Vanagon Intermittent Wiper Relay #19
Repair and Analysis

The Vanagon Intermittent Wiper Relay #19 (OEM part # 321 955 531 A) is a component of mystery and (sometimes) frustration for a number of Vanagon owners. When Relay #19 finally failed in my 1987 GL (after 32 years of operation, so I honestly have no complaints about its longevity), as an engineer I became curious about the construction, operation, and repair of this component.

Some might feel that the creation of this document is a complete waste of time, as an OEM replacement for Relay #19 is readily available from multiple online vendors. And, I am also aware that there are at least 2 different aftermarket replacement models (Bosch, or KAE) of Relay #19 that offer *adjustable* intermittent wipe time intervals, plus the Passat Relay #99 as a replacement. However, this document is for the curious, and the type of tinkering person, who might be interested in repairing and understanding their existing Relay #19. And, if this document saves even one Vanagon owner some time and grief while troubleshooting a windshield wiper problem, the effort was worth it.

Failure Mode

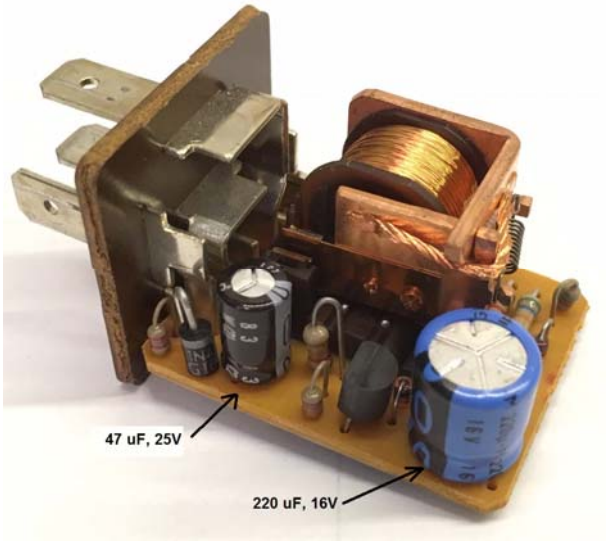
What is the failure I experience with Relay #19? Simply, that when the wiper control lever (the lever on the right side of the steering column) is placed in the "Intermittent" position by pushing the lever down, the wipers simply behave as if you had selected low speed (wiper control lever up one position); the wiper motor runs continuously in slow speed, without the expected "one wipe cycle every 6 seconds".

Construction

Relay #19 is constructed of surprisingly few electronic components: a SPDT relay, one transistor, 3 diodes, 7 resistors, and 2 electrolytic capacitors. Of all these components, only the 2 electrolytic capacitors came to mind as the *likely* failed components in this assembly.

Capacitor Failure

Many millions of electrolytic capacitors, depending on where and when they were produced, can operate continuously for decades without any problems. And also, many millions of electrolytic capacitors, depending on where and when they were produced, have failed prematurely. Thus, electrolytic capacitors have become "the usual suspects" in the failure of any electronic device.



OEM Relay #19 with Cover Removed

Repairing Relay #19 by replacing the Capacitors

If you are handy with a soldering iron and solder, then replacing the two electrolytic capacitors is an easy task. I'd also recommend that you also have some 'desoldering wick' or a 'solder vacuum' to make the job easier.

The two OEM capacitors are as follows:

- 47 uF, 25V, 20%, polarized aluminum electrolytic capacitor. Radial construction (both leads come out of the same end of the case), lead spacing 2.5 mm, case diameter 6.3 mm, case height 12.5 mm.
- 220 uF, 16V, 20%, polarized aluminum electrolytic capacitor. Radial construction, lead spacing 5.0 mm, case diameter 10.0 mm, case height 14.5 mm.

If you live in a city that has a good electronics supply store, you might be able to find replacements for these capacitors, or they can order them for you. Also, you may have a favorite online vendor. Otherwise, the go-to place for electronic components is Digikey Electronics (www.digikey.com). The recommended Digikey part numbers are:

- 1189-2262-ND. 47 uF, 35V, 20%, polarized aluminum electrolytic capacitor. Radial construction, lead spacing 2.5 mm, case diameter 6.3 mm, case height 12.5 mm. Long Life: 10000 Hrs @ 105°C. Wide operating temperature: -40°C ~ 105°C. Rubycon/Japan. $0.28/one; $1.95/ten (plus shipping).
- 1189-1759-ND. 220 uF, 50V, 20%, polarized aluminum electrolytic capacitor. Radial construction, lead spacing 5.0 mm, case diameter 10.0 mm, case height 17.5 mm. Long Life: 10000 Hrs @ 105°C. Wide operating temperature: -40°C ~ 105°C. Rubycon/Japan. $0.51/one; $3.60/ten (plus shipping).

With Digikey, the minimum shipping charge for lightweight parts like these is around $5.00. So, go ahead and order 10 of each type, and repair your friends' Vanagon relays while you are repairing yours!

1. With replacement parts in hand, pop the black plastic cover off of Relay #19, using a couple of small, flat-blade screwdrivers.
2. Make note of the (-) polarization stripe positions of both capacitors (see illustration above); you can use a fine point sharpie to mark the printed circuit board (PCB) if you'd like.
3. Remember that in electronic repair, the PCB is more valuable than the components you are replacing; so don't overheat the PCB, or delamination of the copper traces may occur.
4. Remove the defective capacitors by desoldering, while carefully rocking the capacitor; and/or cutting apart the capacitor.
5. Clean up any excess solder from the PCB with 'desoldering wick' or a 'solder vacuum'.
6. Solder in the new capacitors (again, mind the polarization stripe positions); trim excess lead length.
7. Snap on the black plastic cover, noting that the cover has a groove on the inside for the PCB, and can be installed only one way.

Vanagon Intermittent Wiper Relay #19; Analysis

Please refer to the Bentley Electrical Wiring Diagram page 97.117 [i], and the Vanagon Owner's Manual page 43 [ii] (both attached to this document).

In the upper right of page 97.117, Relay #19 is referred to as "WASH/WIPR INTERMT RLY"; and the "10" indicates that this relay is plugged into socket 10 of the Vanagon's fuse/relay panel (yes, there is a molded number 10 in the fuse/relay panel, it's just very hard to see).

Also, from the upper right of page 97.117, the relay male blade pin numbers are seen, with the mating socket 10 female blade receptacle numbers:

Relay #19 Male Pin Number	Socket #10 Receptacle Number
53S	6
15	3
31	4
T	5
I (definitely 'I' on the relay)	1
53M	2

With ignition switch ON, Circuit 15 and Circuit X (load reduction relay) are both energized. Circuit 15 provides power to the windshield wiper motor internal switch (i.e. the "home position switch"), so the wiper motor continues running to the 'home position' when no other power is provided by the 'wiper control lever' on the right hand side of the steering column.

Terminal 53e on the wiper motor is the common connection of the wiper motor home position switch. When "at home", Terminal 53e on the wiper motor is connected to GND (i.e. frame ground or – battery terminal). When "not at home" (i.e. somewhere in the middle of the wiping motion), Terminal 53e on the wiper motor is connected to +12VDC.

With the wiper control lever in the *Off/O* position, the wiper motor in the home position, and the ignition switch ON (15 & X ON):

- +12VDC from Circuit X, through Fuse 11, to Relay #19 pin 15.
- GND from "home position switch" in the motor, through the *Off/O* lever terminal 53e, out through lever terminal 53, to Relay #19 pin 53S.
- Relay 19 remains deenergized, providing a connection from Relay #19 pin 53M (the low speed winding in the motor) to Relay #19 pin 53S; thus the motor is shorted out to GND.

With the wiper control lever in the *Low Speed/1* position:

- +12VDC from Circuit X, through Fuse 11, to lever terminal 53a, through the Low Speed/1 lever contacts 53, to Relay #19 pin 53S.
- +12VDC continues through deenergized Relay #19 pin 53S to terminal 53M (the low speed winding in the motor); and the motor runs at low speed.
- With the motor running, +12VDC from Circuit 15, travels through Fuse 17, through the wiper motor home position switch, to the lever terminal 53e; but the circuit stops there.

With the wiper control lever in the *High Speed/2* position:

- +12VDC from Circuit X, through Fuse 11, to lever terminal 53a, through the High Speed/2 lever contacts 53b, directly to the high speed winding in the motor.
- Thus, Relay #19 can be unplugged, and high speed will still function (but the wiper motor will not stop at home).

With the wiper control lever initially in the *Low Speed/1* position, and the lever is moved to the *Off/O* position:

- With the motor running, +12VDC from Circuit 15, through Fuse 17, through the wiper motor home position switch, to the lever terminal 53e; through the *Off/O* lever contacts, out lever terminal 53, to Relay #19 pin 53S.
- +12VDC continues through deenergized Relay #19 pin 53S to terminal 53M (the low speed winding in the motor); and the motor continues to run at low speed.
- When the wiper motor home position switch opens, the +12VDC (from Circuit 15, through Fuse 17) is switched off and the motor stops.

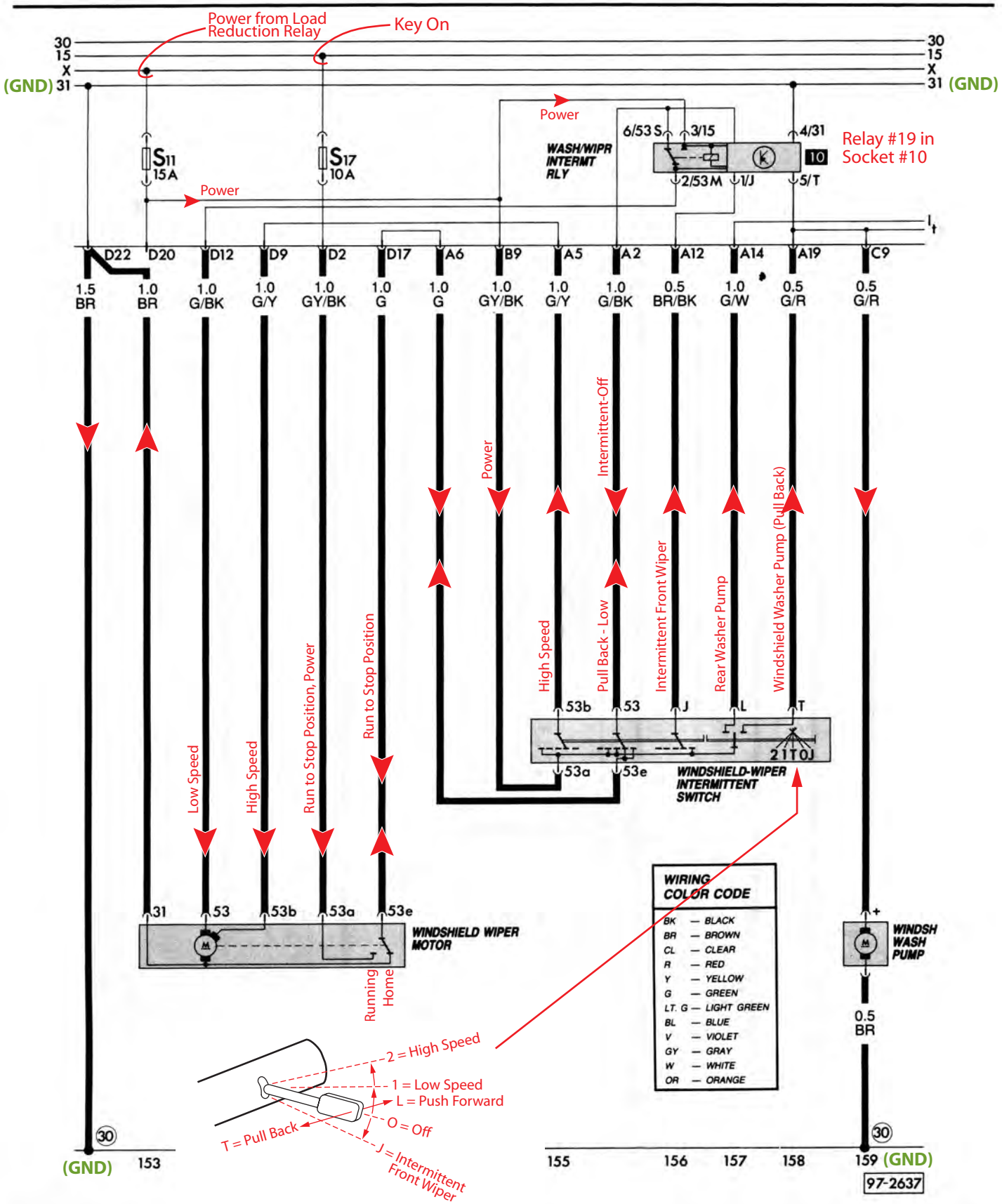
With the wiper control lever in the *Intermittent/J* position:

- +12VDC from Circuit X, through Fuse 11, to Relay #19 pin 15.
- +12VDC from Circuit X, through Fuse 11, to lever terminal 53a, through the *Intermittent/J* lever contacts J, to Relay #19 pin 1.
- Note, through parallel *Intermittent/J* lever terminals 53e & 53, the wiper motor home position switch is connected to Relay #19 pin 53S.
- Relay #19 energizes, connecting Relay #19 pin 15 to pin 53M (the low speed winding in the motor), and the motor runs at low speed.
- With the motor running, +12VDC from Circuit 15, through Fuse 17, through the wiper motor home position switch, through the lever terminals 53e & 53; to Relay #19 pin 53S where Relay 19 circuitry detects the +12VDC signal.
- When the wiper motor home position switch opens, the +12VDC (from Circuit 15, through Fuse 17) is switched off (i.e. switching to GND); the Relay #19 circuitry detects the signal changing from +12VDC to GND through the lever terminals 53e & 53, to Relay #19 pin 53S, where Relay #19 circuitry detects the GND signal. The Relay #19 circuitry then deenergizes Relay #19, stopping the motor.
- Relay #19 circuitry times for approximately 6 seconds, then Relay #19 energizes again; and the above repeats as long as the wiper control lever remains in the *Intermittent/J* position.

[i] Volkswagen Vanagon Repair Manual, Bentley Publishers, Copyright 1991 Volkswagen United States, Inc.

[ii] 1987 Vanagon/Transporter Volkswagen Owner's Manual, Copyright 1996 Volkswagenwerk AG.

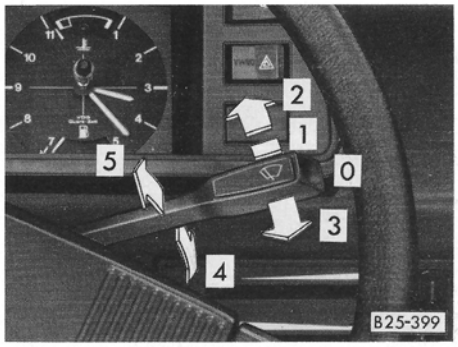
97 Electrical System - Wiring, Waterboxer



97.117 Main wiring diagram Windshield wipers

Water-cooled – Digifant 1987

WINDSHIELD WIPER AND WASHER SWITCH LEVER



The lever on the right side behind the steering wheel is for the windshield wiper and washer. It only works with the ignition on.

Windshield washer

To spray washer fluid on the windshield, pull the lever toward the steering wheel (position 5) from any selected wiping position.

If you pull the lever from the 0-position, washer fluid is sprayed on the windshield and the wipers work. When lever is released, washer stops immediately, but wipers will continue to run several times to dry the windshield.

Windshield wipers

The windshield wipers can be operated at the following speeds:

Lever up to position 1 – low speed
Lever up to position 2 – high speed
Lever down to position 3 – intermittent wiping*

In position 3 the wipers sweep the windshield approximately every six seconds.

Lifting the lever slightly without engaging the first stop allows the wipers to operate for as long as the lever is held in this position. The wipers will stop when the lever is released.

Always loosen blades frozen to glass before operating wipers to prevent damage to the wiping system.

Rear window wiper and washer*

Push lever to position 4 and release – the wiper will operate approx. every six seconds (intermittent wiping).

Push lever to position 4 and hold – both, wiper and washer will operate.

Push lever again to position 4 and release. The wiper stops.

Release lever
– the washer operation stops instantly and wiper stops after two or three sweeps.

Wiper and washer function overrides intermittent wiping. After releasing lever, intermittent wiping continues if previously set.

WARNING

■ Check wiper blades periodically. Worn or dirty blades reduce visibility, making driving hazardous. Loosen blades frozen to glass before operating wipers.

■ Clean all windows, windshield and wiper blades regularly to remove road film and carwash wax buildup. Use an alcohol base cleaning solution and a sponge or soft cloth. Dry glass with a chamois.

■ Avoid running the wiper blades over a dry windshield to prevent scratching the glass. Spray on washer fluid first. A scratched windshield will reduce visibility.

*where applicable