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*Gauging and Measuring in ANSI/NEMA C29 Standards*

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## Background and Introduction

C29 standards regularly reference the use of gauges for measurement with no instructions on how to properly use them. For example, C29.7 and C29.2B both require gauges for use in measuring metal fittings but leave it up to the manufacturer to know how to use the gauge. If the gauges are not used properly, a nonconforming product may pass assessment or, conversely, a conforming product may be rejected.

Beyond the use of gauges, C29 standards have a high number of tolerances and dimension specifications and, similarly to gauges, no instructions or guidance on how to perform the measurements. For example, C29.7 and C29.9 both have specifications for tapped holes with no instructions on how to verify these. There are also requirements for alignment of the end fittings on station post insulators, but no instructions on how to measure them.

When gauges are not used properly, and measurements not performed consistently throughout the industry, product interchangeability is difficult to achieve. With a range of different ways to perform measurements that could yield slightly different but material outputs, there is a need for guidance on acceptable ways to determine conformance for specific measurement applications.

This paper includes a list of different gauges and what they are used for: thread gauge, yoke gauge, ball gauge, GO/NO-GO, socket gauge, and pin gauge. It also recommends a general level of accuracy for compliance by the insulator parts and components being measured.

This paper is structured so that the reader can readily identify which gauges and associated techniques correspond to which C29 standards. Figures for all referenced C29 standards are located in Annex 1 (C29.2B) and Annex 2 (C29.7). The standards can be downloaded at <https://www.nema.org/standards>.

## Through Holes and Slots on Insulators: All Applicable C29 Standards

Mounting holes on post and station post insulators provide the critical function of ensuring proper alignment and strength for the support of energized equipment. As such, sizing and proper spacing are crucial for proper assembly and long-term durability. All holes have dimensions and tolerances and therefore need to be verified against the proper drawing. To accomplish this task, a simple pin gauge or a set of calipers to a complex GO/NO-GO gauge can be used to verify if the hole is correct in size, configuration, and location.

Mounting through holes are defined on the manufacturer's drawings, which provide the proper diameter to mate with appropriate hardware. Tolerances should be included with these hole or slot dimensions because of the need to ensure clearance for the hardware as well as spacing between mounting studs/holes. It is important to use the proper measuring tools within a certified quality program to verify proper product fitment.

When measuring the hole diameter or the maximum width of the hole, the proper use of calipers is required. This can be expanded to the measuring of slots as well. To properly measure a hole, the inner dimension jaws (see Figures 1-3 below) must be used. These need to be placed in the hole with slight pressure placed on the finger hook or roller in the direction of increasing pressure on the part being measured. As this pressure is applied, the edges of the inner dimension jaws should naturally end up at opposite quadrant points on the circle of the hole. The measurement at this point should be the maximum hole diameter.