APTU Uniform Rules (Appendix F to COTIF 1999)

# Uniform Technical Prescriptions (UTP) applicable to Rolling Stock, subsystem

# FREIGHT WAGONS - (UTP WAG) - ANNEX P

# BRAKING PERFORMANCE

## ASSESSMENT OF INTEROPERABILITY CONSTITUENTS

*Explanatory note:*

*The texts of this UTP which appear across two columns are identical to corresponding texts of the European Union regulations. Texts which appear in two columns differ; the left-hand column contains the UTP regulations, the right-hand column shows the text in the corresponding EU regulations. The text in the right-hand column is for information only and is not part of the OTIF regulations.*

| *OTIF UTP* | *Corresponding text in EU regulations* [1] | *EU ref.* [2] |
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## P.1 DESIGN ASSESSMENT

The following list contains brake system and brake constituent designs that at the time of publication are already considered to meet the requirements of this

| UTP | TSI |
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for some applications. This list will be found in Annex FF: List of approved brake components.

### P.1.1 DISTRIBUTOR

Open point – NOT relating to compatibility with infrastructure – see Annex JJ

The test procedure for product design assessment to be used for the Interoperability Constituent distributor shall conform to this

| UTP | TSI |
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### P.1.2 RELAY VALVE

Open point – NOT relating to compatibility with infrastructure – see Annex JJ

#### P.1.2.1 Relay valve for variable load

The design assessment of the interoperability constituent variable load relay valve is described here, whilst the specification is described in

| UTP | TSI |
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section 4.2.4.1.2.2 Braking Power and 4.2.4.1.2.7 Air Supply and the features described in Annex I chapter I.2.1.

The relay shall be tested as an individual unit for the following features when operating at temperatures of – 25 to + 45 °C:

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1 TSI Freight Wagons – The Annex to the Commission Decision 2006/861/EC published in the EU Official Journal L344 on 08.12.2006 as amended by Commission Decision 2009/107/EC published in EU Official Journal L45 on 14.02.2009.

2 If no EU reference is indicated, it means that the chapter/section number is the same as in the OTIF text.

| *OTIF UTP* | *Corresponding text in EU regulations* [1] | *EU ref.* [2] |
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– Application & Release times over the complete load range in accordance with section 4.2.4.1.2.2 of this
UTP; | TSI;
– Graduable application and release of the brakes (minimum 5 steps);
– Variations in output pressure with load signal variation;
– Response time to change in load signal variation. Change within 1 minute;
– No leakage when operating at temperatures of – 25 to + 45 °C.

The test results at temperatures of – 25 to + 45 °C must not affect the operation of the vehicle or the train.

The relay valve shall be tested as an individual unit for the above features when operating at extreme temperatures of – 40 to – 25 °C and + 45 to + 70 °C. Test results can vary from the results between – 25 °C and + 45 °C at these extreme temperatures, but shall not affect the ability to operate the train.

The assessment of the variable load relay valve in the system is to be carried out when fitted in a brake system having an Interoperable Constituent distributor.

The following tests shall be carried out on an individual wagon randomly selected, equipped with at least one variable load relay valve. The change in load shall be both rising and falling through the full range and the vehicle shall be moved before the next set of measurements following a change in load.

– Verification of the brake mass percentages for 120 km/h running. Progressive degradation from a brake mass percentage of 100 % to 90 % is allowed for block braked wagons as the load increases from 18 to 20 tonne axle loads according to this
UTP; | TSI;
– Verification of the brake mass percentages for 100 km/h running. Progressive degradation from a brake mass percentage of 100 % to 65 % is allowed for wagons progressively as the load increases from 65 % of the wagons maximum permissible weight (14,5 tonne axle load for a wagon designed for 22,5 tonne axle loads) to its maximum weight according to this
UTP | TSI
The braked mass for wagons fitted with cast iron block brakes shall not exceed 18 tonnes according to the international technical rules available at the time covering all Contracting States; | Member States;
– Application and release times over the complete load range;
– Graduable application and release of the brakes (minimum 5 steps);
– Variations in output pressure with load signal variation;
– Response time to change in load signal variation;
– Impact and short duration load variations not affecting load adjustment;
– Leakage.

Running tests shall be carried out to verify:

– The equipment is insensitive to random load variations due to the movement of the vehicle;
– The brake mass percentages with (i) empty, (ii) half-loaded, (iii) load corresponding to a brake mass percentage of 100 % and (iv) full load. The brake mass percentage shall not exceed 130 % irrespective of the load value, and for block braked wagons running at 120 km/h in the full load condition shall not exceed 105 %.

### P.1.2.2 Relay valve for automatic empty-load

The design assessment of the interoperability constituent automatic empty/load relay valve is described here, whilst the specification is described in
UTP | TSI

| *OTIF UTP* | *Corresponding text in EU regulations* [1] | *EU ref.* [2] |
|---|---|---|

section 4.2.4.1.2.2 Braking Power and 4.2.4.1.2.7 Air Supply and the features described in Annex I chapter I.2.2.

The relay will be tested as an individual unit for the following features when operating at temperatures of – 25 to + 45 °C:

- Application and release times over the complete load range
- Graduable application and release of the brakes (minimum 5 steps)
- Variations in output pressure with load signal variation
- Response time to change in load signal variation
- No leakage when operating at temperatures of – 25 to + 45 °C

The test results at temperatures of – 25 to + 45 °C must not affect the operation of the train.

The relay valve shall be tested as an individual unit for the above features when operating at extreme temperatures of – 40 to – 25 °C and + 45 to + 70 °C. Test results can vary from the results between – 25 °C and + 45 °C at these extreme temperatures, but shall not affect the ability to operate the train.

The assessment of the automatic empty/load relay valve in the system is to be carried out when fitted in a brake system having an Interoperable Constituent distributor. Tests shall be carried out on an individual wagon equipped with at least one automatic empty/load relay valve. Tests shall be carried out both in the empty and loaded conditions. The vehicle shall be progressively loaded and unloaded in order to ascertain that the automatic change-over mechanism transfers from the 'loaded' to 'empty' mode, rising and falling, within the ± 5 % transition weight range. Where the equipment is designed to operate with varying load with the empty/load equipment, the running tests will be with the load at loads varied around the changeover weight to ensure that the mechanism is not affected by random load variations during normal operation. Tests shall be carried out statically on an individual vehicle and in a train formation of a minimum of 15 wagons fitted with 4 axles which are all fitted with Interoperable Constituent distributors. If test results conform with the above requirements, then tests shall be carried out dynamically on an individual vehicle. The tests shall include:

- Application and Release times in both modes
- Graduable application and release of the brakes (minimum 5 steps)
- Brake Application Time in both modes
- Brake Release Time in both modes
- Variations in output pressure with load signal variation
- Response time to change in load signal variation
- Leakage

Running tests may be carried out if required by the assessing entity. | Notified Body.

## P.1.3 WHEEL SLIDE PROTECTION DEVICE (WSP)

Open point – NOT relating to compatibility with infrastructure – see Annex JJ

The design assessment of the interoperability constituent Wheel slide protection device is described here, whilst the specification is described in UTP | TSI section 4.2.4.1.2.6 Wheel slide protection and 4.2.4.1.2.7 Air Supply and the features described in Annex I chapter I.3.

The tests with the WSP shall be carried out either on a modern 4-axle vehicle or on a validated test rig, which faithfully represents the track geometry, adhesion conditions, vehicle parameters, etc. and validated on a modern 4-axle vehicle.

If the test vehicle is fitted with any brakes not dependent on adhesion these shall be

| *OTIF UTP* | *Corresponding text in EU regulations* [1] | *EU ref.* [2] |
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isolated. When these brakes are activated, the WSP shall work properly: tests are required to confirm this. The test vehicle shall have a brake system representative of the system for which the WSP has been designed (of disc and/or block).

The following shall be measured/recorded as a minimum during all the testing of the WSP system:

- Vehicle speed
- Speed of individual axles
- Brake cylinder pressures
- Vehicle deceleration
- Auxiliary reservoir pressure
- Time
- Commencement of braking
- Activation of the dump valves
- Stopping distance
- Stopping time

The executions of the tests shall be made in accordance with this UTP. | TSI.

## P.1.4 SLACK ADJUSTER

The design assessment of the Interoperability Constituent slack adjuster shall be made by ensuring the mechanical strength is suitable for the load to be transmitted. Interchangeable slack adjusters are shown in Annex I, Section I.4 with their permitted maximum loads. The assessment will also ensure that the friction pair distance can be maintained within sensible limits so that the friction pair do not touch each other without braking, the braking characteristics are maintained and the braking performance is guaranteed.

A life test shall be performed to demonstrate the suitability of the unit for service on railway vehicles and to verify the maintenance requirements for the operational design life. This shall be carried out at the maximum rated load cycling through the full range of adjustment.

## P.1.5 BRAKE CYLINDER/ACTUATOR

The design assessment of the interoperability constituent brake cylinder/actuator is described here, whilst the specification is described in 4.2.4.1.2.2 Braking Power, 4.2.4.1.2.8 Parking Brake, 4.2.4.1.2.5 Energy Limits and 4.2.4.1.2.7 Air Supply and the features described in Annex I chapter I.5.

The mechanical strength shall be assessed to ensure that it is suitable for the mechanical load to be transmitted, mechanical fixings and for the air pressures employed, including over pressure situations due to fault conditions. A full dimensional check shall be carried out. Interchangeable brake cylinders are shown in Annex I, Section I.5 with their permitted dimensions.

The brake cylinder/actuator shall be tested. The features to be tested are:

- No leakage at minimum and maximum stroke with a low input pressure (approximately 0,35 bar) for temperatures of – 25 to + 45 $^{o}$C
- No leakage at minimum and maximum stroke with a high input pressure (at least 3,8 bar) for temperatures of – 25 to + 45 $^{o}$C
- Maximum design stroke
- Pressure required to move the load rod, at the commencement of the movement and at the point of reaching full stroke

*OTIF UTP* | *Corresponding text in EU regulations* [1] *EU ref.* [2]

The test results at temperatures of – 25 to + 45 °C must not affect the operation of the train.

The brake cylinder/actuator shall be tested as an individual unit for the above features when operating at extreme temperatures of – 40 to – 25 °C and + 45 to + 70 °C. Test results can vary from the results between – 25 °C and + 45 °C at these extreme temperatures, but shall not affect the ability to operate the train.

If the brake cylinder or actuator has a slack adjuster, then the features listed under P.1.4 shall be assessed.

A life test shall be performed to demonstrate the suitability of the brake cylinder or actuator for service on railway vehicle and to verify the maintenance requirements the operational design life. This shall be carried out at the maximum rated load cycling through the full range of strokes (and range of adjustment for those fitted with slack adjusters).

## P.1.6 PNEUMATIC HALF COUPLING

The pneumatic half coupling shall be fully dimensionally checked to conform with the details in Annex I, section I.6, and the manufacturers drawings. A representative sample of 10 out of a minimum batch of 25 shall be tested for coupling and to ensure no leakage at 10 bar when operating at temperatures of – 25 and + 45 °C.

The pneumatic half coupling shall be tested as an individual unit for the above features when operating at extreme temperatures of – 40 to – 25 °C and + 45 to + 70 °C. Test results can vary from the results between – 25 °C and + 45 °C at these extreme temperatures, but shall not affect the ability to operate the train.

## P.1.7 END COCKS

The design assessment of the Interoperability Constituent end cocks is described here, whilst the features are described in Annex I chapter I.7.

Check of physical and geometrical characteristics: The requirement of Annex I, I.7~~.4, I.7.7,~~ and figures I.16~~7.2~~ to I.20~~7.5~~ as applicable shall be checked.

The executions of the tests shall be made in accordance with this UTP. | TSI.

## P.1.8 ISOLATING DEVICE FOR BRAKE ATTENUATOR

The design assessment of the Interoperable Constituent Isolating device for distributor is described here whilst the features are described in Annex I chapter I.8.

The Isolating device shall be tested & checked as follows:

- Movement of handle;
- No leakage through the cock when closed when operating at temperatures of – 25 to + 45 °C;
- No leakage from the cock to atmosphere when the cock is open or closed with a low input pressure of 0,35 bar;
- No leakage from the cock to atmosphere when the cock is open or closed with a high input pressure of 7 bar.

The isolating device for distributor shall be tested as an individual unit for the above features when operating at extreme temperatures of – 40 to – 25 °C and/or + 45 to + 70 °C. Test results can vary from the results between – 25 °C and + 45 °C at these extreme temperatures, but shall not affect the ability to operate the train.

| *OTIF UTP* | *Corresponding text in EU regulations* [1] | *EU ref.* [2] |
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## P.1.9 BRAKE PADS

The test procedures for design assessment to be used for the interoperability constituents' brake pads and discs are to be made in accordance with this
UTP. | TSI.

## P.1.10 BRAKE BLOCKS

The test procedure for design assessment to be used for the Interoperability Constituent brake blocks is to be carried out in accordance with the specification in Annex I section I.10.2. That specification is for composite brake blocks still an open point related to compatibility with infrastructure. |

Composite brake blocks that are already in use at the time when this UTP enters into force | have shall be considered as having passed the assessment according to P.2.10 successfully. The list of fully approved composite brake blocks for international transport is set out in
Annex VV. | a Technical Document (to be) published by the European Rail Agency on its website.

For wagons subject to section 7.6.4 of the UTP/TSI WAG which are equipped with composite brake blocks, the use of composite brake blocks which are included in the list in Annex VV is mandatory. In this case the specification for composite brake blocks is not an open point, cf. Annex JJ.

## P.1.11 ACCELERATOR VALVE

Open point – NOT relating to compatibility with infrastructure – see Annex JJ

The Test procedures for design assessment to be used for the interoperability constituent accelerator valve are to be made in accordance with this
UTP. | TSI.

## P.1.12 AUTOMATIC VARIABLE LOAD SENSING AND EMPTY/LOAD CHANGE OVER DEVICE

Open point – NOT relating to compatibility with infrastructure – see Annex JJ

### P.1.12.1 Automatic variable load sensing device

The design assessment of the automatic variable load sensing device is described here, whilst the features of the valve are specified in Annex I, section I.12.1. The tests to show conformity are listed below:

- Static test of load verses output pressure with rising and falling loads;
- Running test to demonstrate that shocks or variations will not affect the output brake force;
- Running test to demonstrate that air consumption is not excessive and will not affect normal operation of the air brake system.

The executions of the tests shall be made in accordance with this
UTP. | TSI.

### P.1.12.2 Empty/load changeover device

The design assessment of the empty/load changeover device is described here, whilst the features of the valve are specified in Annex I, section I.12.2. The tests to show conformity are listed below:

| *OTIF UTP* | *Corresponding text in EU regulations* [1] | *EU ref.* [2] |
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– Static test to show change in output with movement of the measuring device or a load change;
– Static test to show delay to output signal caused by measuring device movement, that would cause a change of output, for greater than 3 seconds;
– Running test to demonstrate that shocks or variations will not affect the output signal;
– Running test to demonstrate that air consumption is not excessive and will not affect normal operation of the air brake system.

The executions of the tests shall be made in accordance with this UTP. | TSI.

# P.2 PRODUCT ASSESSMENT

## P.2.1 DISTRIBUTOR

Every Distributor shall be tested. The features are specified in Annex I, section I.1 and those to be tested are listed below:

– Graduable application and release of the brakes;
– Brake Application Time;
– Brake Release Time;
– Manual Distributor Release Valve;
– Automatic operation;
– Sensitivity and Insensitivity;
– Leakage;
– Charging time of brake supply (auxiliary) reservoir;
– Charging time of control reservoir (may not apply to electrically/electronically controlled distributor).

## P.2.2 RELAY VALVE FOR VARIABLE LOAD AND EMPTY/LOAD

Every relay valve shall be tested. The features are specified in Annex I, section I.2 and those to be tested are listed below:

– Graduable application and release of the brakes (minimum 5 steps);
– Brake Application Time;
– Brake Release Time;
– Variations in output pressure with load signal variation;
– Response time to change in load signal variation;
– No change in output pressure to load signal variations during an application (variable load only);
– Leakage.

## P.2.3 WHEEL SLIDE PROTECTION DEVICE

Every WSP control unit, sensors and dump valves shall be tested. The features of the wheel slide protection device are described in 4.2.4.1.2.6 Wheel Slide Protection and 4.2.4.1.2.7 Air Supply and specified in Annex I, section I.3. The features shall be tested by a self-test programme that has a fault diagnostic display to identify any faults. Random faults shall be introduced to check the self-test.

## P.2.4 SLACK ADJUSTER

Every slack adjuster shall be tested. The features to be tested are:

- Maximum take up;
- Maintenance of set clearance;
- Incremental take up;
- Letting out when no clearance to obtain set clearance (double acting units only);
- Ability to reset to minimum length (contracting slack adjuster) or maximum length (extending slack adjuster).

## P.2.5 BRAKE CYLINDER/ACTUATOR

Every brake cylinder/actuator shall be tested. The features to be tested are:

- No leakage at minimum and maximum stroke with the low input pressure;
- No leakage at minimum and maximum stroke with the high input pressure;
- Maximum stroke;
- Pressure to move load rod.

If the brake cylinder or actuator has a slack adjuster, then the features listed under P.2.4 shall be tested.

## P.2.6 PNEUMATIC HALF COUPLING

Every Pneumatic half coupling shall be tested to ensure no leakage at 10 bar.

## P.2.7 END COCKS

Every end cock shall be tested. The features are specified in Annex I, section I.7 and those to be tested are listed below:

- Movement of handle;
- Torque;
- No leakage through the cock when closed;
- No leakage from the cock to atmosphere when the cock is open or closed with a low input pressure;
- No leakage from the cock to atmosphere when the cock is open or closed with an input pressure of 10 bar;
- Venting of hose side of cock.

## P.2.8 ISOLATING DEVICE FOR DISTRIBUTOR

Every isolating device shall be tested. The features are specified in Annex I, section I.8 and those to be tested are listed below:

- Movement of handle;
- No leakage through the cock when closed;
- No leakage from the cock to atmosphere when the cock is open or closed with the low input pressure;
- No leakage from the cock to atmosphere when the cock is open or closed with the high input pressure.

## P.2.9 BRAKE PADS

Samples of each batch of pads will be dimensionally checked.

| *OTIF UTP* | *Corresponding text in EU regulations* [1] | *EU ref.* [2] |
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## P.2.10 BRAKE BLOCKS

– Geometrical assessment

– Samples of each batch of blocks shall be dimensionally checked.

Assessment procedure for composite brake blocks; the test procedure is an open point relating to compatibility with infrastructure

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|---|---|---|
| except for composite brake blocks on wagons subjects to section 7.6.4, if the brake blocks are included in the list in Annex VV. | For wagons subject to section 7.6.4, the open point identified in Annexes P.1.10 and P.2.10 of this TSI is closed with the related technical document which is published on the ERA website. | 2009/107/EC JJ.2, 1.7 |

During the transitional period the assessment test performed by UIC shall at least comprise:

Rig Testing and Analysis

Composite brake blocks shall be assessed using a standardised test procedure and standardised test rig (ERRI B126/RP 18, 2. version, March 2001). The following criteria shall be examined:

- Brake block performance in dry, wet and drag braking
- Probability of metal pickup from the wheel
- Performance in adverse winter weather conditions (e.g. snow, ice, low temperature)
- Performance in the case of brake failure (brakes locked on)
- Assessment of effects on the electrical resistance of the wheelset (including specific test of compatibility with track circuits in the different countries where the vehicle is intended to operate)

Climactic Test Chamber Assessment

Before proceeding to on-vehicle brake performance tests, the composite brake block shall successfully complete a programme of rig testing as described above.

Brake performance tests on the subsystem:

Composite brake blocks shall be:

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|---|---|
| – assessed according to Annex S of this UTP; | TSI; |
| – proven in operational service in Northern Europe throughout one complete winter period | |
| – assessed for wheel roughness in compliance with UTP Noise | TSI Noise |
| – assessed for the affects on the electrical resistance of the wheelset. | |

Service Evaluation for new products other than composite blocks shall be conducted according to section 6 [where?] and Annex Q.

## P.2.11 ACCELERATOR VALVE

Every Accelerator valve shall be tested. The features are specified in Annex I, section I.11.

## P.2.12 AUTOMATIC VARIABLE LOAD SENSING AND EMPTY/LOAD CHANGEOVER DEVICE

### P.2.12.1 Automatic variable load sensing device

Every sensing device shall be tested. The features are specified in Annex I, section

I.12.1 and those to be tested are listed below:

- Load verses output pressure with rising and falling loads;
- No leakage.

### P.2.12.2 Empty/load changeover device

Every changeover device shall be tested. The features are specified in Annex I, section I.12.2 and those to be tested are listed below:

- Change in output with movement of measuring device/load change;
- Delay to output signal caused by measuring device movement, which would cause a change of output, for greater than 3 seconds;
- No leakage.

## P.3 TEST PROCEDURE CHARACTERISTIC

| No | Characteristic | Limit Value |
|---|---|---|
| | First stroke in percent of the maximum brake shoe pressure for 'goods' brake | About 10 % |
| | High pressure overcharge to 6 bar brake pipe pressure, following a full service application, shall not trigger a brake application if sustained for:- | Passenger Setting<br>Up to 40 seconds |
| | | Goods Setting<br>Up to 10 seconds |
| | Transmission speed in the case of emergency braking | More or equal to 250 m/s |
| | Release time of a train after a full application | Passenger Setting<br>Up to 25 seconds |
| | | Goods Setting<br>Up to 70 seconds |
| | Uneven filling, the brake being released | 6 bar for a period of 2 sec (minimum). Return from 6 bar to 5,2 bar in 1 sec: The brake must not operate during this test. |
| | Inexhaustibility. Percentage of reduction in the average pressure in the brake cylinder. | Maximum 15 % |
| | Operation of the brake with no disturb and compliant to this UTP/(TSI): Emergency application, full application, gradual application, adjustabiity on release. | Test has to be done to show no disturbance and compliance in different braking configurations. |
| | Automatic compensation for leakage at the brake cylinders. | During service braking and emergency braking, a leakage of 1 mm diameter shall be compensated without delay. |