What Defines a Bowline Knot?

There is wide consensus that, in modern English usage, *knot* #1010 from *The Ashley Book of Knots* (*ABOK*) is the bowline knot. The desirable functional behaviours of *ABOK* #1010 include: (i) *fixed eye knot*; (ii) fairly easy to tie (even one-handed, and with the *eye* through a ring) and to set into final useful form (depending on the stiffness of the material in which the *knot* is tied); (iii) *strength* similar to other *eye knots* (non-*knotted rope strength* is reduced by about 30%, depending on test conditions); (iv) *secure* under a load on the *eye* (depending on the directions and consistency of the pull and the springiness of the material in which the *knot* is tied); (v) unlikely to *jam* after a heavy load under most conditions. Some of these features are diminished if the material in which the *knot* is tied is slick, stiff or springy. Thus with synthetic-fibre materials (eg *kernmantle ropes*), added structures may be needed to increase *security*, or other *fixed eye knots* may be preferred (even if they lack some desirable functional behaviours of *ABOK* #1010).

There is not wide consensus on what constitutes a bowline *knot*. Opinions vary from a few *knots* like *ABOK* #1010 and 1034½ (and their *chiral* twins), to almost any *fixed eye knot* that includes a *nipping* structure. If the bowline *knot* definition is too narrow, many *knots* traditionally regarded as bowlines are excluded; but if too wide, *knots* are included that lack more of the useful properties mentioned above.

Nevertheless, it is interesting to attempt a definition in structural terms alone (without using functional features that vary between uses for the *knot*). This should help to emphasize the structural features that confer the desirable functional behaviours of bowline *knot(s)*.
Here is an attempt:

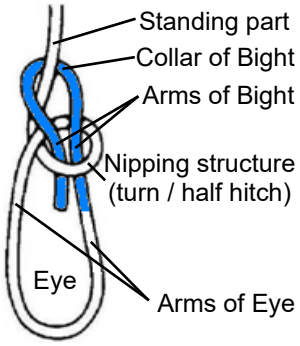
A bowline *knot* has the following characteristics:

1. It is a *fixed-eye knot*.

2. It includes a *nipping* structure that is *tiable in the bight* (*TIB*), the *arms* of which run directly to (i) the *standing part* and (ii) the *eye*.

3. It includes a *closed bight*, the *collar* of which passes around (i) the *standing part* or (ii) the *arm* of the *eye* that departs directly from the *nipping* structure (sometimes called the outgoing *arm* or leg of the *eye*).

4. Both *arms* of the *bight* run directly to the *nipping* structure, and pass through it from the same side.



***ABOK* #1010 has all the structural features of a bowline**

These 4 characteristics are necessary and sufficient to determine that a *knot* is a bowline. Other structural features may also be present. One or more of the defining structural features may be present in a number higher than one.

Notes:

1. Depending on the stiffness of the material in which it is tied, a bowline *knot* should tighten easily into the desired form: by pulling in opposite directions (i) the *arms* of the *bight(s),* after they have passed through the *nipping* structure, and (ii) the part(s) enclosed by the *collar*. *ABOK* #1010 can be tightened by pulling on the *standing part* (*stand*) and the *tail*. Thus complications of the *tail* also complicate tightening. Every *knot* should be inspected before and during use, to ensure that it is correctly *dressed* and *packed*. It is not a bowline *knot* once *capsized* to lose any of characteristics **1-4** (eg towards a sliding *eye*).

2. A *TIB nipping* structure is necessary but not sufficient to ensure that the *knot* is *post-eye tiable* (*PET*). Non-*PET* bowline *knots* include the ‘bowline with a bight’ (*ABOK* #1074) and the ‘bowline on a bight’ (*ABOK* #1080).

3. A limitation of bowline *knots* (and many other *knots*) is that because the *nipping* structure runs directly to the *standing part*, the *knot* can't be tied while the *standing part* is under load.

4. A useful feature of most bowline *knots* is that the size of the *eye* is easily adjusted (even after *locking* the *tail*). If the *nipping* structure is not too complex, this is accomplished by exchanging material between the *standing part* and the *eye*, through the *nipping* structure.

5. The most common *nipping* structure is a single *closed turn*, arranged as a *half hitch*. Under load, both *arms* of the *nipping turn* are commonly pulled, which increases the *nip*. Structures with two *nipping* spaces (such as *round turns*, girth-, or clove-*hitches*) typically have one space with an *arm* directly to the *stand* and one space with an *arm* directly to the *eye*. Depending on surface lubricity of the *rope*, this may result in less satisfactory *nip* under load. It may be argued that the crossing and marling *hitches* do not qualify because neither *arm* of the *nipping* component runs directly to the *eye*, so they may not provide satisfactory *nip* in *ropes* with high surface friction (see note 9).

6. Many users would argue that the *nipping* structure must 'relax' (not *jam*) when the load is released. In that case: (a) if a clove hitch *nipping* structure is used, the two half hitches should be separated as in the 'water bowline' (*ABOK* #1012); (b) a constrictor hitch would be ineligible as a *nipping* structure; and (c) no part of the *knot* should be able to tighten on the *nipping* structure and prevent it from relaxing. Non-*TIB nipping* structures such as thumb knots can also *jam*.

7. The *bight* is stabilized because the *collar* passes around a part of the *knot*. The *collar* commonly passes around the *standing part* (as in *ABOK* #1010), but it may pass around the outgoing *arm* of the *eye* (as in 'Eskimo' or 'Cossack' bowline *knots*). By passing around one of these parts, the *collar* also makes it difficult for the *nipping* structure to slide off the *bight*.

It is possible to tie *eye knots* with a *bight* forming a *collar* around other parts of the *knot* (such as the returning *arm* of the *eye*, or an entire *eye*, or the *tail*) but they are much harder to draw up correctly (*dress* and *pack*). This may make them more susceptible to *capsize* or *jam* (so they are excluded in the bowline *knot* definition above).

8. The teamster's, (single) carrick and 'myrtle' *eye knots* are (by this definition) not bowline *knots*, because the *arms* from the '*collar*' (which is arguably derived from a *loop*, rather than a *bight* in these knots) enter the *nipping* structure from opposite sides, with the effect that some versions of these granny-like *eye knots* are unstable or *jam*.

9. Under load, the *nipping* structure commonly tightens onto the *arms* of the *bight*, so it becomes a *closed bight*, whose *arms* may even cross under load if not otherwise constrained (as also seen with a direct sheet bend). Because both sides of the *nipping* structure are commonly loaded (in contrast with a sheet bend), little pull is transmitted onto the *collar* of the *bight*.

10. If the load is released, the *collar* can be rolled over the part that it encloses, to loosen the *knot*. This (and the observation that the *nipping* structure commonly relaxes when the load is released) explains why bowlines can commonly be relied on not to *jam* after loading. *Knots* in which the *arms* of the *bight* are further complicated before entering the *nipping* structure (eg the 'enhanced bowline' of Asher 1989) reduce this function of the *collar* and may *jam* after loading. By the definition suggested here, they are not bowline *knots*.

Even bowline *knots* may become hard to untie if the material in which they are tied is shrunk under load after the *arms* of the *collar* are drawn tight into the *nipping* structure. The 'water bowline' may reduce this effect (but see also DAY 1947 #66).

11. Bowline *knots* are commonly stable and *secure* under a continuous load between the *standing part* and the *eye* (or multiple *eyes*, if equally loaded). This may be threatened by aberrant loading (eg slack shaking, intermittent-, *ring*- and/or *tail*-loading), especially in 'springy' *ropes* (eg many *kernmantle ropes*). Sustained, equal loading of *arms* of the *eye*, separated at an acute angle, is ideal.

Security of single-*eye* bowline *knots* depends on (i) resistance to *capsize* of the *nipping* structure, (ii) resistance to *capsize* (opening) of the *bight*, and (iii) resistance to slippage through the *nipping* structure. It may be possible to increase (i) and (ii) without proportionately reducing (iii) by using a round turn as the *nipping* structure (*ABOK* #1013). Both (ii) and (iii) are increased by orthodox loading, and by appropriately '*locking*' the *tail*. A long *tail* is commonly recommended (if only to allow an appropriate *lock*). Tail orientation can affect the risk of snagging and/or (ii)-(iii). Some multi-*eye* bowline *knots* allow slip between unevenly-loaded *eyes*, unless appropriately *locked* (see WARNER 1992 #444). Bowline *knots* may also slip in *ropes* of very low surface friction (eg HMPE). Most *knots* are unsuitable in such *ropes*: appropriate *splices* are recommended.

Strength of bowline *knots* is less important than *security* in applications where *line* size can be chosen for the desired *knotted strength*. Under extreme load, breakage seems most often to occur in the vicinity where the load from the *standing part* meets the first sharp inflection at the crossover point of the *nipping* structure. But slippage and heating under load may be critical in some rope compositions. It may be possible to divide the load between two *standing parts* in some applications of the 'bowline on a bight' (*ABOK* #1080). Other stresses caused by tight *turns* may be reduced using additional *rope* diameters through the *nipping* structure. There have been no compelling tests of the effects of these approaches on *knot strength* or *security*. Excessive multiplication of some elements (eg *nipping turns*) may interfere with bowline *knot* function.

12. Bowline *knots* are commonly '*locked*' with added structures if conditions of use can impose a threat to *security*. Traditionally (when riggers carried twine and sailors carried knives) the tail of *ABOK* #1010 was *seized* to the returning *arm* of the *eye*. Other *locks* (made without *seizing*) include (a) additional *tucks* through the *nub* (eg a woven SS369 *lock* or Alston's *tuck* - *ABOK* #1015) or (b) additional structures formed by the *tail* around another part of the *knot* (eg a grapevine form double overhand knot, *ABOK* #516, 1415), according to preference. It would also be interesting to test as *tail locks* some of the other structures used for stoppers (*ABOK* #517-522) or nooses (*ABOK* #1116-1124). There is no evidence that one category of *lock* is inherently more *secure* than the other (and opinions conflict). Ill-considered (or mistakenly executed) *tucks* through the *nub* can compromise *security* of the core *knot* (eg a mis-tightened 'Alston' or 'Yosemite' *tuck*), added structures can interfere with some uses of the *eye*, and either category can fail under the very conditions that threatened the underlying *knot*. The *knot* tier must consider: "*Security* against what?". Because conditions are so important, universal *security* is difficult to measure.

13. Bowline knots can be *toggled* or tied with a *slippery tail* in several ways for special purposes (eg WARNER 1992, p165).

14. Many interesting *knots* have been inspired by bowline *knots*. Results that lack any of the four defining characteristics would, by this definition, not be classified as bowline *knots*. Most figure eight *eye knots* (which are very *secure*, but not easily adjusted in *eye* size after tying, not *PET*, and prone to *jam* after heavy loading) lack defining characteristics **2-4** of bowline *knots*. *Tucked* bowlines may require the least *rope* length among *secure eye knots*, but this rarely matters.

15. Simple bowline *knots* can be fairly easily tied one-handed. Methods that could trap a hand in the *nipping* structure if a load came onto the *standing part* during tying should be avoided.

16. By this analysis, some structures questioned or accepted as bowline *knots* in the interesting (climbing-oriented) analysis by Gommers 2016 (eg 'woven collar', 'double collar crossed-bight', '{single} carrick', 'myrtle', and 'Lee zep' *eye knots*) would unequivocally not be classified as bowline *knots*. Nor would the 'Spanish bowline' qualify. WARNER (1992 #368) also excluded this knot from the bowline category. Of itself, this does not reflect on the utility of a *fixed eye knot*.

17. REFERENCES are detailed, and *italicised* terms are used as explained, in *A Glossary for Practical Knot Tyers*, also available on the IGKT website. *Knots* mentioned here are shown in Ashley (1944), and more recent on-line resources such as animated knots.

Bowline knot security

When knot security is required, a bowline knot should always be used with a ‘lock’ that is appropriate to the circumstances (taking account of the potential causes of insecurity). So far, every invented lock has some undesired feature(s) in some circumstances. Every lock adds complication to tying and untying.

The image at left below shows a common bowline knot (*ABOK* #1010) with a grapevine-form double overhand ‘lock’ tied around the returning arm of the eye then tightened onto the nub of the bowline knot. Chirality of the nipping turn does not matter. I prefer S turns in Z-laid rope, but the fastest tying method for most right-handers yields a Z nipping turn as shown here. Chirality of turns in the overhand lock is probably unimportant (S is shown, but chirality is harder to determine in grapevine-form). The lock should be snug against the nipping turn for greatest benefit against several causes of insecurity, including ring loading, tail snagging, and most types of cyclic loading. It is not expected to alter the efficiency (breaking strength) of the underlying bowline knot.

Notice that some early illustrations show the bowline knot used with a seizing instead of this double overhand lock. A seizing is very secure, but it requires additional materials and it is slower to tie. The double overhand lock requires a longer ‘tail’ when tying the initial bowline knot, which is a good thing for security. The overhand structure also serves to make the longer tail more compact.

The grapevine double overhand lock has the same structure as a half-made double fisherman’s knot. Most people who are already familiar with bowline and fisherman’s knots find it easy to tie. It avoids tucks through the nub that can compromise bowline knot security if they are made incorrectly.

Because little tension is transmitted onto the lock, even after a heavy load on the eye, the knot does not jam (except perhaps in synthetic ropes with very low surface friction). However, the lock is slower to tie and untie than the common bowline knot itself. The tail can be arranged inside or outside of the eye. In either case, this lock must consume a little space within the eye.

As an alternative, consider a carefully-tightened, woven or Scott Safier’s (SS369) lock, which provides good security against aberrant loadings that threaten a non-locked bowline knot. At first glance, it looks a bit gnarly (image at right below), but it is simple to weave. It ends like a ‘Yosemite tuck”, but it avoids the Yosemite flaw by initially circling the nipping turn instead of the returning arm of the eye. Simple errors do not seem to compromise the nub, though multiple rope diameters through the collar increase the risk of collar snagging in any bowline knot (especially if loose). To tighten the knot into correct form: keep some material before the woven tail, tighten the underlying bowline component as usual, then pull on the tail to tighten the lock component. It is easy to recognize (once familiar). The tight first turn of the lock component adopts slightly different orientations when the knot is set, depending on rope properties. It does not shorten an arm of the bight in a way that might facilitate capsize. It retains important advantages of the bowline knot: (i) PET; (ii) easy to loosen by rolling the collar over the stand, and the extra tail tucks do not jam the nipping turn, hence unlikely to jam after a heavy load under most conditions; (iii) easy to adjust eye size by exchanging material between the eye and the stand through the nipping turn; (iv) strength seems OK in tested ropes; (v) uses minimal rope length for a secure fixed eye. Variants based on outside-tail, round-turn (etc) bowlines have been tied, but do not seem better. This simple lock deserves more thorough testing.