General Rules for Inductive Loops

1. The preferred insulation material for loop wire is cross-linked polyethylene (XHHN or XHHW are types of this wire). Wire with PVC insulation should never be used. This includes THHN. The cross-linked polyethylene is a much more durable insulation and, more importantly, has a much lower moisture absorption rate. Moisture absorption can affect loop stability.
2. Wire gauge of the loop wire has little to no impact on the sensitivity of the loop. A larger wire gauge may help extend the life of the loop, especially in asphalt installations where heavy truck traffic is expected.
3. Wire nuts should never be used in loop connections. At a minimum wire to wire connections should be crimped or use a screw terminal. Ideally, solder the connections.
4. Loop saw cuts should be mitered to reduce the loop wire bend angle to not exceed 45 degrees at any location.
5. Use backer rod to hold the loop wire at the bottom of the saw cut before sealing the loop. The backer rod should be cut into 1 inch pieces and one placed every foot or so, as needed.
6. If a loop installation will cross an expansion joint in the roadway surface some method of leaving some slack wire at the joint should be implemented. This can be done by core drilling a 1" or larger hole where the saw cut crosses the expansion joint and leaving a loop of wire in the hole each time you go through it when installing the loop wire. The other option is to dip the saw at the expansion joint to make the saw slot at least two inches deeper at the joint. Then when installing the loop wire, ensure that the wire lays all the way at the bottom of the saw slot at the expansion joint.
7. Useable detection height of a loop is 2/3rds of the shortest leg of the loop. Therefore, if you need to detect semi-truck trailers, no side of the loop can be shorter than 6'.
8. The approximate inductance of the loops can be calculated using the formula:

$$L = (P / 4) \times (N + N2)$$

Where: L = Loop Inductance in microhenries (µH)
P = Perimeter of loop in feet
N = Number of turns in the loop

For example, a 6' by 14' loop with 2 turns would be:

$$L = ((6 + 14 + 6 + 14) / 4) \times (2 + 2^2)$$
$$L = (40 / 4) \times (2 + 4)$$
$$L = 10 \times 6$$

Loop Inductance is approximately 60µH.

9. The approximate inductance of the lead-in cable can be calculated using a value of .22 µH per foot for lead-in cable.

   100’ x .22 µH = 22 µH of inductance in 100’ of lead-in cable.

10. The ratio of loop inductance to lead-in inductance should be 2 to 1 for a well-designed installation. Since the vehicle to be detected can only influence the loop inductance, letting the lead-in inductance get close to the loop inductance will effectively lower the sensitivity of the loop. This is usually only an issue when the loop is 50’ or more away from the detector. If you do have a long lead-in, additional turns should be added to the loop until the 2 to 1 ratio is satisfied.

11. The ideal loop inductance is 50 to 500 µH. Although the detector will tune to loops in the range of 20 to 1000 µH, the 20 to 50 range should be avoided to provide a more stable loop and loss of sensitivity due to lead-in inductance. It is always better to have too much inductance than too little.

12. Lead-in wires must be twisted. Ideally, 3 to 6 twists per foot should be maintained. It is also important that the twists are tight. An air gap between the two wires should not exist as this can cause loop stability issues. The lead-in wires should be kept twisted until right before connection to the detector.

13. A figure 8 loop can be used in locations where electrical interference is expected or seen. This is a standard loop with an extra saw cut down the middle of the loop. This extra saw cut should point toward the source of the interference as much as practical. If the source is overhead or below ground (power lines) the saw cut should be parallel to the short side of the loop. The loop wire is placed in the saw cuts using a figure 8 motion. A figure 8 loop will have more inductance that a similar sized conventional loop.

14. If multiple loops are to be connected to the same detector there are several things to be aware of:
    a. Always connect multiple loops in series. This increase the inductance and insures that a loop failure will cause a loop fault at the detector.
    b. The loops connected together **must** be the same size and the same number of turns. Failure to do this will lead to the loops having different sensitivities that cannot be compensated for.
    c. Connecting two loops together will reduce the sensitivity of each loop by half.
    d. If the two loops are within 6’ of each other, the phasing of the loops should be considered. If the loops are on the same side of a gate and are being used to increase the size of the detection zone, the two edges closest to each other should have opposite phasing (North to South). This will increase the sensitivity in the area between the two loops. If the loops are on opposite sides of a gate, the loops should have the same phasing (North to North). This will decrease the sensitivity in the area between the two loops. Especially at the middle point between the two loops, it may be impossible to detect any object in this area. So this phenomenon can be very useful in sliding gate and lift gate installations.