

Technical Bulletin 2: Fire Performance of Sparkeater® Aramid Roundslings

Slingmax Sparkeater roundslings are rated for use in a maximum temperature of 300 °F (150 °C). They are constructed with aramid fiber, giving them enhanced high temperature performance as well as resistance to flame. Aramid fiber is a high-performance fiber more commonly known by the brand names Technora, Kevlar, and Twaron. Aramids do not melt, but instead decompose at a temperature of 842 °F (450 °C) and have a limiting oxygen index of 29 – 37, depending on grade. The fiber can be ignited, but it generally doesn't support flame and burning stops after the ignition source is removed.

To confirm the fire performance, a sample was tested for ignitability by London Scientific Services, a third-party laboratory, and a report was prepared by the Offshore Certification Bureau. The full test report can be found in Appendix A, but an except of the result is below:

“The sling sample was tested for Ignitability and it was found that the Aramid based sling, as supplied, was resistant to ignition and fire spread and may therefore be considered compatible with wire or chain sling in respect to fire safety on offshore installations. Contamination with diesel oil has been shown to make the sling easier to ignite but not to enable it to continue to burn”

Verification Testing:

Additional high temperature testing was performed on a Sparkeater sling in 2008. This round of testing consisted of rigging the sling directly on a piece of heated steel. A Sparkeater sling with a rated vertical capacity of 10,000 lb was rigged over a steel block that was heated to 400° F (204° C).

The sling was held at its WLL for 15 minutes, and an inspection was performed on the sling which showed no signs of damage. The steel had cooled to 292° F (144° C), so heat was again applied until it reached 400° F (204° C).



Figure 1- Heated Steel Block



Figure 2 - Sling Under Load

The sling was then loaded to WLL again and held for an additional 15 minutes. After the second 15 minute loading, the sling was inspected again. Again, it showed no signs of deterioration or damage from heat.

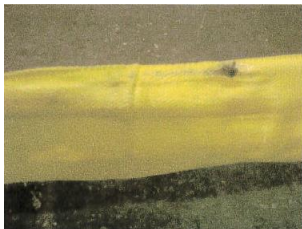


Figure 3 - Sparkeater Sling After Test

The sling was then allowed to cool to room temperature, and then put back on the test bed for a final break test. The Sparkeater sling achieved an ultimate breaking strength of 52,800 lbf, a 5.28:1 design factor – greater than the required 5:1. The sling was examined internally after the break. The core yarns showed no damage or discoloration due to heat.

TITLE

Special investigation of
FIRE PERFORMANCE OF
ARAMID CRANE SLING
SLINGMAX TPSE 3000

REPORT PREPARED FOR

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for the attention of
Mr. P.M.E. Wood

CLIENT REFERENCE

Letter of 8th March 1991

DOCUMENT REFERENCE

LSS/T50025

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Client:- Slingmax International Ltd.

Order No:-

OCB Ref No:- 91/EA/006

Report Date:- 17th June 1991

At the request of SLINGMAX® International Ltd. of half Penny Court, Half Penny Lane, Sunningdale, England; an investigation was carried out regarding the proposed use of SLINGMAX® TPSE 3000 Aramid Fibre Lifting Slings' for use in the United Kingdom and in the united Kingdom Sector of the North Sea.

One unused sling sample was used during the investigation. The sling was identified as SLINGMAX® Twin-Path® -TPSE 3000 x 4 inch, and stated to be made of "Aramid" man made fibre.

Construction

The outer cover was a yellow basket weave fabric with a bright yellow colored coating on the exposed surface. The woven cover was continuous without a longitudinal seam but did have a longitudinal cable stitch which encouraged a flat profile. At the transverse joint there was additional edge stitching and an overlap strip. A similar fabric was used for the inner yellow colored covers. The inner load-bearing part of each sling was provided as two main bundles of continuous filament yellow colored yarns. Each main bundle consisted of 19 individual 3-play bundles with a slight 'Z' twist. The main bundles also contained colorless yarns used as a "tell-tail" safety feature to indicate over-loading of the sling.

Ignitability

The sling sample was tested for ignitability and it was found that the Aramid based sling, as supplied, was resistant to ignition and fire spread and may therefore be considered compatible with wire or chain sling in respect to fire safety on offshore installations.

Contamination with diesel oil has been shown to make the sling easier to ignite but not to enable it to continue to burn.

Details of these tests are contained in London Scientific Services Report LSS/T50025 dated 25th April 1991.

Load Test

Load Tests were carried out on the sample in the supplied condition and after being subjected to diesel oil contamination for 48 hours without any indication of deterioration in the sling sample.

Load Test results are contained in Holstbalm Report Ref: DAC/MKB/Q590 dated 23rd April 1991.

Relevant National Standards and Regulations

There are several standards and regulations that are relevant to lifting slings and there were reviewed to determine the degree of compliance of the sample.

BS 3481: Part 2: 1983. This standard relates to slings made from polyamide (nylon), polyester or polypropylene only. The "Aramid" sling therefore does not comply with this standard and can be certified accordingly. This was confirmed by British Standards Institution.



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Fire and Safety Department
Laboratory Report Reference LSS/T50025

Fire Tests on Slingmax Aramid slings

This report summarises fire and load tests on loop slings provided by Slingmax International Ltd in accordance with their request dated 8th March 1991.

1 Samples

The samples were new crane slings marked on a leather label:-

'Slingmax Twin Path - TPSE 3000 x 4'

The samples were found to be nominally 1.7 kg in weight and a loop length 2.5 m. Our ref No. 0071 and No. 0113.

2 Construction

The outer cover was a yellow basket weave fabric with a bright yellow coloured coating on the exposed surface. The woven cover was continuous without a longitudinal seam but did have a longitudinal cable stitch which encouraged a flat profile. At the transverse joint there was additional edge stitching and an overlap strip. A similar fabric was used for the inner yellow coloured covers. The inner load-bearing part of each sling was provided as two main bundles of continuous filament yellow coloured yarns, presumed to be made from Aramid. Each main bundle consisted of 19 individual 3-ply bundles with slight 'Z' twist. The main bundle also contained colourless yarns used as a 'tell-tail' safety feature to indicate over-loading of the sling.

3 Procedure

3.1 Ignitability

The ignitability was investigated on the individual components and complete sling as received and after contamination with diesel fuel. Tests were of an ad hoc type as no standard laboratory fire tests were considered relevant to the end use.

Ignition sources used covered a range of intensities, from the 'match-equivalent butane flame ignition source (IS 1) in BS 5852 upwards, from which conclusions about performance in fires, especially on offshore installations, have been drawn.

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3.2 Thermal Irradiance

Part of the complete sample as received was subjected to thermal irradiance to simulate the effects of a developed fire. The method of test was based on BS 476 : Part 13 and the level of radiation used was 30kW/m^2 .

3.3 Load Tests

3.3.1 Load tests were carried out in accordance with BS 3481 : Part 2 : 1983. This method is applicable to crane slings made from polyamide (nylon), polyester or polypropylene and was considered the most appropriate test method for slings made of Aramid yarn, notwithstanding that the standard does not specifically include Aramid

3.2 Safe Working Load - The standard requires a proof test to MSWL x 2.

3.3.3 Strength Test - The standard requires a test on one sling in every 250 to be tested to MSWL x 6 for 60 seconds. This test was omitted pending establishment of the supply position for the product.

3.3.4 Contamination - The test in 3.2.1 was repeated after 48 hours immersion in diesel fuel. This represented a form of contamination which might occur on an offshore installation and which could affect the load capacity of a sling made from Aramid. Other contaminants relevant to specific end uses would need to be investigated as necessary.

4 Ignitability

4.1 Initial ignitability tests were made on the individual components, ie, outer and inner covers and load-bearing yarns as well as on a complete section of sling as supplied. As usual with this type of investigation the smallest flaming sources were used first. These simulate accidental or intentional ignition by smoker's materials such as matches and cigarette lighters. Small smouldering sources such as a cigarette were not considered likely to lead to ignition of the materials and were therefore omitted.

4.2 Subsequently larger ignition sources were applied, eg, butane blow torch. The use of slings contaminated with hydrocarbons was considered to represent a realistic scenario for offshore situations. Part of the sample was therefore saturated with diesel fuel to simulate contamination by minor hydrocarbons. The contaminated sample was ignited whilst suspended vertically and observed whilst flaming.

4.3 In the thermal radiation tests the samples were observed for ignition, smoke production or other visible phenomena.

5 Results

- 5.1 The Aramid components were found to be difficult to ignite using small flaming sources representing smoker's materials such as matches and cigarette lighters. The exception was the 'tell-tale' strand which, once ignited continued to burn and spread flame where exposed. No flaming or other molten material was produced by any of the components.
- 2 In the presence of a butane blow torch flame no sustained ignition occurred but a form of charring was noted, consistent with the expected performance of Aramid. In regions of intense heating this charring appeared to take the form of glowing combustion.
- 5.3 When subjected to thermal radiation at a level of 30kW/m^2 the complete sample did not ignite in the presence of a pilot flame. The only noted feature during testing was a slight sweet smell and small amounts of greyish smoke.
- 5.4 The contaminated part of the sample burned freely during consumption of the absorbed diesel fuel. Once the hydrocarbon was consumed flaming died down leaving the charred remains of the sling. There was no apparent flaming of the sample and no flame spread.

6 Load tests

The load test results are summarised in the attached sheet from Hoistpalm Ltd, reference DAC/MKB/Q590.

Comments

- 7.1 On the basis of the tests carried out the sample sling was identified as containing heat resistant load-bearing fibres. The sample and most components were found to be resistant to ignition by various flaming sources. Thermal irradiance at a level of 30kW/m^2 did not cause ignition but damaged the sample by charring. Hydrocarbon contamination on the sample was easily ignited and caused the sample to be damaged by charring but did not cause ignition.
- 7.2 The sample would also be expected to be damaged, but not ignited, by small smouldering sources.
- 7.3 The load tests carried out show that the sample tested met the requirements of BS 3481 : Part 2 : 1983 both as received and after contamination with diesel fuel for 48 hours.

8 Conclusion

The Aramid based sling was resistant to ignition and fire spread as supplied and may therefore be considered comparable with wire or chain slings, eg, in respect of fire safety on offshore installations, subject to approval by an offshore certifying body. Contamination has been shown to make the sling easier to ignite but not to continue to burn.

Kevin Nimmo
Fire and Safety Department