated brake test.</li> <li>▪ This information can be used to trigger an error handling process</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE9.25

**Activity** 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** ▪ -

**Remarks** ▪ -

**Rationale** ▪ -

**Postcondition** ▪ -

### BO9.25

**Activity** 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** ▪ -

**Rationale** ▪ -

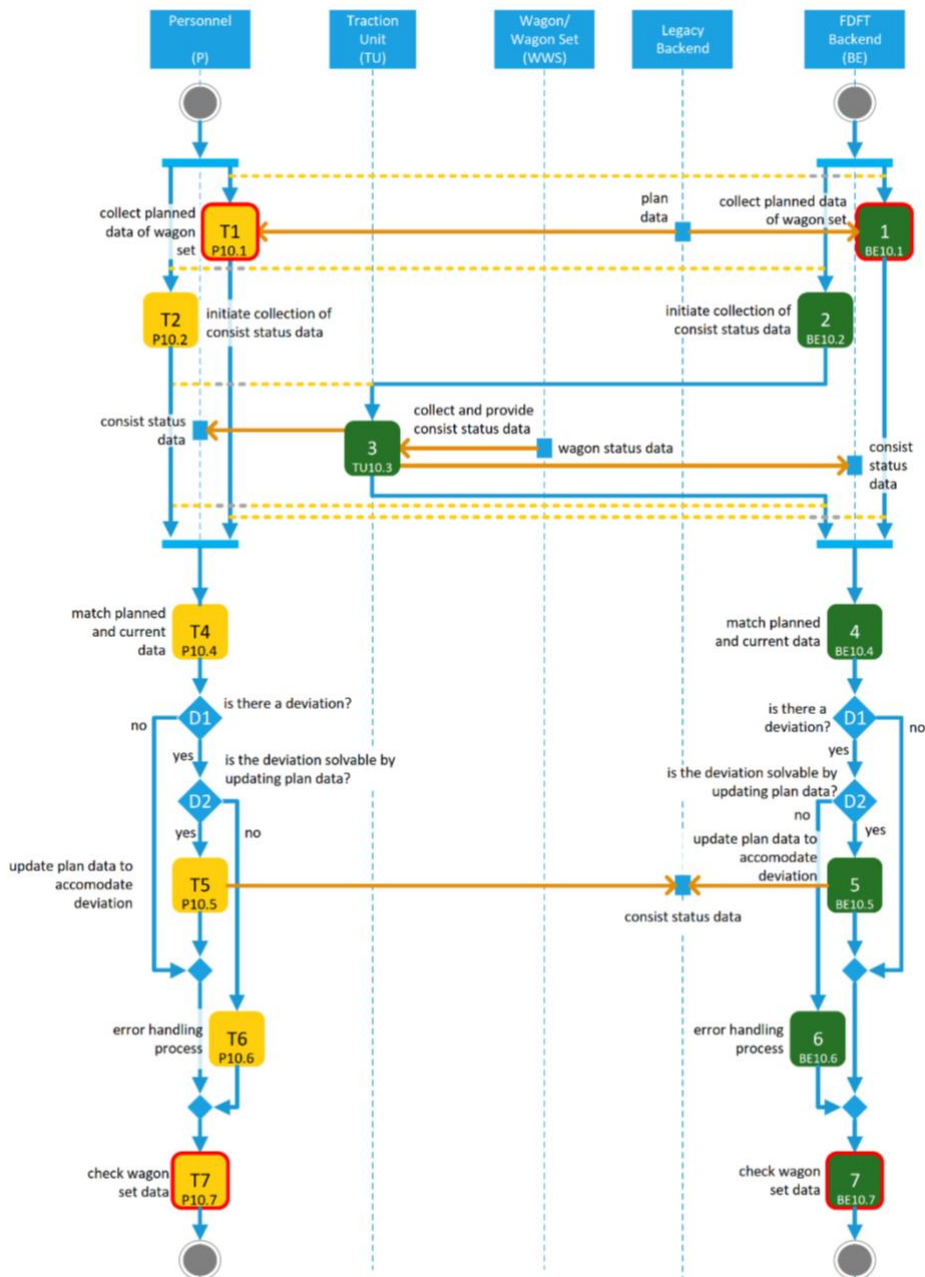
**Postcondition** ▪ -

**BO9.26**

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

### 8.4.11 TP10 - Confirm Wagon Set

#### 8.4.11.1 Target Process



Subprocess TP10 Confirm Wagon Set - Ed. 02P07 14.06.2023

Figure 35: TP10 Confirm Wagon Set - 1 of 1



### 8.4.11.2 Process-Description

#### BE10.1

Activity	Collect planned data of wagon set
Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with FDFT Wagon Base System.
Tasks	<ul style="list-style-type: none"> <li>▪ FDFT Backend collects data on wagon set to be processed.</li> <li>▪ Information is retrieved from planning systems (e.g. operator specific planning systems)</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

#### BE10.2

Activity	Initiate collection of consist status data
Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with FDFT Wagon Base System.
Tasks	<ul style="list-style-type: none"> <li>▪ FDFT Backend triggers train composition detection function</li> <li>▪ -</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### TU10.3

Activity	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
Rationale	▪ -
Postcondition	▪ -

### P10.1

Activity	Collect planned data of wagon set
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel collects planned data of wagon set via legacy system
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### P10.2

Activity	Initiate collection of consist status data
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel triggers train composition detection function
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE10.4

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### D1

Decision	Is there a deviation?
Yes	▪ Deviation between plan data and current data was found.
Remarks	▪ -
Rationale	▪ -

### D2

Decision	Is the deviation solvable by updating plan data?
Yes	▪ A change of plan data is sufficient to correct the deviations.
Remarks	▪ -
Rationale	▪ -

### BE10.5

Activity 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 ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### BE10.6

Activity 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 ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### BE10.7

Activity Check wagon set data

- Precondition ▪ -
- Conditions ▪ FDFT Backend is available.
- Tasks ▪ FDFT Backend checks that current wagon set data matches planned data.
- Remarks ▪ -
- Rationale ▪ -
- Postcondition ▪ -

#### P10.4

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

#### P10.5

Activity	Update plan data to accommodate deviations
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Personnel changes plan data to reflect found deviations.</li> <li>▪ The new plan state equals the current state.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

#### P10.6

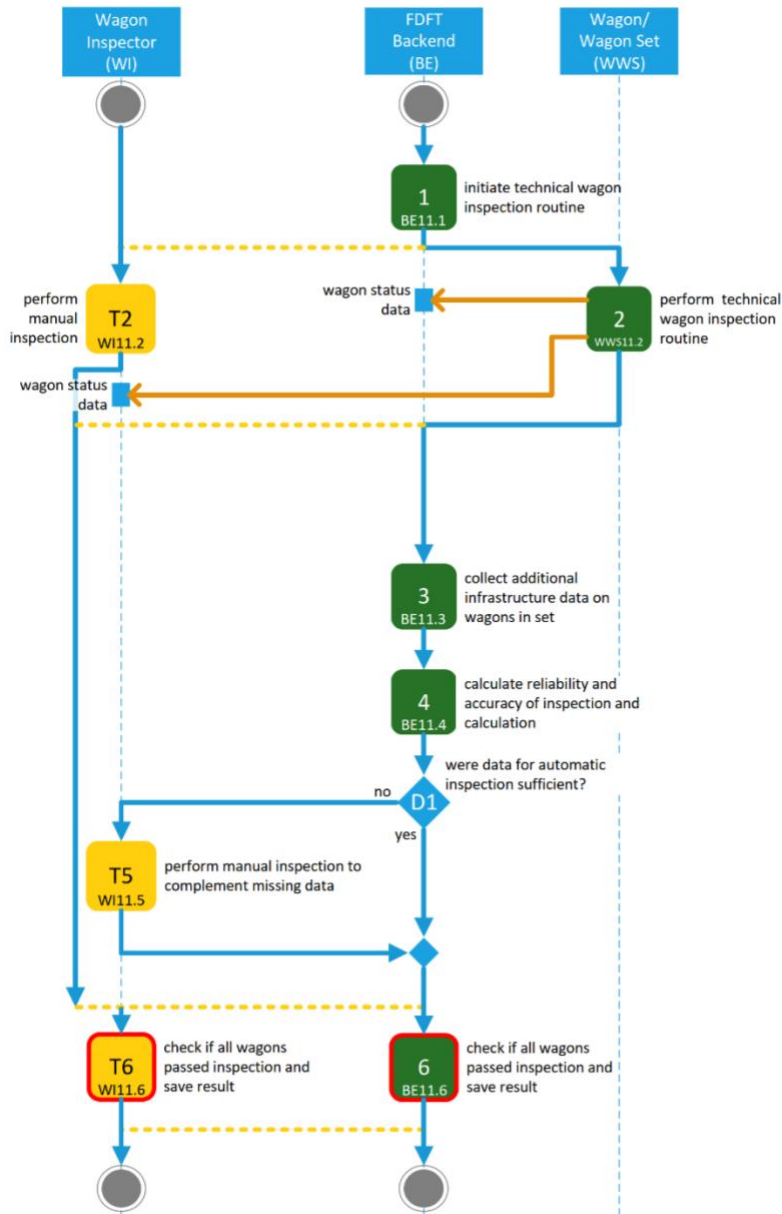
Activity	Error handling process
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Personnel initiates operator specific error handling process to deal with found critical deviations.</li> <li>▪ The process continues as soon as the error handling process finishes. The result plan state does not deviate to current state.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

**P10.7**

Activity	Check wagon set data
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel checks that current wagon set data matches planned data
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

## 8.4.12 TP11 - Technical Wagon Inspection

### 8.4.12.1 Target Process



Subprocess TP11 Technical Wagon Inspection - Ed. 02P07 13.06.2023

Figure 36: TP11 Technical Wagon Inspection - 1 of 1

### 8.4.12.2 Process-Description

#### BE11.1

Activity	Initiate technical wagon inspection routine
Precondition	▪ -
Conditions	▪ - FDFT Backend is available.
Tasks	▪ FDFT Backend initiates wagon inspection routine in FDFT Wagon Base Set for all wagon(s) in set.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

#### WWS11.2

Activity	Perform technical wagon inspection routine
Precondition	▪ -
Conditions	▪ FDFTE Backend is available and can communicate with all wagon(s) in set.
Tasks	<ul style="list-style-type: none"> <li>▪ FDFT Wagon Base System receives command to perform wagon inspection routine and starts the routine.</li> <li>▪ FDFT Wagon Base System send results of inspection to FDFT Backend.</li> </ul>
Remarks	▪ Inspection is supported by the usage of Sensors and other available wagon data.
Rationale	▪ -
Postcondition	▪ -



### WI11.2

Activity	Perform manual wagon inspection routine
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Wagon Inspector performs wagon inspection including report using legacy processes.</li> <li>▪ Wagon Inspector inputs results to FDFT Backend if available.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE11.3

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

### BE11.4

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

**D1**

Decision      Were data for automatic inspection sufficient?

Yes              ▪ -

Remarks        ▪ -

Rationale        ▪ -

**WI11.5**

Activity            Perform manual inspection to complement missing data

Precondition     ▪ -

Conditions        ▪ -

Tasks              ▪ Wagon Inspector performs additional manual inspections on wagon(s) where available data is not sufficient.  
 ▪ Wagon Inspector reports results to FDFT Backend.

Remarks        ▪ -

Rationale        ▪ -

Postcondition    ▪ -

**BE11.6**

Activity            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 wagon status data (sensors on wagon), wagon data provided by infrastructure (e.g. video gate) to verify that wagon(s) 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 wagon(s) prohibiting subsequent movement).

Remarks        ▪ See regulations: General Contract of Use for Wagon(s) (GCU), Appendix 9

Rationale        ▪ -

Postcondition    ▪ -

**WI11.6**

Activity	Check if all wagon(s) passed inspection and save results
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Use legacy processes for technical wagon inspection check.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### 8.4.13 TP20 - Uncouple

#### 8.4.13.1 Target Process

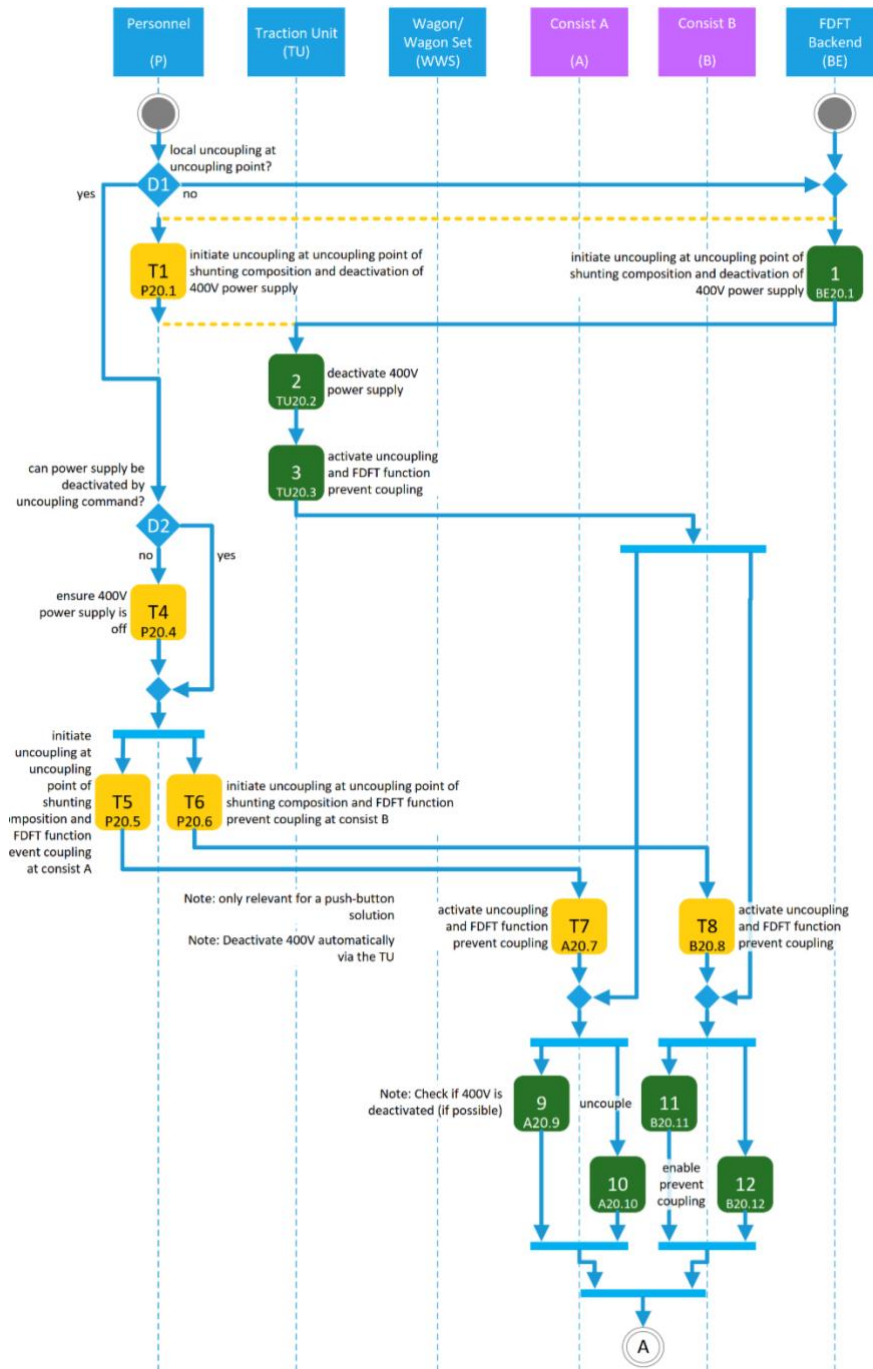


Figure 37: TP20 Uncouple - 1 of 2

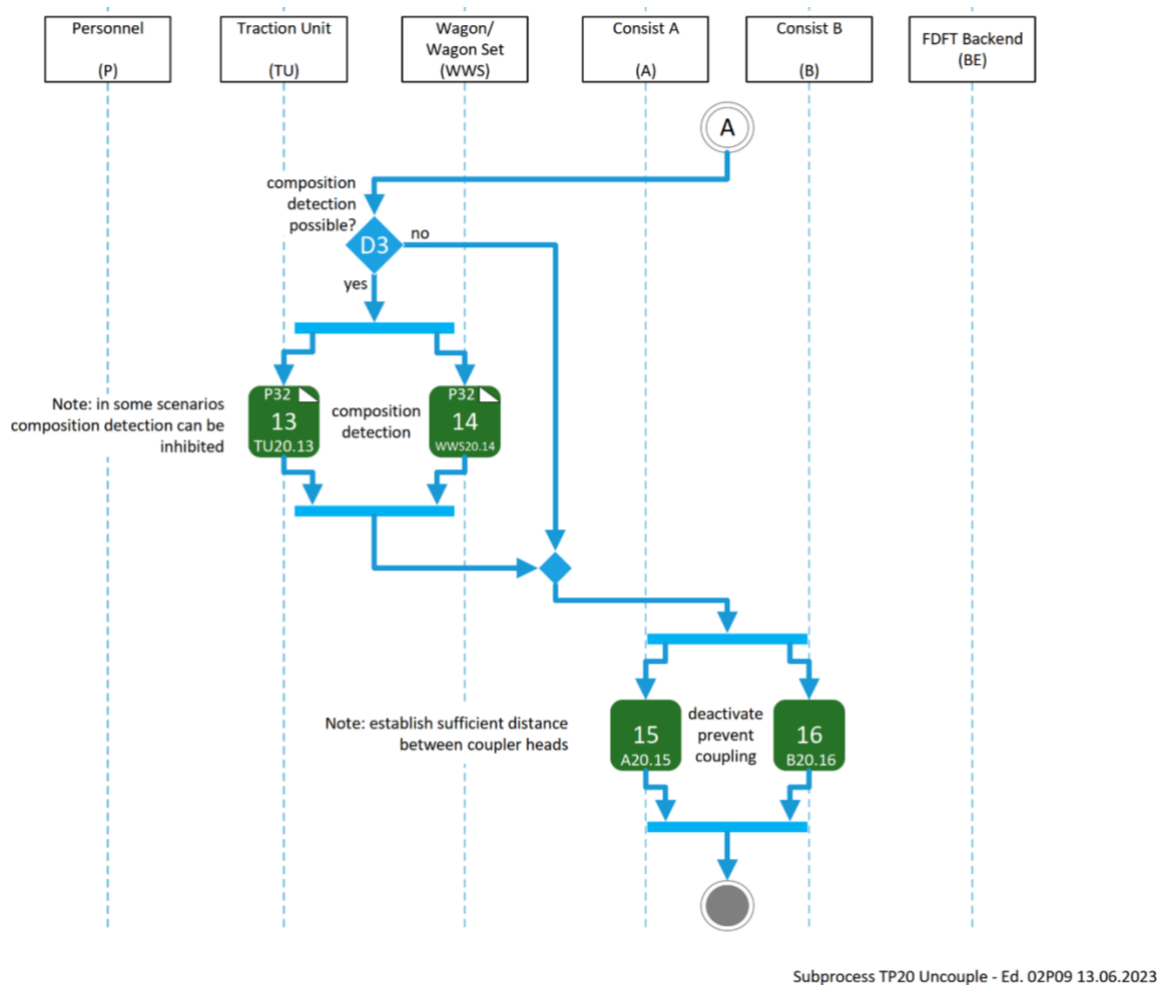


Figure 38: TP20 Uncouple - 2 of 2

### 8.4.13.2 Process-Description

#### D1

Decision Local uncoupling at uncoupling point?

Yes ▪ -

Remarks ▪ -

Rationale ▪ -

#### BE20.1

Activity 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 FDFT Wagon Base Systems and deactivation of 400V power supply.

Remarks ▪ Data from FDFT Backend to FDFT Wagon Base System is transferred through FDFT Link(s).

Rationale ▪ -

Postcondition ▪ -

#### P20.1

Activity 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.

Rationale ▪ -

Postcondition ▪ -

### TU20.2

Activity Deactivate 400V power supply

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

### TU20.3

Activity 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 ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### D2

Decision Can power supply be deactivated by uncoupling command?

- Yes ▪ -
- Remarks ▪ -
- Rationale ▪ -

#### P20.4

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

#### P20.5

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

#### A20.7

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



### P20.6

**Activity** 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 ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### B20.8

**Activity** Activate uncoupling and FDFT function prevent coupling

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

### B20.11

**Activity** Uncouple

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

### B20.12

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

### A20.9

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

### A20.10

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

**D3**

Decision                      Composition detection Possible?

Yes                              ▪ -

Remarks                      ▪ -

Rationale                      ▪ -

**TU20.13**

Activity                        Subprocess Composition Detection

Precondition                ▪ -

Conditions                    ▪ -

Tasks                         ▪ See subprocess description 8.4.21

Remarks                      ▪ -

Rationale                      ▪ -

Postcondition                ▪ -

**WWS20.14**

Activity                        Subprocess Composition Detection

Precondition                ▪ -

Conditions                    ▪ -

Tasks                         ▪ See subprocess description 8.4.21

Remarks                      ▪ -

Rationale                      ▪ -

Postcondition                ▪ -

### A20.15

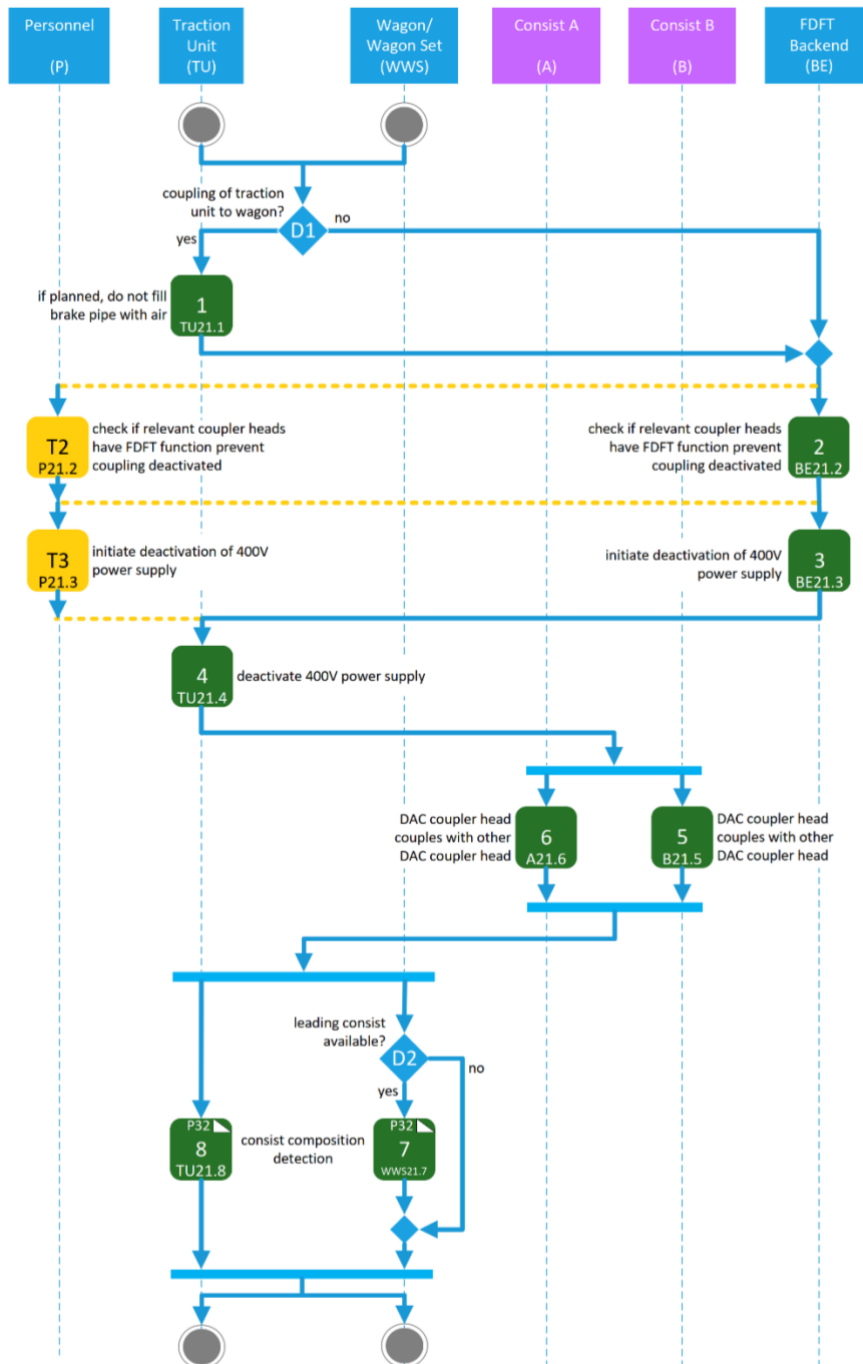
Activity	Deactivate prevent coupling
Precondition	▪ -
Conditions	▪ -
Tasks	▪ The function prevent coupling is deactivated
Remarks	▪ If this function cannot be deactivated by the coupler itself (e.g. actuator), then it must be ensured on the infrastructure side with a device in case of hump shunting..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

### B20.16

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

### 8.4.14 TP21 - Couple

#### 8.4.14.1 Target Process



Subprocess TP21 Couple - Ed. 02P07 13.06.2023

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 wagon(s) thus requiring an FDFT Wagon Base System. The coupling of Stationary Device or other DAC coupler head compatible devices is out of scope of this process.

##### D1

Decision	Coupling of Traction Unit to Wagon?
----------	-------------------------------------

Yes	▪ -
-----	-----

Remarks	▪ -
---------	-----

Rationale	▪ -
-----------	-----

##### TU21.1

Activity	If planned do not fill air pipe with air
----------	--

Precondition	▪ -
--------------	-----

Conditions	▪ -
------------	-----

Tasks	▪ If planned ensure that the air pipe does not fill with air
-------	--

Remarks	▪ -
---------	-----

Rationale	▪ -
-----------	-----

Postcondition	▪ -
---------------	-----

### BE21.2

Activity	Check if relevant coupling points have FDFT function Prevent Coupling deactivated
Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with relevant FDFT Wagon Base Systems.
Tasks	▪ FDFT Backend checks that the two relevant DAC coupler heads have FDFT function Prevent Coupling deactivated.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### P21.2

Activity	Check if relevant coupling points have FDFT function Prevent Coupling deactivated
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Operator checks that the two relevant DAC coupler heads have FDFT function Prevent Coupling deactivated.</li> <li>▪ This can also be achieved by using the Mobile HMI.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE21.3

Activity                    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                ▪ -
- Rationale                ▪ -
- Postcondition         ▪ -

### P21.3

Activity                    Initiate deactivation of 400V power supply

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

### TU21.4

Activity                    Deactivate 400V power supply

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



### B21.5

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

### A21.6

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

### D2

Decision	Leading consist available?
Yes	▪ -
Remarks	▪ -
Rationale	▪ -

### WWS21.7

Activity Subprocess Consist composition detection

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

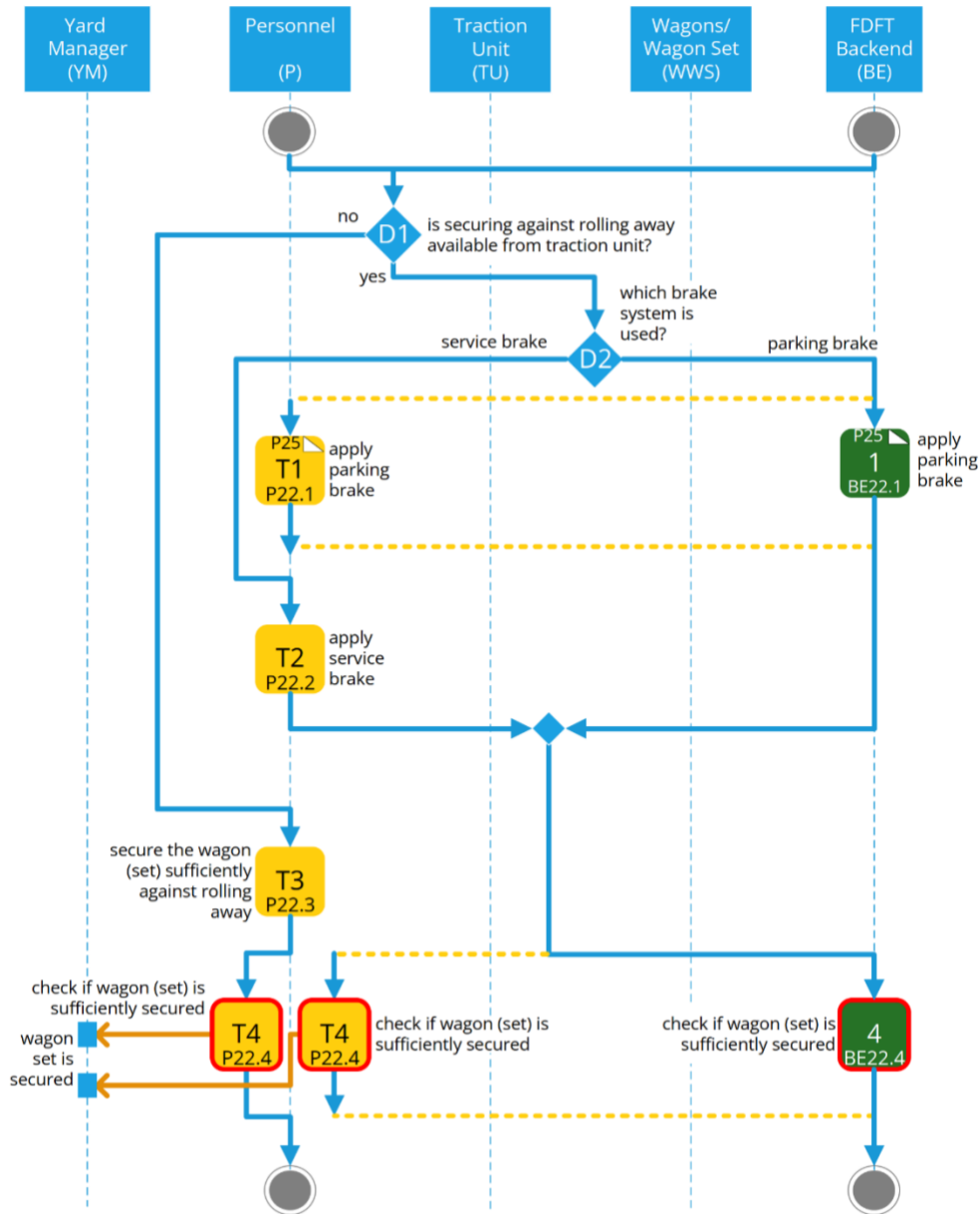
### TU21.8

Activity Subprocess Consist composition detection

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

### 8.4.15 TP22 - Secure Wagon (Set) Against Rolling Away

#### 8.4.15.1 Target Process



Subprocess TP22 Secure Wagon (Set) Against Rolling Away - Ed. 02P11 21.06.2023

Figure 40: TP22 Secure Wagon (Set) Against Rolling Away - 1 of 1

### 8.4.15.2 Process-Description

#### D1

Decision Is securing against rolling away available from traction unit?

Yes                   ▪ -

Remarks            ▪ -

Rationale            ▪ -

#### D2

Decision Which brake system is used?

service brake       ▪ -

parking brake       ▪ -

Remarks            ▪ -

Rationale            ▪ -

#### BE22.1

Activity Subprocess: Apply parking brake

Precondition        ▪ -

Conditions           ▪ FDFT Backend is available, can communicate with FDFT Wagon Base System and can initiate parking brake

Tasks                 ▪ See subprocess description 8.4.17

Remarks            ▪ -

Rationale            ▪ -

Postcondition       ▪ -

### P22.1

Activity Subprocess: Apply parking brake

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

### P22.2

Activity Subprocess: Apply service brake

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

### BE22.4

Activity Check if wagon (set) is sufficiently secured

- Precondition ▪ -
- Conditions ▪ FDFT Backend is available and communicate with FDFT Wagon Base System.
- Tasks ▪ FDFT backend checks if the brakes are activated as planned.  
▪ The Wagon Status Data for each wagon is stored tamper safe.
- Remarks ▪ -
- Rationale ▪ -
- Postcondition ▪ -

**P22.3**

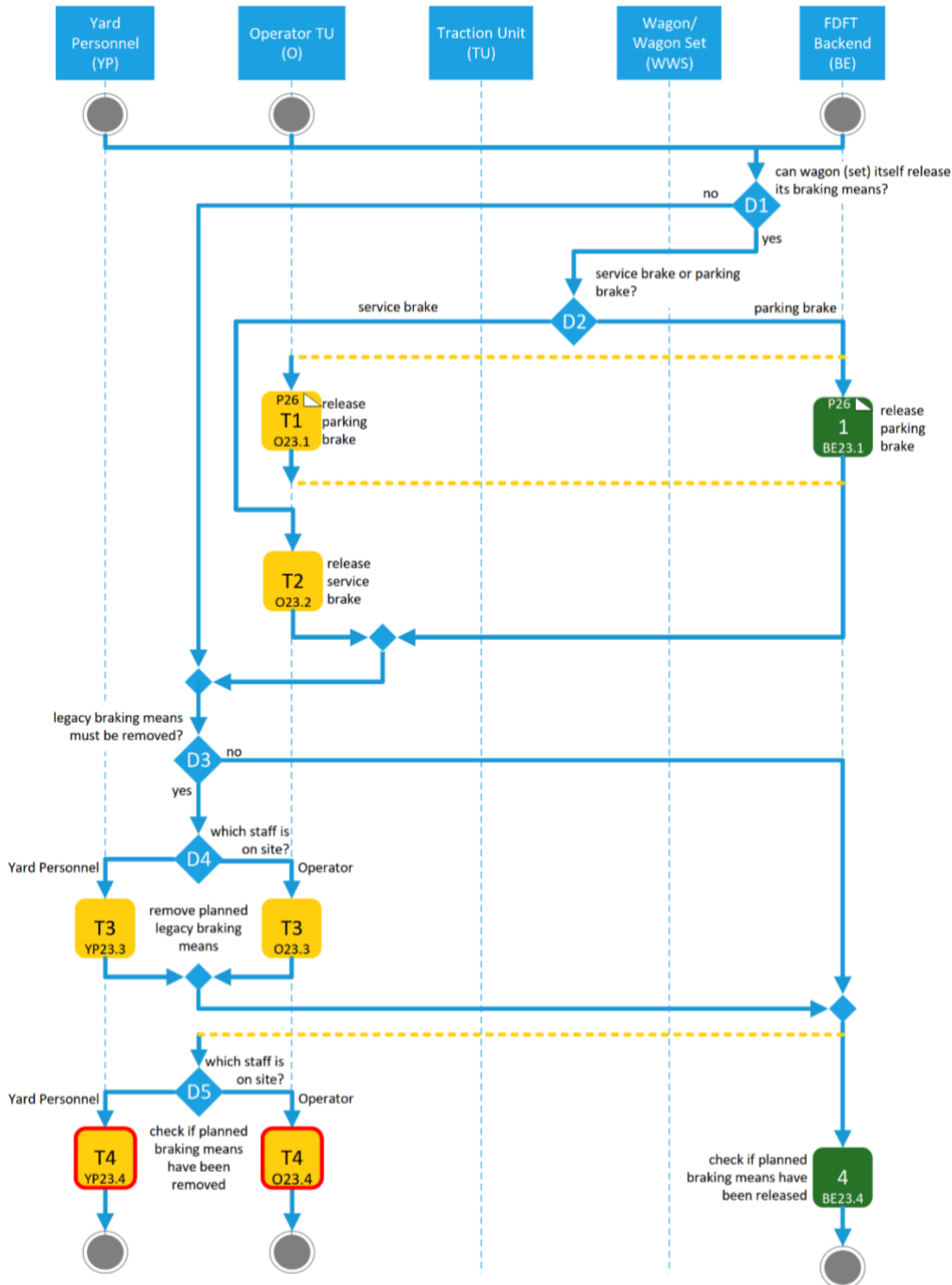
Activity	Secure wagon (set) sufficient against rolling away
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Secure wagon (set) against rolling away as legacy process
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

**P22.4**

Activity	Check if wagon (set) is sufficiently secured
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel checks the braking status and sends data to Yard Manager
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### 8.4.16 TP23 – Remove, Release Braking Means

#### 8.4.16.1 Target Process



Subprocess TP23 Remove All Braking Means - Ed. 02P07 13.06.2023

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

### 8.4.16.2 Process-Description

#### D1

Decision	Wagon (set) itself can release braking means?
Yes	<ul style="list-style-type: none"> <li>FDFT Wagon Base System can control all its braking means.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>

#### D2

Decision	Which staff is on site?
service brake	<ul style="list-style-type: none"> <li>-</li> </ul>
parking brake	<ul style="list-style-type: none"> <li>-</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>

#### BE23.1

Activity	Subprocess: Release parking brake
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available, can communicate with FDFT Base System and can initiate parking brake</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>See subprocess description 8.4.18</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>



### O23.1

Activity	Subprocess: Release parking brake
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.18
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### O23.2

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

### D3

Decision	Legacy braking means must be removed?
Yes	▪ -
Remarks	▪ -
Rationale	▪ -

**D4**

Decision Which staff is on site?

Operator ▪ Operator is on site.

Yard Personnel ▪ Yard Personnel is on site.

Remarks ▪ -

Rationale ▪ -

**O23.3**

Activity 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 ▪ -

Rationale ▪ -

Postcondition ▪ -

**YP23.3**

Activity 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 ▪ -

Rationale ▪ -

Postcondition ▪ -

### BE23.4

Activity	Check if planned braking means have been released
Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with FDFT Wagon Base System
Tasks	<ul style="list-style-type: none"> <li>▪ FDFT backend checks if the brakes are deactivated as planned.</li> <li>▪ The Wagon Status Data for each wagon is stored tamper safe.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### D5

Decision	Which staff is on site?
Operator	▪ Operator is on site.
Yard Personnel	▪ Yard Personnel is on site.
Remarks	▪ -
Rationale	▪ -

### O23.4

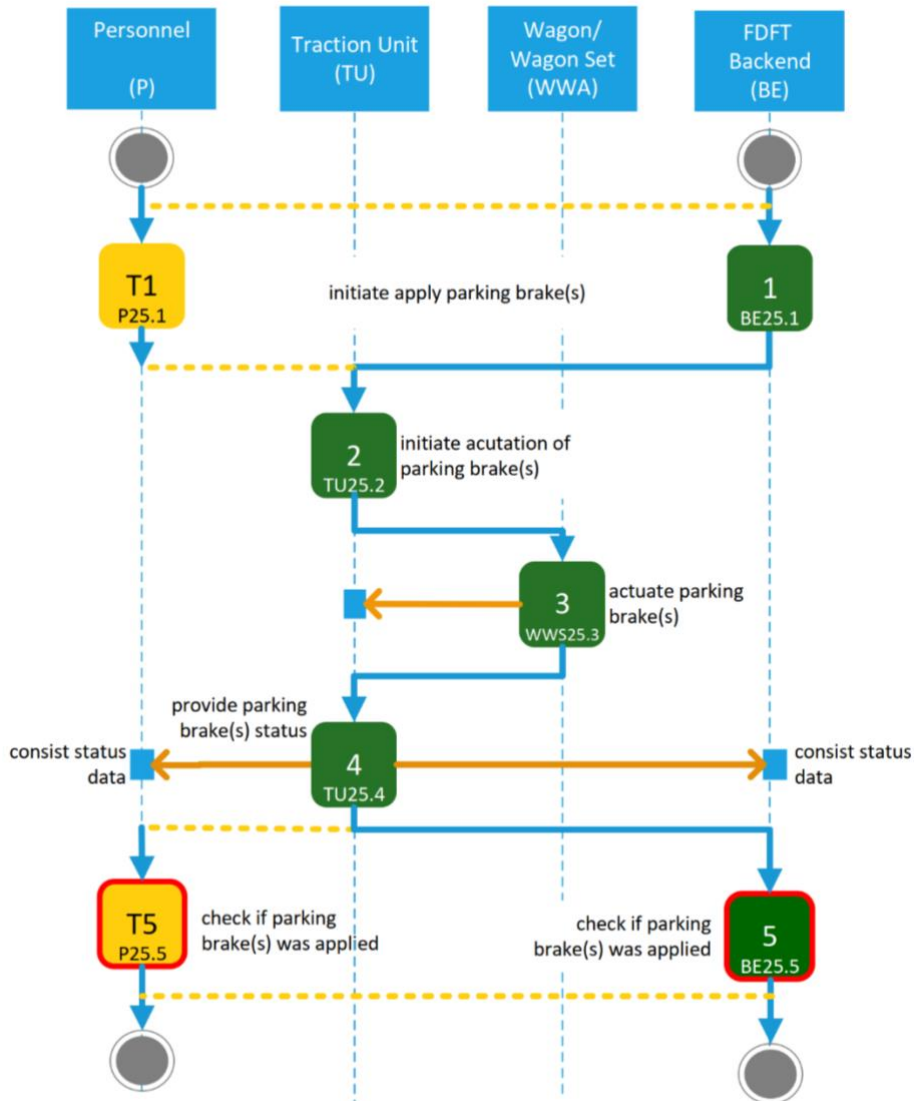
Activity	Check if planned braking means have been removed
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Operator checks that planned braking means have been removed.</li> <li>▪ Operator reports that planned braking means have been removed (Legacy process)</li> <li>▪ Operator reports that planned braking means have been removed to FDFT Backend if available.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

**YP23.4**

Activity	Check if planned braking means have been removed
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Yard Personnel checks that planned braking means have been removed.</li> <li>▪ Yard Personnel reports that planned braking means have been removed (Legacy process)</li> <li>▪ Yard Personnel reports that planned braking means have been removed to FDFT Backend if available.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### 8.4.17 TP25 – Apply Parking Brake

#### 8.4.17.1 Target Process



Subprocess TP25 Apply Parking Brake - Ed. 01P06 26.06.2023

Figure 42: TP25 Apply Parking Brake - 1 of 1

### 8.4.17.2 Process Description

#### BE25.1

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

#### P25.1

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

#### TU25.2

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

### WWS25.3

Activity	Actuate parking brake(s)
Precondition	<ul style="list-style-type: none"> <li>▪ Service brake is active</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>▪ Each consist receiving the apply parking brake command will actuate the parking brake application locally</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>▪ -</li> </ul>

### TU25.4

Activity	Provide parking brake(s) status data
Precondition	<ul style="list-style-type: none"> <li>▪ Train composition is valid</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>▪ FDFT System collects the status of all parking brakes in the wagon(s) and indicates it to Personnel.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>▪ -</li> </ul>

### BE25.5

Activity	Check if parking brake(s) was applied
Precondition	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>▪ FDFT Backend is available. FDFT Base System is available and can communicate with FDFT Base System-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>▪ FDFT Backend checks the status of all parking brakes.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>▪ -</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>▪ -</li> </ul>

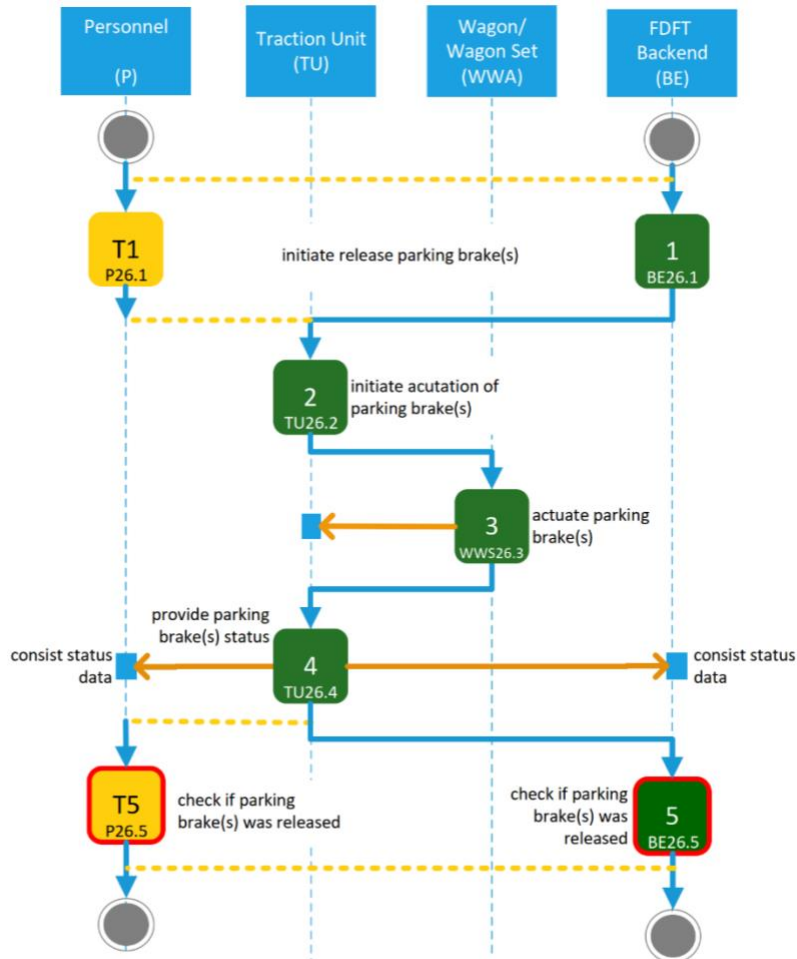
**P25.5**

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



### 8.4.18 TP26 – Release Parking Brake

#### 8.4.18.1 Target Process



Subprocess TP26 Release Parking Brake - Ed. 01P05 26.06.2023

Figure 43: TP26 Release Parking Brake - 1 of 1

### 8.4.18.2 Process Description

#### BE26.1

Activity	Initiate release parking brake
Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with FDFT Wagon Base System 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	▪ -
Rationale	▪ -
Postcondition	▪ -

#### P26.1

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

#### TU26.2

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

### WWS26.3

Activity	Actuate parking brake(s)
Precondition	<ul style="list-style-type: none"> <li>Service brake is active</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Each consist receiving the release parking brake command will actuate the parking brake release locally</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU26.4

Activity	Provide parking brake(s) status data
Precondition	<ul style="list-style-type: none"> <li>Train composition is valid</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>FDFT System collects the status of all parking brakes of the wagon(s) and indicates it to Personnel</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### BE26.5

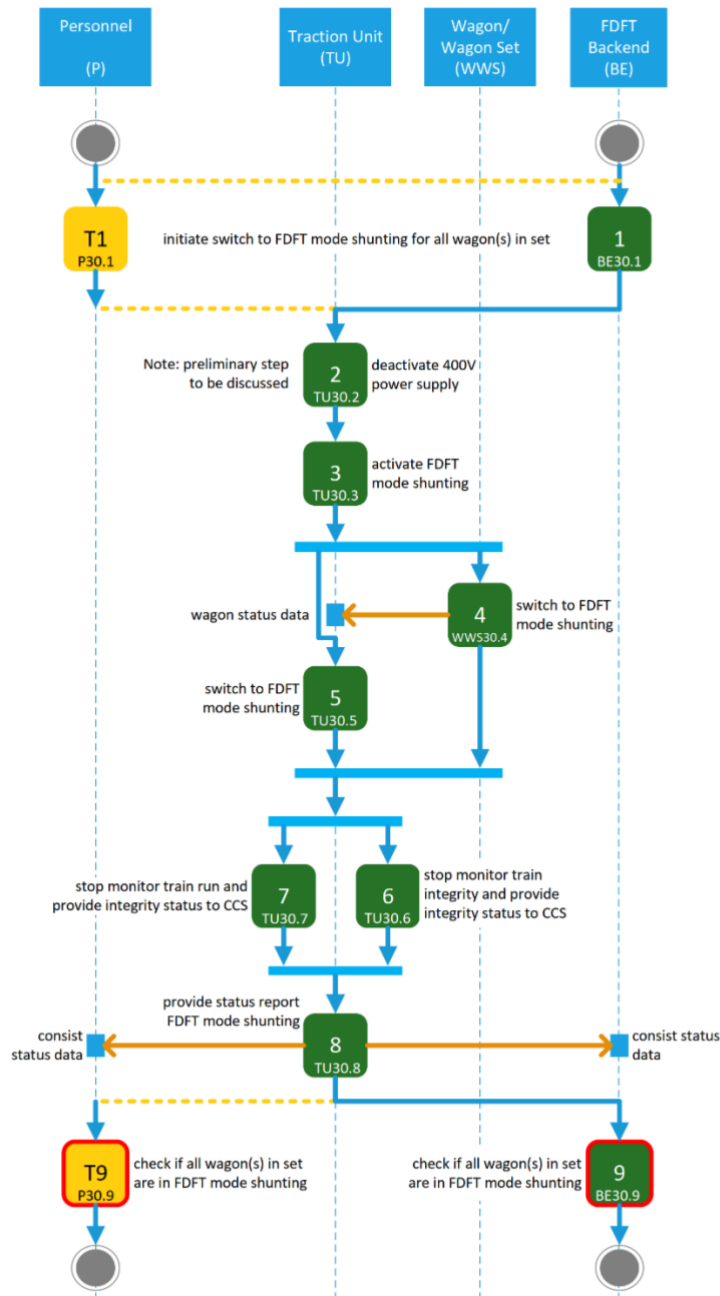
Activity	Check if parking brake(s) was released
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available and can communicate with FDFT Wagon Base System</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>FDFT Backend checks the status of all parking brakes.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

**P26.5**

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

### 8.4.19 TP30 - Switch to FDFT mode Shunting

#### 8.4.19.1 Target Process



Subprocess TP30 Switch To FDFT mode Shunting - Ed. 02P09 14.06.2023

Figure 44: TP30 Switch wagon(s) of set to FDFT mode Shunting - 1 of 1

### 8.4.19.2 Process-Description

#### BE30.1

Activity	Initiate switch to FDFT mode shunting for all wagon(s) in set
Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with FDFT Wagon Base System for each wagon in set and can initiate Switch to FDTF mode shunting.
Tasks	▪ FDFT Backend initiates activation of FDFT mode Shunting for all wagon(s) in set and traction unit.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

#### P30.1

Activity	Initiate switch to FDFT mode Shunting for all wagon(s) in set
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Personnel initiates the activation of the FDFT mode Shunting for all wagon(s) in set and traction unit.</li> <li>▪ This can also be achieved by using the Mobile HMI.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### TU30.2

Activity Deactivate 400V power supply

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

### TU30.3

Activity Activate FDFT mode Shunting

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

### WWS30.4

Activity Switch to FDFT mode Shunting

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

### TU30.5

Activity	Switch to FDFT mode Shunting
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Traction Unit switches to FDFT mode Shunting.</li> <li>▪ If FDFT Backend is available, the Traction Unit sends Wagon Status Data to FDFT Backend.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### TU30.6

Activity	Stop monitor train integrity
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Monitoring of train integrity will be deactivated.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### TU30.7

Activity	Stop monitor train run and provide status to CCU
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ The sensor data relevant for the train run are no longer available to the CCU.</li> <li>▪ The last valid status of the train must be saved.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -



### TU30.8

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE30.9

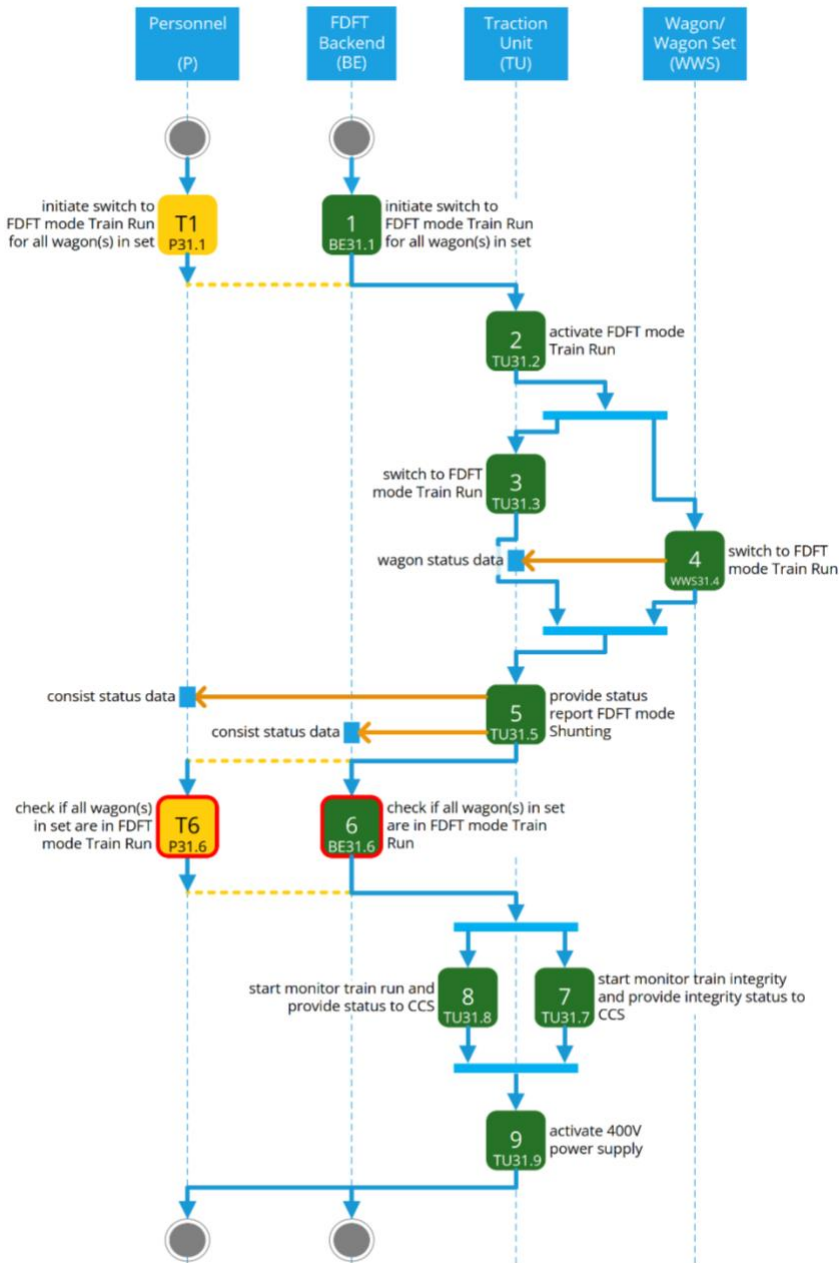
Activity	Check if all wagon(s) in set are in FDFT mode Shunting
Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with the FDFT Wagon Base System.
Tasks	▪ FDFT Backend checks if every wagon in set and traction unit is in FDFT mode Shunting.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### P30.9

Activity	Check if all wagon(s) in set are in FDFT mode Shunting
Precondition	▪ -
Conditions	▪ Personnel must be able to see the status of all wagons on a HMI.
Tasks	<ul style="list-style-type: none"> <li>▪ Personnel checks if every wagon in set and traction unit is in FDFT mode Shunting.</li> <li>▪ This can also be achieved by using the Mobile HMI.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### 8.4.20 TP31 – Switch to FDFT mode Train Run

#### 8.4.20.1 Target Process



Subprocess TP31 Switch To FDFT mode Train Run - Ed. 02P07 14.06.2023

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

### 8.4.20.2 Process-Description

#### BE31.1

Activity	Initiate switch to FDFT mode Train Run for all wagon(s) in set
Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with FDFT Wagon Base System for each wagon in set and can initiate switch to FDFT mode Train Run.
Tasks	▪ FDFT Backend initiates switch to FDFT mode Train Run for all wagon(s) in set and traction unit.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

#### P31.1

Activity	Initiate switch to FDFT mode Train Run for all wagon(s) in set
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Personnel initiates the activation of the FDFT mode Shunting for all wagon(s) in set and traction unit.</li> <li>▪ This can also be achieved by using the Mobile HMI.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### TU31.2

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### TU31.3

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

### WWS31.4

Activity	Switch to FDFT mode Train Run
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ FDFT Wagon Base System switches to FDFT mode Train Run.</li> <li>▪ If FDFT Backend is available, the FDFT Wagon Base System sends Wagon Status Data to FDFT Backend.</li> </ul>
Remarks	▪ E.g. after switch to FDFT mode Train Run, Uncoupling and activation of FDFT function Prevent Coupling is not allowed.
Rationale	▪ -
Postcondition	▪ -

### TU31.5

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE31.6

Activity	Check if all wagon(s) in set are in FDFT mode Train Run
Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with FDFT Wagon Base System..
Tasks	▪ FDFT Backend checks if every wagon in set and traction unit is in FDFT mode Train Run.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### P31.6

Activity	Check if all wagon(s) in set are in FDFT mode Train Run
Precondition	▪ -
Conditions	▪ Personnel must be able to see the status of all wagons on a HMI.
Tasks	<ul style="list-style-type: none"> <li>▪ Personnel checks if every wagon in set and traction unit is in FDFT mode Train Run.</li> <li>▪ This can also be achieved by using the Mobile HMI.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### TU31.7

Activity	Start monitor train integrity and provide integrity status to CCU
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Monitoring of train integrity will be activated and reported to the CCU on the Traction Unit.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### TU31.8

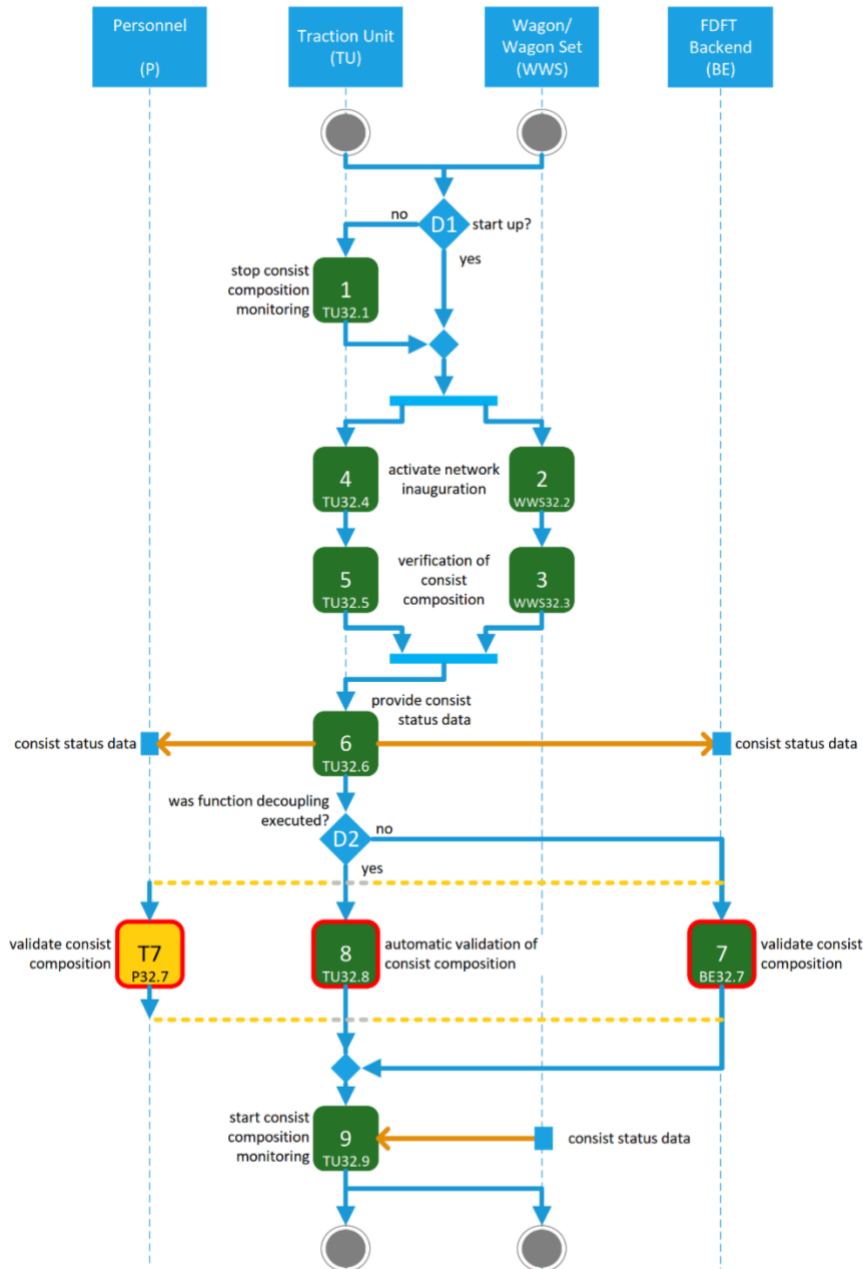
Activity	Start monitor train run and provide status to CCU
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Sensor data relevant for the train run are made available to the CCU in order to be able to record and monitor the condition of the train.
Remarks	▪ E.g. goods monitoring, tracking, ...
Rationale	▪ -
Postcondition	▪ -

### TU31.9

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

### 8.4.21 TP32 – Composition Detection

#### 8.4.21.1 Target Process



Subprocess TP32 Composition Detection Ed 02P06 13.06.2023

Figure 46: TP32 Composition Detection - 1 of 1

### 8.4.21.2 Process Description

#### D1

Decision	Start up?
Yes	<ul style="list-style-type: none"> <li>FDFT System powers up from power off status</li> </ul>
Remarks	<ul style="list-style-type: none"> <li></li> </ul>
Rationale	<ul style="list-style-type: none"> <li></li> </ul>

#### TU32.1

Activity	Stop consist composition monitoring
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Traction Unit stops monitoring of the current consist composition</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

#### WWS32.2

Activity	Activate network inauguration
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Network inauguration is executed by FDFT System in all consists to compile a network node list</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>



### WWS32.3

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### TU32.4

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

### TU32.5

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### TU32.6

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

### D2

Decision	Was function uncoupling executed?
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
Remarks	▪ In case of uncoupling without the train function being activated by Personnel/Backend, the train driver/backend system should receive a status message.
Rationale	▪ -

### BE32.7

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

**P32.7**

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

**TU32.8**

Activity	Automatic validation of consist composition
Precondition	▪ Uncoupling is activated
Conditions	▪ -
Tasks	▪ Consist composition is set to automatically validate if it fits to the last valid composition minus uncoupled consists
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

**TU32.9**

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

### 8.4.22 TP41 – Addition, Removal of Wagon (Set)

#### 8.4.22.1 Target Process

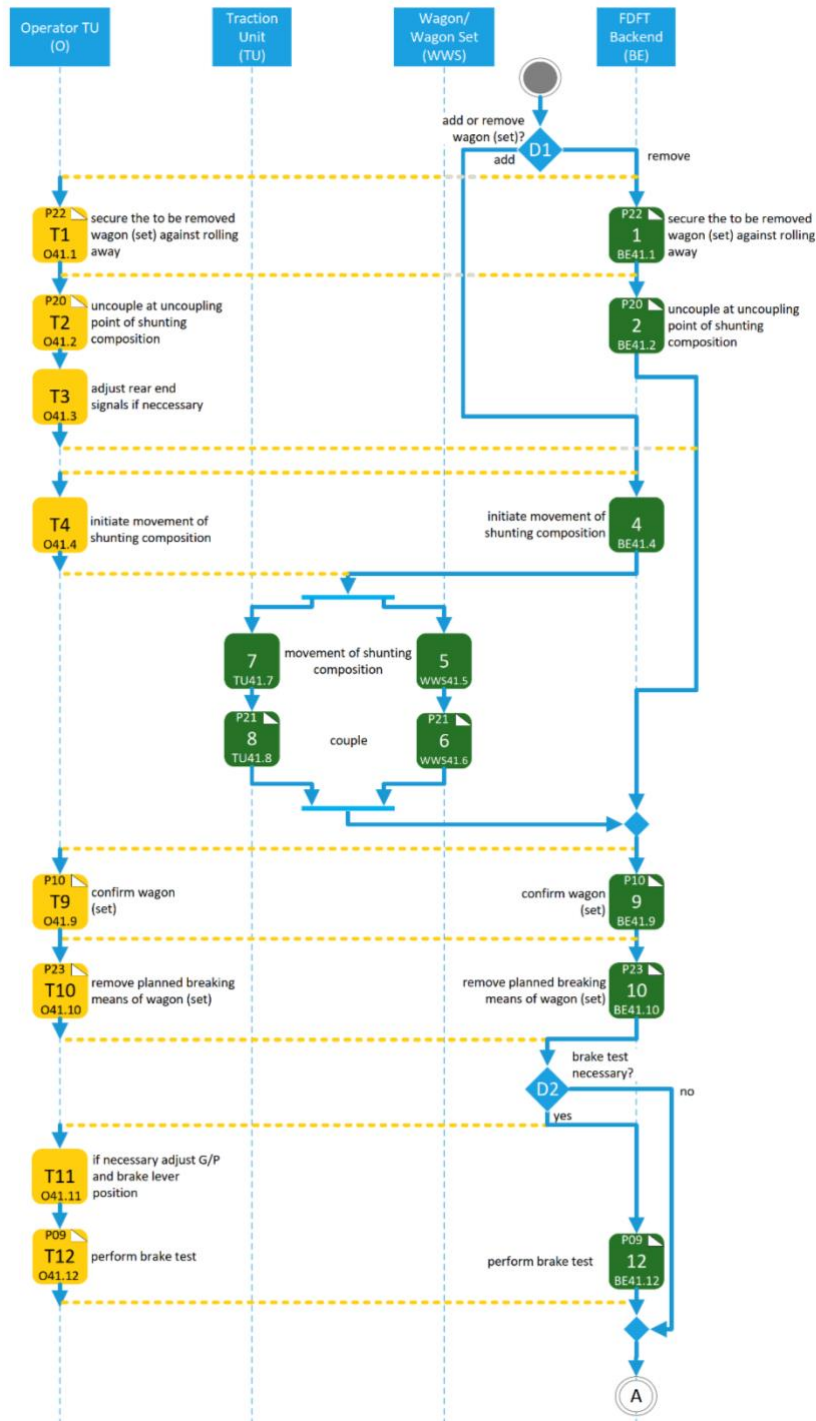


Figure 47: TP41 Addition, Removal of Wagon (Set) - 1 of 2

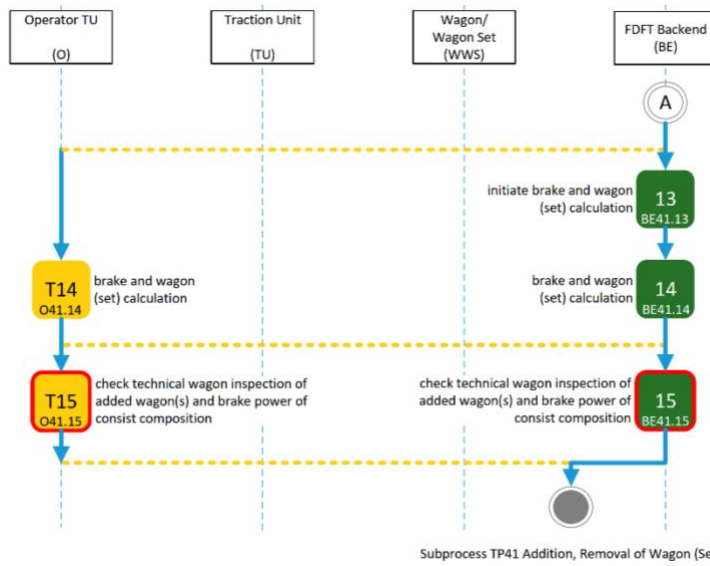


Figure 48: TP41 Addition, Removal of Wagon (Set) - 2 of 2

### 8.4.22.2 Process-Description

#### D1

Decision Add or remove wagon (set)?

- Add                   ▪ -
- Remove               ▪ -
- Remarks             ▪ -
- Rationale            ▪ -

#### BE41.1

Activity Subprocess: Secure to be removed wagon (set) 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             ▪ -
- Rationale            ▪ -
- Postcondition        ▪ -

#### BE41.2

Activity 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             ▪ -
- Rationale            ▪ -
- Postcondition        ▪ -

### O41.1

Activity Subprocess: Secure to be removed wagon (set) against rolling away

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

### O41.2

Activity Subprocess: uncouple at uncoupling point of shunting composition

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

### O41.3

Activity 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.
- Rationale ▪ -
- Postcondition ▪ -

#### BE41.4

Activity	Initiate movement of shunting composition
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

#### O41.4

Activity	Initiate movement of shunting composition
Precondition	<ul style="list-style-type: none"> <li>Automated Parking Brake released, Controllable Brake released, traction is allowed and possible.</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Increase traction force and gain speed up to shunting yard regulatory maximum.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

#### TU41.7

Activity	Movement of shunting composition
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Movement of shunting composition to wagon (set)</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>



### TU41.8

Activity Subprocess: Couple

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

### WWS41.5

Activity Movement of shunting composition

- Precondition ▪ -
- Conditions ▪ -
- Tasks ▪ Movement of shunting composition to wagon (set)
- Remarks ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### WWS41.6

Activity Subprocess: Couple

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

### BE41.9

Activity	Subprocess: Confirm wagon set
Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with FDFT Wagon Base System.
Tasks	▪ See subprocess description 8.4.11
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### O41.9

Activity	Subprocess: Confirm wagon set
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE41.10

Activity	Subprocess: Remove planned braking means of wagon set
Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with FDFT Wagon Base System and can initiate remove braking means.
Tasks	▪ See subprocess description 8.4.16
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### O41.10

Activity Subprocess: Remove braking means of wagon set

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

### D2

Decision Brake test necessary?

- Yes ▪ -
- Remarks ▪ For example, a brake test has to be made when a wagon will be added.
- Rationale ▪ -

### BE41.12

Activity Subprocess: Perform brake test

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

### O41.11

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

### O41.12

Activity	Subprocess: Perform brake test
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.10
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE41.13

Activity	Initiate brake and Wagon (Set) calculation
Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with FDFT Wagon Base System and can initiate brake calculation.
Tasks	<ul style="list-style-type: none"> <li>▪ Compile all information needed to calculate brake power.</li> <li>▪ This may include getting data from other systems (not part of FDFT System environment)</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE41.14

Activity	Brake and Wagon (Set) calculation
Precondition	▪ -
Conditions	▪ -
Tasks	▪ FDFT Backend uses compiled data on wagon(s) of set and load and calculates available brake power.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### O41.14

Activity	Brake and Wagon (Set) calculation
Precondition	▪ -
Conditions	▪ FDFT Backend is available.
Tasks	▪ Legacy processes for calculation of available brake power.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE41.15

Activity	Check technical wagon inspection of added wagon(s) and brake power of consist composition
Precondition	▪ -
Conditions	▪ FDFT Backend is available
Tasks	<ul style="list-style-type: none"> <li>▪ FDFT Backend checks that added wagon(s) passed technical wagon inspection and stores that information tamper safe.</li> <li>▪ FDFT Backend checks that brake power is sufficient.</li> </ul>
Remarks	▪ Technical wagon inspection for added wagon(s) is done beforehand and not part of this process.
Rationale	▪ -
Postcondition	▪ -

**O41.15**

Activity	Check technical wagon inspection of added wagon(s) and brake power of consist composition
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"><li>▪ Operator checks that available brake power is sufficient for planned track.</li><li>▪ Operator checks technical wagon inspection data.</li><li>▪ Operator checks restrictions due to requirements. E.g. wagon clearance, exceptional consignments.</li></ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### 8.4.23 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

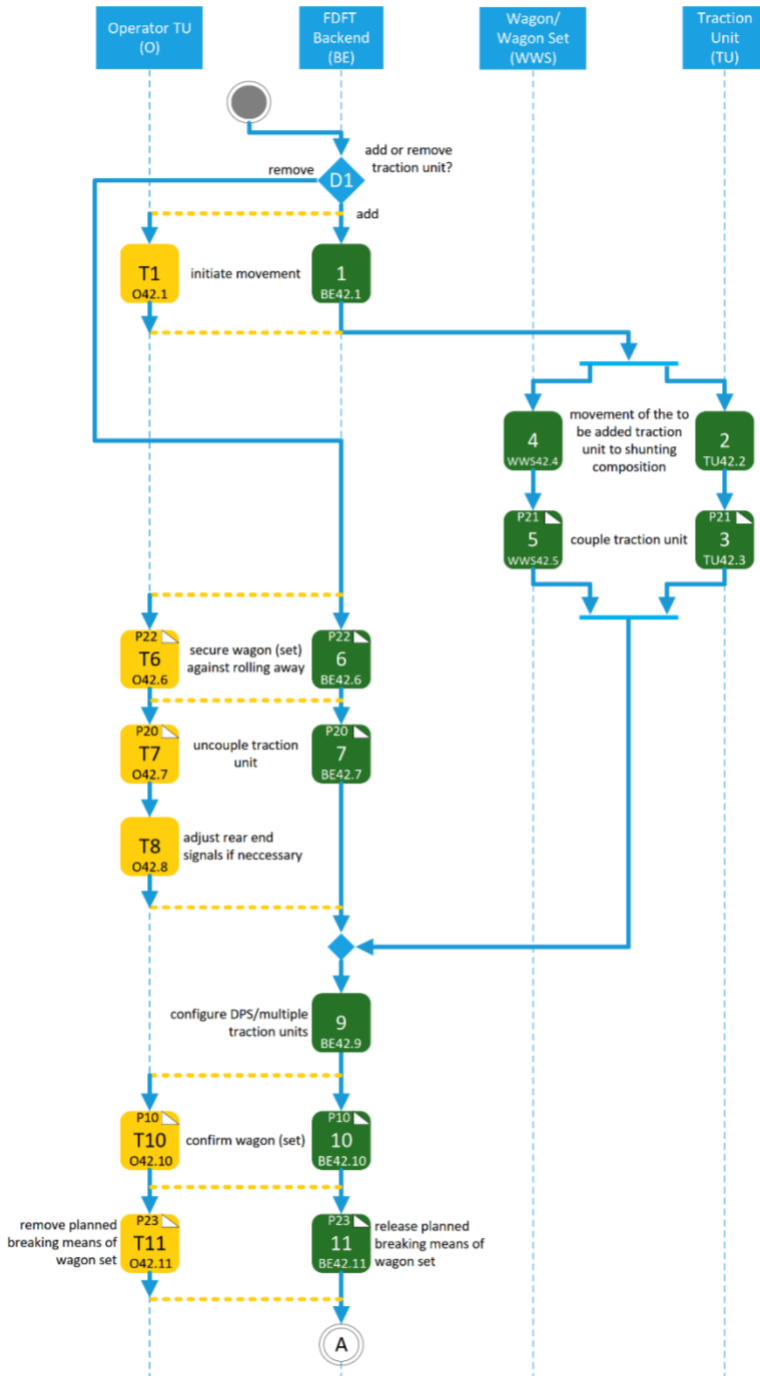
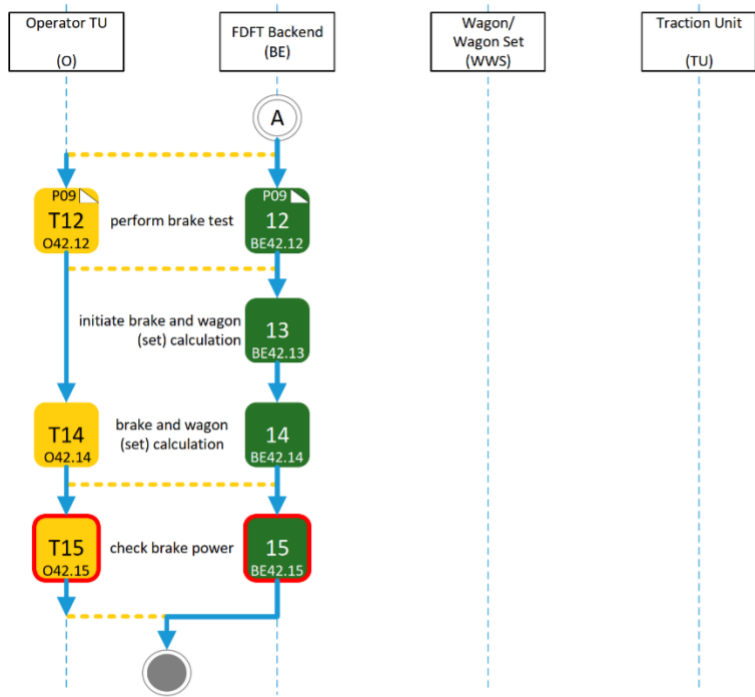


Figure 49: TP42 Addition, Removal of Traction Unit - 1 of 2



Subprocess TP42 Addition, Removal of Traction Unit - Ed. 02P08 14.06.2023

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



### 8.4.23.2 Process-Description

#### D1

Decision Add or remove traction unit?

- Add                   ▪ -
- Remove               ▪ -
- Remarks             ▪ -
- Rationale            ▪ -

#### BE42.1

Activity 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            ▪ -
- Rationale            ▪ -
- Postcondition       ▪ -

#### O42.1

Activity 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            ▪ -
- Rationale            ▪ -
- Postcondition       ▪ -

### TU42.2

Activity Movement of the to be added Traction Unit to shunting composition

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

### TU42.3

Activity Subprocess: Couple Traction Unit

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

### WWS42.4

Activity Movement of the to be added Traction Unit to shunting composition

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

### WWS42.5

Activity Subprocess: Couple Traction Unit

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

### BE42.6

Activity Subprocess: Secure Wagon (Set) against rolling away

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

### BE42.7

Activity Subprocess: Uncouple traction unit

- Precondition ▪ -
- Conditions ▪ FDFT Backend is available, can communicate with the FDFT Wagon Base System and can initiate uncoupling of traction unit
- Tasks ▪ See subprocess description 8.4.13
- Remarks ▪ -
- Rationale ▪ -
- Postcondition ▪ -

#### O42.6

Activity Subprocess: Secure the Wagon (Set) against rolling away

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

#### O42.7

Activity Subprocess: Uncouple traction unit

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

#### O42.8

Activity 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.
- Rationale        ▪ -
- Postcondition   ▪ -

### BE42.9

Activity	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.
Rationale	▪ -
Postcondition	▪ -

### BE42.10

Activity	Subprocess: Confirm wagon set
Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with FDFT Wagon Base System.
Tasks	▪ See subprocess description 8.4.11
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### O42.10

Activity	Subprocess: Confirm wagon set
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.11
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE42.11

Activity	Subprocess: Release planned braking means of wagon set
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	▪ -
Rationale	▪ -
Postcondition	▪ -

### O42.11

Activity	Subprocess: Remove planned braking means of wagon set
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.16
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE42.12

Activity	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	▪ -
Rationale	▪ -
Postcondition	▪ -

### O42.12

Activity Subprocess: Perform brake test

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

### BE42.13

Activity Initiate brake and wagon (set) calculation

- Precondition ▪ -
- Conditions ▪ FDFT Backend is available and can initiate brake calculation
- Tasks ▪ FDFT Backend triggers calculation of brake and wagon (set) values
- Remarks ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### BE42.14

Activity brake and wagon (set) calculation

- Precondition ▪ -
- Conditions ▪ FDFT Backend is available.
- Tasks ▪ FDFT Backend calculates brake and wagon (set) values
- Remarks ▪ -
- Rationale ▪ -
- Postcondition ▪ -

#### O42.14

Activity Brake and wagon (set) calculation

- Precondition ▪ -
- Conditions ▪ -
- Tasks ▪ Carry out brake and wagon set calculation.
- Remarks ▪ -
- Rationale ▪ -
- Postcondition ▪ -

#### BE42.15

Activity 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.  
▪
- Rationale ▪ -
- Postcondition ▪ -

#### O42.15

Activity 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.
- Rationale ▪ -
- Postcondition ▪ -



### 8.4.24 TP43 - Change Of Operator

#### 8.4.24.1 Target Process

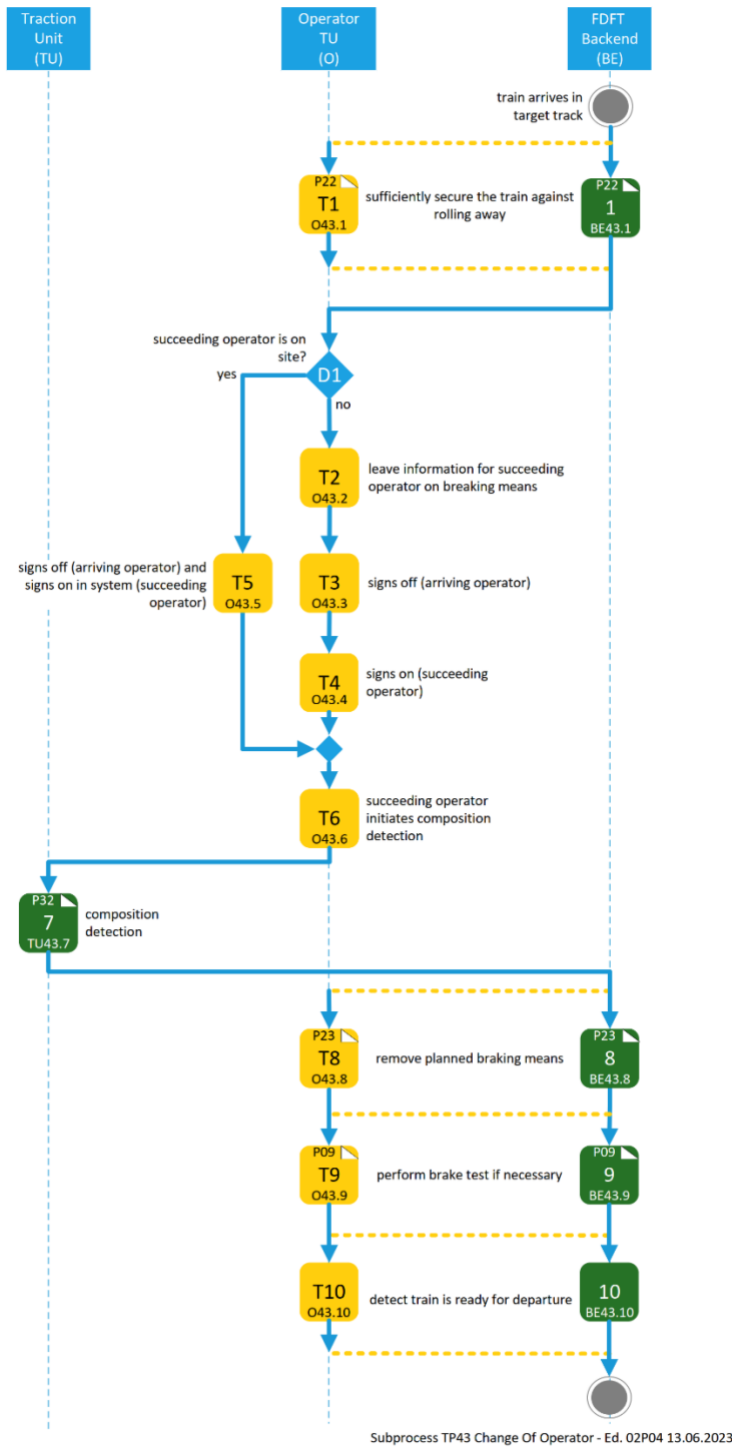


Figure 51: TP43 Change of Operator - 1 of 1

#### 8.4.24.2 Process-Description

##### BE43.1

Activity	Subprocess: Sufficiently secure the train against rolling away
Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with relevant FDFT Wagon Base Systems and can initiate secure Wagon against rolling away.
Tasks	▪ See subprocess description 8.4.15
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

##### O43.1

Activity	Subprocess: Sufficiently secure the train against rolling away
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.15
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

##### D1

Decision	Succeeding operator is on site?
Yes	▪ Operators can change directly.
Remarks	▪ -
Rationale	▪ -

### O43.2

Activity	Leave information for succeeding Operator on braking means
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Operator leaves information how the securing was done for the succeeding Operator (legacy process)</li> <li>▪ If FDFT Backend is available, the information can be retrieved from FDFT Backend</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### O43.3

Activity	Signs off (arriving Operator)
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Arriving Operator signs off on Traction Unit (legacy process)</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### O43.4

Activity	Signs on (succeeding Operator)
Precondition	▪ -
Conditions	▪ -
Tasks	<ul style="list-style-type: none"> <li>▪ Succeeding Operator signs on and takes further steps according to Legacy process.</li> </ul>
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### O43.5

Activity 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 ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### O43.6

Activity Succeeding operator initiates composition detection

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

### TU43.7

Activity Subprocess: Composition detection

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

### BE43.8

Activity	Subprocess: Release planned braking means
Precondition	▪ -
Conditions	▪ FDFT Backend is available, can communicate with the FDFT Wagon Base System and can initiate release braking means.
Tasks	▪ See subprocess description 8.4.16
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### O43.8

Activity	Subprocess: Remove planned braking means
Precondition	▪ -
Conditions	▪ -
Tasks	▪ See subprocess description 8.4.16
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### BE43.9

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

### O43.9

Activity Subprocess: perform brake test if necessary

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

### BE43.10

Activity 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 ▪ -
- Rationale ▪ -
- Postcondition ▪ -

### O43.10

Activity Detect train is ready for departure

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

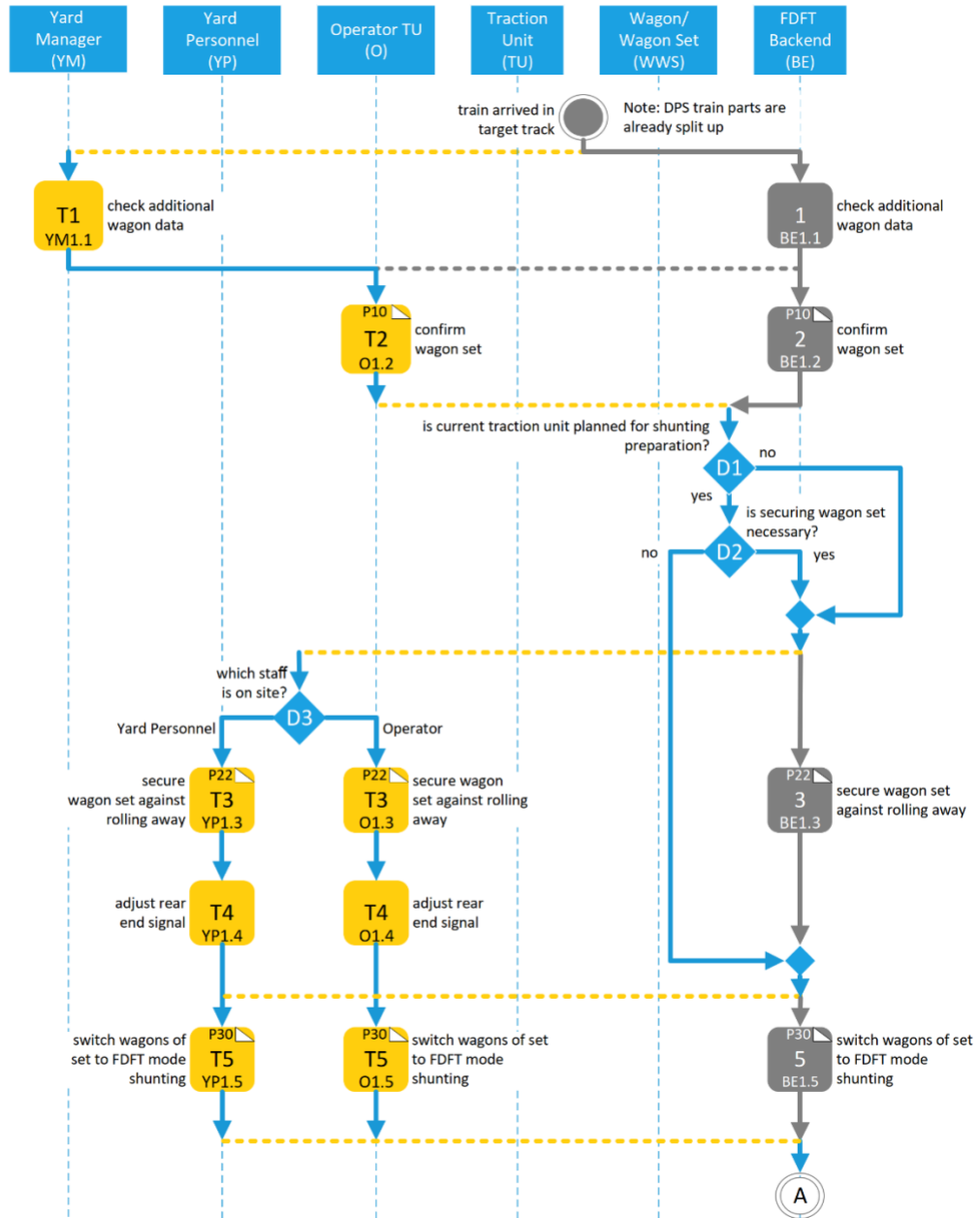
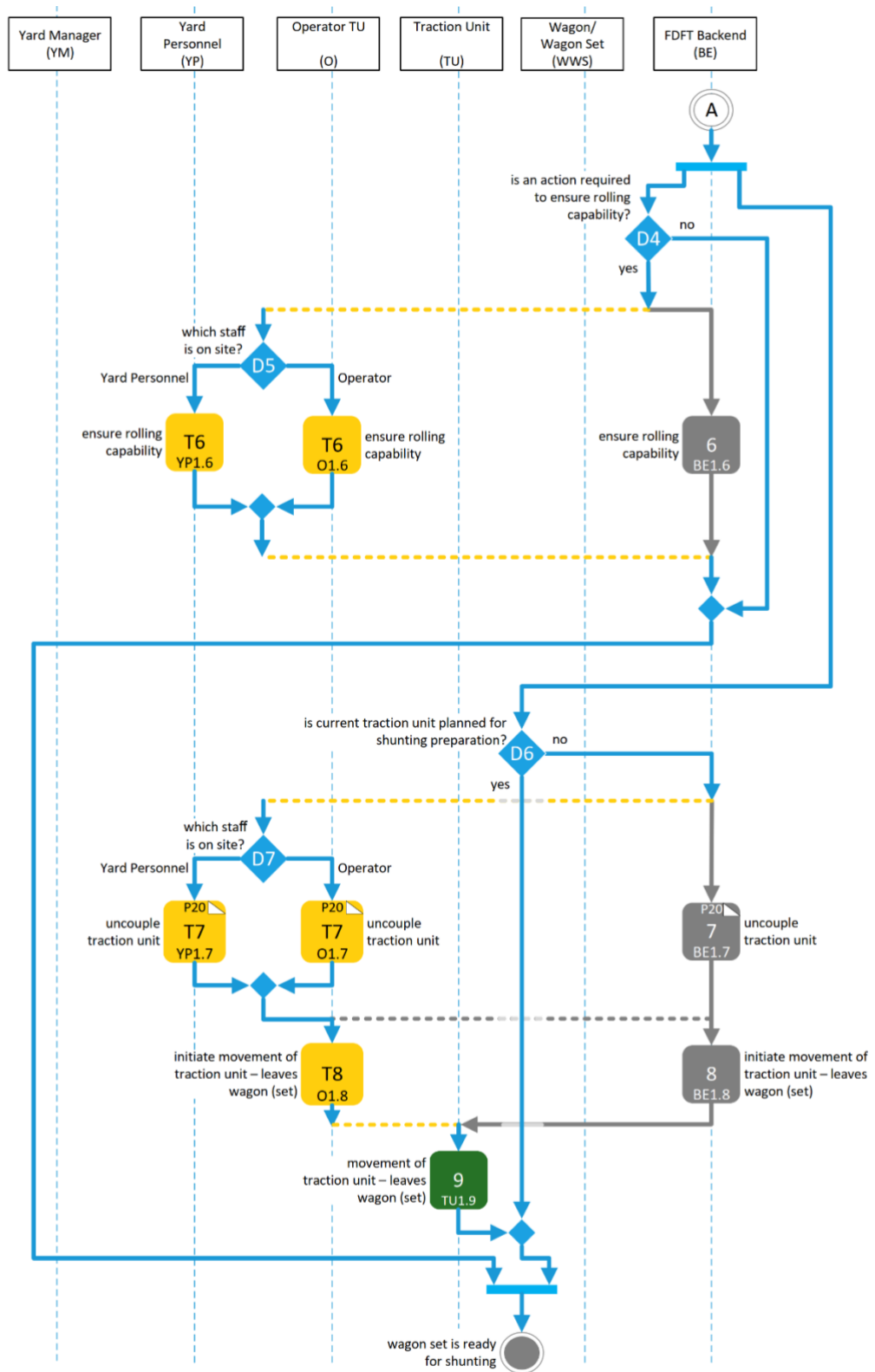


Figure 52: EP01 Shunting Preparation - 1 of 2





EP01 ERJU Shunting Preparation - Ed. 02P08 13.06.2023

Figure 53: EP01 Shunting Preparation - 2 of 2

### 8.5.2 EP02 - Wagon Processing

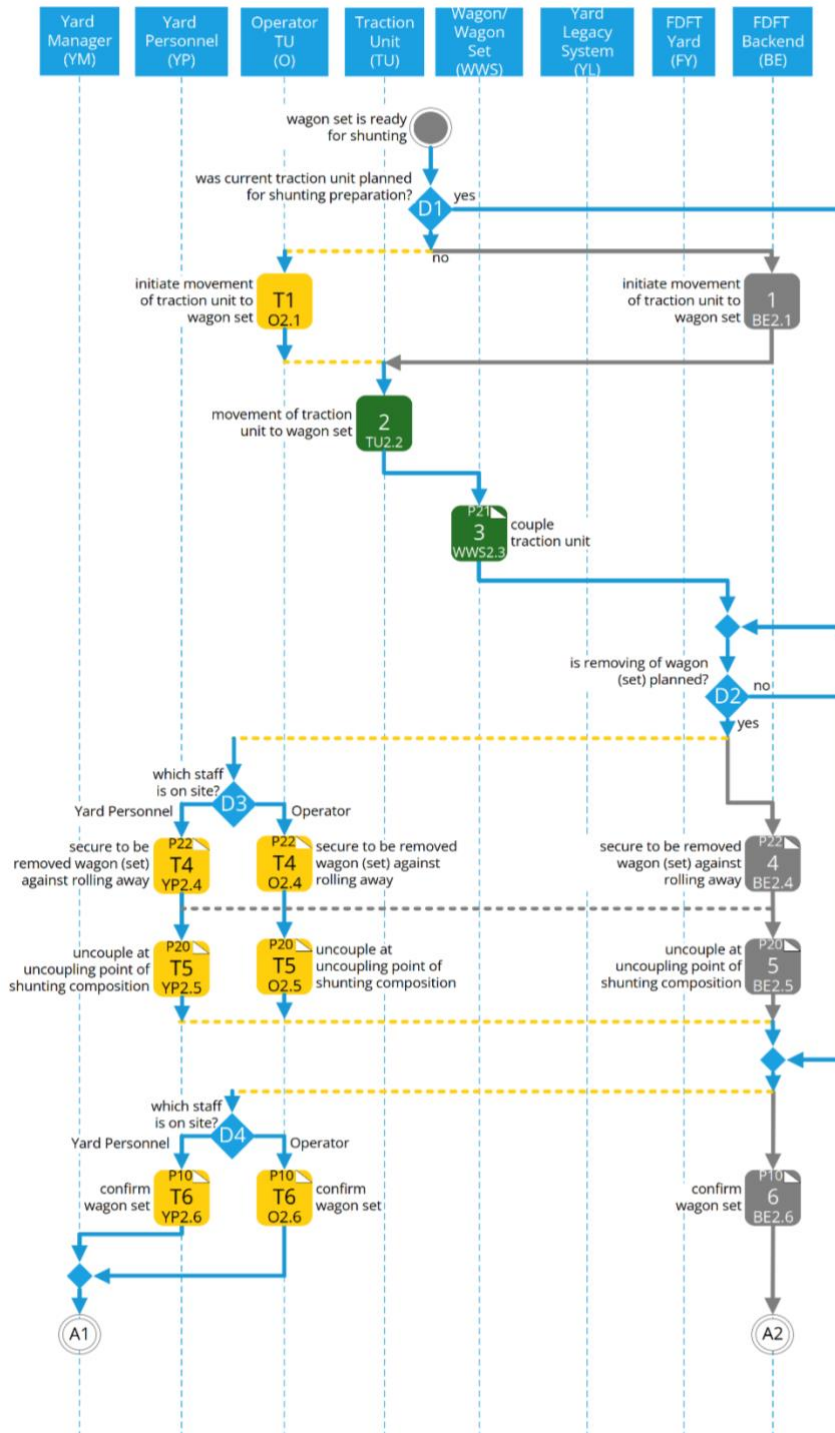


Figure 54: EP02 Wagon Processing - 1 of 4

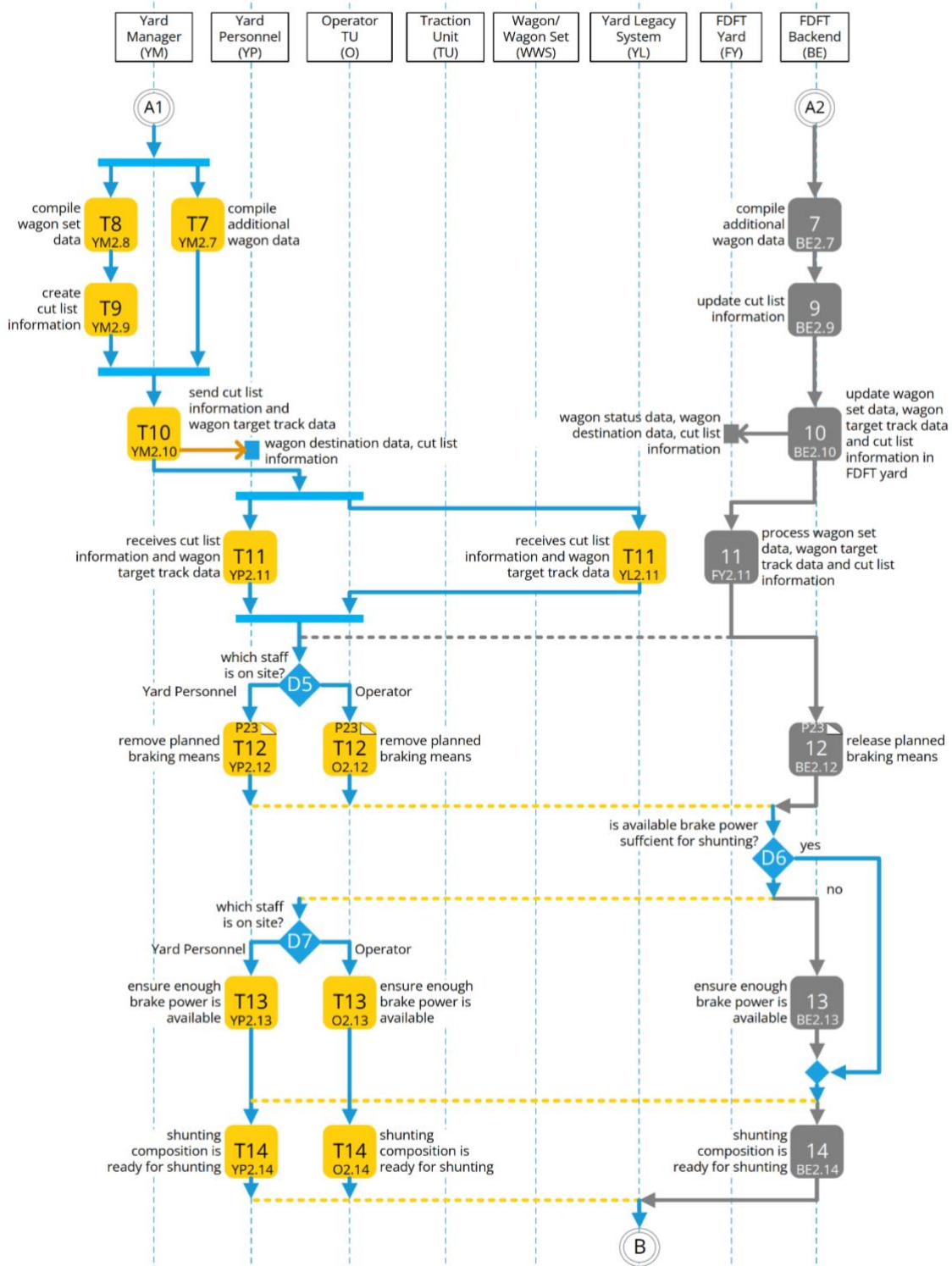


Figure 55: EP02 Wagon Processing - 2 of 4

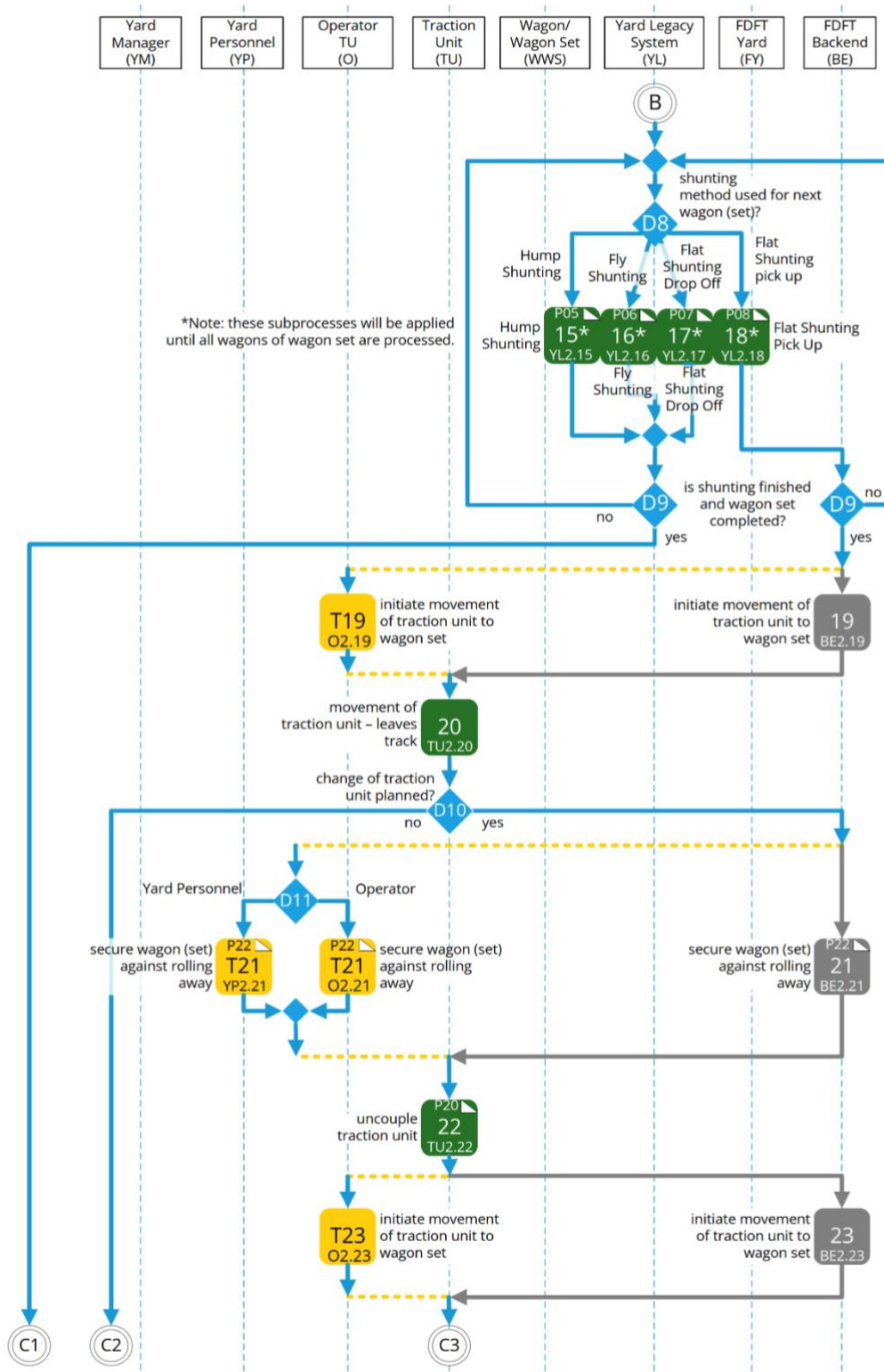


Figure 56: EP02 Wagon Processing - 3 of 4

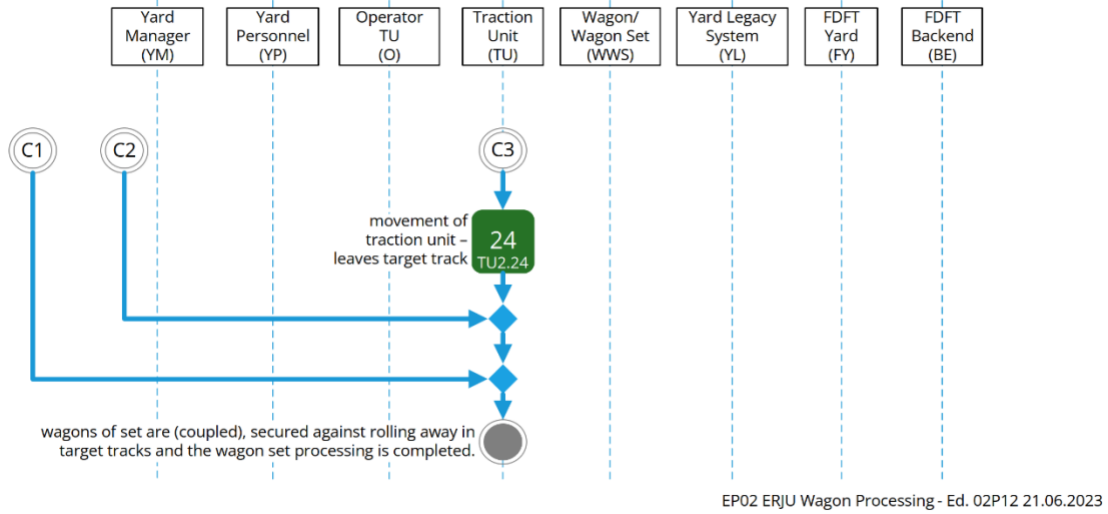


Figure 57: EP02 Wagon Processing - 4 of 4

### 8.5.3 EP03 - Train Preparation

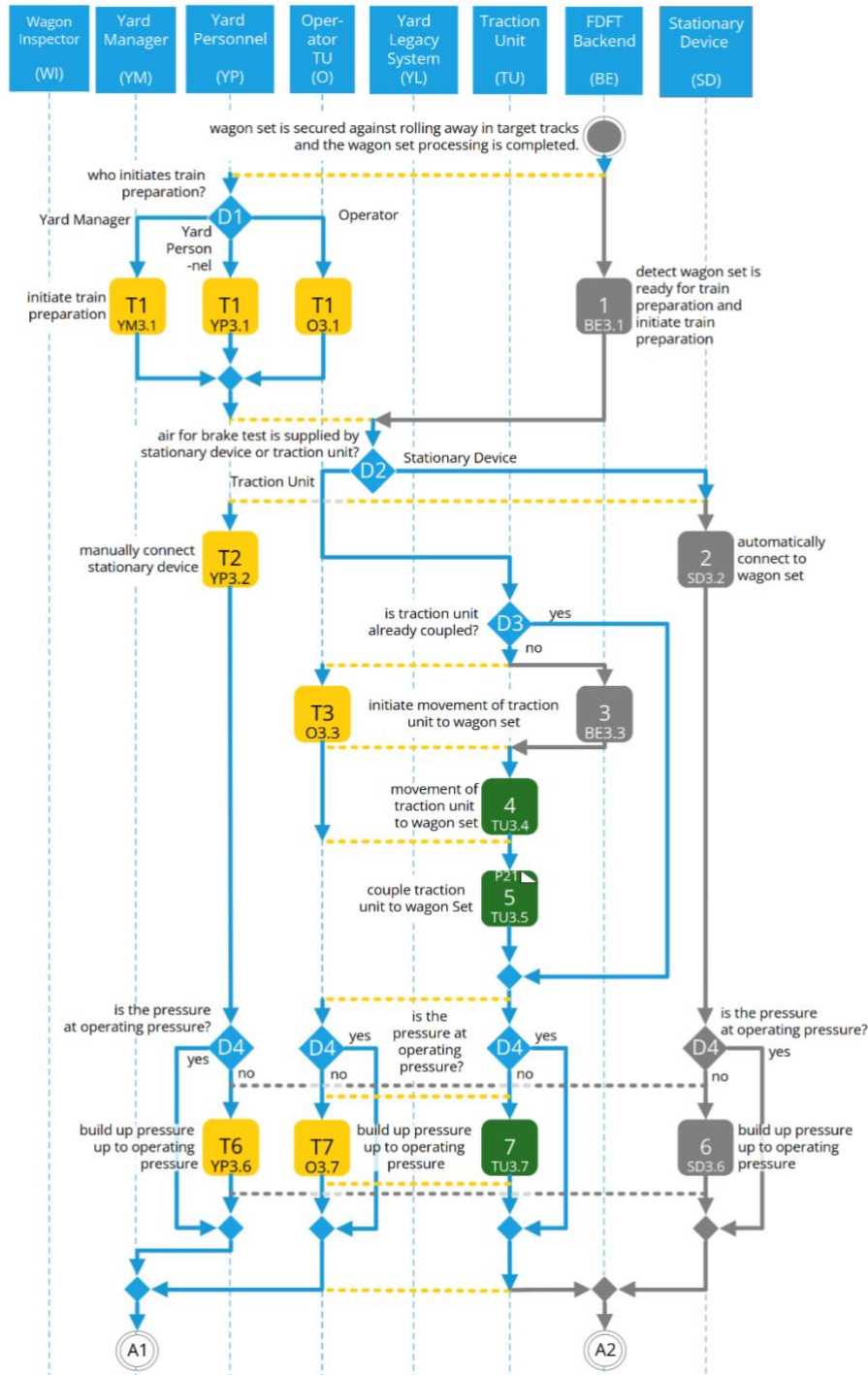


Figure 58: EP03 Train Preparation - 1 of 4

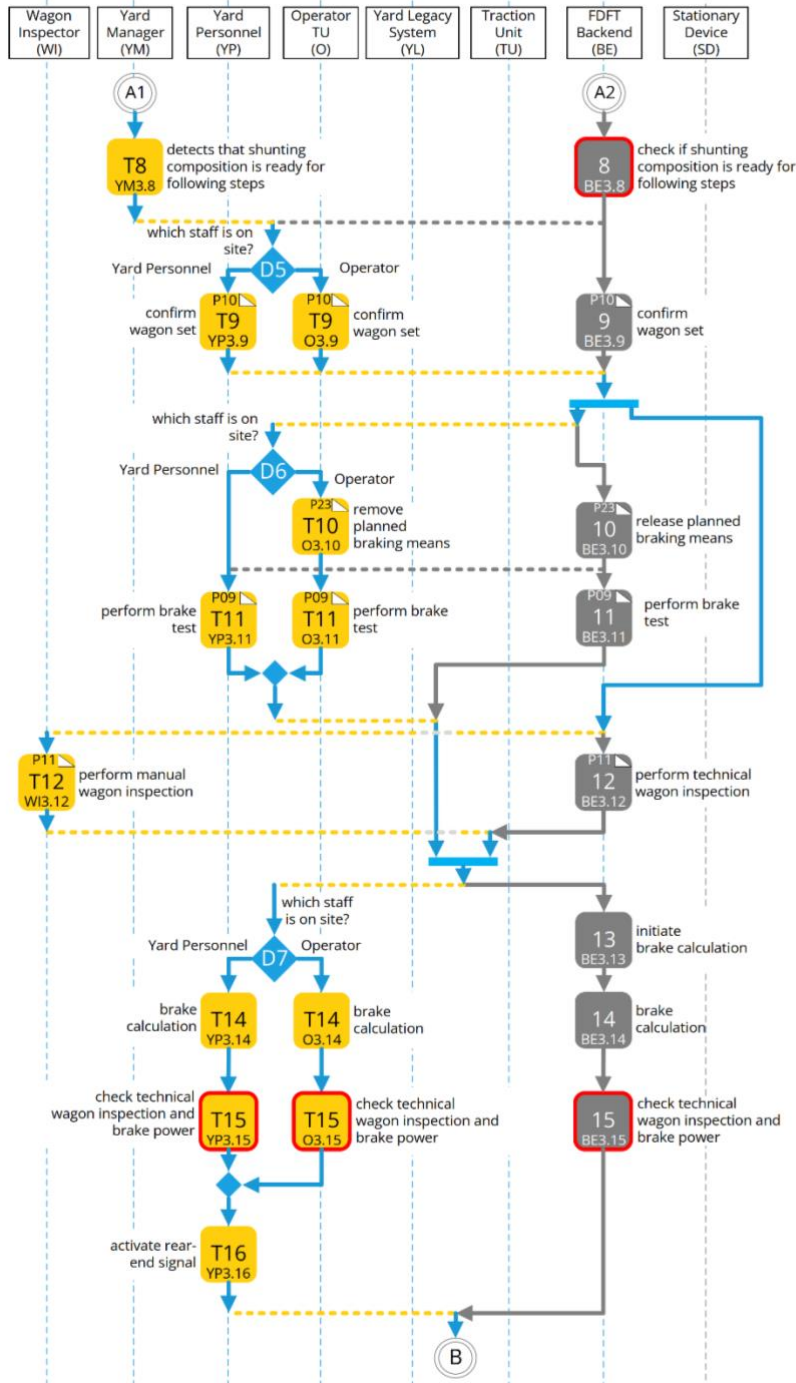


Figure 59: EP03 Train Preparation - 2 of 4

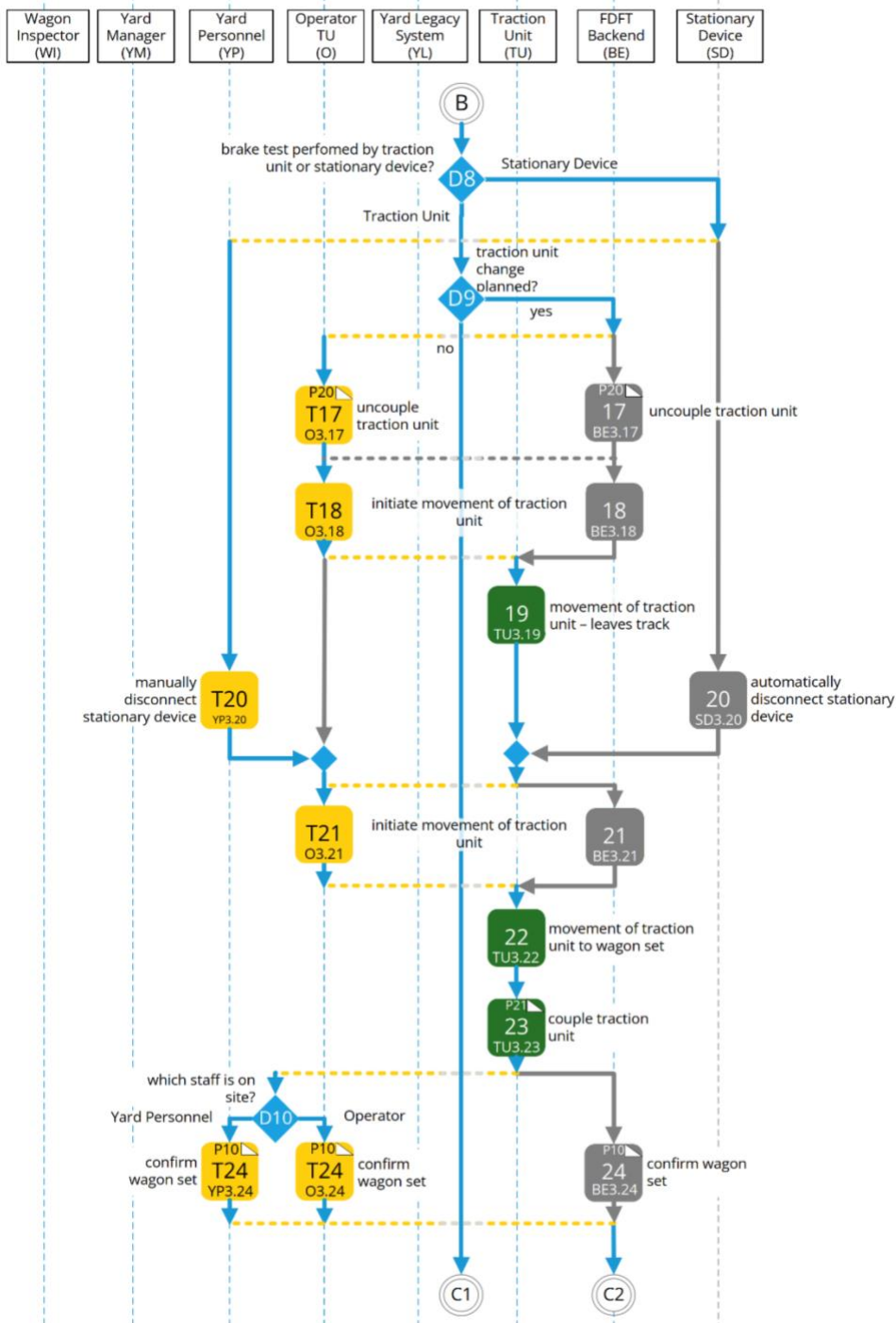


Figure 60: EP03 Train Preparation - 3 of 4



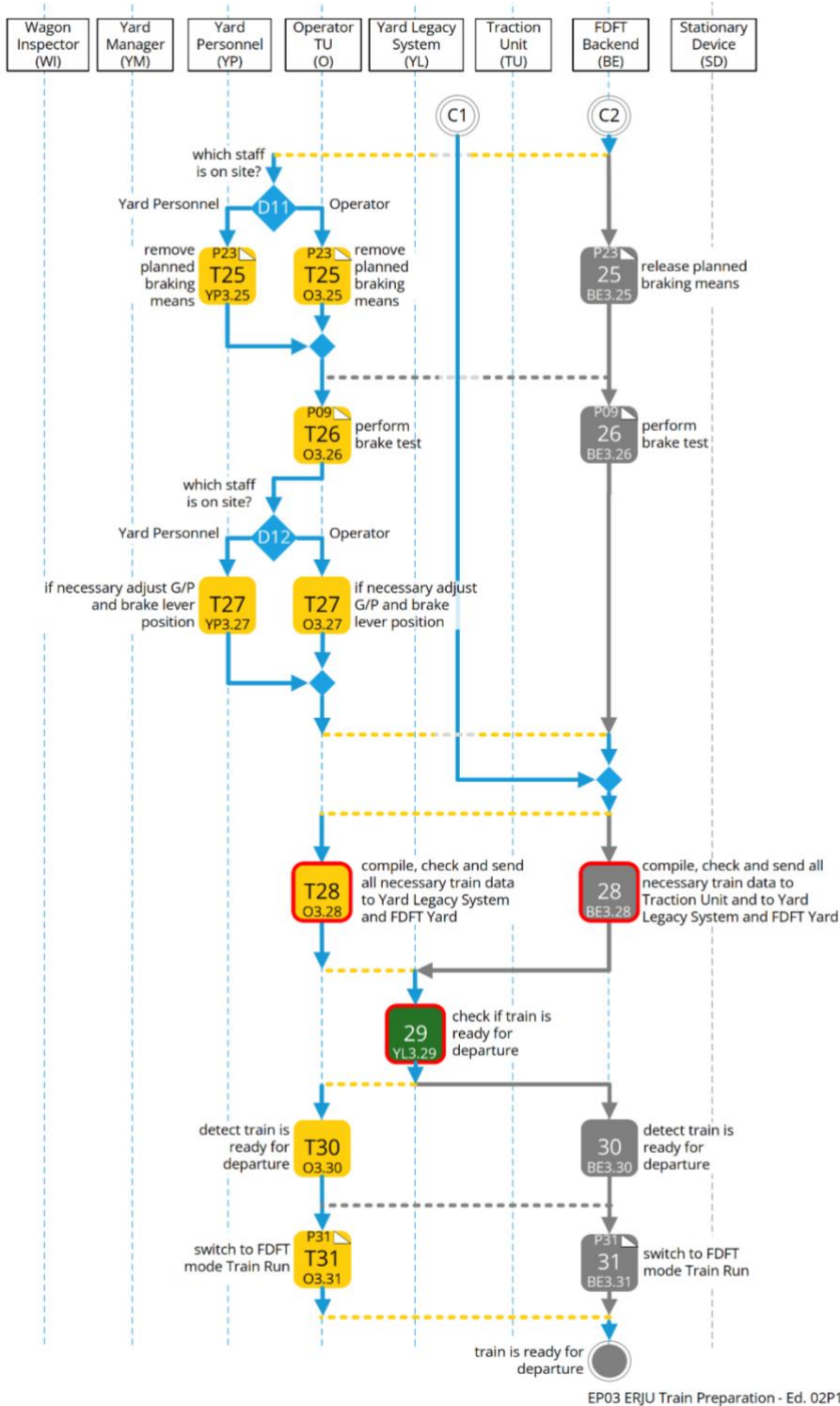


Figure 61: EP03 Train Preparation - 4 of 4

### 8.5.4 EP04 - Train Run

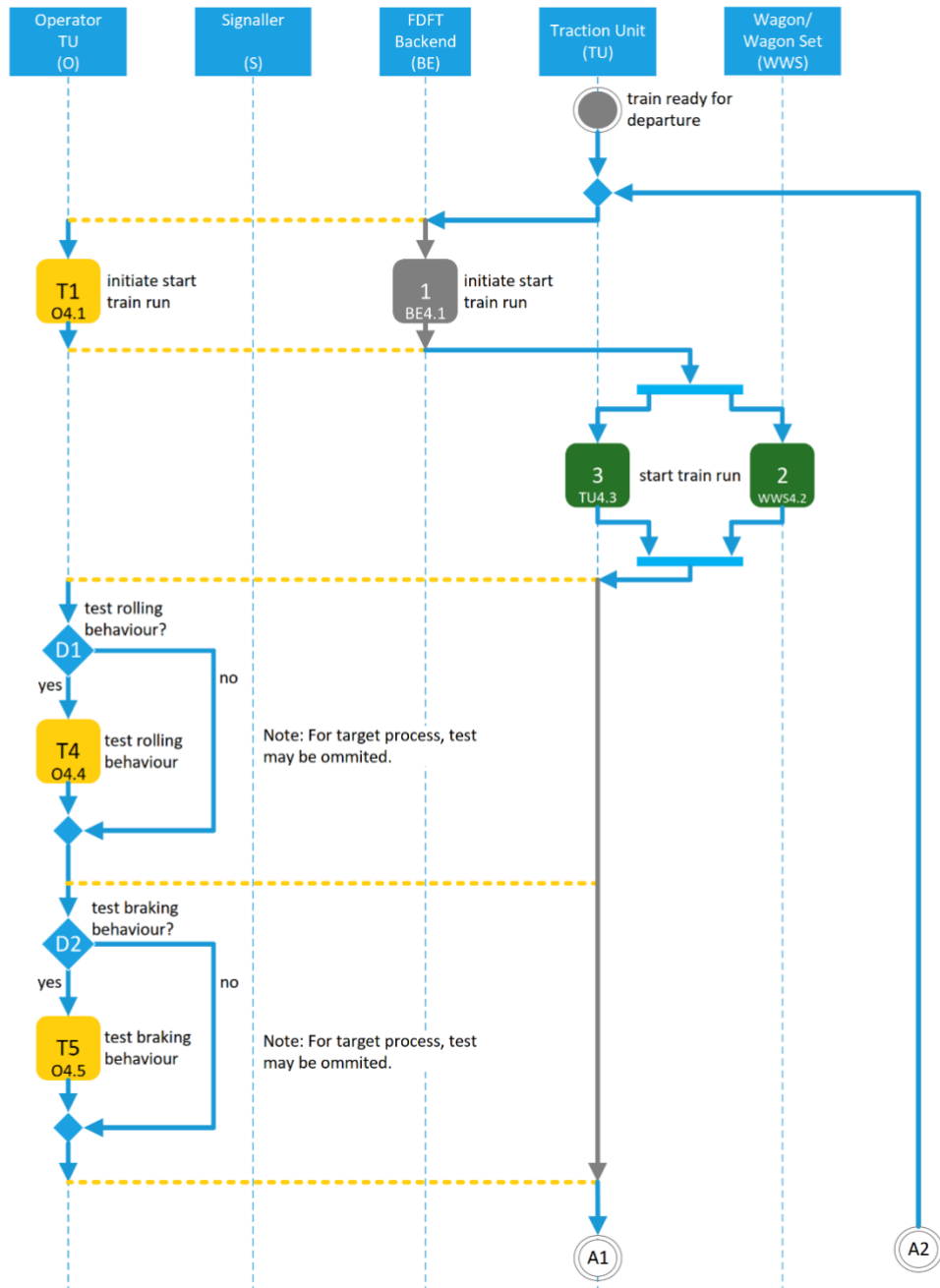


Figure 62: EP04 Train Run - 1 of 2

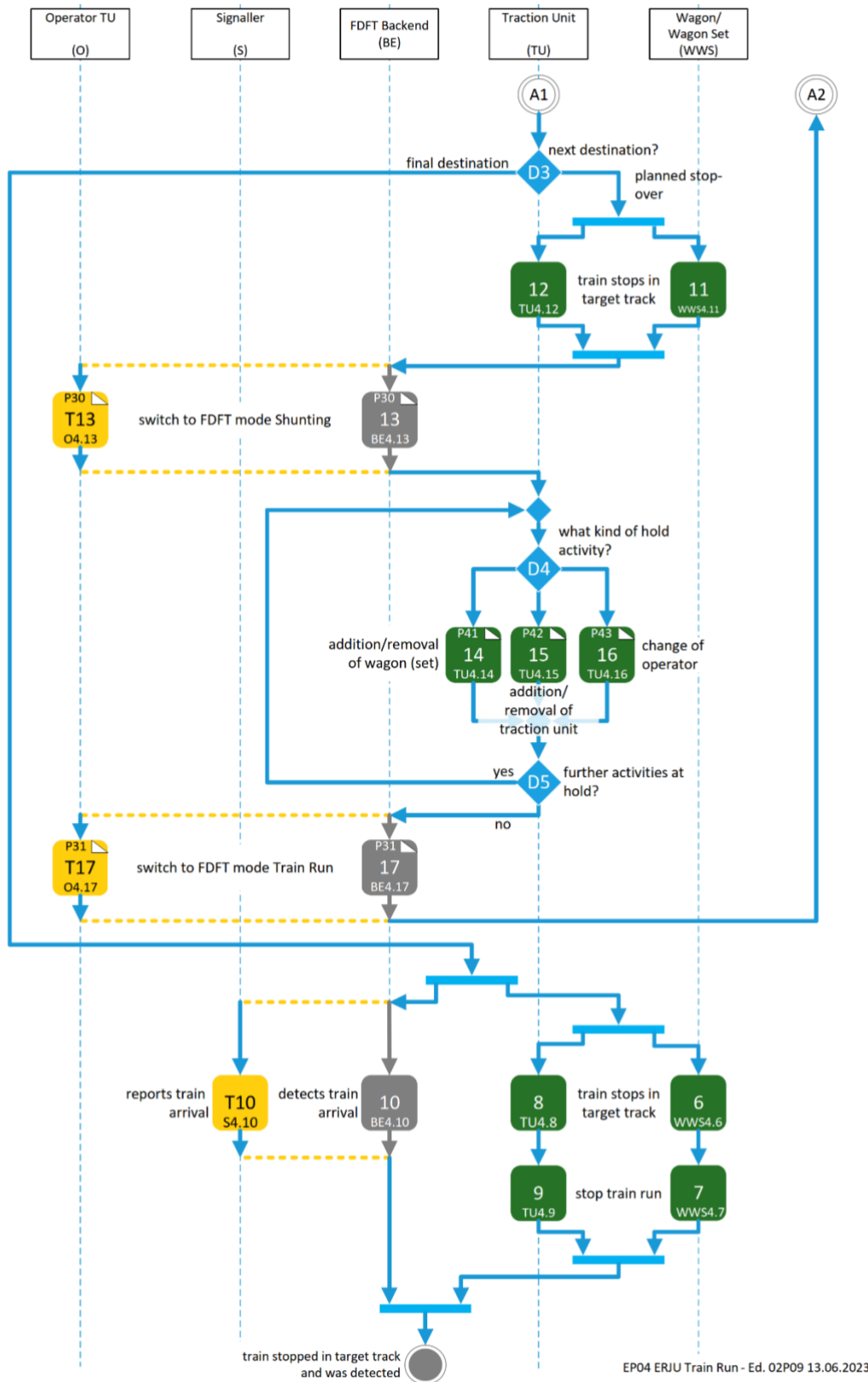


Figure 63: EP04 Train Run - 2 of 2

### 8.5.5 EP05 - Hump Shunting

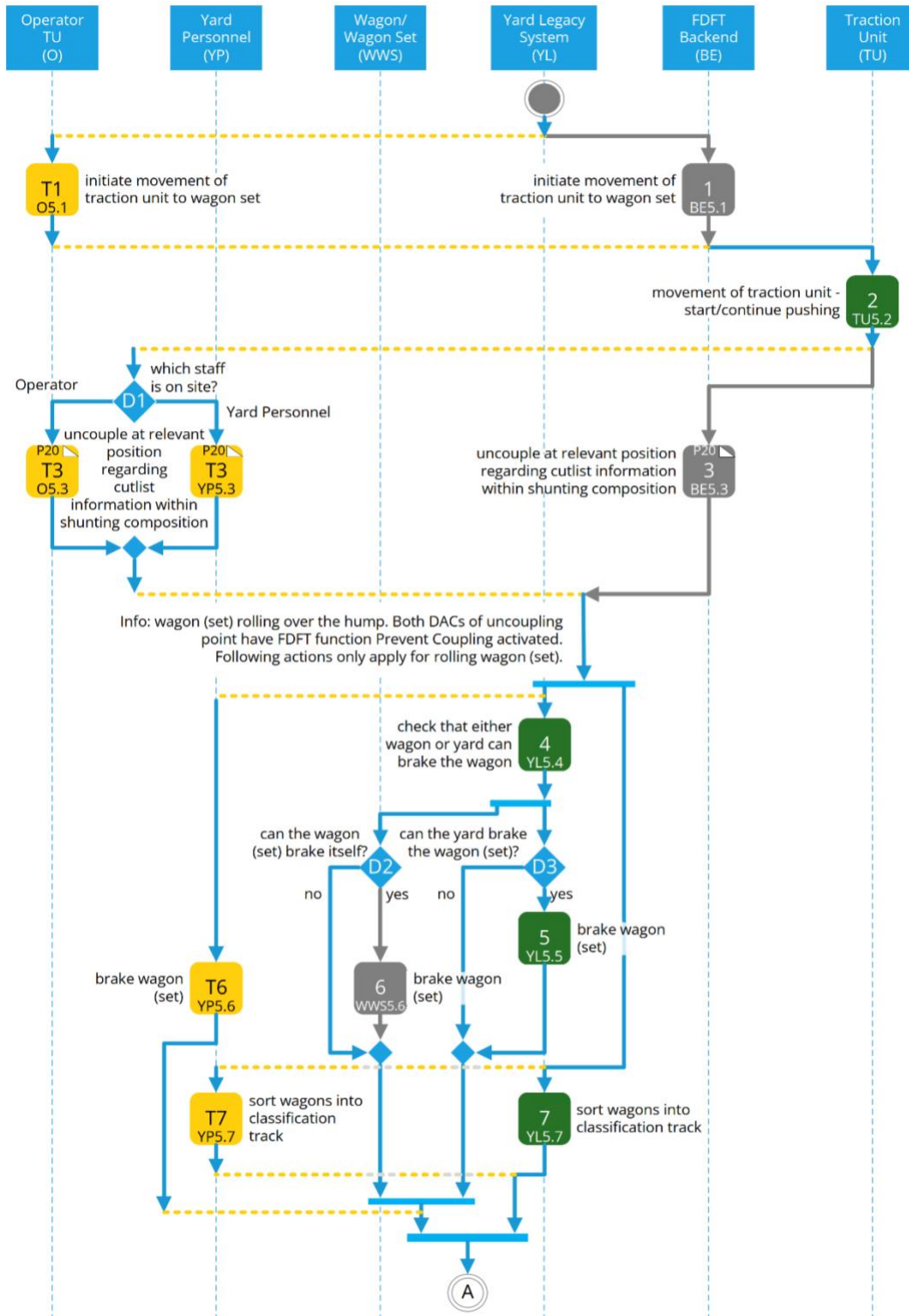
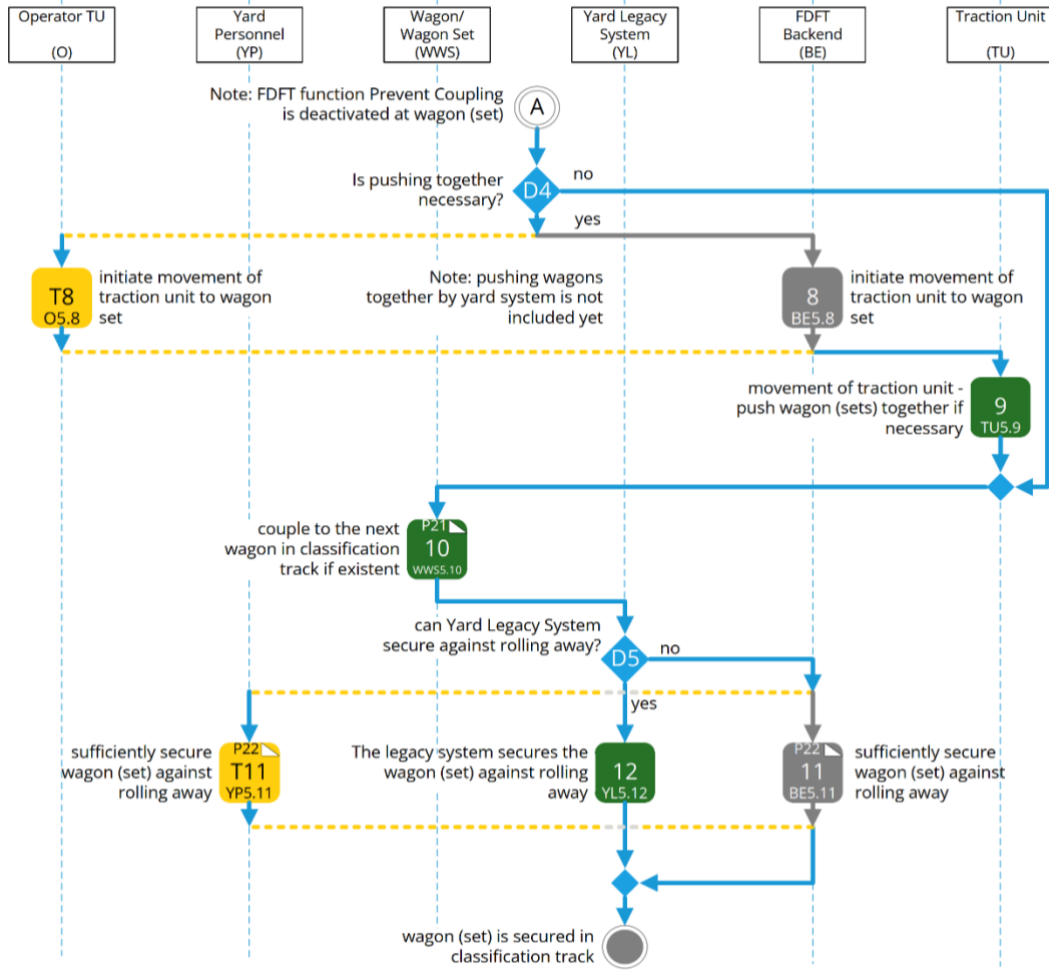


Figure 64: EP05 Hump Shunting - 1 of 2



Subprocess EP05 ERJU Hump Shunting - Ed. 02P10 19.06.2023

Figure 65: EP05 Hump Shunting - 2 of 2

### 8.5.6 EP06 - Fly Shunting

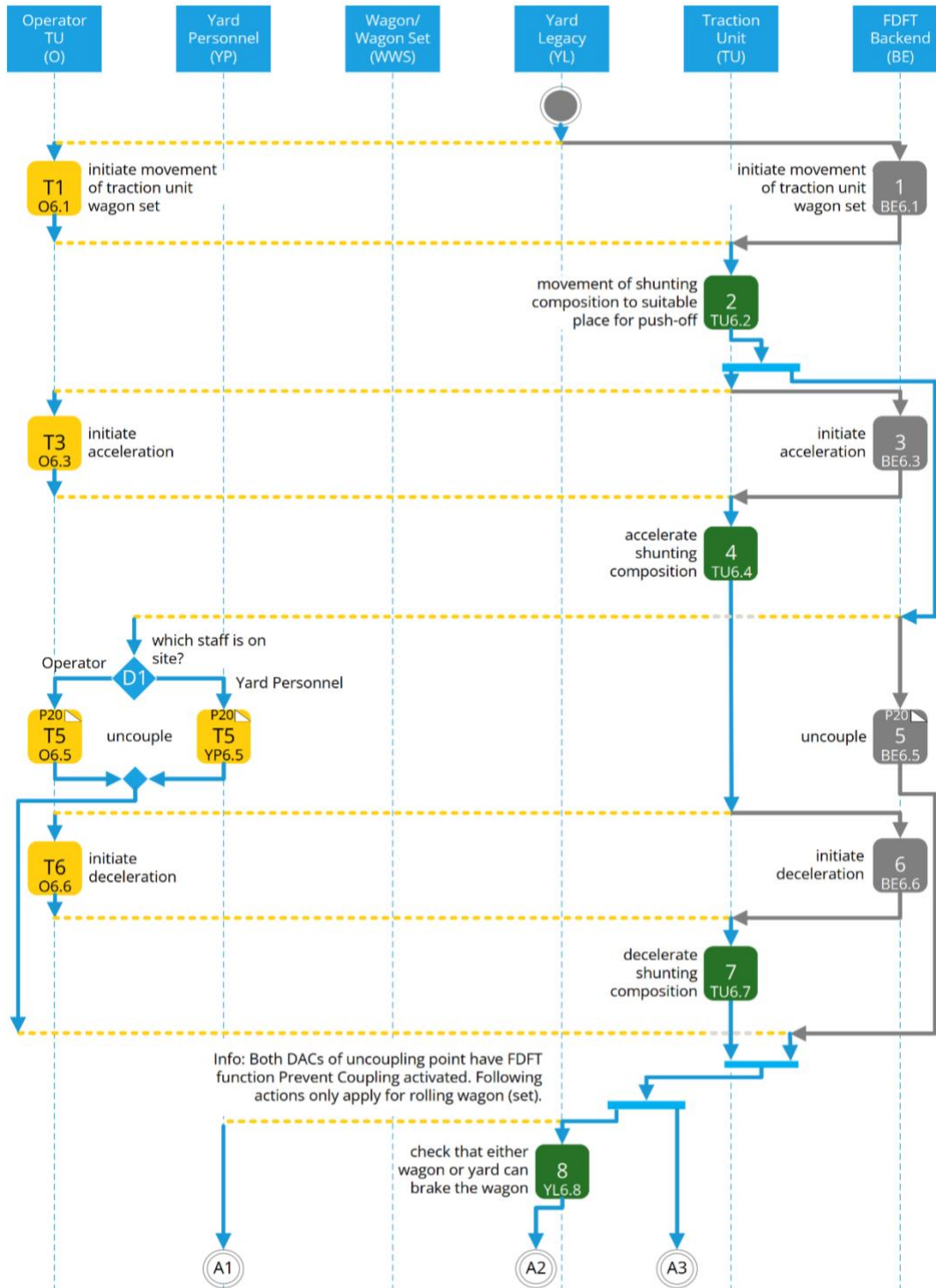
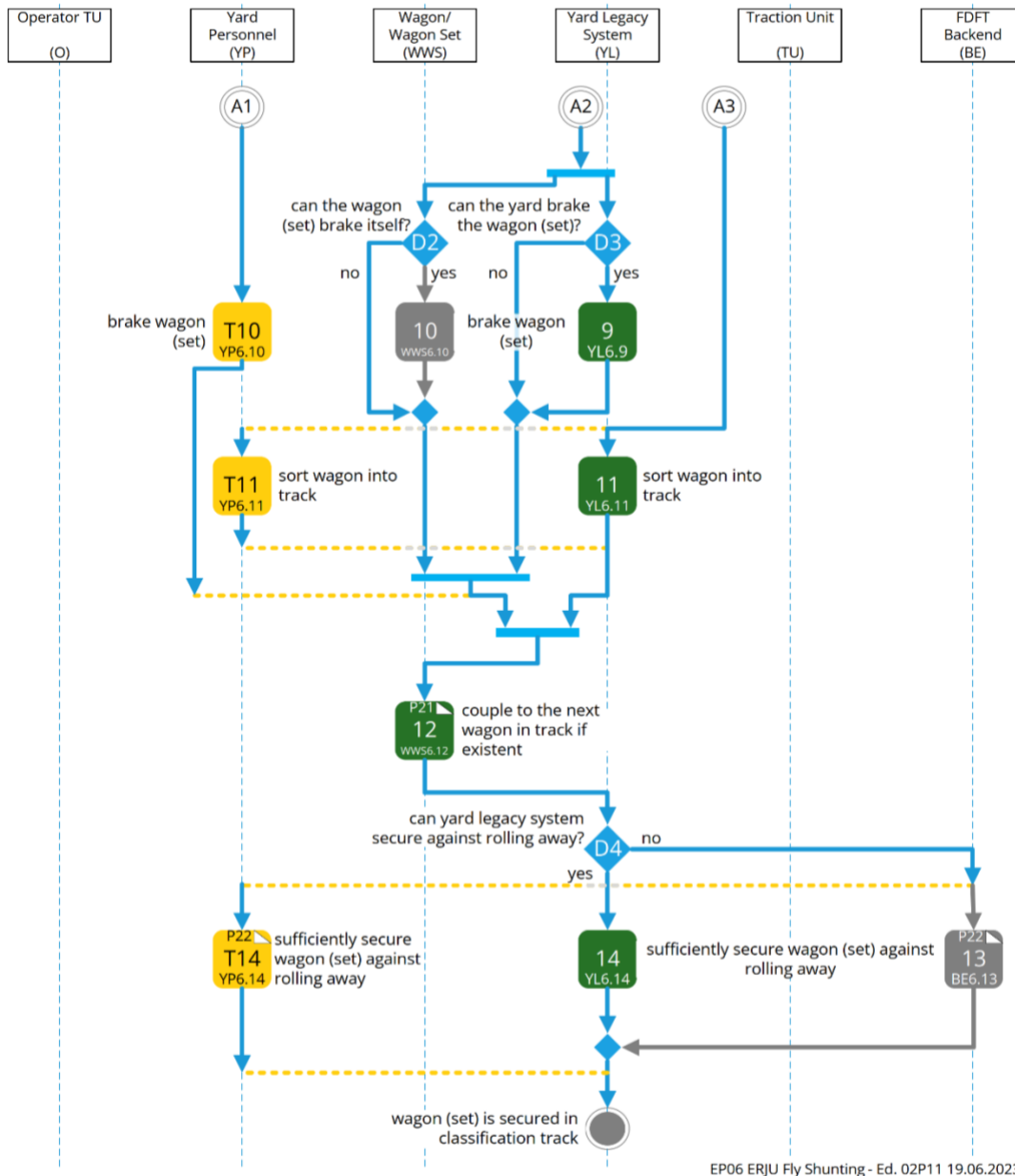


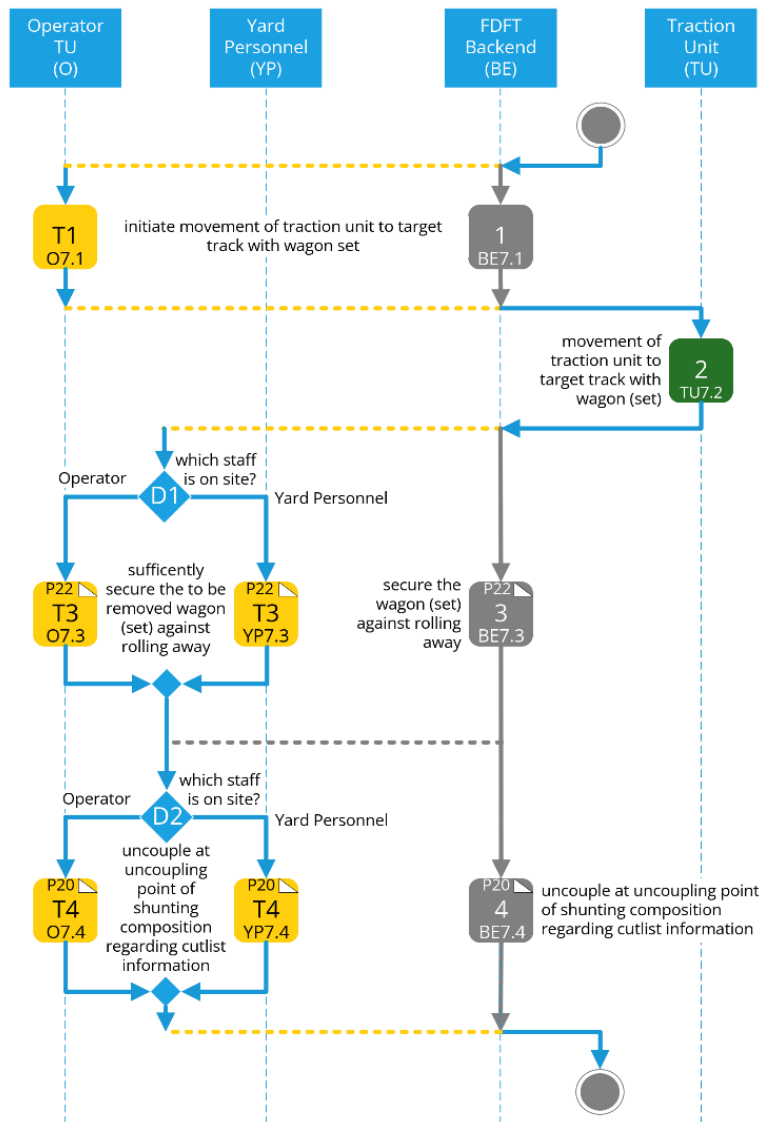
Figure 66: EP06 Fly Shunting - 1 of 2



EP06 ERJU Fly Shunting - Ed. 02P11 19.06.2023

Figure 67: EP06 Fly Shunting - 2 of 2

### 8.5.7 EP07 - Flat Shunting Drop Off

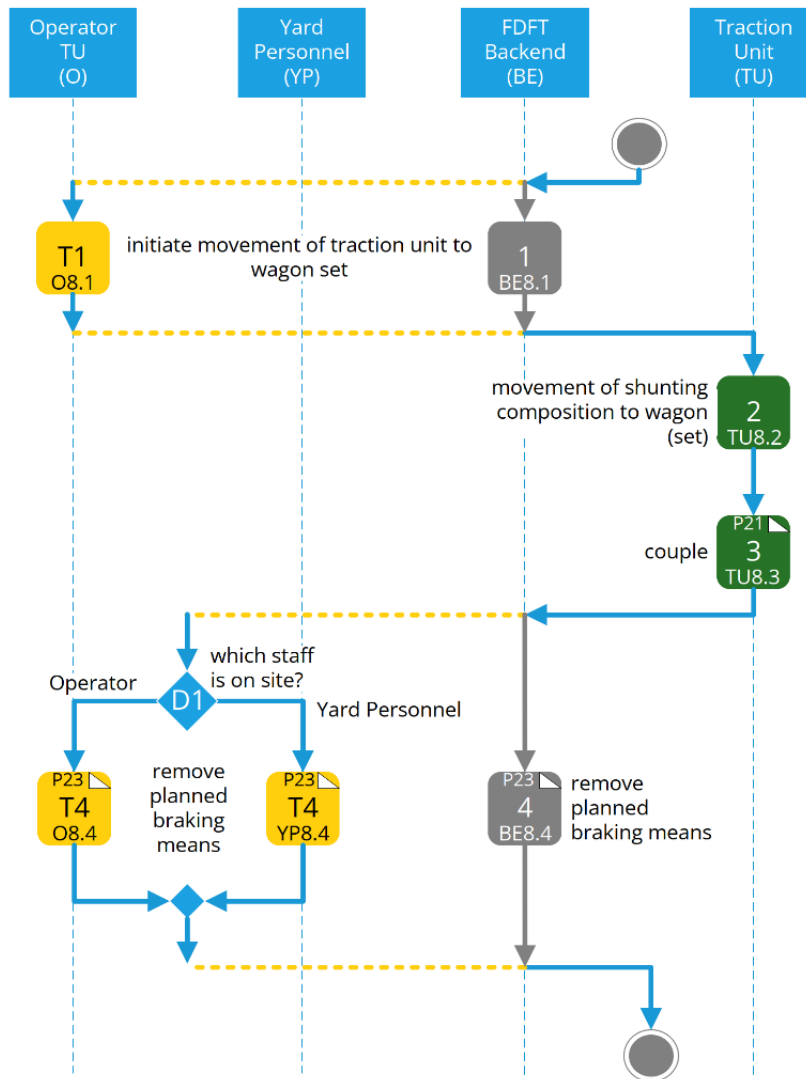


Subprocess EP07 ERJU Flat Shunting Drop Off - Ed. 02P08 13.06.2023

Figure 68: EP07 Flat Shunting Drop Off - 1 of 1



### 8.5.8 EP08 - Flat Shunting Pick Up



Subprocess EP08 ERJU Flat Shunting Pick Up - Ed. 02P08 13.06.2023

Figure 69: EP08 Flat Shunting Pick Up - 1 of 1

### 8.5.9 EP09 - Automated Brake Test

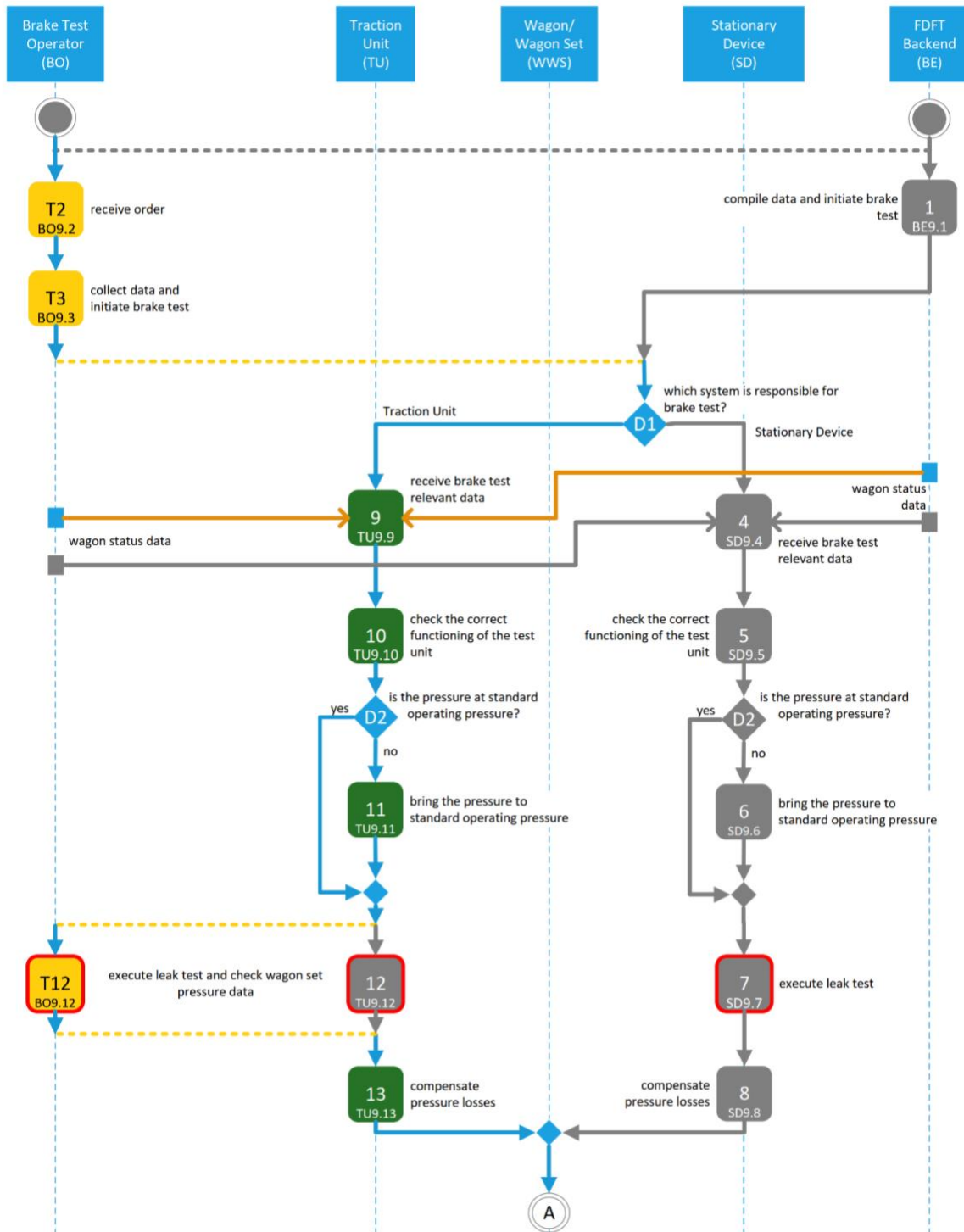


Figure 70: EP09 Automated Brake Test - 1 of 3

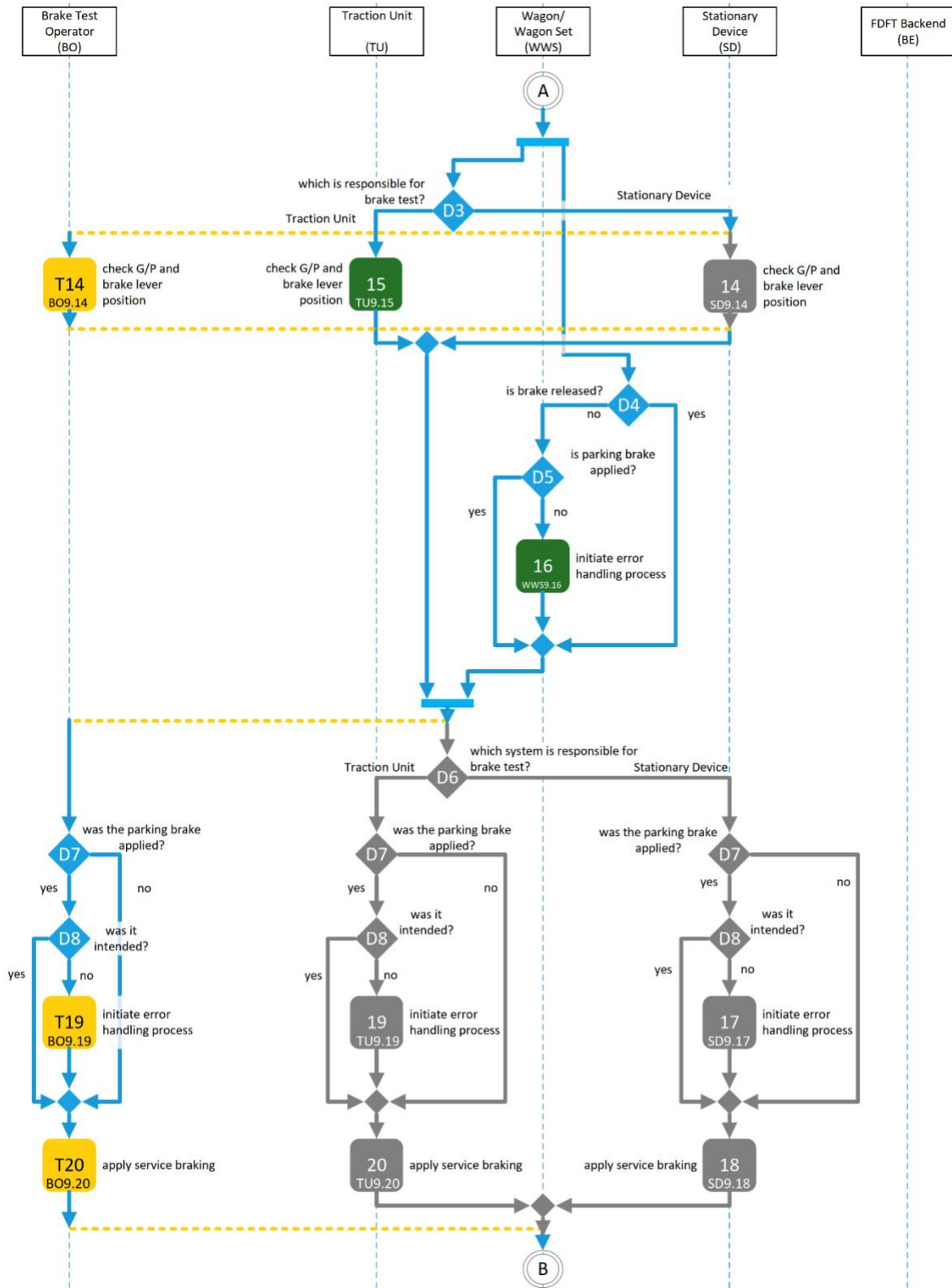
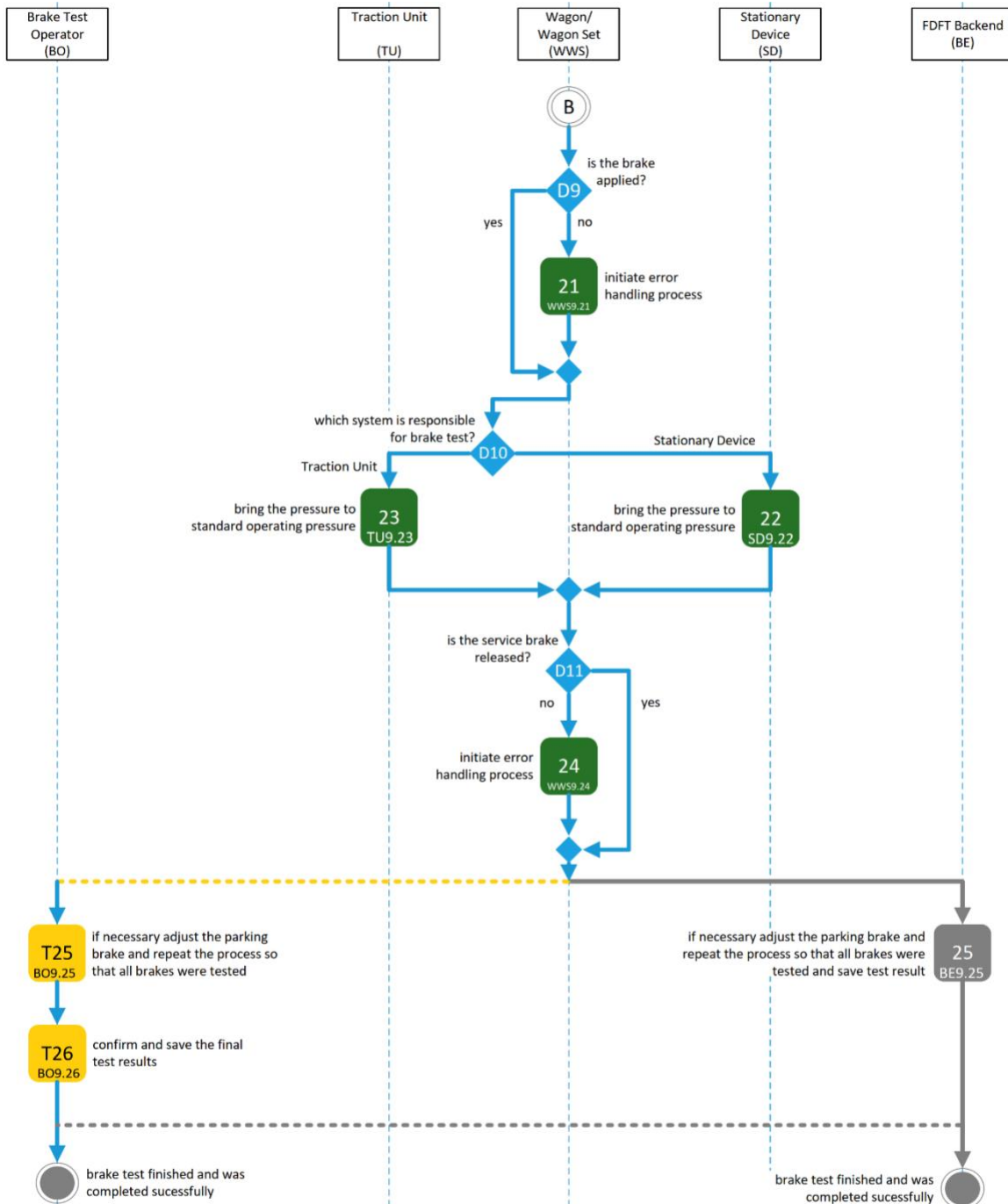


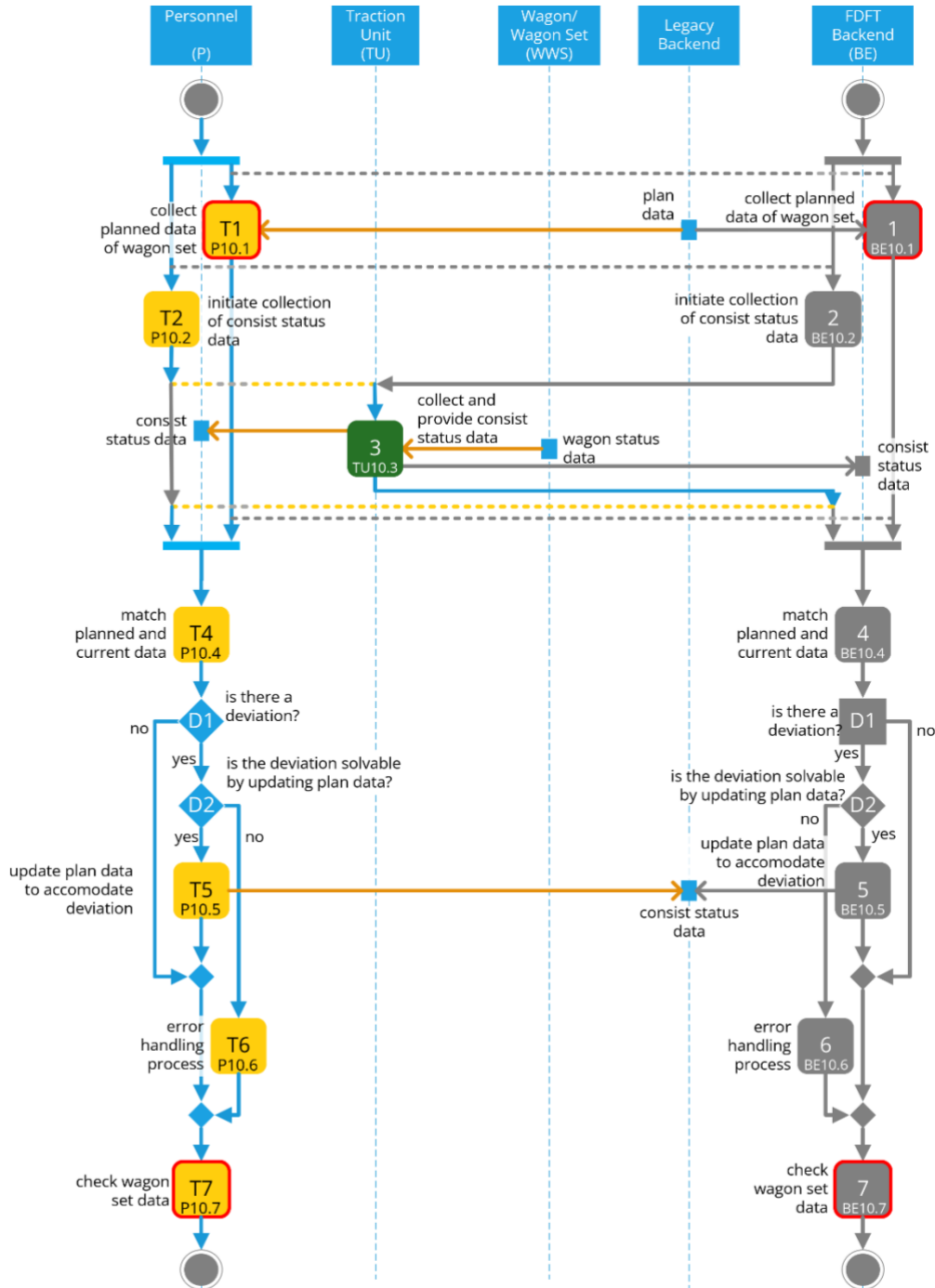
Figure 71: EP09 Automated Brake Test - 2 of 3



EP09 ERJU Automated Brake Test - Ed. 02P09 13.06.2023

Figure 72: EP09 Automated Brake Test - 3 of 3

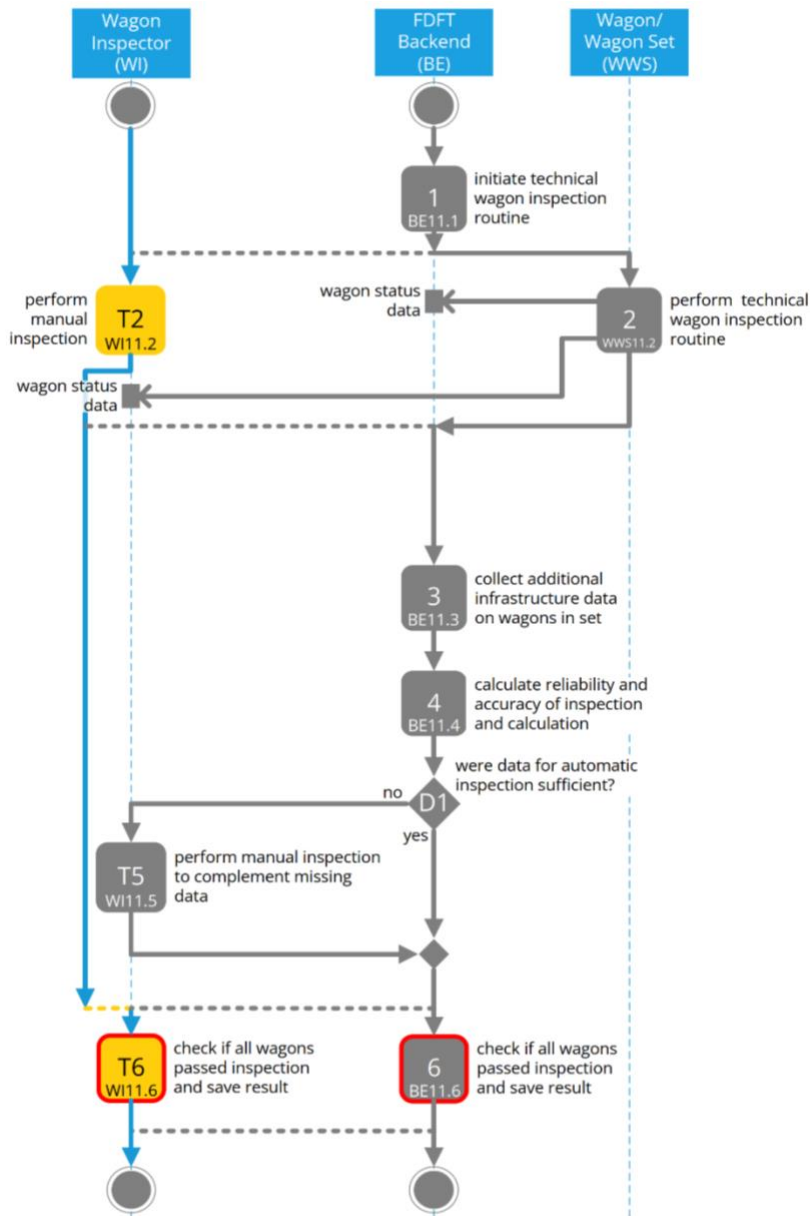
### 8.5.10 EP10 - Confirm Wagon Set



Subprocess EP10 ERJU Confirm Wagon Set - Ed. 02P07 14.06.2023

Figure 73: EP10 Confirm Wagon Set - 1 of 1

### 8.5.11 EP11 - Technical Wagon Inspection



Subprocess EP11 ERJU Technical Wagon Inspection - Ed. 02P08 20.06.2023

Figure 74: EP11 Technical Wagon Inspection - 1 of 1

### 8.5.12 EP20 - Uncouple

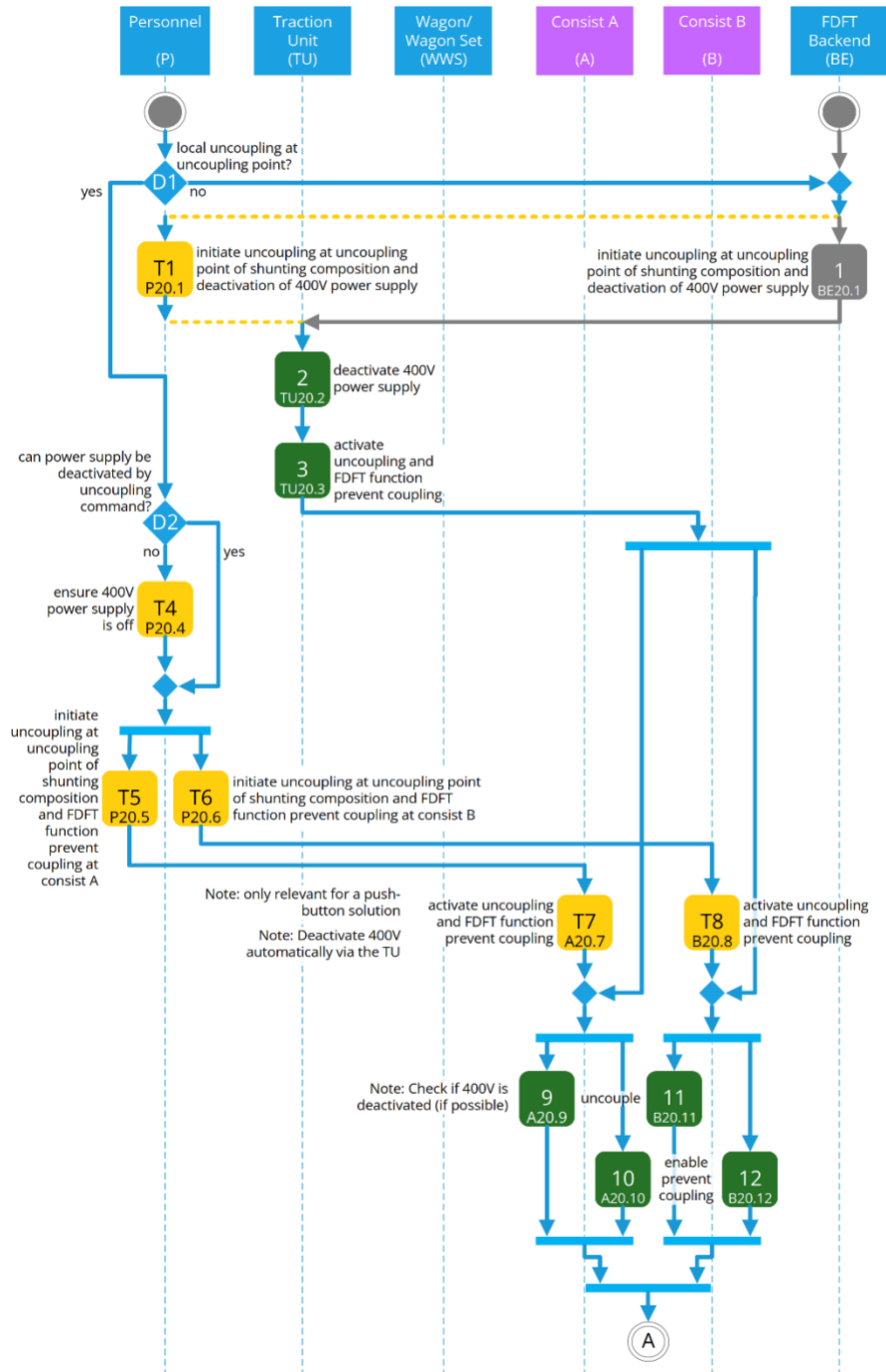


Figure 75: EP20 Uncouple - 1 of 2

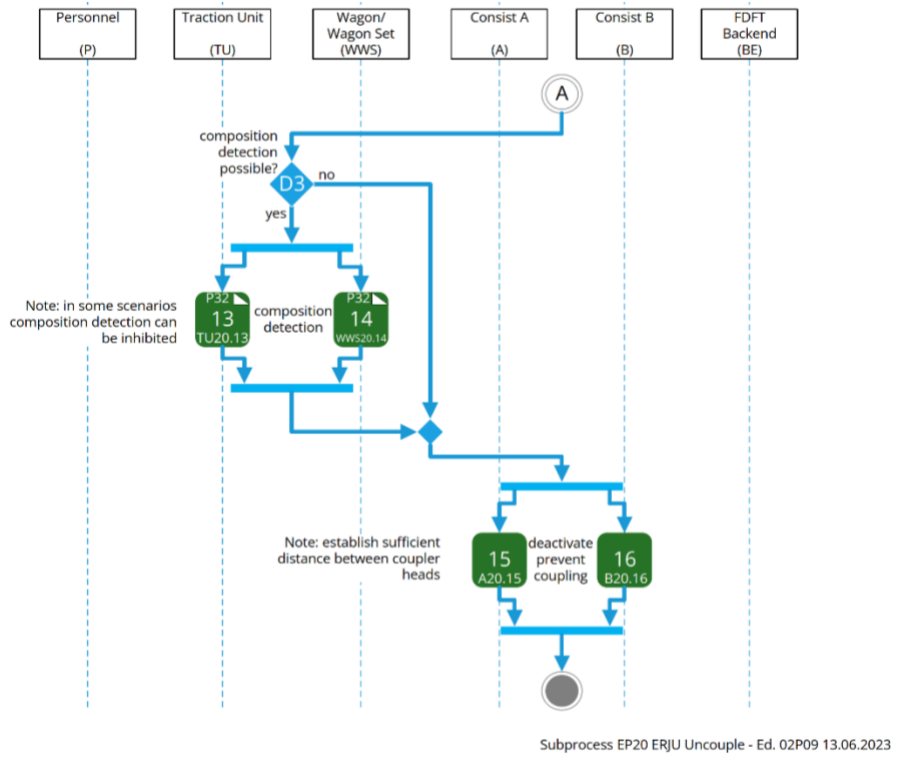
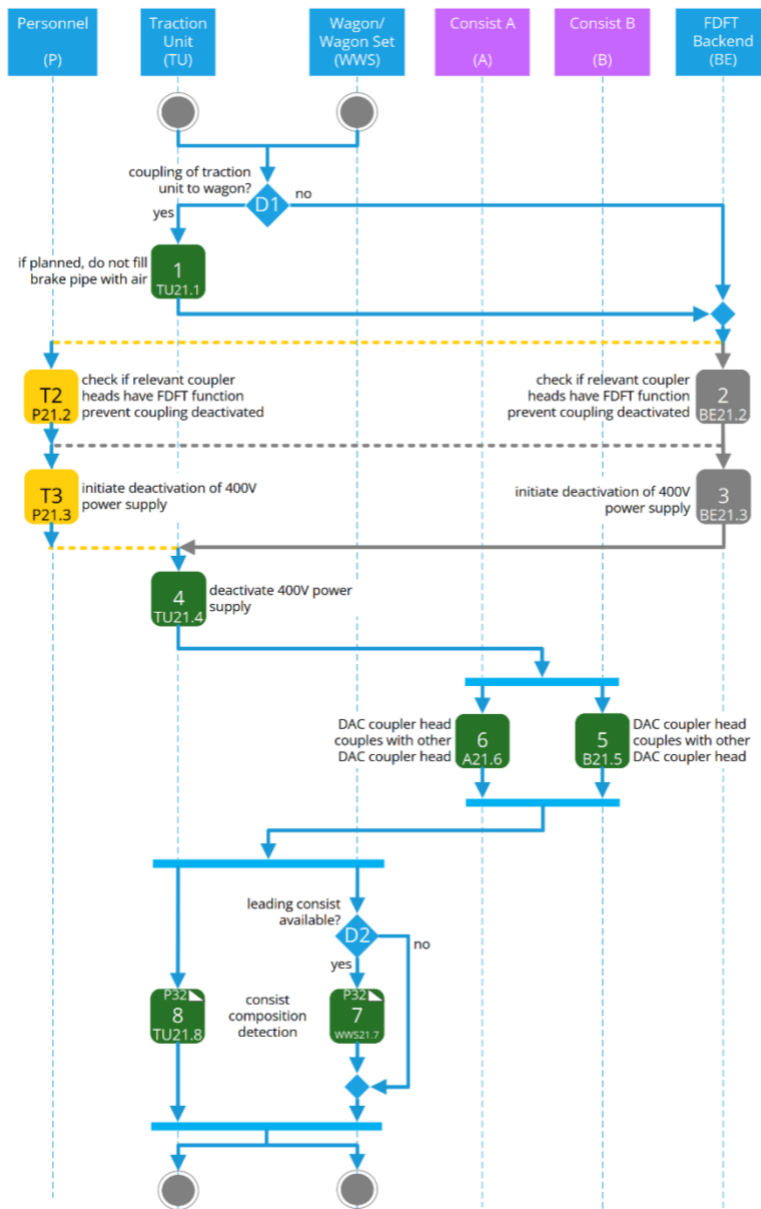


Figure 76: EP20 Uncouple - 2 of 2



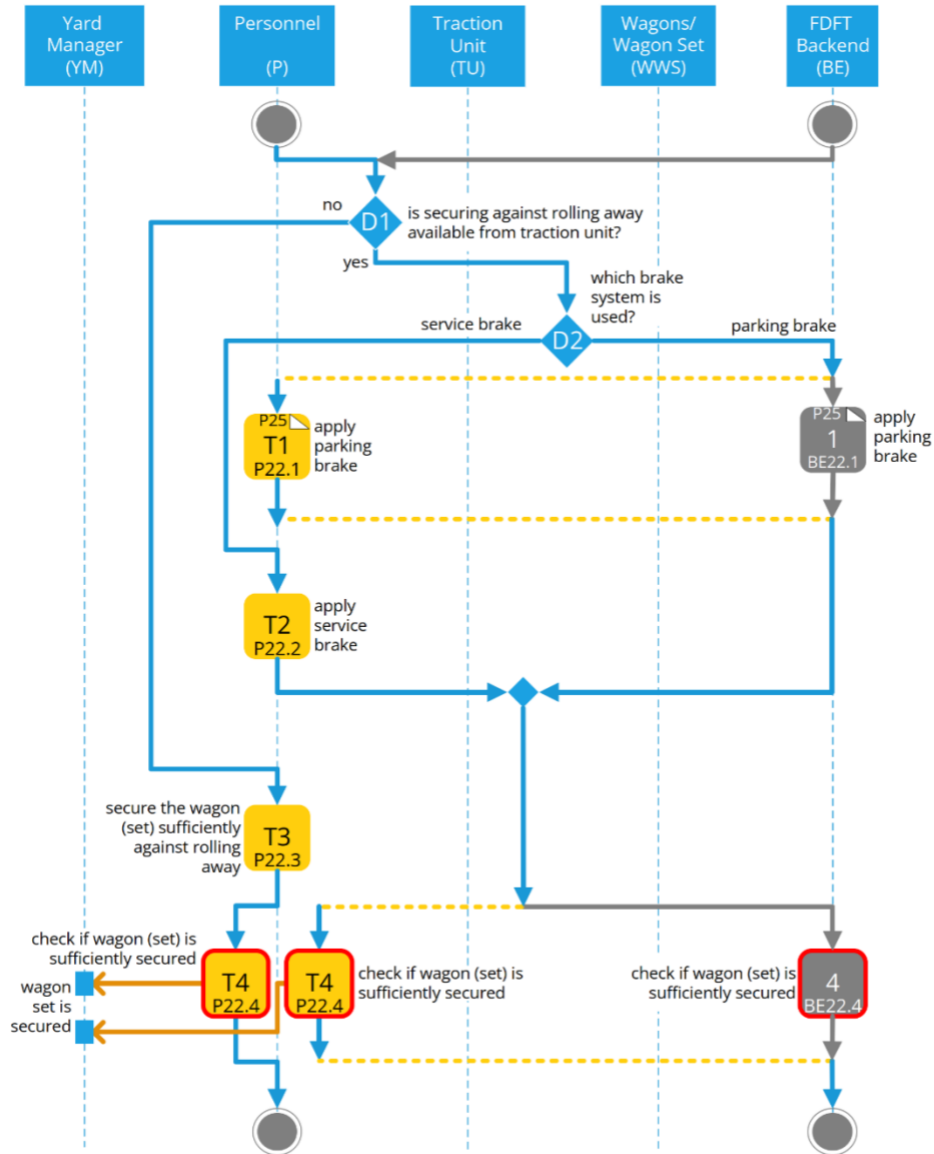
### 8.5.13 EP21 - Couple



Subprocess EP21 ERJU Couple - Ed. 02P07 13.06.2023

Figure 77: EP21 Couple - 1 of 1

### 8.5.14 EP22 - Secure Wagon (Set) Against Rolling Away



Subprocess EP22 ERJU Secure Wagon (Set) Against Rolling Away - Ed. 02P11 21.06.2023

Figure 78: EP22 Secure Wagon (Set) Against Rolling Away - 1 of 1

### 8.5.15 EP23 – Remove, Release Braking Means

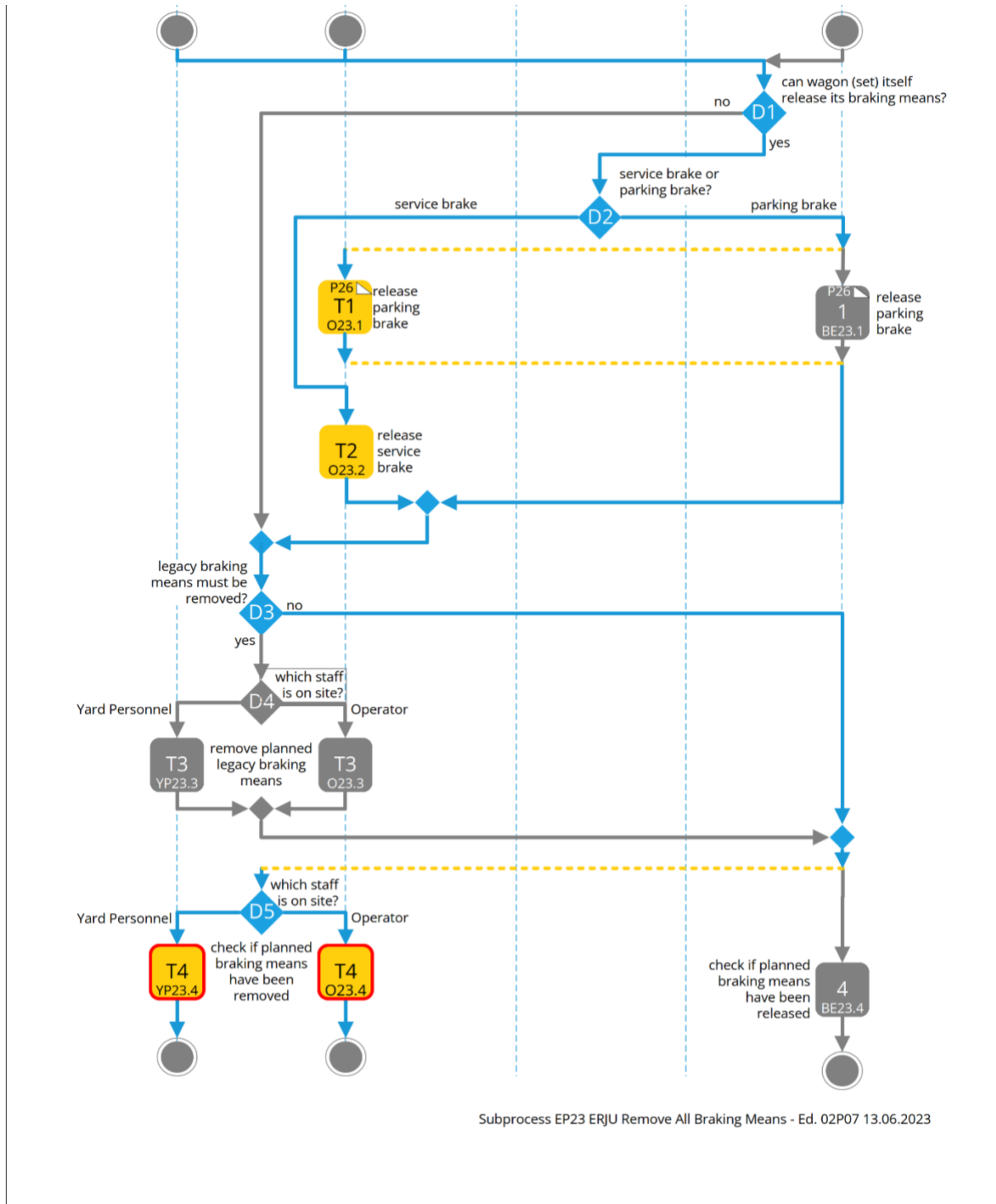
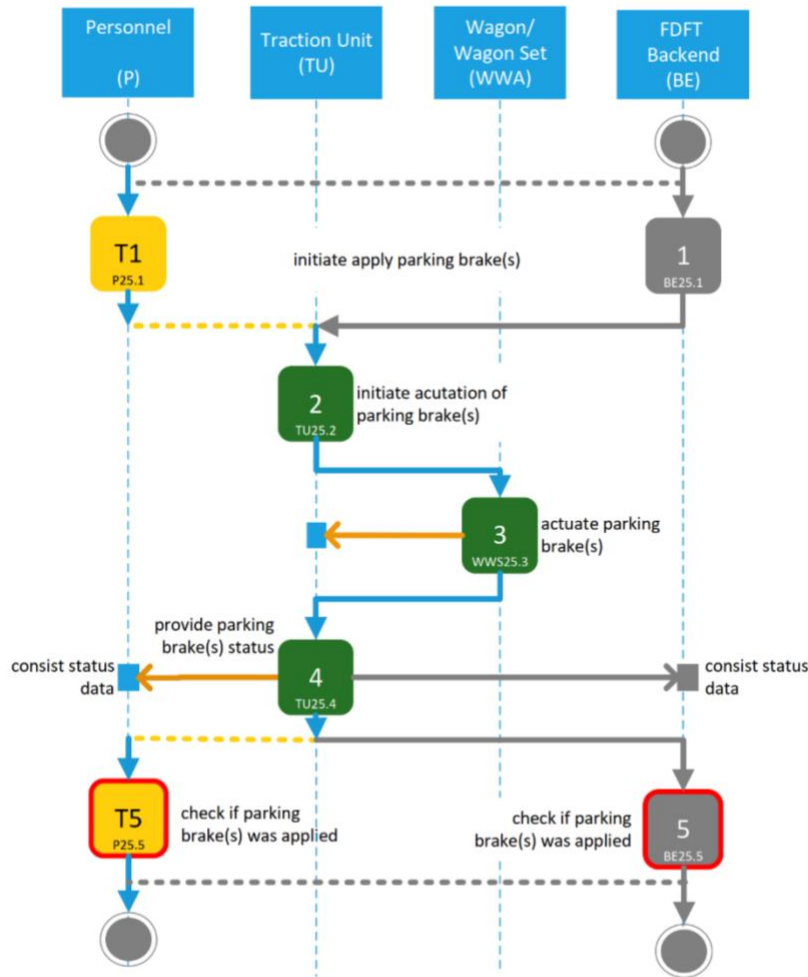


Figure 79: EP23 Remove, Release Braking Means - 1 of 1

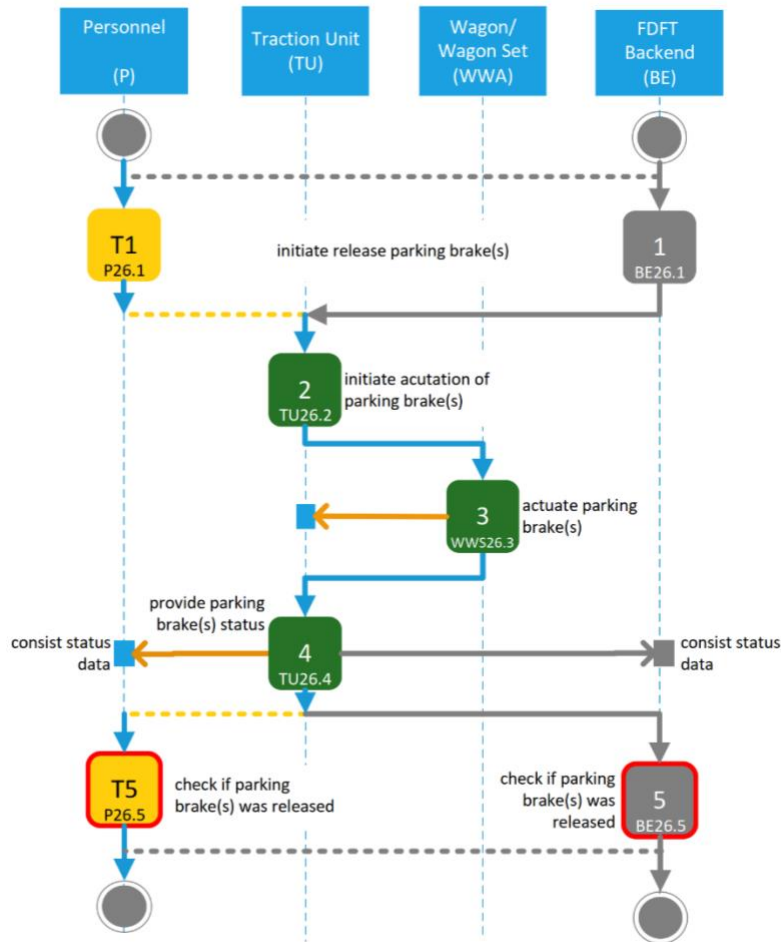
### 8.5.16 EP25 – Apply Parking Brake



Subprocess EP25 ERJU Apply Parking Brake - Ed. 01P06 26.06.2023

Figure 80: EP25 Apply Parking Brake- 1 of 1

### 8.5.17 EP26 – Release Parking Brake



Subprocess EP26 ERJU Release Parking Brake - Ed. 01P05 26.06.2023

Figure 81: EP26 Release Braking Means - 1 of 1

### 8.5.18 EP30 - Switch wagon(s) of set to FDFT mode Shunting

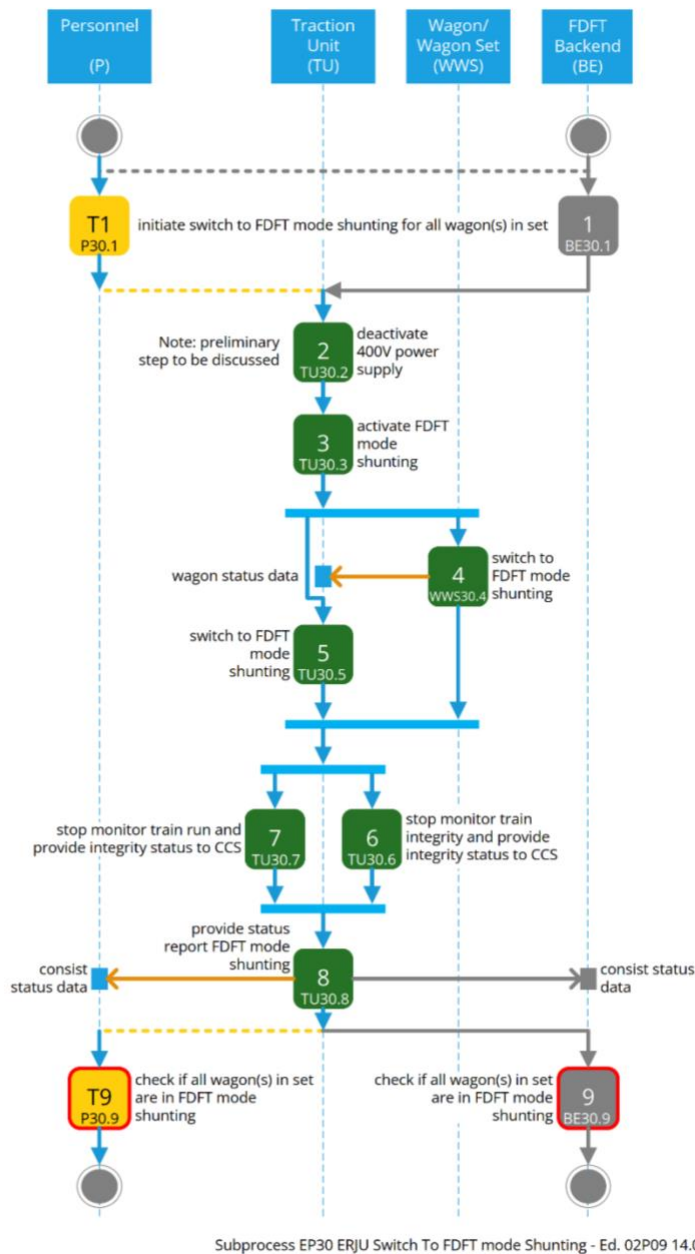
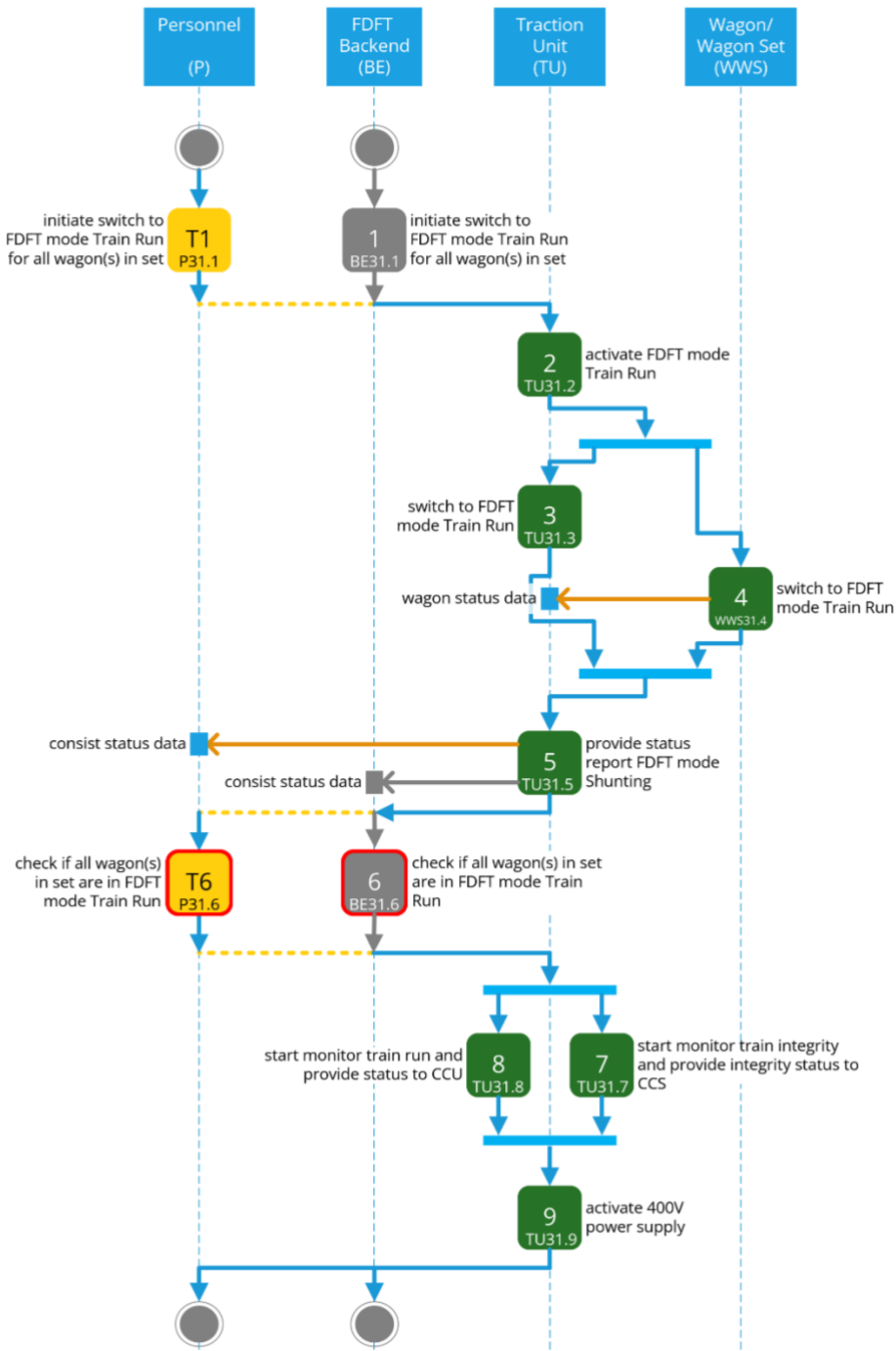


Figure 82: EP30 Switch Wagon(s) Of Set To FDFT Mode Shunting - 1 of 1

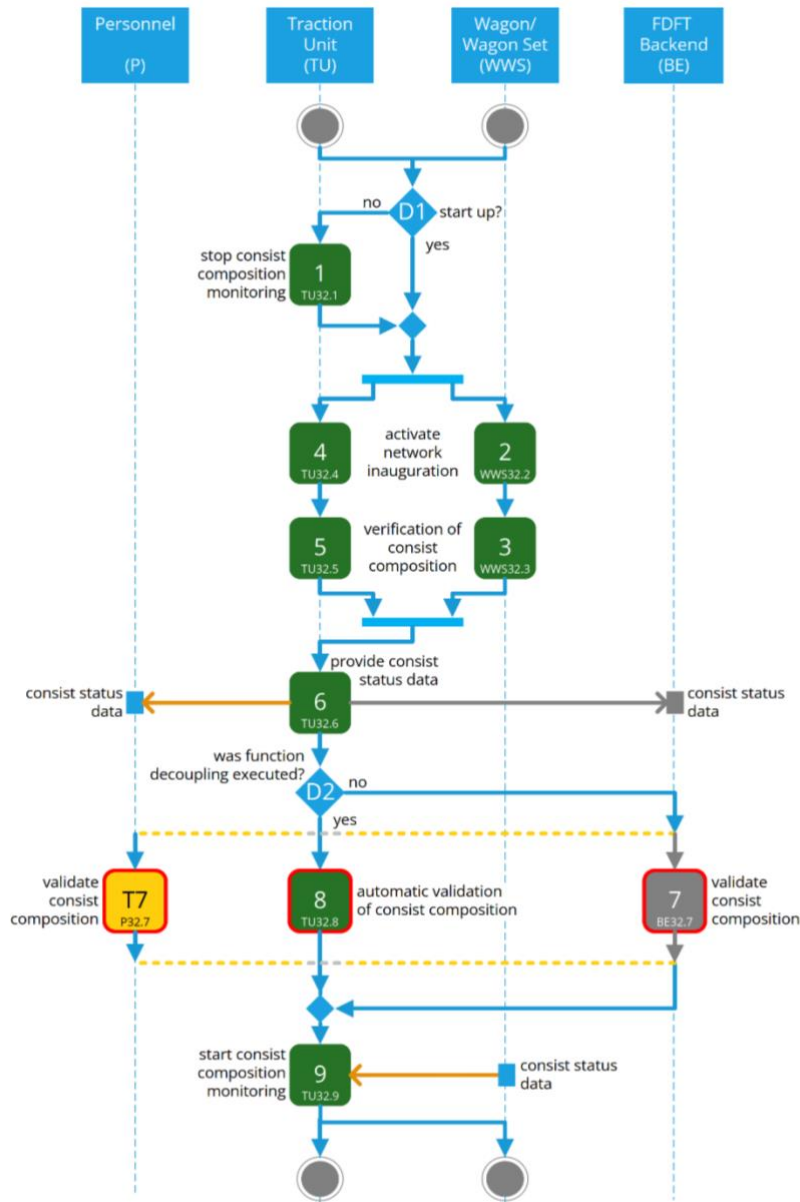
### 8.5.19 EP31 – Switch to FDFT mode Train Run



Subprocess EP31 ERJU Switch To FDFT mode Train Run - Ed. 02P07 14.06.2023

Figure 83: EP31 Switch To FDFT Mode Train Run - 1 of 1

### 8.5.20 EP32 –Subprocess Composition Detection



Subprocess EP32 ERJU Composition Detection Ed 02P06 13.06.2023

Figure 84: EP32 Composition Detection - 1 of 1



### 8.5.21 EP41 – Addition, Removal of Wagon (Set)

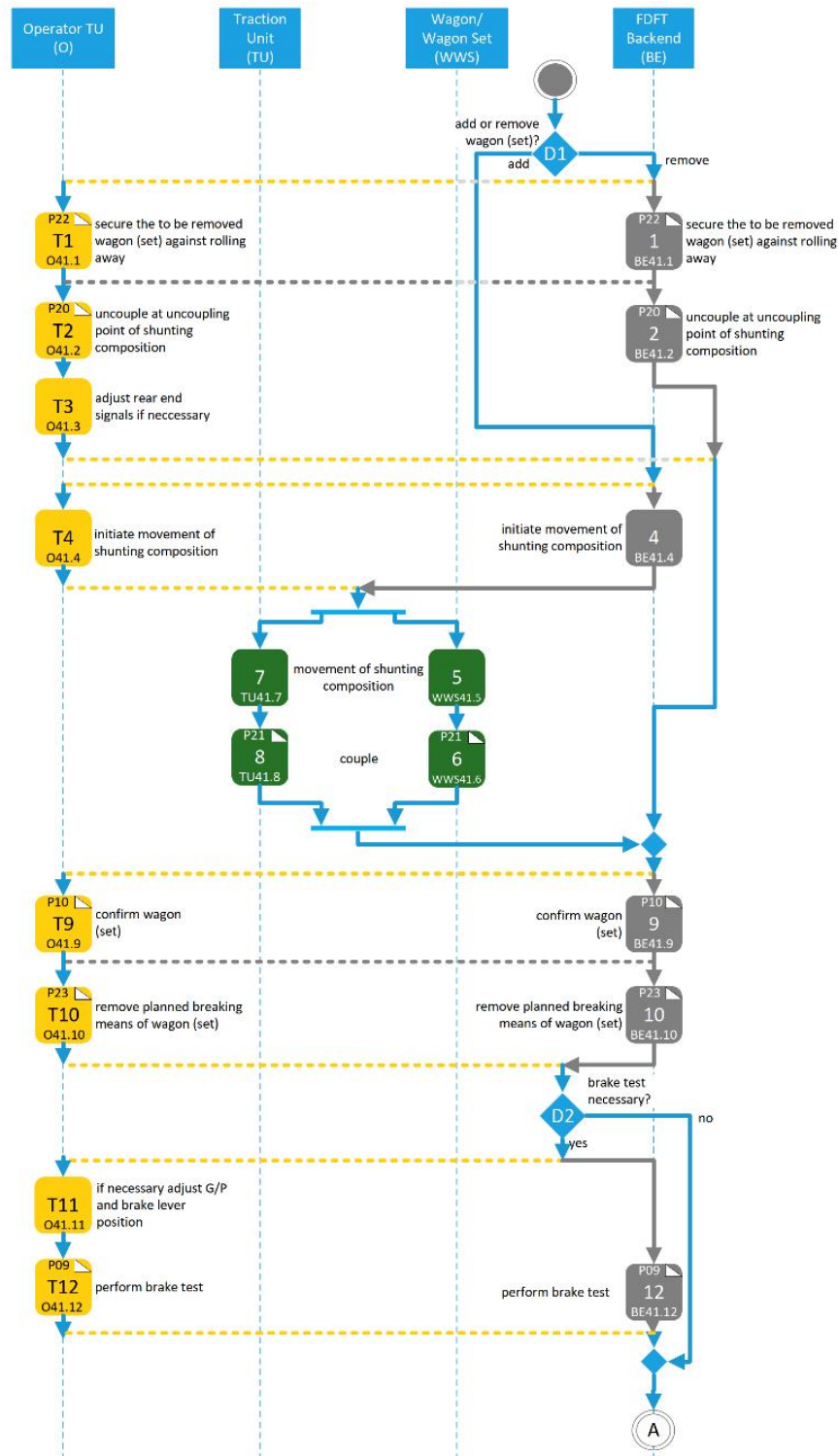
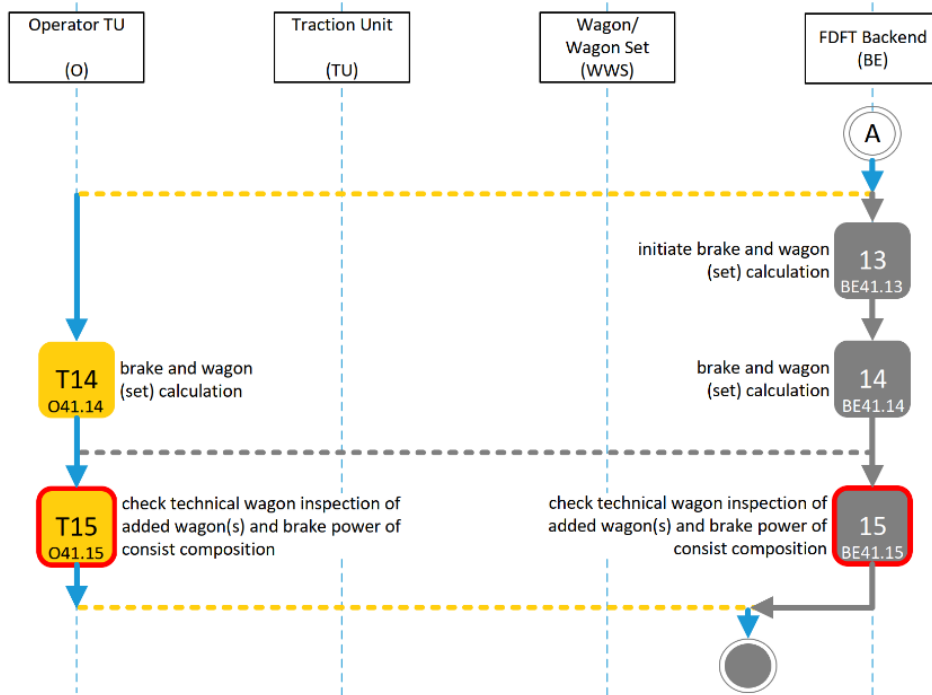


Figure 85: EP41 Addition, Removal Of Wagon (Set) - 1 of 2



Subprocess EP41 ERJU Addition, Removal of Wagon (Set) - Ed. 02P10 14.06.2023

Figure 86: EP41 Addition, Removal Of Wagon (Set) - 2 of 2

### 8.5.22 EP42 – Addition, Removal Of Traction Unit

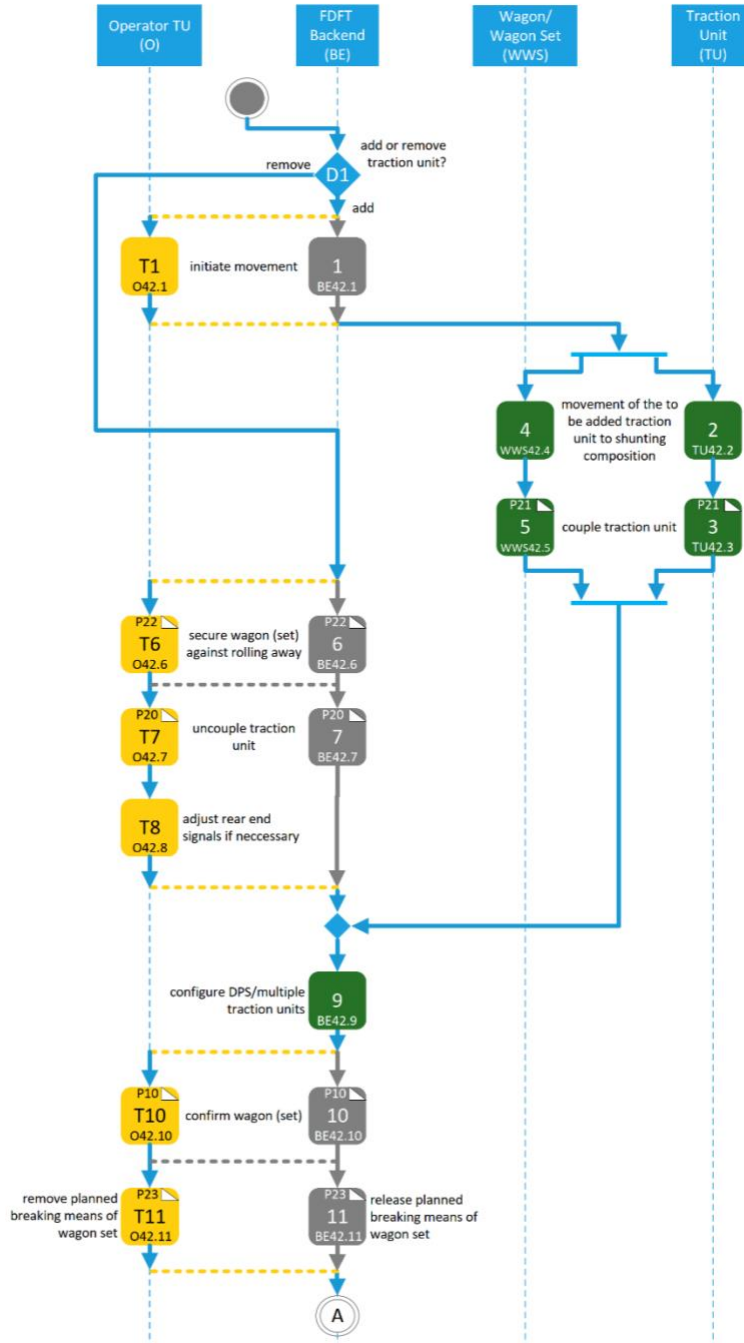
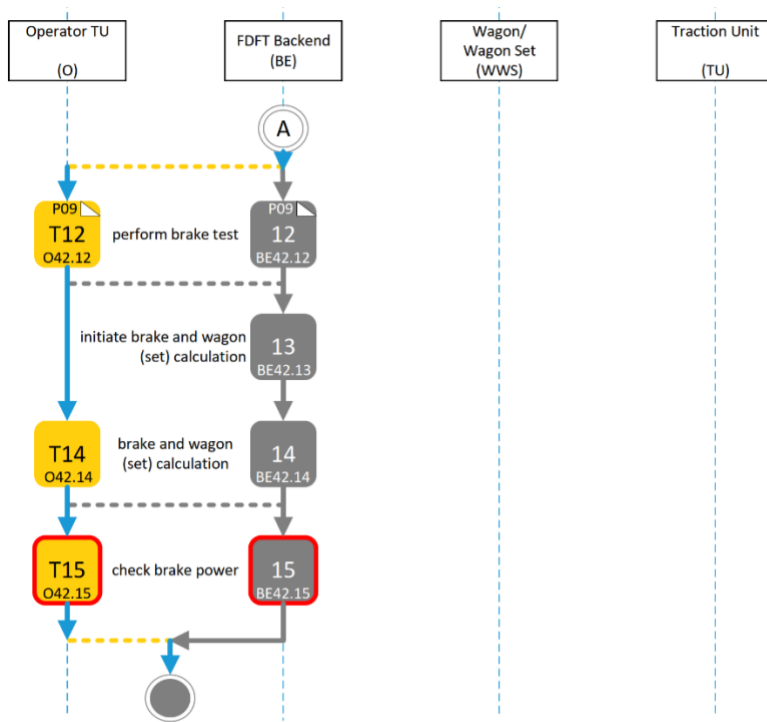


Figure 87: EP42 Addition, Removal Of Traction Unit - 1 of 2



Subprocess EP42 ERJU Addition, Removal of Traction Unit - Ed. 02P08 14.06.2023

Figure 88: EP42 Addition, Removal Of Traction Unit - 2 of 2

### 8.5.23 EP43 - Change Of Operator

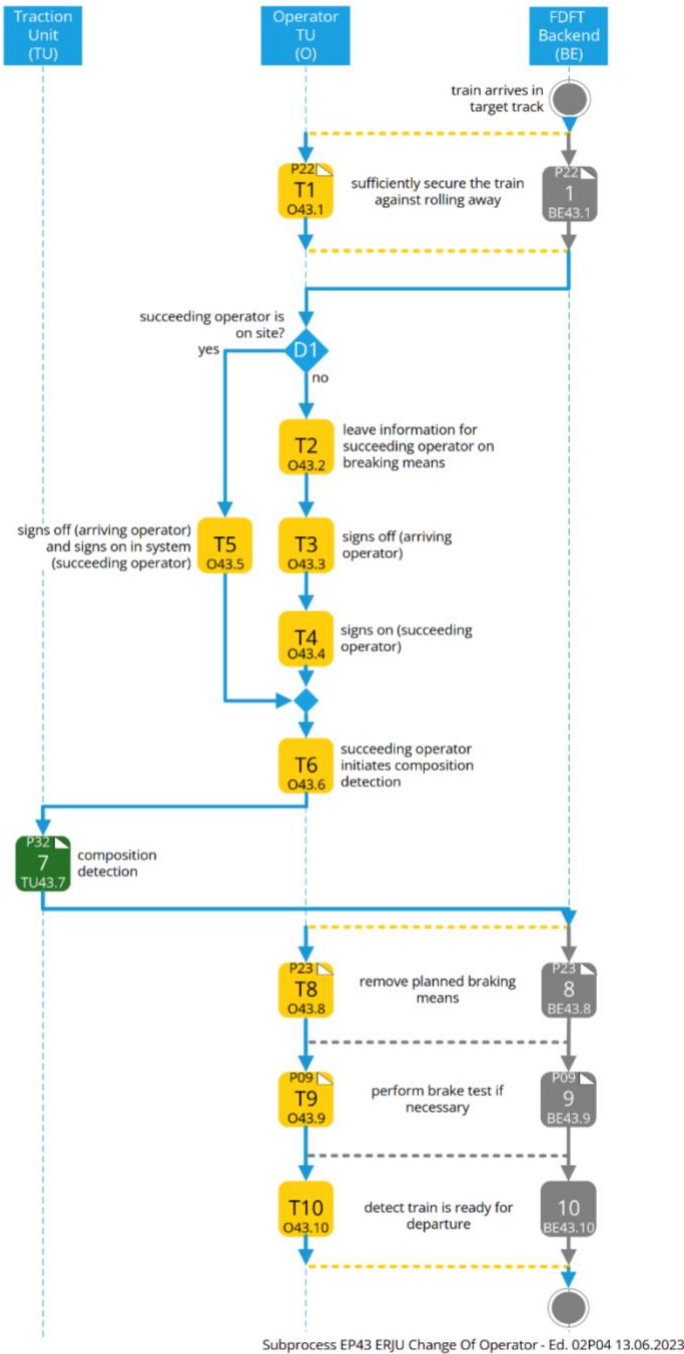


Figure 89: EP43 Change Of Operator - 1 of 1

## 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.

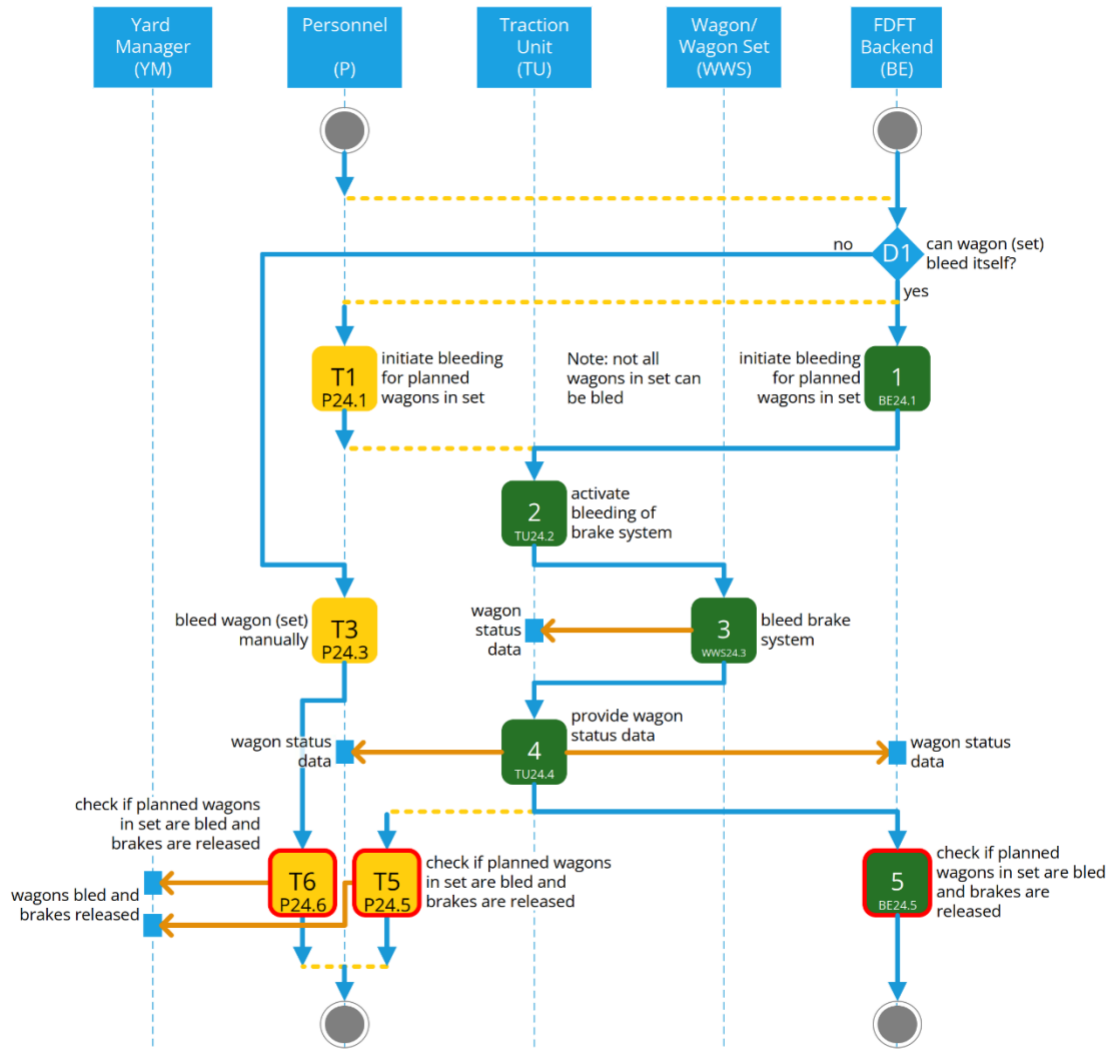
## 10 References

Reference	Title
[REF_1]	DACcelerate; DELIVERABLE D 3.2 Technical Specifications and operational rules; 2022-12-31; V1.0
[REF_2]	DAC4EU; <a href="https://www.dac4.eu/en/">https://www.dac4.eu/en/</a>
[REF_3]	TARO; <a href="https://konzern.oebb.at/en/taro/">https://konzern.oebb.at/en/taro/</a>
[REF_4]	TRUST5; <a href="https://projektdatabas.vti.se/bib/4017">https://projektdatabas.vti.se/bib/4017</a>

# 11 Annexes

## 11.1 P24 – Bleeding

### 11.1.1 Target Process



Subprocess P24 Bleeding - Ed. 02P05 05.06.2023

Figure 90: P24 Bleeding - 1 of 1



## 11.1.2 Process-Description

### D1

Decision	Can wagon(s) in set bleed itself?
Yes	<ul style="list-style-type: none"> <li>Function automated bleeding is available</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>

### BE24.1

Activity	Initiate bleeding for planned wagon(s) in set
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>FDFT Backend is available and can communicate with FDFT Wagen Base System and FDFT Backend can command bleeding of each wagon.</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>FDFT Backend initiates bleeding for each wagon in set.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>It can be required that not all wagon(s) should be bled.</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### P24.1

Activity	Initiate bleeding for planned wagon(s) in set
Precondition	<ul style="list-style-type: none"> <li>-</li> </ul>
Conditions	<ul style="list-style-type: none"> <li>-</li> </ul>
Tasks	<ul style="list-style-type: none"> <li>Personnel initiates bleeding for each wagon in set.</li> <li>This can also be achieved by using the Mobile HMI.</li> </ul>
Remarks	<ul style="list-style-type: none"> <li>-</li> </ul>
Rationale	<ul style="list-style-type: none"> <li>-</li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>-</li> </ul>

### TU24.2

Activity                    Activate bleeding of brake system

- Precondition            ▪ -
- Conditions             ▪ -
- Tasks                    ▪ The Function bleeding is activated.
- Remarks                ▪ -
- Rationale                ▪ -
- Postcondition          ▪ -

### WWS24.3

Activity                    Bleed brake system

- Precondition            ▪ -
- Conditions             ▪ -
- Tasks                    ▪ FDFT Wagon Base System bleeds auxiliary tank and releases brake(s).  
▪ FDFT Wagon Base System sends Wagon Status Data to FDFT Backend if available.
- Remarks                ▪ It must be possible, that single wagon(s) can be individually bled.
- Rationale                ▪ -
- Postcondition          ▪ -

### TU24.4

Activity                    Provide wagon status data

- Precondition            ▪ -
- Conditions             ▪ -
- Tasks                    ▪ The Wagon Status data is provided.
- Remarks                ▪ -
- Rationale                ▪ -
- Postcondition          ▪ -

### BE24.5

Activity	Check if planned wagon(s) in set are bled and brakes are released
Precondition	▪ -
Conditions	▪ FDFT Backend is available and can communicate with each FDFT Wagon Base System
Tasks	▪ Check if all brakes of wagon(s) are released as planned.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### P24.3

Activity	Bleed wagon (set) manually
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel bleeds each wagon in set manually as planned.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### P24.5

Activity	Check if planned wagon(s) in set are bled and brakes are released
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel checks if each wagon in set is bled and brakes are released as planned.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

**P24.6**

Activity	Check if planned wagon(s) in set are bled and brakes are released
Precondition	▪ -
Conditions	▪ -
Tasks	▪ Personnel checks if each wagon in set is bled and brakes are released as planned.
Remarks	▪ -
Rationale	▪ -
Postcondition	▪ -

### 11.1.3 ER JU Process

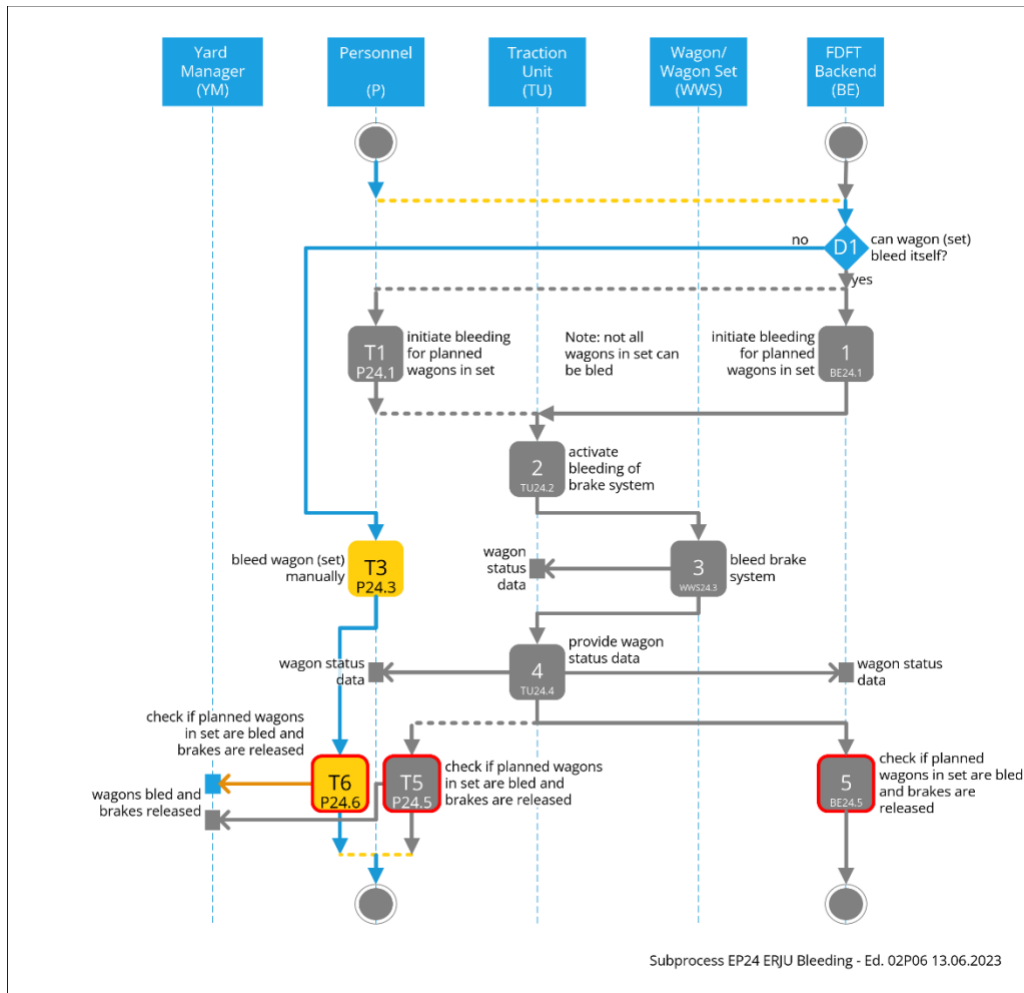


Figure 91: ER JU P24 Bleeding - 1 of 1