

## Sponsor Information



31 Degrees provides beverage dispensing machines and beverage product for customers.

- Special Events
  - Louisiana State Fair, the Fort Worth Livestock Show and Rodeo, various music and margarita festivals.
- Longer-term partnerships
  - Schlitterbahn, the Dallas Cowboys, Typhoon Texas, FC Dallas.

## Project Background

Imagine...

- Up to 100,000 seat capacity venues.
- Up to 100 machines/tanks in over 80 locations.
- 1-2 operators to manually check each supply tank.

No monitors for:

1. Amount of product in tank.
2. Amount of product used.
3. When tanks should be refilled.
4. Temperature of product in tank.
5. Product flavor in each tank.

Centralized Storage Area

## Project Purpose

- Create a smart scale and dashboard system to:
1. Enable event workers to remotely monitor the volume, weight, temperature, and flavor of beverage at each dispensing machine;
  2. Reduce manual inventory checks by operators;
  3. Provide detailed product usage data to 31 Degrees and their customers.

## MFGE Project Objectives

1. Design, prototype, and fabricate an enclosure to house the weight scale circuitry designed by EE sub-team, accounting for:
  - A. The interface to several types and sizes of storage tanks.
  - B. Visual access to a digital display.
  - C. Access to replace batteries.
  - D. Provide for stability on uneven surfaces.
  - E. Provide access to connect a quick-disconnect temperature probe. (Stretch Goal)
2. Design, prototype, and fabricate brackets to support fastening various electronic components, including load cells, within the enclosure.

# M2.04 – 31 Degrees Beverage Monitoring & Tracking Improvements

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## Scale Design

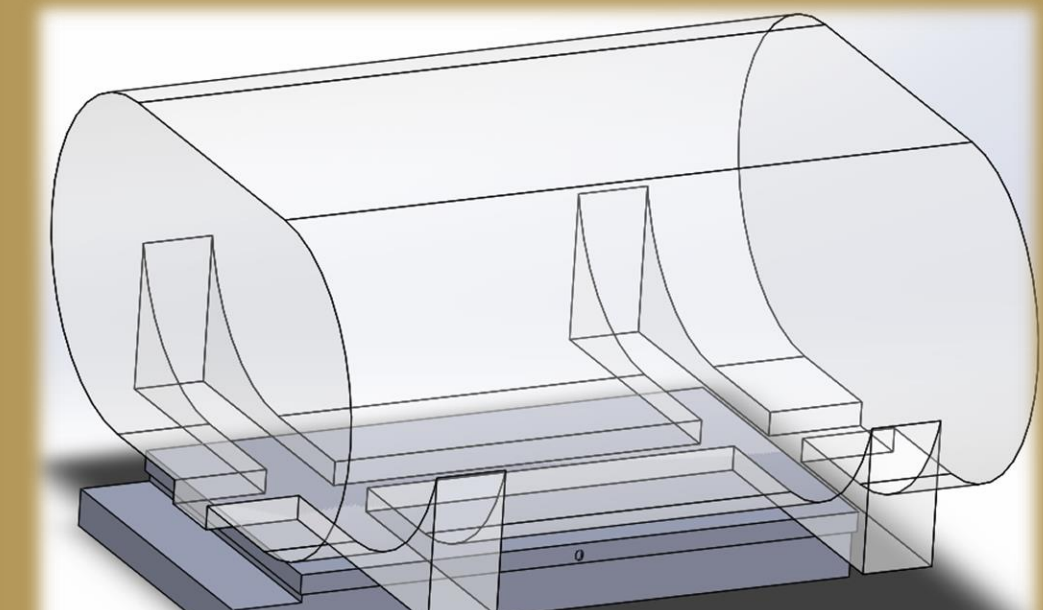
Scale Material Selection:  
.090" 5052-H32 Aluminum sheet metal

Final design features:

- Two versions: one for vertical tanks, one for horizontal tanks
- Upward-facing control panel
- Floating lid design
- Adjustable legs
- Battery port
- 3D printed internal parts



Pictured left: Fully functional product. Met all requirements on a field test at AT&T Stadium.



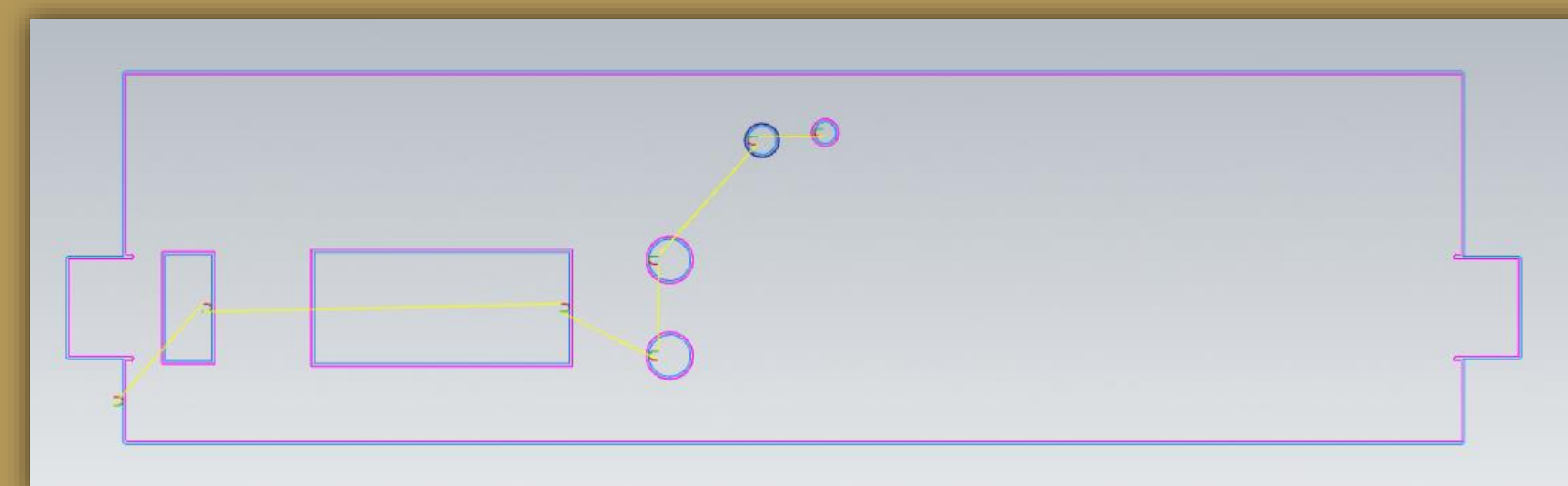
CAD model of horizontal scale and product tank

Pictured right: Control panel with all electrical components installed; engineered for both aesthetics and simplicity.

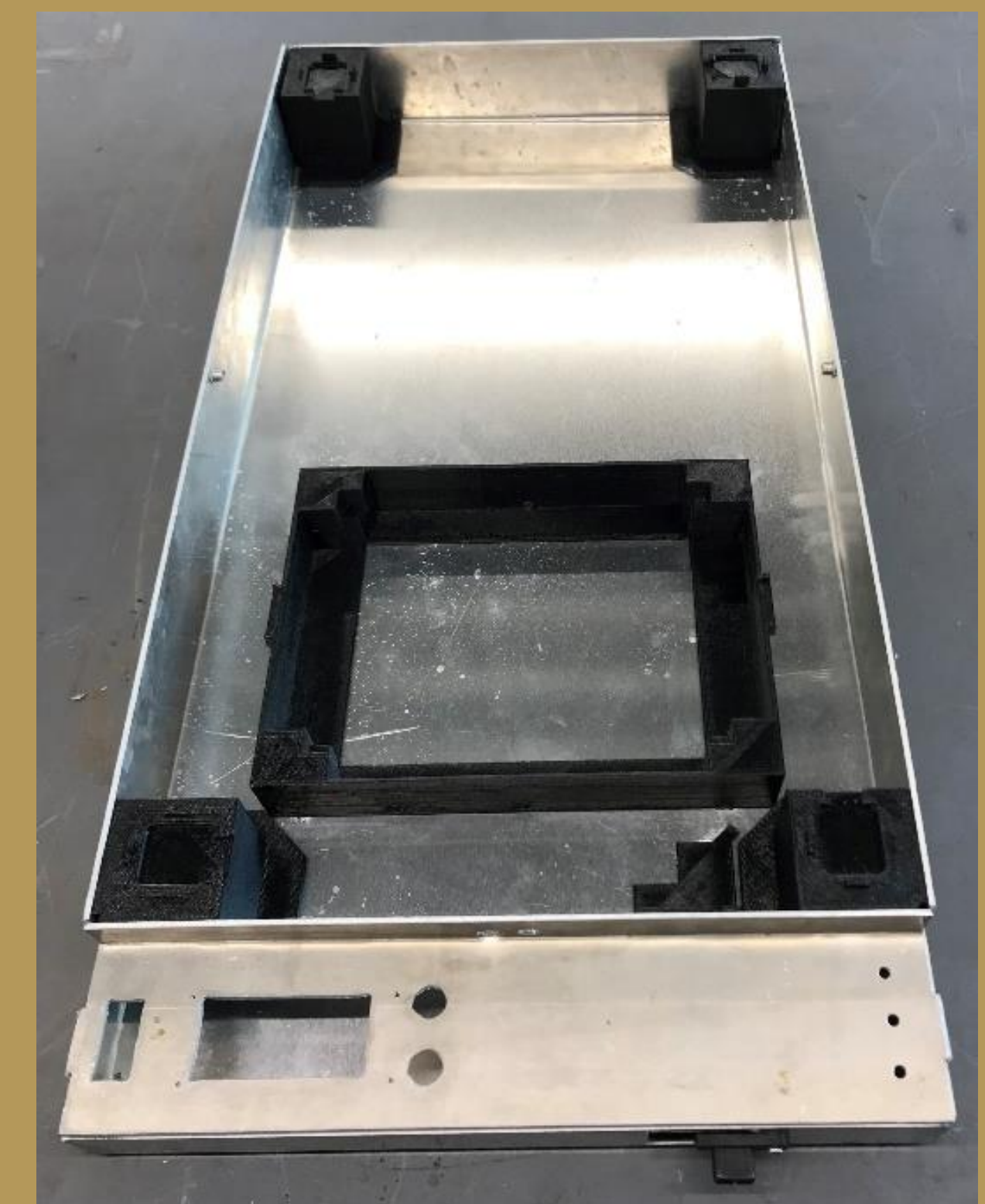


## Fabrication

CAM files with toolpaths were created for both sizes of scales. These flat patterns were cut on the Torchmate 4400, a plasma cutter in IHM.

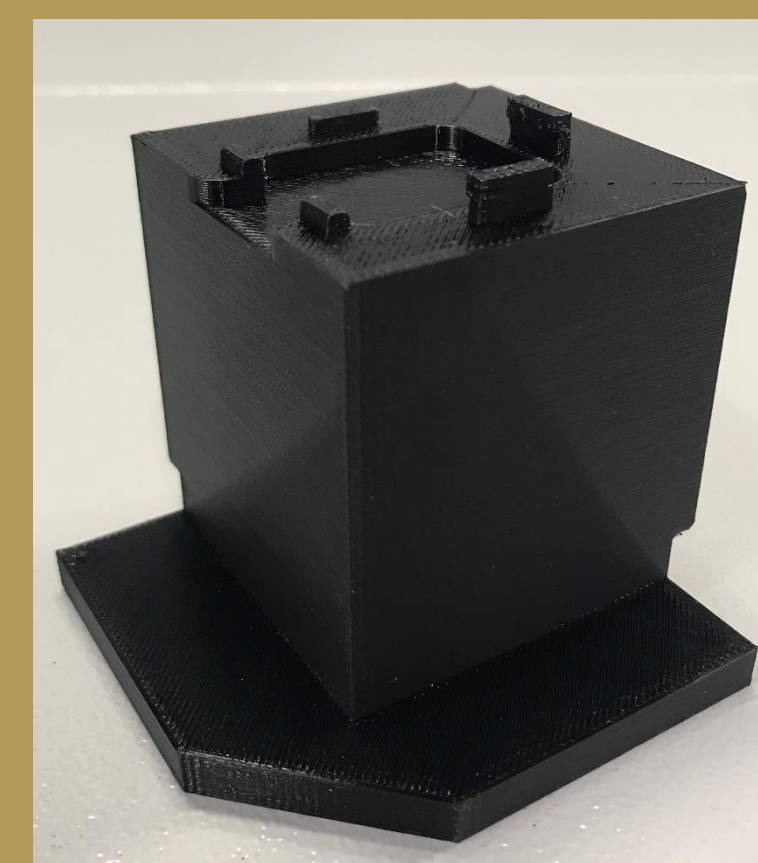


Pictured right: A top view of the scale after all internal parts were glued down. This is what our team gave the Electrical sub-team.

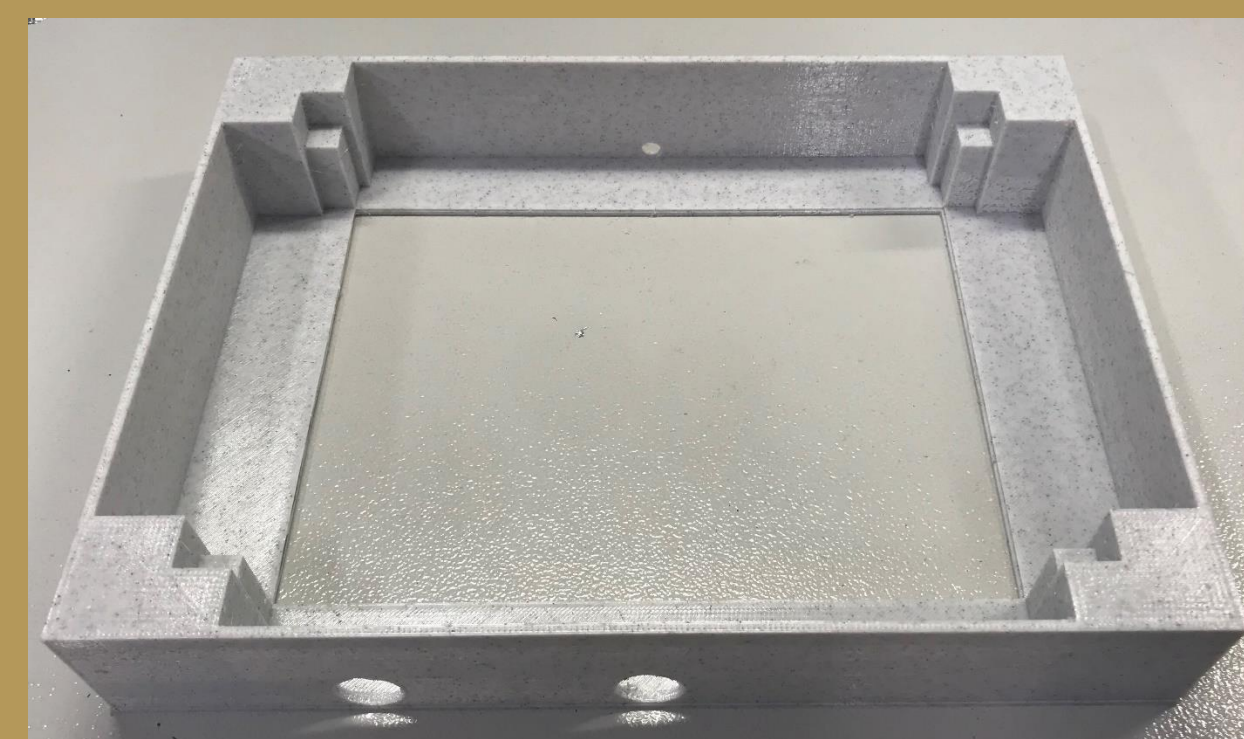


## 3D Print Designs

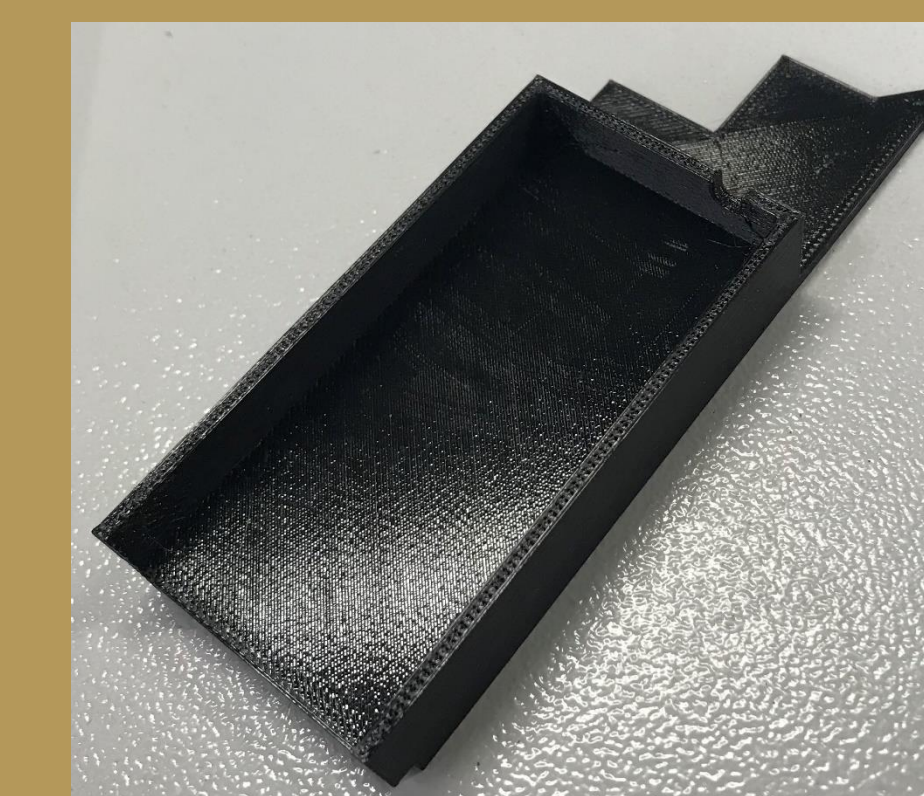
Load Cell Stand: raises load sensors to be in contact with lid, allowing all weight to rest on these four columns. Each can hold more than 250 pounds.



Filament Material Selection:  
1.75 mm PETG filament



Internal Housing: keeps electrical components safe from any debris that does get into the scale.



Battery Holder Bracket: located at its port for accessibility at any time without removing the tank.



## Cost

Smart Scale (\$231.15)	
<b>Top Lid Assembly (\$27.99)</b>	<b>Control Panel Assembly (\$35.32)</b>
<b>Bottom Housing - Main Assembly (\$131.10)</b>	<b>Temperature Sensor Assy (\$5.00)</b>
<b>Battery Sub-Assembly (\$8.26)</b>	<b>Color Sensor Assy (\$22.94)</b>
<b>Internal Housing Sub-Assembly (\$44.23)</b>	<b>Load Cell Stand Sub-Assembly (\$34.15)</b>
<b>Other Parts (\$4.46)</b>	

- Total Cost for Unit 1: \$231.15
- Total Project Cost to date: \$1019.46. This cost accounts for one complete unit, another two partially complete units, a battery charging station, parts not used and tooling costs.

Category	Unit Cost	# Units	Total Part Costs	Estimated Shipping Costs	Estimated Sales Tax & Tariffs	Total Cost
Smart Scale	\$ 231.15	3	\$ 693.45	\$ 85.00	\$ 65.00	\$ 843.45
Battery Charger	\$ 39.84	1	\$ 39.84	\$ 5.96	\$ 5.00	\$ 50.80
Parts Not Used	N/A	N/A	\$ 76.92	\$ 7.00	\$ 6.74	\$ 90.66
Tooling	N/A	N/A	\$ 34.55	\$ -	\$ -	\$ 34.55
<b>Total Project Cost</b>			<b>\$ 844.76</b>	<b>\$ 97.96</b>	<b>\$ 76.74</b>	<b>\$ 1,019.46</b>

## Assembly Documents

At our Sponsor's discretion, future progress is possible due to these detailed documents.

**BOM**

**Parts List**

PART NUMBER	PART NAME	QUANTITY	REFERENCE	OFF FOR ONE SCALE
TXS004-10-100	TOP LID ASSEMBLY	3	23	3
TXS004-10-110	CONTROL PANEL ASSEMBLY	3	24	3
TXS004-10-120	INTERNAL HOUSING SUB-ASSEMBLY	3	25	3
TXS004-10-130	LOAD CELL STAND SUB-ASSEMBLY	3	26	3
TXS004-10-140	TEMPERATURE SENSOR ASSEMBLY	3	27	3
TXS004-10-150	COLOR SENSOR ASSEMBLY	3	28	3
TXS004-10-160	BATTERY SUB-ASSEMBLY	3	29	3
TXS004-10-170	INTERNAL HOUSING SUB-ASSEMBLY	3	30	3
TXS004-10-180	LOAD CELL STAND SUB-ASSEMBLY	3	31	3
TXS004-10-190	TEMPERATURE SENSOR ASSEMBLY	3	32	3
TXS004-10-200	COLOR SENSOR ASSEMBLY	3	33	3
TXS004-10-210	BATTERY SUB-ASSEMBLY	3	34	3
TXS004-10-220	INTERNAL HOUSING SUB-ASSEMBLY	3	35	3
TXS004-10-230	LOAD CELL STAND SUB-ASSEMBLY	3	36	3
TXS004-10-240	TEMPERATURE SENSOR ASSEMBLY	3	37	3
TXS004-10-250	COLOR SENSOR ASSEMBLY	3	38	3
TXS004-10-260	BATTERY SUB-ASSEMBLY	3	39	3
TXS004-10-270	INTERNAL HOUSING SUB-ASSEMBLY	3	40	3
TXS004-10-280	LOAD CELL STAND SUB-ASSEMBLY	3	41	3
TXS004-10-290	TEMPERATURE SENSOR ASSEMBLY	3	42	3
TXS004-10-300	COLOR SENSOR ASSEMBLY	3	43	3
TXS004-10-310	BATTERY SUB-ASSEMBLY	3	44	3
TXS004-10-320	INTERNAL HOUSING SUB-ASSEMBLY	3	45	3
TXS004-10-330	LOAD CELL STAND SUB-ASSEMBLY	3	46	3
TXS004-10-340	TEMPERATURE SENSOR ASSEMBLY	3	47	3
TXS004-10-350	COLOR SENSOR ASSEMBLY	3	48	3
TXS004-10-360	BATTERY SUB-ASSEMBLY	3	49	3
TXS004-10-370	INTERNAL HOUSING SUB-ASSEMBLY	3	50	3
TXS004-10-380	LOAD CELL STAND SUB-ASSEMBLY	3	51	3
TXS004-10-390	TEMPERATURE SENSOR ASSEMBLY	3	52	3
TXS004-10-400	COLOR SENSOR ASSEMBLY	3	53	3
TXS004-10-410	BATTERY SUB-ASSEMBLY	3	54	3
TXS004-10-420	INTERNAL HOUSING SUB-ASSEMBLY	3	55	3
TXS004-10-430	LOAD CELL STAND SUB-ASSEMBLY	3	56	3
TXS004-10-440	TEMPERATURE SENSOR ASSEMBLY	3	57	3
TXS004-10-450	COLOR SENSOR ASSEMBLY	3	58	3
TXS004-10-460	BATTERY SUB-ASSEMBLY	3	59	3
TXS004-10-470	INTERNAL HOUSING SUB-ASSEMBLY	3	60	3
TXS004-10-480	LOAD CELL STAND SUB-ASSEMBLY	3	61	3
TXS004-10-490	TEMPERATURE SENSOR ASSEMBLY	3	62	3
TXS004-10-500	COLOR SENSOR ASSEMBLY	3	63	3
TXS004-10-510	BATTERY SUB-ASSEMBLY	3	64	3
TXS004-10-520	INTERNAL HOUSING SUB-ASSEMBLY	3	65	3
TXS004-10-530	LOAD CELL STAND SUB-ASSEMBLY	3	66	3
TXS004-10-540	TEMPERATURE SENSOR ASSEMBLY	3	67	3
TXS004-10-550	COLOR SENSOR ASSEMBLY	3	68	3
TXS004-10-560	BATTERY SUB-ASSEMBLY	3	69	3
TXS004-10-570	INTERNAL HOUSING SUB-ASSEMBLY	3	70	3
TXS004-10-580	LOAD CELL STAND SUB-ASSEMBLY	3	71	3
TXS004-10-590	TEMPERATURE SENSOR ASSEMBLY	3	72	3
TXS004-10-600	COLOR SENSOR ASSEMBLY	3	73	3
TXS004-10-610	BATTERY SUB-ASSEMBLY	3	74	3
TXS004-10-620	INTERNAL HOUSING SUB-ASSEMBLY	3	75	3
TXS004-10-630	LOAD CELL STAND SUB-ASSEMBLY	3	76	3
TXS004-10-640	TEMPERATURE SENSOR ASSEMBLY	3	77	3
TXS004-10-650	COLOR SENSOR ASSEMBLY	3	78	3
TXS004-10-660	BATTERY SUB-ASSEMBLY	3	79	3
TXS004-10-670	INTERNAL HOUSING SUB-ASSEMBLY	3	80	3
TXS004-10-680	LOAD CELL STAND SUB-ASSEMBLY	3	81	3
TXS004-10-690	TEMPERATURE SENSOR ASSEMBLY	3	82	3
TXS004-10-700	COLOR SENSOR ASSEMBLY	3	83	3
TXS004-10-710	BATTERY SUB-ASSEMBLY	3	84	3
TXS004-10-720	INTERNAL HOUSING SUB-ASSEMBLY	3	85	3
TXS004-10-730	LOAD CELL STAND SUB-ASSEMBLY	3	86	3
TXS004-10-740	TEMPERATURE SENSOR ASSEMBLY	3	87	3
TXS004-10-750	COLOR SENSOR ASSEMBLY	3	88	3
TXS004-10-760	BATTERY SUB-ASSEMBLY	3	89	3
TXS004-10-770	INTERNAL HOUSING SUB-ASSEMBLY	3	90	3
TXS004-10-780	LOAD CELL STAND SUB-ASSEMBLY	3	91	3
TXS004-10-790	TEMPERATURE SENSOR ASSEMBLY	3	92	3
TXS004-10-800	COLOR SENSOR ASSEMBLY	3	93	3
TXS004-10-810	BATTERY SUB-ASSEMBLY	3	94	3
TXS004-10-820	INTERNAL HOUSING SUB-ASSEMBLY	3	95	3
TXS004-10-830	LOAD CELL STAND SUB-ASSEMBLY	3	96	3
TXS004-10-840	TEMPERATURE SENSOR ASSEMBLY	3	97	3
TXS004-10-850	COLOR SENSOR ASSEMBLY	3	98	3
TXS004-10-860	BATTERY SUB-ASSEMBLY	3	99	3
TXS004-10-870	INTERNAL HOUSING SUB-ASSEMBLY	3	100	3
TXS004-10-880	LOAD CELL STAND SUB-ASSEMBLY	3	101	3
TXS004-10-890	TEMPERATURE SENSOR ASSEMBLY	3	102	3
TXS004-10-900	COLOR SENSOR ASSEMBLY	3	103	3
TXS004-10-910	BATTERY SUB-ASSEMBLY	3	104	3
TXS004-10-920	INTERNAL HOUSING SUB-ASSEMBLY	3	105	3
TXS004-10-930	LOAD CELL STAND SUB-ASSEMBLY	3	106	3
TXS004-10-940	TEMPERATURE SENSOR ASSEMBLY	3	107	3
TXS004-10-950	COLOR SENSOR ASSEMBLY	3	108	3
TXS004-10-960	BATTERY SUB-ASSEMBLY	3	109	3
TXS004-10-970	INTERNAL HOUSING SUB-ASSEMBLY	3	110	3
TXS004-10-980	LOAD CELL STAND SUB-ASSEMBLY	3	111	3
TXS004-10-990	TEMPERATURE SENSOR ASSEMBLY	3	112	3
TXS004-10-1000	COLOR SENSOR ASSEMBLY	3	113	3

## Work Aids

Various hole guides are necessary due to the plasma cutter being unable to make small & precise holes.