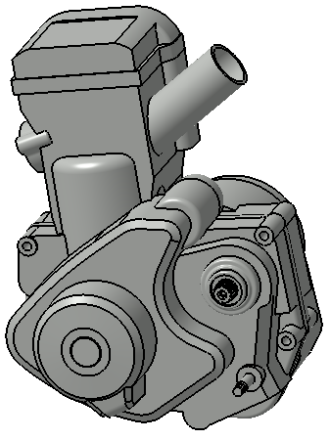


Fig. 1: Engine CAD Model

Table 1: Engine Parameters

Parameter	KTM duke 390
Bore x stroke (mm)	89 x 60
Displacement (cc)	373.4
Compression ratio	12.6:1
Maximum power	42.91 bhp@9500 rpm
Maximum torque	35.3 nm@7000 rpm
Primary ratio	2.66:1
Secondary ratio	3:1

Table 2: Gear Reductions

Gear	Gearbox reduction
1	2.66
2	2.363
3	1.421
4	1.142
5	0.96
6	0.88

Clutch Reduction: 2.667

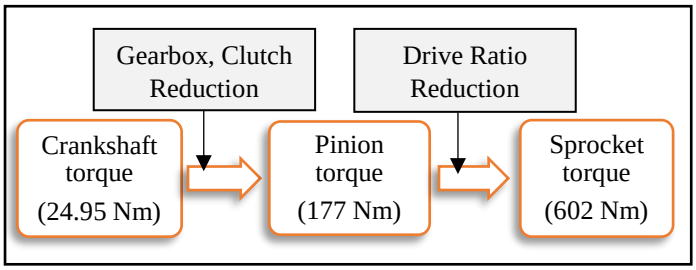


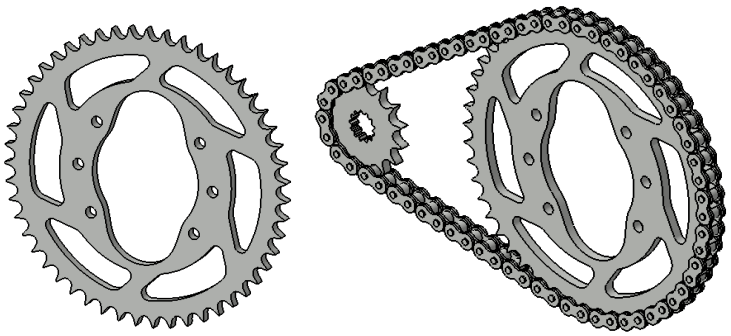
Fig. 2: Engine CAD Model

Table 3: Important gear design parameters

Gear parameters	Values
Teeth on pinion	15
Teeth on sprocket	51
Pitch	12.7 mm
Pitch Centre Diameter of pinion	61.084 mm
Pitch Centre Diameter of sprocket	206.299 mm

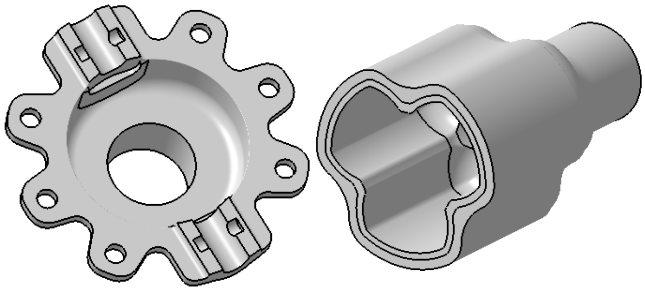
Table 4: Chain design specifications

Chain parameters	Values
Designation	8B-3 R 1278 H
Pitch	12.7 mm
Centre-centre distance	196.04 mm
Number of links	66
Breaking load	20.592 kN
FOS	30.8



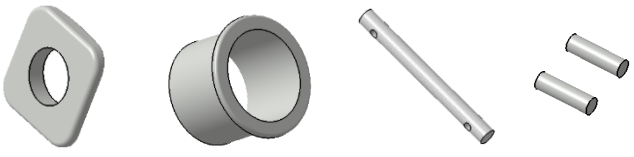
(a) (b)

Fig. 3: CAD models: (a) Sprocket & (b) Chaindrive assembly



(a) (b)

Fig. 4:CAD models: (a) Differential casing & (b) CV cup



(a) (b) (c) (d)

Fig. 5: CAD models: (a) Planetary gear bush, (b) Sun gear bush, (c) Main pin & (d) Small restricting pins

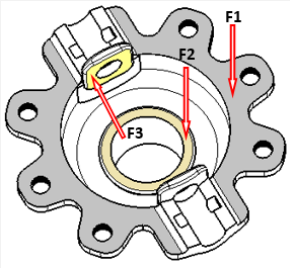
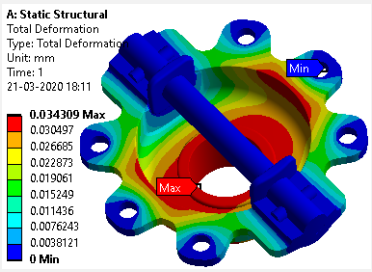
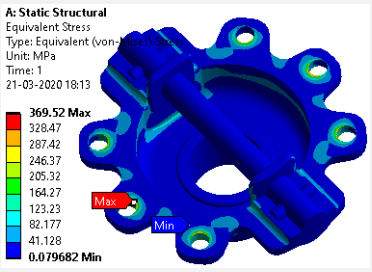
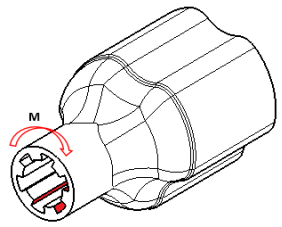
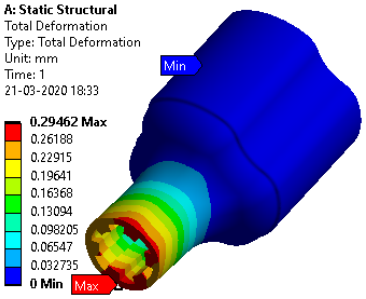
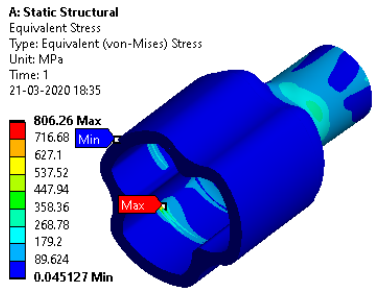
- **Differential Casing:**

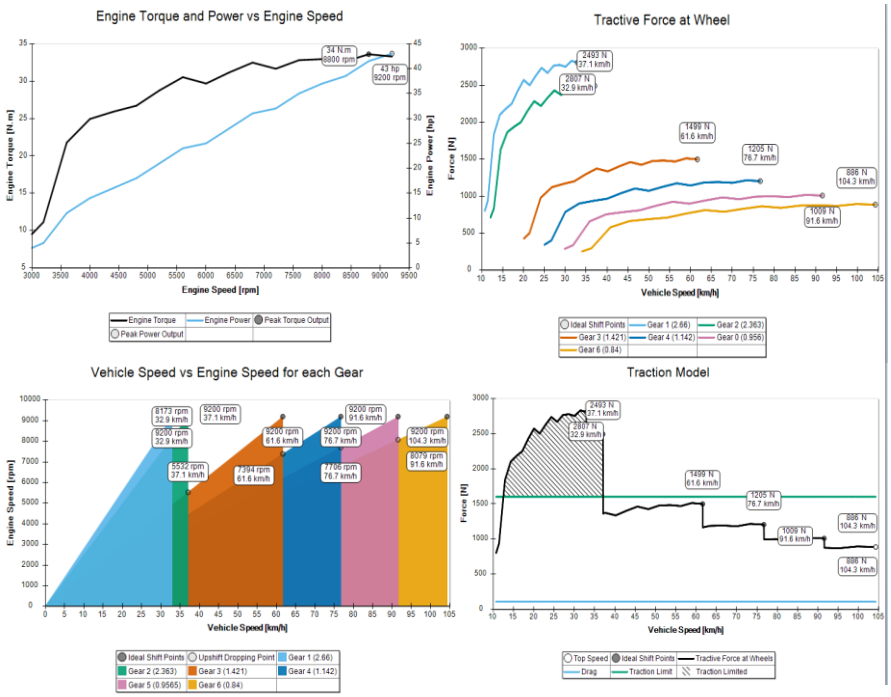
The differential casing has been cumtomized in accordance with the gears, their busings, sprocket and some other influencial parameters. After taking various iterations with different materials, the material Al 7075 T6 has been selected.

- **Cup of constant velocity joint:**

The cup of CV joint is also customized which incorporates the rollers with spider. Thus the inner profile is developed in accordance with the it. The material so chosen for the cup is Al 7075 T6. The inside layer is in contact with the MS rollers constantly and hence a MS layer like bush is embossed to avoid wear.

Table 5: CAE results of the differential casing and the CV cup

Component	Forces	Maximum deformation	Equivalent stress
 Differential Casing	**F1**: Clamping force **F2**: Axial force of planetary gear **F3**: Axial force of sun gear **Fixed-support**: At bolts	 Max deformation: **0.034mm**	 Max. stress**: 369.52 MPa**
 Cup of CV joint	**M**: Torque from sprocket **Fixed-support**: At roller positions	 Max deformation: **0.294mm**	 Max. stress: **306.26 MPa**



Graphs: (a) Engine torque & power Vs engine speed
(b) Tractive force at wheels
(c) Vehicle speed Vs engine speed
(d) Traction model of wheels

These graphs have been plotted in the **Optimum G software** through which the vehicle can be simuated using required input parameters. These graphs are analytically verified as well with results coming exactly the same. Hence these were also used for training the driver to improve his skills.

Table 6: Parameters for designing radiator

Calculation parameters	Values
Inlet water temperature	98 ˚C
Outlet water temperature	86 ˚C
Overall heat transfer coeff.	42.5 W/m^{2}K
Heat rejected by core	43.25 W
Thermal conductivity of fins	25 W/mK
Effectiveness of radiator	0.8894

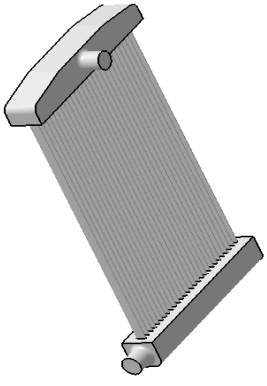


Fig. 6: Radiator

Table 7: Finalized parameters

Finalized parameters	Values
Material	Aluminium
No. of tubes	28
Total volume	0.8815 lit
Overall height	300 mm
Overall length	245 mm
Width	40 mm

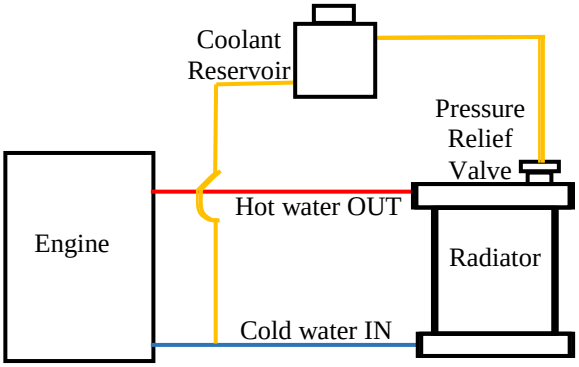


Fig. 7: Schematic diagram of cooling circuit

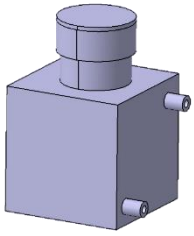


Fig. 8: Coolant reservoir

A coolant reservoir is introduced in the cooling circuitry to recover the losses of cooling water occurring due to formation of steam while circulation. The volume of the coolant reservoir is kept to be 250 ml to compensate these losses.

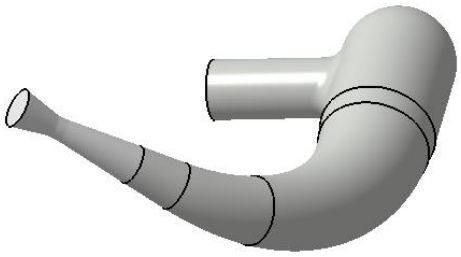


Fig. 9: CAD Model of air intake assembly

Table 8: Design parameters of air intake system

Overall parameters	Values
Total volume	2.8 lit
Orientation	Rear left
Venturi convergent angle	12˚
Venturi divergent angle	6˚
Throat diameter (restrictor)	20 mm

Table 9: Parameters for designing exhaust pipe

Exhaust pipe parameters	Values
Header pipe length	980 mm
Header pipe diameter	38 mm
Header pipe thickness	1 mm

Table 10: Parameters for muffler designing

Parameters of muffler	Values
Muffler length	320 mm
Muffler diameter	114 mm
No. of baffles	3
No. of perforated pipes	2
Diameter of perforated pipes	28 mm

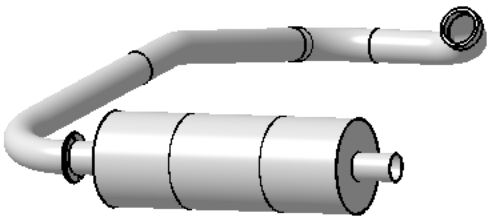
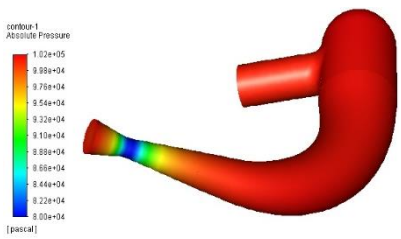
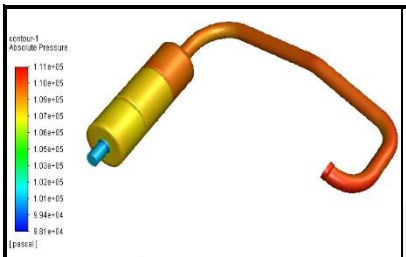


Fig. 10: CAD model of exhaust muffler & pipe

Table 11: Computational fluid dynamis of the air flow in the components

 Air intake system	**Inlet:** Mass flow rate: 0.0704 kg/s **Outlet:** Pressure-outlet Pressure drop: **28.17 Pa**
 Exhaust system	**Inlet:** Mass flow rate: 0.0704 kg/s **Outlet:** Pressure-outlet Pressure drop: **9.46 KPa**