

# FABRICATION OF KTM 390 WIRING HARNESS ACCORDING TO FSAE VEHICLES

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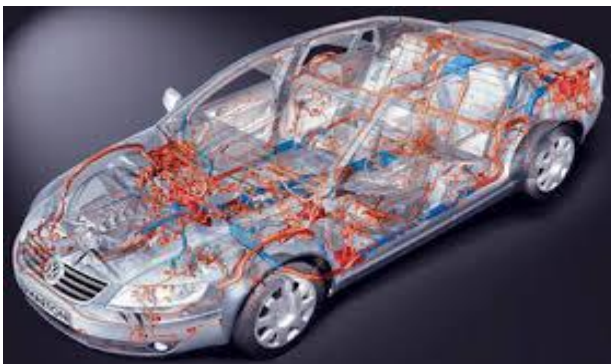
**Abstract** - Wiring tackle shapes the foundation of the electrical engineering in any vehicle electrical framework plan. Due to lack of clarity at the beginning of the project, then the design of wire harness is given the last priority. Additionally, because of its characteristic adaptability to oblige alterations, an excessive number of changes occur in the wire bridle plan as the venture advances. This gives almost no degree for Electrical architect to improve the plan of the wire tackle. The subsequent plan of the wire saddle ought to be surveyed at the proto phase of the vehicle plan. The final design should take care of the design faults and any interference with the other systems in the vehicles. Its should be also used as an opportunity to optimise the design from cost and assembly point of view.

The requirement is to check and test the wire harnesses before dispatch. During vehicle assembly, even a minor fault in the wire harness functionally at any stage of vehicle clearance will put the complete vehicle on hold and rectification become time consume job for vehicle production team. So proper in-line checks should be done at different stages of wire harness production and in the vehicle aggregate sub-assemblies to improve the overall reliability of the wire harness and thereby the total electrical and electronics system in the vehicle.

## 1.1 WIRE HARNESS DESIGN STEPS.

The wire bridle configuration will follow the means recorded which can happen successively or simultaneously;

## 1. ROLE OF WIRE HARNESS IN VEHICLE ELECTRICALS.

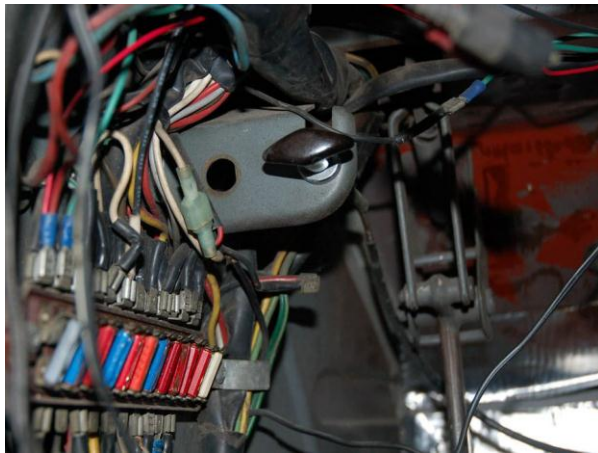


The electrical plan action in any vehicle begins with the main draft of vehicle detail. But its actual design of wire harness can start only after the other vehicle aggregates engine, transmission, cabin etc. get finalised and the feature list of the vehicle is freeze. During earlier vehicle design the electrical and electronics system role was limited to few functions as starting & charging system, few items on dash board and few connections on the due drastically changed over the years to meet the safety and regulation requirements, comfort requirements, improved and driver information.

The increased number of systems and complexity of wire harness design has resulted in manufacturing facilities becoming sophisticated and in order to supply a ready to the assemble wire harness.

- Preparing the electrical and electronics feature list.
- Compiling Electrical circuit diagram for the vehicle.
- Electrical power distributed and circuit protections.
- Deciding on numbers of wire harness.
- Wire Harness layout and many branches in wire harness.
- Wire Harness routing, clamping.
- Selection of cable and wire for functions.
- Type and rating /capacity.
- Deciding the earth and ground points.
- Mechanical protection must be required.
- Environmental protection must be required.
- Selection of connector types housings, parking of connect

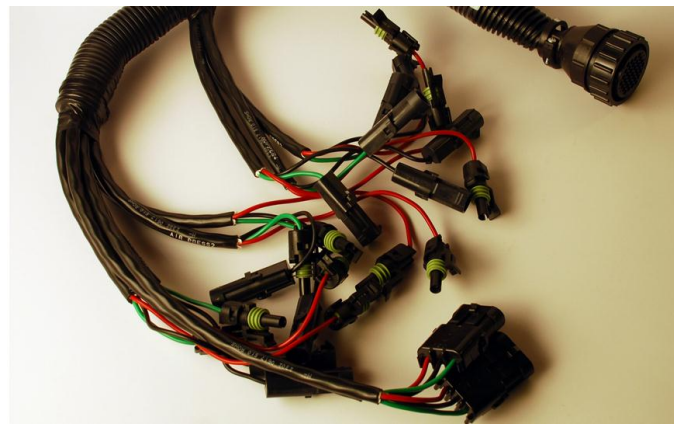
### 1.2. WIRE HARNESS BUILDING BLOCKS.



Wire Harness is involves many other components other than the basic wires and cables At that point the arrangement of the wire bridle plan, the following coherent advance is to set up the bill of material (BOM) for the wire outfit which is the input to the wire harness supplier for planning the manufacturing and testing of the electrical and electronic wire harness. The bill of material (BOM) will generate a list which includes;

- Wire sizes, types and colors codes needed
- PVC sleeves, Corrugated tubes, shrink tubes.
- Connectors :-  
Terminals, Housings, seals, dummy plugs, locks and latches.
- Relay and Fuse Boxes:-  
Fuses, Relays, Covers.
- Clips, Clamps and supports for fixing the wire outfit.
- Rubber grommets , Bellows  
The bill of material (BOM) will enable the wire harness supplier to identify;
- Sources for the connectors and other exceptional things.
- Develop sourcing for items plastic parts, brackets and rubber items

### 1.3. OPTIMISING THE DESIGN OF WIRE HARNESS DESIGN REVIEW



The wire outfit Design survey ought to be done occasionally during the advancement periods of the vehicle project and as the distinctive proto-sorts of vehicle develop the wire tackle ought to also get updated. The design review is not only limited to ensuring the correct functionality of all the circuits. The checks for the various rationales under typical and irregular conditions particularly safeguard activity ought to be assessed. The Design survey of wire saddle ought to incorporate the accompanying significant issues;

- Physical layout of wire harness on the vehicle.
- Electrical schematic circuit diagram
- Interconnections
  - o Between two wire harness.
  - o Between wire harness and component.
- Routing and clamping of wire harness.
- Protection from
  - o Mechanical damage
  - o Hot and Cold components
  - o Moving and Rotating parts
  - o Electrical overload
- Wire size and total bundle size of wire harness branches.

Grommets, brackets, clamps and channels used for supporting wire harness. DFMEA of wire harness

Water and Dust sealing provided in wire harness

#### 1.4. ACTIONS FOR WIREHARNESS DESIGN OPTIMISATION.

- To accomplish streamlined wire bridge plan the cycle ought to incorporate;
- Use of design manuals.
- Wire harness manufacturers catalogues for components and raw materials.
- Set up for testing the wire harness at end of manufacturing line.
- Wire harness acceptance criterion for supplies.

#### 1.5. OPTIMISING THE COST.

- Standardizing the connectors
- Variety reduction
  - Wire size
  - Colours of wire
- Use of standard components as Relays, Fuses, Clamps, Grommets and Rubber parts.
- Wire Harness version control matrix.
- Identifying regions where security given is in abundance of necessity.

#### 1.6. OPTIMISING THE QUALITY.

- Testing process and acceptance criterion.
- Process audits at wire harness supplier.
- Automatic and semi-automatic process of wire harness assembly;
- Circuit testing at final stage of wire harness assembly;
- Training and skill development of wire harness assembly line operators;
- Inward and raw material quality checks;

#### 1.7. OPTIMISING THE RELIABILITY

- Making design full proof and blind assembly;
- Introducing poka-yoke at all assembly stations.

- No re-do or correction actions allowed in transitional testing.
- DFMEA of wire tackle with configuration, producing provider, vehicle gathering, administration and clients backing, testing and quality freedom groups.
- Handling of wire outfit from provider to vehicle sequential construction system and capacity. Proper provision of environmental protection on the wire harness.

#### 1.8. FUTURE TRENDS IN WIRE HARNESS DESIGN OPTIMISATION.

- Integrating the KTM 390 wire harness designs
- Generating automatic bill of material (BOM)
- Linking the final design with manufacturing
- Building exhaustive component library.
- Defining the design rules through written down procedure - DESIGN MANUAL(DM)

However, the major challenge faced by designer is with respect to the differences in actual physical wire harness and its KTM 390 wire harness mode A sharp bowing span appeared in the computerized model (DMU) will show no obstruction with neighboring parts. But when the actual harness is made and assembled it will not follow the KTM 390 Wire harness simulated routing. Similarly, the constraints of availability of components and their KTM 390 wire harness data becomes a limitation in selection of items. Finally, the wire harness design has to be optimized taking into account the contradictory requirements of cost and assembly, manufacturing and servicing on the end product etc. Vehicle(Automobile).

#### 1.9. CONCLUSIONS

The wire harness design in any automotive vehicle plays a important role in the success or failure of the product. Hence, the best design can have a long term impact on the product meeting the target of quality, cost and timeline. Also, critical is the final design output which decides all the factors as customer service, assembling sequence and reliability of the electrical system.

Any problem reported after the launch of vehicle or delivered in the hands of customer may result in **CALLING BACK** for the vehicle. Hence, all project teams perform a fault finding analysis of all foremost vehicle running feedback on the wire

harness. They resolve the issues of wire harness on urgent basis and track them with zero tolerance till the root cause of the problem is solved.

#### **ACKNOWLEDGEMENT**

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