NATO STANDARD

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INTERFACE GEOMETRY, TRACTORS AND SEMI-TRAILERS

Edition A, Version 1

APRIL 2022

NORTH ATLANTIC TREATY ORGANIZATION

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

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NATO LETTER OF PROMULGATION

29 April 2022

1. The enclosed Allied Engineering Publication AEP-4009, Edition A, Version 1, INTERFACE GEOMETRY, TRACTORS AND SEMI-TRAILERS, which has been approved by the nations in the NATO ARMY ARMAMENTS GROUP (NAAG), is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 4009.

2. AEP-4009, Edition A, Version 1, is effective upon receipt.

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4. This publication shall be handled in accordance with C-M(2002)60.

Dimitrios SIGOULAKIS
Major General, GRC (A)
Director, NATO Standardization Office

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
NOR	The reason why Norwegian Armed Forces are not compliant to those values is that thiswould have required a gooseneck with such dimensions that it would have significantly reduced the payload on the Heavy Equipment Transporter (HET) due to weight limitations on public roads in Norway
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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TABLE OF CONTENTS

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CHAPTER 1 GENERAL

Participating nations agree to adopt standard dimensions for the interface geometry of tractors and semi-trailers. Participating nations agree to design their tractors and semi-trailers for interoperability.

a. Standard dimensions for tractors are: the height and location of the fifth wheel; the relation of the cab and the rear bogie with respect to the fifth wheel.

b. Standard dimensions for semi-trailers are: the coupling pin size, the height and location of the coupling pin; the geometry of the gooseneck, the angular displacement of the semi-trailer with respect to the tractor.

The following terms and definitions are used for the purpose of this agreement:

a. Tactical land vehicle - A military vehicle, whether designed primarily for military use or adapted from a commercial vehicle, which has specialized military characteristics to fit it for use by forces in the field in direct connection with, or in support of, combat operations or the training of troops for such operations.

b. Logistic land vehicle - A vehicle which supports military operations. Off-road operation is not expected for logistic land vehicles.

c. General purpose land vehicle - A vehicle which combines the role of a tactical and a logistic land vehicle.

AEP-4009 is for use by the following NATO Forces:

a. NATO Army Forces

b. Those elements of NATO Naval and Air Forces operating in a ground role, e.g. marines, naval landing parties and Air Force ground personnel

This standard applies to the following:

a. New procurement of tactical land vehicles and semi-trailers

b. Tactical land vehicles including semi-trailers which could be modified a reasonable cost without major adverse changes to their military characteristics

c. Future designs of tactical land vehicles

This standard is divided into four parts: Part I deals with semi-trailer coupling pins; Part II deals with logistic tractors and semi-trailers; Part III deals with tactical tractors and semi-trailers; Part IV deals with general purpose tractors and semi-trailers.

Part I - Semi-trailer Coupling Pins

a. Participating nations agree to adopt International Standards - ISO 337: - 50 [0 50.8 mm (2.0 in)] and ISO 4086: - 90 [0 89 mm (3.5 in)] as the basic and mounting dimensions for semi-trailer fifth wheel coupling pin

b. Participating nations agree that the use of "50" or "90" fifth wheel coupling pins shall be determined by the following: Fh shall be as defined in ISO 8717, paragraph 4.
When Fh is greater than 108 (kilonewtons) use coupling pin "90"
When Fh is equal or less than 108 (kilonewtons) either coupling pin "90" or coupling pin "50" may be used

See Annex A for sample calculation of coupling pin size.

Part II - Logistic Tractors and Semi-trailers.

Participating nations agree to adopt International Standard - ISO 1726 as the document controlling interface geometry for logistic tractors and semi-trailers.

Part III - Tactical Tractors and Semi-trailers.

Participating nations agree to adopt the interface geometry as stated in Annex B for tactical tractors and semi-trailers.

Part IV - General Purpose Tractors and Semi-trailers.

Participating nations agree to adopt the interface geometry as stated in Annex C for general purpose tractors and semi-trailers.

ANNEX A SAMPLE CALCULATION FOR COUPLING PIN SIZE

Weights in tonnes (Metric tons), **t** = 1000 kilograms

$\mathbf{F_h}$ as defined in ISO 8717, paragraph 4

$$\mathbf{F_h = \frac{0.6g\,(m_1)\,(m_2)}{m_1 + m_2 - m_3}}$$

1. Given: U.S. M123A1C tractor towing a fully loaded U.S. M870 semi-trailer

   Tractor curb weight = 13.74t
   Semi-trailer gross weight m_2 = 43.86t
   Load at fifth wheel m_3 = 18.18t
   m_1 = tractor curb weight + m_3 = 31.92t

   Then: $\mathbf{F_h} = \frac{0.6 \times 9.81 \times 31.92 \times 43.86}{31.92 + 43.86 - 18.18} = 143$ (kilonewtons)

   Since $\mathbf{F_h} \geq 108$ coupling pin "90" is used

2. Given: U.S. M915 tractor towing a fully loaded U.S. M872 Semi-trailer

   Tractor curb weight = 8.92t
   Semi-trailer gross weight m_2 = 38.18t
   Load at fifth wheel m_3 = 12.55t
   m_1 = tractor curb weight + m_3 = 21.47t

   Then: $\mathbf{F_h} = \frac{0.6 \times 9.81 \times 21.47 \times 38.18}{21.47 + 38.18 - 12.55} = 102$ (kilonewtons)

   Since $\mathbf{F_h} \leq 108$ either coupling pin "90" or coupling pin "50" may be used

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ANNEX B INTERFACE GEOMETRY, TACTICAL TRACTORS AND SEMI-TRAILERS

1. Tabulated Values
   (See Figures 1, 2, and 3)

SYMBOL	VALUE (mm)	SYMBOL	VALUE (degrees)
A unladen max	1650	**α** min	6
A laden min	1550	**ω_1** min	18
C min	100	**ω_2** min	18
D max	1355	**ψ** max	90
D'	530	**ϒ**	16
J_1 min	100	**$\omega_3 = \omega_1$**	
J_2	160	**$\omega_4 = \omega_2$**	
G'	2500		
K	315		
R	200		
S	500		
G	G'/cos **ω_4**		

2. Interoperability Dimensions

   a. A – tractor fifth wheel height

   b. D and D' – forward clearance zone dimensions of the semi-trailer

c. C – position of the fifth wheel forward of the tractor bogie

d. Semi-trailer gooseneck contour

The gooseneck shall be located on the outside of the surface of revolution generated about the vehicle coupling vertical axis, the generator of which is shown in Figure 2 and described below.

The generator is constructed as follows:

- a line AB of length S situated in the horizontal plane of the center of the coupling;
- a line BC making an angle **ϒ** with the horizontal plane;
- a circular arc of radius R, tangent on one hand to BC, previously defined, and on the other hand to line DE situated in a horizontal plane at a distance K from AB;
- a circular arc of radius R, tangent on one hand to DE, previously defined, and on the other hand to line FH, sloped at the angle ω_4 at the distance G' from the coupling axis.

All elements of the generator are located in the median longitudinal plane of the semi-trailer.

During the rotation of the generator, AB and DE describe horizontal planes, BC and FH describe conical surfaces of revolution, and arcs CD and EF describe portions of tori.

The generated gooseneck is shown in Figure 3.

3. Operating Dimensions

a. ω_1 - forward angle (pitch) of the semi-trailer with respect to the tractor

b. ω_2 - rearward angle (pitch) of the semi-trailer with respect to the tractor

c. **α** - later angle (roll) of the fifth wheel and of the semi-trailer with respect to the tractor

d. **ψ** - articulation angle-projection of the angle between the longitudinal axes of the tractor and semi-trailer in the horizontal plane

e. The tractor shall be constructed so that the tractor and semi-trailer components, except those concerned with articulation, do not contact each other when the combined vehicle is running in the straight line, turning, reversing, or maneuvering for the full range of values of ψ, α, and ω_1 or ω_2.

4. Free Space Between Tractor and Semi-Trailer

a. J_1 is the distance between two cylinders of revolution both having the coupling pin axis as their axis. One of this cylinders has radius G (lower part of the gooseneck) and the other is the cylinder of the smallest radius within which all points of the rear part of the tractor are located.

b. J_2 is the clearance between the surface of cylinder of revolution having as its axis the axis of the fifth wheel coupling, and of radius D, and a conical surface of revolution having the same axis. This conical surface is generated by a line making an angle of ω_3 from the vertical towards the front of the tractor. A point X of this surfaces is positioned on the plane of symmetry of the semi-trailer at a height of 250 mm above the fifth wheel coupling face.

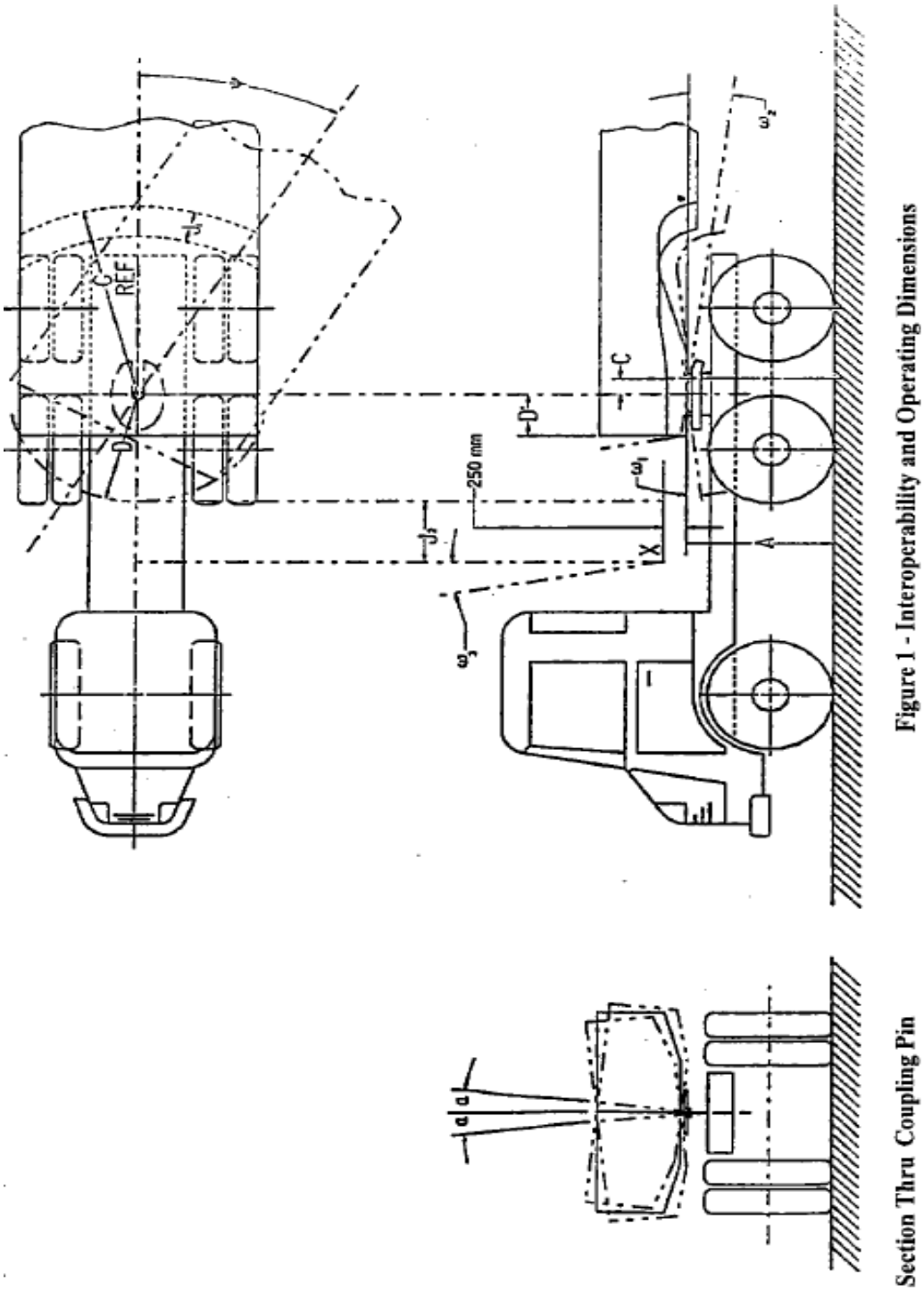

Figure 1: Interoperability and Operating Dimensions

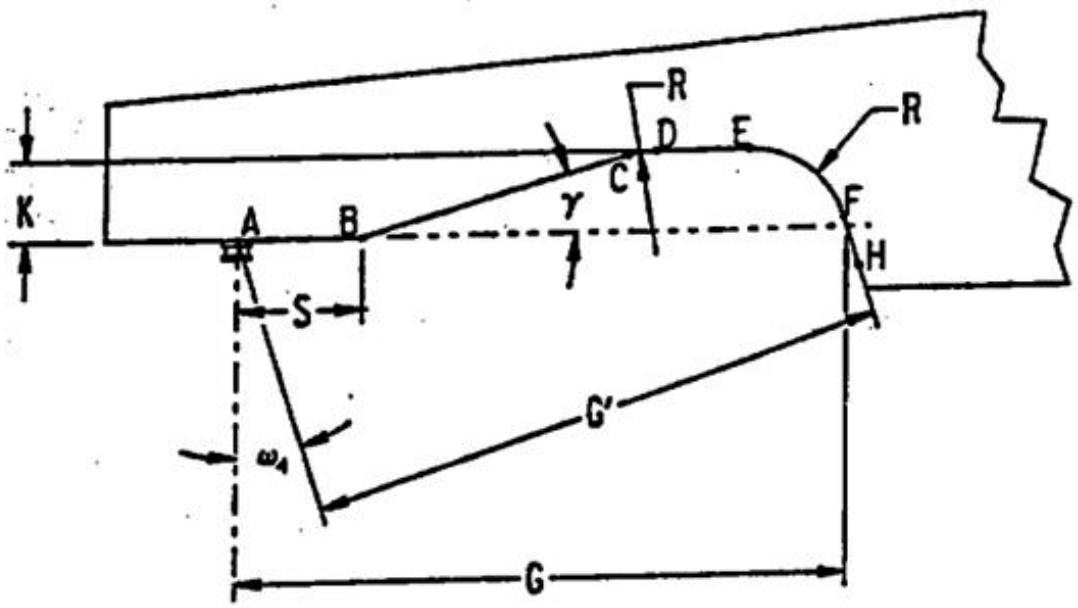

Figure 2: Generator Contour

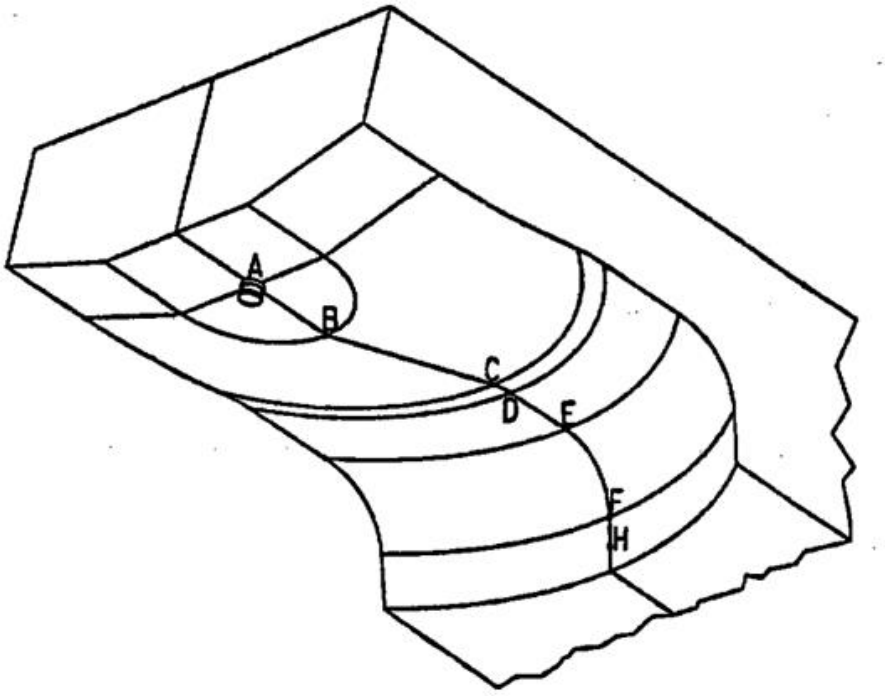

Figure 3: Generated Gooseneck

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ANNEX C INTERFACE GEOMETRY, GENERAL PURPOSE TRACTORS A ND SEMI-TRAILERS

1. Tabulated Values

SYMBOLS	VALUE
A Unladen max	1500
A Laden max	1400
J2	765

J_2 (above) to accommodate semi-trailers constructed to ISO 1726.

J2 = L4 in ISO 1726

Refer to Annex B for Figures and all other dimensions.

AEP-4009(A)(1)