Care in use, inspection and retirement
Special Patrol Insertion and Extraction (SPIE) ropes

Scope
This document is applicable to all versions of the SPIE rope:

- SPIE – Polyester double braided main rope

- SPIE WPX – polyolefin 12 strand braided main rope

- SPIE DPX – HMPE 12 strand braided main rope

Design specification:

All versions of the SPIE rope are designed to meet and exceed the requirements of the NATO DMS.
Main rope minimum strength: 15 tonnes
Primary attachment points (green) minimum strength: 1.5 tonnes
Backup attachment points (red) minimum strength: 1.5 tonnes

Storage and Shelf life
Ropes should ideally be stored in a clean, dry environment protected from extremes of temperature, light and chemical exposure.

When stored under these conditions the shelf life is 10 years.

Service life
Once put into use the life of a rope is typically dependant of the environment the rope is used in and the severity of the application. For these reasons it is impossible for the manufacturer to give a recommended service life. In some applications a rope will last years while in extreme cases the life of the same rope type may only be a single use.

It is therefore the responsibility of the user to inspect the rope at suitable intervals, typically before and after use and to determine the suitability of the rope for further use.

Factors to consider

Rope can be damaged by any of the following:

- Cuts, localised damage
- Abrasion (external)
- Abrasion (internal)
- Excessive heat
- Dynamic loading
- UV radiation
- Chemical exposure
- Knots
- Twist
- Fatigue (tension)
- Fatigue (bending)

Damage to ropes in often caused by the environment the rope is used in. It is therefore prudent to inspect anything that the rope may come into contact with as part of the ropes inspection programme. For instance, load hooks , shackles etc.

Inspection
The preferred method of inspection is detailed below:

The rope is inspected in short ~0.5m sections.
The rope is visually inspected on all sides
The rope is felt to check for stiff or soft sections.
A point on the rope is opened up to check for internal damage.
Move along to the next section.

Retirement criteria (main rope)

Damage to fibre rope normally manifests as broken or damaged filaments. An assessment of the potential residual strength can be made by estimating the % of the fibres that are damaged.

The following are typical of the features to look for and their potential severity.

Cuts and localised damage (WPX and DPX)
The splice is the weakest point in the rope and is typically 10% weaker than the body of the rope. This means that localised damage that totals to less than 10% of the ropes fibres does not normally represent a weakening of the rope beyond the strength of the terminations. The rope's strands transfer load to each other through friction so as long as points of damage are sufficiently separated, more than 50 times the rope diameter, they are not cumulative even if they are in the same strands. This is therefore the upper limit of local damage
Examples include:
No more than ½ of 2 strands cut in 50x the rope diameter
1/3 of 3 strands cut
¼ of 4 strands cut
And any combinations of damage that does not total to more than 1 strand.

Example: A SPIE WPX rope has the following cuts on it over a distance of 1.6m (50xthe diameter) – 1x1/2 strand cut and 2x ¼ strand cut. The total damage in the 1.6m length totals to 1 strand so the rope remains serviceable.

Exceptions: Any damage at the tail of the splice represents a weakening of the rope and the rope should be retired or re-terminated.


Half a strand cut (WPX)

Half a strand cut (DPX)

Cuts and localised damage (SPIE polyester)

The polyester double braid rope is a core and cover construction where each component carries half the total load. The outer jacket provides a degree of protection to the core braid.

The cover consists of 24 plaits, each consisting of 2 strands. Damage up to one of these strands being severed in any 1m of the rope is acceptable and does not represent a significant loss of strength.

One strand cut in SPIE polyester.

Abrasion (external)

As the surface of a rope wears some of the filaments will break, this will result in a fluffy/fuzzy appearance. This provides a cushioning layer that protects the fibres underneath and stabilises the abrasion process.

This fuzzy surface normally represents a negligible reduction in strength.

Abrasion examples – acceptable level of wear.

Abrasion examples - unacceptable

Excessive heat

The SPIE WPX and DPX are made from materials that have relatively low melting points of approximately 150 degC.

Exposure to excessive temperatures of over 80 degC can cause the rope to lose strength, this may not be visible.

Higher temperatures can cause melting/glazing on the rope surface.

The rope should be retired from service if this type of damage is found.

Heat damage examples

Dynamic loading
High speed (dynamic) loading can cause internal heating of the fibres.

In the WPX and DPX ropes this can appear as internal glazing and as fibres that have fused together preventing the strands from being separated.

The rope should be retired from service if this type of damage is found.

UV radiation

Exposure to UV can damage synthetic fibres. The extent of this damage is very difficult to predict as it depends on many factors.

UV damage typically appears as bleaching of pigment colours in the recovery loops. Severe damage can result in a powdery surface to the rope.

All the materials used in the SPIE rope are UV stabilised.

Chemical	Conc	Temperature	time	Polyester	Polypropylene	HMPE
	W/W%	Deg C	Hours	(SPIE)	(WPX)	(DPX and all recovery loops)
Acids						
Hydrochloric	34	20	100	90	100	100
Nitric	66	20	100	70	100	95
Sulphuric	96	20	100	100	100	90
Formic	90	20	100	95	100	100
Acetic	100	20	10	95	100	100
Alkalis						
Caustic Soda	40	20	100	0	90	100
Caustic Soda	20	70	150	0	100	90
Caustic potash	40	20	100	0	90	100
Solvents						
Trichloroethylene	100	30	150	95	80	100
Carbon Tetrachloride	100	20	150	100	100	100
Benzene	100	70	150	100	100	95
Metacresol	100	100	4	0	100	100
Oxidising Agents						
Hydrogen peroxide	10	20	100	100	90	100

Chemical exposure

The following chart give some indications of chemical compatibility with fibres used in SPIE rope construction.

Chemical damage can reduce the rope strength considerably without visible indication If in doubt about a ropes condition following exposure to chemical agents the rope should be retired.

Knots
SPIE ropes should not be Knotted.

Recovery loops

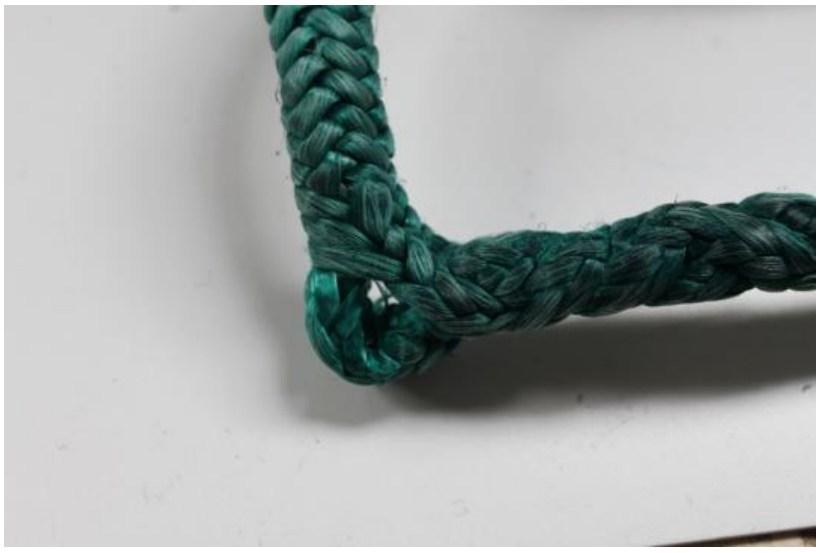
The SPIE recovery loops are made from HMPE braid and splice through the main rope. The strength of the loops significantly exceeds the rip out load of the loop/rope connection.

Any damage to the main rope at the point where the loop attaches is subject to the retirement criteria previously defined.

Damage to the loops up to 3 cut strands in any loop is acceptable.

Cut strand in loop

Any movement in the splice will result in a 'double' section of HMPE in the loop. If this is found the loop must be retired.



Splice movement – retire loop

Where a loop is retired it may be cut and removed from the main rope. The remainder of the rope may continue to be used.