

# SAMSON TECHNICAL BULLETIN

Published Date: November 2005  
Revised: June 2009

## How Cold Can You Go?

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.

Samson mooring lines are routinely exposed to different climatic conditions. Some concerns were raised regarding the performance of ropes that are directly exposed to the extreme cold. The pictures in Fig. 1 depict AmSteel®Blue on a winch buried under heavy ice on board a ship sailing in a cold environment. 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.

### FLEXIBILITY

Fig. 2 shows that rope made from Dyneema® fiber, such as AmSteel®Blue, remains quite flexible even at an extremely cold temperature of  $-125^{\circ}\text{C}$  ( $-193^{\circ}\text{F}$ ).

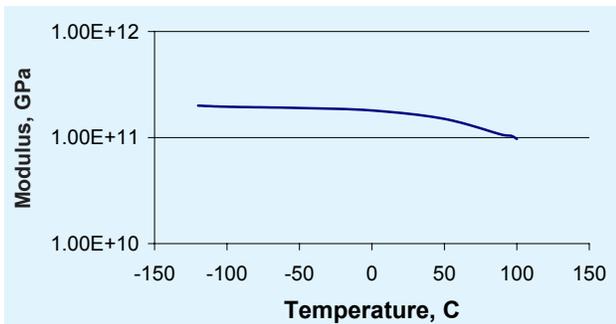


FIGURE 2 Stiffness of Dyneema® fiber vs. Temperature

### STRENGTH

Fig. 3 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  $-50^{\circ}\text{C}$  ( $-58^{\circ}\text{F}$ ). Projections show that the rope gains even more strength at  $-150^{\circ}\text{C}$  ( $-193^{\circ}\text{F}$ ). [2]

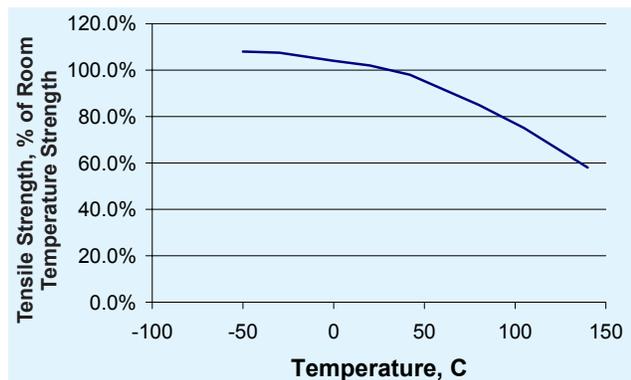


FIGURE 3 Strength of Dyneema® fiber vs. Temperature



FIGURE 1 AmSteel®Blue mooring line on Shuttle Tanker KOMETIC buried in ice and snow



**samson**  
THE STRONGEST NAME IN ROPE

### 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. 4.



**FIGURE 4** Frozen rope bent at 45° on the left and 180° on the right

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
<b>% of Minimum Break Strength</b>	<b>100%</b>	<b>102%</b>

### CONCLUSION

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

For additional information, please contact our Engineering Department at 360-384-4669.

### REFERENCES:

- [1]. Technical Bulletin, *AmSteel®-Blue Mooring Under Hot Climates*, Samson, 2004.
- [2]. DSM Dyneema® fiber technical data sheet, 2002.