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for Wheelchairs –

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Section 20

Wheelchair Seating Systems for Use in Motor Vehicles

RESNA

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Section 20

Wheelchair Seating Systems for Use in Motor Vehicles

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Section 20 Introduction

Transportation safety research has verified that the designs of vehicle seats, along with occupant restraint systems and vehicle interiors, play an important role in reducing the risks of injuries and fatalities to occupants in motor vehicle crashes. For many people with mobility-related disabilities who must remain seated in their wheelchairs when travelling in motor vehicles, their wheelchair must serve as the vehicle seat and therefore becomes an important part of the occupant-protection system. In these situations, wheelchairs must provide stable and effective support for their occupants during normal vehicle operation, emergency vehicle maneuvers, and crash conditions. Providing effective occupant support during crash conditions is especially important for maintaining proper positioning of the lap-belt restraint over the occupant's bony pelvis during impact loading, thereby reducing the likelihood of the occupant "submarining" under the pelvic belt, which can result in injuries to the abdomen and spine from lap-belt loading. Wheelchair frames and seating systems that are not designed to withstand crash forces place their occupants at increased risk of serious injuries in vehicle crashes.

RESNA WC-4:2012, Section 19 establishes design and performance requirements, and associated test methods, for complete wheelchairs comprised of both a wheelchair frame and seating system, relative to using wheelchairs as seats in motor vehicles. However, seating systems are often marketed independent of a specific wheelchair frame, and the same seating system may be adapted to more than one wheelchair frame. Thus, a seating system from one wheelchair manufacturer, or from a specialty-seating manufacturer, may be combined with wheelchair frames from other manufacturers to make a complete wheelchair. It is therefore beneficial to be able to evaluate the design and performance of seating systems relative to their use in motor vehicles independent of specific wheelchair frames.

RESNA WC-4:2012, Section 20, hereafter referred to as "this section of RESNA WC-4:2012," establishes design and performance requirements and related test methods to evaluate wheelchair seating systems relative to their use as seats in motor vehicles independent of their installation on production wheelchair frames. It accomplishes this by installing and testing the seating system on a surrogate wheelchair frame (SWCF) that has been designed and validated to perform during a simulated 48 kph (30 mph) frontal crash in a manner that is representative of typical production wheelchair frames, and so that dynamic loading by an anthropomorphic test device (ATD), or crash-test dummy, representing the wheelchair occupant, produces nominally worst-case loading conditions on the seating system. The SWCF on which the seating system is installed can accommodate a wide range of types and sizes of production seating systems.

This section of RESNA WC-4 applies to complete wheelchair seating systems, consisting of a seat, a back support, and associated attachment hardware, but without a seating-system frame that is separate from, and that attaches to, a wheelchair base frame. Seating systems that comply with this section of RESNA WC-4 are intended for use only with wheelchair frames that are equipped with securement points specified in RESNA WC-4:2012, Section 19, and that have been successfully crash tested using the methods described in Annex A of RESNA WC-4:2012, Section 19. It is anticipated that future sections of RESNA WC-4, or addendums to this section of WC-4, will address individual components of seating systems and seating systems with seat-integrated frames that are separate from the wheelchair base frame.

This section of RESNA WC-4;2012 applies to seating systems intended for use with wheelchairs that are occupied while facing forward in motor vehicles. The dynamic test requirements specified in Annex A are representative of a 48 kph (30 mph) frontal vehicle collision, where 48 kph (30 mph) refers to the change in velocity of the vehicle during the impact, or what is commonly referred to as the crash delta V. SWCF with seating system installed is secured on the sled platform by the surrogate four-point, strap-type tiedown system (SWTORS) specified in Annex E of RESNA WC-4:2012, Section 19, and an appropriate-size crash-test dummy is restrained in the seating system by a surrogate three-point belt with a SWCF-anchored lap belt. It is anticipated that future sections of RESNA WC-4 will address seating-system performance in rear and side impacts.

In the previous versions of related wheelchair transportation safety standards (Section 19 of RESNA WC Volume 1 and SAE Recommended Practice J2249), the performance criteria for the 48 kph (30 mph) frontal-impact test did not allow for any “sign of failure” in primary load-carrying components of the tested equipment. However, it seemed unreasonable to fail a product because of a small sign of failure, such as a small hairline crack in a hardware component, when all other performance criteria are met. The failure-related criteria have therefore been changed to requiring that wheelchair components cannot “completely fail” upon completion of the 48 kph (30 mph) frontal impact test. This section of WC-4 has been harmonized with this approach and only complete failures of seating system components will result in noncompliance. Nevertheless, all signs of seating system failures should be reported by the test laboratory and manufacturers should consider the “signs of failure” when interpreting the test results and should make appropriate modifications to the seating system.

As in RESNA WC-4:2012, Section 19, this section of RESNA WC-4 includes test methods to evaluate how well the seating system accommodates the proper use and positioning of vehicle-anchored belt restraints. These methods rate the seating system with regard to the ease of achieving proper fit of vehicle-anchored belt restraints to the wheelchair-seated passenger, as well the degree to which proper belt fit is achieved.

As with all sections of RESNA WC-4, the primary purpose of this section is to promote and encourage enhanced transportation safety and usability for wheelchair-seated occupants. However, **non-compliance of wheelchair seating systems with the provisions of this section of RESNA WC-4 should not, and cannot, under federal law, be used to deny or limit access to, and availability of, motor vehicle transportation to wheelchair users.**

Section 20:
Wheelchair Seating Systems for Use in Motor Vehicles

1 Scope

This section of RESNA WC-4 establishes design requirements, performance requirements, associated test methods, and requirements for product labeling and manufacturer literature, for complete wheelchair seating systems consisting of a seat, a back support, and attachment hardware, but without a separate seating-system frame that connects to a wheelchair base frame. It applies to seating systems intended for installation on manual and power wheelchair frames that include securement points and pelvic belt-restraint anchor points as required by RESNA WC-4:2012, Section 19. It applies to seating systems intended for use by adults and children with a total body mass over 23 kg (51 lb, or approximately 6 years of age) who are transported facing forward in their wheelchairs in all types of motor vehicles.

NOTE Seating systems that are intended exclusively for use with a specific wheelchair frame should be evaluated using RESNA WC-4:2012, Section 19.

2 Normative references

The following documents contain provisions, which, through reference in this text, constitute provisions of this section of RESNA WC-4. For dated references, subsequent amendments to, or revisions of any of these publications do not apply. However, parties to agreements based on this section of RESNA WC-4 are encouraged to investigate the possibility of applying the most recent editions of the normative documents listed below. For undated references, the latest edition of the normative document referred to applies. The Bibliography provides source information for these documents.

Federal Motor Vehicle Safety Standard 201 (FMVSS 201) 49 CFR 571.201 Occupant protection in interior impact

RESNA WC-1:2009, Section 7: Method of measurement of seating and wheel dimensions

RESNA WC-1:2009, Section 15: Requirements for information disclosure, documentation, and labeling

RESNA WC-4:2012, Section 18: Wheelchair tiedown and occupant restraint systems for use in motor vehicles

RESNA WC-4:2012, Section 19: Wheelchairs used as seats in motor vehicles

SAE Recommended Practice J211: Instrumentation for impact tests

