A Student's Guide to Buying Tools

Advice from Marine Systems Instructors

Welcome to the Marine Systems Program at the Northwest School of Wooden Boatbuilding! This program is designed to prepare you for an entry level position in the Marine Industry. The topics covered are diverse and your training includes both theoretical and hands-on learning. As instructors, we are excited to help you advance your knowledge and prepare you for a professional career in this interesting and dynamic field. Before arriving on campus, you need a basic kit of quality tools. This tool list that we are providing illustrates tools you will use during this program and will get you started in this field. After you graduate and move forward in your career, you should anticipate adding to these tools. **Keep in mind that you are expected to have all required tools prior to the start of the second week of class.**

Our official Marine Systems Program tool lists provided (see tool pages 1-6 that follow) are grouped by categories: Electrical, Corrosion, Mechanical, Layout, Other Tools, and Personal Protection Equipment (PPE). PPE use is required as your safety is always our priority. When a brand and model number is included, that is the recommended item. The prices listed are an estimate of the cost for a quality tool. Having the most expensive tools does not guarantee you will do better work, but you will want reliable and quality tools at hand to make your work more enjoyable. We also would like to share some of what we have learned from our past experiences and best practices working in the field to help guide you regarding tools and storage. Some of us have had the 'luxury' of working in shops and boatyards where we've had a space to call our own – although it's important to remember your neighbors on the job will also be sharing the space with you along with their own tool collections and bench setups.

As you accumulate tools and consider options for choosing tool storage, keep in mind what the workplace of a marine technician will look like. During a typical workday, you will be in and out of vehicles and on and off boats. You should choose tool storage to facilitate your mobility, keep your tools contained to prevent loss off the dock, and to protect working surfaces. Soft-sided backpacks or cases are best to avoid damage to boat interior spaces. It can be helpful to use a canvas 'rigger's bag' type tool bag (which typically costs around $30) and 5-gallon buckets with spin-off 'gamma seal' lids (usually around $15) can be great if you need more space to carry tools and supplies. The bucket can do double-duty as a garbage can as well. However, one downside to the rigger's bag is when it goes upside-down, everything can escape and clatter toward the water. An additional advantage of the soft-sided backpack tool bag is that it can be helpful if you end up climbing a lot of ladders - having both hands free is important!

It is best to have a toolbox to keep things organized and secure, and (if you can have one at your workplace) a locking cabinet can be helpful also to hold power tools, spare clothes, bulky items, and valuable bits and pieces (such as chunks of G10, pieces of various plastics, threaded rod, nice pieces of teak, etc.) that might come in handy on future projects. If you're working on a bench with a small vise mounted on top, it's a great idea to hang tools on the pegboard. But be aware that in a shared workspace sometimes people are not as respectful of your belongings as you might hope – best practice is to limit the items you hang up to supplies and materials that are specific to your jobs in the yard, so others won't have a reason to borrow anything. At most workplaces, employees are expected to have the tools they need to do their jobs. Some companies do help to facilitate this with a tool-purchase assistance program. A good rule of thumb is: "If you borrow a tool more than twice, you should have one of your own." This rule is flexible, of course - some yards will have a selection of tools available for anyone to use, with the understanding that they should be returned to where they came from and in working order. This can commonly include *large* wrenches (36" pipe wrenches, for example), riveting tools, a hydraulic "porta-power" ram and various bottle jacks, cable cutters and crimpers, acetylene torches, remote video scopes, and so on. Not every shop or boatyard is going to have this equipment available - it depends on what kind of work the outfit does, and what kind of budget they have for investment in tools. This equipment is *expensive*, especially when it does not get treated right or gets left out in the rain for a weekend.

Over time on the job, you will come to identify a set of tools that you can take to most any job. If you end up needing something specific, you can expect to head back to your workbench and pull the tool from your toolbox – always remember to plan ahead and grab what you need before going to the job site, but there are always wrinkles in the best-laid plans. If it were a mobile job where a trip back to the toolbox was a distant option, sometimes a "kitchen-sink" approach is best, and you should plan to take along a bigger tool kit. Your bench area is the best home for bigger tools,

such as larger sets of wrenches and sockets, hammers, mallets, additional pliers and screwdrivers, 'wrecking' chisels, woodworking chisels, planes, drill bits, hole saws, cordless and corded drill motors, cordless impact drivers, small routers, various router bits, jigsaws with various blades, prybars, taps and dies, small vacuum cleaners, caulking guns, heat guns, hard hats, sanding blocks, a Weld-Mount kit...the list goes on! For further guidance, below is an example of an "everyday tool kit" as a baseline – but this is by no means comprehensive; be prepared to spend some money on tools (in perpetuity) once you're out in the field. And this could certainly vary depending on the jobs and boats you're working on (you might need to carry a couple of Pozidriv screwdrivers for a European boat, for example). Along the way, you'll discover what tools you use most and might invest in higher quality versions of them, or you may get to use a co-worker's tool and wonder what you've been doing without it for all these years. Even good tools can get worn out eventually - motors will burn out, things will break. Caring for your tools is part of the job – keep them clean and dry as much as possible and a little bit of light oil goes a long way on pivots and moving parts.

Screwdrivers

- Philips #1, #2, #3
- Flat 3/16", ¼", 5/16"
- Philips #0 and tiny flat 'jeweler's screwdrivers'

Wrenches

- SAE 3/8", 7/16", ½" (x2), 9/16" - on a carabiner
- Metric 10, 11, 12, 13, 14, 15, 17 - on a carabiner
- Adjustable wrenches – 8", 10", 12"

Pliers

- Slip-joint pliers
- 8" vise-grip pliers
- Small long-nose pliers
- Larger long-nose pliers
- (sometimes) Channel-lock pliers
- Angle cutting pliers (these often lived in a pants pocket

Ratchets/Sockets

- 3/8" Drive ratchet
- Socket rail w/~10 common sockets

Electrical Tools / Supplies

- Multimeter & test leads in soft case
- Wire stripping tool
- Ratcheting crimper (usually set up with single crimp die)
- A small tackle box of assorted common wire connectors, including some Wago lever connectors

Other

- A small tackle box with a selection of 8-32, 10-32, ¼-20 screws, nuts, & washers, commonly used stuff
- Electrical tape (used on rigging stuff far more than electrical)
- Masking tape
- 12' measuring tape
- Tef-gel, 1 oz. syringe
- Small taps (10-24, 10-32, ¼-20) & drills & tap handle
- Blue thread locker (stick)
- Zip-ties (bundled assorted sizes
- Utility knife with spare blades
- Small case with new single-edge razor blades and plastic 'razor' blades
- Pencils and Rite-in-the-Rain notepad, usually a Sharpie marker too
- A couple of hanks (~60+') of small cordage (2mm-ish)
- A curved-jaw hemostat
- A couple of small picks/hooks
- A small spool of stainless seizing wire
- Foam earplugs (just in case)
- Safety glasses (just in case)
- A couple pairs of nitrile gloves
- Some clean rags
- A folded up heavy-duty black trash bag

In addition to your tools and books (a separate book list is provided), your tuition includes a student membership with the American Boat & Yacht Council (ABYC). Membership with ABYC gives you access to industry standards referenced during the course and study guides used to prepare for certifications. ABYC membership and testing information will be discussed after you start the program. If you have any questions, please feel free to ask. We look forward to teaching and coaching you along on this adventure and wherever this endeavor takes you!

Regards,
Your Marine Systems Instructors
Northwest School of Wooden Boatbuilding

Electrical Tools

Tools listed in bold with a yellow background are the minimum required. Other tools listed are strongly recommended. NWSWB does not recommend a specific tool vendor or supplier. The prices listed are an estimate of the cost for a quality tool.

Tool	Model	Price	Notes
Digital Multimeter	Fluke 117 with Test Leads	$200	Auto-ranging AC/DC multimeter with capacitor & diode test function, and "Low-Z" mode.
Circuit Analyzer	Extech CT70	$200	Powerful tool for diagnosing and troubleshooting AC circuits. Much more functionality than a GFCI/AFCI receptacle tester.
Ratcheting Single-Crimp Tool	Ancor 703010 (straight) **-OR-** 703015 (angled)	$65 (straight) $50 (angled)	For installing terminals on wires. There are a lot of similar tools, some have interchangeable crimping dies for versatility.
Wire Stripper	Knipex 1262180 **-OR-** Klein Katapult (11063W) or similar	$30-$50	The Knipex is a pistol-grip wire stripper. The Klein is more of a pliers-style stripper. Very handy for removing insulation from wires smaller than 12 gauge.
NEMA L5-30 Male Plug & Female Receptacle Set	Journeyman Pro L5-30PR Set	$30	A plug and receptacle set of power cord ends to build a 'split cord', used for shore power testing.
Power Cord Adapter	Marinco S30-15	$40	An adapter to allow circuit analyzer to be plugged into a shore power pedestal.
Precision Flush Cutter	Klein D275-5 Pliers	$15	For *clean* cuts on cable-ties and smaller-gauge wire.
Wire and Cable Cutter	Ancor 703005 or Klein 63050	$30	For clean cuts on larger wire.
Insulated Screwdriver Set (Optional, but very nice to have!)	Phillips, Slotted, Square	$30-$60	The metal shaft of the screwdriver is sheathed in plastic to prevent accidental electrical shorts.
Alligator Clip Test Leads	Sumnacon 5pc 15A	$10-$15	Useful for troubleshooting and prototyping. Make sure they are at least 16-gauge wire.

Corrosion Tools

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Tool	Model	Price	Notes
Mil. Spec. Zinc Reference Electrode** **Discount may be possible if purchased through class**	Electro-Guard RP-2	$98	Used when measuring galvanic activity during corrosion survey data collection.
Scratch Awl (Wood Handle)	Stanley 69-122	$10	We'll modify one of these into a test probe tool. An awl is a useful tool for layout and otherwise – consider buying a package of 3 of these (~$26)
12 AWG Black Silicone Stranded Wire	25 feet	$15	Used to build a corrosion test probe.
Banana Plugs (Solder-on)	Mueller Electric Co. BU-3261410-2	$7	High quality banana plug for test probe. Beware of cheap plugs!
Small Wire Brush		$2	Used to clean metal for corrosion data collection. Lots of uses.
Sawzall Blade		$10	Used to expose bare metal for corrosion data collection.
AC Leakage Clamp Meter	Sonel CMP-200	$79	Sensitive clamp meter, used for troubleshooting and safety surveying.

Tool Tip:
Think of a way to identify your tools – it could be spray paint or a paint pen or an engraving tool. Permanent marker will likely wear off. Many of you will have identical tools and each of you should figure out a recognizable way to mark all the bits and pieces. These tools are an investment and should be protected as such!

Mechanical Tools

A note on these tools: If you already have a set of wrenches and sockets and screwdrivers and so on, use what you have. A good storage solution (a toolbox/bag) is important to keep everything together.

If you are just starting to build a tool kit, buying a packaged set like those listed below takes a lot of the guesswork out of the process. The case helps to keep things organized and offers a nice, portable storage solution. Buying tools at garage sales is also viable but piecing a whole kit together could take some time.

When it comes to torque wrenches, buy a good one that comes *with a certificate*. These tools are calibrated, and if you buy a cheap one or buy second-hand, there's no guarantee that it's still accurate.

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Tool	Model	Price	Notes
Mechanic's Tool Set including: **-1/4", 3/8", 1/2", drive ratchets** **-Metric and fractional inch sockets, regular and deep** **-Metric and fractional Allen wrenches** **-Metric and fractional combination wrenches**	Dewalt DWMT72165 OR WEIZE 270-piece Mechanic Tool Set	$150	There are a lot of comparable kits out there; invest in a good one. It may seem like a lot of tools in there, but a kit like this will take care of a large portion of your wrenching needs. The set listed comes with a blow-molded case, which is very nice if you don't have a place to put 185+ bits & pieces. Don't be afraid to mix and match smaller kits.
Mini Combination wrenches	Duratech mini wrench set	$20	Smaller-sized wrenches for little stuff and tight spaces.
1/4" Drive Torque Wrench	eTork C1200	$58	40-200 *inch-pound* torque range
3/8" Drive Torque Wrench	eTork C2100	$60	20-100 *foot-pound* torque range

Mechanical Tools – *Continued*

Tool	Model	Price	Notes
Pliers Set	Irwin 2078708	$55	This is a basic set of pliers that includes a roll-up for storage. This one doesn't include long-nose pliers or a vise-grip, however. Cheap pliers are just that; you don't have to spend a lot more to get a much better tool. Adjustable wrenches come in several sizes – the 10" included in this set is a good all-purpose size. Other kits include Knipex, Channellock, and Husky.
Channel Lock Pliers	Included in price above		
Diagonal Cutters	Included in price above		
Linesman's Pliers	Included in price above		
Slip-joint Pliers	Included in price above		
10" Adjustable Wrench	Included in price above		
Long-nose pliers	Irwin 6" long-nose pliers	$12	Indispensable tool for fine manipulation.
Locking Pliers ("Vise-Grip")	7" curved jaw locking plier	$15	Useful when you need to grip something hard. Lots of options.
Megapro Multi-Bit Screwdriver	Multiple Different Options	$20	The example is 15-in-1. Compact and capable of many jobs.
Feeler Gauge set	Gearwrench KDT-161	$6-12	Used to precisely measure very small gaps between parts. Get a set marked with both metric and SAE (or one of each).
Thread Pitch Gauge SAE/Metric	Boltsize-It Gauge -or- Parker Thread ID Kit ($70)	$10	Used to identify screws and bolts, including length, diameter, and thread pitch.
Gasket Scraper	OEMTools 26501	$27	Used to remove gaskets and clean up sealing surfaces.
Dead Blow Hammer	Harbor Freight, several weights	$10-15	Softer-headed mallet filled with sand or shot for low-bounce percussive persuasion.
Cordless Drill	Lots of Options (e.g., Milwaukee M18 Brushless Drill/Driver Set)	$180	A good cordless drill motor is a very frequently used tool. If you don't already have one, ***seriously* consider buying one**. We have a limited number available for shop use. Be sure to get one that includes a battery and a charger – sometimes sold as "tool only."

Layout Tools

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Tool	Model	Price	Notes
Small Framing Square (8”x12”)	Irwin 1794462	$12	Helpful for accurate layout on panels, plus general measurement
Tape Measure		$10-20	A 16’ or 25’ tape is a good length for most purposes.
Torpedo Level	Johnson 1421-0900	$10-20	Used for establishing reference lines and general layout.
Scratch Awl (Separate from corrosion)	Stanley 69-122	$11	Can scratch layout lines, punch index holes for drilling, and so on. See corrosion section.

Other Tools

Tool	Model	Price	Notes
Box Cutter, Retractable/Foldable	Stanley 10-499	$12	All-purpose utility knife.
Drill Bit Set	DEWALT DWA1181	$20	1/16” to ½”, 21 pieces. A decent general-purpose set of drill bits.
Digital Caliper	Jiavarry	$14	Used to take inside and outside measurements.
Ball Peen Hammer	Xtremepower15145xp	$20	Dead blow hammer with metal faces.
Small Parts organizer	Plano 2370500	$13	Useful for organizing fasteners and other small parts.
Infrared Thermometer	ThermoWorks IR-GUN-S	$70	Non-contact thermometer, up to 1000F. Great troubleshooting/ diagnostic tool.
Headlamp and/or Flashlight		$15-$45	A small battery-powered work light or flashlight is great, too. Rechargeable is nice.

Personal Protective Equipment (PPE)

We strive to establish good safety habits in the shop that you will take out into the workplace. Having PPE that is comfortable and works well makes those habits much easier to put in place.

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Tool	Model	Price	Priority
Safety Glasses or Goggles with Side Shields		$10-$20	Find a comfortable pair, so you get in the habit of wearing them. If you wear glasses, get something that fits comfortably over them.
Hearing Protection over-ear or plugs	3M 90565-4DC-PS	$10-$30	Noise is harmful and exhausting. A good pair of over-ear muffs is recommended. Go for a high Noise Reduction Rating (NRR) – 30dB or greater. Ear plugs are good for protecting hearing, but they tend to get lost and are not as environmentally friendly.
Dust Masks Non-Vented	3M-8200 or Honeywell RWS54001	$15-$25	Go for R95 (somewhat resistant to oil) or P95 ratings (strongly resistant to oil). The P95 will be more expensive but have a longer life. The familiar N95 masks are OK for particulate but are not oil resistant.
Dual Cartridge Organic Respirator Mask	3M 53P71	$25	This is for protection against organic vapor (usually evaporating solvents). These usually come in small/medium/ large. We will review basic fit-test procedure in class.
Nitrile Gloves		$25-$35	Latex gloves don't stand up to solvents as well as nitrile. There's a lot of variation in fit, we have some samples.
Long-sleeve Coveralls		$30-$50	For dirty work