



**KSHATRIYA
ELECTRIC**



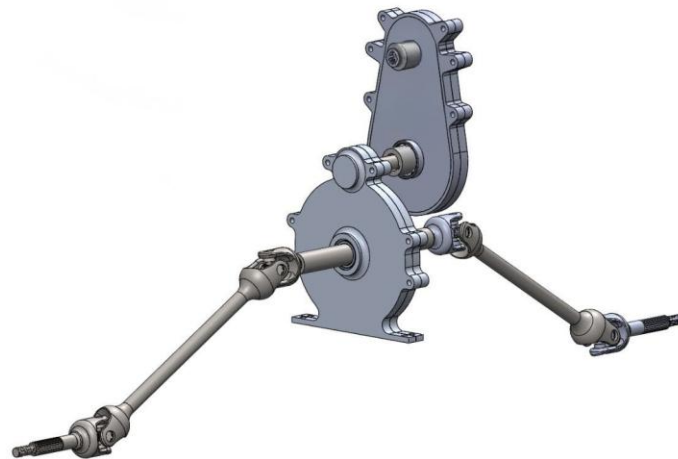
VIT[®]
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Kshatriya Electric

Vellore Institute of Technology – Vellore

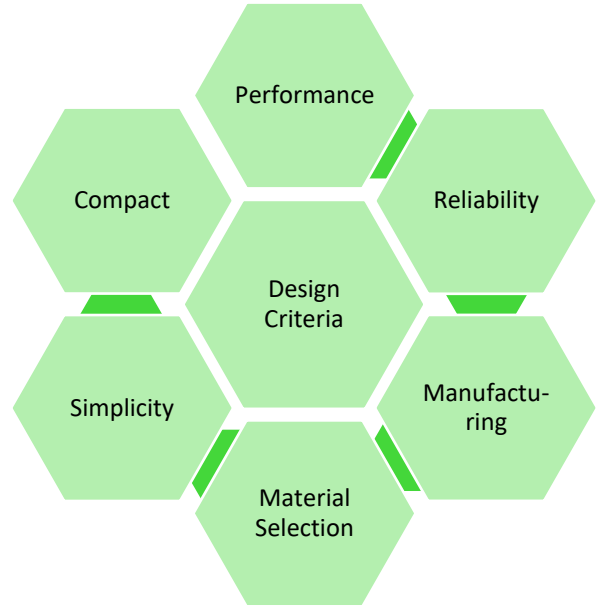
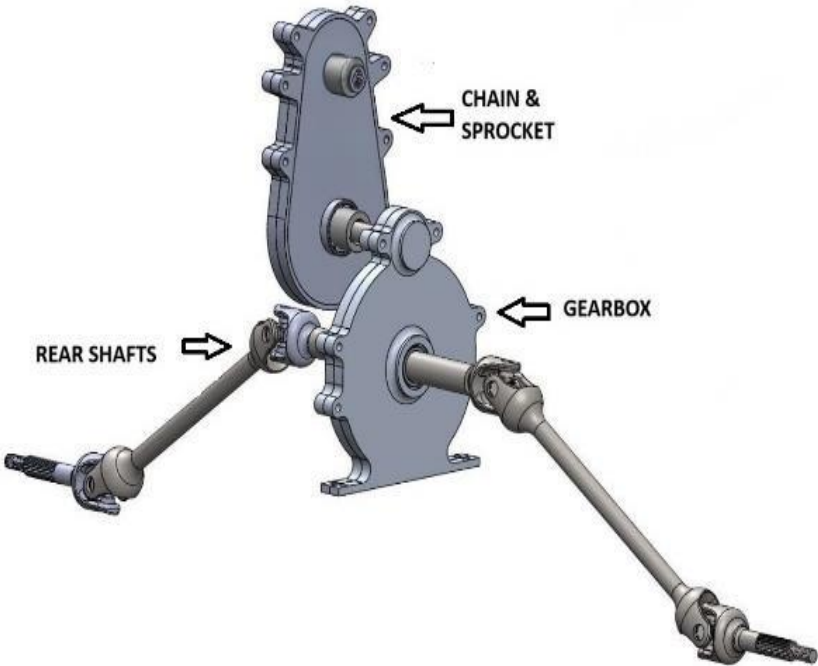
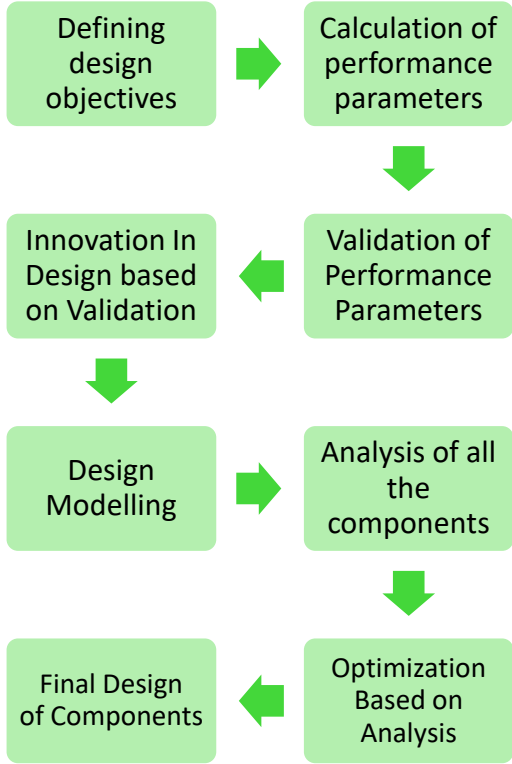
Team ID: 252084

DRIVETRAIN



OBJECTIVES AND PERFORMANCE

Design Methodology

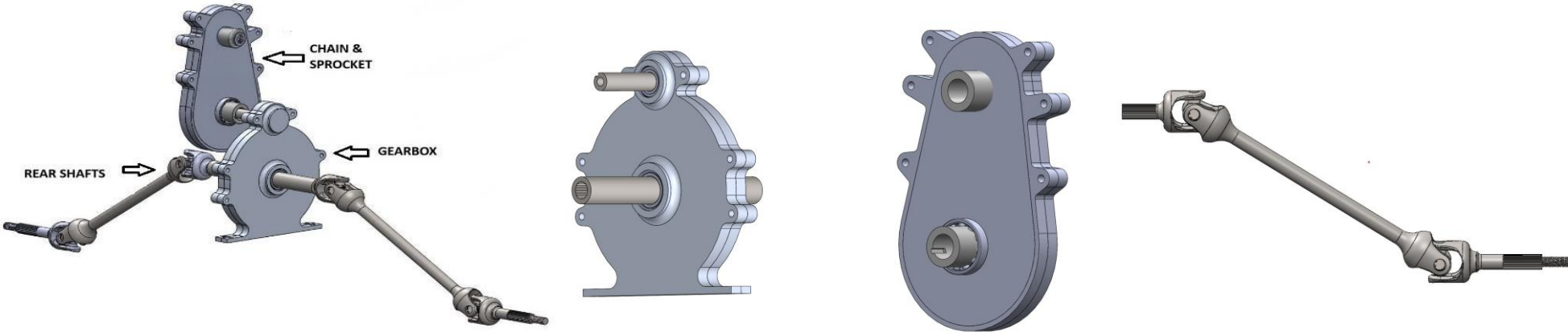
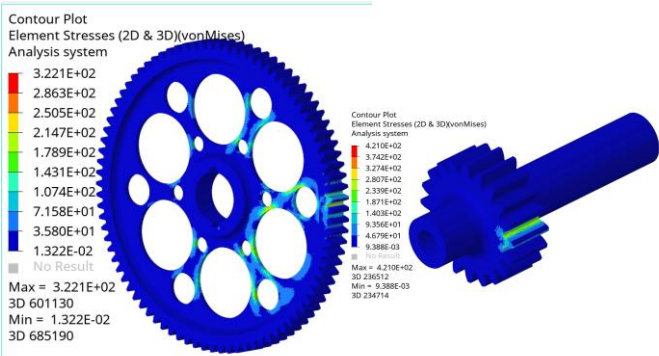
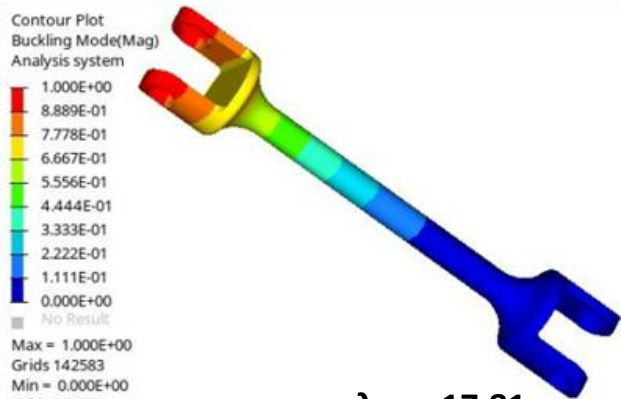
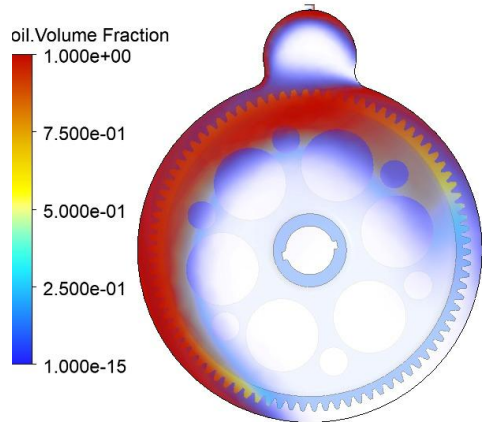


Performance Parameters

Max Speed	55 km/h
Max Tractive Force	1872 N
Acceleration	7.2 m/s ²
Gradeability (%)	53%
Gearbox Ratio	4.3

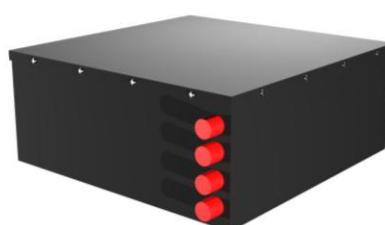

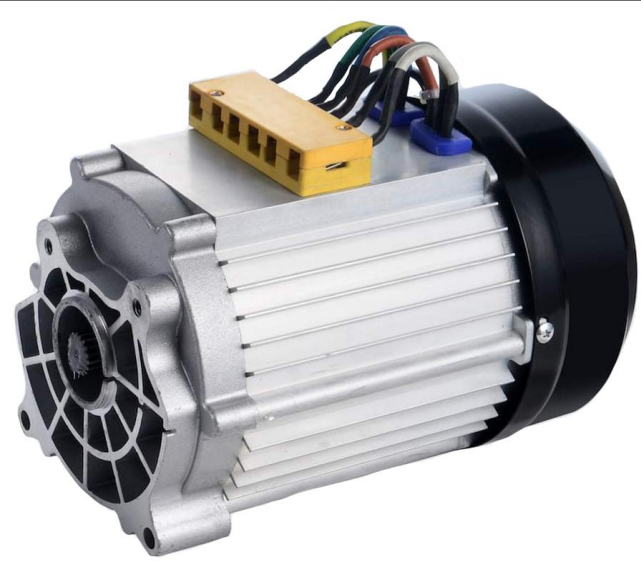
Design Highlights

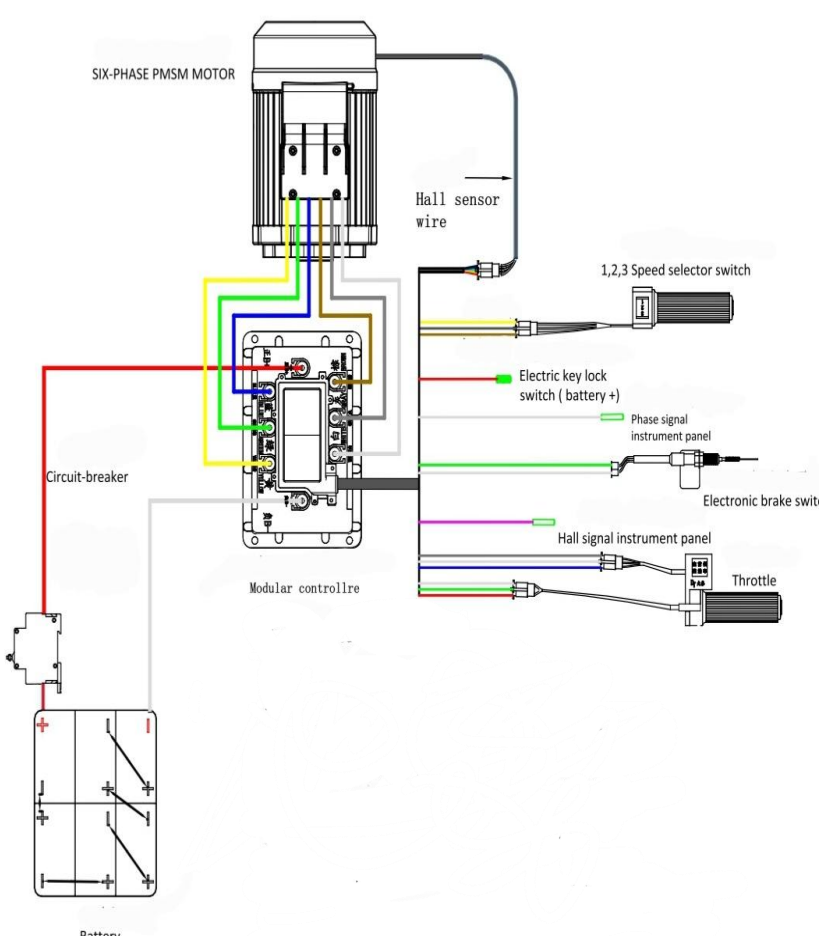
1. A single stage chain and sprocket and a single stage gearbox has been used in the vehicle to provide superior speed along with extraordinary gradeability.
2. The drivetrain components have been designed in a way which helps in giving a better off roading performance and reduce tire wear.
3. Unibody Shaft has been employed to reduce the occurrence of failure in the shafts.
4. A swappable 90Ah battery is employed to power the car and reduce the curb weight of the car compared to the 120Ah battery.

POWERTRAIN									
MOTOR CONTROLLER SPECS.		VEHICLE PARAMETERS		TOTAL REDUCTION		TYRE SPECIFICATION			
KLS7275HC		Top Speed	55 km/h	CHAIN & SPROCKET	1.8	Front	23"x7"- 10"		
		Gradeability	53 %						
		Input Voltage	24V - 72V	Peak Acc.	7.2 m/s ²	GEARBOX	4.30	Rear	23"x7"-10"
Rating		90 Amps DC	POWERTRAIN LAYOUT		GEARBOX & CHAIN AND SPROCKET		UNOBODY HALF SHAFT		
									
MOTOR SPECS.									
Output Power	7200 W								
Voltage	48 V								
Speed	4100 rpm								
BATTERY SPECIFICATION		GEARS ANALYSIS		BUCKLING ANALYSIS		OIL SLOSHING			
Lithium-ion Battery Pack									
Rating	48 V								
Capacity	120 Ah								
Cell Type	21700 - NMC								
									



TRACTIVE SYSTEM SPECIFICATIONS

Battery				MCU					
Chemistry		NMC		Phase current		Discharge		3-speed regulation function	
Nominal Capacity		90Ah							
Temperature		Lower Cut-off Voltage		38V		Maximum			
Operation Range		0-50 degree		Upper Cut-off Voltage		54.6V		Sport mode	
Battery Cooling		Natural Air cooled		Nominal Voltage		48.1V		Normal Mode	
				Throttle Input Type		Hall sensor		Eco Mode	
				Cooling Type		natural			
Weight		Dimensions		IP Rating		PMSM Motor and Motor controller wiring diagram			
35 kg		Length		14in					
IP Rating		Width		12in					
IP67		Height		9in					
Swappable		MOTOR		Motor controller					
YES									
Accumulator									
Series		13s							
Parallel		24p							
Discharge									
Max Cont.		180A							
Instantaneous		300A							
Regen Current		8A							





GLV system & Component analysis

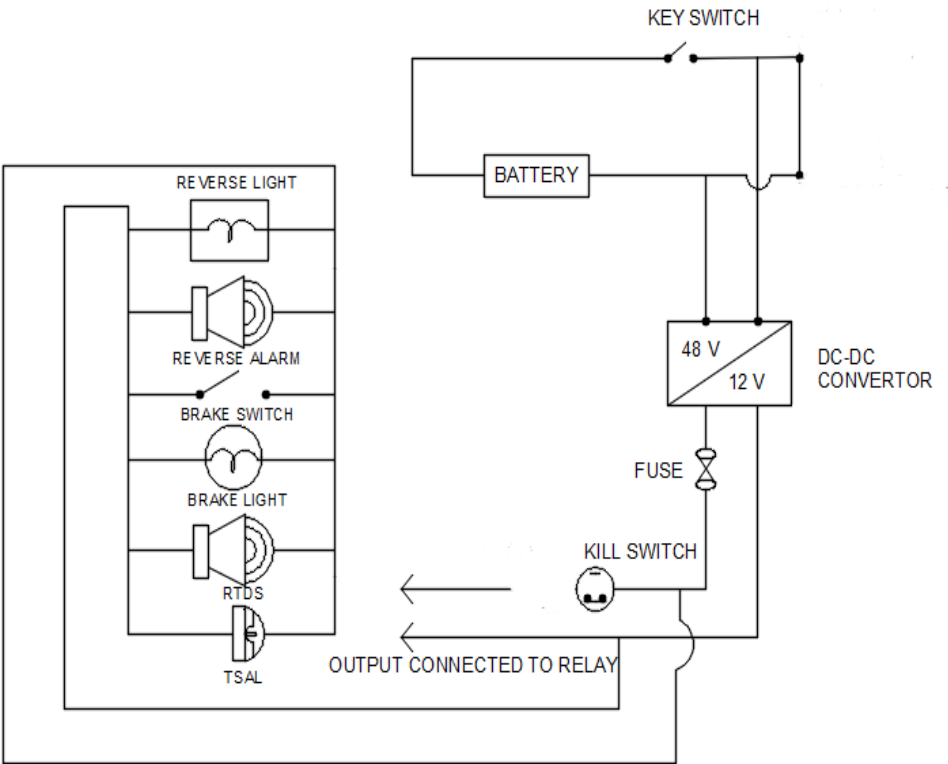
DC-DC converter		Kill switch		TSAL		Sensors and other components		Battery	
Voltage Range	42-60V DC-DC	Cockpit Switch	ISO 13485	Frequency	2 Hz	Ultrasonic HC SR04	Proximity	Lower Cut-off Voltage	38V
Input	48V DC	External Switch	ISO 13485	Supply	12v			Upper Cut-off Voltage	54.6V
Fuse		Microcontroller				Colour	Amber	Hall sensor	Display
Type	SKU: 639209	Raspberry Pi		Fuse					
Wiring Harness	Yes	Node MCU		Circuit Diagram					
Brakelights		DC DC converter		<div><div>KEY SWITCH</div><div></div><div></div></div>					



TSAL



Kill Switch



F-N-R selector switch



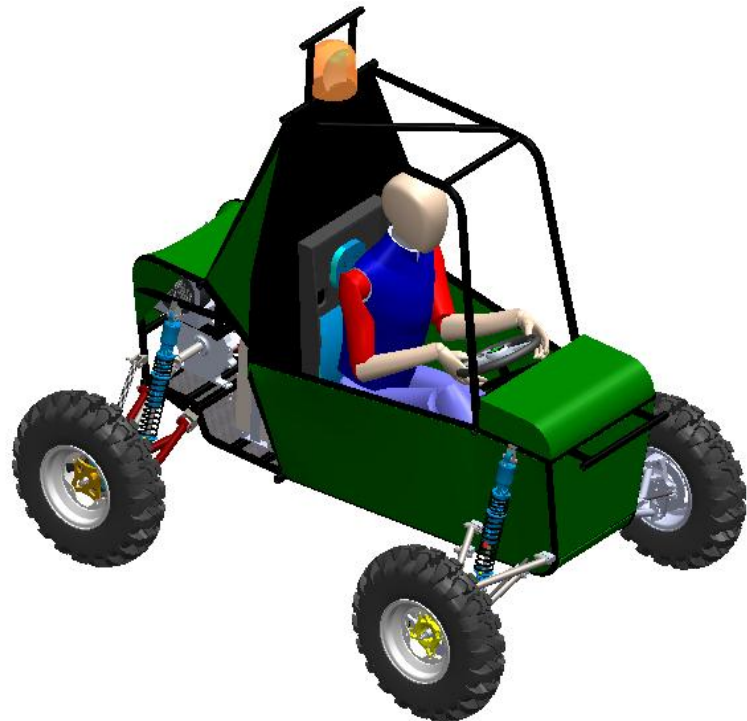
Design Validation Plan										
Sl. No.	Level: Vehicle, Aggregate or part	Performance Target	Acceptance Criteria / Target	Validation Test & Method	Test Resource	No. of Tests	Start Dt.	Finish Dt.	Remarks	Report No.
1	Transmission	4. seconds for 150 feet	Data comparison with MATLAB model	Acceleration Test: Straight 150 ft track	Ultrasonic Sensor	10	28-09-2024	Ongoing	NA	NA
2		9 seconds for 150 feet		Hill Climb Test: 30° Gradient track	Ultrasonic Sensor	5	28-09-2022	Ongoing	NA	NA
4	IPG CarMaker	7 seconds for 150 feet	Data comparison with MATLAB model	Acceleration Test: Straight 150 ft track with 'aggressive driver' mode	IPG Carmaker	5	26-10-2024	30-10-2024	The CG height was within acceptance criteria.	5.3 seconds for 150 feet

TRANSMISSION DFMEA															
ITEM / Function	Potential Failure Mode	Potential Effect(s) of Failures	S	Potential Cause(s)/Mechanism(s) of Failures	O	Current Design Control	D	RPN	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
											Action Taken	S	O	D	RPN
Li-ion battery: It stores energy to power up electric vehicle	Fluctuating voltage output, overheating of the battery pack, an unstable connection from BMS to motor	Malfunctioning of motor, decrease in the efficiency of the battery	10	Improper thermal management system, poor BMS quality, lithium Ion material ignition due to over-heating	4	Active and passive cooling system, improvised BMS	4	160	Verified BMS implementation and ventilation and connected BMS to display using Bluetooth	Riya	Stable connection between BMS and the display, controlled overheating	10	3	4	120
BMS used for balancing cells in a battery pack and monitoring	Failure of voltage detection wire	Overcharging, causing the battery to swell	6	Poor connection, crimping process or poor contact	3	design to control BMS power supply at 12v or 24v	5	90	Switching to 2WD/ unlock center differential and reversing back the vehicle	Anisha	Check whether the bus matching resistance is correct and establish a stable connection between BMS and ECU	6	3	4	72

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ITEM / Function	Potential Failure Mode	Potential Effect(s) of Failures	S	Potential Cause(s)/Mechanism(s) of Failures	O	Current Design Control	D	R P N	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
											Action Taken	S	O	D	R P N
Halfshaft: Transmission of Power from gearbox to the wheels	Ductile Fracture	Seizes The Power Delivering To Wheels Grounding Of The Vehicle	10	The Yield Strength Of The Shaft Being Too Low	6	Preventive control - Design per torque requirement	1	60	Revision in design and hardening technique	Athul	Reduce HRC value from 40 HRC to 30-35 HRC change design to unibody half shaft	10	4	1	40
PMSM Motor: Provides power to the wheels for the movement of the vehicle	Winding rupture, short circuit, breaking failure	Decrease in RPM, abnormal starting, and decreased efficiency	8	Improper installation, Debris Reaccumulation	5	Connected carefully, removal of debris, check for misalignment	2	80	Check connections and ventilation	Riya	Increased efficiency, stable RPM range and controlled over heating	8	3	2	48



Thank You



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