

Tech Inspector's Guide

Thank you for helping our club perform day-of-event technical inspections. Please take a little time to read and familiarize yourself with this guide.

Background and pre-event planning

Arrival. Plan to be ready in the morning *before* Tech Inspection is scheduled to start. This usually implies arriving the moment the track gate opens so that you can register, prepare your own car, gather any tech materials (e.g. gloves) and report to the Tech Inspection area. Feel free to jump the waiver-signing or registration line if needed, politely explaining that you need to get in to help with Tech.

Team. Tech Inspections are performed by a coordinated team. A typical DE with about 70 students requires a team of at least four inspectors to complete the inspections within a 45 minute period in the morning. This allows two lines of cars, each with two inspectors. Five or six inspectors will make the job much less hectic.

Attitude. Adopt a cheerful but busy demeanor. Students may be anxious about their car passing. Or they may be new to the track or this chapter and not know our procedures. Be friendly and understanding, even when you find something ridiculous. Don't poke fun at the car or its defects.

Mechanical skills. At least one person in the Tech team should have extensive automotive experience, especially in relation to suspension and wheel bearing play. Failing a car for excessive play requires judgment.

Harness knowledge. At least one person on the Tech team should be familiar with harness installation instructions. Aftermarket harnesses have the potential to dramatically reduce the manufacturer's seat/belt/pretensioner/airbag safety system.

Which days. We don't recommend inspecting cars the night before the event because they will not be emptied out and prepared as well as they will be on the day of the event. If the event has separate registration for each day, know how many cars to expect on each do so you can have enough help.

Tech box and form storage. We keep a plastic file tote filled with supplies. It contains a folder labeled "Current Event". All forms from the current event go there. If there is an incident, the event chair or chief instructor may request the car's tech form. After the event, transfer the completed forms to a safe storage location, retaining them for at least one year.

The Tech box includes:

- Completed forms for the current event
- Blank forms
- Pens
- Disposable gloves
- Brake fluid tester(s),
- Paper towels
- Helmet stickers for all currently-valid helmet dates
- Current event Student and Instructor Tech stickers
- Harness installation instructions

Brake fluid tester. The club should buy genuine Wurth brake fluid testers (about \$82). Knock-off testers from Amazon are much cheaper but seem to register higher, leading to false negative tests. Have at least two testers so you can double-check a failing car. Have spare fresh batteries as battery strength affects the reading.

Event stickers. Several weeks prior to the event, a Tech Steward should contact the event organizer to obtain student and instructor head counts. This allows ordering of sufficient number of tech stickers. Someone on the team should design and print (or have printed) tech stickers. Our colorful and playful tech stickers are popular, but if they can't be printed, any office supply store will sell some sort of colored dot. The Tech box has an emergency supply.

Helmet stickers. The club purchases a multi-year inventory of inter-chapter helmet stickers, one for each Snell year, such as 2010, 2015, 2020, etc. Ensure an adequate supply well before the event. Stickers are available for order from T-Shirt Express (mel@tsxsport.com 585-256-0070). Specify the year (e.g. S-15) and Northeast Regional BMW CCA helmet stickers.

Instructors. Boston Chapter expects instructors to inspect their own cars. Instructors should turn in a Tech form and receive a sticker, but we don't strictly require it. They do not need to present their car, and should not because there won't be time, *unless a student is co-driving the car.* If a student is co-driving the car, the car must meet all applicable rules for students (two seats, equal restraints) and go through the tech line. Ask instructors to serve themselves (turn in form and get sticker) to save time.

Coordination. Each team member should have a set of tasks to perform on every car in an agreed progression. This reduces the chance of skipping steps on some cars, or performing redundant steps. Just about any plan or division of labor can work. Know your job and stick to it. Don't be shy about talking amongst the Tech team to coordinate.

A "clean hands" person can collect the forms, sticker the helmet, check the interior and trunk, and sticker the car. A gloved "dirty hands" person can check the wheels, under the hood, and brake fluid. If you have an extra person, dedicate them to brake fluid, perhaps servicing both lines (zig-zagging back and forth). An extra person checking harnesses, seats, and cages can prevent the line from bogging down.

Day of event

Rain. If possible, move Tech to inside a garage, garage port, or EZ-Up tent(s). Inspecting cars in the pouring rain isn't fun. Bring full rain gear if there is any chance of rain.

Start and finish on time. Open Tech as soon as possible, with an announcement. Repeat announcements if the line becomes suspiciously short. Make the announcements cheerful and positive, even if you are irritated that students aren't getting to Tech soon enough. Aim to finish Tech prior to the Driver's Meeting. If you are an instructor, you will likely miss the instructor's meeting. Ask another instructor if there is anything new/unusual that you might have missed.

Lines. If you have enough inspectors, form two teams each with their own line. Inspect several cars in place, then have the line pull forward so it doesn't back up too far and so that you don't get too far from the tech box. A few orange cones borrowed from the track will help organize the lines. Keep drivers in their cars during the inspection to avoid delays.

Supplies. While the tech box contains most of what you need, a set of mechanic's gloves will be handy as might be a flashlight for looking at brake pads.

Inspection items. Have an active and open mind. Observe problems not on this checklist. Oil puddle under car? Cracked radiator hose? Threadbare serpentine belt? Cracked rim?

- Collect the Tech form and check for signature.
- Ask "Did you torque your wheels today?" and if so "To what torque spec?" Hesitant answers may not be truthful.
- Ask them to open the hood release.
- Check engine bay, including battery mount if in front of car. If the throttle is readily available and you have time, check for free return of the throttle spring.
- Test the brake fluid. See below.
- Close hood gently. Don't get brake fluid on the paint. If you are rushed, politely ask the driver to close the hood for you.
- Check each wheel.
 - Grab the wheel and shake to check for wheel bearing or suspension play. Hub caps must be removed and indicate that they didn't torque their wheels.
 - Look at the brakes and rotors. If you can see the brake pad, check it for thickness. Show the student significant rotor wear or cracking.
- Check for brake lights.
- Check trunk: battery secure, no items in a hatchback, no heavy or unsecured items in an enclosed trunk.
- Check interior: no floor mats, no junk, empty glove box, nothing in back seat, no un-tethered devices such as cameras or data acquisition units.
- Aftermarket harness. See below.
- Aftermarket seats. Check mounting. Equivalent restraint.
- Roll cage: Check padding and poor design which might injure occupants.
- Inspect helmet. Apply new sticker if needed. See below.
- Apply car tech sticker to top driver's corner of windshield and release car.

Problems. Pull problem cars out of line so they can fetch their helmet, fill out the form, get the brake fluid cover off, fuss with their harness routing, or otherwise fix their issue. If you fail a car, arrange with the owner where you will be to inspect it later and be sure they attend the driver's meeting. If anything remains questionable, speak with the student's instructor as soon as possible so that they are fully aware of the issues and remind the instructor that they have final say whether they are comfortable with the student's car.

While some students will be grateful that you are protecting their safety, others may consider you an impediment to getting on track. Be gentle and understanding when raising problems with the student, particularly if the issue cannot be readily fixed at the track. Be sympathetic; they are having a bad day.

Tech form. Collect a tech form from each student. If the student has no form, provide them a blank form, but inspect the car extra carefully as it almost certainly was not inspected before the event. Be helpful to a novice student, but be more stern and serious to intermediate and advanced drivers. Technical inspection is important for both their safety and their instructor's.

Only collect page one of the form, which contains the checklist. Old-style forms contain the checklist on two pages. The rest is information that can be returned to the student.

Helmets. If an in-date inter-chapter helmet sticker is already affixed to the helmet, you are done.

Helmet stickers from other organizations are not accepted. Locate the foil Snell (or FIA) sticker under the padding inside the helmet and affix the appropriate inter-chapter sticker on the left side so that it can be seen at pit-out. Asking the student to hold the helmet will free your hands to apply the sticker. Both SA and M helmets are acceptable, but only a DOT rating are not. Tell the student to leave the sticker on the helmet and that it is valid until the helmet expires.

If you find an expired or illegal helmet, confiscate it and be sure to return it at the end of the event. The student will have to borrow a helmet.

Brake fluid testing. If the reservoir is covered, ask the owner to remove the cover if tools are needed or if you don't have time. An 8mm socket is needed for some newer BMWs. If you wish to provide tools to the student, be sure they are returned. Hand any cover you removed to the driver so they will remember to install it. Otherwise pull the car out of line and ask the driver to get or borrow the socket and handle.

Some master cylinder covers are colored the same as the washer fluid. Be sure you are testing brake fluid. If you dip the washer fluid reservoir, be sure to tell your friends so they can poke fun at you for years to come.

Push the test button on the tester prior to dipping to confirm a zero reading and battery life. Dip with the tester then wipe the tester clean with a paper towel. If necessary, remove the plastic strainer to expose the fluid. Sometimes a small screwdriver or two are needed.

- 2% or lower is pass.
- 3% is borderline. See below.
- 4% is fail.

For borderline results, consider the car's weight, the driver's run group, and whether the driver is likely to perceive brake fade warning signs. If you decide to pass a borderline car, educate the driver. 4+% should be flushed at the track, with the fluid removed with a turkey baster prior to flushing a liter through all 4 calipers. The student must attend the driver's meeting, so some track time will be lost. Be aware that some low-quality brake fluid, bought in plastic containers, may be as high as 3% right out of a sealed bottle.

When rushed, ask the student to screw on the reservoir cover and replace any plastic covers. Tell the student the brake fluid water content to help them plan their next flush.

When the reservoir is highly inaccessible (such as below a cabin filter assembly, decide how comfortable you are not checking it. Caution the student if you decline to test it.

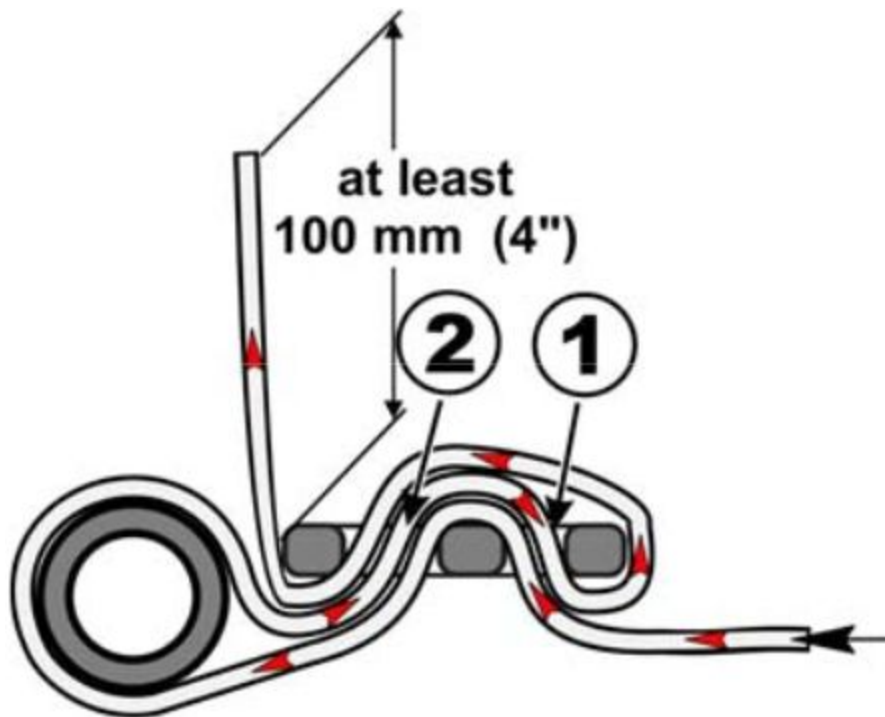
Harnesses. Your ultimate goal is to be absolutely sure that the harnesses are at least as safe as 3-point belts. Improperly installed harnesses *will* fail, making them worse than stock. If the aftermarket harness installation is unsafe, the student and instructor should both revert to the stock 3-point belts during the school. Inertial reel locks must be functional if using the stock belts. Check harnesses for:

- Date: no more than a few years out-of-date. Usually a warning to replace old belts before the next event is appropriate, but fail them if you aren't comfortable with the age or condition.
- Condition: no obvious fade, wear, stretching, or indication of a previous impact.
- Wrap.
 - 3-bar buckles must be correctly woven and doubled back. Only one of the three bars should be visible. Memorize the weave pattern; it's common and simple. A copy of the wrap diagram is in the tech box under "harnesses".
 - 2-bar buckles are difficult to weave. Check them carefully against the diagram. Needle-nose pliers are helpful for installing and adjusting them. Take care to not damage the webbing. A 2-bar buckle should overlap the mounting buckle (i.e. be tight to it).
 - Other wraps are possible (curved buckle around bar, 3-bar integrated with anchor buckle, clamped webbing), but are rarely seen. See Schroth instructions in tech box.
- Close to mounting point. No extra slack between the buckle and mounting point. Extra slack **will** pull through a 2 or 3 bar buckle in an impact.
- No extra slack in the buckle. Webbing should be pulled tight.
- Adequate tail. At least 4" must extend out of the buckle for a 3-bar buckle. 2" for 2-bar.
- Shoulder belts through seat grommets or headrest, not around the outside of an integrated headrest.
- Shoulder belts wrapped around a bar should ideally be secured from lateral movement with split-shaft collars or other metal means (not wire-tied roll bar padding). Suggest that they fix this before the next event, but don't fail them.
- Except for Schroth clip-in 4 point belts, the shoulder harness angle should be between horizontal and 20° downward. The distance between the seat and the anchor should be as short as possible, but if longer than 500mm (about 19"), the belts anchors should be crossed.
- Sub belt must go up through the seat bottom, or forward from under the butt (formula style), never around the seat front. Belts around the seat front will cause extreme

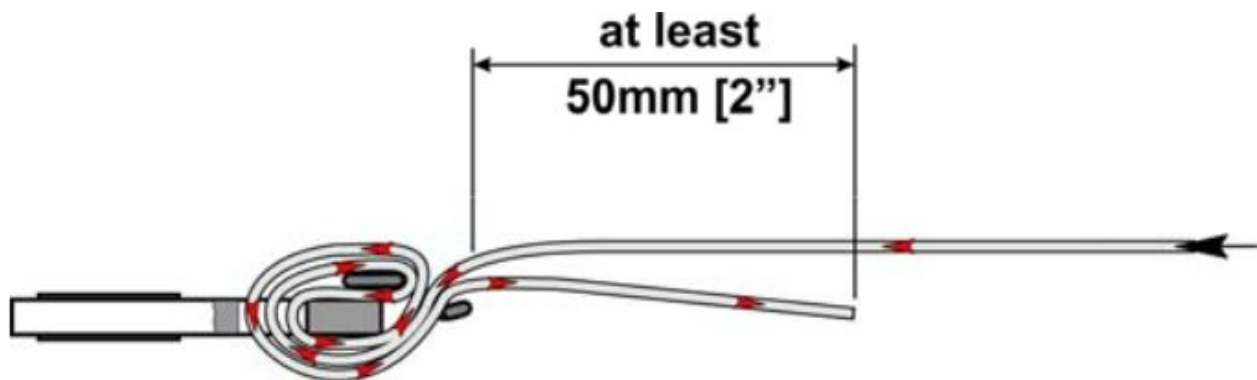
submarining, where the pelvis slides forward under the belt, severely injuring the internal organs.

- For 5-point belts, mounting should be between the plane of the torso and 20° forward. Consider encouraging 5-point belt owners to upgrade to 6 point, if you think they are open to suggestion.
- For 6+ point belts, the mounting should be between vertical and 20° rearward. Webbing must not be routed over any sharp metal edges.
- Eye bolts should be dedicated seat hardware with an adequate backing plate. You probably can't inspect the backing plate easily. Eye bolts should be positioned so that the belt anchors clip in at a right angle. Mounting that is not in-line will rotate upon impact, resulting in belt slack.
- Bolted anchors must be free to rotate or fastened so that the belt is aligned with the direction of pull. An edge-loaded belt will tear in an impact.
- Sewn-in bendable anchors can be bent at most once and should be bent so that the belt is aligned with the direction of pull. Hardened anchors cannot be bent, but should be anchored so they align with the direction of pull (or close to it).
- Clip-in Schroth 4-point belts are acceptable in an approved seat. Unapproved seats may collapse under load.
- Regular 4-point belts should have Schroth ASM. Regular 4-point belts without ASM are accepted at the instructor's discretion.

Three-bar buckle routing



Two-bar buckle routing



Reference: www.schrotracing.com/docs/Competition_Instructions.pdf

Rationale

The Boston Chapter has adopted certain atypical policies and procedures as part of an overall plan to host the best, safest events that we know how. You don't need to know this, but if you're curious, here's why.

Brake fluid testing. Most chapters do not test brake fluid. When we first started, we failed an alarmingly high number of students. Many shops do not empty the reservoir before starting a flush, do not flush enough fluid through the calipers, or do not use high-quality fluid (ideally from a metal can). Some students will lie about the date of the last flush. And, incredibly, some brake fluid may be contaminated with water by mechanical incompetence.

Since adopting fluid testing, the incidence of test failures has dropped dramatically, indicating that the students are responding with appropriate pre-event maintenance.

Harness inspection. Many chapters give harness a quick look-over. Because of the Boston Chapter's long association with HMS Motorsports and Joe Marko, we have had the benefit of additional training and local expertise. Since adopting strict harness inspection, the incidence of serious harness installation errors has dropped dramatically — often to zero problems.

Harnesses replace a high-tested, expertly-engineered safety system comprising the 3-point belt, a pyrotechnic pretensioner, a seat, and one or more airbags. It is *incredibly* easy to incorrectly install harness, resulting in essentially no restraint. Webbing *will* slide through the buckle.

Installation by a professional is no protection. The mechanic or “speed shop” likely has not read the installation instructions, or has not understood and followed them.

In a 30 mph impact, a 165 lb person wearing properly-installed harness, adjusted tightly, will experience:

- The pelvis will move forward 3”-4”, exerting 3100 lbs on each lap belt.
- The upper torso will exert 1500 lbs on each shoulder strap.
- The adjusters will slide up 8”.
- The head will move 16” forward.

No evening-before tech inspection. We have tried offering additional early tech inspection on the evening before the event, particularly at distant tracks where most people will drive out the day before. We have found that the cars are not properly prepared. The student has not yet “moved” into a paddock spot, so the car is full of luggage and has not had its wheels torqued.

Another reason is exhaustion. The inspectors will be getting up extra early on the first day so allow Tech inspection to open on time. Couple that with hours of tech inspection the night before, needing to eat dinner, and still having to check into their motel, and you tend to have tired, crabby inspectors.

Fancy tech stickers. Hey. People love ‘em. It’s not that hard and helps make our events special.

Inter-chapter helmet stickers. They are good until the helmet expires so there’s a good chance some other chapter’s inspector had to dig through the padding to find the Snell sticker, saving you a bunch of time.

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