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“The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an such investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame.”

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 14(14) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

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Failure of a throw bag rescue line during a capsized drill on an unnamed rowing boat Widnes, UK 24 March 2018

SUMMARY

On the evening of 24 March 2018, the Warrington Rowing Club was carrying out a boat capsized drill in a swimming pool. At around 1830, as a young person was being pulled to the side of the pool using a throw bag rescue line, the line parted. The young person was uninjured during the incident. The parted line was examined and found to be made up of four pieces of rope thermally fused together, and it had failed at one of the joints. A customer notification campaign by the manufacturer, RIBER, and prompt publication of the incident in British Rowing’s newsletter, identified a total of ten throw bags with defective rescue lines. Laboratory tests conducted for the MAIB established that the joined sections were 12 times weaker than the rope itself.

The primary purpose of throw bags is to rescue people from the water, and they are classed as public rescue equipment (PRE). They are not mandatory items of carriage on commercial or leisure vessels. There is no legislative framework that governs them and, consequently, throw bag rescue lines are not required to comply with any quality or safety standard. The only applicable obligation is the General Product Safety Directive 2001/95/EC, which requires all products entering the European market to be safe. However, it is estimated that there are tens of thousands of throw bags in use in the UK alone, both in water leisure and public rescue sectors (**Figure 1**).

RIBER has taken several actions to prevent recurrence of faulty manufacturing. However, other throw bag manufacturers have reported that in the past their throw bag rescue lines were also found to have fused joints.

The British Standards Institution has been recommended to develop a standard for PRE, ensuring that the topic of throw bags and their rescue lines is addressed as a priority.



Figure 1: RIBER throw bag

FACTUAL INFORMATION

Narrative

On 24 March 2018, members of Warrington Rowing Club (WRC) were conducting a boat capsize rescue exercise at Halton Baths, Widnes, UK. At approximately 1830, while a young person was being hauled to the side of the swimming pool, the rescue line of the throw bag being used parted. There were no resulting injuries.

On close examination of the parted line, the safety advisor of the club identified that there were two joints in the line, one of which had parted. On checking four more throw bags that also belonged to the club, he found another rescue line with three joints (**Figure 2**). He promptly notified the manufacturer of the throw bag, Riber Products Limited (RIBER), and the national governing body for rowing in the UK, British Rowing. RIBER published news of the failed rescue lines on Facebook. British Rowing published a notice that included RIBER's Facebook notification in its March newsletter. RIBER identified two batches, totalling 471 throw bags, which potentially had the same problem and contacted its customers directly or through retailers. In response to the customer notification campaign, eight further defective throw bags were identified. In June 2018, the MAIB published a safety bulletin to disseminate the lessons learned from this incident and to seek information about similar incidents¹.

Throw bags

The primary purpose of a throw bag is to rescue people from the water. It is designed to pull a casualty to safety either to the side of a vessel or to a safe area away from deep and fast flowing waters. It is not designed to lift a person out of the water. A throw bag consists of a length of buoyant rope, the rescue line, contained in a bag with one end of the rope passing through the bottom of the bag and terminating in a knot or other handhold for the casualty. With the rescue line held at the free end, the bag containing the rescue line is thrown to the casualty in the water. Provided the rescue line is correctly 'flaked'², the weight of the line inside the bag carries it to the casualty while the rescue line unravels (**Figure 3**).

Throw bags are used primarily in the leisure sector to effect rescue during a range of water sporting activities such as canoeing, white-water rafting and kayaking. Almost every live-aboard yacht, of which it is estimated there are 60,000 in the UK alone, has a throw bag or similar device on board. All rescue vehicles and pumping units of Fire & Rescue Services, vehicles used by the Hazard Area Response Teams of the Ambulance Services in England and equivalent organisations in Scotland and Wales, and police rescue craft, carry throw bags.

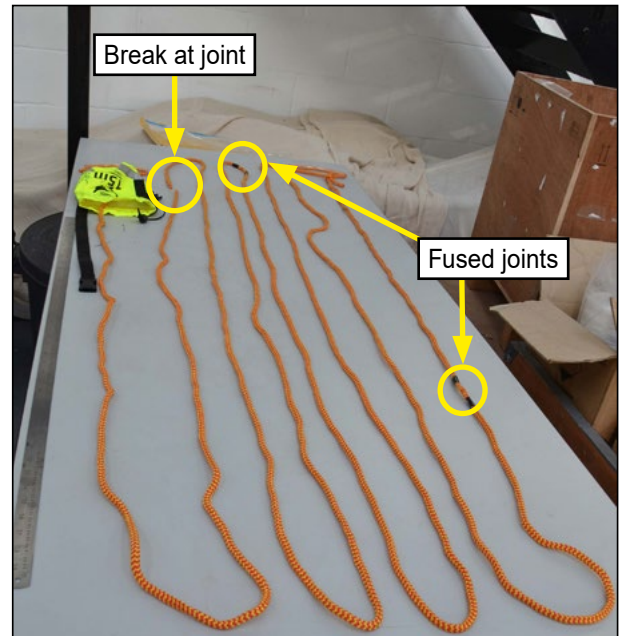


Figure 2: 15m rescue line with three joints

Image courtesy of [RNLI magazine - Be someones lifeline](#)



Figure 3: Illustration showing a throw bag being used to rescue a casualty

¹ [SB2/2018: Failure of a throw bag rescue line during a boat capsize rescue drill.](#)

² Correctly 'flaked': laying out the rescue line inside the bag, to ensure that when thrown it unravels freely.

There are several types of throw bag on the market ranging in price and quality. Information displayed on each throw bag is determined by the manufacturer and can include: minimum breaking load (MBL); compliance with a rope standard; and serial and batch numbers. Most throw bags are manufactured in Asia and are branded with the logo of the company that sells them in Europe, including the UK. A review³ of popular throw bags noted that rope diameter varied from 7.5mm to 11mm and the rope MBL from 3kN⁴ to 17.5kN. RIBER throw bags were available with rescue lines of 15m, 20m and 25m lengths of 8mm diameter ropes. They were stamped with the RIBER logo and the length of the rescue line but did not carry any further information such as serial and batch numbers or MBL. RIBER has since decided to display serial numbers and batch numbers on all its throw bags produced after the WRC incident.

In response to the request for information included in its safety bulletin published in June 2018, the MAIB has been alerted to other areas of concern with throw bag rescue lines, including deterioration when exposed to sunlight, loss of strength when subject to friction, and poor attachment of the rescue line to the bag.

Riber Products Limited

RIBER, set up in 2011, was based in Claycross, Derbyshire. A significant part of its business was in the manufacture and supply of kayaks and canoes for the leisure market in the UK and the rest of Europe. The canoe and kayak manufacturer, Cixi Tecsong Rotomoulding Co. Ltd. (CIXI), based in China, procured throw bags from another manufacturer, also based in China. The throw bag manufacturer, whose main business was in clothing products, purchased the necessary materials including the rope from third parties, assembled and branded the completed product and supplied them to CIXI. The throw bags were then shipped by CIXI to RIBER, who sold them through retailers and via the internet on Amazon and eBay.

RIBER had sold approximately 4000 throw bags between 2011 and the WRC incident, and of late was selling 1000 throw bags annually. Throw bags formed less than 0.2% of RIBER's main business. The throw bag manufacturer in China had the responsibility of carrying out quality checks on its product before transferring it to CIXI. When imported into the UK, RIBER carried out random, visual checks on approximately 10% of the throw bags.

Tests conducted

The MAIB commissioned TTI Testing Limited, UK, to determine the material of the failed rescue line, and to compare the average MBL of the intact sections with that of those containing a joint. TTI conducted tests on four sections of the line: two without joints and two with joints. The average MBL of the intact sections was 2.541kN (259kgf⁵) and that of those containing a joint 0.213kN (21.7kgf). The material of the line was established to be multifilament polypropylene with an outer braid and an inner knitted core.

The report also noted that elongation is a key parameter in the absorption/mitigation of shock loading, and that in the tests of the joined samples it was extremely low.

Standards and guidance

In 1983, the National Fire Protection Association (NFPA) of the USA published the document *Life Safety Rope and Equipment for Emergency Services*, in response to the American fire services' enquiries regarding standards for rescue lines. It was approved as an American National Standard in February 2006. The fourth edition of NFPA 1983 added an item called '*throwline*' described as '*a floating rope that is intended to be thrown to a person in water, or used as a tether for rescuers during water rescue incidents*'.

³ <http://www.internationalrafting.com/gte/river-safety-articles/choosing-the-correct-throwbag-a-helping-hand/>

⁴ kN or kilonewton is a unit of force equivalent to 101.972 kilogram-force (kgf).

⁵ kgf: the magnitude of the force exerted on a mass of one kilogram in the Earth's average gravitational field of 9.80665 m/s².

The scope of the NFPA standard covers safety rope⁶, escape rope⁷, water rescue throw lines, life safety harnesses, belts, and auxiliary equipment for emergency services personnel. Its scope does not include equipment designed for mountain and cave rescue, or fall protection. It provides detailed requirements for the design, performance, testing and certification of the equipment in its scope. It also provides guidance on damage to ropes due to abrasion and exposure to ultraviolet rays from the sun. The American Emergency Services are required to use rescue products complying with NFPA 1983.

The NFPA standard requires an MBL of 13kN (1325kgf) or more for throw lines and for the throw bag to carry a statement of compliance with the standard. The statement is also required to include the type of fibre(s) used in the construction of the line and the line's MBL. There appears to be only one make of throw bag that conforms to NFPA 1983, while another meets the requirements of EN 1891⁸. Several British and European standards exist for ropes used in personal protective equipment (PPE), prevention of fall from heights, and mountaineering. Most throw bags, including those manufactured by RIBER, do not comply with any rope standard.

In 2007, the Royal National Lifeboat Institution published the document *A Guide to Coastal Public Rescue Equipment (PRE)*. Its primary aim was to provide a comprehensive guide to beach rescue equipment that could be easily accessed and used by members of the public. The guide provides a brief specification for a throw bag, which includes a required buoyancy of 40N for the rescue line and an MBL of 500kgf. It further refers to rope standard BS EN 699:1995 (replaced by BS EN ISO 1346:2012⁹) as being acceptable to the Maritime and Coastguard Agency (MCA) for ropes used in lifesaving appliances (LSA) and suggests that throw bag rescue lines should conform to this standard.

Regulations

There is no requirement for the carriage of throw bags on vessels in the commercial or leisure sector. Therefore, they are not governed by international conventions such as SOLAS¹⁰ or European directives such as the Marine Equipment Directive 2014/90/EU. The primary focus of The Recreational Craft Regulations 2017 is on the craft and its components. The Regulations are silent on the equipment the craft carries. Throw bags are covered under neither The Personal Protective Equipment (Enforcement) Regulations 2018 nor The Work at Height Regulations 2005.

CE¹¹ marking on a product is a manufacturer's declaration that the product complies with the essential requirements of the relevant European health, safety and environmental protection legislation. CE markings are required for 20 categories of products imported into the European Union or into countries belonging to the European Free Trade Association. Throw bags do not come under any of the 20 categories that include personal protective equipment and recreational craft.

The General Product Safety Directive 2001/95/EC (GPSD) requires that all products placed in the European market shall be safe, and assigns responsibility on manufacturers to notify the competent authority of the Member State if a product is identified to be unsafe. In the UK, the local Trading Standards office is considered to be the competent authority. The Derbyshire Trading Standards office was the competent authority for RIBER, but they had not communicated with each other before the MAIB safety bulletin was published.

⁶ Safety rope: 'Rope dedicated solely for the purpose of supporting people during rescue, fire-fighting, other emergency operations, or during training evolutions'.

⁷ Escape rope: 'A single-purpose, emergency self-escape (self-rescue) rope'.

⁸ EN 1891: Personal protective equipment for the prevention of falls from a height - Low stretch kernmantel ropes

⁹ Fibre ropes, Polypropylene split film, monofilament and multifilament (PP2) and polypropylene high-tenacity multifilament (PP3). 3-, 4-, 8- and 12-strand ropes.

¹⁰ SOLAS: International Convention for the Safety of Life at Sea 1974, as amended.

¹¹ CE is the abbreviation for the French phrase 'Conformité Européene', meaning 'European Conformity'.

Beach safety study

An inquest into the drowning of seven men in the sea off Camber Sands in 2016 resulted in the MCA commissioning a study, *Review of responsibility for beach safety in the UK*. The study is ongoing and includes a review of existing national legislation and a comparison with the legislation of selected countries. Several project stakeholders have been identified and a review of their practices in relation to the provision of PRE, lifeguards and information for visitors is part of the project scope. The scoping document states:

'There is ambiguity in terms of who has responsibility for managing water safety risks. The current prevention arrangements, particularly at a local level, are at best difficult to understand and interpret. This lack of clarity can inhibit possible duty holders from taking action to reduce risk.'

The project is expected to conclude by March 2019.

Other incidents

In addition to the ten defective throw bag lines already identified in 2018, RIBER had detected another throw bag with joints in its rescue line, supplied to them approximately 6 years ago by its manufacturer in China. In September 2009, Crewsaver Limited, a manufacturer of LSA, reported that a small number of its YAK range of throw bags were found to have defective rescue lines, with joints similar to those found on the RIBER product. The MAIB has been informed by a leading manufacturer of throw bags that it had experienced similar problems and had subsequently decided to test a random 10% of its products to EN 1891⁸.

ANALYSIS

Failure mechanism

The throw bag rescue line that failed during the capsize drill conducted by WRC was made up of four pieces of rope thermally fused together. The laboratory test established that the joints could withstand only a twelfth of the load sustainable by an intact section of the line. It was therefore inevitable that the line would fail when a small load was applied to it during the drill.

This problem does not seem to be limited to RIBER products alone, as evidenced by similar occurrences with throw bags produced by other manufacturers. It is fortunate that, in the case of WRC, the line parted in a safe environment and there were no injuries. The failure of a throw bag rescue line during an emergency rescue operation in fast flowing and deep waters could potentially result in the casualty drowning.

Quality control

Approximately 6 years ago, RIBER had identified that the throw bag manufacturer was supplying them defective products. During the MAIB investigation, a further set of ten defective throw bags from the same supplier were identified. It is not known how many more defective items are in circulation, especially in the possession of members of the public, who may not be aware of the MAIB safety bulletin and other alerts in the media pertaining to this subject.

It is encouraging that RIBER has now introduced batch numbers and serial numbers in addition to introducing the requirement on CIXI to check every throw bag delivered to them before shipment to the UK. However, several other makes of throw bag are available on the market, and it is not known what quality controls are carried out during their production. Since they have no quality benchmark or requirement to work with, the controls are likely to be of different standards.

It would be unreasonable to expect local Trading Standards to verify the quality of every product being imported into the country, especially those that do not require CE markings. The only safeguard against poor and unsafe workmanship is therefore limited to the quality checks of the manufacturer. Such checks lack third party oversight and could be easily compromised; this is neither tenable nor sustainable.

Compliance with an appropriate standard

Compliance with the GPSD is mandatory for all products not covered by specific directives or regulations, and requires items entering the European market to be safe. As a throw bag is not considered to be safety or lifesaving equipment, there is no requirement to manufacture it to a specific safety or quality standard.

It is not clear why only one manufacturer of throw bags conforms to the NFPA 1983 standard. Perhaps other throw bag manufacturers are unaware of the NFPA standard. Equally, in the absence of a specific requirement, it is possible that manufacturers are reluctant to incur the extra cost in manufacturing and certifying their products to any standard.

Although one of the throw bags available on the market conforms to the lifting equipment standard, it may not be the most appropriate for use in water, despite its stringent requirement for rope quality and strength. Developing and manufacturing throw bags to an accepted and well considered standard has many advantages, including:

- Increased reliability and user confidence.
- Reduction in the performance variability among products.
- Incentivisation of manufacturers to prevent loss of market share for their products.

Considering the large number of throw bags in use in the UK, both in the leisure sector and emergency rescue services, the lack of a quality and safety standard needs to be addressed as a matter of priority.

Legislative status of rescue equipment

Throw bags are not required to be carried on vessels in the commercial or leisure sector and consequently they are not governed by international or national regulations. Nevertheless, there are estimated to be tens of thousands of throw bags in use in the UK alone, both in the emergency services and in the water leisure sector.

Currently, no legislative framework exists for throw bags and PRE in general. Until this sector is brought under the scope of an appropriate legal framework capable of enforcing quality and safety requirements, weaknesses in this sector will continue to hinder safe rescue. In this context, the MCA's ongoing study to establish responsibility for beach safety is a first step in the right direction.

CONCLUSIONS

- The throw bag safety line parted under light loading because it was constructed using four sections of line, and the joins between the sections were 12 times weaker than the rope itself.
- The failure of a throw bag rescue line during an emergency rescue operation in fast flowing and deep waters could potentially result in the casualty drowning.
- At present, the only safeguard against poor and unsafe workmanship of throw bags is limited to the quality checks of the manufacturer; such checks lack third party oversight. This situation is neither tenable nor sustainable.
- Considering the large number of throw bags in use in the UK, both in the leisure sector and emergency rescue services, the lack of a quality and safety standard needs to be addressed as a matter of priority.
- The MCA's ongoing study to establish responsibility for beach safety is a first step in the right direction towards identifying the appropriate legislative framework for throw bags and public rescue equipment in general.

ACTION TAKEN

The **Marine Accident Investigation Branch** has:

- Published safety bulletin SB2/2018 in June 2018, to disseminate the safety lessons from this incident and to provide guidance on how to identify poorly manufactured throw bag rescue lines.
- Supplied a range of user feedback on modes of throw bag rescue line failures to the British Standards Institution as background information for a throw bag standard that may be developed in the future.

Riber Products Limited has:

- Introduced batch and serial numbers to uniquely identify its throw bags.
- Instructed its canoe suppliers to inspect each throw bag before dispatching them to the UK.
- Implemented a policy to inspect a randomly selected 10% of its throw bags imported into the UK.

Trading Standards, Derbyshire has:

- Disseminated MAIB safety bulletin SB2/2018 through the European alerting system RAPEX¹².

RECOMMENDATIONS

The British Standards Institution is recommended to:

- 2019/105** Develop an appropriate standard for public rescue equipment ensuring that the topic of throw bags and their rescue lines is addressed as a priority.

Safety recommendations shall in no case create a presumption of blame or liability

¹² RAPEX: Abbreviation for Rapid Exchange of Information. RAPEX is an alerting system available to the members of the European Union to disseminate information regarding faulty consumer products.

SHIP PARTICULARS

Vessel's name	Unnamed rowing boat
Flag	Not applicable
Classification society	Not applicable
IMO number/fishing numbers	Not applicable
Type	Rowing boat
Registered owner	Warrington Rowing Club
Manager(s)	Not applicable
Year of build	Not applicable
Construction	Not applicable
Length overall	Unknown
Registered length	Not applicable
Gross tonnage	Not applicable
Minimum safe manning	Not applicable
Authorised cargo	Not applicable

VOYAGE PARTICULARS

Port of departure	Not applicable
Port of arrival	Not applicable
Type of voyage	Not applicable
Cargo information	Not applicable
Manning	Not applicable

MARINE CASUALTY INFORMATION

Date and time	24 March 2018 at around 1830
Type of marine casualty or incident	Marine incident
Location of incident	Halton Baths, Widnes, UK
Place on board	Not applicable
Injuries/fatalities	None
Damage/environmental impact	None
Ship operation	Not applicable
Voyage segment	Not applicable
External & internal environment	Dry, good visibility, no wind
Persons on board	Unknown