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## *Resistograph S-150 Technical Support Information*

### **An Overview of the Research**

RJM Sales and RJM Contracting, Inc. (often in cooperation with Sears Termite and Pest Control), conducted a series of conclusive tests with the Resistograph. The purpose of these tests were to quantify the ability of the Resistograph technology to consistently locate termite galleries in wood members behind wall coverings. The use of the Resistograph with exposed wood is straight forward and repeatable and therefore not a direct analysis of this test.

As an integral part of these studies, all studs that were probed were first inspected with a moisture meter. The moisture readings were compared to the 'standard' levels of each building as a indicator of 'high' or 'normal' moisture. This preliminary measurement of moisture was used to help 'narrow the field' of inspection into likely problem areas. Additionally, the past history of swarms, previous damage, treatment problems and other such clues were also used in selecting probe locations.

The readings of the Resistograph are highly accurate and repeatable. However, because the probe can only measure a very narrow width of space through a wood member, this research was conducted to quantify the ability of the Resistograph to accurately pinpoint termite galleries. The goal was to find the inspection methods that provide the highest probability of success. The type of research conducted was divided into 2 categories:

#### "100%" Verification of Resistograph Inspection Points:

"100%" Verification was conducted in homes in which the area of interest was to be removed or destroyed. This made it possible to first probe the stud with the Resistograph and later verify the graph readout by cutting through the same area when the wood member was removed from the structure. With this data, the success of a 'positive' or 'negative' reading could be verified conclusively.

#### Maximum Inspection Points per Stud:

In order to also verify the Resistograph on more realistic structures (those not being repaired), nine probes were made for each stud. This process was based on the principle that the more inspection points, the less the probability of inaccurate readings for the entire stud. With this method, any 'positive' readings for termite galleries in a single wood member was used to repute any 'negative' readings in the wood member. Therefore, a reading was deemed 'inaccurate' if a probe location was judged 'negative' if somewhere else in the wood member was a reading of 'positive' (although the probe was accurate in such a case, it was not accurate in locating the termite gallery).

Both methods were used to evaluate the success of different probe locations in relation to the width of the wood members (i.e. center versus left/right of center). Both methods also evaluated different probe locations relative to height (i.e. close to bottom, midpoint, close to top). This helped reduce the probability of missing termite damage that entered the wood member from high rather than low.

## **Interpreting Inspection Results**

To analyze the success of the Resistograph, it is necessary to separate the results of each probe location into 'negative' or 'positive'. 'Negative' readings are graph readouts that show no 'zero' readings - only sound wood or decayed wood. 'Positive' readings are graph readouts that indicate voids (zero graph levels) in the wood.

### **Positive Readings:**

The Resistograph will not 'accidentally' show a void that is not there. If a graph shows a 'zero' drop, it most certainly indicates a void in the wood. However, a void is not necessarily from termites. It could be from other pests, knot holes or drilled holes for electrical cables. Knot holes and drill holes are typically quite distinct because there is only 1 void and not a series of 'peaks and valleys'. Termite damage can be distinguished from other damage by the characteristic up and down of the graph showing the hollowed soft wood, followed by annual rings, and then a void again. The only way to further verify a 'positive' graph readout is to probe nearby areas for a second or third verification of the same results. A second or third readout will all but eliminate any 'misreads' by an untrained operator.

### **Negative Readings:**

The highest risk of misinterpreting Resistograph results is a single 'negative' reading. Because the probe needle is so small, it can only provide a reading for a narrow band within the wood member. Therefore, a single 'negative' reading could simply be 'just to the side' of a gallery. The more readings taken in 1 wood member, the higher the probability of successfully determining that there are no termites in the member. The number of readings you should take on 1 wood member will depend on the level of confidence you need for each site.

The first consideration for 'negative' readings should be the moisture level compared to other moisture levels within the same structure. If the surrounding area has high moisture levels (indicating likely active termite activity), a 'negative' reading should be confirmed with as many as 8 more readings in the same stud. These 9 total probe locations should be in sets of 3 on the same level - 1 set at the base of the stud, 1 set at the midpoint of the stud, and 1 set at the top of the stud. After 1 or 2 'positive' readings, there may be little need to continue with the remaining probes in that stud.

However, there are also situations in which evaluations of areas without high moisture levels may also be necessary. For instance, it may be desired to find old damage in an area with constant retreats (in order to locate the original damage and hence the actual entry point for the termites). A company may also need to confirm where old damage exists as part of repair estimates on damage claims. However, it is not recommended to use the Resistograph to quantify the extent of damage to a wood member. It should be used to identify the existence of damage, not the degree of damage.

When evaluating an area with normal moisture levels for ‘old damage’, the number of probe locations should depend on the degree of concern. A cursory inspection as part of a sales evaluation may only probe 1-3 points at the base of a stud. However, on a retreat, areas around high moisture levels may require 3-9 probes in order to increase the confidence that termites are unlikely to occur in a wood member.

In field tests using 100% verification, there were no situations in which 9 negative probe readings were made and termites were later found in that wood member. It is certainly conceivable that this can occur in the real world. Therefore, the Resistograph should not be perceived as a magical replacement of common sense, detailed training, and the use of all investigative tools.

### **Verifying Live Termites in a Wood Member:**

It is impossible to say that the inability to find ‘live’ termites inside termite galleries is an indication that the wood has no live termites. However, the Resistograph, moisture meter, and small (less than 1/4") Borescope were used in conjunction during testing of the Resistograph. For the most part, only areas showing high moisture content (relative to other areas within the same structure) were selected for holes (less than 1/4") and a Borescope inspection. This process can be used successfully to find termites but it should not be used as conclusive evidence of the LACK of termites - only the existence of termites.

In this study, live termites were positively identified inside over 95% of the wood members selected for detailed Borescope inspections of areas identified with both the moisture meter (comparatively high levels) and the Resistograph (to locate actual termite galleries). Without the Resistograph, drilling and inspecting inside wood members is an exercise in futility and unnecessary wall damage.

## **Recommended Inspection Methods**

### **Finding Active Termite Galleries (damage in areas with high moisture readings):**

Reasons: To pinpoint the most precise treatment methods  
To evaluate success of treatments  
To assist in the sales process to a new client

Methods: Start with moisture meter readings throughout the structure to locate areas with higher than normal readings. Use this information and other inspection details such as past history, past treatments, swarm locations, and other clues to identify key areas. Use a Zircon Stud Finder to locate the center of the wood member. Probe with the Resistograph as close to the bottom of wood member as possible as well as 1 location at the top of the member. If more accuracy is necessary, 1 additional probe on each side of these first two holes will increase the probability of accuracy. Once a termite gallery is located with the Resistograph, note the depth of the damage on the graph paper.

High moisture levels and the presence of galleries should be sufficient evidence of active termites. However, for further proof of activity, drill a hole large

enough for a small Borescope (available with less than 1/4" shafts). Necessary treatments can then be made through the same hole.

### **Finding Inactive Termite Galleries (old damage without high moisture readings):**

Reasons: Reduce costs of damage claims by only repairing areas with actual damage  
To assist in the sales process to a new client  
Verifying the reduction or elimination of termites from infested wood  
Investigating solutions to re-treatment problems

Methods: Inactive galleries can be critical to measure the reduction of termites in an area. It can also be helpful in creating a 3D view of the structure in regard to all current and previous damage. The first measurement should be with a moisture meter to compare the area to 'normal' readings within the same structure. Higher than normal readings may be a possible indication of termite activity or recent activity in the wood.

The most efficient method to use the Resistograph is to probe 1 center location at the base of the stud and 1 in the center at the top of the stud. 3 probe locations (side-by-side) at the base of the stud and 3 at the top will be far more accurate.

### **Researchers Involved with This Project:**

Lead Field Researcher: Ray Meyers, RJM Sales, 1-407-330-0035, vespidae@msn.com  
Field Researcher: Troy Perry, B&G Equipment Company, 1-800-544-8811 ext. 130, tperry@bgequip.com  
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Cooperation: With many thanks for direction and field locations assistance from Dr Phil Nichols with Sears Termite and P.C.; and Michael Beckers with Wilson & Schmidt Insurance Co.

## **Research Data**

### **Overall Success - 100% Verification Analysis:**

Over 15 houses were inspected with the Resistograph using the "100%" Verification Analysis in which the wood members were probed (before removal) for verification. The total wood members inspected were >200 and the total number of probe inspections taken were over >1000. Each probe location was determined to be 'positive' if termite gallery evidence was found in the graph readout, and 'negative' if the graph readout was found to be sound or otherwise.

After each probe location was determined either 'positive' or 'negative', the wood members were removed from the wall voids and cut through the center of the probe location. This verified the existence of termite galleries for each inspection point. Based on the success rate from this >99% Verification of both 'positive' and 'negative' readings, the Resistograph delivers an accuracy reading that varies somewhat for different probe locations on the wood members. The location is the single most important factor dictating the success of each probe inspection.

Probe locations that are at the base of a stud in a wall will provide >99% accuracy. This can vary depending on whether the probe is taken from the center of the stud >99% or from either

side of center >99%. Any bottom locations within a stud will not provide >99% accuracy because even subterranean termites can also attack a wall stud from the top of a wall.

Probe locations that are in the center of the stud in a wall will provide >97% accuracy. This also can vary depending on whether the probe is taken from the center of the stud 97% or from either side of center >97%. Center locations are less likely to provide >97% accuracy than bottom locations since subterranean termites most often enter a wood member from either the top or the bottom and may not reach the center.

Probe locations that are at the top of a stud are the least likely to provide “100%” results when taken by themselves. They provide >95% accuracy overall.

When combining all probe locations (bottom, center, and top) on a stud, the probability that at least 1 location would provide a ‘positive’ reading if the stud had termites was 90%. This demonstrates the ability of the Resistograph to find termites with confidence - depending on the time spent evaluating each wood member. The more locations probed, the more accurate the response.

A more practical inspection technique would be to combine just the top locations and the bottom locations. This method would provide >97% accuracy overall. If only the center (top and bottom) locations were used for probe analysis, the accuracy would be >97%.

### **Overall Success - Maximum Inspection Points per Stud Analysis:**

Because it is more common to inspect a home that is not being repaired or demolished, the Resistograph was evaluated on such homes as well. In order to increase the odds of finding a ‘positive’ result in infested studs, all studs of interest were drilled three times at the bottom (center and left/right of center), three times in center of stud, and three times in top of stud. Based on the “100%” Verification process, this technique will provide >97% accuracy for finding termite galleries.

This process was used on 2 houses and over 60 wood members.

This method of analysis was instituted into the process in order to further evaluate the success of probe locations in the center versus either side of center on the wood member. This set of data further supports the “100%” Verification Analysis methods.

Data for center of stud (bottom) location

Right and left of center (bottom) location

Center of stud (center) location

Right and left of center (center) location

Center of stud (top) location

Right and left of center (top) location