

D3.1

Hybrid coupler for dual-use locomotive

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Table of Contents

Abbreviations & Acronyms.....	4
1 Project Summary	5
2 Task description.....	5
3 Installation of the hybrid coupler for dual-use locomotive	6
3.1 Installation draft gear	6
3.2 Installation vertical support	7
.....	7
3.3 Installation coupler head with shank	9
3.4 UIC mode	10
3.5 DAC mode.....	14
4 Installation conclusion	18
5 References.....	19
6 Appendices.....	Error! Bookmark not defined.

Abbreviations & Acronyms

Abbreviation / Acronym	Description
BP	Brake Pipe
DAC	Digital automatic coupler
e-coupler	Electrical coupler
ERJU	Europe's Rail Joint Undertaking
FDFT	Full Digital Freight Train
FP5	Flagship Project 5 of the ERJU project
KB	Knorr-Bremse AG
P/F	Pass / Fail - criteria
TRL	Technology Readiness Level
TTL	Train Test Lab

1 Project Summary

DACTiVate project brings together 21 European partners from end-users, large industry, railway undertakings – operators and wagon keepers, unions, SMEs, and research, thus, covering the entire value chain. The DACTiVate project is set to advance the full digitalization of freight train operations in Europe, building on prior initiatives such as S2R's IP5, the EDDP, and EU-Rail's FP5-TRANS4M-R. The project aims to enable the pre-deployment of pilot trains with Digital Automatic Coupling (DAC) by executing required additional tests to the complementary project FP5-TRANS4M-R, thus establishing confidence before full implementation, while enabling DAC-authorization processes. The project aims to test the interchangeability of DAC components, expand the number of Wagon Onboard Units in line with FP5-TRANS4M-R's system architecture, and enable thorough validation of the pre-deployment trains by additional locomotives able to integrate hybrid couplers. Collaboration with FP5-TRANS4M-R is vital to align with its functional specifications and technical architecture, ensuring the project's contribution is significant and supports the related DAC authorization process.

2 Task description

The objective of WP3 Task 3.1 within DACTiVate is to provide the Hybrid-DAC integration and FDFT system according to the EDDP basic package into the specific Locomotive Type Euro Dual BR 159 of HVLE, including all necessary functional and technical integration under the lead of KB. All new technology contributions are based on specifications or results of the FP5 TRANS4M-R project. While KB provides the Hybrid-Digital-Automated-Coupler system modification and the Locomotive Control Unit (LCU) integration to the specific needs and constraints of this locomotive type, STAV provides the adaptation of the locomotive power supply system in order to supply the required electrical energy to the train. Furthermore, STAV takes care about the mechanical and electrical integration engineering (e.g. including the mechanical draft gear and DAC integration or the insertion of an operation mode switch into the driver's desk) of all add-ons or exchanged equipment in close co-operation with KB and HVLE. STAV will manage the locomotive documentation revision accordingly. The lead for all installations and changes on the vehicle will be organized by HVLE and executed in the HVLE locomotive workshop in Berlin Spandau with full support of STAV and KB on the specific topics.

D3.1 will describe the installed Hybrid coupler system on the Dual-use locomotive in a detailed report. In particular it will describe the installed system, main functionalities (e.g. folding up/ down, etc.) and the integration of the system into the locomotive. Pictures of the installation will be added to illustrate the report.

3 Installation of the hybrid coupler for dual-use locomotive

On the basis of existing specification for the Eurodual coupler, the design of hybrid coupler was performed and agreed with STAV. The investigation contains to prove the specified dimensions, like total length of coupler and subcomponents, diameter of the draft gear and flange, screw interface dimensions. Additionally the specified horizontal and vertical displacements in DAC an UIC mode need to be checked in order that no interference with the locomotive components occur.

3.1 Installation draft gear

The pictures below (fig 1-3) show the result of the investigation carried out by Knorr-Bremse and STAV, about the installation space around the draft gear on the locomotive, proving that the space is sufficient for the installation, and it's shown from multiple view directions.

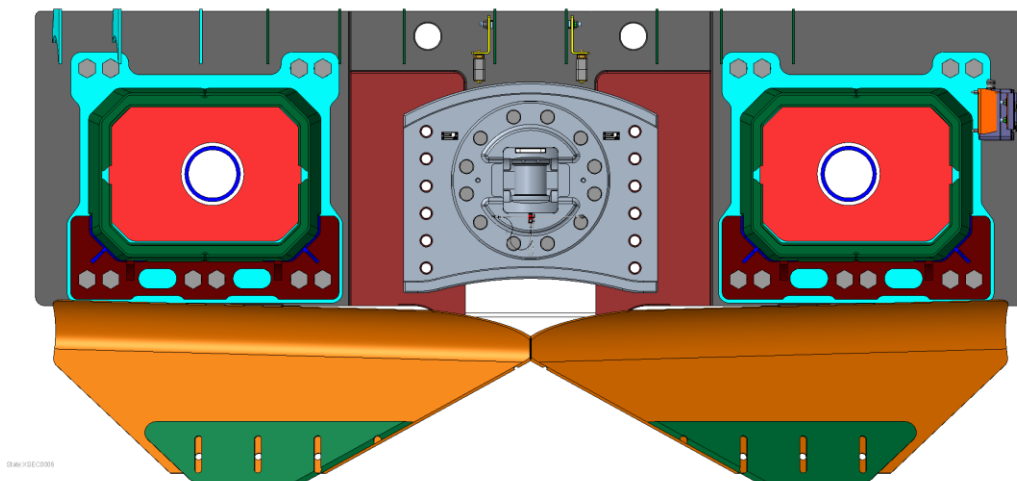


Fig 1. Installation space around the draftgear, front view

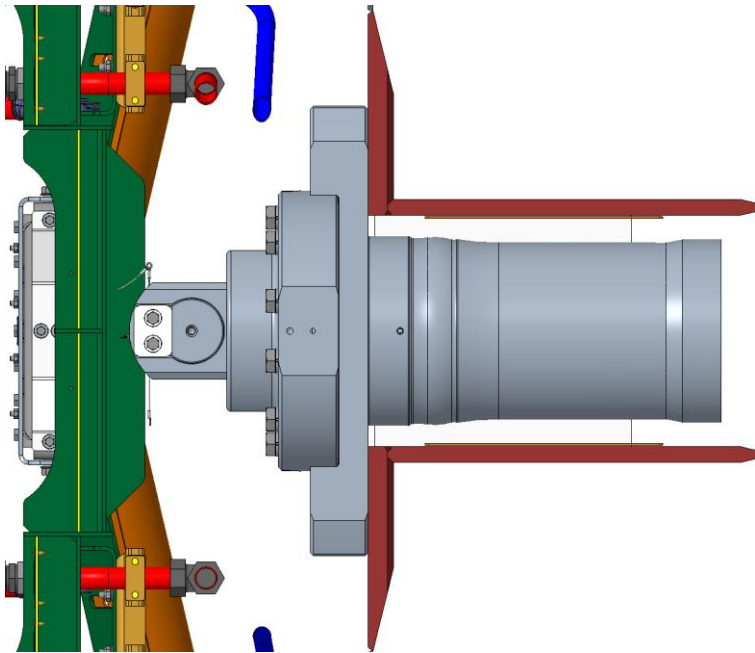


Fig 2. Installation space around the draftgear, section view from top

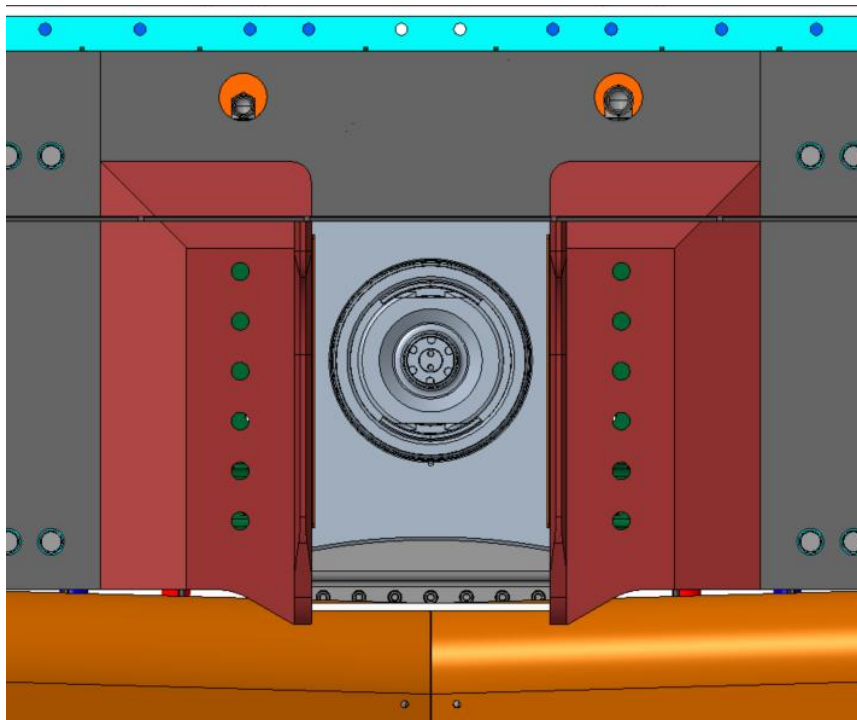


Fig 3. Installation space around the draftgear, back view, through the underframe

3.2 Installation of the vertical support

The pictures below (fig 4-5) show the result of the investigation carried out by Knorr-Bremse and STAV, about the installation space around the vertical support on the locomotive, proving that the space is sufficient for the installation, and it's shown from multiple view directions.

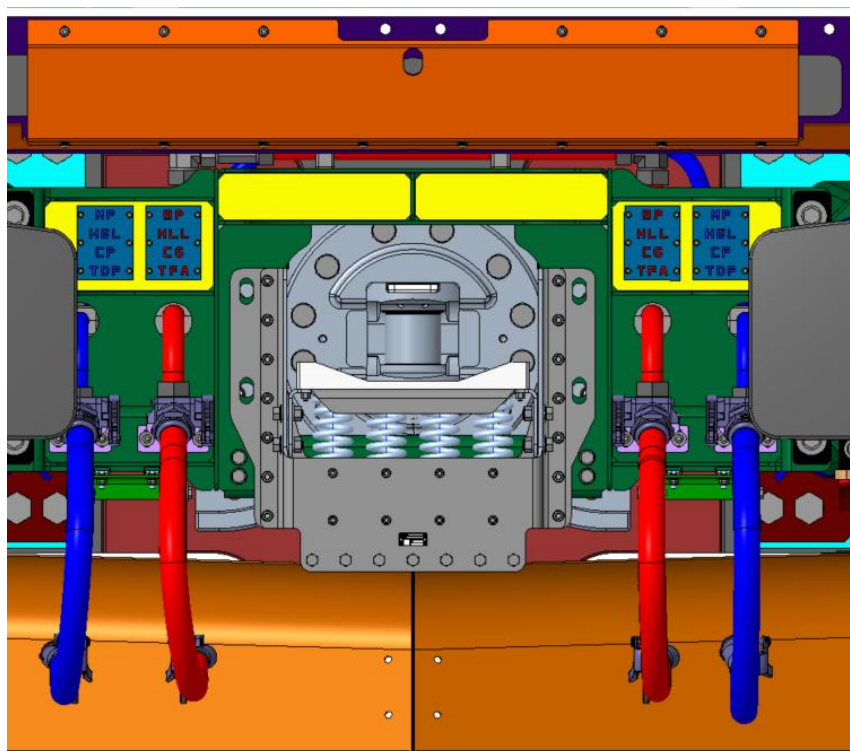


Fig 4. Installation space and clearance around the vertical support, front view

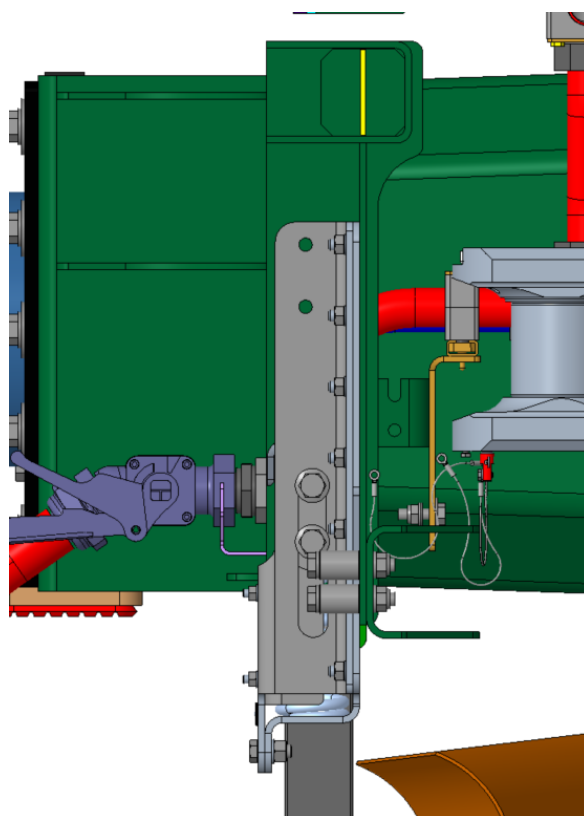


Fig 5. Installation space and clearance around the vertical support, side view

3.3 Installation of the coupler head with shank

The pictures below (fig 6-9) show the result of the investigation carried out by Knorr-Bremse and STAV, about the installation space around the coupler head and the shank on the locomotive, proving that the space is sufficient for the installation shown from multiple view directions. The last two pictures (fig 8-9) show that the space is sufficient to insert the main pin, and its securing plate while mounting the coupler.

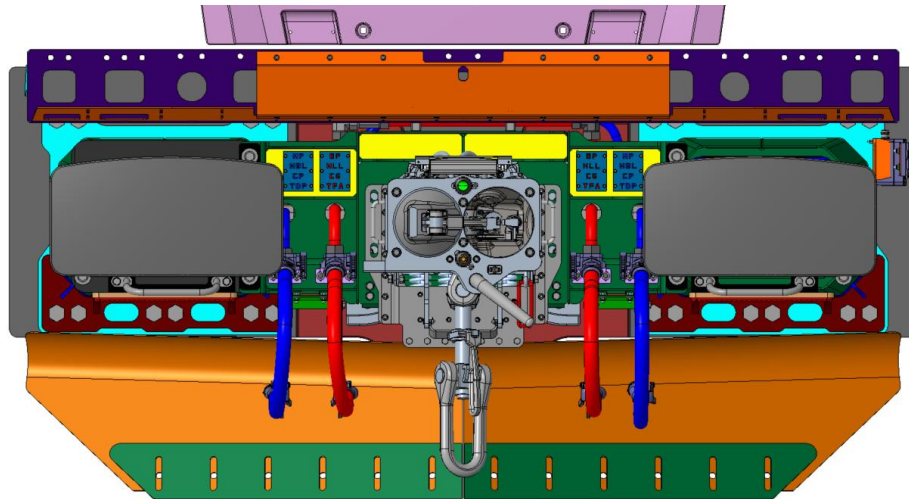


Fig 6. Installation space and clearance around the head and shank, front view

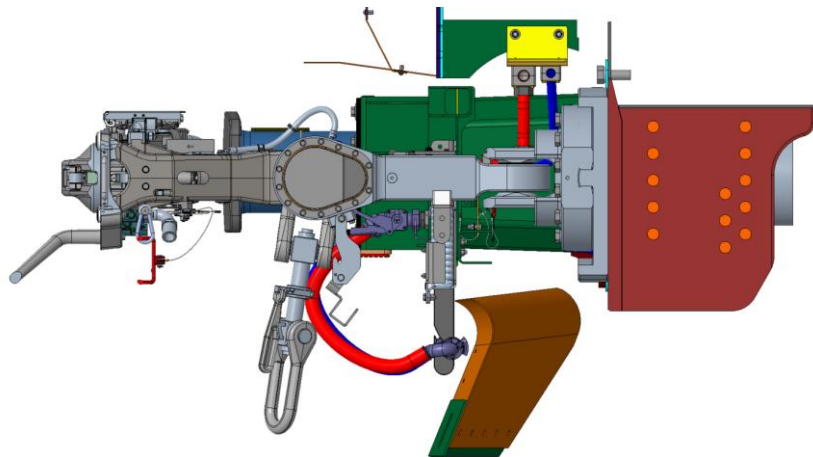


Fig 7. Installation space and clearance around the head and shank, side view

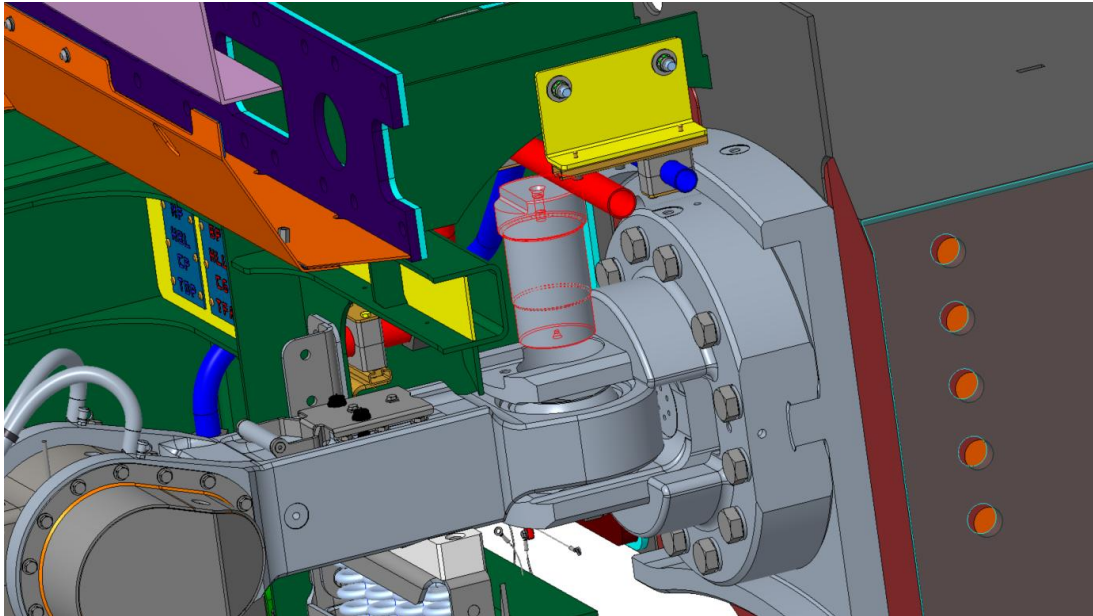


Fig 8. Installation of the main pin

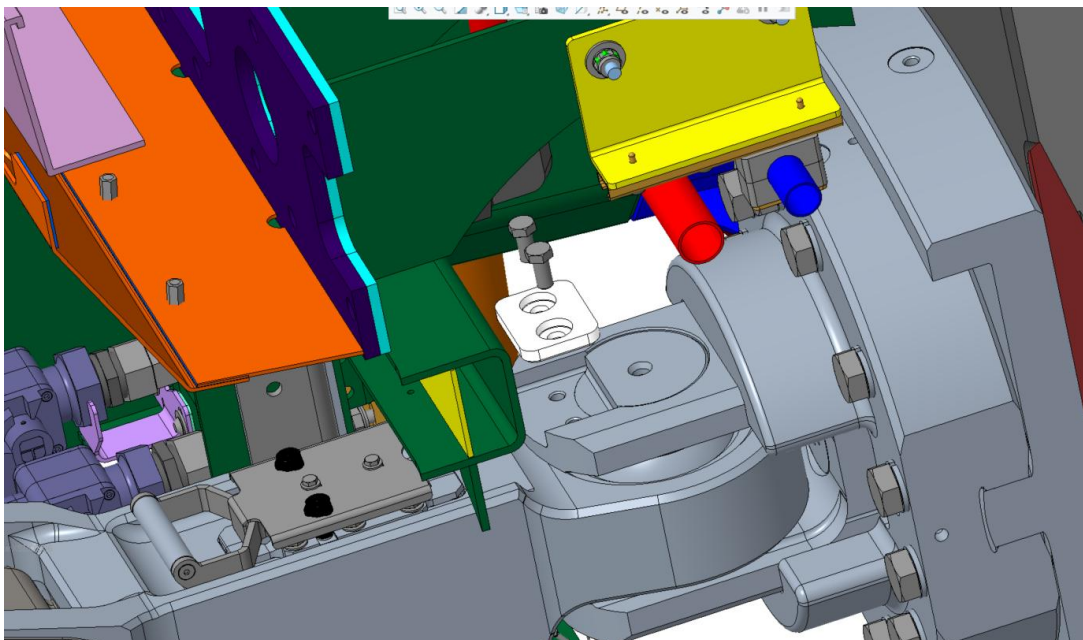


Fig 9. Securing the main pin

3.4 UIC mode with maximum horizontal and vertical displacement

The pictures below show the investigation about the folded-up position (UIC mode), to prove that the coupler can move freely in the whole movement range. The first picture shows the coupler in the cantered position, then the next two picture show the

examination of the maximum horizontal displacement (19°), then the last two pictures show the examination of the maximum vertical displacement (8°, both directions).

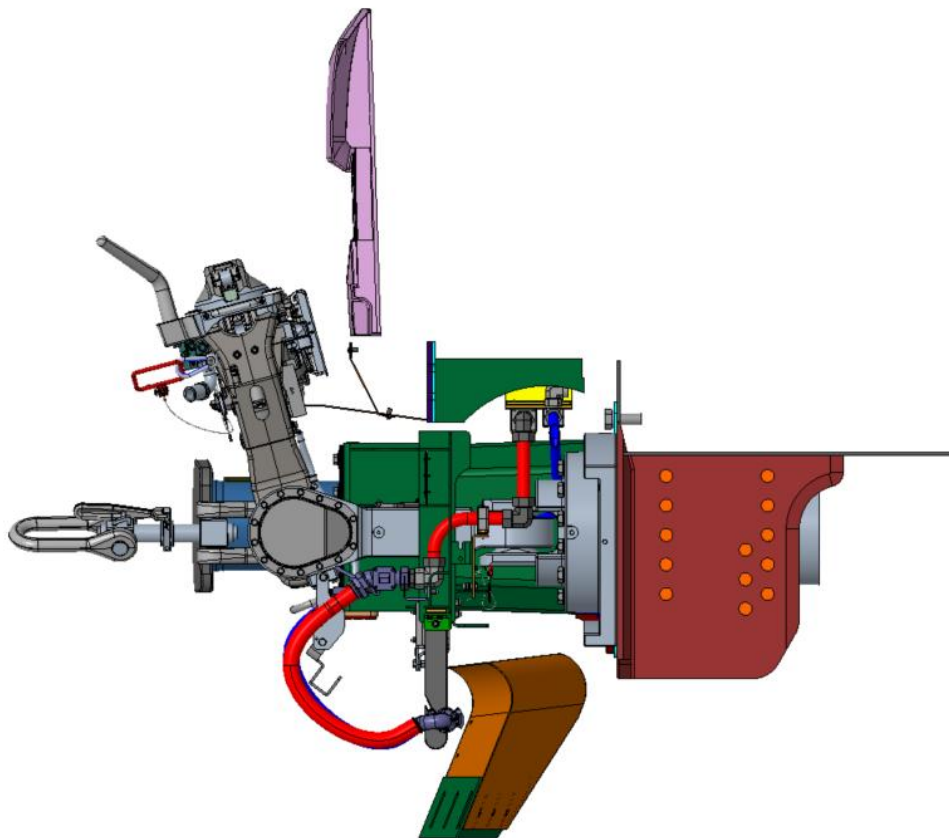


Fig 10. Clearance around the folded up head in UIC mode, side view

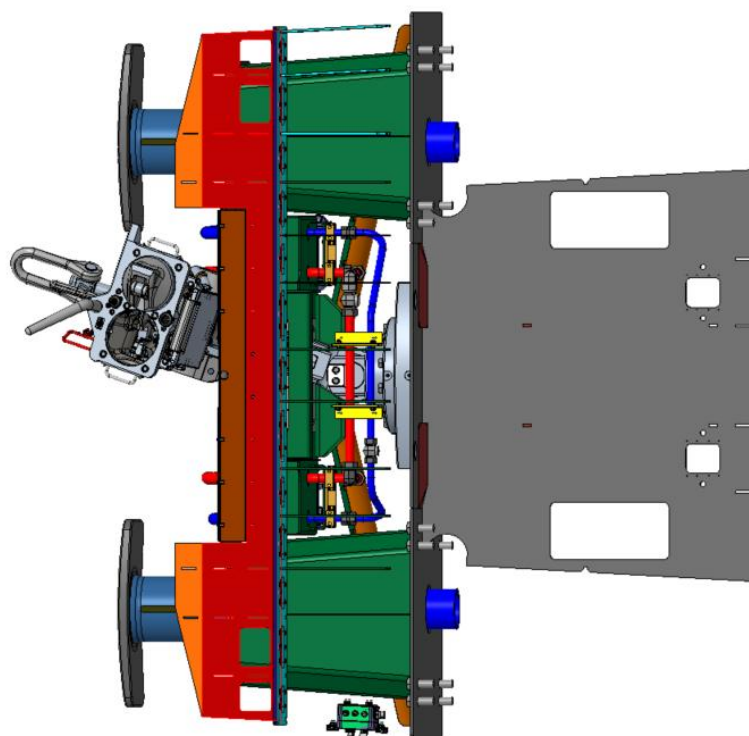


Fig 11. Position of the coupler in maximal horizontal displacement (19°), top view

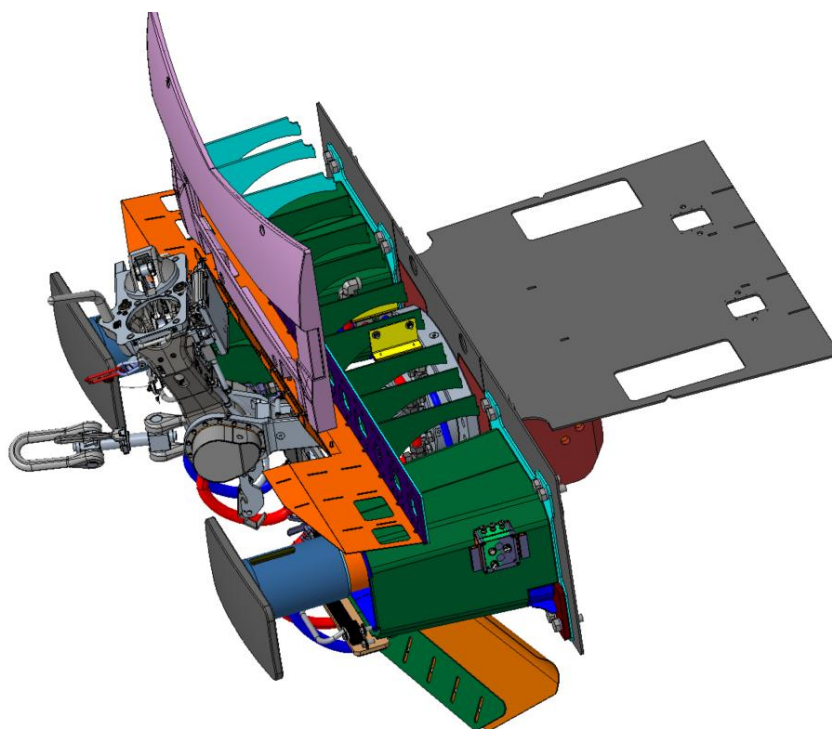


Fig 12. Position of the coupler in maximal horizontal displacement (19°), 3D view

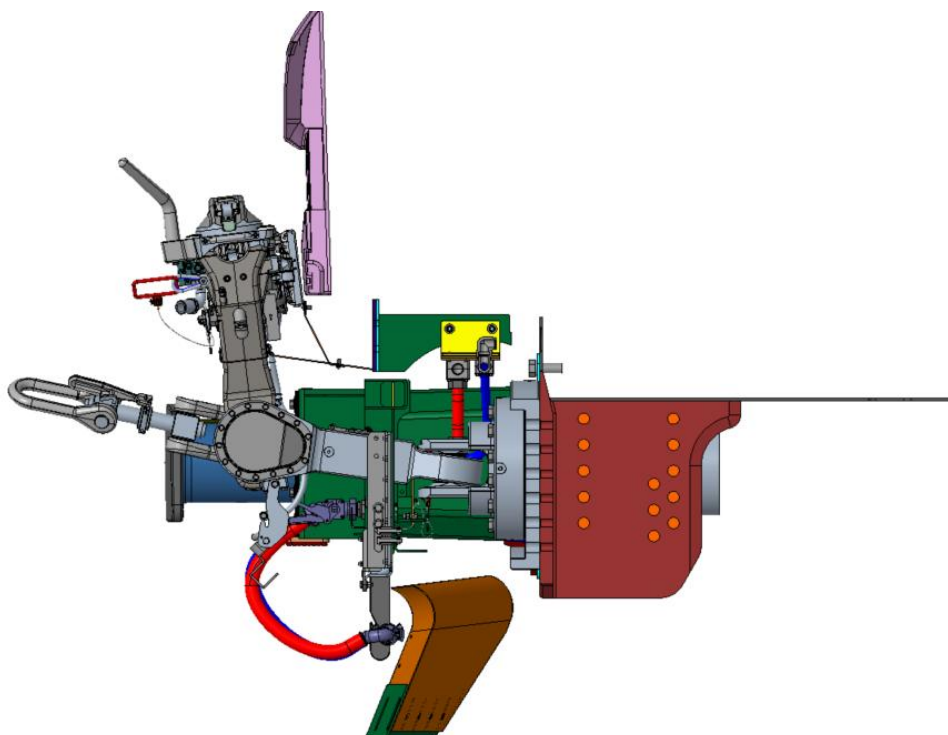


Fig 13. Position of the coupler in maximal vertical displacement (8°, upwards), side view

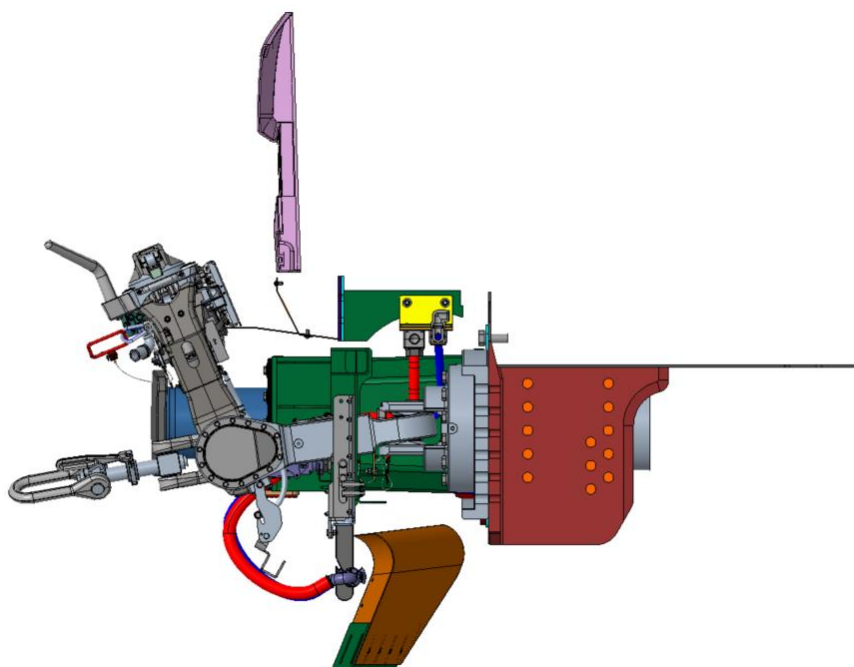


Fig 14. Position of the coupler in maximal vertical displacement (8°, downwards), side view

3.5 DAC mode with maximum horizontal and vertical displacement

The pictures below show the investigation about the coupler in DAC mode, to prove that the coupler can move freely in the whole movement range. The first two pictures show the examination of the maximum horizontal displacement (19°), then the next two pictures show the examination of the maximum vertical displacement (8° , both directions).

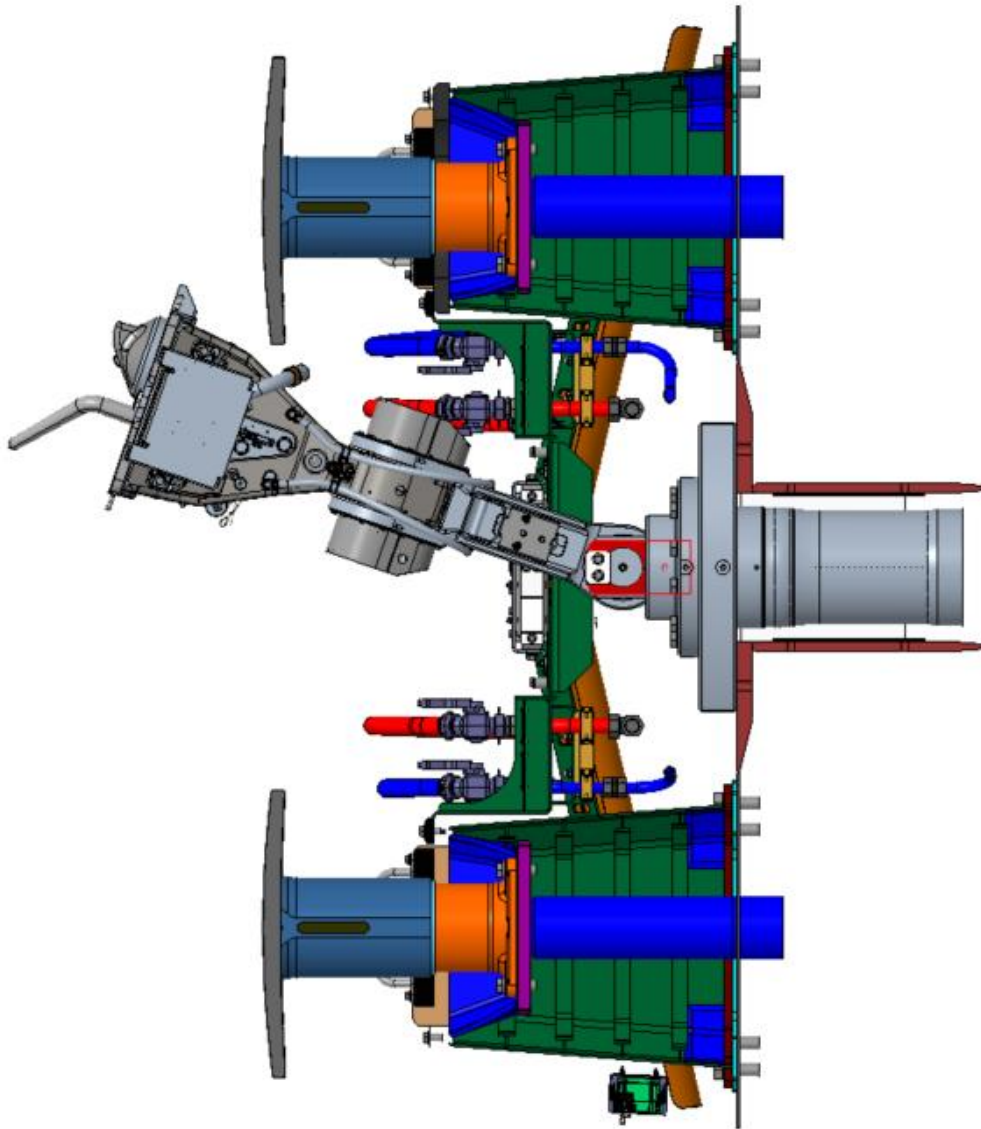


Fig 15. Position of the coupler in maximal horizontal displacement in DAC mode (19°), top view

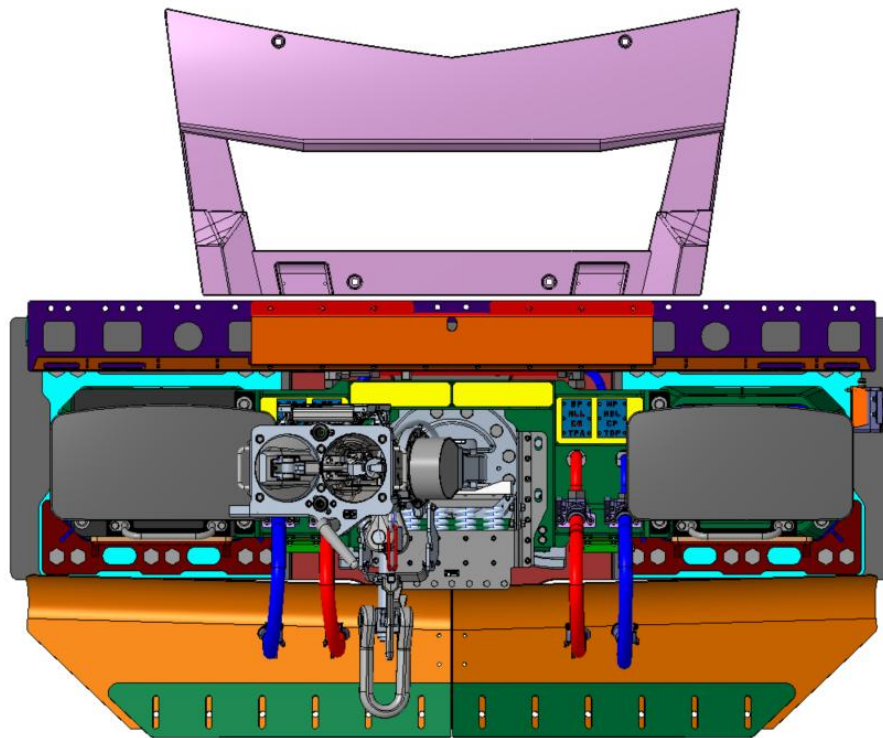


Fig 16. Position of the coupler in maximal horizontal displacement in DAC mode (19°), front view

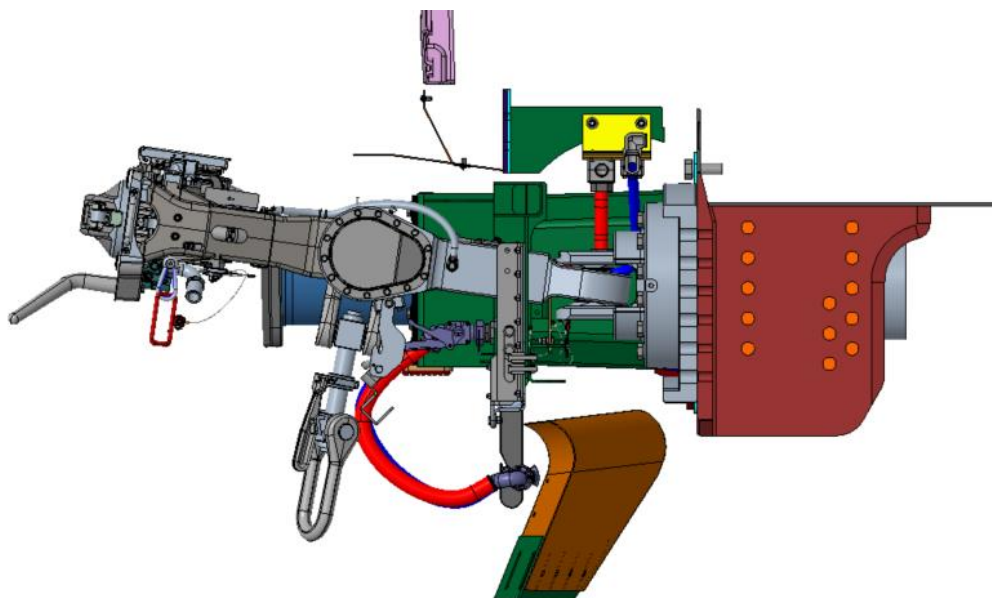


Fig 17. Position of the coupler in maximal vertical displacement in DAC mode (8°, upwards), side view

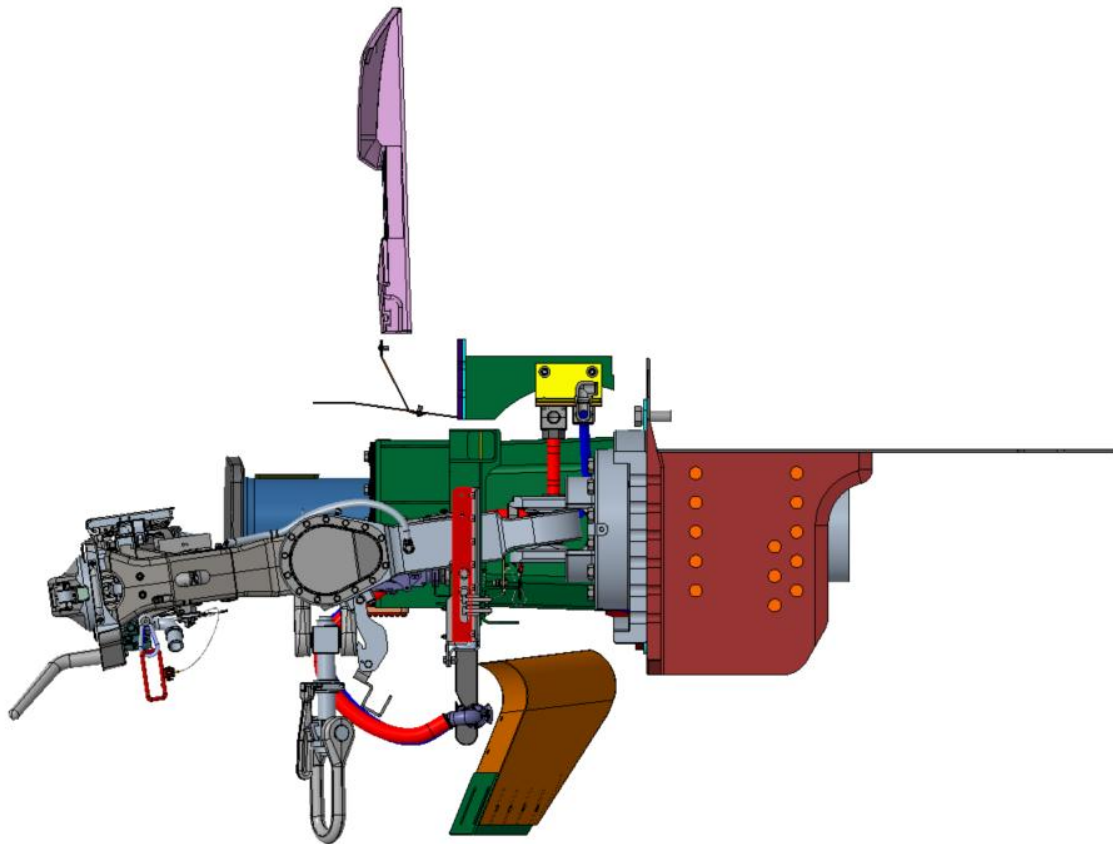


Fig 18. Position of the coupler in maximal vertical displacement in DAC mode (8°, downwards), side view

4 Installation of associated DAC equipment

The next figures show the installation of the Hybrid Couplet Junction Box and its place in the locomotive. The interfaces are available and the components can be installed. The last picture shows the front of the locomotive with the hybrid coupler in the so called DAC-mode. The hybrid coupler is ready to couple with a retrofitted Wagon with an installed DAC.

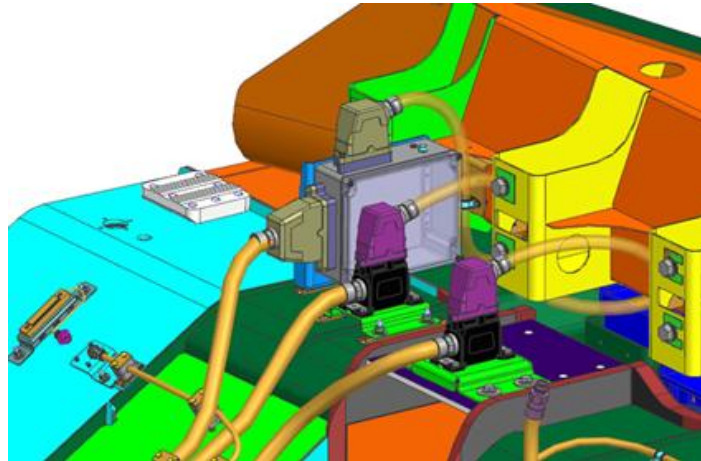


Fig 19. EuroDual assembly of KB-JB (KB Junction Box)

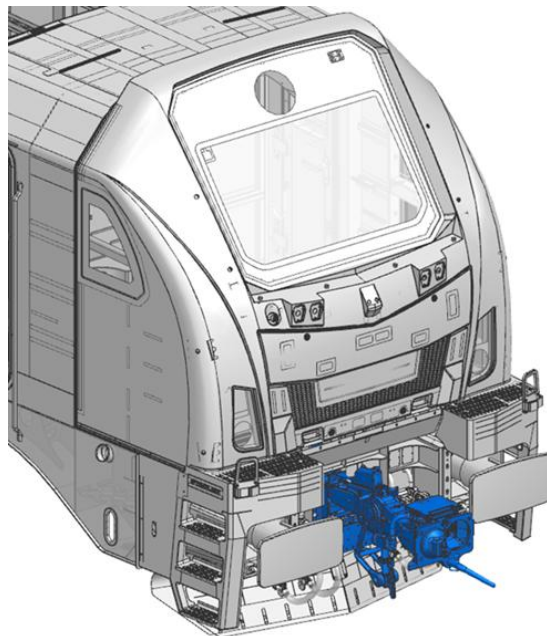


Fig 20. EuroDual DAC assembly

5 Installation conclusion

The added pictures in chapter 3 shows that the design of the hybrid coupler fit into the locomotive frame and do not interfere with any of the locomotive components. It is also to be stated that the shown pictures show the finished design freeze between KB and STAV.

6 References

Abbreviation	Document-Nr.	Title	Author	Date	Version
CEN/TC 256	prEN18171:2025	Railway applications — Railway rolling stock — Digital Freight Automatic Coupler — Performance requirements specific interface geometry and test method	DIN-Normenausschuss - FSF	04.2025	-
EN50125-1	VDE 0115-108-1	Railway applications – Environmental conditions for equipment – Part 1: Rolling stock and on-board equipment;	DIN-Normenausschuss - FSF	01.11.2014	
[UIC524]	UIC 524	International Union of Railways (UIC), UIC Leaflet 524: Wagons - Technical specifications governing spring devices for wagons fitted with automatic couplers belonging to the UIC and OSJD member railways	International Union of Railways (UIC)	1978	-
[EN15551]	EN 15551:2017	Railway applications Railway rolling stock Buffers	DIN-Normenausschuss - FSF	05.2017	-