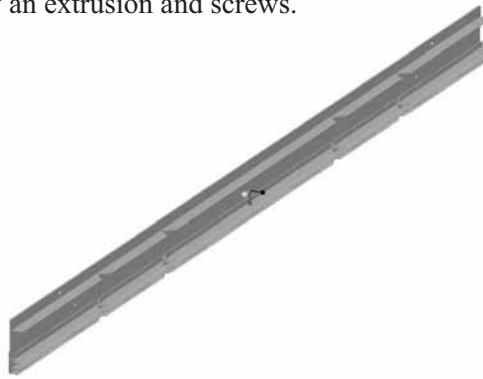


## TCL Signage

### 1.1 Construction and Operation

#### I. Frame housing

- a. Slim line, single piece of extruded aluminum (6063-T5), that houses the polycarbonate, circuit board, as well as the sign back.
  - i. The extruded aluminum consists of a 2.5" depth.
  - ii. The length of the extrusion varies for each sign size customization.
  - iii. The corrosion resistant aluminum bends to the sign size and each end is secured together by an extrusion and screws.



#### II. The back of the sign is .050 aluminum

- a. The back has two 7/8" diameter knockouts for electrical connections.
- b. It also has four 3/8" knockouts for wall mounting options.
- c. At the top of the back, there is a lip that is inserted into the extrusion.
- d. At the bottom of the back, there are two screw holes which secure the back to the extrusion.
- e. Standard wall mount included.
  - i. "Lift 'n Shift" wall mounted back plate bolts to the wall surface; unit hinges on the back plate allowing easy electrical connection without holding sign. Back is secured to cabinet frame using two screws to complete the installation.



- III. Polycarbonate (face material)
- a. Various types of polycarbonate is used
    - i. Tinted polycarbonate
    - i. Blank-out polycarbonate
    - ii. Clear polycarbonate
    - iii. Red tinted polycarbonate (when applicable)
  - b. The polycarbonate used is 0.12" thick.
  - c. Impact resistant.
  - d. The polycarbonate is slip-fit which prevents water as well as other elements from breaching the enclosure.
  - e. The polycarbonate contains UV inhibitors to protect the circuit board from the effects of ultraviolet light and prevents the premature aging of the polycarbonate face.
  - f. Polycarbonate specs

Property		Polycarbonate
Impact Resistance	Drop Test, 0.5 lb	No Break
Cold Bend	Bend Radius	100x material thickness
Sheet Weight	0.125"	0.78 lb/ft <sup>2</sup>
Thermal Expansion Rate	–	3.75 x 10 <sup>5</sup> in/in/°F
Shading Coefficient	0.25" clear sheet	1.02

## g. Polycarbonate Specifications:

<b>Typical Properties</b>			
<b>Property</b>	<b>Test Method</b>	<b>Units</b>	<b>Values</b>
<b>PHYSICAL</b>			
Specific Gravity	ASTM D79	-	1.2
Refractive Index	ASTM D542	-	1.586
Light Transmission, Clear @ 0.125"	ASTM D1003	%	86
Light Transmission, Gray, Bronze	ASTM D1003	%	50
Light Transmission, Dark Gray	ASTM D1003	%	18
Water Absorption, 24 hrs	ASTM D570	%	0.15
Poisson's Ratio	ASTM E132	-	0.38
<b>MECHANICAL</b>			
Tensile Strength, Ultimate	ASTM D638	psi	9,500
Tensile Strength, Yield	ASTM D638	psi	9,000
Tensile Modulus	ASTM D638	psi	340,000
Elongation	ASTM D638	%	110
Flexural Strength	ASTM D790	psi	13,500
Flexural Modulus	ASTM D790	psi	345,000
Compressive Strength	ASTM E695	psi	12,500
Compressive Modulus	ASTM E695	psi	345,000
Izod Impact Strength, Notched @ 0.125"	ASTM E256	ft·lbs/in	18
Izod Impact Strength, Unnotched @ 0.125"	ASTM E256	ft·lbs/in	60 (no failure)
Instrumented Impact, 0.125"	ASTM E3763	ft-lbs	>45
Shear Strength @ Yield	ASTM E732	psi	6,000
Shear Strength, Ultimate	ASTM E732	psi	10,000
Shear Modulus	ASTM E732	psi	114,000
Rockwell Hardness	ASTM E785	-	M70/R118
<b>THERMAL</b>			
Coefficient of Thermal Expansion	ASTM D696	in/in/°F	3.75 x 10 <sup>-5</sup>
Coefficient of Thermal Conductivity	ASTM C177	BTU·in/hr·ft <sup>2</sup> ·F	1.35
Heat Deflection Temperature @ 264 psi	ASTM D648	°F	270
Heat Deflection Temperature @ 66 psi	ASTM D648	°F	280
Brittleness Temperature	ASTM D746	°F	-200
Shading Coefficient, Clear 0.125"	ASHRAE	-	1.02
Shading Coefficient, Gray, Bronze 0.125"	ASHRAE	-	0.70
U factor 0.25" (summer gain, winter loss)	ASTM D1363	BTU·in/hr·ft <sup>2</sup> ·F	0.90, 0.96
<b>ELECTRICAL</b>			
Dielectric Constant, @10Hz	ASTM D150	-	2.96
Dielectric Constant @ 60Hz	ASTM D150	-	3.17
Volume Resistivity	ASTM D257	Ohm·cm	8.2 x 10 <sup>6</sup>
Dissipation Factor @ 60 Hz	ASTM D150	-	0.0009
Arc Resistance			
Stainless Steel Strip Electrodes	ASTM D495	Seconds	10-11
Tungsten Electrodes	ASTM D495	Seconds	120
Dielectric Strength, in air @ 0.125"	ASTM D195	V/mil	380
<b>FLAMMABILITY</b>			
Horizontal Burn, AEB	ASTM D635	in	<1
Ignition Temperature, Self	ASTM D1929	°F	1070
Ignition Temperature, Flash	ASTM D1929	°F	870
Flame Class, Clear @ 0.060"	UL 94	-	V2
Flame Class, Clear @ 0.236"	UL 94	-	V2

- IV. Aluminum extrusion coatings  
 a. Duracron S600 RTS heritage bronze:

#### PRODUCT DESCRIPTION

Viscosity: 25 to 28 Seconds #4 Zahn Cup@ 77 F

Density: 8.5 ±0.2 Lbs/Gal

Theoretical Solids by Wt %: 38 ±2

Lead Content  $\leq$  0.06 % (Lead Metal as % Non-Volatile)

Theoretical Solids by Vol %: 27 ±2

VOC (theoretical): 5.25 Lbs/Gal

Color: Bronze

#### PHYSICAL PROPERTIES

Gloss: 16-22 @ 60°

Hardness: H-2H Eagle Turquoise

Film Thickness: Dry 1.00 - 1.20 Mils Wet 3.70 - 4.44 Mils

Coverage: 394 Sq ft / Gal @1.10 Mils

#### SUGGESTED APPLICATION DATA

Substrate: Aluminum

Primer: NONE

Substrate Prep: Conversion coating at 30 mg/sq ft minimum applied per ASTM D1730, Type B, Method 5 or 7;  
 Processing per ASTM B449, Sec. 5.

<u>Application Method</u>	<u>Type of Reducer</u>	<u>Parts Product</u>	<u>Parts Reducer</u>	<u>Application Viscosity</u>
Conventional / Electrostatic		READY TO SPRAY	READY TO SPRAY	

Clean Up Solvent: Xylene, Toluene

#### CURE SCHEDULE

<u>Bake</u>	<u>Type Oven</u>	<u>Substrate PMT</u>	<u>Time at PMT</u>
	GAS	400 °F	10 mins

#### Additional Information:

Conventional acrylic spray finish shipped at "Ready-To-Spray" viscosity for properly pretreated aluminum extrusions and panels. Oven time and/or temp may vary based on metal thickness and mass. Agitate well before and during use to ensure uniformity. Six month shelf life from date of shipment or recertification is required.

## V. Circuit boards

### a. General

- i. LED circuit boards shall be manufactured using a FR-4 laminated fiberglass printed circuit board with the front face printed with black UV cure ink.
- ii. The failure of an LED string shall not cause the failure of any other LED string.
- iii. The circular base of the discrete LEDs shall be soldered so that they are flush. All LEDs shall be perpendicular to the circuit board.
- iv. All exposed metal on both sides of the LED circuit board (except connector contacts) shall be protected from water and humidity by an application of conformal coating
- v. The conformal coating shall contain a UV brightener to aid in visual inspection.
- vi. The presence of ambient radio signals, magnetic interference, and electromagnetic interference shall not impair the performance of the sign system. Interference includes power lines, transformers, and motors. The sign will not radiate electromagnetic signals that adversely affect any other electronic device, including those located in vehicles passing underneath or near the sign and its controller.
- vii. The cabinet and sign components shall operate in the following temperature and humidity conditions:
  - a. Operational temperature range: -30°F to +165°F
  - b. Humidity range: 0% to 99% (non-condensing)
  - c. Storage temperature range: -40°F to +185°F
  - d. Components will not be damaged by a temporary exposure while operating to a temperature range of -40°F to +185°F

## VI. Discrete LEDs

- i. **Signs will use one of the following three viewing angles:**
  - a. **All LEDs shall have a nominal viewing cone of 15° with a half-power angle of 7.5° measured from the longitudinal axis of the LED. Viewing cone tolerances shall be as specified in the LED manufacturer's product specifications and shall not exceed ± 3 degrees.**
  - b. **All LEDs shall have a nominal viewing cone of 30° with a half-power angle of 15° measured from the longitudinal axis of the LED. Viewing cone tolerances shall be as specified in the LED manufacturer's product specifications and shall not exceed ± 3 degrees.**
  - c. **All LEDs shall have a nominal viewing cone of 60° with a half-power angle of 30° measured from the longitudinal axis of the LED. Viewing cone tolerances shall be as specified in the LED manufacturer's product specifications and shall not exceed ± 3 degrees.**

**(End of viewing angle a selection)**

- ii. The discrete LEDs shall be driven using pulse width modulation (PWM). Signs will use current PWM to achieve the proper LED intensity levels for all light conditions. The drive pulse shall be modulated at a frequency high enough to provide flicker-free operation.
- iii. The LED drive circuit board shall contain a microprocessor-controlled power regulation circuit that controls the pulse width modulation (PWM) applied to the LED strings.

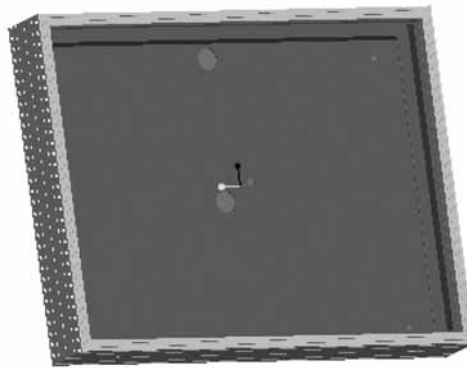
b. LED specifications (**Select appropriate LEDs**)

- i. Color vs. Brightness:

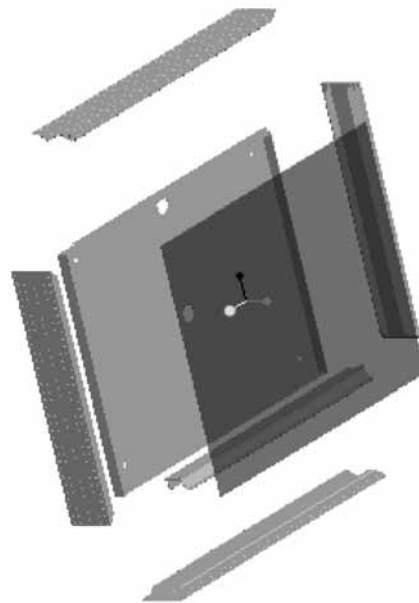
LED Type	Color	Semiconductor	Min. Brightness (mcd)	Viewing Angle
Red	640	AlInGaP	1,800	30°V 70°H
Red	624	AlInGaP	7,000	30°
Amber	589	AlInGaP	7,150	30°
Amber	589	AlInGaP	2,850	30°V 60°H
Green	525	InGaN	12,000	30°
Green	520	InGaN	650	30°V 70°H
White	x=0.30 y=.29	InGaN	18,000	15°
White	x=.30 y=.29	InGaN	8,500	45°
Blue	470	InGaN	2,250	30°V 65°H

- c. Internal Wiring
  - i. Wiring for the sign components shall be installed in a neat and professional manner. Wiring shall not impede the removal of power supplies or other sign components.
  - ii. Wires shall not make contact with or bend around sharp metal edges. All wiring shall conform to the National Electrical Code.
  - iii. All internal wiring shall use drip loops and strain relief.
- d. Earth Grounding
- e. Cabinet shall have one earth ground lug that is electrically bonded to the sign cabinet. All earth grounding shall conform to the National Electrical Code.

VII. Complete enclosure:



Complete Enclosure Views:



(TCL1418)