

Other Delivery Content, Tec 40-2

Study assignment: Tec 40 Handout 2

Learning Objectives

By the end of this section, you should be able to answer these questions:

- 1. Why can the equipment requirements for Tec 40 be less stringent than the standardized technical rig?*
- 2. What are the guidelines for selecting masks, fins and snorkels for the Tec 40 level?*
- 3. What characteristics do you look for cylinders and cylinder valves for the Tec 40 kit?*
- 4. What is the minimum number of fully independent regulators, per diver, and how do you configure each?*
- 5. What type of BCDs can you use for Tec 40 level diving? Why is a tec diving harness recommended?*
- 6. How do you choose an appropriate exposure suit for technical diving?*
- 7. What are your options regarding weight systems, and what are the advantages and disadvantages of each?*
- 8. What types of dive computers and other instruments do you need for Tec 40 level diving?*
- 9. What types of cutting tools are appropriate for deep technical diving, and how many should you have?*
- 10. What are six general guidelines regarding pockets, accessories and clips you might need when technical diving?*
- 11. What is a “stage/deco cylinder”?*
- 12. How do you set up a stage/deco cylinder?*
- 13. Why might you need a lift bag/DSMB and reel on a technical dive?*
- 14. What are suitable lift bags/DSMBs and reels, and how do you secure them on your rig?*
- 15. What are four recommendations regarding equipment maintenance?*

You should also be able to:

- 16. Describe the layout, arrangement and configuration of the basic Tec 40 rig, with options, from head to toe as worn by a Tec 40 diver.*

- A. Tec 40 equipment requirements and the standardized technical rig
 1. The technical diving community has a generally accepted open circuit equipment configuration as worn on a technical deep dive. This standardized technical rig employs all required equipment in a streamlined configuration based on a philosophy that minimizes confusion and procedural error. The

standard technical rig (backmount or sidemount) is required at the Tec 45 level and beyond.

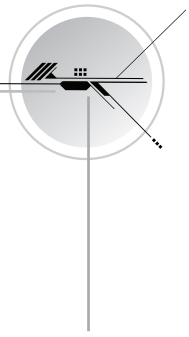
2. You can dive with a less stringent equipment configuration (i.e., the Tec 40 kit or rig) within Tec 40 limits because the depth and decompression time limits are very restricted compared to broader technical deep diving.
 - a. Exceeding Tec 40 limits (40 metres/130 feet and up to 10 minutes total required decompression) is *not* acceptable or reasonable with the Tec 40 rig.

B. Mask, fins and snorkel

1. Generally, the mask and fins you use for recreational scuba diving in a given environment are acceptable for the Tec 40 rig.
 - a. Full sized fins (appropriate to your size) are generally recommended.
 - b. Secure/tape loose straps so they don't dangle and can't slip.
 - c. Spring heel fins (in place of straps) are good options because they're very strong, nothing dangles and they don't need adjustment and are easy to don and remove.
2. Snorkels are optional, but generally recommended for the Tec 40 rig.
 - a. They allow you to breathe at the surface without using gas from your cylinder.
 - b. They can be slightly cumbersome in an air sharing situation, so you may want to carry a folding/collapsible model in your pocket.

C. Cylinders and valves

1. You generally want a high capacity cylinder as your primary cylinder with the Tec 40 kit. This is because you use more gas on a deeper dive, and you need to keep a larger reserve.
2. 11-12 litre/71.2-80 cubic foot cylinders are generally considered the minimum size – larger (18 litre/100 cubic foot+) cylinders are preferred, but not readily available in some locations.
 - a. If you opt for double cylinders, you should wear the standardized technical rig, not the Tec 40 kit.



3. The cylinder should have an H or Y valve, which allows you to have two entirely separate regulators. In case of a failure, you can shut down the gas to either one and still access the remaining gas with the other.
 - a. With Tec 40 limits, it is alternatively acceptable to have a large, main cylinder with a pony bottle in place of an H/Y valve.
 - b. If you use a pony instead of an H/Y valve, it should have a capacity of 850 litres free gas/30 cf or larger.
 - c. The pony usually has the same gas (EANx blend or air) as the main cylinder. **If it has a higher oxygen content, the gas must still be breathable at the deepest planned depth (max 1.4 ata/bar), with a margin for error.**
4. The DIN (Deutsche Industrie Norm) threaded system for valve apertures is generally preferred to the yoke system in tec diving.
5. Valve caps should *not* be tied to valves as they commonly are in recreational diving. Remove completely when diving.

D. Regulators

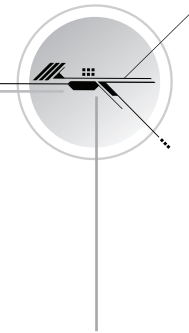
1. Because you cannot immediately surface, tec diving always requires a minimum of two fully independent regulators per diver (does not count those on stage or decompression cylinders).
2. Choose top of the line, balanced regulators for maximum reliability and performance at depth.
3. Configure the regulator that goes on the right valve post with a low pressure inflator hose and second stage with a two metre/seven foot hose.
4. Configure the regulator that goes on the left valve post with the SPG and a second stage on a standard length hose (about 80 cm/32 inches). If using a dry suit or a double bladder BCD system, this regulator also has a low pressure inflator hose.
 - a. If using a pony bottle instead of an H valve, *both* regulators have SPGs. In this case, the SPGs must be clearly marked or secured to avoid any confusion.
5. Neither regulator has two second stages.
6. The DIN connection system is preferred (most DIN regulators accept adaptors for yoke use).

E. BCD and harness

1. Most BCDs with shoulder and hip D-rings (other suitable attachment hardware in those locations) can be used for a Tec 40 rig. The D-rings are necessary for your decompression cylinder.
2. A tec diving harness configured for a single cylinder is generally recommended, though not essential, for the Tec 40 kit.
 - a. Tec harnesses are harnesses that mount on top of an interchangeable BCD bladder. There are rigid plate (steel, aluminum or plastic) and all fabric versions.
 - b. Tec harnesses have crotch straps, adjustable shoulder and waist D-rings and other features suited to higher level tec diving.
 - c. The tec harness is recommended because you will use it when you move on to the Tec 45 course, and because you can use a double bladder BCD (BCD with two independent bladders and inflation/deflation systems) so you have backup buoyancy control.
 - In a decompression situation, simply dropping weights to restore buoyancy may not be an option because you would have too much buoyancy to maintain a decompression stop.
 - **Planning for BCD failure must be part of planning any technical dive. The double bladder BCD is the simplest, most reliable option.**
 - The Tec 40 rig (single cylinder) is not as negatively buoyant as higher level tec rigs, so redundant buoyancy is not mandatory at this level.

F. Exposure suits

1. Choose your exposure suit based on the water temperature at depth and the dive duration.
2. Tec dives tend to be longer than recreational dives, calling for more exposure protection. You also don't exert and generate much heat while decompressing.
3. Dry suits offer the longest durations and coldest water protection.
 - a. They may provide ample backup buoyancy.
 - b. You should master dry suit diving as a recreational diver before using a dry suit for technical dives.



- 20 dry suit dives is a conservative minimum before tec diving dry.
 - In recreational diving, you only use your dry suit for buoyancy control while underwater.
 - In tec diving, you typically add gas to the suit to avoid a suit squeeze and use your BCD. This means controlling the gas in both your suit and BCD – a more complex skill to master.
4. Wet suits are adequate in warmer waters and well suited to dives within Tec 40 limits.
- a. A full 6 mm/.25 in wet suit with hood will generally handle dives up to two or three hours (far longer than a Tec 40 dive) in water 24°C/75°F or warmer.
 - b. In a heavy rig, you need a double bladder BCD or other means for reliably handling a BCD failure.
 - c. The advantage of a wet suit over a dry suit is operational simplicity – you only need to adjust your BCD.
- G. Weight systems
1. Except in very warm water requiring minimal exposure protection, you will usually need weights even in a technical rig. A weight belt, integrated weights or a weight harness are acceptable.
 - a. Some tec divers choose a metal plate harness to reduce the amount of lead they need to wear.
 2. Weight belt
 - a. Advantages: simple, readily available when needed
 - b. Disadvantages: with crotch strap, must don after putting on rig so it's not trapped.
 3. Integrated weights
 - a. Advantages: no need to put on last, positioned amid rig
 - b. Disadvantages: must have BCD/harness system with weight system build in; makes overall scuba rig heavier
 4. Weight harness
 - a. Advantages: put on before scuba rig, doesn't add to rig's weight
 - b. Disadvantages: may be awkward to adjust rig so it doesn't interfere with quick release weight ditching.

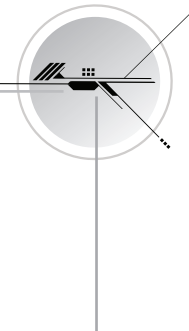
5. Loss of weights can be significant hazard on a decompression dive because it can make it difficult or impossible to stay at stop depth.
 - a. Some tec divers put two quick release buckles on weight belts to avoid accidental loss.
 - b. Another option is to wear a crotch strap over a weight belt to avoid accidental loss. With this approach, it's recommended that the crotch strap have a quick release so the weights can be discarded if necessary.

H. Instrumentation

1. You need *two* ways of determining your decompression requirements.
 - a. The simplest option is to wear two dive computers.
 - b. The second option is to wear a computer with depth gauge, timer and decompression tables.
2. For Tec 40, you only *need* a standard air dive computer or computers.
 - a. An EANx compatible computer is recommended – allows you to benefit from more bottom time with enriched air, and calculates your oxygen exposure.
 - b. If you have yet to invest in your dive computers, choose models that run multiple gases and trimix so you'll be set for Tec 45 and beyond.
3. Arm mounted instruments (other than SPG) are generally preferred (required at the Tec 45 level and up).
4. Mechanical SPGs are generally preferred because they're simple and reliable.
5. Compass – You need a high quality, liquid filled model if using a standard compass. Many newer dive computers have electronic compasses. The compass is commonly carried in a pouch or pocket until needed.

I. Cutting tools

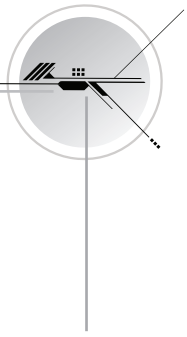
1. You should have a cutting tool, and ideally two (two required at Tec 45 level up). Mount at least one where you can reach it with either hand (generally waist/chest area).
2. Typical dive knife, dive shears, Z-knife (hook with blade), stainless folding knives and dive tools are all acceptable.
3. Large, calf-mounted knives/tools are generally avoided in tec diving, especially cave diving and wreck penetration, because they entangle easily.



- J. Guidelines for pockets, accessories and clips
1. Avoid large pocket pouches on harnesses – they cause too much bulk and clutter.
 2. Most useful pockets in tec diving are thigh pockets on your exposure suit.
 3. Mount stainless steel or brass clips on accessories to clip to your BCD or harness. Don't mount the clips on the BCD or harness.
 4. Sliding gate clips (a.k.a. dog clips) are preferred to marine snaps (swinging gate clips), because they won't accidentally clip to things by themselves.
 5. Choose clips based on the environment – you need larger clips when wearing thick gloves.
 6. Using and mounting clips
 - a. When possible, keep accessories in pockets until needed.
 - b. Clip accessories well out of the way, secured so they don't dangle.
 - c. Attach clips so they can break away so you can release in an emergency. The simplest approach is to mount the clip via a small o-ring or thin pull tie that breaks with a sharp tug.
- K. Stage/deco cylinders
1. A stage cylinder is used to extend the deep portion of the dive. A deco (decompression) cylinder provides gas (usually with higher oxygen content) during decompression. They are rigged the same, so it's common to call deco cylinders "stages" or "stage cylinders." The general term for both is "stage/deco cylinder." In context, the terms are seldom confusing.
 2. Stage/deco cylinders are worn on the side under the arm, clipped at the waist and on the chest.
 3. **A stage/deco cylinder *never* replaces one of the two regulators/valves you need from your primary gas supply.**
 4. As a Tec 40 diver, you will often use a deco cylinder.
 - a. Some dives at this level do not need a deco cylinder, because you have enough gas, plus your required reserve, for the entire dive including decompression.
 - b. But, a deco cylinder is recommended nonetheless because it provides extra gas capacity, plus gives you the option of switching to EANx with a higher oxygen content for added decompression conservatism. (More about this later).

5. Typical stage/deco cylinder setup
 - a. The cylinder is typically a 4 litre/30 cf size or larger. The popular aluminum 11 litre/80 cf has more capacity than you usually need at the Tec 40 level, but it is commonly available and easy to handle. It is perfectly acceptable to use – having too much gas is seldom an issue.
 - b. The cylinder has a nylon rope/strap approximately 46 cm/18 in, approximately under the valve opening, running down to a band around the cylinder with a clip at each end. This serves as a handling strap; the clips attach the cylinder on your BCD D-rings at the waist and chest/shoulder.
 - c. The regulator has a single second stage and SPG. Hoses tuck under inner tubing, bungee or stretch nylon straps around cylinder.
 - d. The second stage has break-away clip usually attached to the hose close to where it meets the second stage.
 - e. The SPG may have a very short hose, or a standard length hose that is tucked along the cylinder length.
 - f. It's recommended that the clips be attached via rope or nylon so you can cut the cylinder free if a clip jams.
 - g. **For safety, stage/deco cylinders are *always* clearly marked with the gas blend they contain, the maximum depth you can breathe the gas (based on the oxygen partial pressure) and the diver's name. These markings are always large and positioned so a team mate can read them while the cylinder is worn.**

- L. Lift bags/DSMBs (Delayed Surface Marker Buoys) and reels
 1. You may find yourself accidentally away from your planned ascent line (anchor/mooring line).
 2. In this case, your team uses a reel to deploy a lift bag or DSMB. This gives you an ascent reference, allows surface support personnel to track your position, and helps you maintain your decompression stop in midwater.
 3. Suitable lift bags are brightly colored, with large capacities (45 kg/100 lbs lift) preferred. DSMBs are taller and more compact; they don't have to have the same lift capacities. Preferred DSMBs have one-way valves for filling, with overpressure valves. These keep the buoy inflated even if it topples at



the surface momentarily. It is recommended that you write your name on your lift bag/DSMB for surface support identification.

4. Lift bags are carried rolled up and tucked into special carrying pockets or put in bungees that stow them horizontally in the small of the back. DSMBs roll up more compactly, generally, and fit in harness/BCD pockets or thigh pockets.
5. A suitable reel is compact with ample line to reach the surface.
6. The reel is clipped to a D-ring on the right hip.

M. Maintenance

1. You rely on your gear for life support. Therefore, maintain it according to manufacturer recommendations.
2. Have regulators, valves, BCDs and gauges inspected and overhauled at least annually, or more frequently for heavy use or as manufacturer specified.
3. Have anything that doesn't appear to work normally serviced before using it.
4. *Never tec dive with gear in anything but top shape and within its design parameters.* To do otherwise needlessly raises your risk of injury or death by starting the dive with a potential problem.

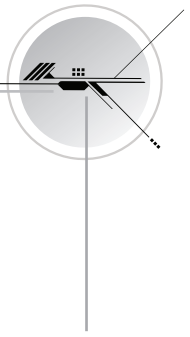
N. Putting it together: basic Tec 40 rig, head to toe

1. Use a cylinder with H or Y valve in a BCD/tec harness.
2. The left side regulator has a short hose second stage. This is the secondary regulator. It routes to the right and hangs below the chin on a bungee. The SPG hose goes down along the cylinder; the SPG has a clip to secure it to waist or chest D-ring (as preferred). Low pressure hose(s) feeds the dry suit and/or backup BCD (if used). The valve is open all the way (do not close it back a quarter turn).
3. The right side regulator has a long hose second stage. This is the primary regulator. It is the last thing you put in place when kitting up. The hose routes straight down along the cylinder to the hip, then up across the chest and around the left side of the neck into the mouth. At the hip, the safety reel lies on top of it to help keep it in place. The low pressure hose feeds the primary BCD inflator. There is no SPG. The valve is open all the way (do not close it back a quarter turn).

4. If using a pony instead of an H/Y valve, the pony goes on the left side of the main cylinder and takes the left side (secondary) regulator. In this case, the right (primary) regulator has the primary SPG, which is clipped as described above. The pony/secondary SPG is clipped low and behind the diver, where it is retrievable but not easily confused with the primary. It is also clearly marked (label, color, etc.) to easily distinguish it from the primary SPG.
5. With double bladder BCDs, the backup inflator is secured behind the diver so that it is easy to deploy, but not easily confused with the primary (you only use one BCD bladder at a time).
 - a. Some divers leave the LP hose disconnected from, but bungeed to the backup inflator. This avoids accidental inflation (leaking inflator valve), but is easily connected for use.
6. Instruments are ideally arm mounted (except SPG), though compact consoles are acceptable in the Tec 40 rig.
7. The weight system is secure, free for ditching. The backup buckle is secured if used.
8. Mask and fins are preadjusted and inspected, secured so they can't slip out of adjustment.

Exercise, Other Delivery Content, Tec 40-2

1. Tec 40 has less stringent equipment requirements than the standardized technical rig, because the limits of Tec 40 diving keep you within recreational depth limits and a relatively short decompression time.
 - True
 - False
2. You cannot use the same fins you use in recreational diving for Tec 40 diving.
 - True
 - False
3. The recommended valve type for the Tec 40 kit is
 - a. the standard yoke valve.
 - b. a J reserve valve.
 - c. an H or Y valve, DIN system.
 - d. a J or K valve, yoke system.



4. The minimum number of fully independent regulators, per diver, is
- a. 1
 - b. 2
 - c. 3
 - d. 6
5. You can use any BCD with D-rings or attachment hardware at the shoulder/waist for the Tec 40 kit.
- True
 - False
6. Choose an exposure suit for a tec dive based on _____. (choose all that apply)
- a. depth
 - b. duration
 - c. temperature
 - d. activity level
7. You never use a weight belt while tec diving.
- True
 - False
8. For the Tec 40 level, a single computer is all the instrumentation you need.
- True
 - False
9. At the Tec 40 level, you should have at least one cutting tool, but it's recommended you have two.
- True
 - False
10. General guidelines regarding pockets, accessories and clips include (check all that apply):
- a. mount clips to the accessories.
 - b. attach clips so they can break away.
 - c. thigh pockets on your exposure suit are a good option.
 - d. marine (swing gate) clips are the best choice.
11. At the Tec 40 level, a stage/deco cylinder will be used to
- a. carry a decompression gas.
 - b. carry gas to extend the deepest portion of the dive.
 - c. both a or b.
 - d. None of the above.

12. A stage/deco cylinder is always marked with the gas it has in it, the maximum depth and the diver's name.

- True
- False

13. You may need a lift bag/DSMB and reel

- a. as a backup BCD.
- b. in case you lose track of your ascent point.
- c. to open a shipwreck hatch

14. A suitable lift bag or DSMB should have ample lift and be blue or gray.

- True
- False

15. Never, ever tec dive with gear that's in anything less than top shape.

- True
- False

16. The primary regulator (choose all that apply)

- a. goes on the right.
- b. has a long hose second stage.
- c. has the primary BCD low pressure hose.
- d. goes on the left.

How did you do?

1. True. 2. False. The same fins you use recreational diving are usually suitable for the Tec 40 level. 3. c. 4. b. 5. True. 6. a, b, c, d. 7. False. A weight belt is a common option in tec diving. 8. False. You need at least two computers, or one computer and a depth gauge, timer and decompression tables. You should also have SPGs and a compass. 9. True. 10. a, b, c. 11. a. 12. True. 13. b. 14. False. It should be red, yellow or some other bright color. 15. True. 16. a, b, c.