SAMSON
TECHNICAL
BULLETIN

How Cold Can You Go?

Overview In order to understand how our mooring lines perform in an extremely cold environment, we studied the flexibility and strength of ropes being directly exposed to a broad range of temperatures.

Samson mooring lines are routinely exposed to extreme climatic conditions. Samson recently modeled and analyzed the application of our high-performance mooring lines under hot climate conditions [1]. In this technical bulletin, we look at how our mooring lines perform in an extremely cold environment. Some concerns were raised regarding the performance of ropes that are directly exposed to the extreme cold. The picture in Fig. 1 shows *AmSteel®-Blue* on a winch buried under heavy ice on board a ship sailing in a cold environment.

FIGURE 1 AmSteel®Blue mooring line on shuttle tanker *Kometic* buried in ice and snow.

Strength

Fig. 2 shows that Dyneema® fiber rope actually becomes stronger at lower temperatures. The rope may gain 5–10% of breaking strength if the environment becomes as cold as -50°C (-58°F). Projections show that the rope gains even more strength at -150°C (-193°F). [2]

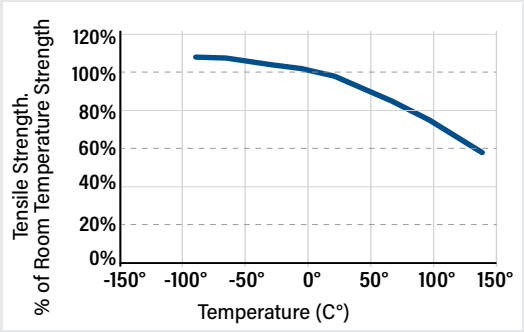

FIGURE 2 Strength of Dyneema® fiber vs. Temperature

Ice

In cold environments, there is a concern that ice may damage the rope through abrasion or cutting due to the ice's rigidity and sharp edges. To test this theory, we froze wet *AmSteel®-Blue* rope to -5°C (23°F) in two different configurations, as shown in Fig. 3.

We then measured the strength of the frozen rope samples. The results in Table 1 show that there was no loss of strength regardless of the frozen configuration.

TABLE 1 Strengths of frozen 7/16" AmSteel®Blue

CONFIGURATION	45° BEND	180° BEND
Percent of Minimum Break Strength	**100%**	**102%**

FIGURE 3 Frozen rope bent at 45° on the left and 180° on the right

Conclusion

The safe operation temperature for ropes constructed from high modulus polyethylene (HMPE) fiber like Dyneema®, such as *AmSteel®-Blue*, *Force-8™*, *Neutron-8™*, *Turbo-DPX™*, *Turbo-75™*, etc., is at least as low as -125°C (-193°F).

REFERENCES

[1] Technical Bulletin, *Mooring in High-Temperature Climates,* Samson, 2019.

[2] DSM Dyneema® fiber technical data sheet, 2002.

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