



SURFACE VEHICLE RECOMMENDED PRACTICE	J1574™-1	JAN2018
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Measurement of Vehicle and Suspension Parameters for Directional Control Studies		

RATIONALE

This technical report is being Stabilized because it covers technology, products, or processes which are mature and not likely to change in the foreseeable future. The Committee considers the report to have considerable reference value. It is being stabilized as issued in 1994 without updates in terminology or test procedures. Stabilization of this report assures its continued accessibility. The Committee may elect to update and republish it in the future.

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1. SCOPE

The parameters measured according to this SAE Recommended Practice will generally be used in simulating directional control performance in the linear range. (The “linear range” is the steady-state lateral acceleration below which steering wheel angle can generally be considered to be linearly related to lateral acceleration.) But they may be used for certain other simulations (such as primary ride motions), vehicle and suspension characterization and comparison, suspension development and optimization, and processing of road test data.

This document is intended to apply to passenger cars, light trucks, and on-highway recreational and commercial vehicles, both non-articulated and articulated. Measurement techniques are intended to apply to these vehicles, with alterations primarily in the scale of facilities required. But some differences do exist between passenger cars and trucks, especially heavy trucks, such as differences in body/frame flexibility, suspension stiffness, and suspension friction. These will be addressed in this document or SAE J1574-2, where appropriate.

1.1 Purpose

The purpose of this document is to define the basic design requirements for test equipment and the test procedures to be employed in measuring certain vehicle characteristics generally required for directional control simulation. In addition, data processing procedures are provided so that data from different laboratories can be directly compared. The companion Information Report gives the rationale behind the Recommended Practice, where appropriate.

1.2 Assumptions and Limitations

The approach used to develop this document was to consolidate and document existing technology as embodied in equipment and procedures currently employed for routine tests. As a result, the assumptions and limitations of those practices must be acknowledged in this document.

The major assumptions stemming from this established document are:

- a. Static-suspension characteristics (kinematic and elastic) are valid for simulation and suspension comparison purposes. This does not apply to shock-absorber characteristics required to determine ride and roll damping.
- b. Phenomenological suspension descriptions, such as kinematic and elastic gradients, are valid for simulation and suspension comparison purposes.
- c. Kinematic and elastic suspension characteristics measured for the inertial loads and suspension-roll angles associated with the linear range are valid for simulating vehicle behavior in the linear range.
- d. Kinematic and elastic suspension characteristics associated with the linear range describe a system which may be approximated as linear. Therefore, they may be used in simulations using the principle of superposition and may be measured singly, with set points of other variables at zero or nominal value.

In addition to these broad assumptions, two other assumptions related to the use of this document must be stated. First, it is assumed that the vehicle description and preparation, as described in Section 3, will be performed prior to any of the tests described in subsequent sections. (The procedures described in Sections 4 through 10 may be performed somewhat independently of each other, once those in Section 3 are complete.) Second, the terminology of SAE J670e will be observed wherever possible.

The limitations associated with this document may be divided into those associated with the uses of the final data and the vehicle characteristics addressed. Limitations in both categories generally stem from the limitations of existing practices. Simulations which are not addressed are those involving lateral accelerations beyond the linear range, free control dynamics, combined lateral and longitudinal accelerations, accelerating and braking performance, or oscillations of any parts of the unsprung masses or steering system at frequencies above those associated with directional control. In addition, assumption 1.2b results in experimental procedures and suspension data which is not useful for multibody simulations such as ADAMS or DADS.

Vehicle and component characteristics which are not addressed are those not required for directional control simulation in the linear range. While this list is clearly quite long, some bear mentioning for the convenience of the user of this document. These are:

- a. Suspension side view kinematic properties
- b. Suspension steer and camber compliances resulting from longitudinal force, overturning moment, and rolling resistance moment
- c. Kingpin and caster offsets
- d. Characteristics of fifth wheels of articulated vehicles
- e. Rotational inertias of wheels, tires, brakes, and driveline components

Tire force and moment characteristics (addressed in SAE J1106 and SAE J1107)

The first two of these may be addressed with methods analogous to those described in Sections 8 and 9.

In addition, certain other vehicle characteristics will not be addressed due to their relative newness and the associated absence of established experimental practice. Examples of less conventional chassis systems which will not be fully addressed are active and adaptive suspension systems, four-wheel steering, and speed-sensitive steering. However, procedures formally discussed may well be adapted to these less conventional systems. Such adaptation may be discussed when appropriate.

1.3 Characteristics Measured

The previous paragraphs covering purpose, scope, and assumptions and limitations have not explicitly listed the vehicle characteristics which will be addressed in this document. Table 1 does this, showing the section in which each is addressed and whether it is a suspension or total vehicle characteristic. In addition to this summary of variables measured, the list of variables for each section will be repeated in paragraph 1 of that section, in a different format, providing expected ranges for different vehicle types.

After reviewing Table 1, the reader may see that some of the variables listed are not directly required for vehicle simulation or data reduction. Such a variable may have been included in Table 1 because it is required in the documentation process or in the determination of another variable. In addition, some variables listed may be measured very simply, precluding the need for an in-depth measurement practice or discussion thereof.

1.4 Nature of Measurements

This document covers the measurement of a broad range of vehicle characteristics using an equally broad range of experimental practices. This paragraph briefly outlines the nature of these experimental approaches.

The measurements of Sections 3 (Vehicle Description and Preparation) and 4 (Measurement of Dimensional and Geometric Characteristics) generally involve only measurements of linear dimensions, to varying degrees of accuracy. Measurement devices range from steel tapes to micrometers and are generally available in most vehicle shops. In addition, a flat, planar reference surface (bed plate) and certain specialized tools are required for a few of the measurements. In general, vehicle loading and suspension trim are important.

The measurement of vehicle and component weights (Section 5) and center of gravity positions (Section 6) generally require the direct measurement of weight or force. Scales of varying load capacity are used for these measurements. The measurement of center of gravity positions also requires a specialized tilt table and the measurement of angular displacement. The measurement of component weights and center of gravity positions requires some vehicle disassembly.

The measurement of moments and products of inertia (Section 7) requires very specialized equipment for inducing lightly damped vehicle oscillations about a specified axis. These measurements are based on the measurement of natural frequency and restoring moment(s).

The measurements of Section 8 (Measurement of Suspension Kinematic Characteristics) generally require a prescribed steer or suspension displacement (ride or roll) and the measurement of steer or camber displacement. In some cases, equilibrium techniques can be used, allowing the indirect determination of a kinematic swing center. All of the measurements require very specialized facilities for providing the suspension or steering displacement, minimizing unwanted forces or moments, and allowing the determination of desired displacements.

TABLE 1 - CHARACTERISTICS MEASURED

Variable	Section	Front Suspension	Rear Suspension	Total Vehicle
Dimensional and Geometric Characteristics:				
axle spread, tandem axle	4	x	x	
dual spacing, dual axle	4	x	x	
fifth wheel position	4			x
pintle position	4			x
roadwheel dimensions	4	x	x	
stabilizer bar diameter	4	x	x	
steering wheel diameter	4			x
suspension or steering coordinates	4	x	x	
suspension alignment	4	x	x	
suspension trim height	4	x	x	
tire pressure	4	x	x	
tire tread depth	4	x	x	
wheel track	4	x	x	
wheelbase	4			x
Vehicle and Component Weights:				
sprung weight	5			x
tire normal forces	5	x	x	
total vehicle weight	5			x
unsprung weight	5	x	x	
Center of Gravity Positions:				
sprung cg position	6			x
total vehicle cg position	6			x
unsprung cg position	6	x	x	
Moments and Products of Inertia:				
sprung mass pitch moment	7			x
sprung mass roll moment	7			x
sprung mass yaw moment	7			x
sprung mass roll-yaw product	7			x
total vehicle pitch moment	7			x
total vehicle roll moment	7			x
total vehicle yaw moment	7			x
total vehicle roll-yaw product	7			x
unsprung mass pitch moment	7	x	x	
unsprung mass roll moment	7	x	x	
unsprung mass yaw moment	7	x	x	
unsprung mass roll-yaw product	7	x	x	
Suspension Kinematic Characteristics:				
overall steering ratio	8	x		
ride camber coefficient	8	x	x	
ride caster coefficient	8	x		
ride shock absorber travel ratio	8	x	x	
ride steer coefficient	8	x	x	
roll camber coefficient	8	x	x	
roll caster coefficient	8	x		
roll center height	8	x	x	
roll shock absorber travel ratio	8	x	x	

TABLE 1 - CHARACTERISTICS MEASURED (CONTINUED)

Variable	Section	Front Suspension	Rear Suspension	Total Vehicle
roll steer coefficient	8	x	x	
Suspension Elastic and Coulomb Friction Characteristics:				
aligning moment camber coefficient	9	x	x	
aligning moment steer coefficient	9	x	x	
lateral force camber coefficient	9	x	x	
lateral force defl. coefficient	9	x	x	
lateral force steer coefficient	9	x	x	
ride Coulomb friction	9	x	x	
ride rate	9	x	x	
roll Coulomb friction	9	x	x	
suspension roll rate	9	x	x	
wheel rate	9	x	x	
Shock Absorber Characteristics:				
bushing spring rate	10	x	x	
damping coefficient	10	x	x	
ride damping	10	x	x	
roll damping	10	x	x	
shock absorber spring rate	10	x	x	

Similarly, the measurement of suspension elastic and Coulomb friction characteristics (Section 9) generally requires a prescribed suspension displacement (ride or roll) or an externally applied load (lateral force or aligning moment) and the measurement of wheel displacement (linear or angular). Again, very specialized facilities are required to provide the desired displacement or load, to minimize unwanted displacements or loads, and to allow the determination of desired displacements. These measurements are generally made with the tires on the vehicle; the complete rationale for this is discussed in 9.2.2 of SAE J1574-2 for Section 9, Measurement of Suspension Elastic and Coulomb Friction Characteristics. Other brief references can be found in SAE J1574-2 for this section, paragraph 1.5, and the Recommended Practice for Section 9, 9.2.2.

Finally, the measurement of shock-absorber characteristics (Section 10) requires specialized equipment to stroke the shock absorber through a range of amplitudes and/or frequencies. Measurements of amplitude, frequency, and force are required.

In many of these measurements, equivalent, or nearly equivalent, methods may exist. Where possible, alternatives are discussed with some indication of their relative merits.

1.5 Use of SAE J1574-1 and SAE J1574-2

The purpose of this paragraph is to give the user of this document some insight into its structure and some suggestions for its effective use. Table 1 has indicated some of this structure. But, for convenience and reference for the following discussion, all of the sections of this document and SAE J1574-2 are given as follows:

1. Scope
2. References
3. Vehicle Description and Preparation
4. Measurement of Dimensional and Geometric Characteristics

5. Measurement of Vehicle and Component Weights
6. Measurement of Center of Gravity Positions
7. Measurement of Moments and Products of Inertia
8. Measurement of Suspension Kinematic Characteristics
9. Measurement of Suspension Elastic and Coulomb Friction Characteristics
10. Measurement of Shock Absorber Characteristics

This document covers vehicle description, vehicle preparation, recommended testing practices, and recommended data processing and presentation practices for the measurements listed previously. The companion Information Report (SAE J1574-2) gives the background and rationale for procedures presented in this document, if such background is appropriate. With one exception, it is written in parallel to SAE J1574-1, with the same paragraph numbers and titles. The two should be used together for complete understanding of the test procedures and the principles behind them.

Sections 4 through 10 are intended to provide test procedures which may be performed somewhat independently of each other, provided that the vehicle description and preparation of Section 3 are complete. Each of these seven sections is divided into the following five major paragraphs:

- a. Variables Measured
- b. Apparatus
- c. Test Procedures
- d. Data Processing and Presentation
- e. Calibration Procedures

Each major paragraph may be subdivided further with decimal suffixes (e.g., 4.3.2.1).

This document will be easier to understand and use with reference to SAE J670e and SAE J1106 and SAE J1107.

1.6 Rationale

This document has been reaffirmed to comply with the SAE 5-Year Review policy.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J670 Vehicle Dynamics Terminology

SAE J874 Earthmoving Machines - Method for Locating the Center of Gravity

SAE J1106 Laboratory Testing Machines for Measuring the Steady State Force and Moment Properties of Passenger Car Tires

SAE J1107 Laboratory Testing Machines and Procedures for Measuring the Steady State Force and Moment Properties of Passenger Car Tires

SAE J1574-2 Measurement of Vehicle and Suspension Parameters for Directional Control Studies - Rationale

2.1.2 Tire and Rim Association

Available from Tire and Rim Association, Inc., 175 Montrose West Avenue, Suite 150, Copley, OH 44321.

Tire and Rim Association Yearbook

3. VEHICLE DESCRIPTION AND PREPARATION

3.1 General Vehicle Description

A general vehicle description entails both qualitative and quantitative information and is usually accomplished by using a standard form, designed for this purpose. Two such forms are presented at the end of this section. The first, Figure 1, is generally applicable to (non-articulated) passenger vehicles and light trucks. The second, Figures 2, 3, and 4, is more specifically applicable to heavy commercial vehicles, both articulated and non-articulated, including a trailer. Both allow for the description of a broad range of vehicle types. As such, either may be more lengthy than required for a given application and may best be used as a reference for a simpler form, more suited to vehicle types encountered in a specific laboratory.

3.2 Specific Measurements

The vehicle definition summarized in the following description forms includes, in addition to a general description, various dimensions and weights whose measurement is discussed in Sections 4 and 5. Those addressed in Section 4 are generally, but not entirely, physical dimensions of the vehicle or its parts. Those addressed in Section 5 are the static tire normal forces, among others. The measurement of overall steering ratio is addressed in Section 8. While accurate knowledge of overall steering ratio is generally required for directional control simulation and for data reduction of certain directional control tests, values for gear ratio or C factor (rack travel for each full revolution of the pinion) are generally not. It is common practice to use nominal values for these characteristics, if available, obtained from part numbers or independent sources, to more fully define the vehicle and/or check the directly measured overall steering ratio.

GENERAL DEFINITION

Year _____ Make _____ Model _____ Mileage _____
 VIN _____ Fleet No. _____
 Body Style _____ Body Code _____
 Status: ☐ Production ☐ Pilot ☐ Prototype
 ☐ Preprototype ☐ Development ☐ Pretest
 ☐ Component ☐ Experimental
 Options: ☐ Air Cond. ☐ Power Brakes ☐ Power Stg.

MAJOR DIMENSIONS

Wheelbase _____ mm
 Front Track _____ mm Rear Track _____ mm

MASSTIRE NORMAL FORCES

LF _____ kg RF _____ kg
 LR _____ kg RR _____ kg

DRIVETRAINENGINE

Configuration: Disp. _____ l Conf. ____ (L4,...)
 Layout: ☐ Front ☐ Rear ☐ Transverse
 Fuel: ☐ Gasoline ☐ Diesel ☐ Alcohol
 Induction: ☐ Carburetor ☐ Fuel Inject. ☐ Turbocharged
 ☐ Supercharged

POWER TRANSMISSION

Drive Wheels: ☐ FWD ☐ RWD ☐ Part 4WD
 ☐ Full 4WD
 Transmission: ☐ Manual ☐ Automatic Forward Gears ____

FRONT SUSPENSIONSOLID AXLE

☐ Leaf Spring ☐ Mult. Link ☐ Track Bar Other _____

INDEPENDENT

☐ Uneq. A arm ☐ Strut ☐ Mult. Link Number Links ____

Other _____

SPRINGS

☐ Coil ☐ Torsion Bar ☐ Long. Leaf ☐ Trans. Leaf

☐ Air Other _____

Material _____ Code _____

STABILIZER BAR

☐ Link Type ☐ Strap Down ☐ Tubular Diameter _____ mm

Material _____ Code _____

SHOCK ABSORBERS

☐ Air Pressure _____ kPa ☐ Selectable ☐ Adaptive

☐ Active Code _____

FIGURE 1 - VEHICLE DEFINITION
(PASSENGER VEHICLES AND LIGHT TRUCKS (NONARTICULATED))

RIDE CONTROL

☐ Level Control ☐ Active

REMARKS

REAR SUSPENSION

SOLID AXLE

☐ Leaf Spring ☐ 4 Link ☐ Track Bar ☐ Watt Linkage

Other _____

INDEPENDENT

☐ Uneq. A arm ☐ Strut ☐ Mult. Link Number Links ____

Other _____

SPRINGS

☐ Coil ☐ Torsion Bar ☐ Long. Leaf ☐ Trans. Leaf

☐ Air Other _____

Material _____ Code _____

STABILIZER BAR

☐ Link Type ☐ Strap Down ☐ Tubular Diameter ____ mm

Material _____ Code _____

SHOCK ABSORBERS

☐ Air Pressure ____ kPa ☐ Selectable ☐ Adaptive

☐ Active Code _____

RIDE CONTROL

☐ Level Control ☐ Active

REMARKS

STEERING

FRONT

Gear Type: ☐ Worm/Sector ☐ Rack and Pinion
 Linkage Location: ☐ Ahead of W.C. ☐ Behind W.C.
 Linkage Type: ☐ Parallelogram ☐ End Take Off ☐ Ctr. Take Off
 Assist: ☐ Integral ☐ Linkage
 ☐ Hydraulic ☐ Electric ☐ Electro-Hyd.
 ☐ Conventional ☐ Engine Speed ☐ Vehicle Speed
 Damper: ☐ Integral ☐ Linkage
 Ratios: ☐ Linear ☐ Nonlinear

Overall ____:1 Gear ____:1 C-Factor ____ mm

Steering Wheel Dia.: Vertical ____ Horizontal ____

REAR

Gear Type: ☐ Worm/Sector ☐ Rack and Pinion
 Linkage Location: ☐ Ahead of W.C. ☐ Behind W.C.
 Linkage Type: ☐ Parallelogram ☐ End Take Off ☐ Ctr. Take Off
 Actuation: ☐ Mechanical ☐ Hydraulic ☐ Electric
 ☐ Electro-Hyd.
 Displ. Reference: ☐ Front Wheels ☐ Vehicle Speed

REMARKS

FIGURE 1 - VEHICLE DEFINITION
 (PASSENGER VEHICLES AND LIGHT TRUCKS (NONARTICULATED)) (CONTINUED)

Brand _____
 Assist: [] Vacuum [] Hydraulic Other _____
 Front: [] Disc [] Drum
 Rear: [] Disc [] Drum
 ANTI-LOCK
 Brand [] Front [] Rear
 REMARKS _____

Front	Brand _____	Size _____	Model _____	Const. _____
	Status: _____	☐ Production	☐ Experimental	
	Type: _____	☐ Mud + Snow	☐ Performance	Other _____
	Construction: _____	☐ Steel Radial	☐ Other Radial	☐ Belted Bias
		☐ Bias	Other _____	
	Tread: _____	☐ New	☐ Half Worn	☐ Full Worn
		☐ Shaved	Depth _____ mm	
	Pressure: _____	Pressure _____ kPa	☐ Cold _____	☐ Hot _____
	Rim: _____	Width _____ mm	Offset _____ mm	
REAR	☐ Same as Front			
	Brand _____	Size _____	Model _____	Const. _____
	Status: _____	☐ Production	☐ Experimental	
	Type: _____	☐ Mud + Snow	☐ Performance	Other _____
	Construction: _____	☐ Steel Radial	☐ Other Radial	☐ Belted Bias
		☐ Bias	Other _____	
	Tread: _____	☐ New	☐ Half Worn	☐ Full Worn
		☐ Shaved	Depth _____ mm	
	Pressure: _____	Pressure _____ kPa	☐ Cold _____	☐ Hot _____
	Rim: _____	Width _____ mm	Offset _____ mm	

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PART I: UNIT TRUCKS AND TRACTORS**General***Chassis Cab*

Year _____	Make _____	Model _____	Millage _____
VIN _____	Fleet No. _____	GVWR _____	GCWR _____
Status:	☐ Production	☐ Pilot	☐ Prototype
	☐ Pre-prototype	☐ Development	☐ Pretest
	☐ Component	☐ Experimental	
Cab Style:	☐ COE	☐ Cab Forward	☐ Conventional
	☐ Short Nose Conventional		
Options:	☐ Air Conditioning	☐ Other _____	

Body

Year _____	Make _____	Model _____	ID No. _____
Description _____	_____		

Loading _____

Major Dimensions¹

AF _____ mm	BA _____ mm	BBC _____ mm	BH _____ mm
BL _____ mm	CE _____ mm	CH _____ mm	FH _____ mm
FMH _____ mm	OL _____ mm	WB _____ mm	

Mass*Tire Loads*

Axle No. (from front):	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Left Side:	_____ kg	_____ kg	_____ kg	_____ kg	_____ kg
Right Side:	_____ kg	_____ kg	_____ kg	_____ kg	_____ kg

¹ Figure 2a identifies these and other dimensions.

FIGURE 2 - VEHICLE DEFINITION (UNIT AND ARTICULATED HEAVY TRUCKS)
PART I: UNIT TRUCKS AND TRACTORS

Drivetrain*Engine*

Make _____	Model _____	Displc _____	Config _____
Fuel: _____	☐ Gasoline	☐ Diesel	☐ Alcohol
Stroke: _____	☐ Two Stroke	☐ Four Stroke	
Induction: _____	☐ Carburetor	☐ Fuel Injection	☐ Turbocharged

Power Transmission*Transmission*

Make _____	Model _____	Number of Forward Gears _____
☐ Manual	☐ Automatic	☐ OD Range Selector

Full-Time Drive Axles

Make _____	Model _____	Axle(s) No(s) _____
☐ Single Speed	☐ Two Speed	☐ Ratio(s) _____
☐ Inter-axle Diff. Lock		

Selectable Drive Axles

Make _____	Model _____	Axle(s) No(s) _____
☐ Single Speed	☐ Two Speed	Ratio(s) _____
☐ Inter-axle Diff. Lock		

Axles

Axle No. (from front):	1	2	3	4	5
Spacing from preceding axle (Sn) ¹ , mm:	_____	_____	_____	_____	_____
Make:	_____	_____	_____	_____	_____
Model:	_____	_____	_____	_____	_____
Load rating, kg:	_____	_____	_____	_____	_____
Axle width (AW) ¹ , mm:	_____	_____	_____	_____	_____
Track width (TW) ¹ , mm:	_____	_____	_____	_____	_____
Dual spacing (DS) ¹ , mm:	_____	_____	_____	_____	_____
Steering:	☐	☐	☐	☐	☐
Self-Steering:	☐	☐	☐	☐	☐
Drive:	☐	☐	☐	☐	☐
Lift:	☐	☐	☐	☐	☐

¹ Figure 2a identifies these and other dimensions.

FIGURE 2 - VEHICLE DEFINITION (UNIT AND ARTICULATED HEAVY TRUCKS)
PART I: UNIT TRUCKS AND TRACTORS (CONTINUED)

Suspension No. _____

Includes Axle(s) No(s): _____

Make: _____ Model: _____ Load Rating, kg: _____

Style—Single-Axle Suspensions☐ Leaf Spring ☐ Air ☐ Lift
☐ Other _____**Style—Multi-Axle Suspensions**☐ Walking Beam ☐ Four Leaf ☐ Air ☐ Torsion Bar
☐ Other _____**Spring(s)**Make _____ Model _____
☐ Multi-Leaf ☐ Taper Leaf No. of Leaves _____ Length, mm _____
☐ Air ☐ Torsion Bar ☐ Rubber Block
☐ Other _____

Remarks _____

Suspension No. _____

Includes Axle(s) No(s): _____

Make: _____ Model: _____ Load Rating: _____

Style—Single-Axle Suspensions☐ Leaf Spring ☐ Air ☐ Lift
☐ Other _____**Style—Multi-Axle Suspensions**☐ Walking Beam ☐ Four Leaf ☐ Air ☐ Torsion Bar
☐ Other _____**Spring(s)**Make _____ Model _____
☐ Multi-Leaf ☐ Taper Leaf No. of Leaves _____ Length, mm _____
☐ Air ☐ Torsion Bar ☐ Rubber Block
☐ Other _____

Remarks _____

FIGURE 2 - VEHICLE DEFINITION (UNIT AND ARTICULATED HEAVY TRUCKS)
PART I: UNIT TRUCKS AND TRACTORS (CONTINUED)

Suspension No. _____

Includes Axle(s) No(s): _____

Make: _____ Model: _____ Load Rating, kg: _____

Style—Single-Axle Suspensions☐ Leaf Spring ☐ Air ☐ Lift
☐ Other _____*Style—Multi-Axle Suspensions*☐ Walking Beam ☐ Four Leaf ☐ Air ☐ Torsion Bar
☐ Other _____*Spring(s)*Make _____ Model _____
☐ Multi-Leaf ☐ Taper Leaf No. of Leaves _____ Length, mm _____
☐ Air ☐ Torsion Bar ☐ Rubber Block
☐ Other _____

Remarks _____

Suspension No. _____

Includes Axle(s) No(s): _____

Make: _____ Model: _____ Load Rating: _____

Style—Single-Axle Suspensions☐ Leaf Spring ☐ Air ☐ Lift
☐ Other _____*Style—Multi-Axle Suspensions*☐ Walking Beam ☐ Four Leaf ☐ Air ☐ Torsion Bar
☐ Other _____*Spring(s)*Make _____ Model _____
☐ Multi-Leaf ☐ Taper Leaf No. of Leaves _____ Length, mm _____
☐ Air ☐ Torsion Bar ☐ Rubber Block
☐ Other _____

Remarks _____

FIGURE 2 - VEHICLE DEFINITION (UNIT AND ARTICULATED HEAVY TRUCKS)
PART I: UNIT TRUCKS AND TRACTORS (CONTINUED)

Steering System

Gear Make: _____ Gear Model: _____
 Assist: ☐ Manual ☐ Integral Asst. ☐ Linkage Asst.
 Gear Location: ☐ Frame ☐ Axle
 ☐ Ahead of WC ☐ Behind WC

 Ratios: Overall: _____ : 1 Gear: _____ : 1
 Pitman Arm Length, mm _____ Steering Arm Length, mm _____
 Ackerman wheelbase, mm _____
 Handwheel Dia, mm: Vertical _____ Horizontal _____
 Remarks _____

Brakes*Actuation*

☐ Air
☐ Hydraulic ☐ Vacuum Asst. ☐ Hydraulic Power

Wheel Brakes

Axle No. (from front):	1	2	3	4	5
Make:	_____	_____	_____	_____	_____
Disc:	☐	☐	☐	☐	☐
Drum:	☐	☐	☐	☐	☐
Disc or Drum size:	_____	_____	_____	_____	_____
Wedge:	☐	☐	☐	☐	☐
Wedge Angle, degrees:	_____	_____	_____	_____	_____
S-Cam:	☐	☐	☐	☐	☐
Slack Length, mm:	_____	_____	_____	_____	_____
Automatic Slacks:	☐	☐	☐	☐	☐
Air Chamber Type:	_____	_____	_____	_____	_____
Spring Brake:	☐	☐	☐	☐	☐
Anti-lock:	☐	☐	☐	☐	☐
Anti-Lock Make:	_____		Anti-Lock Model: _____		
Remarks	_____				

FIGURE 2 - VEHICLE DEFINITION (UNIT AND ARTICULATED HEAVY TRUCKS)
PART I: UNIT TRUCKS AND TRACTORS (CONTINUED)

Tires and Wheels

Axle No. (from front): 1 2 3 4 5

Wheels

Make:	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Spoke Style:	<u> [] </u>	<u> [] </u>	<u> [] </u>	<u> [] </u>	<u> [] </u>
Disk Style:	<u> [] </u>	<u> [] </u>	<u> [] </u>	<u> [] </u>	<u> [] </u>
Rim Size:	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Tires

Make:	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Model:	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Size and Load Range:	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Tread Style:	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Tread Condition					
New:	<u> [] </u>	<u> [] </u>	<u> [] </u>	<u> [] </u>	<u> [] </u>
Half Worn:	<u> [] </u>	<u> [] </u>	<u> [] </u>	<u> [] </u>	<u> [] </u>
Full Worn:	<u> [] </u>	<u> [] </u>	<u> [] </u>	<u> [] </u>	<u> [] </u>
Tread Depth, mm:	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Pressure, kPa:	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Taken: [] Hot or [] Cold					

FIGURE 2 - VEHICLE DEFINITION (UNIT AND ARTICULATED HEAVY TRUCKS)
PART I: UNIT TRUCKS AND TRACTORS (CONTINUED)

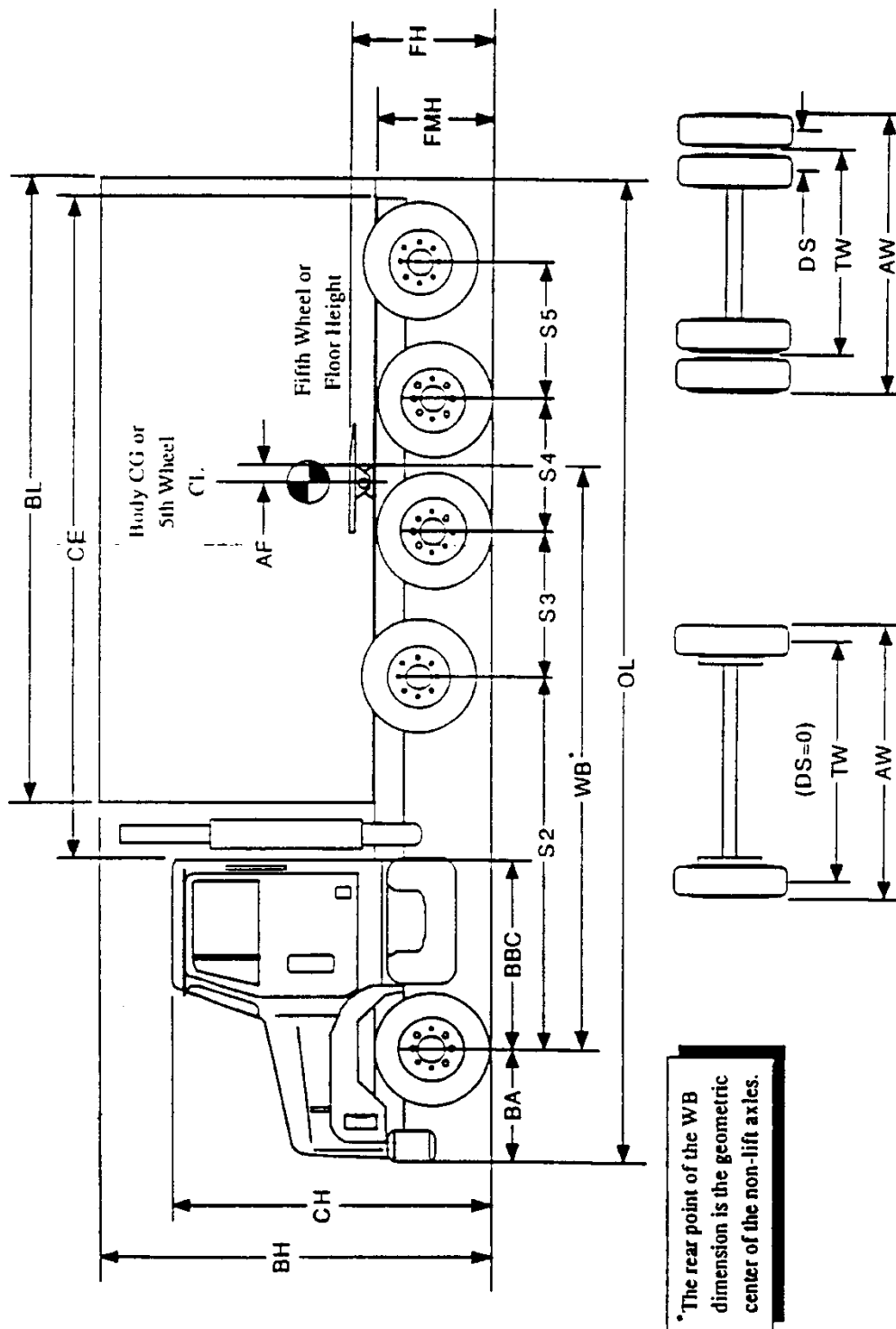


FIGURE 2A - DIMENSIONS FOR UNIT TRUCKS AND TRACTORS

PART II: SEMITRAILERS**General**

Year _____	Make _____	Model _____	Millage _____
VIN _____	Fleet No. _____	GVWR _____	
Status:	☐ Production	☐ Pilot	☐ Prototype
	☐ Pre-prototype	☐ Development	☐ Pretest
	☐ Component	☐ Experimental	
Body Style:	☐ Van	☐ Liquid Tanker	☐ Dry Bulk Tanker
	☐ Flat Bed	☐ Single Drop	☐ Drop Center
Options:	☐ Refrigeration	☐ Other _____	

Loading _____

Major Dimensions¹

BH _____ mm	BL _____ mm	BW _____ mm	FH _____ mm
KPS _____ mm	OH _____ mm	PH _____ mm	WB _____ mm

Mass**Tire Loads**

Axle No. (from front):	1	2	3	4	5
Left Side:	_____ kg	_____ kg	_____ kg	_____ kg	_____ kg
Right Side:	_____ kg	_____ kg	_____ kg	_____ kg	_____ kg
Axle No. (from front):	6	7	8		
Left Side:	_____ kg	_____ kg	_____ kg		
Right Side:	_____ kg	_____ kg	_____ kg		

¹ Figure 3a identifies these and other dimensions.

FIGURE 3 - VEHICLE DEFINITION (HEAVY TRUCKS - UNIT AND ARTICULATED)
PART II: SEMITRAILERS

Axles	1	2	3	4	5	6	7	8
Axle No. (from front):								
Spacing from kingpin or preceding axle (Sn) ¹ , mm:								
Make:								
Model:								
Load rating, kg:								
Axle width (AW) ¹ , mm:								
Track width (TW) ¹ , mm:								
Dual spacing (DS) ¹ , mm:								
Self-Steering:	[]	[]	[]	[]	[]	[]	[]	[]
Lift:	[]	[]	[]	[]	[]	[]	[]	[]

¹ Figure 3a identifies these and other dimensions.

FIGURE 3 - VEHICLE DEFINITION (HEAVY TRUCKS - UNIT AND ARTICULATED)
PART II: SEMITRAILERS (CONTINUED)

Suspension No. _____

Includes Axle(s) No(s): _____

Make: _____ Model: _____ Load Rating, kg: _____

Style—Single-Axle Suspensions☐ Leaf Spring ☐ Air ☐ Lift
☐ Other _____*Style—Multi-Axle Suspensions*☐ Walking Beam ☐ Four Leaf ☐ Air ☐ Torsion Bar
☐ Other _____*Spring(s)*Make _____ Model _____
☐ Multi-Leaf ☐ Taper Leaf No. of Leaves _____ Length, mm _____
☐ Air ☐ Torsion Bar ☐ Rubber Block
☐ Other _____

Remarks _____

Suspension No. _____

Includes Axle(s) No(s): _____

Make: _____ Model: _____ Load Rating: _____

Style—Single-Axle Suspensions☐ Leaf Spring ☐ Air ☐ Lift
☐ Other _____*Style—Multi-Axle Suspensions*☐ Walking Beam ☐ Four Leaf ☐ Air ☐ Torsion Bar
☐ Other _____*Spring(s)*Make _____ Model _____
☐ Multi-Leaf ☐ Taper Leaf No. of Leaves _____ Length, mm _____
☐ Air ☐ Torsion Bar ☐ Rubber Block
☐ Other _____

Remarks _____

FIGURE 3 - VEHICLE DEFINITION (HEAVY TRUCKS - UNIT AND ARTICULATED)
PART II: SEMITRAILERS (CONTINUED)

Suspension No. _____

Includes Axle(s) No(s): _____

Make: _____ Model: _____ Load Rating, kg: _____

Style—Single-Axle Suspensions☐ Leaf Spring ☐ Air ☐ Lift
☐ Other _____*Style—Multi-Axle Suspensions*☐ Walking Beam ☐ Four Leaf ☐ Air ☐ Torsion Bar
☐ Other _____*Spring(s)*Make _____ Model _____
☐ Multi-Leaf ☐ Taper Leaf No. of Leaves _____ Length, mm _____
☐ Air ☐ Torsion Bar ☐ Rubber Block
☐ Other _____

Remarks _____

Suspension No. _____

Includes Axle(s) No(s): _____

Make: _____ Model: _____ Load Rating: _____

Style—Single-Axle Suspensions☐ Leaf Spring ☐ Air ☐ Lift
☐ Other _____*Style—Multi-Axle Suspensions*☐ Walking Beam ☐ Four Leaf ☐ Air ☐ Torsion Bar
☐ Other _____*Spring(s)*Make _____ Model _____
☐ Multi-Leaf ☐ Taper Leaf No. of Leaves _____ Length, mm _____
☐ Air ☐ Torsion Bar ☐ Rubber Block
☐ Other _____

Remarks _____

FIGURE 3 - VEHICLE DEFINITION (HEAVY TRUCKS - UNIT AND ARTICULATED)
PART II: SEMITRAILERS (CONTINUED)

Brakes		1	2	3	4	5	6	7	8
Actuation									
[] Air									
[] Hydraulic: [] Vacuum Asst. [] Hydraulic Power									
Wheel Brakes									
Axle No. (from front):		1	2	3	4	5	6	7	8
Make:									
Disc:		[]	[]	[]	[]	[]	[]	[]	[]
Drum:		[]	[]	[]	[]	[]	[]	[]	[]
Drum or drum size:									
Wedge:		[]	[]	[]	[]	[]	[]	[]	[]
Wedge angle, degree:									
S-Cam:		[]	[]	[]	[]	[]	[]	[]	[]
Slack length, mm:									
Automatic slacks:		[]	[]	[]	[]	[]	[]	[]	[]
Air chamber type:									
Spring brake:		[]	[]	[]	[]	[]	[]	[]	[]
Anti-lock:		[]	[]	[]	[]	[]	[]	[]	[]
Anti-lock make: _____		Anti-lock model: _____							
Remarks									

FIGURE 3 - VEHICLE DEFINITION (HEAVY TRUCKS - UNIT AND ARTICULATED)
PART II: SEMITRAILERS (CONTINUED)

Tires and Wheels		1	2	3	4	5	6	7	8
Axle No. (from front):									
Wheels									
Make:									
Spoke style:		[]	[]	[]	[]	[]	[]	[]	[]
Disk style:		[]	[]	[]	[]	[]	[]	[]	[]
Rim size:									
Tires									
Make:									
Model:									
Size and load range:									
Tread style:									
Tread condition									
New:		[]	[]	[]	[]	[]	[]	[]	[]
Half worn:		[]	[]	[]	[]	[]	[]	[]	[]
Full worn:		[]	[]	[]	[]	[]	[]	[]	[]
Tread depth, mm:									
Pressure, kPa:									
Taken: [] Hot or [] Cold									

FIGURE 3 - VEHICLE DEFINITION (HEAVY TRUCKS - UNIT AND ARTICULATED)
PART II: SEMITRAILERS (CONTINUED)

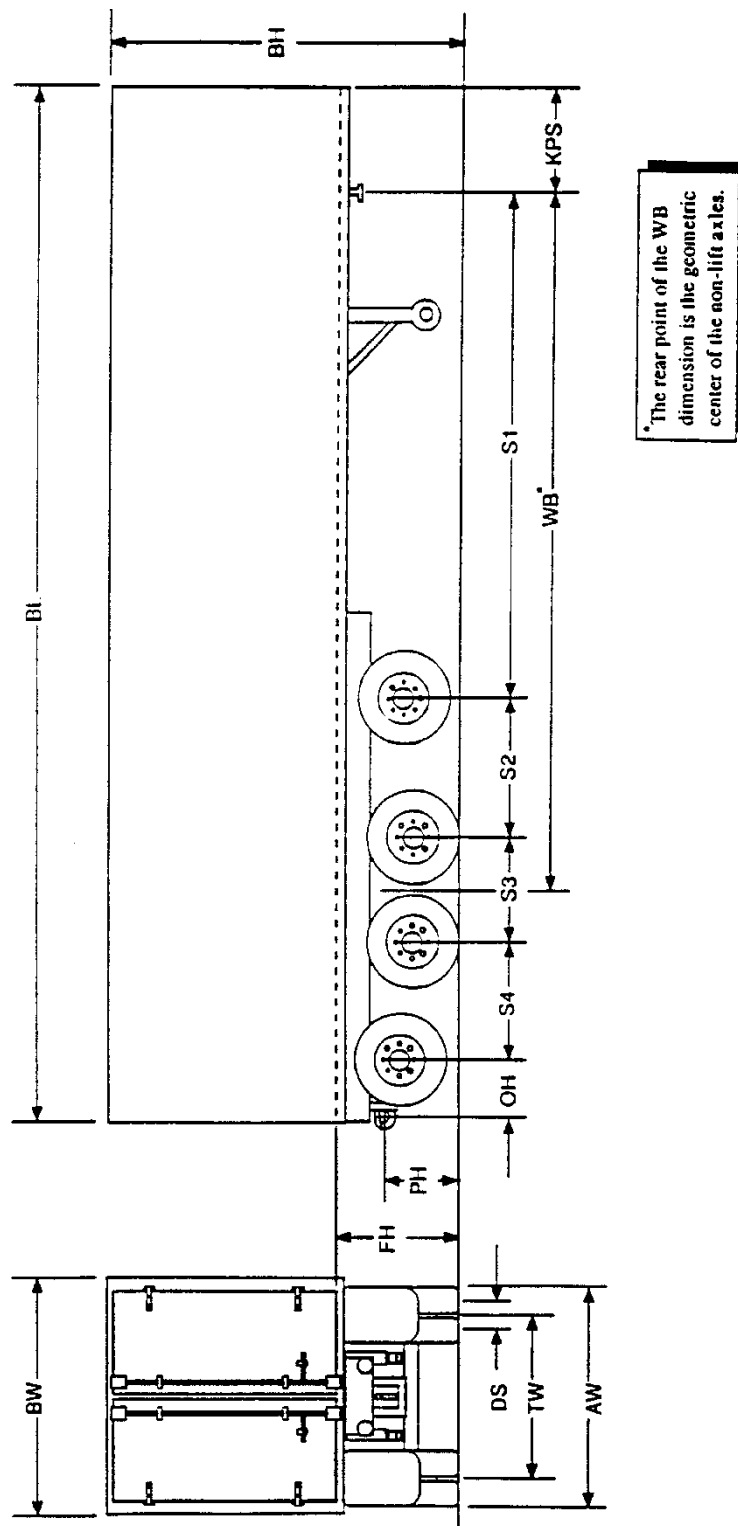


FIGURE 3A - DIMENSIONS FOR SEMITRAILERS

PART III: CONVERTER DOLLIES**General**

Year _____	Make _____	Model _____	Millage _____
VIN _____	Fleet No. _____	GVWR _____	
Status:	☐ Production	☐ Pilot	☐ Prototype
	☐ Pre-prototype	☐ Development	☐ Pretest
Style:	☐ Component	☐ Experimental	
	☐ A-Dolly	☐ B-Dolly	
	Other _____		

Major Dimensions

AF _____ mm OL _____ mm WB _____ mm FH _____ mm

Mass**Tire Loads**

Axle No. (from front):	_____ 1 _____	_____ 2 _____	_____ 3 _____
Left Side:	_____ kg	_____ kg	_____ kg
Right Side:	_____ kg	_____ kg	_____ kg

Axles

Axle No. (from front):	_____ 1 _____	_____ 2 _____	_____ 3 _____
Spacing from pintle hitch (S1) ¹ or preceding axle (S2) ¹ , mm:	_____	_____	_____
Make:	_____	_____	_____
Model:	_____	_____	_____
Load rating, kg:	_____	_____	_____
Axle width (AW) ¹ , mm:	_____	_____	_____
Track width (TW) ¹ , mm:	_____	_____	_____
Dual spacing (DS) ¹ , mm:	_____	_____	_____
Self-steering:	☐	☐	☐

¹ Figure 4a identifies these and other dimensions.

FIGURE 4 - VEHICLE DEFINITION (HEAVY TRUCKS - UNIT AND ARTICULATED)
PART III: CONVERTER DOLLIES

Suspension

Make: _____ Model: _____ Load Rating: _____

Style—Single-Axle Suspensions

☐ Leaf Spring ☐ Air ☐ Lift
☐ Other _____

Style—Multi-Axle Suspensions

☐ Walking Beam ☐ Four Leaf ☐ Air ☐ Torsion Bar
☐ Other _____

Spring(s)

Make _____ Model _____
☐ Multi-Leaf ☐ Taper Leaf No. of Leaves _____ Length, mm _____
☐ Air ☐ Torsion Bar ☐ Rubber Block
☐ Other _____

Remarks _____

Brakes*Actuation*

☐ Air
☐ Hydraulic ☐ Vacuum Asst. ☐ Hydraulic Power

Wheel Brakes

Axle No. (from front):	<u>1</u>	<u>2</u>
Make:	_____	_____
Disc:	☐	☐
Drum:	☐	☐
Disc or drum size:	_____	_____
Wedge:	☐	☐
Wedge angle, degrees:	_____	_____
S-Cam:	☐	☐
Slack length, mm:	_____	_____
Automatic slacks:	☐	☐
Air chamber type:	_____	_____
Anti-lock:	☐	☐

Anti-Lock Make: _____ Anti-Lock Model: _____

Remarks _____

FIGURE 4 - VEHICLE DEFINITION (HEAVY TRUCKS - UNIT AND ARTICULATED)
 PART III: CONVERTER DOLLIES (CONTINUED)