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Overview of Automotive Seating System

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Abstract:-In Automobiles, Seat is very important part. The standard car seat is designed to support thighs, the buttocks, lower and upper back, and head support. The front driver and passenger seats of most vehicles have three main parts: the seat back (squab), seat base (cushion), and the head-rest. These components are usually constructed from foam to provide comfort to the rider. When choosing this product, foam manufacturers must consider the most suitable foam for balancing comfort, support, safety, and recycling properties. This paper gives overall idea of Automotive seating system.

Keywords— Automobile, Seat, Head rest, Foam, Tracks, Recliners, Seat belt.

INTRODUCTION

Automotive seat is used to give comfort to the person who is driving. The cushioning agent is especially important when considering that moving cars can transmit vibrations near the human spine's resonant frequency of 3 Hz. The base can usually be moved forward and back on metal railings and may move up and down to adjust to different body types. This movement is accomplished either by manual latches or by electric levers. Now we will see the entire Seating System.

MAIN FUNCTION OF SEAT:-

Seat system is the very important part of the vehicle which always comes in contact with the occupant when the vehicle is used and is also directly responsible for the comfort/safety of the occupant.

1. Occupant Support:-

    a. Occupant should get stable support for long time.

    b. Occupants of various weights, sizes and proportions should be accommodated in the Seat.

2. Occupant Position:-

    a. Occupant position is very important for safe operation of the vehicle.

    b. Occupant should be positioned ergonomically so as to have clear field of vision.

    c. Occupant should have good Head, leg and arm room.

3. Protect Occupant:-

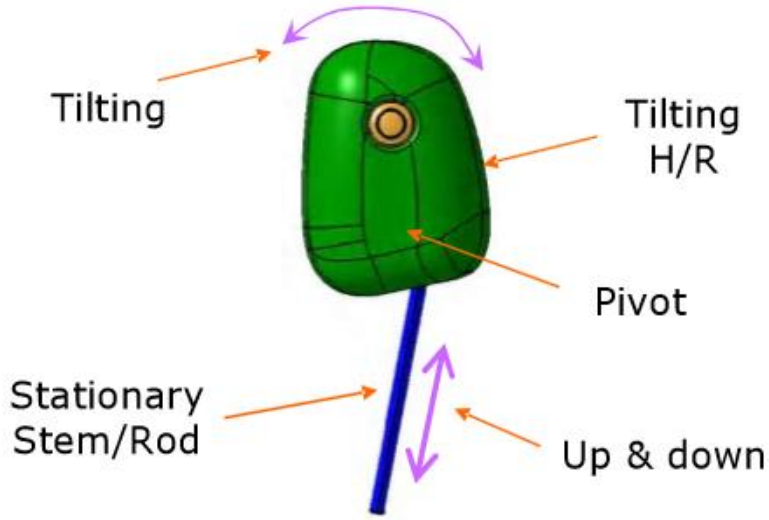
    a. During the crash occupant should not be unduly displaced from the seat.

    b. Seat system parts should not injure occupant before/during/after vehicle crash.

Main assemblies / areas within the Seat (CAD):-

The automotive seating system consist of following parts:-

1. **Head Rest:-**



In most cars head restraints are kept relatively small in order not to unnecessarily obstruct the rear passenger visibility. Two seater sports cars often have a much larger head restraint area which is safer. A small head restraint has to be adjustable for the user and some are also adjustable in angle as if they might be used as a head rest. An effective comfortable head rest, as for instance on a fireside chair, has to support the base of the skull near the top of the neck. This would be extremely dangerous in a car. It is this confusion and the simple fact that what can be adjusted right will usually be adjusted wrong that led Design to avoid any adjustment in head rests.

FUNCTION OF HEAD REST:-

1. Prevents head injury during vehicle crash.
2. Supports head.
3. DVD/VCD screen can be packaged in Head rest.

TYPES OF HEAD REST DEPENDING UPON SAFETY:-

1. Active – Activates during vehicle crash.
2. .Passive – Does not activates during crash.

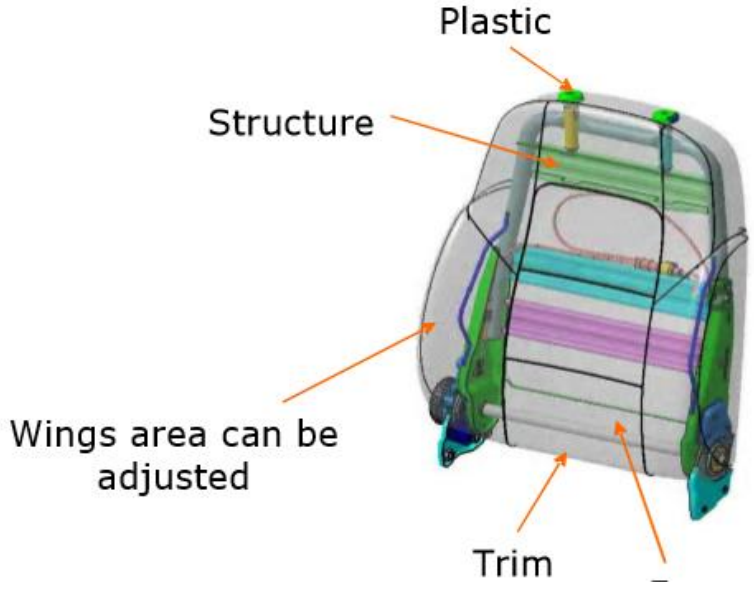
STANDARD MATERIAL USED IN HEAD REST:-

1. Head rest structure (Rod/Stem).
2. Plastic
3. Foam.
4. Trim.

HEAD REST CONFIGURATIONS:-

1. Can move up and down.
2. Can rotate (Tilt) along the pivot in forward and rearward direction.
3. Wings on the Head restraint can rotate and support head.
   (Head rest can be 2-Way, 4-Way and 6-Way depending upon above combination)

2. Seat Back :-



Seat back assembly mainly consist of 4 parts as shown in the picture above. It is very important in order to have comfortlness to the occupant

FUNCTION OF SEAT BACK :-

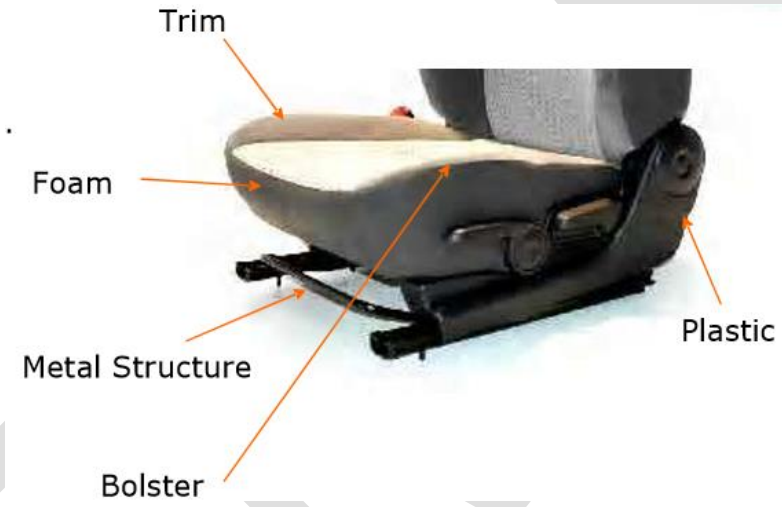
1. Supports occupant's back.
2. Positions occupant's back.

Standard seat back assembly consists of

1. Metal structure.
2. Plastic
3. Foam
4. Trim

There are a lot of features which are incorporated within the seat back assembly. Lumber support is one feature. Back of seat is so designed to have enough lumber support. In some cases it is also used as the heating and ventilation purpose. Folding pad, Lap top tray, Side Air bag, Knee air bag for Rear seat occupant are some of the important features.

3. Seat Cushion:-



Seat cushion is important in order to get the thighs support and position of occupants. During the manufacturing of seat cushions polyethers are used.

FUNCTION OF SEAT CUSHION:-

1. Supports occupant ischium and thighs.
2. Positions occupant.

Standard Seat Cushion assembly consists of

1. Metal structure.
2. Plastic
3. Foam.
4. Trim.

SEAT CUSHION CONFIGURATIONS:-

1. Can move in forward and rearward direction.
2. Can move up and down (Height adjustment).
3. Can tilt (Thigh support)
4. The Bolster can rotate.

5. SEAT BELT:-

In a severe collision, the occupant can either strike the dashboard, or strike the seat belt. How much trauma the body of the occupant experiences will depend on the time period over which the force is applied and the stiffness of the body parts absorbing the force. Stretching the time epoch of the collision for the occupants and redistributing the crash forces to the stiffest parts of the human anatomy is the duty of the seat belt. Equally important, seat belts are the best way to prevent ejection from the vehicle.
The seat belt restraint system contains some or all of these components

1. shoulder guide loop,
2. webbing
3. non-locking retractor
4. automatic locking retractor
5. emergency locking retractor
6. vehicle sensitive retractors
7. webbing sensitive retractors
8. buckle
9. buckle release
10. tongue (latch plate)
11. selvage

6. AIRBAGS:-

All cars feature dual-stage front airbags as well as front side-impact and side curtain airbags, controlled by a "smart" airbag system that detects passenger weight, seatbelt use and driver's seat position, then deploys the front airbags accordingly while ensuring the side-impact and side curtain airbags only deploy when needed. The dual-stage means they can be deployed in one of two ways: a low to medium speed collision will cause a single-stage deployment, while a severe impact will trigger a full deployment. The front side-impact airbags are built right into the front seats to ensure they are in proper position at all times. The side curtain airbags deploy from above the side windows to almost completely cover the front and rear side windows and the center pillar, helping to protect against injury and intrusions into the cabin in a side impact.

MECHANISMS USED IN THE SEATS:-

1. Recliners:-

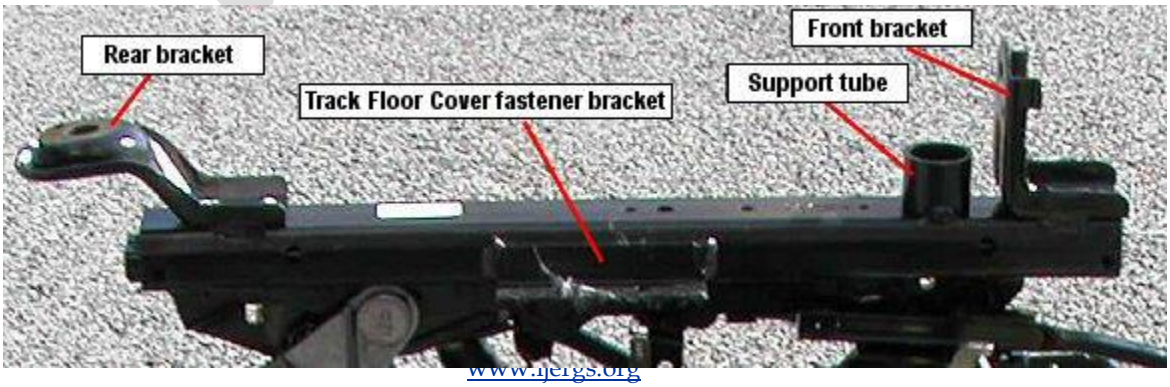
FUNCTION OF RECLINER:-

- Allow to tilt Seat back in forward and rearward direction by specified angle.

Selection of recliner depends upon following factors:-

1. Safety and regulation – The load which Recliner is going to take
2. Manual / Power – It depends upon whether seat is luxurious or not.
3. Price
4. Continuous or discontinuous
5. Availability

2. Tracks:-



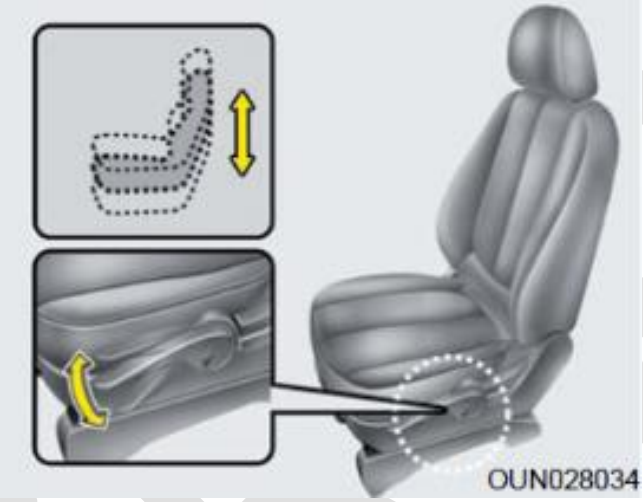
FUNCTION OF TRACKS:-

- The Function of track is to allow movement of Seat in forward and reverse direction by specified distance.

Selection of Track depends upon following factors –

1. Safety and regulation – The load which track going to take
2. Manual / Power – It depends upon whether seat is luxurious or not.
3. Price
4. Availability

3. Cushion height adjustment/tilt:-



FUNCTION OF CUSHION HEIGHT ADJUSTMENT:-

- Allows to move Seat up and down direction by specified distance.

Selection of Track depends upon following factors –

1. Safety and regulation
2. Manual / Power – It depends upon whether seat is luxurious or not.
3. Price
4. Availability

FACTORS NEED TO BE CONSIDERED WHILE DESIGNING THE SEAT:-

1. **Sheet metal design:-**
   a. In most of the seats, sheet metal contribute more than 70% of weight, so it is important to understand sheet metal design thoroughly.
   b. One should know all the processes of the sheet metal – Blanking, piercing, Bending, Drawing, Deep drawing, hemming, Lancing, forming etc.
   c. The designer should understand the importance of part in terms of safety, support etc.
   d. Selection of material – It depends upon
      1. Yield stress.
      2. Thickness of the sheet.
      3. Availability in particular region.
      4. Cost.
   e. Process to manufacture –
      1. The designed Sheet metal part should have manufacturability.
      2. The cost for the tooling should be minimum.

2. **Tube Structure Design:-**
   a. Few of the seats are made up of tube structure. The tube may have circular, box type cross section.
   b. One should know the processes of the tube structure design – Bending, flattening etc.
   c. The designer should understand the importance of part in terms of safety, support etc.
   d. Selection of material – It depends upon
      1. Yield stress.
      2. Diameter/Thickness of the tube.
      3. Availability in particular region.
      4. Cost.
   e. Process to manufacture –
      1. The designed tube part should have manufacturability.
      2. The cost for the tooling should be minimum.

3. **Wire structure design:-**
   a. Mainly wire structure is used to give support to foam and trim. ISO fix and Top tether anchorages are made up of wires.
   b. One should know the processes of the wire structure design – Mainly bending
   c. The designer should understand the importance of part in terms of safety, support etc.

4. **Foam Design**:–
   a. Foam is designed by considering A-surface and structure of the seat.
   b. Design of the foam directly affects the comfort of the occupant.

5. **Trimming consideration:**– It mainly deals with the craftsmanship issues

6. **Plastics: -** It mainly deals with the craftsmanship issues and covers the metal structure.

7. **Joints:-**
   a. Welding - CO2/Gas metal arc welding, spot welding are generally used in Seating. Welding length, welding overlapping of two parts need to be considered.
   b. Bolting - Selection of particular bolt size for required application is important. E.g. Cushion and Back marriage bolts should be minimum of size M10, Self tapping screws like M4 are used to attach plastic part to Seat.
   c. Rivet - At few places riveting is used as a joint.
   d. Free pivot – Free pivot is used where the joint is required but two parts needs to rotate freely with respect to each other

8. **Assembly sequence:-**
   a. By understanding assembling sequence different assemblies and sub-assemblies are created.
   b. Generally following is the assembly sequence – Welded parts-Bolted/riveted/free pivot parts-foam-Trim- Plastic
   c. JIT line will have different assembly sequence.

9. **Assembly/Part drawing**:-
   a. Every drawing should have all the important dimensions with GD & T.
   b. Drawing should be made in specific Template e.g. Nissan will have Nissan template.
   c. If required, BOM, welding information, Torque table etc. should be provided.
   d. Tolerance stack up is done where ever required.

10. **Packaging**:–
    a. During the packaging of the Seat in Vehicle environment or individual component of seat with in seat, kinematics of the seat or part should be done to check the interference.
    b. Tool runner access and welding gun access should be checked.
    c. Meat to metal should be checked between Manikin and Seat Hard points.

CONCLUSION:-

In conclusion according to the above information should be considered while designing the seat. It gives the information about different parts of seat which will surely helpful to the designer.

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