UNIFE Position for authorisation of locomotives fitted with DAC

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Introduction

UNIFE supports DAC (Digital Automatic Coupler) implementation, and its members actively contribute to Europe's Rail Joint Undertaking activities aiming at developing a technical solution for the integration and deployment of DAC. Nevertheless, challenges remain, in particular for **integrating DAC to locomotives**, either for **existing locomotives** to be retrofitted, or for **locomotives that would be ordered originally equipped with DAC** by a customer. A clear distinction has to be made here between "new locomotives" ordered with an existing locomotive design (that can be ordered today) and "new locomotives" to be ordered with a locomotive design accommodating DAC but yet to be developed (and that **cannot be ordered "On the shelf" today** as the locomotive design is not existing). DAC on locomotives implies hugely re-thinking how locomotives are currently designed, which comes with **important engineering, and preparation for approval** work, which depend on the full DAC specifications (mechanical, electrical and data) yet to be issued.

If the revision of the current TSIs to accommodate DAC specifications is planned before 2030, the next step for DAC implementation is the PioDAC project, which Pioneer DAC trains start of operation is wished for 2027. The scope of this paper is thus to explore high-level solutions for authorisation of PioDAC trains, and later full DAC deployment, with focus on the locomotives.

While the tender process for PioDAC locomotives are still in progress, it is important to note that **until now, no financial provision is made** by locomotive suppliers for the **heavy engineering work** - including the process-related resources - with the full migration in view. This engineering work is needed to come up with new designs of locomotive families or new design adaptations of existing locomotives that could be retrofitted, and authorised, to accommodate DAC on locomotives. This paper however clarifies pre-conditions and contains paths for solutions to allow authorising DAC-fitted locomotives.

1. Problem statement

DAC on locomotives implies huge re-thinking on how locomotives are designed today, from the mechanical forces in the locomotive frame to the commands and power supply to be managed by the machine. Multi-functional locomotives - used by operators both for passenger and freight services - should not become too specific to DAC, as they risk losing their multipurpose function. There is also huge design variability in locomotives under operation today, which means standardised retrofitting solutions would be scarce. Particularly, retrofitting DAC on current, and especially older locomotives would need important adaptations of these locomotives. The older the locomotive, the further it is to current technical requirements; which means that if retrofitted with DAC, older locomotives designed to be authorised with a very different past regulatory framework to now, could not be authorised with the latest updated regulatory framework unless it is hugely re-designed.

The PioDAC project doesn't intend to authorise rolling stock for testing purposes, but for commercial operation, which requires a vehicle authorisation for placing on the market in accordance with the Interoperability Directive (EU) 2016/797. Cross-border traffics will need an authorisation from ERA, and cannot be authorised only nationally. The revision of the current TSIs, to accommodate DAC specifications (mainly LOC&PAS, and WAG) in the regulatory framework will also not happen before the start of the PioDAC project. Consequently, any locomotive equipped with DAC and to be run in a specific area of use in **commercial operation** will need to **be delivered with an authorisation** to run in this area of use. Depending on the PioDAC tenders under discussion, the current area of use of the locomotives may have to be kept in the new authorisation, which means that a DAC-equipped locomotive in the frame of PioDAC project could need authorisation for more areas of use than only PioDAC countries. Otherwise, negotiations need to happen between the supplier and customer to reduce the area of use of the to-be-retrofitted locomotives.

Future authorisation of rolling stock for the PioDAC project is discussed in an ERA Topical Working Group on freight renamed "meeting for the retrofitting of freight trains with DAC". In particular, ERA is developing guidelines to facilitate future applicants' work to authorise DAC fitted and retrofitted vehicles. Up until end 2025, the agency proposed the approach of requirement capture based on the current TSIs to authorise DAC equipped vehicles for commercial operation in today's regulatory framework. However, UNIFE and its locomotive manufacturer members experts identified

several major obstacles for authorisation through the current TSIs of locomotives fitted with DAC, that they presented in a dedicated meeting to DG-MOVE, ERA and EU-RAIL on 25 September 2025. Here is a concise summary of the main points considered as major obstacles for the authorisation of locomotives fitted with DAC.

- **Crashworthiness standard EN15227 and locomotive frame**:
  EN 15227:2020 is a standard related to crashworthiness requirements for railway vehicles and is referenced (mandatory) in Appendix J of current TSI LOC&PAS version. The case of the hybrid DAC in UIC-position is not covered in EN 15227:2020 and the frames of the locomotives on the market today have not been designed for the central buffer concept of DAC. In addition, the publication of Technical Opinion ERA/OPI/2025-7 of ERA (regarding new standards or new standards versions released since the publication of TSI package 2023) repealed ERA/OPI/2024-5 which was allowing the use of updated EN 15227:2020 + A1:2024 to fulfil the matching TSI requirement. The CEN/TC 256/SC 2/WG 2 expert group tasked with the revision of EN 15227:2020 standard also confirmed that collision speeds for design crash scenarios superior to 20 km/h are not physically feasible with current locomotive designs if equipped with DAC.

  Major obstacle: Current locomotives designs, if fitted with DAC, would not get authorised through normal procedure, as they could not fulfil the current legal requirements for crashworthiness required by ERA

- **Excess of authorised locomotive axle load and weight with DAC**:
  Adding two hybrid DACs and the necessary electrical equipment to a current locomotive design increases the actual vehicle mass by around 2 tonnes. For an important share of the locomotives on the market today, this additional mass would exceed the authorised axle load and weight. Locomotives are so packed with hardware systems, based on different requirements, that they are already **close to their weight limit** and **opportunity for part removal is very scarce**.
  The obstacle is also on the side of Infrastructure Managers, which would be responsible to allow **excess of line category limits** (e.g. from 22,5 t to 23 t) to allow heavier locomotives to run on their network.

  Major obstacle: An important share of current designs of locomotives, if fitted with DAC, would not get authorised through normal procedure, as they would exceed the current allowed mass limit legally required for both the vehicle and the infrastructure.

- **Bern's room infringement with hybrid DAC**:
  When fitted on a locomotive, elements of the hybrid coupler infringe Bern's room (the space around the coupler for staff operation – image in Annex) on both sides. The alternative to compensate this infringement by having smaller locomotive buffer plates is not feasible as longer locomotives precisely need wider buffer plates. Consequently, the requirement with Bern's room in current TSI LOC&PAS 4.2.2.2.5 and EN16839:2022 cannot be fully fulfilled.

  Major obstacle: An important share of current designs of locomotives, if fitted with hybrid DAC, would not get authorised, as they would not fulfil Bern's room requirement in TSI LOC&PAS.

- **Running dynamics with hybrid DAC**:
  Additional weight at both ends of the locomotive mainly caused by the fitment of hybrid couplers significantly increases the locomotive inertia. The side buffers removal, which could compensate for this weight is not possible. The "lambda table" in EN 14363 referred to in 4.2.3.4.2 TSI LOC&PAS is therefore no longer fulfilled, and full sets of expensive and time consuming track tests would be necessary to fulfil these TSI requirements.

  Major obstacle: A significant share of current designs of locomotives, if fitted with hybrid DAC, would get authorised only if a full set of expensive and time consuming track tests can be carried out.

Following the dedicated meeting between UNIFE and DG-MOVE, ERA and EU-RAIL on 25 September 2025, ERA announced beginning of 2026 they were working on a technical opinion to cover concrete requirements (e.g. for crashworthiness of locomotives fitted with DAC). The content of this technical opinion is being discussed with the sector in specific sub-groups of the "meeting for the retrofitting of freight trains with DAC" – in which the rail supply industry is actively participating - and should be made available as draft but stable version from June 2026.

2. UNIFE´s proposed way forward with possibilities for authorisation

2.1 Pre-requisites for any certification and authorisation process to start

In order to trigger planning of resources on the side of the suppliers and start "common preparation of authorisation" for PioDAC trains, or for a future migration certification and authorisation process, **strong pre-requisites** remain:

- **DAC specifications have to be ready**
- A **mature-enough technical solution** is existing, that went through normal testing phase of a new technology, including return of experience of prototyping. This will facilitate authorisation of the new technology.
- **Orders to suppliers need to be placed, also for locomotives-related tenders**

It is crucial to keep and closely monitor the **Timeline boundaries** of a certification and authorisation schedule for the train operations to happen in time. Naturally, it has to be clear, out of tender process, by whom preparation of certification, as well as certification itself will be performed and who will apply for authorisation; in order to start planning **resources on the side of the locomotive suppliers**.

2.2 Short-term solution for PioDAC traffics

2.2.1 Non-application of TSIs – IOD article 7

Based on the situation faced today with obstacles for authorisation explained above in current TSIs, and with no alleviation of current regulatory rules to be accepted by ERA, a possibility is existing for overpassing remaining obstacle points to allow the authorisation of locomotives fitted with DAC. Article 7 of the Interoperability Directive offers the possibility for the applicants to ask for **derogation** "Non-application of TSIs". In particular, paragraph 1.c) could be called in the case of PioDAC locomotives:

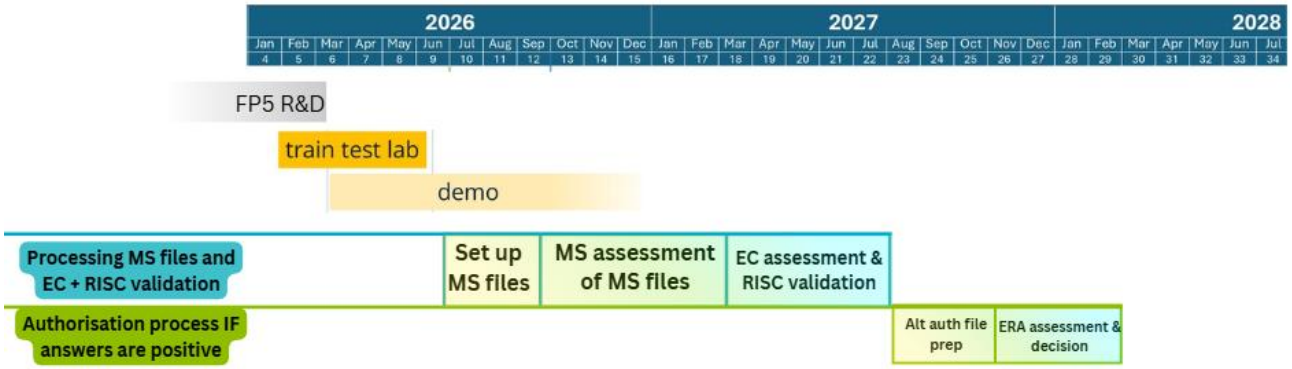
" *Article 7*
Non-application of TSIs

1. Member States may allow the applicant not to apply one or more TSIs or parts of them in the following cases:
(...)
(c) for any proposed renewal, extension or upgrading of an existing subsystem or part of it, when the application of the TSI(s) concerned would compromise the economic viability of the project and/or the compatibility of the rail system in the Member State concerned, for example in relation to the loading gauge, track gauge, space between tracks or electrification voltage;
(…) "

In order to do this, the applicant would have to (time estimations are based on past derogation processes completed by the industry in the past):

- Set up a file for each member state and each locomotive concerned justifying the need for a non-application of TSIs (2 to 3 months).
- Submit the file to each member state, and necessary time for them to assess the request and provide an answer (4 to 6 months).
- European Commission to assess the request from the member states and provide an answer on the alternative provisions to apply instead of the TSIs - The decision should be validated in RISC committee (4 months). In case of positive answer, the European Commission should issue an implementing act.
- If the answers from the member states and the Commission are positive, the applicant can start preparing the alternative authorisation file for the locomotives equipped with DAC: 3 months are necessary at least to prepare the authorisation file and application in OSS, and 5 months (1 month for completeness check and 4 months for assessment) for the agency to provide the vehicle authorisation for placing on the market.

The advantage of this authorisation path is to alleviate the obstacle points for the authorisation of locomotives fitted with DAC with the current TSIs. However, it has to be noted that the applicant would still **need to provide necessary and enough justification for the alternative** - physically possible and with **high safety level - provisions** to apply instead of the TSIs. Indeed, the alternative **would not waive safety requirements**, which would need to be covered through **mitigation measures** (e.g. operational constraints, tests to give evidence of safe operation...).
It is acknowledged this proposed process is widely recognised in the sector as long and time consuming and requires positive answers from all member states concerned as well as from the European Commission. However, obtaining TSIs **derogation would open the door for authorising current-design locomotives fitted with DAC** for PioDAC traffics, under the condition safety equivalent mitigation measures are found.



The planning above uses parts of the schedule developed in the Tiger team and includes in its bottom part the estimated time required to complete a derogation process which is not reflected in the original overview.

The time challenges and pre-requisites mentioned above (full mechanical, electrical, and data DAC specifications ready, solution proven with first time installation and documentation from DAC DEMO trains and tender process completed) are also faced in the case of IOD article 7 procedure. However, the derogation path offers the possibility to find alternative-to-TSIs solutions for remaining obstacle points with high safety level equivalent to the TSIs' safety level. According to the current FP5 technology and tests schedule, and time estimations based on past derogation processes completed by the industry in the past: the set-up of the member states files for derogations applicable to locomotives fitted with DAC could start from June 2026, while authorisation for locomotives fitted with DAC could be granted by ERA by March 2028.

2.2.2 ERA subgroups of TWG-Freight related to authorisation of locomotives

The work and discussion in the specific sub-groups of the "meeting for the retrofitting of freight trains with DAC" make good progress to provide the content of a technical opinion planning to cover concrete requirements. Yet, for some points, including crashworthiness, discussions are continuing but no solution has been found so far.

- **Crashworthiness standard EN15227 and locomotive frame**:
  Discussions are on-going between CEN experts participating in the working group responsible for EN15227, FP5 and ERA. In particular, an analysis of past accidents is undergoing. It is acknowledged that a derogation would be needed when the safety level is degraded. However, no mitigation measure has yet been found and agreed within the group to justify, in the derogation request, that the safety level will be maintained. If the requirement of 36km/h collision speed design scenario is to be maintained, the working group could investigate introducing restricted operation speed as operational constraints in the derogation request.

  ***No solution found yet**: In order to continue investigating more in details possible mitigation measures part of a **derogation**, sector experts would need more resources in the next months, **possibly through EU-Rail funding**.*

- **Excess of authorised locomotive axle load and weight with DAC**:
  After the first meetings of the subgroup on Axle load, ERA agreed to allow the 3% tolerance offered in point

6.2.3.1 of TSI LOC&PAS for locomotives to be retrofitted with DAC if they didn't already benefit from this extra 3% allowance. If it is found after retrofitting that the axle load is still higher than the threshold, the use of such a locomotive on a network would need to be negotiated with the related Infrastructure Manager.

Solution found: *The procedure to allow 3% tolerance should be detailed in ERA's Technical Opinion*

- **Bern's room infringement with hybrid DAC**:
  After discussions between FP5 and ERA, it has been recognised that a derogation request justifying that health and safety levels are maintained would be necessary. Evidence would need to be developed and provided, demonstrating that space for operation in this room would still be safe enough for operation.

  Solution under discussion*: Evidence of safe operation is needed to support the derogation request.*

- **Running dynamics with hybrid DAC**:
  In the dedicated subgroup, FP5 proposed to plan PioDAC traffics on simple track geometry corridors only, where the issue of running dynamics with locomotives fitted with hybrid DAC would not appear. Additionally, locomotive manufacturers proposed to limit the speed to 120km/h. in order to perform the necessary investigations, additional resources would be needed, possibly through EU-Rail funding.

  Solution under discussion*: Proposals on* ***track choice*** *and* ***restriction of speed limit*** *need to be investigated.*

2.3 Long-term solution for wider DAC deployment (post-2030)

As a long-term solution, and for a potential wider deployment of DAC on European freight trains (also known as "migration"), the adaptation of the regulatory framework will be needed. This work is planned in the next batch of TSI revisions which request the European Commission already sent ERA in 2024, and is also covered in the STIP (Standardisation and TSI Input Plan). For what regards authorisation of the rolling stock, if derogation with equivalent safety level solutions is a possibility for PioDAC trains, it is not a solution for full migration authorisations. Therefore, technical long-term solutions need to be found to tackle the "major obstacles" mentioned above. For the full migration authorisation of locomotives with DAC, strong pre-conditions are needed, in addition to the already mentioned in 2.1:

- **A strong signal** from the rail supply industry **customers** confirming implementation of DAC (e.g. by issuing tenders for the migration phase) is needed
- **TSIs and supporting standards need to be updated** to accommodate DAC on locomotives (e.g with STIP)
- **Further research** work is needed to develop technical solutions targeted at the most recent locomotives families, ensuring **equivalent safety level** to now. UNIFE therefore call on **additional EU-Rail funding** to be earmarked for these activities.

Hereunder are paths for solution that would need to be explored - for example supported by EU-Rail-led projects:

- **Crashworthiness standard EN15227 and locomotive frame**:
  It is already planned to update standard EN 15227:2020 for crashworthiness in STIP version 2.0 (an updated version EN 15227:2020+A1:2024 has been issued, but withdrawn by ERA as means of compliance for TSI fulfilment in January 2026, until further notice). The same safety level related to collision speed would have to be achieved through mitigation measures like extension of functionalities (e.g. earlier detection of potential collision) and/or long-term adaptation of operational rules, yet to be defined and developed.

- **Excess of authorised locomotive axle load and weight with DAC**:
  STIP plans to update EN 15663 and EN 15528. However, as additional weight percentage can be applied only for locomotives that did not benefit from it before, it is proposed to target the retrofit of locomotives based on a weight list of all locomotives before migration, assessing if the weight and axle load margin is large enough to allow migration to DAC. The retrofit of a locomotive would thus need to be approved by design.
  Additionally, retrofitting heavier locomotives could be targeted for the end of full DAC deployment. This would allow retrofitting these locomotives with DAC only instead of Hybrid DAC, thus saving weight and axle load.

- **Bern's room infringement with hybrid DAC**:
  TSI LOC&PAS 4.2.2.2.5 (2) and EN16839:2022 need to be updated to allow specific infringement of Bern's room in the case of hybrid DAC. TSI LOC&PAS 4.2.2.2.5 text change proposal:
  "*4.2.2.2.5 Staff access for coupling and uncoupling*
  (...)
  (2) To comply with this requirement, units fitted with manual coupling systems of UIC type as per point 4.2.2.2.3(b) shall comply with the following requirements (the 'Bern rectangle'):
  - *On units equipped with screw couplers and side buffers, the space for staff operation shall be in accordance to the specification referenced in Appendix J-1, index [2].*
  - *Where a combined automatic and screw coupler is fitted it is permissible for the auto coupler head to infringe the Berne rectangle on the left-hand and right-hand side when it is stowed and the screw coupler is in use."*

  Evidence would need to be developed and provided, justifying that space for operation in this room would still be enough.

- **Running dynamics with hybrid DAC**:
  Track tests would need to be carried out in order to give evidence of safe operation with modified weight distribution and inertia. Based on the results of these tests, a TSI text amendment for 4.2.3.4.2 TSI LOC&PAS and/or updated EN 14363 would be needed to allow fulfilment of these TSI requirements for all locomotives equipped with hybrid DAC.

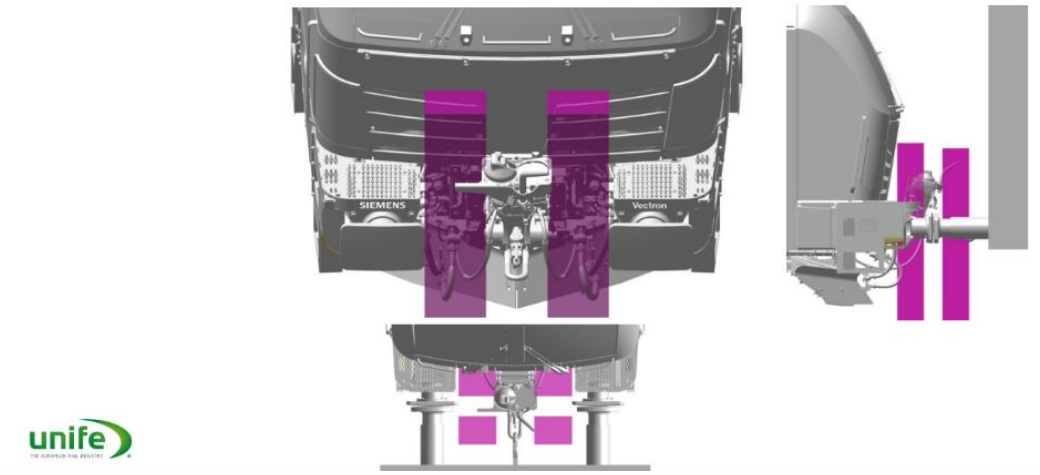
All these updates could be ready for 2030 for the start of a full-scale wider DAC deployment provided development is financed, solutions are found and opinions are aligned within technical committees.

Annex

List of abbreviations

DAC	Digital Automatic Coupler
EDDP	European DAC Delivery programme
EDDP PB	EDDP Programme Board
EDDP SB	EDDP Supervisory Board
PioDAC	Pioneer DAC Train project
TSIs	Technical Specifications for Interoperability
ERA	European Union Agency for Railways
EU-Rail	Europe's Rail Joint Undertaking
STIP	Standardisation and TSI Input Plan
IOD	Interoperability Directive (EU) 2016/797
VA	Vehicle Authorisation
FP5	Flagship Project 5 also known as TRANS4M-R project, funded by EU-Rail
CEN	"Comité Européen de Normalisation" – European Committee for Standardisation

Bern's room illustration locomotive and wagon



Summary and status of mitigation measures to ensure safety and interoperability

		Status of TWG-freight sub-groups discussions	UNIFE proposed possibilities for authorisation and mitigation measures ensuring safety and interoperability	
			Short-term (PioDAC trains authorisations)	Long-term (wider DAC deployment post-2030)
	Supporting regulatory frameworks	ERA Technical opinion including application of IOD article 7	ERA Technical opinion including application of IOD article 7	Through fulfilment of revised TSIs (regular application process)
Main obstacles for authorisation	**Crashworthiness**	On-going analysis of accidents and exploration of possible path for solutions – **Additional resources** needed. **No way forward found yet**.	**Derogation** based on operational constraints (e.g. restricted speed for shunting) and tests to give evidence of safe operation under crash scenario speed of 36km/h	Extension of functionalities (e.g. earlier detection of potential collision), adaptation of operational rules, additional stability requirements – **R&D resources** needed
	Excessive Weight and axle load	Retrofit only low-weight locomotives with sufficient weight margin within 3% tolerance	Retrofit only low-weight locomotives with sufficient weight margin within 3% tolerance	Prioritisation of retrofit to low-weight locomotives
	Bern's room infringement	Derogation based on evidence of safe operation	**Derogation** based on evidence of safe operation	TSI text amendment, based on operational evidence
	Running dynamic	Traffics on simple track geometry corridors only. Investigation on proposal to reduce speed to 120 km/h would be needed - for that, **additional resources** are needed.	**Derogation** based on operational speed constraints (A first proposal is speed reduction to 120 km/h : investigation needed to find the correct speed reduction)	TSI text amendment based on evidence of safe operation of running stability – **R&D resources** needed
	Investigation of potential additional blocking point	To be covered in the locomotive sub-group of TWG-freight. For that, **additional resources** would be needed.	To be covered in the locomotive sub-group of TWG-freight. For that, **additional resources** would be needed.	**R&D resources** needed

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