The NFPA Standards
and the Confusion within the Fire Service

Presented by:
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The NFPA Standards and the Confusion within the Fire Service

Our presentation will be on the NFPA standards that apply to rope rescue and the confusion within the fire service over interpreting those standards. We will look at several standards and how they are interpreted by team leaders and instructors and how they affect the decisions made by firefighters and their rescue teams.

About the Presenter

Jim Kovach has been a firefighter with the Fairview Park Fire Department in Ohio for 30 years. He has presented at several past NATRS and ITRS symposiums over the years on a variety of topics, including Tower Rescue, Personal Escape, Fall Factors, Bottom Belaying and equipment testing.
The NFPA Standards and the Confusion within the Fire Service

It is my belief that some of us in the fire service, are confused and do not understand the NFPA standards as they apply to rope rescue. There are 4 NFPA standards that address technical rope rescue:

- NFPA 1983 the Standard on Fire Service Life Safety Rope and System Components which was first issued in 1985, the current edition is 2001 with a new edition expected in 2006
- NFPA 1500 the standard on Fire Department Occupational Safety and Health Program which was first issued in 1987, the current edition is 2002.
- NFPA 1670 the Standard on Operations and Training for Technical Search and Rescue Incidents which was first issued in 1999, the current edition is 2004.
- NFPA 1006 the Standard for Rescue Technician Professional Qualifications which was first issued in 2000 and the current edition is 2003.

Each standard has different committee members and as you can see, each standard has a different revision date. I believe the fact that they are revised in different years has lead to some of the confusion.

I am not a member of the NFPA, nor have I ever attended an NFPA meeting. Most firefighters are not members of NFPA but many of our departments are. I am here in support of the NFPA standards. I believe they are necessary for the fire service and I welcome them. I also have a great deal of respect for the committee members and I’m grateful for their time, their dedication, and their involvement in this process. They have a difficult job and I appreciate their efforts.

My personal confusion with the standards resurfaced, when I was ordering equipment for our fire school. In anticipation of teaching tower classes, I met with some of our instructors and proposed the idea of using 11mm rope instead of 12.5 mm rope for tower rescue. A rescuer can carry 200 ft of 11mm PMI rope and it weighs the same as 150 ft of 12.5mm PMI rope. Naturally there was some discussion that centered on the NFPA standards and the use of 11mm rope and whether or not 11mm was acceptable as a two person rope. Our instructors come from different departments and are on different rescue teams and have attended a variety of different rope classes. They all embraced the use of the lighter rope but anticipated questions from our students concerning the use of the 11mm one person rope vs. using 12.5mm two person rope.

So why do I believe the fire service is confused by these standards? I believe a good portion of our confusion is caused by fire service instructors, including myself. I think that we, as instructors, have not kept abreast of the standards and
have perpetuated some of the misunderstanding. An example of this would be my previous statement where I referred to one person rope and two person rope. These load classifications were changed in the 2001 edition of NFPA 1983, and my use of the terms one person rope and two person rope is incorrect.

NFPA 1983 is NOT written to be used by the fire service. Once we accept this statement some of the confusion should clear up. The NFPA standard 1983 IS written to be used by manufactures in making the equipment that we, the fire service, and others that follow the standard, will ultimately use.

This is stated in Chapter 1, of 1983 and I quote “This standard shall specify minimum design, performance, testing, and certification requirements for new life safety rope and new system components including escape rope, water rescue throwlines, life safety harnesses, belts, and auxiliary equipment used for rescue and training by the fire service or similar emergency service organizations.”

The first two lines are the most important. In the fire service we don’t design, we don’t test and we don’t certify the rope or equipment that we use. That is done by a third party and if the “fire service” or anyone else wants to use NFPA compliant equipment, then that equipment must meet the 1983 Standard. The fact that 1983 is NOT a user standard, is clearly stated in the first chapter in the 2001 edition. It states “This standard shall not apply to use requirements for fire service life safety rope and system components as these requirements are specified in NFPA 1500, Standard on Fire Department Occupational Safety and Health Program.” Again, the 1983 standard “shall not apply to use requirements”. NFPA is very clear about this, but we in the fire service either didn’t read this or chose to ignore it. On August 8th of this year I called the NFPA and spoke to Larry Stewart who confirmed this and further stated, “1983 is a product standard”. And this confirmed what I was told by NFPA 1983 Staff Liaison Bruce Teele in June. He also said, quote “it is not a user standard but a product standard”. He continued “On the user side it is to be used as a reference with purchasing specifications”. End of quote. It should be noted, this statement was not in any of the previous standards, but was added to the latest edition of 1983 in 2001.

So NFPA 1983 referenced NFPA 1500 which is also referenced in NFPA 1670. The reference to 1500 in 1670 is in Chapter 4 General Requirements under the section titled “Safety”. It references: Section 5.4, Special Operations; Chapter 7, Protective Clothing and Protective Equipment; and Chapter 8, Emergency Operations. And this is part of the confusion.

Chapter 8 of 1500 is broken down into 8 areas and none of these address the use of rope or equipment as indicated in NFPA 1983.

Chapter 7 of 1500 addresses Life Safety Rope and System Components. It discusses how to inspect rope and if it passes inspection it can be reused, what to do if rope does not pass inspection, and documenting rope usage. It also states “all life safety ropes, harnesses, and hardware used by fire departments shall meet the applicable requirements of NFPA 1983”.

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So NFPA 1983 refers us to 1500 for use requirements and Chapter 7 of 1500 states that our ropes should meet the requirements of 1983, but says nothing about how to use the equipment at a rescue, other than, we can re-use a rope that is no longer a “new” rope, if it passes inspection.

Chapter 5 of 1500 addresses Training and Education. In a section on Special Operations Training it states: “Members expected to perform technical operations as defined in NFPA 1670, Standard on Operations and Training for Technical Rescue Incidents, shall meet the training requirements specified in NFPA 1006, Standard for Rescue Technician Professional Qualifications.”

So, again, 1500 does not address how to use rope or equipment but does refer us to NFPA1006.

In Chapter 1 of 1006 it states “This standard establishes the minimum job performance requirements necessary for fire service and other emergency response personnel who perform technical rescue operations.”

This standard is about performance requirements of the rescuer. It does not address how to use rope or equipment, and it DOES NOT mandate training requirements as implied in Chapter 5 of NFPA 1500. In an answer to a question I asked of the 1006 committee, Mr. Frank E. Florence, the liaison to 1006 replied, “NFPA 1006 is not a training document.”

So NFPA 1983 refers us to 1500 for use requirements, which 1500 does not have, and 1500 refers us to 1006 for training requirements, but 1006 is not a training document.

The fourth standard is NFPA 1670. In Chapter 1, it states, “The purpose of this standard shall be to assist the authority having jurisdiction (AHJ) in assessing a technical search and rescue hazard within the response area, to identify the level of operational capability, and to establish operational criteria.”

1670 is an organizational document. In a phone conversation with Don Cooper the chairman of 1670, he stated, “The standard does not describe how a procedure is done, it describes what needs to be done.”

All four of these NFPA standards define the word “approved” as, “Acceptable to the authority having jurisdiction.” This is further explained in the appendix. “Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories.”

So the standards do not approve or certify any installations or procedures. For example, that means it is up to the AHJ if they want to run a belay along the ground or through a pulley at the top of a tripod. ……Or the AHJ can choose not to use a belay at all. Which brings up the question: Do the NFPA standards require a belay for rope rescue or training? And a related question, Do the NFPA standards permit the use of single rope techniques?
It has been stated several times now that NFPA 1983 is not a user standard so we won’t find the answers to these questions there.

This presentation has shown that NFPA 1500 is also not a user standard for rope. This is confirmed by the answers received from Mr. Carl E. Peterson, Assistant Director Public Fire Protection Division of the NFPA, to the following questions:

**Question:** Does 1500 allow the use of single rope techniques for escape at a structure fire?
**Answer:** Rope techniques are outside the scope of the document.

**Question:** Does 1500 allow the use of single rope techniques for escape at a rope rescue incident?
**Answer:** Rope techniques are outside the scope of the document. We won’t find the answer in 1500 because belaying is a rope technique and 1500 does not address rope techniques.

The following questions were asked concerning the NFPA 1006 standard and were answered by Frank E. Florence, Senior Fire Service Specialist, Public Fire Protection Division of the NFPA:

**Question:** Does 1006 require a rope rescue technician to always use a belay?
**Answer:** Rope use techniques are outside the scope of this document.

**Question:** Does 1006 require a belay at all times, in each of the following: at low angle operations level training, at high angle operations level training, at technician level training?
**Answer:** NFPA 1006 is not a training document and the 2003 edition does not cover operations level evaluations.

**Question:** Does 1006 permit the use of single rope techniques during a rescue?
**Answer:** Rope use techniques are outside the scope of this document. The NFPA standard 1006 is not a user document. According to Frank E. Florence the NFPA liaison to 1006, “The standard does not specify any rope techniques. It can be used by a certifying agency to evaluate its members.”

Questions concerning NFPA 1670 were answered in a phone conversation with the chairman of that committee:

**Question:** Does 1670 permit single rope techniques at the high angle operations level?
**Answer:** The standard does not specify or prohibit any technique.

**Question:** Does 1670 prohibit single rope techniques at the technician level?
**Answer:** The standard does not specify or prohibit any technique.

**Question:** Do high angle operations level rope rescues always require a belay?
**Answer:** No.
**Question:** Do technician level rope rescues always require a belay?
**Answer:** No.

**Question:** Is a separate unloaded belay line always required when ascending a fixed rope?
**Answer:** No.

So the apparent answer to the question: Do the NFPA standards require a belay? would be no.

Do the NFPA standards permit the use of single rope techniques? It appears the answer to that question is that “the NFPA standard 1670 does not specify or prohibit any technique”, which means that decision would probably be made by the (AHJ) authority having jurisdiction.

It should be noted that all these answers, both verbal and written, concerning the different standards, come with a qualifier that states: “Please note that this correspondence is not a Formal Interpretation issued pursuant to NFPA Regulations. Any opinion expressed is the personal opinion of the author, and does not necessarily represent the official position of the NFPA or its Technical Committees. In Addition, this correspondence is neither intended, nor should be relied upon, to provide professional consultation services.”

The disclaimer I just read was as the bottom of each of the letters I received from the NFPA with answers to the questions I asked. It was also mentioned in some of the phone conversations I had with NFPA personnel and contained similar language in the e-mail I received. I would like to reiterate that these answers came from NFPA staff liaisons or from committee chairman.

It seems to me that some of our confusion can be traced back to the way the standards were first written. Many firefighters believe we have a 15:1 safety factor if we follow NFPA standards. Others believe it is 15:1 on rope and 10:1 on hardware, and still others believe its 10:1 on everything. Now I’d like to try and explain why I feel some of us are confused about safety factors and load classifications. Load classifications are important in determining safety factors.

The first edition of 1983 came out in 1985 and it gave the definition of MAXIMUM WORKING LOAD AS “Weight supported by the rope that shall not be exceeded in use,” “ONE-PERSON LOAD as 300 lb” and “TWO-PERSON LOAD as 600 lbs”.

“One-Person Rope: Life safety rope designed to support a one-person load when in use: may be used to support a two-person load when used in systems where two ropes are used as separate and equal members.” What this is saying is if you have 2 people and you only have one-person rated ropes, you need 2 one-person rated ropes to perform the operation.

“Two-Person Rope: Life safety rope designed to support a two-person load when in use.”
2-1.2: “Rope designed to have a “maximum working load” of not less than 300 lb shall be classified as a one-person life safety rope.”

2-1.3: “Rope designed to have a “maximum working load” of not less than 600 lb shall be classified as a two-person life safety rope.” This is where the fire service was first introduced to the idea that 1 person rope was rated for a safe working load of 300 lbs and a 2 person rope was rated for a safe working load of 600 lbs.

2-3.2.1: “The person classification shall be calculated by dividing the maximum working load by a factor of not less than 300. Fractions occurring in the product of this calculation shall be rounded downward to the nearest whole number.” From this we can see that the NFPA intended it to be very clear that the maximum working load would be used to create a safe “person classification” by rounding downward.

2-3.3 “Life safety rope shall have a circumference of not less than 1 1/8 in. and not more than 1 1/2 in. for one-person rope, and not less than 1 1/2 in. and not more than 2 3/4 in. for two-person rope”.

2-3.4 “Life safety rope shall have a maximum weight of 0.09 lb/ft for one-person rope and 0.18 lb/ft for two-person rope”……So the maximum working load of 300 lbs and 600 lbs, the circumference of the rope and the weight of the rope per foot determined whether it was one-person rope or two-person rope.

Chapter 3 Life Safety Harnesses of the 1985 edition of 1983 is the only reference that establishes a 10:1 safety factor.

3-3.1….”Harnesses can be subjected to two-person loads during rescue operations. A 6000-lb rating establishes a 10:1 safety factor for this component. While harnesses are not subjected to the same dangers as ropes, they are more fragile than hardware to physical effects.” This statement implies that ropes need a greater safety factor because they face greater dangers and hardware a smaller safety factor because they aren’t as fragile as harnesses.

This appears to be true according to Chapter 4 of this same edition.

4-3.4* “All snap-links shall withstand a tensile test of not less than 5000 lb without failure when tested in manner of function.”

So in this first edition of 1983, it appears hardware had a smaller safety factor than harnesses which had an established safety factor of 10:1 and its implied that ropes have an even greater safety factor. This can be shown by dividing a two-person 600 lb load into a snap-link with a MBS of 5000 lbs. Its’ an 8.3:1 safety factor, or 600 lbs into a harness with a MBS of 6000 lbs. Its’ a 10:1 safety factor. If we divide our rope with its MBS of 9000 lbs by 600lbs, we have a 15:1 safety factor.
In 1990 the 2nd edition of NFPA 1983 came out. Under definitions, one-person rope was still 300 lb and two-person rope was still 600 lb.

“One-Person Rope. Life safety rope designed to support a one-person load when in use; may also be used to support a two-person load when used in systems where two ropes are used as separate and equal members.” The word “also” was added to help clarify this concept.

“Two-Person Rope. Life safety rope designed to support a two-person load when in use.”

3-1.2” Rope designed to have a maximum working load of not less than 300 lb shall be classified as a one-person life safety rope.”

3-1.3 “Rope designed to have a maximum working load of 600 lb shall be classified as a two-person life safety rope.”

3-3.1.2 New rope minimum breaking strength for one-person rope shall not be less than 4500 lb and for two-person rope shall be not less than 9000 lb.

3-3.2 “Maximum working load shall be expressed in pounds and calculated by dividing the new rope minimum breaking strength as specified in 3-3.1.2 of this section by a factor of not less than 15.” If we divide 4500 by 15 we get 300 which is the maximum working load for a one-person rope. Or stated another way, 300 divided into 4500 is 15. Many firefighters assumed that meant the maximum working load on a one-person rope had a 15:1 safety factor. So if we continue with that logic and divide 9000 by 15 and we get 600 which is the maximum working load for a two-person rope. Or 600 divided into 9000 is 15 and again many firefighters assumed that meant the maximum working load on a two-person rope had a 15:1 safety factor.

3-3.3 “Life safety rope shall have a circumference of not less than 1 1/8 in. and not more than 1 1/2 in. for one-person rope, and not less than 1 1/2 in. and not more than 2 1/4 in. for two-person rope”…..

3-3.4“Life safety rope shall have a maximum weight of 0.09 lb/ft for one-person rope and 0.18 lb/ft for two-person rope”….these did not change from the first edition.

The third edition of 1983 came out in 1995 and had some added definitions. This 3rd edition continued the one-person and two-person terminology and also classified rope as a class one-person life safety rope or a class two-person life safety rope. In addition auxiliary equipment would now be marked as “G” for general use or “P” for personal use.

So for 16 years the fire service was exposed to the terms one-person rope and two person rope, one person load and two person load, 300 lb maximum working load and 600 lb maximum working load.
Definitions of the 3rd edition:

“General Use. A designation of auxiliary equipment system components intended for use where the system could be subjected to a two-person load.”

“Personal Use. A designation of auxiliary equipment system components intended for the sole use of the rescuer for personal escape or self-rescue, or for the sole use of the rescuer in gaining access to victims.”

“One-Person Load. 300 lb (136kg).”
“One-Person Rope. See Rope.”
“Two-Person Load. 600 lb (272kg).”
“Two-Person Rope. See Rope.”.

“One-Person Rope. Life safety rope designed to support a one-person load when in use; also can be used to support a two-person load when used in systems where two ropes are used as separate and equal members.”

“Two-Person Rope. Life safety rope designed to support a two-person load when in use.”

4-1.1.1 “Rope designed to have a maximum working load of at least 300 lbf (1.34 kN) shall be designated as a class one-person life safety rope.”

4-1.1.2 “Rope designed to have a maximum working load of at least 600 lbf (2.67 kN) shall be designated as a class two-person life safety rope.”

4-1.2 “The life safety rope person class designation shall be calculated by dividing the maximum working load by a factor of not less than 300. Fractions occurring in the product of this calculation shall be rounded downward to the nearest whole number.”

5-1.1 “The minimum breaking strength for new one-person life safety rope shall not be less than 4500 lbf (20kN) when tested as specified in 6-1.1, Breaking and Elongation Testing.”

5-1.2 “The minimum breaking strength for new two-person life safety rope shall not be less than 9000 lbf (40kN) when tested as specified in 6-1.1, breaking and Elongation testing.”

5-1.3
5-1.5 “One-person life safety rope shall have a circumference of”…
5-1.6 “Two-person life safety rope shall have a circumference of”…
5-1.8 “New one-person life safety rope shall have a maximum weight of”…
5-1.9 “New two-person life safety rope shall have a maximum weight of”…

4-5.2.1* “The designation of “personal use” shall apply to auxiliary equipment intended for the sole use of the rescuer for personal escape or self-rescue, or for the sole use of the rescuer in gaining access to victims. The designation of
“personal use” shall not be applied to auxiliary equipment intended for use where the system could be subjected to the load of two or more persons.

4-5.2.2* “The designation of “general use” shall apply to auxiliary equipment intended for use where the system could be subjected to a two-person load.”

So from 1985 through the year 2000, the terms used were one-person load and two-person load, one person rope and two person rope. 300 lb maximum working load and 600 lb maximum working load were also used extensively. It certainly seemed like these terms implied that 1983 was a user standard.

In 2001, the fourth edition of 1983 came out and things changed. It wasn't until this edition was released, that the NFPA finally stated that 1983 was not intended for use by the fire service. This was stated in the first chapter 1.1.5 “This standard shall not apply to use requirements for fire service life safety rope and system components…….” This should have cleared the air, but honestly, most of us never read it. Very few firefighters are actual NFPA members. Many departments do belong to the NFPA and they receive access to the standards which are usually kept at headquarters. Often times this means access to the standards is difficult to get.

Under Origin and Development, in the 8th paragraph it states “The former terminology for one- and two-person load classifications has been changed to a simpler load classification based on the weight that the rope or system is designed to support.” This was huge. This meant there was no longer one-person rope or two-person rope, no more one-person load or two-person load, and no more 300 lb or 600 lb maximum working load. These terms were no longer listed under definitions in NFPA 1-9-8-3. They were replaced with new terminology:

1.3.16* “Design Load: The load for which a given piece of equipment was engineered for under normal static conditions.”

1.3.25 “General Use: A designation of system components or manufactured systems designed for general-use loads, light-use loads, and escape, and is compliant with this standard.” This definition differs from the 1995 standard which stated general use was quote “where the system could be subjected to a two-person load.”

1.3.33 “Light Use: A designation of system components or manufactured systems designed for light-use loads and escape, and is compliant with this standard.” This term was not used in the 1995 standard.

3.1.6.3…”auxiliary equipment shall also be stamped, engraved, or otherwise permanently marked with a “G” for general use, an “L” for light use, or an “E” for escape use”…. In the 1995 edition it was “G” for general use, “P” for personal use and there was no “E”.
1.3.47.2 “Life Safety Rope: Rope dedicated solely for the purpose of supporting people during rescue, firefighting, other emergency operations, or during training evolutions.” Notice that there is no mention of one or two person rope.

5.1* “Life Safety Rope  Light-use life safety rope shall be tested for breaking strength as specified in 6.1.1, Breaking and Elongation Testing, and shall have a minimum breaking strength of not less than 20 k/N (4496 lbf).” Again, notice that there is no mention of “one-person rope”.

5.1.2 “General-use life safety rope shall be tested for breaking strength as specified in 6.1.1, Breaking and Elongation Testing, and shall have a minimum breaking strength of not less than 40 k/N (8992 lbf).” Again, no mention of “two-person” rope.

5.1.5* “Light-use life safety rope shall have a diameter

5.1.6* “General-use life safety rope shall have a diameter

Neither of these mentioned one-person rope or two-person rope.

One of the questions submitted to the NFPA was: Can light-use life safety rope be used to support multiple persons (two or more)? These are the answers received from the NFPA. Mr. Frank E. Florence, the NFPA Staff Liaison to 1006 gave the following opinion.

Question: Can light-use life safety rope be used to support multiple persons (two or more)?
Answer: Rope use techniques are outside the scope of this document. Rope Standards are covered in NFPA 1983, Standard on Fire Service Life Safety Rope and System Components.

The question submitted to Bruce Teele, the NFPA Staff Liaison to 1983 for the 2001 edition was different but relevant:

Question: How is the design load for life safety rope determined?
Answer: Users of rope need to consider the types of operations expected to be performed, the loads the rope is expected to bear, and set purchase specifications at or above the requirements of NFPA 1983 to assure the safety deemed necessary for such operations and loads will be met by their equipment.

Mr. Donald C. Cooper, past secretary and current chairman of 1670, supplied the following opinion during a telephone conversation:

Question: Can light-use life safety rope be used to support multiple persons (two or more)?
Answer: NFPA 1670 does not describe how specific techniques are done, nor does it prohibit any technique. That would be up to the AHJ.
This ties in with our next question: Does the NFPA have a recommended safety factor(s) for rope rescue?

These are the answers received from the NFPA:

“I have your request for a formal interpretation of questions related to life safety rope in NFPA 1500, Standard on Fire Department Occupational Safety and Health program 2002 Edition. After reviewing these questions, I find they are not issues for a formal interpretation as many do not even apply to NFPA 1500. I am providing the following answers or guidance for you on each question you raise.”

Question: Does 1500 require a 15:1 safety factor for rope rescue?
Answer: NFPA 1500 requires life safety rope meet NFPA 1983.

Question: Does 1500 require a certain safety factor for rope rescue? If so what is it?
Answer: NFPA 1500 requires life safety rope meet NFPA 1983.

“I have received your request for a Formal Interpretation of questions related to rope rescue for both NFPA 1670, Standard on Operations for Technical Search and Rescue Incidents 2004 edition, and NFPA 1006, Standard for Professional Qualifications for Rescue Technician 2003 edition. After reviewing these questions, I find they are not issues for a formal interpretation as many do not even apply to NFPA 1670 and 1006.

Question: Does 1006 recommend or require a safety factor for rope rescue?
Answer: No

Questions concerning NFPA 1670 were answered in a phone conversation with the chairman of that committee.

Question: Does 1670 require or recommend a 15:1 safety factor for rope rescue?
Answer: No

Question: Does 1670 require or recommend a 10:1 safety factor for rope rescue?
Answer: No

Question: Does 1670 have a required or recommended safety factor for rope rescue?
Answer: NFPA 1670 does not require or specify any safety factor.

The following is from an e-mail received from Bruce Teele, Senior Fire Service Safety Specialist, Public Fire Protection Division, NFPA:

“In response to your request for a Formal Interpretation on NFPA 1983, Standard on Fire Service Life Safety Rope and System Components, 2001 edition, please be advised that in accordance with the Regulations Governing Committee Projects (RGCP), Section 6, your request will not be processed as a Formal Interpretation under 6-1.4 of the RGCPs.”
“In an attempt to perhaps clarify some issues for you, I offer the following:"

Questions 1 and 2: Is it the intent of 1983 to establish a safety factor for rope or auxiliary equipment? If so, what is the safety factor?
Answer: On Questions 1 & 2, The scope statements in Section 1 of NFPA 1983 do not address “safety factors” but do address that the standard is based on minimum design, performance, testing, and certification requirements. Safety factors, as such, are not specified in NFPA 1983.

It appears that none of the NFPA standards requires or recommends a safety factor for rope rescue, which means that determination would probably be made by the (AHJ) authority having jurisdiction. Those of us that have been teaching or suggesting that the NFPA requires a 15:1 or 10:1 safety factor, we may have been confused, but we were also wrong.

Critical angles are a topic included in most rigging lectures and rightfully so. Rigging systems that exceed 120 degrees interior angle can place excessive forces on equipment and anchors. Through the years I’ve heard a number of instructors state that ice climbers don’t like to exceed 60 degrees critical angle, rock climbers don’t like to exceed 90 degrees critical angle, and in rescue we should try and keep our critical angle below 120 degrees. In the fire service our training in rope rescue was learned from mountaineers, cavers and climbers who understood the reasons for not exceeding certain critical angles. In 1996 Steve Attaway gave a presentation at the North American Technical Rescue Symposium that included a discussion on the strength and weaknesses of climbing protection, the forces generated in leader falls and the forces that would cause failure of cams and wire type anchors. Mountain rescue teams and cave rescue teams that need to set multiple pieces of protection to create an anchor have legitimate reasons for not exceeding certain critical angles. But for many of us in the fire service that refuse to exceed certain critical angles in our rigging, it may be a lack of understanding on our part. In the fire service this lack of understanding may actually be confusion, confusion with the NFPA standards written for rope rescue.

The definition of “critical angle” in NFPA 1006 is “An internal angle in a system of 120 degrees or greater that results in an amplification of a force applied to the system.”
The definition of “critical angle” in NFPA 1670 is “An angle of 120 degrees or less created between two rope rescue system components wide enough so as to create excessive force on the anchor points to which they are attached.”
These two definitions appear to be different.

On the survey handed out at registration there were two drawings, A and B, depicting critical angles and the forces created on the anchors. The three examples in drawing B were taken from the appendix of NFPA 1006. Two of these examples list incorrect forces on those anchors. The forces listed in drawing A are correct.
The drawings in the survey were given to a high school physics teacher and 5 other individuals with engineering degrees and they all agreed that drawing B was incorrect. Unfortunately, drawing B appears in the appendix of NFPA 1006. This presentation was an attempt to explain why I believe that some of us in the fire service are confused with the NFPA standards as they apply to rope rescue. Hopefully this presentation has accomplished that. If anyone would like to seek clarification on anything presented here or any other issues with the standards they can contact the NFPA at 1-800-344-3555 or send an e-mail. The e-mail should be addressed to the standard you are requesting information on. As an example, if you have a question concerning NFPA Standard 1983 the e-mail should be addressed to nfpa1983@nfpa.org.

I opened this presentation stating that I believe there is confusion surrounding the standards as they apply to rope rescue. I’d like to close this presentation by reading a paragraph from Origin and Development of NFPA 1983 the 2001 edition.

“Throughout the document, modifications to existing text were made in the continuing attempt to make the document clearer, less ambiguous, and easier to use by both manufactures and the certification organizations. This process continues during every revision cycle, and the input received from document users has been very helpful in fixing many of these issues.”

It appears to me that the 1983 committee recognizes the fact that the standards can be confusing and I for one, appreciate their efforts to make the standards more user friendly.

On a final note, I would like to make it very clear that I support the work of the NFPA and nothing in this presentation was meant to detract from their work.

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