

This Field Operations Guide contains specific information on technical rescue procedures.

THIS GUIDE IS NOT ALL INCLUSIVE!

It is intended to be used as a tool for training and for quick field reference. Refer to current training manuals and your department policies for detailed explanations. There is no substitute for regular, quality, hands-on training by a qualified instructor.



The techniques and procedures illustrated in this guide follow NFPA standards and OSHA regulations as much as possible. This guide can be used by rescuers at all skill levels but was specifically developed for fully qualified technical rescue technicians. Special operations are inherently dangerous and serious injury or fatality may result from improper performance of these techniques. The author accepts no responsibility for damage, loss, injury or death resulting from information contained in or omitted from this guide.

Thanks to the Phoenix Fire Department and everyone who helped make this guide possible. Special thanks to my friend Ron Jamison for helping to write this guide, Kathy Darrow for editing and to George Drees, Ken Phillips and Jim Frank for great ideas and input.

This guide is dedicated to all those people who go the extra inch every day to make themselves better rescuers.

This handbook is based on the Phoenix Fire Department and Arizona State Fire Marshall's Office technical rescue programs.

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Rescue Medical Situations

There are certain medical situations which are common and in some cases unique to technical rescue. The following section contains brief outlines of several of these situations. As always, use common sense and follow local protocol.

Crush Syndrome

Crush syndrome should be suspected in patients who have large parts of their body (lower legs and pelvis) subjected to pressure and immobilization. In cases of severe pressure it can occur in as little as one hour but usually takes 4-6 hours to develop.

If you suspect crush syndrome, it is important to begin treatment prior to removing pressure from the patient.

Treatment (should follow local protocol when available)

- ABC's, high flow oxygen and c-spine precautions
- Cardiac monitor – watch for peaked T waves and print baseline strip
- Establish two large bore IV's and begin fluid resuscitation at 20 cc/kg NS prior to release of compression
- Consider sodium bicarb 1 mEq/kg IVP
- Consider IV dextrose and IM insulin
- Consider calcium in the event of hyperkalemia
- Contact local medical control and ask for orders for suspected crush syndrome
- Document and report suspected crush syndrome at patient transfer

Suspension Trauma

Also known as harness-induced pathology, suspension trauma occurs when an individual hangs motionless in a harness. Typically this happens when a subject's fall is arrested by their fall protection system or when a subject is overcome by exhaustion and or hypothermia.

Lack of muscle activity and the harness itself compromise venous return from the lower extremities and progressive hypotension develops leading to syncope. Syncope begins a vicious cycle of no movement and increased blood pooling, resulting in death.

Signs and Symptoms

- Light headedness
- Nausea
- Difficulty breathing
- Syncope

Prevention for Rescuers

Keep your legs moving and reposition frequently if you are required to hang in a harness for any length of time (as little as 20 minutes)

Treatment

- Advise patient to move their legs and flex leg muscles while waiting for rescue
- If unconscious, address ABC's and quickly remove them from suspension
- Keep the subject sitting up to prevent the rapid return of acidotic blood from the legs to central circulation
- Transition the subject to a horizontal position slowly over a period of 20 to 40 minutes
- Avoid rapid IV bolus and treat for potential crush syndrome at the hospital

Hypothermia

Whenever a subject is immobile in a cold environment, hypothermia can occur. Hypothermia is especially common in confined space rescue and structural collapse when access and extrication takes an extended period of time.

Moderate Hypothermia 82-89° F (27-32° C) Core Temperature

Signs and Symptoms

- No shivering
- Dilated pupils
- Bradycardia
- Decreased respiration
- A-fib
- Marked decrease in mental function

Treatment (less active/more passive)

- Careful handling (watch out for V-fib)
- Remove to warm, dry environment
- Hot packs/hot water bottles
- Warm IV fluid
- Warm humidified oxygen
- Re-warm over several hours

Severe Hypothermia <82° F (<27°C) Core Temperature

Signs and Symptoms

- Progressive decrease in metabolism can result in death
- Coma (remember, not dead till warm and dead)
- Significant hypotension
- Respiratory arrest
- V-fib to asystole

Treatment

- Careful handling (watch out for V-fib)
- Remove to warm dry environment
- Slow re-warming (very passive in the field)
- Do not give ACLS drugs until the patient is re-warmed above 86° (30°C) core temperature
- Re-warm in hospital

Appendix A

NFPA 1983, 2001 edition, pertinent definitions

Auxiliary equipment System components that are load bearing accessories designed to be used with life safety rope and harnesses including but not limited to, ascending devices, carabiners, descent control devices, rope grab devices and snap links.

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

Light use rope (one person) 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. Minimum breaking strength not less than 20kn (4496 lbf.).

Light 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.

General use rope (two person) Life safety rope designed to support a two person load when in use. Minimum breaking strength not less than 40kn (8992 lbf.).

NFPA 1670 1999 edition, operational levels

Awareness The minimum capability of a responder who, in the course of his or her regular job duties, could be called upon to respond to, or could be the first on the scene of, a technical rescue incident. This level can involve search, rescue and recovery operations. Members of a team at this level generally are not considered rescuers.

Operational The capability of hazard recognition, equipment use and techniques necessary to safely and effectively support and participate in a technical rescue incident. This level can involve search, rescue and recovery operations, but usually operations are carried out under the supervision of technician level personnel.

Technician The capability of hazard recognition, equipment use and techniques necessary to safely and effectively coordinate, perform and supervise a technical rescue incident. This level can involve search, rescue and recovery operations.

Appendix B

Standard color codes for 1 in. tubular webbing

Yellow	6 ft. (2m)	Green	20 ft. (6m)
Blue	12 ft. (3.5m)	Black	30 ft. (9m)
Red	15 ft. (4.5m)		

Standard lengths for 8mm nylon system prusiks

for use in a tandem prusik belay and in pulley systems with 1/2 in. (13mm) NFPA life safety rope (total linear measurement untied)

- Short = 54 in. (137cm)
- Long = 66 in. (168cm)

Rope Rescue equipment kit inventories

Working line kit

- 1 - large rope bag with pockets, inventory and rope log
- 1 - 200 ft. (60m) 1/2 in. (13mm) rope
- 8 - steel carabiners
- 1 - prusik minding pulley
- 4 - single pulleys
- 2 - double pulleys
- 1 - 6 bar brake rack
- 1 - anchor plate
- 3 - sets system prusiks
- 3 - yellow webbing
- 3 - red webbing
- 2 - green webbing
- 2 - black webbing

Belay line kit

- 1 - large rope bag with inventory and rope log
- 1 - 200 ft. (60m) 1/2 in. (13mm) rope
- 8 - steel carabiners
- 1 - prusik minding pulley
- 2 - load releasing hitches
- 2 - set system prusiks
- 3 - yellow webbing
- 3 - red webbing
- 2 - green webbing
- 2 - black webbing

Edge management kit

- 1 - nylon utility pack
- 2 - 33 ft. (10m) 9mm rope
- 2 - edge rollers
- 8 - steel carabiners
- 1 - knot passing pulley
- 2 - canvas pads
- 1 - pocket saw
- 3 - yellow webbing
- 3 - red webbing
- 2 - green webbing
- 2 - black webbing

Patient packaging kit

- 1 - nylon utility pack
- 4 - blankets
- 1 - set cervical collars
- 1 - red webbing
- 1 - green webbing
- 2 - black webbing
- 1 - weather barrier
- 1 - roll 2 in. tape
- 1 - litter w/face shield

Medical kit (BLS)

- 1 - nylon medical pack
- 1 - blood pressure cuff
- 1 - stethoscope
- 1 - pen light
- 4 - encounter forms
- 2 - black ink pen
- 10 - pair latex gloves
- 8 - rolls cling
- 1 - roll 2 in. tape
- 10 - 4x4 dressings
- 2 - 6x9 dressing
- 2 - formable splint
- 1 - hand powered suction
- 1 - bag valve mask
- assorted OPA's

Appendix C

Recommended rope minimum strengths

diameter in. (mm)	lbs. (kN)	use	NFPA rating
3/8 (9.5)	4496 (20)	lifeline	light use
7/16 (11.1)	6000 (277)	lifeline	light use
3/8 (9.5)	2923 (13)	floating lifeline	
1/2 (12.7)	8992 (40)	lifeline	general use
5/8 (16)	12,500 (56)	lifeline	general use

Recommended accessory cord minimum strengths

diameter in. (mm)	lbs. (kN)	diameter in. (mm)	lbs. (kN)
6mm	1620 (7)	8mm	2870 (13)
7mm	2200 (10)	9mm	3670 (16)

Recommended hardware minimum strengths

item	light lbf. (kN)	general lbf. (kN)
carabiner (major axis)	6069 (27)	8992 (40)
carabiner (minor axis)	1574 (7)	2473 (11)
descent control device	3000 (13.5)	4946 (22)
auxiliary equipment	5000 (22)	8093 (36)

Recommended miscellaneous hardware minimum strengths

item	lbs. (kN)	item	lbs. (kN)
rigging ring	25000 (111)	rigging plate	8900 (39)
prusik minding pulley	8093 (36)	standard pulley	8000 (36)
tri link (10mm)	9900 (44)	tri link (12mm)	12000 (54)
screw link (7mm)	6000 (26)	screw link (12mm)	13784 (61)
multi-loop strap	5000 (22)	anchor strap	8093 (36)
1 in. tubular webbing	4000 (17)		

Actual breaking strengths may vary from manufacturer to manufacturer.

Appendix D

Minimum Personnel Requirements

Rope Rescue

High angle: 2 TRT companies
Steep angle: 3 TRT companies
Command Post LZ: 1 Technician

Trench Rescue

3 TRT Companies
1 Trench support truck
1 Utility truck

Confined Space Rescue

3 TRT companies
1 Support truck
1 Hazmat company
1 Utility truck

Swiftwater Rescue

3 TRT Companies
2 Support trucks

Minimum Team Equipment Requirements

Confined Space

2 Multi gas monitors (calibrated)
1 Personal monitor
per each entrant
1 Rescue tripod with
winch or pulley system
4 Intrinsically safe lights
1 Set grounded duct for fan
2 Remote air supply carts
1 Intrinsically safe intercom kit
1 Load rated extrication device

1 Lock-out, tag-out kit
1 Intrinsically safe
ventilation fan with cord
4 Supplied air breathing
apparatus
1 Working line kit
1 Belay line kit
4 Life safety ropes
1200 ft. Air supply hose
1 Sked stretcher

Swiftwater

1 Inflatable rescue boat
7 Paddles
1 Fill kit
1 Line gun
1 Working line kit

1 Belay line kit
2 600 ft. (180m) ropes
2 300 ft. (90m) ropes
2 Subject PFD's with helmets
6 Throw bags

Trench

10 sheets form sheeting
20 Ellis screw jacks
4 carpenter kits
4 ground ladders
16 2x10x10's
Joist hangers
Various hydraulic speed shore
Pump can
8 4x4 's
Fluorescent ground marking paint
Patient immobilization device

2 Folding shovels
2 Square shovels
2 Round shovels
4 Five gallon buckets
10 16 ft. Utility ropes
2 Garden hoes
1 Roll hazard tape
Power saw
10 concrete stakes
Ventilation equipment
Air monitor

Suggested Resources

Phoenix Fire Department 1999. *Standard Operating Procedures*, Volume II. Phoenix, AZ.

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Tom holds a helicopter private pilot rating and is an avid mountaineer and river runner.

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This new updated, third edition guide contains over 120 high quality graphic illustrations, command checklists and easy to follow step-by-step procedures for rope rescue, confined space rescue, swiftwater rescue, trench rescue, structural collapse rescue and helicopter rescue. Designed to be used during and after a full training program, this guide is an essential tool for rescuers of all levels to assist in safe and efficient technical rescue. Made to be taken in the field, it assists rescuers in recall of the most important aspects of techniques and safety.

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