**The Weakest Link**

Over the years, we have observed multiple issues with drive chains either derailing or just breaking under load, both on the pump and motor sides. This is disappointing to the team and the program when it prohibits a team from competing. So much focus is on the hydraulic circuits and overall vehicle design that sometimes, it is the simple things that get overlooked.

Below are some bullet points of potential causes and solutions for these issues. This list is not all inclusive and NFPA encourages all teams to perform research in this area. There is endless information on the Internet.

* Chain breakage
	+ Cause
		- Using old worn chain and sprockets
		- Using low-cost chain that comes with a purchased bike.
		- Misalignment of chain to sprockets
		- Incorrect tension /slack chain adjustment.
	+ Solutions (You can use your stipend funding to purchase chains)
		- If using stock bicycle drive sprockets, purchase aftermarket heavy duty chain such as BMX or Mountain bike chain (i.e., Shadow brand Interlock Chain)
		- Insure alignment of chain to sprockets.
			* Single gear, ensure that chain and sprockets are inline and parallel.
			* Multiple gear cassettes, ensure that alignment is set up on the middle gear of the cartridge.
				+ Again, consider using a heavy-duty chain (i.e., Shimano HG71)
		- Insure the correct tension.
			* Slack in single gear set up should be no more that a total of ½”.
			* If no adjustment is possible, use a chain made up of half links to create a chain length that maintains the slack to no more than ½”.
			* If using a cassette, set slack according to the manufacturer’s recommendations.
* Options
	+ Design the drive using industrial type chain and sprockets when feasible.
	+ Bicycle chain is inherently weak.
	+ There are a wide variety of drive options when industrial applications are considered in the design.
	+ Network with other teams that have been successful with their designs that have avoided chain issues.
	+ Always carry an extra chain and few extra master links in case of breakage.