

# Galv Notes



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## DETERMINING INSPECTION LOT SIZE

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### Introduction

A sampling protocol has been adopted by ASTM to ensure high quality products because the inspection of the coating thickness for every piece of material galvanized in a project would not be practical. The lot size is an important component of the sampling protocol because it is used to determine the total number of randomly chosen test articles and measurements required to ensure quality of hot-dip galvanized coatings provided by the galvanizer.

For products hot-dip galvanized according to ASTM A123/A123M and A153/A153M, the following table is used to determine the

minimum number of specimens for sampling from a given lot size.

### Minimum Specimen Requirements Per ASTM A123/A123M (Section 7.3) and ASTM A153/A153M (Section 6.2)

Number of Pieces in Lot	Number of Test Articles
3 or less	all
4 to 500	3
501 to 1,200	5
1,201 to 3,200	8
3,201 to 10,000	13
10,001 and over	20

For rebar hot-dip galvanized according to ASTM A767/A767M, the information summarized below is used to determine the minimum number of samples per lot, measurements per sample, and the total

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number of measurements required for each of the different coating thickness measurement techniques.

**Summary of Mass (Weight) of Coating Test Requirements Related to Lot Size Per ASTM A767/A767M (Section 4.2.3)**

<b>Magnetic Thickness</b>	<b>Microscopy Method</b>	<b>Stripping &amp; Weighing</b>
3 samples per lot	5 samples per lot	3 samples per lot
5 or more measurements per sample	4 measurements per sample	
15 measurements, at minimum, comprise the average	20 measurements, at minimum, comprise the average	

However, sometimes confusion can arise as to what constitutes the definition of an inspection lot, especially for large orders where multiple material shipments of a single order are hot-dip galvanized over a period of several days using potentially more than one kettle. Additionally, it may be required to differentiate between inspections performed *at the galvanizing facility* and *by the purchaser after delivery*.

This *Galvanizing Note* serves to expand upon the inspection lot size requirements within the ASTM specifications to clarify meaning and provide additional guidance.

**Lot Size For Inspections Performed At The Galvanizing Facility**

The definition of an inspection lot size *at the galvanizing facility* differs slightly between hot-dip galvanizing specifications. In order to determine what constitutes a lot for each governing ASTM specification, refer to the associated definitions in addition to the provided flow charts.

*ASTM A123/A123M*

The specification language used to describe an inspection lot at the galvanizing facility is as follows:

*7.2 A lot is a unit of production or shipment from which a sample is taken for testing. Unless otherwise agreed upon between the galvanizer and the purchaser, or established within this specification, the lot shall be as follows: For testing at a galvanizer’s facility, a lot is one or more articles of the same type and size comprising a single order or a single delivery load, whichever is the smaller, or any number of articles identified as a lot by the galvanizer, when these have been galvanized within a single production shift and in the same bath. [...]*

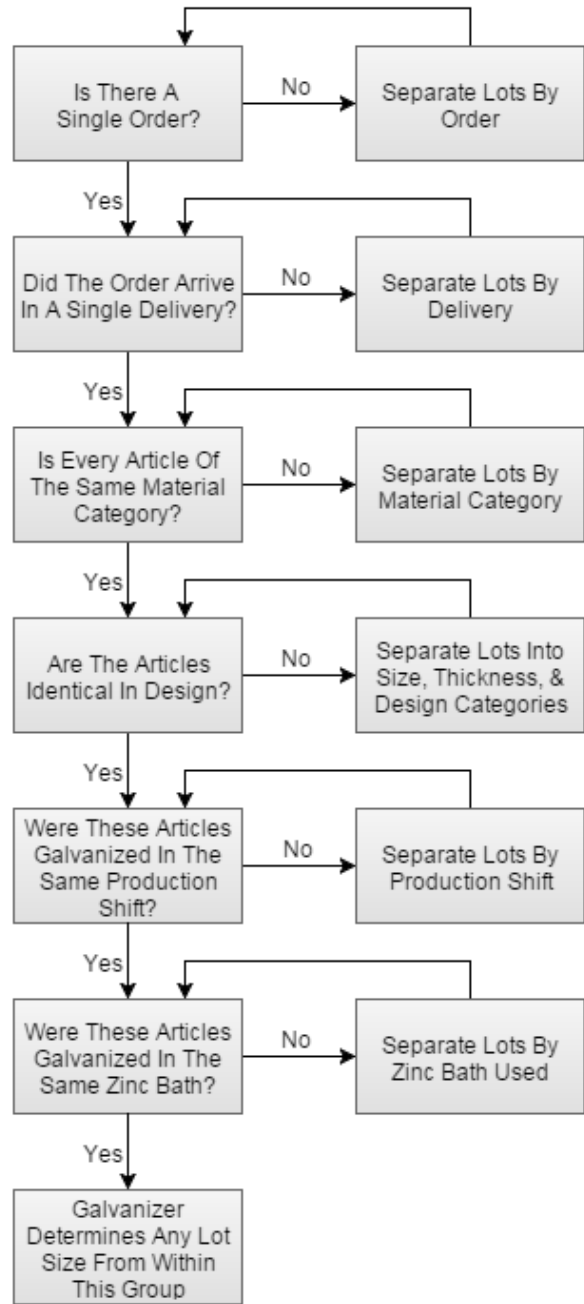
To condense the specification language, a lot in this case consists of:

- Articles of the same type and size comprising a single order or single delivery (whichever is smaller).

- And articles identified as a lot by the galvanizer when (both must be true):
  - The articles are galvanized within a single production shift.
  - The articles are galvanized in the same galvanizing bath.

For example, let's imagine that fifteen identical 20ft long pipes have been delivered in a single shipment to the galvanizing facility under one order. Five pipes were galvanized on Day 1 in Kettle #1. The remaining ten pipes were galvanized on Day 2, but five of the pipes were sent to Kettle #1 while the other five pipes were sent to Kettle #2. As a result, three inspection lots are required for this order because of the two-day production span and use of two kettles. At the galvanizer's discretion, the three inspection lots may be further subdivided based on plant preference.

Unless another inspection lot definition is agreed upon between the galvanizer and the purchaser, the flow chart in *Figure 1* may be used to assist in determining lot size when inspecting articles hot-dip galvanized to ASTM A123/A123M at the galvanizing plant.



*Figure 1: Determining Lot Size at the Galvanizing Plant (ASTM A123)*

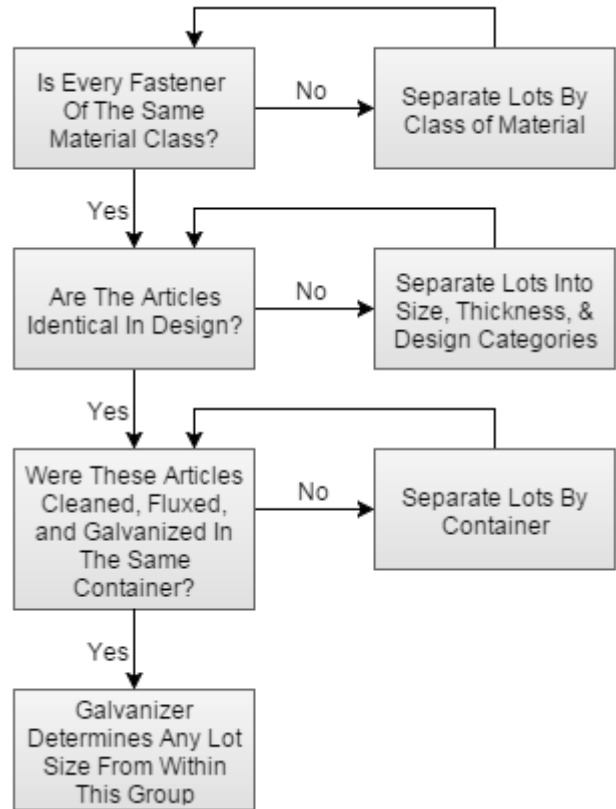
*ASTM A153/A153M*

The specification language used to describe an inspection lot at the galvanizing facility is as follows:

*3.2.5 inspection lot, n – the quantity of identical parts cleaned, fluxed and galvanized together at one time in an appropriate container that is being submitted for acceptance as a group.*

For example, a shipment of hardware that requires separation into four baskets in order to perform hot-dip galvanizing will constitute four inspection lots, regardless of whether the items were hot-dip galvanized on the same day or over a period of days. At the galvanizer’s discretion, the three inspection lots may be further subdivided based on plant preference.

Unless another inspection lot definition is agreed upon between the galvanizer and the purchaser, the flow chart in *Figure 2* may be used to assist in determining lot size when inspecting articles hot-dip galvanized to ASTM A153/A153M at the galvanizing plant.



*Figure 2: Determining Lot Size at the Galvanizing Plant (ASTM A153)*

*ASTM A767/A767M*

The specification language used to describe an inspection lot at the galvanizing facility is as follows:

*4.2.3 Note 5 – A lot shall be as follows: All bars of one size furnished to the same steel reinforcing bar specification that have been galvanized within a single production shift.*

The flow chart in *Figure 3* may be used to assist in determining lot size when inspecting articles hot-dip galvanized to ASTM A767/A767M at the galvanizing plant.

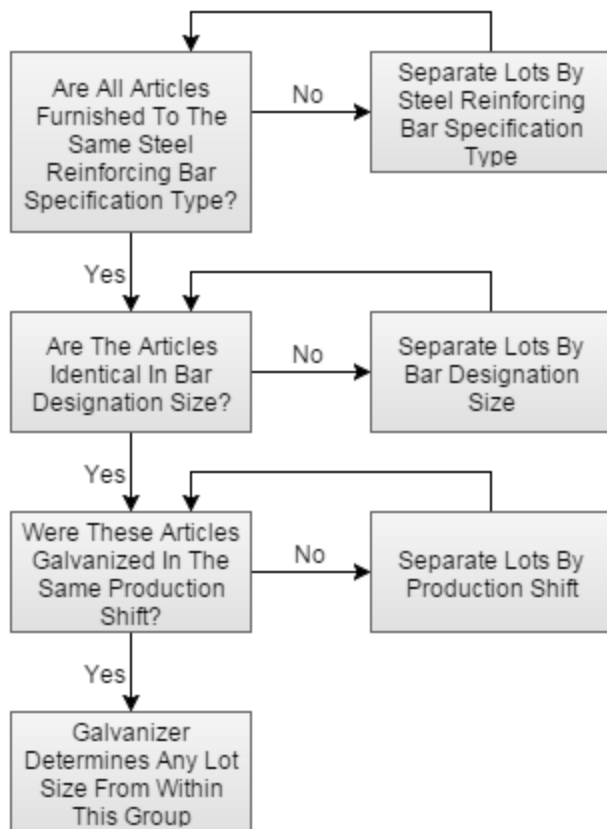


Figure 3: Determining Lot Size at the Galvanizing Plant (ASTM A767)

### Lot Size For Inspection Performed By The Purchaser After Delivery

ASTM A123/A123M is the only specification which differentiates between inspection at the galvanizing plant and by the purchaser after delivery. The specification language used is as follows:

7.2 [...] For test by the purchaser after delivery, the lot consists of the single order or the single delivery load, whichever is the smaller, unless the lot identity, established in accordance with the above, is maintained and clearly indicated in the shipment by the galvanizer.

To condense the specification language, a lot in this case consists of:

- The single order or single delivery load (whichever is smaller).
- The lot identity from the galvanizing plant when it has been maintained during shipping and clearly indicated (and meets the requirements above).

The flow chart in Figure 4 may be used to assist in determining lot size when inspecting articles hot-dip galvanized to ASTM A123/A123M after delivery by the purchaser.

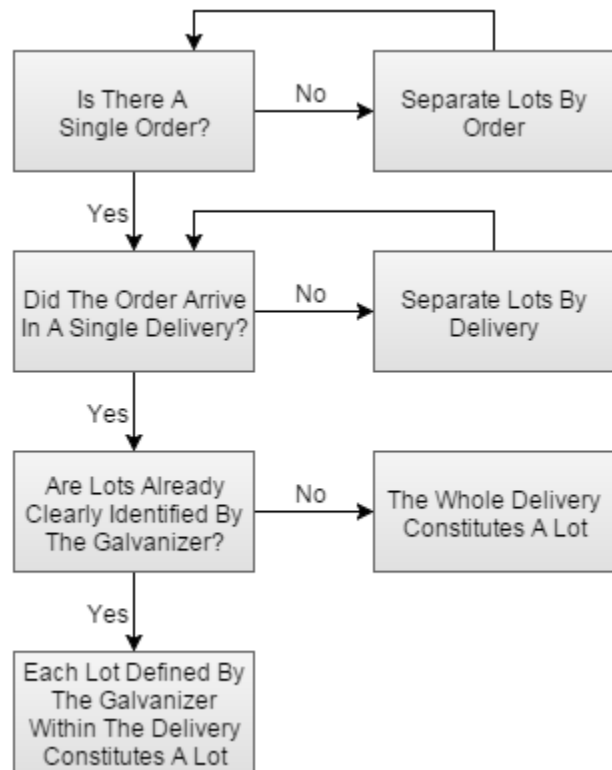


Figure 4: Determining Lot Size After Delivery By The Purchaser (ASTM A123)

## Using Flow Charts To Determine Inspection Lot Size

In order to demonstrate how to use the flow charts contained within this specification, let us consider the following example:

Fabricator X requested a single order of 100 beams and 100 channels to be galvanized at ABC Galvanizing, who operate a single large kettle. The material arrived at ABC Galvanizing in two shipments:

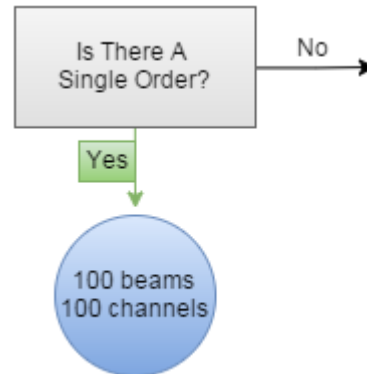
1. 80 beams
2. 20 beams + 100 channels

Upon receiving the beam and channel material, all the items in the order were galvanized over 3 production shifts using the same kettle. The length and frequency of production shifts may vary according to the needs of each galvanizer, but the definition of a production shift at each plant should be consistently applied. In this example, ABC Galvanizing runs only one production shift per day:

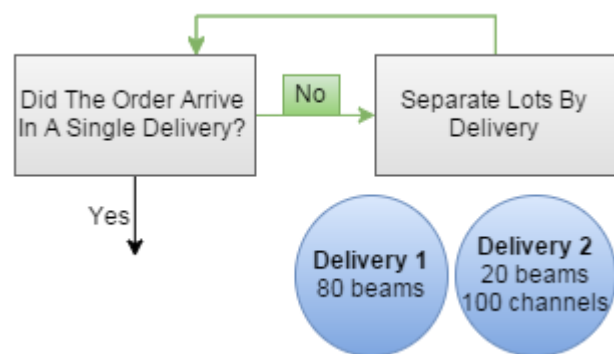
- Shift/Day 1: 80 beams (delivery 1)
- Shift/Day 2: 20 beams, 50 channels
- Shift/Day 3: 50 channels

How many inspection lots are required for this scenario at ABC Galvanizing, and what are the minimum requirements for inspection lot size?

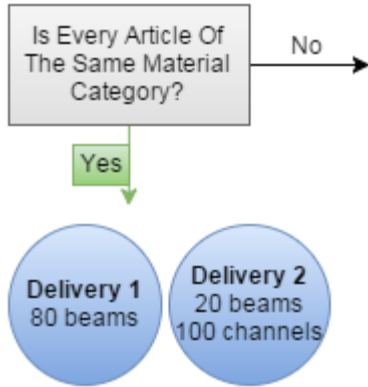
Both beams and channels are galvanized according to ASTM A123. Therefore, the flow chart from *Figure 1* may be used to assist in determining lot size. Each step in the flow chart must be considered, in order, starting from the top:



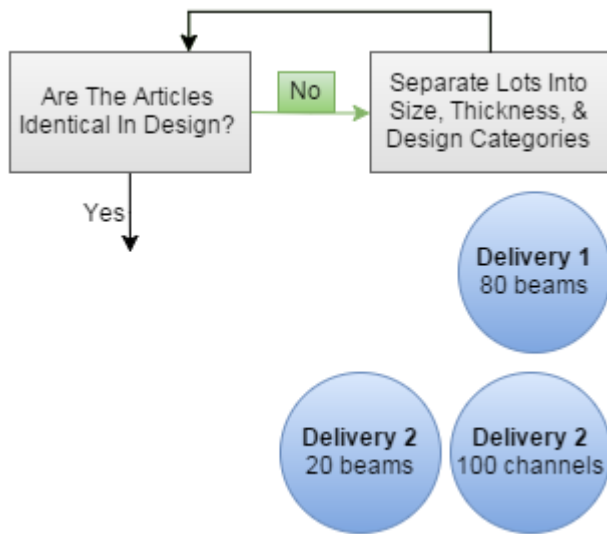
Because the example involved a single order from Fabricator X, it is not required to separate the lot for this reason. When no further lot separation is required, the next step in the flow chart can be addressed.



The next step in the flow chart involves the number of deliveries for the order. Because the material arrived at ABC Galvanizing in two shipments, the lots must be separated by delivery number.

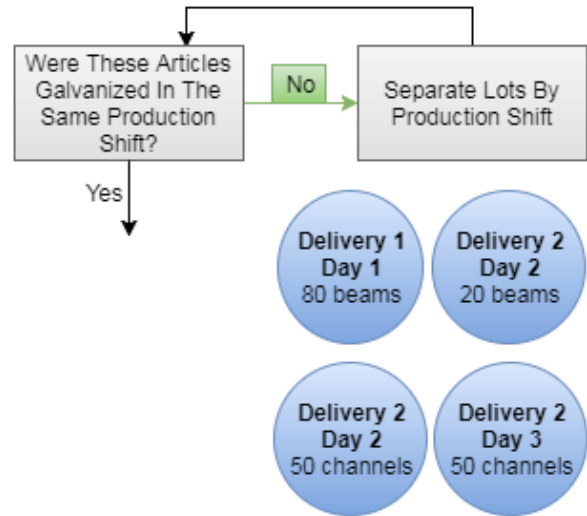


Next, it must be determined whether each grouping is of the same material category. Both beams and channels are considered “structural shapes” within Table 1 of ASTM A123. Therefore, no further separation of the lots is required for this reason.

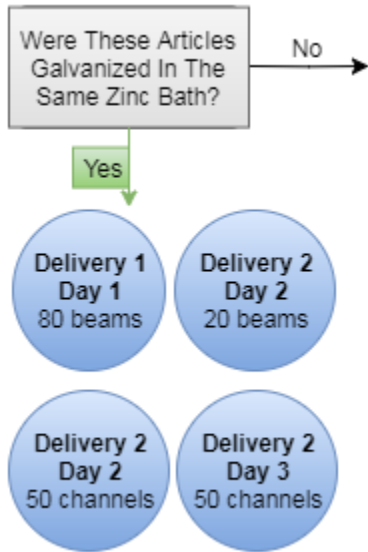


Once the lots have been separated by material category, differences in design must be considered. Articles are not considered identical in design if they vary in shape, thickness, or steel grade. Delivery 1 is only comprised of the beam design, and requires

no further lot separation at this point. However, Delivery 2 is comprised of two designs (beams and channels) and must therefore be further divided as shown.



Next, the lots must be further separated by the number of production shifts required to galvanize the material. All 80 beams from Delivery 1 were galvanized within the same production shift (Shift/Day 1), and therefore no further lot separation is required. The 20 beams from Delivery 2 were galvanized within the same shift (Shift/Day 2) and also do not require lot separation. Conversely, the 100 channels from Delivery 2 were galvanized over a period of 2 production shifts (Shift/Day 2 and Shift/Day 3) and therefore the lot must be separated accordingly.



Further separation is required when items are galvanized using multiple kettles. Because ABC Galvanizing only operates one kettle, then no further separation of the lots is required for this reason.

When the last option in the phase diagram has been completed and the final lot groupings determined (80 beams, 20 beams, 50 channels, and 50 channels), the galvanizer may determine any lot size from within each grouping. Depending on the galvanizer’s preference and/or the quantity of items within each of the groups, the galvanizer may choose an entire group as a lot or any subsection within each group.

At this point, the inspection lot size has been determined, the minimum quantity of randomly chosen test articles or specimens can be clearly defined, and the final inspection process may continue.

