IT'S EITHER A MICRO SWITCH BASIC OR IT'S NOT

Competitive Comparison

Honeywell

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MICRO SWITCH (a division of Honeywell) designed the first snap-action switch in 1932. At that time, the world was introduced to the first large basic switch in history.

By Darryl Ballard, Honeywell Application Engineer

INTRODUCTION

Since that initial design, MICRO SWITCH has continued to revise, improve, and expand the design of their electromechanical switches through design innovations, new materials, and continued enhancements to both processes and process control.

Similarly, during this same general time frame of the snap-switch introduction, the invention of center-pivot irrigation occurred. This revolutionary method of irrigation greatly improved water distribution to agriculture fields to enhance crop yields. And over the coming decades, this technology has also been refined and enhanced to ultimately become a standard within the agricultural community.

With two industry standards firmly established in their respective fields, it was only a matter of time before the precise and repeatable controls of a MICRO SWITCH large basic switch were incorporated into multiple variations of a center-pivot machine. Together, these two technologies have grown and evolved over the years to address complex application challenges and meet the growing demands of agricultural professionals for longer service times while maintaining precise controls.

From similar beginnings, these entities have collectively addressed specific application challenges, and ultimately withstood the test of time. Now, with each technology quickly approaching the 100-year milestone, both have strengthened and grown as customer expectations and application needs have evolved. And today, both are considered industry standards for safe, reliable, and dependable service.

Becoming an industrial standard is certainly something every company strives to accomplish. And once achieved, they can not rest as competitors suggest claims of equal or better performance at a more economical price point. Since 1932, the MICRO SWITCH products have encountered many competitors. And while the competitive landscape is constantly changing, competitors to Honeywell basic switches continue to utilize the same two approaches they've used for decades... 1) simply attempt to replicate the Honeywell design with claims of equal performance at a lower cost, or 2) revert to a standard switch design and attempt to convince a customer their

product is sufficient for the application. Both approaches miss key advantages of the Honeywell products, and both can potentially lead to higher costs of quality through repair/replace programs, lower customer satisfaction, and ultimately jeopardize the high-performance standards a company has worked so hard to achieve.

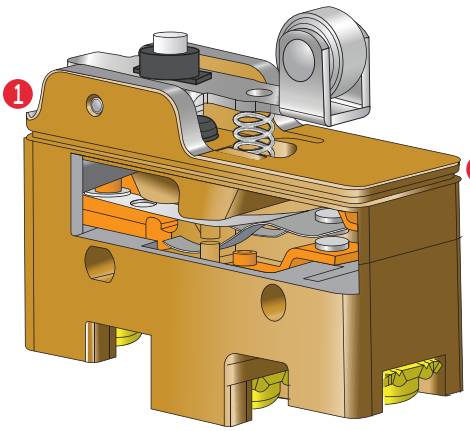
Within the center-pivot irrigation sector, competitors have continually attempted to unseat the MICRO SWITCH BZ switch that has provided decades of reliable service. In these instances, the competitors assert they look the same and/or a standard offering will be sufficient in the target application. But it doesn't take long to discover that these are deceiving. The competitive switches lack the attention to detail and technical insight the designers of the MICRO SWITCH have placed into every single component and assembly. Materials used within each specific component have unique functionality that contributes to the overall performance of the Honeywell switch. And our engineering know how – based on almost 100 years of switch engineering expertise – have kept our switches accurate, repeatable, reliable, and one of the most rugged in the industry. Something we've proven our competitors can't match.

Figure 1. MICRO SWITCH BZ Series Basic Switch

Figure 2. SUNS Competitive Switch

Figure 3. Eaton Competitive Switch

At first glance, the switch photos captured in Figures 1 to 3 appear to share many of the same features. They all have the same general shape, each employ a short roller lever with a set-screw to allow for operation position manipulation, and each appear to provide the same electrical rating with similar agency approvals. So, they must be the same. Right? No! In fact, the two competitive designs don't come close to the MICRO SWITCH design. And to prove this, Honeywell test engineers took a deep dive into both competitive offerings and have provided the following summary of their findings as it relates to both external (what can be seen) and internal (what can't be seen) elements of the switches.



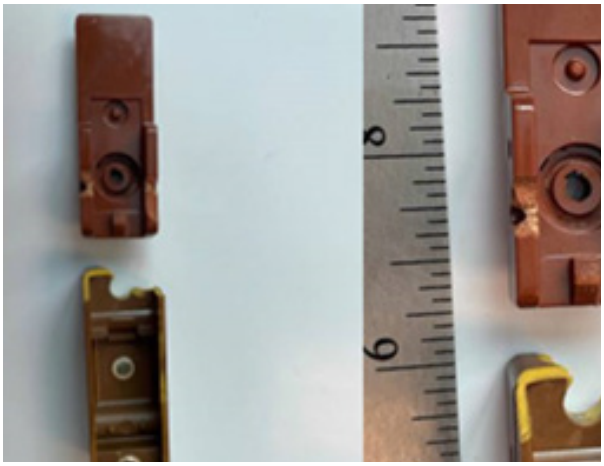
1 Switch case and cover components are made from a special formulated thermoset phenolic material to combat the negative impact of temperature and humidity to ensure dimensional stability and provide accurate/repeatable characteristics

EXTERNAL: HOUSING (CASE AND COVER) CONSTRUCTION

From the outside, the MICRO SWITCH BZ switch and the competitive offerings often share similar colors, or even similar design elements. One could even assume they are constructed with the same materials and same precise functionality. But that is not the case. The Honeywell switch design can be configured from several different phenolic materials to provide the best performance under specific application parameters. The competitor's switch cannot match this.

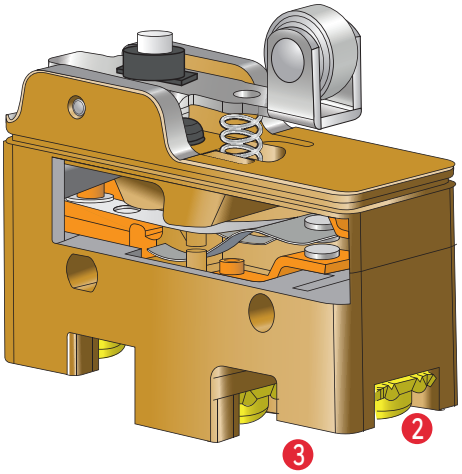
For demanding irrigation applications, the Honeywell switch is designed with a unique phenolic that is specially formulated to maintain dimensional stability under high humidity and temperature conditions. Consider the comparative photo below – the SUNS switch is on the top, and the Honeywell BZ is on the bottom. Our engineers broke the case and cover components of the switch intentionally to show the composition of each molded part. The difference in color (going from a rust-brown to a yellowish tone) provides evidence that Honeywell performs a post-bake operation to drive out phenolic gases. This process, widely known within the thermoset molding community as "normalizing", is a standard practice in order to yield the most dimensionally stable components. Based on the visual analysis of the competitive component, their phenolic appeared to maintain a solid color throughout. This is an indication the component wasn't post baked. Consequently, and based on standard molding practices, components that haven't been normalized would not be as dimensionally stable under elevated humidity and temperature conditions that are typically present within a center-pivot irrigation application, without the added normalization process. As a result, this could lead to variation within switch characteristics, and ultimately, variation within the application itself.

Figure 4. Comparison of Phenolic Components – MICRO SWITCH vs. SUNS



OUR TAKEAWAY...

- All phenolics, and molding processes, are not created equal. Not only does Honeywell offer several different phenolics specially formulated for specific application challenges, but we also have the insight and process knowledge to apply precise post bake time/temperature sequences to make the industry's most dimensionally stable phenolic components.



2 Terminal screws employing Termi-Lox® lock-washers ensure all electrical connections remain secure while absorbing high levels of shock and vibration

3 Rugged switch case design stops electrical connections from rotating and prohibits the possibility of 'daisy-chaining' multiple switches together to over-ride safety requirements

EXTERNAL: HOUSING AND TERMINAL DESIGN

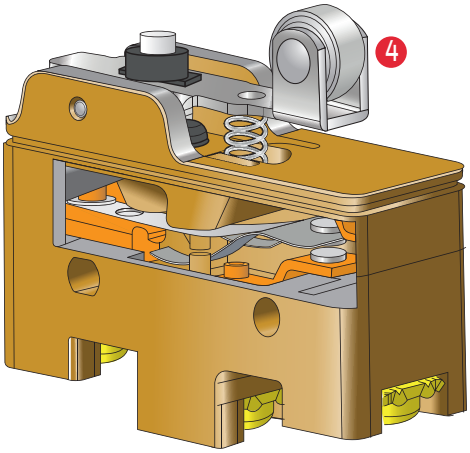
Each of the competitive switches being examined as part of this evaluation seem to have duplicated the Honeywell switch housing geometry and termination style. Each switch appears to offer similar molded case geometry that prohibits 'daisy-chaining' multiple switches together to over-ride safety requirements. Additionally, each switch design employs a pressure-plate and terminal screw in each terminal location to maximize the hold force on wire connections. MICRO SWITCH originally utilized this design element to combat the excessive shock and vibrations often present in a center-pivot irrigation application.

But a closer look at the Eaton switch shows the size of the over-molded case inserts is significantly smaller when compared to the Honeywell MICRO SWITCH design. In fact, the flange diameter employed by the Eaton switch was measured to be 30% smaller in diameter. Within a controlled application environment, this insert size discrepancy may not be an issue. But in a 'real-world' application, such as center-pivot irrigation systems with exposure to a combination of moisture, heat, and potential chemicals that can create and accelerate corrosion, a larger size of over-molded inserts, such as those employed by the MICRO SWITCH product can aid the switch in sustaining the electrical connection and maintaining continuity throughout the application life of the switch.

Figure 5. Comparison of Insert Size – MICRO SWITCH vs. Eaton

OUR TAKEAWAY...

- The Honeywell design of over-molded case inserts maintain a larger flange diameter when compared to similar competitive switches. The larger inserts provide increased surface area effectively promoting and maintaining electrical continuity better than the competition.



4 Robust stainless steel lever design employing sintered steel roller, integral bracket, and heavy-duty return spring for long life and accurate repeatable characteristics

EXTERNAL: LEVER DESIGN AND OPERATING POSITION

Switches featuring the Honeywell special actuating lever design provide the customer with the ability to adjust each switch to a specific operating position – effectively customizing the switch to each installation. This design feature was developed by Honeywell engineers over 30 years ago and further enhanced a product portfolio that was already class leading in adjustability, accuracy, and repeatability. The Honeywell design incorporates a tightly controlled molded plastic nut mated with an exact thread-forming set-screw to yield the most precise, repeatable, and customizable operating position. The Honeywell design also gives the customer the ability to customize each switch, and possibly most importantly, the operating position stays where it's adjusted for accurate and repeatable characteristics. Based on Honeywell's internal testing, the SUNS competitive offering was often difficult to set, and in many instances, was not repeatable – with an interface that was loose and variable. In the case of the Eaton switch, we found units where the integrity of set screw assembled into the nut was not aligned correctly. This also led to variability with switch operating position from actuation-to-actuation.

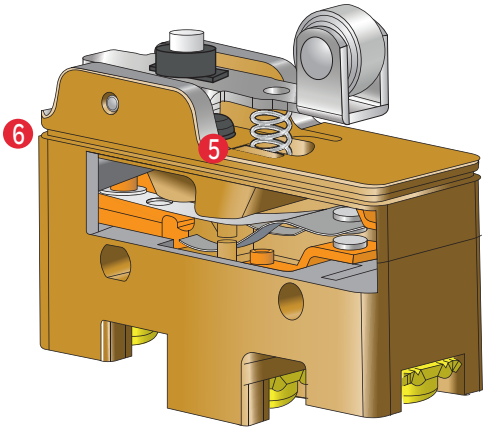
Why is this important? Within the center-pivot irrigation applications, assemblers, dealers, and operators want to achieve a predictable result. In other words, a quarter turn of the set-screw will yield the same amount of operating position change each and every time. This leads to more predictable and quicker installs and field adjustments. If screw misalignment within the plastic nut is present, the interface with the plunger becomes variable during each actuation of the switch. This increases the odds of machines running out of alignment within the designated areas of irrigation.

Simply put, the integrity of the Honeywell switch build is unmatched. MICRO SWITCH products are not compromised with misalignment. Our manufacturing processes yield consistent switches with predictable operating position adjustment ranges.

Figure 6. Example of Set Screw Misalignment Within the Eaton Switch

OUR TAKEAWAY...

- When assemblers, installers, and end users adjust the switch to a "custom operating position" within a target application, the set point needs to remain set and be repeatable. The competitor's switches that were evaluated were more difficult to set and often not repeatable. Honeywell switches do not have this variability in the interface of set screw to plunger and provide a more robust switching product.



5 Elastomer plunger seal provides splash and dust resistance while also providing excellent resistance to chemicals commonly found within agriculture and irrigation applications

6 Epoxy sealant applied to cover/case junction to provide splash and dust resistance

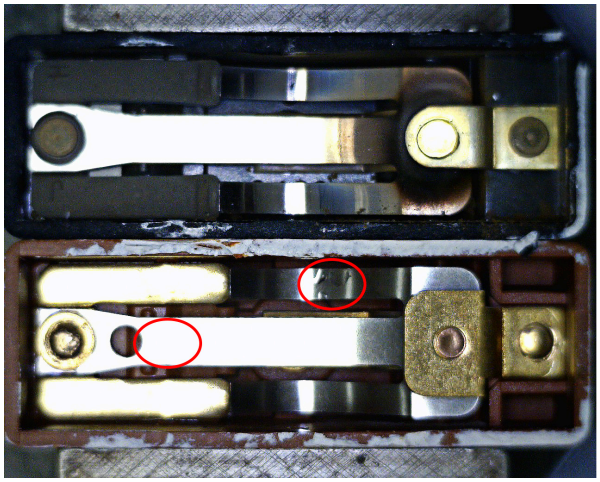
EXTERNAL: SEALING

For splash and water resistance, the MICRO SWITCH BZ switch design combines a cover-to-case seal using a unique epoxy mixture with an elastomer plunger seal that keeps the internal components dry and functioning optimally. As with our wide range of phenolic materials, we offer multiple elastomer plunger seal materials to provide the best switch performance based on application parameters. Within the center-pivot irrigation market segment, the switch is not only exposed to water, but is often subjected to fertilizers, ammonia nitrate, and other chemical solutions. If these corrosive elements are allowed to enter the switch body, either in liquid or gas/vapor form, they will attack an internal snap spring made from standard material and compromise the integrity of the overall internal mechanism – meaning switch failure. And that translates into field repairs, downtime, and unexpected costs. Our competitors claim to use the same sealing materials and methods as the Honeywell switch. But when side-by-side testing is conducted, the results are very different. After subjecting switches to a rigorous electrical life test, our engineers performed submersion tests using standard IP67 criteria of submersion in 1 meter of water for a duration of 30 minutes, comparing the MICRO SWITCH BZ product and the SUNS offering. Upon conclusion of the evaluation, each switch was opened and examined. There was moisture inside the competitor's switch, while the Honeywell switch was dry. And based on the results, there is a distinct difference between competitive materials and processes verses the Honeywell product.

OUR TAKEAWAY...

- While competitors claim to offer the same thing as the Honeywell switch, this is rarely the case... either in materials or in the process controls necessary to ensure a product that is truly splash and dust resistant. Honeywell offers multiple seal materials and a unique epoxy mixture to provide the absolute best possible seal to address a multitude of application challenges.

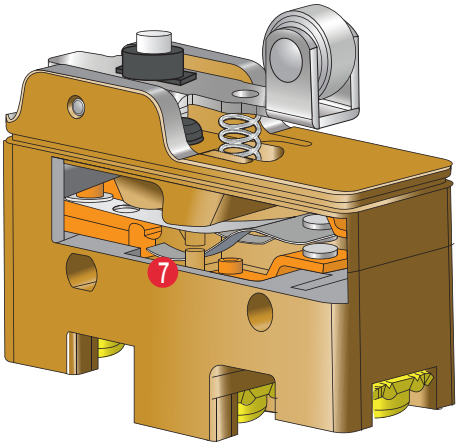
Figure 7. Moisture Ingress: Honeywell vs SUNS



Honeywell

SUNS

Water present in circled areas



7 Special alloy snap spring material provides extra long life and Protects against the corrosive agriculture environments while allowing full agency coverage up to 15 A

INTERNAL: SNAP SPRING

At the heart of every electromechanical basic switch is the snap spring. Without it, the product simply doesn't work. But just like selecting the correct phenolic, or elastomer seal material, to address a specific application challenge, there is nothing more important to a functioning basic switch than to select the correct snap spring material. The spring controls the amount of electricity the switch can confidently control, dictates the characteristics the switch will exhibit, and ultimately determines how successful the entire switch assembly will be in a specific application. Even when all the correct decisions are made about the external features of a switch, the wrong internal snap spring design/material can lead to early failures. The center-pivot irrigation application demonstrates the critical nature of the snap spring within a basic switch package.

During the 1970s, the MICRO SWITCH BZ switches began to encounter premature failures within several center-pivot irrigation applications – causing the directional controls of the irrigation system to veer off course! This not only created a performance issue, but also a safety issue. Honeywell engineering teamed with center-pivot irrigation engineers and the farmers to determine the root cause of the issue. It was determined that farmers had begun incorporating highly soluble ammonia nitrate into their irrigation activities for better crop yield. In turn, the ammonia nitrate attacked the standard internal snap spring material used by the electromechanical switches and ultimately led to spring fractures and premature product failures. Fueled by the need to overcome this problem, Honeywell engineers developed a new spring material that would maintain the conductivity of the standard spring material to maintain the 15-ampere electrical rating, while also providing corrosion resistance that would allow the farmers to continue to utilize the center-pivot irrigation systems to deliver ammonia nitrate to their crops.

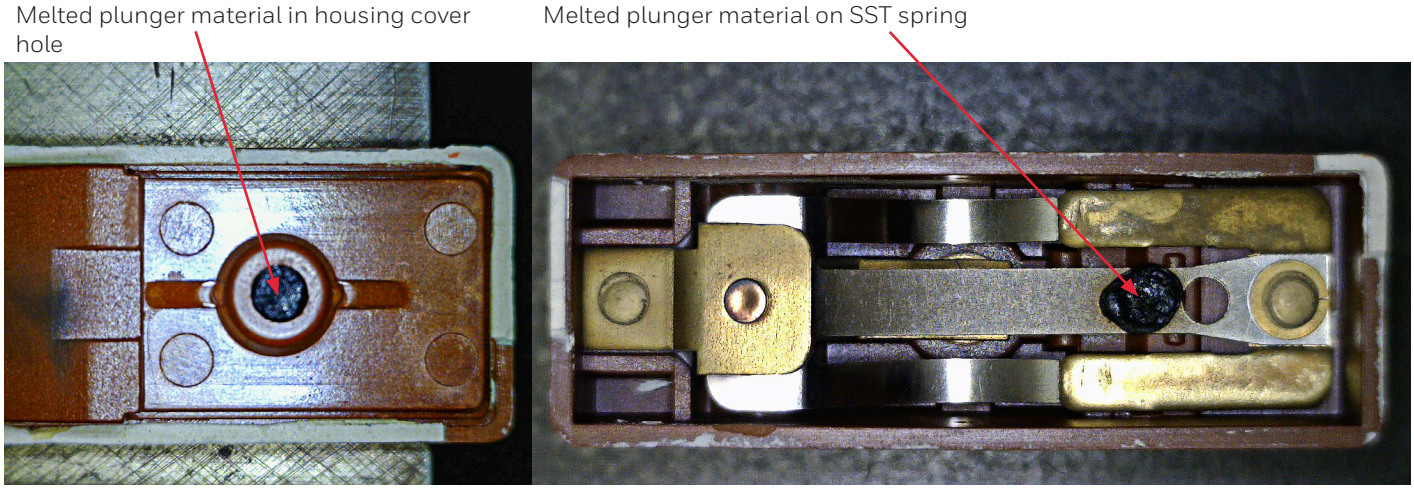
Now, almost 50 years later, competitors of the Honeywell MICRO SWITCH product have yet to replicate the results that Honeywell products continue to deliver to its customers. Is the solution simply too expensive, too cumbersome and difficult to implement, or too hard to consistently control the processes to make it a viable offering? While we won't attempt to answer those questions, what we have consistently seen is our competitors continue to use the same tired approach of providing something that looks similar to the MICRO SWITCH product or try to convince the customer there's no need for the specialized Honeywell switch in their application, and their standard product, with a much lower price point, will be sufficient. When using either strategy, the only consistent thing competitors can bring to the table is being consistently wrong.

OUR TAKEAWAY...

- Honeywell's specially designed snap spring, originally designed almost 50 years ago for center-pivot irrigation applications, remains unmatched by competition. This spring achieves similar conductivity levels previously achieved only by standard materials, which keeps the internal temperatures of the switch cooler allowing for longer life with stable, accurate, and repeatable characteristics over the life of the switch. The special material also provides the highest level of corrosion protection – effectively providing performance on par with standard switch designs without sacrificing critical requirements of the center-pivot irrigation market.

During this competitive evaluation, we discovered Eaton's spring material is the standard spring material that Honeywell introduced in 1932 with our very first switch. They work to convince the center-pivot irrigation customer the standard product is acceptable. The SUNS product takes the other approach and provides a switch with a spring material that appears similar to the Honeywell solution. But it also falls short. While the spring would provide protection against corrosion, the spring design is inherently flawed. It is far less conductive than a spring made from standard material, yet, unlike the Honeywell offering, it doesn't do anything to address this shortcoming. As a result, heat dissipation will be an issue. Some would argue that center-pivot irrigation systems do not subject the switch to the full electrical load of 15 amperes. And while this may be true in most instances, the same engineering principles continue to apply. As electricity flows, heat is created. And without a means of efficiently dissipating heat over time, any electromechanical switch will succumb to the negative impact of the internal heat build-up – including loss of spring force, unstable and variable characteristics, sticking/welding contacts, and ultimately premature failure. And in extreme instances, the heat build-up can be so intense, internal components can begin to melt. As we experienced when subjecting the SUNS switch to 15 A during endurance testing.

Figure 8. Post Endurance Testing: SUNS Switch – Melted Plunger



PERFORMANCE: ENDURANCE TESTING

In the Honeywell test lab, endurance testing was performed comparing the MICRO SWITCH BZ switch with the offering from SUNS using the full electrical load of 15 A, 250 Vac. The offering from Eaton wasn't included in this head-to-head evaluation because the design elements of the switch were simply a standard basic switch design.

TABLE 1. TEST #1 RESULTS

Manu.	Listing	Sample	Average Cycles Completed
Suns	Z-15GW22A-55SS-P3-US	1	49,045
Honeywell	BZ-3RW8995516-PCS-S	1	193,215

TABLE 2. TEST #2 RESULTS

Manu.	Listing	Sample	Average Cycles Completed
Suns	Z-15GW22A-55SS-P3-US (B)	2	55,780
Honeywell	BZ-7RW82132T-S	2	254,729

In Test #1, based on average cycle counts to make or break full-rated load, the Honeywell BZ switch exhibited 3.6 times longer life as there was extreme heat build-up in the competitive switch (see Figure 8). The Honeywell switch averaged 193,215 completed cycles as compared with the competitor's 49,045 cycles. During Test #2, based on average cycle counts to make or break full-rated load, again the Honeywell switch demonstrated a significantly longer life: 5.9 times the competitor's switch. The Honeywell BZ averaged 254,729 cycles compared to the competitor's 55,780 cycles at full-rated load.

OUR TAKEAWAY...

- Regardless of stated claims, differences in materials, or outcomes of isolated comparisons, the quality of any electromechanical switch can be best determined by how the switch performs under the rated electrical load, i.e., electrical endurance. And in laboratory testing, the Honeywell MICRO SWITCH BZ switch out-performed the competition by a wide margin. At best, our tests showed that it requires 3 to 4 competitive switches to equal the life of one MICRO SWITCH large basic switch. And when you add Honeywell service and support teams ready to assist night or day to the most capable switch in the industry, the value of the Honeywell switch is obvious.

⚠ WARNING
PERSONAL INJURY

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.

Failure to comply with these instructions could result in death or serious injury.

⚠ WARNING
MISUSE OF DOCUMENTATION

- The information presented in this comparison is for reference only. Do not use this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

Failure to comply with these instructions could result in death or serious injury.

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