

**Potential
 Failure Mode and Effects Analysis
 (Design FMEA)**

Key Date 10/7/2019

Component	Item / Function	Potential Failure Mode(s)	Potential Effect(s) of Failure	S e v	Potential Cause(s)/ Mechanism(s) of Failure	P r o b	Current Design Controls	D e t	R P N	Recommended Action(s)	Responsibility	Target Completion Date	Action Results			
													Actions Taken	New Sev	New Occ	New Det
Runner Sub-Assembly																
Runners - Modified	Skid Structure, Holding Rear Suspension and Driver Assemblies in Position	Fracture on Impact	Loss of suspension integrity, loss of rear driving axle efficiency. i.e. catastrophic structure failure	10	Heavy Impact	2	Heat Treated Rails, Stock Manufacturing Of Rails	3	60	Heat Treatment	Aref					
		Yielding		10	Significant torque bias, Side impact	2	Heat Treated Rails, Stock Manufacturing Of Rails	3	60	Heat Treatment						
		Fatigue Fracture		10	Heavy Impact, Cyclic fatigue	2	Heat Treated Rails, Stock Manufacturing Of Rails	3	60	Heat Treatment						
Intermediate Rail Spacers	Keeping Runners Separated at Optimal Width For Assembly	Yield	Added friction to driving axles	2	Impact	2	Size of Spacer	4	16	Propper Spacting						
Rear Axle Mounting Plate	Modified Expansion Steel Plate Mended to the Runners, to fit on new rear axle position.	Fracture in slot neck	Rear axle loss of drive power, belt failure, loss of track tension	8	Excessive Loading, Impact	2	Large Slot Neck Thickness	2	32	None						
		Bending/ Yielding		8	Side Impact	2	Thickness of Plate	2	32	Propper Meterial Choice and sizing Width						
Rear Axle Weld Plate	Welded Mending Piece for Rear Axle Mounting Plate.	Weld Failure	Rear axle loss of drive power, belt failure, loss of track tension	8	Poor Weldment, Cyclic Fatigue	3	Larger Welds	2	48	Multiple Weld Paths Overlayed						
		Yielding/ Bending		8	Side Impact	2	Thickness of Plate	2	32	Material Choice						
		Bolt Hole Pull-out, tear-out		8	Excessive Loading, Impact	2	Thickness of Plate, Bolt Hole Spacing	2	32	Material Choice						
Front and Rear Driving Axle Sub-Assemblies																
Axles	Driving Axles for Snowmobile Track	Yielding	Loss of driving efficiency	8	Consistent irregular torsional forces	2	Diameter of axle, mounting method of axle	2	32	Propper attention to detail in lathe and taping set up						
		Fatigue Fracture	Loss of driving power	10	Irreversible plastic deformation	2		2	40							
Brake Disk	Modified Stock Brake Disk to smaller circular pattern with 7" Diameter	Fracture	Loss of breaking	9	Irregular bending moments on disk	3	Disk is mounted in-line with driving axle	3	81	Sizing Down stock diameter by lathe						
Spline Cut-off Weld Insert	Spline added mounting piece to weld ends on to newly manufactured driving axle's	Weld Failure	Loss of driving power	10	Poor Weldment, Cyclic Fatigue	3	Larger welds	2	60	Weld inspection after testing						

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Spline Cut-off	Spline removed piece for the stock silent drivers being reused	Tooth Fracture	Loss of driving power	10	Excessive torsional forces	1	Tooth design	2	20	Mitigated by Design	Brannon							
Driver Internal Hub	Internally Mounted Hub within rear Newly Designed and Manufactured Plate Steal Supporting the Driving Axle's	ID yielding	Loss of drive efficiency	8	Prolonged irregular axle motion	2	Fit on axle	2	32	Inspection should irregular axle motion occur								
		Bolt Hole Pull-out, tear out	Loss of driver ability to drive track	7	Bolt hole stripping	2	Bolt Hole Spacing	2	28	Bolt sizing and use of properly sized washers								
Keyed Dog	Pre fixed "slots" to fasten the radially mounted driving axle assembly members on a new driving shaft.	ID yielding	Loss of drive efficiency	8	Prolonged irregular axle motion	2	Fit on axle	2	32	Sizing								
		Bolt Hole Pull-out, tear out	Loss of driver ability to drive track	7	Bolt hole stripping	2	Bolt Hole Spacing	2	28	Bolt sizing and use of properly sized washers								
Machined Key	Pre Fabricated to specified Lengths to Key in Members to the driving shaft	Fracture	Loss of driver ability to drive track	8	Irregular forces on key	1	Size of Key	2	16									
Silent Driver	BRP Specialized Snowmobile Track Drivers, optimizing frequency for less output sound	Press fit pattern wears down	Loss of driving power	10	Poor assembly	1	Press fit nature	2	20									
Bearing Block Ends	Slim Plate Steel to press inward and hold bearing in optimal position on driving shaft	Bolt Hole Pull-out, tear out	Irregular bearing operation	8	Bolt hole stripping	2	Bolt Hole Spacing	2	32	Bolt sizing and use of properly sized washers								
Bearing Block Center	Prefabricated Sheet Steel to hold Bearing Block in Position	Bolt Hole Pull-out, tear out	Irregular bearing operation	8	Bolt hole stripping	2	Bolt Hole Spacing	2	32	Bolt sizing and use of properly sized washers								
Brake Side Bearing Block End	Prefabricated Sheet Steel to hold Bearing Block in Position	Bolt Hole Pull-out, tear out	Irregular bearing operation	8	Bolt hole stripping	2	Bolt Hole Spacing	2	32	Bolt sizing and use of properly sized washers								
Frame End Retainer	Prefabricated Sheet Steel to hold Driving Shaft in Position	Bolt Hole Pull-out, tear out	Loss of track tension	8	Bolt hole stripping	2	Bolt Hole Spacing	2	32	Bolt sizing and use of properly sized washers								
Screw Tensioner	Manual Driver Pretensioning Screw "pushing track out"	Bolt Hole Pull-out, tear out	Loss of track tension	8	Bolt hole stripping	2	Bolt Hole Spacing	2	32	Bolt sizing and use of properly sized washers								
Intermediate Axle Sub-Assembly																		
Intermediate Axle	Transitioning Torsional Power from Front Driving Belt to Secondary/Rear Driving Belt	Yielding	Loss of driving efficiency	8	Consistent irregular torsional forces	2	Diameter of axle, mounting method of axle	2	32									
		Fatigue Fracture	Loss of driving power	10	Irreversible plastic deformation	2		2	40									

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Intermediate Bearing Block End	Slim Plate Steel to press inward and hold bearing in optimal position on driving shaft	Bolt Hole Pull-out, tear out	Irregular bearing operation	8	Bolt hole stripping	2	Bolt Hole Spacing	2	32	Bolt sizing and use of properly sized washers	Adam					
Intermediate Bearing Block Center	Prefabricated Sheet Steel to hold Bearing Block in Position	Bolt Hole Pull-out, tear out	Irregular bearing operation	8	Bolt hole stripping	2	Bolt Hole Spacing	2	32	Bolt sizing and use of properly sized washers						
Intermediate Axle Mounting Plate	Meding Member Connecting the Intermeadiate Axle/Shaft Holding in the correct postioning	Fracture in slot neck	Rear axle loss of drive power, belt failure, loss of track tension	8	Excessive Loading, Impact	2	Large Slot Neck Thickness	2	32	Spacing from edges, material used						
		Bolt Hole Pull-out, tear out		7	Bolt hole stripping	2	Bolt Hole Spacing	2	28	Bolt sizing and use of properly sized washers						
		Bending/ Yielding		8	Side Impact	2	Thickness of Plate	2	32	Mounted using fail-safe design						
Rear Suspension Sub-Assembly																
Rear Suspension Top Arm	Upper Rear Suspension Pivot Axis	Yielding/Bending/Fracturing	Total Mechanical Failure of Rear Suspension	9	Rear Arms Fracturing/Yielding Upon Compression	2	Thickness of Plates, Added Braces	2	36	Reactive Link-Arm Design between lower and upper arms	Thomas					
Rear Suspension Lower Link	Lower Rear Suspension Axis	Yielding/Bending/Fracturing	Total Mechanical Failure of Rear Suspension	9	Rear Arms Fracturing Upon Compression	2	Thickness of Plates, Added Braces	3	54	Static testing of adding weight						
Rear Shock	Piston and Shock with Rod	Bottoming Out/Blowout	Loss of Rear Suspension Damping	4	Overloading Suspension, Suspension Failure	1	Bumpstops, Length Optimization	2	8	N/A						
Push Rod(s)	Direct Rear Suspension Rotation	Yielding/Bending	Over Powering Compression Force Allowed to Shock	7	One Pushrod Bending unevenly with the other	3	Bumpstops, Length Optimization	2	42	N/A						
Larger Idler Wheel(s)	Track Upper Idler Wheels	Fracture, Rubber Loss	Uneven Forces Holding Track off Inner Suspension	4	Foreign Object Impacting Wheel	2	Thickness of Wheel, Diameter of Wheel	3	24	N/A						
Torsion Spring(s)	Pre Tensioning Torsional Springs for Track	Yielding, Fracture,	Loss of Rear Suspension Rebound, Loss of Track Tension	7	Fatigue, Overloading, Over-Torsion	2	Profile, Size of Wire	2	28	Static testing of adding weight						
Manual Torsion Spring Tensioner	Bolt Adaptive Manual Pre Tensioner for Torsional Sp.	Falling off, Bending, Fracture	Loss of Rear Suspension Rebound, Loss of Track Tension	7	Cap Breakage	3	Pre-tension Quantity, Cap Size	2	42	Tension carefully, test different pre-tensions						
Plastic Torsion Spring Skid Mount	Plastic Holding Mount for Torsional Spring Members	Yielding, Fracture,	Loss of Rear Suspension Rebound, Loss of Track Tension, Track Impalement	4	Material Strength Failure, Shock Loading, Over Pre-Tension	3	Thickness of Plastic, Elasticity	3	36	N/A						
Forward Suspension Sub-Assembly																

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Triple Link	Actuates Rear Suspension to Forward Suspension Linkage	Yielding, Fracture	Loss of Rear Suspension Actuation	7	Bushing Failure, directional yielding, Impact, over-centering	3	Material Thickness	2	42	Static testing of suspension moevement	Omar						
Track Idler Bushings	Keeps Track From wearing Rear Shock	Wear, Yielding, Fracture, Stalling	Wear on triple link and rear shock	3	Friction stalling, wearing, Material properties	4	material selection	4	48	N/A							
Forward Swing Arm	Forward Swing arm of Multilink Suspension	Fracture, Yielding	Catastrophic Failure	9	weld failure, shape, Load path bending	2	Material Shape, Bracing,	2	36	Consider additional bracing options							
Retaining Strap	Prevents Over-Extension of swing arm	Snapping, Wear	Over extension, setup difficulty	3	wear, insufficient strength	2	material, thickness	2	12	N/A							
Bump Stops	Prevents Swing arm Over-Travel, Prevents System Collision	Wear, Fracture, Yielding	System collision, Belt wear/ failure, Front Shock Failure	7	wear, high impact, bolt bending, position	3	Shape, Size, Location	2	42	Static testing of suspension moevement							
Shock Rail Mount	Attaches/Locates Forward Coil-Over Shock	Yielding, Fracture	Impalement of track, loss of suspension performance	8	weld failure, shape, Load path bending	3	Material, Bracing, Location	2	48	Static testing of suspension moevement							
Roller	Prevents belt collision with forward swing arm	Wear, Yielding, Fracture, Stalling	forward Belt wear/failure	3	Friction stalling, wearing, Material properties	4	Material, Diameter	2	24	N/A							
Forward Shock	Rebound force, and shock damping for forward suspension	Bottoming Out/Blowout, Spring Yield, Fracture	Loss of suspension performance,	7	Mount failure/bending, coil bind, Over Compression	2	Preload, Spring rate	3	42	N/A							
Misc.																	
Brake Cover	Prevents Internal Combustion of Brake from hurting anyone around at time of mechanical failure	Fracture, Yielding	If Brake internally combusts, pieces wont be caught from launching, Brake Impalement	2	Impact, Falling Off, Any cause of Deformation	5	Thin Material, Fully Self Contained Assembly, Inner Drainage Holes, Light Material Choice	3	30	consider additional material on flat sections	Saleh						
Spiral Retaining Rings	Prevents shifting on axels of any item its butted up against	Wear, Yielding, Fracturing	Catastrophic Failure of Driving Axle Imploding	9	Material Wearing, Material Corrosion, Over Fatigued	1	Selection of type of axle retaining clip/ring/ Material Selection	3	27	purchase extras							