

PRODUCT SPECIFICATION

TITLE	DATE	REV
Product Requirements	26 September 2019	2

Project Rear Drive Product Requirements

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Document History

Rev Number	Date	Modified By	Reason
1	3 June 2019	O. Ruiz	Initial Release
2	26 September 2019	T. Entwit	Updated for 2 nd Half of Team
3	18 October 18 2019	B. Hudson	Updated: 4.1, 4.2, 5.1, 5.3, 5.4, 5.7, 7.2, 8.2

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1 Objective

The objective of this document is to document the requirements for the creation and development of a rear driven snowmobile skid

2 Scope

The scope of this document is to define the requirements needed to fulfill the clients, and the designers' requests for the project. By using details derived from the 2018 850CC E-TEC Skidoo owner's manual, and designer insight into the project, this document should be able to explain most, if not all of the requirements needed to complete this project, to the satisfaction of the clients' requirements.

3 References

3.1 Cited Documents

SAE Clean Snowmobile Challenge Rules, Retrieved June 19, 2019, from <http://www.saeleansnowmobile.com/cdsweb/gen/DocumentResources.aspx>

BRP Operators Guide, Retrieved June 24, 2019, from <http://www.operatorsguides.brp.com/Index.aspx?lang=E&s1=38e7b57d-6b36-4c0b-822d-9aaa0bac6340>

3.2 Acronyms

EPO Engineering Purchase Order
ER Engineering Release
POC Proof of Concept
CSC Clean Snowmobile Challenge

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4 Functional Requirements

4.1 *User Interface Requirements*

The operator shall not be required to apply any force to the rear drive system. The rear drive system should be designed to operate in full autonomy to the power provided by the chain case. The rear drive system may be changed to either forward drive or dual drive, with minimal user skill (removing/ adding bolts). The user shall not be required to do more than switch the snowmobile from forward to reverse in order to complete such motions. Only users with an in-depth knowledge of skid set-up should attempt self-maintenance. In order to insure personal safety, the user shall not attempt to modify, alter, or work on the system while the snowmobile engine is running.

4.2 *What it should do*

The rear driven snowmobile system should be capable of driving the track from the rear, forward, or both axles. The rear driven snowmobile skid should be able to withstand extended use anywhere from minutes to several hours at a time. The system in entirety should be durable for the life cycle of the snowmobile. In its entirety the rear drive system should be able to swap out with the stock system with minimal user effort. The braking system must have comparable performance to stock, and the suspension must have similar performance and geometry to stock.

5 Mechanical Requirements

5.1 *Strength Requirements*

The design shall be able to transfer a torque of at least 100 ft-lbs from the chain case to the rear drivers. The suspension system should be able to support any weight, ranging from 100 to 250 lbs. without severe contact between parts of the skid and/or complicating the exchange of power transferred from the chain case to the rear drivers. The drive belts should be able to transmit 1000 lbf of tension

5.2 *Spatial Requirements*

The product will fit in the same space as the stock skid, specifically the system will not extend past the rear of the snowmobile tunnel. Ideally, the system will make use of the same length track as the stock configuration.

5.3 *Weight/Mass Requirements*

The total system shall weigh no more than 35 lbs. more than the stock skid. This will be subject to change as further knowledge on the design and fabrication of parts becomes available from the design team.

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5.4 Mounting / Interface Requirements

The new skid shall mount to the tunnel of the snowmobile using the same bolt pattern as the stock skid, this being two forward bolts of M10x1.50 and two rear bolts of M10x1.50. The new skid should also maintain the current chain case to forward driver shaft connection system, with alteration to the shaft only in order to implement the transfer of power from the forward driver shaft to the rear drivers.

5.5 Appearance Requirements

The final product is a purely mechanical system with little to be seen when operated, thus no detailed appearance requirements are necessary, unless otherwise stated by the client. The final product should be satisfactory to the SAE Clean Snowmobile Challenge officials and shall represent the University of Idaho at the Spring 2020 competition.

5.6 Durability Requirements

The system shall be designed to operate for up to 200 hours without any scheduled maintenance. Any parts manufactured by the designers must be able to withstand torsional forces up to and beyond 100 ft-lbs.

5.7 Reliability Requirements

All components (bearings, bolts, screws, gears, belts, etc.) shall have 95+% reliability. The mechanical system shall be designed to last at least as long as the track is usable, this being anywhere from 2000 to 9000 miles. This could mean an operating time of anywhere from 40 hours to 200 plus hours.

6 Electrical Requirements

6.1 Operational Voltage

As of yet, there are no voltage requirements for the mechanical system.

6.2 Operational Power Capability

As of yet, there are no power capability requirements for the mechanical system.

6.3 Energy Storage Capacity

As of yet, there are no energy storage capacity requirements for the mechanical system.

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7 Software Requirements

7.1 *Functionality*

As of yet, there are no software requirements for the mechanical system.

7.2 *User Interface*

As of yet, there are no software - user interface requirements for the mechanical system.

8 Environmental Requirements

8.1 *Temperature*

The Snowmobile is expected to operate at full capacity under, but not limited to, extreme cold conditions for extended periods of time.

8.2 *Environmental*

All snowmobile components must be resistant to snow, ice, and water damage

9 Regulatory Requirements

9.1 *Rules and Safety*

The snowmobile chassis shall comply with the SAE Clean Snowmobile Challenge rules listed in the CSC rule book. Specifically rules outlining chassis modifications, suspension, chain and belt requirements 8.4.1, 8.6.2, 8.7.7. Any modifications made to the snowmobile shall also comply with University of Idaho safety standards.

10 Cost Requirements

10.1 *Prototype Cost*

The cost to design and fabricate an operative rear driven track for the Clean Snowmobile challenge shall not exceed \$2000.

10.2 *Production Requirements*

Estimated annual volume of the product will potentially be 1-unit total. Projected cost for a single rear driven snowmobile skid, will approximately be < \$1000.

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11 Schedule Requirements

The following are the major Project Milestones:

- Portfolio Sept. 26th, 2019
- Advisory Board Snapshot Sept. 30, 2019
- Mini Design Review Oct. 8, 2019
- Detailed Design Review Oct. 17, 2019
- Design Validation Plan Oct. 24, 2019
- Project Value Proposition Oct. 31, 2019
- Updated Wikipage Nov. 7, 2019
- Complete Prototype build Nov. 29, 2019
- Snapshot Day 4 Dec. 6, 2019
- Final Design Report & Portfolio Dec. 13, 2019