Innovation in Simplicity

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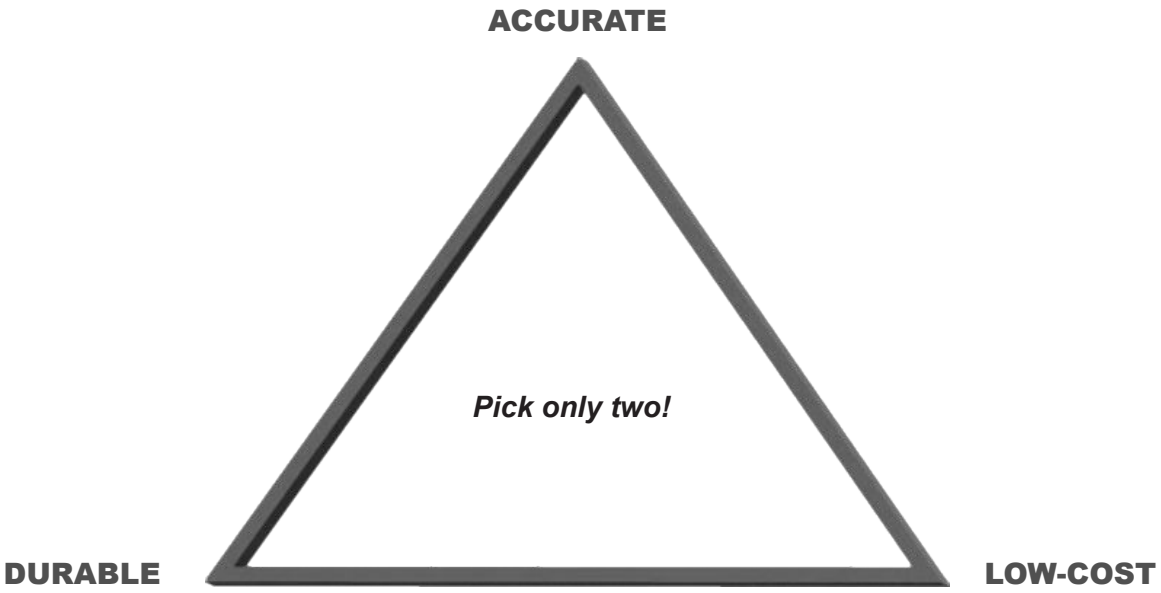
The Unattainable Triangle of Load Cell Manufacturing

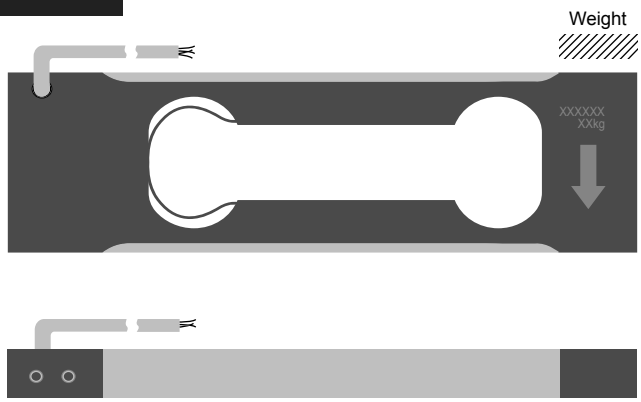
In business, there is an age-old golden paradigm called the '*unattainable triangle*'. Some variation of cost, speed, and quality; you can pick 2 of these but do not expect to have a product that delivers all three.



In the weighing industry, speed is generally constant and depends on a company's manufacturing capacity. A more fitting '*unattainable triangle*' might be one between accurate, resilient, and low cost. When buying load cells, you can get accurate and resilient, but it probably won't be low cost. You can get low-cost and resilient, but it'll be inaccurate. And around the triangle we go. Well, occasionally, there is a load cell that meets the rare trifecta of all three: accurate, resilient, and low-cost. Developed originally at the start of our company's history as one of our defining flagship load cells, the 108AA has persisted through these decades as a favorite in delivering performance.

Diagram of Model 1004

Normal State



Overloaded

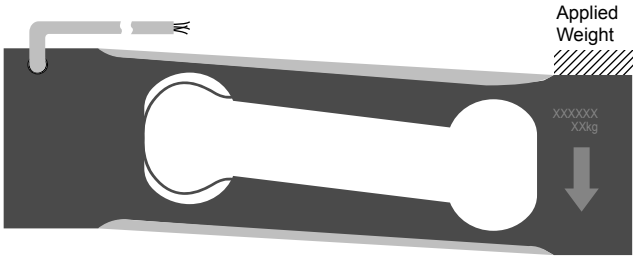
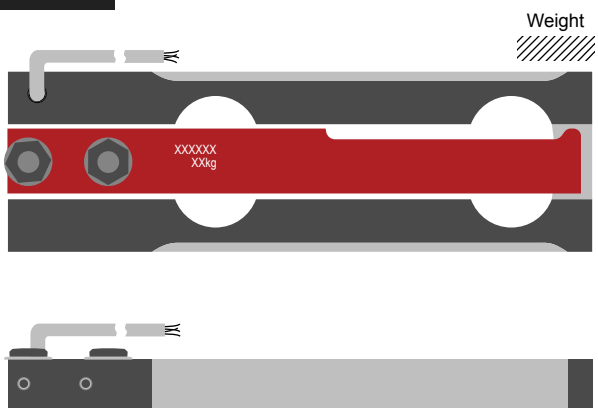


Diagram of Model 108AA

Normal State



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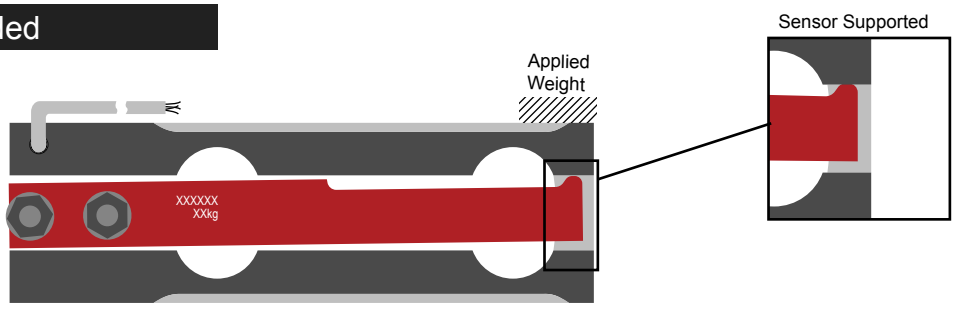

In the 90s and early 2000s, the HBM SPL/Vishay Tedea-Huntleigh 1004 single point load cells were dominant in the market in high-accuracy, lower-capacity weighing. This design had innate limitations due to the top & bottom only four-hole mounting design, two mounting holes at the "live end" and two at the "dead end" for mounting, all with M3 metric thread. It was easy for less-experienced end-users to over torque the bolts and damage the thread. This was simple to fix, the M3 threads were replaced with M4 in the 108AA prototype. Another issue was with the standard model's length. At 110mm (4.3 in), the SPL/1004 could not fit into smaller envelope cavities that some applications required. The length also meant that this design was more prone to overloading, due to the short distance between the mounting holes (approximately two strain gauges' distance apart). With these load cells often only having capacities of a few hundred grams, it was all too easy to overload this load cell.

Model	S/N	Linearity %FS	Repeatability %FS	Hysteresis %FS	Creep mV/V	Creep Return mV/V
108AA-500g	1217022357	0.001	0.003	0.001	-0.00002	-0.00003
	1217022296	0.005	0.006	-0.006	-0.00007	-0.00005
	1217022297	0.004	0.004	0.006	-0.00019	-0.00018
	1217022336	0.002	0.002	-0.003	-0.00007	-0.00005
	1217022345	0.003	0.004	-0.005	-0.00012	-0.00015

Table of the 108AA-500g load cell model calibration

So, the "live end" mounting was changed from top bolt hole mounting to front end bolt mounting, to keep total length of the load cell to a minimum and to further strengthen the natural overloading capacity of a stouter design. The final design came down to 92mm in length. A horizontal steel plate was added to the design as compression and uplift overload stop, since end-users sometimes accidentally lift the platform and inadvertently damage the load cell. Now instead of any over capacity loading being exerted directly onto the sensing section consisting of the strain gages, the steel plate mechanically limits applied loads above a "safe load" capacity, keeping the solution technologically simple while still delivering consistent results. When it came to costs, this 108AA design held costs within a 25% increase from what it most likely cost to manufacture the SPL/1004 design. The added cost was made up in longevity and endurance.

After receiving a recent inquiry for a 400g x 0.1g resolution load cell, we tested some of our 500g capacity 108AA single point load cells from off the shelf to see if we can send some sample units that would meet this customer's performance target. The results affirmed what we believed and with a superior design and a comprehensive dedication to the workmanship of every load cell, we can consistently deliver sustainable performance. Better yet, due to the nature of this load cell design and application intent, being able to inherently combat overloading and uplift challenges opposed to other traditional methods, it simply works better too. Of course, these results were achieved in our testing laboratories under optimal conditions. To deliver to a customer a product that works well in thefield, under far less controlled conditions, takes more than having a good product. This requires clear communication with the customer, an open minded and eager engineering team that will cater to the defined performance objectives and prototyping for in-the-field testing. At the end of the day, supplying load cells doesn’t simply require silver bullet technology, but also the human processes of customer service, communications, and a commitment to going above and beyond by listening and learning along the way.

What we are working on nowadays, is in many ways, far more advanced than the classic technical drawing boards relied upon for decades past. Can you believe how much faster finite element analyses are running in 2022, or the ability to provide models via 3D printing? As we look ahead to the innovations we are providing on a steady basis to OEM's and scale dealers alike, it is important to remind ourselves that there is lasting value in simplicity, opposed to the stigma of analysis paralysis. Often times, the simplest solutions were drawn up when the company was no bigger than a rented-out garage and they might very well outlast more complex designs we see today.