

SECTION 1650 – PERMANENT SIGNING

1651 SCOPE. This section covers the work necessary to furnish and install signing materials.

1652 GENERAL. All signs shall conform to the requirements of the current editions of the Manual on Uniform Traffic Control Devices (MUTCD), Standard Highway Signs, FHWA, and City of Lawrence Standard Drawings.

1653 SHOP FABRICATION OF SIGNING ITEMS.

- A. Flat Sheet Signs. Provide flat sheet sign blanks that comply with the Contract Documents. Remove warps, burrs and other defects.
- B. Flat Sheet Sign Blank Preparations. After fabrication, prepare the metal for sheeting application using a Class 2 conversion coating according to ASTM B 921, "Standard Specification for Nonhexavalent Chromium Conversion Coatings on Aluminum and Aluminum Alloys". Handle the metal with a mechanical device or clean canvas gloves, between the etching operation and application of retroreflective sheeting. Prevent the metal from coming in contact with greases, oils or other contaminants before the application of sheeting, films or inks.
- C. Application of Retroreflective Sheeting. Use pressure sensitive retroreflective sheeting of the color shown in the Contract Documents.

Apply the sheeting to the treated blanks and panels according to the manufacturer's recommendation, or by a method that will produce an equivalent result.

Overlap pressure sensitive sheeting a minimum of 3/16 inch at splices. If heat activated sheeting is spliced, the minimum overlap is 3/16 inch. If adjacent sheets of heat activated sheeting are butted together, the gap between adjacent sheets may not exceed 1/32 inch.

On flat sheet signs, 1 vertical or horizontal splice is permitted. Make horizontal lap splices with the uppermost piece overlapping the lower piece. Splicing is prohibited if the sign face is made using the reverse screen process.

- D. Sign Legend and Border Details. Provide sign legend and border that complies with the requirements specified in the Contract Documents.

Use capital letters and numbers that comply with the standard rounded capital letter alphabets in the latest edition of Standard Alphabets for Highway Signs. Use lower case letters that comply with the latest edition of Standard Lower-Case Alphabet for Highway Signs. Use initial capital letters that are 1 $\frac{1}{3}$ times the loop height of the lower-case letters, from a modified series "E" alphabet in which the stroke width is increased to approximately 1/5 of the height of the letter or number.

Make the sign face for flat sheet signs using one of these processes:

- Direct Screen: the legend and border color are applied to the face of the sign by the silkscreen process.
- Reverse Screen: a transparent color is applied to the face of the sign by the silkscreen process to form the legend and border.
- Direct Applied: the legend and border is retroreflective sheeting applied to the face of the sign by the appropriate methods.
- Digital Printing.

E. Application of Process Inks and Lettering Films. Use the color of film or ink to obtain the sign face, legend and border as shown in the Contract Documents.

Apply process inks to the sign faces according to the retroreflective sheeting manufacturer's recommendation, or by a method that will produce an equivalent result. Apply lettering films to the sign faces according to the lettering film manufacturer's recommendation, or by a method that will produce an equivalent result.

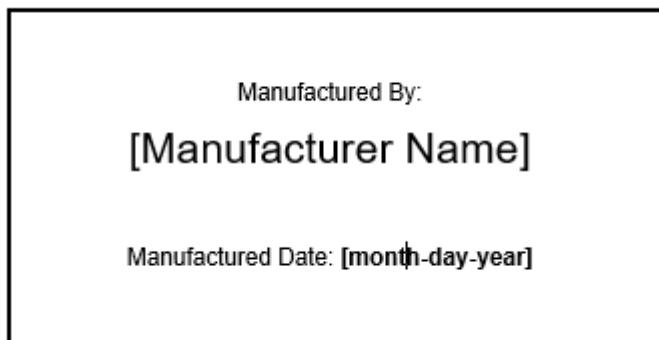
F. Sign Identification. Install a clear or light colored, pressure sensitive decal with a printed (not handwritten) black legend and install on the back of each sign. Decal shall include the following information:

Sign Manufacturer

Manufactured date (month-day-year)*

*A punch-out-the-date option may be used like the 3M Unique Dating Sticker or approved equal.

Example:



Locate the legend horizontally, vertically or diagonally along the bottom or right edge of the sign in a position that is not covered up when the sign is installed.

On a sign with an area of less than 16 square feet, the legend shall be a minimum of $\frac{1}{2}$ inch in height. On a sign with an area of 16 square feet or more, the legend shall be a minimum of 1 inch in height.

G. Sign Overlays. Provide sign overlays that comply with the Contract Documents. Fabricate the sign overlays from flat sheet blanks covered with retroreflective sheeting. Prepare the flat sheet blanks and apply the retroreflective sheeting as specified for flat sheet signs. Apply the legend

and border to the retroreflective sheeting as specified for the flat sheet sign.

H. Delineators. Provide the types of delineators specified in the Contract Documents.

Fabricate delineators for steel post mount or bracket mount from flat sheet blanks covered with retroreflective sheeting. Prepare the flat sheet blanks and apply the retroreflective sheeting as specified for flat sheet signs.

I. Object Markers. Provide the type of object markers specified in the Contract Documents.

Fabricate Type 1 object markers from 18-inch by 18-inch flat sheet blanks covered with yellow high-performance retroreflective sheeting.

Fabricate Type 2 object markers from 6-inch by 12-inch flat sheet sign blanks covered with yellow high-performance retroreflective sheeting.

Fabricate Type 3 object markers from 12-inch by 36-inch flat sheet blanks covered with yellow high-performance retroreflective sheeting with black non-reflective hash marks as shown in the Contract Documents.

Prepare the flat sheet blanks and apply the retroreflective sheeting as specified for flat sheet signs.

J. Fabrication of Sign Posts. The total length of posts shown in the Contract Documents is estimated. Contractor shall field verify prior to installation.

The number, type, and size of posts shown in the Contract Documents are determined from theoretical sections. Order sign post based on field measurements for each post for the sign or the sign assembly.

Perforated square steel tube posts may be ordered in stock lengths and cut to the required length in the field. Do not torch-cut steel posts. Treat all field cuts with preservative material. Paint all cut ends of steel posts with zinc-rich paint.

1654 INSTALLATION AND REMOVAL.

A. General. Erect the permanent signing as necessary to expedite the completion of the project and the opening of the roadway. The Engineer may require that the Contractor mobilize permanent signing operations whenever it is feasible to complete a portion of the project. The Contractor may have to mobilize and, upon completion of all currently feasible work, suspend the permanent signing operations more than once before the project is completed.

It is the Contractor's responsibility to verify the utility locations.

If a temporary sign interferes with the installation of a permanent sign, remove and reset the temporary sign to a location designated by the Engineer.

B. Sign Location and Orientation. Locate and stake each sign installation according to the Contract Documents. Orient the signs in relation to the roadway alignment as shown in the Contract Documents.

C. Sign Post Lengths. Provide the Engineer with the length of each sign post and with the vertical and horizontal measurements from the top of the pavement edge to:

- the ground line (for posts with no footings)
- the top of the footing (for posts with footings)

Do not extend the post above the top of sign unless street name signs are noted in the plans to be installed "by others". Unless otherwise noted in the plans, street name signs shall be provided and installed by the Contractor.

D. Sign Post Installation.

1. Footings for Perforated Square Steel Tube Posts: Install the perforated square steel tube post footings plumb as shown in the Contract Documents. Do not damage the galvanized coating during installation or alter the cross-sectional dimensions of the perforated square steel tubes. Remove and replace any footing damaged during the perforated square steel tube installation.
2. Post Installation: Install the posts as shown in the Contract Documents. Plumb the sign posts as they are installed. The maximum allowable tolerance from vertical is 1 inch (from the top of the post to the ground line). Install and attach the perforated square steel posts in the footings or anchors as detailed in the Contract Documents.

E. Sign Installation. Mount the signs as shown in the Contract Documents. Position the signs so the sign face is vertical. If required for installation, drill the holes in the fabricated signs from the sign face sheeting side.

After the sign is installed, the post shall be plumb and secure in the ground.

Repair damaged retroreflective sheeting on the sign faces. Use pressure sensitive retroreflective sheeting to patch the damaged areas, overlapping the damages area a minimum of $\frac{1}{4}$ inch. Match the retroreflective sheeting patch to the adjacent pieces of sheeting for color and uniform appearance and brilliance under both day and night illumination. Repair damaged galvanized areas on posts and structural members by cleaning and painting with zinc-rich paint.

F. Delineators and Object Markers. Install delineators and object markers as shown in the Contract Documents.

G. Remove and Reset Existing Signs. Remove, transport, store and reset existing signs according to the details in the Contract Documents. Provide new bolts, nuts, washers, post clips and other attachments as necessary to reset the existing signs. When directed by the Engineer, repair or replace all existing signs damaged during the removal and resetting operations at own expense.

1655 MATERIALS.

- A. Perforated Square Steel Tube (PSST). Provide posts, post anchors and anchor sleeves that have a square cross section which is uniform throughout the post length and having dimensions shown on the Contract Documents. Perforate the total length (all four sides) of sign posts, post anchors, and anchor sleeves with 7/16-inch diameter holes on one-inch centers initiating one inch from one end of the post relative to the first hole center. Embossed rings or die-cut knockouts are an acceptable substitute for perforated holes. The method of perforation is at the discretion of the post manufacturer; however, the holes must be uniform in diameter, de-burred, and smooth sided. Perform all perforating, cutting, and machining operations prior to application of the clear, colorless corrosion protection coating. Manufacture posts, post anchors and anchor sleeves, from zinc coated steel sheet that conforms to the requirements of ASTM A 653 SS Grade 50 Class 1, coating designation G90 (total both sides). Provide certification meeting Kansas Department of Transportation Specifications. Posts will be subject to inspection by field personnel for compliance with dimensional requirements and quality of zinc and clear corrosion protection coatings. Final disposition of all posts will be completed at the final destination as the result of inspection for the quality of workmanship and the delivery condition.
- B. Zinc Paint. Provide one-component organic zinc rich paint for repairing damaged spelter coatings, manufactured as a coating for steel and having a minimum of 85% zinc by weight in the dried film.
- C. Aluminum Signing Materials.
 1. Provide materials that comply with the dimensions shown in the Contract Documents.
 2. Tolerances are as shown in the Contract Documents or as specified by ASTM or other referenced specifications.

3. Provide aluminum alloys that comply with the following table:

ALUMINUM ALLOYS FOR SIGNS		
Material	Test Method	Alloy
Fasteners		
Bolts and Screws	ASTM B 211	2024-T4* or 6061-T6
Nuts, $\frac{1}{4}$ inch tap and under	ASTM B 211	2024-T4*
Nuts, $\frac{5}{16}$ inch tap and over	ASTM B 211	6061-T6 or 6262-T9
Washers, Flat	ASTM B 209	2024 with 1230, T4 temper (Alclad 2024-T4)
Locknuts	ASTM B 211	2017-T4*
Rivets, blind (Front entry, expanding)	ASTM B 316	2017-F* or 2117-F*
Sign Blanks	ASTM B 209	6063-T6, 5154-H38 or 5052-H38

*Anodize to produce an oxide coating not less than 0.0002 inch thick and seal to decrease permeability.

D. Sheeting. Provide retroreflective sheeting and process inks that comply with the following:

1. Type. Type XI sheeting shall be used on all street signs. Provide retroreflective sheeting that complies with ASTM D 4956. Types and classes are as defined in ASTM D 4956.
2. Conformable Retroreflective Sheeting. Provide High Intensity retroreflective sheeting that has a conformable aluminum foil backing with an aggressive pressure sensitive adhesive. This material is designed for application to moderately rough or porous metal, wood or masonry surfaces. Provide material that complies with ASTM D 4956 with the following exceptions and additions:
 - i. Conformable aluminum backing thickness – 0.005 inches to 0.010 inches.
 - ii. Follow all manufacturers' recommendations for application procedures and temperatures.
3. Anti-graffiti Film. Finish signs with a clear anti-graffiti protective overlay film applied to the entire face of the sign in accordance with the retroreflective sheeting manufacturer's recommendations. Anti-graffiti film must be resistant to inks, spray paints, paints, markers, solvents, and stickers so that they can be easily removed using simple detergent and cloth when following the manufacturer's recommendations. Anti-graffiti film must include UV inhibitors that block at least 90% of ultraviolet light.
4. Manufacturer Warranty. The following warranty conditions apply only to the retroreflective sheeting manufacturer. Provide a product warranty for a minimum period of 10 years on all Types of High Intensity retroreflective sheeting for placement on permanent signing. Failure to comply with this warranty may be cause for removal from the prequalified list. The High Intensity retroreflective sheeting warranty must comply with the following requirements and obligations:

- i. Certification: Submit with each lot or shipment, a certification which states that the material supplied is subject to and complies with the requirements. Include in the certification, the manufacturer's office, address, phone number and the contact for potential claims under the provisions of this warranty. Provide documentation as to which signs were fabricated from each lot. Include a copy of this certification and any supporting documentation to the Municipal Services and Operations Department.
- ii. Field Performance: Field Performance applies to retroreflective sheeting applied to sign blank materials or overlaid on existing signs. The field performance obligation period begins with the date of erection. The sheeting is considered unsatisfactory if it has deteriorated due to natural causes to the extent that the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions or shows any of the following defects:
 1. Cracking discernible with the unaided eye from a driver's position at a distance of 50 feet or greater from the sign;
 2. Scaling, pitting, orange peel, delamination, edge lifting or curling;
 3. Peeling in excess of 3/8 inch;
 4. Shrinkage in excess of 3/16 inch total per yard of sheeting width;
 5. Fading or loss of color to the extent that retroreflective sheeting color fails to comply with ASTM D 4956 or;
 6. Loss of retroreflectivity reducing the coefficient of retroreflection as measured by a retroreflectometer to less than the minimum specified in Table 12 of ASTM D 4956 at 0.2° observation and -4° entrance angles.Make all measurements after cleaning the sign.

Defective Material Replacement: When traffic signs with High Intensity sheeting fail to comply with the field performance requirements, re-sheet or replace the signs at no cost to the City for materials and labor. Employ a qualified contractor to perform signing work. Install signs, as shown in the Contract Documents and the MUTCD and provide proper traffic control.

Replace all defective material within 60 days after written notification by the City. Signs not corrected within 60 days, will be removed and replaced by the City. Signs removed by the City will be placed in storage for inspections by the manufacturer, and the manufacturer will be billed for all costs of replacement of the sheeting.

When more than 25% of the signs within a lot fail to comply with the requirements, replace all signs made from that lot.

5. Prequalified Materials. Sheeting materials products used on City projects shall be Avery Dennison or 3M.
6. Image Systems for Retroreflective Sheeting.
 - i. General. Provide durable traffic and work zone signs and devices using a combination of retroreflective sheeting, screen print inks, acrylic overlay films, and/or eco-solvent spot inks. Provide transparent or opaque print inks with reducers and thinners as required for proper application. Provide durable, acrylic, transparent or opaque, colored overlay films with a pressure sensitive adhesive and a removable liner. With digital print systems, provide durable transparent acrylic overlay applied to the face as required for proper application. Provide materials that are suitable for processing legends, borders, and background colors on retroreflective sheeting.
 - ii. Color. Provide transparent screen print inks, overlay films, and eco-solvent spot inks in standard traffic colors of yellow, red, orange, green, blue, or brown. CMYK inks will only be permitted for graphic logos, nonregulated colors and imagery; mixing various colors to achieve the appropriate performance is not permitted. Opaque screen print ink, opaque overlay film, or opaque eco-solvent spot ink is black. Each color, when applied to retroreflective sheeting, must be distinctly manufactured and supplied to comply with the chromaticity limits in ASTM D 4956.
 - iii. Performance. Provide screen print inks, acrylic overlay films, and eco-solvent spot inks that, when applied according to the sheeting manufacturer's recommendations, comply with the following:
 1. They are compatible with the retroreflective sheeting.
 2. They have good adhesion to the sheeting and do not cause blistering, puckering, shrinkage, expansion or other deterioration of the sheeting.
 3. After artificial weathering, stay within the ASTM D4956 chromaticity limits, and show no evidence of cracking, edge lifting, curling or other surface deterioration.
 4. Screen print inks should be dry to the touch within 2 hours, and ready for shipment within 24 hours.

1656 MEASUREMENT AND PAYMENT

- A. If no bid item is included in the plans, removal or removal and resetting of existing signs is subsidiary to other bid items.

- B. When included in the plans, signage will be measured by Lump Sum and include all components required to provide a complete installation as detailed in the plans.
- C. When included in the plans, removal of existing permanent signage will be measured by Lump Sum. This work includes removal and hauling salvaged signs to City designated property. If the City does not want to salvage the signs, they shall become the property of the Contractor.