

DRAFT
AMENDMENT
TO

AUTOMOTIVE INDUSTRY STANDARD -169
(AIS – 169)

**Guidelines on Provisions for Adapted
Vehicles of categories M1, N1 and M2**

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INTRODUCTION

The Government of India felt the need for a permanent agency to expedite the publication of standards and development of test facilities in parallel when the work on the preparation of the standards is going on, as the development of improved safety critical parts can be undertaken only after the publication of the standard and commissioning of test facilities. To this end, the erstwhile Ministry of Surface Transport (MOST) has constituted a permanent Automotive Industry Standards Committee (AISC) vide order No. RT-11028/11/97-MVL dated September 15, 1997. The standards prepared by AISC will be approved by the permanent CMVR Technical Standing Committee (CTSC). After approval, the Automotive Research Association of India, (ARAI), Pune, being the Secretariat of the AIS Committee, has published this standard. For better dissemination of this information ARAI may publish this document on their web site.

Motor Vehicle Amendment Act 2019 has introduced terminology of Adapted Vehicles in section 2 and alteration provisions under section 52 thereof. In 56th meeting of CMVR TSC held on 22nd August 2019 need to formulate procedure for adapted vehicles of category M1 was highlighted. This standard has been formulated covering adaptations for vehicle of category M1 covering requirements for accommodation and accessibility for differently abled driver and passengers of reduced mobility.

Vehicle selection for adaptation shall be done very thoughtfully, since each vehicle of category M1 may not be suitable for adaptation. This standard is intended to address mobility needs of persons with reduced mobility. Various parameters considered for adaptations are:

1. In a family person who drives vehicle (driver) may be with reduced mobility and using wheel chair or may have reduced upper limb function, however other family members may be with normal mobility and function;
2. To have vehicle with provision for mobility of passenger with reduced mobility (wheel chair user or elderly people without limb disability);
3. Combination of above 1 and 2;
4. Elderly person may be requiring additional space facilitating boarding and alighting vehicle. For them priority seat option is provided;
5. Air suspensions are generally found more in buses, however high-end luxury M1 category vehicles may have these systems. Air suspensions and kneeling systems are costly option, however to avoid any restriction while converting vehicles as adapted vehicle, these provisions are mentioned as optional provisions (at choice of manufacturer), however when these systems are provided compliance to this standard is required;
6. Few optional features are recommended instead of mandatory keeping cost involved in adaptations;
7. Intended occupants with reduced mobility can have entry from side or rear of vehicle.

Further this standard covers adapted vehicles of category N1, so that by introducing

ad-on controls (secondary controls), N1 vehicle can be driven by person with disability and earn livelihood in specific applications.

This standard also covers small M2 vehicles can be adapted for providing Taxi service for passenger with reduced mobility.

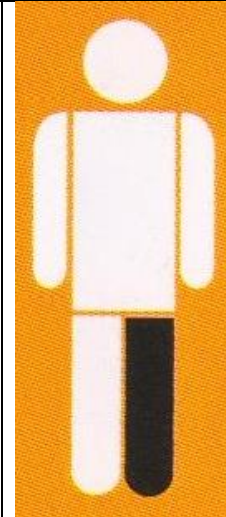
There is no direct base standard, however while preparation of this standard considerable assistance is derived from procedure prepared previously by AISC, which is incorporated as Part A of this standard in the form of Ad-on controls or secondary controls and further addition of allowable minor modifications for M1 and N1. Regulation (EU) 2007/46/EC and Regulation (EU) 2018/858 is cross-referred in Part C of this standard. Part C contain major modifications for M1 vehicle adaptation. Annexure C1, for additional requirements for testing the wheelchair tie down and occupant restraint system for adapted vehicles of category M1. UN R107 is cross referred in Part B for small M2 and M1 vehicles for vehicle accessibility and accommodation related requirements.

The AISC panel and the Automotive Industry Standards Committee (AISC) responsible for preparation of this standard are given in Annexure 1 and Annexure 2 respectively.

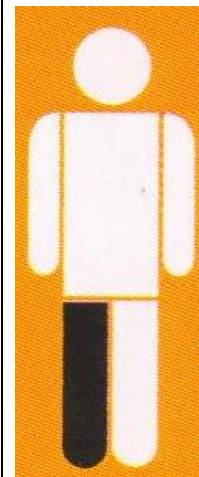
Photographs for Part A modifications as example only

(Photographs are provided only for illustrative purpose and does not cover all the Part A adaptations)

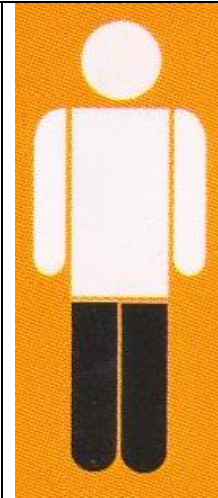
Brake and accelerator control in left hand operated mobility device fixed near steering wheel. Adaptation for differently abled driver with right lower limb disability.



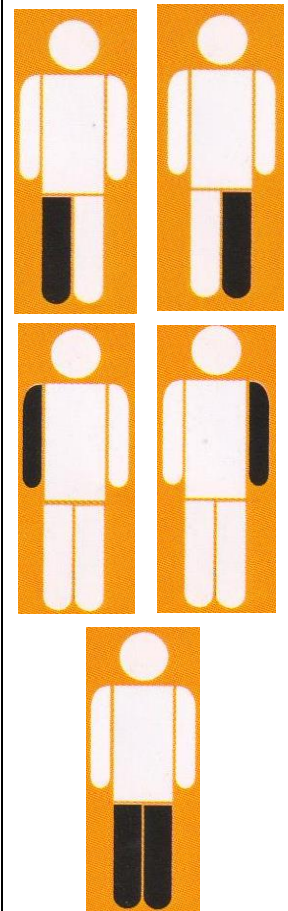
Clutch control in hand operated mobility device, fixed to gear knob for use by differently abled driver having left lower leg disable.



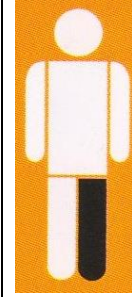
Clutch, brake and accelerator are controlled by hand operated mobility device fixed near gear knob and steering wheel to be used by differently abled driver with both lower leg disabled.



Steering wheel nob: hand operated mobility device fixed to steering wheel to be used by differently abled driver with one hand disability and one or both lower leg disability.



Accelerator extension control: Left leg operated mobility device, fixed near brake pedal, to be used by right lower limb disabled differently abled driver.



Brake & accelerator control with the left hand or pedal extension and seat modification as per height of differently abled driver.



Photographs for Part B modifications as example only

(Photographs are provided only for illustrative purpose and does not cover all the Part B adaptations).



Photographs for Part C modifications as example only

(Photographs are provided only for illustrative purpose and does not cover all the Part C adaptations)





Above photograph is to demonstrate only ramp fitment on side entry and fitment support handles on seats. It is not to say anything about RHD to LHD conversion



Guidelines on Provisions for Adapted Vehicles of categories M1, N1 and M2

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Guidelines on Provisions for Adapted Vehicles of categories M1, N1 and M2

1.0	SCOPE
	<p>The provisions of this code are applicable to following adapted vehicles:</p> <p>Part A: Provisions for vehicle adaptation when minor modifications are carried out by introducing secondary control(s) and/or allowable minor modifications as listed in Part A so as differently abled driver* with limb disability can drive adapted vehicle of categories M1 and / or N1 (including N1 derived from M1).</p> <p>Part B: Provisions for adapted vehicles of category M1 and M2 (including M2 derived from M1) having seating capacity not exceeding 12 seats excluding driver before adaptation. Adaptation in this part are with respect to vehicle accessibility and wheel chair accommodation.</p> <p>Part C: Provisions for adapted vehicles of category M1 when major vehicle modifications are carried out which needs reverification and / or re-testing by testing agency for differently abled driver and / or passengers with reduced mobility.</p> <p>Part D: Information on: vehicle adaptation recent legal provisions; authorized workshops / retro-fitters in India; and panel's recommendations.</p> <p>This standard is not applicable to provisions related to drivers of M2.</p>
1.1	Definitions - The definitions are for the purpose of this standard
1.1.1	<p>"Adapted vehicle" means a motor vehicle either specially designed and constructed, or to which alterations have been made under sub-section (2) of section 52, for the use of a person suffering from any physical defect or disability, and used solely by or for such person. (Reference: Motor Vehicle (Amendment) Act 2019 No. 32 of 2019 issued by Ministry of Law and Justice dated 9th August 2019.)</p>
1.1.2	<p>(a) "Low floor vehicle M1 category" for the purpose of this standard is a vehicle, which has vehicle accessibility area without steps.</p> <p>(b) "Low floor vehicle of M2 category" for the purpose of this standard is a vehicle having passenger seating capacity not exceeding 12 excluding driver before adaptation in which at least 35 per cent of the area is available for wheel chair user, an area without steps and includes access to at least one service door.</p>
1.1.3	<p>"Exterior courtesy lamp" means a lamp used to provide supplementary illumination to assist the entry and exit of the vehicle driver and passenger or in loading operations as applicable for the specific adaptation.</p> <p>Note: In case of M1 category vehicles, ramp conspicuity in the form of LED strips is required, however when ramps are illuminated by any means or feature on vehicle / ramp and it meets visibility needs, ramp conspicuity in the form of LED strips and Exterior courtesy lamp are deemed to be complied with.</p>
<p>* For the purpose of this standard, terminology of "Differently abled driver" is used throughout this standard for driver with limb disability or short stature and is eligible to drive Adapted Vehicle.</p>	
1.1.4	<p>"Emergency or assist lighting system" means a system that provides a minimum level of lighting necessary to enable occupants to safely egress from the vehicle.</p>

1.1.5	<p>(a) “Differently abled driver*” means person with limb disability[#] including person with short stature and is eligible to drive adapted vehicle(s) of category M1 and / or N1 having complied with provisions about disability mentioned in this standard and driving licence tests. Here person with short stature is as specified in Person with Disability Act 2016.</p> <p>(b) "Passenger with reduced mobility" means all passengers who have a difficulty when using public transport, such as disabled person, wheelchair users, person with limb impairments, elderly person (senior citizens), visually impaired, hearing impaired, short stature.</p> <p>Note: *Various limb disability and short stature considerations for vehicle adaption are mentioned in Part A of this standard.</p> <p># For the purpose of this standard Person with limb disability also includes person having operated for spinal cord injury or disc disorder.</p>
1.1.6	" Wheelchair user " means a person who due to infirmity or disability uses a wheelchair for mobility.
1.1.7	<p>“Priority Seats” means a seat with additional space for elderly people who do not have limb impairments but are with reduced mobility. In public transport vehicles (e.g. taxi), these specific seats are marked accordingly.</p> <p>Note: Priority Seats are optional and wherever these seats are provided in vehicles of categories M1 or M2, they shall meet the requirements of the standard. In case of vehicles of category M1 fitted with swivel or rotary seat at co-driver position, the requirement of priority seat is deemed to be complied with.</p>
1.1.8	" Boarding device " means a device to facilitate wheelchair access to vehicle, such as lifts, ramps, portable ramp, etc.
1.1.9	" Lift " means a device or system with a platform that can be raised and lowered to provide driver or passenger access in the vehicles.
1.1.10	" Ramp " means a device to bridge the gap between the floor of driver and /or passenger compartment and the ground or kerb. In its position for use, it includes any surface that may move as part of the ramp deployment or be available for use only when the ramp is in its deployed position and over which a wheelchair is intended to travel.
1.1.11	" Portable ramp " means a ramp that may be detached from the vehicle structure and capable of being deployed by a driver or passenger and also can be carried in the vehicle.
1.1.12	<p>a) "Demountable seat" means a seat that can be easily detached from the vehicle.</p> <p>b) Foldable seats are seats with easy entry mechanism as specified in IS15546 AIS-023 as amended time to time.</p>
1.1.13	" Kneeling system " means a system which lowers and lifts totally or partially the body of a vehicle relative to the normal position of travel.
1.1.14	" Swivel Seats " means the seat that can swivel to 90 degrees in either direction in the front co-passenger seat in M1 category due to limited space. In case of M2 category swivel can be 360 degrees but the swivel seat must have a locking system in place.
1.1.15	Secondary controls are ad-on dual controls, which does not change basic control or systems of vehicle. Performance of Secondary controls are verified as per Part A of this standard.
1.1.16	Docking tie-down device or docking securement device means assembly of fixtures and components designed for installation in motor vehicles for the purpose of securing a wheelchair

	<p>by engaging with, and locking onto, securement points on the wheelchair frame or on wheelchair securement adaptors attached to the wheelchair frame</p> <p>NOTE: Securement of the wheelchair generally occurs automatically during wheelchair engagement with the device in the vehicle, but release of the wheelchair usually requires operation of a mechanical lever or electrical switch.</p>
2.0	Technical and safety requirements
2.1	Consideration of Vehicle Age for adaptation
2.1.1	While adaptations as per Part A of this standard for differently abled driver are being carried out, vehicle having valid registration can be considered for adaptation.
2.1.2	When N1 vehicle adaptation are taken up for hire and reward purpose, however adaptations as per Part A of this standard are only carried out, vehicle having valid registration can be considered for adaptation.
2.1.3	When vehicle adaptation are taken up for hire and reward purpose (e.g. passenger wheelchair taxi service, mobile shops are fabricated for self-reliance) and also necessitating allowable structural changes or allowable major modifications, vehicle upto 5 (five) years age (from its date of registration) and having valid registration can be considered for adaptation
2.2	Change in seating capacity after adaptations: Calculation of change in seating capacity shall be done as per criteria specified in W8 of Part C of this standard.
2.3	Recommendations on adaptation for rear engine vehicle
2.3.1	In case of M1 vehicles with rear engine, adaptations specified in Part A of this standard may be carried out.
2.3.2	In case of M2 vehicles wheelchair lifts may be fitted for side entrance for vehicle accessibility.
2.4	(Reserved)
2.5	<p>Braking Performance & Vehicle Stability Function: When vehicle modified still meets braking performance as that of original type approved vehicle considering criteria for extension of approval. Declaration for vehicle compliance for braking performance as that of original type approved vehicle shall be submitted by the manufacturer or retro-fitter, in such case test according to paragraph A 4.1 shall be carried out.</p> <p>If base vehicle is fitted with ESC and modifications are done while adaptation, Criteria for extension of approval specified in AIS-133, as amended from time to time shall be followed.</p>
2.6	Fire extinguisher: Wherever provided, fire extinguisher shall be well secured and easily accessible in the vehicle.
2.7	EMC/EMI: Wherever vehicle and /or wheel chairs are added with electronic system(s), or ESA they shall comply with requirements specified in AIS-004 (Part 3) as amended from time to time.
2.8	Kneeling System wherever provided in M1 or M2 category vehicles: Vehicles shall be provided with ramp or other device facilitating boarding and alighting of wheel chair user.
	At the choice of manufacturer or retro-fitter, vehicle with air suspension may be taken up for adaptations by providing kneeling system. Wherever Kneeling System is provided, kneeling height shall be 60 mm at the entry/exit level.

2.8.1	Unless otherwise stated, all measurements shall be made when the vehicle is at its unladen weight and it is standing on a smooth and horizontal ground surface and in the normal condition for travel. If a kneeling system is fitted, it shall be set so the vehicle at its normal ride height for travel.
2.8.2	Wherever there is a requirement in this Standard for a surface in the vehicle to be horizontal or at a specific angle when the vehicle is at its unladen weight, in the case of a vehicle with mechanical suspension, the surface may exceed this slope or possess a slope when the vehicle is in unladen weight, provided that this requirement is met when the vehicle is in the loading condition declared by the manufacturer or retro-fitter. If a kneeling system is fitted to the vehicle, it shall not be in operation.
2.8.3	In low floor vehicles with floor height up to 400mm, ramp or kneeling system, but not a retractable step, may be engaged. In other vehicles ramp or either a kneeling system and/or a retractable step may be engaged.
2.8.4	In the event of the failure of a safety device, lifts, ramps and kneeling systems shall be incapable of operation, unless they can be safely operated by manual effort. The type and location of the emergency operating mechanism shall be clearly marked. In the event of power failure, lifts and ramps shall be capable of manual operation.
2.8.5	A switch shall be required to enable operation of the kneeling system.
2.8.6	Any control which initiates the lowering or raising of any part or the whole of the bodywork relative to the road surface shall be clearly identified and be under the direct control of the driver.
2.8.7	The lowering process shall be capable of being stopped and immediately reversed by a control both within the reach of the driver in seated position, and also adjacent to any other operating controls provided for the operation of the kneeling system.
2.8.8	Any kneeling system that is fitted to a vehicles shall not allow the vehicles to move when the vehicles is lower than the normal height of travel.
2.9	Emergency Lighting System for M1 and M2 category vehicles:
2.9.1	Vehicles of M1 and M2 shall be equipped with an emergency lighting system. Note: In case of M1 category vehicle when room light illuminate passenger area, Emergency or assist lighting requirement is deemed to be complied with. This needs to be demonstrated by the manufacturer or retro-fitter to the satisfaction of test agency.
2.9.2	It shall be possible for the driver to activate the emergency lighting system from the driver's seating position.
2.9.3	The operation of the emergency control of any door shall activate the emergency lighting system.
2.9.4	The emergency lighting system, once activated, shall remain active for at least 15 minutes unless de-activated by the driver.
2.9.5	The power supply for the emergency lighting shall be suitably located within the vehicle to minimise the risk of its continued operation being prejudiced as the result of an accident.
2.9.6	All units providing the emergency lighting shall produce a white light.

2.9.7	Maximum uniformity of illuminance <u>Maximum lighting level recorded</u> Average lighting level recorded
2.9.8	Minimum uniformity of illuminance <u>Minimum lighting level recorded</u> Average lighting level recorded
2.9.9	The emergency lighting system shall provide a minimum illuminance of 10 lx throughout the passenger compartment at a height of 750mm above vehicle floor.
2.9.10	The uniformity of the illuminance over the length of the passenger compartment at a height of 750 mm above vehicle floor shall be between 0.15 and 2.
2.9.11	The emergency lighting system shall provide a minimum illuminance of 1 lx at floor level.
2.9.12	Conformity with the uniformity requirements shall be demonstrated over a period of at least 15 minutes from initiation of the emergency lighting by measurements taken at distances not exceeding 2m.
2.9.13	Control of the mandatory interior lighting shall be by manual switches under the control of the driver or automatically controlled.
2.9.14	Individual lights for each of the items in Paragraph 2.9.1 above are not required providing adequate illumination can be maintained during normal use.
2.10	(Reserved)
2.11	(Reserved)
2.12	Accommodation and Accessibility for Passengers of Reduced Mobility
	Vehicles with maximum 650 mm floor height shall be accessible for people with reduced mobility with wheel chair according to the technical provisions laid down in Part B of this standard.
2.13	Intelligent Transport System (ITS) Equipment for public transport vehicle of category M1 and M2.
2.13.1	Vehicle tracking devices may be fitted as per AIS-140 as amended from time to time for facilitating emergency support to occupants of vehicle.
2.13.2	CCTV System with and Integrated Emergency System for vehicles :
	CCTV System, if fitted, shall be complying with the requirements specified in IS 16833 as amended from time to time.
2.14	Speed Limiter requirement for transport vehicles of category M1, N1 and M2: Requirement of AIS-018, as amended from time to time shall be complied with. In case of retro-fitment of vehicle for vehicle adaptation, original setting of speed limiting devices shall not be changed.
2.15	Hill hold ability or sensible braking system: While travelling on gradients with frequent start and stops, unexpected forward or rearward movement of vehicle shall be restricted, Note: This requirement is optional and wherever these systems are fitted in M1 category vehicles, they shall comply with requirements of the Part C, Annexure C-2 of the standard.

2.16	<p>Docking Systems: Wheelchair docking is an alternative system for securing the wheelchair to the floor of a vehicle. Docking systems use an automated clamp like device mounted to the floor that locks on to a pin that is added to the frame of the wheelchair. Docking systems utilize an electronic push- button control console for quickly locking and releasing the wheelchair, eliminating the need for tie-down straps. Wherever docking systems are provided they shall comply with relevant requirements of Part C, Annexure C1 of this standard.</p>
2.17	<p>Exterior courtesy lamp: wherever these lamps are provided they shall meet relevant requirements AIS-008 (Rev. 2) as amended from time to time.</p>
2.18	<p>Ramp conspicuity lamp:</p> <ol style="list-style-type: none"> 1. Presence: Required on M1 and M2 category vehicles when ramp is in use. 2. Number: No special requirements. 3. Arrangement: No special requirement. 4. Position: No special requirement (Ramp shall have adequate illumination when lit) 5. Geometric visibility: No special requirement. 6. Orientation: No special requirement. 7. Light source: No special requirement 8. Color of light emitted: No special requirement 9. Electrical connections: Control shall be by manual switches under the control of the driver or automatically controlled when ramp is in use.

PART A: APPROVAL OF RETRO FITMENT/ ADAPTATION KIT FOR FOUR WHEELED VEHICLE FOR DIFFRENTLY ABLED DRIVER	
A 1.0	OBJECTIVE <ul style="list-style-type: none"> ➤ To provide safe mobility to a person having lower or upper limb physical disability. ➤ To standardize modifications in the four wheeled vehicles of category M1 and N1 to make them suitable for a specific type of disability ➤ After complying provisions mentioned in Part A of this standard for N1 adaptation, it is expected that, differently abled driver can have his small business in the form of mobile shop (e.g. mobile food stall, vegetable shop, zerox shop, etc.) to achieve self-reliance. The movement of such N1 adapted vehicles shall be restricted within transport jurisdiction limits of the registering authority under which it has been registered.
A 2.0	POSSIBLE MODIFICATIONS IN THE VEHICLE (M1 and N1 categories) <p>Modifications to be carried out would solely depend upon the type and nature of physical disability of a person. Usually these modifications would involve shifting/ relocation/ adaptation of foot controls and/ or hand controls.</p> <p>Vehicle with manual transmission as well as with automatic transmission may be considered for carrying out modifications. Details regarding type of disability, vehicle selection, recommended solution for retro fitment/ adaptation, etc. are given in Annexure A-1 of this standard.</p>
A 2.1	List of minor allowable modifications for vehicle adaptation as per Part A of this Standard: When following minor modifications are already approved as a part of Adaptation Retro-fitment kit for specific vehicle model / OE genuine parts, further testing while adaptation as per part A is not required:
A 2.1.1	Increase of door opening, where door stopper length is to be increased and / or door hinge is to be modified.
A 2.1.2	Fitment of steering knob for one hand steering operation.
A 2.1.3	Fitment of light switch to operate lights / wipers in dual / tandem to the original system of the vehicle.
A 2.1.4	Adaptation and fitment of Swivel (Rotary) cum transfer seat mechanism in the front LHS (co-driver side) of the vehicle.
A 2.1.5	Adaptation and fitment of Swivel (Rotary) cum transfer seat mechanism in the rear seat of a suitable vehicle.
A 2.1.6	Fitment of wheelchair hoist or chair topper on the roof of the vehicle to load and unload the wheelchair. Fitment will be just like the fitting of a normal roof carrier.
A 2.1.7	Fitment of mechanical lever to operate the original light control levers from left side to right side and vice versa in cases of either hand disability.
A 2.1.8	Fitment of switch on the flooring in automatic or AMT vehicles to operate the lights as required for cases of persons with either hand disability.

A 2.1.9	Fitment or adaptations of telescopic portable ramps for loading wheelchairs into the vehicle.									
A 2.1.10	Fitment of CP seat (like a child seat) inside the vehicle.									
A 2.1.11	Fitment of curtains or screen inside the vehicle, specially required to keep the sun off the disabled person, and also when they have to change, clothes or relieve themselves inside the vehicle.									
A 2.1.12	Fitment of light on roof top in adapted vehicle symbol.									
A 2.1.13	Increasing height of gear nob.									
A 2.1.14	Fitment of system which will act as parallel system for signal activation.									
A 2.1.15	Fitment of light for illumination, so that ramp will be properly visible after opening of door.									
A 2.1.16	Buzzer while ramp is in use. Portable Ramp may have lights and buzzer.									
A 2.1.17	Folding support (handle) to ease-out standing while egress from vehicle. This is fitted at door lock hook.									
A 2.1.18	Fitment of hand rest to bucket seat.									
A 2.1.19	Increasing seat height.									
A 2.1.20	Increasing seat cushion.									
A 2.1.21	Provision of puncture repair kit.									
A 2.2	Allowable alterations in Motor Vehicles by owner of the vehicle without further certification and without modification in Registration Certificate (Ref. No. RT-11036/06/2019-MVL dated 28 th February 2019 by MoRTH)									
A 2.2.1	Replacement of parts or components by the identical parts or components.									
A 2.2.2	Replacement of parts or components with parts or components with equivalent performance.									
A 2.2.3	Optional parts or components as prescribed by vehicle's manufacturer.									
A 2.2.4	Following modifications are permissible in the motor vehicles, subject to conditions mentioned below (only relevant shall criteria reproduced below) <table><tr><th>Sr. No.</th><th>Changes of parameter</th><th>Subject to compliance of the following</th></tr><tr><td>1.</td><td>Seats A. Lateral / side facing seat fitment or alteration in 4 wheelers B. Deletion of seats</td><td>1. Vehicle weight after the alteration / changes not to exceed the permissible Gross Vehicle Weight 2. Seating capacity to remain within the same motor vehicle category 3. Seating dimensions as per prescribed specifications.</td></tr><tr><td>2.</td><td>Soft top to hard top or vice versa in M1 vehicles</td><td>4. Seats fitted should not obstruct other occupant(s) 5. Folding seats, if fitted, should have auto lock in both used / unused position. 6. Such seats shall be fitted in rows other than first row of the driver. 7. Such fitments shall not obstruct ingress and egress of the occupants.</td></tr></table>	Sr. No.	Changes of parameter	Subject to compliance of the following	1.	Seats A. Lateral / side facing seat fitment or alteration in 4 wheelers B. Deletion of seats	1. Vehicle weight after the alteration / changes not to exceed the permissible Gross Vehicle Weight 2. Seating capacity to remain within the same motor vehicle category 3. Seating dimensions as per prescribed specifications.	2.	Soft top to hard top or vice versa in M1 vehicles	4. Seats fitted should not obstruct other occupant(s) 5. Folding seats, if fitted, should have auto lock in both used / unused position. 6. Such seats shall be fitted in rows other than first row of the driver. 7. Such fitments shall not obstruct ingress and egress of the occupants.
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A 3.0	APPROVAL OF RETRO FITMENT/ ADAPTATION KIT
A 3.1	<p>Application for approval</p> <p>Kit manufacturer shall submit the already type approved vehicle model fitted with recommended retro fitment / adaptation kit along with technical information as per details given in Annexure A-2 of this standard.</p>
A 4.0	<p>REQUIREMENTS</p> <p>The vehicle model fitted with retro fitment/ adaptation kit shall be tested for tests as mentioned in A4.1 to A4.4. When vehicle model or type of disability changes compared to earlier approval, re-verification as per Part A of this standard shall be carried out. However, in case of earlier approvals granted for vehicle adaptation involving multiple disability compliance and deletion of any one of the disability from retro-fitment kit feature shall not necessitate such re-verification.</p>
A 4.1	<p>Functional brake test</p> <p>Vehicle shall be driven on a normal city road at 50 km/h speed (as indicated on speedometer). Service brake shall be applied and the stopping behavior of the vehicle shall be checked. During this test, the vehicle shall not show any instability or unsafe condition.</p>
A 4.2	<p>Functional gradeability test</p> <p>The vehicle shall be driven on the minimum 7 degree gradient such as city fly over. While negotiating the gradient, brakes shall be applied. The vehicle shall not skid and roll back. There shall be provision of applying and releasing parking brake. On release of brake, the vehicle shall be able to easily climb the gradient.</p>
A 4.3	<p>Functional steerability test</p> <p>The vehicle shall be able to negotiate the steering course as per figure of '8'</p>
A 4.4	<p>Accessibility and operational functionality of hand controls</p> <p>Accessibility and operational functionality of various hand controls for the devices such as head lamps, direction indicators, horn, wind screen wiping system etc. shall be checked.</p>

A 4.5	<p>Identification symbol</p> <p>The vehicle shall carry following symbol on the front and rear, indicating that the vehicle is meant for driving by a differently abled driver. The symbol shall be made up of retro-reflective material (tape)</p> <p>Wherever space constraint is there, square blue background below may be provided in circular shape having diameter 80 mm.</p> <div data-bbox="578 415 1222 819" data-label="Image"> </div> <p style="text-align: center;">Figure A-1</p> <p>Note: Affixing of symbol shall not obstruct drivers field of vision.</p>										
A 4.6	<p>Failure mode effect analysis (FMEA) and trouble-shooting guidelines as submitted by the installer shall be examined. Following FMEA and trouble-shooting guidelines are as example only. As per vehicle adaptation these are liable to change.</p>										
A 4.6.1	<p>Vacuum assisted Hand operated Clutch:</p> <table border="1" data-bbox="302 1066 1468 1902"> <tr> <td data-bbox="302 1066 586 1205">Clutch not operating</td><td data-bbox="586 1066 1468 1205"> <p>NOTE :(Make sure the engine is running while checking the vacuum assisted hand operated clutch)</p> <p>Check if the clutch ON / OFF Master switch is in “ON” position</p> </td></tr> <tr> <td data-bbox="302 1205 586 1398">If clutch ON/ OFF Master switch is “ON” and the switches on the gear lever do not operate</td><td data-bbox="586 1205 1468 1398"> <p>Check for faulty Master switch or the supply voltage to the ON / OFF Master.</p> </td></tr> <tr> <td data-bbox="302 1398 586 1518">If supply to the ON / OFF Master switch is OK</td><td data-bbox="586 1398 1468 1518"> <p>It indicates that the Master switch is faulty and needs to be replaced.</p> </td></tr> <tr> <td data-bbox="302 1518 586 1738">If the ON / OFF Master switch is working and both the switches on the gear lever is not working.</td><td data-bbox="586 1518 1468 1738"> <p>The wiring from the Master switch to the gear lever switch is faulty and needs to be rectified / replaced.</p> </td></tr> <tr> <td data-bbox="302 1738 586 1902">If all the switches are operational and you can hear the click of the solenoid valve.</td><td data-bbox="586 1738 1468 1902"> <p>Check if the cable is broken (at the clutch pedal end or at the connector of the rubber bellows fitted under the co-driver seat). If cable is broken then replace with new cable of same specification.</p> </td></tr> </table>	Clutch not operating	<p>NOTE :(Make sure the engine is running while checking the vacuum assisted hand operated clutch)</p> <p>Check if the clutch ON / OFF Master switch is in “ON” position</p>	If clutch ON/ OFF Master switch is “ON” and the switches on the gear lever do not operate	<p>Check for faulty Master switch or the supply voltage to the ON / OFF Master.</p>	If supply to the ON / OFF Master switch is OK	<p>It indicates that the Master switch is faulty and needs to be replaced.</p>	If the ON / OFF Master switch is working and both the switches on the gear lever is not working.	<p>The wiring from the Master switch to the gear lever switch is faulty and needs to be rectified / replaced.</p>	If all the switches are operational and you can hear the click of the solenoid valve.	<p>Check if the cable is broken (at the clutch pedal end or at the connector of the rubber bellows fitted under the co-driver seat). If cable is broken then replace with new cable of same specification.</p>
Clutch not operating	<p>NOTE :(Make sure the engine is running while checking the vacuum assisted hand operated clutch)</p> <p>Check if the clutch ON / OFF Master switch is in “ON” position</p>										
If clutch ON/ OFF Master switch is “ON” and the switches on the gear lever do not operate	<p>Check for faulty Master switch or the supply voltage to the ON / OFF Master.</p>										
If supply to the ON / OFF Master switch is OK	<p>It indicates that the Master switch is faulty and needs to be replaced.</p>										
If the ON / OFF Master switch is working and both the switches on the gear lever is not working.	<p>The wiring from the Master switch to the gear lever switch is faulty and needs to be rectified / replaced.</p>										
If all the switches are operational and you can hear the click of the solenoid valve.	<p>Check if the cable is broken (at the clutch pedal end or at the connector of the rubber bellows fitted under the co-driver seat). If cable is broken then replace with new cable of same specification.</p>										

	If all the switches are operational and you cannot hear the click of the solenoid valve.	Indicated that the solenoid valve is faulty and need to be replaced.
	If Cable is found to be OK.	Press either button on the gear lever, if a hissing sound is heard, it indicates the rubber bellows assembly located under the co-driver seat is leaking and needs replacement.
	Clutch operates very slowly and does not engage/disengage fully.	Check for wear on the clutch cable and replace with new cable.
	If cable is found to be in good condition.	Check the vacuum line for leaks. Tighten all hose clips, and check if the vacuum pipe is damaged or cut. Replace with high quality vacuum pipe only. Do not use any other pipe besides recommended vacuum pipe.
	Applicable only for vehicles fitted with brake and accelerator switch console.	
	Small red clutch switch on switch console not working	If the switches on the gear lever are operational, it indicates that the switch console switch is faulty and needs to be replaced.
	Recommendations:	Check clutch cable for wear every 6 months. Replace with recommended cable only.
		Hand operated Cable: For replacement use OE genuine clutch cable only.
		Check Bellows for any signs of fatigue or wear every 12 months and replace every 18 - 24 months
A 4.7	Retro-fitment kit installer shall provide user guide (instruction manual) to vehicle owner involving at least following instructions: 1. Name of Retro-fitter and his contact details, including mobile number / helpline number. 2. Ways for effective use of secondary controls fitted while vehicle adaptation. 3. Remedies on possible failures.	
A 5.0	APPROVAL OF WORKSHOPS FOR THE FITMENT OF APPROVED KIT The kit manufacturer shall identify the workshops, which shall carry out the fitment on his behalf. This shall be done on the basis of: <ul style="list-style-type: none"> - Competence - Availability of necessary of equipment - Experience in the relevant field. - Trained manpower etc. 	
A 6.0	TYPES OF PHYSICAL DISABILITIES THAT CAN BE CONSIDERED FOR USE OF ABOVE VEHICLES WITH RETRO-FITTED / ADAPTATION KIT Authorized medical practitioner shall examine type of physical disabilities of the person and may calculate degree of disability based on specific norms. Physical disabilities more than 25% may be acceptable for person with disability to be differently abled driver	

	<p>for driving a vehicle fitted with retro fitment / adaptation kit.</p> <p>Following are some typical disabilities of limbs, for consideration for driving:</p> <ol style="list-style-type: none"> Left leg (partial or full) : May be considered Right leg (partial or full) : May be considered Both leg (partial or full) : May be considered Left /right hand (partial or full): May be considered Both hands (partial or full): Not recommended under normal situations. May be considered under special case. Person with short stature: May be considered <p>Following aspects may be considered for certifying the differently abled driver for his driving abilities of the vehicle fitted with retro fitment /adaptation kit.</p> <ol style="list-style-type: none"> Vision; Muscle strength, flexibility and range of motion; Co-ordination and reaction time; Judgment and decision making abilities; Ability to drive with adaptive equipment as specified above. <p>Medical report may contain specific recommendations on driving requirements or restrictions.</p>
A 7.0	<p>REGISTRATION OF VEHICLE FITTED WITH RETRO FITMENT/ ADAPTATION KIT AND OFFERING DRIVING LICENSE.</p> <p>Road Transport Authorities (RTO) shall register the vehicle fitted with approved retro fitment / adaptation kit for a person with physical disabilities as adapted vehicle in compliance to:</p> <ul style="list-style-type: none"> - Valid certificate of retro fitment / adaptation kit from authorized Test Agency. - Valid certificate of authorized workshop for the fitment of approved retro-fitment or adaptation kit. - Medical fitness certificate from authorized medical practitioner. - Driving test.

ANNEXURE A-1

(Ref. clause A2.0)

Sr. No. (1).	Type of Physical Disability (2)	Vehicle Selection* (3)	Recommended modifications (4)
1	Impairment in both legs.	Manual clutch/ gear shift mechanism OR Automatic Transmission	a) Hand operated driving control for Clutch, Gearshift, Brake and Accelerator. OR a) In case of automatic transmission, hand operated driving control for Brake and Accelerator. b) Unit providing easy hand operated controls such as head lamps, direction indicators, horn. wind screen wiping system etc. (optional). c) Space for aids / crutches / wheel chair (optional). d) Symbol for vehicle for a person with physical disability
2	Impairment in left leg.	Manual clutch/ gear shift mechanism OR Automatic Transmission	a). Hand operated driving control for Clutch, Gear shift mechanism, right leg for accelerator and brake pedal. OR a) In case of automatic transmission, no modifications required. b) Space for aids / crutches (optional). c) Symbol for vehicle for a person with physical disability
3	Impairment in right leg	Manual clutch/ gear shift mechanism OR Automatic Transmission	a) Hand operated driving control for, Brake and Accelerator. OR In case of automatic transmission left leg operated driving control for brake and accelerator pedal. b) Space for aids / crutches (optional) c) Symbol for vehicle for a person with physical disability
4	Impairment in Left /right hand (partial or full)	Automatic Transmission	a) Unit providing easy hand operated controls such as head lamps, direction indicators, horn, wind screen wiping system etc., (optional) b) Steering knob
5.	For short height person	Automatic Transmission	a) Brake and accelerator control with the left hand or pedal extension and seat modification as per height.
		Manual clutch	b) Hand operated driving control for Clutch, Gearshift, Brake and Accelerator.

* MORTH advisory dated 13th November 2020 states that “vehicles with automatic gear have been considered suitable for driving by some of the divyangjan without altering the vehicle.

ANNEXURE A-2

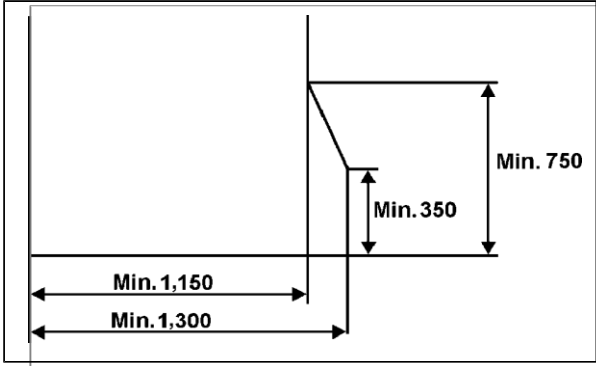
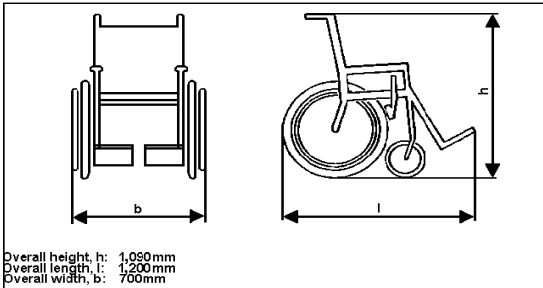
(Ref. Clause A3.1)

**TECHNICAL INFORMATION TO BE SUBMITTED BY THE VEHICLE
MANUFACTURER/RETRO-FITTER FOR COMPLIANCE OF PART A
OF THIS STANDARD**

1.0	Manufacturers /Retrofitter's name and address	
1.1	Tel. / Mobile No.	
1.2	Fax No.	
1.3	E mail address	
1.4	Contact person	
1.5	Website address, if any.	
2.0	Vehicle model selected for retro fitment/adaptation.	
3.0	Details of modifications carried out on the original vehicle	
4.0	Authenticated drawings, in duplicate, with following details a) Kit identification / model No. b) List of kit components c) Details of individual component and assembly of kit on the vehicle e) Locations and fixing details for person's aids / crutches / wheel chair etc.	
5.0	Instruction / Maintenance manual	
6.0	Detailed explanation about safety in case accidental failure of modified control other mechanisms	

PART B: WHEEL CHAIR ACCOMODATION AND VEHICLE ACCESSIBILITY REQUIREMENTS

B 1.0	<p>GENERAL</p> <p>This part contains the provisions for M2 vehicles which apply to a vehicle designed for easy access for passengers with reduced mobility using wheelchair. This part also contains the vehicle accessibility and wheel chair accommodation related provisions for M1 vehicles, which are not covered in Part C of this standard. For the purpose of this part, in case of M1 category vehicle, wheelchair user can be passengers with reduced mobility or differently abled driver.</p>
B 2.0	(Reserved)
B 3.0	REQUIREMENTS
B 3.1	<p>Steps (if provided) for M2 and M1 category vehicles: The height of the first step from the ground of door shall not exceed 250 mm.</p> <p>In low floor vehicle only a kneeling system (if provided), but not a retractable step, may be engaged. In other vehicles either a kneeling system and/or a retractable step may be engaged.</p> <p>In case of M1 category vehicles adaptation steps, running boards may be provided.</p>
B 3.2	Space for Passengers with Reduced Mobility for M2 and M1 category vehicles
B 3.2.1	Seats shall be either forward or rearward facing and shall be situated in a position suitable for boarding and alighting.
B 3.2.2	The minimum width of a priority seat cushion, measured from a vertical plane passing through the centre of that seating position, shall be as per AIS-023 / IS 15546 as applicable and as amended from time to time.
B 3.2.3	The height of the uncompressed seat cushion relative to the floor shall be such that the distance from the floor to a horizontal plane tangent to the front upper surface of the seat cushion is between 400 mm and 500 mm.
B 3.3 to B3.5	(Reserved)
B 3.6	Wheelchair accommodation provisions for M1 and M2 category vehicles:
B 3.6.1	<p>For each wheelchair user provided for in the passenger compartment there shall be a special area at least 750 mm wide and 1,300 mm long sufficient for the easy movement of wheelchair user. The longitudinal plane of the special area shall be parallel to the longitudinal plane of the vehicle and the floor surface of the special area shall be slip resistant and the maximum slope in any direction shall not exceed 5%. In the case of a rearward facing wheelchair complying with the requirements specified in Paragraph B 3.8.4 of this part, the slope in the longitudinal direction shall not exceed 8% provided that this slope inclines upwards from the front end to the rear end of the special area.</p> <p>In the case of a wheelchair space designed for a forward facing wheelchair, the top of preceding seat-backs may intrude into the wheelchair space if a clear space is provided (See Fig. B-1 below to this part).</p>

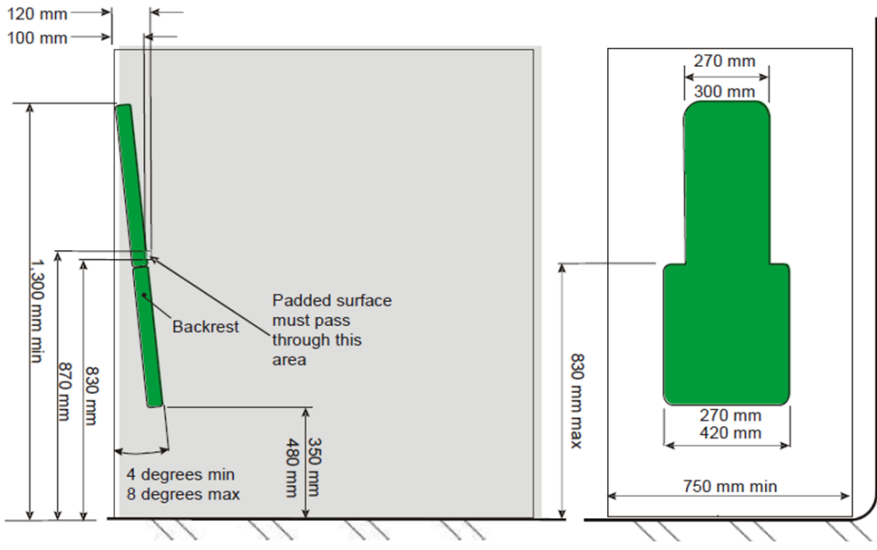
	 <p>Figure B-1: Minimum Clear Space for the Wheelchair User at the Wheelchair Space.</p> <p>In case of M1 category vehicle, adaptation for clause B 3.6.1, condition specified under W3 in Part C of this standard may be alternatively complied with at the choice of manufacturer/ retro-fitter.</p>
B 3.6.2	There shall be at least one doorway through which wheelchair users can pass. The wheelchair access door shall bear a boarding device complying with the provisions of Paragraph B 3.11.3. (a lift) or B 3.11.4. (a ramp) of this part
B 3.6.3	<p>A door intended for wheel chair access shall have the following minimum dimensions:</p> <p>Height: 1400 mm Width: 900 mm</p> <p>A maximum reduction of 100 mm in the width dimension is permitted at handholds.</p> <p>However, door dimensions less than these minimum values may be permitted in any specific M1 category vehicle if the applicant seeking approval is able to demonstrate that the adult occupant seated in the specific wheel chair is able to conveniently enter and exit through the door.</p>
B 3.6.4	<p>It shall be possible for an occupant seated in a wheel chair of height of approximately 1090 mm, length of approximately 1200 mm and width of approximately 700 mm as shown in fig B-2 to enter and exit the vehicle freely and easily through at least one of its doors.</p>  <p>Figure B-2 Reference Wheelchair</p> <p>However, wheelchairs with dimensions less than these values may be</p>

	permitted in case of M1 category vehicles if the applicant seeking approval is able to demonstrate that the adult occupant seated in that specific wheelchair is able to enter and exit the vehicle freely and easily through at least one of its doors.
B 3.6.4.1	By "moving freely and easily", it is meant that there exists:
B 3.6.4.1.1	Sufficient space available for the wheelchair user to maneuver without the assistance of a person
B 3.6.4.1.2	There are no steps or gaps which could be an obstacle to the free movement of the wheelchair user.
B 3.6.5	In vehicles fitted with a ramp for wheelchair access, it shall be possible for a reference wheelchair having the dimensions shown (See Fig. B-2 to this part) to enter and exit a vehicle with the wheelchair moving in a forward direction.
B 3.6.6	Vehicles fitted with a wheelchair space shall have pictogram in accordance with Figure (See Figure A-1 to Part A of this standard) visible from the outside, both on the front nearside of the vehicle and adjacent to the relevant service door(s).
B 3.7	Vehicles having provisions for passenger with reduced mobility shall have easily visible Adapted Vehicle symbol as shown in Figure under clause A 4.5 to Part A of this standard.
B 3.8	Stability of Wheelchairs for wheelchair user passengers in M2 category vehicle
B 3.8.1	In vehicles required to have occupant restraint systems fitted, the wheelchair space shall be designed for the wheelchair user to travel facing forwards and shall be fitted with restraint systems complying with either the requirements specified in Paragraph B3.8.2. or those specified in Paragraph B3.8.3. below
B 3.8.2	Forward-facing Wheelchair – Static Test Requirements for M2 category vehicle
B 3.8.2.1	Each wheelchair space shall be provided with a restraint system capable of restraining the wheelchair and the wheelchair user.
B 3.8.2.2	This restraint system and its anchorages shall be designed to withstand forces equivalent to the ones required for the passenger seats and occupant restraint systems.
B 3.8.2.3	A static test shall be carried out in accordance with the following requirements:
B 3.8.2.3.1	The forces referred hereto shall be applied in forward and rearward directions, separately and on the restraint system itself;
B 3.8.2.3.2	The force shall be maintained for a period of not less than 0.2 s;
B 3.8.2.3.3	The restraint system shall be capable of withstanding the test. Permanent deformation, including partial rupture or breakage of the restraint system shall not constitute failure if the required force is sustained for the specified time. Where applicable, the locking device enabling the wheelchair to leave the vehicle shall be operable by hand after removal of the traction force.
B 3.8.2.4	In forward direction in the case of a separate wheelchair and wheelchair user restraint system

B 3.8.2.4.1	Wheelchair user restraint system test shall be carried out for anchorages as per IS 15139 as amended from time to time.
B 3.8.3	Forward-facing Wheelchair – Hybrid Test Requirements for M2 category vehicle
B 3.8.3.1	A wheelchair space shall be fitted with a wheelchair restraint system suitable for general wheelchair application and shall allow the carriage of a wheelchair and a wheelchair user facing the front of the vehicle;
B 3.8.3.2	A wheelchair space shall be fitted with a wheelchair user restraint system which shall comprise of a minimum of two anchorage points and a pelvic restraint (lap belt) designed and constructed of components intended to perform in a similar manner to those of a seat belt conforming to IS 15140 as amended from time to time.
B 3.8.3.3	Any restraint system fitted to a wheelchair space shall be capable of being easily released in the case of an emergency;
B 3.8.3.4	Any wheelchair restraint system shall either:
B 3.8.3.4.1	Meet the dynamic test requirements described in Paragraph B3.8.3.8. and be securely attached to vehicle anchorages meeting the static test requirements in Paragraph B3.8.3.6. below; or
B 3.8.3.4.2	Be securely attached to vehicle anchorages such that the combination of restraint and anchorages meets the requirements of Paragraph B3.8.3.8.
B 3.8.3.5	Any wheelchair user restraint shall either:
B 3.8.3.5.1	Meet the dynamic test requirements described in Paragraph B3.8.3.9. and be securely attached to vehicle anchorages meeting the static test requirements in Paragraph B 3.8.3.6. below; or
B 3.8.3.5.2	Be securely attached to vehicle anchorages such that the combination of restraint and anchorages meets the dynamic test requirements described in Paragraph B 3.8.3.9. when attached to anchorages set up as described in Paragraph B3.8.3.6.7.
B 3.8.3.6	A static test shall be carried out on the anchorage points for both the wheelchair restraint system and the wheelchair user restraint in accordance with the following requirements:
B 3.8.3.6.1	The forces specified in Paragraph B 3.8.3.7. below shall be applied by means of a device reproducing the geometry of the wheelchair restraint system;
B 3.8.3.6.2	The forces specified in Paragraph B 3.8.3.7.2. below shall be applied by means of a device reproducing the geometry of the wheelchair user restraint and by means of a traction device specified in IS 15139 as amended from time to time;.
B 3.8.3.6.3	The forces in Paragraph B3.8.3.6.1. above and Paragraph B3.8.3.6.2. shall be applied simultaneously in the forward direction and at an angle of $10^{\circ} \pm 5^{\circ}$ above the horizontal plane;
B 3.8.3.6.4	The forces in Paragraph B 3.8.3.6.1. above shall be applied in the rearward direction and at an angle of $10^{\circ} \pm 5^{\circ}$ above the horizontal plane;
B 3.8.3.6.5	The forces shall be applied as rapidly as possible through the central vertical axis of the wheelchair space; and
B 3.8.3.6.6	The force shall be maintained for a period of not less than 0.2s.

B 3.8.3.6.7	The test shall be carried out on a representative section of the vehicle structure together with any fitting provided in the vehicle which is likely to contribute to the strength or rigidity of the structure.
B 3.8.3.7	The forces specified in Paragraph 3.8.3.6. above are:
B 3.8.3.7.1	In the case of anchorages provided for a wheelchair restraint system fitted to vehicle:
B 3.8.3.7.1.1	1,110 daN \pm 20 daN applied in the longitudinal plane of the vehicle and towards the front of the vehicle at a height of not less than 200mm and not more than 300 mm measured vertically from the floor of the wheelchair space, and
B 3.8.3.7.1.2	550 daN \pm 20 daN applied in the longitudinal plane of the vehicle and towards the rear of the vehicle at a height of not less than 200 mm and not more than 300mm measured vertically from the floor of the wheelchair space;
B 3.8.3.7.2	In the case of anchorages provided for a wheelchair user restraint system the forces shall be in accordance with the requirements of IS 15139 as amended from time to time; The forces shall be applied by means of a traction device as appropriate to the belt type as specified in IS 15139 as amended from time to time.
B 3.8.3.8	A wheelchair restraint system shall be subject to a dynamic test carried out in accordance with the following requirements:
B 3.8.3.8.1	A representative wheelchair test trolley of mass 85 kg shall, from a speed of between 48 km/h to 50 km/h to rest, be subject to a deceleration-time pulse:
B 3.8.3.8.1.1	Exceeding 20 g in the forward direction for a cumulative period of at least 0.015 s;
B 3.8.3.8.1.2	Exceeding 15 g in the forward direction for a cumulative period of at least 0.04 s;
B 3.8.3.8.1.3	Exceeding a duration of 0.075 s;
B 3.8.3.8.1.4	Not exceeding 28 g and for not more than 0.08 s;
B 3.8.3.8.1.5	Not exceeding a duration of more than 0.12 s, and
B 3.8.3.8.2	A representative wheelchair test trolley of mass 85 kg shall, from a speed of between 48 km/h to 50 km/h to rest, be subject to a deceleration-time pulse:
B 3.8.3.8.2.1	Exceeding 5 g in the rearward direction for a cumulative period of at least 0.015 s;
B 3.8.3.8.2.2	Not exceeding 8g in the rearward direction and for not more than 0.02 s;
B 3.8.3.8.2.3	However, for the purposes of this standard, alternatively "A longitudinal horizontal deceleration corresponding to the deceleration pulse given in Fig. 2 of AIS-023 shall be applied.
B 3.8.3.8.3	The test in Paragraph B3.8.3.8.2. above shall not apply if the same restraints are used for the forward and rearward direction or if an equivalent test has been conducted;
B 3.8.3.8.4	For the above test, the wheelchair restraint system shall be attached to either:
B 3.8.3.8.4.1	Anchorage fixed to the test rig which represents the geometry of the anchorages in a vehicle for which the restraint system is intended, or

B 3.8.3.8.4.2	Anchorage forming part of a representative section of the vehicle for which the restraint system is intended, set up as described in Paragraph B3.8.3.6.7. above.
B 3.8.3.9	A wheelchair user restraint shall comply with the test requirements specified in IS 15140 as amended from time to time; or an equivalent test to the deceleration-time pulse in Paragraph B 3.8.3.8.1. above. A seat belt approved to IS 15140 as amended from time to time; and so marked shall be deemed to comply.
B 3.8.3.10	A test in Paragraph B 3.8.3.6., B 3.8.3.8. or B 3.8.3.9. above shall be deemed to have failed unless the following requirements are met:
B 3.8.3.10.1	No part of the system shall have failed, or shall have become detached from its anchorage or from the vehicle during the test;
B 3.8.3.10.2	Mechanisms to release the wheelchair and user shall be capable of release after completion of the test;
B 3.8.3.10.3	In the test in Paragraph B 3.8.3.8. above the wheelchair shall not move more than 200mm in the longitudinal plane of the vehicle during the test;
B 3.8.3.10.4	No part of the system shall be deformed to such an extent after completion of the test that, because of sharp edges or other protrusions, the part is capable of causing injury.
B 3.8.3.11	Its operating instructions shall be clearly displayed adjacent to it.
B 3.8.4.	Rearward-facing Wheelchair – Static Test Requirements for wheelchair user passengers in M2 category vehicle
B 3.8.4.1.	Vehicles not required to have occupant restraint systems fitted may, as an alternative to the provisions of Paragraph 3.8.2 or 3.8.3. above, be provided with a wheelchair space designed for the wheelchair user to travel unrestrained with the wheelchair facing rearwards against a support or backrest, in accordance with the following provisions:
B 3.8.4.1.1.	One of the longitudinal sides of the space for a wheelchair shall rest against a side or wall of the bus or a partition;
B 3.8.4.1.2.	A support or backrest perpendicular to the longitudinal axis of the bus shall be provided in the forward end of the wheelchair space;
B 3.8.4.1.3.	The support or backrest shall be designed for the wheels or the back of the wheelchair to rest against the support or backrest in order to avoid the wheelchair from tipping over and shall comply with the provisions of Paragraph 3.8.5. below;
B 3.8.4.1.4.	A handrail or handhold shall be fitted to the side or wall of the bus or a partition in such a way to allow the wheelchair user to grasp it easily. This handrail shall not extend over the vertical projection of the wheelchair space, except by not more than 90mm and only at a height not less than 850mm above the floor of the wheelchair space;
B 3.8.4.1.5.	A retractable handrail or any equivalent rigid device shall be fitted on the opposite side of the wheelchair space in order to restrict any lateral shift of the wheelchair and to allow the wheelchair user to grasp it easily;

B 3.8.5.	Backrest and support requirements for wheelchair user passengers in M2 category vehicle.
B 3.8.5.1.	A backrest fitted to a wheelchair space in accordance with Paragraph B3.8.4. shall be fitted perpendicular to the longitudinal axis of the bus and shall be capable of bearing a load of $250 \pm 20\text{daN}$ applied to the centre of the padded surface of the backrest, at a height of not less than 600mm and of not more than 800mm measured vertically from the floor of the wheelchair space, for a minimum of 1.5s by means of a block 200mm X 200mm in the horizontal plane of the bus towards the front of the bus. The backrest shall not deflect more than 100mm or suffer permanent deformation or damage.
B 3.8.5.2.	A support fitted to a wheelchair space in accordance with Paragraph B 3.8.4. shall be fitted perpendicular to the longitudinal axis of the bus and shall be capable of withstanding a force of $250\text{daN} \pm 20\text{daN}$ applied to the centre of the support, for a minimum of 1.5s in the horizontal plane of the bus towards the front of the bus in the middle of the support. The support shall not deflect more than 100mm or suffer permanent deformation or damage.
B 3.8.6.	<p>Example of a backrest meeting the requirements of paragraph 3.8.4.1.3. above (See Fig. B-3 to this part).</p>  <p style="text-align: center;">Figure B-3 Example of a Backrest for a Rearward-facing Wheelchair</p>
B 3.8.6.1.	The bottom edge of a backrest shall be at a height of not less than 350 mm and of not more than 480 mm measured vertically from the floor of the wheelchair space.
B 3.8.6.2.	The top edge of a backrest shall be at a height of not less than 1,300 mm measured vertically from the floor of the wheelchair space.
B 3.8.6.3.	A backrest shall have a width of:
B 3.8.6.3.1.	Not less than 270 mm and of not more than 420 mm up to a height of 830 mm measured vertically from the floor of the wheelchair space, and
B 3.8.6.3.2.	Not less than 270 mm and of not more than 300 mm at heights exceeding 830 mm measured vertically from the floor of the wheelchair space.

B 3.8.6.4.	A backrest shall be fitted at an angle of not less than four degrees and of not more than eight degrees to the vertical with the bottom edge of the backrest positioned closer to the rear of the vehicle than the top edge.
B 3.8.6.5.	The padded surface of a backrest shall form a single and continuous plane.
B 3.8.6.6.	The padded surface of a backrest shall pass through any point on an imaginary vertical plane situated to the rear of the front end of the wheelchair space and situated not less than 100 mm and not more than 120 mm from the front end of the wheelchair space measured horizontally and not less than 830 mm and not more than 870 mm from the floor of the wheelchair space measured vertically.
B 3.9	Door Controls for M2 vehicles
B 3.9.1	If a door referred to in Paragraph B3.6 is fitted with opening controls for use under normal circumstances, these controls shall:
B 3.9.1.1	In the case of exterior controls, be on or adjacent to that door at a height between 850mm and 1,300mm from the ground and be not more than 900mm from the door, and
B 3.9.1.2	In the case of interior controls vehicle, be on or adjacent to that door at a height of between 850mm and 1,300mm from the upper surface of the floor nearest the control and be not more than 900mm in any direction from the door aperture.
B 3.10	Docking Systems for M2 and M1 vehicles: Wherever provided, docking systems shall not cause any obstruction for free movement of wheel chair and its clamps or systems acting as anchorages shall comply with provisions of Annexure C1 of this standard.
B 3.11	Provisions for Boarding Devices for M2 and M1 vehicles
B 3.11.1	General requirements:
B 3.11.1.1	The controls actuating the boarding devices shall be clearly marked as such. The extended or lowered position of the boarding device shall be indicated by a tell-tale to the driver.
B 3.11.1.2	In the event of the failure of a safety device, lifts, ramps and kneeling systems shall be incapable of operation, unless they can be safely operated by manual effort. The type and location of the emergency operating mechanism shall be clearly marked. In the event of power failure, lifts and ramps shall be capable of manual operation.
B 3.11.1.3	Access to one of the service or emergency doors on the vehicle may be obstructed by a boarding device providing the following two conditions are satisfied from both inside and outside the vehicle.
B 3.11.1.3.1	The boarding device does not obstruct the handle or other device for opening the door.
B 3.11.1.3.2	The boarding device can be readily moved to leave the doorway clear for use in an emergency

B 3.11.2	Kneeling System
B 3.11.2.1	A switch shall be required to enable operation of the kneeling system.
B 3.11.2.2	Any control which initiates the lowering or raising of any part or the whole of the bodywork relative to the road surface shall be clearly identified and be under the direct control of the driver.
B 3.11.2.3	The lowering process shall be capable of being stopped and immediately reversed by a control both within the reach of the driver, whilst seated in the vehicle, and also adjacent to any other operating controls provided for the operation of the kneeling system.
B 3.11.2.4	Any kneeling system that is fitted to a vehicle shall not allow the vehicle to move when the vehicle is lower than the normal height of travel.
B 3.11.3	Lift
B 3.11.3.1	General Provisions
B 3.11.3.1.1	Lifts shall only be capable of operation when the vehicle is at standstill. Any movement of the platform shall be prevented unless a device preventing the wheelchair from rolling off has been activated or has automatically come into operation.
B 3.11.3.1.2	The lift platform shall not be less than 800mm wide, and not less than 1200mm long and shall be capable of operating when carrying a mass of at least 300kg. In case of M2 having care giver facility minimum mass carrying capacity of lift shall be 350kg.
B 3.11.3.2	Additional technical requirements for power-operated lifts
B 3.11.3.2.1	The operating control shall be designed in such a way that, if released, it automatically returns to the off position. As it does so the movement of the lift shall immediately be stopped and it shall be possible to initiate a movement in either direction
B 3.11.3.2.2	A safety device (e.g. reversing mechanism) shall protect areas not visible to the operator, where the movement of the lift might trap or crush objects.
B 3.11.3.2.3	In the event of one of these safety devices coming into operation, the movement of the lift shall immediately be stopped and movement in the opposite direction initiated
B 3.11.3.3	Operation of power operated lifts
B 3.11.3.3.1	Where the lift is at a service door situated within the direct field of vision of the driver of the vehicle, the lift may be operated by the driver when in the driver's seat.
B 3.11.3.3.2	In all others cases, the controls shall be adjacent to the lift. They shall be capable of being activated and deactivated only by the driver from his seat.
B 3.11.3.4	Manually operated lift
B 3.11.3.4.1	The lift shall be designed for operation by controls adjacent to the lift.
B 3.11.3.4.2	The lift shall be so designed that excessive forces are not required to operate it
B 3.11.4	Ramp
B 3.11.4.1	General Provisions

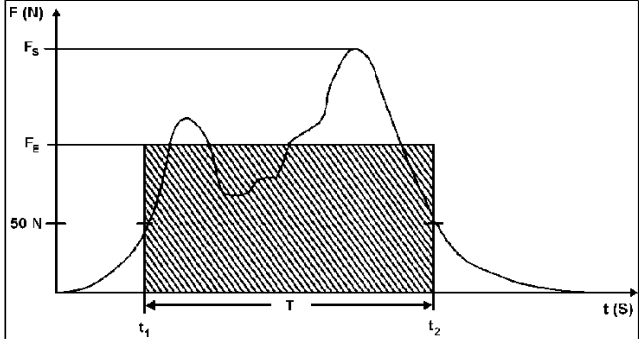
B 3.11.4.1.1	The ramp shall only be capable of operation when the vehicle is at standstill
B 3.11.4.1.2	Edges on the outside shall be rounded to a radius of no less than 2.5mm. Corners on the outside shall be rounded to a radius of not less than 5mm.
B 3.11.4.1.3	The useable surface of a ramp shall be at least 800mm wide. The slope of the ramp, when extended or folded out on to a kerb of 150 mm in height, should not exceed 25%. The slope of the ramp, when extended or folded out to the ground, should not exceed 60%. A kneeling system may be used to achieve this test.
B 3.11.4.1.4	Any ramp which when ready for use exceeds 1,200mm in length shall be fitted with a device to prevent the wheelchair rolling off the sides.
B 3.11.4.1.5	Any ramp shall be capable of operating safely with a load of 300kg
B 3.11.4.1.6	<p>The outer edge of ramp surfaces available for use by a wheelchair shall be clearly marked with a band of colour 45mm to 55mm in width which contrasts visually with the remainder of the ramp surface. The band of colour shall extend along the outermost edge and along both edges parallel to the direction of travel of the wheelchair.</p> <p>Marking of any trip hazard or where part of the ramp surface also forms part of the step is permissible</p>
B 3.11.4.1.7	A portable ramp shall be secure when in its position for use. A portable ramp shall be provided with a suitable position where it can be safely stowed and where it is readily available for use.
B 3.11.4.2	Modes of Operation
B 3.11.4.2.1	Deployment and stowage of the ramp may be either manually or power-operated.
B 3.11.4.3	Additional Technical Requirements for Power-operated Ramps
B 3.11.4.3.1	Deployment and stowage of the ramp shall be indicated by flashing yellow lights and an audible signal.
B 3.11.4.3.2	Deployment and stowage of the ramp that may create a risk of injury shall be protected by a safety device(s).
B 3.11.4.3.3	These safety devices shall stop the movement of the ramp when the ramp is subject to a reactive force not exceeding 150N. The peak force may be higher than 150N for a short time provided that it does not exceed 300N. The reactive force may be measured by any method to the satisfaction of the Test Agency. Guidelines for measuring the reactive forces are given in ANNEXURE B-1 to this Standard.
B 3.11.4.3.4	The horizontal movement of a ramp shall be interrupted when a mass of 15kg is placed upon it
B 3.11.4.4	Operation of power-operated ramps
B 3.11.4.4.1	Where the driver has an adequate view of the ramp sufficient to monitor its deployment and use, to ensure the safety of passengers, the ramp may be operated by the driver when in the driver's seat. This requirement may be met by a suitable indirect vision device(s).
B 3.11.4.4.2	In all others cases, the controls shall be adjacent to the ramp. They shall be capable of being activated and deactivated only by the driver from his seat.
B 3.11.4.5	Operation of manually-operated ramp

B 3.11.4.5.1	The ramp shall be so designed that excessive forces are not required to operate the ramp.
B4.0	<p>Type approval as per Part B and criteria for extension of approval for Adapted Vehicles of Category M2</p> <p>For adaptation as per Part B which is built on already type approved vehicle shall comply the requirements of CMVR and those specified in Part B, after taking into consideration the provisions in ANNEXURE B-3.</p> <p>In case of change in parameters or provision(s) compare to earlier approval, ANNEXURE B-3 needs to be referred along with its allowable modifications. Application of the exemptions is only permitted if the manufacturer or retro-fitter demonstrates to the satisfaction of the test agency that the vehicle, due to the special function, cannot meet all the requirements. Tests to be carried out for parameters which are affected by modifications. For type approval of adapted vehicle as per this part of the standard relevant technical specifications as per AIS-007 as amended from time to time and ANNEXURE B-2 for respective provisions under verification or testing as per ANNEXURE B-3 shall be submitted by applicant (vehicle manufacturer or retro-fitter).</p>

ANNEXURE B-1

(See Paragraph B 3.11.4.3.3.)

THE REACTIVE FORCES OF POWER- OPERATED RAMPS FOR M2 VEHICLES

1.0	<p>GENERAL</p> <p>The operation of a power-operated ramp is dynamic processes. When a moving ramp hits an obstacle, the result is a dynamic reaction force, the history of which (in time) depends on several factors (e.g. mass of the door or ramp, acceleration, dimensions).</p>
2.0	<p>DEFINITIONS</p>
2.1	<p>Closing or reactive force $F(t)$ is a time function, measured at the outer edge of the ramp (see Paragraph 3.2. below).</p>
2.2	<p>Peak force F_S is the maximum value of the closing or reactive force</p>
2.3	<p>Effective force F_E is the average value of the closing or reactive force related to the pulse duration:</p> $F_E = \frac{1}{T} \int_{t_1}^{t_2} F(t) dt$
2.3.1	<p>2.0.1 Pulse duration T is the time between the t_1 and t_2:</p> $T = t_2 - t_1$ <p>Where,</p> <p>t_1 = threshold of sensitivity, where the closing or reactive force exceeds 50 N.</p> <p>t_2 = fade-away threshold, where the closing or reactive force becomes less than 50 N.</p>
2.3.2	<p>The relation between the above parameters is shown in Figure 1 below (as an example):</p> 

2.3.3	<p>Clamping or mean reactive force F_c is the arithmetical mean value of the effective forces, measured at the same measuring point subsequently more times:</p> $F_c = \frac{\sum_{i=1}^{i=n} (F_E)_i}{n}$
3.0	CONDITIONS OF MEASUREMENT
3.0.1	Temperature range: 10° - 30°C
3.0.2	The vehicle shall be standing on a horizontal surface. In the case of ramp measurements, this surface shall be fitted with a rigidly mounted block or other similar device having a face against which the ramp can react.
3.2	Measurements points shall be :
3.2.1	In the case of ramps :
3.2.1.1	<p>At the outer edge of the ramp situated perpendicularly to its direction of movement: one in the middle of the ramp;</p> <p>one 100mm inboard from each of the edges parallel to the direction of travel of the ramp.</p>
3.3	At least three measurements shall be taken at each of the measuring points to determine the clamping or mean reactive force.
3.4	The signal of the closing or reactive force shall be recorded by means of a low-pass filter with a limiting frequency of 100Hz. Both the threshold of sensitivity and the fade-away threshold to limit the pulse duration shall be set at 50 N
3.5	The deviation of the reading from the rated value shall not be more than $\pm 3\%$.
4.0	MEASURING DEVICE
4.1	The measuring device shall consist of two parts: one handle and one measuring part which is a load cell (see Figure 2 below).
4.2	The load cell shall have the following characteristics:
4.2.1	It shall consist of two sliding housings with the outer dimension of 100mm in diameter and 115mm in width. Inside the load cell a compression spring shall be fitted between the two housings such that the load cell can be pressed together if an appropriate force is applied.

4.2.2

The stiffness of the load cell shall be 10 ± 0.2 N/mm. The maximum spring deflection shall be limited to 30mm so that a maximum peak force of 300N is achieved.

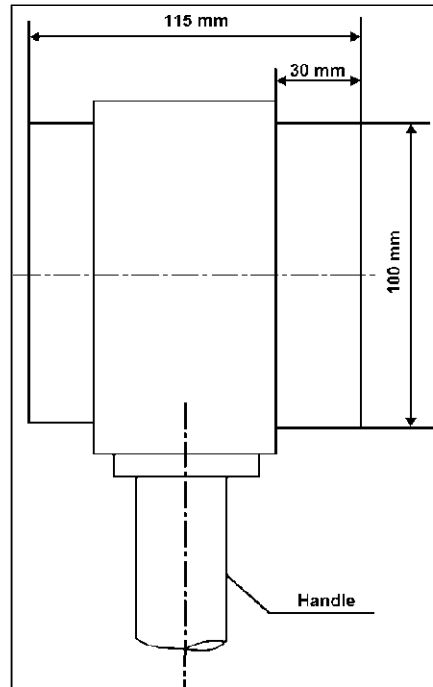


Figure -2

ANNEXURE B-2

**ADDITIONAL TECHNICAL INFORMATION ON VEHICLES TO BE SUBMITTED
BY VEHICLE MANUFACTURER /RETRO-FITTER TO TESTING AGENCY FOR
PART B COMPLIANCE**

1.0	Details of vehicle manufacturer /retrofitter	
1.1	Name & address of the vehicle manufacturer or importer or retro-fitter	
1.2	Telephone / Mobile No.	
1.3	Fax. No.	
1.4	E-mail address	
1.5	Contact person	
1.6	Address of the Plant(s)of manufacture	
1.7	Model Name	
1.8	Variant Name	
1.9	Vehicle Type (Variant (OE) / Retro-fitted)	
1.10	Seating Layout Drawing No.	
1.11	Seating Capacity	
2.0	Overall Vehicle Dimensions (mm)	
2.1	Vehicle length, mm	
2.2	Vehicle width, mm	
2.3	Vehicle height, mm	
2.4	Wheel Base (mm)	
3.0	Fire extinguisher, if provided	
3.1	Name and address of manufacturer of the Fire extinguisher	
3.2	Test report for complying required class	
3.3	Description of the device	

4.0	Fire Suppression System, if fitted.	
4.1	Name and address of manufacturer of the fire suppression system	
4.2	Type of the fire Suppression system	
4.3	Extinguishing agent (make and type):	
4.4	Mass of extinguishing agent:	
4.5	Minimum operating temperature	
4.6	Dimensions of pipes and fittings	
4.7	Detailed description, layout drawings and installation manual of the fire suppression system and its components	
4.8	Devices provided additionally Acoustic or visual, If visual, duration and type of optical signal	
5.0	Kneeling System (Yes/No)	
5.1	Floor Height	
5.2	Kneeling Height	
5.3	Location of switch for operation of kneeling system for downward, upward and stop position.	
6.0	Emergency Lighting System (Yes/No)	
6.1	Location of switch	
6.2	Min. Time for activation	
6.3	Location of power supply	
6.4	Colour of light	
7.0	Docking System provided (Yes/No)	
8.0	Priority Seats	
8.1	Forward/Rearward facing	
8.2	Number	
8.3	Width of priority seat cushion	
8.4	Height of uncompressed seat cushion from floor.	
8.5	Free height above priority seat	
9.0	Wheelchair	
9.1	Forward facing/ Rearward facing	
9.2	Wheelchair accommodation provisions	
9.2.1	Width	
9.2.2	length	
9.3	Percentage of Slope	

9.4	Height of wheelchair access door	
9.5	Width of wheelchair access door	
9.6	Foldable or detachable seats in wheel chair area provided (Yes/ No)	
9.7	Type of wheelchair restraint system	
10.0	Wheelchair Electronics provided (Yes/No)	
11.0	Boarding Devices	
11.1	Type Lift/Ramp	
11.2	Area of boarding	
11.2.1	Length	
11.2.2	Width	
11.3	Load Carrying capacity of boarding device	
11.4	Slope of ramp in %	
11.5	Slope of extended ramp if provided in %	
11.6	Mode of operation of ramp (Manual/ power operated)	
12.0	Single Controller Unit (SCU) - If Fitted	
12.1	Make	
12.2	Model	
12.3	Hardware Version	
12.4	Software Version	
12.5	Part No	
13.0	Driver Console (BDC)- If Fitted	
13.1	Make	
13.2	Model	
13.3	Hardware Version	
13.4	Software Version	
13.5	Part No	
14.0	Security Camera Network- If Fitted	
14.1	Make	
14.2	Model	
14.3	Hardware Version	
14.4	Software Version	
14.5	Part No	

ANNEXURE B-3
(See B4.0)

**Provisions for consideration for CMVR approval of Adapted Vehicle of category M2
on already type approved vehicle ~~(see clause B 4.0)~~**

Sr. No.	Requirements	Allowable modifications	Standard	CMV Rule No.
1.	Registration marks	T	--	50, 51
2.	Overall dimensions	T	--	93; 1,2,4,6,7
3.	Condition of Tyre	T	--	94; 1,2,3
4.	Size and Ply rating of Tyres.	G	IS: 15636	95; 1,2,3,5,6
5.	Brakes	G	IS: 11852	96; 1, 2, 3, 4ii, 7a ,8 & 9
6.	Steering effort/ Steering gear	G	IS 11948/IS: 12222	98; 1,2,3
7.	Forward and backward motion	G	--	99
8.	Safety glass	G+N	IS:2553 (Part 2)	100; 1, 2 & 3
9.	Windscreen Wiping system	G	IS-15802	101; 1 & 2
10.	*Signaling devices, direction indicators and stop lights	T	--	102; 1 & 2
11.	*Position of the indicator	T	--	103; 1 & 2
12.	* Fitment of Reflectors and Affixing of Reflective tapes	T	AIS- 057 (Rev.1) & AIS-090	104; 1 (iv)& 4
13.	*Lamps	T	--	105; 1(a), 2,3,4,5 & 7
14.	*Deflection of lights	T	GSR 291(E) dated 24.04.2014	106; 1
15.	*Use of red, white or blue light	T	--	108; 1,7
16.	*Parking light	T	--	109
17.	*Prohibition of spotlights etc.	T	--	111
18.	*Exhaust gases	T	--	112
19.	*Location of exhaust pipes	T	--	113

Sr. No.	Requirements	Allowable modifications	Standard	CMV Rule No.
20.	Emissions	G+Q	AIS-137	115; 1,2ii, 4, 6, 18i
21.	Engine power	G		
22.	Diesel smoke	H		
23.	Speedometer	G+N	IS-11827	117; 1& 2
24.	Speed Governor	G	AIS-018	118; 1 & 2
25.	Horns	G+N	IS 1884 & IS 15796:	119; 1, 2
26.	*Silencer	G+H	IS-3028	120; 1 & 2
27.	Vehicle Identification Number including month & Year of Manufacture	G	AIS-065, Table-11	122; 1 & 2
28.	Rear Underrun Protective devices & lateral Protection (Side Guards)	G + N	IS-14812 & 14682	124; 1-A
29.	Safety-belts assembly	G+D+M	IS 15140	125, 1
30.	Safety belt anchorages	G+D+L	IS 15139	125, 1
31.	Seat, seat strength, seat anchorages	G+D	AIS-023	125, 6
32.	Head Restraint	G+D	AIS 023	125, 6
33.	Rear View Mirror Specification & Installation	G	AIS-001 (Part 1) (Rev. 1) & AIS-002 (Part 1) (Rev. 1):	125; 2
34.	Warning Triangles	G+N	AIS-022	138, 4c
35.	Automotive lamps (Bulbs)	G+N	AIS-034 (Part-1) Rev.1	124(1), 1
36.	Hydraulic brake hose	G+N	IS-7079	124(1), 2
37.	Hydraulic brake fluid	G+N	IS-8654	124(1), 3
38.	Fuel tanks Non-Plastic/Plastic	F	AIS-095/ IS-15547	124(1), 7
39.	Wheel rims	G+N	IS-9438	124(1), 8
40.	Exterior projections	T + A	IS-13942	124(1), 11

Sr. No.	Requirements	Allowable modifications	Standard	CMV Rule No.
41.	Wheel nuts, wheel discs and hub caps	G+N	IS-13941	124(1),14
42.	Accelerator Control System	G	IS-14283	124(1), 15
43.	Door lock and retention components	G+N	IS-14225	124(1), 16
44.	Identification of controls, tell-tale & Indicators and control locations & Operation requirements	G	AIS-071: (Part 1 & Part 2)	124(1), 18
45.	Installation requirements of lighting and light- signaling devices	T	AIS 008 (Rev.1)	124(1), 20
46	Performance requirements of lighting and light- signaling devices	N	AIS-010 Part-1 Rev.1& AIS-012 Part (1 to 10) as applicable	124(1), 20
47	Electromagnetic radiation	T	AIS-004 Part-3	124(1), 21
48	Gradeability	G+N	AIS-003	124(1), 23
49	Interior fittings	G+N	AIS-047	124(1), 38
50	Interior Noise Level	G	IS12832	124(1), 40
51	Handholds	G+N	AIS-046	124(1), 42
52	Protective Devices against authorized use	T	AIS-075	124(1), 51
53	Vehicle Reverse Parking Alert System	T	AIS-145	125 (10)

* Test is Physical Verification in-case of change in the system/Component

Note: These guidelines are general in nature. However, individual IS and AIS standards notified under CMVR during first registration of the vehicle shall be referred to evaluate the test applicability, extension parameters & worst case criteria.

Meaning of letters:

N/A: This requirement is not applicable to this vehicle.-

A: Exemption permitted where special purposes make it impossible to fully comply with the desired requirements/ performance. The manufacturer shall demonstrate this to the satisfaction of the testing agency that the vehicle cannot meet the requirements.

D: Application limited to seat designated for normal use when the vehicle is travelling on the road.

- F: Modification to the routing and length of the refueling duct and re positioning of the approved tank inboard is permissible.
- G: Requirements for the corresponding category of the base vehicle, based on the maximum mass,(complete/incomplete vehicle).
- H: Modification of exhaust system length after last silencer not exceeding 2 m is permissible without any further test.
- L: Application limited to the seats designated for normal use when the vehicle is travelling on the road. At least anchorages for lap belts are required in the all rear seating positions.
- M: Application limited to seats designated for normal use when the vehicle is travelling on the road. At least lap belts are required in all rear seating positions.
- N: During successive stage of vehicle completion, test shall be applicable in case of change (addition or deletion) from earlier approved test specific technical parameters and safety critical components.
- Q: Modification of exhaust system length after last silencer not exceeding 2m is permissible without any further test. CMVR approval issued to the most representative base vehicle remains valid irrespective of change in the reference weight.
- T: No exemption except those specified in the CMVR and /or applicable standard.

Part C

Provisions for adapted vehicles of category M1 when major modifications are carried out which needs reverification or re-testing by testing agency for differently abled driver and passengers with reduced mobility.

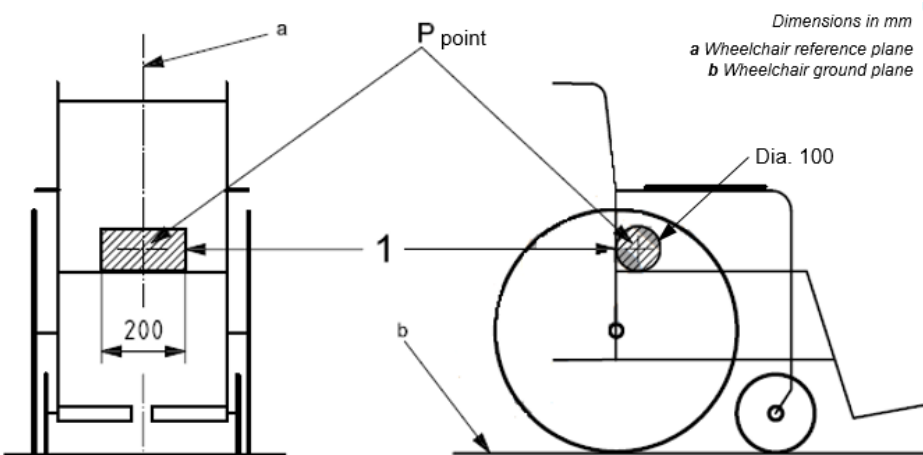
C 1.0	Requirements to be complied by Wheel-chair accessible vehicles: In case of change in parameters or provision(s) compare to earlier approval, following table needs to be referred along with its allowable modifications. Application of the exemptions is only permitted if the manufacturer or retro-fitter demonstrates to the satisfaction of the test agency that the vehicle, due to the special function, cannot meet all the requirements. Tests to be carried out for parameters which are affected by modifications. For type approval of adapted vehicle as per this part of the standard relevant technical specifications as per AIS-007 as amended from time to time for respective provisions under verification or testing as per table below shall be submitted by applicant (vehicle manufacturer or retro-fitter). Vehicle modifications as per Part C of this standard does not contain provisions on secondary controls, for approval of adapted vehicles for such modifications, provisions of Part A of this standard needs to be referred.			
	Table			
Sr. No.	Requirements	Allowable modifications	Standard	CMV Rule No.
1.	Sound levels	X	IS 3028	120(1), (2)
2.	Emissions	G + W1	TAP 115/116 AIS-137 (Part 3)	115
3.	Fuel tanks	X + W2	AIS-095/ IS 15547/IS 12056	124(1), Table Sr. 7
4.	Rear registration plate space	X	-----	50
5.	Steering effort	X	IS 11948	98(3)
6.	Door latches and hinges	X	IS 14225	124(1), Table Sr. 16
7.	Audible warning	X	IS 1884/ IS 15796	119(1), (2)
8.	Indirect vision devices	X	AIS-001 (Part 1) (Rev. 1) & AIS-002(Part 1)(Rev. 1)	125(2)
9.	Braking	X	IS 11852 or IS 15986/ AIS-151	96(4)
10.	EMC	X	AIS-004 (Part 3)	124(1), Table Sr. 21
11.	Diesel smoke	X	AIS-137 (Part 3)	115
12.	Interior fittings	X	IS 15223	124(1), Table Sr. 38

Sr. No.	Requirements	Allowable modifications	Standard	CMV Rule No.
13.	Anti-theft and immobilizer	X	AIS-075, AIS-076	124(1), Table Sr. 51 & 52
14.	Protective steering	X	IS 11939 / AIS-096	124(1), Table Sr. 5 (b)
15.	Seat strength	X + W3	IS 15546 / UN R 17	125(5)
16.	Exterior projection	X + W4	AIS-120	124(1), Table Sr. 11
17.	Speedometer and reverse gear	X	IS:11827	117(1) (2)
18.	Plates (statutory)	X	AIS-159	50 & 51
19.	Seat belt anchorages	X + W5	IS 15139 / UN R 14	125(1A)
20.	Installation of lighting and light signaling devices	X	AIS-008 (Rev. 1)	124(1), Table Sr. 20
21.	Reflex reflectors	X	AIS-057 (Rev. 1)	104(4)
22.	End-outline, front position (side), rear- position (side), stop, side marker, if provided with daytime running lamps	X	AIS-012 / AIS-012 (Part 6, 9 & 10)	124(1), Table Sr. 20
23.	Direction indicators	X	AIS-012 / AIS-012 (Part 5)	124(1), Table Sr. 20
24.	Rear registration plate lamps	X	AIS-012 / AIS-012 (Part 4)	124(1), Table Sr. 20
25.	Head lamps (including bulbs)	X	AIS-034 / AIS-034 (Part 1) Rev. 1 AIS-010 (Part 1 & 2) (Rev. 1)	124(1), Table Sr. 1 and 20

Sr. No.	Requirements	Allowable modifications	Standard	CMV Rule No.
26.	Front fog lamps	X	AIS-012 (Part 1)	124(1), Table Sr. 20
27.	Rear fog lamps	X	AIS-012 (Part 2)	124(1), Table Sr. 20
28.	Reversing lamps	X	AIS-012 / AIS-012 (Part 7)	124(1), Table Sr. 20
29.	Parking lamps	X	AIS-012 / AIS-012 (Part 8)	124(1), Table Sr. 20
30.	Seat belts and restraint systems	X + W6	IS 15140	125 (1-A)
31.	Forward vision	X	AIS-021	124(1), Table Sr. 34
32.	Identification of controls (Tell-tales and indicators)	X	AIS-071 (Parts 1 & 2)	124(1), Table Sr. 18
33.	Defrost/demist	X	AIS-084 (Parts 1 & 2)	124(1), Table Sr. 46
34.	Windscreen Wiper / Washing System	X	IS 15804	101(1) and (2)
35.	Wheel guards	X	IS 13943	124(1), Table Sr. 13
36.	CO2 emissions/fuel consumption	X + W7		115 F
37.	Engine power	X	AIS-137 (Part 5)	115
38.	Diesel emissions	X	AIS-137 (Part 3)	115
39.	Masses and dimensions(cars)	X + W8		93
40.	Safety glass	X	IS 2553 (Part 2)	100 (1)(2)(3)
41.	Tyres	X	IS 15633	95(1)

Sr. No.	Requirements	Allowable modifications	Standard	CMV Rule No.
42.	Frontal impact	X + W9	AIS-098	124(1), Table Sr. 5 (c)
43.	Side impact	X + W10	AIS-099	124(1), Table Sr. 6 (a)
44.	Pedestrian protection	X	AIS-100	124(1), Table Sr. 6 (c)
45.	Safety Belt Reminder	X	AIS-145	125 (9)
46.	Wheelchair tie-down or restrain system	X	Annexure C1 of this standard	---
Meaning of letters				
X	No exemptions except those specified in the regulatory act / rules and respective standard notified thereunder. Tests to be carried out for parameters which are affected by modifications. However, considering allowable age (five years) of old vehicle for adaptation, norms applicable at the time of first registration of the vehicle shall be considered. Non-existent norms during first registration for old vehicle shall not be applicable while adaptation.			
G	Requirements according to the category of the base/incomplete vehicle (the chassis of which was used to build the special purpose vehicle). In the case of incomplete/completed vehicles, it is acceptable that the requirements for vehicles of the corresponding category N (based on max. mass) are satisfied.			
W1	Requirements must be complied with, but modification in the exhaust system is permitted without any further test provided the emission control devices including particulate filters (if any) are not affected. No new evaporative test shall be required on the modified vehicle on condition that the evaporative control devices are kept as fitted by the manufacturer of the base vehicle. Type approval issued to the most representative base vehicle remains valid irrespective of change in the reference mass.			
W2	Requirements must be complied with, but modification of the routing, length of the refueling duct, fuel hoses and fuel vapour pipes is permitted. Re-location of the original fuel tank is permitted.			
W3	<p>The longitudinal plane of the special area (intended wheelchair-travelling position) shall be parallel to the longitudinal plane of the vehicle.</p> <p>Appropriate information shall be made available to the vehicle owner that, a wheel-chair used as a seat in the vehicle must be capable of withstanding the forces transmitted by the tie-down mechanism during the various driving conditions, a wheelchair with a structure meeting the relevant part of ISO 7176-19:2008 is recommended.</p> <p>The seats of the vehicle may be adapted without further testing provided that their anchorages, mechanisms and head restraints guarantee the same level of performance provided for in the standard. Wheelchair tie-down and occupant restraint system shall meet requirements of Annexure C 1 of this part. The luggage retention requirements set out in UN Regulation No 17 do not apply.</p>			
W4	Compliance with standard shall be required for the boarding aids when in the resting position.			

W5	Each wheel-chair location shall be fitted with an integrated restraint system which consists of a restraint system for the wheel-chair and a restraint system for the wheel-chair user. Wheelchair tie-down and occupant restraint system shall meet requirements of Annexure C 1 of this part.
W6	When, due to the conversion, anchorage points for the safety belts need to be moved outside the tolerance provided in IS 15139 as amended from time to time, the testing agency shall check whether the alteration constitutes a worst case or not. If that is the case, the test provided for in IS 15139 as amended from time to time shall be performed for affected parameter. Extension to the type-approval does not need to be issued.
W7	A new measurement relating to CO2 emissions does not need to be performed when, in application of the provisions under W1, no fresh tests have to be performed with regard to tail pipe emissions.
W8	<p>For the purposes of calculations, the mass of the wheel-chair including the user shall be assumed to be 100 kg.</p> <p>The mass shall be concentrated at the H point of the three- dimensional machine.</p> <p>The test agency shall also consider the possibility to use electric wheelchair(s), the mass of which, including the user, is assumed to be 250 kg. Any limitation in the passenger capacity resulting from the use of electric wheelchair (s) shall be recorded in the type-approval certificate and an appropriate language thereto shall be included in the certificate of conformity.</p>
W9	No new test shall be required on the modified vehicle on condition that the front part of the chassis located in front of the R point of the driver is not affected by the conversion of the vehicle and no part of the supplementary restraint system (air- bag(s)) has been removed or deactivated.
W10	No new test shall be required on the modified vehicle on condition that the side reinforcements have not been altered and no part of the supplementary restraint system (side air-bag(s)) has been removed or deactivated.

<p style="text-align: center;">ANNEXURE C - 1</p> <p style="text-align: center;">Requirements for testing the wheelchair tie-down and occupant restraint system</p>	
	The following point 2 and either point 3 or 4 shall apply.
1.	Definitions
1.1.	Test wheelchair (TWC) : SWC or SWM wheelchair that is used to test wheelchair-tiedown and occupant-restraint systems
1.1.1	Surrogate wheelchair (SWC) means rigid, reusable device that conforms with Appendix C-1a of this standard and that is used to simulate a wheelchair for the purpose of testing wheelchair tie-down and occupant-restraint systems
1.1.2	Specific wheelchair model (SWM) make or model of wheelchair for which the WTORS is specifically designed
1.2.	<p>Point P is a reference point that lies at the cross-sectional centre of a cylinder of diameter 100 mm and length 200 mm, positioned with the longitudinal axis perpendicular to the wheelchair reference plane such that the curved surface of the cylinder contacts the back support and the upper surface of the seat. See figure below</p>  <p style="text-align: right;"><i>Dimensions in mm</i> <i>a Wheelchair reference plane</i> <i>b Wheelchair ground plane</i></p>
2.	General requirements
2.1.	Each wheelchair location shall be provided with anchorages to which a wheelchair tie-down and occupant restraint system (WTORS) shall be fitted.
2.2.	The wheelchair occupant's lower belt anchorages shall be located in accordance with UN Regulation No 14.07, paragraph 5.4.2.2, relative to Point P on the SWC, when placed in the travelling position designated by the manufacturer. The upper actual anchorage(s) shall be located at least 1 100 mm above the horizontal plane passing through the points of contact between the rear tyres of the SWC and the vehicle floor. That condition shall still be satisfied after the test carried out in accordance with point 3 of this Annexure.
2.3.	An assessment shall be made of the WTORS occupant belt to ensure compliance with the UN Regulation No 16.06, paragraphs 8.2.2 to 8.2.2.4 and 8.3.1 to 8.3.4. 2.4. The minimum number of ISOFIX child seat anchorages need not to be provided. In the case of a multi-stage type-approval where an ISOFIX anchorage system has been affected by the

	conversion, either the system shall be re-tested or the anchorages shall be rendered unusable. In the latter case the ISOFIX labels shall be removed and appropriate information shall be given to the vehicle purchaser.
3.	Static in-vehicle testing
3.1.	Wheelchair occupant restraint anchorages
3.1.1.	The wheelchair occupant restraint anchorages shall resist the static forces prescribed for occupant restraint anchorages in UN Regulation No 14.07, simultaneously with the static forces applied to the wheelchair tie-down anchorages as specified in point 3.2 of this Annexure.
3.2.	Wheelchair tie-down anchorages The wheelchair tie-down anchorages shall resist the following forces, for at least 0,2 seconds, applied via the SWC (or a suitable surrogate wheelchair having a wheelbase, seat height and tie-down attachment points in accordance with the specification for the SWC), at a height of 300 +/- 100 mm from the surface on which the SWC rests:
3.2.1.	In the case of a forward-facing wheelchair, a simultaneous force, coincident with the force applied to the occupant restraint anchorages, of 24,5 kN, and
3.2.2.	a second test applying a static force of 8,2 kN directed towards the rear of the vehicle.
3.2.3.	In the case of a rearward-facing wheelchair, a simultaneous force, coincident with the force applied to the occupant restraint anchorages, of 8,2 kN, and
3.2.4.	a second test applying a static force of 24,5 kN directed towards the front of the vehicle.
3.3.	Components of the system
3.3.1.	Components of the WTORS shall meet the following requirements. However, the dynamic test specified in ANNEXURE C - 1 of this standard and paragraphs 4.1.1 and 4.1.2 shall be carried out on the complete WTORS using the vehicle anchorage geometry instead of the test geometry specified in Appendix C-1a of this standard. This may be carried out within the vehicle structure or on a surrogate structure representative of the vehicle's WTORS anchorage geometry. The location of each anchorage shall lie within the tolerance provided for in paragraph 7.7.1 of UN Regulation No 16.06. Where the occupant restraint part of the WTORS is approved in accordance with UN Regulation No 16.06, it shall be subject to the dynamic test the complete WTORS specified in paragraph 3.3.1 of this Annexure but the requirements of paragraphs 4.1.1, 4.1.2 and 4.3 shall be considered to have been met.
3.3.1.1	All webbing, metal parts, buckles, release mechanisms and adjustment mechanisms of wheelchair tie-down and occupant-restraint systems shall conform to the applicable sub-clauses indicated in the applicable column of Table 1 or Table 2 of either a) ECE Regulation no. 16 or b) FMVSS 209 Seatbelt assemblies

Table 1 — Applicable sub-clauses of ECE regulation No.16

Sub cl.	Component	Subject	ECE R 16 tests referenced	Application ^a
6.2.1.1	rigid parts	sharp edges	—	OR + WTD
6.2.1.2	rigid parts	corrosion	7.2	OR + WTD
6.2.1.4	rigid parts	cold impact test	7.5.4	OR + WTD
6.2.2.1	buckles	correct use and size	—	OR
6.2.2.2	buckles	closing/releasing	7.8.2	OR
6.2.2.3	buckles	cold mating	7.5.3	OR
6.2.2.4	buckles	repeated testing	7.7	OR
6.2.3.2	adjustment devices	micro-slip	7.3	OR
6.2.3.4	belt-adjusting device	force	7.5.6	OR + WTD
6.2.5	various belt retractors	performance	7.2, 7.6.1 to 7.6.4	OR
6.2.6	preloading devices	performance	7.2, 7.9.2	OR
6.3.1	belts	general specs	7.4.3	OR
6.3.2	belts	strength	7.4.1.1, 7.4.2	OR + WTD
6.3.3	belts	strength	7.4.1, 7.4.2	OR + WTD
6.4.2	belts	strength	7.4.1.6, 7.4.2, 7.5	OR + WTD
a OR = occupant restraint, WTD = wheelchair tiedown.				

Table 2 — Applicable sub-clauses of FMVSS 209

Sub cl.	Component	Subject	FMVSS 209 tests referenced	Application ^a
S4.1 (d)	hardware	burrs and sharp edges	—	OR + WTD
S4.1 (e)	release mechanism	design	—	OR
S4.1 (h)	webbing	unravelling	—	OR + WTD
S4.2 (a)	webbing	belt width	S5.1(a)	OR
S4.2 (b)	webbing	breaking strength	S5.1(b)	OR + WTD
S4.2 (c)	webbing	elongation	S5.1(c)	OR + WTD
S4.2 (d)	webbing	abrasion resistance	S5.1(d), S5.3(c)	OR
S4.2 (d)	webbing	abrasion resistance	S5.1(d)	WTD
S4.2 (e)	webbing	light resistance	S5.1(e)	OR + WTD
S4.3 (a)	hardware	corrosion resistance	S5.2(a)	OR + WTD
S4.3 (b)	hardware	temperature resistance	S5.2(b)	OR + WTD
S4.3 (d)	buckle release	release force	S5.2(d)	OR
S4.3 (e)	adjustment device	adjustment force	S5.2(e)	OR
S4.3 (f)	tilt-lock devices	locking angles	S5.2(f)	OR
S4.3 (g)	buckle latch	separation force	S5.2(g)	OR
S4.3 (i)	belt retractor	performance	S5.2(i)	OR
S4.3 (j)	belt retractor	performance	S5.2(j)	OR

	<table><tr><td>S4.3 (k)</td><td>belt retractor</td><td>performance</td><td>S5.2(k), S4.4</td><td>OR</td></tr><tr><td>S4.4 (a)</td><td>pelvic restraints</td><td>performance</td><td>S5.3(a)</td><td>OR</td></tr><tr><td>S4.4 (b)</td><td>3-point restraints</td><td>performance</td><td>S5.3(b)</td><td>OR</td></tr><tr><td colspan="5">a OR = occupant restraint, WTD = wheelchair tiedown.</td></tr></table>	S4.3 (k)	belt retractor	performance	S5.2(k), S4.4	OR	S4.4 (a)	pelvic restraints	performance	S5.3(a)	OR	S4.4 (b)	3-point restraints	performance	S5.3(b)	OR	a OR = occupant restraint, WTD = wheelchair tiedown.				
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S4.4 (a)	pelvic restraints	performance	S5.3(a)	OR																	
S4.4 (b)	3-point restraints	performance	S5.3(b)	OR																	
a OR = occupant restraint, WTD = wheelchair tiedown.																					
3.3.1.2	All webbing and padding used in WTORS shall have a burning rate not exceeding 100 mm/min when tested as specified in ISO 3795.																				
4.	<p>Dynamic in-vehicle testing</p> <p>The full assembly of the WTORS system shall be tested by an in-vehicle dynamic test in accordance with paragraphs 5.2.2 and 5.2.3 and Appendix C-1a of this standard testing all components/anchorages simultaneously, using a vehicle body-in-white or representative structure.</p> <p>The component parts of the WTORS shall meet the requirements of Annexure C1 <i>of this standard</i>. These requirements shall be deemed to have been met in respect of the occupant restraint if it is approved in accordance with UN Regulation No 16.06.</p>																				
4.1.	Dynamic testing requirements																				
4.1.1	When the WTORS is tested in accordance with Appendix C-1a, the horizontal excursions of the ATD with respect to the impact sled shall not exceed the values given in Table 3 during the test;																				
4.1.2	<p>Requirements after the test when tested with SWC</p> <p>When the WTORS is tested in accordance with Appendix C-1a with an SWC, the following requirements shall be met at the conclusion of the test,</p> <ul style="list-style-type: none">a) The ATD shall be retained in the seat of the TWC.b) The TWC shall remain on all four wheels on the impact sled platform.c) No WTORS anchorage components or securement end fittings shall be detached or separated.d) Release of the TWC from the wheelchair tie-down shall not require the use of tools.e) Release of the ATD from the occupant restraint shall not require the use of tools.f) No part of the WTORS shall exhibit visible signs of tearing, fragmentation, fracture, or complete failure of any load-bearing part, unless such parts are intended to fail in a manner that limits the forces on the occupant.g) The WTORS shall exhibit no dangerous roughness, sharp edges or protrusions likely to increase the risk of injury to the occupant																				
	<table><tr><td colspan="3">Table 3 — Horizontal excursion limits</td></tr><tr><td>Measurement point</td><td>Excursion variable</td><td>Excursion limit mm</td></tr><tr><td>Point P of TWC</td><td>X_{wc}</td><td>200</td></tr><tr><td>ATD knee centre</td><td>X_{knee}</td><td>375</td></tr><tr><td>ATD front of head</td><td>X_{head}</td><td>650</td></tr><tr><td colspan="3"><p>x_{wc} is the forward horizontal distance relative to the sled platform between the point-P target on the TWC at time t₀ and the point P target at the time of peak wheelchair excursion.</p><p>x_{knee} is the horizontal distance relative to the sled platform between the ATD knee joint target at time t₀ and the knee-joint target at the time of peak knee</p></td></tr></table>	Table 3 — Horizontal excursion limits			Measurement point	Excursion variable	Excursion limit mm	Point P of TWC	X _{wc}	200	ATD knee centre	X _{knee}	375	ATD front of head	X _{head}	650	<p>x_{wc} is the forward horizontal distance relative to the sled platform between the point-P target on the TWC at time t₀ and the point P target at the time of peak wheelchair excursion.</p> <p>x_{knee} is the horizontal distance relative to the sled platform between the ATD knee joint target at time t₀ and the knee-joint target at the time of peak knee</p>				
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	<p>excursion.</p> <p>x_{headF} is the horizontal distance relative to the sled platform between the most forward point on the ATD's head above the nose at time t_0 and the most forward point on the ATD's head at the time of peak head excursion.</p>
4.2.	Webbing slippage at tie-down adjustment devices: When tested in accordance with the procedure given in ECE R 16:2009, 7.3, or Annex C of this part of ISO 10542, strap-type adjustment mechanisms of wheelchair tie-downs shall not show slippage greater than 25 mm.
4.3	Partial engagement of anchorage and securement components: When WTORS anchorage and securement components are tested in accordance with Annex D of ISO 10542-1:2012, all improper and partial engagements shall separate with a force of less than 22 N.

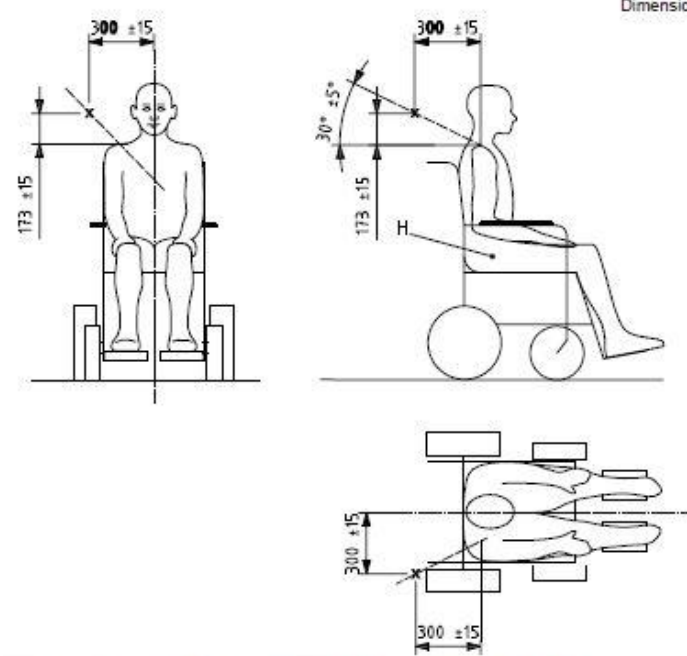
	<p style="text-align: center;">Appendix C-1a</p> <p style="text-align: center;">Test method for frontal impact</p>
1	<p>Principle</p> <p>A test wheelchair (TWC) is mounted in a forward-facing configuration on the impact sled of an impact simulator and is loaded with an anthropomorphic test device (ATD).</p> <p>The WTORS is installed to secure the TWC and restrain the ATD. The sled platform is subjected to a defined acceleration/deceleration-time pulse in order to achieve a defined horizontal velocity change (Δv). Observations and measurements are made to determine whether the strength and performance of the WTORS are satisfactory under the test conditions.</p>
2	<p>Test Sample</p> <p>An unused WTORS, including upper-torso and pelvic restraints, all fittings, anchorages, fasteners and instructions for installation and use, shall be provided for testing. If a WTORS is designed to use the vehicle original equipment manufacturer (OEM) belt-type restraint system, the WTORS manufacturer shall provide a representative OEM restraint system, appropriately modified for use in testing. Documentation shall be included to indicate any components of the WTORS that are designed to provide controlled failure or deformation under dynamic loading.</p>
3	<p>Test wheelchair selection</p> <p>Select a test wheelchair (TWC) for the frontal impact test as follows.</p> <ol style="list-style-type: none"> If the WTORS is intended for use with all types of manual and powered wheelchairs, then the TWC will consist of the surrogate wheelchair (SWC) constructed in accordance with Annex E of ISO 10542-1:2012. If the WTORS is intended to be used only with specific makes and models of wheelchairs, then the TWC will consist of the specific wheelchair model (SWM) it is designed for.
4	Test equipment
4.1	<p>An impact simulator shall be used that includes the following:</p> <ol style="list-style-type: none"> an impact sled with a flat, horizontal, structurally rigid platform on which the TWC can be mounted, and to which the WTORS can be fastened; a rigid structure attached to the impact sled to which the upper-torso restraint can be anchored in the manner, and to the geometry, specified by the WTORS manufacturer; a means to drive the impact sled through a change in velocity of 48 km/h -0/+2 km/h; a means to accelerate and/or decelerate the impact sled and test setup such that the processed sled acceleration and/or deceleration time pulse <ol style="list-style-type: none"> falls within the shaded area of Figure A.1, exceeds 20 g for a cumulative time period of at least 15 ms, exceeds 15 g for a cumulative time period of at least 40 ms, and has a duration of at least 75 ms from t_0 to t_f, where t_0 is the time at the beginning of the deceleration and t_f indicates the time at the end of deceleration pulse.
4.2	<p>If the WTORS is intended for use with all types of manual and powered wheelchairs, the following shall be used:</p> <ol style="list-style-type: none"> an SWC that conforms with the specifications of Annex E of ISO 10542-1:2012; a Hybrid III 50th percentile ATD with an approximate total mass of 77.7 kg.
4.3	<p>If the WTORS is intended to be used only with specific makes and models of wheelchairs, the following shall be used:</p> <ol style="list-style-type: none"> an SWM it is designed for; an ATD that is <ol style="list-style-type: none"> representative of the upper size range of users for which the SWM is designed, selected from ISO 7176-19:2008, Table A.1, and 3) from the Hybrid III family of crash test dummies.

4.4	A means shall be provided to measure the ATD and TWC horizontal excursions specified in 5.2.2 a) and 5.2.4 a) of ISO 10542-1:2012 with a precision of ± 5 mm.
4.5	<p>A means shall be provided to measure the horizontal acceleration and/or deceleration of the impact sled in the direction of travel at a sampling rate in accordance with ISO 6487, and with a precision of $\pm 0,5$ g.</p> <p>The acceleration/deceleration of the impact sled shall stay within the shaded area and exceed the indicated levels for the specified continuous (unbroken arrows) and cumulative (broken arrows) time periods.</p> <p>X axis, time (ms) and Y axis, deceleration (g)</p> <p>Figure A.1 — Acceleration/deceleration requirements for the impact test 48 km/h -0/+2 km/h</p>
4.6	A means shall be provided to measure the horizontal velocity change (ΔV) of the impact sled during the impact with a precision of ± 0.5 km/h
4.7	<p>Provision shall be made to filter analogue transducer signals using a low-pass filter in accordance with ISO 6487, including</p> <ol style="list-style-type: none"> Pre-filtering of all transducer signals to Channel Class 1 000 (-4 dB at 1 650 Hz) prior to digitizing at 10 000 Hz, and filtering of the digitized accelerometer and load-cell signals to Channel Class 60 (-4 dB at 100 Hz).
5	Test preparation and procedure
5.1	<p>The procedures for setting up the test may be undertaken in any order.</p> <p>EXAMPLE It may be more convenient to position the ATD on the TWC prior to lifting the assembly onto the impact sled.</p>
5.2	Adjust the ATD to achieve a static resistance of 1 g at each joint, as indicated by a just-noticeable movement from the mass of the distal body segment, as specified by the ATD manufacturer.
5.3	Place close-fitting cotton clothing on the pelvis, thighs and torso of the ATD.
5.4	Set up the test equipment (see 4 of Appendix C-1a).
5.5	<p>If the SWC is used as TWC, prepare it as follows.</p> <ol style="list-style-type: none"> Modify the frame structure as needed to accommodate the tie-down system to be tested while maintaining the SWC specifications within the tolerances specified in Annex E of ISO 10542-1:2012.

	<ul style="list-style-type: none"> b) Inflate the SWC tyres as specified in Annex E of ISO 10542-1:2012, with the wheelchair unoccupied and resting on a horizontal surface. c) Inspect the tyres for cracks or damage and replace if applicable. d) Inspect the seat plate and plate-support structures and replace if deformed. e) Inspect all frame joints and components and repair if there are signs of fatigue or deformation. f) Install, if needed, wheelchair tie-down adaptors on the SWC.
5.6	<p>If the SWM is used as TWC, prepare it as follows.</p> <ul style="list-style-type: none"> a) Set up the SWM as specified in ISO 7176-19:2008, 4.1 c) to 4.1 g).. b) If applicable, adjust the seat and back support as specified in ISO 7176-19:2008, 4.5. c) Equip the SWM with any required tie-down adaptors.
5.7	Position the TWC facing forward on the sled platform, with the wheelchair reference plane parallel to the direction of sled travel within $\pm 3^\circ$.
5.8	Secure the TWC with the wheelchair tie-down according to the manufacturer's instructions
5.9	<p>In case of a four-point strap-type tie-down, prepare as follows.</p> <ul style="list-style-type: none"> a) Secure the TWC with the four-point tie-down, selecting anchor points that <ul style="list-style-type: none"> 1) are symmetrical about the wheelchair reference plane, 2) are located 1 300 mm 0 +20 mm from the front anchor point to the rear anchor point, 3) have a lateral distance between rear anchor points equal to the lateral distance between rear securement points of the TWC ± 25 mm, and 4) have a lateral distance between front anchor points of 300 mm to 810 mm. <p>NOTE 1 For purposes of locating the anchor points, the front-to-back location of an anchor point is the location of the primary fastener that secures the anchorage to the test platform or, in the case of multiple fasteners, the centre of these fasteners. The lateral location of an anchor point is considered to be the centre of the location where the tie-down end fitting contacts the anchorage hardware attached to the test platform.</p> <ul style="list-style-type: none"> b) Secure the TWC in accordance with the WTORS manufacturer's instructions to achieve lengths of the rear tie-down strap assemblies of 495 mm to 533 mm, measured from the interface of the tie-down end fitting and the securement point on the wheelchair to the anchor point. c) Tension the adjustable-length tie-down straps to the manufacturer's specifications, making sure that the TWC reference plane is parallel to the centre line of the impact simulator within 3°.
	<ul style="list-style-type: none"> d) If the WTORS is tested with an SWM where the location of the securement points makes it impossible to comply with the anchor point locations and strap lengths as stipulated in a) and b), then the SWM should be secured within, or as close as possible to, the angles given in Figures 3 and 4.
5.10	For tie-down systems other than four-point strap-type tie-down, install the wheelchair tie-down anchorages in accordance with the manufacturer's instructions. If a range is given for any installation dimensions, use the midpoint of the range. If fasteners supplied with the WTORS are not compatible with the impact sled, use replacement fasteners with the same thread and material specification.
5.11	<p>In case of a clamp-type tie-down system,</p> <ul style="list-style-type: none"> a) measure the force for securing and releasing the wheelchair tie-down as specified in A.6, and b) ensure that the forces to secure and release the clamp-type tie-down do not exceed the

	<p>requirement given below,</p> <p>Clamp-type wheelchair tiedowns shall be designed such that securing and releasing the tiedown according to the manufacturer's instruction shall not require operating forces in excess of 60 N for hand-operated and 100 N for foot-operated devices or 2,25 N·m torque for screw-operated clamp-type tiedowns, and function accordingly when tested to the performance requirements of Clause 5.</p>
5.12	Position the ATD in the TWC, sitting upright and symmetrical about the wheelchair reference plane, with the pelvis and buttock as far back on the wheelchair seat as possible, and the elbows resting on the armrests or the hands resting on the ATD's thighs.
5.13	<p>If the SWM is used as TWC,</p> <p>a) apply the parking brakes, if fitted, and</p> <p>b) install postural belts as specified in ISO 7176-19:2008, 4.7 of this appendix, if provided.</p>
5.14	Install the pelvic restraint anchorages in accordance with the manufacturer's instructions, selecting anchor points at the midpoints of the recommended zones, if applicable.
5.15	<p>For WTORS that do not include upper anchor or upper webbing-guide supports for shoulder or harness restraints, install the upper-torso restraint anchorages at the point or points marked by a bold cross (X) or crosses in Figure A.2 or A.3, as applicable, to achieve a fit across the ATD shoulders and chest as indicated in Figure H.1 of ISO 10542-1:2012.</p> <p>Use the upper-torso restraint anchorage and fastener hardware, if supplied as part of the complete WTORS by the manufacturer.</p> <p>When an upper-torso restraint webbing guide is provided, the guide shall be located to achieve the desired shoulder belt geometry as indicated in Figure A.2 or Figure A.3, as appropriate.</p> <p>NOTE The anchor points are located relative to the top centre of the ATD's shoulders. ^a Wheelchair reference plane.</p>

Figure A.2 — Locations for upper anchor point(s) of centre-anchored and two-point-anchored harnesses in frontal impact test

	<p style="text-align: right;">Dimensions in millimetres</p>  <p>Adjust the anchor-point location to give a good fit to the ATD chest and shoulder.</p> <p>The lateral position of the anchor point should be adjusted to achieve a good fit over the ATD's shoulder.</p> <p>NOTE The anchor point may be located on either side of the wheelchair and ATD, and is located relative to the top centre of the ATD's shoulder.</p> <p>Figure A.3 — Location for upper anchor point of shoulder belt in frontal impact test</p>
5.16	For WTORS that include support components for upper anchor points or upper guide points for upper torso belts, install the anchorages or guides as specified by the manufacturer to achieve a good fit to the ATD's shoulders and chest.
5.17	Place the pelvic belt on the ATD and adjust the tension in the pelvic belt to achieve a snug fit.
5.18	Place the shoulder belt or harness on the ATD and adjust the belts as follows. <ul style="list-style-type: none"> a) If an emergency-locking or automatic-locking retractor is provided, adjust the belts to achieve a snug fit. b) If no emergency-locking or automatic-locking retractor is provided, adjust the belts to achieve a snug fit with a 75 mm × 75 mm × 25 mm thick plate inserted between the ATD's chest and the belt webbing with the plate lying flat against the ATD's chest, and then remove the plate.
5.19	If the SWM is used as TWC, and <ul style="list-style-type: none"> a) if the SWM provides anchor points for wheelchair-anchored pelvic- and shoulder-belt restraints, install and position the occupant restraint as specified in ISO 7176-19:2008, A.4.9; b) if the SWM is equipped with a wheelchair-anchored pelvic-belt restraint, install and position the pelvic-belt restraint as specified in ISO 7176-19:2008, .4.10 a).
5.20	If a high-speed camera or high-speed video is used for the measurements in .4.4 of this appendix, apply contrast markers appropriate to the measurement system at: <ul style="list-style-type: none"> a) the lateral aspect and centre of the ATD's knee joint, and b) point P of the TWC, and
	<ul style="list-style-type: none"> c) H points of the ATD. <p>NOTE Use appropriate targeting to give accurate displacement of P point.</p>
5.21	Ensure that the TWC reference plane is parallel to the centre line of the impact simulator within 3°.

5.22	<p>If the SWM is used as TWC,</p> <p>a) install the foot/leg strap as specified in ISO 7176-19:2008, 4.13, and</p> <p>b) carry out the recordings and measurements as specified in ISO 7176-19:2008 4.14 and 4.15</p> <p>NOTE: To minimize damage to the ATD during testing, ISO 7176-19 specifies a foot/leg strap that restricts knee-joint and shoulder movements due to limb inertia in a manner that does not affect the WTORS loading and ATD excursions during testing. The leg strap changes ATD kinematics slightly during rebound, making the rebound more consistent and repeatable. It does not affect forward excursions and WTORS loading.</p>
5.23	<p>Make provisions to subject the impact sled and the test specimens to</p> <p>a) a horizontal velocity change of 48 km/h -0/+2 km/h,</p> <p>b) using a deceleration-time pulse that conforms to .4.1.d.1) to .4.1.d.4) of this appendix.</p>
5.24	<p>Conduct the test by executing the appropriate sequence of steps to activate the impact sled and start the recording equipment.</p>
6	<p>Measurement procedures for operation force</p> <p>NOTE : The measurement procedures for the operation force included in this annex are based on the measurement procedures defined in EN 12184.</p>
6.1	<p>Measurement procedure for lever-operated clamps</p> <p>a) Select the part of the lever through which the force is to be applied.</p> <ol style="list-style-type: none"> 1) If the lever is fitted with a generally spherical knob, apply the force through the centre of the knob. 2) If the lever is tapered, apply the force through the point where the largest cross-section intersects the centre line of the lever. 3) If the lever is parallel or any shape other than those above, apply the force through a point on the centre line of the lever 15 mm below the top. 4) If the shape of the lever is such that the lever is gripped by the whole hand- or is foot-operated, apply the force through the centre line of the lever 15 mm from the end. 5) If the lever is hand-operated by pushing or pulling a bar or pad, apply the force to the centroid of the bar or pad. <p>b) Operate the wheelchair tie-down by applying the means to measure the force until the wheelchair is secured in accordance with the manufacturer's instructions.</p> <p>c) Record the maximum force applied for securing.</p> <p>d) Operate the wheelchair tie-down by applying the means to measure the force until the wheelchair is released in accordance with the manufacturer's instructions.</p> <p>e) Record the maximum force applied for releasing.</p> <p>f) Repeat b) to e) three times in total and calculate the average values for securing and releasing.</p> <p>g) Record the average values for securing and releasing.</p>
6.2	<p>Measurement procedures for screw-operated clamps</p> <p>a) Apply force by using a torque meter positioned concentrically on the operating nut of the clamp-type tie-down system, increasing to the maximum operating force as slowly as possible.</p> <p>NOTE: The torque meter may require the addition of an appropriate device to fit the shape of the operating nut.</p> <p>b) Record maximum operating torque for securing and releasing the wheelchair.</p> <p>c) Perform a) and b) three times in total.</p> <p>d) Calculate the average values for securing and releasing.</p> <p>e) Record the average values for securing and releasing.</p>

7	<p>Evaluation of test results : After the test, examine the TWC, ATD and WTORS, and analyse the excursion measurements relative to the requirements of 4.2 or 7.1 of this appendix to determine if the WTORS, and if applicable the SWM, meet the requirements of 4.0.</p>
7.1	<p>Requirements after the test when tested with SWM</p> <p>When the WTORS is tested in accordance with Appendix C-1a using an SWM, at the conclusion of the test:</p> <p>a) the requirements of 4.1.2 c) to g) Annexure C-1 of this standard, and</p> <p>b) the requirement in ISO 7176-19:2008, 5.2.2 shall be met.</p>
	<div data-bbox="438 514 1404 976"> <p>Dimensions in millimetres</p> <p>1 rear securement points</p> <p>NOTE The angles shown are obtained by projecting the angle of each tiedown strap onto a vertical plane parallel to (side view) or perpendicular to (rear view) the wheelchair reference plane.</p> <p>a Wheelchair reference plane.</p> </div> <p>Figure 3-Preferred angles of rear wheelchair tie-down straps and locations of tie-down anchor points</p>
	<div data-bbox="430 1260 1372 1711"> <p>Dimensions in millimetres</p> <p>1 front securement points</p> <p>NOTE The angles shown are obtained by projecting the angle of each tiedown strap onto a vertical plane parallel to (side view) or perpendicular to (front view) the wheelchair reference plane.</p> <p>a Wheelchair reference plane.</p> </div> <p>Figure 4-Preferred angles of front tie-down straps and locations of tie-down anchor points</p>

Annexure C-2 Requirement for Hill-hold or Sensible Braking System (SBS)				
1.	SBS is applicable for Hydraulic and Air Braking System laid Vehicles. Including ABS and Non-ABS Vehicles. SBS is applicable for Manual, Automatic and Auto Manual Transmission Vehicles.			
2.	Additional ON/OFF Switch can be provided to enable or disable SBS system.			
3.	Technical requirement: Wherever Hill-hold or Sensible Braking System (SBS) are fitted they shall comply with following provisions.			
3.1.	Testing Procedure for Manual Transmission Vehicles			
	<u>18 % Grade - Uphill</u>		<u>18 % Grade – Downhill</u>	
	Vehicle Stationary up to 15 Minutes	Vehicle Roll Back	Vehicle Stationary up to 15 Minutes	Vehicle Roll Front
Service Brake Force to Hold Vehicle Stationary (N)				
"SBS" Activated and Service Brake Dis Engaged (N) at Zero Speed				
"SBS" Activated and Service Brake Dis Engaged in Gear Position (Clutch Engaged) at Zero Speed				
	YES	NO	YES	NO
Data Indicates Compliance				
Comments (If Any)				

3.2	Testing Procedure for Auto Transmission and Auto Manual Transmission Vehicle			
	<u>18 % Grade – Uphill</u>		<u>18 % Grade – Downhill</u>	
	Vehicle Stationary up to 15 Minutes	Vehicle Roll Back	Vehicle Stationary up to 15 Minutes	Vehicle Roll Front
Service Brake Force to Hold Vehicle Stationary (N)				
"SBS" Activated and Service Brake Dis Engaged (N) at Zero Speed				
"SBS" Activated and Service Brake Dis engaged D Mode (Driving Mode) at Zero Speed				
	YES	NO	YES	NO
Data Indicates Compliance				
Comments (If Any)				

Annexure C-3 Technical specifications other than those specified in clause C1.0 to be provided by vehicle manufacturer / retro-fitter for Approval as per Part C		
1.0	Details of vehicle manufacturer / retro-fitter	
1.1	Name & address of the vehicle manufacturer or importer or retro-fitter	
1.2	Telephone / Mobile No.	
1.3	Fax. No.	
1.4	E-mail address	
1.5	Contact person	
1.6	Address of the Plant(s) of manufacture	
1.7	Model Name	
1.8	Variant Name	
1.9	Vehicle Type (Variant (OE) / Retro-fitted)	
1.10	Seating Layout Drawing No.	
1.11	Seating Capacity	
2.0	Overall Vehicle Dimensions (mm)	
2.1	Vehicle length, mm	
2.2	Vehicle width, mm	
2.3	Vehicle height, mm	
2.4	Wheel Base (mm)	
3.0	Docking System provided (Yes/No)	
4.0	Wheelchair	
4.1	Forward facing/ Rearward facing	
4.2	Wheelchair accommodation provisions	
4.2.1	Width	
4.2.2	length	
4.3	Percentage of Slope	
4.4	Height of wheelchair access door	
4.5	Width of wheelchair access door	
4.6	Foldable or detachable seats in wheel chair area provided (Yes/ No)	
4.7	Type of wheelchair restraint system	
5.0	Wheelchair Electronics provided (Yes/No)	
6.0	SBS system as per Annexure C-2 provided (Yes/No)	

<p style="text-align: center;">Part D</p> <p style="text-align: center;">Vehicle adaptation legal provisions made by the Central Government of India recently, facilities in India and good engineering practices</p>	
D 1.0	Information on recent notifications issued by the Central Government for Adapted Vehicles
D 1.1	MORTH letter No. RT-11036/06/2019 dated the February, 2019 (signed on 28 th Feb. 2019) regarding Alterations in Motor Vehicles which allows deletion of seats, lateral/side facing seat fitment and conversion from soft top to hard top and vice versa for M1. In case of deletion of seats as specified in clause A 2.2.4 no reduction in State / Centre Tax.
D 1.2	Motor Vehicle (Amendment) Act 2019 No. 32 of 2019 dated 9th August 2019 issued by Ministry of Law and Justice – It has definition of Adapted Vehicle under Section 2 of MVA and provisions on allowable changes under Section 52 of MVA.
D 1.3	MORTH notification Draft GSR 336 (E) dated 29th May 2020, regarding definitions of L1 and L2 Two wheelers, alterations in vehicle, provisions for adapted vehicles, etc.
D 1.4	Draft GSR 337 (E) dated 29th May 2020, regarding vehicle recall and testing of adapted vehicle, etc.
D 1.5	MoHI&PE order F. No. 12(42)/2015-AEI dated 24 th October 2019 regarding various criteria for GST exemption for Adapted Vehicle (Vehicles length shall not exceed 4.0 m, gasoline engine capacity ≤ 1200 CC; diesel engine capacity ≤ 1500 CC).
D 1.6	MORTH notification GSR 401 (E) dated 24th, June 2020, regarding issuance of driving license to person with partial color blindness.
D 1.7	GSR 661 (E) dated 22nd October 2020 for modifications in Form 20 (Application for Registration of Vehicle) modifications related to addition of Ownership type e.g. Autonomous body; Divyangjan (availing GST concession / without availing GST concession); multiple owner, etc.
D 1.8	MORTH letter No. RT- 11021/40/2014-MVL dated 14 th June 2016 adapted vehicle driving licence linking with type of disability.
D 1.9	MORTH advisory dated 13 th November 2020 stating no need of alteration in case of auto-gear vehicle.
D 2.0	<p>List of approved retro-fitment kit manufacturers or authorized workshops for vehicle adaptations</p> <p>(Note: This list is inserted to give information on such facilities available in India, as a quick reference to differently abled driver for his vehicle adaptation. It is arranged as per alphabetical order of State and District. Testing agencies are requested to provide such information with them for further elaboration. While publishing of this standard and when alternative for availing such information is made, it may be separated from the standard, if required.). Also it is to be noted that following retro-fitters/workshops may or may not have approval for all type of disabilities mentioned in this standard.</p>
D 2.1	M/s. Vir Easy Drivers , B 62C Shabad Daulatpur, Main Bawana Road, Opposite Arya Samaj Mandir, Delhi – 42

D 2.2	M/s. Power Link Automation B165, Electronic Estate, Sector – 25, Gandhinagar – Pin-code 382024, Gujarat
D 2.3	M/s. SAIKA, 25-Goyal Park, Opposite Goyal Park, Premchand Nagar Road, Ahmedabad – 380007, Gujarat E-mail : samirkakkad@gmail.com
D 2.4	M/s. DECCAN MOTOR CYCLE & SCOOTER GARAGE Opp. R. K. S. Motors or Dunlop Company, Nampally, Hyderabad – T. S. E-mail deccanmotorcycle@gmail.com
D 2.5	Mr Biju Varghese Purayadathil House, Venkurinji, Mukkoottuthara, Kottayam (Via), Kerala – 686 510
D 2.6	M/s. Perfect Vehicle Care Centre Thanikkal. P.O. Kodur Malappuram, Kerala Pin code - 676504
D 2.7	M/s. FORECH ENGINEERS, EQUIPMENT AND ACCESSORIES 848/1 Gala No 1, A Ward, Kalamba, Indira Tower, Gargoti Road, Kolhapur - 416000
D 2.8	M/s. Ferro Equip Jay Nagar Coop. Hsg. Society Ltd., Wing, Flat No. 85, Janakalyan Nagar, Kharodi, Malad (W), Mumbai – 400 095. E-mail : ferdirodricks@gmail.com ferdi@ferroequip.com
D 2.9	M/s. Laxmi Equipments & Accessories B-1/4, Best Rajhans Co-operative Housing Society, Ghatkopar (E), Mumbai - 400075
D 2.10	M/s. Volkswagen India Pvt. Ltd. E1, MIDC Industrial Area (Phase III), Village Nigoje Mhalunge, Kharabwadi, Tal. Khed, Chakan, Pune – 410 501
D 2.11	M/s. Automate India, 10, Aasawari, 21, Bhosale Nagar, PUNE – 411007, Maharashtra. E-mail: ceo@automateindia.in
D 2.12	M/s. Auto Buddy India 504 B, Shaniwar Peth Pune - 411030. E-mail : gaikwadyr@gmail.com
D 2.13	M/s. Kotkar Energy Dynamics Pvt. Ltd.. Rhudayaniwas, Kotkar Lane, Bhau Patil Marg 40, B, Aundh Road, Khadki, Pune - 411020. E-mail atul.kotkar@kotkar.com
D 2.14	M/s. Anand Motors 8 Krishna Colony, Naya Khera Ambabari, Jaipur, Rajasthan Pin code – 302039
D 2.15	M/s. Tirupati Car Modifier, 22 Gupteshwar Nagar, Sector No. 7, Hiran Magari Udaipur, Rajasthan. E-mail : ravi_lovina@rediffmail.com
D 3.0	Panel's recommendations
D 3.1	In case of automatic transmission vehicle suitable for particular type of disability and no further modifications are required for differently abled driver's driving, he/she shall be issued driving licence for driving of Adapted Vehicle suitable for the type of disability.
D 3.2	As per present CMVR provisions for adapted vehicle, driving licence has vehicle registration number endorsed on it, which restricts him/her from driving other adapted vehicle suitable for his/her type of disability. Driving licence shall be issued for type of disability of the person, so that person with particular type of disability can drive other adapted vehicles suitable for the type of disability.
D 3.3	Adapted vehicle shall be allowed to be driven by person without disability as well. This is required in following cases as example: 1. In a family one person is differently abled driver however other member(s) is/are

	<p>without disability, the family shall not be required to purchase extra vehicle.</p> <p>2. In case of repairing, servicing of Adapted Vehicle, it can be driven by normal person (person without disability).</p>
D 3.4	<p>Adapted vehicle suitable for multiple limb disability shall be registered mentioning its suitability for those type of disabilities. This is required in following case as example but not limited to:</p> <p>e. g. In a family more than one person can be differently abled driver however other member(s) is/are with different type of limb disability, however with introduction of flexible system enabling suitability of adapted vehicle to be driven by two or more types of disabilities is possible. This will safeguard the family from undue burden to purchase another vehicle at their wish.</p>
D 4.0	<p>Information and procedure on getting physically disabled certificate is available on following website : www.swavlambancard.gov.in</p>
D 5.0	<p>Good engineering practices followed while vehicle adaptation</p>
D 5.1	<p>Good engineering practices followed while vehicle adaptation as per part A</p> <ul style="list-style-type: none"> • Nyloc nuts to be used as retainers for locking all bolts. • Standard thread size of nut & bolts to be used, so that when replacement is required, they are easily available. • Use of high tensile nut / bolts for fittings that have load bearing. • Metal Material thickness to be maintained and should not be thinner than the OE vehicle metal thickness. • Any wiring carried out to be well insulated and secured with shrink tubing to ensure that contacts are securely fitted and fitted with 4 point / 5 point connectors. • Any additional wiring for adapted fittings to be supported with a fuse • Toughened glass as per IS 2553 (Part 2) specifications and thickness to be used only. • Components used in the adaptations should be as standard as possible so that availability is easy. • Seat belts & wheelchair restraints wherever required to be used should be secured to proper strong points, such as seat mountings. • Any cables used should be easily available for replacement. DIY videos should be made available on YouTube unless expertise is required.
D 5.2	<p>Information on good engineering practices followed for Kneeling System provisions</p>
	<p>Adapted vehicles will find applications for enhancing mobility of differently abled individuals including individuals in paraplegic situation. Requirements of such users may require their transportation along with their wheelchair and associated mobility equipment's and / or require enhanced comfort to avoid trauma during travel.</p> <p>For example - impairment in locomotive & spinal injuries - may or may not need access by wheelchair to vehicle by ramp, lift, and / or kneeling and may or may not require enhanced comfort by change of suspension characteristics with an aim to enhance the ex-factory suspension characteristics.</p>

D 5.2.1	What Is a Kneeling System?
	<p>A kneeling system lowers the vehicle to adjust the floor height for ease in entry to the vehicle. A ramp or lift could be used to push or lift a wheelchair into the vehicle. There could be one or more technologies used for lowering the vehicle safely and also ensuring that the vehicle is not driven in the lowered condition. If lowering is applied on the rear axle of the vehicle can only be lowered on the rear side. If the lowering is applied on the front and rear axle, then the kneeling can be done side to side as well.</p> <p>Examples of kneeling system: Hydraulic Kneeling – via hydraulic jacks / shock absorbers Pneumatic kneeling – air suspension</p>
D 5.2.2	Kneeling System requirements
D 5.2.2.1	Kneeling to be as low as possible with existing axle configuration however the kneeling system may not have negative influence on the drivability of the base vehicle.
D 5.2.2.2	To incorporate a kneeling system, the suspension may be partially or completely changed without negative impact on the drivability of the base vehicle.
D 5.2.2.3	A vehicle with steel suspension, has ride height or floor height or normal height changing with respect to loading in the vehicle. Pneumatic suspensions are designed to give fixed ride height irrespective of loading in the vehicle, hence helping adapted vehicles where there may be additional fixed load.
D 5.2.2.4	The selected kneeling system affecting the suspension should meet or enhance the original suspension system in terms of vehicle stability & drivability and braking and comfort in accordance with UNECE R-13 and / or UNECE R-140. The guidelines for comfort can be referred under ISO 2631 / 8041.
D 5.2.2.5	In comparison with the vehicle's series condition, driving and steering performances must not be affected in a negative way by the installation of the components.
D 5.2.2.6	The braking behaviour as well as the behaviour of the ESC must not be affected by system. The fulfilment of the requirements for the ESC behaviour of UN ECE R13 / R140 should be demonstrated.
D 5.2.2.7	The fulfilment of the requirements for the steering according to UN ECE R79 should be demonstrated.
D 5.2.2.8	The assembly / attachment of the components to the vehicle should be regarded as being safe and permanent. A typical kit may be adapted to the vehicle without making critical permanent changes to the existing chassis ensuring that the OEM parts can be restored like the series production.
D 5.2.2.9	The components' adequate strength as well as the strength of the relevant vehicle components must be proven.
D 5.2.2.10	There should be free movement of the vehicle's chassis parts with the installation of the kneeling system during all operational conditions. The ground

	clearance must be sufficient.
D 5.2.2.11	Marking of the components by means of an adhesive foil or embossing should be permanent and safe against manipulations.
D 5.2.2.12	After the kneeling system has been installed in the vehicle, headlights alignment must be adjusted to the value specified by the manufacturer.
D 5.2.2.13	The vehicles' electro-magnetic compatibility will not be impaired by the installation of the kneeling system. The electronic components of the kit must comply with the requirements for electromagnetic compatibility (EMC) according to UNECE R10.
D 5.2.2.14	The system should have a "Limp-Home" function in case of a malfunction of the kneeling system.
D 5.2.2.15	Further to this, there is need for adapted vehicles and it is the obligation of the manufacturers to make this possible in a good and safe way. Therefore, it is a must that vehicle manufactures cooperate with body builder / Tier 1 suppliers to make sure that there is a share of information to have safe converted vehicles (agreements of association). The OEM body builder guideline released by the OEM will be helpful in designing the adapted / customized vehicles.

ANNEXURE D-1

Standard Operating Procedure for adaptations as per part A

1.	Differently abled driver approaches the Regional Transport Authority for driving license.	<pre> graph TD A([Approach RTA]) --> B[Go to Civil Surgeon Or AIIPMR with 'Referral Letter'] B --> C[BTI form filling and taking RTO permission] C --> D[Vehicle adaptation by authorized workshop] D --> E[Adapted vehicle inspection By RTO] E --> F[Apply and get driving license] F --> G([Drive AV]) </pre>
2.	They direct him/her to the Civil Surgeon and hand over a 'Referral Letter'.	
3.	The Civil Surgeon or AIIPMR (All India Institute of Physical Medicine & Rehabilitation) examines the Differently abled driver and issues a Driving Fitness Certificate, in which modification(s) the Differently abled person would require are suggested, so that the person can drive with able limbs. Driving fitness certificate also states that the person is fit to drive an Automatic transmission / manual transmission fitted with hand controls (depending on the disability.). Vehicle shall have registration in the name of Differently abled person.	
4.	B.T.I. form is to be filled by the differently abled person stating the type of modifications / hand controls required to be done in the vehicle. The form is to be signed by the owner and to be approved by the RTO – taking permission for fitment of hand controls.	
5.	Vehicle to be modified by authorized workshop and relevant documents to be submitted by the RTO approved / authorized workshop.	
6.	Adapted Vehicle (AV) is to be presented (with a modification certificate from the modifier) for inspection at RTO to verify fittings are as per recommendations and requirements of the differently abled driver and gets it registered as an “Adapted Vehicle”. Endorsement of the fittings will be done in the registration book by the RTO	
7.	differently abled person can now apply for a learner’s license. After one month he / she can give a driving test for a permanent license.	
	Note : These steps in Annexure D-1 are for vehicle adaptation from retro-fitter / authorized workshop.	

ANNEXURE 1
(See introduction)
**COMPOSITION OF AISC PANEL ON
ADAPTED VEHICLES***

Convener	ORGANISATION
Mr. A. V. Mannikar	ARAI
AISC Secretariat	
Mr. V. P. Rawal	The Automotive Research Association of India (ARAI)
Members	Representing
Mr. B. V. Shamsunder	The Automotive Research Association of India (ARAI)
Mr. Vishwas A. Khedekar	The Automotive Research Association of India (ARAI)
Mr. D. S. Bhalerao	The Automotive Research Association of India (ARAI)
Mr. Mihir A. Kulkarni	The Automotive Research Association of India (ARAI)
Mr. Tagad Nilesh R.	Central Institute of Road Transport (CIRT)
Mr. Mohammed Suhail	Global Automotive Research Centre (GARC)
Mr. Hariharan R	Global Automotive Research Centre (GARC)
Mr. V. M. Dhanasekar	Global Automotive Research Centre (GARC)
Ms. Vijayanta Ahuja	International Centre for Automotive Technology (ICAT)
Dr. Anita Gupta	All India Institute of Physical Medicines and Rehabilitation (AIIMPR)
Dr. Vaishali Kolhe	Tata Institute of Social Sciences (TISS)
Mr. J. V. Shah	Rtd. - Gujarat Road Safety Authority
Mr. B Wagale	Rtd. - RTO Maharashtra
Mr. S. Ravishankar	In personal capacity
Mr. Ved Prakash Gautam	SIAM (Ashok Leyland Ltd.)
Mr. V. Faustino	SIAM (Ashok Leyland Ltd.)
Mr. Girish S. Kodolikar	SIAM (Force Motors Ltd.)

Mr. Karuppasamy	SIAM (Honda Cars R&D India Ltd.)
Mr. Alauddin Ali	SIAM (Jaguar Land Rover India Ltd.)
Mr. V. G. Kulkarni	SIAM (Mahindra Truck & Bus Div.)
Mr. Arun Jalali	SIAM (Mahindra & Mahindra Ltd.)
Ms. Pushpanjali Pathak	SIAM (Mahindra & Mahindra Ltd.)
Mr. Gururaj Ravi	SIAM (Maruti Suzuki India Ltd.)
Mr. Raj Kumar Diwedi	SIAM (Maruti Suzuki India Ltd.)
Ms. Buvaneswari	SIAM (Maruti Suzuki India Ltd.)
Mr. Selvam M	SIAM (Renault Nissan India Pvt. Ltd.)
Mr. Milind K. Jagtap	SIAM (Skoda Auto Volkswagen India Pvt. Ltd.)
Mr. P. S. Gowrishankar	SIAM (Tata Motors Ltd.)
Mr. Pratyush Khare	SIAM (Tata Motors Ltd.)
Mr. Vinay Maurya	SIAM (Tata Motors Ltd.)
Ms. Namrata Deb	SIAM (Tata Motors Ltd.)
Mr. Atul A. Date	SIAM (Tata Motors Ltd.)
MR. Vijeth Gatty	SIAM (Toyota Kirloskar Motor Pvt. Ltd.)
Mr. Uday Harite	ACMA
Mr. Deepak M. K.	Toyota Boshoku Automotive India (P) Ltd.
Mr. Srikanth Nallur	Hyundai Construction Equip. Ind.
Dr. Ferdinand Rodricks	Ferro Equip.
Mr. Samir Kakkad	Saika Mobility Hub, Ahmedabad
Mr. Hiren Patel	Saika Mobility Hub, Ahmedabad
Mr. Yashwant Gaikwad	Autobuddy India
Mr. Atul Kotkar	Kotkar Energy Dynamics P. Ltd.
Mr. Shantanu Kadlaskar	Kotkar Energy Dynamics P. Ltd.
Mr. Ravindra Pandey	Tirupati Car Modifier

Mr. R. D. Nerurkar	Janva Motors Pvt. Ltd.
Mr. Sanjeev V. Mestry	Sanva Motors (P) Ltd.
Ms. Sanjana Aswani,	Mobicab
Mr. Rrajesh Patil	EZY MOV.
Mr. Jayesh N. Shah	Heelix / Kenex India Pvt. Ltd.
Mr. Ravi Mundada	VB Air-suspension INDIA
Mr. Paul Peters	VB Air-suspension Netherland
Mr. Yuvaraja P	Auto Tricks Pvt. Ltd.
Mr. K. Yuvaraj	Auto Tricks Pvt. Ltd.
Mr. Dipak	Toyota Seats
Mr. Kapil Saproo	Rasoi Group
Mr. Swapnil Tambe	Pinnacle Industries

* At the time of approval of this Automotive Industry Standard (AIS)

ANNEXURE 2
(See Introduction)

COMMITTEE COMPOSITION *
Automotive Industry Standards Committee

Chairperson	
Dr. Reji Mathai	Director The Automotive Research Association of India, Pune
Members	Representing
Representative from	Ministry of Road Transport and Highways (Dept. of Road Transport and Highways), New Delhi
Representative from	Ministry of Heavy Industries and Public Enterprises (Department of Heavy Industry), New Delhi
Shri S. M. Ahuja	Office of the Development Commissioner, MSME, Ministry of Micro, Small and Medium Enterprises, New Delhi
Shri Shrikant R. Marathe	Former Chairman, AISC
Shri R.R. Singh	Bureau of Indian Standards, New Delhi
Director	Central Institute of Road Transport, Pune
Director	Global Automotive Research Centre
Director	International Centre for Automotive Technology, Manesar
Director	Indian Institute of Petroleum, Dehra Dun
Director	Vehicles Research and Development Establishment, Ahmednagar
Director	Indian Rubber Manufacturers Research Association
Representatives from	Society of Indian Automobile Manufacturers
Shri R. P. Vasudevan	Tractor Manufacturers Association, New Delhi
Shri Uday Harite	Automotive Components Manufacturers Association of India, New Delhi
Shri K. V. Krishnamurthy	Indian Construction Equipment Manufacturers Association
Member Secretary	
Shri Vikram Tandon	The Automotive Research Association of India,
* At the time of approval of this Automotive Industry Standard (AIS)	