Tools of the Trade

Common and Uncommon Tools
Used By Water & Wastewater
Operators and Maintenance Mechanics

Safety!

• Proper technique
• PPE
• Organization
• Planning
What Tools Do

• Push things in
• Pull things out
• Turn things
• Keep things from turning
• Measure things
• Shape things
• Anything we need done easier, faster, or more accurately

What Tools Do

• Some basic notes on the perspective of things that turn
  – Righty-tighty:
    • Clockwise
  – Lefty-loosey:
    • Counter clockwise
  – Standards:
    • ISO, ANSI, ASTM, ASME, and many others
Every toolbox should include these 12 must-haves, say the experts at The Family Handyman.

1. **Cordless drill**: A 12-volt model will handle most drilling tasks.
2. **16-ounce hammer**: Great for big and small jobs.
3. **Angle square**: Use it for layout, cut-line marking or to check corners for squareness.
4. **Multihead screwdriver**: You’ll need Phillips and slotted tips for most household projects.
5. **Pry bar**: Use it to dismantle framing, pull nails and remove moldings, and for demolition.
7. **25-foot tape measure**: Compact for small-scale work, but stretches for bigger chores.
8. **Adjustable wrench**: A 10-inch model is the perfect size.
9. **Chalk line**: Use it to snap straight guidelines for cutting plywood or laying floor tile.
10. **Non-contact voltage tester**: A must for electrical repairs.
11. **Circular saw**: Look for 12 amps minimum, to cut metal and concrete with the appropriate blade.
12. **24-inch level**: For big and small tasks.

From Reader's Digest - May 2005 Originally in Complete Do-It-Yourself Manual

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**Mechanic’s Pouch**

- Troubleshooting tools
  - VOM
  - Pick-up magnet & a mirror
- Screwdrivers
- Wrenches
- Pliers
- Tape Measure
- Electrical tape
Mechanic’s Portable Box

- Socket set
- Adjustable wrench(es)
- Hammer
- Punches, chisels, drift pins
- Hack saw

US Army Specification circa 1960

- Manually actuated fastener insertion device
- Hammer
- $5000.00
Hand Tools

• Hammers
  – Many sizes & purposes

• Wrenches
  – Fitting Wrenches
  – Friction Wrenches

• Drivers for fasteners
  – Nuts, Bolts, Screws, Rivets…
Hand Tools

• Wrenches
  – Fitting Wrenches
  – Friction Wrenches

Hand Tools

• Wrenches
  – Fitting Wrenches
Hand Tools

• Adjustable Open End
  – Fitting Wrenches
  – “Crescent”
  – “Knuckle-Busters”

• Adjustable Wrenches
  – Fitting Wrenches
  – “Spud” Wrench
  – “Monkey Wrench”
Hand Tools

- Wrenches
  - Friction Wrenches

Hand Tools

- Wrenches
  - Fitting Wrenches
  - Friction Wrenches
Hand Tools

• Drivers for fasteners
  – Nuts, Bolts, Screws…

Hand Tools

• Multi-Purpose Tools
  – Handy, but not as efficient
  – Many levels of Quality, mostly poor
Fasteners

• Nuts, Bolts, Screws

<table>
<thead>
<tr>
<th>Bolt Diameter</th>
<th>Head and Wrench Size</th>
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<tbody>
<tr>
<td></td>
<td>Hex Bolt - Lag Bolt</td>
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<td>Heavy Hex Bolt</td>
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Nut Size to Wrench Size Chart

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*This is the diameter across the flats. It is also the size of wrench to use.*

Thread Tapping & Dies

- Drilling
- Tapping
- Dies
<table>
<thead>
<tr>
<th>Tap</th>
<th>Fractional Drill Bit</th>
<th>Number Drill Bit</th>
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</tbody>
</table>

Drill sizes are for 75% depth of thread.

Fastener Information Websites:

- www.boltdepot.com
- www.boltscience.com
- www.gizmology.net/nutsbolts.htm
- www.nutsandbolts.com/
- www.k-bolt.com/us_bolt_head_wrench_table
- www.engineersedge.com/screw_threads_chart
Hand Tools

- Drivers for fasteners
  - Rivets...

Hand Tools

- Pliers
  - Lineman’s
  - Needle Nosed
  - Nippers & Cutters
  - Wire Strippers
  - Grooved
  - Locking Pliers
  - ???…
Hand Tools

- Cutting Tools
  - Saws
  - Chisels & Planes
  - Knives
  - Drills
  - Files & Rasps
Power Tools

- Mechanical Tools
  - Electric
  - Air Operated
  - Hydraulic
- Drills
- Saws, sanders, planers, and other cutting tools

Drills
- Make a hole
- Hand held
- Drill Presses
Basic Drill Bits

- Spade
- Lip and Spur
- Masonry
- Twist Bit

Special Drill Bits

- Unibit
- Forstner
- Auger
Power Cutting Tools

- Saws
- Sanders
- Planers
- Routers
Power Cutting Tools

- Sanders
- Planers
- Routers

Power Cutting Tools

- Planers
Power Cutting Tools

- Routers

Measuring Tools

- Measuring & Layout Tools
  - Tape Measures & Rulers
  - Squares
  - Calipers
Measuring Tools

- Measuring & Layout Tools
  - Micrometers
    - ID, OD, & Depth

\[ 24 \text{ mm} + 0.70 \text{ mm} = 24.70 \text{ mm} \]
Measuring Tools

- Measuring & Layout Tools
  - Micrometers

```
0-25 x 0.01mm
R x 0.001mm
```

Measuring Tools

- Measuring & Layout Tools
  - Levels
  - Plumb Bobs
Measuring Tools

• Measuring & Layout Tools
  – Marking Gauge
  – Compass

Leverage Tools

• Leverage Tools
  – Pry Bars
  – Wedges & Alignment Pins
  – Hoists, jacks, and come-alongs

• Pullers
  – Gear pullers
  – Packing pullers
  – Seal removal tools
  – Hydraulic press
Other Stuff...

- Home-made Tools

Other Stuff...

- Stethoscope
- Flashlight
Other Stuff...

- Non-contact Voltage Tester

Uncommon Tools

- Alignment Systems
- Vibration Monitoring
- Thermal Monitoring
Alignment Tools

• Mechanical Measurement
  – Feeler Gauges
  – Straight Edges
  – Dial Indicator Systems

• Laser Alignment Systems
  – Commercial kits available
  – Uses a computer to direct the movements to align equipment

Alignment Tools

• Mechanical Systems:
  – Pro: Inexpensive
  – Con: Time Consuming
  – Con: Accuracy requires training and experience, not all mechanics have the patience to understand the geometry involved.
Alignment Tools

• Laser Alignment Systems
  – Cons: Expensive, delicate, may be too technical for some mechanics
  – Pros: Accurate, fast, computer driven calculations

Vibration monitoring

• SCADA tie in
  – Alarms and/or constant readout
  – Power consumption
  – Costs
• Equipment
  – Electronic sensors
  – Needs to be maintained, calibrated
Thermal Monitoring

- SCADA tie in
  - Alarms and/or constant readout
  - Power consumption
  - Costs
- Equipment
  - Electronic sensors
  - Special digital cameras