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CHILD RESTRAINT ANCHORAGE SYSTEMS – LOWER ANCHORAGES AND TETHERS
COMPARISON BETWEEN
NORTH AMERICAN REGULATIONS (FMVSS No. 225/CMVSS 210.1/210.2)
AND UNECE REGULATIONS Nos. 14, 16, and 44

Transmitted by the expert from the United States of America

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**CHILD RESTRAINT ANCHORAGE SYSTEMS – LOWER ANCHORAGES AND TETHERS:
COMPARISON BETWEEN NORTH AMERICA REGULATIONS (FMVSS No. 225/CMVSS 210.1/210.2)
AND UNECE REGULATIONS Nos. 14, 16, and 44**

	U.S. (FMVSS No. 225), Transport Canada (CMVSS 210.1/2)	UNECE Regulations Nos. 14, 16 and 44
A. Application		
1. Vehicles		
	Passenger cars Trucks and multipurpose passenger vehicles with a gross vehicle weight rating (GVWR) of 3,855 kilogrammes (8,500 pounds) or less Buses (including school buses) with a GVWR of 4,536 kg (10,000 lb) or less (<i>lower anchorages only</i>) (Reference FMVSS No. 225, S2; CMVSS 210.1, S1, CMVSS 210.2, S1(a), (b), (c))	M1: Vehicles used for the carriage of passengers and comprising not more than eight seats in addition to the driver's seat. (<i>14 and 16</i>) N1: Vehicles used for the carriage of goods and having a maximum mass not exceeding 3.5 tonnes. (<i>14 and 16</i>)
2. Exemptions		
	Walk-in van-type vehicles Shuttle buses Vehicles manufactured to be sold exclusively to the U.S. Postal Service (US only) (Reference FMVSS No. 225, S2; CMVSS 210.2, S2(a)(b))	

B. General Vehicle Requirements			
1. Requirements	FMVSS No. 225	CMVSS No. 210.1 / 210.2	UNECE Regulations Nos. 14, 16, 44
	Each tether anchorage installed, either voluntarily or pursuant to this standard, in any new vehicle manufactured on or after September 1, 1999, shall comply with the configuration, location, marking and strength requirements of the standard. (Reference FMVSS No. 225, S4.1)		-Any ISOFIX anchorages system and any top tether anchorage shall enable the vehicle, in normal use, to comply with the provisions of this regulation. -Any ISOFIX anchorages system and top tether anchorage which could be added on any vehicle shall also comply with this regulation. (14) -ISOFIX top tether anchorage resistance are designed for any ISOFIX child restraint system of mass 0; 0+; 1 as defined in Regulation No. 44.
	The vehicle shall be delivered with written information, in English, on how to appropriately use those anchorages and systems. (Reference FMVSS No. 225, S4.1)		National authorities may require the manufacturers of vehicles to state clearly in the instructions for operating the vehicle where the anchorages are; and for what type of belts the anchorages are intended.
			ISOFIX anchorage systems are designed for any ISOFIX child restraint system of mass 0; 0+; 1 as defined in Regulation No. 44.
			One of the two ISOFIX positions shall allow installation of at least one out of the two forward facing fixtures as defined in appendix 2 of Annex 17. The second ISOFIX position must allow at least the installation of one of 3 rear facing fixtures. If installation of a rear facing fixture is not possible on the second row of seats due to vehicle design, the installation of one of five fixtures is allowed in any position in the vehicle.
	Each vehicle with three or more forward-facing rear designated seating positions shall be equipped with:		
	A child restraint anchorage system conforming to the requirements at not fewer than two forward-facing rear designated seating positions. (Reference FMVSS No. 225, S4.4(a)(1); CMVSS 210.2, S4(c))		Any vehicle of category M1 must be equipped with at least two ISOFIX positions. At least two of the positions shall be equipped with an ISOFIX anchorages system and a top tether anchorage. At least one of the two ISOFIX positions systems shall be installed at the second seat row. At least two of the ISOFIX positions shall be equipped both with an ISOFIX anchorages system and an ISOFIX top tether anchorage. (14)
	At least one of the child restraint anchorage systems shall be installed at a forward-facing seating position in the second row in each vehicle that has three or more rows, if such a forward-facing seating position is available in that row. (Reference FMVSS No. 225, S4.4(a)(1); CMVSS 210.2, S4(c))		At least one of the two ISOFIX positions systems shall be installed at a second row seat. (14)

	<p>Each vehicle shall be equipped with a tether anchorage conforming to the requirements of S6 at a third forward-facing rear designated seating position. (Reference FMVSS No. 225 S4.4(a)(2));</p>	<p>A user ready tether anchorage shall be installed for:</p> <ol style="list-style-type: none"> (1) each forward-facing designated seating position in the second row of seating positions in a passenger car, three-wheeled vehicle or truck; (Reference CMVSS 210.1, S3(b)) (2) each of any 2 forward-facing designated seating positions in the second row of seating positions in a multi-purpose passenger vehicle that has 5 or fewer designated seating positions; and (Reference CMVSS 210.1, S3(c)) (3) each of any 3 forward-facing designated seating positions that are located to the rear of the first row of designated seating positions in a multi-purpose passenger vehicle that has 6 or more designated seating positions (Reference CMVSS 210.1, S3(d)) 	
	<p>The tether anchorage of a child restraint anchorage system may count towards the third required tether anchorage. (Reference FMVSS No. 225 S4.4(a)(2));</p>		
	<p>In each vehicle with a forward-facing rear designated seating position other than an outboard designated seating position, at least one tether anchorage (with or without the lower anchorages of a child restraint system) shall be at such a designated seating position. (Reference FMVSS No. 225 S4.4(a)(2));</p>		
	<p>Each vehicle with not more than two forward-facing rear designated seating positions shall be equipped with:</p> <p>A child restraint anchorage system conforming to the requirements at each forward-facing rear designated seating position (Reference FMVSS No. 225, S4.4(b); CMVSS 210.2, S4(b))</p>		
	<p>Each vehicle without any forward-facing rear designated seating positions shall be equipped with:</p>		

	A lower universal anchorage system in one forward-facing designated seating position, other than that of the driver (Reference CMVSS 210.2, S4(a)) [unless there is no air bag cut off switch – reference CMVSS 210.2, S2(c)(i)]	If a vehicle is only equipped with one seat row, no ISOFIX position is required.
	A tether anchorage conforming to the requirements at each front forward-facing passenger seating position. (Reference FMVSS No. 225, S4.4(c); CMVSS 210.1, S3(a))	
	A vehicle may be equipped with a built-in child restraint system instead of one of the required tether anchorages or child restraint anchorage systems (Reference FMVSS No. 225, S5(b)); The number of lower universal anchorage systems required in a vehicle may be reduced by the number of built-in child restraint systems installed in the vehicle (Reference CMVSS 210.2, S7)	The number of ISOFIX positions to be provided shall be at least two minus the number of integrated “built in” child restraint system(s) of mass groups 0, or 0+, or 1 (0-18 kg).
	Tether and lower anchorages shall be available for use at all times, except when the seating position for which it is installed is not available for use because the vehicle seat has been removed or converted to an alternate use such as the carrying of cargo. (Reference FMVSS No. 225, S4.6(b); CMVSS 210.1, S3.1)	
	If a lower universal anchorage system is installed in a designated passenger seating position in the first row of designated seating positions in accordance with subsection 210.2(8) one user-ready tether anchorage shall be installed in that designated seating position. (Reference CMVSS 210.1, S3.3)	
	The number of user-ready tether anchorages required in the second row of designated seating positions under subsection (3) may be reduced by one if a user-ready tether anchorage is installed in the first row in accordance with subsection (3.3). (Reference CMVSS 210.1, S3.4)	
	A lower universal anchorage system may be installed only at a designated seating position that is equipped with a user-ready tether anchorage, except in the case of convertibles. (Reference CMVSS 210.2, S6)	

	A vehicle that is equipped with a forward-facing rear designated seating position that can be relocated such that it is capable of being used at either an outboard or non-outboard forward-facing seating position shall be considered as having a forward-facing non-outboard seating position. Such an adjustable seat must be equipped with a tether anchorage (with or without the lower anchorages of a child restraint anchorage system) if the vehicle does not have another forward-facing non-outboard seating position that is so equipped. (Reference FMVSS No. 225, S4.6(a))	A vehicle that is equipped with a seat that slides sideways such that it can be installed in any other seating position in the vehicle shall meet the requirements of this section with the seat adjusted in any adjustment position. (Reference CMVSS 210.2, S9)	
2. Exceptions	FMVSS No. 225	CMVSS No. 210.1 / CMVSS 210.2	UNECE Regulations Nos. 14, 16, 44
Convertibles	Convertibles and school buses are excluded from the requirements to be equipped with tether anchorages. (Reference FMVSS No. 225, S5(a), CMVSS 210.1, S2(a))		Convertibles are not required to have top tether anchorages. (14)
		An open-body type vehicle or a designated seating position at which a built-in child restraint system is provided that is not part of a removable vehicle seat. (Reference CMVSS 210.1, S2(b) and (c))	
Air Bags	Each vehicle that does not have a rear designated seating position and has an air bag on-off switch shall have a child restraint anchorage system for a designated passenger seating position in the front seat, instead of only a tether anchorage. In the case of convertibles, the front designated passenger seating position need have only the two lower anchorages. (Reference FMVSS No. 225, S5(c)(1); CMVSS 210.2, S2(c)(i))		If an ISOFIX anchorage system is installed at a front seating position protected with a frontal airbag, a de-activation device for this airbag shall be fitted.
	Each vehicle that has a rear designated seating position, but which is too small to accommodate rear-facing child restraints, and has an air bag on-off switch , shall have a child restraint anchorage system for a designated passenger seating position in the front seat instead of a child restraint anchorage system that is required for the rear seat. In the case of convertibles, the front designated passenger seating position need have only the two lower anchorages. (Reference FMVSS No. 225, S5(c)(2); CMVSS 210.2, S8)		If an ISOFIX anchorage system is installed at a front seating position protected with a frontal airbag, a de-activation device for this airbag shall be fitted.
	A vehicle that does not have an air bag on-off switch shall not have any lower anchorages installed at a front designated seating position. (Reference FMVSS No. 225, S5(d))		
General	A vehicle with a rear designated seating position for which interference with transmission and/or suspension components prevents the location of the lower bars of a child restraint anchorage system anywhere within the zone described such that the attitude angles could be met, is excluded from the requirement to provide a child restraint anchorage system at that position. However, except as provided elsewhere in this standard, for vehicles manufactured on or after 1 September 2001, such a vehicle must have a tether anchorage at a front passenger designated seating position. (Reference FMVSS No. 225, S5(e); CMVSS 210.2, S2(c)(ii))		

C. Requirements for Tether Anchorages			
1. Configuration	FMVSS No. 225	CMVSS No. 210.1	UNECE Regulations Nos. 14, 16, 44
	Each tether anchorage shall permit the attachment of a tether hook of a child restraint system meeting the configuration and geometry specified in Figure xx of the standard (Reference FMVSS No. 225, S6.1(a); CMVSS 210.1, S)		The ISOFIX top tether anchorage shall have dimensions to permit the attachment of an ISOFIX top tether hook as specified in figure 3. (same as 213)
	Each tether anchorage shall be accessible without the need for any tools other than a screwdriver or coin; (Reference FMVSS No. 225, S6.1(b))	The portion of a user-ready tether anchorage that is designed to bind with the tether strap hook shall be readily accessible and, if under a cover, the cover shall be identified by one of the symbols or the mirror image of one of the symbols set out in Figure 2 and shall be removable without the use of tools. (Reference CMVSS 210.1, S4)	Clearance shall be provided around each ISOFIX top tether anchorage to allow latching and unlatching to it. For each top tether anchorage under a cover, the cover shall be identified by for example one of the symbols or the mirror image of one of the symbols set out in figure 13 of annex 9 (same symbol as US). The cover shall be removable without the use of tools.
	Each tether anchorage shall, once accessed, be ready for use without the need for any tools; and (Reference FMVSS No. 225, S6.1(c))		
	Be sealed to prevent the entry of exhaust fumes into the passenger compartment (Reference FMVSS No. 225, S6.1(d))		
2. Location	FMVSS No. 225	CMVSS No. 210.1	UNECE Regulations 14, 16, 44
Tether anchorage zone	The part of each tether anchorage that attaches to a tether hook must be located within the shaded zone shown in Figures 3 to 7 of this standard of the designated seating position for which it is installed. The zone is defined with reference to the seating reference point. (For purposes of the figures, "H Point" is defined to mean seating reference point.) (Reference FMVSS No. 225, S6.2..1; CMVSS 210.1, S5)		Tether location can be determined by either of these methods: (a) The portion of each top tether anchorage that is designed to bind with a top tether connector shall be located not further than 2000 mm far from the shoulder reference point within the shaded zone (<i>zone is larger than US/Canadian zone</i>). The zone is defined with reference to the H-point (<i>same as US/Canada</i>). (b) The top tether anchorage zone can also be located with the aid of a reduced height CRF (ISO/F2 B) that has a tether attachment location 550 mm up from the base. The zone is similar to the zone in option (a). The top tether anchorage shall also be more than 200 mm but not more than 2000 mm from the origin of the tether strap on the rear face of the fixture.
	A tether anchorage may be recessed in the seat back, provided that it is not in the strap wrap-around area at the top of the vehicle seat back. (Reference FMVSS No. 225, S6.2..1)		
	For the area under the vehicle seat, the forwardmost edge of the shaded zone is defined by the torso line reference plane. (Reference FMVSS No. 225, S6.2..1)		

<p>Requirements for tether anchorages located outside zone</p>	<p>In the case of a vehicle that:</p> <p>(a) Has a user-ready tether anchorage for which no part of the shaded zone shown in Figures 3 to 7 of this standard of the designated seating position for which the anchorage is installed is accessible without removing a seating component of the vehicle; and</p> <p>(b) Has a tether strap routing device that is:</p> <p>(1) Not less than 65 mm behind the torso line for that seating position, in the case of a flexible routing device or a deployable routing device, measured horizontally and in a vertical longitudinal plane; or</p> <p>(2) Not less than 100 mm behind the torso line for that seating position, in the case of a fixed rigid routing device, measured horizontally and in a vertical longitudinal plane,</p> <p>the part of that anchorage that attaches to a tether hook may, at the manufacturer's option (with said option selected prior to, or at the time of, certification of the vehicle) be located outside that zone. (Reference FMVSS No. 225, S6.2.1.2; CMVSS 210.1, S7)</p>	<p>The portion of the top tether anchorage that is designed to bind with the top tether connector may be located outside of the shaded zones mentioned above if a location within a zone is not appropriate and the vehicle is equipped with a routing device that, ensures that the top tether strap functions as if the portion of the anchorage designed to bind with the top tether anchorage were located within the shaded zone; and is at least 65 mm behind the torso line, in the case of a non-rigid webbing type routing device or a deployable routing device, or at least 100 mm behind the torso line, in the case of a fixed rigid routing device.</p>
	<p>The measurement of the location of the flexible or deployable routing device described in S6.2.1.2(b)(1) is made with SFAD 2 properly attached to the lower anchorages. A 40 mm wide nylon tether strap is routed through the routing device and attached to the tether anchorage in accordance with the written instructions required by S12 of this standard. The forwardmost contact point between the strap and the routing device must be within the stated limit when the tether strap is flat against the top surface of the SFAD and tensioned to 55 to 65 N. In seating positions without lower anchorages of a child restraint anchorage system, the SFAD 2 is held with its central lateral plane in the central vertical longitudinal plane of the seating position. The adjustable anchor attaching bars of the SFAD 2 are replaced by spacers that end flush with the back surface of the SFAD. (Reference FMVSS No. 225, S6.2.1.2(c))</p>	

3. Strength Requirements	FMVSS No. 225	CMVSS No. 210.1	UNECE Regulations 14, 16, 44
	After preloading the device with a force of 500 N, the tether anchorage shall not separate completely from the vehicle seat or seat anchorage or the structure of the vehicle. (Reference FMVSS No. 225, S6.3.1; CMVSS 210.1, S8)		A tension pre-load of <u>50 N</u> must be applied between the SFAD and the top-tether anchorage. Horizontal excursion (after pre-load) of point X during application of the 8 kN force shall be limited to 125 mm and permanent deformation including partial rupture or breakage of any ISOFIX lower anchorage and top tether anchorage, or surrounding area shall not constitute failure if the required force is sustained for the specified time.
	In the case of vehicle seat assemblies equipped with more than one tether anchorage system, the force may, at the agency's option, be applied simultaneously to each of those tether anchorages. However, that force may not be applied simultaneously to tether anchorages for any two adjacent seating positions whose midpoints are less than 400 mm apart. (Reference FMVSS No. 225, S6.3.3(a); CMVSS 210.1, S11)		
	A tether anchorage of a particular child restraint anchorage system will not be tested with the lower anchorages of that anchorage system if one or both of those lower anchorages have been previously tested under this standard. FMVSS No. 225, S6.3.3(b))		Tests may be performed on different structures if the manufacturer so requests.
		If the zones in which tether anchorages are located overlap and if, in the overlap area, a user-ready tether anchorage is installed that is designed to accept the tether strap hooks of two restraint systems simultaneously, both portions of the tether anchorage that are designed to bind with a tether strap hook shall withstand the force referred to in subsection (8) or (9), as the case may be, applied to both portions simultaneously. (Reference CMVSS 210.1, S10)	

4. Test Conditions	FMVSS No. 225	CMVSS No. 210.1	UNECE Regulations 14, 16, 44
Vehicle Seat Position	Vehicle seats are adjusted to their full rearward and full downward position and the seat back is placed in its most upright position. (Reference FMVSS No. 225, S7(a); CMVSS 210.1, S12)		If the seats and head restraints are adjustable, they shall be tested in the position defined by the technical service within the limited range prescribed by the car manufacturer as provided by: <ul style="list-style-type: none"> (a) The seat may be adjusted longitudinally to its rearmost position and in its lowest position. (b) The seat back angle is adjusted to the manufacturer's design position. In the absence of any specification an angle of the seat back corresponding to a torso angle of 25-degrees from the vertical, or the nearest fixed position of the seat-back, shall be used.
Head Restraints	Head restraints are adjusted in accordance with the manufacturer's instructions, provided pursuant to S12, as to how the head restraints should be adjusted when using the child restraint anchorage system. If instructions with regard to head restraint adjustment are not provided pursuant to S12, the head restraints are adjusted to any position. (Reference FMVSS No. 225, S7(b))		The head restraint is in the lowest and rearmost position.
Vehicle Seat Position Alternative	When SFAD 2 is used in testing and cannot be attached to the lower anchorages with the seat back in this position, adjust the seat back as recommended by the manufacturer in its instructions for attaching child restraints. If no instructions are provided, adjust the seat back to the position that enables SFAD 2 to attach to the lower anchorages that is the closest to the most upright position. (Reference FMVSS No. 225, S7(a))		If the CRF cannot be installed without interference with the vehicle interior, the seat back and head restraint may be adjusted to alternative positions designated by the manufacturer.
Interference with Interior Fittings			If the CRF cannot be positioned when some removable interior fittings were present, such fittings may be removed.

5. Test Procedures ¹	FMVSS No. 225	CMVSS No. 210.1	UNECE Regulations 14, 16, 44
General	For the testing specified in these procedures, the SFAD used in the test has a tether strap consisting of webbing material with an elongation limit of 4 percent at a tensile load of 65,000 N (14,612 lb). Pretension the tether strap with 53.5 N to 67 N of preload prior to the test. The strap is fitted at one end with a high strength steel tether hook for attachment to the tether anchorage. The tether hook meets the specifications in FMVSS No. 213 as to the configuration and geometry of tether hooks required by the standard. A steel cable is connected to the X point through which the test force is applied. (Reference FMVSS No. 225, S8)		

¹ Use the following specified test device, as appropriate: SFAD 1, to test a tether anchorage at a designated seating position that does not have a child restraint anchorage system; or, SFAD 2, to test a tether anchorage at a designated seating position that has a child restraint anchorage system.

<p>Installation procedure</p>	<p>SFAD 1: Attach the SFAD 1 to the vehicle seat using the vehicle belts and attach the test device to the tether anchorage, in accordance with the manufacturer's instructions provided pursuant to S12 of this standard. For the testing specified in this procedure, if SFAD 1 cannot be attached using the vehicle belts because of the location of the vehicle belt buckle, the test device is attached by material whose breaking strength is equal to or greater than the breaking strength of the webbing for the seat belt assembly installed as original equipment at that seating position. The geometry of the attachment duplicates the geometry, at the pre-load point, of the attachment of the originally installed seat belt assembly. All belt systems (including the tether) used to attach the test device are tightened to a tension of not less than 53.5 N and not more than 67 N on the webbing portion of the belt. For SFAD 1, apply a rearward force of 135 N +/- 15 N, in a horizontal plane through point ``X" of SFAD 1. While maintaining the force, tighten the vehicle seat belt to a tension of not less than 53.5 N and not more than 67 N measured at the lap portion of the seat belt and maintain the tension during the preload, lock the seat belt retractor, and tighten the tether belt strap to remove all slack. (Reference FMVSS No. 225, S8.1(b))</p>		<p>Same</p>
	<p>SFAD 2: A rearward force of 135 N, plus-minus 15 N, shall be applied to the centre of the lower front crossmember of SFAD 2 to press the device against the seat back as the fore-aft position of the rearward extensions of the SFAD 2 is adjusted to remove any slack or tension. (Reference FMVSS No. 225, S8.1(b))</p>		

<p>Forward Force Direction</p>	<p>Apply the force-- (1) Initially, in a forward direction in a vertical longitudinal plane and through the Point X on the test device; and (2) Initially, along a line through the X point and at an angle of 10, plus-minus 5 degrees above the horizontal. Apply a preload force of 500 N to measure the angle. (Reference FMVSS No. 225, S8.1(c)(1) and (2); CMVSS 210.1, S8b(i) and (ii))</p>		<p>Forces in the forward direction shall be applied with an initial force application angle of 10 ± 5 degrees above the horizontal. A pre-load force of 500 ± 25 N shall be applied at the prescribed loading point X indicated in figure 2 annex 9.</p>
<p>Forward Force Load Requirements</p>	<p>Increase the pull force as linearly as practicable to a full force application of 15,000 N in not less than 24 seconds and not more than 30 seconds, and maintain at a 15,000 N level for 1 second. (Reference FMVSS No. 225, S8.1(c)(3))</p>	<p>Apply a force of 10,000 N, attained within 30 seconds, at any onset force rate of not more than 135,000 N/s, and maintained at a 10,000 N level for a minimum of 1 second. (Reference CMVSS 210.1, S8(c) and (d))</p>	<p>A tension pre-load of $50 \text{ N} \pm 5 \text{ N}$ must be applied between the SFAD and the top-tether anchorage. The 8kN \pm 0.25 kn force shall be applied to the SFAD in the forward direction (0 ± 5 degrees). Full application of the force shall be achieved within a period of 2 s or less. The force shall be maintained for a minimum period of 0.2 s. Horizontal excursion of point X of SFAD shall be limited to 125 mm and permanent deformation including partial rupture or breakage of any ISOFIX lower anchorage or surrounding area shall not constitute failure if the required force is sustained for the specified time.</p> <p>All measurements shall be made according to ISO 6487 with CFC of 60 Hz or any equivalent method.</p>

D. Requirements for Lower Anchorages			
1. Configuration	FMVSS No. 225	CMVSS No. 210.2	UNECE Regulations 14, 16, 44
Anchorage Diameter	The lower anchorages shall consist of two bars that are 6 mm +/- .1 mm in diameter. (Reference FMVSS No. 225, S9.1.1(a); CMVSS 210.2, S3(b))		Same
Position	Are straight, horizontal, and transverse (Reference FMVSS No. 225, S9.1.1(b); CMVSS 210.2, S3(a))		The lower anchorages shall consist of two bars that transverse horizontal rigid bar(s) located on the same axis as defined in figure 4 annex 9.
		Are parallel, with collinear centroidal longitudinal axes (Reference CMVSS 210.2, S3(c))	
Anchorage Length	The lower anchorages shall consist of two bars that are not less than 25 mm, but not more than 50 mm in length (Reference FMVSS No. 225, S9.1.1(c))	The lower anchorages shall consist of two bars that length of not less than 25 mm (Reference CMVSS 210.2, S3(b))	The lower anchorages shall consist of two bars that 25 mm minimum effective length
Anchorage Spacing	The anchorage bars are located at the vehicle seating position by using the CRF rearward extensions, with the CRF placed against or near the vehicle seat back. (Reference FMVSS No. 225, S9.2.1)	Spaced laterally so that they permit the lower connectors on a child restraint fixture to be attached to them over the entire length of the lower connectors. (Reference CMVSS 210.2, S3(c))	For any ISOFIX anchorages system installed in a vehicle, it shall be verified the possibility to attach the ISOFIX child restraint fixture "ISO/F2" (B). Rigid attachments of fixture are spaced 280 mm apart and are 25 mm wide.
Attachment	The lower anchorages shall consist of two bars that are permanently attached to the vehicle or vehicle seat such that they can only be removed by use of a tool, such as a screwdriver or wrench (Reference FMVSS No. 225, S9.1.1(f); CMVSS 210.2, S3(d))		The lower anchorages shall consist of two bars that shall be permanently in position or <u>storable</u> . In the case of storable anchorages, the requirements relating to anchorages system shall be fulfilled in the deployed position.
Deformation Requirement	The lower anchorages shall consist of two bars that are rigidly attached to the vehicle such that they will not deform more than 5 mm when subjected to a 100 N force in any direction (Reference FMVSS No. 225, S9.1.1(g); CMVSS 210.2, S3(e))		
Checking Device		Permit a checking device to be attached to them over the entire width of the checking device, with a gap of less than 1 mm between the surface of the bars and line M, shown in Figure 5 (Reference CMVSS 210.2, S3(f))	

2. Location and Fit	FMVSS No. 225	CMVSS No. 210.2	UNECE Regulations 14, 16, 44
Pitch, Roll, and yaw	With the CRF attached to the anchorages and resting on the seat cushion, the bottom surface shall have attitude angles within the limits in the following table, angles measured relative to the vehicle horizontal, longitudinal and transverse reference planes. Requirements in table are (1) Pitch: 15 ± 10; (2) Roll: 0 ± 5; and (3) Yaw: 0 ± 10. (Reference FMVSS No. 225, S9.2.1)		The bottom surface of the fixture ISO/F2 (B) shall have attitude angles within the following limits, angles measured relatively to the vehicle reference planes as defined in annex 4 appendix to this regulation: Pitch 15 ± 10 degrees, Roll 0 ± 5 degrees, and Yaw 0 ± 10 degrees.
Longitudinal Position of Anchorage Bars	With adjustable seat backs adjusted in the manufacturer's nominal design riding position in the manner specified by the manufacturer and in the full rearward and full downward position, each lower anchorage bar shall be located so that a vertical transverse plane tangent to the front surface of the bar is (a) not more than 70 mm behind the corresponding point Z of the CRF, measured parallel to the bottom surface of the CRF and in a vertical longitudinal plane, while the CRF is pressed against the seat back by the rearward application of a horizontal force of 100 N at point A on the CRF, and (b) not less than 120 mm behind the vehicle seating reference point, measured horizontally and in a vertical longitudinal plane. (Reference FMVSS No. 225, S9.2.2; CMVSS 210.2, S12 except the 100 N rearward force at point A on the CRF is not specified)		Any ISOFIX anchorages system shall be installed on a vehicle seating position shall be located not less than 120 mm behind the design H-point measured horizontally and up to the centre of the bar.
Adequate Fit of Anchorage Bars	Each vehicle and each child restraint anchorage system in that vehicle shall be designed such that the CRF can be placed inside the vehicle and attached to the lower anchorages of each child restraint anchorage system. To facilitate installation of the CRF in a vehicle seat, the side, back and top frames of the CRF may be removed for installation in the vehicle. If necessary, the height of the CRF may be 560 mm (Reference FMVSS No. 225, S9.2.3; CMVSS 210.2, S12, except Transport Canada specifies maximum height of 635 mm).		For any ISOFIX anchorages system installed in the vehicle, it shall be verified the possibility to attach the ISOFIX child restraint fixture ISO/F2 (B). (Height is 650 mm.)
3. Strength Requirements	FMVSS No. 225 LOWER ANCHORAGES ONLY	CMVSS No. 210.2 LOWER ANCHORAGES + TETHER	UNECE Regulations 14, 16, 44
	When tested in accordance with S11, after preloading the device, the lower anchorages shall not allow point X on SFAD 2 to be displaced horizontally more than:	A lower universal anchorage system installed in a row of designated seating positions:	
Forward Force Direction	175 mm , when a force of 11,000 N is applied in a forward direction in a vertical longitudinal plane (Reference FMVSS No. 225, S9.4.1(a))	shall not separate completely from the vehicle seat or seat anchorage or the structure of the vehicle (Reference CMVSS 210.2, S13)	Horizontal longitudinal excursion (after pre-load) of point X of SFAD during application of the 8 kN ± 0.25 kN force shall be limited to 125 mm and permanent deformation including partial rupture or breakage of any ISOFIX low anchorage or surrounding area shall not constitute failure if the requested force is sustained for the specified time.

Lateral Force Direction	150 mm , for lower anchorages that are in an outboard designated seating position, or 150 mm , for lower anchorages that are in a seating position other than an outboard designated seating position, when a force of 5,000 N is applied in a lateral direction in a vertical longitudinal plane that is 75 +/- 5 degrees to either side of a vertical longitudinal plane (Reference FMVSS No. 225, S9.4.1(b))	Point X on the test device shall not be displaced by more than 125 mm if the test device is installed in an outboard designated seating position, or 150 mm if the test device is installed in an inboard designated seating position. (Reference CMVSS 210.2, S14)	Excursion in the direction of the force (after pre-load) of point X of SFAD during application of the 5kN ± 0.25kN force shall be limited to 125 mm and permanent deformation including partial rupture or breakage of any ISOFIX low anchorage or surrounding area shall not constitute failure if the required force is sustained for the specified time.
	The amount of displacement is measured relative to an undisturbed point on the vehicle body. (Reference FMVSS No. 225, S9.4.1.2)		
Simultaneous Testing	In the case of vehicle seat assemblies equipped with more than one child restraint anchorage system, the lower anchorages may, at the agency's option, be tested simultaneously. However, forces may not be applied simultaneously for any two adjacent seating positions whose midpoints are less than 400 mm apart. (Reference FMVSS No. 225, S9.4.2(a); CMVSS 210.2, S16)		All ISOFIX positions that can be used simultaneously, shall be tested simultaneously.
	The lower anchorages of a particular child restraint anchorage system will not be tested if one or both of the anchorages have been previously tested under this standard. (Reference FMVSS No. 225, S9.4.2(b))		Forward and oblique static force tests may be performed on different structures if the manufacturer so requests.
4. Test Conditions	FMVSS No. 225	CMVSS No. 210.2	UNECE Regulations 14, 16, 44
Seat Position	Adjust vehicle seats to their full rearward and full downward position. (Reference FMVSS No. 225, S10(a); CMVSS 210.2, S17(b))		If the seats and head restraints are adjustable, they shall be tested in the position defined by the technical service within the limited range prescribed by the car manufacturer as provided by: (a) seat may be adjusted longitudinally to its rearmost position and in its lowest position.
	Place the seat backs in their most upright position. (Reference FMVSS No. 225, S10(a))	The vehicle seat back is adjusted in the nominal design riding position (Reference CMVSS 210.2, S17(c))	The seat back angle is adjusted to the manufacturer's design position. In the absence of any specification an angle of the seat back corresponding to a torso angle of 25-degrees from the vertical, or the nearest fixed position of the seat-back, shall be used.

	When SFAD 2 is used in testing and cannot be attached to the lower anchorages with the seat back in this position, adjust the seat back as recommended by the manufacturer in its instructions for attaching child restraints. If no instructions are provided, adjust the seat back to the position closest to the upright position that enables SFAD 2 to attach to the lower anchorages. (Reference FMVSS No. 225, S10(a))		If the CRF cannot be installed without interference with the vehicle interior, the seat back and head restraint may be adjusted to alternative positions designated by the manufacturer.
			If the CRF cannot be positioned when some removable interior fittings were present, such fittings may be removed.
Head Restraint	Head restraints are adjusted in accordance with the manufacturer's instructions as to how the head restraints should be adjusted when using the child restraint anchorage system. If instructions with regard to head restraint adjustment are not provided, the head restraints are adjusted to any position. (Reference FMVSS No. 225, S10(b); CMVSS 210.2, S17(d))		The head restraint is in the lowest and rearmost position.
5. Test Procedures	FMVSS No. 225	CMVSS No. 210.2	UNECE Regulations 14, 16, 44
SFAD Placement	Place SFAD 2 in the vehicle seating position and attach it to the two lower anchorages of the child restraint anchorage system. <u>Do not attach the tether anchorage.</u> (Reference FMVSS No. 225, S11(a))	SFAD 2 is <u>installed using both the user ready tether anchorage and the lower universal anchorage system</u> as a child restraint system would be installed in accordance with the vehicle manufacturer's instructions (Reference CMVSS 210.2, S13(a)(i))	
	A rearward force of 135 +/- 15 N shall be applied to the centre of the lower front crossbar of SFAD 2 to press the device against the seat back as the fore-aft position of the rearward extensions of the SFAD is adjusted to remove any slack or tension. (Reference FMVSS No. 225, S11(a); CMVSS 210.2, S17(e))		A force of 135 N ± 15 N shall be applied to the centre of the lower front crossbar of the SFAD in order to adjust the fore-aft position of the SFAD rearward extension to remove any slack or tension between the SFAD and its support.
Forward Force Direction	Forces in the forward direction shall be applied with an initial force application angle of 10 ± 5 degrees above the horizontal. (Reference FMVSS No. 225, S9.4.1.1; CMVSS 210.2, S13(a)(iii))		Forces in the forward direction shall be applied with an initial force application angle of 10 ± 5 degrees above the horizontal.
Lateral/Oblique Force Direction	Forces described in the lateral direction shall be applied horizontally 0 +/- 5 degrees. (Reference FMVSS No. 225, S9.4.1.1; CMVSS 210.2, S13(b)(iii))		Oblique forces shall be applied at 75 ± 5 degrees to both sides of straight forward and horizontally 0 ± 5 degrees.

<p>Forward Force</p>	<p>Apply a preload force of 500 N at point X of the test device. Increase the pull force as linearly as practicable to a full force application of 11,000 N in not less than 24 seconds and not more than 30 seconds, and maintain at an 11,000 N level for 1 second. (Reference FMVSS No. 225, S11(a))</p>	<p>Starting with a pre-load force of 500 N, maintained for at least 2 minutes but not more than 5 minutes, apply a force of 15,000 N in a forward direction parallel to the vehicle’s vertical longitudinal plane through the X point on the test device, attained within 30 seconds, at any onset force rate of not more than 135,000 N/s, and maintained at a level of 15,000 N for a minimum of 1 second (Reference CMVSS 210.2, S13(a)(ii)(iv)(v))</p>	<p>A preload force of 500 N ± 25N shall be applied at the prescribed loading point X indicated in figure 2 annex 9. Full application of the 8 kN ± 0.25 kN force shall achieved within a period of 2s or less. The force shall be maintained for a minimum period of 0.2s.</p>
<p>Lateral Force</p>	<p>Apply a preload force of 500 N at point X of the test device. Increase the pull force as linearly as practicable in a lateral direction in a vertical longitudinal plane that is 75 +/-5 degrees to either side of a vertical longitudinal plane that is parallel to the vehicle’s longitudinal centreline, to a full force application of 5,000 N in not less than 24 seconds and not more than 30 seconds, and maintain at a 5,000 N level for 1 second. (Reference FMVSS No. 225 S9.4.1(b), S11(b))</p>	<p>Starting with a pre-load force of 500 N, maintained for at least 2 minutes but not more than 5 minutes, apply a force of 5,000 N along a vertical longitudinal plane that is at an angle of 75 +/-5 degrees to either side of a vertical longitudinal plane that is parallel to the vehicle’s longitudinal centre line through the X point on the test device, attained within 30 seconds, at any onset force rate of not more than 135,000 N/s, and maintained at a level of 5,000 N for a minimum of 1 second (Reference CMVSS 210.2, S13(b)(ii)(iv)(v)) [Note: At the manufacturer’s option, the lower universal anchorage system may be used without attaching the top tether for this test.]</p>	<p>A preload force of 500 N ± 25N shall be applied at the prescribed loading point X indicated in figure 2 annex 9. Full application of the 5kN ± 0.25kN force shall achieved within a period of 2s or less. The force shall be maintained for a minimum period of 0.2s.</p>
<p>6. Marking and Conspicuity</p>	<p>FMVSS No. 225</p>	<p>CMVSS No. 210.2</p>	<p>UNECE Regulations 14, 16, 44</p>
<p>Each vehicle shall comply with either:</p>	<p>Above each bar, the vehicle shall be permanently marked with a circle: (Reference FMVSS No. 225, S9.5(a))</p>	<p>The presence of each bar of the system shall be indicated by the symbol shown in Figure 10, consisting of a circle containing a pictogram, which symbol shall meet the following conditions: (Reference CMVSS 210.2, S18)</p>	<p>The vehicle shall be permanently marked adjacent to each bar or guidance device. This marking shall consist of one of the following:</p> <p>(1) As a minimum, the symbol of annex 9, figure 12 consisting of a circle with a diameter of minimum 13 mm and containing a pictogram, or (2) the word “ISOFIX” in capital letters of a least 6 mm height.</p>
	<p>That is not less than 13 mm in diameter; (Reference FMVSS No. 225, S9.5(a)(1), CMVSS 210.2, Figure 10)</p>		

	That is either solid or open, with or without words, symbols or pictograms, provided that if words, symbols or pictograms are used, their meaning is explained to the consumer in writing, such as in the vehicle's owners manual (Reference FMVSS No. 225, S9.5(a)(2))	The pictogram shall contrast with the background of the circle, and the circle shall contrast with its background, namely, the seat back or seat cushion of the vehicle (Reference CMVSS 210.2, S18(a)(b))	The pictogram shall contrast with the background of the circle
	That is located such that its centre is on each seat back between 50 and 75 mm above or on the seat cushion 100 +/- 25 mm forward of the intersection of the vertical transverse and horizontal longitudinal planes intersecting at the horizontal centreline of each lower anchorage, as illustrated in Figure 22. (Reference FMVSS No. 225, S9.5(a)(3), CMVSS 210.2, S18(d) and Figure 11)		The pictogram shall be located close to each bar of the system
	The centre of the circle must be in the vertical longitudinal plane that passes through the centre of the bar (+/- 12 mm). (Reference FMVSS No. 225, S9.5(a)(3))	Its centre shall be located no more than 25 mm from the vertical longitudinal plane that passes through the centre of each bar of the system (Reference CMVSS 210.2, S18(c))	
	The circle may be on a tag, provided that the tag is sewn on at least half of its border. (Reference FMVSS No. 225, S9.5(a)(4))	It shall be permanently marked by any means in a manner that makes it impossible to remove without defacing or destruction. (Reference CMVSS 210.2, S18(e))	
OR	The vehicle shall be configured such that the following is visible: (Reference FMVSS No. 225, S9.5(b))	The vehicle shall be configured such that:	
	Each of the bars installed pursuant to S4, or a permanently attached guide device for each bar. (Reference FMVSS No. 225, S9.5(b))		Each ISOFIX lower anchorage bar (when deployed for use) or each permanently installed guidance device shall be visible
	The bar or guide device must be visible without the compression of the seat cushion or seat back, when the bar or device is viewed, in a vertical longitudinal plane passing through the centre of the bar or guide device, along a line making an upward 30 degree angle with a horizontal plane. Seat backs are in the nominal design riding position. (Reference FMVSS No. 225, S9.5(b); CMVSS 210.2, S18)		without compression of the seat cushion or seat back, when the bar or the guidance device is viewed, in a vertical longitudinal plane passing through the centre of the bar or of the guidance device, along a line making an upward angle of 30 degrees with a horizontal plane.
	The bars may be covered by a removable cap or cover, provided that the cap or cover is permanently marked with words, symbols or pictograms whose meaning is explained to the consumer in written form as part of the owner's manual. (Reference FMVSS No. 225, S9.5(b) CMVSS 210.2, S20(a)(b))		

E. Child Restraint Requirements	FMVSS No. 213	CMVSS	UNECE Regulations 14, 16, 44
1. General			
Mass			Shall not exceed 15 kg
Lower Anchorages			Rigid mechanism having provision for adjustment.
Adjustment Provisions	In the case of each child restraint system that has components, including belt webbing, for attaching the system to a tether anchorage or to a child restraint anchorage system, the belt webbing shall be adjustable so that the child restraint can be tightly attached to the vehicle. Reference FMVSS No. 213, S5.9(b))		ISOFIX attachments or the ISOFIX child restraint system shall be adjustable to accommodate the range of ISOFIX anchorage locations described in UNECE Reg 14.
Instructions			The instructions for use must be given to read the car manufacturer's handbook.
2. Attachments		<p>Every forward-facing child restraint system must be capable of being secured to the vehicle by means of</p> <ul style="list-style-type: none"> (a) a lower connector system together with the tether strap provided with the restraint system; and (b) a vehicle seat belt together with the tether strap provided with the restraint system <p>Every rearward-facing child restraint system must be capable of being secured to the vehicle by means of</p> <ul style="list-style-type: none"> (a) a lower connector system or a lower connector system together with the tether strap provided with the system; and (b) a vehicle seat belt or a vehicle seat belt together with the tether strap provided with the system 	

a. Lower Anchorages		
	<p>Each add-on child restraint anchorage system manufactured on or after September 1, 2002, other than a car bed, harness and belt-positioning seat, shall have components permanently attached to the system that enable the restraint to be securely fastened to the lower anchorages of the child restraint anchorage system specified in Standard No. 225 (Sec. 571.213) and depicted in Drawing Package SAS-100-1000 with Addendum A: Seat Base Weldment (consisting of drawings and a bill of materials), dated October 23, 1998, or in Drawing Package, "NHTSA Standard Seat Assembly; FMVSS No. 213, No. NHTSA-213-2003," (consisting of drawings and a bill of materials) dated June 3, 2003 (incorporated by reference; see Sec. 571.5). (Reference FMVSS No. 213, S5.9(a))</p>	
	<p>The components must be attached by use of a tool, such as a screwdriver. (Reference FMVSS No. 213, S5.9(a))</p>	
	<p>In the case of rear-facing child restraints with detachable bases, only the base is required to have the components. (Reference FMVSS No. 213, S5.9(a); CMVSS 213.1, S2(b)(2))</p>	
Dimensions		<p>Portion that engages the anchorage system must not exceed the maximum dimensions given by the envelope in figure 0(b). (93L x 25w x 33h)</p>
Partial Latching Indication	<p>Each child restraint system with components that enable the restraint to be securely fastened to the lower anchorages of a child restraint anchorage system, other than a system with hooks for attaching to the lower anchorages, shall provide either an indication when each attachment to the lower anchorages becomes fully latched or attached, or a visual indication that all attachments to the lower anchorages are fully latched or attached. Visual indications shall be detectable under normal daylight lighting conditions. (Reference FMVSS No. 213, S5.9(d); CMVSS 213, S7.1.2)</p>	<p>CRS shall incorporate means by which there is a clear indication that both of the ISOFIX attachments are completely latched with the corresponding ISOFIX lower anchorage. The indication means may be audible, tactile or visual or a combination of two or more. In case of visual indication it must be detectable under all normal lighting conditions.</p>
b. Tether Attachment		
Connector Dimensions	<p>In the case of each child restraint system that has components for attaching the system to a tether anchorage, those components shall include a tether hook that conforms to the configuration and geometry specified in the standard. (Reference FMVSS No. 213, S5.9(b); CMVSS 213, S7.2)</p>	<p>Should be an ISOFIX top tether hook as shown in Figure 0(c) or a similar device that fits within the envelope given by figure 0(c).</p>

Tether Strap Features			Shall be supported by webbing (or its equivalent), having a provision for adjustment and release of tension.
Tether Strap Length			At least 2,000 mm
No-Slack Indicator			The ISOFIX top tether strap or the ISOFIX child seat shall be equipped with a device that will indicate that all slack has been removed from the strap. The device may be part of an adjustment and tension relieving device.
3. Testing			
Dynamic Test			ISOFIX CRS tested with and without anti-rotational device. (The test without is subject for review 5 years after entry into force.)
Attachment Specifications			ISOFIX attachments and latching indicators shall be capable of withstanding repeated operations and shall, before the dynamic test prescribed, undergo a test comprising 2000 ± 5 opening and closing cycles under normal conditions of use.
Tether			If the ISOFIX child restraint must use a top tether, one test shall be carried out with the smallest dummy with the shorter distance of the top tether (anchorage point G1). A second test shall be carried out with the heavier dummy with the longer distance of the top tether (anchorage point G2). Adjust the top tether to achieve a tension load of 50 ± 5 N.