ANNEX VI

VERIFYING TRANSMISSION, TORQUE CONVERTER, OTHER TORQUE TRANSFERRING COMPONENT AND ADDITIONAL DRIVELINE COMPONENT DATA

5. Other torque transferring components (OTTC)

The scope of this section includes engine retarders, transmission retarders, driveline retarders, and components that are treated in the simulation tool as a retarder. These components include vehicle starting devices like a single wet transmission input clutch or hydro-dynamic clutch.

5.1. Methods for establishing retarder drag losses

The retarder drag torque loss is a function of the retarder rotor speed. Since the retarder can be integrated in different parts of the vehicle driveline, the retarder rotor speed depends on the drive part (= speed reference) and step-up ratio between drive part and retarder rotor as shown in Table 2.

TABLE 2

Retarder rotor speeds

Configuration		**Speed reference**	**Retarder rotor speed calculation**
A.	Engine Retarder	Engine Speed	$n_{retarder} = n_{engine} * i_{step\text{-}up}$
B.	Transmission Input Retarder	Transmission Input Shaft Speed	$n_{retarder} = n_{transm.input} * i_{step\text{-}up}$ $= n_{transm.output} * i_{transm} * i_{step\text{-}up}$
C.	Transmission Output Retarder or Propshaft Retarder	Transmission Output Shaft Speed	$n_{retarder} = n_{transm.output} * i_{step\text{-}up}$

where:

$i_{step\text{-}up}$ = step-up ratio = retarder rotor speed/drive part speed
i_{transm} = transmission ratio = transmission input speed/transmission output speed

Retarder configurations that are integrated in the engine and cannot be separated from the engine shall be tested in combination with the engine. This section does not cover these non-separable engine integrated retarders.

Retarders that can be disconnected from the driveline or the engine by any kind of clutch are considered to have zero rotor speed in disconnected condition and therefore have no power losses.

The retarder drag losses shall be measured with one of the following two methods:

(1) Measurement on the retarder as a stand-alone unit

(2) Measurement in combination with the transmission

5.1.1. General requirements

In case the losses are measured on the retarder as stand-alone unit, the results are affected by the torque losses in the bearings of the test setup. It is permitted to measure these bearing losses and subtract them from the retarder drag loss measurements.

The manufacturer shall guarantee that the retarder used for the measurements is in accordance with the drawing specifications for series production retarders.

Modifications to the retarder to meet the testing requirements of this Annex, e.g. for the inclusion of measurement sensors or the adaption of an external oil conditioning systems are permitted.

Based on the family described in Appendix 6 to this Annex, measured drag losses for transmissions with retarder can be used for the same (equivalent) transmission without retarder.

The use of the same transmission unit for measuring the torque losses of variants with and without retarder is permitted.

Upon request of the approval authority the applicant for a certificate shall specify and prove the conformity with the requirements defined in this Annex.

5.1.2. Run-in

On request of the applicant a run-in procedure may be applied to the retarder. The following provisions shall apply for a run-in procedure.

5.1.2.1 If the manufacturer applies a run-in procedure to the retarder, the run-in time for the retarder shall not exceed 100 hours at zero retarder apply torque. Optionally a share of a maximum of 6 hours with retarder apply torque may be included.

5.1.3. Test conditions

5.1.3.1. Ambient temperature

The ambient temperature during the test shall be in a range of 25 °C ± 10 K.

The ambient temperature shall be measured 1 m laterally from the retarder.

5.1.3.2. Ambient pressure

For magnetic retarders the minimum ambient pressure shall be 899 hPa according to International Standard Atmosphere (ISA) ISO 2533.

5.1.3.3. Oil or water temperature

For hydrodynamic retarders:

Except for the fluid, no external heating is allowed.

In case of testing as stand-alone unit, the retarder fluid temperature (oil or water) shall not exceed 87 °C.

In case of testing in combination with transmission, the oil temperature limits for transmission testing shall apply.

5.1.3.4. Oil or water quality

New, recommended first fill oil for the European market shall be used in the test.

For water retarders the water quality shall meet the specifications set out by the manufacturer for the retarder. The water pressure shall be set to a fixed value close to vehicle condition (1 ± 0,2 bar relative pressure at retarder input hose).

5.1.3.5. Oil viscosity

If several oils are recommended for first fill, they are considered to be equal if the oils have a kinematic viscosity within 50 % of each other at the same temperature (within the specified tolerance band for KV100).

5.1.3.6. Oil or water level

The oil/water level shall meet the nominal specifications for the retarder.

5.1.4. Installation

The electric machine, the torque sensor, and speed sensor shall be mounted at the input side of the retarder or transmission.

The installation of the retarder (and transmission) shall be done with an inclination angle as for installation in the vehicle according to the homologation drawing ± 1° or at 0° ± 1°.

5.1.5. Measurement equipment

As specified for transmission testing in 3.1.4.

5.1.6. Test procedure

5.1.6.1. Zero torque signal compensation:

As specified for transmission testing in 3.1.6.1.

5.1.6.2. Measurement sequence

The torque loss measurement sequence for the retarder testing shall follow the provisions for the transmission testing defined in 3.1.6.3.2. to 3.1.6.3.5.

5.1.6.2.1. Measurement on the retarder as stand-alone unit

When the retarder is tested as stand-alone unit, torque loss measurements shall be conducted using the following speed points:

200, 400, 600, 900, 1 200, 1 600, 2 000, 2 500, 3 000, 3 500, 4 000, 4 500, 5 000, continued up to the maximum retarder rotor speed.

5.1.6.2.2. Measurement in combination with the transmission

5.1.6.2.2.1. In case the retarder is tested in combination with a transmission, the selected transmission gear shall allow the retarder to operate at its maximum rotor speed.

5.1.6.2.2.2. The torque loss shall be measured at the operating speeds as indicated for the related transmission testing.

5.1.6.2.2.3. Measurement points may be added for transmission input speeds below 600 rpm if requested by the manufacturer.

5.1.6.2.2.4. The manufacturer may separate the retarder losses from the total transmission losses by testing in the order as described below:

(1) The load-independent torque loss for the complete transmission including retarder shall be measured as defined in point 3.1.2. for transmission testing in one of the higher transmission gears

$= T_{l,in,withret}$

(2) The retarder and related parts shall be replaced with parts required for the equivalent transmission variant without retarder. The measurement of point (1) shall be repeated.

$= T_{l,in,withoutret}$

(3) The load-independent torque loss for the retarder system shall be determined by calculating the differences between the two test data sets

$= T_{l,in,retsys} = T_{l,in,withret} - T_{l,in,withoutret}$

5.1.7. Measurement signals and data recording

As specified for transmission testing in 3.1.5.

5.1.8. Measurement validation

All recorded data shall be checked and processed as defined for transmission testing in 3.1.7.

5.2. Complement of input files for the simulation tool

5.2.1 Retarder torque losses for speeds below the lowest measurement speed shall be set equal to the measured torque loss at this lowest measurement speed.

5.2.2 In case the retarder losses were separated out from the total losses by calculating the difference in data sets of testing with and without a retarder (see 5.1.6.2.2.4.), the actual retarder rotor speeds depend on the retarder location, and/or selected gear ratio and retarder step-up ratio and thereby may differ from the measured transmission input shaft speeds. The actual retarder rotor speeds relative to the measured drag loss data shall be calculated as described in 5.1. Table 2.

5.2.3 The torque loss map data shall be formatted and saved as specified in Appendix 12 to this Annex.