



## Bedre bremsetilpasning i tunge vogntog

Forslag om ændring af UN-ECE Regulativ 13

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Rapport nr. 1/2012  
Køretøjer og Transporter



## **NVF Køretøjer og Transporter**

Nordisk Vejteknisk Forbunds arbejdsgruppe om Køretøjer og Transporter er et viden-netværk mellem de nordiske lande. Netværket virker for international harmonisering af regler for køretøjer og transporter og for nordisk koordinering inden for EU. Netværket består af 55 nordiske eksperter fra myndigheder, styrelser, universiteter og forskningsorganisationer, synsvirksomheder, regeludstedende myndigheder, transportindustrien samt fabrikanter og importører af køretøjer.

## **NVF (NRA) Vehicles and Transportation**

Nordic Road Association's working group on Vehicles and Transportation (Nordiskt VägForum – NVF – Fordon och Transporter) is a knowledge-cluster within the Nordic countries. Our cluster aims for international harmonization of regulations for vehicles and transportation, and for Nordic coordination within the EU. We are in total 55 Nordic experts from departments, road administrations, universities and research organizations, control inspection bodies, regulatory authorities, transport industry, vehicle importers, vehicle manufacturers and suppliers.

## Sammenfatning

Denne rapport er en del av NVF Køretøjer og Transporters arbejdsområde om sikrere køretøjer og køretøjskontrol, herunder harmoniserede, kvalitetssikrede metoder til periodisk kontrol af tunge køretøjers bremsesystemer.

Forskellige studier og resultater fra de årlige periodiske syn samt erfaringer rapporteret fra IRU (International Road Transport Union, som organiserer vognmandserhvervet) peger på et behov for fokus på reducerede vedligeholdelsesomkostninger af tunge vogntogs bremsesystemer og forbedret og mere konsistent bremseevne for navnlig tunge påhængskøretøjer.

ETAC [1] (European Truck Accident Causation Study) fandt tekniske fejl ved 5,3% af alle hovedårsager til trafikulykker med lastbiler og at bagendekollisioner udgjorde 20,6% af alle ulykker. Bremsesystemer kan spille en rolle i disse ulykker.

Et dansk studie [2] af tunge vogntogs bremsepræstation fandt, at de fleste lastbiler bremsede godt, idet kun 4% havde utilstrækkelig bremseevne. Imidlertid havde de tunge påhængskøretøjer store problemer med bremseevnen, idet 38% ikke levede op til minimumskravene.

EU-forordningen om generel sikkerhed for køretøjer (661/2009) stiller krav om automatisk nød-bremsefunktion (AEBS - Automatic Emergency Brake System) på lastbiler typegodkendt fra 01.11.2013. Velfungerende bremsesystemer er en forudsætning for at opnå de forudsatte forbedringer af færdselssikkerheden.

Den internationale standard ISO 20918 ("Road vehicles - Braking threshold pressures for heavy commercial vehicle combinations with fully pneumatic braking systems - Test with roller brake tester") beskriver en metode til at vurdere bremsetilpasningen af tunge vogntog med trykluft-bremsefunktion ved hjælp af en rullebremsetester. Den internationale standard beskriver proceduren til brug for værkstederne og definerer et trykinterval, som starttrykket for både lastbilen og påhængskøretøjet skal falde inden for. Standarden angiver også en metode til måling af starttrykket.

Standarden beskriver at optimering og lav friktionsudnyttelse kræver god bremsebalance mellem akslerne i trykområdet op til 200kPa. Forbedringen i bremsebalance nås ved at minimere variationen i det tryk, hvor alle bremsesystemer begynder at udvikle bremsekraft, og standarden anbefaler et interval på 50-80kPa.

Tilsvarende inspiration er høstet i den tidligere svenske frivillige XTB (Extra Tested Bremser) vedligeholdelsesforeskrift. XTB vedligeholdelsesforeskriften anbefaler et bremsestarttryk på 50 til 80kPa for hver enkelt hjulbremse. Sverige planlagde at indføre krav om et tilsvarende starttryk, men kravet blev ikke indført på grund af de lavere krav i de internationale EU/ECE regler. ECE Regulativ 13 tillader et starttryk mellem 20 og 100 kPa for hvert køretøj i vogntoget, hvilket er en stor tolerance efter dagens standard.

### Referencer:

- [1] International Road Transport Union og EU-Kommissionen, Directorate General TREN, 2007: [European Truck Accident Causation Study](#).
- [2] Færdselsstyrelsen og Applus, 2005: [Undersøgelse af tunge køretøjers bremsesystemer](#).

## Summary

This report is published by NVF Vehicles and Transport as a part of their task to improve vehicle safety. The need for harmonised and quality certified methods for periodic technical inspection of heavy goods vehicle brakes is addressed within this scope.

Various studies and results from annual periodical technical inspections as well as experiences reported from IRU (International Road Transport Union) call for focus on reduced maintenance costs for heavy goods vehicle combinations and enhanced and more consistent brake performance of trailers in particular.

The European Truck Accident Causation Study [1] found technical failures in 5.3% of all main causes for traffic accident with trucks, and that queue accidents accounted for 20.6% of all accidents. Brakes can play a role in these accidents.

A Danish study [2] of brake performance of heavy goods vehicle combinations found that most heavy trucks performed well as only 4% were under-performing. However major problems were identified regarding brake performance of trailers as 38% did not meet legal requirements.

The EU General Safety Regulation 661/2009 requires AEBS (Automatic Emergency Brake System) for trucks type approved from 01.11.2013. Well functioning wheel brakes are a prerequisite for obtaining the safety benefit.

The ISO 20918 International Standard "Road vehicles - Braking threshold pressures for heavy commercial vehicle combinations with fully pneumatic braking systems - Test with roller brake tester" describes a method to evaluate the braking threshold of heavy commercial vehicle combinations with pneumatic braking systems by means of a roller brake tester. This International Standard describes procedures for workshops and garages and provides a recommended pressure range of the system threshold pressure for motor vehicles and trailers, and a recommended practice for determining the system threshold pressure. The standard says that optimization and low adhesion utilization requires good braking balance between axles in the pressure range up to 200kPa. This improvement in balance is achieved by minimizing the variation in pressure when all brakes start to develop a braking force and recommends an interval of 50-80kPa.

Likewise inspiration has been found in the former Swedish voluntary XTB (Extra Tested Brakes) maintenance prescription. The XTB maintenance prescription recommended a brake activation pressure of 50 to 80kPa for each individual wheel brake. A similar demand were planned to be introduced in Swedish national demands at PTI, but it was not implemented due to the less stringent EU/ECE demands: The ECE R13 allows for a brake activation pressure spread between 20 and 100kPa for each vehicle in the combination, which is a too wide tolerance by today's standards.

### References:

- [1] International Road Transport Union and European Commission Directorate General TREN, 2007: [European Truck Accident Causation Study.](#)
- [2] Danish Road Safety and Transport Authority and Applus, 2005: [Investigation of brakes of heavy vehicles.](#)

## Forslaget

Vedrørende de detaljerede baggrunde for og indhold i forslaget henvises til afsnittet "Justification" i selve forslaget, som er gengivet nedenfor.

## Forslagets tilblivelse

Forslaget er udviklet på baggrund af drøftelser under fire møder i NVF

- København, den 30.11.2010
- Oslo, den 4. april 2011
- Helsingfors, den 24.08.2011
- Reykjavik, den 15.11.2011

På møderne har der – ud over embedsmænd fra de nordiske lande – deltaget repræsentanter fra

- IRU (International Road Transport Union)
- SÅ (Sveriges Åkeriföretag)
- ITD (International Transport Danmark)
- DTL (Dansk Transport og Logistik)
- Volvo
- Haldex

Forslagene har været præsenteret som uformelle dokumenter på det 71. GRRF-møde i Genève den 13.-15. september 2011. (GRRF står for "Working Party on Brakes and Running Gear". Deltagerne er tekniske eksperter fra medlemslandenes myndigheder og internationale brancheorganisationer.

## Forslagets videre behandling

Det tilpassede og [endelige forslag](#) er optaget som arbejdsdokument til behandling på det 72. GRRF-møde i Genève den 20.-24. februar 2012. Hvis der blandt de tekniske eksperter er flertal for forslaget – eventuelt efter forhandling og tilpasning – vil forslaget blive fremsendt til "[World Forum for Harmonization of Vehicle Regulations \(WP29\)](#)", som holder møde tre gange om året. Næste møde i WP29 er 13. – 16. marts 2012. Hvert lands myndighedsrepræsentant har én stemme. EU afgiver stemme på medlemslandenes vegne, og har derfor stor vægt. Hvis forslaget vedtages, vil det blive indarbejdet i Regulativ 13 om bremsesystemer, som i praksis skal opfyldes af alle nye køretøjer, som skal typegodkendes med henblik på brug i Europa.

Forfatterne af denne rapport vil hermed gerne takke alle mødedeltagerne for deres værdifulde bidrag.

## Forslaget

Forslaget er indsat herunder i sin helhed.





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**Economic Commission for Europe**

Inland Transport Committee

**World Forum for Harmonization of Vehicle Regulations****Working Party on Brakes and Running Gear****Seventy-second session**

Geneva, 20–24 February 2012

Item 3(b) of the provisional agenda

**Regulation Nos. 13 and 13-H (Braking) – Trailer braking****Proposal for Supplement 10 to the 11 series of amendments to Regulation No. 13 (Heavy vehicle braking)****Submitted by the expert from Denmark, coordinated and supported by the International Road Transport Union, International Commission of Technical Affairs (IRU CIT) and the Nordic Road Association, Vehicles and Transport Committee (NVF).\***

The text reproduced below was prepared by the expert from Denmark, coordinated and supported by the International Road Transport Union, International Commission of Technical Affairs (IRU CIT) and the Nordic Road Association, Vehicles and Transport Committee (NVF). The text aims at improving brake distribution between the truck and the trailer of heavy vehicle combinations doing at everyday low decelerations, to enhance uniform use of all wheel brakes and thereby to counteract loss of full brake performance. The text is based on informal documents GRRF-71-18 and GRRF-71-19 distributed during the seventy-first session of the Working Party on Brakes and Running Gear and is based on ISO 20918 International Standard "Road vehicles - Braking threshold pressures for heavy commercial vehicle combinations with fully pneumatic braking systems". The modifications to the existing text of the Regulation are marked in bold characters for new or strikethrough for deleted characters.

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\* In accordance with the programme of work of the Inland Transport Committee for 2010–2014 (ECE/TRANS/208, para. 106 and ECE/TRANS/2010/8, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate

## I. Proposal

*Insert a new paragraph 5.1.4.2.4., to read:*

**"5.1.4.2.4.: In the control line between the coupling head and the trailer relay emergency valve."**

*Existing paragraphs 5.1.4.2.4. and 5.1.4.2.5. to be renumbered as paragraphs 5.1.4.2.5. and 5.1.4.2.6.*

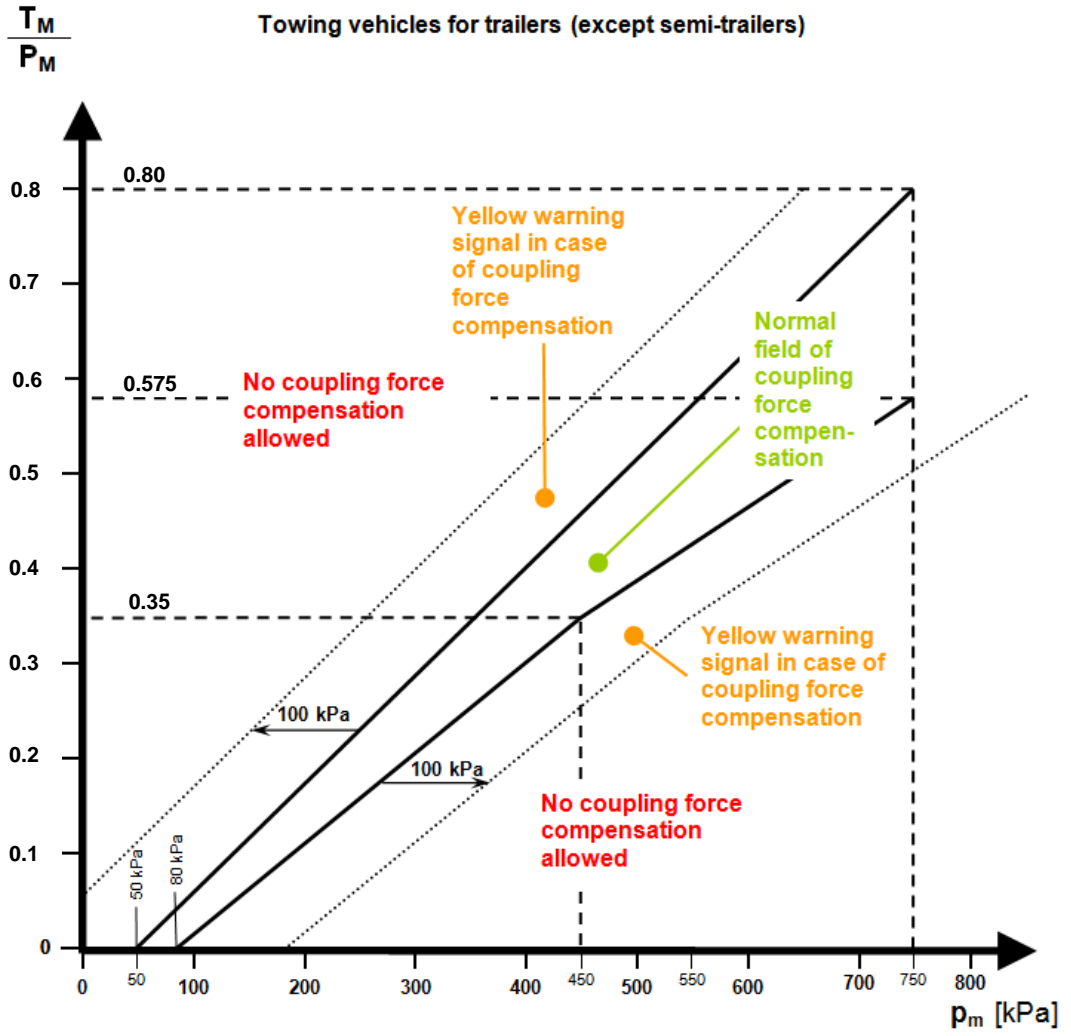
*Paragraph 5.2.1.28.5., amend to read:*

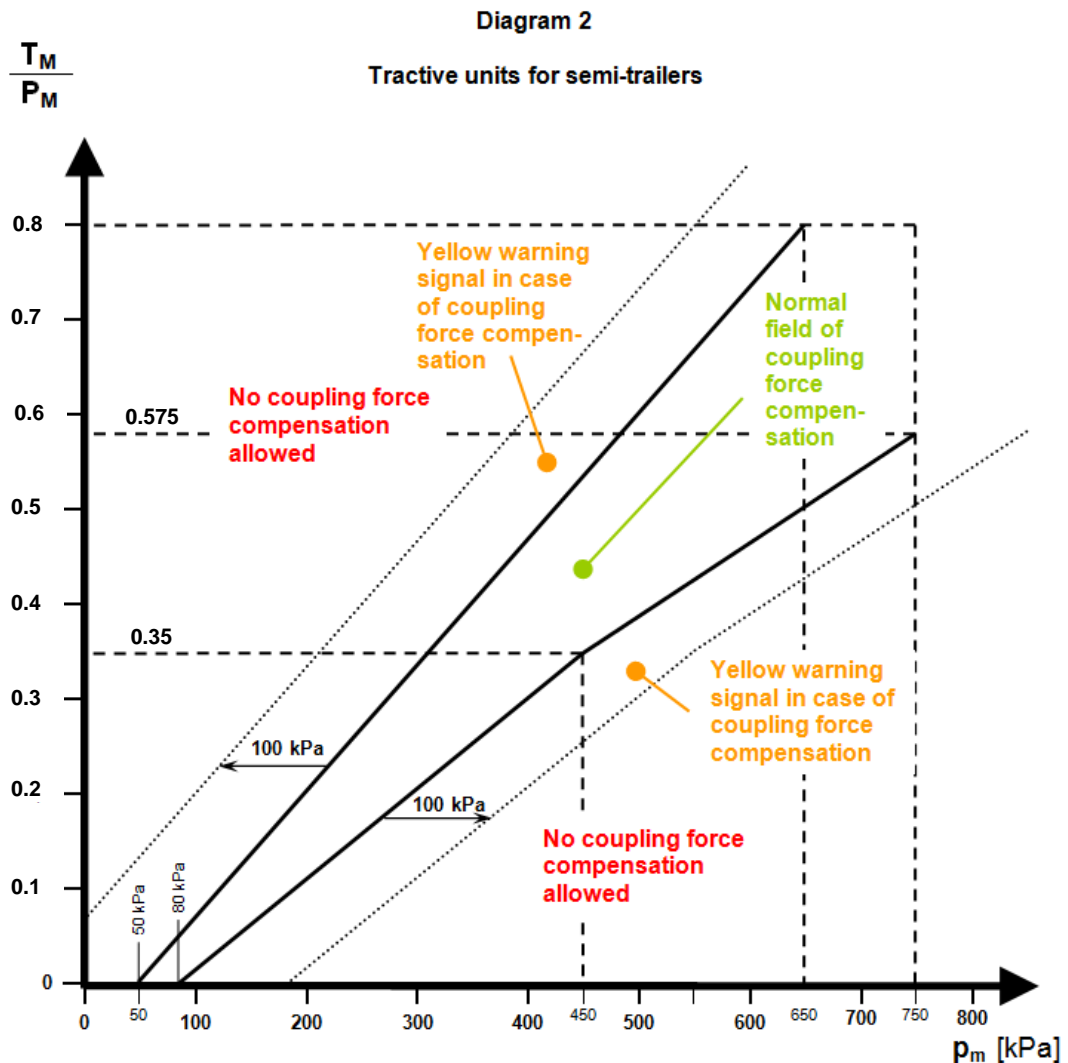
**"5.2.1.28.5. The coupling force control system shall tend to minimise the coupling force. Maximum allowed compensation by the coupling force control system is 100 kPa below the lower limit of the compatibility band and 100 kPa above the upper limit of the compatibility band as specified in Annex 10. If this compensation causes the operating point to lie outside the compatibility band as specified in Annex 10 for the motor vehicle the yellow warning signal specified in paragraph 5.2.1.29.2. shall be activated. After recoupling, no compensation is allowed before the coupling force control system has registered a difference between the braking rates of the vehicles in the combination. "**

*Diagrams 1 and 2, amend to read:*

Diagram 1

Towing vehicles for trailers (except semi-trailers)





Annex 10, paragraph 1.3.1., amend to read:

"1.3.1. At the time of type approval it shall be checked that the development of braking ~~on an axle of each independent axle group 2/~~ shall be within the following pressure ranges:

a) ~~Laden vehicles:~~

~~At least one axle shall commence to develop a braking force when the pressure at the coupling head is within the pressure range 20 to 100 kPa.~~

~~At least one axle of every other axle group shall commence to develop a braking pressure at the coupling head is at a pressure  $\leq 120$  kPa.~~

(b) ~~Unladen vehicles:~~

All axels ~~At least one axle~~ shall commence to develop a braking force when the pressure at the coupling head is within the pressure range ~~20 to 100~~ **50 to 80** kPa."

Annex 10, diagrams 2, 3 and 4A, amend to read:

"

DIAGRAM 2

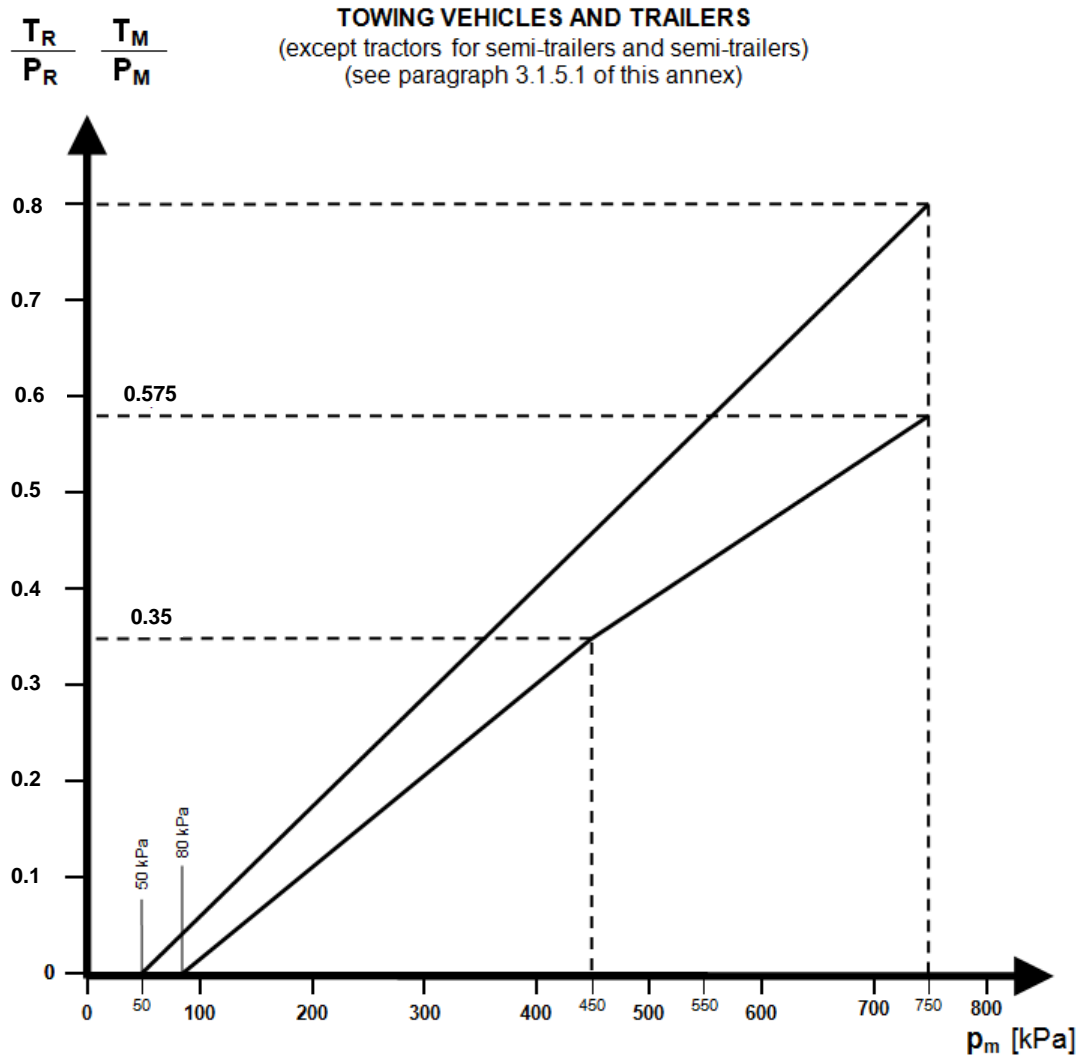


DIAGRAM 3

TRACTORS FOR SEMI-TRAILERS  
(see paragraph 3.1.6.3 of this annex)

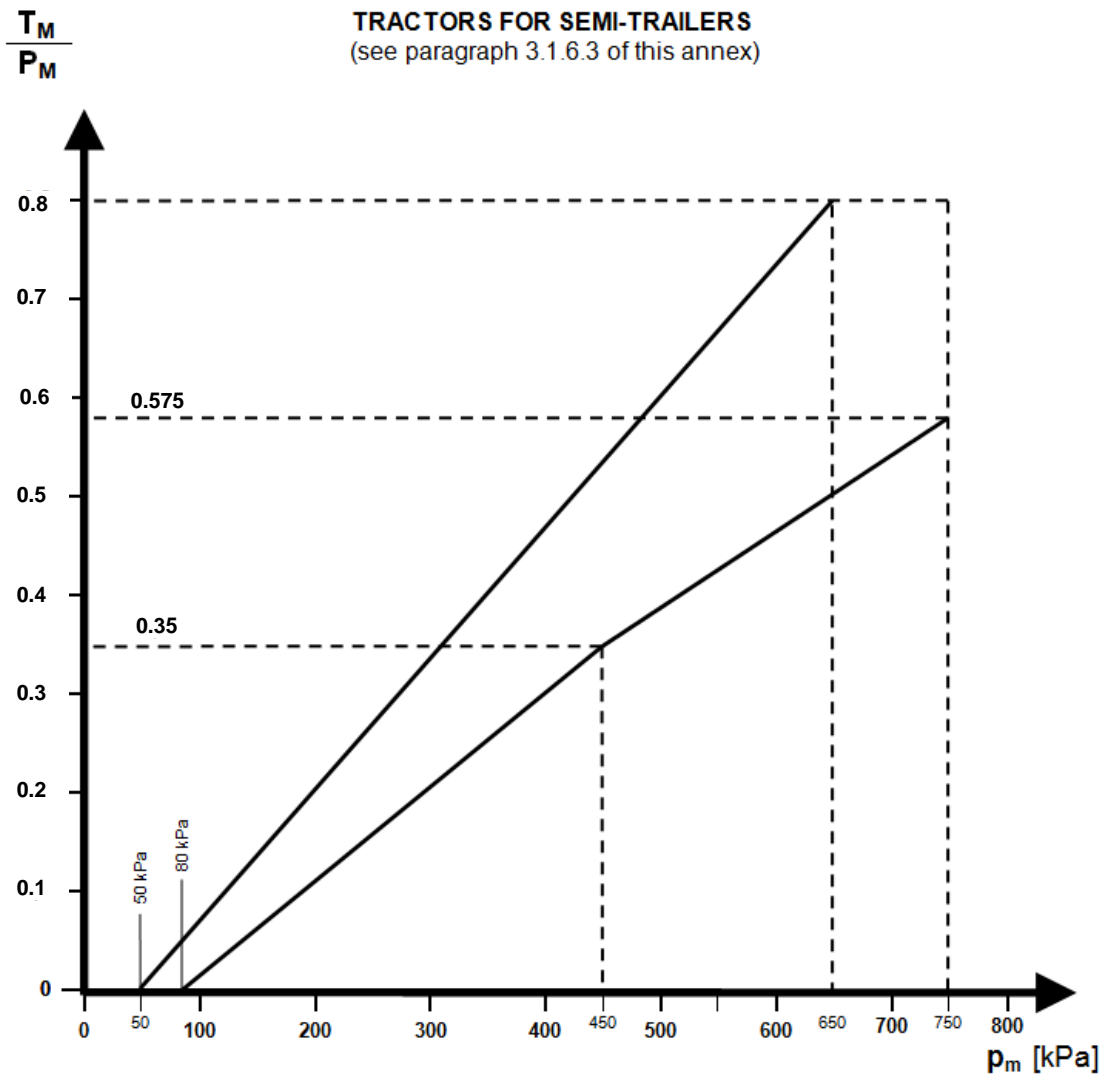
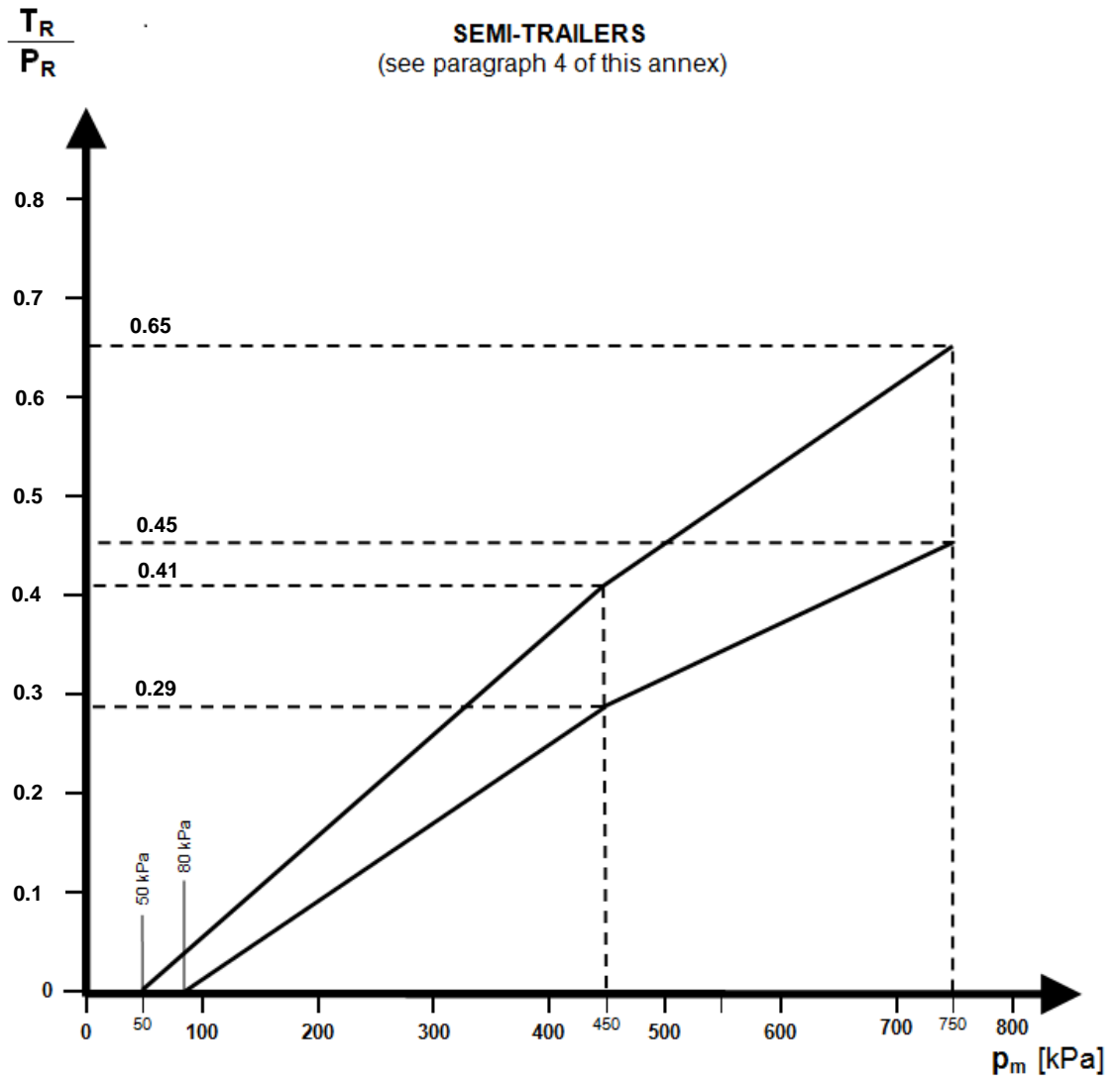


DIAGRAM 4

SEMI-TRAILERS  
(see paragraph 4 of this annex)



Annex 13,

Paragraph 1.1., amend to read:

"1.1. This annex defines the required braking performance for road vehicles fitted with antilock systems. In addition, power-driven vehicles which are authorized to tow a trailer, and trailers equipped with compressed-air braking systems, shall, when the vehicles are laden, meet the requirements for compatibility set out in Annex 10 to this Regulation. However, for all load conditions, **the requirements for compatibility set out in Annex 10 to this Regulation shall be fulfilled for a pressure ( $p_m$ ) below 200 kPa or the equivalent digital demand value at the coupling head of the control line(s).**"

## II. Justification

1. Various studies and results from annual periodical technical inspections as well as experiences reported by the International Road Transport Union (IRU) call for focus on reduced maintenance costs for heavy goods vehicle combinations and enhanced and more consistent brake performance of trailers in particular.
  - (a) [The European Truck Accident Causation Study \(2007\)](#) – although human factors were dominant – found technical failures in 5.3 per cent of all main causes for traffic accident with trucks, and that queue accidents accounted for 20.6 per cent of all accidents. Brakes can play a role in these accidents.
  - (b) [A Danish study \(2005\)](#) of brake performance of heavy goods vehicle combinations found that most heavy trucks performed well as only 4 per cent were under-performing. However major problems were identified regarding brake performance of trailers as 38 per cent did not meet legal requirements.
  - (c) [The European Union \(EU\) General Safety Regulation 661/2009](#) requires Automatic Emergency Brake System (AEBS) for trucks type approved from 01.11.2013. Well performing wheel brakes are a prerequisite for obtaining the safety benefit.
  - (d) [The ISO 20918 International Standard](#) "Road vehicles - Braking threshold pressures for heavy commercial vehicle combinations with fully pneumatic braking systems - Test with roller brake tester" describes a method to evaluate the braking threshold of heavy commercial vehicle combinations with pneumatic braking systems by means of a roller brake tester. This International Standard describes procedures for workshops and garages and provides a recommended pressure range of the system threshold pressure for motor vehicles and trailers, and a recommended practice for determining the system threshold pressure. The standard says that optimization and low adhesion utilization requires good braking balance between axles in the pressure range up to 200 kPa. This improvement in balance is achieved by minimizing the variation in pressure when all brakes start to develop a braking force and recommends an interval of 50-80 kPa.
  - (e) Likewise inspiration has been found in the former Swedish voluntary [XTB \(Extra Tested Brakes\) maintenance prescription](#). The XTB maintenance prescription recommended a brake activation pressure of 50 to 80 kPa for each individual wheel brake. A similar demand were planned to be introduced in Swedish national demands at Periodical Technical Inspection (PTI), but it was not implemented due to the less stringent EU/ECE demands: The UN Regulation No. 13 allows for a brake activation pressure spread between 20 and 100 kPa for each vehicle in the combination, which is a too wide tolerance by today's standards.
2. Indications show that the limits for coupling force control system are too lenient which results in the possibility for overcompensation. This proposal also limits a strategy by some manufactures to start compensation before an actual need has been discovered. This compensation is a challenge for the brake compatibility and can result in overloading of the trailer brakes.
3. Denmark, IRU and NVF are aware that
  - (a) the braking performance measured at PTI differs in various countries depending on different braking calculations ([NVF report 2004](#));



- (b) the precision of the measuring equipment – the roller brake tester – should be taken into account when evaluating measurement results ([NVF report 2009](#));
- (c) in the future, reference braking forces will be available for all vehicles due to UN Regulation No. 13 PTI requirements for new type approved vehicles and can be used as common method of determining brake performance resulting in a harmonized evaluation at PTI;
- (d) the ISO 20918 standard sets out a method to determine braking balance of vehicle combinations which means that the whole transport unit starts braking at the same time resulting in truck and trailer braking their own proportion of the total unit weight;
- (e) the ISO 20918 standard limits the starting pressure span to 50 kPa – 80 kPa;
- (f) Swedish experiences has shown that the ISO 20918 pressure span of 50 kPa – 80 kPa can be fulfilled even with conventional non-EBS vehicles ([Better brakes on heavy vehicles, 2005](#));
- (g) demands for improvement of brake balance between truck and trailer resulting in enhancement of durability in brake performance should be implemented for new vehicles and thereafter implemented for those vehicles in use as outlined in the ISO standard;
- (h) the yellow warning lamp regarding the coupling force control - in line with other MIL-lights - indicates a possible problem with the trailer brakes and should be taken care of. A supplementary text message in the dashboard could explain the reason for the signal, for instance "trailer 1.5 kPa outside compatibility band, check trailer brakes". A good practical method for the driver to check if brakes are active is to check brake temperature;
- (i) glazed brake linings are a common problem and can be a result of bad low pressure compatibility resulting in lowered full brake performance;
- (j) maintenance of the heavy vehicle brakes is one of the most significant maintenance cost for the vehicle owner ([Better brakes on heavy vehicles, 2005](#)).

This proposal for an amendment of ECE R13 is presented as based on the above points.

The following diagrams show the difference between the existing diagrams and the new proposed diagrams:

Annex 10, diagram 2, 3 and 4A (compatibility):

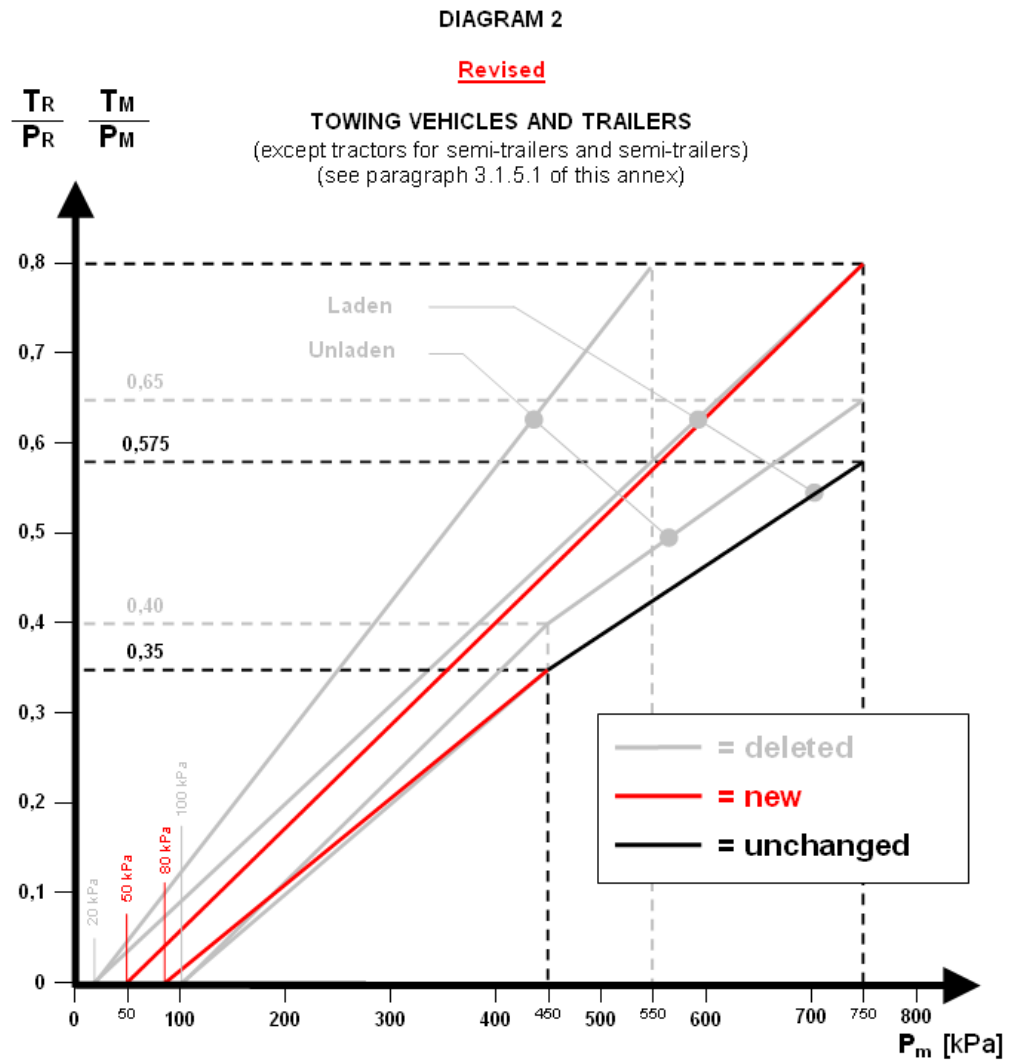


DIAGRAM 3

Revised

TRACTORS FOR SEMI-TRAILERS  
(see paragraph 3.1.6.3 of this annex)

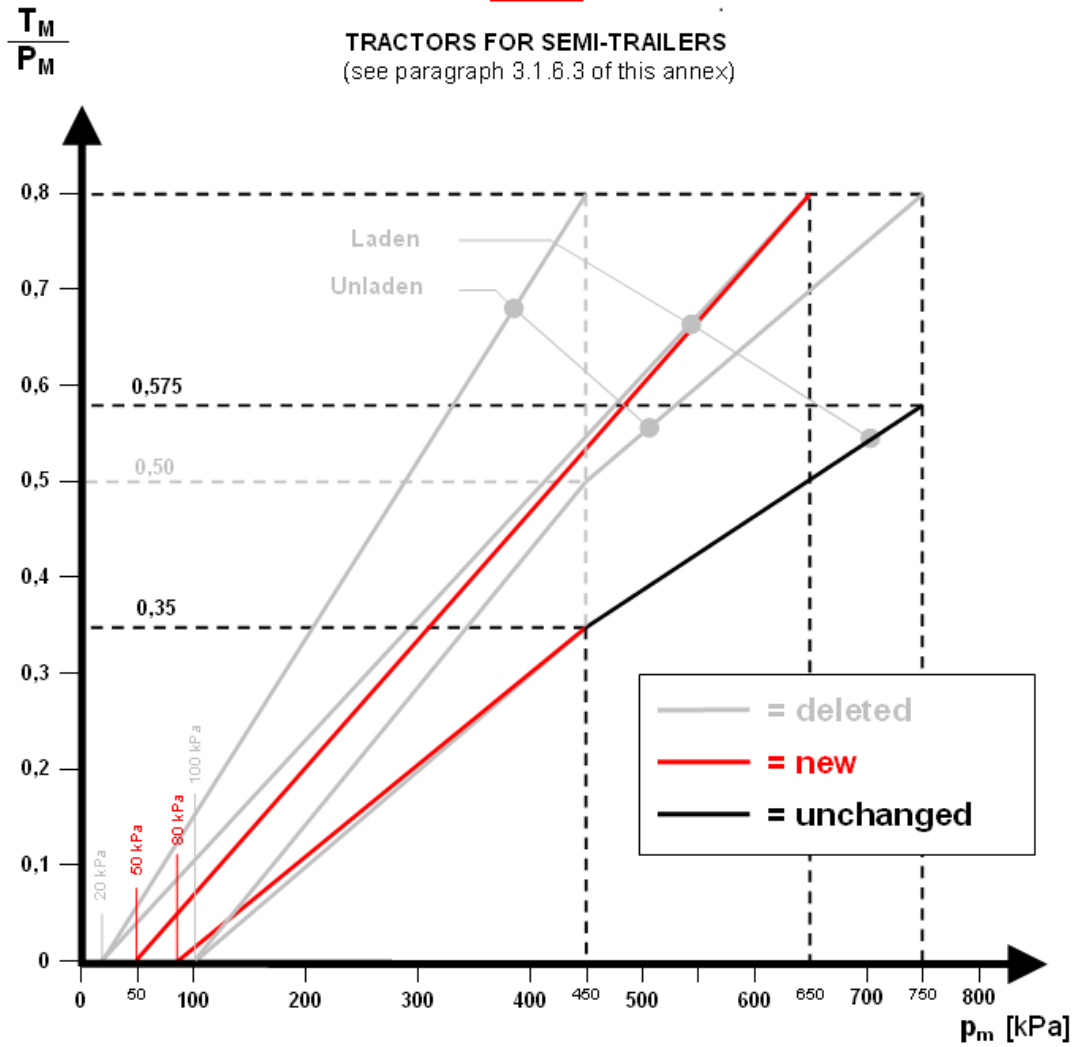
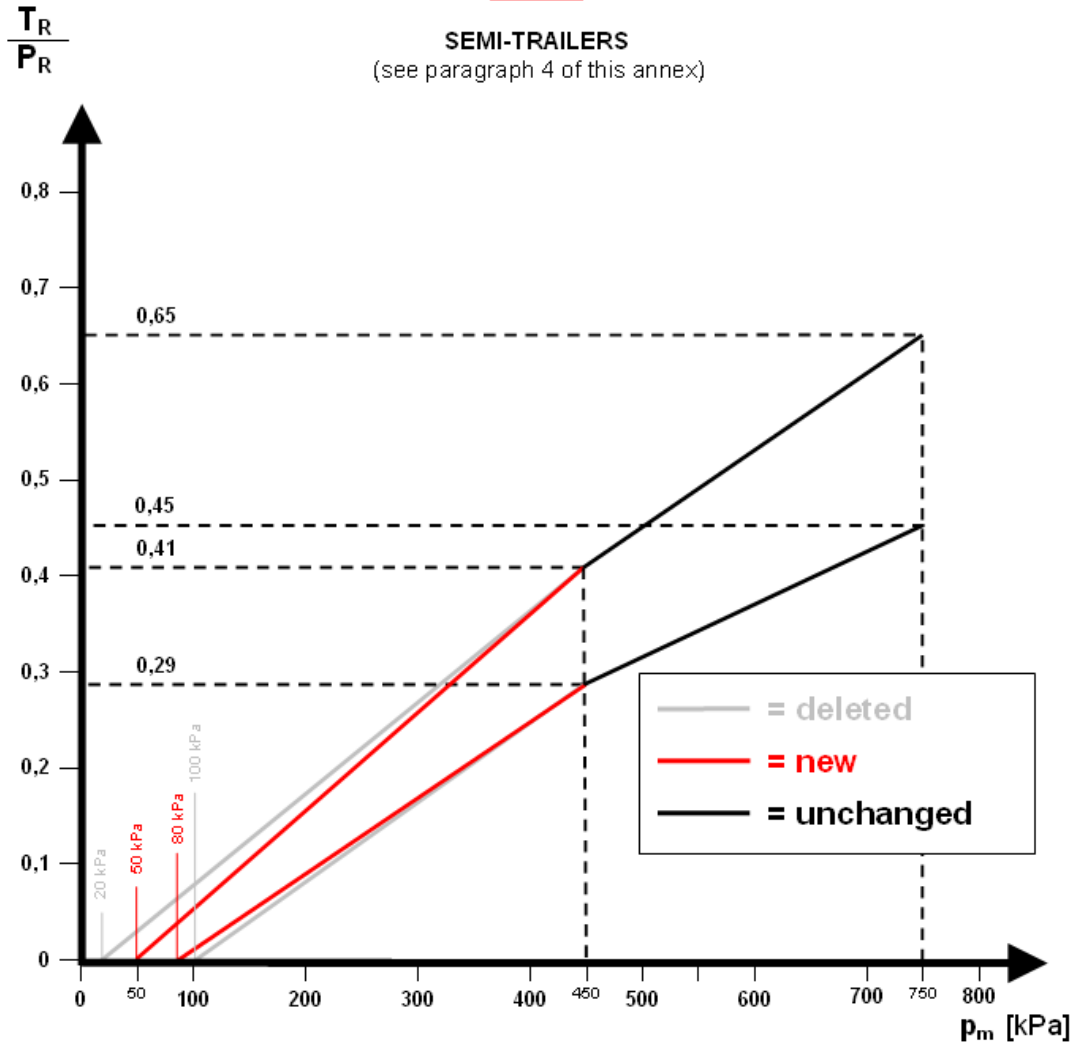


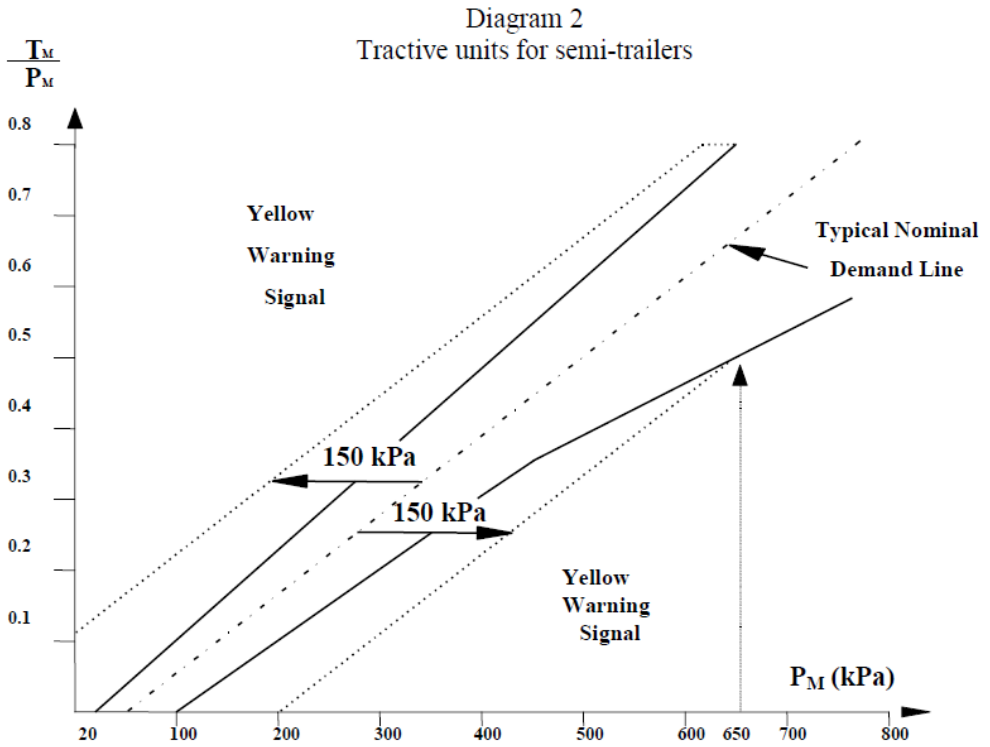
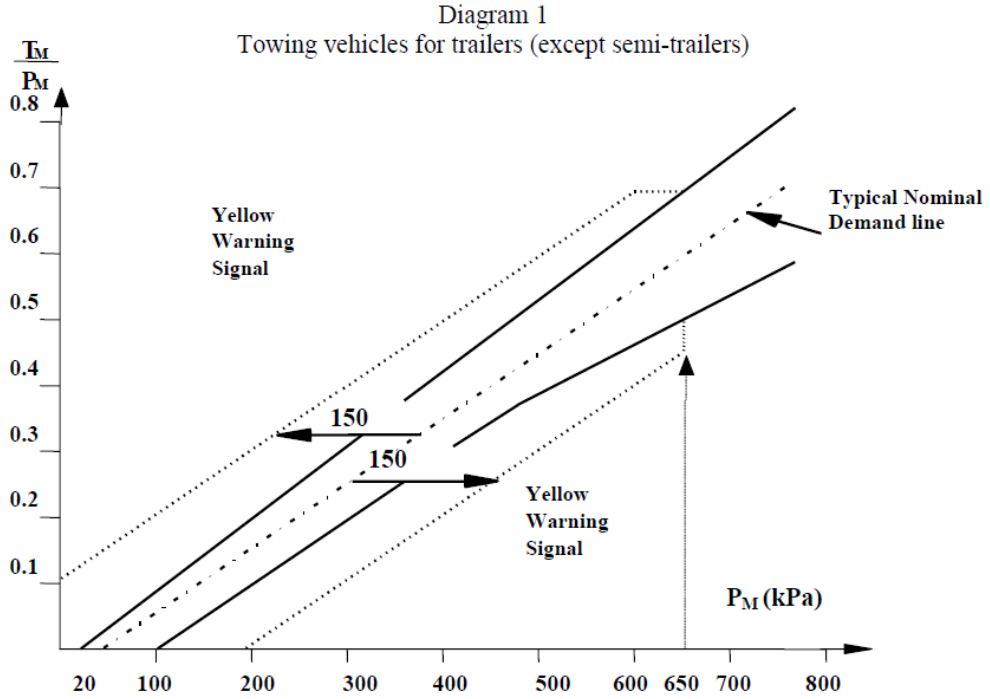
DIAGRAM 4

Revised

SEMI-TRAILERS  
(see paragraph 4 of this annex)



Existing diagrams in paragraph 5.2.1.28.5. (coupling force control) for reference:





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